OP 2211 (VOLUME 1)

SURFACE ROCKETS

DEPARTMENT OF THE NAVY
BUREAU OF ORDNANCE

18 NOVEMBER 1958

DEPARTMENT OF THE NAVY
BUREAU OF ORDNANCE
WASHINGTON 25, D.C.

18 NOVEMBER 1958.

ORDNANCE PAMPHLET 2211 (VOLUME 1)

SURFACE ROCKETS

1. Ordnance Pamphlet 2211 (Volume 1) contains information about the more widely known surface-to-surface rockets, surface-to-air rockets, and projector charges used by the Operating Forces of the Department of the Navy. Both general and specific data are given, including descriptions of components, assemblies, use, and identification.

2. This publication is issued in two volumes to satisfy security regulations. When new surface rockets are authorized for use by the naval establishment, CHANGES to this publication will be issued. Similarly, as items are removed from service use, notices will be promulgated to destroy the applicable sections of this publication.

3. This publication supersedes OP 1111, OP 1175, OP 1742, OCL A34-45, and OHI A5-45, which shall be destroyed.

JOHN QUINN,
Rear Admiral, U.S. Navy
Deputy Chief, Bureau of Ordnance

CONTENTS

ILLUSTRATIONS

Frontispiece—Rockets in Action.

Chapter 1

GENERAL INFORMATION

Scope

This publication covers general and specific information about Navy surface rockets (surface-to-air and surface-to-surface) and projector charges. The launchers, fire control equipment, and other gear accessory to the firing of rockets and projector charges are not included.

This publication is divided into two parts: volume 1 contains unclassified material and volume 2 contains classified material.

Principles of Rocket Propulsion

Rockets are propelled by the rearward expulsion of expanding gases from the nozzle of the rocket motor. It is a common misconception that rockets are pushed forward by the action of the hot gases on the surrounding air, but rockets can function even in a vacuum.

To understand how a rocket operates, consider a closed tube into which a gas under pressure has been introduced. The pressure of the gas against all the interior surfaces is equal and the system is in equilibrium, figure 1.2A. If the right end of the tube is removed, figure 1.2B, the pressure against the left end is unopposed, and the tube tends to move to the left.

In a rocket motor, sufficient confinement of the gases evolved in the burning of the propellant is necessary to permit a build-up of pressure which provides the sustaining driving force. This can be accomplished by restricting the size of the opening, figure 1.2C. In this case, the useful thrust is the difference between that force acting on the remainder of the left end and that acting on the right end. However, with this type of design, considerable turbulence is caused in the flow of gas through the opening, with a consequent loss of available energy. This turbulence can be greatly decreased by adopting a design similar to figure 1.2D. In this instance, the horizontal component of the force acting on the right wall is equal in magnitude to the force acting on the right wall, figure 1.2C.

If a divergent expansion section is added, figure 1.2E, advantage can be taken of the force of the expanding gases acting on the wall of the expansion section. This force adds to the useful thrust.

Rocket Development

Rocket History to World War II. The history of rocket development covers a span of eight centuries. Both rockets and guns developed contemporaneously, but guns attained ascendancy because of their greater accuracy.

The intense development of rockets during World War II stemmed from the need for greater firepower which did not require heavy and elaborate sub-structures to sustain weight and counteract recoil. This particularly was true in area bombardment of beachheads, in increased coverage patterns in antisubmarine warfare, and in missiles adapted to firing from aircraft, where accuracy could be sacrificed.

Rocket development in the modern period may be said to have been started by Sir William Congreve, an Englishman, in the early 19th century. Congreve's rockets weighed up to 24 pounds and had ranges of the order of two miles. These rockets were stabilized by a trailing stick.

An improved type, stabilized by rotation, was developed by William Hale, an American. Hale achieved his spin stabilization from curved vanes in the nozzle. The British rockets were used successfully in a number of campaigns, including the War of 1812 against the United States. It was their "rockets' red glare" which became a part of our national anthem.

About 1860, the greatly increased accuracy of fire resulting from the development of modern artillery brought about a gradual loss of interest in rockets, and they soon disappeared from the military scene. During World War I and the years following, interest in rockets revived to a degree, not so much in the military organizations but among a few scientists and rocket societies.

The Rocket-Propelled Bomb. The Navy's first program with rockets during the World War II period was the development of a rocket-propelled bomb. The armor-piercing ability of a bomb is dependent on velocity at time of impact. This is a function of the distance it falls, unless there is some other propulsive force. High-altitude bombing is poorly suited for naval warfare with its relatively small and moving targets. Rocket propulsion offered a substitute for extreme dis-

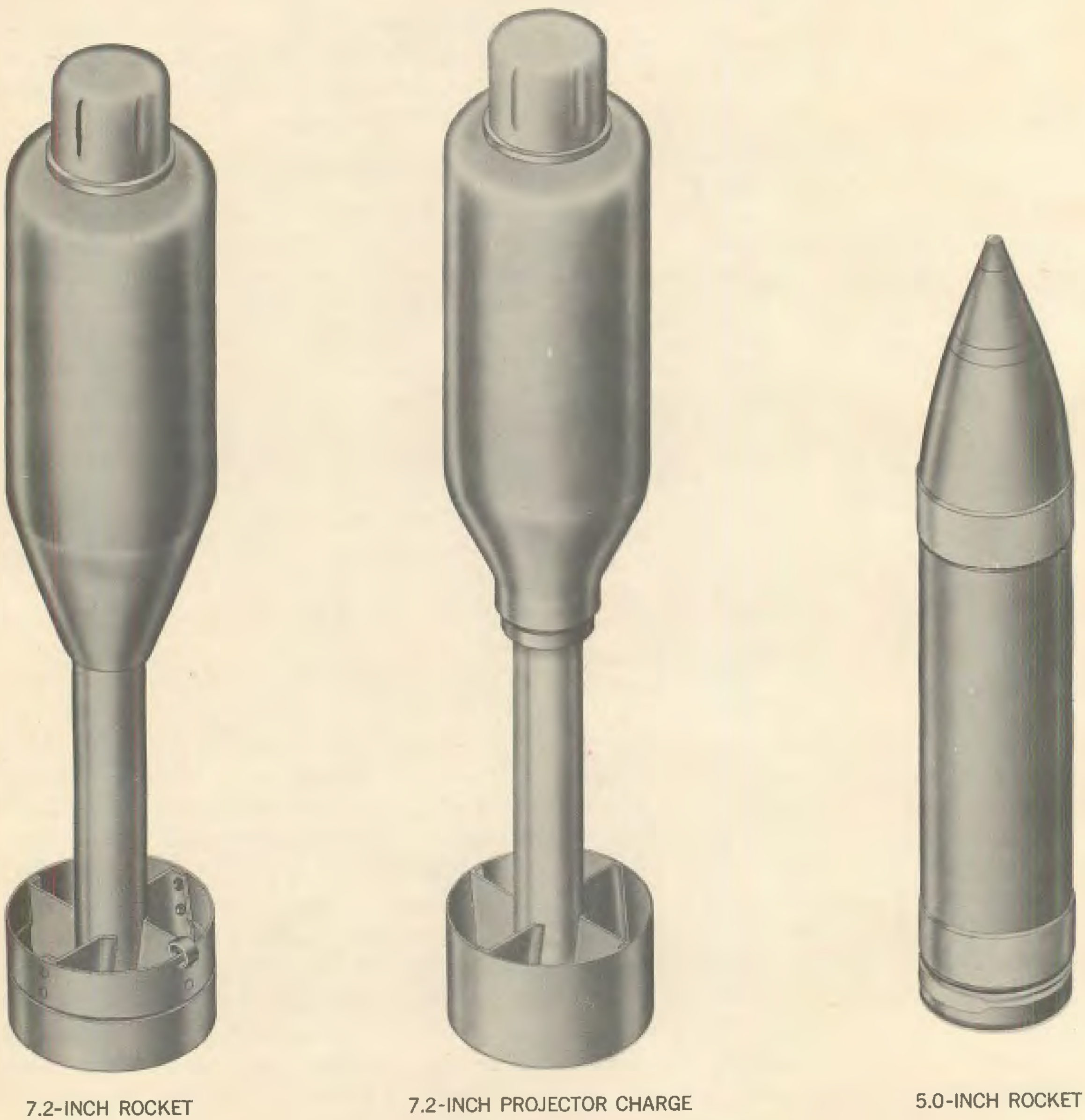


Figure 1.1—Typical Rocket and Projector Charge Ammunition.

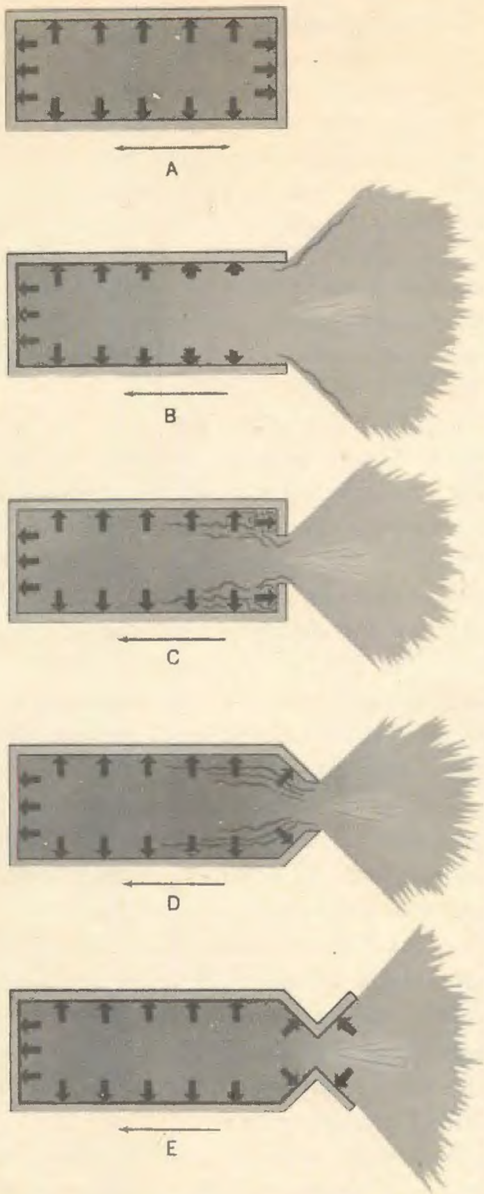


Figure 1.2—Principles of Rocket Propulsion.

tance of fall by adding velocity to the bomb, so the Bureau of Ordnance started a program to develop a bomb of this type in 1940.

Despite their promise, however, armor-piercing bombs proved less valuable in practice than those types which compensated for their lack of penetrative ability with a greater volume of high explosive. Success with the general-purpose bombs and new attack techniques made large-scale procurement of rocket-assisted bombs unjustified later in the war. Another reason for abandoning the rocket-propelled bomb project was the critical necessity for developing weapons to combat submarines.

The Hedgehog, Mousetrap, and Retrobomb. Because of the urgency of this need, the Navy adopted the Hedgehog device used by the British. The British were about four years ahead of this nation in the development of antisubmarine weapons, on account of their earlier participation in the war. The Hedgehogs were 7.2-inch explosive charges propelled by electrically fired impulse propellent charges. They were mounted on destroyers and thrown out ahead of the vessel in patterns. But the Hedgehogs were an imperfect solution to the total problem of dealing with submarines. Their recoil force was such that they were limited to use on vessels of at least destroyer size. To utilize smaller vessels, a rocket-propelled weapon which would have no recoil seemed to be the answer.

The 7.2-inch charge, attached to a 2.25-inch rocket motor and launched from a quadruple launcher, was developed by the Bureau of Ordnance and placed in service in 1942. Because of the appearance of the launcher, the weapon was dubbed the Mousetrap. Though humble in name, the Mousetraps made a small vessel 25 times more effective, theoretically, than it would be carrying the same weight in conventional depth charges.

With but slight modification, the 7.2-inch charge used in the Hedgehog and Mousetrap proved applicable for a third antisubmarine weapon—the retrobomb. This was an unusual missile that was fired backward from a plane. The need for the weapon stemmed from the use of the Magnetic Airborne Detector.

The MAD is an instrument which indicates the presence of a submarine only when the plane is directly above the submarine. Ordinary bombing or depth charging is impracticable because the trajectory of either weapon follows the path of flight of the plane.

The retrobomb was designed to fall straight toward the target when it was released. Rocket propulsion was adaptable to the requirement for firing backward to cancel the forward motion of the plane.

The usefulness of the retrobomb was short-lived because submarines changed their tactics. When attacked by planes, submarines made a practice of surfacing and using their antiaircraft guns. Planes were forced to fly directly over the submarines at altitudes between 100 and 300 feet to make a hit with the retrobomb. This bombing run made them vulnerable to the antiaircraft fire of the submarine.

Barrage Rockets. The utilization of rockets in the bombardment of enemy installations during an amphibious landing operation soon became a necessity. Conventional weapons, especially aircraft bombs and warship guns, were a partial answer to the problem of destroying the enemy fortifications or forcing him to take cover, but their use left a considerable gap in ordnance needs. Bombing had to cease entirely before troops could be put ashore. Even gunfire from warships was restricted during the critical landing phase of invasions. A weapon was needed that could duplicate the firepower, if not the accuracy, of naval guns and continue an effective cover as the first invasion waves moved to the beach.

A barrage rocket, suitable for use on landing craft, was the answer. The first barrage rockets were 20-pound general-purpose bombs (4.5-inch diameter or caliber), threaded to the same 2.25-inch motors used for the Mousetrap. They were produced hurriedly and put into service in the Allied landing at Casablanca in 1942. Early in 1943, the first American-designed rocket ships made their appearance. They were converted LCI(L)'s, each carrying 40 launchers which could throw 480 rockets without reloading.

There was a need for a rocket of longer range than the 4.5-inch rocket described in the preceding paragraph. A new method of stabilization also was required because of the great dispersion of rockets stabilized by fins. To meet these requirements, a 5-inch spin-stabilized type was developed and placed on PT boats and landing craft in late 1944. An automatic, gravity-feed launcher was produced for this weapon. It was the last major development in barrage rockets during World War II.

Grapnel Rockets. Another problem in amphibious landings was to remove mines and other obstacles in the shallow waters near the beaches. One proposed solution employed rockets to project grapnels and a steel cable from small craft over the obstructions. Then they were dragged away by snubbing the cable to the craft. The first such grapnel rocket was called the "Cutteroo" by the Fleet. It was never used against the enemy. However, it had more recent use in collecting earth samples after atomic bomb tests.

Aircraft Rockets. The early discarding of the retrobomb and the rocket-propelled bomb did not discourage those who realized the advantages of rocket weapons launched from aircraft. The speed of planes lent fin-stabilized rockets an initial velocity that gave them stability and accuracy not possible when fired from the ground. Also, the combination of large missiles and low recoil afforded by rockets gave planes a firepower greater than that of machine guns.

The British produced the first rockets fired from aircraft in World War II. These were modifications of a 3-inch fin-stabilized rocket that was being used as an antiaircraft weapon. The first United States Navy aircraft rockets combined a 3.5-inch solid head and a 3.25-inch motor. They were launched from rails mounted under the wings of torpedo bombers. The solid head was designed to rupture the hull of a submarine.

The early aircraft rockets, using 3.5-inch heads in antisubmarine warfare, proved inadequate against land targets. A 5-inch head with a larger payload of high explosive and an air-arming, impact-firing fuze was designed for the same 3.25-inch motor. The assembly, however, proved to be unsatisfactory in accuracy and range. A new design, employing the same 5-inch head with a 5-inch motor, was developed. It became known as HVAR (high-velocity aircraft rocket). It first was put into combat use in August, 1944.

A need for a simple, economical rocket for practice firing resulted in the 2.5-inch SCAR (subcaliber aircraft rocket).

Meanwhile, work was in progress to develop the largest practicable rocket which carrier-based aircraft were capable of carrying. This project produced the Tiny Tim, a rocket consisting of a 500-pound semi-armor-piercing bomb, which measured 11.75 inches in diameter, and an 11.75-inch motor. The rocket was launched from a slightly modified bomb rack. It was first used in action in March, 1945. It had the effect of a 12-inch projectile, being capable of penetrating 4 feet of concrete.

Rocket development during World War II did not follow a normal plan. Time was not available for detailed study of the whole complex of rockets—their components, materials, launchers, and personnel factors. There was not enough of certain materials to produce the best designs. A case in point is the 11.75-inch rocket. The 11.75-inch pipe for the motor tube was chosen because the material for the tube was available and it coincided with the outside diameter of a 500-pound bomb, which could be used as the rocket head.

Comparison of Rockets With Gun Ammunition

Rockets possess certain definite advantages over gun ammunition. They have the advantage of being relatively simple and economical; they have no recoil force; and they possess a larger missile capacity with comparatively less weight of missile and launcher combined.

In general, much more propellant must be used to bring a given payload up to a given velocity by means of rocket propulsion than by means of firing from a gun. The fact that the motor, which is not usually of much value for fragmentation or other purposes, must be propelled along with the payload accentuates this disadvantage of rockets.

Another disadvantage is their relative inaccuracy when compared to guns. The mean deviation in deflection for most standard spin-stabilized surface rockets is of the order of 20 to 40 mils, while for guns it is of the order of 1 mil or less. Rockets are, therefore, of little value in situations requiring hits on point targets with the expenditure of only a few rounds. The intensive effort to develop and produce guided missiles has resulted in a very significant improvement in the target hitting properties of rocket propelled missiles. It is expected, however, that conventional rockets long will remain an essential portion of military armament.

Rocket Terminology

Common Terms. The following are terms which are not defined elsewhere in this publication. They are illustrated in the appropriate chapters.

1. Ammunition—all components and any and all explosives in any case or contrivance prepared to form a charge, complete round, or cartridge for small arms, rifle, gun, cannon, or for any other weapon, or for explosive actuated device, impulse device, torpedo warhead, mine, bomb, depth charge, demolition charge, fuze, detonator, projectile, rocket, or guided missile. Ammunition includes all solid propellants, as well as all conventional explosives; it also includes hypergolic liquid propellent systems and other hazardous materials applied to ordnance uses and/or requiring surveillance for reasons of explosive safety. Ammunition includes all JATO's, boosters, sustainers, military pyrotechnics, and offensive type chemical warfare materials. The principal expenditures of ammunition are for offensive, defensive, training, security, signaling, illuminating, testing, impulse, and saluting purposes.

2. Ammunition Components—integral units which are parts of a complete round of ammunition. Ammunition components may consist of inert parts, explosive parts, or both. Examples of ammunition components are fuzes, rocket heads, rocket motors, rocket fins and fin assemblies, projector charge heads, projector charge tails, dummy nose fuzes, auxiliary boosters, igniters, and propellent grains.

3. Ammunition Details—accessories used in packing, handling, protecting, and surveillance of ammunition; for example, containers, thread protectors, spacers, and fuze covers.

4. Booster—an assembly containing an intermediate explosive which is sensitive enough to be detonated by a small amount of initiating explosive and is powerful enough to cause detonation of a less sensitive explosive.

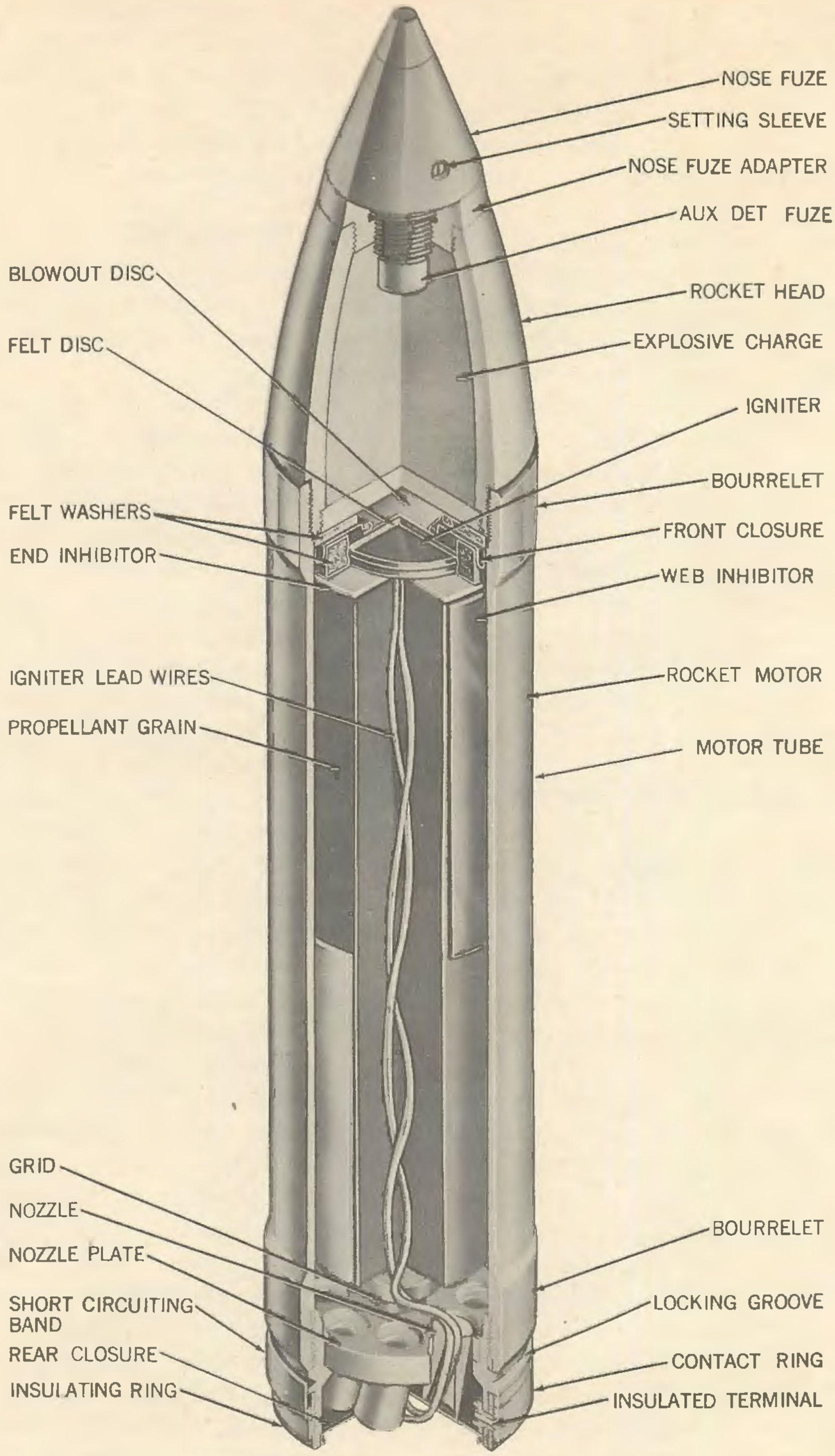


Figure 1.3—Rocket Terminology.

5. COOK-OFF—inadvertent launching of a rocket when the propellant is heated to the point of reaction by a hot launcher tube.

6. DELAY ELEMENT—an assembly containing a relatively slow burning explosive, initiated by a primer, which delays the functioning of the succeeding units of the explosive train. Black powder consolidated under pressure commonly is used for delay elements.

7. DETONATOR—an assembly in the explosive train of a fuze which contains a charge of high brisance. When fired by the primer or delay element, the detonator explodes with sufficient force to initiate a booster or, in some cases, the main charge. Lead azide is the most common explosive loaded in detonators. Certain detonators may include an increment of tetryl. In some instances the primer mixture may form the first increment loaded in a detonator. Such detonators are employed in fuzes equipped with a "stab type" firing pin.

8. EXPLOSIVE—a chemical compound or mixture of substances which, when subjected to suitable initiating impulses or agents such as flame, spark, heat, impact, or friction (whether applied mechanically or electrically), will undergo chemical and physical transformation at speeds varying from extremely rapid to near-instantaneous. This transformation will create a more stable compound, resulting in a considerable and rapid rise in pressure caused either by the generation of a much larger volume of gas than originally present or by the evolution of large quantities of heat (without generating gas) and other forms of energy with consequent expansion of the surroundings or both. The transformation accomplishes work of either useful or destructive character, depending on the measures of control exercised over the reaction. A list of common rocket explosives follows:

a. Explosive D—a relatively insensitive explosive used as a main charge chiefly in armor-piercing rocket heads because of its ability to withstand severe shock.

b. HBX—a mixture of TNT, RDX, aluminum powder, and a desensitizer. HBX is not sensitive to the shock of normal water impact. It is used as a main charge in 7.2-inch rocket and projector charge ammunition for antisubmarine warfare.

c. Lead azide—a highly sensitive explosive used in primers and detonators.

d. Lead styphnate—similar in its properties to lead azide, except that it may be initiated more easily. It sometimes is found mixed with lead azide to form a more sensitive mixture than azide alone; however, it most frequently is used alone. Lead styphnate often is used in the preparation of primer mixtures.

e. Tetryl—a sensitive explosive used in boosters and detonators.

f. TNT—a general purpose explosive used in cast form as a main charge in some rocket heads not designed to pierce heavy armor. TNT is sensitive to high-order shock.

9. EXPLOSIVE TRAIN—a functional arrangement of different types of explosives in a fuze, which initiates the main charge of a rocket head. Depending on the fuze, the explosive train may consist of a primer, delay element, detonator, and booster.

10. FINS OR FIN ASSEMBLY—a flight stabilization device, usually a number of tail planes, which tends to keep the rocket on its aimed trajectory.

11. FUZE—the initiating device which detonates a high-explosive main charge; or expels, disperses, or fires some other type of load.

12. HANGFIRE—a misfire which later fires from delayed functioning of the igniter.

13. HEAD—that part of the rocket containing the payload; either high explosive, chemical, or special filler and the fuze. The payload may be solid metal, with no fuze.

14. IGNITER—the initiating device which ignites the propellent grain. It is usually an assembly consisting of an electric squib, match composition, and black powder.

15. MAIN CHARGE—the high-explosive filler of the rocket or projector charge head.

16. MISFIRE—a situation in which a rocket or projector charge does not fire when the firing circuit is energized.

17. MOTOR—the propulsive component of a rocket. It contains the propellant, the igniter, and the nozzle(s).

18. PRIMER—the first element in the explosive train of a fuze. It is a sensitive explosive

which is initiated by a firing pin and, in turn, initiates the next element in the explosive train.

19. PROPELLENT GRAIN—the solid fuel used in a rocket motor which, upon burning, generates a volume of hot gases that streams from the nozzle and propels the rocket. Also called propellant or propellent powder grain.

20. PROJECTOR CHARGE—a missile used in antisubmarine warfare, which is similar in appearance to a rocket. A projector charge is propelled by a single impulse rather than the sustained thrust of a rocket motor. A projector charge tail does not contain nozzles or as much propellent powder as a comparable rocket motor.

21. ROCKET—a missile propelled by the sustained reaction of a discharging jet of gas against the container of the gas.

22. ROUND—an assembly of all the components necessary for functioning of the rocket for the purpose intended. This includes head, motor, and fuze(s).

23. SUBCALIBER—a term meaning less than the regular caliber or size. Although smaller than service rounds, subcaliber rockets have the same characteristics of trajectory and are used for training.

24. THRUST—the force exerted through the nozzle of a rocket motor.

Abbreviations.

ADF or Aux. Det. — auxiliary detonating fuze
AIC — Ammunition Identification Code (Army)
AP — armor piercing
ASP — antisubmarine projectile
ASW — antisubmarine warfare
A/T (Army), AT — antitank
BDF — base detonating fuze
CG — center of gravity
CWR-N — chemical warfare rocket (Navy) (obsolete term)
DNF — dummy nose fuze
DNP — dummy nose plug
dwg — drawing
EX — experimental
EXP — explosive
Exp D — explosive D
FCL — fuze cavity liner
FF — folding fin
FFAR — folding-fin aircraft rocket
FRAG — fragmentation
FS — fin stabilized
FSL — fuze seat liner
GP — general purpose
HC — high capacity (no longer used)
HE — high explosive
HEAT — shaped-charge rocket head (high-explosive antitank)
M — Model (Army, used like Navy mark except with experimental models)
MFR — manufacturer
Mk — mark
mm — millimeter
Mod — modification. (The term "mod" now commonly is used as a noun or adjective and no longer is considered strictly an abbreviation.)
NAD — Naval Ammunition Depot
NAS — Naval Air Station
NAVORD-INST — Naval Ordnance Instruction
NAVORD OD — Ordnance Data (publication)
NAVORD OS — Ordnance Specification (will become Military Specification—Mil Spec)
NM — Naval Magazine
NOB — Naval Operating Base
NOP — Naval Ordnance Plant
NOTS — Naval Ordnance Test Station
OP — Ordnance Pamphlet (publication)
PC — projector charge
PDF — point detonating fuze
PRAC — practice
psi — pounds per square inch
Rd — round
RH — rocket head
RM — rocket motor
RTP — requirements and test procedures
PWP — white phosphorus, plasticized
PWPV — white phosphorus, plasticized, vulcanized

SMOKE-TAR — smoke target (head)
SQ — superquick
SS — spin stabilized
TAR — target
VT — radio proximity; i.e., a fuze activated by its proximity to the target. It also is called "variable time" and "influence" fuze. (VT is a code symbol, not strictly an abbreviation.)
W — window
WP — white phosphorus

Classification of Rockets. Rockets may be classified as either fin stabilized (FS) or spin stabilized (SS). The fin-stabilized rockets have fins attached to the rear of the motor. The spin-stabilized have gas nozzles so arranged in the rear of the motor that the rocket spins when the motor is in use. A folding-fin-type rocket has been developed to fire from launchers within aircraft or from tube-type launcher pods mounted externally on the plane.

Rockets may also be classified according to their use as either surface or aircraft. Surface rockets are fired from shore installations or ships, and aircraft rockets are fired from planes.

Rockets further may be classified as to their purpose; i.e., service, practice, dummy-drill, or subcaliber.

Service rockets have live-loaded motors and heads which carry a payload of high explosive, smoke mixture, window material, or a flare. One type of service head is solid steel. The service heads are used in combat and as otherwise directed.

Practice rockets have a live-loaded motor and a head with an inert load, usually plaster, to simulate the weight of a high explosive load in the service head. They are used for target practice.

Dummy-drill (or dummy) rockets have an inert-loaded motor and a practice head. They are used for training in handling rockets and for testing launchers.

Subcaliber rockets have live-loaded motors and solid heads. They are made smaller than the service rockets which they simulate. This is for economy in practice firing. Subcaliber rockets are fired from launchers of the rockets they simulate by means of an adapter.

Practice and subcaliber rockets have the same velocity and trajectory as the service rockets which they replace. Recently, the use of subcaliber rockets has been discouraged; instead, practice rockets for all except the 12.75-inch size are used.

Rocket Heads

Several different types of rocket heads have been developed to meet various tactical requirements. Figure 1.4 illustrates some of the types used in surface operations. The approved descriptive names and abbreviations of rocket head types are as follows.

Armor-Piercing (AP). The armor-piercing head used in surface rockets has thick walls and contains a small percentage of explosive charge by weight (less than 10 percent). The head achieves maximum penetration with a relatively small blast effect. This type employs a base detonating fuze. The term "Common" (Com), which designated some heads in this category in the past, no longer is used. A solid type of AP head also has been designed that provides for maximum penetration.

High-Explosive (HE). This head contains a relatively high percentage of explosive charge by weight (about 30 percent). The head has a large blast effect but will penetrate only light armor. It requires a nose fuze.

Practice (PRAC). Practice heads are of two types, subcaliber and inert-loaded. The subcaliber head is a solid shot. The inert-loaded head is a service head filled with plaster or similar inert filler. The weight and placement of the filler is such that the physical characteristics of the inert-loaded head are equivalent to those of the service head. The inert head is used for training and practice firing from a service launcher.

Smoke (SMOKE-WP, SMOKE-PWP, SMOKE-FS, or SMOKE-TAR). The heads loaded with white phosphorus (SMOKE-WP), plasticized white phosphorus (SMOKE-PWP), or sulfur trioxide plus chlorosulfonic acid (SMOKE-FS) are used primarily to

495862 O—59——2

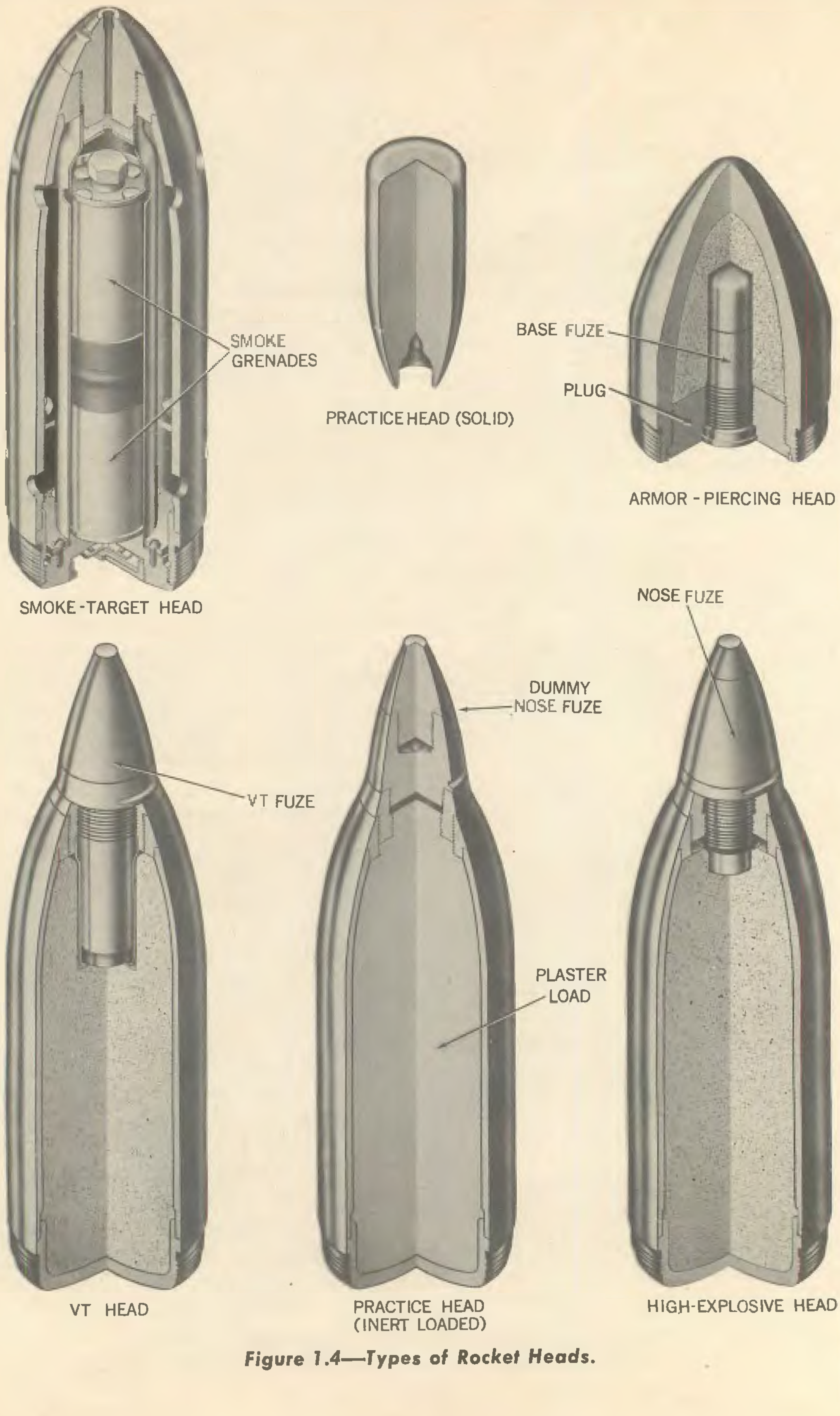


Figure 1.4—Types of Rocket Heads.

produce screening smoke. Another use is for target indication.

The smoke target head (SMOKE-TAR) is loaded with two smoke grenades. It produces a smoke trail during rocket travel and is used to train gunnery crews in the tracking of targets.

VT. This head is similar to the HE head. It requires a VT fuze.

In addition to the rocket heads shown in figure 1.4, the following types also may be used.

Flare (FLARE). This head contains a pyrotechnic flare element, attached to a small parachute, and a small ejection charge. When ejected from the forward end of the head, the flare burns suspended from the parachute.

Fragmentation (FRAG). This head is similar to the GP head in explosive content; however, the walls are laminated, wire-wound, or are made in some other special manner to control the size of the fragments.

Gas (GAS (Abbreviation of type gas such as HC)). This head is loaded with one of several chemicals which produce gas casualties among personnel.

General-Purpose (GP). This is similar in structure to the HE head, but uses either a nose fuze or a steel nose plug and a base fuze. The term "High Capacity" (HC), previously used for a variation of this head, no longer will be used.

Shaped Charge Antitank (HEAT.) This head contains a high percentage of explosive by weight. The shaped charge provides deep penetration into concrete or armor by action of the cavity-directed jet. The HEAT head is used primarily against installations where it is desired to breach a thick protective armor without an added explosion inside the target. One type of HEAT head employs a point detonating nose fuze. It fires a length of detonating cord (primacord) which leads to a booster located in the rear of the head.

Window (W). This head contains a payload of foil strips or metal rods and a small ejection charge. When ejected from the forward end, the strips or rods disperse in air to form a "cloud" to reflect radar waves.

All current surface rocket heads are illustrated in chapter 2.

Rocket Heads Classified According to Physical Type. Surface rocket heads for service use are of three general types. HE, VT, SMOKE, and SMOKE-TAR heads have steel walls of varying thickness and are closed at the base. These heads may be either one-, two-, or three-piece. The several pieces are brazed or silver-soldered. The nose or nosepiece is threaded to receive the nose fuze adapter or VT fuze cavity liner.

One type of AP head has heavy steel walls, a thick-walled nosepiece, and a base plug threaded to the nosepiece. The base plug is threaded forward to receive a base fuze cavity liner and at the rear to receive a base fuze.

HE-loaded rocket heads and projector charge heads for antisubmarine warfare have sheet-steel walls. The body consists of a cylindrical section with a flat nose plate section and a cone-shaped after section. The nose plate is threaded to receive a nose fuze or nose fuze seat liner. The after section has a threaded portion to receive the rocket motor tube or projector charge tail tube. The sections are welded or silver-soldered together.

Heads either may be threaded externally at the base for assembly to the motor tube, or may be threaded internally to accept a motor head adapter into which the motor is screwed. The heads usually have two spanner holes located 180 degrees apart near the base to facilitate assembly of the head and motor or tail.

Rocket heads are supplied with base thread protectors or base shipping caps to protect the threads during handling and shipping. If necessary, a nose shipping plug replaces the nose fuze during handling and shipping.

Practice heads have the same inert parts as the HE-loaded service heads.

Rocket Motors and Projector Charge Tails

Rocket motors and projector charge tails for 7.2-inch heads, figures 1.5 and 1.6, are similar in appearance and purpose. Projector charge tails, however, do not operate on the rocket principle and are not rockets in any sense of the word.

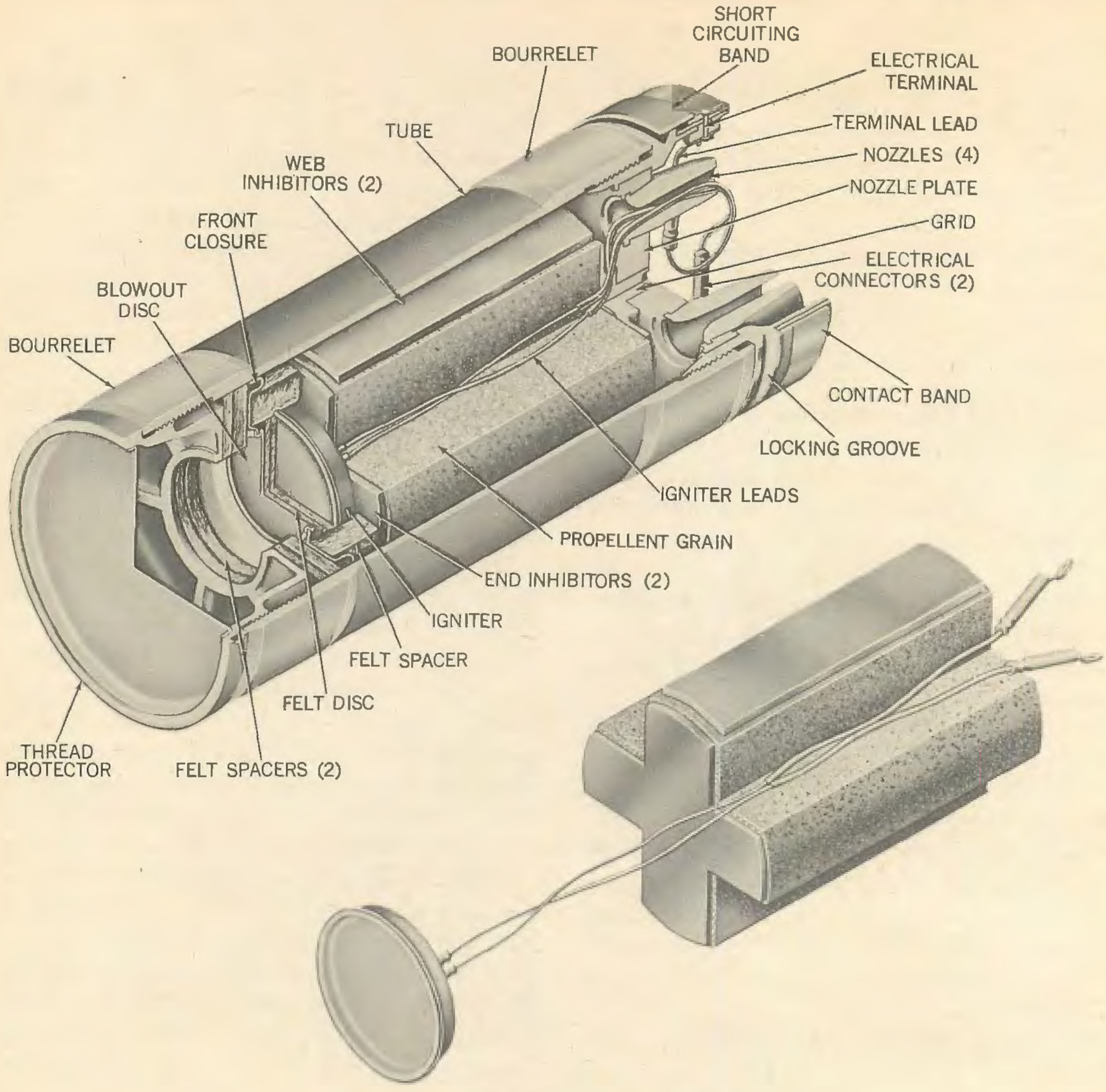


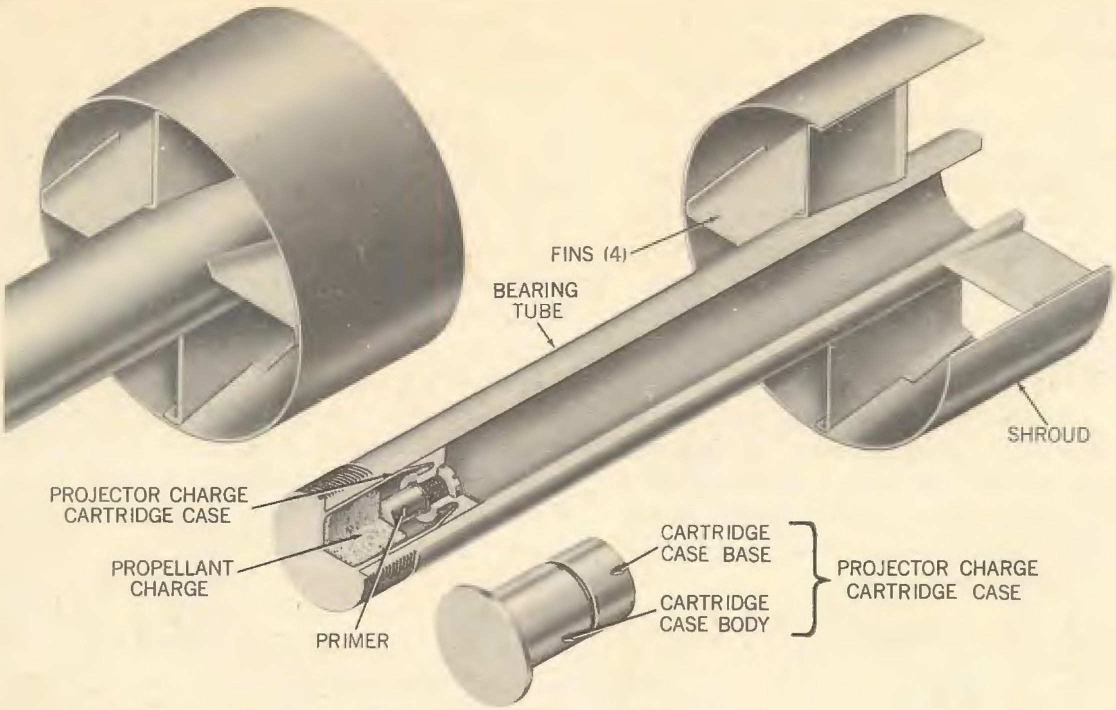
Figure 1.5—Rocket Motor Terminology.

Projector charge tails are fired by cartridges. Rocket motors, on the other hand, have propellants which burn at a constant rate for a relatively long period of time compared to the short burst from the cartridge.

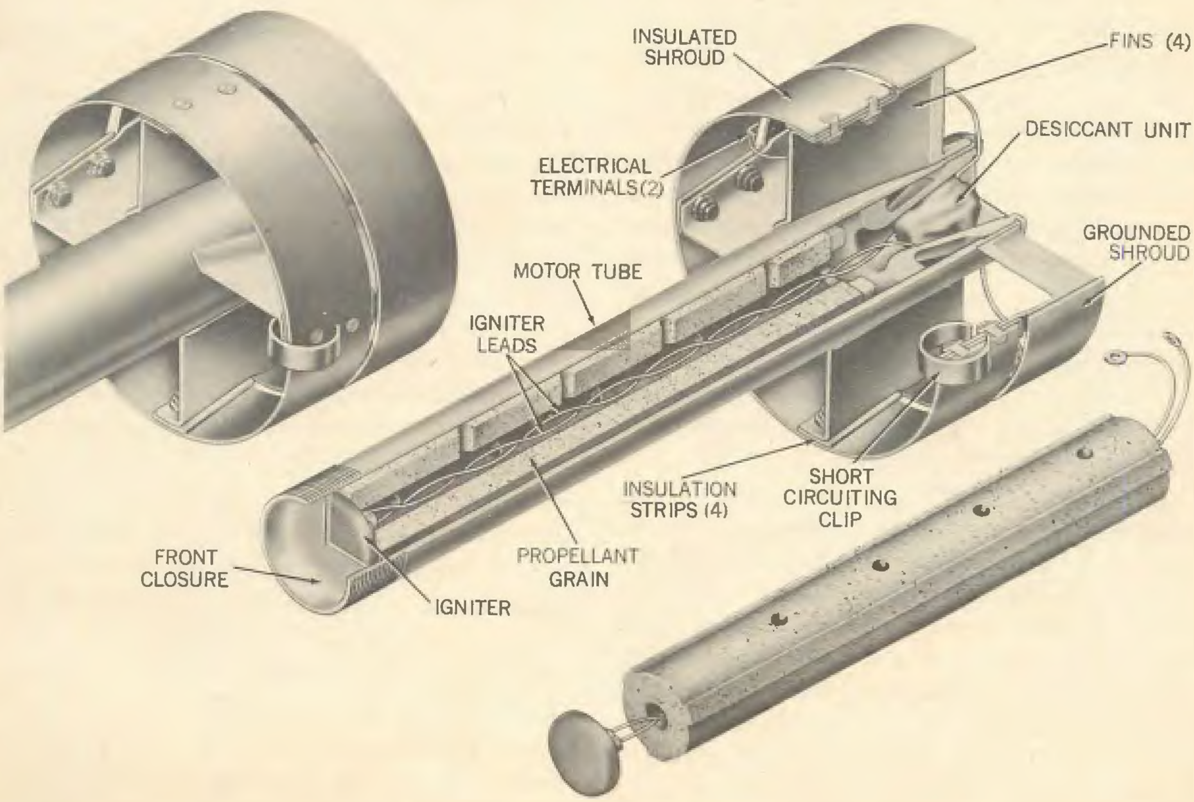
Surface rocket motors are of two general types: those which impart a spin to the rocket for stability, and those which utilize fins for the same purpose. Motors which produce spin achieve it through a group of canted nozzles arranged on a plate in the rear of the motor. Motors which use fins for stability generally have only a single nozzle.

The principal parts of rocket motors are described and illustrated in this section. Specific information on particular types is in chapter 3.

Motor Tube. The tube is usually a seamless steel cylinder. One end is secured to the rocket head by threads. The other end receives the nozzle assembly, which may be secured by threads or welds. The tube serves to hold the motor components in place and provides a combustion chamber for the propellant. On the outside surface of the motor tubes of spin-stabilized rockets are two bour-



2.25 INCH PROJECTOR CHARGE TAIL



2.25 INCH ROCKET MOTOR

Figure 1.6—Rocket Motor and Projector Charge Tail Terminology.

relets. Bourrelets are of slightly greater diameter than the remainder of the tube. They serve as bearing surfaces for the motor in a launcher. By presenting a smaller overall bearing surface, they reduce friction.

Propellant. All rockets treated in this publication use a solid propellant. The rocket propellant is in the form of a long grain. Navy surface rockets use a single grain. Rocket motors require that the propellant burn evenly and continuously. Gas pressure must be sufficient to propel the round and yet not so high as to burst the relatively thin metal walls of the motor tube. To obtain uniform burning and to prevent sudden excessive pressure rises, a double-base smokeless powder, ballistite, is employed. Ballistite has the following approximate proportions:

	Percent
Nitrocellulose (gun cotton)	51.40
Nitroglycerine	42.90
Plasticizer (diethylphthalate)	3.23
Ethyl centrolite	1.00
Flash depressant (potassium sulfate)	1.25
Carbon black	0.20
Candelilla wax	0.02

Propellent grains are shaped to attain an even rate of burning. Also, since the propellent grain occupies a considerable portion of the volume inside the rocket motor during most of the reaction, the grain must be shaped to permit the gas to escape to the nozzle end. Three shapes are common. One is cruciform (cross-shaped); another is cylindrical with an axial hole, radial perforations, and three ridges about the periphery 120 degrees removed from each other and extending longitudinally along the grain; and the third is cylindrical with an axial hole.

Inhibitors. Inhibitors are fire-resistant plastic strips cemented to portions of the surface of propellent grains. They decrease the rate of combustion in those areas and bring about, in total, a more uniform rate of burning. Strip inhibitors are used on cruciform grains. End inhibitors are used on radially perforated grains. A combination of end inhibitors and a spirally wound tape inhibitor is used on simple cylindrical grains.

Igniter. The igniter ignites the propellent grain. The igniter is a thin, disc-shaped metal or plastic container which fits against the forward end of a single propellent grain. The igniter contains black powder and an electric squib; some igniters have two parallel squibs. The squib consists of a resistance wire filament, termed the bridge, encased in match composition. Lead wires extend from the squib through the rear wall of the igniter. The lead wires pass along the length of the propellent grain and through the nozzle to the wire connectors.

