TM 9-1950

WAR DEPARTMENT TECHNICAL MANUAL

ROCKETS

RESTRICTED. DISSEMINATION OF RESTRICTED MATTER. No person is entitled solely by virtue of his grade or position to knowledge or possession of classified matter. Such matter is entrusted only to those individuals whose official duties require such knowledge or possession. (See also paragraph 23b, AR 380–5, 15 March 1944.)

WAR DEPARTMENT • *9 JULY 1945*

WAR DEPARTMENT TECHNICAL MANUAL

TM 9-1950

This Technical Manual supersedes WDTB ORD 121, dated 12 July 1944, and WDTB ORD 236, dated 21 December 1944.

ROCKETS

WAR DEPARTMENT • *9 JULY 1945*

RESTRICTED. *DISSEMINATION OF RESTRICTED MATTER.* No person is entitled solely by virtue of his grade or position to knowledge or possession of classified matter. Such matter is entrusted only to those individuals whose official duties require such knowledge or possession. (See also paragraph 23b, AR 380-5, 15 March 1944.)

WAR DEPARTMENT
Washington 25, D. C., 9 July 1945

TM 9-1950, Rockets, is published for the information and guidance of all concerned.

[A.G. 300.7 (20 Sep 44)
O.O. 300.7/3253]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

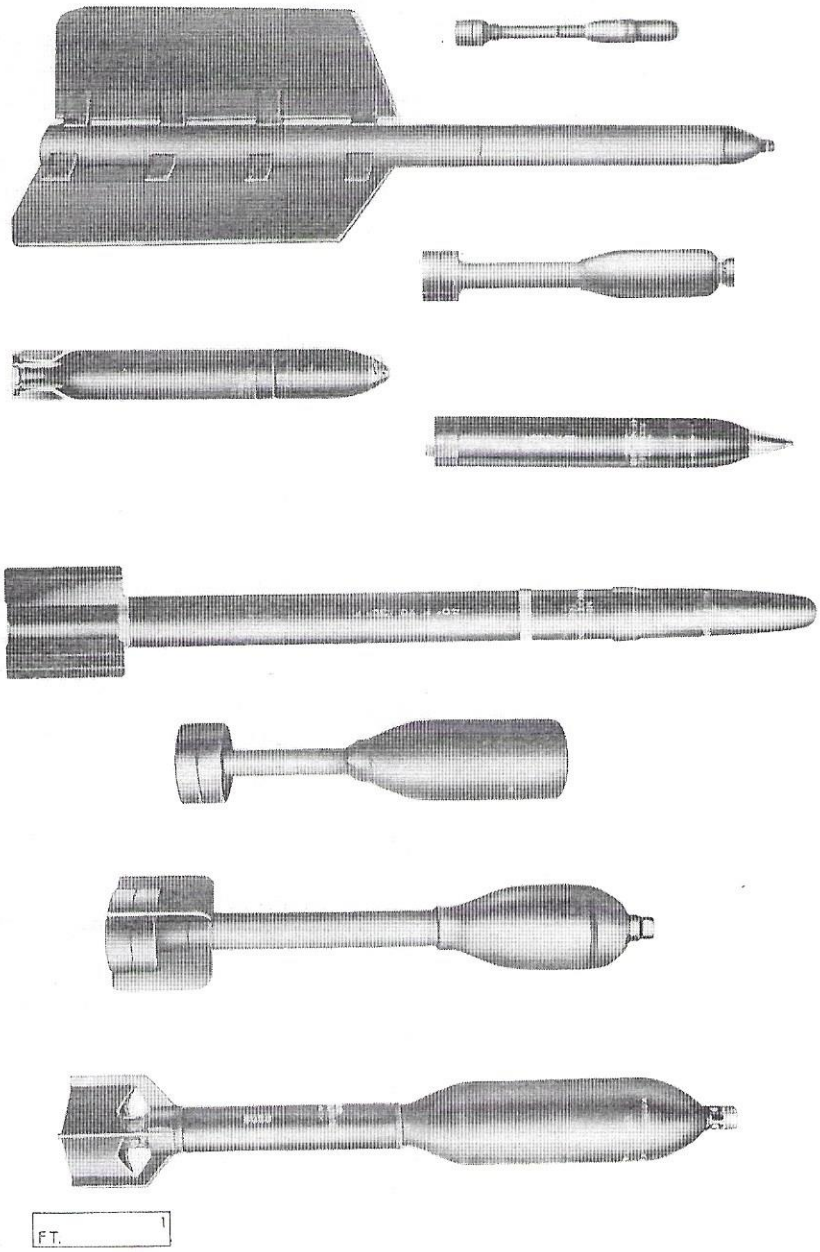
OFFICIAL:
EDWARD F. WITSELL,
Major General,
Acting The Adjutant General.

DISTRIBUTION: AAF (5); AGF (2); ASF (2); S Div ASF (1); T of Opn (10); AAF Comd (2); Arm & Sv Bd (1); Tech Sv (2); SvC (10); FC (1); BU (1); PE, Ord O (5); Dist O, 9 (3); Establishments, 9 (3) except Am Establishments (2); Decentralized Sub-O, 9 (2); Gen & Sp Sv Sch (5); A (3); CHQ (2); D (2); B 2, 4-6, 18, 44 (1); R 2, 4-7, 9, 10, 11, 17, 18, 44 (1); Bn 2-7, 9, 10, 11, 17, 18, 44 (1); C 9 (1); AF (2); G (1); LS (1).

(For explanation of symbols, see FM 21-6.)

CONTENTS

		Paragraphs	Pages
SECTION	I. Introduction	1– 2	1
	II. General information	3–14	2–27
	III. 2.36-inch rockets	15–26	28–36
	IV. Target rockets	27	37–39
	V. 4.5-inch rockets	28–38	40–56
	VI. 5-inch rockets	39–40	57–59
	VII. 7.2-inch rockets	41–42	60–62
	VIII. Large-caliber rockets	43	63
	IX. Fuzes	44–56	64–81
	X. References	57–60	82–84
INDEX			85–86



RA PD 95643

Figure 1 — Representative Types of Rockets

RESTRICTED

This Technical Manual supersedes WDTB ORD 121, dated 12 July 1944, and WDTB ORD 236, dated 21 December 1944.

Section I

INTRODUCTION

1. SCOPE AND ARRANGEMENT.

a. Scope. This manual describes all types of military rockets and contains such technical information as may be necessary for their identification, care, and use. Military rockets include those war rockets designed to inflict direct damage on the enemy and those used for auxiliary purposes such as illumination, signaling, and practice.

b. Arrangement. Section II contains general information, data, and description common to all rockets. In succeeding sections, specific information is given on each type and model; these sections are arranged by caliber. A section on fuzes incorporates a description of each type of fuze. The final section on references lists pertinent publications and gives tables of data.

2. FIELD REPORT OF ACCIDENTS.

a. When an accident involving the use of ammunition occurs in training practice, the occurrence and all available data will be reported to the ordnance officer under whose supervision the ammunition was maintained or issued in order that the ordnance officer may take such action as prescribed in AR 750-10.

b. While it is not required, it is highly desirable that malfunctions of ammunition in combat be reported to the Chief of Ordnance. Such reports should include nomenclature and lot number of the ammunition involved, type of malfunction, and conditions under which it occurred, and any other information having a bearing on the cause of the malfunction or its prevention in other cases.

Section II

GENERAL INFORMATION

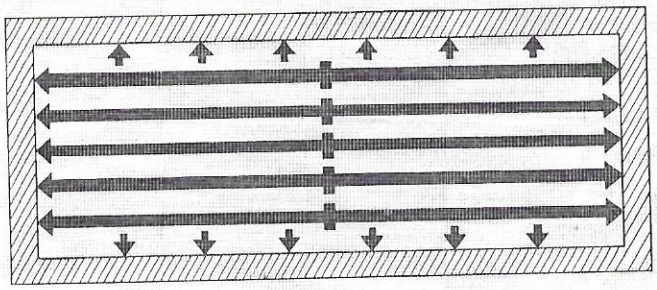
3. DESCRIPTION. A rocket (fig. 1) is a projectile which is propelled by the reaction, or recoil, from discharging a jet of gas to the rear at high velocity. The gas is produced by burning a charge of special powder within the rocket. In general, a military rocket consists of a head and a motor; the head contains all the necessary elements to produce the effect desired, and the motor comprises all those elements necessary to propel the rocket and stabilize its flight to the target. The rocket may be regarded as one assembly of both ammunition and weapon which uses its own recoil for propulsion. The only requirement remaining is that the rocket be so oriented at the moment of firing that it will have proper initial direction, that is, a device is required to launch the rocket only in order to aim it. Consequently rocket launchers may be so light and portable that rockets can be fired from airplanes and from areas inaccessible to conventional artillery. A further advantage of rockets lies in the fact that the forces of set-back are spread over a comparatively long period of acceleration, thus permitting the use of light-case projectiles of higher capacity than artillery shell of similar caliber, and fuzes of more fragile or complex construction. The disadvantages of rockets, as compared with conventional artillery, lie in the fact that friendly personnel and inflammable materiel must be protected from the rearward blast of hot gas, and that dispersion of rockets is considerably greater than comparative artillery shell.

4. THE ROCKET PRINCIPLE.

a. The basic principle of rocket propulsion may be roughly and schematically described as follows:

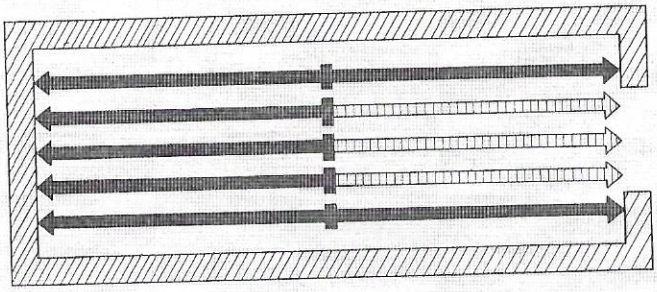
(1) If a gas is held under compression in a closed tube, pressure is equal and opposite in all directions, that is, pressure in one direction is counterbalanced by an equal pressure in the opposite direction. This is illustrated diagrammatically in figure 2. Note that pressure on the side walls is represented in this figure but omitted in the diagrams which follow, because it cancels out in all cases represented.

(2) If an opening is made in one end of the tube (fig. 3), and pressure maintained (as by further burning of the propellant), the area of the closed end is the same but the area of the open end is reduced. The total pressure on the closed end is greater than total pressure on the end with the opening and, as a consequence, the tube tends to move in that direction. The energy of compression represented by the dotted arrows in figure 3 may be regarded as expended in giving velocity to the escaping gas.



RA PD 104818

Figure 2 – Closed Tube



RA PD 95645

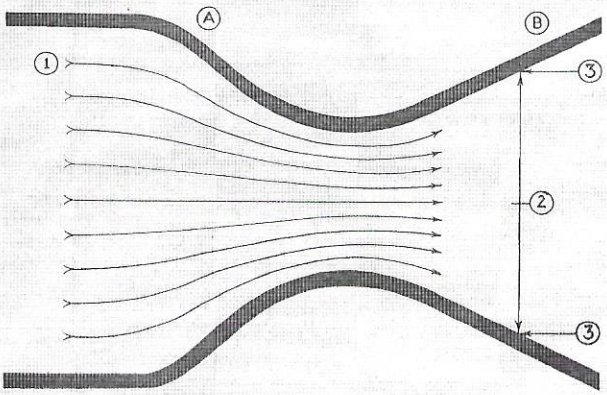
Figure 3 – Open Tube

(3) To state the principle in other terms: Under the basic laws of motion, every action has an equal and opposite reaction. In this case, a small mass of gas discharged at extremely high velocity causes a large mass, the rocket, to move in the opposite direction with a correspondingly lower velocity.

(4) The disadvantages of the type of opening shown in figure 3 are overcome by using the shape shown in figure 4 for the rocket nozzle. It is made up of a smooth contour with inner and outer slopes. The inner slope (A) provides for a smooth, nonturbulent flow of gas (1). The constricted opening prevents a too fast escape of gas and thereby maintains pressure within the rocket. The outer slope (B) uses the lateral expansion (2) of the hot discharge gas to obtain additional forward thrust (3). From its similarity to the venturi tube, the rocket nozzle is often called the venturi.

5. CLASSIFICATION.

a. Purpose. Rockets are classified according to purpose as service, practice, and target. Service rockets are used for effect in combat; practice rockets are used for training and target practice; and target rockets are used to provide a fast moving flying target for target practice with automatic antiaircraft weapons.



RA PD 95646

Figure 4 — Nozzle

b. Filler. Rockets are classified, according to the filler of the head, as high explosive, chemical, and inert.

(1) High-explosive rockets contain a filler of high explosive for blast, fragmentation, mining, or demolition effect. A special loading, high-explosive antitank (HE,AT), is especially effective against armored targets.

(2) Chemical rockets contain a chemical agent and a burster or an igniter to disperse or ignite the agent at the target. The chemical agent may be a gas for producing a toxic or harassing effect, a smoke producer for screening or signaling, an incendiary, or a combination of these.

(3) Inert rockets may have solid steel heads for perforation of armor, or may have inert-filled heads for target practice.

6. IDENTIFICATION.

a. General. Rockets, in common with other types of ammunition, are identified by the standard nomenclature and lot number of the item. Such identification is marked on all containers and, unless the item is too small, on the ammunition itself.

b. Standard nomenclature. Standard nomenclature is established in order that each item supplied may be specifically identified by name. Nomenclature consists of the type, size, and model of the item. The use of standard nomenclature is mandatory for all purposes of record, except as noted in subparagraph h, below.

c. Lot number. When ammunition is manufactured, a lot number is assigned in accordance with pertinent specifications. A "lot" consists of a number of items, manufactured from similar materials under similar conditions, which may be expected to function

alike. The lot number consists, in general, of the loader's initials or symbol, the number of the lot, and the date loaded. The use of the lot number is required in all references to specific items of ammunition in reports and records.

d. Model. When a particular design is adopted as standard, it is assigned a model designation consisting of the letter "M" and an arabic numeral. If this design is modified, the fact is indicated by the addition of the letter "A" and the appropriate arabic numeral; for example, M6A3 indicates the third modification of a model whose original designation was M6. Modifications which are functionally identical with the original model but which may require different treatment in handling or storage are designated by the letter "B" and an arabic numeral. When a particular design is standardized only for limited procurement and service test, the model designation is indicated by the letter "T" and an arabic numeral, and modifications by the addition of "E" and an arabic numeral. When the design is standardized for general issue, the "M" designation is assigned but some lots on hand marked with the "T" designation may be issued without remarking.

e. Painting. Ammunition is painted to prevent rust and to provide, by the color, a means of concealment and a means of identification. In general, rocket motors are painted olive drab. The colors used for rocket heads are as follows:

High-explosive	Painted lusterless olive drab; marked in yellow.
Chemical (gas)	Painted lusterless grey; marked in green.
Chemical (smoke)	Painted lusterless grey; marked in yellow.
Chemical (incendiary)	Painted lusterless olive drab; marked in purple.
Practice	Painted lusterless blue; marked in white.
Inert	Painted black; marked in white.

f. Marking. Ammunition items are marked, by stamping in the metal or by stenciling, with the type, size, model, and lot number. Rocket motors are marked with the safe temperature limits. Variations from standard are also indicated by appropriate markings.

g. Data card. A 5- by 8-inch card for each lot is supplied with each shipment of ammunition. This card gives the ammunition lot number of the item, the lot number of each component of the item, and any other pertinent data.

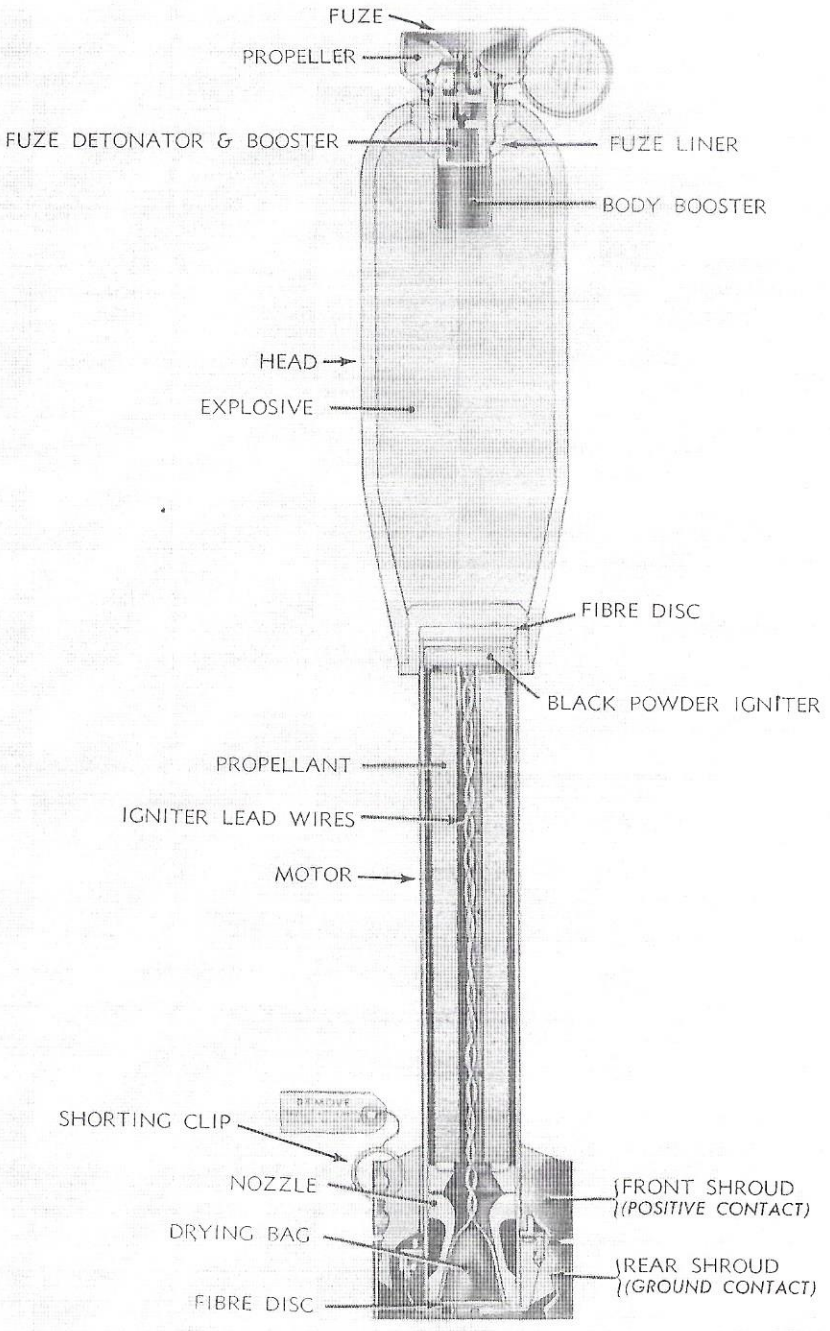


Figure 5 — Complete-round — Section

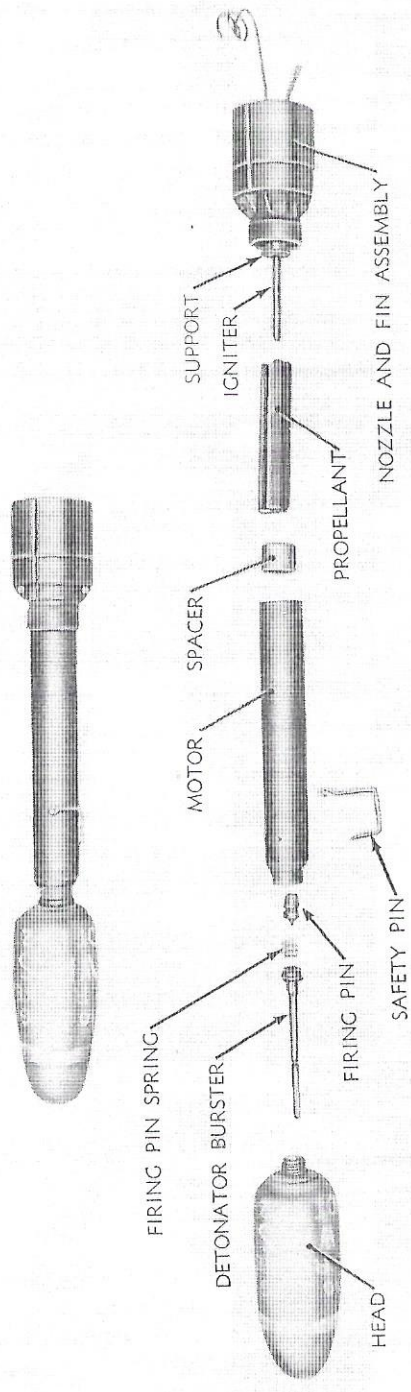


Figure 6 – Complete Round, Disassembled (2.36-inch Smoke Rocket)

h. Ammunition identification code. An ammunition identification code (AIC) is established in order to facilitate requisitioning and record keeping in the field. The code symbol consists of five characters, the first two of which indicate the standard nomenclature list in which the item is listed, the other three are peculiar to the item. Once a code symbol is properly assigned to an item and published it is never changed. Code symbols are published in the Standard Nomenclature Lists.

7. COMPLETE ROUND.

a. Definition. The complete round consists of all the components of the rocket necessary for the rocket to function. For flexibility of supply, a complete round, as issued, may contain alternative components, only one of which may be used. The complete round may be issued as a single assembled item or as separate components to be assembled in the field.

b. Rockets. The complete round of rocket ammunition (figs. 5, 6, and 7) consists of: (1) the motor, containing the propelling charge and the igniter, and (2) the head, containing the charge, the booster, and the fuze. These components are described in detail in paragraphs 8 and 9 below.

c. Definition. The approved designations of rocket components are defined below. The names which were formerly applied to each component by the various agencies engaged in rocket development are given in parentheses following the approved term.

(1) ROCKET HEAD (ROCKET SHELL, ROCKET BODY). The rocket head is that forward component which produces the desired effect at the target. It may be a solid shot or a loaded shell.

(2) ROCKET MOTOR. The rocket motor is that component, usually assembled to the rear of the head, which propels the rocket. It consists of a motor tube (body) closed at the forward end and constricted at the rear to form the nozzle (venturi). The motor contains the propellant (charge, grain, powder, or sticks) on a support (trap, grid, or cage) and an igniter which is connected to contact rings, fin shrouds, or igniter cable (rip cord, or leads) and plug.

d. Explosive train. The explosives selected for such large scale use as the filling of rocket heads must be comparatively insensitive to permit safe handling in storage and transit. Sensitive explosives that can be detonated by the impact of a firing pin are safe to handle only when they are in small quantities, highly compressed, and inclosed in a metal capsule. They are used in that form in fuzes and primers. However, the small spit of flame from a primer will not properly detonate a large charge of comparatively insensitive explosive, and it is necessary to interpose a medium quantity of explosive of medium sensitivity. Such an arrangement of explosive charges is called an

explosive train. The propelling charge explosive train consists of the igniter and the propelling charge. The bursting charge explosive train consists essentially of a detonator, a booster, and the bursting charge. When delay action is desired, a primer and a delay charge may be added, in which case the flame passes through a delay charge prior to initiating the detonator.

8. HEAD.

a. High explosive. Some high-explosive rocket heads are of thin-walled construction for maximum capacity of explosive and blast affect; some have heavy walls to permit perforation of armor before exploding; and others have walls of medium thickness to provide a maximum number of effective fragments. High-explosive rocket heads are adapted for point fuzes, base fuzes, or both.

b. Chemical. Chemical rocket heads are usually of thin-walled construction. They are adapted for point fuzes and have a burster well extending along the axis of the head from the fuze seat. Chemical rocket heads may be loaded with casualty or harassing gas, or smoke.

c. Practice. Practice rocket heads usually consist of the metal parts of high-explosive heads loaded with inert material.

d. Fuze. A fuze is a mechanical device which initiates an explosion at the time and under the circumstances desired. Fuzes are classified according to location on the shell as "point" or "base" and according to function as "time" or "impact." Time fuzes produce an explosion a preselected number of seconds after the round is fired. Impact fuzes produce an explosion upon impact or a fixed time thereafter. Impact fuzes are further classified as "superquick," those that function immediately on impact; "non-delay," those that function on impact but depend on inertia for ignition; or "delay," those that function a fixed time after impact to permit penetration of the target before the shell explodes.

e. Boresafe. Boresafe fuzes are those in which the explosive elements are separated in such a manner that explosion of the shell is prevented if the more sensitive elements, primer and detonator, should function before the rocket leaves its launcher.

