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OP 1017

(SECOND REVISION)

C.2

FUZES
FOR
ROCKETS AND PROJECTOR CHARGE



A BUREAU OF ORDNANCE PUBLICATION

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NAVY DEPARTMENT
BUREAU OF ORDNANCE
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14 June 1948

ORDNANCE PAMPHLET 1017 (SECOND REVISION)
FUZES FOR ROCKETS AND PROJECTOR CHARGE

1. Ordnance Pamphlet 1017 (Second Revision) describes the Rocket and Projector Charge Fuzes (except VT fuzes) and contains the general data, description, functioning, safety features, disposal and servicing, installation, and packing and marking information on these fuzes.

2. It is important that a full and complete report of malfunctioning or difficulties encountered with any fuze be made to the Chief of the Bureau of Ordnance, Navy Department, Washington 25, D. C. The report should contain a detailed identification, particularly the mark and mod, lot number, and any other discernible markings appearing on the fuze. The report should also contain all information concerning conditions, history, and description of the trouble.

3. Ordnance Pamphlet 1017 (First Revision) dated 13 June 1944 and NavOrd OHI A5-44 dated 24 March 1944, are hereby superseded and should be destroyed.

4. It is not intended that this publication be carried in aircraft for use therein.

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A. G. Noble

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Rear Admiral, U. S. Navy
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INTRODUCTION

Purpose

The purpose of this Ordnance publication is to acquaint personnel with the rocket and projector charge fuzes now in use and those rocket fuzes which may not have been produced for the purpose of issue but which may be released for production should circumstances warrant.

Content of Publication

Illustrations are included for each type of fuze. In general, the explanatory matter is arranged to cover General Data, Description, Functioning, Safety Features, Disposal and Servicing, Installation in Rocket, and Packing and Marking for each fuze described. In addition the introduction lists and briefly describes the various forces which determine rocket fuze design, explosive components utilized, safety features and methods of test. Radio proximity fuzes are not included in this pamphlet but are described in OP 1470 and OP 1480.

Classes of Fuzes Used in Rockets

There are three general classes of fuzes used in rockets which are as follows:

- Nose Fuzes
- Base Fuzes
- Auxiliary Detonating Fuzes

Types of Rocket Fuzes

Rocket fuzes may be classified according to the type of rocket in which they are employed:

1. Fuzes for fin-stabilized (non-rotating) rockets which include both nose and base fuzes. This includes rockets launched from aircraft and those launched from ground or shipboard.
2. Fuzes for spin-stabilized (rotating rockets) which may be either nose or base and also include the auxiliary detonating fuzes when nose fuzes are employed.
3. Fuzes for anti-submarine rockets or projector charges which generally depend on passage through water to complete arming.

Forces Used in Arming Rocket Fuzes

The forces which are utilized in rocket fuzes depend upon the characteristics of the rocket for which the fuze is designed. The principal forces used in arming gun ammunition fuzes are those due to setback in the bore of the gun, and centrifugal force due to spin. The principal force utilized in bomb fuzes is that exerted by the wind stream as the bomb falls through the air. These forces are also present in rockets but in different degrees and the design of rocket fuzes is controlled to a great extent by what forces are available that can be utilized.

1. Acceleration (setback). Long burning times and low accelerations, as compared to gun ammunition, are characteristic of rockets. Acceleration attained is greatly dependent upon the initial temperature of the propellant of the rocket motor and is quite low for lower temperatures. Because of this condition, fuzes actuated by setback forces must be designed to operate at the minimum acceleration. Setback is often utilized to delay the arming of rocket fuzes. Small setback forces are made effective where applicable by making the parts operated by setback relatively massive and springs relatively weak as compared to gun ammunition fuzes.

2. Wind forces. The force exerted by the wind stream past the rocket in flight is utilized to arm many rocket nose fuzes for fin-stabilized rockets.

3. Gas pressure of 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, if present. This pressure is fairly constant during burning and is in the magnitude of several hundred pounds. Because the pressure lasts for a considerable time, its entrance into the fuze can be controlled and utilized to start as well as delay the arming of the fuze.

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4. Centrifugal force. This force is available in spin-stabilized rockets, due to the rotation of the rocket and attains its maximum at the end of burning after the rocket is launched. The spin is of the same order as that of projectiles, and has permitted the adoption of some gun ammunition fuzes for rockets where forces other than centrifugal forces are not required to arm the fuze.