Igniters are designed to respond in a minimum time with a squib current of 1.0 ampere or more. However, as small a current as 0.2 ampere will set off the match composition and black powder after a short delay. The nominal resistance of the squib is 1.0 ohm. Therefore, ignoring any line resistance, application of 0.2 volt is sufficient to set off the charge in time. Application of 0.75 volt gives generally satisfactory performance for the squib alone. In practice, however, the line and contact resistance of the igniter circuit require higher voltages.

Nozzles. Nozzles direct the gas jet and utilize the expansion of the gas in an exit cone to increase total thrust (about 30 percent more than a simple opening). They also restrict the rate of gas escape from the reaction chamber, thus maintaining the pressure within the motor tube at a value suitable for the reaction of the propellent. Nozzles are metal parts formed as illustrated in figures 1.5 and 1.6. Some single nozzles are threaded directly to the metal tube. Other nozzles are inserted, and brazed or staked to a nozzle plate which is secured by threads to the metal tube. As in the rocket motors used in the 5.0-inch spin-stabilized rockets, there may be several nozzle inserts in the nozzle plate. To impart spin, nozzles are installed at an angle to the longitudinal axis of the motor. Direction of the spin is clockwise, as viewed from the rear.

Grid. The grid is located at the rear end of the propellent grain and in front of the nozzle assembly. It supports the grain structurally before and during burning. The grid in a spin-stabilized rocket motor has projecting pins which prevent turning of the grain. The grid is shaped to allow clearance for the gases flowing toward the nozzle.

Felt Spacers. Felt spacers may be washers, discs, or pads. Depending on the particular motor, a felt spacer or combination of spacers is used with the front closure to locate, support, or cushion the propellent grain and igniter. Some motors do not require spacers. Felt washers also are used forward of the front closure as distance pieces between the front thread protector and the front closure in the 5.0-inch spin-stabilized rocket motor series. These washers remain in the motor tube when the rocket head is assembled to the motor.

Suspension Buttons. Some surface rocket motors have metal buttons which hold the round to the launcher. The buttons, which are welded to the motor tube, engage a T-slot in the guide rail. In those motors which employ electrical connectors, the rear button also holds the connector during shipping. The connector cable partially is wrapped around the button and secured to it by means of a washer and spring retaining clip.

Closures. There is a closure for each end of the motor tube. The front closure, which is pressed or sealed to the motor tube, may be a simple metal cup, or a disc with re-entrant side walls and a central blowout disc crimped to the larger disc. The front closure is used with the nozzle or nozzle plate to hold the igniter, grain, grid, and other motor components in place. It also acts as a seal to prevent the entry of foreign matter. The central blowout disc is blown out easily if the motor should become ignited accidentally when it is not assembled to the head; propulsion of the motor thereby is prevented.

Rear closures may be simple cup discs which are friction-fitted to the motor tube. Another type may be simple cup nozzle closures which are sealed into the nozzles. The nozzle closures may be an integral part of an electrical connector. The rear closure serves to prevent the entry of foreign matter. It also prevents the entry of flame from rounds fired previously in multifiring launchers with magazine feeds. The rear closure is blown out when the round is fired.

Fins and Fin Assemblies. Some shrouded-fin motors have four fins welded to the rear of the motor. A circular plate, the shroud, is welded to the fins. The other shroud is insulated from the fins and secured by rivets. Both shrouds are of the same diameter. Other shrouded-fin motors have fins welded to the motor tube and a one-piece circular plate, the shroud, welded to the fins. Shrouded-fin motors which propel rockets traveling only in air have straight fins. Those shrouded-fin motors which propel rockets employed in antisubmarine warfare have canted fins. The fins are 10 degrees out of line with the motor axis to improve the underwater trajectory.

Projecting fins may be welded to the motor tube. When welded or secured to circular bands, they comprise a fin assembly. The assembly is fitted on and secured to the rear of the motor tube. Fin assemblies which have split bands are secured to the tube by bolts passing through one edge of the band and threaded through nuts welded to the other edge. Other fin assemblies are secured by tail rings which are fitted on the tube behind the assemblies. The rings are secured by setscrews.

Electrical Connectors. Certain shrouded-fin and projecting-fin motors employ an electrical connector. The electrical connector is a length of cable with a plug at one end. The two igniter leads are connected to the electrical connector cable by solderless wire connectors. The plug is either the two-prong Navy type or the common household type. A nozzle closure, through which the cable passes, may be an integral part of the electrical connector. The closure is crimped and sealed to the cable. Electrical continuity exists from one prong of the plug, through the igniter, to the other prong. Another type of plug is the Army-type jack plug used in aircraft rocket motors. Electrical continuity exists between the shank of the plug, through the igniter, to the axially mounted tip of the jack. When the rocket is on the launcher way, the plug is inserted into a receptacle in the launcher firing circuit.

Electrical Contacts. Some fin-stabilized motors having shrouded fins employ an insulated forward shroud and a rear shroud grounded to the motor tube. Other shrouded-fin motors do not use the shrouds as contact means; they use an electrical connector.

One type has four fins welded to the motor tube. The fins are formed so that the outside diameter of the rear section of the fin is larger than that of the forward section. A circular plate, the rear shroud, is welded to the rear section. Another circular plate, the front shroud, is placed over insulating strips extending fore and aft on the forward section of the fins. Split rivets pass through holes in the circular plate, the insulating strips, and the fins. An insulating washer, which extends through the fin, and a steel washer are placed over each rivet. The rivets are staked to secure the assembly. The two shrouds are of the same diameter. Terminals are welded to each of the shrouds. The two igniter leads with terminal lugs are connected to the terminals. Electrical continuity exists from the forward insulated contact shroud, through the igniter, to the rear contact shroud.

Spin-stabilized motors have a circular insulated contact band around the rear of the motor. The contact band is insulated from the motor tube by a plastic sleeve. Two rivets pass through the contact band, insulating ring, and nozzle plate ring; one carries the grounded terminal lug and wire lead and the other, the live terminal lug and wire lead. The grounded terminal lug touches the inside surface of the nozzle plate ring. An insulating bushing prevents contact of the lug with the rivet. The live terminal lug is in contact with the rivet. A bushing prevents contact of the lug with the nozzle plate ring.

Both terminal lugs are soldered to the rivets which are staked to the contact ring to secure the assembly. Glyptal sealing compound covers the terminals, bushings, and rivets thoroughly. The two igniter leads are connected to the terminal leads by solderless wire connectors. Electrical continuity exists from the contact ring, through the igniter, to the nozzle plate ring, and then to the metal motor tube.

A short-circuiting band usually is fastened around the nozzle assembly in such a manner that it creates a short circuit between the contact ring and the motor tube, thus preventing accidental functioning of the igniter.

Rocket Fuzes and Auxiliary Boosters

A rocket fuze is a mechanism used in a rocket head to initiate the detonation of an explosive charge, the dispersion of a chemical or special filler, or the expulsion of a flare, window, or special filler.

Classification. Rocket fuzes usually are classified according to location in the rocket head or type of action of the fuze.

Rocket fuzes classified according to location in the rocket head are either nose fuzes or base fuzes. VT fuzes, those which are initiated by their nearness to a target, are special types of fuzes. The following are rocket fuzes classified as to type of action.

1. Impact-firing fuzes are those which function when the rocket strikes a target which offers a sufficient resistance. They usually are called point detonating fuzes (PDF) or base detonating fuzes (BDF). The fuzes may fire either instantaneously or after a short delay that affords the rocket time to penetrate the target before the head explodes.

2. Proximity-firing fuzes (VT) are those which incorporate a radio receiver and transmitter, and after being fired, send out signals and receive back the same signals reflected by

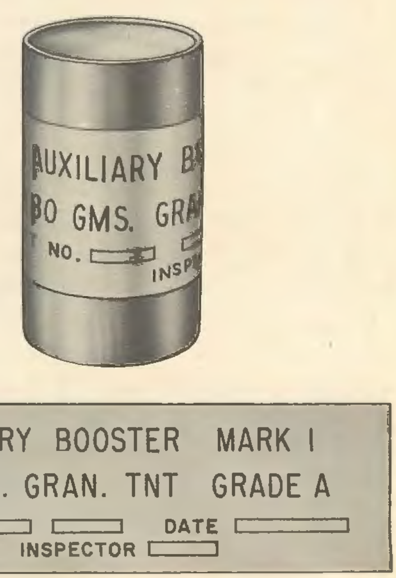


Figure 1.7—Typical Auxiliary Booster.

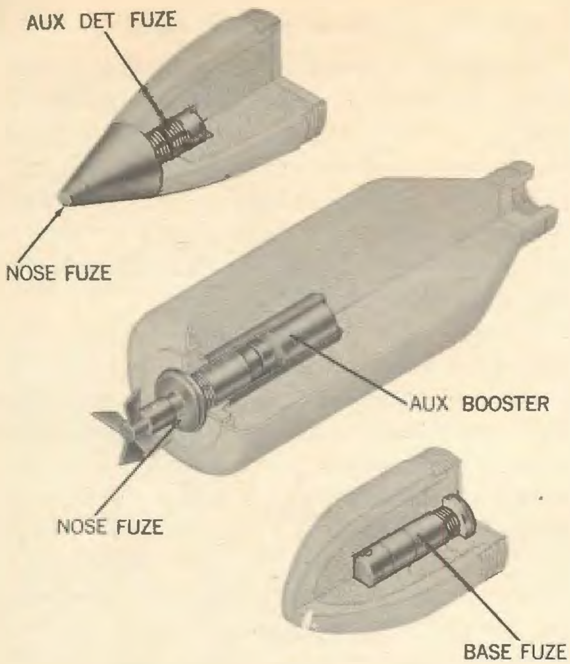


Figure 1.8—Rocket Heads Showing Fuzes and Auxiliary Booster in Place.

the intended target. If the strength of the reflected signal is sufficient, the receiver triggers an electronic firing switch which starts the detonation of the firing train. These fuzes are classified.

3. Auxiliary detonating fuzes are those which function as a result of flash or a shock wave from the nose fuze. An auxiliary detonating fuze is used with a point detonating nose fuze or as an integral part of the VT fuze.

Forces Used in Arming Rocket Fuzes

The forces which are utilized to arm rocket fuzes depend upon the characteristics of the rocket for which the fuze is designed. Many of these forces are present in gun ammunition and bombs, but to a different degree of magnitude.

Setback. Setback is the term applied when fuze parts react to acceleration of the rocket assembly. It affects fuze operation by causing certain movable fuze parts to move aft when the fuze as a whole moves forward. Slow accelerations (compared to gun ammunition) are characteristic of rockets. The acceleration attained is dependent greatly upon the initial temperature of the propellant; it is quite low at lower temperatures. Because of this condition, fuzes actuated by setback forces must be designed to operate at the minimum acceleration.

Setback often is utilized to delay the arming of rocket fuzes. Small setback forces are made effective by making the parts operated by setback relatively massive and the retaining mechanisms relatively weak, as compared to gun ammunition fuzes.

Water Travel. The force exerted by the water stream past the rocket in water travel is used to arm many rocket nose fuzes for fin-stabilized rockets by turning propeller vanes.

Gas Pressure from Burning Propellant. During the burning of the rocket motor propellant, pressure of the resulting gases is exerted on the base of the rocket head and base fuze. This pressure is fairly constant during burning and is of the magnitude of several hundred psi. Because the motor pressure lasts for a considerable time, gas entrance into the fuze can be controlled and utilized to delay the arming of the fuze.

Centrifugal Force. Centrifugal force is available in spin-stabilized rockets, owing to the rotation of the rocket. This force attains its peak at the end of burning after the rocket is launched. Centrifugal force moves an interrupter out against an interrupter spring, clearing the flash channel and arming the fuze. The base fuze illustrated in figure 1.13 also utilizes centrifugal force to become armed. When the detents move out under centrifugal force, the two plungers are allowed to float against the anticreep spring, and the fuze is in the armed condition.

Creep. Creep is a continuous inertial retarding force caused by surface drag (air resistance) on the rocket after the motor has burned out and forward acceleration has ceased. Internal fuze parts tend to move toward the nose of the round. These forces may be controlled in rocket fuzes by anticreep springs. They prevent fuze initiation until the fuze strikes a target with sufficient impact to overcome the forces exerted by these springs.

Friction. Frictional forces caused by setback and creep are not high in rockets, but frictional forces caused by centrifugal force may be quite high. Friction is not being utilized to any extent at present in rocket fuze operation.

Impact Inertia. An impact inertial retarding force is present in rocket fuzes when the rocket hits water. Fuze parts tend to move forward. The collar weight of a water-travel-arming-fuze, used on some projector charges, moves forward upon impact of the round with the water surface to arm the fuze partially. The weight depresses detent springs holding the arming-vane hub to allow the propeller to rotate.

Forces Used in Firing Rocket Fuzes

Surface rocket fuzes treated in this publication are of the mechanical type. The forces which are utilized to fire these fuzes depend on the tactical use of the rockets.

Various means are employed in the fuzes to support the firing pin in the unfired position. Firing pins may be held by shear pins or springs. In some fuzes, the firing pin may be held stationary while the primer is free to move.

Point detonating fuzes have the firing pin located in the forward part of the fuze. Upon impact, the firing-pin extension or assembly is driven to the rear by the direct force of the target. The support is crushed or sheared. The firing pin pierces the detonator, causing initiation of the explosive train.

Base fuzes have a weighted body holding a primer. An anticreep spring retains the body. Upon impact, inertia causes the body to move forward and overcome the spring. The primer face is pierced by the firing pin, causing initiation of the explosive train.

Water-travel-arming nose fuzes have a firing-pin assembly cocking arrangement with a weighted body that acts as a trigger. Upon impact, inertial forces cause the body to move forward and laterally. The firing pin is released and driven by a spring into the detonator, thus firing the explosive train.

Explosives Used in Rocket Fuzes

The explosives used in rocket fuzes are essentially the same as those used in bomb and projectile fuzes, and are subject to the same requirements and composed of the same materials. The explosive train of a rocket fuze usually consists of a primer, delay element, and detonator. These are described in the following paragraphs.

Primer. The primer is initiated mechanically by a firing pin. There are two types of primers used; namely, the stab-type detonator (on sensitive primers) and the percussion primer. The stab type is initiated by penetration of a sharp-pointed firing pin through the metal case into the primer mixture. Stab-type primers generally are used when instantaneous fuze action and increased sensitivity are desired. The percussion type is initiated by the crushing of the primer mixture against an anvil by a round-pointed firing pin. The percussion type is used more often when the fuze contains a delay element.

Primer mixtures are intended to produce flame, hot gases, and particles, as a result of being struck or otherwise mechanically disturbed. They are composed generally of an initiating substance, such as lead azide or lead styphnate; an oxidizing agent, such as potassium chlorate; and a reducible substance, such as antimony sulfide. They may also contain a friction-creating material, such as fine carborundum crystals.

The nose fuze, figure 1.9, contains a primer and a round-pointed firing pin in its delay or plunger assembly. Upon impact, inertia carries the plunger assembly forward, allowing the firing pin to indent the primer and set off the remainder of the explosive train.

The base fuze, figure 1.13, contains both a stab-type sensitive primer and a percussion-type primer in its detonator plunger. Impact allows the stab-type primer to be pierced by the forward firing pin. The force of this explosion locks the plunger in armed position and causes the round-pointed firing pin to indent the percussion primer and initiate the remainder of the explosive train.

Delay Element. The delay element is a compressed pellet of black powder which is ignited by the primer. The delay time obtained with a given primer is varied by adjusting the composition of the black powder, the packing of the pellet, and the thickness of the wall through which burning must occur. The plunger assembly of the nose fuze, figure 1.9, uses a black-powder delay element, which is initiated by the plunger-assembly primer in the body of the fuze.

Detonator. The detonator is initiated by the primer, delay element, or firing pin. It is composed of a pure initiating explosive, usually lead azide, often followed by a small amount of tetryl compressed in the same detonator cup. Relay detonators are utilized in nose fuzes in combination with auxiliary detonating fuzes to insure completion of the explosive train of the fuze combination. They may be initiated by a primer or by the flash from a detonator.

The nose fuze, figure 1.9, uses both a stab-type detonator having an integral increment of primer mixture and a relay detonator in its instantaneous-action explosive train. Impact on the nose of the fuze drives the firing pin aft to initiate the stab detonator. The flash which follows initiates the relay detonator. The base fuze, figure 1.13, has a detonator in its detonator-plunger assembly. The percussion primer initiates the detonator which, in turn, fires the lead-out and lead-in.

Lead-Out and Lead-In. The lead-out and lead-in are small pellets of tetryl which reinforce the relatively small explosion of the detonator and transmit it to the booster. A lead-out is not necessarily used; if it is, it usually moves with the detonator during the arming of the fuze. The base fuze, figure 1.13, has both lead-out and lead-in. The lead-out is initiated by the detonator and, in turn, fires the lead-in which initiates the booster.

Booster. The booster is a comparatively large tetryl pellet, loaded in a container or magazine as part of the fuze. It usually is initiated by the lead-in and, in turn, detonates the main high-explosive filler of the head, either directly or through an auxiliary booster of granulated TNT.

Functional Description. Each fuze incorporates a fuze train, the elements of which are placed or moved into place to insure initiation in sequence of each element of the train. At least two explosive elements are present in every fuze train; an initiating element (primer or detonator), fired by a change of structure or change of state of the fuze as the fuze comes into contact either directly or indirectly with the target, and a final element, in contact with the charge in the rocket head, the final element being fired by the last element of the fuze train.

The final element may be a booster to explode the main explosive charge in an HE head (an auxiliary booster may be placed immediately after the booster), a burster tube to disperse the contents of a SMOKE head, a black powder charge to expel a filler from a rocket head, or a first-fire mixture to initiate the burning of a SMOKE-TAR head.

Elements of the train are close to each other, or located in line so that a flash or shock wave from the preceding element may fire the succeeding one. A delay element may be placed between the primer and booster for tactical purposes (such as to allow the head to bury itself in the ground before exploding). Other explosive elements may be placed in the fuze train to maintain the flash or shock wave path if the primer and booster are separated by structural elements embodying safety features in the fuze.

Safety Features. In general, the safety requirements for rocket fuzes are similar to those for gun ammunition and bomb fuzes. The fuze contains adequate safety features to prevent detonation from normal causes during storage, transportation, handling, assembly, loading, and launching of the rocket.

In addition, the fuze will remain inoperative until the rocket well is clear of the launcher. Design requirements call for a detonator-safe fuze; that is, the explosive train must be interrupted so that, if the detonator is prematurely initiated while the fuze is unarmed, the booster of the fuze and, hence, the explosive filler of the head will not be detonated. In some fuzes, this is accomplished by an out-of-line location of the detonator and the booster when the fuze is in an unarmed condition. In others, the flash from the primer is blocked by an interrupter. The arming of a fuze is mainly the alining of the explosive train between the initiator and booster, or the opening of a flash path.

The type and amount of explosive in a fuze depends on the purpose of the fuze and the degree of safety required for the particular fuze or rocket assembly. Some fuzes contain initiating charge, explosive train, and booster charge; some contain only the initiating charge and train; others contain only the explosive train and booster charge. All base fuzes, and some nose fuzes, contain initiating charge, train, and booster. All auxiliary detonating fuzes contain only the explosive train and booster. The nose fuzes which contain only an initiating charge and train must be used in conjunction with an auxiliary detonating fuze to initiate the main charge of a high-explosive-loaded head.

Nose fuzes are secured by threads in rocket heads either directly or by means of adapters. Adapters are necessary because all fuzes and heads do not have the same size threads.

Sensitive explosive material loses its effectiveness if it picks up moisture. Rocket fuzes require gaskets and the application of sealing materials to render them moistureproof. In addition, fuzes are packaged in hermetically sealed, tear-strip shipping containers. Special care should be taken to prevent damage from moisture to fuzes assembled in rockets or stowed in ready-service boxes or magazines.

Fuze Operation

The marks and mods of rocket fuzes usually involve only minor changes in the design of a relatively few prototypes. This section discusses the basic or general operation of these prototypes when they are subjected to the forces used in arming and firing. Essentially, they embody all basic methods of surface rocket fuze operation. The difference between the specific fuzes and the prototypes is explained in chapter 4.

Centrifugal - Arming, Point Detonating Nose Fuzes. This type, for use in spin-stabilized rockets only, is illustrated in figure 1.9. It is designed to fire either instantaneously or with a delay action, depending on the action selected prior to firing. The instantaneous and delay firing systems are independent of each other. The delay system will function regardless of the selection, thus increasing the dependability of the fuze. Since there is no booster charge as an integral part of this fuze, an auxiliary detonating fuze must be used with it.

The external parts are the body, ogive, and head. These parts are joined internally by the threads of the flash tube. The fuze body houses an interrupter assembly, which consists of a solid metal interrupter and a subassembly. The subassembly is composed of a setting sleeve in an eccentric-bored interrupter guide well, and an interrupter spring that bears against the spring cup at one end and against the setting sleeve at the other end. The subassembly is held in place by a tension spring and the setting sleeve retainer. The spring cup bears against, and is free to move on, the interrupter.

The components of the delay firing system are housed in the aft end of the fuze body. The delay plunger assembly consists of a plunger housing, a plunger support, a plunger body assembly, and a plunger restraining spring.

The plunger housing, a light metal cup, contains the components of the delay arming mechanism. The forward end of the plunger housing has a central flash hole, three centering tabs, and the off-center-mounted delay firing pin. The forward end of the hollow plunger support rests between the centering tabs and is alined with the flash hole.

The plunger restraining spring fits over the plunger support and bears against the flange at the forward end of the plunger support.

The plunger body assembly, containing the arming and explosive elements, and the lock check washer are mounted over the plunger support and bear against the rear end of the restraining spring. An alining pin, extending from the side of the plunger body, rides in a small, elongated guide hole in the plunger housing side wall. It alines the plunger body

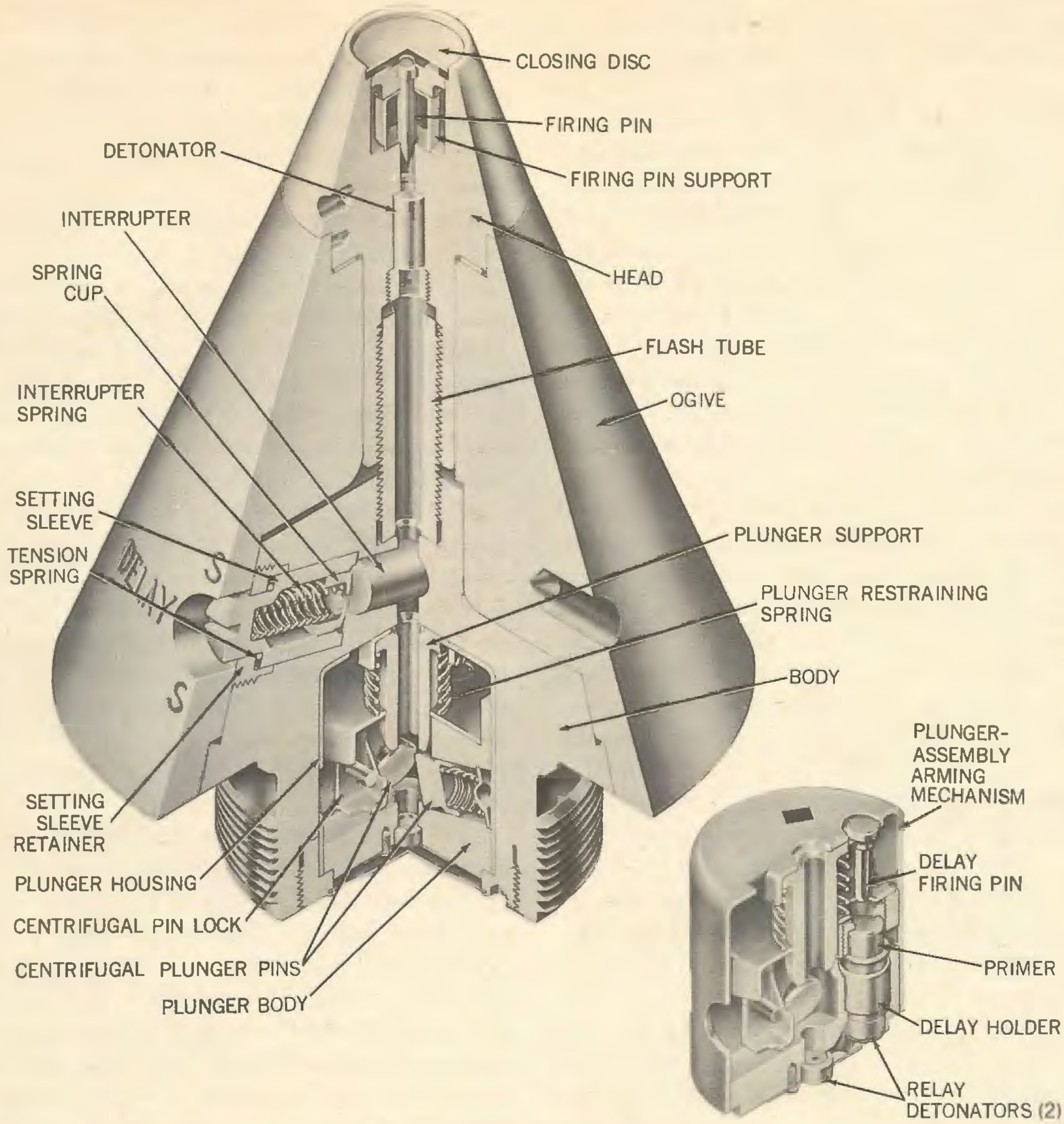


Figure 1.9—Typical Nose Fuze (Centrifugal-Arming, Point Detonating), Unarmed, Sectional View.

with the fixed firing pin and allows the plunger body assembly to float against the plunger restraining spring.

The plunger body assembly consists of a cylindrical brass body with a central flash hole, an offset well threaded to receive the relay detonator, delay holder assembly, and primer and detonator assemblies. A milled slot extending into the flash hole receives the centrifugal pin lock. Two diametrically opposite centrifugal plunger pins and a flash-hole relay detonator are also in the plunger body. The two plunger pins extend partially into the central flash channel of the plunger assembly to prevent the plunger assembly from moving forward on the plunger support upon accidental impact.

The delay holder assembly consists of the baffle, the primer, and the delay pellet. The delay holder assembly and the delay relay detonator are secured in a well by a threaded retaining bushing. The baffle is grooved a half turn on the outside diameter for flash travel. A diagonal flash channel connects the two relay detonators. A brass washer, held by three drive screws, seals the aft end of the plunger body. The delay plunger is secured to the fuze body by a bottom-closing screw with a central airtight disc.

When the setting sleeve is in the DELAY-DELAY position, the interrupter rests against a narrow shoulder formed by a shallow counterbore in the guide well. The interrupter is not free to move axially and thus blocks the flash channel. When the setting sleeve is rotated 90 degrees to the SQ-SQ position, the interrupter clears the sleeve shoulder. It becomes alined coaxially with the guide well and is free to move out of the flash tube, against the spring cup, and into the guide well when acted upon by centrifugal force.

When the slot is set on SQ-SQ, centrifugal forces arm the fuze by moving the interrupter out of the flash tube. The interrupter moves against its spring when rotational velocity of the rocket reaches 1500 to 2000 rpm, which requires about 6 feet of travel. Upon impact, the closing disc and firing pin support are crushed, and the firing pin is driven into the detonator. The flash from the detonator passes through the flash tube and plunger support, and initiates the central relay detonator. The delay firing system also functions at this setting of the fuze, later than the instantaneous system. If the instantaneous system fails to function, the delay system will fire the fuze.

The fuze is set for delay action by turning the setting sleeve to DELAY-DELAY. The interrupter is locked at this setting of the sleeve and the flash tube is blocked, preventing operation of the instantaneous firing system. The centrifugal force from the rocket's spinning causes the centrifugal plunger pins to move outward against their springs and unlock the plunger body. These plungers move when the rocket's rotational velocity reaches 1500 to 2000 rpm. Centrifugal force also causes the centrifugal plunger pin lock to rotate outwards and lock the centrifugal plunger pins in the outward position. On impact, the plunger assembly moves forward, pushing the primer against the stationary round-pointed firing pin. Firing of the primer fires the two relay detonators.

This type of fuze will fire on impact with wood, ½-inch metal plate, ground, or water when it strikes at a nonricochet angle. Functioning is reliable at impact angles of 8 degrees or more on solid targets, 12 degrees or more on water.

The detonator and firing pin are always in line and sufficient impact on the nose of the fuze will cause the firing pin to function. In case the detonator does fire during rough handling, the interrupter will normally block passage of the flash. (The interrupter and the centrifugal plunger pins will not move to their armed positions unless the fuze is subjected to 1500 to 2000 rpm.)

If a fuze is damaged in handling, an examination of the condition of the closing disc will determine the method for disposing of the fuze. If the closing disc has been deformed or broken, it is probable that the detonator has been fired and has rendered the fuze inactive, or the detonator has been pierced but not fired. In either case, the fuze or the fuzed rocket head should be disposed of as an extreme hazard.

If it is found that the closing disc has not been damaged, and the setting sleeve is in the DELAY-DELAY position, the fuze may be considered safe for further handling. If the closing disc is not damaged and the setting sleeve is in the SQ-SQ position, the fuze may be rendered safe for handling by rotating the setting sleeve to the DELAY-DELAY position. This fuze is unsafe to handle after the round has been launched because the delay assembly, once armed, remains locked in position. For ordinary handling, the fuze is considered safe because the detonators are insensitive to normal shocks.

The fuze may be removed from a rocket head in accordance with the instructions in chapter 6. Before removing the fuze, turn the setting sleeve to the DELAY-DELAY position.

Water-Travel-Arming Nose Fuzes. A prototype water-travel-arming, impact-firing nose fuze for antisubmarine rockets and projector charges is illustrated in figure 1.10. The arming vane and arming-vane hub are secured to the arming screw by a setscrew. A setback

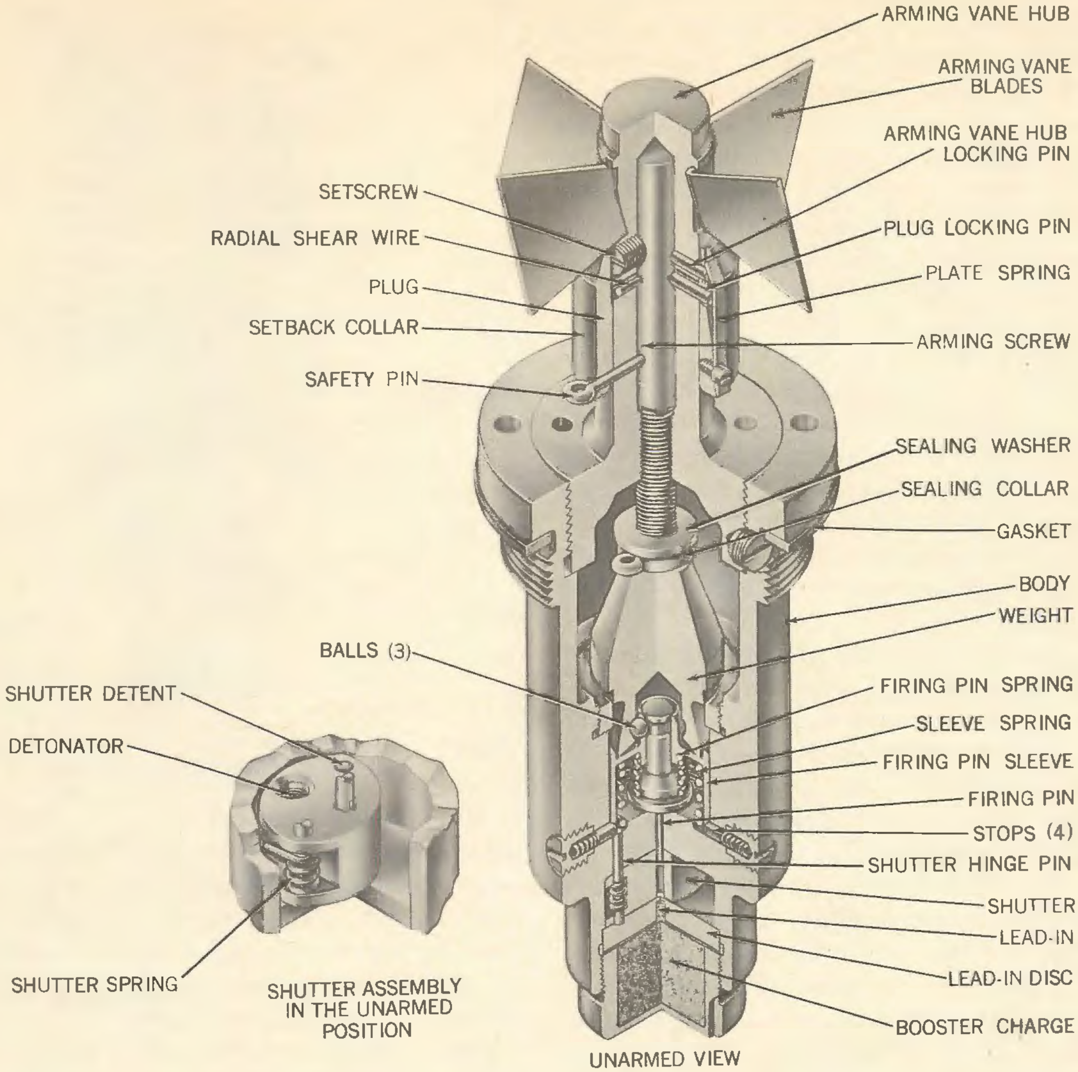


Figure 1.10—Typical Nose Fuze (Water-Travel-Arming, Impact-Firing), Unarmed, Sectional View.

collar is fitted over the plug neck and the arming-vane hub. Locking pins in the arming-vane hub and the plug fit into a slot in the setback collar. They lock the arming-vane hub until the setback force of launching causes the collar to move backward on the plug. The setback collar is maintained in the forward position by means of a flat plate spring secured to the setback collar. The spring presses against the locking pins.

Shear wire (inserted into matching holes in the arming screw and plug) prevents the air stream from turning the arming vane and arming the fuze during travel.

The firing-pin assembly consists of a firing-pin sleeve with a raised forward central portion that has a side wall with three holes, a firing-pin head into which the firing pin is screwed, a firing-pin spring, three balls, and a firing-pin weight. These elements comprise the cocked firing-pin assembly. The firing pin is held in the cocked position, with the firing-pin spring compressed, by the three balls in the holes in the raised central portion of the firing pin and firing-pin sleeve. Tipping of the weight will cause the balls to be displaced outward and release the firing pin. Retraction of the firing pin from the shutter well, when the fuze arms, is accomplished by the action of the sleeve spring.

The shutter is located immediately below the bottom wall of the body. The shutter contains a spring-loaded detent operating in a hole in the bottom wall. It locks the shutter in the armed position. A spring mounted on the shutter hinge pin rotates the shutter into the armed position as soon as the firing pin is withdrawn from the shutter well. A tetryl lead-in disc is inserted immediately below the shutter. A tetryl booster in a magazine is screwed into the base of the fuze body.

At launching, setback forces the setback collar to the rear. This unlocks the arming vanes. The collar is prevented from moving forward by the flat plate spring catching behind the locking pin in the plug. The internal shear wire prevents the air stream from turning the arming screw and arming the fuze during air travel.

On impact with water, the arming vanes are forced to rotate and sever the internal shear wire. Continuing rotation withdraws the arming screw and arms the fuze. The firing assembly moves with the arming screw under the force of the sleeve spring until the firing-pin sleeve meets the retaining ring.

At the end of the travel of the arming screw, the rubber sealing washer is jammed against the rear wall of the plug, thereby sealing the fuze. As the firing assembly moves forward, the firing pin is withdrawn from the shutter cavity, releasing the shutter. The shutter rotates out against the stop pin, alining the shutter detonator with the booster lead-in and the firing pin. Two pairs of opposing sleeve stops are arranged in the lower body wall, one pair 90 degrees removed from the other. These are pushed by the stop springs into the space previously occupied by the firing pin assembly sleeve; one pair just before the firing pin releases the shutter and the other pair just after the release.

Upon impact of the rocket with the target, setback moves the firing-pin-assembly weight either forward or laterally to release the three balls, figure 1.11. The shape of the weight allows it to function in either direction. The balls release the cocked, spring-driven firing pin. The firing pin pierces the detonator and initiates the lead-in and booster charge.

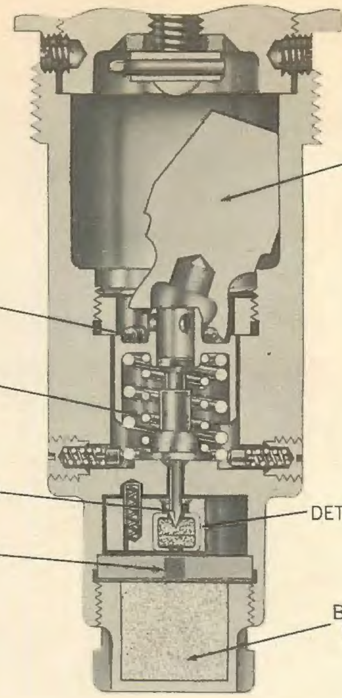


Figure 1.11—Typical Nose Fuze (Water-Travel-Arming), Fired, Cross Section.

This type of fuze will fire upon impact with any underwater obstruction that creates sufficient deceleration to move the weight either forward on normal impact or laterally on oblique impact. Obstructions, such as the steel surfaces or the wood deck gratings of a submarine, consistently will initiate the fuze.

This fuze is detonator safe. The firing pin itself holds the detonator out of alinement with the lead-in and booster charge. Premature functioning of the detonator while the fuze is unarmed will not detonate the lead-in and booster.

The setback collar prevents rotation of the arming vane until the force of setback causes the collar to move aft on the plug. The safety pin, the plug, and the arming screw prevent movement of the setback collar during transportation and stowage. The shear wire prevents the arming vane from turning, even if the setback collar has moved back on the plug, unless considerable force is applied to the vane.

This fuze is very dangerous when armed. Disposal and handling under this condition are most hazardous. The following precautions are to be observed rigidly.

1. The safety pin must be in place through the setback collar at all times and must not be removed until just prior to the firing of the round. In case the round is not fired immediately after removal of the safety pin, the safety pin must be reinserted.

2. The setback collar of this fuze must not be retracted manually under any operating conditions.

When installing the fuze in the rocket head, a special spanner wrench (BuOrd SK 119862) must be used. The joint between the fuze and the fuze seat liner must be made watertight by screwing the fuze tight against its gasket. The pins of the spanner wrench must be fitted into the holes in the fuze body and not into the holes in the plug; that is, they must be fitted into the outer pair of holes. The fuze must not be grasped by the arming vanes. Pipe wrenches or other unauthorized tools must not be used on the plug, setback collar, or arming vane when the fuze is installed in the rocket. If this precaution is not followed, the plug may be unscrewed and/or the arming vane turned, thereby arming the fuze. A serious accident was caused by the use of improper tools.

This fuze may be removed from the rocket head if the safety pin through the setback collar is in place. The special spanner wrench must be used and the same handling precautions observed as in installation. The fuze should be removed from the round if the round is to be taken below decks.

Centrifugal-Arming, Auxiliary Detonating Fuzes. A prototype auxiliary detonating fuze, figure 1.12, houses two off-center rotors and a booster charge. One of the off-center rotors carries a detonator; the other carries a lead-in charge. When the rocket reaches a threshold rate of spin, centrifugal force moves these rotors from their off-center position into a direct line with the booster charge. When the nose fuze fires, the flash is transmitted through the charges in the rotors to the booster. Auxiliary detonating fuzes always are used with a nose fuze.

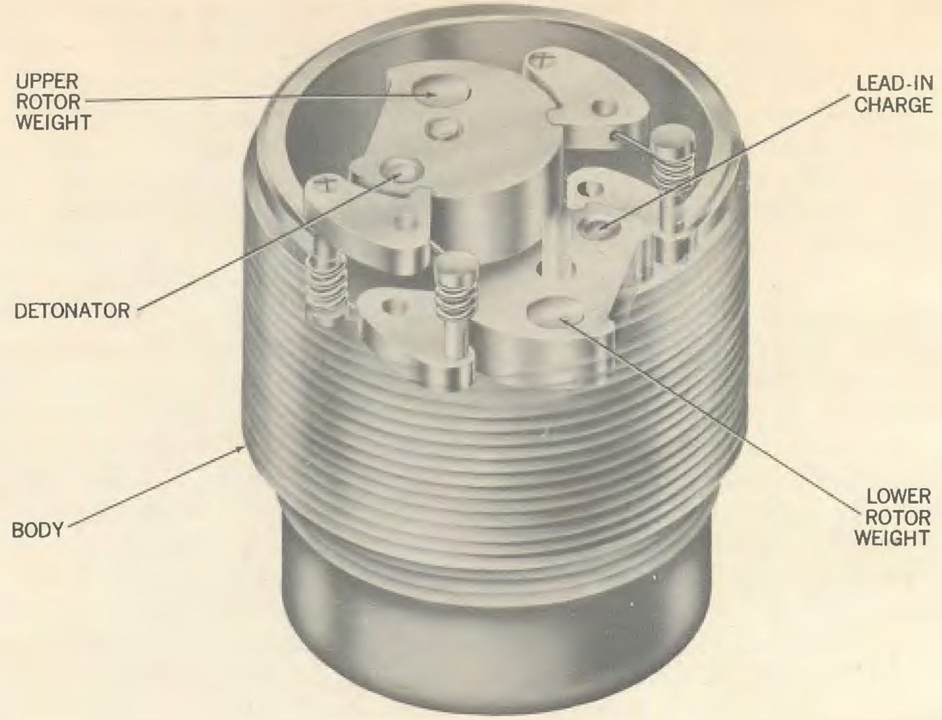
This auxiliary detonating fuze consists of a threaded body which holds the rotor housing assembly, the booster lead-in, and the booster magazine. The body is closed at the forward end by a cover disc, which has a hole in the center and a 0.002-inch-thick copper sealing cover crimped in place. A partition between the rotor housing assembly and the booster magazine holds a booster lead-in. The booster magazine contains a tetryl booster charge. It is separated from the partition by a paper disc.

The rotor housing assembly is a die-cast block that accommodates the rotors, the spring-held rotor detents, and the rotor shafts. Both rotors are semicylindrical blocks which rotate about shafts in eccentric walls. The rotors are located on diagonally opposite sides of the rotor housing. Each rotor is weighted on one side and has a flat section cut out to engage a rotor stop. The rotor's movement will be stopped when the detonator and lead-in charge are alined. Two detents engage two slots in each rotor to lock the rotor in the unarmed position. The rotors in the unarmed position block the flash channel.

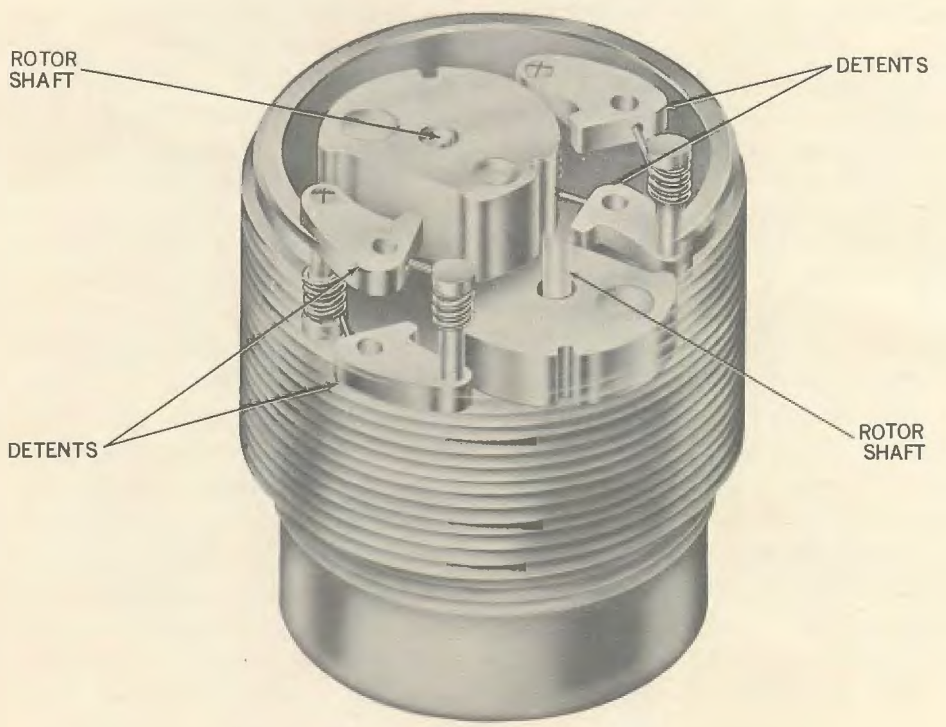
This auxiliary detonating fuze is detonator safe. The two detents locking each rotor in the unarmed position are spring loaded in opposite directions. They will move simultaneously only under centrifugal force. Any force other than centrifugal force, which might unlock one set of detents, would tend to hold the opposite set in the locked position. A dud round containing this type of auxiliary detonating fuze, which previously has attained the required arming spin in flight, may be considered armed fully, since the rotors do not return to the unarmed position once they have moved to the armed position. This fuze, by itself, does not result in a sensitive dud because it has no firing pin, but the nose fuze with which it is used may be in a dangerous condition.

Auxiliary detonating fuzes are installed in the rocket head at the loading activity when they are to be used with fuzes other than VT fuzes. The auxiliary detonating fuzes are assembled with most VT fuzes as units. In some VT fuzes, the auxiliary detonating fuze is an integral part of the fuze.

Under operating conditions, the auxiliary detonating fuze is not removed from a rocket



UNARMED POSITION



ARMED POSITION

Figure 1.12—Typical Auxiliary Detonating Fuze (Centrifugal-Arming), Unarmed and Armed, Sectional Views.

head, except when an integral part of a VT fuze assembly.

Centrifugal-Arming Base Fuzes. A prototype centrifugal-arming base fuze is illustrated in figure 1.13. This type of fuze becomes armed when the rotational velocity of the rocket reaches a designed minimum. Since it is fired by movement of an inertia plunger, there is an inherent delay of a few thousandths of a second.

The main external parts of this fuze are the nose cap, the body, the booster cover, and the plunger retaining plug. The nose cap houses the stab firing pin, the spring-loaded firing-pin detents, and the two firing pin locking pins. The fuze body contains the auxiliary plunger assembly, the detonator plunger assembly, the two detonator plunger detents, and the anticreep spring assembly. The booster charges and booster lead-in charges are located in the side wall of the body.

The auxiliary plunger, a cylindrical brass block containing a desiccant (dehydrating) unit, floats on four rows of ball bearings in the auxiliary plunger well of the fuze body. The aft end of the auxiliary plunger bears against the plunger retaining plug; the forward end bears against the detonator plunger.

A shoulder at the aft end of the detonator plunger bears against the two spring-loaded detonator-plunger detents. The forward end of the detonator plunger is guided by the anticreep spring assembly through a well in the nose cap and bears against the firing pin detents in the nose cap. Two alining pins, located in the plane of the detonator assembly, extend from the wall of the detonator plunger and ride in slots in the fuze body. The detonator plunger houses the sensitive primer, the percussion primer, the detonator assembly, the detonator-plunger load, and the two lead-out charges.

The anticreep spring assembly consists of a tubular inner cup, an outer cup, and the anticreep spring. The inner cup is lipped outward at the aft end to provide a footing for the anticreep spring. The fixed outer cup, which serves as a guide and retainer for the spring, is lipped inward to provide another footing for the spring. The anticreep spring bears against the inner cup lip at the aft end and against the outer cup lip at the forward end.

The sensitive firing pin floats against the two firing-pin detents in the nose cap and is positioned in its well by the two locking pins. Two diametrically opposed holes are provided to permit the expansion of the anticreep spring inner cup, insuring the locking of the detonator plunger when firing occurs. They are sealed externally with cover plugs, and are located 90 degrees from and slightly aft of the firing-pin detents. A locking screw is installed in the wall of the nose cap to secure its assembly to the fuze body. Two locking pins secure the plunger retaining plug to the fuze body. A base plug fills the hole threaded for a tracer in projectile assemblies. The inner cup of the anticreep spring assembly is installed over the forward end of the detonator plunger. It is secured by the threaded holder containing the sensitive primer.

Under the centrifugal force generated by the spinning rocket, the firing-pin detents and the detonator-plunger detents move out against their load springs. This allows both the detonator plunger and auxiliary plunger to float against the anticreep spring. The anticreep spring assembly resists the inertia (creep) which tends to move both plungers forward towards the stab firing pin.

Upon impact, inertia forces both plungers forward. Three actions then take place simultaneously.

First, the detonator plunger moves forward and the detonator-plunger load becomes alined with the lead-ins and lead-outs to the booster. At the same time, the sensitive primer is pierced by the stationary stab firing pin. The primer fires and produces expanding gases which pass through small ports in the sensitive primer and delay-element firing-pin section of the detonator plunger. The pressure of the gases expands the anticreep spring inner cup at points adjacent to the two locking holes. This locks the detonator plunger in the forward fired position; it insures alinement of the explosive train. Also, the same expanding

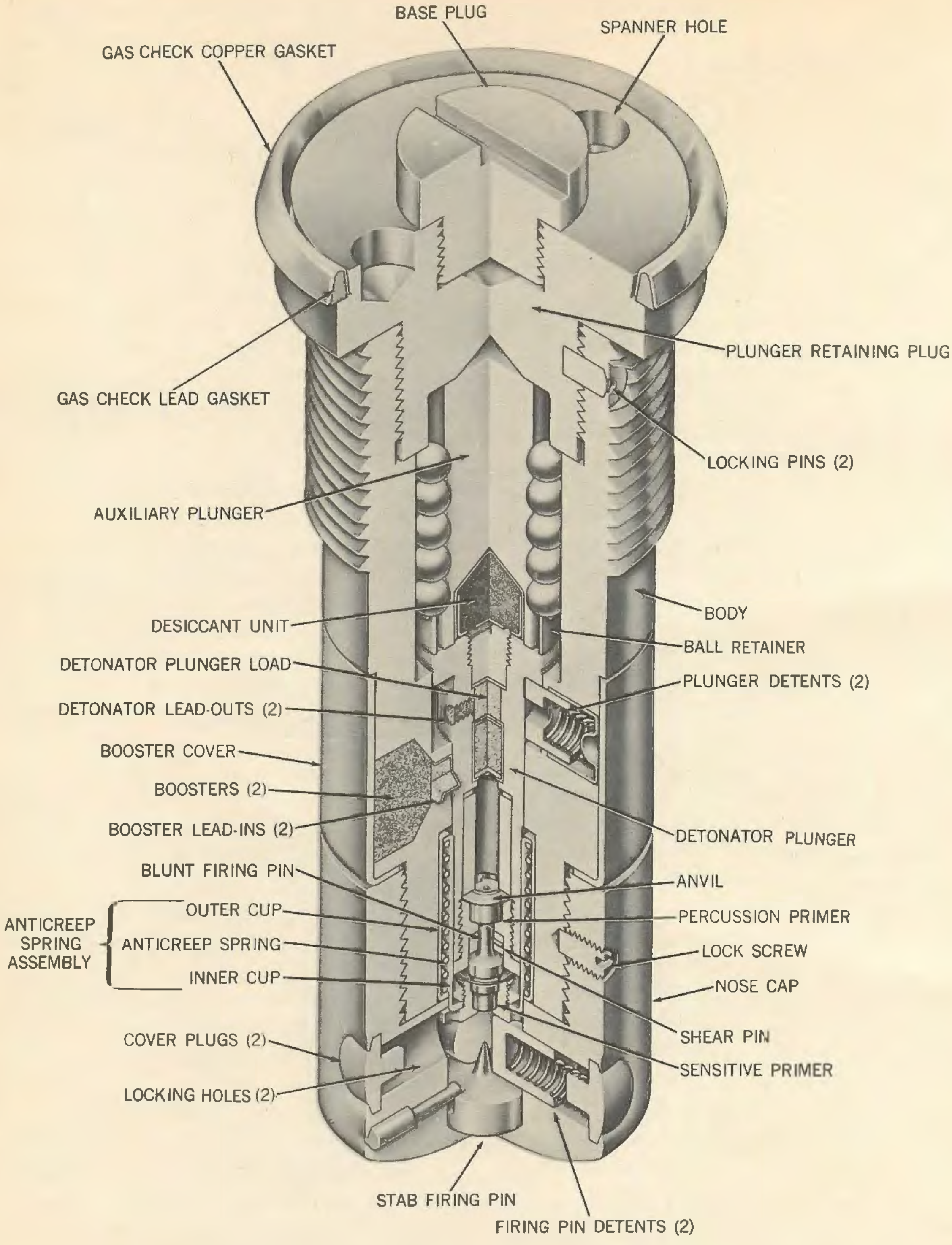


Figure 1.13—Typical Base Fuze (Centrifugal-Arming), Unarmed, Sectional View.

gases drive aft the movable blunt firing pin, breaking the shear pin, and forcing the firing pin into the percussion primer. The functioning of this primer sets off the rest of the explosive train—the detonator, the detonator plunger load, the detonator lead-outs in the plunger, the booster lead-ins in the body, and the boosters. The fuze fires with the inherent delay of approximately 0.003 second.