9. MOTOR.

a. The rocket motor is that component which propels the rocket and is assembled to the rear of the head. It consists of a motor tube which is closed at the forward end by its attachment to the shell and constricted at the rear end to form the nozzle. The motor contains the propelling charge, propelling charge support, and the igniter. The flight of the rocket is stabilized by fins attached to the rear of the motor, or by rotation which is produced by using a number of smaller nozzles set at an angle rather than a single large nozzle directed along

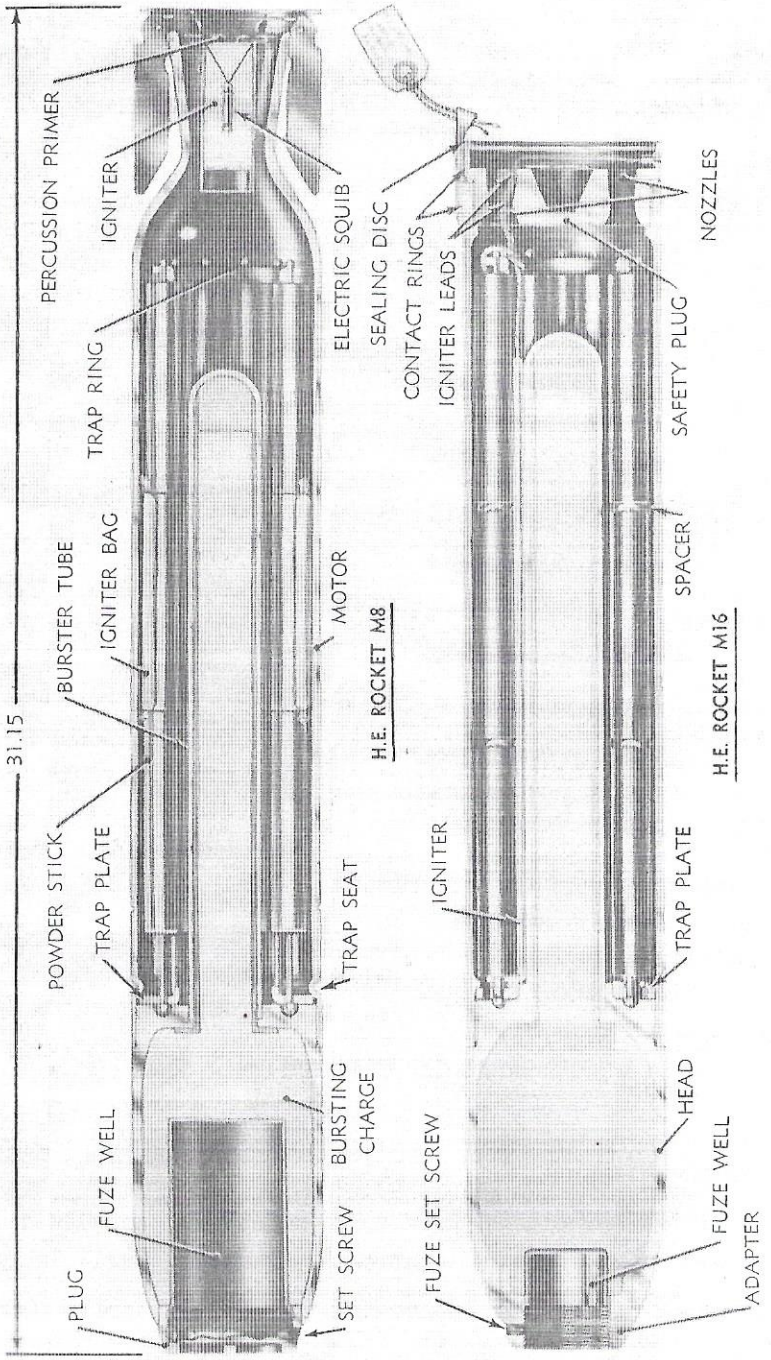


Figure 7 — Sections of Unfuzed Rockets M8 and M16

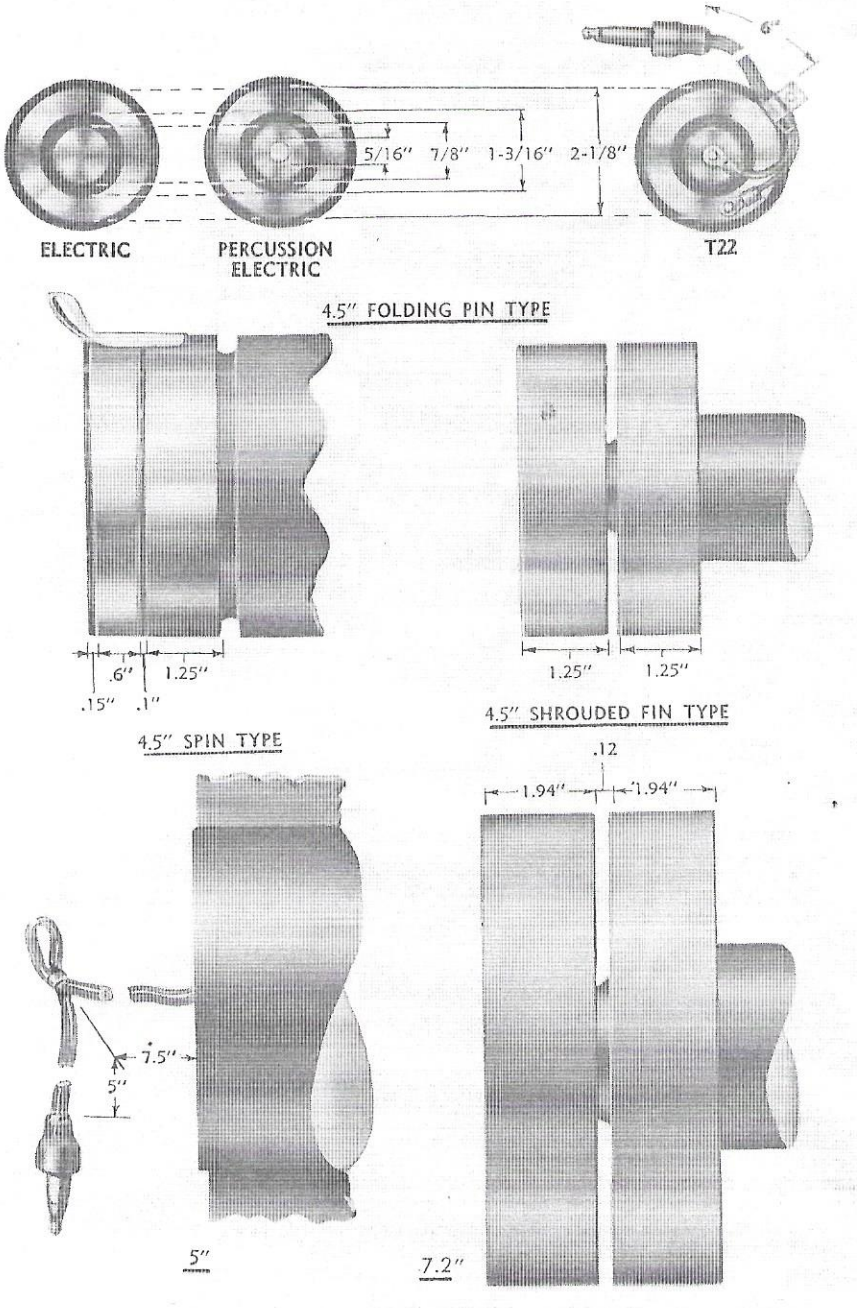


Figure 8 — Electrical Contacts on Rockets

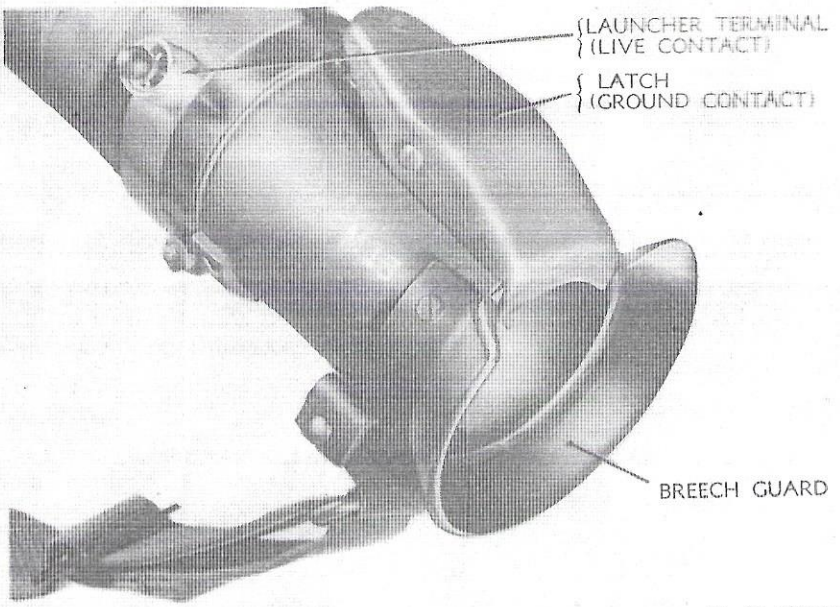


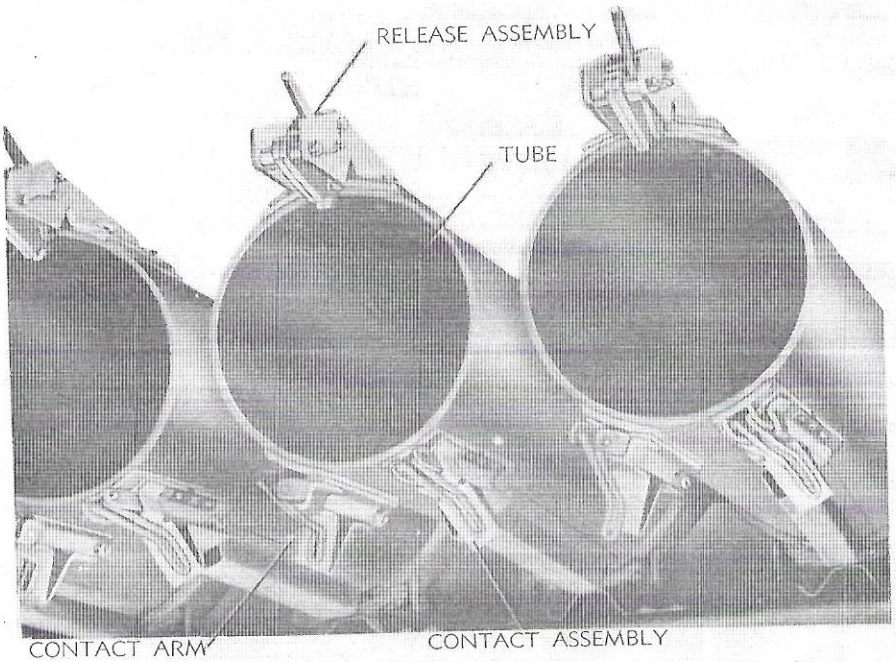
Figure 9 — Clamp and Contacts, 2.36-inch Launcher

the axis of the rocket. The openings in the motor are sealed against the entrance of dirt and moisture by fiber disks which are blown off when the rocket is fired.

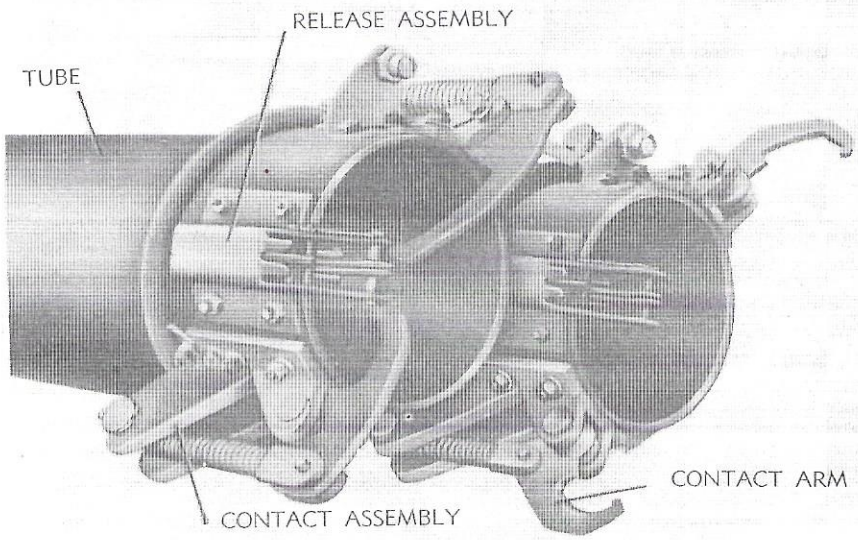
b. The igniter consists of a charge of black powder and an electric squib. In general, the lead wires of the squib pass through the nozzles and are connected to a source of electricity on the launcher by means of an igniter cable and plug, or by means of contact rings on the rocket which contact electrodes on the launcher.

c. Propelling charge. The propelling charge in rocket ammunition generally consists of double-base powder. The charge may be formed into a single large grain or a number of smaller grains, and held in place by a support of appropriate shape (figs. 5, 6, and 7). The weight of the propelling charge is adjusted for each lot of powder to give uniform flight.

d. Effect of temperature. The burning rate of propellent powder changes with the temperature and the pressure so that the higher the temperature or pressure, the faster the powder will burn. When rockets are fired at temperatures higher than those for which they are designed, the pressure builds up faster than the nozzle can release it and, as a consequence, dangerous pressures are built up which will cause erratic ranges and may cause the motor to burst. When the



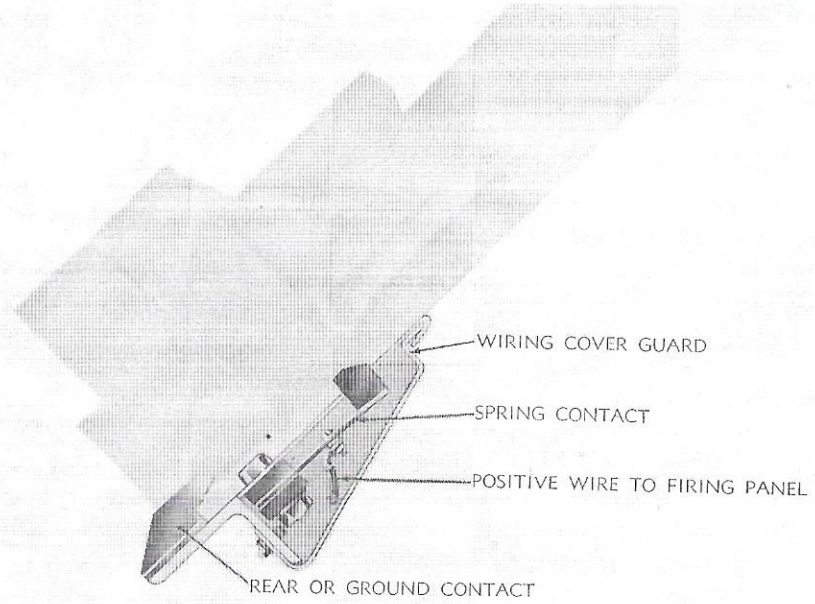
EARLY TYPE CONTACT ASSEMBLIES

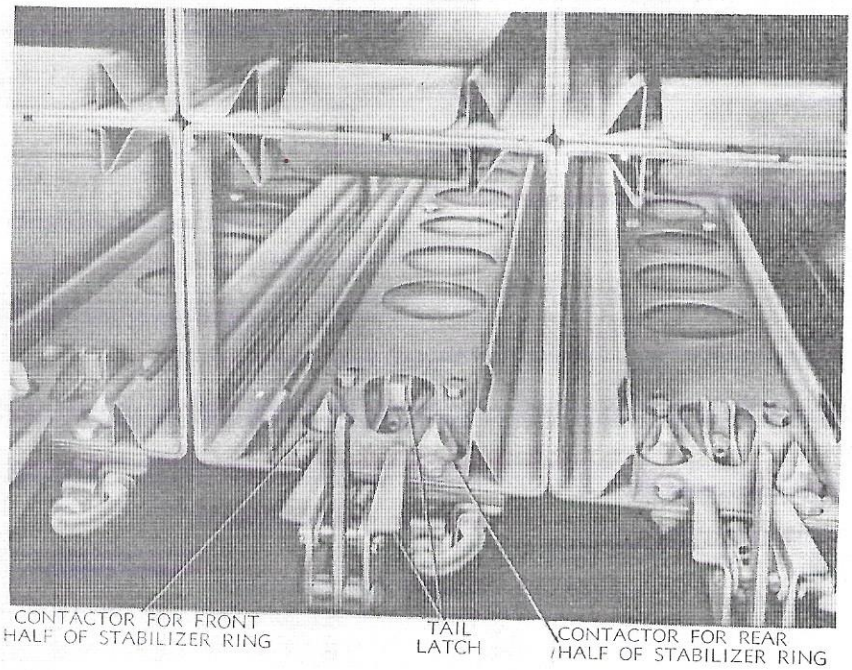


LATER TYPE CONTACT ASSEMBLIES

RA PD 91995

Figure 10 — Release Assemblies and Contacts, 4.5-inch Launchers





RA PD 95650

Figure 11 — Clamp and Contacts, BR and 7.2-inch Launchers

rocket is fired at temperatures below the specified range, the propellent charge burns slowly, range is erratically short, and there may be a back blast of flame and burning fragments of powder after the rocket leaves the launcher.

10. LAUNCHERS.

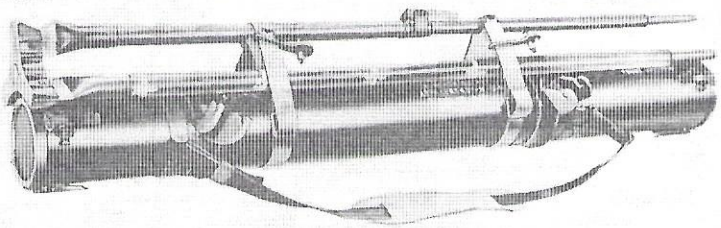
a. General. The rocket launcher serves to hold and aim the rocket, to provide a source of electric power for firing, and, in some cases, to protect the firer against the blast of the rocket. The launcher proper, as distinct from the mount, consists of a tube or a pair of rails with a means of holding the rocket in place and a system of electrical contacts. Some launchers are expendable, that is, they are used for the firing of only one rocket; in such cases, the launcher consists of the tube or crate in which the rocket is shipped. Other launchers may be of semipermanent or permanent construction, designed for firing a limited or a substantial number of rounds respectively.

b. 2.36-inch launchers. The launcher for 2.36-inch rockets is a permanent type consisting of a single long metal tube or a two-piece tube equipped with sights, grips, and a stock. The source of electricity for firing is in the form of batteries or a magneto assembled in the grip or stock. The rocket is held in place by a single spring clamp which also serves as the ground contact for the electric leads. The live contact is in the form of a spring terminal mounted on an insulated band (fig. 9). The launcher tube is long enough for the propelling charge generally to burn completely before the rocket leaves the muzzle. Protection for loading and firing personnel against the occasional long-burning rocket is provided by a small conical blast deflector. For a complete description, see TM 9-294.

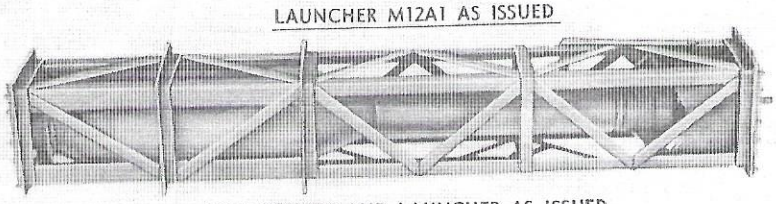
c. 3.25-inch target rocket launchers. This launcher is in the form of two parallel steel rails mounted, with means of elevation, on a two-wheel carriage. Traverse is accomplished by shifting the trail. The rocket rests on the rails against a backstop. Ground contact is through the body of the launcher. Live contact is made through a darting firing contact with the head of the rocket. Batteries are mounted on the carriage and a long firing cable provides for firing from cover or a safe distance. For a complete description, see TM 9-856.

d. 4.5-inch expendable launchers. See paragraph 11.

e. 4.5-inch launchers for folding fin rockets. These are permanent or semipermanent types consisting of an assembly of a number of tubes mounted on various types of carriages and aircraft mounts. The launcher consists of a metal or plastic tube equipped with a release assembly for holding the fin flange of the rocket and a pair of spring-type contacts (fig. 10). For further information, see TM 9-394 and TM 9-395.



LAUNCHER M12A1 AS ISSUED



8 INCH ROCKET AND LAUNCHER AS ISSUED

RA PD 104819

Figure 12 — Expendable Launchers (4.5-inch and 8-inch) as Issued

f. 4.5-inch launchers for shrouded fin rockets. Launchers for the beach-barrage type of rocket may consist of assemblies of box-type rails or metal tubes, or may be double-rail type with an automatic gravity-feed magazine. A knife edge contact for the forward fin shroud provides for live contact; the ground contact to the rear fin shroud also serves as a backstop (fig. 11). For further information, see TM 9-394.

g. 4.5-inch launchers for fixed-fin rockets. These are the same as the launchers described under "Post launchers" (subpar. i, below).

h. 4.5-inch launchers for spin-type rockets. Launchers for 4.5-inch spin-type rockets consist of an assembly of metal or plastic tubes each of which has three internal ribs, or rails, and a backstop to hold the rocket in firing position. Plastic tubes have two spring-type electrical contacts, and metal tubes have single contact, the body of the tube serving as ground contact. Tubes for spin-type rockets need be only as long as the rocket (see also TM 9-392).

i. Post launchers. This type consists of a pair of posts; it was formerly designated as the "zero-length" launcher because the rocket is free of the launcher after ½ to 3 inches of total travel. The forward post of the launcher incorporates a fork for engaging a button-type lug on the rocket, and may also include an arming mechanism for retaining or releasing the nose fuze arming wire. The rear post carries a hook to engage the staple of the lug band, and a receptacle for the rocket igniter plug. An adapter rail, the M9, is necessary for firing converted folding-fin rockets. This rail carries a fork with two pegs for the forward band and a post with a single peg for the rear lug band.