5. Creep (deceleration). This is a continuous inertia force caused by drag which tends to move internal fuze parts toward the nose of the round. In some cases these forces are controlled in rocket fuzes by anti-creep springs to prevent fuze initiation until the fuze strikes a target with sufficient impact to overcome the springs.

6. Friction. Frictional forces due to setback and creep are not high in rockets. However, they must be considered in their effect on moving parts. Friction due to centrifugal force may be quite high in rockets.

Explosives Used in Fuzes

The explosive materials used in rocket fuzes are 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 in a rocket fuze usually consists of the following components:

1. The primer, which is initiated mechanically by the firing pin. There are two types used, namely, the stab type, and the percussion type. The stab type is initiated by penetration of a sharp-pointed firing pin through the metal case into the primer mixture and the percussion type is initiated by crushing the primer mixture between an anvil and the indentation of the primer cup caused by a round-pointed firing pin. Stab type primers are in general used when instantaneous fuze action and increased sensitivity are desired and the percussion type when the fuze contains a delay element. Primer mixtures are intended to produce flame and hot gases and particles as a result of mechanical disturbance, and are generally composed of an initiating substance (lead azide or mercury fulminate), an oxidizing agent (potassium chlorate) and a reducible substance (antimony sulfide) and may also contain a friction-creating material (fine carborundum crystals). Lead azide primer mixture is usually used for stab-type primers because of its

slower rate of decomposition. Mercury fulminate primer mixture is often used in percussion primers for fuzes because of its greater sensitivity.

2. The delay element, 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 pellet pressure, and the thickness of the wall that must be burned through.

3. The detonator, which is initiated by the primer or delay element. It is composed of a pure initiating explosive, usually lead azide, followed by a small amount of tetryl. The above materials may be sealed in small containers separately or they may be sealed together in one container.

4. The lead-out and lead-in, which are small pellets of tetryl used to reinforce the small detonation of the detonator, and to transmit it to the booster. A lead-out is not necessarily used; if used, it usually moves with the detonator during arming.

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

Safety Features

The safety requirements for rocket fuzes are in general similar to those for gun ammunition and bomb fuzes. The fuze must contain adequate safety features to prevent detonation from any cause during normal transportation, handling, assembly, loading, and launching of the rocket. Design requirements stipulate that the fuze be detonator safe, that is, the explosive chain must be interrupted, so that if the detonator is prematurely initiated while the fuze is in the unarmed condition, the booster of the fuze and hence the explosive filler of the head will not be detonated. This is accomplished by interrupting the explosive train between the detonator and booster. The arming process in a fuze consists essentially in the alignment of these components. Ordinarily it is endeavored to have at least two independent safety features to prevent functioning before and during the initial stages of flight.

Test of Safety Features

Reference to the applicable specification for each fuze will be required to ascertain the specific tests required for production lots of fuzes.

The first three tests listed below are tests which are considered to be more severe than conditions encountered during normal shipment and handling. After the tests the fuzes are disassembled and examined for evidence of functioning of explosive components, and any dangerous condition arising from derangement of parts or missing parts.

1. **A drop test**, requiring that fuzes assembled in inert loaded heads be dropped (usually 40 feet) on nose, side, and base onto armor plate.

2. **A jolt test**, requiring that fuzes be mounted in a fixture in a standardized test machine and subjected to 1,750 drops in each of various positions from a height of 4 inches onto a leather-covered anvil.

3. **A jumble test**, requiring that fuzes be placed in a closed rectangular box mounted in a machine which revolves the box around one of its long diagonals at 30 rpm for 3,600 revolutions.

4. **A vibration test** (simulation), requiring that fuzes be subjected to a simple harmonic vibratory motion parallel and perpendicular to the fuze axis when packed in the shipping containers as well as when assembled in a rocket head or suitable test fixture. The duration of test covers a period of 24 hours at frequencies ranging from 700 to 3000 cycles per minute and amplitudes varying from 0.030 to 0.009 inch. The purpose of the test is to determine whether or not the fuze is capable of withstanding transportation vibration without damage.

5. **Various other tests** may be specified at the manufacturing or loading plant to check arming spin, arming pressure, etc.