This fuze will function reliably on impact with water at angles of fall of 5 degrees or greater. Tests indicate that the fuze will function on 85 percent of hits on ⅛-inch mild steel plates at angles of obliquity up to 55 degrees when fired in 5.0-Inch Rocket Mk 24 Mods 0 and 1 with 5.0-Inch Rocket Head Mk 8 Mods 1 and 2. On special-treatment steel of 1-inch or greater thickness, breakup of the rocket head usually occurs.

The fuze is detonator safe. The detonator plunger lead-outs and the booster lead-ins are not alined until the detonator plunger moves forward on impact. This occurs after the detonator-plunger detents have moved out.

It is unsafe to handle the fuze after the round has been launched. No attempt should be made to remove the fuze from the round. Base fuzes are shipped installed in the rocket head. Under operating conditions, base fuzes are not removed from rounds.

Disassembly, Removal, and Maintenance of Fuzes

Disassembly. Breakdown of surface rocket fuzes is not permitted except at authorized activities.

Removal from Round. Nose fuzes are removed from rocket heads with the proper fuze wrench and replaced in the shipping container. The shipping container should be closed and sealed with adhesive tape along the broken tear-strip surface. The shipping plug and gasket should be replaced in the rocket head after the fuze is removed. Further information is to be found in sections on specific rounds in chapter 6, Assembly of Complete Rounds.

Maintenance. Maintenance of fuzes is not authorized except as discussed in the maintenance section of this chapter.

Rocket Details and Containers

Rocket details are devices used in packaging, packing, protecting, and handling ammunition. They are not attached to the rocket when it is in flight. They include items, such as thread protectors on heads and motors, figure 1.14; cardboard shipping spacers in fuze holes to prevent auxiliary boosters from moving, figure 2.16; shipping plugs to protect fuze-hole threads, and head or motor threads, figure 1.14; and short-circuiting clips, bands, or wires, figure 1.14.

Rocket ammunition and components are shipped in wood boxes, and metal tanks or boxes, figures 1.15 and 1.16.

Rockets and Projector Charges

A complete rocket or projector charge assembly is called a round. A complete rocket round consists of a fuzed projectile or missile powered by a rocket motor with stabilizing means. A complete projector charge round consists of the bomb-like fuzed missile powered by a tail with stabilizing means.

The separate components—heads, motors, and fuzes—may be assembled only in authorized combinations for which range data are valid. The complete round usually is issued as separate components to be assembled in the field. In certain instances, however, the round may be issued as a single assembled unit.

Rocket and Projector Charge Operation

Launching Rockets. Launchers are used to aim and fire rockets. Various types of launchers serve surface rockets. These surface launchers are described in OP 1304, "Rocket Launchers and Related Equipment."

Rocket ammunition must be used only in the launcher for which it is designed. Figure 1.17 shows the means of securing, placement, and firing of spin-stabilized and shrouded-fin rockets in the type launcher that is illustrated.

The spin-stabilized rocket is inserted into the launcher tube. A pawl retains the round which rests on two parallel guide rails in the tube. The bourrelets of the motor touch the guide rail and the contact ring of the motor touches the spring-loaded electrical contact of

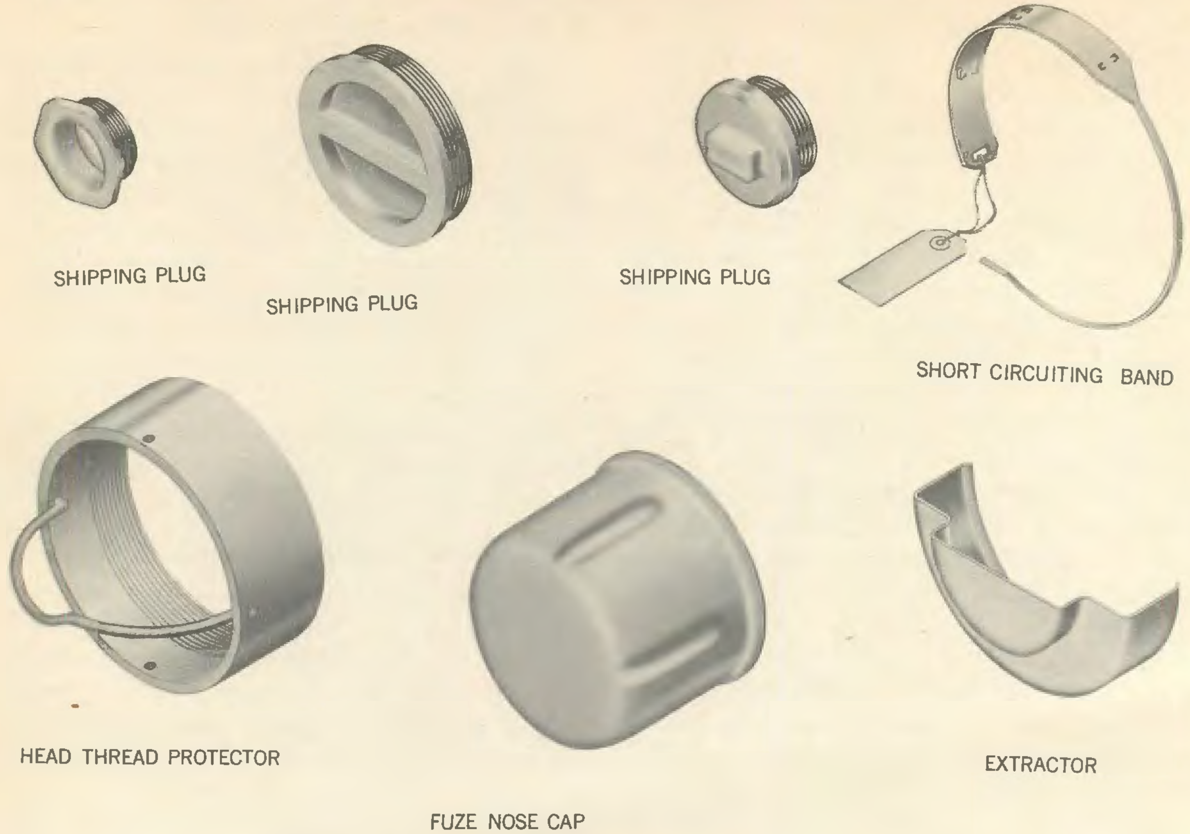


Figure 1.14—Rocket Details.

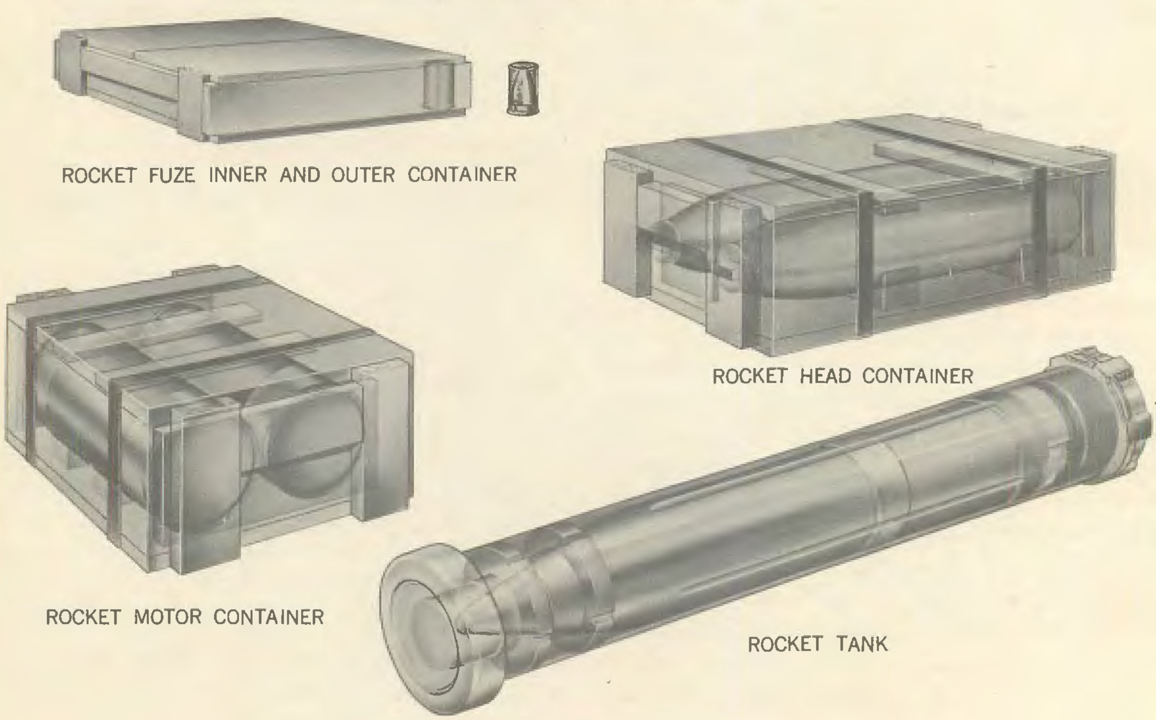


Figure 1.15—Typical Rocket and Rocket Component Containers.

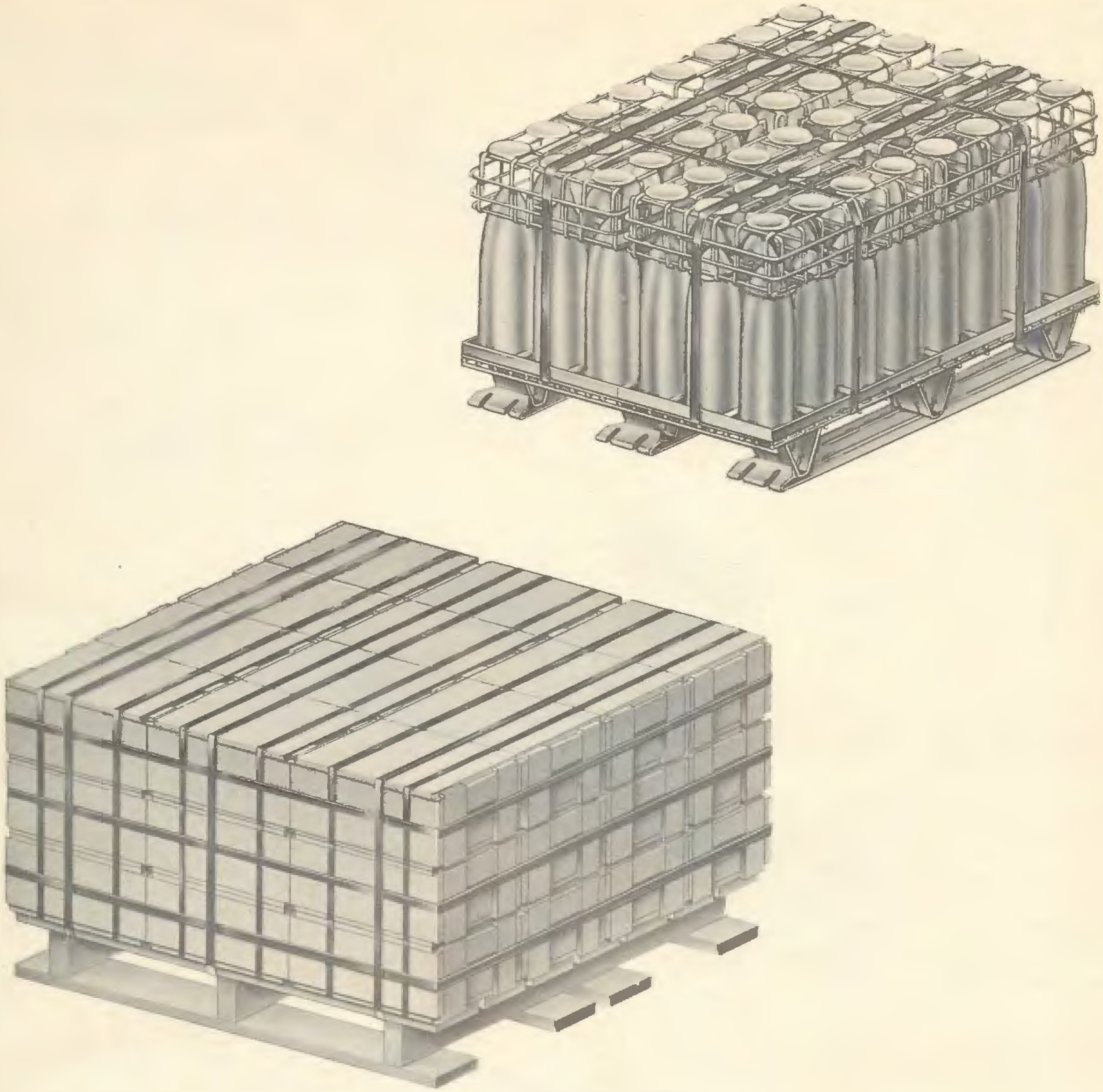


Figure 1.16—Typical Pallets.

the launcher. When the launcher firing circuit is energized, a current passes from the electrical contact pin through the motor igniter to the ground guide rails.

The shrouded-fin rocket is inserted in the launcher way. The rocket head and the shrouds rest on the trough of the launcher way. The insulated forward shroud touches the spring-loaded, upper electrical contact (live) of the launcher; the rear shroud touches the lower electrical contact (ground) of the launcher. When the launcher firing circuit is energized, current passes from the upper contact through the igniter to the lower contact.

Surface rockets using the electrical connector are obsolescent. Electrical connectors are used now only to ignite aircraft rockets.

Figure 1.18 shows the operation of an HE-loaded 5.0-inch spin-stabilized rocket. The fuze is shown in outline since the scale of the illustration does not permit the drawing of the fuze detail. Refer to chapter 4 for details of particular fuzes.

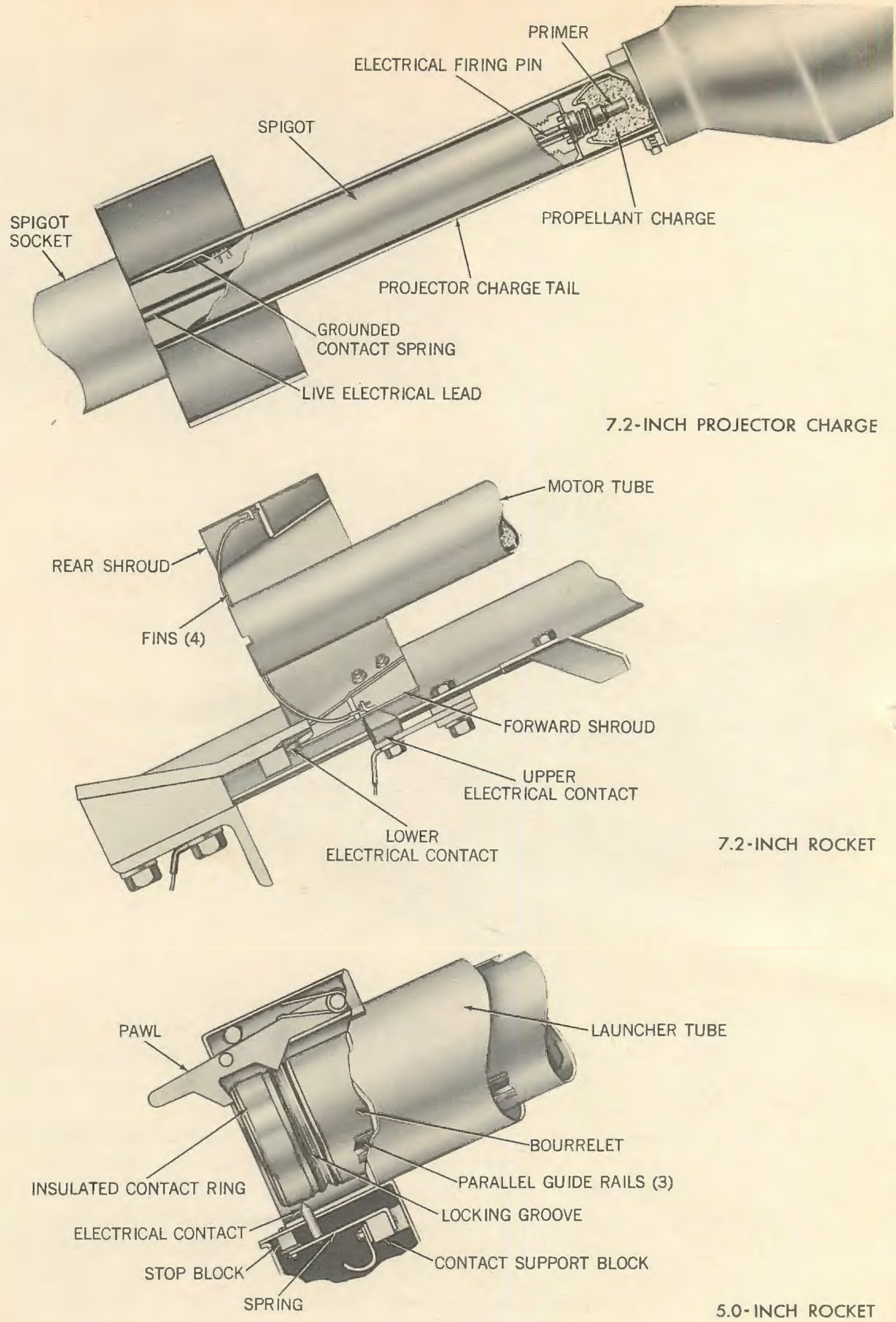
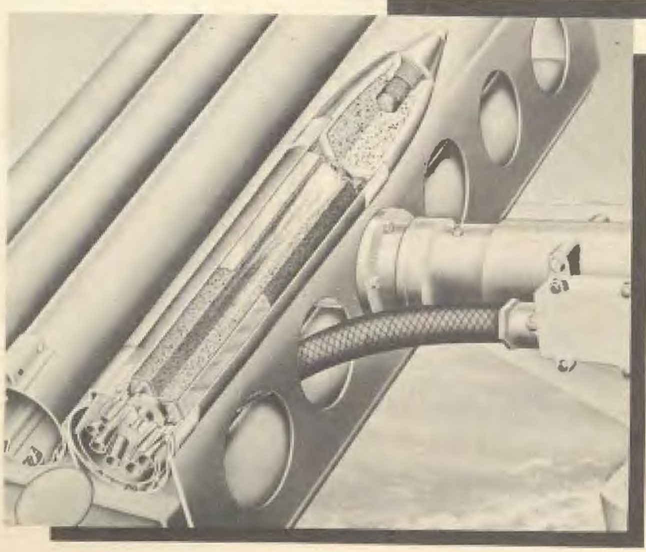


Figure 1.17—Methods of Ignition in Typical Launching Devices.

PHASE 3

PHASE 2



PHASE 1

Figure 1.18—Rocket Operation Showing Propellant Ignition, Propellant Burning, and Rocket with Propellant Burned Out Dropping on Target.

Phase 1 shows the rocket being ignited in the launcher. The rear closure is blown off. The igniter has flamed and fired the propellent grain. The round starts rotating because of the direction of the expelled rocket gases while the rocket is still in the launcher tube. The nose fuze becomes armed in a distance of 6 to 10 feet of trajectory travel and the auxiliary detonating fuze in a distance of 45 to 135 feet.

Phase 2 shows the rocket with the grain burning at a constant rate. The rocket is under constant acceleration. The fuzes have become armed fully and stay armed with the explosive train in line.

Phase 3 shows the grain just burned out. No thrust is being exerted on the rocket. The rocket has achieved maximum velocity (the burnt velocity) in a distance of approximately 700 feet of trajectory travel.

Launching Projector Charges. Projectors serve to aim and fire projector charges. The top portion of figure 1.17 shows a projector charge on a launching spigot.

The projector charge tail is inserted over the spigot. A spring-loaded firing pin contacts the cartridge electric primer. The grounded contact spring of the projector spigot touches the inside surface of the tail. When the projector firing circuit is energized, current passes through the firing pin and the primer, to the bearing tube of the projector charge tail, and then to the grounded contact spring of the projector spigot.

The projector fires a group of 24 projector charges. They strike the water in an elliptical or circular pattern, depending on the projector used. The fuzes used in projector charges arm during water travel and fire on impact with the target.

Propellant Characteristics. The burning of a solid propellent grain proceeds perpendicularly inward from all ignited surfaces. The rate is determined by the pressure and the temperature of the grain. As the powder burns, the pressure rises until the pressure in the tube and at the nozzle where the gas is discharging is equal. This situation will prevail until most of the propellant is consumed. This condition is called "steady state of flow," "steady state," or "equilibrium." When the amount of burning surface and the pressure are decreasing, the condition is known as "regressive burning." If the amount of burning surface and pressure are increasing, the condition is known as "progressive burning."

A constant rate of burning is most desirable. Grains are formed to attain this constancy of combustion. The most common types are a cylinder with radial perforations having an axial hole; and a cruciform shape without perforations, but with fire-resistant plastic inhibitor strips cemented on its surfaces.

Propellent grains burn from about 0.15 to 2.5 seconds, depending on the size, temperature, burning area, size of perforations, and shape. The rate of burning varies directly with the initial temperature of the grain. The final velocity attained by two rockets of the same type, launched under the same conditions except for different propellent temperatures at the time of ignition, will be practically the same. But the rocket launched at 100° F will attain its final velocity before the one launched at 40° F. Very high temperatures cause such a rapid rate of burning and high pressure that the motor tube may burst. Very low temperatures cause the grain to burn unevenly. Either spurts of gas are emitted from the nozzles (called "chuffing") or the grain may disintegrate, emitting burning slivers of ballistite. When so fired, the rocket will travel a very short distance.

The firing of rockets is limited to a relatively narrow temperature range when compared to that suitable for the firing of guns. The upper limit is about 120° F; the lower limit varies from 40° to –20° F with different motor designs.

Factors Affecting Trajectory. Other than temperature, the factors are those associated with the launcher, those associated with the rocket itself, and those associated with the winds along the line of flight.

The Launcher. Here the principal factor is the length of the guide rail. There is an optimum length for guide rails, but it is usually too long for the space limitations in existing Navy installations.

The Rocket Itself. Here the principal factors are the mechanical misalinement and the gas misalinement. Mechanical misalinement is an effect resulting from the inherent imperfections in manufacturing and assembling the rounds. The axis of the nozzle is not likely to be exactly in line with the axis of the motor tube. The same discrepancy is likely because of the several axes of the nozzles in a multiple-nozzle plate assembly. Since the motor usually is attached to the head by a threaded joint, it is not likely that the axes of the head and motor are both coincident with the axes of their respective threads. By regulating tolerances in manufacture, these errors can be reduced to a low value. In an assembled rocket, the distance between the prolonged axis of the nozzle and the center of gravity of the round is known as the mechanical misalinement. It is usually a few thousandths of an inch.

Gas misalinement stems from the fact that gas does not flow through a nozzle uniformly. If the flow were perfectly symmetrical and concentric with the nozzle axis, the line of thrust would also coincide with the axis. In this case, knowledge of the mechanical misalinement would suffice to predict the turning moment caused by the line of thrust failing to pass through the center of gravity. Experiments, however, show that the line of thrust deviates from the nozzle axis by a small angle which is unpredictable in direction and magnitude. The causes are obscure and presumably are to be sought in the dynamics of the flow of gas down the motor tube and through the nozzle. It does not lend itself to easy measurement. The distance of the line of thrust from the center of gravity, owing to the action of the jet, is the degree of gas misalinement.

In any particular rocket assembly, the total misalinement is the vector sum of the mechanical and the gas misalinement.

Stable flight is accomplished by fins or by the spinning of the rocket. After launching, the flight is unstable for a very small fraction of the total motor burning time. This burning time varies from 0.15 to 2.5 seconds. The distance a rocket travels during this time is about 1500 feet. The momentary instability of rockets at launching is not critical because of the rapid acceleration and the high restoring moment produced by the fins or by the spinning.

Because of inherent flight characteristics, the dispersion of spin-stabilized rockets is less than that of fin-stabilized rockets.

Winds Along the Line of Flight. The total effect of a crosswind on a rocket is determined by the effects during burning and after burning. During burning, the action of the wind on fins tends to turn a rocket into the wind. A spin-stabilized rocket will not be turned in this manner. It will drift downwind, like a gun-ammunition projectile. After burning, a rocket with fins will also drift downwind with its nose pointing slightly into the wind.

Precautions

1. Except for ready service rounds, do not assemble rockets and projector charge assemblies until just before they are to be fired. If this is not practicable, assemble them as near to this time as is feasible.

2. Do not fire a rocket when the motor has been exposed for more than one hour to temperatures outside the safe firing temperature limits specified on the motor tube. If fired at too high a temperature, the motor may burst. If fired at too low a temperature, the incomplete burning of the propellant may expel burning slivers of ballistite.

3. If, during stowage, the rocket motor temperature has gone above or below the temperature range marked on the motor tube, it shall not be fired until after it has been kept for 6 hours within the required temperature range.

4. Never remove the short-circuiting clip, plug, or band from a rocket motor until just prior to loading it on the launcher. Retain the clip, plug, or band, in case the rocket is not fired.

5. Safety pins or other devices requiring removal before firing shall not be removed until the ammunition has been loaded in projectors or launchers, and not until after the arming wire or device has been put in place.

6. Fuze-arming wires or devices shall not be removed from the unarmed position until just before firing.

7. When the launcher or projector is loaded and in firing position, keep all other rockets

or projector charges to the side and at a safe distance.

8. Rockets or projector charges made ready for firing but not fired shall be made "safe" as soon as possible.

9. When removing a round from a launcher or projector, the fuze safety wire shall be inserted only after the safety plug is removed from the firing panel or the firing key is removed from the launcher.

10. Fuzes which have been set to an ON position shall be reset to the OFF position before they are returned to storage.

Precautions in Event of Misfires. In the event of a misfire, make another attempt to fire. If the attempt fails, proceed with the following precautions:

1. De-energize the firing circuit by removing the safety plug in the firing panel or disconnecting the firing key from the cable leading to the power receptacle.

2. Keep unnecessary personnel out of the danger area and keep the tube aimed clear of the ship's structure, friendly ships and/or friendly areas.

3. If the rocket was one being fired from a multiple launcher and the launcher tube in which the misfire occurred is likely to be hot enough to cook-off the misfired round, water should be applied to the whole length of the heated tube until it stops steaming.

4. Wait ten minutes before approaching the rocket. In time of action, this waiting period may be waived by the Commanding Officer.

5. Approach the launcher from the side and replace the short-circuiting clip, band, or plug of the rocket motor. If this cannot be replaced before removal of the rocket from the launcher, do so as soon as possible thereafter.

6. Remove the rocket from the launcher and render the fuze safe. See if the nozzle closure(s) has blown out. If so, detach the head and dispose of the motor.

7. Test the electric circuits of the launcher. If a defective circuit is located and repaired, the same rocket may be reloaded and fired.

8. If the electric firing circuit is in order, the misfire may be attributed to an internal defect of the motor. The motor should be disposed of in accordance with current regulations.

Shipping and Handling

Packaging and Shipping. Illustrations of representative containers are found in figure 1.15. Base detonating fuzes and auxiliary boosters are shipped installed in a rocket head. Heads, motors, and nose fuzes usually are shipped in separate packages.

Handling. The precautions to be taken in handling rockets are the same as those taken in handling other Navy ammunition. The fundamental instructions follow:

1. Handle rockets or rocket components as little as possible.

2. Instruct personnel who will be involved in the handling as to the nature of the material. If working with chemical rocket heads, protective gear should be on hand. When entering concentrated smoke clouds produced by smoke rockets, personnel should wear gas masks. Only those men essential for handling should be in the area.

3. In fuzing, defuzing, assembling, disassembling, cleaning, or painting, choose a location safely removed from other explosives and vital installations. Operate on the smallest number of rounds practicable.

4. Handle rockets and projector charges which are fuzed or assembled with firing mechanisms as if they are armed. An assembled round may become accidentally armed in handling or stowage. It is not always possible to ascertain readily whether this arming has taken place.

5. Certain types of rockets and projector charges normally are issued unfuzed. Do not insert the fuzes in such rounds until just prior to firing.

6. Do not remove base fuzes from rocket heads at any time. Before assembling a head to a motor, make certain that the fuze is securely in place.

7. No disassembly of rocket motor components as shipped is authorized. The propellent grain is not to be removed from the motor tube under any circumstances. (Paragraphs 6 and 7 do not apply to authorized production and renovation activities.)

8. Do not use a circuit continuity tester aboard ship without specific authority from the Bureau of Ordnance. The electric circuit should be checked before the motor is placed on board.

9. Fuzes or firing mechanisms for rockets and projector charges shall not be removed, disassembled, repaired, or in any way altered, except as provided by special instructions from the Bureau of Ordnance.

10. Under no circumstances are nose fuze adapters or base plates to be removed from a head. If a fuze adapter becomes loose while a fuze is being removed from a head, stop and do not disassemble; such an assembly of fuze and head will be considered hazardous.

11. If dropped from a height exceeding 5 feet, a fuzed rocket head (whether or not in a container) shall be marked appropriately and returned to an ammunition depot. If the return to the depot is not practicable, the head shall be disposed of as instructed by the Bureau of Ordnance.

Disposal of Defective Rounds. Disposal of defective rounds and components shall be accomplished as directed by the Bureau of Ordnance.

Stowage

The following paragraphs list the general requirements for stowage of rocket components.

Rocket heads, motors, and fuzes present different types of hazard (explosion, missile or fragmentation, and fire) to personnel and installations; consequently, they should be stowed separately except when placed in ready service spaces. A rocket motor is not propulsive unless assembled with a head. Some rockets which are not fuzed are stowed fully assembled otherwise.

Aboard ship, primary magazines are used to stow a complete allowance of ammunition. These magazines are located below deck, are equipped with sprinkling apparatus, and can be securely locked. Ready-service boxes on deck permit temporary stowage of a small percentage of the total rocket ammunition allowance at a point which is convenient to the launchers. Ammunition in such boxes is liable to rapid deterioration. It shall be inspected carefully and necessary repairs effected before returning it to a primary magazine.

Heads. Rocket heads loaded with high explosives including rocket heads loaded with high explosives which are shipped unassembled with motors in a single tank shall be stowed in cool, dry ammunition magazines.

Rocket heads loaded with chemicals shall be stowed in dry, well-ventilated enclosures on the upper decks, convenient for jettisoning in an emergency. These heads shall not be stowed with high-explosive heads.

Solid and inert-loaded practice rocket heads and dummy-drill rockets may be stowed in locations convenient to the launcher. Solid and practice heads and dummy-drill rockets are inert material and shall not be stowed in magazines; however, they must be protected from moisture so that the threads and exterior surfaces will not rust.

Motors. Rocket motors are stowed in smokeless-powder-type magazines. The propellent grains must not be exposed to extremely high temperatures. Since shipboard surveillance tests are not authorized, the oldest propellent lots shall be used first to obtain maximum safety.

Fuzes. Separately issued fuzes which contain integral detonators or other explosive components shall be stowed only in designated fuze magazines. These fuze magazines shall not be located adjacent to magazines containing high explosives.

Precautions.

1. Rocket motors shall be stowed separately from rocket heads where possible. The rocket motor is not propulsive unless joined to the head.

2. Electrically fired rocket motors, and electric or electronic fuzes shall not be stowed in the same compartment with, or be exposed within 5 feet of, any exposed electronic transmitting apparatus, or exposed antenna leads. An exception can be made when the electronic apparatus or antenna is a part of authorized test equipment of a weapon or is integral with a weapon containing such a rocket motor. In this event, the special instructions pertinent thereto shall apply.

3. Do not allow matches, naked lights, or any open flame in the vicinity of rocket stowage.

4. Rockets containing pyrotechnic material, such as flares or an incendiary mixture, shall be stowed in regular pyrotechnic storage spaces, if such are provided, or in pyrotechnic lockers on upper decks.

5. Nothing shall be stowed in rocket ammunition magazines except rocket ammunition, its containers, and authorized magazine equipment. No oily rags, waste, or material susceptible to spontaneous combustion shall be stowed in these spaces.

6. Remove all rocket explosive components from a magazine before work which might cause an abnormally high temperature or an intense local heat is undertaken in the magazine.

7. After assembly, rockets shall be stowed topside in ready-service stowage or at least protected from water and direct rays of the sun.

8. Prolonged stowage of rocket propellants at or above 100° F is hazardous.

Maintenance

Proper maintenance and careful handling are necessary so that ammunition will be ready for use when needed. The life of all types of ammunition may be prolonged by proper maintenance.

In cases where repair is not permitted by the forces afloat, repairable ammunition components, containers, and details are to be returned to an ammunition depot.

Reports and Records. The Bureau of Ordnance Manual and other directives will indicate the required reports and procedures for reporting the condition and inventory of rocket and projector charge ammunition.

Reports of malfunctioning or any difficulties encountered with rocket or projector charge assemblies should be sent to the Bureau of Ordnance. The report should contain the ammunition lot numbers, the lot number of the fuze, the assembly lot number of the rocket head and motor assembly or projector charge and tail assembly, and a complete detailed history of the rocket or projector charge assembly.

Inspections

The following inspections of components will be made as they are removed from containers for assembly. Verify that contents are correct items. Items found to be unserviceable, but not in a hazardous condition, should be returned to an ammunition depot. Items in a hazardous condition should be disposed of in accordance with current instructions from the Bureau of Ordnance.

Head Inspection.

1. See that the head is not dented or cracked.

2. See that the fuze adapter is staked to the head.

3. See that no threads have been damaged. This inspection includes the threads in the fuze adapter and the motor adapter if present.

4. See that there is no rust or corrosion and that the paint and lettering are in good condition. If there is rust, or if the paint or lettering requires restoring, these repairs should be made before the round is stowed.

Motor Inspection.

1. See that the safety short-circuiting clip or wire is in place on the motor shrouds or on the electrical connector plug.

2. See that the front and rear closure discs, or other nozzle closures are in place and tight.

3. See that the shrouds or fins are not bent or broken.

4. See that the terminal lead wires in the shroud type and the electric connector in the projecting-fin type are not broken or the insulation damaged. This inspection cannot be made on the spin-stabilized type since its rear closure must not be removed.

5. See that there is no rust or corrosion and that the paint and lettering are in good condition. If there is rust, or if the paint or lettering requires restoring, this maintenance should be accomplished before the round is stowed.

Projector Charge Tail Inspection.

1. See that the rear interior surface of the tail is painted and covered with a thin coat of grease. See that the interior of the tail is free of all foreign matter and excess grease.

2. See that the rubber tail-tube plugs, supplied for use with projector charge tails, are in place in the rear of the tail when the round is in ready-service stowage.

3. See that the tail shroud is not bent or broken.

4. See that the tail, which is shipped assembled to the head, has not become loose from the head. If it has, it may be tightened with a stillson wrench. Then the setscrew should be tightened.

5. See that there is no rust or corrosion and that the paint and lettering are in good condition. If there is rust, or if the paint or lettering require restoring, this maintenance should be accomplished before the round is stowed.

Fuze Inspection.

1. See that the vanes are not bent and the body is not dented. Fuzes in such condition should be replaced in their containers and returned to an ammunition depot. Fuzes that are otherwise damaged; fuzes that show signs of other conditions that make the fuze hazardous, such as loose or missing safety clips or devices; and fuzes that are armed partially or fully must be disposed of in accordance with current instructions from the Bureau of Ordnance.

2. See that fuzes are free of moisture. It may be necessary to apply grease to fuzes on 7.2-inch rockets or projector charges in ready-service stowage.

Shipboard Repair

Rocket and Projector Charge Heads. Only the repainting, relettering, or removal of corrosion is authorized.

Rocket Motors. Repainting, relettering, removal of corrosion, or repair of inert items is authorized. No paint should be applied to the firing contact areas on the shroud-type or spin-stabilized-type motors, or to the bourrelets of the spin-stabilized motors. If the firing contact areas are corroded, the deposits should be removed. Shrouds and fins, if bent, may be straightened.

Projector Charge Tails. Repainting, relettering, removal of corrosion, or repair of inert items is authorized. Shrouds and fins, if bent, may be straightened.

Tails, if loose, may be tightened onto the head with a stillson wrench, after which the setscrew should be tightened.

Rocket and Projector Charge Fuzes. No maintenance should be attempted on fuzes. Fuzes used with 7.2-inch rockets or projector charges require the removal of moisture and the application of grease to their vanes and collars when they remain for long periods in ready-service stowage or on the launching devices.

Marking and Identification

Ammunition is marked to facilitate identification, use, or disposal, and to safeguard personnel. This is accomplished by affixing labels or tags; and indent stamping or painting mark and mod numbers, drawing numbers, precautions, or color codes. Each rocket head and motor, and projector charge head and tail has a mark and mod to identify it. Each major component also has a data card with pertinent technical information. This data card is in the container in which the component is shipped.

Designations. Mark and mod numbers are assigned to rocket heads, motors, and complete rounds.

1. Rocket Heads. The designations for loaded rocket heads consist of information combined in the following sequence:

a. Caliber (the nominal outside diameter of the rocket head).

b. The words "Rocket Head."

c. Mark and mod of the inert metal parts of the head (considered as a unit).

d. Parenthetical descriptive term describing the type of load (such as GP or VT).

The loaded rocket head is identified by the mark and mod of the metal parts plus the descriptive term. The same type of head may be loaded with several types of fillers, yet the only difference in designation will be in the descriptive term following the mark and mod. For example, 5.0-Inch Rocket Head Mk 6 Mod 1 (inert metal parts), when loaded with explosive and assembled with a nose fuze and base fuze, would be designated "5.0-Inch Rocket Head Mk 6 Mod 1 (GP)." If the same head were inert loaded, it would be designated "5.0-Inch Rocket Head Mk 6 Mod 1 (PRAC)."

2. ROCKET MOTORS. The designation for loaded rocket motors is determined by combining information in the following sequence:

a. Caliber (the nominal outside diameter of the motor tube).

b. The words "Rocket Motor."

c. Mark and mod of the loaded motor.

d. Parenthetical descriptive term if required.

Each caliber of motor is assigned its series of mark numbers. Each time a new mark number is assigned, it begins with Mod 0. Usually, the loaded motor is assigned the same mark number as that assigned the inert metal parts.

When there is a change in the inert metal parts, a new mark number is assigned. The loaded rocket motor is assigned a new mark number under these conditions; and also whenever there is a change in igniter, propellent grain, electrical connector, or other component that makes it noninterchangeable, either physically or functionally, in all required installations.

When a new mod number is assigned to the inert metal parts, a new mod number is assigned to the loaded motor. A new mod also is assigned when there is a change in either mark or mod number of the igniter, propellent grain, electrical connector, or other component which does not affect the physical or functional interchangeability of the motor. (The mod assigned to the loaded motor in this case will never be the same as that assigned to inert metal parts.)

3. COMPLETE ROUNDS. A complete round is the rocket, assembled with all its components, ready for service use. The designation for complete rounds is the combination of information in the following sequence:

a. Caliber (the nominal outside diameter of the rocket head).

b. The word "Rocket."

c. Mark and mod of the complete round.

d. A parenthetical phrase which includes type of craft from which launched, such as "Aircraft" or "Surface"; followed by a term describing the head, such as "GP," "PRAC," or "HEAT"; and completed by "SS" if spin-stabilized or "FF" if stabilized by folding fins. Rockets used in antisubmarine warfare employ the parenthetical phrase including a term describing the head, such as "GP," and "PRAC," followed by "ASW."

Mark and mod designations are assigned to complete rounds in each caliber of rocket. Within a caliber, the same mark number is assigned to rounds which meet all the following conditions:

a. Dimensionally equivalent or interchangeable to the extent that they can be fired from the same launcher installations.

b. Essentially equivalent in exterior ballistics.

c. Fitted with a head of the same mark number and with the same type loading (GP, smoke, or practice).

Different mod numbers are assigned to a complete round within a particular mark series when one or more of the following conditions are present:

a. Different types of fuzing are used (nose only, base only, or nose and base).

b. Different fuze delays are used.

c. The dimensions are similar enough to permit interchangeability on launcher installations, but dissimilar enough to require different stowage or handling equipment.

d. Different head fillings of the same basic type (FS and PWP smoke fillings). This does not apply to entirely different loads, such as GP and practice loads; they would require a new mark number for the complete round.

Projector charge heads and tails are designated in a manner similar to rockets and components. The complete round employs the designation of antisubmarine rockets.

In general, mark and mod designations are not assigned to assemblies containing components identified by experimental designations.

Lot Numbers. The ammunition lot system for rocket and projector charge ammunition provides a means by which an adequate record may be maintained of the components assembled into this type ammunition. The ammunition lot serves as a unit by which defective components may be withdrawn from the Fleet or restricted from issue or from service use.

The ammunition lot is used as a unit for record control, stowage, and shipping.

Each ammunition lot is assigned a number consisting of three parts: the prefix designation, the numerical group, and the suffix designation. A typical lot number is RHDF–1764–HAW–45.

The first letter "R" of the prefix designation indicates rocket ammunition. The second letter indicates the rocket unit. In this example, "H" indicates head. "M" would indicate motor and "T" would indicate a head and motor packed unassembled in a single container. The third letter (A to Z) and fourth letter (A to Z) are assigned from a list of rocket assemblies to designate the caliber and type of load, respectively. Examples are:

1. RHDF—7.2-inch HE rocket head with HBX–1 explosive filler.

2. RMEA—5.25-inch rocket motor for 12.75-inch antisubmarine rocket with Mk 26 All Mods Propellent Grain.

3. RTCD—2.75-inch HEAT rocket with an RHHC rocket head (composition B filler) and an RMHA rocket motor.

4. A fifth letter "R" at the end of the ammunition lot prefix indicates that the lot has been renovated, i.e., RMHAR.

The numerical group is one of a consecutive series of numbers assigned under each prefix designation by a particular loading activity. Each numerical group begins with number one (1) for the first lot loaded under each prefix designation in the year of 1945 and continues consecutively ad infinitum.

The suffix consists of a code group assigned to identify each loading activity and the year of assembly. In the example, "HAW" represents Naval Ammunition Depot, Hawthorne, Nevada.

A complete reading of the lot number "RHDF–1764–HAW–45" is "the 1764th lot of 7.2-inch rocket heads (HE) loaded with HBX–1 explosive filler at Hawthorne."

Projector charge assemblies comprise a projector charge, tail, cartridge case, electric primer, and smokeless powder. Projector charge assemblies have a three-letter prefix designation, such as "RCA–26–HAW–45." "RC" stands for projector charge ammunition and the third letter (A to Z) is assigned from a list of projector charge assemblies to designate the caliber and type of load. For example, RCA designates a 7.2-inch PC head with TNT explosive filler.

Color Coding and Marking. Rocket heads, motors, and accessories are painted different colors to distinguish types. They also are stenciled or stamped with information required for identification and record control. Rocket fuzes are not painted. Fin assemblies are painted the same color as the motor.

Color	Items
Olive drab	Solid steel heads and heads loaded with high-explosive filler for use in service rounds.
Ocean gray	Heads loaded with smoke, incendiary, or special filler for use in service rounds.
Black	Dummy or inert-loaded heads intended for use in dummy rounds.
Light blue	Practice heads for use in practice rounds.
Yellow band (one ½-inch band on rear of head).	Smoke-filled heads.
Blue gray	All service motors.
Black	Dummy or inert-loaded motors.

Marking. Rocket heads, motors, and fuzes are identified by legends which may be stenciled, rubber stamped, or indent stamped on their exterior. Rocket heads have four legends, motors have three, and fuzes one. Following are descriptions of each of the legends found on rockets:

1. Manufacturer's Identifying Legend. This is stenciled or rubber stamped by the inert metal parts manufacturer on each head and motor, as illustrated in figures 1.20A and 1.20D.

a. The first line contains the nominal caliber in inches; the word "HEAD" or "MOTOR," as applicable; and the applicable mark and mod number.

b. The second line bears the Bureau of Ordnance drawing number and revision letter of the inert parts assembly.

c. The third line contains the contract number and the contractor's lot number.

d. The fourth line bears the contractor's initials or identifying symbol in the rectangle

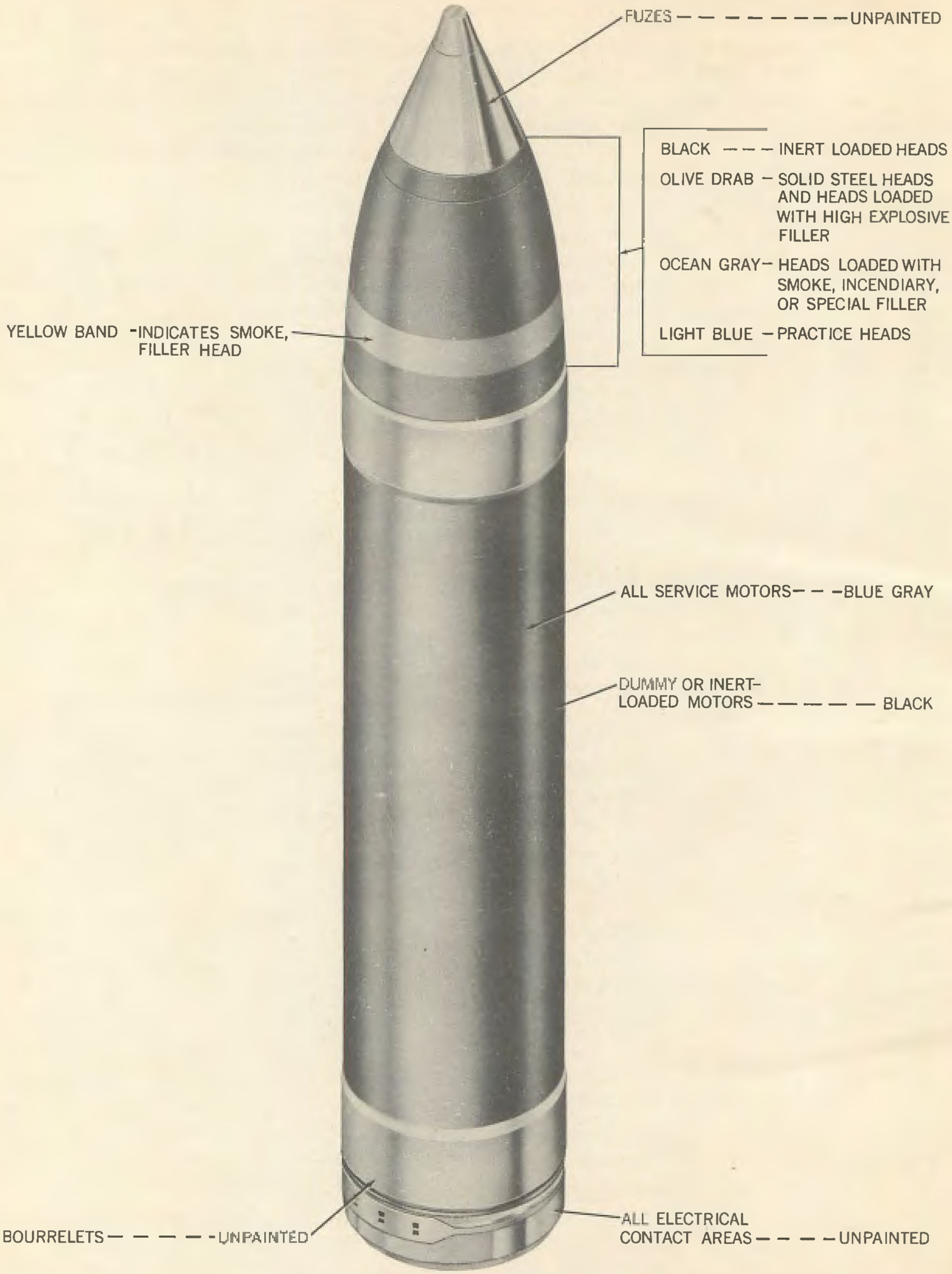


Figure 1.19—Rocket Color Code.

A MANUFACTURER'S IDENTIFYING LEGEND

B LOADING ACTIVITY'S LEGEND

C LOADING ACTIVITY'S LEGEND

D MANUFACTURER'S IDENTIFYING LEGEND

E LOADING ACTIVITY'S LEGEND

Figure 1.20—Rocket Head and Rocket Motor Markings.

and the Department of Defense inspector's stamp (eagle) or Navy inspector's stamp (anchor) indicating acceptance of an item.

2. MANUFACTURER'S CODE SYMBOL. This is stenciled or rubber stamped by the inert metal parts manufacturer on each head and motor. The symbol contains the following information:

a. Applicable mark and mod numbers.

b. The code number designating the type of inert parts assembly as follows:

ASSEMBLY	CODE NUMBER
Rocket head	3
Rocket motor	4
Projector charge head	5
Projector charge tail	6

c. The letter symbol assigned by the Bureau of Ordnance to each manufacturer which applies to all inert parts assemblies of any one type.

d. The same lot number used in the manufacturer's identifying legend.

A typical manufacturer's code symbol legend might be "Mk 17–2 Lot 4A157." This would mean Lot No. 157 of Rocket Motor Mk 17 Mod 2 manufactured by a contractor identified by the letter "A."

3. HEAD LEGEND (FIRST). This legend is placed only on the head by the loading activity. The following information is located 120 degrees from the manufacturer's identifying legend, as illustrated in figure 1.20B.

a. The type of filler, such as "WP–SMOKE" and "CAST TNT"; and the weight of the filler to the nearest tenth of a pound.

b. Navy ammunition lot number.

c. Navy ammunition code number.

d. Mark and mod number of base detonating fuze. This is omitted when no such fuze is installed.

4. HEAD LEGEND (SECOND). The following legend also is placed only on the head by the loading activity as illustrated in figure 1.20C. It is located 240 degrees from the manufacturer's identifying legend. It consists of one of the following to indicate the type of load: HE, GP, SOLID, FLARE, INERT, or SM.