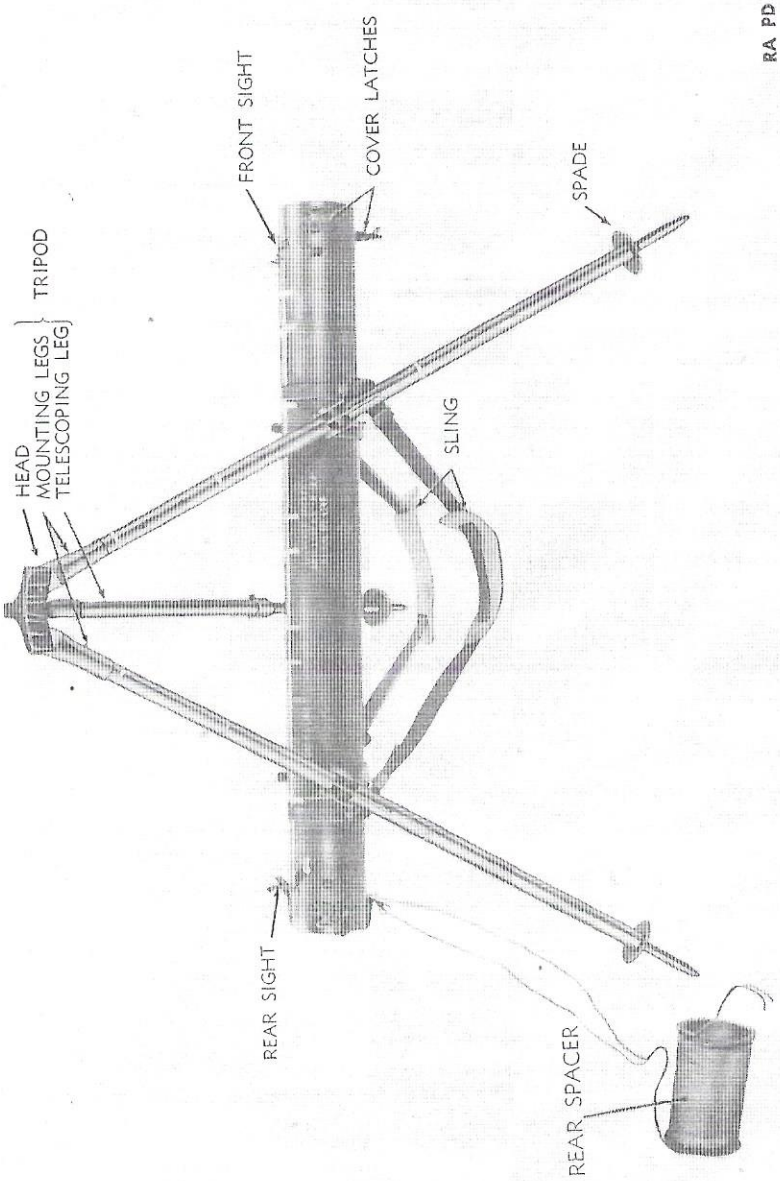


Figure 13 — Launcher M12A1, Emplaced

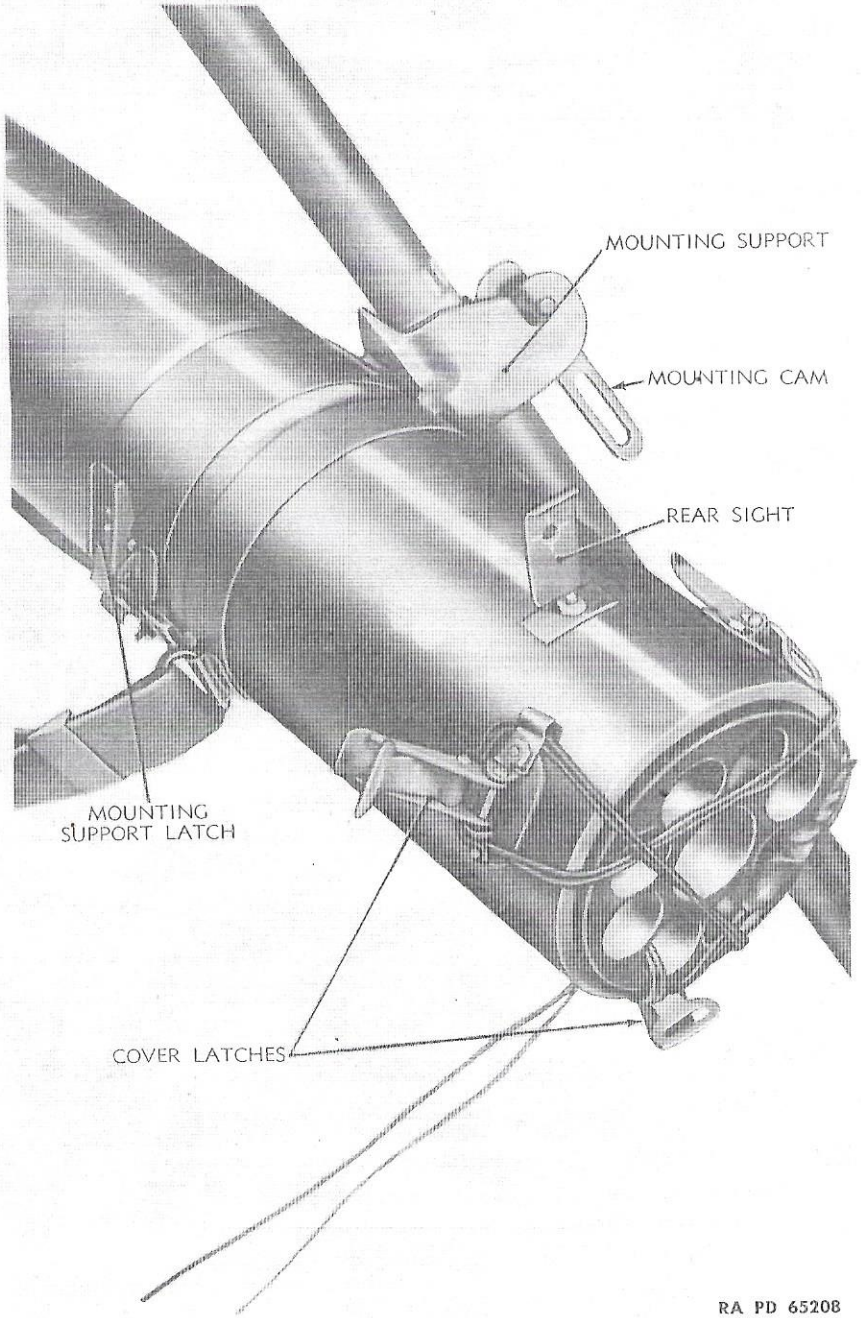


Figure 14—Launcher M12A1, Breech Detail

j. T-slot launcher. This type of launcher consists of an assembly of single rails, each of which has a T-slot running its entire length for engaging button-type suspension lugs. A spring catch at the rear serves as a backstop and allows the entry and removal of the suspension lugs. An electrical receptacle for the rocket igniter plug and a hook for attaching the igniter cable are mounted at the rear of each rail. A snap for the attachment of the arming wire is mounted on the side of each rail near the midpoint.

k. 7.2-inch launchers. Launchers for the 7.2-in. rockets consist of parallel-rail, box-type assemblies. Those with adjustable elevation incorporate a spring clamp for holding the rocket in place; those with elevation fixed utilize a backstop (fig. 11). Both types use spring-actuated, knife-edge contacts for making electrical connection to the fin shrouds. For further information, see TM 9-396.

11. EXPENDABLE LAUNCHERS.

a. General. Two general types of expendable launcher are in current use, the shipping tube with tripod mount, represented by the launchers of the M12 series for 4.5-inch rockets, and the steel-crate type for 8-inch rockets (fig. 12). In both types, long wires are connected to the igniter leads to provide for firing from a safe distance.

b. Shipping-tube type. This type (figs. 13, 14, and 15) consists of a plastic or metal-alloy tube, in which the rocket and fuze are shipped, and a light adjustable tripod for mounting. Sights and mounting clamps are assembled to the launcher as shipped, and accessories such as spades, batteries, and reels of wire are packed in the spacers within it (fig. 15). In using this type of launcher, the covers are removed and the rocket is fuzed. The tripod is then set up and adjusted and the launcher attached and aimed. The lead wires are unreeled to reach a safe firing position and the rocket is fired alone or in salvo by means of the batteries or a magneto-type firing device. For further information, see TM 9-394.

c. Crate type. The shipping-crate type of launcher is supplied with 8-inch demolition rockets. A hinged stand attached to the crate serves as rear support and two detachable legs shipped within the crate furnish the front support (fig. 16). When the entire assembly is shipped crated, the rocket is unfuzed but otherwise ready for firing and the fuze is packed in its own container inside the launcher.

12. INSPECTION PRIOR TO USE.

a. When rockets are unpacked in preparation for use, the following conditions should prevail:

(1) All safety devices, such as safety wires, safety pins, short-circuiting devices (shorting strips or clips), and the like should be in place.

Figure 15 — Launcher M12A1, Componenis



RA PD 58613

Figure 16 — 8-inch Launcher, Emplaced

(2) Motors should be free of serious dents and fins should be straight.

(3) Motor sealing disks and caps should be securely in place. Loose disks may be replaced and the rocket used if it can be ascertained that no moisture or other foreign material has entered the motor.

(4) All components should be free of serious corrosion, dirt, grease, or other foreign material. This applies particularly to contact surfaces, mating threads, and fuze seats.

(5) Temperature range, marked on the rocket, should cover the temperature at the time of use.

(6) Exuding high-explosive heads may be cleaned and used; leaking chemical heads and exuding motors should be carefully segregated and destroyed.

(7) Rocket heads designed for base fuzes should be inspected for presence of the fuze. If the base fuze is omitted, the rocket head will detonate on firing the rocket.

13. PRECAUTIONS.

a. General. Rockets, in common with other types of ammunition, are designed to be as safe in handling as is consistent with their function, and are packed to withstand all conditions ordinarily en-

countered in storage and transit. In order to insure that the ammunition will be in serviceable condition when required for use and to provide the highest possible protection to personnel and materiel, the precautions in this paragraph, which apply to all rockets, and the precautions specified in the description of each item, will be observed.

(1) Boxes of ammunition should not be handled roughly, dropped, slid, tumbled, "walked" on the corners, or struck, as in lining up a stack.

(2) Rockets should be protected from sources of high temperatures such as furnaces, steam lines, and direct sunlight on a hot day. Those rockets which are known to have been exposed to a temperature higher than indicated as their upper limit for more than 2 hours will not be fired until they have been cooled down. They will be placed in cool storage until they have returned to a safe temperature when they may then be fired.

(3) Rockets should not be exposed to extreme, rapid, and recurrent variations in temperature which exceed the temperature limits prescribed for them.

(4) Complete rounds should not be assembled in advance of anticipated requirements, and those rounds assembled for use but not used will be returned to their original condition and packings.

(5) Safety devices will be removed, as specified, in preparation for firing, but at no other time.

(6) Packings will not be opened until the items are required for use or for inspection. Partly used containers and repacked items will be resealed and marked. They will be used first for subsequent requirements in order that stocks of opened packages may be kept to a minimum.

(7) Damaged packings will be repaired or replaced, and special care will be given in transferring all markings to new parts of the container.

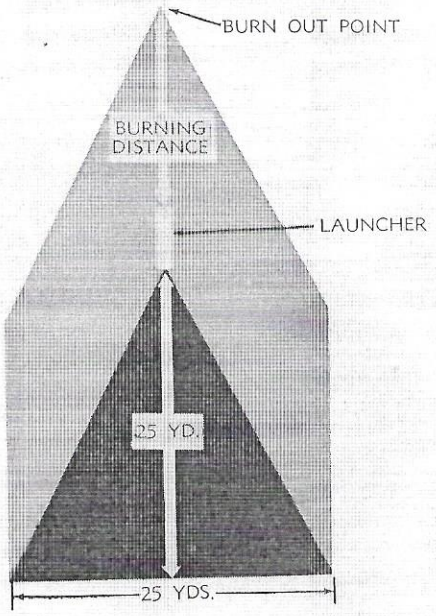
(8) Packings will not be opened, repaired, or replaced within 100 feet of a magazine or other store of explosives.

(9) No round or component will be disassembled except as specifically authorized.

b. Storage.

(1) Separate rocket heads will be stored in accordance with regulations for separate-loading shell of comparable loading, that is, pentolite-loaded and high-capacity heads in class 10, TNT-loaded heads in class 7, WP-loaded heads in class 2, and CG in class 11 (TM 9-1900).

(2) Separate rocket motors are closed only by fiber, chipboard, or sheet metal disks and caps which, in the event of accidental ignition, will be blown away and the propellant will burn, virtually unconfined, out of both ends of the motor and constitute no more than



RA PD 104820

Figure 17 — Blast Danger Area

a fire hazard. However, rocket propellant is sensitive and, on strong initiation, will detonate rather than burn; as a consequence, separate rocket motors will be stored the same as fixed rounds (class 4) with the propellant computed as high-explosive.

(3) Separate rocket fuzes will be stored under the same conditions as class 6 fuzes.

(4) When rockets are assembled, they are similar to fixed rounds of artillery ammunition with two important exceptions. The first, as noted above, is that the propellant will detonate if the head detonates; as a consequence, the weight of the propellant must be added to the weight of the high-explosive filler in computing quantity-distance requirements. The second, is that, when involved in a fire, the range of the rocket is not limited, as is the case with other fixed rounds. On ignition, whether deliberate or accidental, the rocket takes off with full service velocity. As a consequence, the range of the rocket must be added to the effective radius of the shell burst in computing fragmentation or missile distances.

(5) Assembled rockets should be stored with the rockets all pointing in one direction—preferably nose down or toward a barricade.

(6) Rocket components will ordinarily be stored as shipped. That is, those components shipped in one packing may be stored to-

gether, and those shipped separately should be stored separately. However, rocket heads and the motors therefor may be stored together.

c. **Handling and use.**

(1) Care should be taken to protect rockets from heat. If heated to extremely high temperatures, they will ignite. However, spontaneous ignition is not at all likely if they are stored even for several hours at temperatures up to 200° F. Prolonged hot storage at these high temperatures and at lower temperatures (between 120° F and 150° F) causes gradual deterioration of the propellant and, therefore, should be avoided. Sunlight in itself has no effect on rocket motors except that it may heat the entire unit, including the propellant, quite significantly.

(2) The upper safe temperature limit marked on rockets is the maximum temperature at which the rockets should be fired. If fired at higher temperatures, pressures will be produced which exceed the design strength of the metal parts. The lower temperature limit is the minimum temperature at which the rockets should be fired. If fired at lower temperatures, the flight of the rocket may not be regular and dependable. Therefore, all rockets should be used only when within the recommended temperature range. If, in emergency, rockets must be used when slightly too hot or too cold, allowance should be made for the malfunction which may be expected.

(3) If any change is made in an item, the item will be marked to indicate the change. If the item is repacked, the packings will also be so marked.

(4) Care should be exercised to avoid denting the motor or bending the fins. Serious dents may cause dangerous pressures; bent fins will cause erratic flight.

(5) Assembled rockets should not be stood on the tail or base as this may damage fins, electrical connections, or motor seals.

(6) Care should be exercised in firing through a screen of brush or trees. Impact with a twig or branch may deflect the rocket or cause it to detonate.

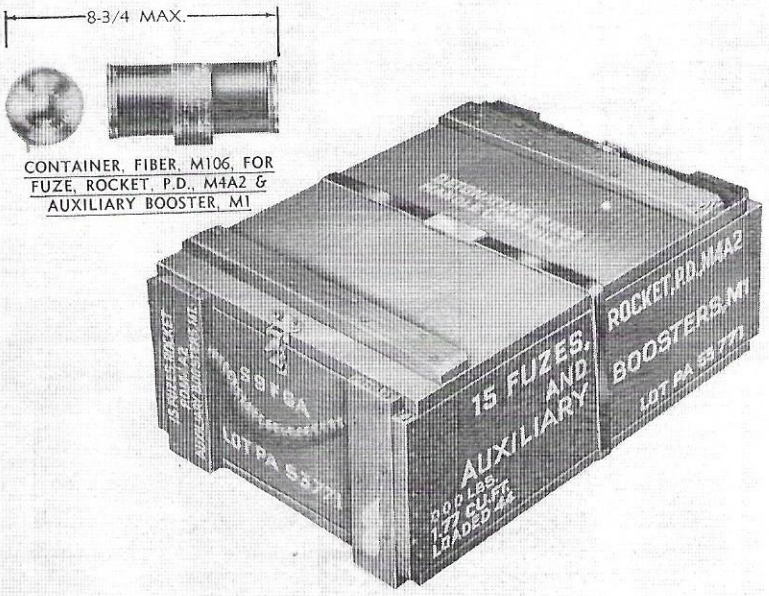
(7) In making electrical connections, care should be exercised to see that connections are good and that uninsulated sections are protected against short circuit.

(8) The danger area from the blast of ground-launched rockets is illustrated in figure 17. The burn-out distance is given in the data table for each type. In some cases, the rocket burns out before leaving the launcher; in others, the rocket may continue to burn as much as 50 yards in front of the muzzle of the launcher. Personnel should not be permitted in the danger area after the launcher is loaded and



RA PD 103581

Figure 18 — Packings: Metal Container



RA PD 104805

Figure 19 — Fuze Packings

prepared for firing, except when protected by adequate shelter. Ammunition and inflammable materiel should be given the same protection as personnel. If practicable, the danger area should be cleared of dry vegetation and other inflammable material before firing.

d. Misfires and hangfires.

(1) A misfire is a failure of the propelling charge or igniter to function when the firing mechanism is operated in the normal manner. A hangfire is a temporary failure to function—that is, there is an unexpected delay between operation of the firing mechanism and ignition of the propelling charge.

(2) Since misfire and hangfire cannot be distinguished immediately, any failure to fire will be regarded as a hangfire until sufficient time has elapsed to render the existence of a hangfire distinctly improbable. Such time ranges from 5 seconds for 2.36-inch rockets to 2 minutes for 4.5-inch rockets and larger.

(3) A failure to fire may be caused by failure of electric power from weak batteries or generator, by poor connections in the firing circuit, by short circuit in the firing circuit, by broken lead wires, by faulty squib in the igniter, or by moisture in the igniter powder or propellant.

(4) After a failure to fire, several more attempts should be made to fire. If the malfunction persists, the safety interval should be observed and then the launcher may be approached from the side. The firing circuit should be examined for good contact and for short circuits. If, after checking, the rocket still fails to fire, the launcher should be unloaded (after observing the hangfire interval), safety devices should be replaced, and the rocket turned in for disposition with a report of the malfunction.

(5) During hangfire intervals and examination of firing circuit, the launcher should point towards the target.

e. Duds. A dud is an item of ammunition which has reached its target but failed to function. A dud must be regarded as liable to function at any time. Unless the cause of the malfunction is evident without moving the dud (for example, failure to remove safety pin or fuze dropping off in flight), the dud will not be moved but will be destroyed in place by authorized and experienced personnel in accordance with the provisions of TM 9-1900.

14. PACKING. Small rockets are packed as assembled complete rounds in sealed fiber or metal containers which, in turn, are packed in wooden boxes. Some medium-caliber rockets are packed unfuzed, others fuzed, in fiber containers which are packed in metal containers (fig. 18) or wooden boxes. Large-caliber rockets are shipped with head and motor unassembled. Complete round may be shipped unassembled in one box or components may be shipped separately. Rocket nose fuzes are packed in individual sealed containers which, in turn, are packed in boxes (fig. 19). Base fuzes are shipped assembled to the rocket head. Dimensions, weights, and other packing and shipping data are published as soon as available in ASF Catalog ORD 11 SNL S-9.

Section III

2.36-INCH ROCKETS

15. DESCRIPTION AND DATA.

a. General. The 2.36-inch rocket (figs. 20 to 24) consists of a head which contains the charge, and a motor and fin assembly, which includes an integral fuze, the motor, and the fin assembly. The head and the fin assembly are full caliber in diameter; the motor tube is approximately one-half caliber in diameter. In earlier models, the head is pointed and the fin assembly is made up of six long radial fins; in later models, the head is rounded and the fin is circular, that is, shrouded.

(1) HEAD. The rocket head varies with each type and model and is described below in the paragraph on the specific model.

(2) MOTOR AND FIN ASSEMBLY. The motor tube is closed at the forward end by a steel cup which contains the fuze mechanism. The forward end is threaded for assembly to the rocket head. The fin assembly is welded to the tube at its rear end.

(3) FUZE. The fuze consists of a simple inertia plunger carrying the firing pin, a creep spring, a primer detonator, and, in high-explosive rockets, a tetryl booster. For safety in handling, the plunger is held in safe position by a safety pin which passes through the plunger and the fuze housing, and clips around the motor tube. This pin is a simple wire clip in earlier models (fig. 20) and a waterproof band-type in later manufacture (fig. 20). When the safety wire is removed, a blow equivalent to dropping the rocket on its nose from a height of 1 foot will cause the plunger to strike the primer with sufficient force to operate the fuze. These fuzes are described in detail in paragraphs 45 and 46.

(4) PROPELLING CHARGE. The propelling charge consists of five sticks of double-base powder each approximately 4.15 inches long. It is ignited by an electric igniter assembled within the motor. The lead wires pass out the nozzle through a plastic closing cup which seals the motor against the entrance of dirt and moisture. The igniter lead wires are of unequal length; the short wire is soldered to a fin and the long wire, called the contact wire, is stripped of insulation near its outer end for attachment to the launcher terminals. For shipping, the contact wire is coiled, to take up the slack, and attached to a fin with tape.

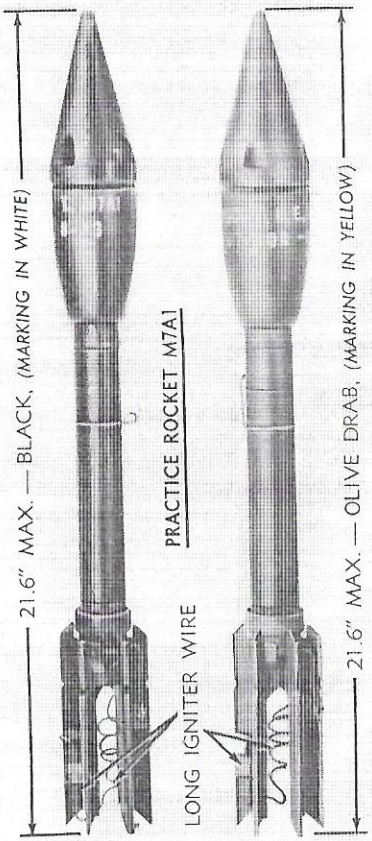


Figure 20 — 2.36-inch Rockets: HE, AT, M6A1 and Practice M7A1

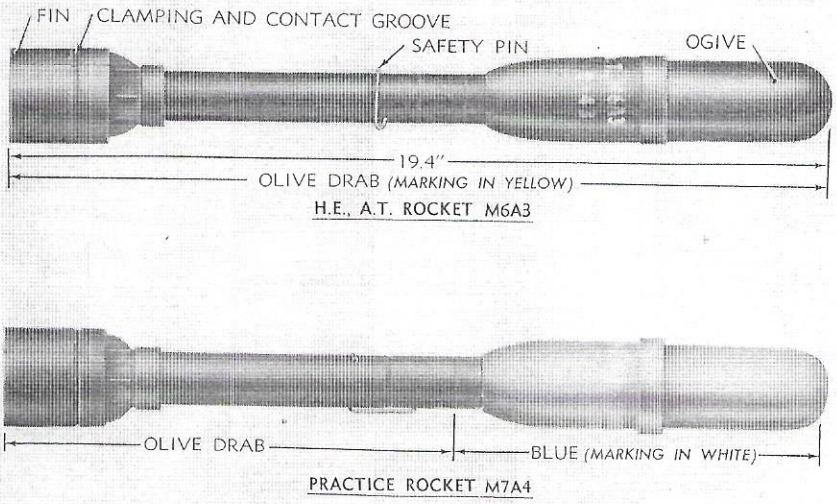


Figure 21 — 2.36-inch Rockets: HE, AT, M6A3 and Practice M7A4

b. Data.

	M6A1	M10 M6A3	M10A1 M6A3D	M10A2 M10A3 M6A3F M6A4 M6A5
Range (max)	600 yd	700 yd	700 yd	700 yd
Dispersion	8.5 mils	6 mils	6 mils	6 mils
Velocity (max)	265 ft per sec	270 ft per sec	270 ft per sec	275 ft per sec
Temperature limits	0 to 120 deg F	0 to 120 deg F	−20 to +120 deg F	−40 to +120 deg F
Burning time	0.08 to 0.03 sec	0.08 to 0.03 sec		
Burn-out point (feet from muzzle)	(Normally within launcher)			

16. 2.36-INCH HE,AT ROCKET M6. This rocket and the corresponding practice rocket M7 are no longer issued, but are to be held for modification to the corresponding A1 models. They resemble the rockets M6A1 and M7A1, but may be distinguished by a contact band, on the nose of the rocket, which is connected to the igniter lead by a wire taped to the body.

17. 2.36-INCH HE,AT ROCKET M6A1.

a. Data. This rocket (fig. 20) is 21.6 inches long and weighs 3.4 pounds. The head is 8.8 inches long and weighs 1.57 pounds. It contains a half-pound charge of pentolite. The propellant consists of 5 cylindrical grains each 0.375-inch diameter by approximately 4.15 inches long. This model may be identified by the pointed nose and the long, radiating fin assembly. The fuze of this model may be expected to function after removal of the safety pin by a blow on

the nose equivalent to a drop of 48 inches on normal soil. It will ordinarily not function on impact with mud, loose sand, or water, nor on glancing impact with normal soil.

b. Effect. This rocket has effect against various targets as follows:

(1) ARMOR PLATE. Penetration of armor found on most tanks may be expected at all ranges. A hole is blown through the armor and heated particles of metal are sprayed through in a cone-shaped pattern. Any ammunition within this pattern is usually exploded.

(2) MASONRY. Penetration of brick and masonry from several inches to a foot or more may be expected, depending on quality of structure.

(3) STRUCTURAL STEEL. Produces shattering effect against cast steels and such materials as girders and railroad rails. Produces extensive damage, probably irreparable, to motor blocks.

(4) WOOD. Penetration of timber from several inches to a foot or more may be expected, depending on the timber.

(5) SOIL. Impact with ground at ranges below 300 yards will ordinarily result in a ricochet rather than a detonation. At ranges in excess of 300 yards, the angle of impact is steep enough to cause a detonation which resembles that of a 75-mm high-explosive shell. However, impact on a very soft materal such as mud, soft sand, or water will not cause detonation of the rocket.

(6) FRAGMENTATION. Fragmentation and antipersonnel effects are slightly greater than 60-mm mortar shell.

18. 2.36-INCH HE,AT ROCKET M6A3.

a. Data. This rocket (fig. 21) is 19.4 inches long and weighs 3.4 pounds. The head is 8.8 inches long and weighs 1.64 pounds. It contains a half-pound shaped charge of pentolite. The propellant and fuze are similar to those of the rocket M6A1 described above. This model may be identified by the rounded nose and shrouded fin assembly.

b. Effect. This model has effect similar to the rocket M6A1 described above.

19. 2.36-INCH HE,AT ROCKET M6A3: MODIFICATIONS.

a. 2.36-inch HE,AT rocket M6A3C. This model (fig. 22) is similar to the rocket M6A3 described above, except that the detonator cover has been omitted in the fuze, thereby making the fuze extremely sensitive. This model will function (with safety pin removed) on a blow equivalent to a drop on normal soil of only 11 inches. Rocket M6A3C is marked, for additional identification, by a half-inch white band around the ogive. The effect of this rocket is similar to that of the rocket M6A1 described above (par. 17),

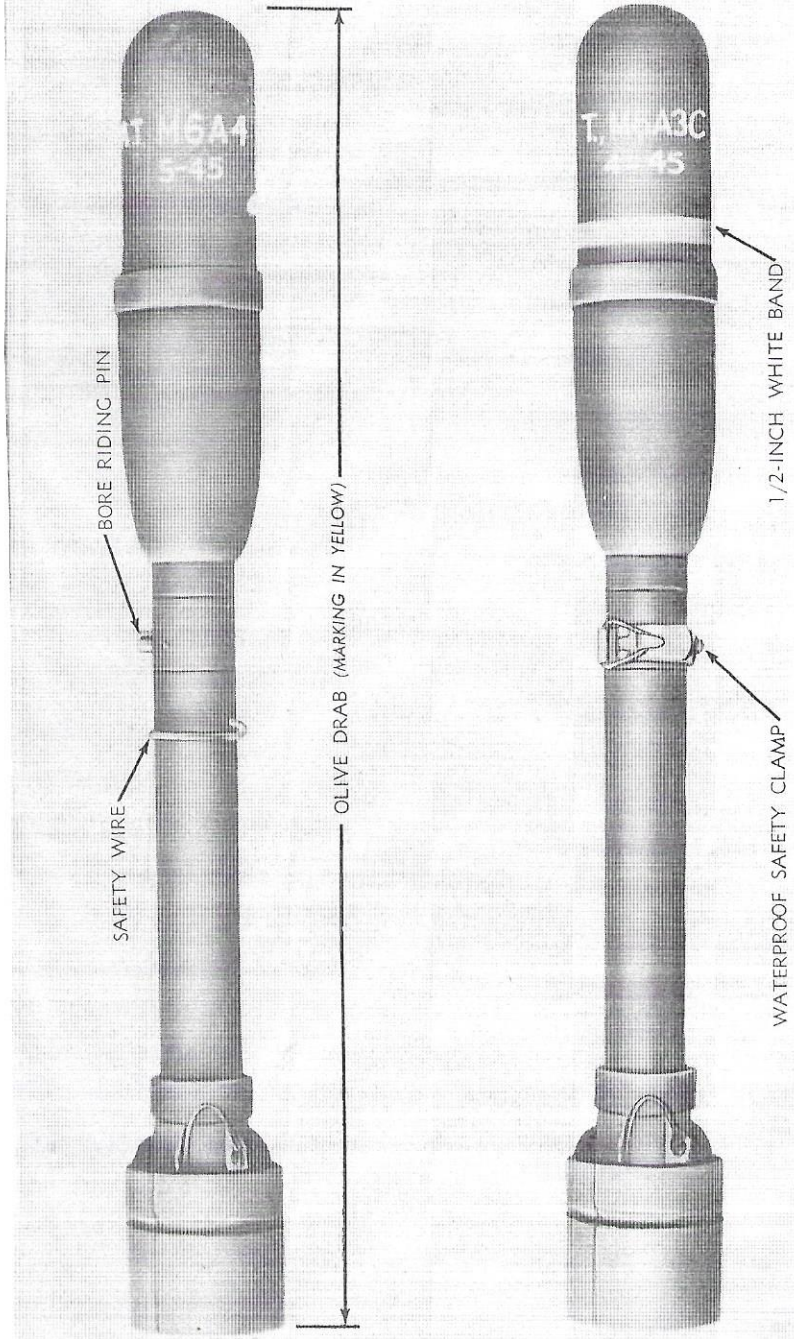


Figure 22— 2.36-inch Rockets: HE, AT M6A4 and M6A3C

except that function may be expected on glancing impact, or on impact with soft soil, heavy brush, or hedge.

b. 2.36-inch HE,AT rocket, M6A3D. This model is similar to the rocket M6A3C except that the propellant is T1E1 (salted) powder, which has better burning characteristics at lower temperatures. The temperature range for motors loaded with this powder is from –20° F to +120° F.

c. 2.36-inch HE,AT rocket M6A3F. This model is similar to the M6A3C except that the propellant is M7 (T4) powder. The safe temperature range is from –40° F to +120° F.

20. 2.36-INCH HE,AT ROCKETS M6A4 AND M6A5. These models (figs. 22 and 23) are similar to the rocket M6A3F except for the fuze. Rocket M6A4 incorporates the base-detonating rocket fuze M400; rocket M6A5 incorporates the fuze M401 (par. 46). Both fuzes employ a bore-riding pin which keeps the fuze unarmed until the rocket leaves the launcher.

21. 2.36-INCH WP SMOKE ROCKET M10.

a. Data. This rocket (fig. 24) is 17.1 inches long and weighs 3.4 pounds. The head is 5.9 inches long and weighs 1.64 pounds. It contains a 0.9-pound charge of phosphorus. The propellant consists of five cylindrical grains each 0.375-inch diameter by approximately 4.15 inches long. This model may be identified by appropriate markings and by the short head without smoke ports. The fuze is similar to that of the HE,AT rocket M6A3 except that the booster is replaced by a long detonator-burster extending into the head (fig. 6).

b. Effect. The WP smoke rocket bursts on impact to produce a spray of phosphorus particles over a radius of 25 yards. The phosphorus ignites spontaneously on contact with air and produces a dense white smoke. The smoke itself is harmless but the burning particles produce painful burns.

c. Development models. During development, the white phosphorus smoke rocket M10 was designated T26E2. The rocket T26E1 differs only in internal burster details; the rocket T26 differs in that the motor is equipped with the long fin, similar to that of the HE,AT rocket M6A1.

22. 2.36-INCH WP SMOKE ROCKETS M10A1 AND M10A2. These models differ from the white phosphorus smoke rocket M10 only in the type of propellant. The motor of the rocket M10A1 is loaded with salted powder T1E1; the safe temperature range of this model is –20° F to +120° F. The motor of the rocket M10A2 is loaded with powder M7 (T4); the safe temperature range is –40° F to +120° F.

Figure 22—2.36-inch Rockets; HE, AT (M6A3C, M6A3D, M6A3F, M6A4, M6A5)

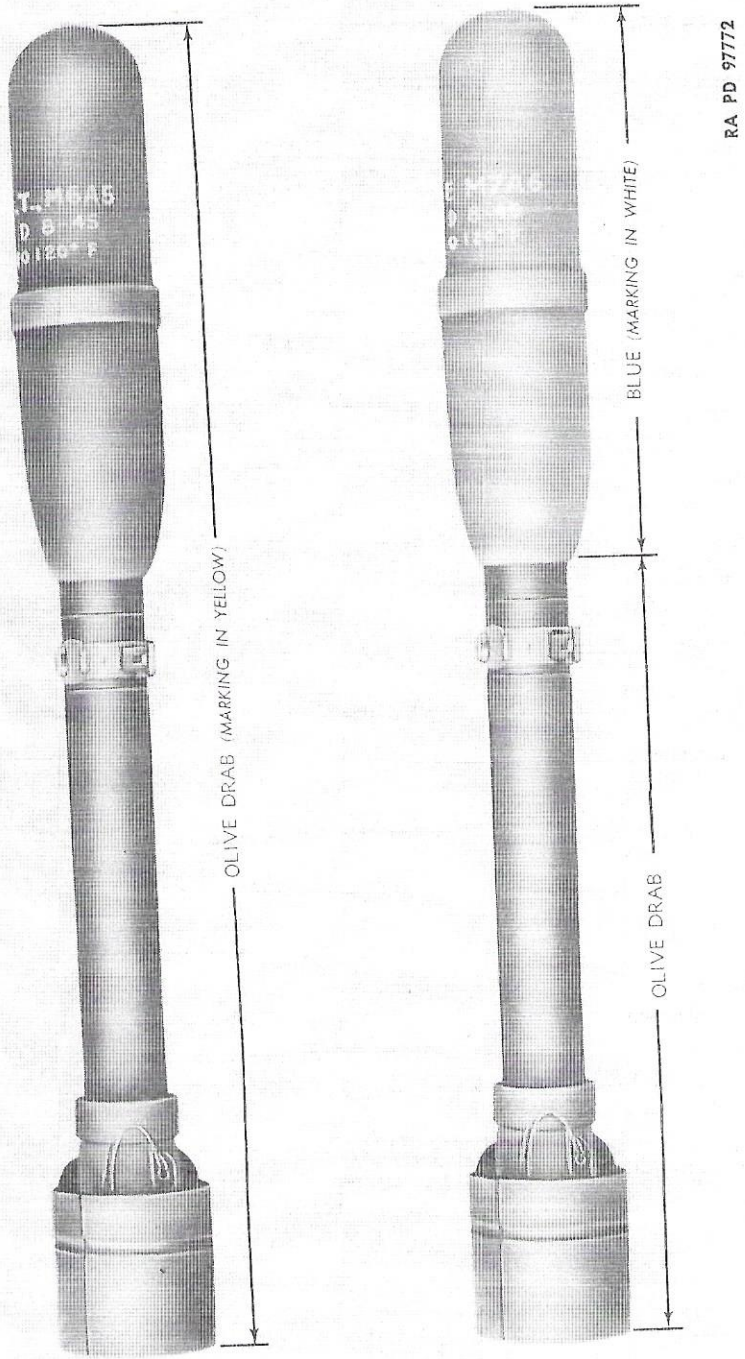


Figure 23 — 2.36-inch Rockets: HE, AT M6A5 and Practice M7A6

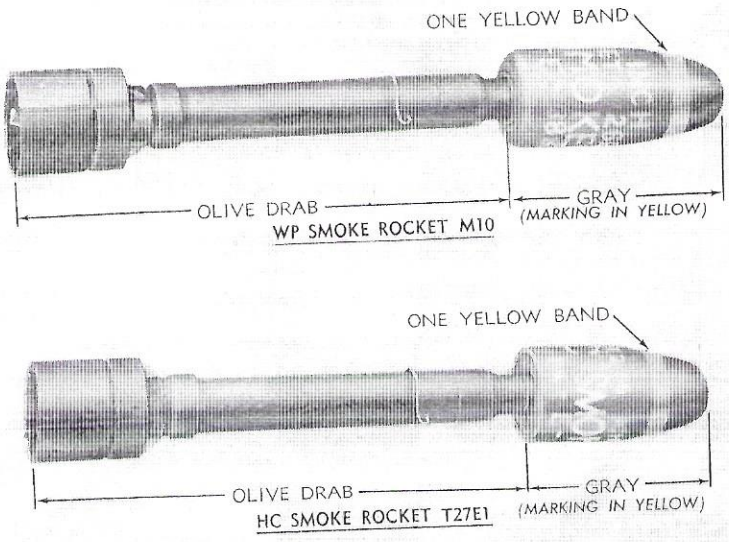


Figure 24 — 2.36-inch Smoke Rockets: WP, M10 and HC, T27E1

23. **2.36-INCH WP SMOKE ROCKET M10A3.** This model is similar to the rocket M10A2 except that it incorporates the boresafe base-detonating rocket fuze M401 (par. 46). The propellant is M7 powder and the safe temperature limits are –40° F to +120° F.

24. **2.36-INCH HC SMOKE ROCKET T27E1.**

a. **Data.** This rocket (fig. 24) is 16.1 inches long and weighs 3.4 pounds. The head is 4.5 inches long and weighs 1.64 pounds. It contains a 1-pound charge of HC smoke mixture. The propellant consists of five cylindrical grains, each 0.375-inch diameter by approximately 4.15 inches long. This model may be identified by appropriate markings and by the short head with a circle of smoke ports in the base. The fuze is similar to the other fuzes for this size of rocket except that it is an igniting rather than detonating type.

b. **Effect.** On impact, the HC rocket ignites and burns for approximately 1 minute producing a cloud of white smoke.

25. **2.36-INCH INCENDIARY ROCKET T31.**

a. **Data.** This rocket is 17.7 inches long and weighs 3.4 pounds. The head is 4.1 inches long and weighs 1.64 pounds. It contains a 1.1-pound charge of thermate. This model may be identified by the short head and the type of motor characteristic of rocket M6A1. The fuze is of the igniting type.

b. Effect. On impact, this rocket ignites and burns, producing extreme heat. It is currently authorized for practice only, but in using it, the incendiary effect on the target should be considered and, when necessary, guarded against.

26. 2.36-INCH PRACTICE ROCKETS.

a. General. Practice rockets are provided to simulate the various modifications of HE,AT rockets in firing for target practice. In general, they are made up of the corresponding service type motor and a head of the same shape, weight, and center gravity as the service round. In earlier modifications, the head is brought up to weight with an iron rod; later modifications use the metal parts of the service head loaded with inert material.

b. Practice rocket M7A1. This model (fig. 20) simulates the HE,AT rocket M6A1. It has the same size, shape, weight, and flight characteristics as the service round.

c. Practice rocket M7A3. This model simulates the HE,AT rockets M6A2 and M6A3C. It consists of the service type motor and an empty head brought up to weight with an iron rod.

d. Practice rocket M7A4. This model (fig. 21) also simulates the HE,AT rockets M6A3 and M6A3C. It differs from the practice rocket M7A3 in that the head is inert loaded rather than weighted.

e. Practice rocket M7A5. This model simulates the HE,AT rocket M6A3D. The motor is loaded with salted powder and has the same safe temperature range, –20° F to +120° F, as the corresponding service round.

f. Practice rocket M7A6. This model (fig. 23) simulates the HE,AT rockets M6A3F, M6A4, and M6A5. The motor is loaded with M7 powder and has the same temperature limits, –40° F to +120° F, as the service rounds.

Section IV

TARGET ROCKETS

27. DESCRIPTION AND DATA.

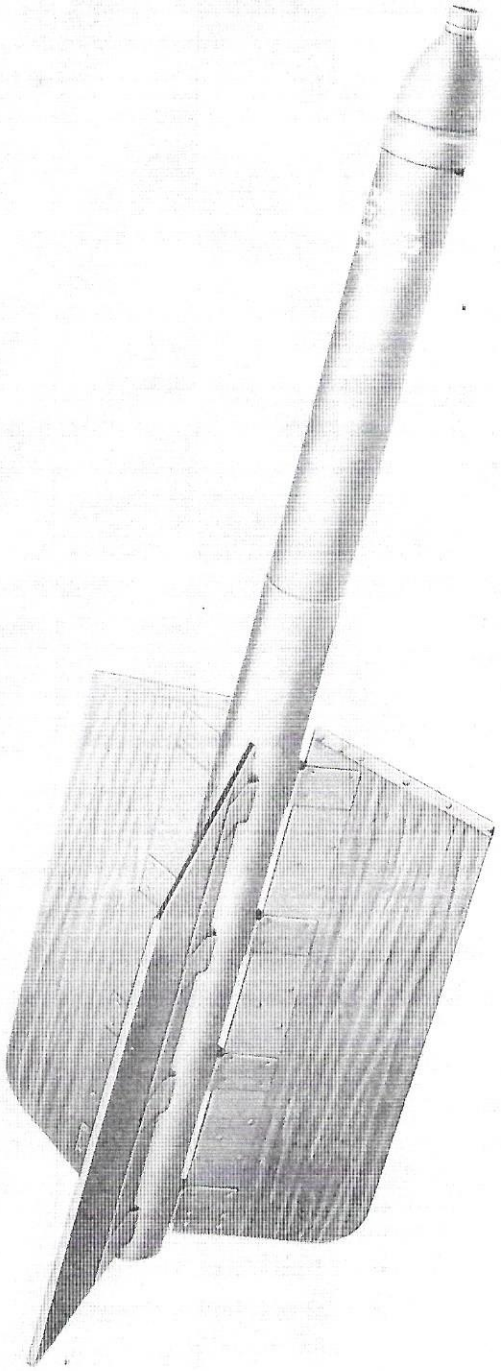
a. General. The 3.25-inch target rocket (fig. 25) is designed to provide a fast-flying target for training of automatic antiaircraft gun crews. It consists of a motor assembled in a long tubular body to which three large plywood fins are attached. Later models have a flare assembled to the nose for increased visibility and easier spotting. The motor is assembled in the forward part of the body and contains a 3.2-pound propelling charge in the form of 18 single-perforated grains strung on the wires of a cage-like support. The individual grains are ⅞-inch outside diameter and 5 inches long. The igniter consists of a charge of black powder divided between a tube in the nose and a pair of cylindrical bags attached to the propellant. The igniter squib is assembled in the tube with one lead grounded to the body of the rocket and the other connected to the nose which is insulated from the body by a fiber disk. The fins are shipped unassembled and are attached to the body by spring hooks. The fins are much larger than necessary to stabilize flight in order to provide a large target area. However, care should be exercised in firing with a cross wind since the large fins cause the rocket to tend to head into the wind.

b. Models.

(1) 3.25-inch AA target rocket M2 is characterized by the ogival nose closed by a standard pipe cap.

(2) 3.25-inch AA target rocket M2A1 is characterized by the addition of a small flare assembly to the nose of the rocket. The flare assembly replaces the pipe cap.

(3) 3.25-inch AA target rocket M2A2 is characterized by a flat nose with the flare assembled thereto, and a different system of igniter contact. This model has the lead wires passing in turn through the nozzle and an inner fiber closing cup, and is connected to a household-type service plug, which is held by an outer fiberboard closing cup.



RA PD 89398

Figure 25 — 3.25-inch AA Target Rocket M2

Eighteen inches of igniter cable coiled between the closing cups provides for withdrawing the plug for connection to the launcher.

c. Data.

MODEL	M2	M2A1
Range (max)	1700 yd	1700 yd
Velocity (max)	530 ft per sec	530 ft per sec
Temperature limits	+30 to +120 deg F	+30 to +120 deg F
Burning time	.25 to .10 sec	.25 to .10 sec
Burn-out point (feet from muzzle)	70 ft	70 ft
Length	59.1 in.	59.9 in.
Weight	35.1 lb	36.3 lb
Flare, burning time	—	30 sec

Section V

4.5-INCH ROCKETS

28. TYPES.

a. There are four general types of 4.5-inch rockets which may be distinguished by the type of stabilization.

(1) FOLDING FIN. This type has a circle of fins pivoted on a ring. Prior to firing, the fin blades are folded into the constriction of the motor forming the nozzle. Set-back due to firing, causes the fins to open to a 12-inch spread. This type is represented by the rockets of the M8 series and rockets T22 and T46 (fig. 26).

(2) CIRCULAR FIN (SHROUDS). This type has a fixed shrouded fin of caliber diameter. It is represented by the Navy-type beach-barrage rocket (fig. 27).

(3) FIXED FIN. This type has a large, fixed, four-vane fin, and is equipped with lug bands for firing from the zero-length rail aircraft launcher. The folding-fin type may be converted to this type by means of kit T23 (fig. 28).

(4) SPIN STABILIZED. This type does not use fins, but uses rotation of the rocket for stabilizing flight (fig. 26).

29. FOLDING-FIN TYPE.

a. General. This type of rocket is cylindrical except for the ogival nose and nozzle constriction at the tail. It is issued as unfuzed complete rounds. There is a corresponding practice round for each service model, the only difference being that the shell of the practice round is loaded with inert filler and uses a dummy fuze.

b. Head. The rocket head consists of a shell body and a burster tube (fig. 7). The shell body is approximately 1.6 calibers in length, and has an ogive of 2 calibers radius. The burster tube extends about 15 inches from the base of the shell body into the motor. In addition to increasing the explosive capacity of the head, the burster tube has the advantage of using the motor as an additional source of fragments. The head contains a fuze well which is closed in storage and transit by a plug screwed into the nose of the shell and held by a set screw. The bursting charge consists of 4.3 pounds of cast TNT.

c. Fuze. The standard impact fuze for the service rocket is the point-detonating rocket fuze M4A2 with auxiliary booster M1A1 (par. 47). The standard fuze for the practice rocket is the dummy rocket fuze M6 (par. 48).

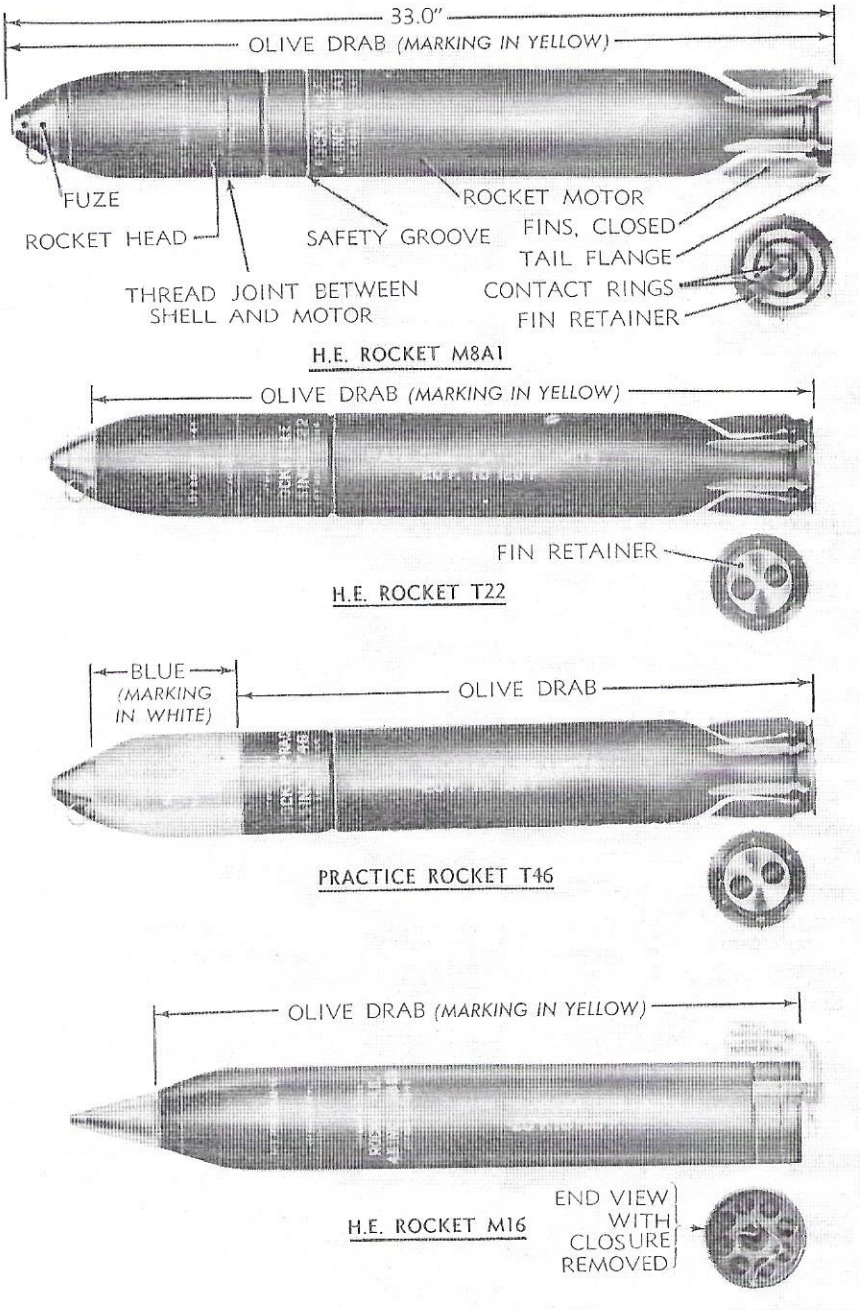
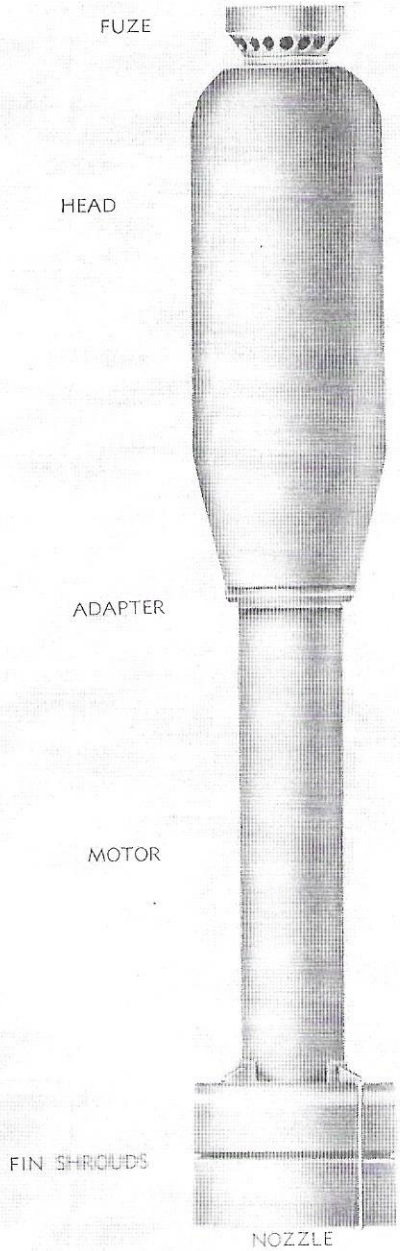


Figure 26 — 4.5-inch Army Rockets



RA PD 104811

Figure 27 — 4.5-inch Beach Barrage Rocket

d. Motor. The basic components of the motor are the motor tube, the propellant, the propellent support, and the igniter. The motor tube is of steel and is constricted near the tail end to form a nozzle. The forward end is threaded for assembly to the rocket head, and the rear end is adapted for attachment of the fin assembly. The fin assembly consists of a fin ring holding a circle of six fins which are held folded into the constriction of the motor tube by a fin retainer. When the rocket leaves the launcher, the fins are opened by set-back to a 12-inch spread. A safety groove is formed in the motor tube to permit it to separate at a definite point, should an excessive pressure be generated within the motor body on firing. Such occurrences are very rare, but can be expected if the rocket is fired when its temperature is above that given as its safe operating temperature, or if the nozzle should become blocked. When separations occur, the shell and the propellent charge will travel forward with low velocity and have a range of from 100 to 1,000 yards. The motor body will be blown backward from the launcher tube for some distance.

e. Propellant. The propelling charge consists of 30 sticks of double-base powder mounted on the wires of a cage-like support. This consists of ten wires attached to a base ring and an annular plate which is slotted to receive the top ends of the wires. The plate rests on a seat formed by a shoulder in the forward end of the motor tube. The weight of powder used varies with each lot. Since the burning rate of smokeless powder varies with the initial temperature, the weight of each charge is adjusted so that, when fired within the temperature range specified for the rocket, excessive and dangerous pressures will not be produced.

f. Igniter. The igniter (figs. 7 and 8) consists essentially of a charge of black powder and an electric squib. In earlier models, the squib and black powder are contained in a plastic cup which is cemented in the nozzle opening. The leads of the squib are connected to a contact disk and a contact ring on the base of the cup. In combination igniters, a percussion primer is assembled in the base. In later models, the igniter is assembled in a long plastic tube attached to the support plate with the igniter wires leading to a contact plate in the nozzle. This plate has, in addition to the contact rings, a cable and plug for electrical connection. When this igniter is used in the launchers equipped with spring contact arms, the plug wires should be cut close to the contact rings.

g. Preparation for use. After removing the packings, the rocket is ready for use except for installation of the fuze (par. 47).

h. Data.