5. MOTOR LEGEND. The following legend is placed only on the motor by the loading activity. It is located 180 degrees from the manufacturer's identifying legend on the motor, as shown in figure 1.20E.

Figure 1.21—Rocket Fuze Markings.

a. Propellent grain mark and mod number; and propellent grain lot number, which indicates the grain extrusion activity followed by the lot number. For example, "NPF 21" means Lot No. 21 from the Naval Powder Factory.

b. Navy ammunition lot number.

c. Navy motor code number.

d. Motor temperature limits.

6. FUZE LEGEND. The following legend usually is indent stamped on the fuze. The arrangement of its data may vary to conform to the shape of the fuze. The legend will contain the following information:

a. Letters indicating the type of fuze, such as "NF," "ADF," or "BDF."

b. The mark and mod.

c. The manufacturer's initials or symbol.

d. The lot number.

e. The initials or symbol of the loading activity.

f. The month and year of loading.

g. Department of Defense inspector's stamp (eagle) or Navy inspector's stamp (anchor).

7. LEGEND ON PROPELLENT GRAIN. This is rubber stamped or indent stamped and includes the manufacturer's initials, lot number, and mark and mod.

8. IGNITER LEGEND. Either stamped or stenciled, this legend includes the term "igniter," mark and mod, lot number, loading depot symbol, and date of loading (month and year).

9. AUXILIARY BOOSTER LEGEND. This is either rubber stamped on the booster or printed on a label attached to the booster. The legend consists of the term "auxiliary booster," mark and mod, weight (in grams), the explosive filler, lot number, place of loading; date of loading (month and year), and the inspector's initials.

10. ELECTRIC CONNECTOR LEGEND. This is stamped on a cable clamp or a cable marking tape. The legend consists of the mark and mod only.

11. LEGENDS ON OTHER COMPONENTS. If its size and function permit, the item is marked with the drawing number, piece number, and revision letter.

Some items, such as springs and ball bearings, are not marked in any way.

Data Cards. Data cards are made for each ammunition lot of rockets, projector charges, and components. They list such information as caliber, quantity, contract number, container dimension, contents, components, mark and mod, nose fuze thread diameter, note as to use with other components of round, propellent grain loading, and reference to pertinent ordnance pamphlets. This information is necessary in making out defective ammunition reports. One copy of the data card is included in each shipping container.

General Safety Precautions

The general precautions follow. Specific regulations are found in other portions of this publication where they apply.

1. The Bureau of Ordnance shall be informed of any circumstances which conflict with the safety precautions or which, for any reason, require changes in or additions to them.

2. When in doubt as to the exact meaning of a safety precaution, an interpretation shall be requested from the Bureau of Ordnance.

3. Do not make changes in or additions to rocket material without explicit authority from the Bureau of Ordnance.

4. No ammunition or explosive assembly shall be used in any rocket launcher for which it is not designated.

5. No ammunition other than dummy-drill shall be used for drill.

Chapter 2

ROCKET AND PROJECTOR CHARGE HEADS

5.0-INCH ROCKET HEAD MK 7 MODS 1, 2, AND 3 (HE)

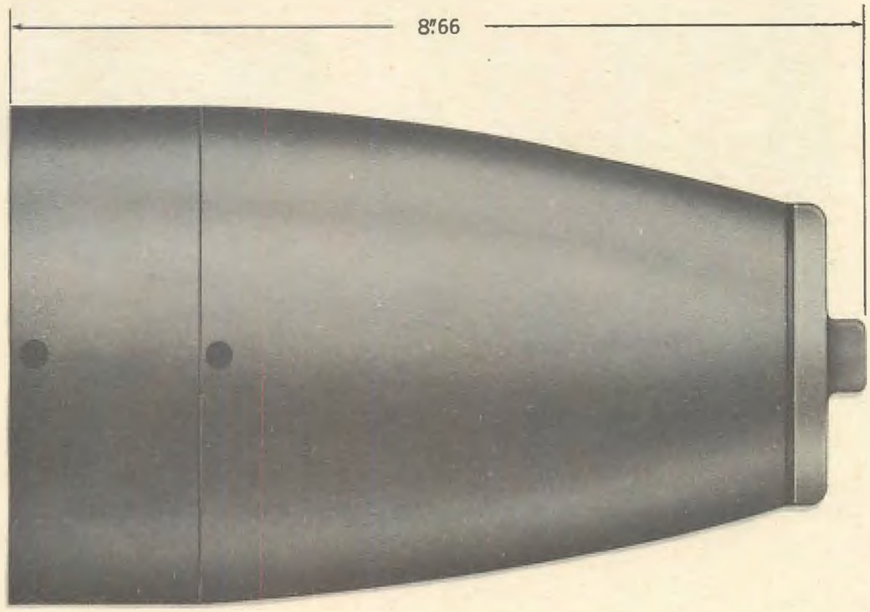


Figure 2.1—5.0-Inch Rocket Head Mk 7 Mod 2 (HE), External View.

Mark	7	7	7
Mod	1	2	3
Lot No. Prefix	RHCO	RHCO	RHCO
List of Drawings	165261	165261	165261
Loading Assembly No	561528	561528	561528
Overall Shipping Length (in.)	8. 66	8. 66	8. 66
Maximum Length (in.)	7. 22	7. 22	7. 22
Nominal Weight Shipped (lb)	19. 83	19. 83	19. 83
Nominal Weight Fired (lb)	17. 42	17. 42	17. 42
Filler:			
Type	TNT	TNT	TNT
Weight (lb)	2. 85	2. 85	2. 85
Nose Fuze Mk-Mod	100–2	100–2	100–2
ADF:			
Mk-Mod	44–2	44–2	44–2
Number Required	1	1	1
Container Mk-Mod	13–0	13–0	13–0
Lot No. Prefix (Practice Head)	RHCP	RHCP	RHCP

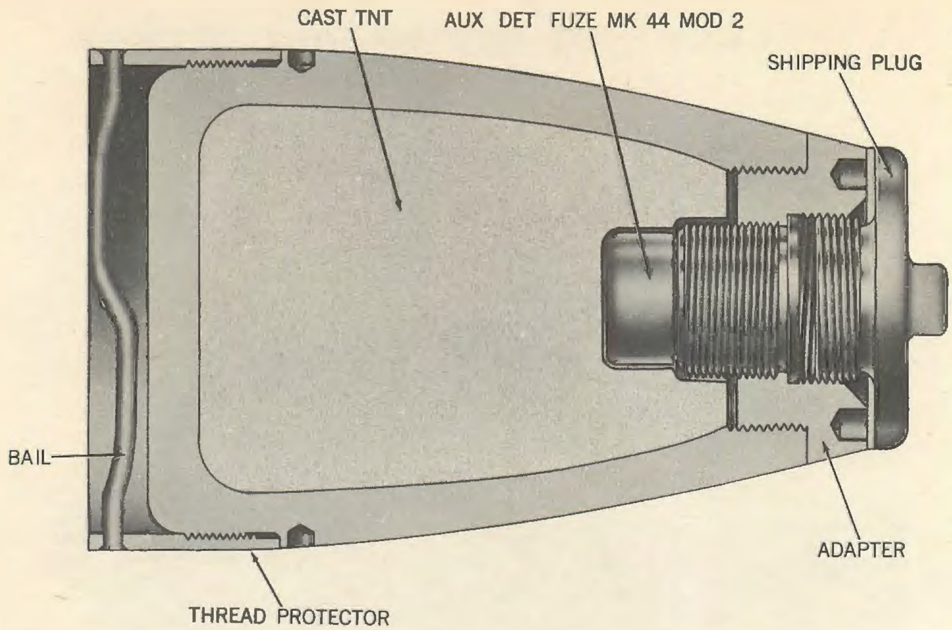


Figure 2.2—5.0-Inch Rocket Head Mk 7 Mod 2 (HE), Cross Section.

Special Information

Mods of 5.0-Inch Rocket Head Mk 7 differ chiefly in the manner in which they are manufactured. Mod 1 is made in two pieces, with the base brazed to the remainder of the head; Mod 2 is formed in one piece figure 2.2; Mod 3 is made in two pieces, with the base silver soldered to the remainder of the head.

5.0-INCH ROCKET HEAD MK 8 MODS 0, 1, AND 2 (AP)

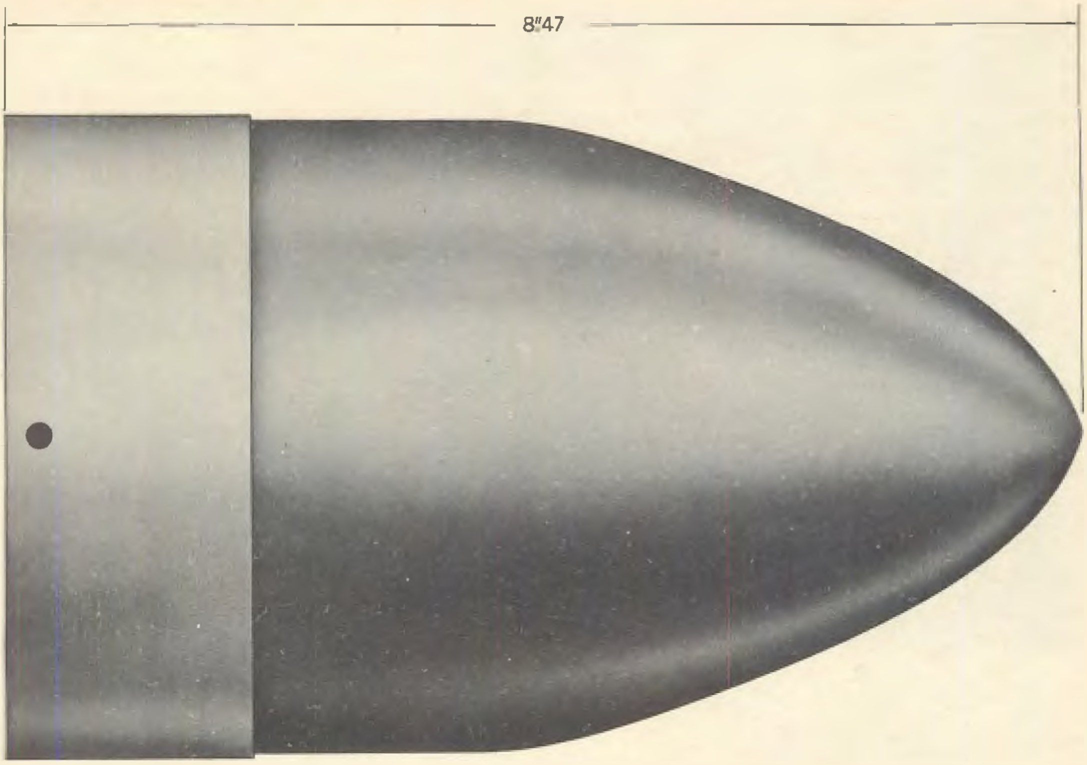


Figure 2.3—5.0-Inch Rocket Head Mk 8 Mod 2 (AP), External View.

Mark	8	8	8
Mod	0	1	2
Lot No. Prefix	RHCK	RHCK	RHCK
List of Drawings	CIT	139686	174539
Loading Assembly No	CIT	479492	656313
Overall Shipping Length (in.)	8. 47	8. 47	8. 47
Maximum Length (in.)	7. 53	7. 53	7. 53
Nominal Weight Shipped (lb)	21. 25	21. 25	21. 49
Nominal Weight Fired (lb)	20. 00	20. 00	20. 24
Filler:			
Type	Exp D	Exp D	Exp D
Weight (lb)	1. 70	1. 70	1. 56
Base Fuze Mk-Mod	31–0, 2, or 36–0	31–0 or 36–0	31–2
Fuze Cavity Liner	None	None	457734
Container Mk-Mod	7–0	7–0	7–0
Lot No. Prefix (Practice Head)	None	RHCM	None

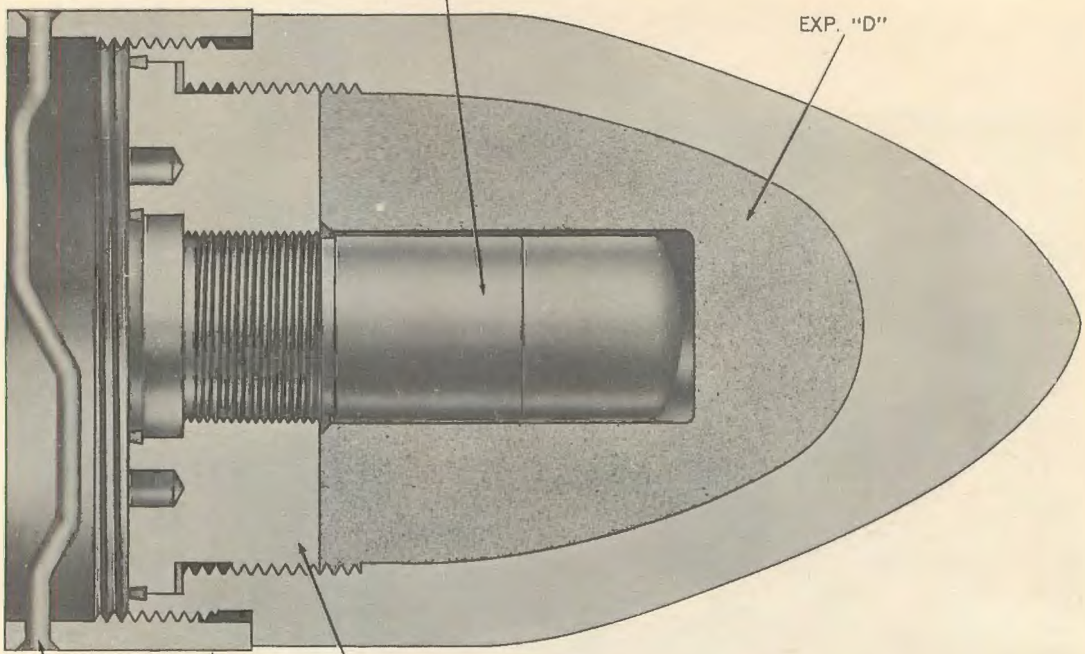


Figure 2.4—5.0-Inch Rocket Head Mk 8 Mod 2 (AP), Cross Section.

Special Information

Mod 0 is the designation for the California Institute of Technology production of this head. Mod 1 is the designation for the Bureau of Ordnance production of the same head. Mod 2 differs from Mod 1 in that Mod 2 has a fuze cavity liner.

The base fuze must be in place in these rocket heads before the head is assembled to the motor; otherwise, the head will detonate when the rocket is fired. Any Rocket Head Mk 8 from which the base fuze has been omitted must be disposed of.

Container Mk 7 Mod 0, a wood box, is used for shipping this head, but the head is not to be stowed aboard ship in this container. The head is stowed aboard ship without any container. Shipboard stowage is in racks.

5.0-INCH ROCKET HEAD MK 10 MODS 6, 7, 9, AND 12 (HE) AND MODS 9 AND 11 (VT)

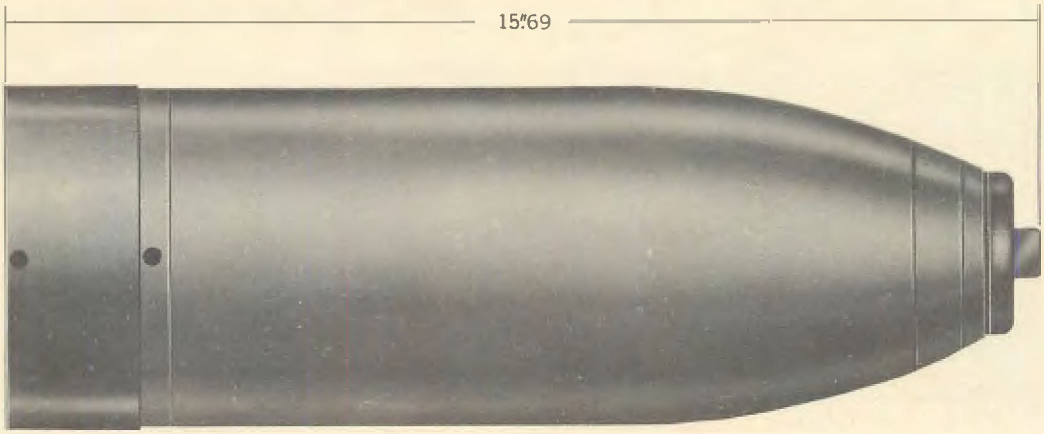


Figure 2.5—5.0-Inch Rocket Head Mk 10 Mod 12 (HE), External View.

Head Type	HE	VT	VT	HE
Mark	10	10	10	10
Mod	9	9	11	12
Lot No. Prefix	RHCL	RHCT	RHCT	RHCL
List of Drawings	145933	166309	267528	267533
Loading Assembly No	467052	467052	656333	656335
Overall Shipping Length (in.)	15. 69	18. 32	15. 33	15. 69
Maximum Length (in.)	14. 63	18. 07	14. 58	14. 63
Nominal Weight Shipped (lb)	29. 41	29. 97	29. 11	29. 04
Nominal Weight Fired (lb)	27. 24	28. 72	26. 82	26. 87
Filler:				
Type	TNT	TNT	TNT	TNT
Weight (lb)	9. 60	9. 90	9. 90	9. 40
Nose Fuze Mk-Mod	30–3, 4	173–4 or 174–0	173–4 or 174–0	30–3, 4
ADF:				
Mk-Mod	44–2	None	None	44–2
Number Required	1	None	None	1
Fuze Cavity Liner	None	None	457206	None
Container Mk-Mod	23–0	23–0	23–0	23–0
Lot No. Prefix (Practice Head)	RHCN	RHCN	RHCN	RHCN

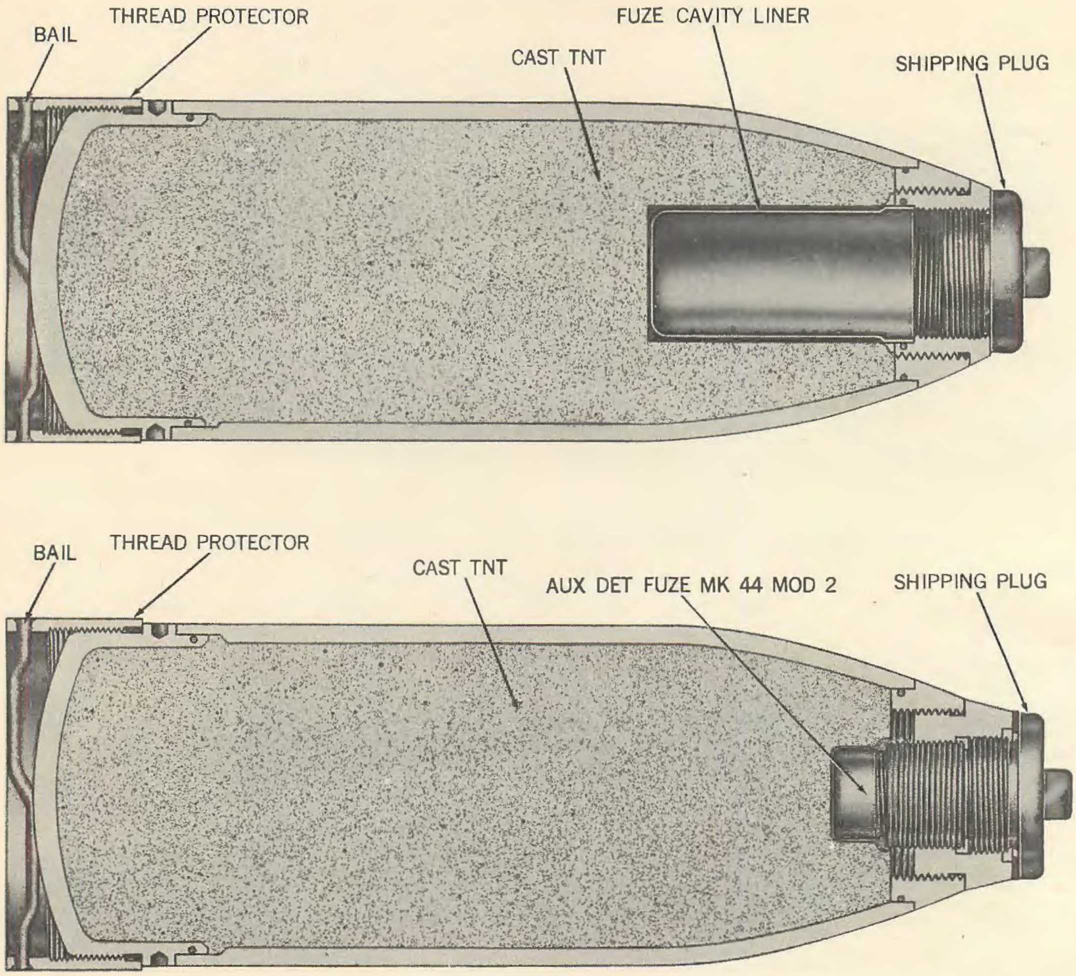


Figure 2.6—5.0-Inch Rocket Head Mk 10 Mod 11 (VT), and Mod 12 (HE), Cross Sections.

Special Information

Mods 6 and 7 are no longer being produced. On Mod 6, the nose and base are welded to the body. Mod 7 has a drawn nose and base. Both Mod 6 and Mod 7 are used infrequently. They never are assembled with a VT fuze.

Mods 9 (HE) and 9 (VT) have the same inert parts. On both, the nose and base members are attached by brazing or silver-soldering. However Mod 9 (VT) does not have the nose fuze adapter of the HE head. These heads are shipped with the fuze installed. Unlike most VT heads, 5.0-Inch Mk 10 Mod 9 (VT) has no fuze cavity liner; the fuze is in direct contact with the explosive filler. Because of this, refuzing of Mk 10 Mod 9 (VT) head is performed only at ammunition depots.

Mod 11 resembles Mod 9 (VT) and Mod 12 resembles Mod 9 (HE), except for differences shown in the table.

5.0-INCH ROCKET HEAD MK 12 MODS 0 AND 3 (HE)

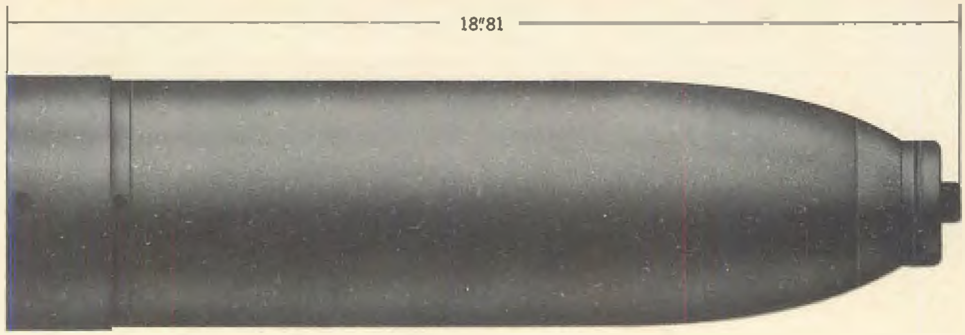


Figure 2.7—5.0-Inch Rocket Head Mk 12 Mod 3 (HE), External View.

Mark	12	12
Mod	0	3
Lot No. Prefix	RHCS	RHCS
List of Drawings	165459	165462
Loading Assembly No.	561530	561530
Overall Shipping Length (in.)	18. 81	18. 81
Maximum Length (in.)	17. 75	17. 75
Nominal Weight Shipped (lb)	34. 99	34. 99
Nominal Weight Fired (lb)	34. 20	34. 20
Filler:		
Type	TNT	TNT
Weight	12. 0	12. 0
Nose Fuze Mk-Mod	30–3,4	30–3,4
ADF Mk-Mod	44–2	44–2
Container Mk-Mod	20–0	20–0
Lot No. Prefix (Practice Head)	RHCS	RHCS

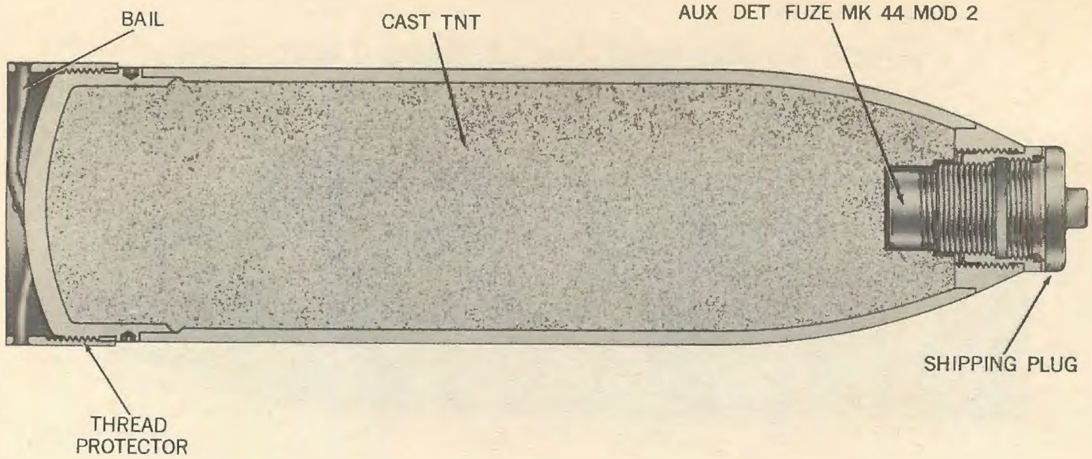


Figure 2.8—5.0-Inch Rocket Head Mk 12 Mod 3 (HE), Cross Section.

Special Information

Mods of 5.0-Inch Rocket Head Mk 12 differ chiefly in the manner in which they are manufactured. Mod 0 has a welded nose and base; Mod 3, a soldered nose and base.

5.0-INCH ROCKET HEAD MK 13 MOD 0 (HE)

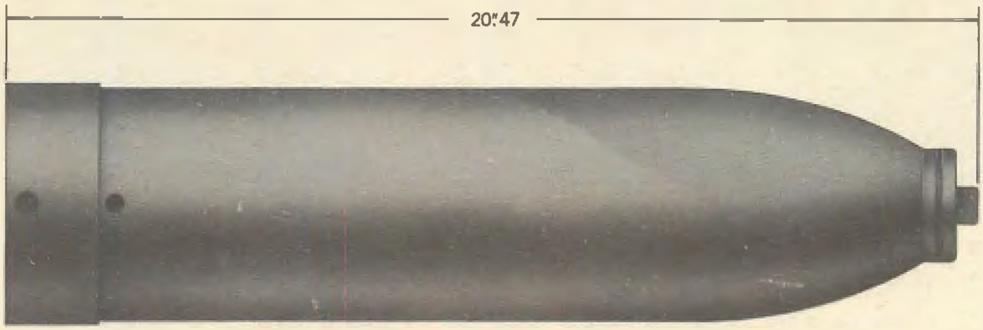


Figure 2.9—5.0-Inch Rocket Head Mk 13 Mod 0 (HE), External View.

Mark	13
Mod	0
Lot No. Prefix	RHCW
List of Drawings	166358
Loading Assembly No	467143
Overall Shipping Length (in.)	20.47
Maximum Length (in.)	19.41
Nominal Weight Shipped (lb)	38.18
Nominal Weight Fired (lb)	37.39
Filler:	
Type	TNT
Weight	13.50
Nose Fuze Mk-Mod	30–3,4
ADF Mk-Mod	52–2
Container Mk-Mod	24–0
Lot No. Prefix (Practice Head)	RHCW

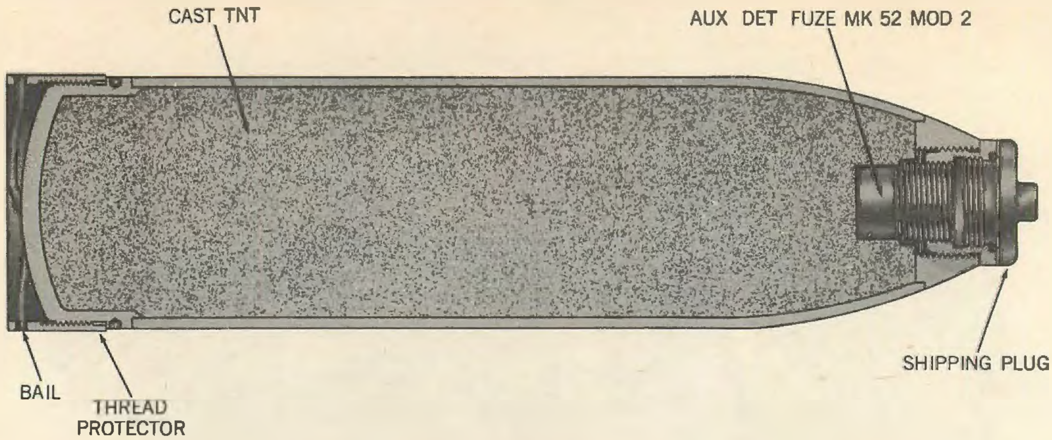


Figure 2.10—5.0-Inch Rocket Head Mk 13 Mod 0 (HE), Cross Section.

Special Information

The 5.0-Inch Rocket Head Mk 13 Mod 0 has a welded nose and base.

5.0-INCH ROCKET HEAD MK 21 MODS 0 AND 1 (SMOKE-TAR)

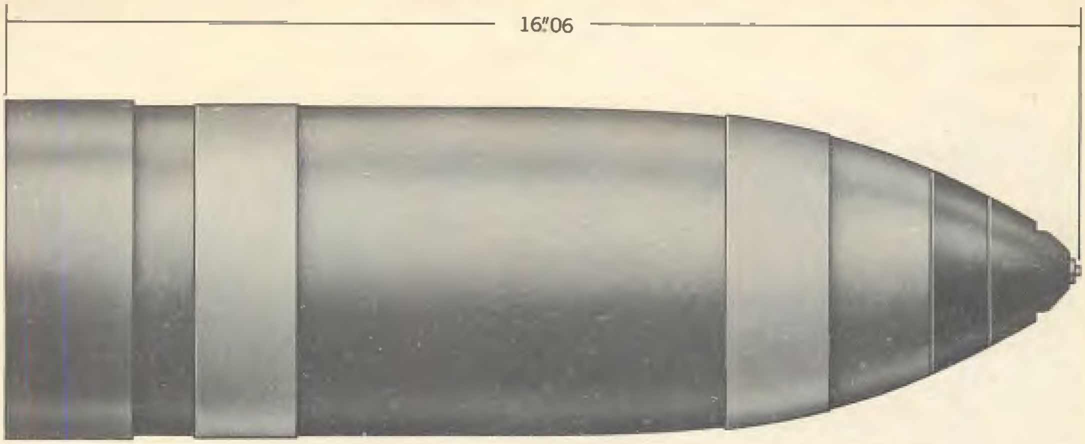


Figure 2.11—5.0-Inch Rocket Head Mk 21 Mod 1 (SMOKE-TAR), External View.

Mark	21	21.
Mod	0	1.
Lot No. Prefix	RHKC	RHKC.
List of Drawings	174494	174517.
Loading Assembly No	660864	656290.
Overall Shipping Length (in.)	16.06	16.06.
Maximum Length (in.)	15.37	15.37.
Nominal Weight Shipped (lb)	23.27	23.27.
Nominal Weight Fired (lb)	22.00	22.00.
Filler Type	Two M18 Grenades (Modified).	Two M18 Grenades (Modified).
Container Mk-Mod	23–0	23–0.

Special Information

The 5.0-Inch Rocket Head Mk 21 Mods 0 and 1 are each composed of a perforated head with adhesive-tape-covered holes arranged circumferentially fore and aft, a loading components assembly, and a nose plug.

Mod 0 is a modified version of 5.0-Inch Rocket Head Mk 10 Mod 9, which has a deep-drawn steel base. Mod 0 differs from Mod 1 in that the base of the head is made of a different steel.

The loading components assembly consists of the following:

1. Two Colored Smoke Grenades M18, which are connected back-to-back with adhesive tape. The holes which normally appear in the front end of a grenade are tape-covered. The forward grenade has a grenade plug closing the fuze well.

2. A base subassembly is attached to the after-grenade by a threaded stud in the fuze well. The base assembly has a diaphragm with a central firing boss and a .32-caliber-long cartridge with primer and "first-fire mixture." This first-fire mixture is composed of 3 parts of black powder and 5 parts of a mixture of aluminum and potassium perchlorate. This is blended with a 7-percent solid solution of shellac and ethanol. The ethanol is evaporated, leaving about 1 percent of shellac in the final first-fire mixture.

3. A cylindrical, perforated grenade support encloses the grenades, and is attached to the base subassembly by a flange and screws. The cylindrical support has a neck that receives the nose plug.

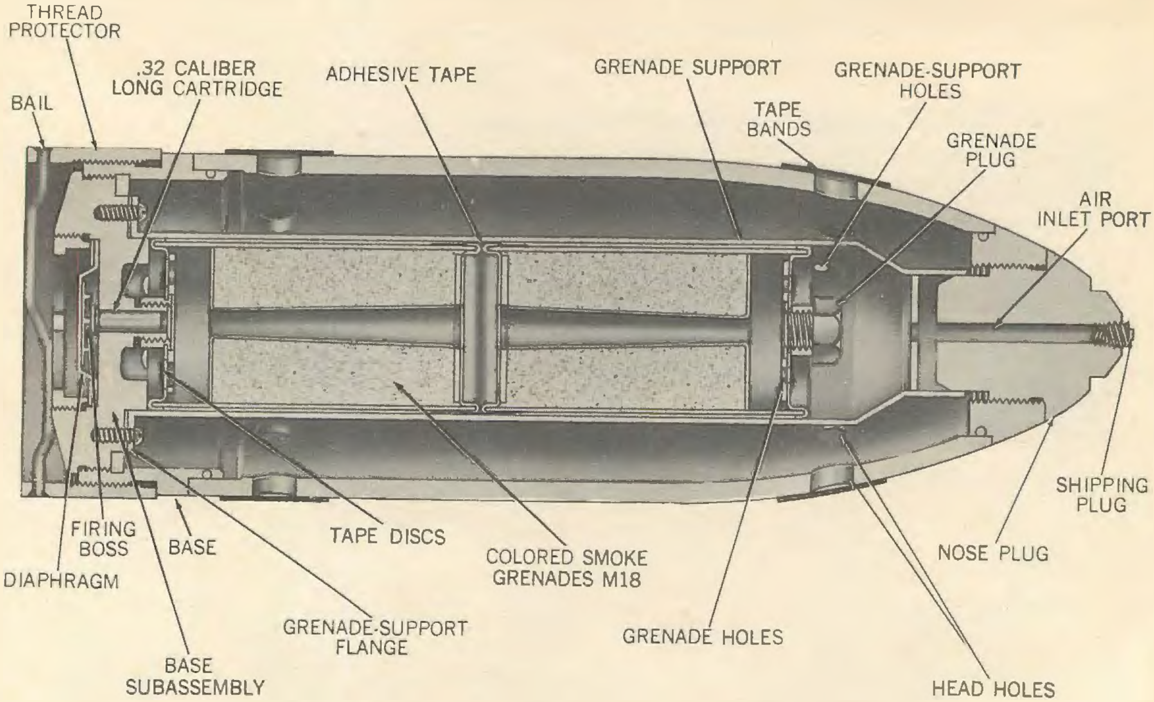


Figure 2.12—5.0-Inch Rocket Head Mk 21 Mod 1 (SMOKE-TAR), Partial Cross Section.

The nose plug supports the grenade support assembly. An air-inlet port is bored through the center of the nose plug.

When the round is fired, motor gases snap the diaphragm forward. The central firing boss impinges against the primer in the cartridge case. The primer fires the first-fire mixture, causing the grenades to ignite. The smoke generates increasing pressure and bursts the adhesive tape covering the grenade holes. The smoke passes through the holes in the ground support, bursts the adhesive tape covering the head holes, and flows into the surrounding atmosphere.

This 5.0-inch rocket head is shipped with a thread protector on the aft end and a shipping plug in the air-inlet port of the nose plug. Attached to the shipping plug is a tag which reads as follows:

Remove this plug just prior to loading round into launcher. Replace this plug just after removing unfired round from launcher.

7.2-INCH ROCKET HEAD MK 5 MOD 0 (HE, ASW)

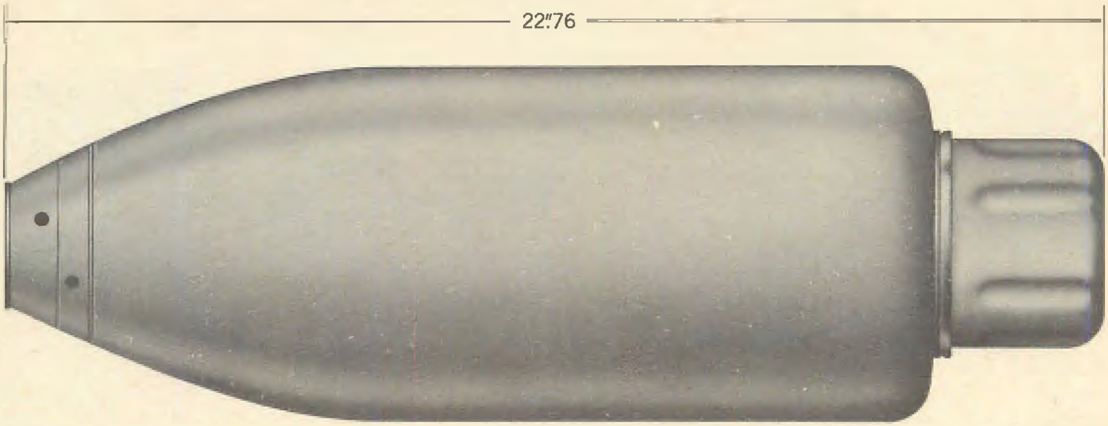


Figure 2.13—7.2-Inch Rocket Head Mk 5 Mod 0 (HE, ASW), External View.

Mark	5
Mod	0
Lot No. Prefix	RHDF
List of Drawings	108945
Loading Assembly No	393836
Overall Shipping Length (in.)	22.76
Maximum Length (in.)	19.12
Nominal Weight Shipped (lb)	50.58
Nominal Weight Fired (lb)	52.79
Filler:	
Type	HBX–1
Weight (lb)	34.96
Nose Fuze Mk-Mod	156–0, 177–0
Booster:	
Mk-Mod	1–0
Number Required	1
Container	329967
Lot No. Prefix (Practice Head)	RHDC

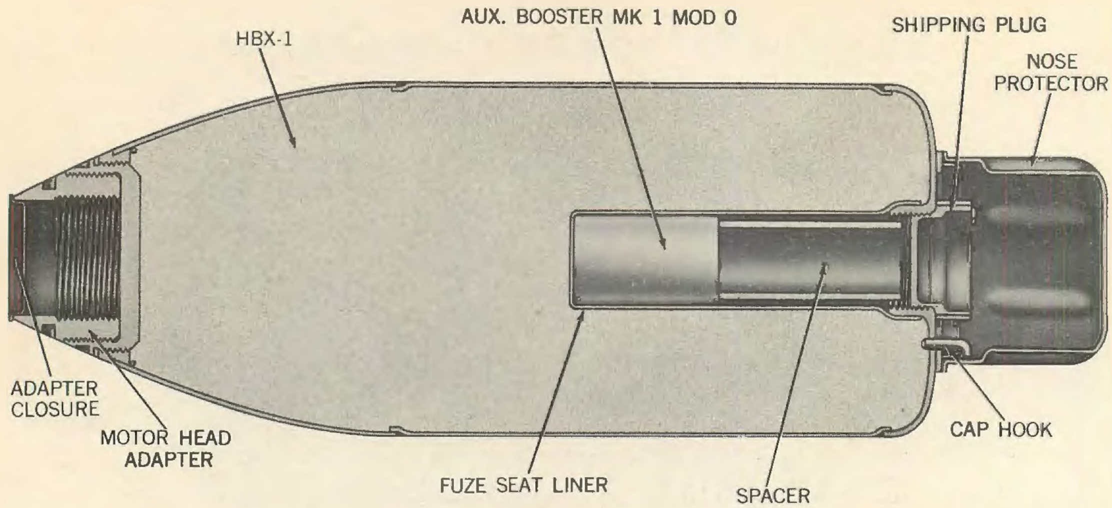


Figure 2.14—7.2-Inch Rocket Head Mk 5 Mod 0 (HE, ASW), Cross Section.

Special Information

The 7.2-Inch Rocket Head Mk 5 Mod 0 has a fuze seat liner integral with the nose plate. A fuze cap and gasket are secured to the nose plate to protect the fuze during stowage. Three cap hooks are welded to the nose plate. The hooks engage the locking cam inside the cap. Twisting the cap secures the cap and gasket to the head.

7.2-INCH PROJECTOR CHARGE HEAD MK 4 MOD 0 (HE, ASW)

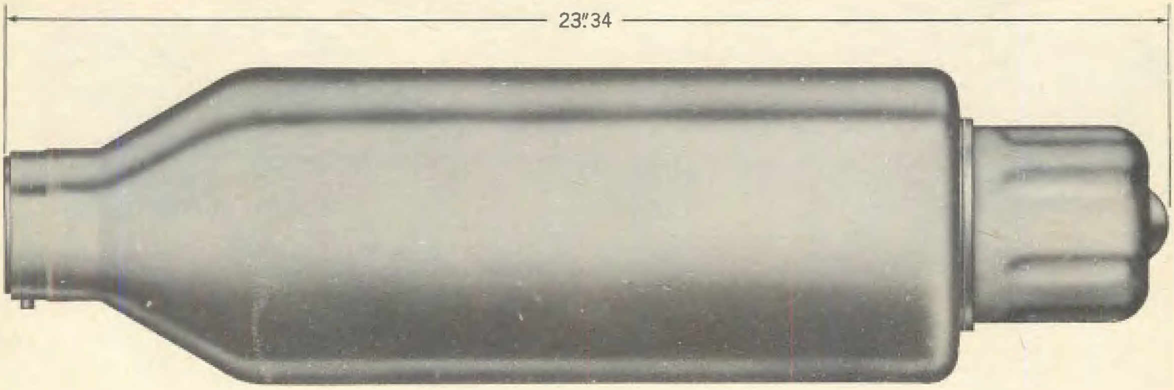


Figure 2.15—7.2-Inch Projector Charge Head Mk 4 Mod 0 (HE, ASW), External View.

Mark	4	
Mod	0	
Lot No. Prefix	RHDF	
List of Drawings	None	268526
Loading Assembly No	329139	656870
Overall Shipping Length (in.)	23.47	23.46
Maximum Length (in.)	19.66	19.66
Nominal Weight Shipped (lb)	52.2	52.9
Nominal Weight Fired (lb)	50.8	51.5
Filler:		
Type	TNT	HBX–1
Weight (lb)	30.3	31.0
Nose Fuze Mk-Mod	177–0,1	177–0,1
Booster:		
Mk-Mod	1–0	1–0
Number Required	1	1
Container	329967	329967
Lot No. Prefix (Practice Head)	RHDC	---------

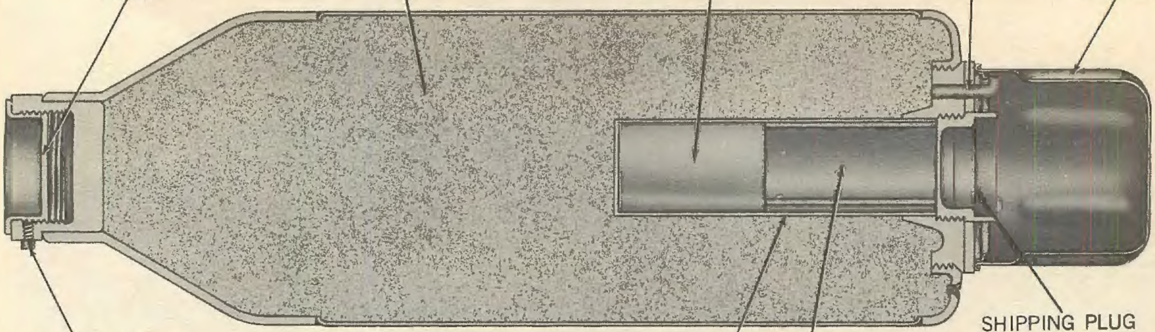


Figure 2.16—7.2-Inch Projector Charge Head Mk 4 Mod 0 (HE, ASW), Cross Section.

Special Information

The 7.2-Inch Projector Charge Head Mk 4 Mod 0 is available in two different types, both of which are used in service rounds. The two types differ chiefly in their explosive load and in their nose cap assemblies. The older, TNT-loaded type has three cap hooks welded to the nose plate. The hooks engage the locking cam inside the cap. Twisting the cap secures the cap and gasket to the fuze seat liner. The HBX-1-loaded type has a nose cap which is secured to the fuze seat liner by means of a threaded ring.

The 7.2-Inch Projector Charge Head Mk 4 Mod 0 will be received assembled to a projector charge tail. Disassembly of these components is not permitted.

ROCKET AND PROJECTOR CHARGE HEADS FOR PRACTICE AND DUMMY ROUNDS

Inert-loaded rocket and projector charge heads are used in practice and dummy rounds. The following heads are used:

5.0-Inch Rocket Head Mk 7 All Mods
5.0-Inch Rocket Head Mk 8 Mod 1
5.0-Inch Rocket Head Mk 10 All Mods
5.0-Inch Rocket Head Mk 12 All Mods
5.0-Inch Rocket Head Mk 13 All Mods
7.2-Inch Rocket Head Mk 5 Mod 0
7.2-Inch Projector Charge Head Mk 4 Mods 0, 1, 2, and 3

Chapter 3

ROCKET MOTORS AND PROJECTOR CHARGE TAILS

2.25-INCH ROCKET MOTOR MK 3 MODS 2 AND 3

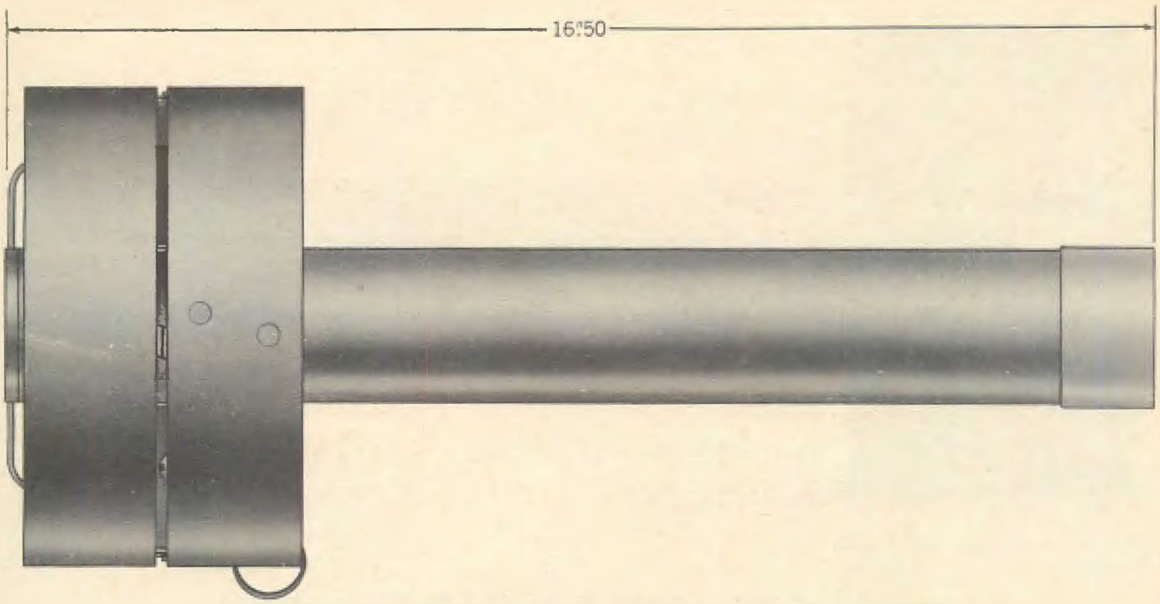


Figure 3.1—2.25-Inch Rocket Motor Mk 3 Mod 2, External View.

Mark	3
Mod	2, 3
Loading Assembly No	329533
List of Drawings	166301
Lot No. Prefix	RMBC
Type Stabilization	Fin
Nominal Weight Shipped (lb)	9.43
Nominal Weight Fired (lb)	9.43
Thrust (lb)	825
Overall Shipping Length (in.)	16.50
Maximum Length (in.)	16.50
Fin Diameter (in.)	7.0
Burning Time (sec.)	0.40
Propellent Grain Mk-Mod	3–1
Igniter Mk-Mod	104–0 or 1
Container	329968

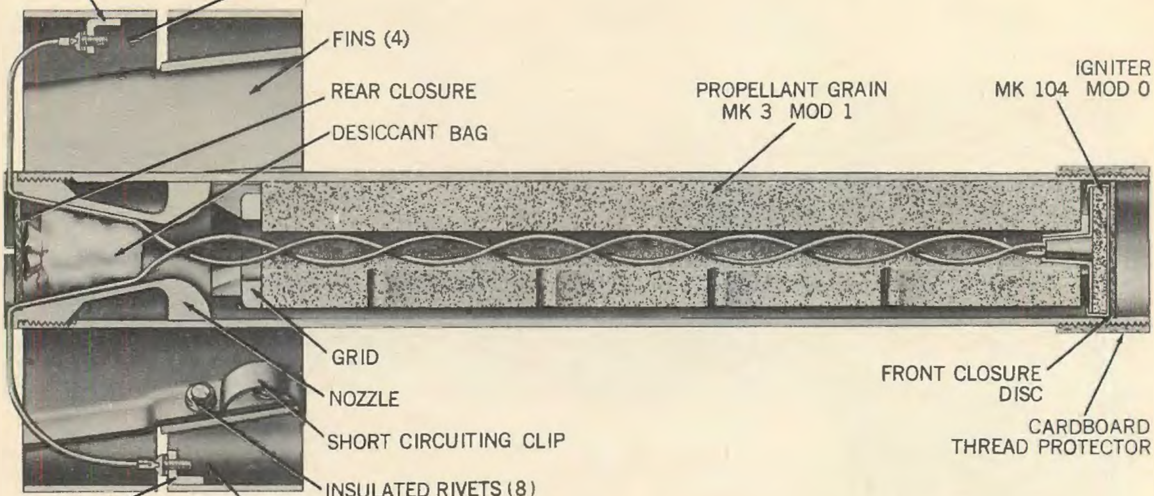


Figure 3.2—2.25-Inch Rocket Motor Mk 3 Mod 2, Cross Section.

Special Information

The 2.25-Inch Rocket Motor Mk 3 Mod 2 has two cylindrical shrouds surrounding four radial fins, which are inclined 10 degrees relative to the motor tube axis. This design is intended to impart rotation to the rocket and to cancel ruddering effects which would disturb the underwater trajectory.

The motor contains a long single pellet of smokeless powder which burns to produce a pressure of 1000 to 2500 psi.

The 2.25-Inch Rocket Motor Mk 3 Mods 0, 2, and 3 are used in practice rounds. The same mods, inert loaded, are used in dummy rounds.