	HE M8 and Pract. M9	HE M8A1 and Pract. M9A1	HE M8A2 and Pract. M9A2	HE T22 and Pract. T46
Length, unfuzed	31.1 in.	31.5 in.	30.5 in.	30.5 in.
Weight	38.1 lb	38.8 lb	38.2 lb	40 lb
Range (max)	4,000 yd	4,000 yd	4,600 yd	4,600 yd
Dispersion	15 mils	15 mils	15 mils	12 mils
Velocity (max)	850 ft per sec	840 ft per sec	850 ft per sec	865 ft per sec
Temperature limits	+20 to +90* deg F	−10 to +105 deg F	−10 to +105 deg F	−20 to +120 deg F
Burning time	0.3 to 0.12 sec	0.3 to 0.13 sec	0.3 to 0.13 sec	0.36 to 0.10 sec
Burn-out point (feet from launcher)	70 to 80 ft	70 to 80 ft	70 to 80 ft	70 to 80 ft
Head, length	7.5 in.	7.5 in.	7.4 in.	7.4 in.
Head, weight	15.25 lb.	16.1 lb	16.1 lb	16 lb
Head, weight of filler	4.3 lb	4.5 lb	4.3 lb	4.3 lb
Propellant, weight	4.65 lb	4.65 lb	4.65 lb	4.75 lb

i. Precautions. In this type of rocket, the fins open to a spread of 12 inches as soon as the rocket leaves the launcher, and care should be exercised to see that there is sufficient clearance.

30. 4.5-INCH HE ROCKET M8 AND PRACTICE ROCKET M9.

a. Description. The original model of the 4.5-inch rocket has a comparatively light shell and motor. As a consequence, safe temperature ranges are narrow, and it is necessary to change the propelling charge to provide for full coverage of the temperature range. As issued, the charge is adjusted for firing at temperatures between 20° F and 90° F. The charge may be modified as described below for firing at temperatures between 50° F and 130° F. The temperature at the time of firing governs the selection of the charge. Under no circumstances should a rocket be fired at a temperature outside the range for which the charge is adjusted.

b. Adjustment of propelling charge. The propelling charge may be adjusted for high temperatures as follows:

(1) Unscrew the head from the motor, using two strap wrenches.

(2) Place the rocket on its tail on a clean level surface, and lift the head out of the motor.

(3) Lift the propellant and support out of the body. Be careful not to rub the igniter bags against the wall of the body.

(4) Remove tape holding wires in place in the plate.

(5) Push wires outward and remove the three silver-painted sticks of powder.

(6) Return wires to slots, and replace tape to hold wires in place.

*For full charge; reduced charge +50 deg F to +130 deg F (par. 30).

(7) Lower assembly into the motor body. Be careful that the powder bags are on the outside of the powder sticks, and that they are not damaged by rubbing against the body when the assembly is lowered into place.

(8) Replace the head in the rocket motor, using the strap wrenches to insure a tight joint.

(9) Mark the rocket to indicate the change in the charge. If rocket is repacked, mark packings as well.

(10) If there is a probability that the low-temperature charge will need to be restored, mark the rocket and the removed sticks so that the same three sticks may be returned to that rocket. It is mandatory that the same sticks be replaced because the weight of the stick varies with each powder lot and is adjusted for each rocket.

31. 4.5-INCH HE ROCKET M8A1 AND PRACTICE ROCKET M9A1. These rockets have a strengthened motor tube and may be fired at temperatures between −10° F and +105° F. No modification of the propelling charge is necessary.

32. 4.5-INCH HE ROCKET M8A2 AND PRACTICE ROCKET M9A2. These rockets in addition to the heavier motor body, have a smaller, heavier-walled shell. Its temperature limits are the same, −10° F to +105° F, and its velocity is slightly higher than the rockets M8A1 and M9A1.

33. 4.5-INCH HE ROCKET M8A3 AND PRACTICE ROCKET M9A3. All fins of these rockets have a slight bur or crimp to insure a tight fit in the fin ring when the fins open. Temperature ranges and other features are otherwise the same as for the rockets M8A2 and M9A2.

34. 4.5-INCH HE ROCKET T22 AND PRACTICE ROCKET T46. These rockets retain the heavier shell of the rockets M8A2 and M9A2. The motor tube is further strengthened and the fin assembly is modified. The igniter is assembled in a tube attached to the trap and extending the length of the propelling charge. Its temperature limits are −20° F to +120° F.

35. CIRCULAR-FIN (SHROUD) TYPE.

a. General. This type rocket (figs. 5 and 27) is commonly called the beach-barrage rocket. It consists of a streamlined head, motor and fin assembly, and nose fuze, all issued separately. Head and fin assembly are full caliber but the motor is of smaller diameter.

b. Head. The head is cylindrical with a hemispherical nose and tapered rear. There is a fuze well opening in the nose, and an adapter for attachment of the motor at the tapered end. Both are

protected by shipping plugs in storage and transit. An auxiliary booster is shipped in the fuze well of the high-explosive round.

c. Motor. The motor is a steel tube 2.25 inches outside diameter and 15 inches long. It contains an electric igniter, a propelling charge consisting of a single large grain, a grid-like support and a bag of drying agent. Both ends of the motor are sealed by waterproof fiber disks. The forward end of the motor is threaded for assembly to the adapter in the head; the rear end carries two fin shrouds which serve as flight stabilizers and as electrical contacts for the igniter. A shortening clip connects the two shrouds to protect against accidental ignition. This clip must be removed when the rocket is loaded into the launcher.

d. Fuze. The standard fuze for the high-explosive round is the rocket nose fuze Mk137 (par. 51). Fuze Mk145 (0.02-sec delay) may also be used. The standard fuze for the smoke rocket is the rocket nose fuze Mk154 which is the same as the fuze Mk137 with a long burster replacing the booster in the base of the fuze.

e. Preparation for use. Prior to use, it is necessary to assemble the round as follows:

(1) Unpack components and inspect for serviceability (par. 12).

(2) Remove shipping plug from adapter and protection *cap* from motor tube. Leave the closing *disk* in place.

(3) Screw motor into adapter and tighten with strap wrench. Be sure at least 1 inch of threads is engaged.

(4) Remove shipping plug from fuze well. Make sure that booster is in place for high-explosive rocket or that burster well is clear for smoke rocket.

(5) Inspect fuze and screw into place. Tighten with fuze wrench.

(6) Remove fuze safety wire and shroud shorting clip when loading the rocket into the launcher.

(7) If rocket is returned to storage, reverse the above steps.

f. Data.

	High Explosive	Smoke
Model, shell	4.5", Mk3	4.5", Mk7
Model, motor	2.25", Mk9	2.25", Mk9
Model, fuze	{Mk137 (SQ) / Mk145 (0.02-sec delay)}	Mk 154
Complete round with fuze, length	30 in.	37 in.
Complete round, weight	29 lb	29 lb
Range (max)	1,130 yd	1,130 yd
Dispersion	37 mils	37 mils
Velocity (max)	360 ft per sec	360 ft per sec
Temperature limits	+10 to +120 deg F	+10 to +120 deg F
Burning time	0.30 sec	0.30 sec

	High Explosive	Smoke
Head, length	16 in.	23 in.
Head, weight	20 lb	20 lb
Head, filler type	TNT	FS
Head, weight of filler	6.4 lb	12.1 lb
Propellant grain	Mk 1	Mk1
Propellant, grain	1.4 lb	1.4 lb

36. FIXED-FIN TYPE.

a. General. This type of rocket (fig. 28) is a high-velocity type for zero-length aircraft launchers. It is cylindrical except for the ogival nose and the fin assembly. There are two service heads, high-explosive and semi-armor-piercing, and the corresponding practice rounds. All rounds use the same motor. Head, motor, and fin assembly are issued separately, as is the fuze for the high-explosive round. Lug bands are assembled to the motor as issued.

b. Components.

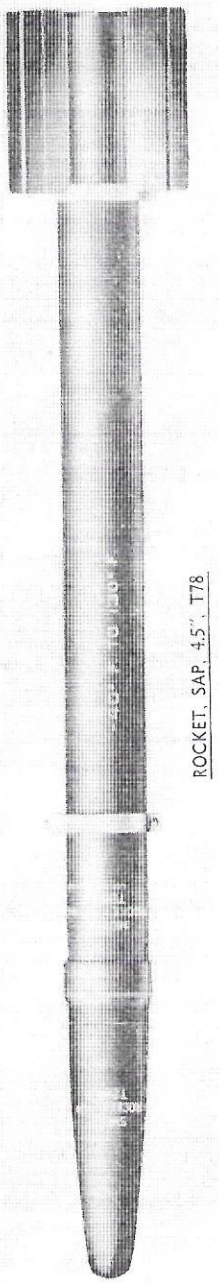
(1) Rocket, HE, 4.5″, T83, consists of:
Shell, rocket, HE, 4.5″, T2002, unfuzed
Motor, rocket, 4.5″, T2000
Fuze rocket, nose, Mk149 (Navy)
Fin, assembly, for 4.5″ rocket motor, T2000
Wire, arming, assembly

(2) Rocket, practice, 4.5″, T87, consists of:
Shell, rocket, practice, 4.5″, T2003, unfuzed
Motor, rocket, 4.5″, T2000
Fuze, rocket, dummy, Mk149
Fin, assembly, for 4.5″ rocket motor, T2000
Wire, arming, assembly

(3) Rocket, SAP, 4.5″, T78, consists of:
Shell, rocket, SAP, 4.5″, T2000, w/BD fuze, T156
Motor, rocket, 4.5″, T2000
Fin, assembly, for 4.5″ rocket motor, T2000

(4) Rocket, practice, 4.5″, T86, consists of:
Shell, rocket, practice, 4.5″, T2001
Motor, rocket, 4.5″, T2000
Fin, assembly, for 4.5″ rocket motor, T2000

c. Head. The high-explosive shell is comparatively thin walled with a correspondingly large charge of explosive. The nose of the shell is closed by an adapter and fuze seat liner assembly; the base is threaded externally for assembly of the motor. An auxiliary booster, Mk3 Mod1 (Navy), is shipped in the fuze seat protected by a chipboard disk and a shipping plug. The base threads are protected by a shipping cap. The SAP head is of heavy-walled construction and is threaded at the base for assembly of the motor. It



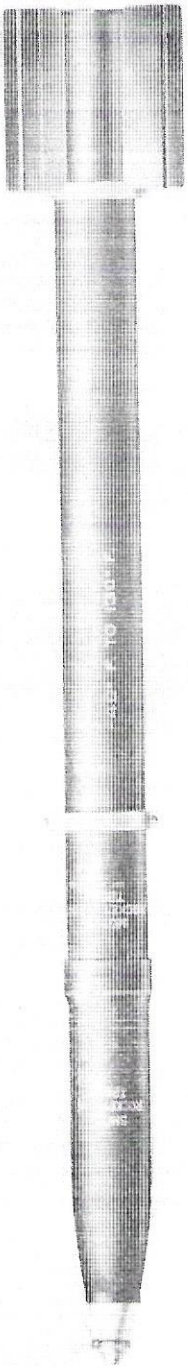


Figure 28 — 4.5-inch Fixed Fin Rockets

tapers from the base to a rounded nose. Base-detonating fuze T156 is assembled as shipped. Base threads and fuze are protected by a shipping cap.

d. Fuzes. The nose fuze Mk149, for the high-explosive rocket, is described in paragraph 56. The base fuze T156, for the semi-armor-piercing rocket, is a simple inertia-type fuze with an 0.01-second delay. Upon impact, the weighted firing pin in this fuze shears a washer and moves forward to strike the primer.

e. Motor. Rocket motor T2000 consists of motor tube, propelling charge, igniter, closing cap, lug bands, and fin assembly. The body is a steel tube closed at the forward end by a steel coupling and constricted to the rear to form the nozzle. The coupling is threaded internally for assembly to the motor and the shell. The fin assembly consists of four large flat fins mounted radially on a metal sleeve. It is held in place by a retainer ring threaded on the end of the nozzle. The lug bands comprise one button-type band and one zero-length band assembled 45.53 inches and 10.25 inches, respectively, from the base of the rocket.

f. Propelling charge. The propelling charge consists of 12 single-perforated sticks of powder $\frac{7}{16}$ inch inside diameter and 1.22 inches outside diameter by 20.6 inches long. The sticks are mounted in two banks of six each on the bars of a cage-like support.

g. Igniter. The igniter consists of 2⅔ ounces of black powder and an electric squib assembled in a plastic tube approximately 6¾ inches long and 1 inch in diameter. The igniter assembly is suspended from the forward end of the propelling charge in the center of the motor. The igniter lead wires pass to the rear through a plastic closing cap cemented in the throat of the nozzle, and terminate in a phone-type plug. The plug and about 2 feet of igniter cable are held in the flare of the nozzle by a fiber cap cemented in place. A loop of cord is passed through the cap to facilitate removal when the rocket is prepared for firing.

h. Preparation for use of HE rocket.

(1) Remove components from packing and inspect for serviceability.

(2) Remove fin retainer ring from motor. Place fin assembly on motor with locating lug of fin in rear lug band. Replace fin retainer ring and tighten.

(3) Remove shipping cap from head and assemble head to coupling. Tighten with strap wrenches.

(4) Remove shipping plug and chipboard filler from nose of shell. See that auxiliary booster is in place. Screw in the nose fuze and tighten with fuze wrench.

Figure 28 — 4.5-inch Fixed Fin Rockets

(5) Turn the cap clamp of fuze to proper position and insert arming wire. Adjust the arming wire so that the loop can be attached to the launcher arming wire release without strain and without slack. Place a Fahnestock clip on the wire against the fuze and cut off wire 2 inches in front of the clip. Be sure there are no kinks or burs.

(6) When loading launcher, remove safety wire from fuze, and remove outer closing cap from motor nozzle. Draw the igniter plug from the nozzle, remove the shorting cap, and insert plug in the launcher outlet. Be sure not to pull on the cable so hard as to loosen the inner cap.

i. Preparation for use of SAP rocket.

(1) Remove components from packing and inspect for serviceability.

(2) Remove fin retainer ring from motor. Place fin assembly on motor with locating lug of fin in rear lug band. Replace fin retainer ring and tighten.

(3) Remove shipping cap from base of shell and remove safety from fuze. Assemble shell to coupling and tighten with strap wrenches.

(4) When loading launcher, remove the outer closing cap from motor nozzle. Draw the igniter plug from the nozzle, remove the shorting cap, and insert plug in launcher outlet. Be sure not to loosen the inner closing cap.

j. Preparation for firing of practice rocket. Practice rockets are prepared for firing in the same manner as specified above for the corresponding service rounds.

k. Return to storage. If rocket is to be returned to storage, reverse the above steps returning components to original condition and packings.

l. Data.

	HE T83 and Practice T87	SAP T78 and Practice T86
Length	75.88 in.	70.89 in.
Weight	98 lb	98 lb
Range, effective	1,500 yd	1,500 yd
Dispersion, lateral (probable error)	5 mils	5 mils
Velocity (max) (relative to aircraft)	1,000 ft per sec	1,000 ft per sec
Temperature limits	−40 to +130 deg F	−40 to +130 deg F
Burning time	0.7 to 0.3 sec	0.7 to 0.3 sec
Burn-out point	700 to 300 ft	700 to 300 ft
Head, length	16.68 in.	15 in.
Head, weight	39 lb	39 lb
Head, weight of filler	8.8 lb	2.8 lb
Propellant	14 lb	14 lb
Fuze, model	Mk149	T156
Fuze, type	PD, SQ	BD, 0.017-sec delay

m. Precautions. The rocket motor T2000, unlike other motors shipped separately, is closed by a steel cap. Consequently, on accidental ignition, the motor will take off at full velocity, whether or not the shell is assembled.

37. SPIN TYPE.

a. General. The spin-type rocket (figs. 7 and 26) is cylindrical throughout except for the ogival nose and a groove near the base. A contact ring assembly is crimped to the nozzle plate on the base of the rocket. The rocket is issued as an unfuzed round.

b. Head. The rocket head is the same as that for the folding-fin type (par. 29) except that the fuze seat is designed for smaller artillery-type fuzes.

c. Fuzes. The fuze authorized for use with the spin-type rocket is the point-detonating fuze M81. This fuze consists of the fuze M48A2 (SQ-0.05-sec delay) assembled with the booster M24. The alternate fuze approved is the fuze M48A2 (SQ-0.05-sec delay) assembled with the booster M21A1. No other type of booster can be used. The fuze and booster for this round will be staked together and shipped as a unit. However, if such units are not available, components of fuze and booster as stated above may be assembled in the field.

d. Motor. The motor tube (fig. 7) is a cylindrical steel tube threaded at one end for assembly to the shell, and at the other for assembly of the nozzle plate. It contains the propelling charge and the igniter. The nozzle plate is a thick steel plug pierced by eight nozzles arranged in a circle and a central vent which is normally closed by a blow-out plug. The nozzles are inclined at an angle to impart rotation as well as driving thrust. The plug in the central vent is designed to blow out when motor pressures exceed a predetermined limit. The closing cap consists of a metal collar crimped to the nozzle plate and a plastic disk cemented in place. An insulated contact ring is assembled on the collar and a safety shorting strip connects the contact ring and nozzle plate.

e. Propellant. The propelling charge is similar to that for the folding-fin type rocket described in paragraph 29.

f. Igniter. The igniter consists of a charge of black powder and an electric squib assembled in a long flat plastic tube which is hung from the support plate beside the propellent sticks. The lead wires are tied to the trap ring and pass through one of the nozzles. One wire is grounded to the nozzle plate; the other is connected to the contact ring on the closing cap.

g. Preparation for use. The spin-type rocket is prepared for use as follows:

(1) Remove from packings and inspect for serviceability. If the closing cap or closing disk is loose, it may be replaced if it can be determined that no moisture or other foreign material has entered the motor.

(2) Remove nose plug and assemble fuze. Tighten with fuze wrench. Some models may have a set screw in the fuze adapter. In this case the set screw should be loosened to remove the nose plug and tightened after assembly of the fuze.

(3) Set fuze for desired action (par. 49).

(4) Remove safety shorting strip when loading the rocket into the launcher.

(5) If the rocket is returned to storage, reverse the above steps, returning the rocket to its original condition and packings.

h. Data.

	HE, M16, M20 and Pract. M17, M21
Length, unfuzed	27.75 in.
Weight	42.5 lb
Range (max)	5,200 yd
Dispersion	9 mils
Velocity (max)	890 ft per sec
Temperature limits	–20 to +130 deg F
Burning time	0.36 to 0.10 sec
Burn-out point, feet from launcher	80 ft
Head, length	9.4 in.
Head, weight	17 lb
Head, weight of filler	5.2 lb
Propellant, weight	4.75 lb
Fuze (HE)	M81, SQ-0.05-sec delay
Fuze (practice)	M73, dummy

i. Models.

(1) The standard high-explosive and practice rounds described above are designated respectively:

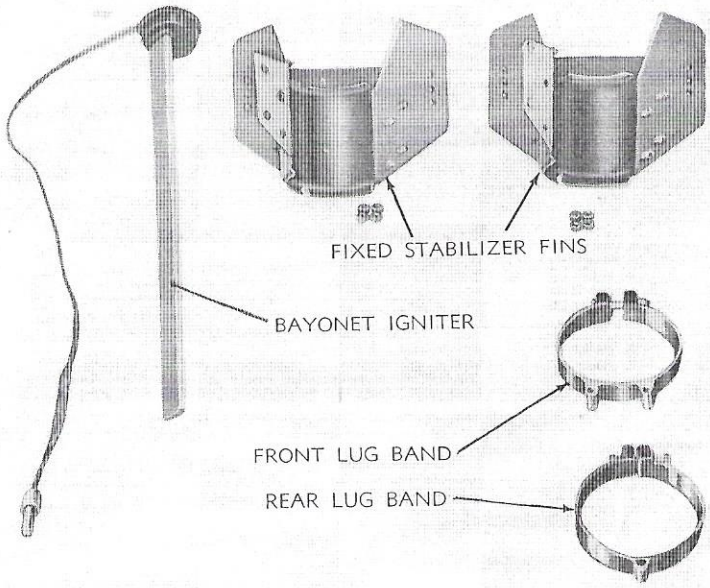
ROCKET, HE, 4.5", M16
ROCKET, practice, 4.5", M17

NOTE: *Rockets M16 and M17 were formerly designated T38E and T39E3, respectively.*

(2) Modifications, for use with expandable launchers (par. 11), which differ in that the igniter wires are not connected to the contact rings but are brought through the closing disk and connected to spools of wire, are designated:

ROCKET, HE, 4.5", M20
ROCKET, practice, 4.5", M21

NOTE: *Rockets M20 and M21 were formerly designated T38E7 and T39E7, respectively.*



RA PD 104813

Figure 29 — 4.5-inch Aircraft Rocket Kit T23

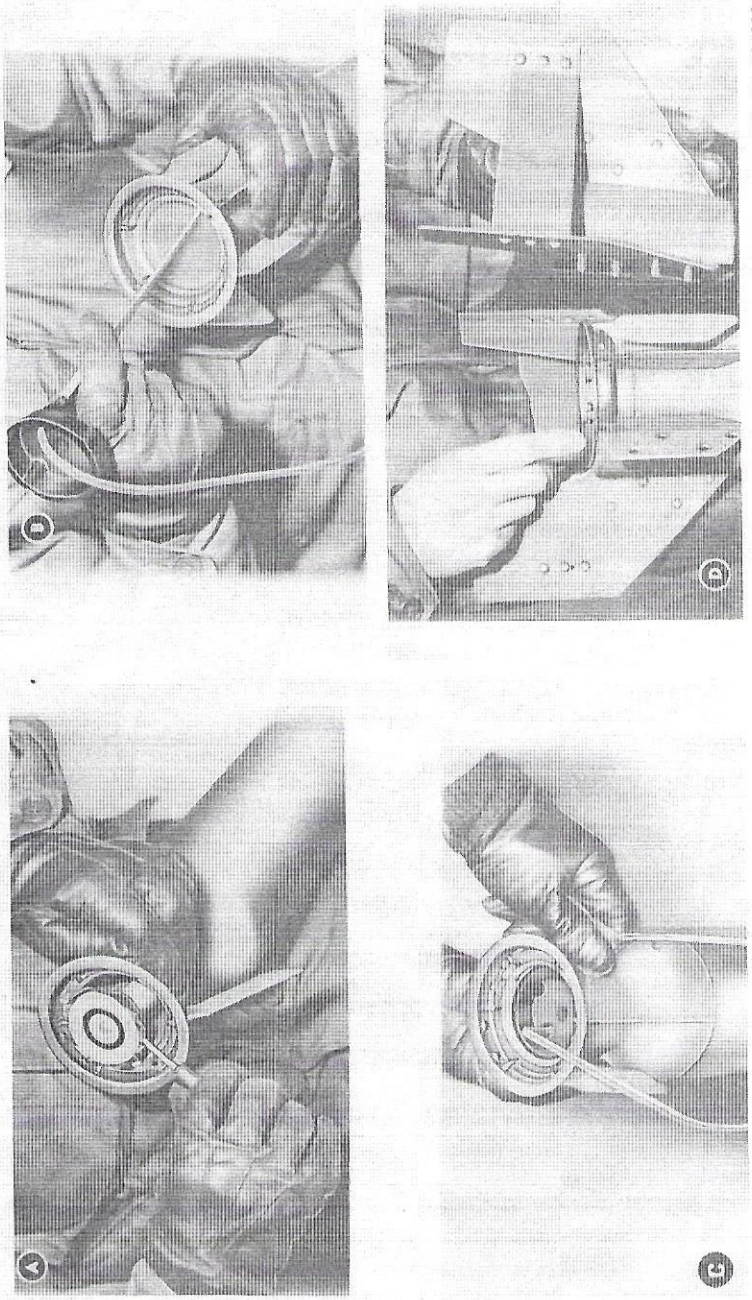
(3) Modifications which have a deep fuze well, similar to that of the folding-fin type, are designated respectively:

ROCKET, HE, 4.5″, T38E2
ROCKET, HE, 4.5″, T38E8
ROCKET, practice, 4.5″, T39E2

NOTE: *Rockets T38E2 and T38E8 are the same except that rockets T38E8 has its deep cavity partly filled in with a removable supplementary explosive charge, thus making it adaptable for use with fuzes requiring deep or shallow cavities.*

38. 4.5-INCH AIRCRAFT ROCKET KIT T23.

a. Description. This conversion kit is issued to modify folding-fin type rockets to the fixed-fin type (fig. 29). Each kit consists of a front and a rear lug band, a fin assembly, a bayonet-type igniter, and a supply of sealing compound. The forward lug band carries two loops positioned at eleven and one o'clock; the rear band carries a single loop at twelve o'clock. The fin assembly is in two parts, each consisting of two vanes connected by a flat brace and attached to a flanged half-sleeve. The igniter consists of a 20-inch flat, plastic tube mounted on a plastic closing cup. The outer 14-inch section of the tube contains approximately 1 ounce of black powder and an electric squib held between two plugs; the inner section contains the



RA PD 104812

Figure 30 — Conversion of M8 Rocket

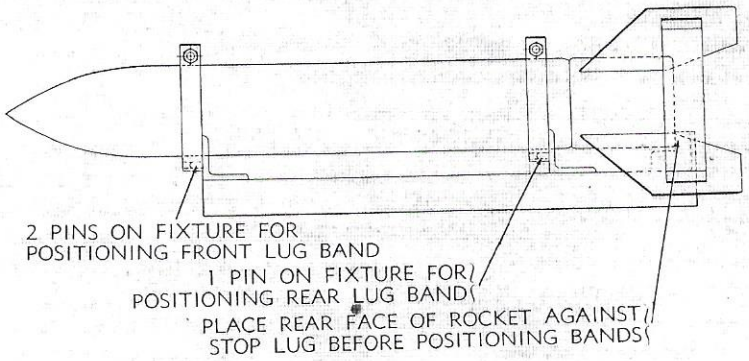


Figure 31 — Fixture for Positioning by Bands

squib lead wires and may be filled with inert material. The lead wires pass through the closing cup and are connected to a phone-type plug.

b. Conversion. Since use of the conversion kit involves black powder operations, all precautions should be observed (TM 9-1900).

(1) ASSEMBLY FIN (fig. 30). Place fin assembly so that the rear of the fin sleeve butts against, but does not cover, the fin flanges of the rocket. Bolt the two halves of the assembly together so that it will not slip.

(2) ASSEMBLE LUG BANDS. Place rear lug band (single loop) over rocket in approximate position, then place the forward lug band (two loops) over the joint between head and motor. Use a launcher adapter rail or the fixture supplied (fig. 31) for final positioning of the bands. Be sure that the fin vanes are at 45 degrees and that the fin braces are vertical. Tighten the lug bands securely.

(3) REPLACE CUP-TYPE IGNITER. Earlier models have the igniter cup assembled to the contact plate which is cemented in the rocket nozzle (for example, rocket M8 (fig. 7)). This type of igniter is removed and replaced by the bayonet igniter supplied in the kit (fig. 30). Place the rocket tail up, in a suitable holding device. If a shop vise is used, the jaws should be faced with wood, fiber, copper, or other nonsparking material. Use nonsparking tools. Punch or drill a hole in the contact plate near the surface of the nozzle. Be careful not to puncture the igniter cup and, in case of those models with percussion primers (fig. 8), be very careful not to strike the percussion primer in the center of the plate. Pry out the plate and clean residual cement from the nozzle. Insert the end of bayonet igniter by feeling for the space between the burster tube and powder trap. Spread a thin coat of sealing compound on the tapered surface

RA PD 104812

Figure 30 — Conversion of M8 Rocket

of the closing cup and press it firmly in place in the rocket nozzle. In order not to loosen the igniter, handle the assembly with care for about 2 hours, until the cement sets.

(4) MODIFY SUSPENDED IGNITER. Later models have the igniter charge suspended to the powder trap with lead wires connecting it to the contact plate in the rocket nozzle. This type is similar to the igniter of the rocket M16 (fig. 7). This type of igniter is modified by removal of the contact plate and substitution of closing cup and igniter cable of the bayonet igniter assembly. Remove the powder charge intact from the bayonet igniter by cutting the tube between the inner plug and closing cup—4 to 5 inches from the inner face of the cup. Cut the plastic tube back about 2 inches toward the cup and strip an inch of insulation from each of the lead wires exposed. Remove the contact plate from the rocket as described above and cut the lead wires as close to the plate as possible. Strip an inch of insulation from each wire. Splice one wire from the rocket to one wire from the modified bayonet igniter cup and insulate the splice. Splice the other two wires and insulate. Spread a thin coat of sealing compound on the tapered surface of the closing cup and press it firmly in place. Let cement set for 2 hours before placing any strain on the assembly.

(5) DISPOSAL OF IGNITERS. Igniter cups removed from rockets and charges of modified bayonet igniters will be disposed of in accordance with regulations governing the destruction of large artillery primers (TM 9-1900).

Section VI

5-INCH ROCKETS

39. DESCRIPTION.

a. General. The 5-inch rocket is designed for firing from aircraft rocket launchers of the post type (zero-length). Included in this category, because of similarity in use and construction, are: (1) high-velocity aircraft rocket, 5″.0 HVAR; (2) aircraft rocket, 5″.0 AR; (3) 3.5-inch aircraft rocket, 3″.5 AR; and (4) 2.25-inch subcaliber rocket, 2″.25 SCAR.

b. Head. The 5-inch rocket head is an adaptation of an antiaircraft artillery shell. It is designed for both nose fuze and base fuze although either may be replaced by a steel plug. The HVAR head is threaded externally at the base for assembly of the 5-inch motor; the AR head has an adapter threaded internally for assembly of the 3.5-inch motor. The same 3.5-inch motor is used with a solid head to make up the 3.5-inch AR rocket. The 2.25-inch subcaliber rocket head is solid, for target practice, and is adapted for a 2.25-inch motor.

c. Motor. All motors for aircraft rockets are similar in construction except for size. They are threaded forward for attachment of the head and have nozzle and fin assembly to the rear. Front and rear openings are protected by waterproof disks. The igniter is assembled in a flat container in the front end of the motor. The propellant consists of a single grain. The igniter lead wires pass through the length of the motor and out through the nozzle and closing disk, and are connected to a plug.

d. Fuzes. Base fuzes assembled to the 5-inch rocket head are of the pressure-arming, impact-operating type (PIR) (par. 53). Nose fuzes for the 5-inch heads are of the vane (propeller)-arming, impact-operating type (par. 51), some of which require the use of an arming wire similar to bomb fuzes. The arming mechanism is similar to that of a bomb shackle. The rocket can be fired with the nose fuze armed or safe, thus making selection between superquick action of nose fuze and delay action of base fuze possible at the time of firing.

e. Data.

	5"/0 HVAR	5"/0 AR	3"/5 AR	2.25" SCAR
Length	68.9 in.	65.8 in.	54.7 in.	29.2 in.
Weight	134 lb	85.5 lb	54.7 lb	11.9 lb
Range (maximum effective)	4,000 yd	2,000 yd	4,000 yd	2,000 yd
Velocity (max)	1,350 ft per sec	760 ft per sec	1,150 ft per sec	1,170 ft per sec
Temperature limits	0 to +120 deg F	0 to +120 deg F	0 to +120 deg F	0 to +120 deg F
Burning time	1.4 to 0.9 sec	1.5 to 0.61 sec	1.5 to 0.61 sec	0.91 to 0.38 sec
Burn-out point (static firing) (feet from launcher)	575 to 950 ft	230 to 530 ft	350 to 800 ft	230 to 480 ft
Head, length	16.73 in.	18.3 in.	10.35 in.	3.7 in.
Head, diameter	5 in.	5 in.	3.5 in.	2.25 in.
Head, weight	45.5 lb	48 lb	20 lb	1.6 lb
Head, weight of filler	7.5 lb	8 lb	—	—
Motor, diameter	5 in.	3.25 in.	3.25 in.	2.25 in.
Motor, length	51.4 in.	46 in.	46 in.	26 in.
Motor, propellant, weight	24.8 lb	8.5 lb	8.5 lb	1.75 lb
Nose fuze, model	Mk149	Mk149	Mk149	None
Nose fuze, type	AIR-SQ	AIR-SQ	AIR-SQ	—
Base fuze, model	Mk159	Mk159	None	None
Base fuze, type	PIR-0.015-sec delay	PIR-0.015-sec delay	—	—

f. Preparation for firing.

(1) Remove components from packings and inspect for serviceability. Rocket heads should be inspected to see that fuze and adapter threads are clear, that nose fuze well contains an auxiliary booster, and that heads adapted for base fuze have the base fuze assembled. Motors should be inspected to see that they are free from dents, that threads are clear, that closing disks and short circuit clips are effectively in place, that fins are not bent, and that lugs appropriate to the launcher or adapter are securely in place. Fuzes should be inspected as specified for the particular fuze (sec. IX).

(2) Remove shipping plugs and caps and assemble motor and head. Tighten with strap wrenches. If necessary, assemble fin to motor.

(3) Assemble fuze to head as prescribed by paragraph on the particular fuze (sec. IX).

(4) Remove shorting clip from igniter plug and safety wire from fuze after rocket is loaded on the launcher.

g. **Precautions.**

(1) Be sure that rockets adapted for base fuze have the fuze assembled. If such a rocket is fired with the base fuze missing, the head will detonate on the launcher when the rocket is fired.

(2) In case of misfire, wait 10 minutes before approaching the launcher. If the igniter has fired, base fuzes must be regarded as armed and the round handled with extreme care until it can be destroyed.

40. MODELS.

a. Differences in various models are described below:

(1) 5″.0 HVAR. The 5″.0 rocket heads Mk5 and Mods and Mk6 and Mods are essentially the same except for details of the base fuze assembly. The 5″.0 rocket motors differ principally in the fin assembly; Mk1 and Mk2 Mod0 had fins welded to the motor; Mk2 Mod2 had fins attached to a sleeve which is assembled to the motor as issued; and Mk2 Mod3 has fins issued separately.

(2) 5″.0 AR. The 5″.0 rocket head Mk1 can be distinguished from the HVAR by the internally threaded motor adapter. The various modifications of the 3″.5 rocket motor Mk7 are in details of nozzle construction.

(3) 3″.5 AR. The 3″.5 rocket head has been manufactured in TNT-, FS-, WP-, and special-loaded models. However, the only types currently issued through Army ordnance channels are the solid shot Mk2 and Mk8.

(4) 2″.25 SCAR. The subcaliber rocket is supplied in two types to match trajectories of the 5″.0 HVAR and 5″.0 AR, respectively. This was formerly accomplished by providing a light and a heavy head. At present the weight of the head is kept constant and the motor varied. The 2″.25 rocket head Mk1 and Mods or Mk3 and Mods is used with 2″.25 rocket motor Mk10 and Mods (fast motor) to match the trajectory of the HVAR; and with the 2″.25 rocket motor Mk12 (slow motor) to simulate the AR.

Section VII

7.2-INCH ROCKETS

41. TYPES.

a. General. The 7.2-inch rocket (fig. 32) is a high-capacity projectile for ground firing. The head and fin assembly are of caliber diameter; the diameter of the motor is varied to obtain the desired ballistic properties. High-explosive, chemical, and practice shell are provided, with point or base fuzing as required. Shell and motor are issued unassembled, but may be packed together (fig. 33).

b. Models. The chemical rocket T21 and high-explosive rocket T24 are for medium ranges; the high-explosive rocket T37 is for short-range demolition.

c. Head. The rocket head is pear-shaped, with a tapered tail and a hemispherical or flattened nose for the medium-range and short-range models, respectively. Round-nose shell are adapted for nose fuze, and flat-nose shell are adapted for base fuze. Practice shell are similar to the corresponding service types except for inert filler.

d. Motor. The motors are similar to those for 5″.0 AR and 4″.5 BR rockets described above except that shrouded fins 7.2 inches in diameter, are assembled to the motor and the igniter leads are connected to the forward (live contact) and rear (ground contact) fin shrouds.

42. MODELS.

a. 7.2-inch chemical rocket T21. This round is issued with shell, fuze and burster, and motor unassembled. These components may be packed in the same box, with fuze and burster packed separately, or with all three packed separately. The complete round is assembled as follows:

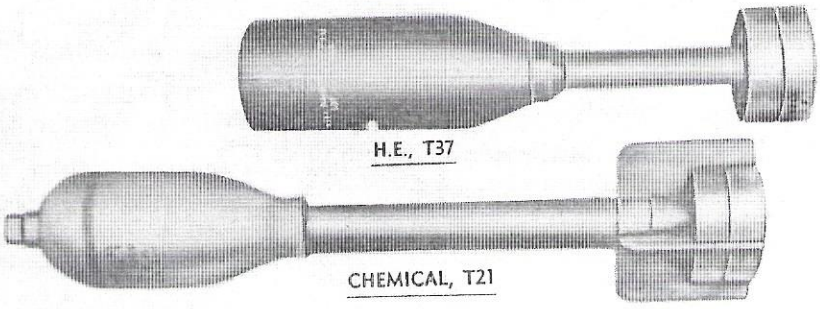


Figure 32 — 7.2-inch Rockets, Assembled

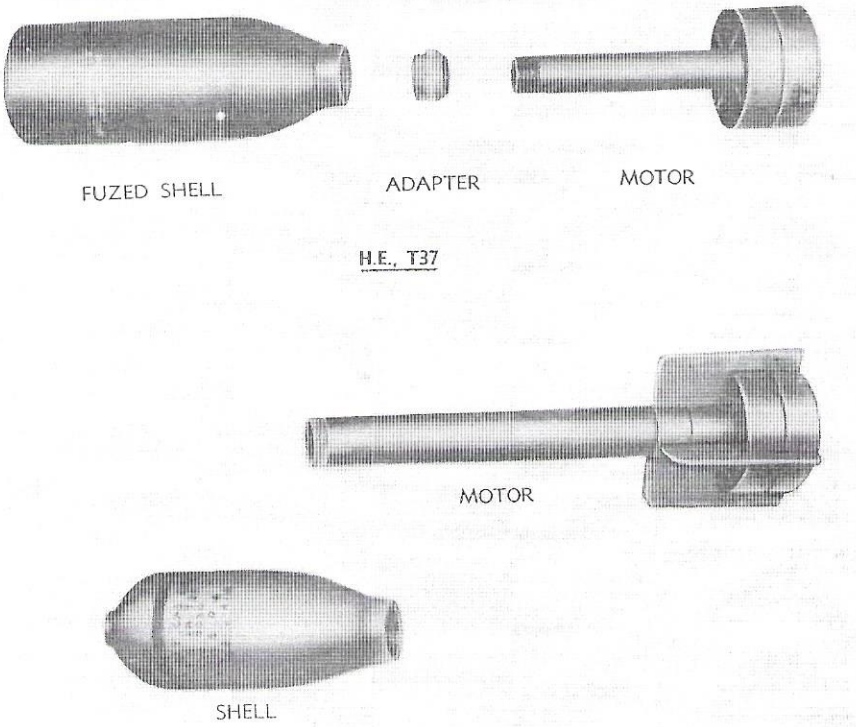


Figure 33 — 7.2-inch Rockets, Unassembled Rounds

(1) Remove components from packing and inspect for serviceability.

(2) Assemble motor to shell. Tighten with strap wrench.

(3) Insert fuze and burster assembly in fuze seat, screw in hand-tight, and tighten with fuze wrench.

(4) Remove fuze safety wire and shroud shorting clip when rocket is loaded into the launcher.

(5) If rocket is not used, return to storage, reversing the above steps.

b. 7.2-inch HE rocket T24. This round is similar to the rocket T21 described above except that the shell filler is high-explosive and the fuze has a short booster assembled instead of a long burster. For

assembly of complete round, the same procedure may be followed as specified above.

c. 7.2-inch HE rocket T37. This round is issued with fuzed shell, motor adapter, and motor unassembled. Shell and motor may be packed together or separately. The complete round is assembled as follows:

(1) Remove components from packings and inspect for serviceability. Be sure that the base fuze is assembled to the shell.

(2) Screw the motor adapter into the shell and tighten securely.

(3) Screw the motor into the adapter and tighten with strap wrench.

(4) Remove short circuiting clip from fin shrouds when loading the launcher.

(5) If rocket is not used, reverse the above steps and return the components to original condition and packings.

CAUTION: *There is no way of determining whether or not the base fuze is armed. Consequently all misfired rounds in which the igniter has fired, will be regarded as having armed fuzes. The round will be handled nose up with extreme care until it can be destroyed. No attempt will be made to disassemble such rounds.*

d. 7.2-inch practice rocket T44E1. This round simulates the high-explosive rocket T37 described above. The same procedure may be followed in preparation and use.

e. Data.

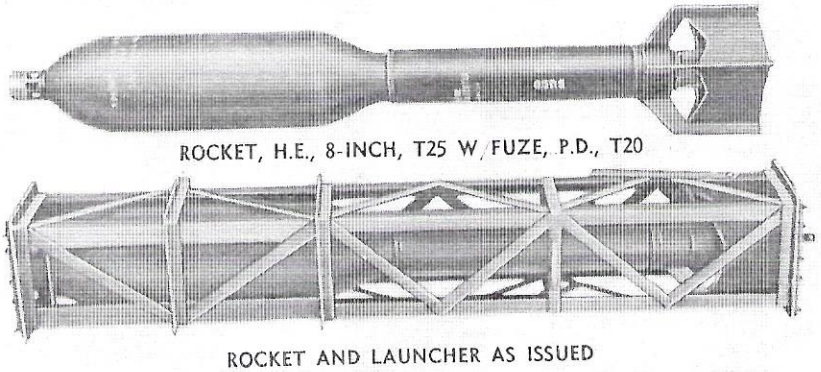
	Chemical T21	HE T24	HE T37
Length (without fuze)	47 in.	41.6 in.	35 in.
Weight	51.8 lb	51.8 lb	61 lb
Range (max)	3,300 yd	3,300 yd	230 yd
Dispersion	35 mils	35 mils	10 mils
Velocity (max)	680 ft per sec	680 ft per sec	160 ft per sec
Temperature limits	+10 to +120 deg F	+10 to +120 deg F	+10 to +120 deg F
Burning time	1.0 to 0.33 sec	1.0 to 0.33 sec	0.6 to 0.2 sec
Head, length	17.4 in.	13.7 in.	19 in.
Head, weight	31 lb	29.4 lb	48.1 lb
Head, type of filler	Gas	TNT	Plastic exp.
Head, weight of filler	20 lb	21.6 lb	32 lb
Motor, diameter	3.25 in.	3.25 in.	2.25 in.
Motor, weight of propellant	5.25 lb	5.25 lb	1.5 lb
Fuze, model	Mk147 w/burster	Mk147 w/booster	Mk146
Fuze, type	AIR-PD	AIR-PD	BD

Section VIII

LARGE-CALIBER ROCKETS

43. 8-INCH HE ROCKET T25.

a. Description. This rocket is a modified 100-pound general-purpose bomb equipped with a 4.5-inch rocket motor (fig. 34). It is issued in a metal crate which serves as an expendable launcher (par. 11, fig. 16). The crate is closed at each end by a removable plate held in place by L-bars. A U-shaped strap riveted to the crate serves as a rear support; two hinged legs, shipped within the crate, are inserted in sockets welded to the side of the crate to serve as front supports. The rocket nose fuze T20 is packed in its own container which is taped in the launcher. The rocket head consists of the body of a standard 100-pound general-purpose bomb modified by removal of the suspension lugs, by alteration of the nose-fuze seat, and by substitution of a motor adapter for the standard base plug. The motor is the standard 4.5-inch motor for the folding-fin type of rocket modified by the substitution of a box-type fin assembly. The fin lock nut has a tubular extension to the rear to prevent the expansion of exhaust gases distorting the fin.



ROCKET, H.E., 8-INCH, T25 W/ FUZE, P.D., T20

ROCKET AND LAUNCHER AS ISSUED

RA PD 95663

Figure 34 — 8-inch Rocket and Launcher

b. Data.

	HE, T25		HE, T25
Length	60.25 in.	Burn-out point	20 ft from launcher
Weight	137 lb	Shell, length	27.5 in.
Range (max)	550 yd	Shell, weight	107 lb
Dispersion	11 mils	Shell, weight of filler	58 lb
Velocity (max)	220 ft per sec	Propellant, weight	4.65 lb
Temperature limits	−10 to +105 deg F	Fuze, model	T20
Burning time	0.3 to 0.12 sec	Fuze, type	AIR-SQ

Section IX

FUZES

44. GENERAL.

a. Definition. A fuze is a mechanical device which initiates an explosion at the time or under the circumstances desired. Rocket fuzes are designated "nose" or "base" according to position on the shell, and as "time" or "impact" according to whether they function a set time after firing the rocket or on impact with the target. Powder-train time fuzes operate through the burning of a pressed charge of black powder or a delay fuze. Mechanical time fuzes operate through the action of a clock-like mechanism. The action of impact fuzes may be superquick (or instantaneous), nondelay, or delay. Superquick fuzes operate when the firing pin strikes the target. Nondelay fuzes operate when the shell strikes the target and decelerates sufficiently for inertia to cause a weighted striker to move forward and strike the primer. Delay fuzes have a fixed-delay element incorporated in the explosive train.

b. Arming. A fuze is armed when the various parts are in position to operate. For safety in shipping and handling, fuzes are kept unarmed. This may be accomplished by safety pins or wires preventing the motion of the firing mechanism, or by arrangement of the components so that they cannot function until moved into position by forces incident to firing. A fuze in which the detonator is held out of line so that it cannot explode the shell until armed, is detonator safe; when this condition persists until after the round leaves the weapon, the fuze is boresafe. Various forces are employed for arming rocket fuzes. Fuzes used on fin-stabilized rockets may be armed by set-back, the air resistance operating a propeller, motor pressure, cessation of acceleration, or a combination of these. Fuzes for spin-stabilized rockets are usually armed by set-back and centrifugal force.

c. Precautions. Fuzes contain the most sensitive explosives used for military purposes. They are particularly susceptible to heat, moisture, and shock, and should be handled with due care at all times. Safety devices should be removed only in preparation for firing and should be replaced in unused rounds before further handling. Fuzes will not be disassembled except when specifically authorized. A fuze which is suspected of being armed should be handled as though it were certainly armed. No attempt will be made to disarm a fuze; many fuzes are designed so that an attempt to reverse the steps in arming will cause the fuze to detonate.