5.0-INCH ROCKET MOTOR MK 3 MODS 0, 1, 2, AND 4

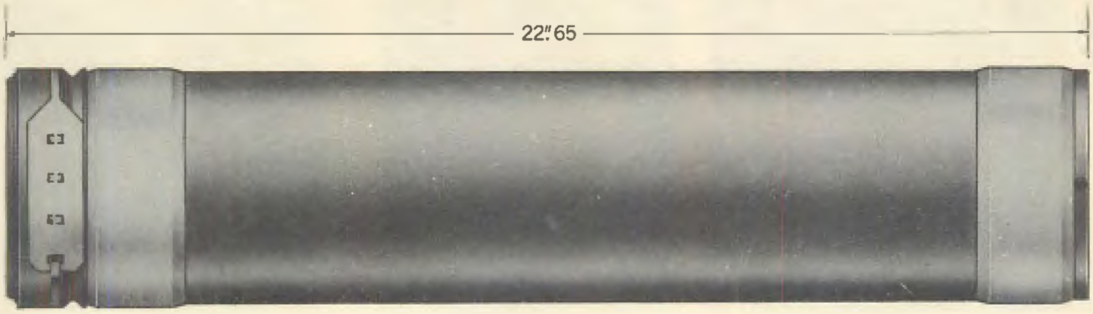


Figure 3.3—5.0-Inch Rocket Motor Mk 3 Mod 4, External View.

Mark	3	3	3	3
Mod	0	1	2	4
Loading Assembly No	CIT	467046	CIT	655916
List of Drawings	CIT	166301	CIT	174608
Lot No. Prefix	RMDB	RMDB	RMDB	RMDB
Type Stabilization	Spin	Spin	Spin	Spin
Nominal Weight Shipped (lb)	32.50	32.90	33.31	32.90
Nominal Weight Fired (lb)	30.59	30.59	30.59	30.59
Thrust (lb)	2080	2080	2080	2080
Overall Shipping Length (in.)	22.65	22.65	22.65	22.65
Maximum Length (in.)	22.28	22.28	22.28	22.28
Burning Time (sec.)	1.07	1.07	1.07	1.07
Propellent Grain Mk-Mod	21–0 or 2	21–0 or 2	21–0 or 2	21–0 or 2
Igniter Mk-Mod	117–0, 1, or 2	117–0, 1, or 2	117–0, 1, or 2	117–0, 1, or 2
Container Mk-Mod	19–0	19–0	19–0	19–0

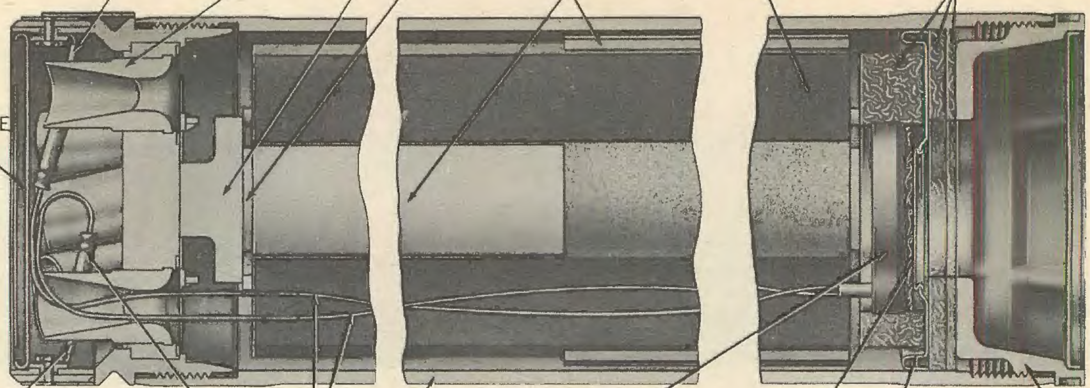


Figure 3.4—5.0-Inch Rocket Motor Mk 3 Mod 4, Cross Section.

Special Information

Mod 1 is the Bureau of Ordnance production of Mod 0, which is the rocket produced by the California Institute of Technology. Mod 2 is similar to Mod 1, except that Mod 2 has a 0.25-inch-thick nozzle plate ring compared to a 0.10-inch-thick ring in Mod 1. Mod 4 differs from Mod 2 in that the nozzles in Mod 4 are both pressed and staked to the nozzle plate while Mod 2 nozzles are only pressed.

The 5.0-Inch Rocket Motor Mk 3 Mod 1 is used in practice rounds. Inert-loaded 5.0-Inch Rocket Motor Mk 3 Mods 0 and 1 are used in dummy rounds.

5.0-INCH ROCKET MOTOR MK 4 MODS 0, 1, 2, AND 4

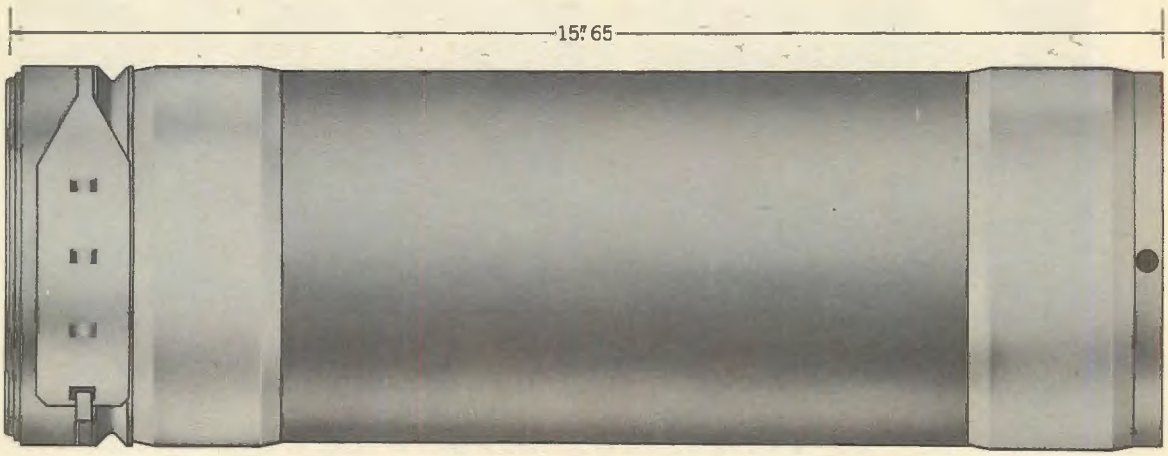


Figure 3.5—5.0-Inch Rocket Motor Mk 4 Mod 4, External View.

Mark	4	4	4	4
Mod	0	1	2	4
Loading Assembly No	CIT	467049	CIT	655922
List of Drawings	CIT	166305	CIT	174611
Lot No. Prefix	RMDC	RMDC	RMDC	RMDC
Type Stabilization	Spin	Spin	Spin	Spin
Nominal Weight Shipped (lb)	24.51	24.51	24.51	24.51
Nominal Weight Fired (lb)	21.69	21.69	21.69	21.69
Thrust (lb)	1145	1145	1145	1145
Overall Shipping Length (in.)	15.65	15.65	15.65	15.65
Maximum Length (in.)	15.28	15.28	15.28	15.28
Burning Time (sec.)	1.06	1.06	1.06	1.06
Propellent Grain Mk-Mod	22–0, 1, 2, or 3	22–0, 1, 2, or 3	22–0, 1, 2, or 3	22–0, 1, 2, or 3
Igniter Mk-Mod	118–0, 1, or 2	118–0, 1, or 2	118–0, 1, or 2	118–0, 1, or 2
Container Mk-Mod	23–0	23–0	23–0	23–0

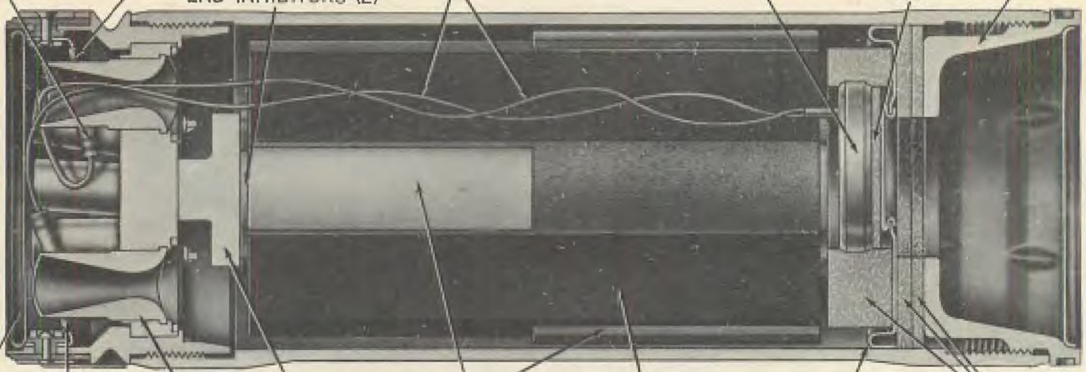


Figure 3.6—5.0-Inch Rocket Motor Mk 4 Mod 4, Cross Section.

Special Information

Mod 0 is the motor produced by California Institute of Technology. Mod 1 is the Bureau of Ordnance production of the same motor. Mod 2 is similar to Mod 1 except that Mod 2 has a 0.25-inch-thick nozzle plate ring, compared to the 0.10-inch-thick ring in Mod 1. Mod 4 is like Mod 2 except that Mod 4 nozzles are both pressed and staked to the nozzle plate where Mod 2 nozzles are only pressed.

The 5.0-Inch Rocket Motor Mk 4 Mod 1 is used in practice rounds. Inert-loaded 5.0-Inch Rocket Motor Mk 4 Mod 1 is used in dummy rounds.

5.0-INCH ROCKET MOTOR MK 5 MODS 0, 1, 2, AND 4

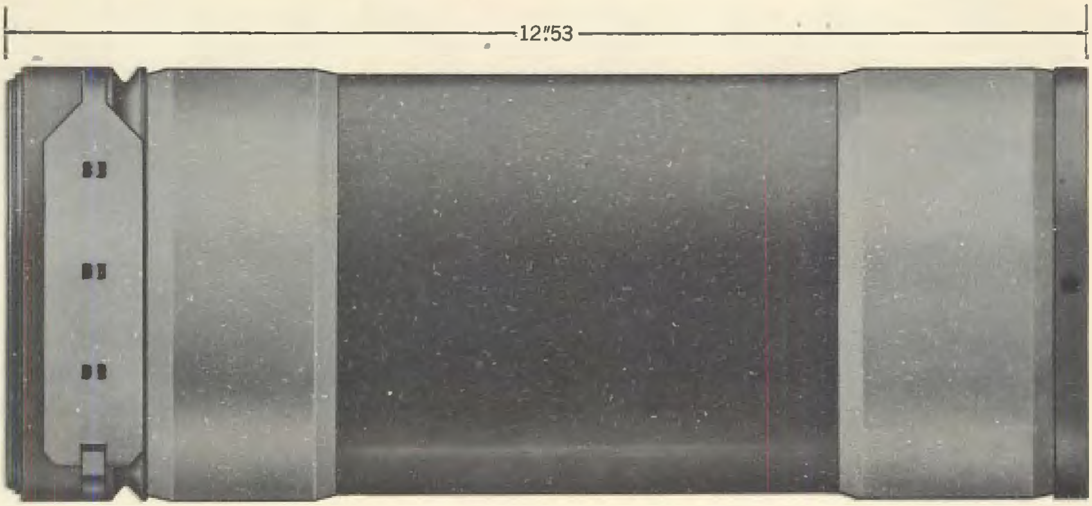


Figure 3.7—5.0-Inch Rocket Motor Mk 5 Mod 4, External View.

Mark	5	5	5	5
Mod	0	1	2	4
Loading Assembly No	467115	467158	CIT	655924
List of Drawings	166350	166375	CIT	174613
Lot No. Prefix	RMDD	RMDD	RMDD	RMDD
Type Stabilization	Spin	Spin	Spin	Spin
Nominal Weight Shipped (lb)	20.93	20.48	18.5	20.48
Nominal Weight Fired (lb)	18.40	17.66	17.66	17.66
Thrust (lb)	875	875	875	875
Overall Shipping Length (in.)	12.3	12.53	12.53	12.53
Maximum Length (in.)	12.16	12.16	12.16	12.16
Burning Time (sec.)	0.97	0.97	0.97	0.97
Propellent Grain Mk-Mod	24–0, 1, or 2	24–0, 1, or 2	24–0, 1, or 2	24–0, 1, or 2
Igniter Mk-Mod	120–0, 1, or 2	120–0, 1, or 2	120–0, 1, or 2	120–0, 1, or 2
Container Mk-Mod	21–0	21–0	21–0	21–0

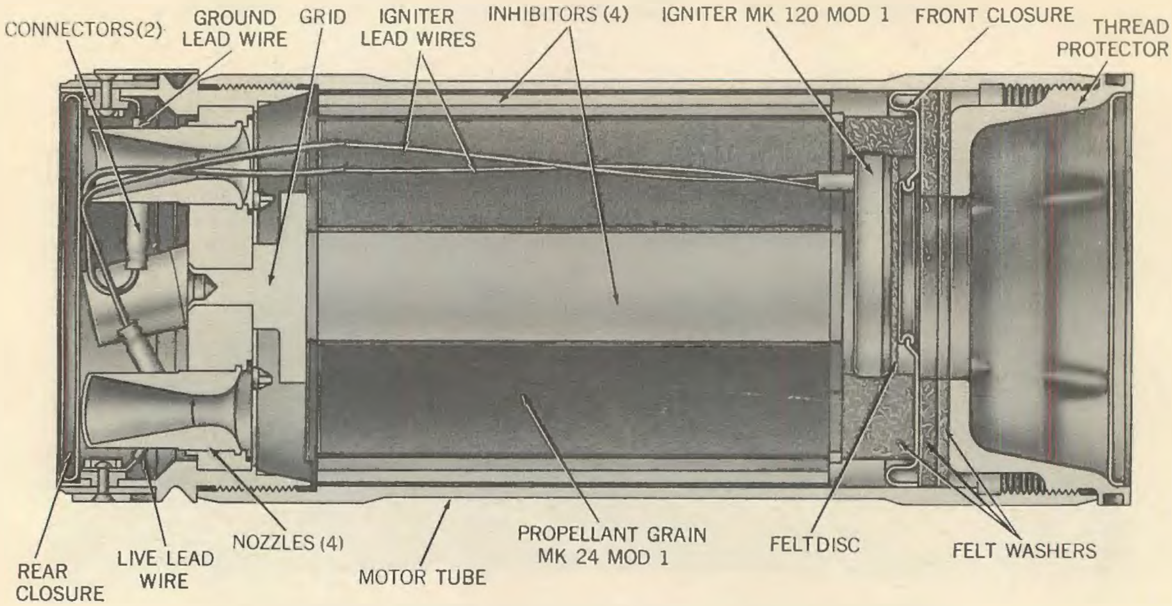


Figure 3.8—5.0-Inch Rocket Motor Mk 5 Mod 4, Cross Section.

Special Information

Mod 0 has a $\frac{3}{16}$-inch-thick nozzle plate ring; Mod 1 has a $\frac{1}{16}$-inch-thick nozzle plate ring. Mod 2 is the California Institute of Technology production of the motor designated as Mod 0 in the Bureau of Ordnance production. Mod 4 is like Mod 1 except that Mod 4 nozzles are both pressed and staked to the plate while Mod 2 nozzles are only pressed.

The 5.0-Inch Rocket Motor Mk 5 Mod 1 is used in practice rounds. Inert-loaded 5.0-Inch Rocket Motor Mk 5 Mod 1 is used in dummy rounds.

5.0-INCH ROCKET MOTOR MK 6 MODS 1 AND 4

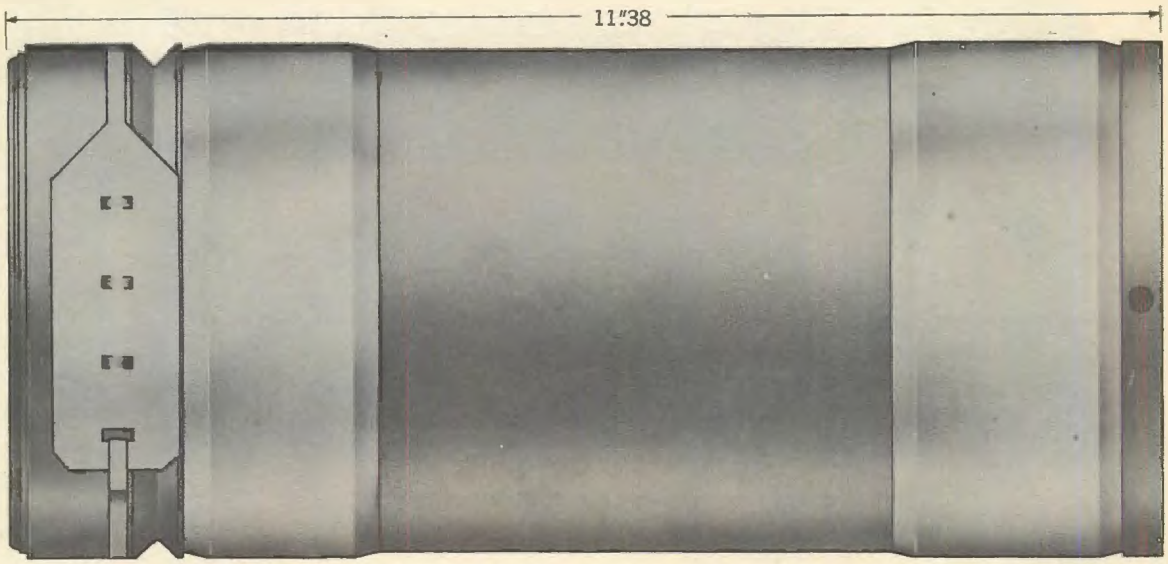


Figure 3.9—5.0-Inch Rocket Motor Mk 6 Mod 1, External View.

Mark	6	6
Mod	1	4
Loading Assembly No	467160	655926
List of Drawings	166377	174615
Lot No. Prefix	RMDE	RMDE
Type Stabilization	Spin	Spin
Nominal Weight Shipped (lb)	19.73	19.73
Nominal Weight Fired (lb)	16.91	16.91
Thrust (lb)	687	687
Overall Shipping Length (in.)	11.38	11.38
Maximum Length (in.)	11.01	11.01
Burning Time (sec.)	0.93	0.93
Propellent Grain Mk-Mod	25–0, 1, or 2	25–0, 1, or 2
Igniter Mk-Mod	120–0, 1, or 2	120–0, 1, or 2
Container Mk-Mod	25–0	25–0

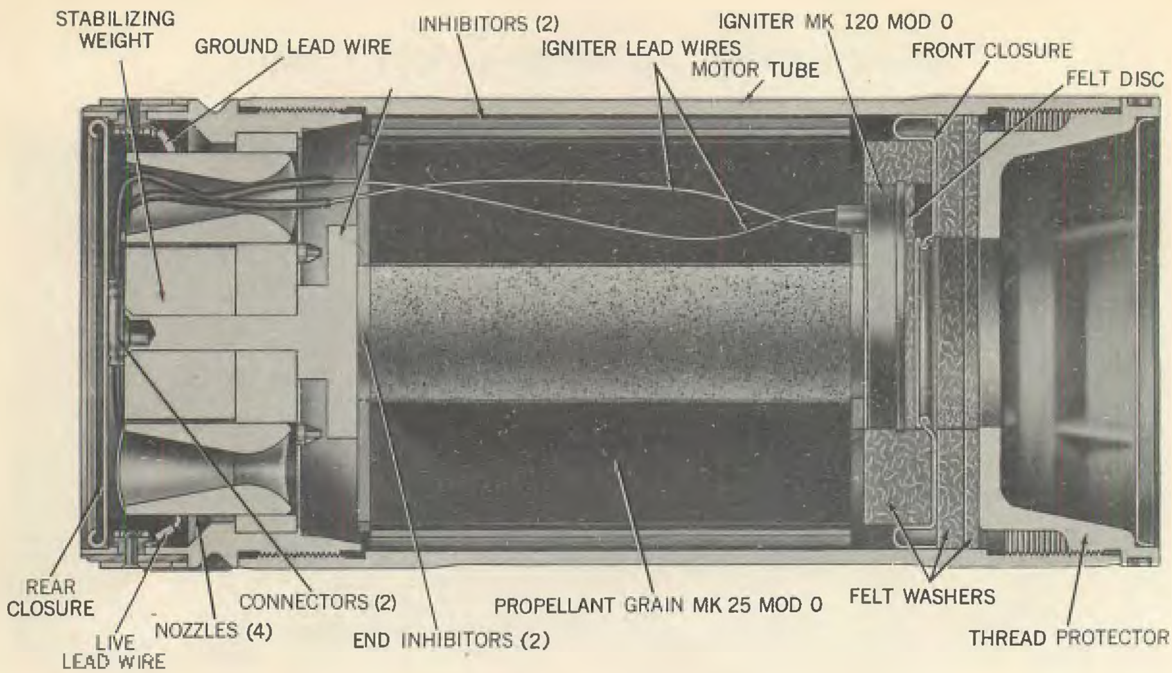


Figure 3.10—5.0-Inch Rocket Motor Mk 6 Mod 1, Cross Section.

Special Information

Differences between mods of 5.0-Inch Rocket Motor Mk 6 are shown in the table. Mod 4 differs also from Mod 1 in that Mod 4 has staked nozzles.

The 5.0-Inch Rocket Motor Mk 6 Mod 1 is used in practice rounds. Inert-loaded 5.0-Inch Rocket Motor Mk 6 Mod 1 is used in dummy rounds.

5.0-INCH ROCKET MOTOR MK 9 MOD 0 (DUMMY)

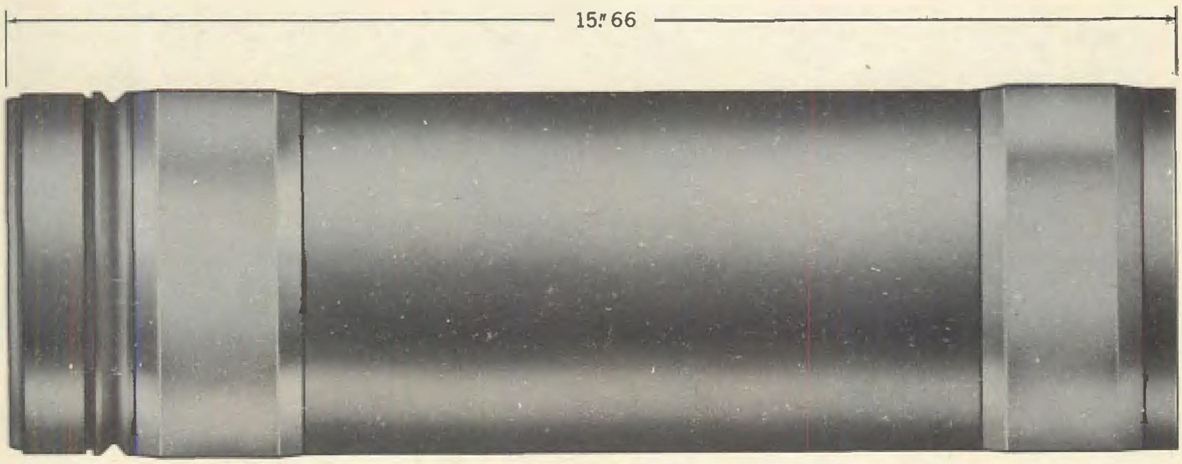


Figure 3.11—5.0-Inch Rocket Motor Mk 9 Mod 0, External View.

Mark	9
Mod	0
Assembly Drawing No	D–660844
List of Drawings	174490
Nominal Weight Shipped (lb)	17.23
Overall Shipping Length (in.)	15.66

Figure 3.12—5.0-Inch Rocket Motor Mk 9 Mod 0, Cross Section.

Special Information

This dummy motor is assembled with inert-loaded heads to make dummy rounds for cycling and electrical tests of automatic launchers.

The motor is like 5.0-Inch Rocket Motor Mk 4 Mod 1 except for the base assembly and the empty motor tube.

In testing the electric firing circuit of a launcher, the access door in the base ring of this motor may be unscrewed, and the leads of a test lamp inserted in the receptacles of the terminal plug.

2.25-INCH PROJECTOR CHARGE TAIL MK 6 MODS 0 AND 1

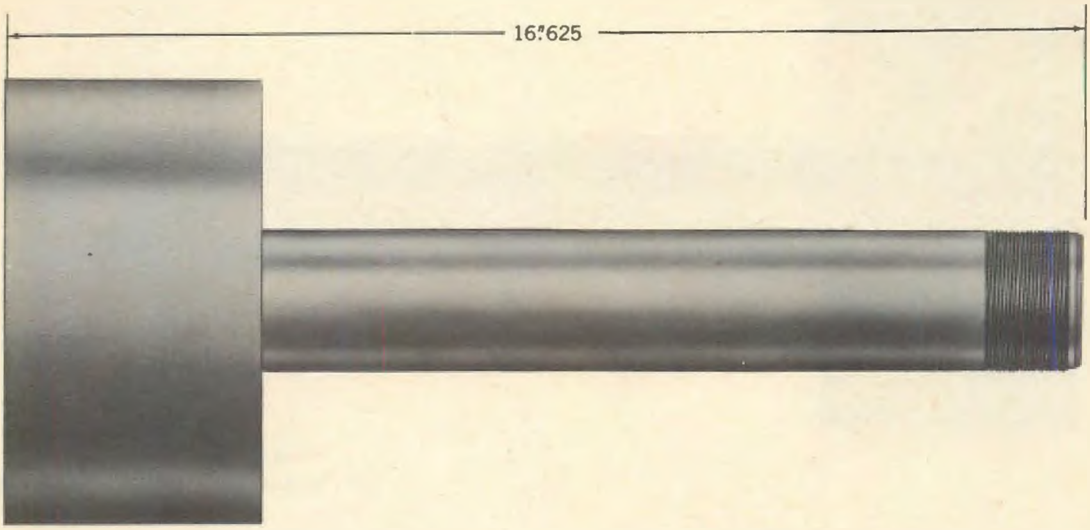


Figure 3.13—2.25-Inch Projector Charge Tail Mk 6 Mod 0, External View.

	Short Range	*Long Range*
Mark	6	6
Mod	0	1
Loading Assembly No	657651	657652
List of Drawings	175441	175442
Type Stabilization	Fin	Fin
Length (in.)	16.625	16.5
Inside Tube Diameter (in.)	1.75	1.75
Fin Diameter (in.)	7.0	7.0
Primer Mk-Mod	25–0	25–all mods
Cartridge Case Mk-Mod	2–0	2–0
Range (ft)	600	855

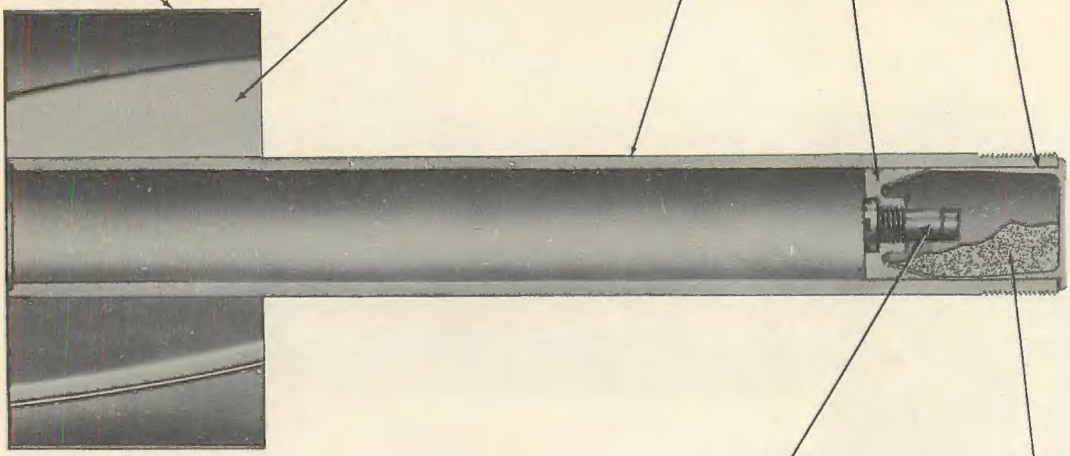


Figure 3.14—2.25-Inch Projector Charge Tail Mk 6 Mod 0, Cross Section.

Special Information

The 2.25-Inch Projector Charge Tail Mk 6 Mod 0 consists of a steel tube, four radial fins, and a cylindrical shroud surrounding the fins. The fins are inclined 10 degrees relative to the tube axis. This imparts a slow spin to the charge that improves its underwater trajectory.

The cartridge case, which contains a smokeless powder propellant, consists of a body and a base cemented together. The cartridge is luted into place in the tail to insure a watertight assembly and provide a more uniform ballistic character. The amount of propellant to be used is determined by the overall weight of the projector charge. Assembly of the head and tail, therefore, is done only at loading depots.

WARNING

Do not assemble or disassemble this round. Return it to the ammunition depot intact.

The base of the cartridge case is threaded at its center to receive an electric primer. It is flared at its rim to permit snug assembly in the tail tube.

Rubber tail-tube plugs (BuOrd dwg 1123521) are to be used to prevent the entrance of water into the open ends of projector charges that are stowed tail-up in ready-service stowage.

Chapter 4

ROCKET FUZES

NOSE FUZE MK 29 MOD 3 (CENTRIFUGAL-ARMING, POINT DETONATING)

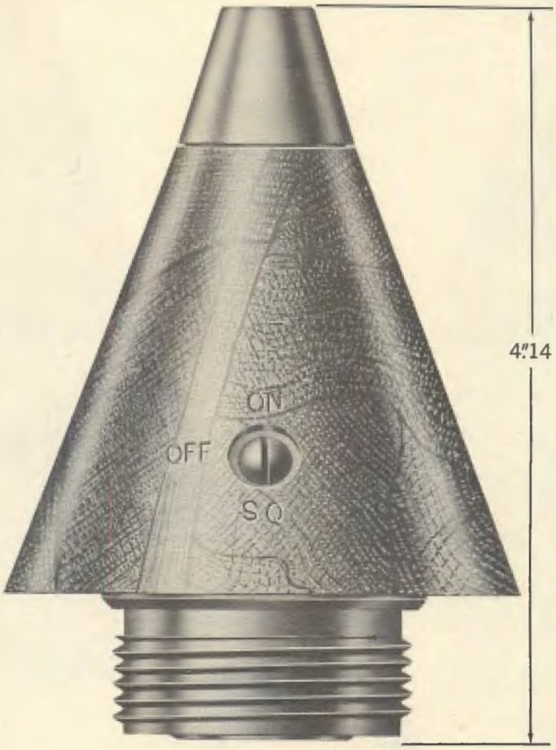


Figure 4.1—Nose Fuze Mk 29 Mod 3, External View.

Mark	29.
Mod	3.
General Arrangement	422325.
List of Drawings Ordnance Specifications	3303, 3013, and 4541 (Plastic Ogive).
Nominal Weight (lb)	1.45.
Overall Length (in.)	4.14.
Armed by	Centrifugal Force.
Fired by	Impact.
Delay Time (sec.)	Instantaneous.
Sensitive to Firing on Water Impact	Yes.
Explosive Components:	
Detonator:	
Type	Stab Type, Lead Azide and Azide Primer Mixture.
Mk-Mod	25–0.
Type	Lead Azide.
Relay Detonator:	
Mk-Mod	29–0.
Packaging:	
Outer Container Mk	18.
Inner Container Mk-Mod	17–0.

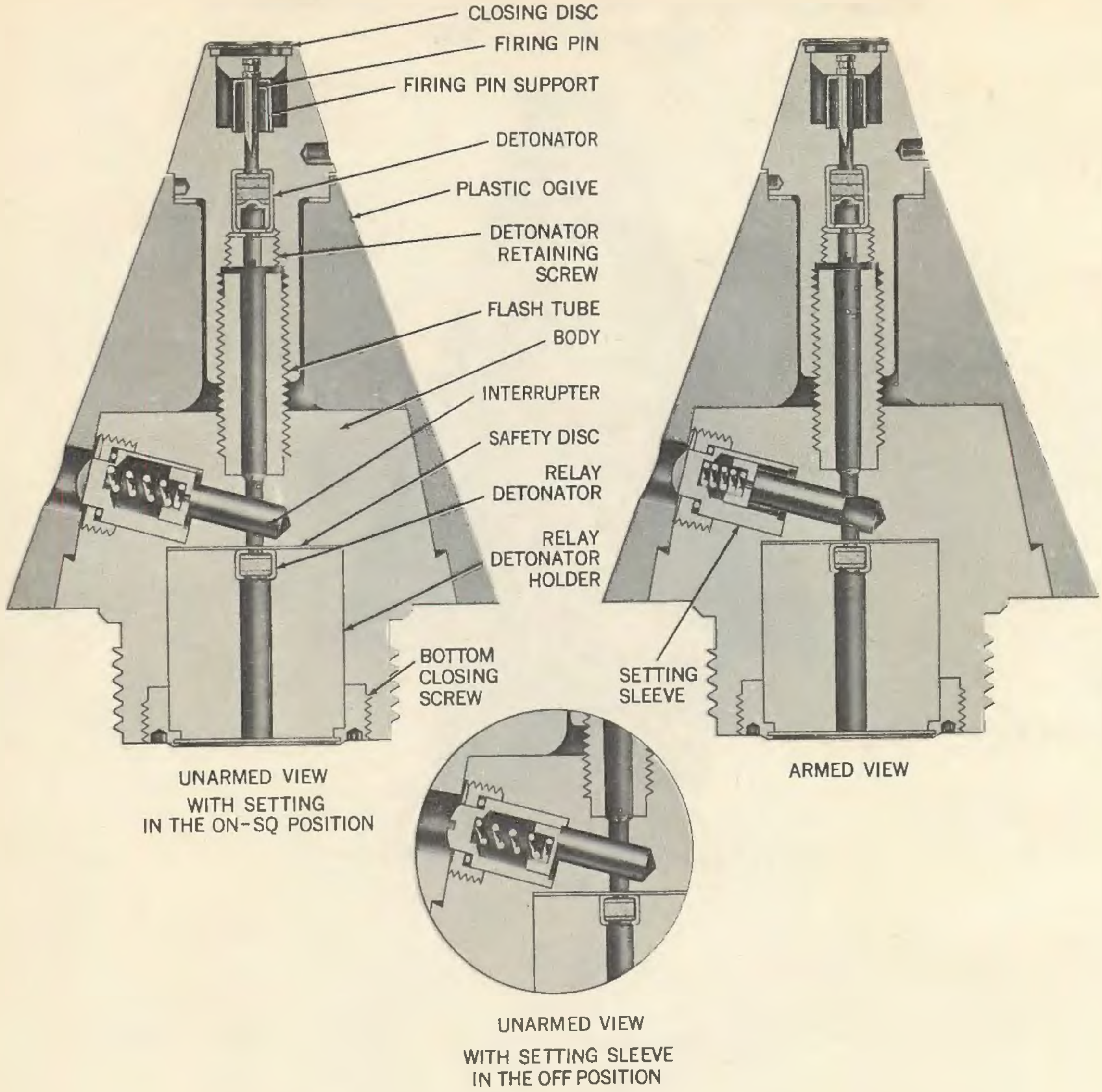


Figure 4.2—Nose Fuze Mk 29 Mod 3, Cross Section.

Special Information

Nose Fuze Mk 29 Mod 3 is a projectile fuze adopted for use in spin-stabilized rockets. It is designed to fire superquick on impact. An auxiliary detonating fuze must be used in conjunction with this fuze.

This fuze differs from the prototype in the following respects.

1. Mk 29 Mod 3 has no delay firing system; hence the setting sleeve may be set only on ON-SQ or OFF-OFF positions.

2. A thin (0.010-inch) aluminum safety disc is placed between the detonator and the relay detonator. This safety disc, in most cases, will prevent the passage of flash from accidental initiation of the detonator; that is, the disc will stop that portion of the flash which might pass around the interrupter. The disc does not appreciably impede normal functioning of the fuze.

The fuze is shipped with the setting sleeve at the OFF-OFF position. Before firing, the setting sleeve is rotated to the ON-SQ position. The fuze mechanism operates in the same manner as the corresponding mechanism in the prototype fuze.

The same safety conditions described for the prototype apply to this fuze, except that the safe setting of the interrupter setting sleeve is OFF-OFF instead of DELAY-DELAY.

In removing the fuze from a round, follow the same procedure as for the prototype, except that the setting sleeve is returned to the OFF-OFF instead of the DELAY-DELAY position.

NOSE FUZE MK 30 MODS 3 AND 4 (CENTRIFUGAL-ARMING POINT DETONATING)

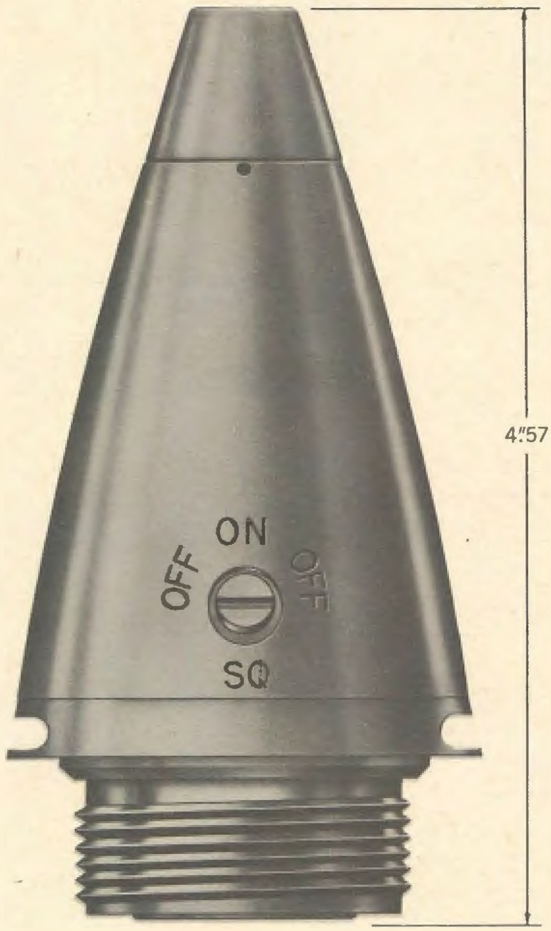


Figure 4.3—Nose Fuze Mk 30 Mod 4, External View.

495862 O—59——7

Mark	30	30.
Mod	3	4.
General Arrangement	422326	562339.
List of Drawings	109113	165551.
Ordnance Specifications	3303	3303.
Nominal Weight (lb)	1.38	1.38.
Overall Length (in.)	4.57	4.57.
Armed by	Centrifugal Force	Centrifugal Force.
Fired by	Impact	Impact.
Delay Time (sec.)	Instantaneous	Instantaneous.
Sensitive to Firing on Water Impact.	Yes	Yes.
Explosive Components:		
Detonator:		
Type	Stab Type, Lead Azide and Azide Primer Mixture.	Stab Type, Lead Azide and Azide Primer Mixture.
Mk-Mod	25–0	25–0.
Relay Detonator	(Lead Azide) Mk 29 Mod 0.	(Lead Azide) Mk 29 Mod 0.
Packaging:		
Outer Container Mk-Mod	20–0	20–0.
Inner Container Mk-Mod	19–0	19–0.

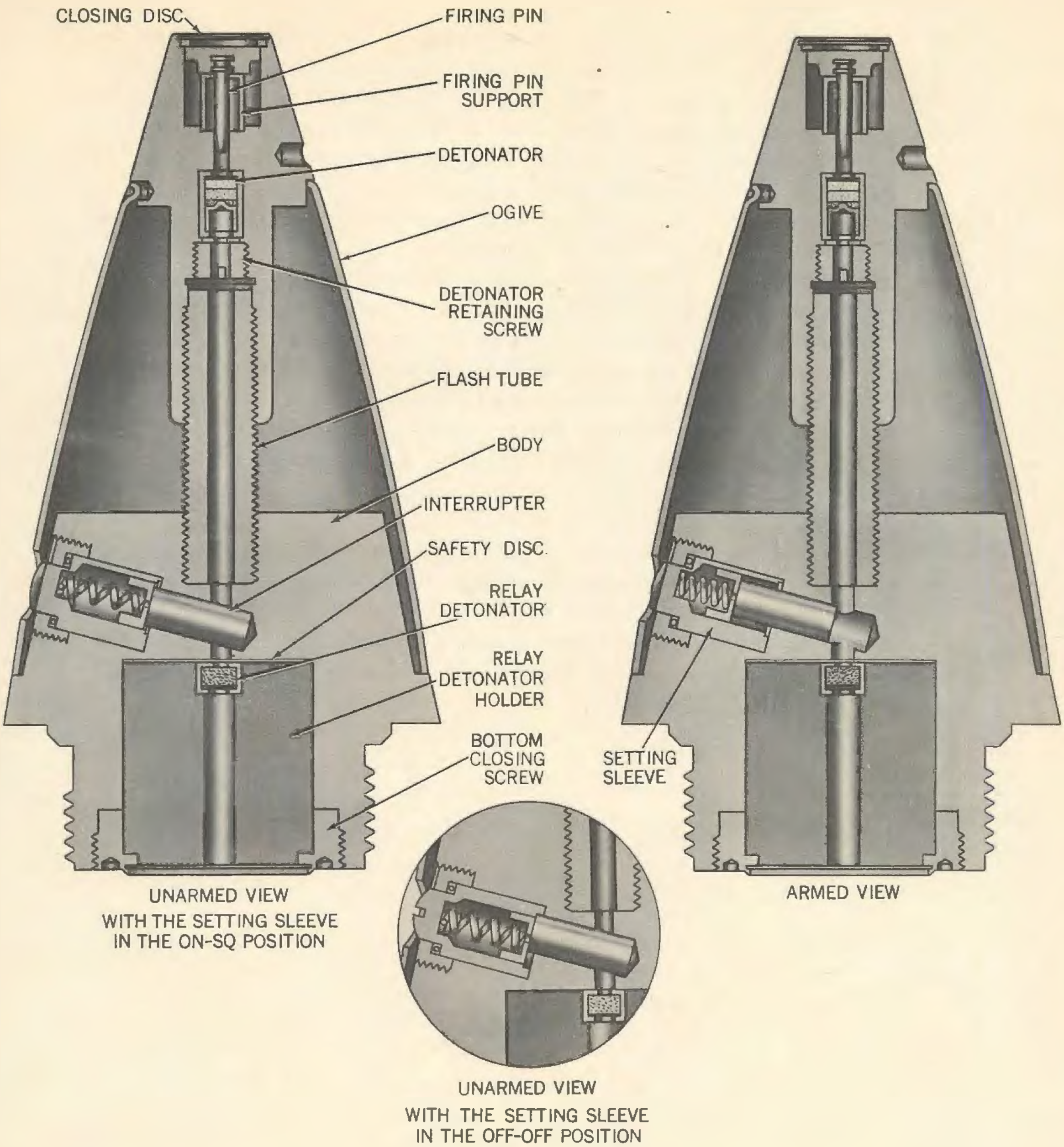


Figure 4.4—Nose Fuze Mk 30 Mod 4, Unarmed and Armed, Cross Sections.

Special Information

Nose Fuze Mk 30 Mods 3 and 4 is a projectile fuze adopted for use in spin-stabilized rockets. It is designed to fire superquick on impact. An auxiliary detonating fuze must be used with it. Mod 4 differs from Mod 3 in that Mod 4 has a thin steel ogive while Mod 3 has a solid plastic ogive.

Mk 30 Mods 3 and 4 differ from the prototype fuze in these respects:

1. Shape of the ogive and related parts.

2. Mk 30 has no delay firing system; hence the setting sleeve may be set only on the ON-ON or OFF-OFF positions.

3. A thin (0.010-inch) aluminum safety disc is placed between the detonator and the relay detonator. This safety disc, in most cases, will prevent the passage of a flash from accidental initiation of the detonator; that is, the disc will stop that portion of the flash which might pass around the interrupter. The disc does not appreciably impede normal functioning of the fuze.

The fuze is shipped with the setting sleeve at the OFF-OFF position. Before firing, the setting sleeve is rotated to the ON-SQ position. The mechanism operates in the same manner as the corresponding mechanism in the prototype fuze.

The same safety conditions described for the prototype (Mk 100 Mod 2) apply to this fuze, except that the safe setting of the interrupter setting sleeve is OFF-OFF instead of DELAY-DELAY.

In removing the fuze from a round, follow the same procedure as for the prototype, except that the setting sleeve is returned to the OFF-OFF instead of the DELAY-DELAY position.

NOSE FUZE MK 100 MOD 2 (SQ AND DELAY) (CENTRIFUGAL-ARMING, POINT DETONATING)

Figure 4.5—Nose Fuze Mk 100 Mod 2, External View.

Mark	100.
Mod	2.
General Arrangement	425156.
List of Drawings	165472.
Requirements and Test Procedures	1170742.
Nominal Weight (lb)	1.60.
Overall Length (in.)	4.17.
Armed by	Centrifugal Force.
Fired by	Impact.
Delay Time (sec.)	Instantaneous or 0.025.
Sensitive to Firing on Water Impact	Yes.
Explosive Components:	
Percussion Primer	Mk 104.
Delay Element	Black Powder.
Detonator:	
Type	Stab Type, Lead Azide and Azide Primer Mixture.
Mk-Mod	25–0.
Relay Detonators (2)	(Lead Azide) Mk 49 Mod 0.
Packing:	
Outer Container	18–0.
Inner Container Mk-Mod	17–0.

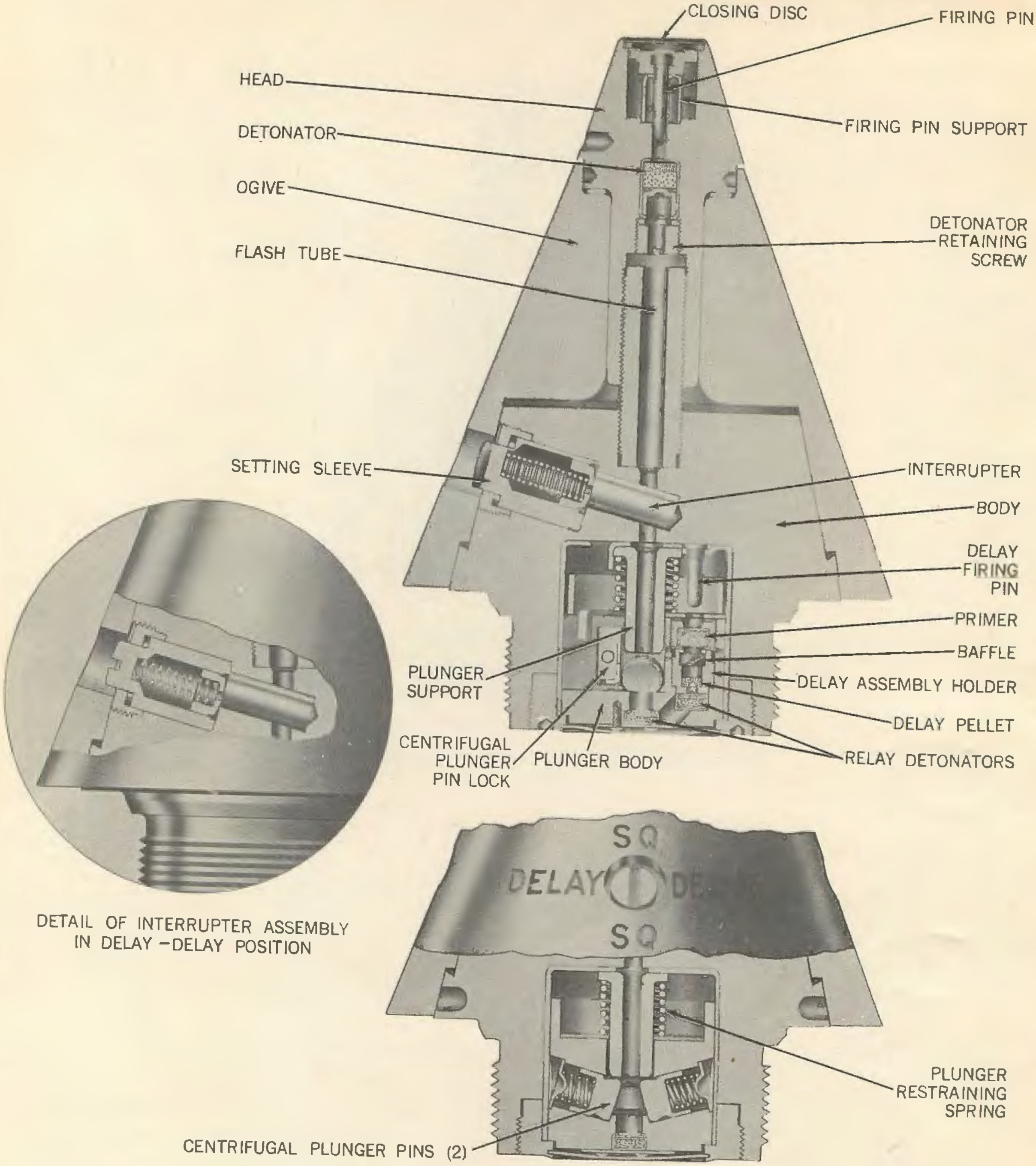


Figure 4.6—Nose Fuze Mk 100 Mod 2, Unarmed, Cross Section.

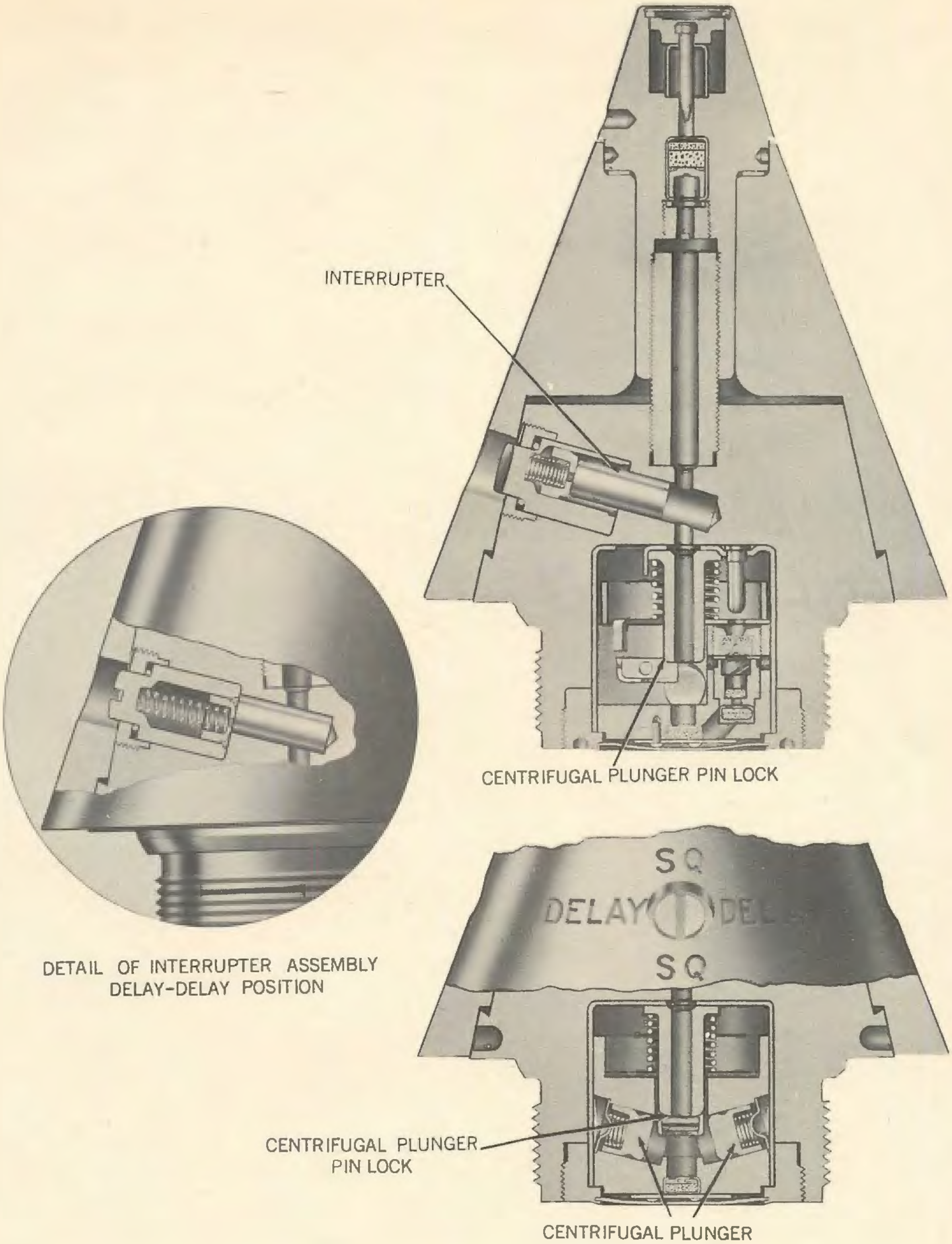


Figure 4.7—Nose Fuze Mk 100 Mod 2, Armed, Cross Section.