45. INTEGRAL BASE FUZES. The base-detonating fuze which is integral with 2.36-inch rockets is a simple inertia type consisting of a weighted firing pin which is held away from the detonator by a light creep spring (fig. 35). The firing pin is prevented from mov-

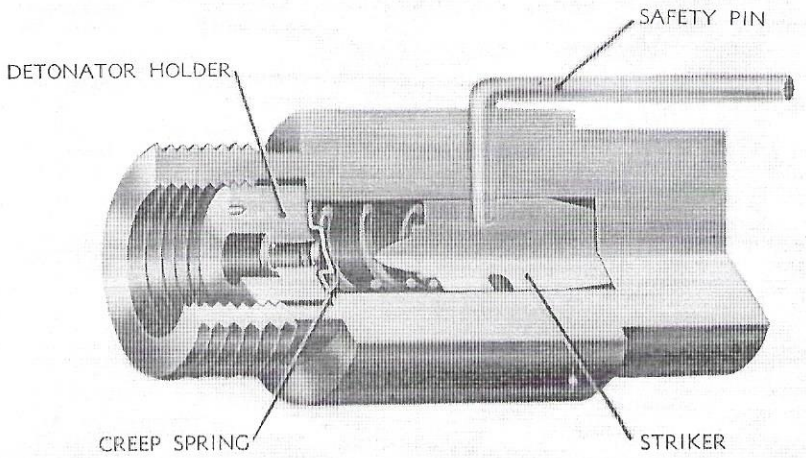


Figure 35 — BD Fuze for 2.36-inch Rockets

ing in shipping and handling by a safety wire which passes through the fuze body. The sensitivity of this fuze is controlled by varying the thickness of a thin metal disk covering the detonator. In some models this disk is omitted, making the fuze extremely sensitive.

46. BD FUZES M400 AND M401. These fuzes (figs. 36 and 37) incorporate a bore riding pin which prevents the striker moving until after the rocket leaves the launcher. When unarmed, the striker is held by the safety pin and bore riding pin (B, fig. 36 and B, fig. 37). On firing the rocket, the arming sleeve sets back, compressing the set-back spring and releasing the bore riding pin which is held by the wall of the launcher (C, fig. 36 and C, fig. 37). On leaving the launcher, the pin is completely ejected and the striker is restrained only by the creep spring (D, fig. 36 and D, fig. 37). On impact equivalent to a 12-inch drop, the striker overcomes the resistance of the creep spring and fires the fuze.

47. PD ROCKET FUZE M4A2.

a. General. This is a selective superquick-delay, impact fuze for fin-stabilized rockets. It is used in 4.5-inch rockets of the M8 series and rocket T22. The delay time is indicated in the nomenclature and marked on the fuze. At present, the SQ-0.10-second delay fuze is furnished for ground-fired rockets, the SQ-0.015-second delay fuze is furnished for aircraft-fired rockets. The rockets for which this fuze is designed have deep fuze cavities, therefore an auxiliary booster (fig. 40) is issued with the fuze. The fuze is standard contour type with booster assembled to the base (fig. 38).

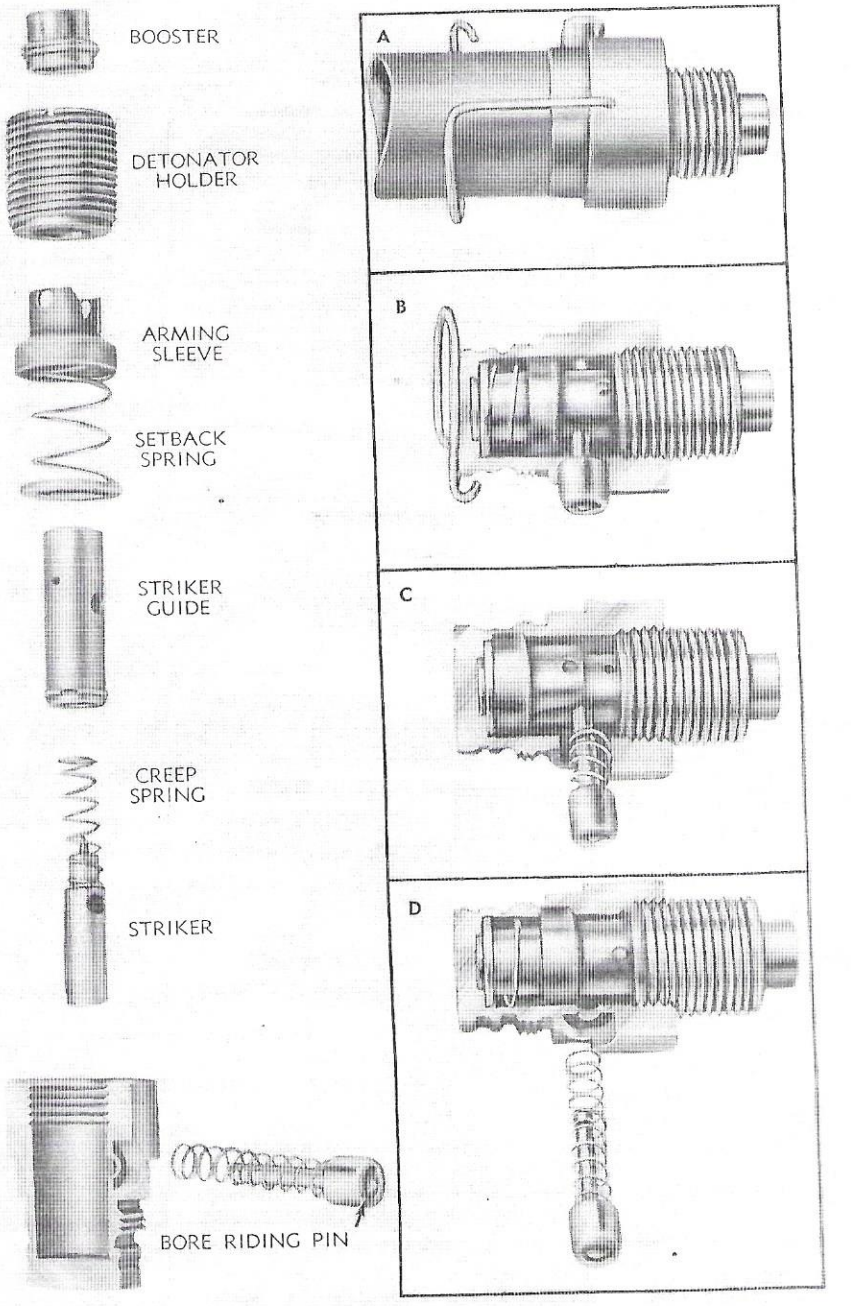
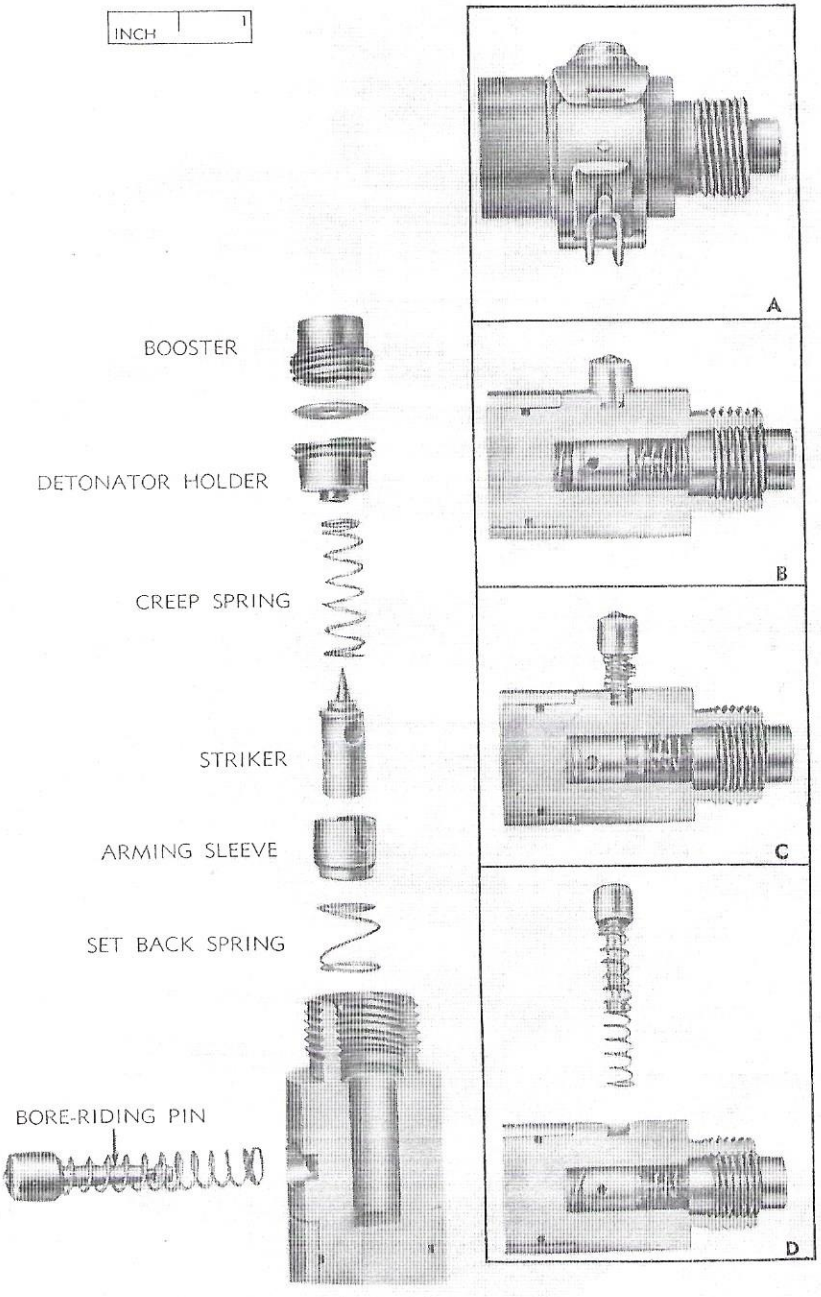


Figure 36 — BD Fuze M400, Disassembled and Functioning



RA PD 104816

Figure 37 — BD Fuze M401, Disassembled and Functioning

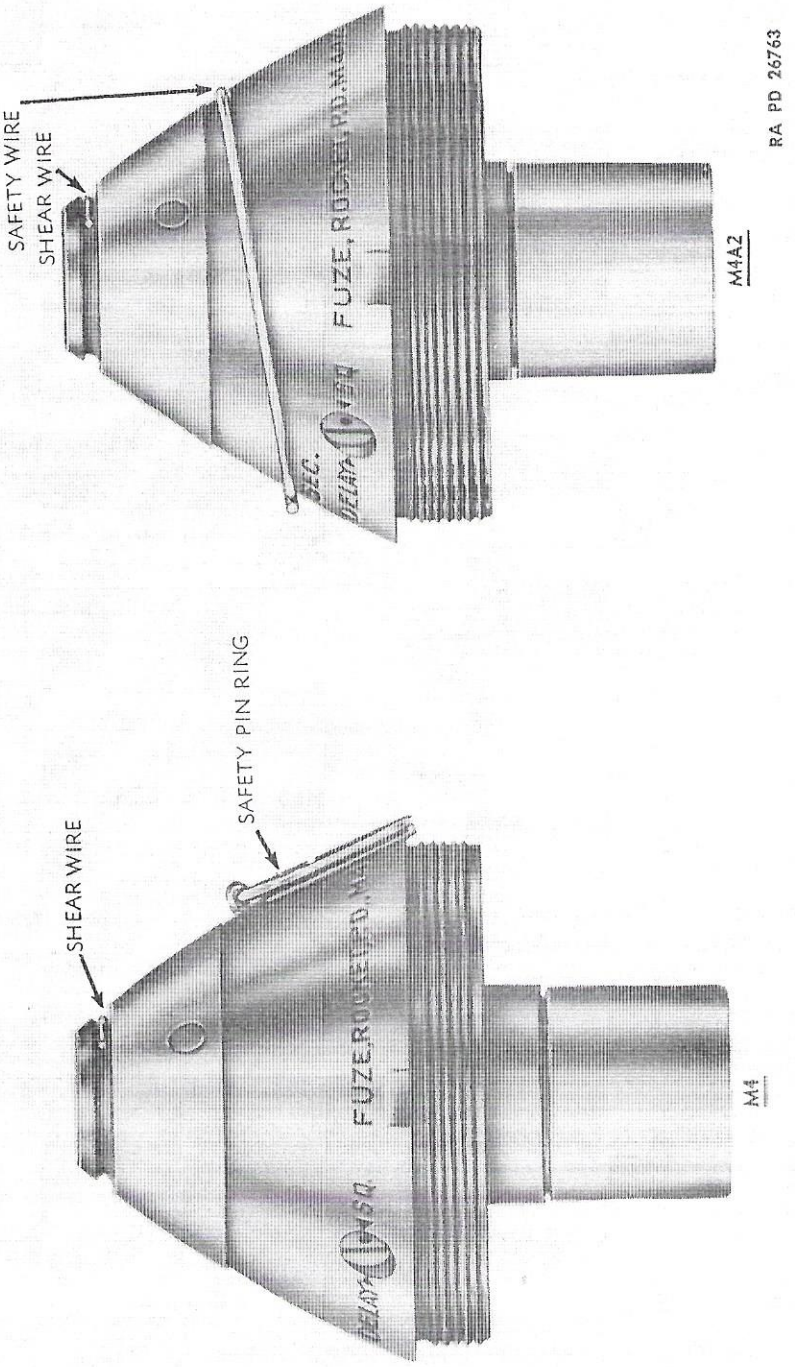


Figure 38 — PD Fuzes M4 and M4A2

A safety wire, or a safety pin with pull ring, prevents arming of the fuze while the pin is in place. The slotted head of the setting pin appears in the side of the fuze, with the body of the fuze marked to indicate "SQ" or "delay." The action of the fuze is selected by turning the setting pin so that the marker on the pin indicates the desired action.

b. Function. On firing, the set-back pin (fig. 39) compresses its spring and moves toward the base of the fuze, releasing the locking ball. The arming pin is held in place by set-back until acceleration is over. When the motor is burned out and the rocket is in free flight, the arming pin moves forward by its spring, thus releasing the detonator slider which moves into position, alining the detonator with the booster lead and the common flash tube. On impact, the striker is forced back, cutting the shear wire and firing both superquick and delay primers. The delay primer ignites the delay charge which ignites the relay charge which, in turn, fires the detonator. The superquick primer, if the fuze is set "superquick," fires the detonator directly; if the fuze is set for delay, the channel in the setting pin is turned out of line, closing the flash tube, and the superquick primer has no effect. NOTE: *If the safety wire is not removed, the set-back pin cannot move and the fuze will not arm.*

c. Modifications. The fuze M4A2 requires a set-back of 100G to arm; the fuze M4 requires 165G. In the fuzes M4 and M4A1, the setting sleeve also controls the delay flash tube; as a consequence, if the setting pin slot is not parallel to the fuze axis, both flash tubes are blocked and the fuze will be a dud.

d. Auxiliary booster. The auxiliary booster (fig. 40) is provided to fill the space left in deep fuze wells, thus increasing the explosive charge and insuring that the fuze will detonate the shell. The auxiliary booster M1 is a cylindrical chipboard and metal container with flat ends. It contains 0.8 pound of flake TNT. The auxiliary booster M1A1 is longer, but one end contains a recess in which the fuze booster nests. It contains 0.8 pound of TNT and a 0.2-pound tetryl ring.

e. Fuzing. The following procedure will be followed in assembling this type of fuze to the rocket:

(1) Remove fuze from packings and inspect for clear threads, presence of safety wire and shear wire, absence of corrosion, or other evidence of unserviceability.

(2) Loosen set screw in adapter and remove rocket shipping plug. Inspect fuze seat for clear threads and absence of foreign material.

(3) Insert auxiliary booster with marked end outward.

(4) Screw fuze in place and tighten. Tighten adapter set screw.

Figure 38.—PD Fuzes M4 and M4A2

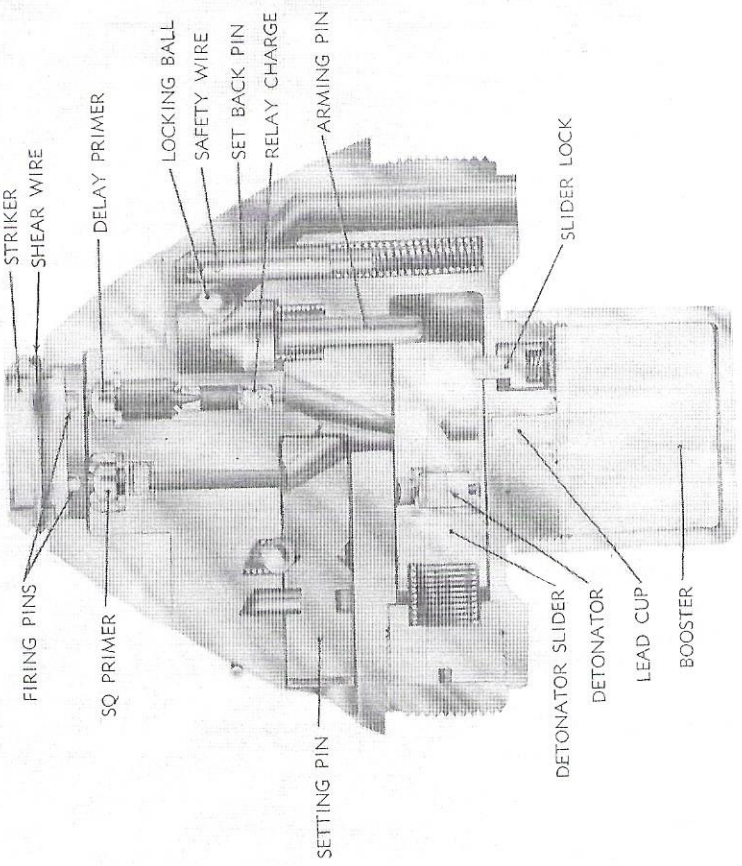
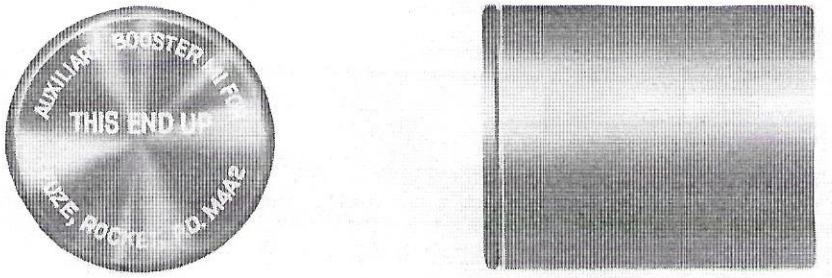
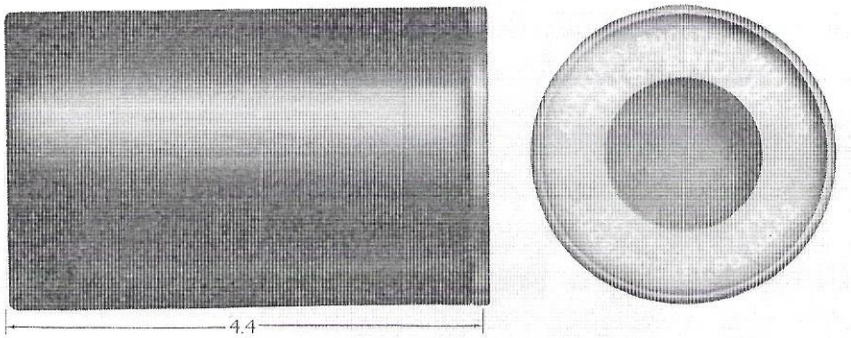


Figure 39 — PD Fuze M4A2 — Schematic Section



RA PD 26764



RA PD 65193

Figure 40 — Auxiliary Boosters M1 and M1A1

(5) If necessary, set fuze for desired action with screwdriver or similar tool. Be sure slot is parallel with fuze axis.

(6) Remove safety wire when loading rocket into launcher.

f. Unfuzing. If the rocket is not used, return components to original packings by reversing above steps. Reseal packings and mark so that these components may be used first in subsequent operations.

g. Precautions.

(1) If the shear wire is broken or missing, the fuze should be handled, nose down, with care until it can be destroyed.

Figure 39 — PD Fuze M4A2 — Schematic Section

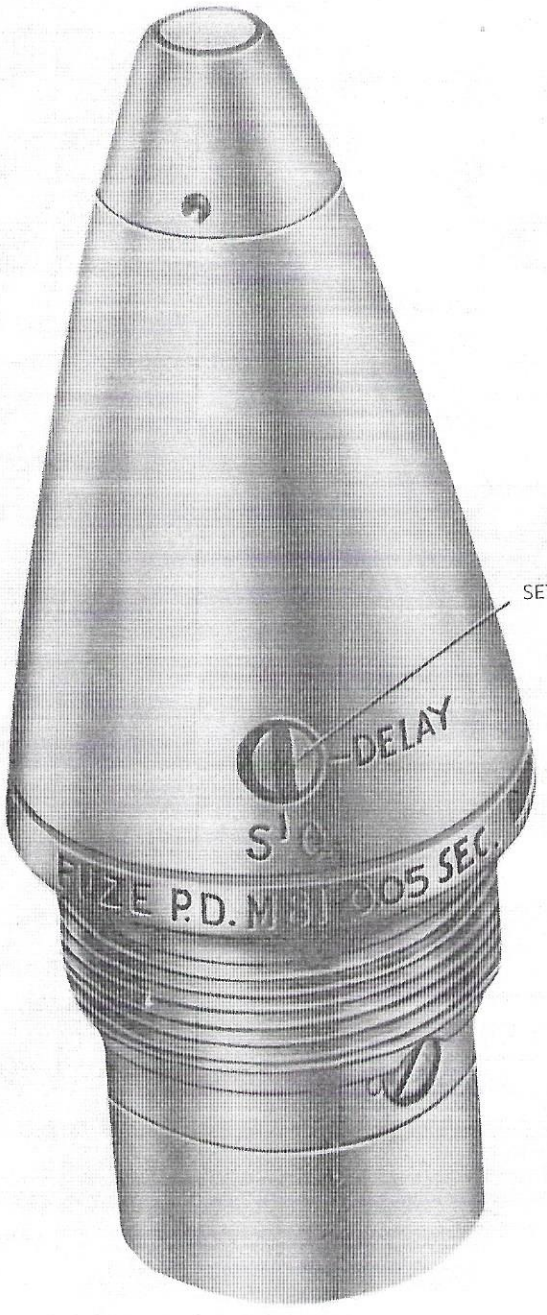


Figure 41 — PD Fuze M81

(2) If the slot in the setting pin is not parallel to the fuze axis, fuze M4A2 will function only with delay action, but fuzes M4 and M4A1 will not function at all.

(3) A small amount of external corrosion is not harmful in itself but it does indicate the possibility of sufficient internal corrosion to bind or freeze moving parts and cause malfunction.

(4) The striker must be protected from blows. If the shear wire is broken, the primers are liable to fire. Light blows which do not break the shear wire may weaken it to such an extent that it will shear from set-back on firing.

(5) The auxiliary booster is an essential part of the fuze when used in deep cavity rocket shell; it must not be omitted.

48. DUMMY ROCKET FUZE M6. This is an inert fuze of the same shape and weight as the fuze M4 type. It is intended for use in practice rockets of the M9 series and rocket T46.

49. PD FUZE M81.

a. General. This fuze is an artillery type with booster assembled for spin-stabilized rockets. It is selective superquick-0.05-second delay, and arms by centrifugal force. The fuze consists of the standard fuze M48A2, SQ-0.05-second delay with booster M24. Booster M21A1 may be substituted. Dependent upon the source of the components, the fuze may be marked M81, M48A2, or M51.

b. Description. The fuze is a standard contour artillery fuze (fig. 41) with booster assembled. The slot of the setting sleeve is parallel to the axis of the fuze when set "superquick" and perpendicular to the axis when set for delay action. Booster M21A1 differs from the booster M24 illustrated, in that it has a safety cotter pin and pull ring which must be removed before assembling the fuze to the rocket, and replaced if the rocket is unfuzed. The components of this fuze are described and illustrated in TM 9-1901.

c. Fuzing. After removing fuze from packing and inspecting fuze and fuze seat, set the fuze for the desired action and screw into adapter; tighten fuze and adapter set screw.

50. DUMMY FUZE M73. This is an inert fuze of the same shape and weight as the fuze M81 and is provided for use in practice rockets M17 and M21.

51. NOSE ROCKET FUZE MK137.

a. General. This is an air-arming, impact-operated rocket fuze (AIR). It is detonator safe and functions with superquick action on impact with ground or water.

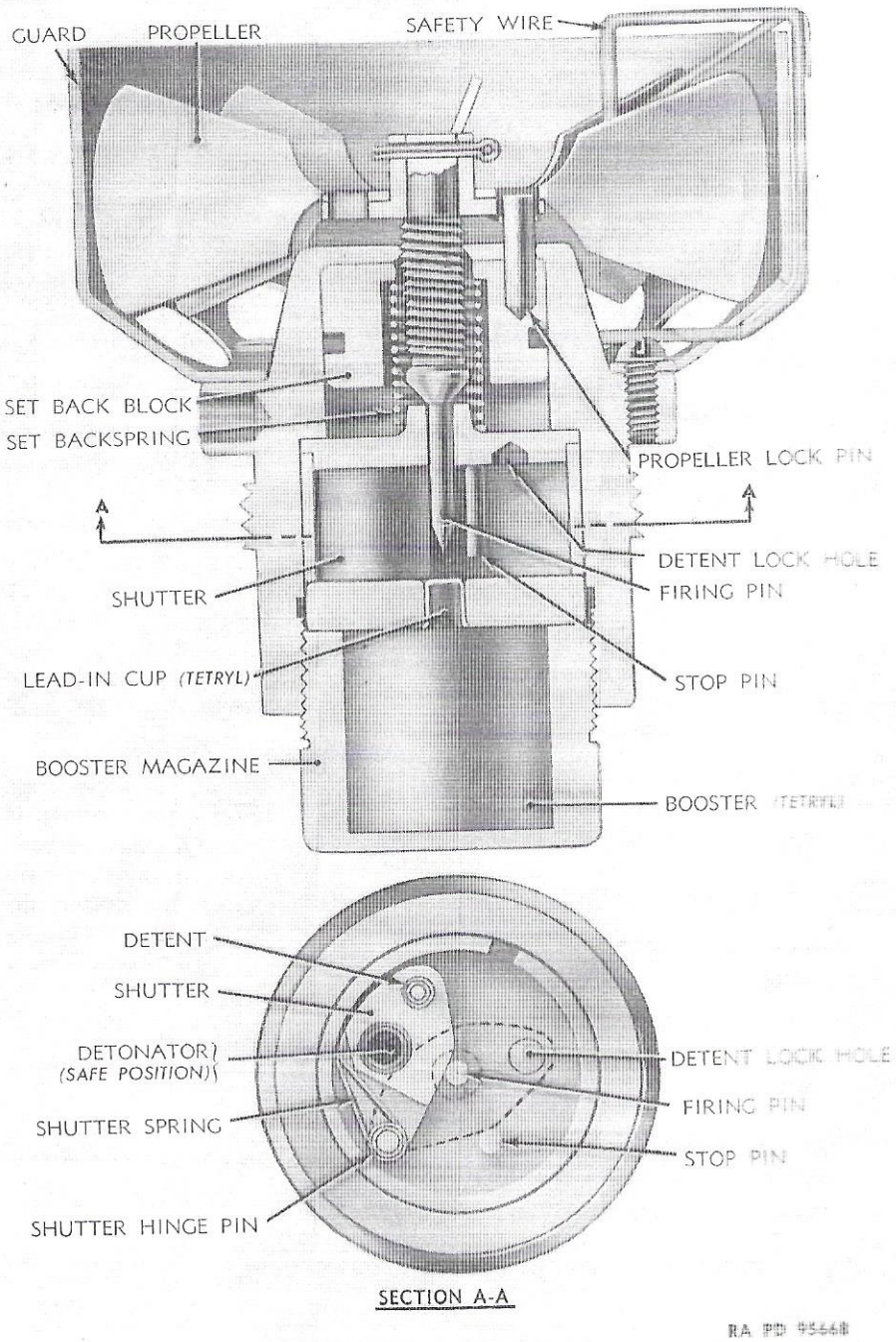


Figure 42 — Nose Fuze Mk137 (AIR)

b. Description. The fuze (fig. 42) is roughly cylindrical with booster assembled to the base and propeller, and vane guard assembled to the front. The detonator is assembled in a spring-loaded shutter which is held out of the armed position by the firing pin. The firing pin passes through the firing pin guide and is threaded through a shear plate in the top of the fuze. The propeller is attached to the outer end of the firing pin. The propeller is kept from turning by a lock pin mounted in a set-back block within the fuze. The set-back block is held in place by a safety wire passing through the fuze body.

c. Function. The safety wire is withdrawn when the rocket is loaded into the launcher. On firing the rocket, the set-back block is forced back against its spring, withdrawing the lock pin from the propeller. The air stream rotates the propeller, and screws the firing pin forward through the shear plate. When acceleration is over, the propeller has progressed far enough so that the lock pin will not re-engage it. Meanwhile the firing pin is withdrawn from the detonator shutter, allowing it to swing the detonator into line with the firing pin and booster lead. On impact, the propeller and firing pin are driven inward, shearing the threads in the shear plate, and the pin strikes the detonator, firing the fuze.

d. Inspection. In addition to inspection for clear threads, bent vanes, and corrosion, the following points will be observed:

(1) If the tips of the propeller vanes extend beyond the guard, the fuze will be considered armed and will be handled with extreme caution until it can be destroyed.

(2) Remove the safety wire and try to turn the propeller clockwise (looking at the nose of the fuze) to see if the lock pin prevents it turning. *Do not turn the propeller more than one-half turn.* If the propeller can be turned, the fuze will be considered as armed and destroyed.

(3) With safety wire, push on the head of the lock pin to see that it is free to move. Do not allow the propeller to turn during this test. Be sure the lock pin springs back into place in the propeller hub. Replace safety wire.

e. Fuzing.

(1) Remove fuzes from containers and inspect as specified above.

(2) Remove shipping plug, gasket, and paper tube from rocket. Inspect fuze seat for clear threads, absence of foreign matter, and presence of auxiliary booster.

(3) With fuze gasket in place, screw the fuze into the adapter, and tighten with fuze wrench.

(4) When the rocket is placed in the launcher, remove fuze safety wire.

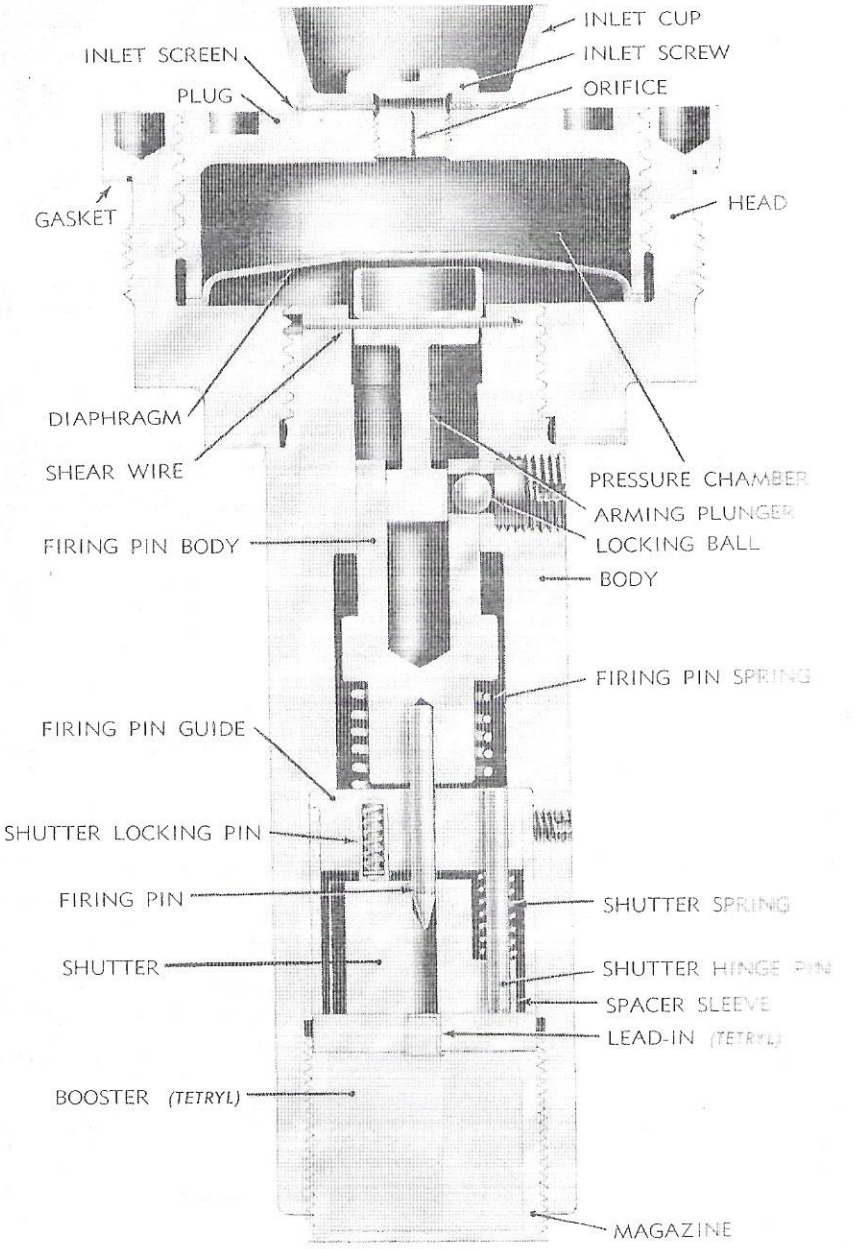


Figure 43 — Base Fuze Mk146 (PIR)

(5) If the rocket is not used, replace the safety wire, then remove fuze and restore components to original condition and packing.

f. Precautions. If the fuze is accidentally armed, no attempt will be made to disarm it, because turning the arming vane will cause the firing pin to pierce the detonator and fire the fuze. If the fuze is assembled to the rocket when its armed condition is discovered or suspected, the rocket will not be unfuzed, but the entire round will be handled with utmost care until it can be safely disposed of.

52. NOSE ROCKET FUZE MK145. This fuze resembles the fuze Mk137 described above except that the detonator incorporates a 0.02-second delay element. The same descriptions are pertinent and the same procedures and precautions will be observed.

53. BASE ROCKET FUZE MK146.

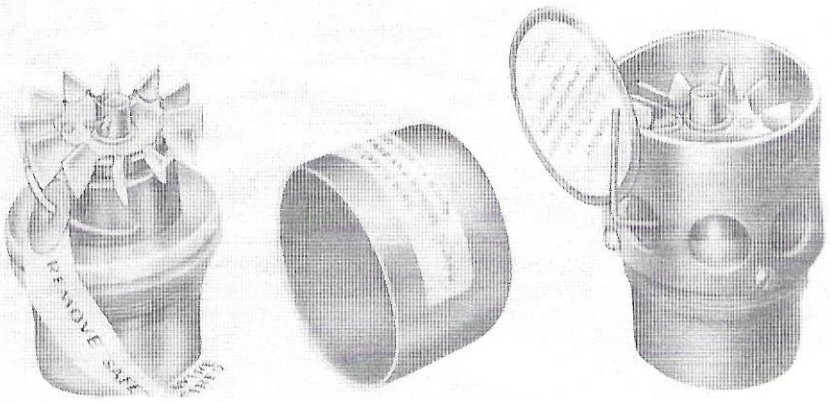
a. General. This is a pressure-armed, impact-operated rocket fuze (PIR) (fig. 43). It is detonator safe and operates with non-delay action on impact with ground or water. The fuze is assembled in the base of the rocket head as issued, and, when the round is assembled, forms the forward wall of the rocket motor.

b. Function. When the rocket is fired, pressure built up in the rocket motor forces gases through the inlet screen, through an orifice in the inlet screw and into the pressure chamber. When the pressure reaches 250 pounds per square inch, the diaphragm collapses and forces the arming plunger to cut the shear wire and move forward. This releases the locking ball and allows the firing pin spring to retract the firing pin. Meanwhile acceleration has forced the shutter to the rear, compressing the shutter spring and engaging the shutter locking pin in a recess in the firing pin guide. On cessation of set-back, the shutter spring forces the shutter forward, disengaging the lock pin, and swings the shutter to aline the detonator with the firing pin and booster lead. On impact equivalent to 10G, the inertia of the firing pin overcomes the spring and forces the pin into the detonator, firing the fuze.

c. Precautions. In addition to the care prescribed for handling fuzed ammunition, the following will be observed.

(1) When this fuze is specified, always inspect the rocket head to be sure that the fuze has been assembled. If a high-explosive rocket adapted for base fuze is fired with the fuze omitted, the head will detonate on the launcher when the rocket is fired.

(2) It is impossible to determine from external examination whether or not this fuze has armed. Consequently, if there is any reason to suspect that the fuze has armed, the round will be treated as though it were certain that the fuze is armed. No attempt will be made to disassemble the round; it will be handled, nose up, with extreme care until it can be safely destroyed.



RA PD 97718

Figure 44 — Fuze Mk147 (Right) and Mk147 Mod1 (Left) Without Bursters

54. NOSE ROCKET FUZE MK147 AND MODS.

a. Fuze Mk147. This fuze is similar to the fuze Mk137 described above (par. 51) except that a long burster is assembled in place of the booster. With this exception, the same descriptions, procedures, and precautions apply.

b. Fuze Mk147 Mod1. This modification is similar to the basic model except that the propeller guard is replaced by a removable shipping cap (fig. 44). The shipping cap, as well as the safety wire, is removed when placing the rocket in the launcher. If the round is not used, both wire and cap must be replaced.

55. NOSE ROCKET FUZE MK148.

a. Description. This fuze is similar in construction to the fuze Mk137 described above (par. 51) except that the vane guard is replaced by a shipping cap as in the fuze Mk147 Mod1 (fig. 44) and an arming wire guide is added to permit the use of an arming wire with this fuze.

b. Fuzing.

(1) Remove fuze from packing and inspect as prescribed for the fuze Mk137 (par. 51).

(2) Remove shipping plug from rocket and inspect fuze seat for clear threads, absence of foreign material, and presence of auxiliary booster. Assemble adapter for fuze Mk148 and tighten securely.

(3) Screw fuze, with gasket in place, into fuze seat. Tighten with fuze wrench.

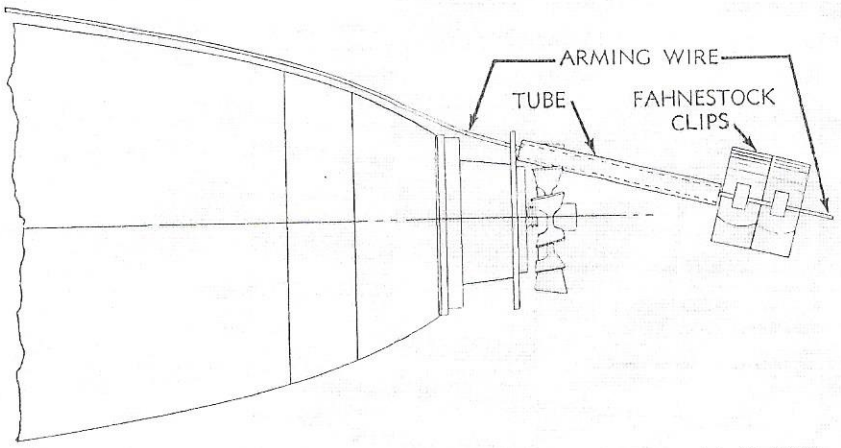


Figure 45 — Installation of Arming Wire (Fuze Mk148)

(4) After rocket is placed in launcher, remove shipping cap and safety wire.

(5) Thread arming wire through arming-wire guide and between propeller vanes (fig. 45). Attach wire to arming mechanism of launcher and pull wire through fuze to take up all slack. Place protective metal tube over wire in position between vanes so that it butts against the arming-wire guide. Place two safety clips (Fahnestock clips) on wire to hold the tube in place. Be sure the tube bears on the arming-wire guide and not on the propeller.

(6) Cut off excess wire and remove all kinks and burs.

(7) If rocket is not used, remove arming wire, replace safety wire and shipping cap, then remove rocket from launcher and disassemble round, returning components to original condition and packings.

56. NOSE ROCKET FUZE MK149 MOD0.

a. General. This is an air-arming, impact-operated fuze for forward firing aircraft rockets. It is detonator safe and functions with superquick action on impact with ground, water, or plate. It requires the use of an arming wire.

b. Description. This fuze (fig. 46) is streamlined and has a spring-loaded protective cap which protects the propeller and seals the fuze against the weather. The cap is held in position by a split clamp which in turn is held together by a collar and pin through which the safety wire and arming wire are assembled. The mechanism of the fuze is similar to that of other AIR fuzes described above except that the detonator shutter is held in the safe position by a

Figure 46 – Nose Rocket Fuze M15

locking pin controlled by a set-back pellet. Thus the detonator cannot move to the armed position until acceleration stops, even if the firing pin has been retracted by propeller action.

c. Fuzing.

(1) Remove fuze from packing and inspect for clear threads and absence of corrosion and dents. If slight corrosion is present, work clamp back and forth so that it slides freely on fuze body and cap. If the fuze is more than slightly corroded, discard it.

(2) Remove shipping plug from rocket and inspect fuze seat for clear threads, absence of foreign material, and presence of auxiliary booster.

(3) Screw fuze into fuze seat and tighten securely.

(4) After rocket is placed in launcher, turn clamp so that the safety wire is alined with launcher arming mechanism.

(5) Thread arming wire through second hole in clamp pin and collar.

(6) Attach arming wire to launcher arming mechanism. Pull wire through clamp pin so as to take up all slack but not to place any strain on the wire.

(7) Place one Fahnestock clip on the wire against the collar.

(8) Cut off excess wire and remove all kinks and burs.

(9) Remove safety wire from clamp pin.

d. Unfuzing. If the rocket is not used, first replace the safety wire in the clamp pin; then the arming wire may be removed. The rocket may be removed from the launcher and unfuzed. All components should be returned to their original condition and packings.

Figure 45 — Nose Rocket Fuze MK149

Section X

REFERENCES

57. **PUBLICATIONS INDEXES.** The following publications indexes should be consulted frequently for the latest changes or revisions of references given in this section and for new publications relating to materiel covered in this manual:

a. Ordnance Supply Catalog Index ..... ASF Cat., ORD 2

b. Ordnance Major Items and Combinations, and Pertinent Publications ..... SB 9-1

c. List and Index of War Department Publications (Listing new AR's, CCBP's, Cir's, Forms, FM's, FT's, GO's, LO's, MR's, MTP's, MWO's, PCT's, SB's, TB's, TC's, RR's, TM's, TR's, WDB's, WDP's, T/O & E's and similar publications) ..... FM 21-6

d. List of Training Films, Film Strips, and Film Bulletins ..... FM 21-7

e. Military Training Aids (listing graphic training aids, models, devices, and displays) ..... FM 21-8

f. Index of Ordnance Publications (Navy).... OP 0

58. **STANDARD NOMENCLATURE LISTS.**

a. Cleaning, preserving, and lubricating materials, recoil fluids, special oils, and miscellaneous related items..... ASF Cat., ORD 5 SNL K-1

b. Rockets, all types, and components ..... ASF Cat., ORD 11 SNL S-9

59. **EXPLANATORY PUBLICATIONS.**

a. **Ammunition.**

Ammunition, General ..... TM 9-1900
Artillery Ammunition ..... TM 9-1901
Ammunition Inspection Guide ..... TM 9-1904
Ammunition, Renovation ..... TM 9-1905
Ballistic Data, Performance of Ammunition TM 9-1907
Bombs for Aircraft ..... TM 9-1980
Military Explosives ..... TM 9-2900
Inspection of Ordnance Materiel ..... TM 9-1100

Ordnance Safety Manual	O.O. Form No. 7224
Supply Bulletins	WDSB 9-series WDSB 9-AMM-series
Range Regulations for Firing Ammunition for Training and Target Practice	AR 750-10
Qualifications in Arms and Ammunition Training Allowances	AR 775-10
Special Fuzes for Rockets and Projector Charges	OP 1017 (Navy)
4".5 Rocket Ammunition	OP 1111 (Navy)
2".25 Subcaliber Rockets	OP 1187 (Navy)
5".0 Rocket (5".0 Motor)	OP 1239 (Navy)

b. Launchers.

(1)	2.36-INCH	
	2.36-inch AT Rocket Launcher M1A1	TM 9-294
	Hand and Rifle Grenades, Rocket, AT, HE, 2.36-inch	FM 23-30
	2".36 Sextuple Rocket Launcher Mk1	OP 1136 (Navy)
(2)	3.25-INCH	
	Instructions for Use of Rocket Target M2 by Antiaircraft Units	TM 4-236
	Target Rocket Projector M1	TM 9-856
(3)	4.5-INCH	
	4.5-in. Aircraft Rocket Materiel	TM 9-395
	4.5-inch Rocket Materiel for Ground Use	TM 9-394
	4".5 Rocket Launcher Mk2 Mod1	OP 1127 (Navy)
	4".5 Rocket Launcher Mk4	OP 1128 (Navy)
	4".5 Rocket Launcher Mk10 Mod0	OP 1202 (Navy)
(4)	7.2-INCH	
	7.2-inch Multiple Rocket Launcher M17	TM 9-396

c. General information.

Ammunition Supply	FM 9-6
Cleaning, Preserving, Sealing, Lubricating and Related Materials for Ordnance Materiel	TM 9-850
Decontamination	TM 3-220
Defense Against Chemical Attack	FM 21-40
Graphical Firing Tables	TM 9-526

References

Instruction Guide — Ordnance Packaging and Shipping (Posts, Camps, and Stations)	TM 9-2854
Military Chemistry and Chemical Agents	TM 3-215
Ordnance Service in the Field	FM 9-5

60. FIRING TABLES AND RANGE TABLES.

a. 2.36″ rockets. Usual fire control by launcher sights. See also FT R2.36-B-1.

b. 3.25″ target rocket. Range data and diagrams are published in TM 9-856.

c. 4.5″ rockets, folding-fin type. RT 4.5AC-B-2.

d. 4.5″ rockets, spin type. RT 4.5-C-1, Graphical firing table, T-2.

e. 4.5″ rockets, circular-fin type (BR). Firing data are published in OP 1111 (Navy).

f. 4.5″ rockets. This includes 5″.0 HVAR, 5″.0 AR, 3″.5 AR, and 2″.25 SCAR.

Bore Sighting Data	OP 1296 (Navy)
Manual for Computation of Effective Rocket Temperatures	OP 1235 (Navy)
Range table for 2″.25 SCAR, 3″.5 AR, 5″.0 AR, and 5″.0 HVAR	OP 1355 (Navy)

g. 7.2″ rockets. Firing data are published in TM 9-396.

h. 8″ rockets. Firing data packed with rocket.

INDEX

	Page
A	
Aircraft rocket kit	
conversion	55
description	53
Ammunition identification code	8
Auxiliary booster	69
E	
Expendable launchers	19
F	
Field report of accidents	1
Fuzes	
arming and precautions	64
data	
2.36-inch rockets	28
4.5-inch rockets	53
5-inch rockets	58
description	
BD fuzes M400 and M401	65
dummy fuze M73	73
dummy rocket fuze M6	73
2.36-inch rockets	28
4.5-inch rockets	
circular-fin	46
fixed-fin	49
folding-fin	40
spin-type	51
5-inch rockets	57
integral base	64
modifications	69
nose rocket fuzes	
Mk137	75
Mk145 and Mk146	77
Mk147	78
Mk149	79
PD fuze M81	73
PD rocket fuze M4A2	65
H	
Heads, description	
general	9
2.36-inch rockets	28
4-5-inch rockets	
circular-fin	45
fixed-fin rockets	47
folding-fin	40
spin-tvpe	51
5-inch rockets	57
7.2-inch rockets	60
I	
Igniters	
description	
4.5-inch rockets	
fixed-fin	49
folding-fin	43
spin-type	51
disposal	56
general information	12
modification of suspended	56
replacement	55
L	
Launchers, description	15, 16, 19
M	
Motor, description	
4.5-inch rockets	
circular-fin	46
fixed-fin	49
folding-fin	43
spin-type	51
5-inch rockets	57
7.2-inch rockets	60
P	
Packing	27
Post launchers, description	16
Propellants, description	43, 51
Propelling charges	
description	12, 28, 49
effect of temperature	12
R	
Rocket head (See Head)	
Rockets	
classification	3
complete round	8

R—Contd.

	Page
Rockets—Contd.	
data	
2.36-inch	
HC smoke	35
HE,AT	30, 31
incendiary (T31)	35
4.5-inch	
circular-fin	46
fixed-fin	50
folding-fin	44
spin-type	52
5-inch	58
8-inch HE (T25)	63
practice	
2.36-inch	36
4.5-inch HE	44, 50, 52
7.2-inch	62
target	39
description	
2.36-inch	
HE,AT	30, 33
WP smoke	33, 35
4.5-inch	
circular-fin	45
fixed-fin	47
folding-fin	40
high explosive	45
practice	44
spin-type	51
7.2-inch	[illegible]
8-inch HE (T25)	[illegible]
target	[illegible]
differences in models	[illegible]
effect	[illegible]
identification	[illegible]
inspection prior to use	[illegible]
packing	[illegible]
painting and marking	[illegible]
precautions	
general	[illegible]
handling and use	[illegible]
misfires and hangfires	[illegible]
storage	[illegible]
preparation for:	
firing	[illegible]
use	[illegible]
principle of	[illegible]

T

T-slot launcher, description	[illegible]
Target rocket (See under Rockets)	

RAPD3AUG45—34M
PUBLICATIONS DEPARTMENT - RARITAN ARSENAL