Special Information

Rocket Nose Fuze Mk 100 Mod 2 is exactly like the prototype. Auxiliary Detonating Fuze Mk 44 Mod 2 always is used with this fuze.

NOSE FUZE MK 156 MOD 0 (WATER-TRAVEL-ARMING, IMPACT-FIRING)

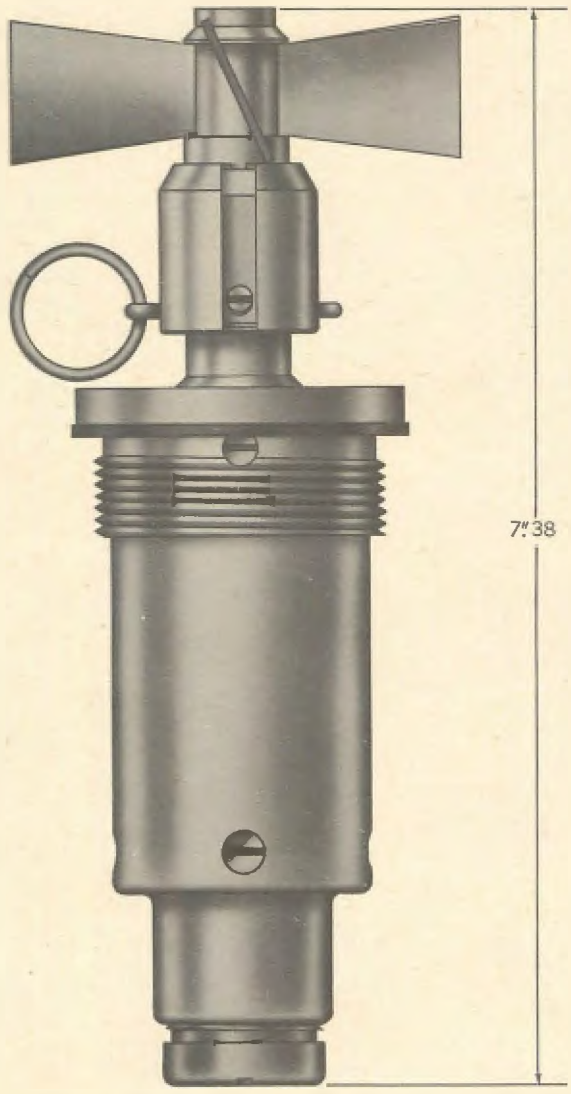


Figure 4.8—Nose Fuze Mk 156 Mod 0, External View.

Mark	156.
Mod	0.
General Arrangement	438552.
List of Drawings	109482.
Ordnance Specifications	3418.
Nominal Weight (lb)	2.80.
Overall Length (in.)	7.34.
Armed by	Water vanes.
Fired by	Inertia.
Delay Time (sec.)	Instantaneous.
Sensitive to Firing on Water Impact	No.
Explosive Components:	
Detonator:	
Type	Lead Azide and Azide Priming Mixture.
Mk-Mod	27–0.
Booster Lead-in	Tetryl.
Booster	Tetryl (approx. 9 gm).
Packaging:	
Outer Container	24–0.
Inner Container Mk-Mod	23–0.

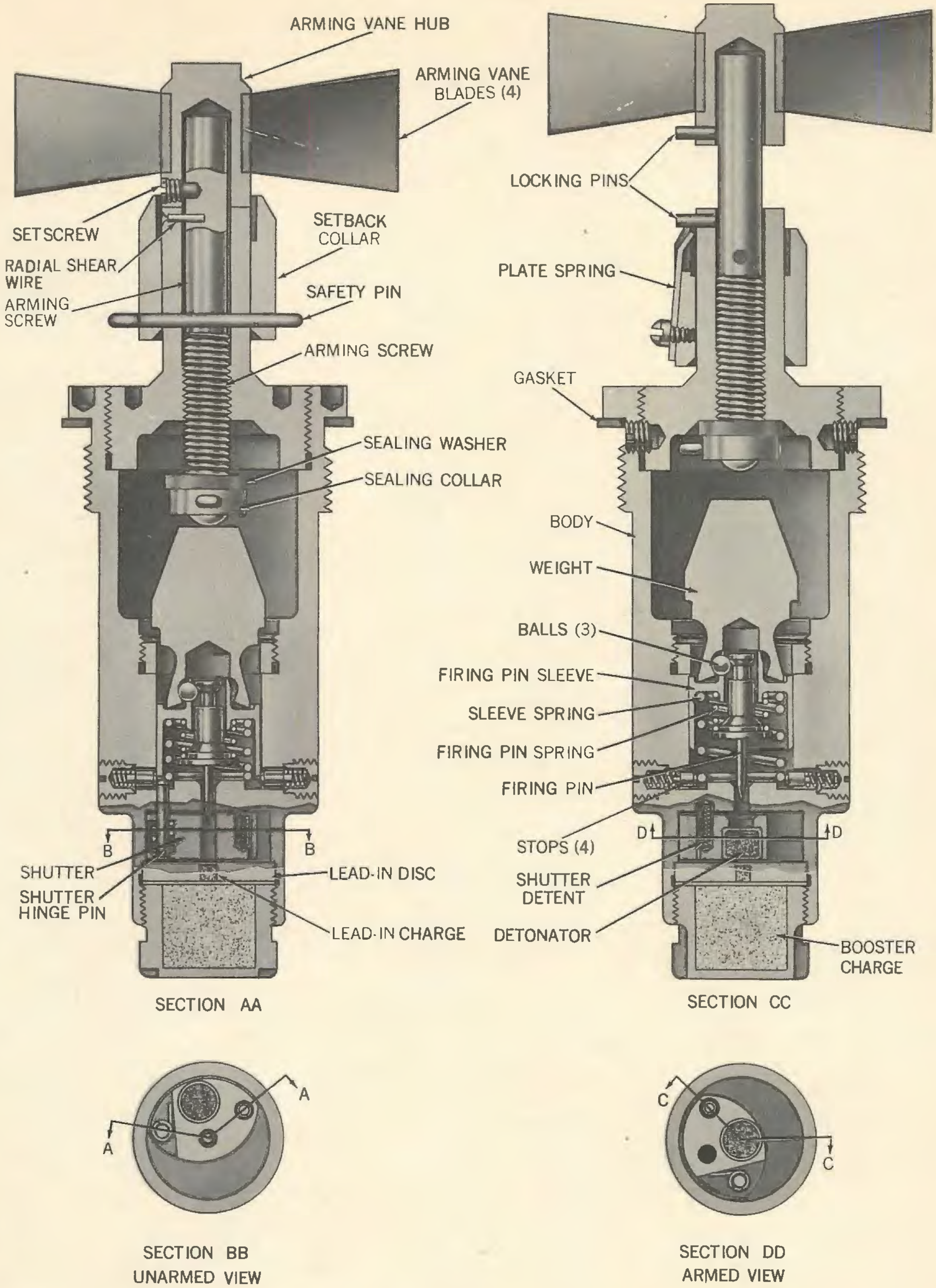


Figure 4.9—Nose Fuze Mk 156 Mod 0, Unarmed and Armed, Cross Sections.

Special Information

Nose Fuze 156 Mod 0 is exactly like the prototype fuze. Its aerodynamic characteristics limit its use to low-velocity rockets. Arming is accomplished by four to eight revolutions of the arming vanes, which occur in 15 to 25 feet of water travel.

NOSE FUZE MK 177 MODS 0 AND 1 (WATER-TRAVEL-ARMING, IMPACT-FIRING)

Mark	177	177.
Mod	0	1.
General Arrangement	399141	1362217.
List of Drawings	284495	290804.
Requirements and Test Procedures	1170785	1183384.
Nominal Weight (lb)	3.75	3.75.
Overall Length (in.)	7.94	7.26.
Armed by	Water Vanes	Water Vanes.
Fired by	Impact	Impact.
Delay Time (sec.)	Instantaneous	Instantaneous.
Sensitive to Firing on Water Impact.	No	No.
Explosive Components:		
Detonator:		
Type	Lead Azide, Azide Priming Mixture, and Tetryl.	Lead Azide, Azide Priming Mixture, and Tetryl.
Mk-Mod	23–0	23–0.
Booster Lead-in	Tetryl	Tetryl.
Booster	Tetryl (approx. 15.5 gm)	Tetryl (approx. 15.5 gm).
Packaging:		
Outer Container Mk-Mod	114–0	114–0.
Inner Container Mk-Mod	113–0	113–0.

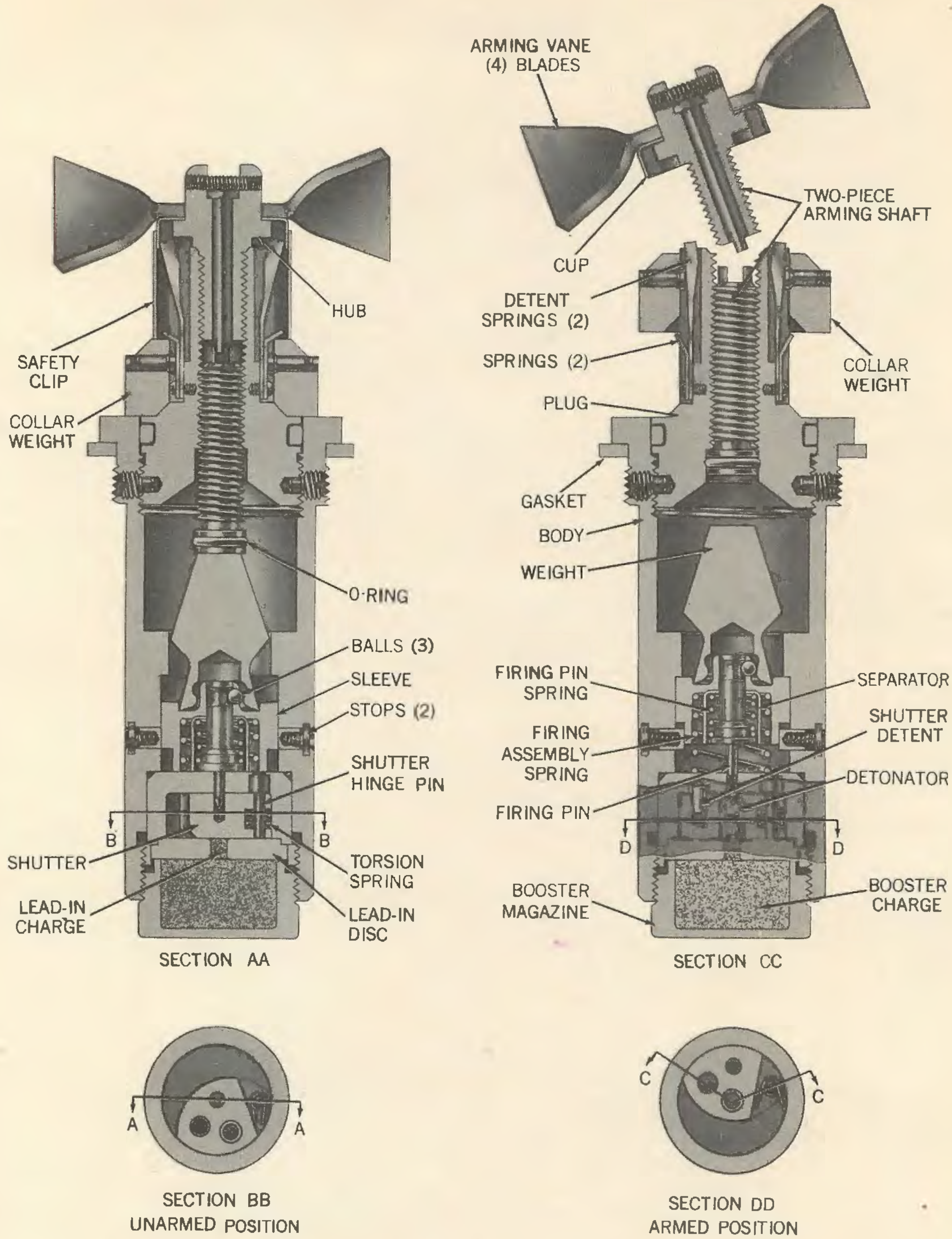


Figure 4.10—Nose Fuze Mk 177 Mod 1, Unarmed and Armed, Cross Sections.

Special Information

Nose Fuze Mk 177 Mods 0 and 1 are similar to the prototype water-travel-arming fuze, except for the following features.

1. Mk 177 has a two-piece arming shaft.
2. Mk 177 has a different arrangement of the collar weight and its attachments.
3. The plug of Mk 177 has no spanner holes.
4. Mk 177 has a separator between the two springs under the sleeve to prevent meshing of these springs.
5. Mk 177 has only two spring-loaded stops for the sleeve.

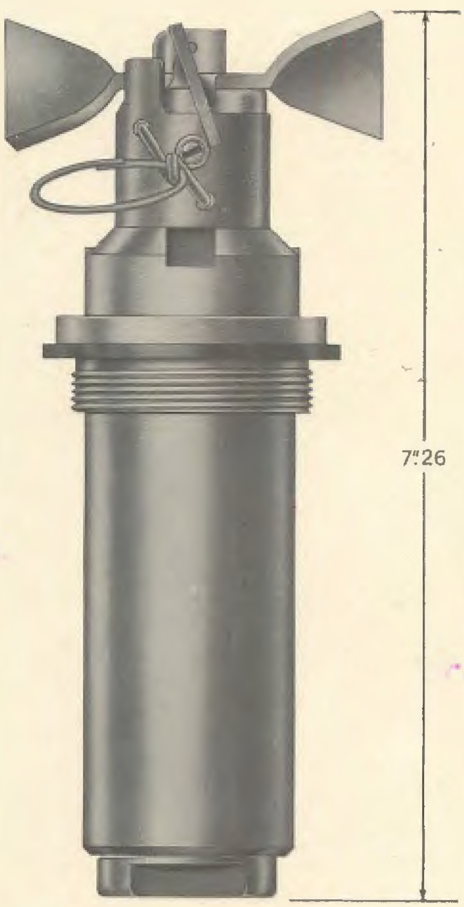


Figure 4.11—Nose Fuze Mk 177 Mod 1, External View.

6. An O-ring seal in Mk 177 replaces the sealing washer of the prototype.

The forward part of the two-piece arming shaft is secured to the vane assembly. The safety clip prevents rotation of the arming vanes and movement of the collar weight during shipping. The safety clip is prevented from turning by a stud mounted on the nose plug. After the safety clip is removed and the rocket launched, the two detent springs lock the arming shaft until the rocket strikes the water, and the collar weight moves forward. The detent springs bear against the inner surface of the cup and project into spaces formed in the hub flange. Two springs, located at the points of attachment of the detent springs, prevent the collar weight from moving forward freely and compressing the detent springs.

The differences between Mod 0 and Mod 1 are shown, for the most part, in the table. Another difference is that Mod 0 has a cap on its arming vane assembly; Mod 1 has none.

Prior to firing the rocket, the safety clip is removed. This permits the collar weight to move forward when the rocket strikes the water. As the collar weight moves forward, it deflects the detent spring which frees the hub and allows the arming vanes to rotate during travel through water. Rotation of the arming shaft threads it to its forward position. The O-ring on the aft end of the shaft seals the shaft in the base of the plug. The forward part of the arming shaft continues to rotate until it threads out of the plug and falls free. The remainder of the sequence in arming and firing is the same as that described for the prototype, except that the sleeve is locked in its forward position by two, instead of four, stops.

The same safety conditions described for the prototype apply to this fuze with the following exceptions. A safety clip replaces the safety pin of the prototype. Also, the collar weight moves forward to arm Mk 177. It moves to the rear in arming the prototype. The collar weight of Mk 177 should not be moved forward manually under any operating conditions.

When installing the fuze in the rocket head, the fuze spanner wrench is shipped with each box of fuzes must be used. The pins of the spanner wrench fit into the spanner holes in the fuze body. The joint between the fuze and the fuze seat liner must be made watertight by screwing the fuze in tight against its gasket.

This fuze may be removed from the head if the safety clip is in place. The fuze should be removed if the round is to be taken below decks. In removing the fuze, use the special spanner wrench that was used for installing the fuze.

AUXILIARY DETONATING FUZE MK 44 MOD 2 (CENTRIFUGAL-ARMING)

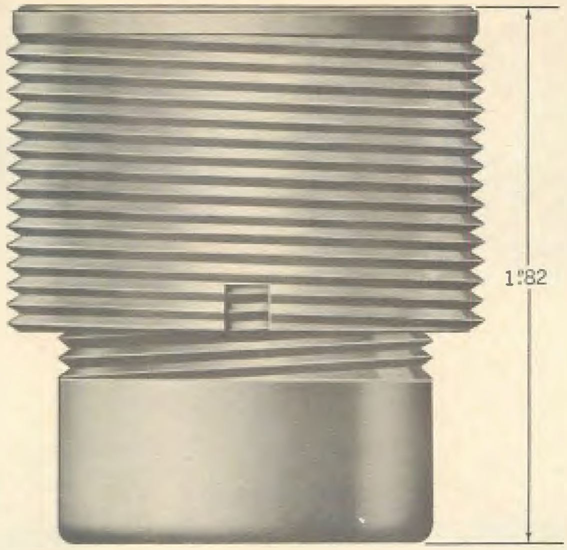


Figure 4.12—Auxiliary Detonating Fuze Mk 44 Mod 2, External View.

Mark	44.
Mod	2.
General Arrangement	440406.
List of Drawings	165193.
Ordnance Specifications	2985.
Nominal Weight (lb)	0.50.
Overall Length (in.)	1.82.
Armed by	Centrifugal Force.
Fired by	Nose Fuze Flash.
Delay Time (sec.)	Instantaneous.
Explosive Components:	
Detonator:	
Type	Flash Type, Lead Azide and Tetryl.
Mk-Mod	37–0.
Rotor Lead-in	Tetryl.
Booster Lead-In	Tetryl.
Booster	Tetryl (approx. 25 gm).

Special Information

Auxiliary Detonating Fuze Mk 44 Mod 2 is exactly like the prototype. The detent springs of Mk 44 allow its rotors to arm at a rotational velocity of 3000 to 4500 rpm, which represents 45 to 135 feet of travel from the launcher.

495862 O—59——8

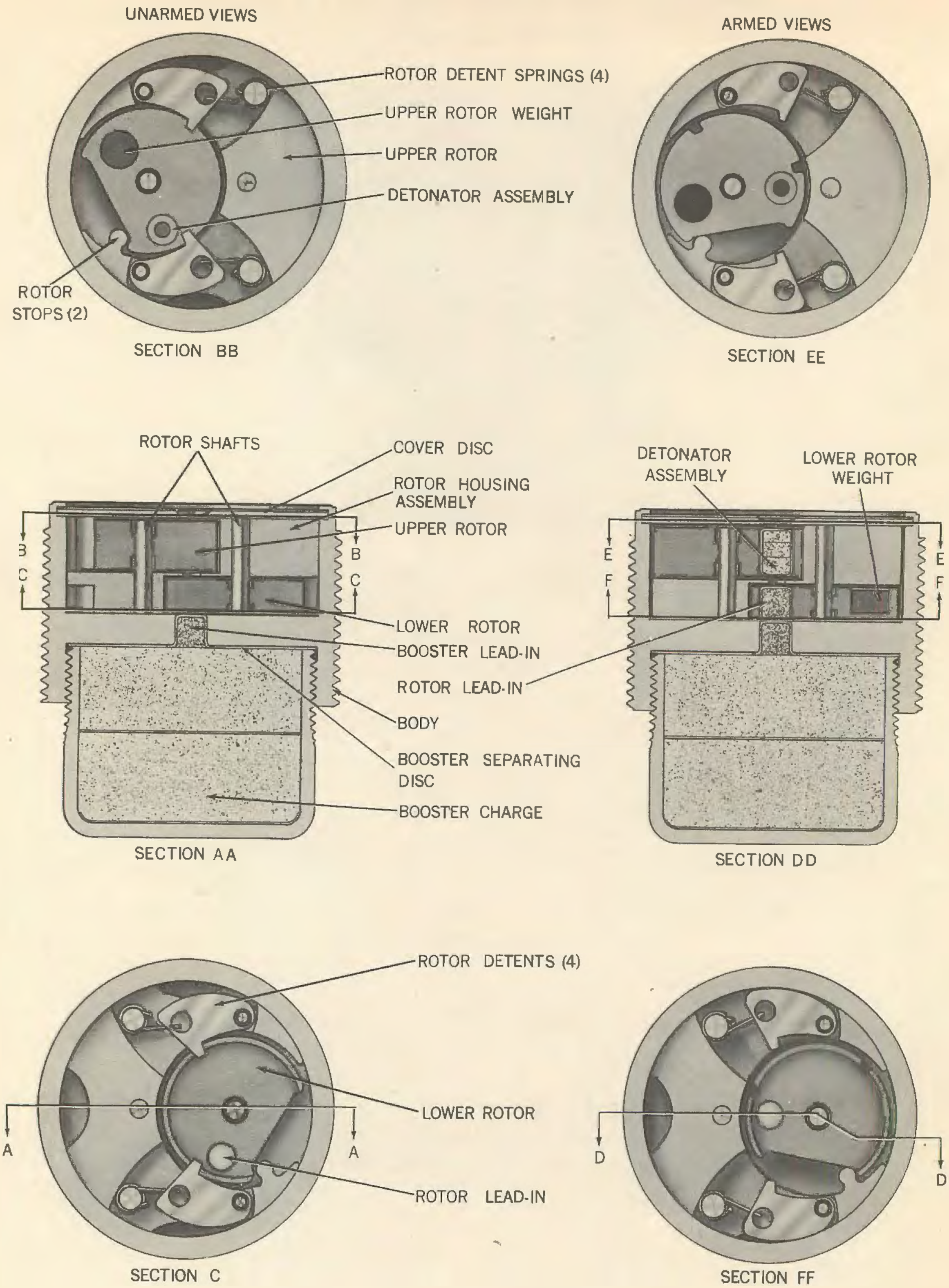


Figure 4.13—Auxiliary Detonating Fuze Mk 44 Mod 2, Unarmed and Armed, Cross Sections.

AUXILIARY DETONATING FUZE MK 52 MOD 2 (CENTRIFUGAL-ARMING)

Figure 4.14—Auxiliary Detonating Fuze Mk 52 Mod 2, External View.

Mark	52.
Mod	2.
General Arrangement	563653.
List of Drawings	165988.
Ordnance Specifications	2985.
Nominal Weight (lb)	0.50.
Overall Length (in.)	1.82.
Armed by	Centrifugal Force.
Fired by	Noze Fuze Flash.
Delay Time (sec.)	Instantaneous.
Explosive Components:	
Detonator:	
Type	Flash Type, Lead Azide and Tetryl.
Mk-Mod	37–0.
Rotor Lead-in	Tetryl.
Booster Lead-in	Tetryl.
Booster	Tetryl (approx. 25 gm).

Special Information

Auxiliary Detonating Fuze Mk 52 Mod 2 is exactly like the prototype. The detent springs of Mk 52 Mod 2 allow its rotors to arm at a rotational velocity of 1600 to 1900 rpm, which represents about 30 feet of travel from the launcher.

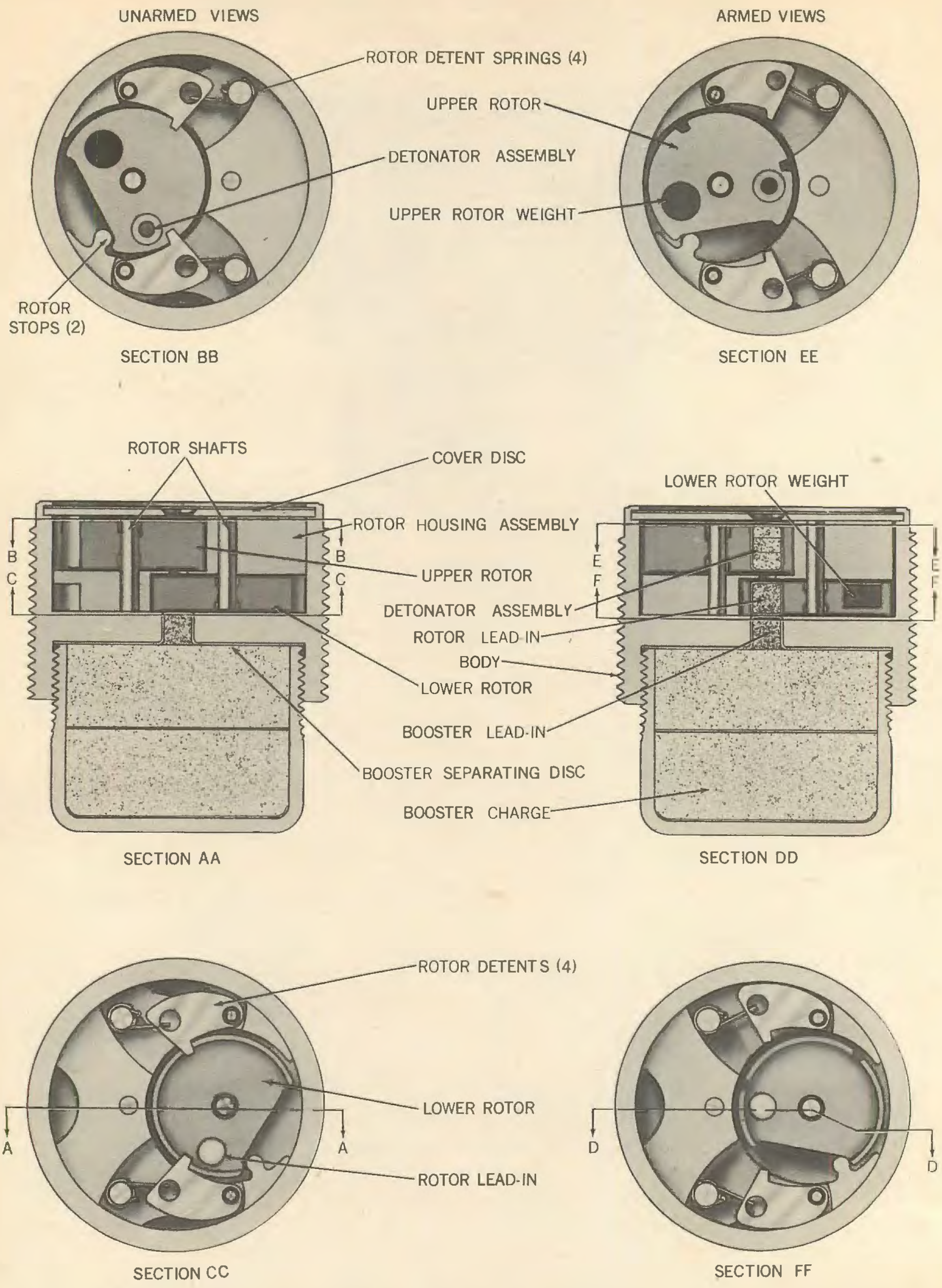


Figure 4.15—Auxiliary Detonating Fuze Mk 52 Mod 2, Unarmed and Armed, Cross Sections.

BASE FUZE MK 31 MODS 0 AND 2 (CENTRIFUGAL-ARMING, IMPACT-FIRING)

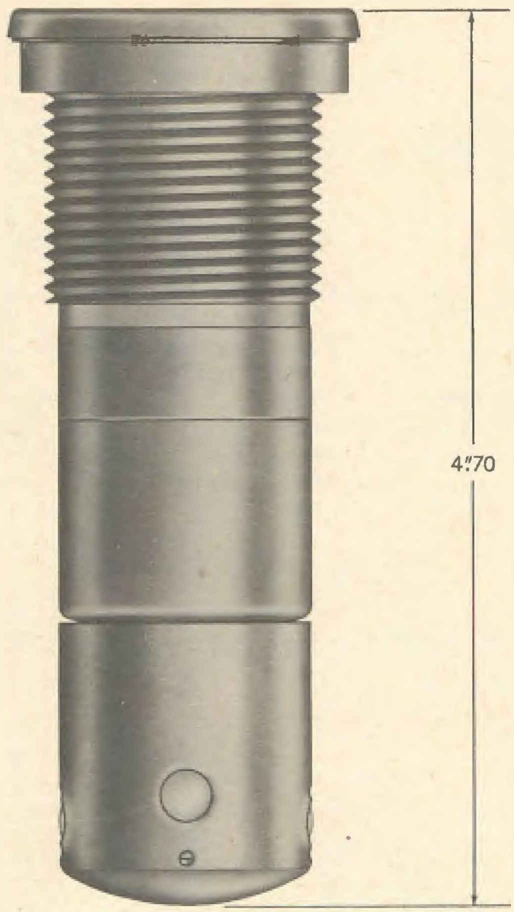


Figure 4.16—Base Fuze Mk 31 Mod 2, External View.

Mark	31	31.
Mod	0	2.
General Arrangement	423486	399148.
List of Drawings	109344	384619.
Ordnance Specifications	3429	2484.
Nominal Weight (lb)	1.58	1.58.
Overall Length (in.)	4.67	4.70.
Armed by	Centrifugal Force	Centrifugal Force.
Fired by	Inertia	Inertia.
Delay Time (sec.)	Inherent (0.003)	Inherent (0.003).
Sensitive to Firing on Water Impact.	Yes	Yes.
Explosive Components:		
Sensitive Primer	Primer Mixture No. 74, Mk 102 Mod 0.	Mk 102 Mod 1.
Secondary Primer	Flash Type, Lead Azide, Mk 101 Mod 0.	Flash Type, Lead Azide, Mk 101 Mod 3.
Detonator	Flash Type, Lead Azide, Mk 33 Mod 0.	Flash Type, Lead Azide, Mk 33 Mod 0.
Detonator Plunger Load	Tetryl	Tetryl.
Plunger Lead-outs (2)	Tetryl	Tetryl.
Booster Lead-ins (2)	Tetryl	Tetryl.
Boosters	Tetryl (approx. 3.2 gm) (2).	Tetryl (approx. 7.16 gm) (6).

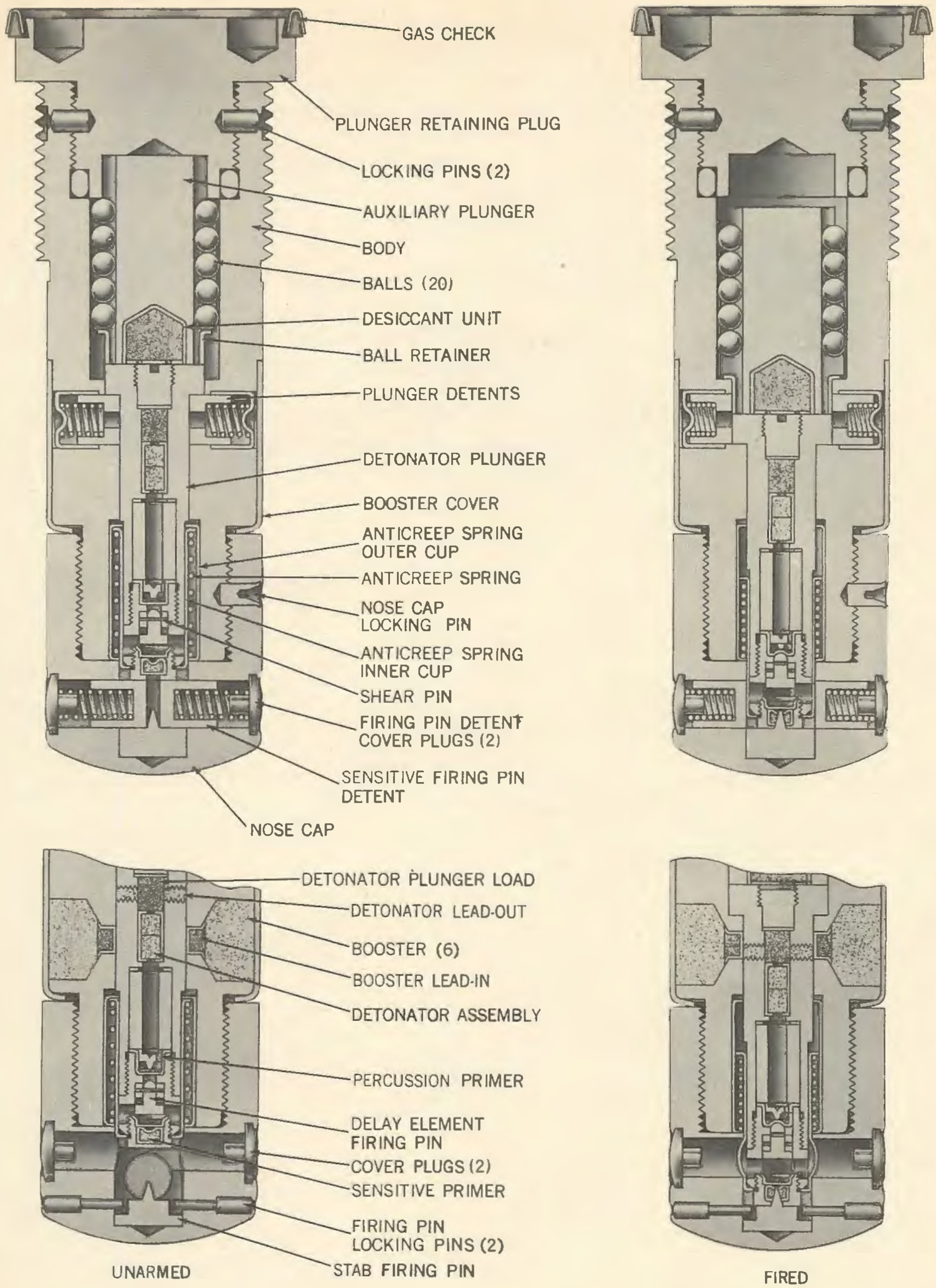


Figure 4.17—Base Fuze Mk 31 Mod 2, Unarmed and Armed, Cross Sections.

Special Information

Base Fuze Mk 31 was originally developed for use as a projectile fuze; however, it has been adopted for use in spin-stabilized rockets. Mk 31 Mod 0 is exactly like the prototype fuze. It arms completely when the rotational velocity of the round reaches 3000 to 4500 rpm, which represents approximately 30 feet of travel.

The differences between mods are shown in the table. Mod 2 differs from Mod 0 also in the following respects.

1. Mod 2 has no base plug (a provision for attaching a tracer to the plunger retaining plug in Mod 0).

2. The plunger retaining plug in Mod 2 is sealed to the body with an O-ring.

3. The desiccant unit of Mod 2 is of different construction.

4. Mod 2 has four additional booster charges located in the side walls of the body between the two main booster charges. Each of the secondary boosters contains approximately 1 gm of tetryl. The secondary boosters have no lead-ins; they are fired by detonation of the two main boosters.

5. Mod 2 is installed in a fuze cavity liner.

BASE FUZE MK 36 MOD 0 (CENTRIFUGAL-ARMING, IMPACT-FIRING)

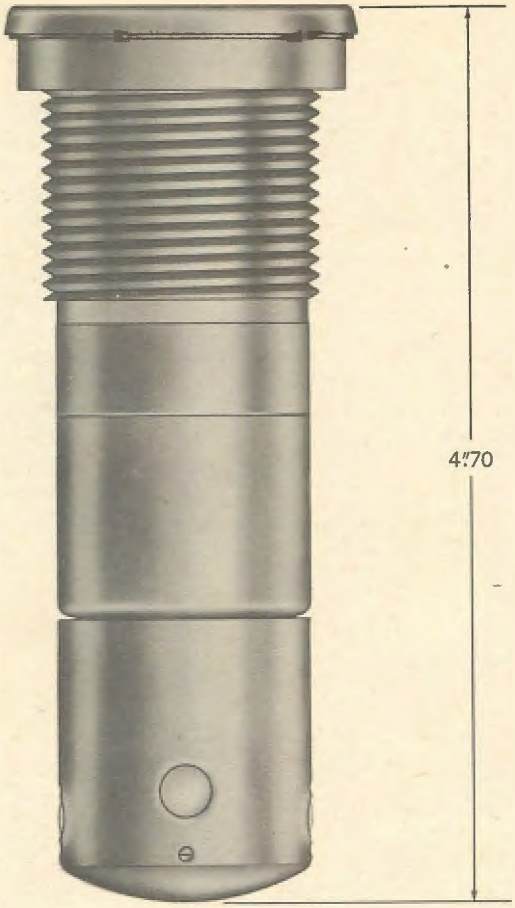


Figure 4.18—Base Fuze Mk 36 Mod 0, External View.

Mark	36.
Mod	0.
General Arrangement	423485.
List of Drawings	109345.
Ordnance Specification	3429.
Nominal Weight (lb)	1.58.
Overall Length (in.)	4.67.
Armed by	Centrifugal Force.
Fired by	Inertia.
Delay Time (sec.)	0.010.
Sensitive to Firing on Water Impact	Yes.
Explosive Components:	
Sensitive Primer and Secondary Primer.	Fulminate of mercury cap mixture (includes potassium chlorate and antimony sulphide).
Delay Pellet	Black Powder.
Detonator	Flash Type, Lead Azide.
Detonator Plunger Load	Tetryl.
Plunger Lead-outs (2)	Tetryl.
Booster Lead-ins (2)	Tetryl.
Boosters (2)	Tetryl (approx. 3.2 gm).

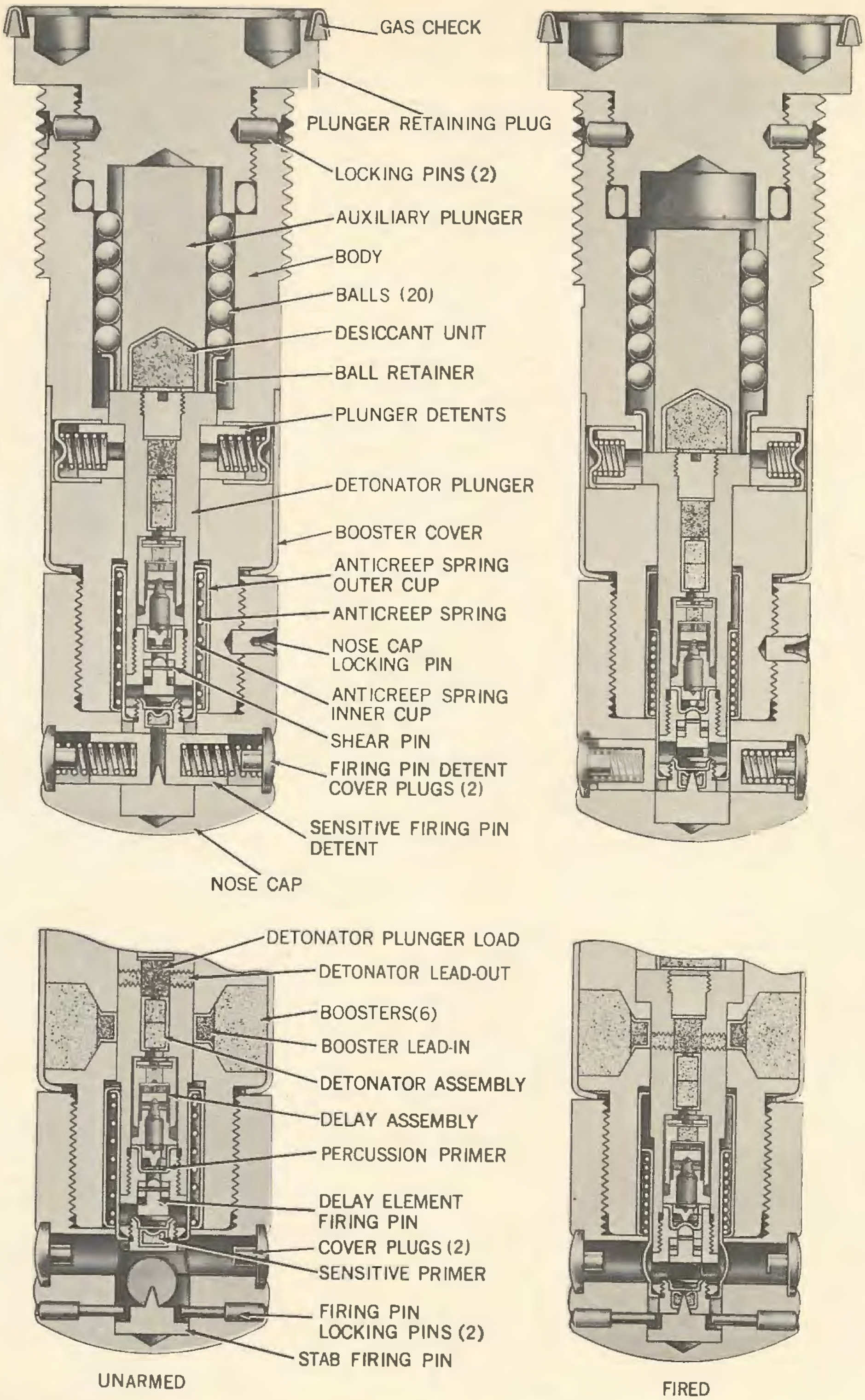


Figure 4.19—Base Fuze Mk 36 Mod 0, Unarmed and Armed, Cross Sections.

Special Information

Mk 36 is exactly like the prototype, except that Mk 36 has a 0.01 second-delay pellet housed aft of the anvil—a space which is an open flash channel in the prototype. Mk 36 arms when the rotational velocity of the round reaches 3000 to 4500 rpm, which represents approximately 30 feet of travel.

Chapter 5

ROCKET AND PROJECTOR CHARGE ASSEMBLIES

5.0-Inch Spin-Stabilized Rockets

The 5.0-inch spin-stabilized rockets are fired from many different craft for attack and bombardment purposes.

Five-inch spin-stabilized rockets can be fired only from designated launchers. Serious accidents will occur if this regulation is not observed.

Spin-stabilized dummy-drill rockets, used for training with and adjusting of automatic-firing launchers, are of the same weight as the service round.

Handling and Shipping. Five-inch rockets are shipped in metal tanks. The fuze, head, and motor may be in separate containers or the fuzed head and motor may be in the same container, unassembled.

7.2-Inch Fin-Stabilized Rockets

The 7.2-inch fin-stabilized rocket was designed for use by patrol vessels against enemy submarines. The rocket was given a streamlined shape to lend stability in flight and a high rate of sinking during water travel. Its shrouded fins are inclined 10 degrees relative to the tube axis. This design imparts spin to the round, improving its underwater trajectory.

Handling and Shipping. The 7.2-inch rockets are issued to ships in three units; heads (auxiliary boosters installed), rocket motors, and fuzes.

Stowage. The 7.2-inch rockets are stored assembled only in ready magazines or ready, ready magazines. No more than ten layers of these rockets shall be stacked on top of each other. Separators should be used between the motors to protect the shrouds.

7.2-Inch Projector Charges

The 7.2-inch projector charge is an ahead-thrown weapon used against submarines. Projector charge groups are ripple-fired in pairs to fall in predetermined patterns. To fire this weapon, vessels larger than standard patrol vessels are required, because of the large degree of recoil. The projector charge has a streamlined shape to lend stability in flight and a high sinking rate in water travel. The projector charge tail consists of a steel bearing tube containing the propellant, a cartridge case, and shrouded fins. The fins are inclined 10 degrees relative to the tube axis. This design imparts spin to the round, improving its underwater trajectory.

Handling and Shipping. The 7.2-inch projector charges are issued assembled, except for fuzes. The auxiliary booster is in place in the head and the projector charge cartridge is installed in the tail.

Stowage. The charges shall be stowed in magazines with head and tail assembled and unfuzed. They shall be stacked on top of each other in rows up to ten high. Separators shall be used to keep the tails apart.

5.0-INCH ROCKET MK 7 MODS 2 AND 3 (SURFACE, HE, SS)

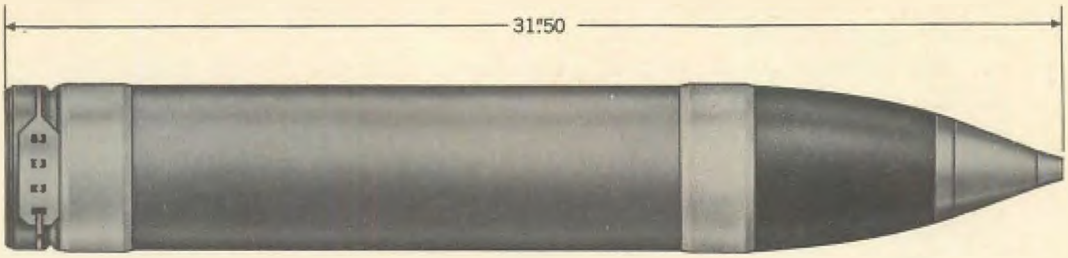


Figure 5.1—5.0-Inch Rocket Mk 7 Mod 2 (Surface, HE, SS), External View.

Mark	7	7
Mod	2	3
General Arrangement:		
Complete Round	467113	-------------
Head Mk 7 all mods	561728	561728
Motor Mk 3 Mod 1	467046	467046
Motor Mk 3 Mod 4	655916	655916
List of Drawings:		
Head Mk 7 all mods	165261	165261
Motor Mk 3 Mod 1	166301	166301
Motor Mk 3 Mod 4	174608	174608
Nominal Velocity	1387	1387
Nominal Weight (lb)	49.61	49.46
Overall Length (in.)	31.50	31.50
Head, 5.0-Inch, Mk-Mod	7–1, 2, or [1] 3	7–1, 2, or [1] 3
Motor, 5.0-Inch, Mk-Mod	3–1 or [1] 4	3–1 or [1] 4
Nose Fuze Mk-Mod	100–2	29–3
Base Fuze Mk-Mod	None	None
Aux. Det. Fuze Mk-Mod	44–2	44–2
Range (yd)	10,050	10,050
C.G., Before Burning (in.) (Measured from rear)	15.88	15.88
C.G., After Burning (in.) (Measured from rear)	17.03	17.03
Ballistic Table in OP No.	2031	2031
Container Mk-Mod	10–0	10–0

[1] Interchangeable.

Special Information

The 5.0-Inch Surface Rocket Mk 7 Mods 2 and 3 has a maximum range of 10,050 yards, but is used chiefly for short-range attacks by patrol boats. This rocket has a limited penetrating power, delivering less than three pounds of TNT on the target.

The differences between mods of 5.0-Inch Surface Rocket Mk 7 are shown in the table. Mod 3 is an alternate round for Mod 2. Nose Fuze Mk 100 Mod 2, used in 5.0-Inch Rocket Mk 7 Mod 2, may be set for either instantaneous or delay action. Nose Fuze Mk 29 Mod 3, used in 5.0-Inch Rocket Mk 7 Mod 3, is the predecessor of Nose Fuze Mk 100 Mod 2 and is very similar to it. Nose Fuze Mk 29 Mod 3 can be set only for instantaneous action.

The practice round for 5.0-Inch Rocket Mk 7 All Mods is 5.0-Inch Rocket Mk 8 Mod 0 which consists of an inert, plaster-filled 5.0-Inch Rocket Head Mk 7 All Mods and a live-loaded 5.0-Inch Rocket Motor Mk 3 Mod 1. The dummy round for 5.0-Inch Rocket Mk 7 All Mods is 5.0-Inch Rocket Mk 9 Mod 0 which is composed of an inert, plaster-filled 5.0-Inch Rocket Head Mk 7 All Mods and an inert-loaded 5.0-Inch Rocket Motor Mk 3 Mods 0 and 1.

5.0-INCH-ROCKET MK 10 MODS 0 AND 3 (SURFACE, HE, SS) AND MODS 1 AND 2 (SURFACE, VT, SS)

Head Type	HE	VT	VT	HE
Mark	10	10	10	10
Mod	0	1	2	3
General Arrangement:				
Complete Round	467066	--------	656331	656339
Head Mk 10 Mod 9	467052	467052	--------	--------
Head Mk 10 Mod 11	--------	--------	656333	--------
Head Mk 10 Mod 12	--------	--------	--------	656335
Motor Mk 4 Mod 1	467049	467049	467049	467049
Motor Mk 4 Mod 4	655922	655922	655922	655922
List of Drawings:				
Complete Round	--------	--------	267526	267535
Head Mk 10 Mod 9	166309	166309	--------	--------
Head Mk 10 Mod 11	--------	--------	267528	--------
Head Mk 10 Mod 12	--------	--------	--------	267533
Motor Mk 4 Mod 1	166305	166305	166305	166305
Motor Mk 4 Mod 4	174611	174611	174611	174611
Nominal Velocity (fps)	778	778	778	778
Nominal Weight (lb)	50.3	50.41	50.95	49.94
Overall Length (in.)	31.97	31.66	31.66	31.97
Head, 5.0-Inch, Mk-Mod	10–6, 7, or 9	10–9	10–11	10–12
Motor, 5.0-Inch, Mk-Mod	4–1 or 4	4–1 or 4	4–1 or 4	4–1 or 4
Nose Fuze Mk-Mod	30–3 or 4	173–4 or 174–0	173–4 or 174–0	30–3 or 4
Aux. Det. Fuze Mk-Mod	44–2	44–1	44–1	44–2
Range (yd)	4620	4620	4620	4620
C.G., Before Burning (in.) (Measured from rear).	14.55	14.74	14.74	14.55
C.G., After Burning (in.) (Measured from rear)	15.46	15.86	15.86	15.46
Ballistic Table in OP	1498	1498	1498	1498
Container Mk-Mod	10–0	10–0	10–0	10–0

495862 O—59——9

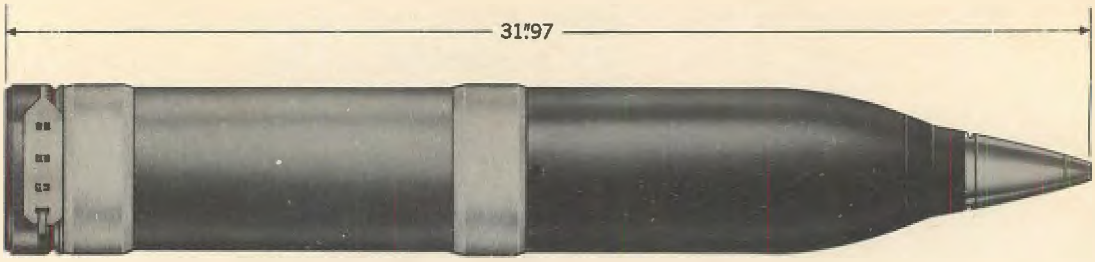


Figure 5.2—5.0-Inch Rocket Mk 10 Mod 3 (Surface, HE, SS), External View.

Special Information

The 5.0-Inch Surface Rocket Mk 10 Mods 0, 1, 2, and 3 is fired from surface craft against shore installations or for barrage purposes. It has a maximum range of 4620 yards and is capable of delivering between nine and ten pounds of TNT on the target.

The differences between mods of 5.0-Inch Surface Rocket Mk 10 are shown in the table. Mods 1 and 2, having a VT fuze, are fired against personnel and light armament or similar equipment.

VT Fuzes Mk 173 Mod 4 and Mk 174 Mod 0 are designed for spin-stabilized rockets. These fuzes operate most effectively at ranges between 3000 and 5000 yards. Bursting heights over average land targets vary from 20 to 80 feet, depending on the angle of elevation at which the rocket is fired and the type of terrain at which the attack is aimed.

The practice round for 5.0-Inch Surface Rocket Mk 10 Mods 0 and 1 is 5.0-Inch Surface Rocket Mk 11 Mod 0, which consists of an inert, plaster-filled 5.0-Inch Rocket Head Mk 10 All Mods and a live-loaded 5.0-Inch Rocket Motor Mk 4 Mod 1.

The dummy round for 5.0-Inch Surface Rocket Mk 10 Mods 0 and 1 is 5.0-Inch Surface Rocket Mk 12 Mod 0, which consists of an inert, plaster-filled 5.0-Inch Rocket Head Mk 10 All Mods and an inert-loaded 5.0-Inch Rocket Motor Mk 4 Mod 1.

5.0-INCH ROCKET MK 13 MOD 0 (SURFACE, HE, SS)

Mark	13
Mod	0
General Arrangement:	
Complete Round	467138
Head Mk 12 Mod 0, 3	561530
Motor Mk 5 Mod 1	467158
Motor Mk 5 Mod 4	655924
List of Drawings:	
Head Mk 12 Mod 0	165459
Head Mk 12 Mod 3	165462
Motor Mk 5 Mod 1	166375
Motor Mk 5 Mod 4	174613
Nominal Velocity (fps)	498
Nominal Weight (lb)	51.86
Overall Length (in.)	31.97
Head, 5.0-Inch, Mk-Mod	12–0 or 3
Motor, 5.0-Inch, Mk-Mod	5–1 or 4
Nose Fuze Mk-Mod	30–3 or 4
Base Fuze Mk-Mod	None
Aux. Det. Fuze Mk-Mod	44–2
Range (yd)	2145
C.G., Before Burning (in.) (Measured from rear)	14.56
C.G., After Burning (in.) (Measured from rear)	15.43
Ballistic Table in OP	2029
Container Mk-Mod	10–0

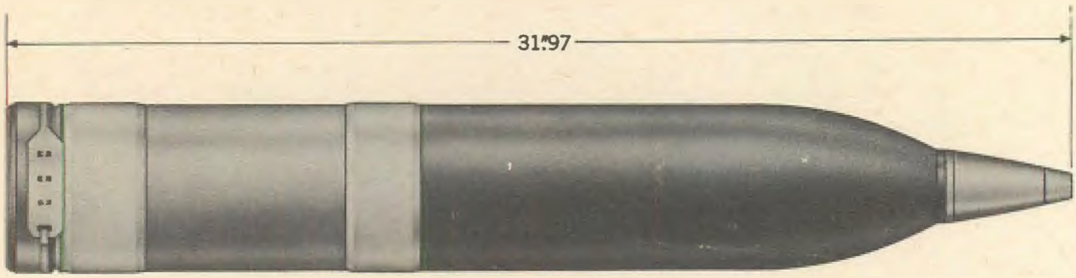


Figure 5.3—5.0-Inch Rocket Mk 13 Mod 0 (Surface, HE, SS), External View.

Special Information

The 5.0-Inch Surface Rocket Mk 13 Mod 0, fired from surface craft against shore installations, is capable of delivering 12 pounds of TNT on the target.

The practice round for 5.0-Inch Surface Rocket Mk 13 Mod 0 is 5.0-Inch Surface Rocket Mk 14 Mod 0, which consists of an inert, plaster-filled 5.0-Inch Rocket Head Mk 12 All Mods and a live-loaded 5.0-Inch Rocket Motor Mk 5 Mod 1.

The dummy round for 5.0-Inch Surface Rocket Mk 13 Mod 0 is 5.0-Inch Surface Rocket Mk 15 Mod 0, which consists of an inert, plaster-filled 5.0-Inch Rocket Head Mk 12 All Mods and an inert-loaded 5.0-Inch Rocket Motor Mk 5 Mod 1.

5.0-INCH ROCKET MK 16 MOD 0 (SURFACE, HE, SS)

Mark	16
Mod	0
General Arrangement:	
Complete Assembly	465155
Motor Mk 6 Mod 1	467160
Motor Mk 6 Mod 4	655926
List of Drawings:	
Motor Mk 6 Mod 1	166377
Motor Mk 6 Mod 4	174615
Nominal Velocity (fps)	400
Nominal Weight (lb)	54.30
Overall Length (in.)	32.48
Head, 5.0-Inch, Mk-Mod	13–0
Motor, 5.0-Inch, Mk-Mod	6–1 or 4
Nose Fuze Mk-Mod	30–3 or 4
Base Fuze Mk-Mod	None
Aux. Det. Fuze Mk-Mod	52–2
Range (yd)	1480
C.G., Before Burning (in.) (Measured from rear)	14.50
C.G., After Burning (in.) (Measured from rear)	15.14
Ballistic Table in OP	1498
Container Mk-Mod	10–0

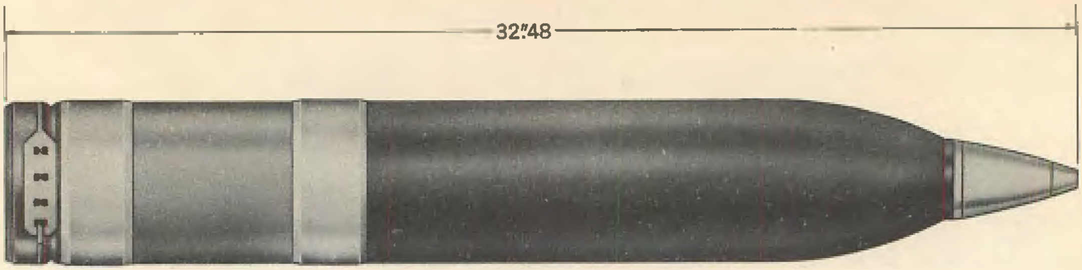


Figure 5.4—5.0-Inch Rocket Mk 16 Mod 0 (Surface, HE, SS), External View.

Special Information

The 5.0-Inch Surface Rocket Mk 16 Mod 0, fired from surface craft for use against shore installations, is capable of delivering more than 13 pounds of TNT on the target.

The practice round for the 5.0-Inch Surface Rocket Mk 16 Mod 0 is the 5.0-Inch Surface Rocket Mk 17 Mod 0, which consists of inert, plaster-filled 5.0-Inch Rocket Head Mk 13 All Mods and live-loaded 5.0-Inch Rocket Motor Mk 6 Mod 1.

The dummy round for 5.0-Inch Surface Rocket Mk 16 Mod 0 is 5.0-Inch Surface Rocket Mk 18 Mod 0, which consists of inert, plaster-filled 5.0-Inch Rocket Head Mk 13 All Mods and inert-loaded 5.0-Inch Rocket Motor Mk 6 Mod 1.

5.0-INCH ROCKET MK 24 MODS 0 AND 1 (SURFACE, AP, SS)

Mark	24	24
Mod	0	1
General Arrangement:		
Complete Round	467068	656311
List of Drawings:		
Complete Round	----------	174539
Head Mk 8 Mod 0	CIT	----------
Head Mk 8 Mod 1	139686	----------
Head Mk 8 Mod 2	----------	174539
Motor Mk 3 Mod 1	166301	166301
Motor Mk 3 Mod 4	174608	174608
Nominal Velocity (fps)	1334	1334
Nominal Weight (lb)	50.59	50.83
Overall Length (in.)	28.81	28.81
Head, 5.0-Inch, Mk-Mod	8–0 or 1	8–2
Motor, 5.0-Inch, Mk-Mod	3–1 or 4	3–1 or 4
Nose Fuze Mk-Mod	None	None
Base Fuze Mk-Mod	31–0, 2, or 36–0	31–2
Range (yd)	9180	9180
C.G., Before Burning (in.) (Measured from rear)	15.55	15.55
C.G., After Burning (in.) (Measured from rear)	16.57	16.57
Ballistic Table in OP	2030	2030
Container Mk-Mod	10–0	10–0

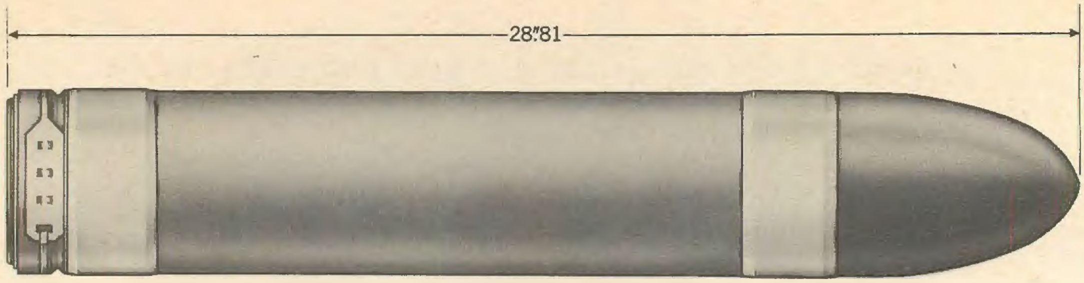


Figure 5.5—5.0-Inch Rocket Mk 24 Mod 1 (Surface, AP, SS), External View.

Special Information

The 5.0-Inch Surface Rocket Mk 24 Mods 0 and 1 has a maximum range of 10,050 yards but is used chiefly for short-range attack by patrol boats. It is a semi-armor-piercing rocket which carries less than two pounds of payload to the target.

The differences between mods of 5.0-Inch Surface Rocket Mk 24 are shown in the table.

The practice round for 5.0-Inch Surface Rocket Mk 24 is 5.0-Inch Surface Rocket Mk 8 Mod 1, which consists of inert-loaded 5.0-Inch Rocket Head Mk 8 Mod 1 and live-loaded 5.0-Inch Rocket Motor Mk 3 Mod 1.

The dummy round for 5.0-Inch Surface Rocket Mk 24 is 5.0-Inch Surface Rocket Mk 9 Mod 1, which consists of inert-loaded 5.0-Inch Rocket Head Mk 8 Mod 1 and inert-loaded 5.0-Inch Rocket Motor Mk 3 Mod 0 or 1.

Mark	27
Mod	0
General Arrangement	660860
List of Drawings	174495
Nominal Velocity (fps)	778
Nominal Weight (lb)	43.69
Overall Length (in.)	29.15
Head, 5.0-Inch, Mk-Mod	21–0 or 1
Motor, 5.0-Inch, Mk-Mod	4–1 or 4
Range (yd)	4620
C.G., Before Burning (in.) (Measured from rear)	13.36
C.G., After Burning (in.) (Measured from rear)	14.23
Ballistic Table in OP	1498
Container Mk-Mod	10–0

5.0-INCH ROCKET MK 27 MOD 0 (SURFACE, SMOKE-TAR, SS)

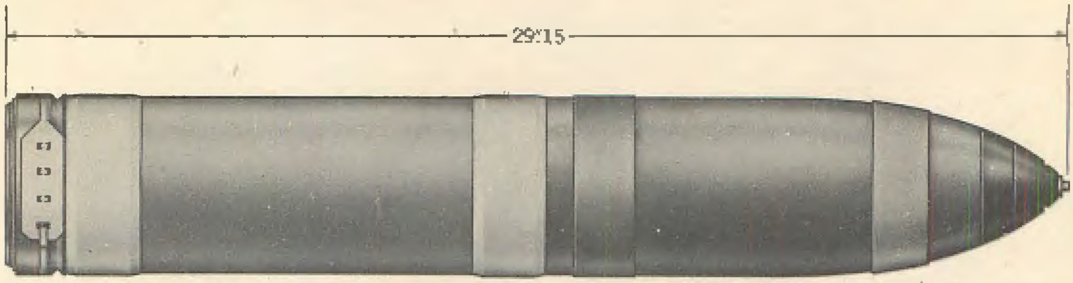


Figure 5.6—5.0-Inch Rocket Mk 27 Mod 0 (Surface, SMOKE-TAR, SS), External View.

Special Information

The 5.0-Inch Surface Rocket Mk 27 Mod 0 is used to simulate fast-moving aerial targets for gunnery-crew practice. The smoke trail which issues from M18 grenades in the head assists in locating the target rocket.

7.2-INCH ROCKET MK 1 MOD 3 (SURFACE, HE, ASW)

Mark	1.
Mod	3.
General Arrangement	329136.
List of Drawings:	
Head Mk 5 Mod 0	108945.
Motor Mk 3 Mods 2, 3	166301.
Nominal Velocity (fps)	175.
Nominal Weight (lb)	62.22.
Overall Length (in.)	37.13.
Head, 7.2-Inch, Mk-Mod	5–0.
Motor, 2.25-Inch, Mk-Mod	3–2 or 3.
Nose Fuze Mk-Mod	156–0, 131–3 or 6, 177–0.
Auxiliary Booster Mk-Mod	1–0.
Number of Boosters	1.
Range (yd)	300.
Ballistic Table in OP	1437.
Container Mk-Mod	1–0.

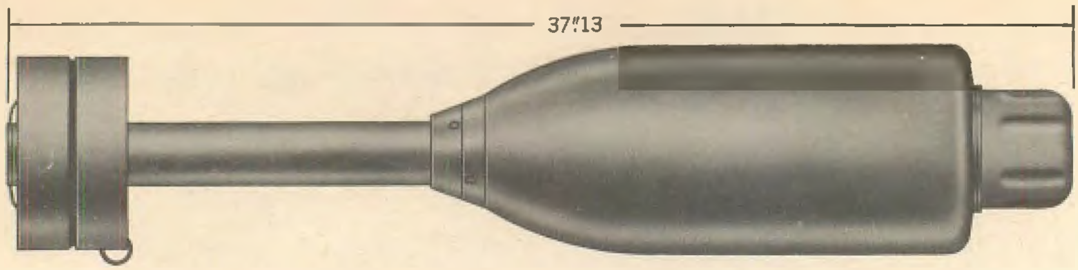


Figure 5.7—7.2-Inch Rocket Mk 1 Mod 3 (Surface, HE, ASW), External View.

Special Information

The 7.2-Inch Surface Rocket Mk 1 Mod 3 (Mousetrap) is forward-fired from surface craft for use against enemy submarines.

Although this round uses Nose Fuze Mk 156 Mod 0, Nose Fuze Mk 131 All Mods may be used if available. There are only minor design differences between the two fuzes.

This rocket has a range of approximately 300 yards when fired from the appropriate launchers.

The subcaliber practice round for 7.2-Inch Rocket is 2.5-Inch Subcaliber Rocket Mk 1 Mod 2, which is treated in appendix B.

The practice round for 7.2-Inch Rocket Mk 1 Mod 3 is 7.2-Inch Surface Rocket Mk 2 Mod 0, which consists of inert, plaster-filled 7.2-Inch Rocket Head Mk 5 Mod 0 and live-loaded 2.25-Inch Rocket Motor Mk 3 Mods 0, 2, or 3.

The dummy round for 7.2-Inch Surface Rocket Mk 1 Mod 3 is 7.2-Inch Surface Rocket Mk 3 Mod 0, which consists of inert, plaster-filled 7.2-Inch Rocket Head Mk 5 Mod 0 and inert-loaded 2.25-Inch Rocket Motor Mk 3 Mods 0, 2, or 3.

7.2-INCH PROJECTOR CHARGE ASSEMBLY (HE, ASW) MK 10 MODS 0 AND 1

	Short Range	*Long Range*
Mark	10	10.
Mod	0	1.
General Arrangement	657654	657656.
List of Drawings	175444	175446.
Initial Velocity (fps)	145.5	175.
Nominal Weight (lb)	66.85	65.
Overall Length (in.)	38.64	38.40.
Head, 7.2-Inch, Mk-Mod	4–0	4–0.
Tail, 2.25-Inch, Mk-Mod	6–0	6–1.
Primer Mk-Mod	25 All Mods	25 All Mods.
Nose Fuze Mk-Mod	177–0 or 1	177–0 or 1.
Auxiliary Booster Mk-Mod	1–0	1–0.
Number of Boosters	1	1.
Range (ft)	600	855.
Ballistic Table in OP	1904	1925.
Container	389102	Mk 1 Mod 2.

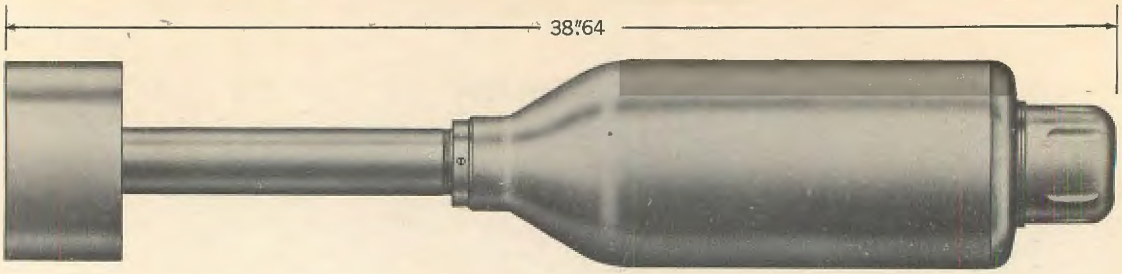


Figure 5.8—7.2-Inch Projector Charge Assembly Mk 10 Mod 0 (HE, ASW), External View.

Special Information

The 7.2-Inch Projector Charge Mk 10 Mods 0 and 1 is forward-fired from surface craft for use against enemy submarines. The range of these projector charges, measured from launcher to center of pattern, is approximately 600 feet for short range Mod 0 and 855 feet for long range Mod 1.

Although these rounds use Nose Fuze Mk 177 Mods 0 and 1, Nose Fuze Mk 136 Mods 8, 9, and 10 or Nose Fuze Mk 158 Mod 0 may be used if available. The three fuzes operate on the same principles but have slightly different design features.

A projector charge will be received from the loading depot with projector charge head and projector charge tail assembled together. Each cartridge case is custom-loaded for the particular round. This is necessary to insure proper range characteristic because these rounds usually are fired in groups of 24 which fall in an established pattern. Projector charge heads and tails are not interchangeable and shall not be disassembled.

The practice round for 7.2-Inch Projector Charge consists of inert, plaster-filled 7.2-Inch Projector Charge Head Mk 4 Mods 0, 1, 2, and 3 and live-loaded 2.25-Inch Projector Charge Tail Mk 6 Mod 0. The practice round, which weighs approximately 65 pounds, simulates flight and sinking characteristics of the service round, and is used during maneuvers and in practice in conjunction with friendly submarines.

The dummy round consists of inert, plaster-filled 7.2-Inch Projector Charge Head Mk 4 Mods 0, 1, 2, and 3 and inert-loaded 2.25-Inch Projector Charge Tail Mk 6 Mod 0.

Chapter 6

ASSEMBLY OF COMPLETE ROUNDS

General

This chapter describes the procedure and precautions to be observed in assembly operations. General instructions for inspection, handling, and maintenance of components before assembly are given in chapter 1 and in the special sections on the particular items.

In any operation involving assembly, disassembly, fuzing, unfuzing, cleaning, or painting, the work shall be done in the most suitable location, taking into account safe removal from other explosives and possible damage to vital installations. The smallest number of rounds practicable shall be exposed. Only personnel essential to the work shall be in the vicinity. The ideal situation would be that where only one round at a time is worked at a location on deck remote from all magazines, ready stowage, other ammunition or explosives, and vital installations.

Inspection Before Assembling Rounds. Inspect heads, motors, and fuzes for defects before assembling them into rounds, according to the section on maintenance in chapter 1.

Handling of Defective Components. Defective heads and motors which cannot be repaired aboard ship, defective fuzes, and armed or partially armed fuzes must be disposed of in accordance with instructions from the Bureau of Ordnance. Repairable defective heads and motors must be handled in accordance with the instructions found in chapter 1 under the paragraphs on repair of inert items in the maintenance section. Repairable fuzes must be handled in accordance with the special information on particular fuzes in chapter 4.

Fuze wrenches are to be used only on the fuzes for which they are issued. Spark-resistant tools are used to break open boxes and crates.

Assembly Procedure.

1. Preparing Head and Motor for Assembly.

a. Remove the thread protector from the head or the rear shipping plug from the motor-head adapter.

b. Remove the motor thread protector from the motor.

c. Check the threads of the head and motor for wax, dirt, or injury. Clean if necessary.

Figure 6.1 shows representative rocket tools used in the assembly of rocket rounds.

2. Assembling Head and Motor. Screw together the head and motor, using proper tools and supporting either the head or motor. Care must be taken to avoid cross-threading. See figures 6.2 and 6.3 which show a rocket motor being assembled to a rocket head. The motor is seated easily by employing a suitable strap wrench. It is necessary to tighten the motor only enough to keep out moisture. Note the shorting clip in place.

3. Preparing for Nose Fuze Installation. Fuzing and defuzing of rockets must be undertaken by qualified personnel only.

a. Hold the rocket with the nose up or in some other suitable position, and remove the shipping plug, shipping-plug gasket, and any packing or spacer from the head cavity. In removing the shipping plug, it may be necessary to obtain more leverage by using a short section of brass pipe on the wrench handle or by tapping the handle of the wrench with the heel of the hand.

b. See that the proper auxiliary booster or auxiliary detonating fuze is in place if either one is used.

c. Make certain that the fuze-hole threads are not damaged.

d. Remove the nose fuze from its sealed container.

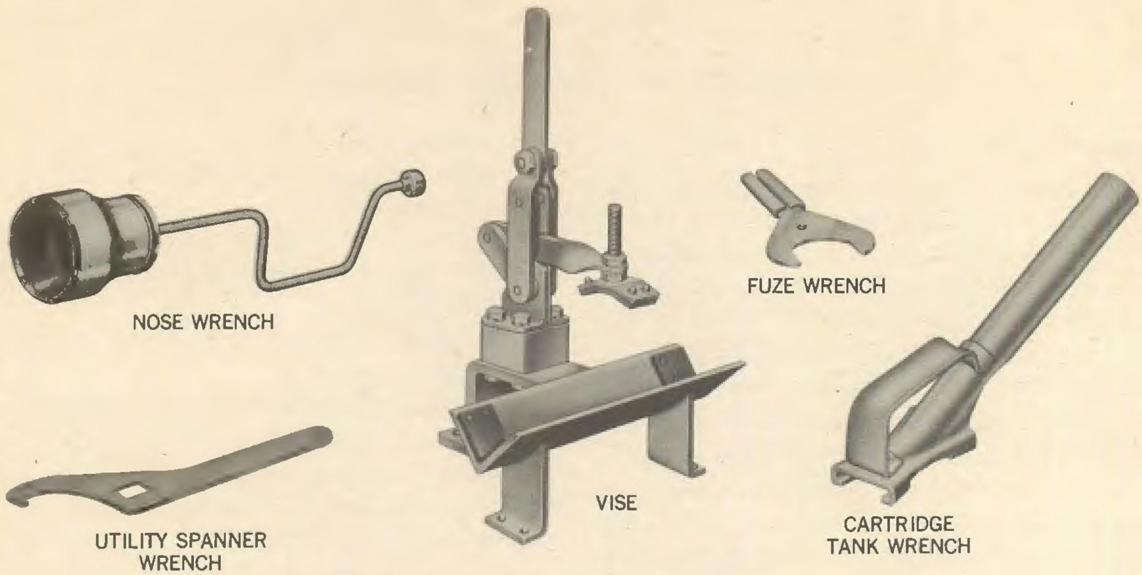


Figure 6.1—Representative Rocket Tools.

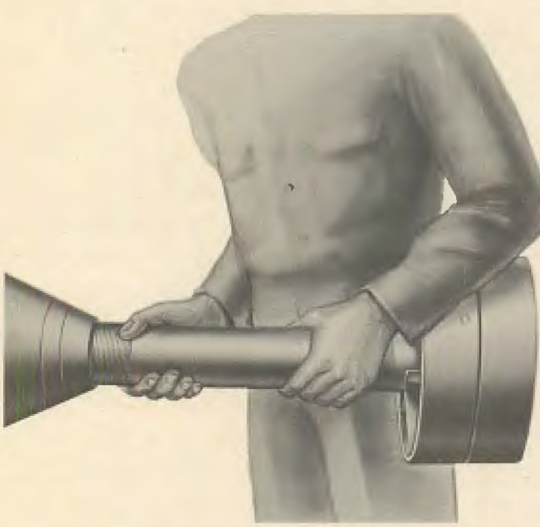


Figure 6.2—Starting Motor into Rocket Head.

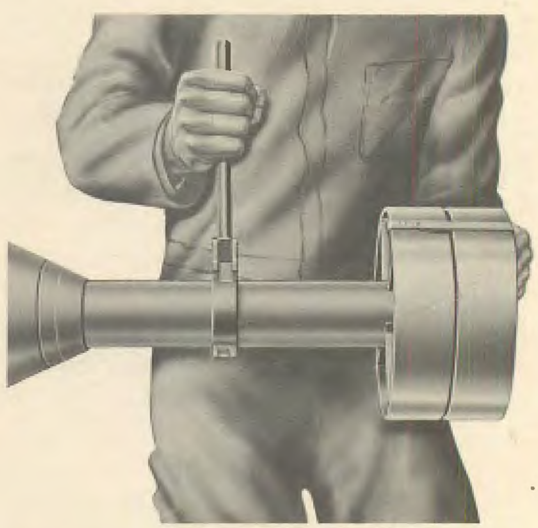


Figure 6.3—Use of Strap Wrench in Assembly of Head and Motor.

e. Inspect the fuze for defects. Make certain that the safety pin or clip, if any, is securely in place.

4. INSTALLING NOSE FUZE. Install the inspected fuze in the head with the fuze wrench issued. Do not replace the shipping-plug gasket. Use a gasket only when one is supplied with the fuze being installed. Some means of holding the head should be provided. In starting, care must be taken to avoid cross-threading. See figures 6.4 and 6.5 which show a rocket fuze being installed in a rocket head. It is necessary only to tighten the fuze to keep out water.

Loading and Unloading of Launchers and Projectors. For the loading of rounds and the removal of misfired or unfired rounds from launching devices, proceed in a manner governed by the safety precautions in chapter 1 and according to the special instructions pertaining to the launching device being used. These special instructions are in the ordnance publications describing these launching devices. The numbers of these publications are given in the section dealing with the particular caliber or mark of the rocket.

Disassembly of Complete Rounds. Undamaged rounds are ordered disassembled by the officer in charge of the firing operation.

Figure 6.4—Starting Nose Fuze into Rocket Head.

Figure 6.5—Use of Special Fuze Wrench in Installation of Nose Fuze in Rocket Head.

Damaged rounds, such as rounds with armed or partially armed fuzes, will be disassembled by explosive ordnance disposal personnel. If none is available, disassembly or disposal of rounds is ordered by competent authority in accordance with existing instructions.

Inspection Before Disassembling Rounds. Inspect rounds for defects before disassembling them into their component fuzes, heads, and motors according to the instructions in chapter 1.

Defective rounds which cannot be repaired aboard ship, such as armed or partially armed fuzes, must be handled in accordance with the instructions found in the paragraphs on disposal of defective rounds in the handling and shipping section of chapter 1 and the special information sections on the items which will be found in chapters 2, 3, and 4.

Defective rounds which can be repaired aboard ship will be disassembled with care, and the defective component or components will be handled in accordance with the instruc-

495862 O—59——10

tions found in this chapter under the section on handling of defective components.

Disassembly Procedure. Inspect rounds for defects before disassembling them. In general, to disassemble rounds which are not defective, follow the assembly steps in reverse order.

WARNING

It is important that the fuze wrench designed for use with any particular fuze be used to remove the fuze from the round. Use of an improper wrench may engage the wrong holes, flats, or slots and result in arming of the fuze.

WARNING

If the fuze adapter becomes loose while the fuze is being removed, stop the operation. Grains of explosive may be lodged between the adapter threads and head threads, and unscrewing the adapter may pinch the explosive, and cause an explosion.

Upon removal of components from the round, inspection of those parts of the components which could not be inspected when the round was assembled must be made before the components can be returned to normal stowage.

Return of Rockets and Components to Stowage. Rockets and components which have been inspected and found free of defects will be returned to normal stowage. Rockets which have been repaired and declared serviceable will also be returned to normal stowage.

5.0-Inch Spin-Stabilized Rockets

Removal from Containers. Figures 6.6 and 6.7 illustrate the method of removing rounds, or heads and motors from metal tanks. Proceed as follows.

1. Remove the cover and spacer.

2. Lay the tank in a horizontal position to take out components.

3. If the round is unassembled, remove the motor by means of the extractor and the head

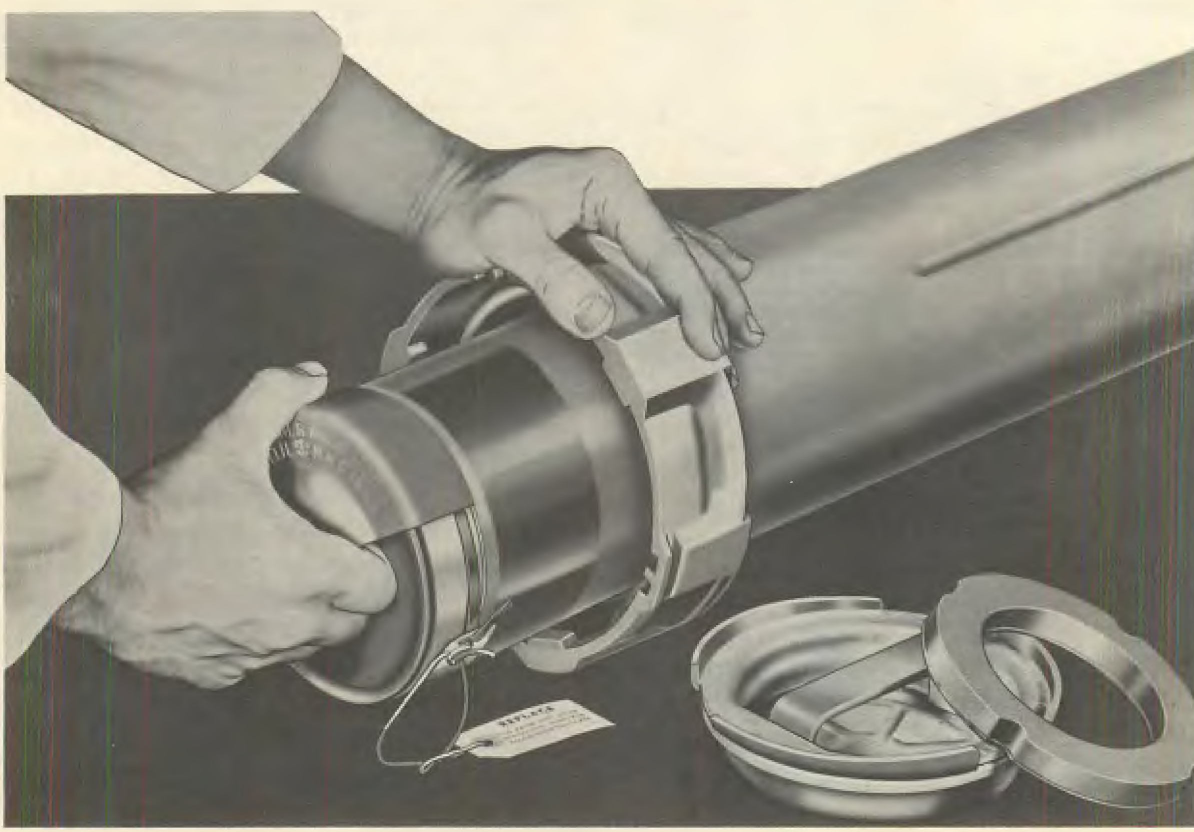


Figure 6.6—Use of Extractor in Removal of 5.0-Inch Rocket Motor from Rocket Container Mk 10 Mod 0.

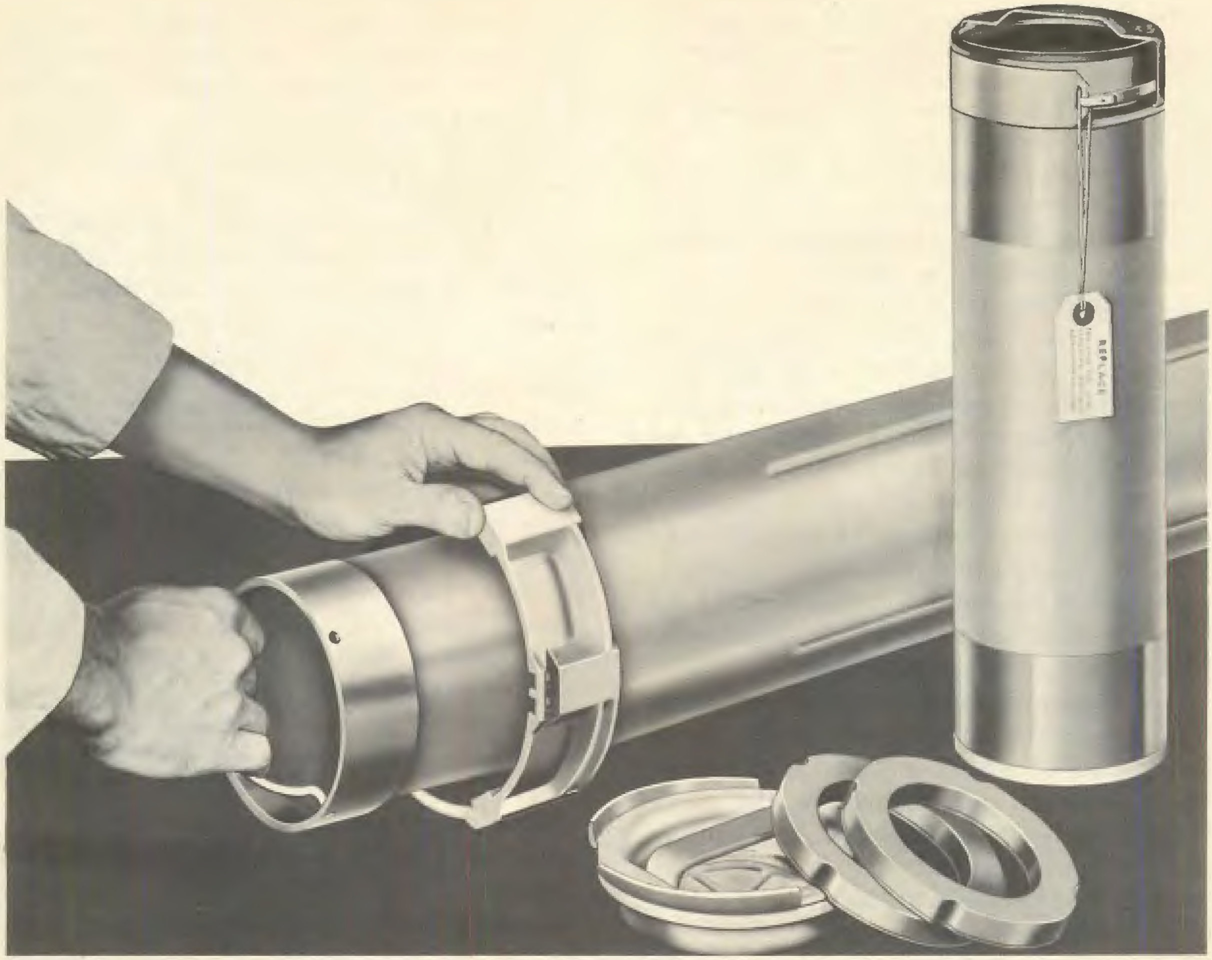


Figure 6.7—Removal of 5.0-Inch Rocket Head from Rocket Container Mk 10 Mod 0.

by reaching into the tank and grasping the thread protector bail. The extractor is a drawn aluminum half-shell which engages a locking groove in the motor.

4. If the round is assembled, remove the round by means of the extractor.

> CAUTION: If an attempt is made to remove the motor or round from a position other than the horizontal, there is a tendency for the extractor to slip off. This may result in damage to the motor or round.

5. After removing the round or the components from the tank, place the extractor, spacers, and thread protectors (if any) back in the tank. Replace the cover and put the tank in storage for return to a naval ammunition depot.

Assembly Kits and Special Equipment. After the rocket components have been removed from their containers and inspected, they are assembled with the tools in Assembly Kit Mk 2 Mod 0. Their use is shown in figures 6.8 through 6.12. If this kit is not available, strap wrenches and common bench clamps should be used for making the assembly. Assembly Kit Mk 2 Mod 0 consists of the following tools: one Vise Mk 2 Mod 0 and two 5-inch utility spanner wrenches (BuOrd dwg 592882 Rev. A).

Vise Mk 2 Mod 0 is used to hold the motor during assembly or disassembly. The vise is of the quick-acting, toggle-clamp type, figure 6.1. It should be bolted to a bench or table.

To adjust the upper jaw of the vise for a tight grip on the motor, proceed as follows:

1. Place the motor in the lower jaw.
2. Loosen the locknuts on the screw of the upper jaw.
3. Move the handle of the clamp to the closed position.
4. Tighten the lower locknut until the motor cannot be turned in the vise.
5. Tighten the upper locknut.

The 5-inch utility spanner wrench is used on the heads, and on the head and motor thread protectors which are recessed to accept the pin of the wrench. A rectangular hole in the handle of the wrench fits the flats of nose shipping plugs. All the heads, thread protectors, and nose plugs of current rounds will accommodate this wrench.

Assembly Procedure. In assembling 5.0-inch spin-stabilized rockets with Assembly Kit Mk 2 Mod 0, proceed as follows.

1. Preparing Head and Motor for Assembly. Follow the general instructions. If necessary, secure the head in the vise while using the spanner wrench to remove the thread protector. Where a base fuze is employed, make certain that the fuze is present, gas checked, and properly installed in the head. If necessary, secure the motor in the vise while using the spanner wrench to remove the thread protector.

> CAUTION: Do not remove the felt spacers which are necessary for the proper spacing of the head, igniter, and propellent grain.

WARNING

> Do not remove the rear closure of the motor. Flame might enter the nozzles and ignite the propellant prematurely. A rocket without a rear closure, placed in the magazine of an automatic launcher, might be ignited by the exhaust blast deflected from a rocket in the firing tube. The launcher would be damaged and, since the spinning of the rocket would arm the fuze, the head might be detonated.

2. Assembling Head and Motor.

a. Place the head on the vise in front of the motor and start the threading operation by hand, figure 6.8. If the threads bind, turn the head in the opposite direction until the threads are properly alined. If the head does not thread easily into the motor, a strap wrench, figure 6.9, may be used.

b. The head should be screwed into the motor until it is wrench tight and, insofar as possible, the seating surfaces meet firmly. If more force than can be applied with the strap wrench is needed, the utility spanner wrench, figure 6.10, may be used to tighten the head by engaging the pin of the wrench in the hole at the base of the ogive.

3. Preparing for Nose Fuze Installation. Proceed according to the general instructions, except that it will not be necessary to raise the nose of the rocket or remove it from the vise. Figure 6.11 shows the removal of a shipping plug with a spanner wrench.

4. Installing Nose Fuze. Screw the nose fuze wrench-tight into the nose of the head, figure 6.12. Remove the assembled round from the vise.

Wipe the grease off the bourrelets and the contact ring before loading the round in the launcher.

Loading and Unloading of Launchers. For the loading of rounds on launchers, and the removal of misfired or unfired rounds from launchers, see the general section of this chapter and the following ordnance publications all of which deal with launchers for the 5.0-inch spin stabilized rockets.

OP 1244	Rocket Launchers Mk 50 Mods 0 and 1; Description and Instructions for Use.
OP 1246	Rocket Launcher Mk 51 Mod 0; Description and Instructions for Use.
OP 1424	Rocket Launcher Assembly Mk 102 Mod 0; Description and Instructions for Use.
OP 2110	Rocket Launcher Mk 105 Mod 2; Description, Operation, and Maintenance.

When unloading, make certain that the short-circuiting band is in place on the motor. Fasten the band around the motor so that the tongue and projections lie in the depression between the contact ring and the locking groove. Tighten the clip securely.

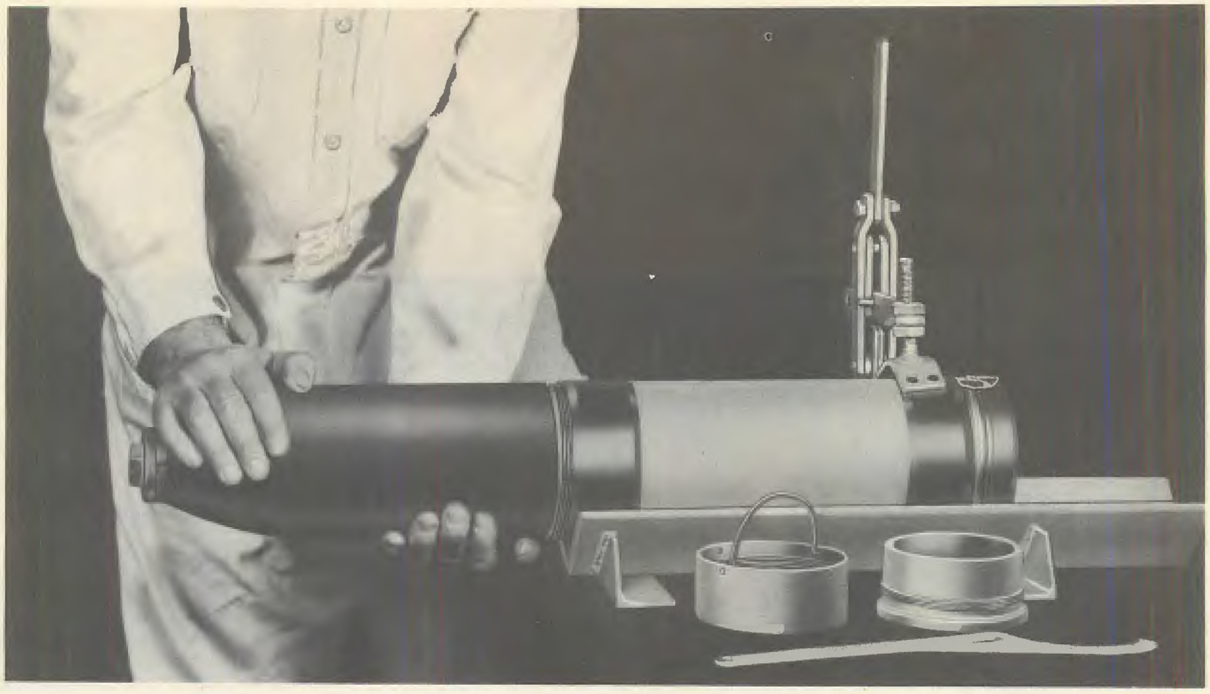


Figure 6.8—Use of Assembly Kit Mk 2 Mod 0 in Threading of 5.0-Inch Head to Motor by Hand.

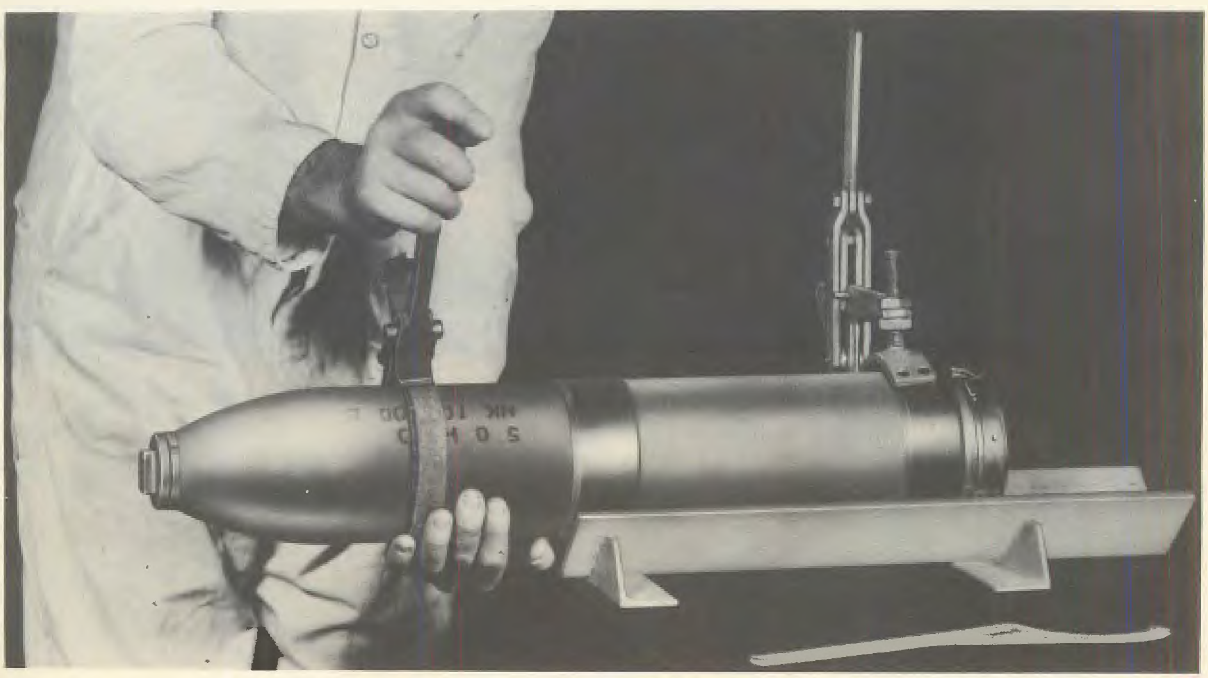


Figure 6.9—Use of Strap Wrench in Assembly of 5.0-Inch Head and Motor.

Figure 6.10—Use of Spanner Wrench in Assembly of 5.0-Inch Head and Motor.

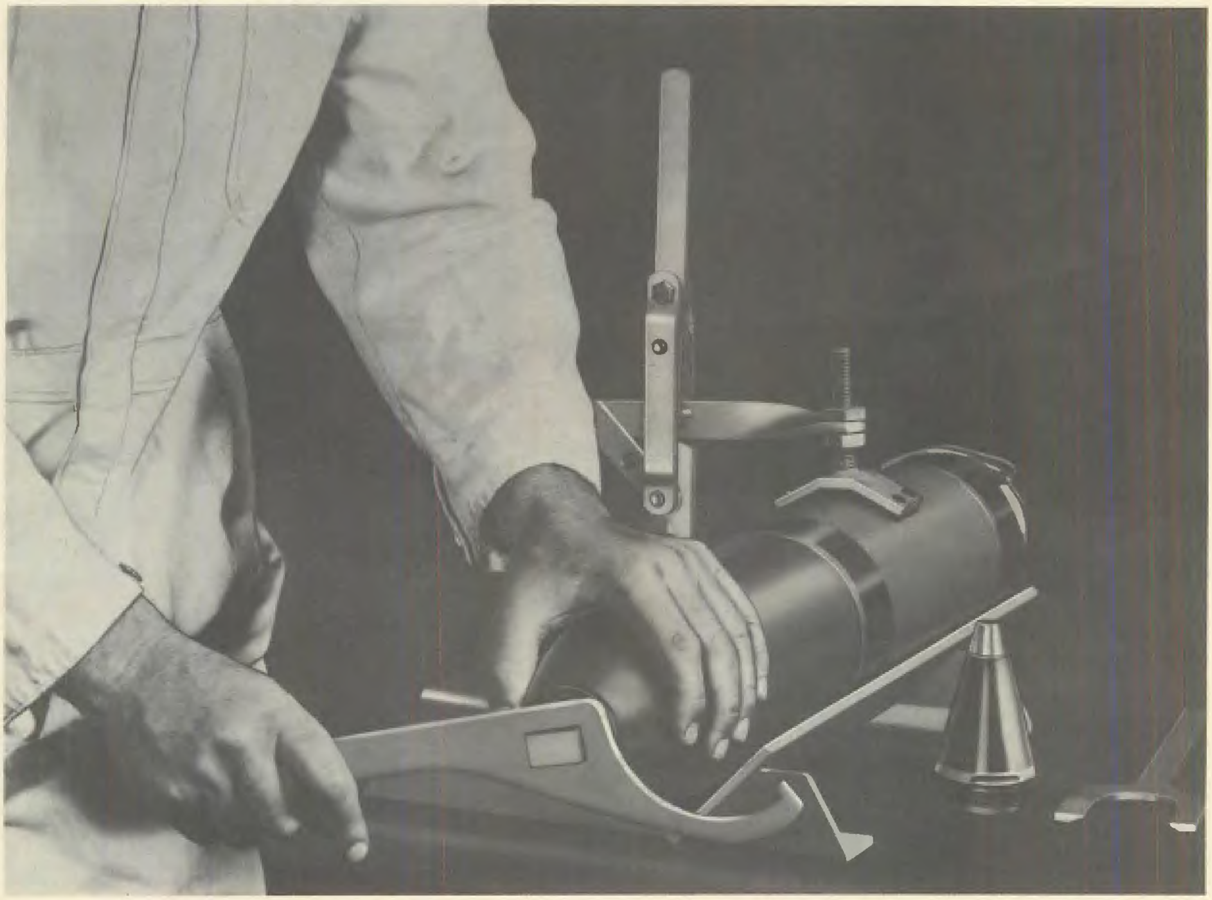


Figure 6.11—Removal of Nose Shipping Plug with Utility Spanner.

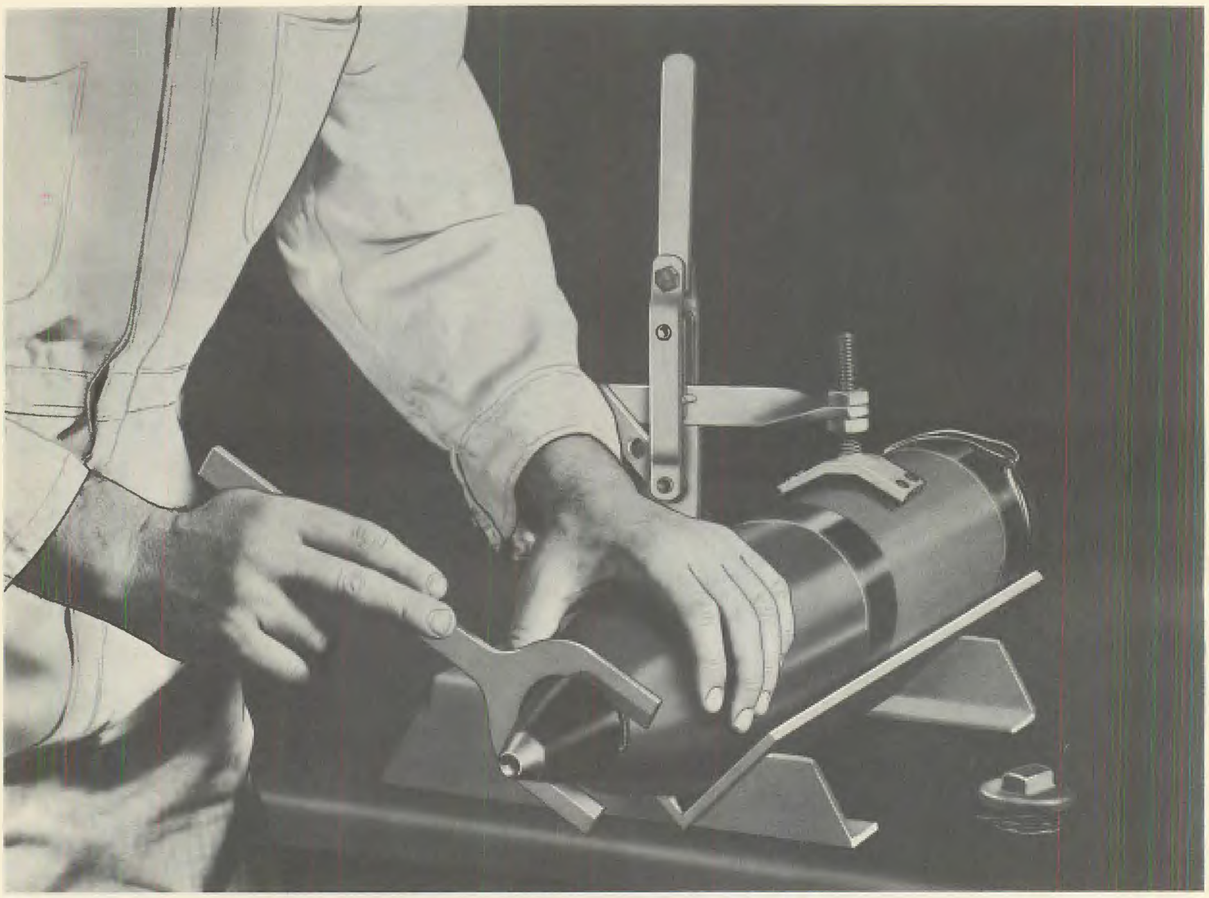


Figure 6.12—Use of Special Fuze Wrench in Installation of Nose Fuze in 5.0-Inch Head.

Disassembly Procedure.

WARNING

Make certain that the short-circuiting band is in place on the motor and that the fuze cannot be armed.

To disassemble 5.0-inch spin-stabilized rockets with Assembly Kit Mk 2 Mod 0, proceed as follows.

1. Remove the nose fuze with the proper fuze wrench and replace the nose shipping plug. Inspect the fuze for moisture and salt coating, and replace it in the fuze container if neither is present.

2. Unscrew the head from the motor and replace the head thread protector on the base of the head. Then replace the motor thread protector on the motor.

3. To prevent rusting, coat the bourrelets on the motor lightly with Rust Inhibitor, MIL–C–972 Grade II, or its equivalent.

Return of Rockets to Stowage. Replace components in the metal shipping tanks, putting the head support and spacer blocks back in their original position. Stow as directed in chapter 1.

7.2-Inch Rockets (ASW)

Assembly Procedure.

1. Preparing Head and Motor for Assembly. Follow the general instructions.

2. Assembling Head and Motor. Follow the general instructions. In addition, it will be necessary to employ strap wrenches to drive the head fully into the motor.

3. Preparing for Nose Fuze Installation. Follow the general instructions.

4. Installing Nose Fuze. Follow the general instructions when inserting the nose fuze in the head, but add the following.

   a. Screw the fuze down tightly on its gasket to insure a watertight seal.

   b. Replace the fuze cap over the fuze for protection against the weather and safety in handling. This completes the installation for ready service.

If fuzed rounds are to remain in ready-service boxes for considerable periods, the fuze caps should be removed daily for inspection of the fuzes. In the inspection, check for the presence of safety pins or clips. Remove any moisture which may have accumulated under the covers. Greasing of the collar and vanes is permissible to prevent rusting. After the rockets are placed on the launcher and prior to firing, remove the fuze cap and the safety pin or clip. Save the safety pins or clips so that they can be reinserted into the collars, in case the round is not fired.

Loading and Unloading of Launchers. For the loading of rounds on launchers, and the removal of misfired or unfired rounds from launchers, see the general section of this chapter and the ordnance publications pertaining to the launchers used. At no time is it permissible to stand this rocket on its tail since the wires leading out of the rocket motor may be damaged. For special information concerning Launchers Mk 20 and Mk 22, see OP 1002.

Disassembly Procedure. To disassemble the 7.2-inch rocket proceed in a reverse manner under the instructions given for assembly of this round.

Return of Rockets to Stowage. To return this round to stowage, follow the general instructions in this chapter on the return of rockets to stowage. In addition, inspect the fuze for moisture and salt coating which should be removed if present. Replace the fuze in its container.

7.2-Inch Projector Charges

Assembly Procedure. In assembling 7.2-inch projector charge assemblies, proceed as follows.

1. Preparing for Nose Fuze Installation. Follow the general instructions.

2. Installing Nose Fuze. Follow the general instructions but, when inserting the fuze in the projector charge, screw the fuze down tightly on its gasket to insure a watertight seal. Replace the fuze cap for protection against the weather and safety in handling.

If fuzed rounds are to remain in ready-service boxes for considerable periods, the fuze caps should be removed daily for inspection. In the inspection, check for the presence of the safety pins or clips. Remove any moisture which may have accumulated under the covers.

Greasing of the collar and vanes is permissible to prevent rusting. Close the tail end of the projector charges with the nonexpendable rubber tail-tube plugs (BuOrd dwg 1123521). This completes the installation for ready service.

Prior to the placing of projector charges on spigots, remove the rubber tail-tube plugs. After the projector charges have been placed on the spigots and prior to firing, remove the fuze cap and the safety pins or clips. Save the safety pins or clips so that they can be reinserted in the fuze, in case the salvo is not fired.

Loading and Unloading of Projectors. For the loading of rounds on projectors, and the removal of misfired or unfired rounds from projectors, see the general section of this chapter and the OP's pertaining to the projectors used. For Projectors Mk 10 Mods 0 and 1 and Mk 11 Mod 0 used with projector charges, see OP 1001 (Second Revision).

It is important that the rubber tail-tube plugs be in place if the projector charge is returned to ready-service stowage.

Disassembly Procedure. To disassemble the 7.2-inch projector charge, follow the general instructions.

Return of Projector Charges to Stowage. Follow the general instructions. Make certain that all moisture has been removed from the fuze and repack it in its metal container.

Return the projector charge assembly to normal stowage.

Chapter 7

CIRCUIT CONTINUITY TESTERS, ARMY-TYPE TRIPLET MODELS, 680A AND 680B

General

The Circuit Continuity Tester 680A or 680B is issued for testing the electric circuit in a rocket motor. When the electric circuit of a rocket motor is found to have a resistance that is too high or too low, the motor should not be used.

The complete electric circuit is tested including the terminal lead wires, wire connectors, igniter lead wires, bridge of the igniter squib, and the joints made by these elements.

Use of these testers for testing rocket motors located far from the tester, such as in an isolated cell, is not deemed advisable because of the limited output of the battery used in the tester. It would also be necessary to recalibrate the scale to incorporate the resistance added by using leads longer than the test leads supplied with the testers.

Neither of the testers is suitable for testing the 5.25-Inch Rocket Motor used in the 12.75-Inch Rocket, since they are not sensitive enough to indicate the extremely small variation allowed in this rocket motor. The 5.25-Inch Rocket Motor may be tested with an Alinco Model 101 Circuit Tester, which is described in OP 2211, Volume 2.

At present, rocket motors are tested at ammunition depots by remote control. The test station may comprise an isolated cell and a remotely located operating panel. The tester (similar to the Circuit Continuity Testers 680A and 680B) and a switch are installed on the operating panel. Suitable lengths of test cables with suitable connecting means are located in the cell. One end of each cable is connected to the switch. Motors are placed nozzle-end up on mobile racks. The motors are contacted by the other ends of the test cables. An operator may test several motors at one cell loading.

There is no standard testing facility nor test procedure employed at the several Navy Ammunition Depots. However, each test facility, test procedure, and operational safety program must be authorized by the Bureau of Ordnance.

Description

Circuit Continuity Testers 680A, figure 7.1, and 680B, figure 7.2, are electric instruments based on a Wheatstone bridge circuit. Each test set consists of a meter, a switch, two external sockets, a means for connecting either rocket motor electrical connector plugs or tester test leads, a 1½-volt dry cell, and two test leads. It is so designed that the current flowing through the rocket motor circuit under test cannot exceed 5 milliamperes.

The motor on the instrument has a double scale and indicates resistance in ohms. The lower scale, marked HVAR, is to be used only with motors for 5.0-inch high velocity aircraft rockets and 11.75-inch aircraft rockets. The motors of these two rocket types contain an igniter which consists essentially of two squibs wired in parallel. The upper scale indicates the resistance of the electric circuit in all other rocket motors containing single-squib motor igniters. An adjusting screw, located below the meter dial, is used for zeroing the pointer.

The Circuit Continuity Tester 680B was developed to receive the Army-type connector plug and to provide a smaller, more accurate unit than the 680A. The 680B has a receptacle for the Army-type plug on the top surface of the tester; it has no receptacle for the Navy-type plug.

Two test leads are issued with the instrument for use on rockets without electrical connector plugs. Each test lead assembly consists

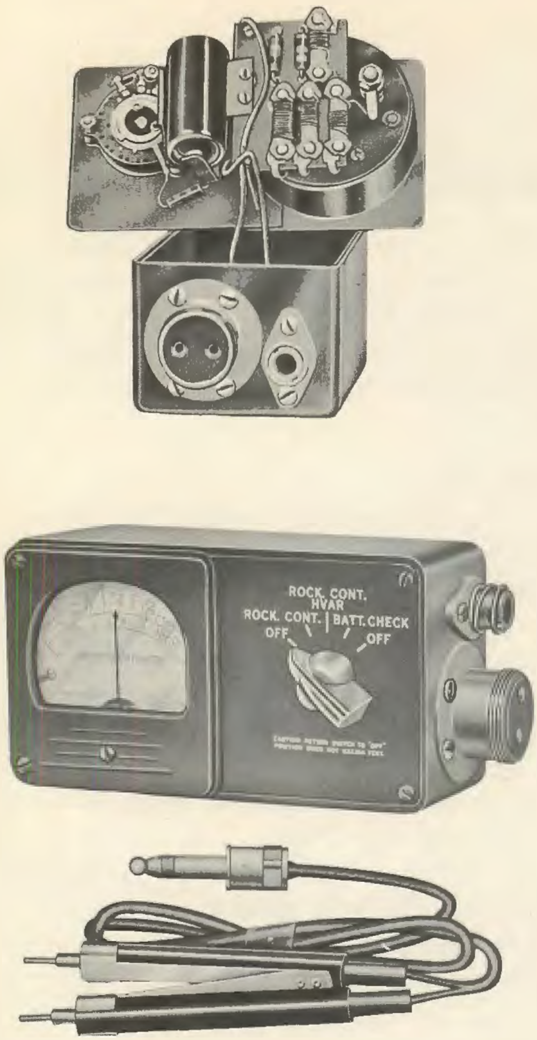


Figure 7.1—Circuit Continuity Tester Model 680A, External and Disassembled Views with Test Leads.

Figure 7.2—Circuit Continuity Tester Model 680B, External and Disassembled Views with Test Leads.

of two prods, joined by means of long leads to an Army plug or jack plug. The prods are maintained a fixed distance apart by a distance member. These leads are used to test rocket motors, such as those used in 5.0-inch spin-stabilized surface rockets, which have motor igniter lead wires terminating in an insulated contact band and the motor tube.

> CAUTION: The rocket circuit continuity tester should not be issued or used aboard ships without specific authority of the Bureau of Ordnance.

Preparing Test Set for Use

Zeroing the Pointer. The procedure for zeroing the meter calibration pointer is as follows.

1. Turn the switch off.
2. Turn the adjusting screw slowly and carefully so that the pointer rests directly over the index mark centered over OK on the dial.

Checking the Dry Cell. The procedure for checking the dry cell of the circuit continuity tester is as follows.

1. Remove the Army plug from the socket.

2. Turn the switch to BATT CHECK and note the reading on the dial.

3. Turn the switch to OFF. A good dry cell is indicated by a pointer deflection to the right of the line marked BATTERY OK. A low dry cell (15 percent below normal) is indicated by a pointer deflection to the left of the line marked BATTERY OK.

Replacing the Dry Cell. Figures 7.1 and 7.2 show the location of the dry cell battery in Models 680A and 680B. The procedure for replacing a bad dry cell is as follows.

1. Unscrew the four screws in the corners of the instrument and remove the face of the instrument by lifting it away from the base and turning the face over.

2. Replace the dry cell with a Dry Battery BA–42 or an authorized equivalent. Make sure that the center terminal of the dry cell is toward the long battery-holder member marked with a red dot.

3. Replace the face of the instrument and repeat the dry-cell check. If the dry cell tests OK, the motor-circuit test may be performed.

> CAUTION: Dry cells should be changed by authorized personnel only. Any damage to the test set might cause abnormal currents to be delivered to the rocket-motor igniter circuit.

Handling Precautions.

1. It is important that the test set be handled carefully at all times to prevent damage to the internal and external parts.

2. When the instrument is returned to its carrying case, the motor end should always be toward the bottom of the case. Keep the test set and carrying case dry.

Test Procedures

Rocket motors shall be tested for continuity only in a Bureau-of-Ordnance-approved rocket assembly building which provides a suitable barricaded or isolated cell. A minimum of personnel shall be present when motor circuits are being tested.

Rocket-motor igniter circuits shall be tested only while the motor is in the non-propulsive state; that is, before assembly of motors and heads. All personnel should keep clear of the ends of the motor in case of accidental ignition.

The procedure for testing rocket motors that have electric plugs is as follows.

1. Check the test-set battery.

2. Turn the switch to the type of rocket being tested. For surface rocket motors covered in this pamphlet turn the switch to ROCK CONT. Read the higher scale.

3. Remove the shorting clip or other shorting device from the motor electrical connector plug. Insert the plug into the appropriate socket on the instrument. Note the movement of the pointer on the meter.

4. If the pointer rests within the space marked OK, the motor is satisfactory for use. Do not use the motor if the pointer rests within the LOW or HIGH regions of the scale.

5. Remove the plug from the socket and turn the switch off. Replace the shorting clip or other shorting device on the electrical connector plug.

The procedure for testing rocket motors with contact rings, shrouds, or contact discs is as follows.

1. Check the test-set battery.

2. Insert the plug of the test leads firmly into the Army socket on the test set.

3. Turn the switch to ROCK CONT.

4. Remove the short-circuiting band, clip, or other shorting device from the rocket motors.

5. To test motors with contact rings, figure 7.3, or contact shrouds, touch one prod of the test leads (both prods in distance member) to one contact ring or shroud of the motor and, at the same time, touch the other prod to the other contact ring or shroud.

6. To test motors with contact discs, disengage one of the prods from the distance member. Touch one prod to the contact disc and, at the same time, touch the other prod to the motor tube.

7. Note the movement of the pointer on the meter. If it rests within the space marked OK, the motor is satisfactory for use. Do not use the motor if the pointer rests within the LOW or HIGH regions of the scale.

8. Remove the prods from the meter and withdraw the Army plug from the test set.

Figure 7.3—Testing of a 5.0-Inch Rocket Motor Igniter Circuit with Circuit Continuity Tester Model 680A.

9. Turn the switch off. Replace the short-circuiting band, clip, or other shorting device on the motor.

Handling Precautions.

1. Keep the tester switch in the OFF position at all times when the instrument is not in use. Failure to do so will cause the battery to run down.

2. Equipment containing batteries or other sources of electricity must never be tested with this circuit continuity tester. The meter or Wheatstone bridge circuit can be burned out.

Appendix A

RANGE TABLE PUBLICATIONS

Ballistic data given in the following range tables are based on the results of proving-ground firing and calibration tests, and represent as nearly as possible the mean performance of surface rockets and projector charges in prescribed service applications. These publications provide ballistic information which serves as a basis for fire-control graduation, sight setting, and the solution of ballistic problems arising in the use of surface rockets and projector charges against surface and underwater targets.

Range Tables

Size	Type	Mk-Mod	Average Weight (lb)	Range (yd)	Range Table
		SURFACE ROCKETS			
5.0-Inch	HE, SS	Mk 7 Mods 2 and 3	49. 5	10, 050	OP 2031
5.0-Inch	HE, SS	Mk 10 Mods 0 and 3	50. 1	4, 620	OP 1498
5.0-Inch	VT, SS	Mk 10 Mods 1 and 2	50. 7	4, 620	OP 1498
5.0-Inch	HE, SS	Mk 13 Mod 0	51. 9	2, 145	OP 2029
5.0-Inch	HE, SS	Mk 16 Mod 0	54. 3	1, 480	OP 1498
5.0-Inch	AP, SS	Mk 24 Mods 0 and 1	50. 7	9, 180	OP 2030
5.0-Inch	SMOKE-TAR, SS	Mk 27 Mod 0	43. 7	4, 620	OP 1498
7.2-Inch	HE, ASW	Mk 1 Mod 3	62. 2	300	OP 1437
		PROJECTOR CHARGE			
7.2-Inch	HE, ASW	Mk 10 Mod 0	67	200	OP 1940
7.2-Inch	HE, ASW	Mk 10 Mod 1	65	285	OP 1925

Appendix B

OBSOLESCENT COMPONENTS AND ASSEMBLIES

Some obsolescent rounds that still are capable of use but generally have been replaced by more current rounds are treated in this appendix. Those obsolescent rocket motors that are used with the NAE Beacons also are treated here.

The general instructions in chapter 5 pertaining to rocket assemblies are applicable also to these rounds.

See OP 1515 (Second Revision), Unserviceable Ammunition for information concerning rounds and components which have been declared obsolete.

495862 O—59——11

2.5-INCH ROCKET MK 1 MOD 2 (SURFACE, PRAC, SUBCALIBER, ASW)

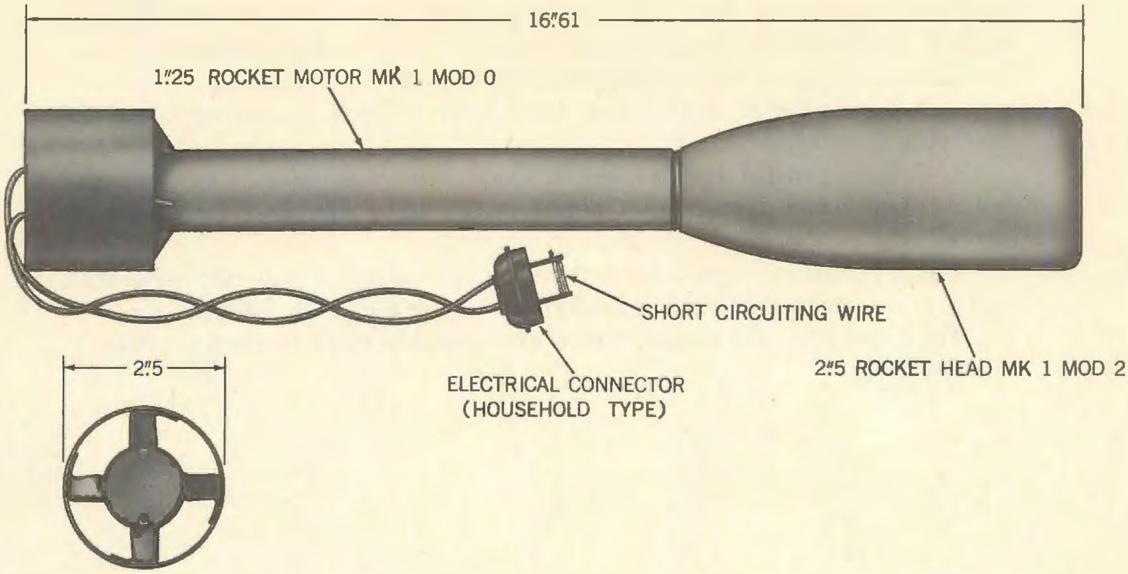


Figure B.1—2.5-Inch Rocket Mk 1 Mod 2 (Surface, PRAC, SUBCALIBER, ASW), External View.

Mark	1
Mod	2
General Arrangement	330232
List of Drawings	91326
Nominal Velocity (fps)	175
Nominal Weight (lb)	8.74
Overall Length (in.)	16.61
Head, 2.5-Inch, Mk-Mod	1–2 or 3
Motor, 1.25-Inch, Mk-Mod	1–0
Propellent Grain Mk-Mod	4–0 or 1
Nose Fuze Mk-Mod	None
Base Fuze Mk-Mod	None
Range (yd at 49° launcher elevation)	286
C.G., Before Burning (in.) (Measured from rear)	11.65
C.G., After Burning (in.) (Measured from rear)	11.87
Ballistic Table in OP	1437
Container	329948

Special Information

The 2.5-Inch Surface Rocket Mk 1 Mod 2 (Minnie Mouse) is the subcaliber practice round for 7.2-Inch Surface Rocket Mk 1. It is forward-fired from surface craft for practice against submarines. This subcaliber round simulates trajectories of 7.2-Inch Surface Rocket Mk 1. It consists of a solid 2.5-inch head and a live-loaded 1.25-inch motor. The head is not fuzed.

In assembling 2.5-Inch Rocket Mk 1 Mod 2, proceed as follows.

1. Follow general instructions in chapter 6 when preparing head and motor for assembly.

2. Follow general instructions in chapter 6 when assembling head and motor. Use a strap wrench, if necessary, to drive the head fully into the motor.

For information regarding the removal of misfired or unfired rounds from the launcher, see the general instructions in chapter 6 and OP 1002.

To disassemble the rocket, follow the assembly steps in reverse order.

3.5-INCH ROCKET MK 4 MOD 5 (SURFACE, W)

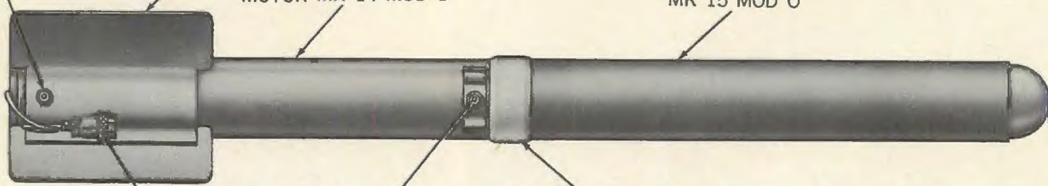


Figure B.2—3.5-Inch Rocket Mk 4 Mod 5 (Surface, W), External View.

Mark	4
Mod	5
General Arrangement	
List of Drawings	
Nominal Velocity (fps)	400
Nominal Weight (lb)	31.5
Overall Length (in.)	44.0
Head, 3.5-Inch, Mk-Mod	15–0
Head Load Mk-Mod	5–0
Motor, 3.25-Inch, Mk-Mod	14–1
Propellent Grain Mk-Mod	7–1
Igniter Mk-Mod	111–0
Electrical Connector Mk-Mod	7–0
Ejector Delay Fuze Mk-Mod	134–0
Range (yd)	2000
Ballistic Table in OP	
Head	437890
Containers:	
Motor	3–0

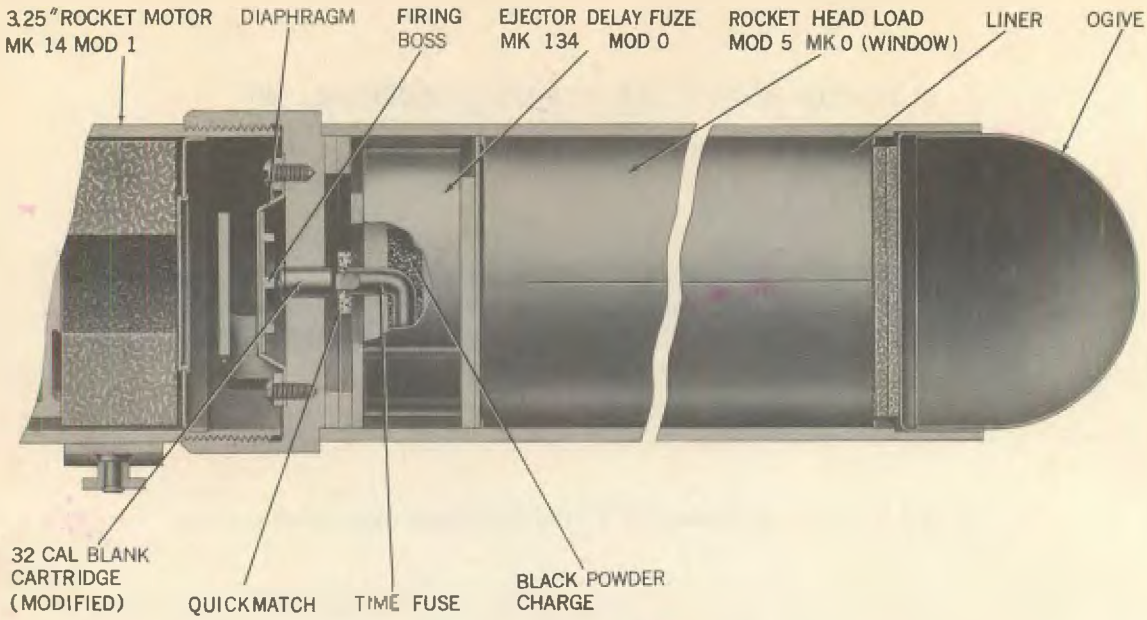


Figure B.3—3.5-Inch Rocket Mk 4 Mod 5 (Surface, W), Partial Cross Section.

Special Information

The 3.5-Inch Window Rocket Mk 4 Mod 5 is a fin-stabilized rocket fired from surface craft. Metal-foil strips ejected from the head are dispersed in the air to jam enemy radar detection.

For information on the rocket launchers used with this round, see OP 1304.

The 3.5-Inch Rocket Head Mk 15 Mod 0 contains the rocket-head load which consists of 76,800 paper-coated foil strips, each of which is 1⅞-inch long, 3/16-inch wide, and 0.003-inch thick. The strips are packed into an ejection liner consisting of two steel half-shells.

The head load is ejected from the head in a forward direction by Ejector Delay Fuze Mk 134 Mod 0. The fuze consists of a closed plastic case containing 20 grams of black powder and a length of time fuse sheathed in plastic tubing. A length of quickmatch is clamped to one end of the time fuse. Fuze Mk 134 is fired by an ignition system housed in the base of the head, aft of the fuze. The principal part of the ignition system is a copper diaphragm, in the center of which is a small firing boss. Gas pressure from the burning of the rocket-motor propellant soon after ignition snaps the diaphragm forward, causing the firing boss to strike the primer of a modified .32-caliber blank cartridge. The flash from the cartridge ignites the exposed end of the time fuse. After this time fuse burns for approximately 15 seconds, it ignites the black powder and ejects the rocket-head load. The liner halves fall open and the strips are dispersed in the air.

In assembling 3.5-Inch Window Rocket Mk 4 Mod 5, proceed as follows.

1. Follow general instructions in chapter 6 when preparing head and motor for assembly.
2. Follow general instructions in chapter 6 when assembling head and motor.

For information regarding the removal of misfired or unfired rounds from the launcher, see the general instructions in chapter 6.

To disassemble the rocket, follow the assembly steps in reverse order.

4.5-INCH ROCKET MK 1 MOD 0 (SURFACE, HE)

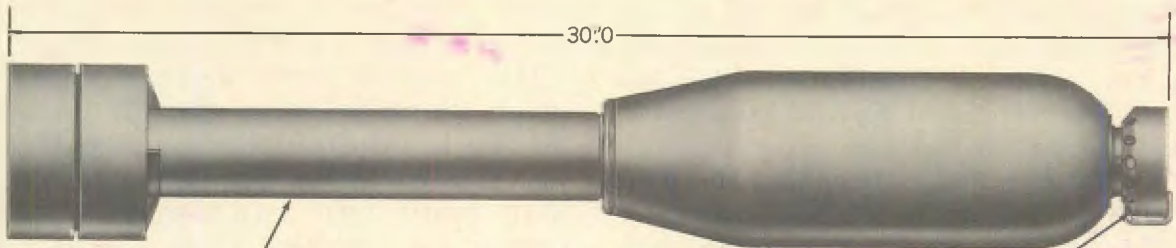


Figure B.4—4.5-Inch Rocket Mk 1 Mod 0 (Surface, HE), External View.

Mark	1
Mod	0
General Arrangement	
List of Drawings	
Nominal Velocity (fps)	355
Nominal Weight (lb)	28.7
Overall Length (in.)	30.0
Head, 4.5-Inch, Mk-Mod	3–0
Motor, 2.25-Inch, Mk-Mod	9–0
Propellent Grain Mk-Mod	1–0
Igniter Mk-Mod	Mk 104 or Mk 106
Nose Fuze Mk-Mod	145–1
Auxiliary Booster Mk-Mod	3–0, 1
Number of Boosters	1
Range (yd)	1130
Ballistic Table in OP	
Container Mk-Mod	1–0 or 2–0

Special Information

The 4.5-Inch Surface Rocket Mk 1 Mod 0 is a lightweight rocket fired from small landing craft, amphibious trucks, or other vehicles, and is used primarily for beach barrage purposes.

For information on the rocket launchers used with this round, see OP 1304.

The 4.5-Inch Rocket Head Mk 3 Mod 0 contains a high-explosive filler and is shipped with the auxiliary booster installed in the fuse seat liner. The rear end of the head has a motor-head adapter.

The 2.25-Inch Rocket Motor Mk 9 Mod 0 has a silica gel desiccant in the motor nozzle.

The Nose Fuze Mk 145 Mod 1 is a setback and air-arming, impact-firing rocket fuze. It incorporates a 0.02-second delay in its detonator assembly.

This fuze is detonator safe; however, should the detonator function while the fuse is unarmed, the force of the detonator action will be dissipated forward through a hole in the firing-pin guide away from the remaining explosive components.

Nose Fuze Mk 145 Mod 1 is provided with a safety locking wire, which is bent so that one end can pass through holes in the fuze body to lock the internal setback block in the forward position. It also causes the propeller locking pin to engage the propeller hub. The other end of the locking wire passes over the propeller guard to prevent the propeller from rotating. The propeller guard is a circular metal piece surrounding the propeller vanes. It has holes around its base to permit air to pass by the vanes.

If the fuze becomes armed accidentally, no attempt should be made to unarm it. If the fuze is armed, turning the propeller counterclockwise will cause the fuze to operate. The fuze is considered to be armed when the propeller is free to rotate. To dispose of a fuze or fuzed round, the fuze propeller should be taped carefully and the fuze or fuzed round disposed of in accordance with existing instructions.

Before assembling the round, each of the components should be inspected to see that it is not damaged in any way and that it is safe to handle.

The fuze must be checked to see if the forward tips of the propeller blades extend out beyond the plane of the rim of the propeller guard. The fuze is considered armed when in this condition and should be disposed of.

If the propeller is below the propeller guard, remove the safety locking wire. Try to turn the vane in a clockwise direction to see if the vane is locked by the vane locking pin. DO NOT TURN THE VANE MORE THAN ONE-HALF A TURN. If the propeller can be turned, consider the fuze armed and dispose of it. If the propeller cannot be turned in the clockwise direction, try to turn it in the opposite direction. If the propeller can be turned counterclockwise, give it one-half a turn and see that the propeller locking pin snaps into the nearest hole in the propeller hub. Replace the safety locking wire, and the fuze is safe to handle.

In assembling 4.5-Inch Rocket Mk 1 Mod 0, proceed as follows.

1. Follow general instructions in chapter 6 when preparing head and motor for assembly.
2. Follow general instructions in chapter 6 when assembling head and motor. Use a strap wrench if available; if not, the two parts can be made handtight by giving the motor a quick turn just before it starts to become tight in the head. Make sure that at least 1 inch of the motor threads engage the motor-head adapter.
3. Follow general instructions in chapter 6 for preparation and installation of the nose fuze.

For information regarding the removal of misfired or unfired rounds from the launchers, see the general instructions in chapter 6.

To disassemble the rocket, follow the assembly steps in reverse order.

4.5-INCH ROCKET MK 4 MOD 2 (SURFACE, SMOKE-PWP)

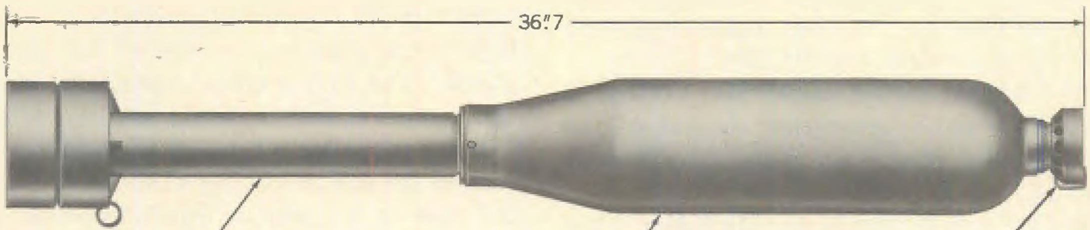


Figure B.5—4.5-Inch Rocket Mk 4 Mod 2 (Surface, SMOKE-PWP), External View.

Mark	4
Mod	2
General Arrangement	
List of Drawings	
Nominal Velocity (fps)	355
Nominal Weight (lb)	28.8
Overall Length (in.)	36.7
Head, 4.5-Inch, Mk-Mod	10–0
Motor, 2.25-Inch, Mk-Mod	9–0
Propellent Grain Mk-Mod	1–0
Igniter Mk-Mod	Mk 104 or Mk 106
Nose Fuze Mk-Mod	154–3
Range (yd)	1130
Ballistic Table in OP	
Container Mk-Mod	4–0

Special Information

The 4.5-Inch Surface Rocket Mk 4 Mod 2 is a lightweight rocket fired from small landing craft, amphibious trucks, or other vehicles, and is used for laying down screening smoke.

For information on the rocket launchers used with this round, see OP 1304.

The 4.5-Inch Rocket Head Mk 10 Mod 0 contains the smoke-generating element of the round, usually plasticized white phosphorous (PWP).

The 2.25-Inch Rocket Motor Mk 9 Mod 0 has a silica gel desiccant in the motor nozzle.

Nose Fuze Mk 154 Mod 3 is a setback and air-arming, impact-firing rocket fuze. It has a tetryl-filled, 14-inch burster tube attached to the base of the fuze body.

This fuze is detonator safe; however, should the detonator function while the fuze is unarmed, the force of the detonator action will be dissipated forward through a hole in the firing-pin guide away from the remaining explosive components.

Nose Fuze Mk 154 Mod 3 is provided with a safety locking wire which is bent so that one end can pass through holes in the fuze body to lock the internal setback block in the forward position. It also causes the propeller locking pin to engage the propeller hub. The other end of the locking wire passes over the propeller guard to prevent the propeller from rotating. The propeller guard is a circular metal piece surrounding the propeller vanes. It has holes around its base to permit air to pass by the vanes.

If this fuze becomes armed accidentally, no attempt should be made to unarm it. If the fuze is armed, turning the propeller counterclockwise will cause the fuze to operate. The fuze is considered to be armed when the propeller is free to rotate. To dispose of a fuze or fuzed round, the fuze propeller should be taped carefully, and the fuze or fuzed round disposed of in accordance with existing instructions.

Before assembling the round, each of the components should be inspected to see that it is not damaged in any way and that it is safe to handle.

The fuze must be checked to see if the forward tips of the propeller blades extend out beyond the plane of the rim of the propeller guard. The fuze is considered armed when in this condition, and it should be disposed of.

If the propeller is below the propeller guard, remove the safety locking wire and try to turn the vane in a clockwise direction to see if the vane is locked by the vane locking pin. DO NOT TURN THE VANE MORE THAN ONE-HALF A TURN. If the propeller can be turned, consider the fuze armed and dispose of it. If the propeller cannot be turned in the clockwise direction, try to turn it in the opposite direction. If the propeller can be turned counterclockwise, turn it one-half a turn and see that the propeller locking pin snaps into the nearest hole in the propeller hub. Replace the safety locking wire and the fuze is safe to handle.

In assembling 4.5-Inch Rocket Mk 4 Mod 2, proceed as follows.

1. Follow general instructions in chapter 6 when preparing head and motor for assembly.
2. Follow the general instructions in chapter 6 when assembling head and motor. Use a strap wrench if available; if not, the two components can be made handtight by giving the motor a quick turn just before it starts to become tight in the head. Make sure that at least 1 inch of the motor threads engage the motor-head adapter.
3. Follow general instructions in chapter 6 for preparation and installation of the nose fuze.

For information regarding the removal of misfired or unfired rounds from the launcher, see the general instructions in chapter 6.

To disassemble the rocket, follow the assembly procedure in reverse order.

NAE BEACON MK 1 MOD 4 WITH 1.25-INCH ROCKET MOTOR MK 5 MOD 0

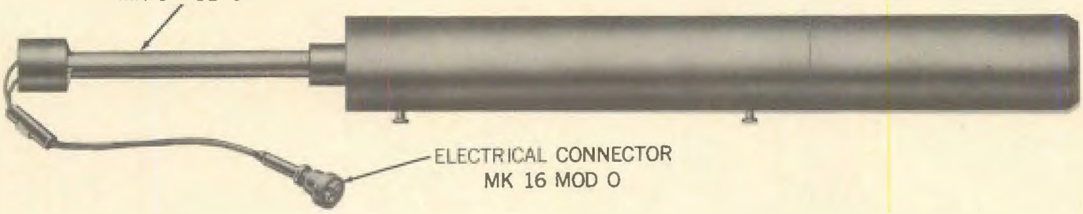


Figure B.6—NAE Beacon Mk 1 Mod 4, with 1.25-Inch Rocket Motor Mk 5 Mod 0, External View.

NAE Beacon Mk-Mod	1–4
1.25-Inch Rocket Motor Mk-Mod	5–0
Loading Assembly No	655886
List of Drawings	174577
Lot No. Prefix	RMAD
Type Stabilization	Fin
Nominal Weight Shipped (lb)	1.87
Nominal Weight Fired (lb)	1.87
Thrust (lb)	320
Maximum Length (in.)	13.50
Fin Diameter (in.)	2.50
Burning Time (sec.)	0.19
Propellent Grain Mk-Mod	12–1
Igniter Mk-Mod	105–0 or 1
Electrical Connector Mk-Mod	16–0
Container Mk-Mod	1–0

Special Information

The NAE Beacon is propelled by 1.25-Inch Rocket Motor Mk 5 Mod 0. The motor has four fins placed 90 degrees apart, parallel to the motor tube axis. The fins are surrounded by a single circular shroud.

The round is held on the launcher ways by lugs on the beacon. The motor has no lugs. For information on Launcher Mk 38 Mods 0 and 1 used with this round, see OP 1805, Beacon Launching System Mk 2 Mod 0, and OP 1826, Beacon Launching System Mk 3 Mod 0.

NAE BEACON MK 1 MOD 5 WITH 2.25-INCH ROCKET MOTOR MK 14 MOD 1

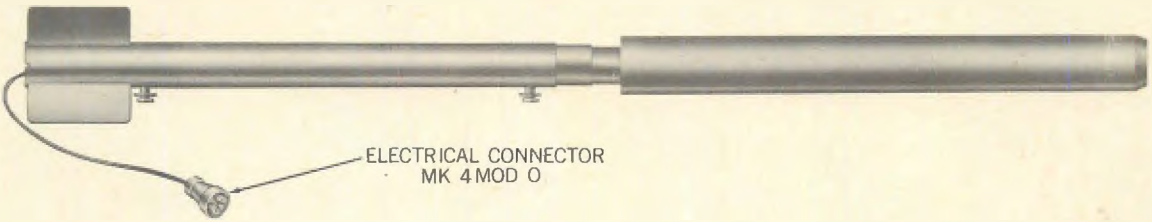


Figure B.7—NAE Beacon Mk 1 Mod 5, with 2.25-Inch Rocket Motor Mk 14 Mod 1, External View.

NAE Beacon Mk-Mod	1–5
2.25-Inch Rocket Motor Mk-Mod	14–1
Loading Assembly No.	
List of Drawings	
Lot No. Prefix	RMBG
Type Stabilization	Fin
Nominal Weight Shipped (lb)	9.75
Nominal Weight Fired (lb)	9.72
Thrust (lb)	525
Overall Shipping Length (in.)	26.28
Maximum Length (in.)	26.18
Fin Diameter (in.)	8.25
Distance Between Lugs (in.)	18.50
Burning Time (sec.)	0.47
Propellent Grain Mk-Mod	17–0
Igniter Mk-Mod	113–0
Electrical Connector Mk-Mod	4–0
Container Mk-Mod	1–0 or 2–0

Special Information

The NAE Beacon is propelled by 2.25-Inch Rocket Motor Mk 14 Mod 1. The motor has four fins placed 90 degrees apart, parallel to the motor tube axis.

The round is held on the launcher ways by lugs on the motor tube. For information on Launcher Mk 39 Mods 0 and 1 used with this round, see OP 1805, Beacon Launching System Mk 2 Mod 0, and OP 1826, Beacon Launching System Mk 3 Mod 0.

Appendix C

ASSOCIATED PUBLICATIONS

A list of publications for the guidance of personnel using rocket ammunition follows:

OP 1001	Projectors Mk 10, Mk 10 Mod 1, and Mk 11, and Ammunition; Description and Instructions for Use.
OP 1002	7.2-Inch Rocket Launchers Mk 20, Mk 22, and Ammunition.
OP 1244	Rocket Launchers Mk 50 Mods 0 and 1; Description and Instructions for Use.
OP 1246	Rocket Launcher Mk 51 Mod 0; Description and Instructions for Use.
OP 1304	Rocket Launchers and Related Equipment.
OP 1415	Rocket Assemblies.
OP 1424	Rocket Launcher Assembly Mk 102 Mod 0; Description and Instructions for Use.
OP 1515	Restricted and Unserviceable Ammunition.
OP 1805	Beacon Launching System Mk 2 Mod 0; Description and Instructions.
OP 1826	Beacon Launching System Mk 3 Mod 0; Description and Instructions.
OP 2110	Rocket Launcher Mk 105 Mod 2, Description, Operation, and Maintenance.

SAFETY PRECAUTIONS

General Precautions

1. The Bureau of Ordnance shall be informed of any circumstances which conflict with the safety precautions or which, for any reason, require changes in or additions to them.

2. When in doubt as to the exact meaning of a safety precaution, an interpretation shall be requested from the Bureau of Ordnance.

3. Do not make changes in or additions to rocket material without explicit authority from the Bureau of Ordnance.

4. No ammunition or explosive assembly shall be used in any rocket launcher for which it is not designated.

5. No ammunition other than dummy-drill shall be used for drill.

Operating Precautions

1. Except for ready service rounds, do not assemble rockets and projector charge assemblies until just before they are to be fired. If this is not practicable, assemble them as near to this time as is feasible.

2. Do not fire a rocket when the motor has been exposed for more than one hour to temperatures outside the safe firing temperature limits specified on the motor tube. If fired at too high a temperature, the motor may burst. If fired at too low a temperature, the incomplete burning of the propellant may expel burning slivers of ballistite.

3. If, during stowage, the rocket motor temperature has gone above or below the temperature range marked on the motor tube, it shall not be fired until after it has been kept for 6 hours within the required temperature range.

4. Never remove the short-circuiting clip, plug, or band from a rocket motor until just prior to loading it on the launcher. Retain the clip, plug, or band, in case the rocket is not fired.

5. Safety pins or other devices requiring removal before firing shall not be removed until the ammunition has been loaded in projectors or launchers, and not until after the arming wire or device has been put in place.

6. Fuze-arming wires or devices shall not be removed from the unarmed position until just before firing.

7. When the launcher or projector is loaded and in firing position, keep all other rockets or projector charges to the side and at a safe distance.

8. Rockets or projector charges made ready for firing but not fired shall be made "safe" as soon as possible.

9. When removing a round from a launcher or projector, the fuze safety wire shall be inserted only after the safety plug is removed from the firing panel or the firing key is removed from the launcher.

10. Fuzes which have been set to an ON or SQ position shall be reset to the OFF or DELAY position before they are returned to storage.

Precautions in Event of Misfires

1. De-energize the firing circuit by removing the safety plug in the firing panel or disconnecting the firing key from the cable leading to the power receptacle.

2. Keep unnecessary personnel out of the danger area and keep the tube aimed clear of the ship's structure, friendly ships, and/or friendly areas.

3. If the rocket was one being fired from a multiple launcher and the launcher tube in which the misfire occurred is likely to be hot enough to cook-off the misfired round, water should be applied to the whole length of the heated tube until it stops steaming.

4. Wait ten minutes before approaching the rocket. In time of action, this waiting period may be waived by the Commanding Officer.

5. Approach the launcher from the side and replace the short-circuiting clip, band, or plug of the rocket motor. If this cannot be replaced

495862 O—59——12

before removal of the rocket from the launcher, do so as soon as possible thereafter.

6. If the electric firing circuit is in order, the misfire may be attributed to an internal defect of the motor. The motor should be disposed of in accordance with current regulations.

Handling Precautions

1. Handle rockets or rocket components as little as possible.

2. Instruct personnel who will be involved in the handling as to the nature of the material. If working with chemical rocket heads, protective gear should be on hand. When entering concentrated smoke clouds produced by smoke rockets, personnel should wear gas masks. Only those men essential for handling should be in the area.

3. In fuzing, defuzing, assembling, disassembling, cleaning, or painting, choose a location safely removed from other explosives and vital installations. Operate on the smallest number of rounds practicable.

4. Handle rockets and projector charges which are fuzed or assembled with firing mechanisms as if they are armed. An assembled round may become accidentally armed in handling or stowage. It is not always possible to ascertain readily whether this arming has taken place.

5. Certain types of rockets and projector charges are normally issued unfuzed. Do not insert the fuzes in such rounds until just prior to firing.

6. Do not remove base fuzes from rocket heads at any time. Before assembling a head to a motor, make certain that the fuze is securely in place.

7. No disassembly of rocket motor components as shipped is authorized. The propellent grain is not to be removed from the motor tube under any circumstances.

NOTE: Paragraphs 6 and 7 do not apply to authorized production and renovation activities.

8. Do not use a circuit continuity tester aboard ship unless specifically authorized by the Bureau of Ordnance. The electric circuit should be checked before the motor is placed on board.

9. Fuzes or firing mechanisms for rockets and projector charges shall not be removed, disassembled, repaired, or in any way altered, except as provided by special instructions from the Bureau of Ordnance.

10. Under no circumstances are nose fuze adapters or base plates to be removed from a head. If a fuze adapter becomes loose while a fuze is being removed from a head, stop and do not disassemble; such an assembly of fuze and head will be considered hazardous.

11. If dropped from a height exceeding 5 feet, a fuzed rocket head (whether or not in a container) shall be returned to an ammunition depot. If the return to the depot is not practicable, the head shall be disposed of as instructed by the Bureau of Ordnance.

Stowage Precautions

1. Rocket motors shall be stowed separately from rocket heads where possible. The rocket motor is not propulsive unless joined to the head.

2. Electrically fired rocket motors, and electric or electronic fuzes shall not be stowed in the same compartment with, or be exposed within 5 feet of, any exposed electronic transmitting apparatus, or exposed antenna leads. An exception can be made when the electronic apparatus or antenna is a part of authorized test equipment of a weapon or is integral with a weapon containing such a rocket motor. In this event, the special instructions pertinent thereto shall apply.

3. Do not allow matches, naked lights, or any open flame in the vicinity of rocket stowage.

4. Rockets containing pyrotechnic material, such as flares or an incendiary mixture, shall be stowed in regular pyrotechnic storage spaces, if such are provided, or in pyrotechnic lockers on upper decks.

5. Nothing shall be stowed in rocket ammunition magazines except rocket ammunition, its containers, and authorized magazine equipment. No oily rags, waste, or material susceptible to spontaneous combustion shall be stowed in these spaces.

6. Remove all rocket explosive components from a magazine before work which might

cause an abnormally high temperature or an intense local heat is undertaken in the magazine.

7. After assembly, rockets shall be stowed topside in ready-service stowage or at least protected from water and direct rays of the sun.

8. Prolonged stowage of rocket propellents at or about 100° F is hazardous.

Precautions for Water-Travel-Arming Nose Fuzes

1. The safety pin must be in place through the setback collar at all times and must not be removed until just prior to the firing of the round. In case the round is not fired immediately after removal of the safety pin, the safety pin must be reinserted.

2. The setback collar of this fuze must not be retracted manually under any operating conditions.

Precautions for 2.25-Inch Projector Charge Tail Mk 6 Mod 0

Do not assemble or disassemble this round. Return it to the ammunition depot intact.

Precautions for Disassembling Complete Rounds

1. It is important that the fuze wrench designed for use with any particular fuze be used to remove the fuze from the round. Use of an improper wrench may engage the wrong holes, flats, or slots and result in arming of the fuze.

2. If the fuze adapter becomes loose while the fuze is being removed, stop the operation. Grains of explosive may be lodged between the adapter threads and head threads, and unscrewing the adapter may pinch the explosive, and cause an explosion.

Precautions for Removal of 5.0-Inch Spin-Stabilized Rockets from Containers

If an attempt is made to remove the motor or round from a position other than the horizontal, there is a tendency for the extractor to slip off. This may result in damage to the motor or round.

Precautions for Assembling 5.0-Inch Spin-Stabilized Rockets

1. Do not remove the felt spacers which are necessary for the proper spacing of the head, igniter, and propellent grain.

2. Do not remove the rear closure of the motor. Flame might enter the nozzles and ignite the propellent prematurely. A rocket without a rear closure, placed in the magazine of an automatic launcher, might be ignited by the exhaust blast deflected from a rocket in the firing tube. The launcher would be damaged and, since the spinning of the rocket would arm the fuze, the head might be detonated.

Precautions for Disassembling 5.0-Inch Spin-Stabilized Rockets

Make certain that the short-circuiting band is in place on the motor, and that the fuze cannot be armed.

Precautions for Using Circuit Continuity Testers

1. The rocket circuit continuity tester should not be issued or used aboard ships without specific authority of the Bureau of Ordnance.

2. Dry cells should be changed by authorized personnel only. Any damage to the test set might cause abnormal currents to be delivered to the rocket-motor igniter circuit.

Handling Precautions for Circuit Continuity Testers

1. It is important that the test set be handled carefully at all times to prevent damage to the internal and external parts.

2. When the instrument is returned to its carrying case, the meter end should always be toward the bottom of the case. Keep the test set and carrying case dry.

3. Keep the tester switch in the OFF position at all times when the instrument is not in use. Failure to do so will cause the battery to run down.

4. Equipment containing batteries or other sources of electricity must never be tested with the circuit continuity tester. The meter or Wheatstone bridge circuit can be burned out.

INDEX

S

T

U

V

W

DISTRIBUTION

SNDL Part 1 (No. 70) and Part 2 (No. 27)

One copy each:

21; 22 (2nd); 23; 24B,24C,24F,24G,24H,24J; 27C.

Two copies each unless otherwise indicated:

24A,24E (3 copies); 26A,26F,26H; 29E,29–O; 31L; 32C,32S,32W; 45S; B5; F2 (except 3rd, PRNC),F3; J4,J12,J28,J33,J56,J60,J71,J76,J97,J98; K2A (5 copies),K5B (11 copies),K5E,K8,K12; R13,R20.

Requests for additional copies of OP 2211 Volume 1 should be submitted on DD Form 1149 to the appropriate Forms and Publications Supply Point in accordance with the applicable portions of the BUSANDA Manual.

11 December 1958/1500/1

O