Functioning Tests

Performance tests are usually conducted on fuzes when assembled in loaded rounds to determine the overall functioning of the fuze. These tests present an opportunity to determine if the fuze functions as designed, and that it has been assembled and loaded in the proper manner. It also permits a check on quality which may reveal any design and manufacturing weaknesses. The details of acceptance tests of each fuze are stated in the individual fuze descriptions.

Special Notes

Installation and removal of rocket fuzes. In any operation involving fuzing, unfuzing, assembly, disassembly, cleaning, painting, etc., of all types of munitions, the work shall be accomplished in the most suitable location, taking into account safe removal from other explosives and possible damage to vital installation, and shall involve exposing the smallest number of rounds practicable. Only those persons actually essential for the work shall be in the vicinity. The ideal situation would be that where work would be performed on only one round at a time, in a location on deck, remote from all magazines, from ready stowage, from other supplies of ammunition or explosives, and from vital installations.

Use of lubricants and preservatives. No lubricants or preservatives of any kind shall be used on any fuzes unless so indicated.

Reports of malfunctionings. Fuze malfunctions or any difficulties encountered with fuzes should be reported to the Bureau of Ordnance. The report should contain all pertinent information concerning the fuze such as mark and mod number, lot number, manufacturer, date of production, etc., together with the details and description of the conditions.

Chapter 1

NOSE AND AUXILIARY DETONATING FUZES
FOR SPIN STABILIZED ROCKETS

The fuzes described in this group are as follows:

- Section A—Fuze Mk 30 Mods 3 and 4 (Point Detonating)
- Section B—Fuze Mk 100 Mod 2 (Nose—SQ and Delay)
- Section C—Fuze Mk 44 Mod 2 (Auxiliary Detonating)
- Section D—Fuze Mk 52 Mod 2 (Auxiliary Detonating)

The fuzes described in sections A, B, C, and D, of this chapter, require only spin to arm and are either outright adoptions of gun ammunition fuzes or modifications of gun ammunition fuzes to function in rockets. Fuze Mk 30 Mod 3 may be used in gun ammunition as well as rockets. Fuzes Mk 30 Mod 4, Mk 100 Mod 2, Mk 44 Mod 2, and Mk 52 Mod 2 are authorized for use in rockets only.

Section A—Fuze Mk 30 Mods 3 and 4 (Point Detonating) (Centrifugal Arming)

1. General Data

Used in:

- 5.0-inch Rocket Head Mk 10 (High Capacity)
- 5.0-inch Rocket Head Mk 12 (High Capacity)
- 5.0-inch Rocket Head Mk 13 (High Capacity)

Overall dimensions and weight of fuze:

- Length..... 4.57 inches.
- Diameter (maximum)..... 2.30 inches.
- Body threads.... 1.70 inches—14 NS-1 RH.
- Weight..... 1.40 lbs. approx.

Applicable specification: OS 3303

General arrangement drawing:

- 422326 (Mod 3)
- 562339 (Mod 4)

Sketch list of drawings & specs:

- 109113 (Mod 3)
- 165551 (Mod 4)

Explosive components:

- A sensitive stab type Detonator Mk 25 (lead azide priming mixture and lead azide) located in the head of the fuze.
- A Relay Detonator Mk 29 (lead azide) located in a bakelite detonator holder in the body of the fuze.

2. Description

General. Fuze Mk 30 was originally developed for use as a projectile nose fuze; however, Fuze Mk 30 Mod 3 or Mod 4 has been adopted for use with the spin-stabilized rocket. Fuze Mk 30 is a centrifugal arming, impact firing, nose fuze and is completely armed when the rotational velocity of the rocket reaches the range of 1500 to 2000 rpm. The fuze is designed to fire superquick on impact with suitable targets. Fuzes Mk 30 Mods 3 and 4 differ from Fuzes Mk 30 Mods 0, 1, and 2 (obsolete) by the addition of a safety disc between the exhaust end of the flash tube and the relay detonator to prevent occasional initiation of the relay detonator by the flash from accidental firing of the nose detonator when the fuze is unarmed. Fuzes Mk 30 Mods 0, 1, 2, and 3 have a plastic ogive whereas Fuze Mk 30 Mod 4 has a drawn steel ogive. Fuze Mk 30 is always used in conjunction with an auxiliary detonating fuze to assure the complete initiation of the main explosive charge of the rocket head and to provide additional safety.

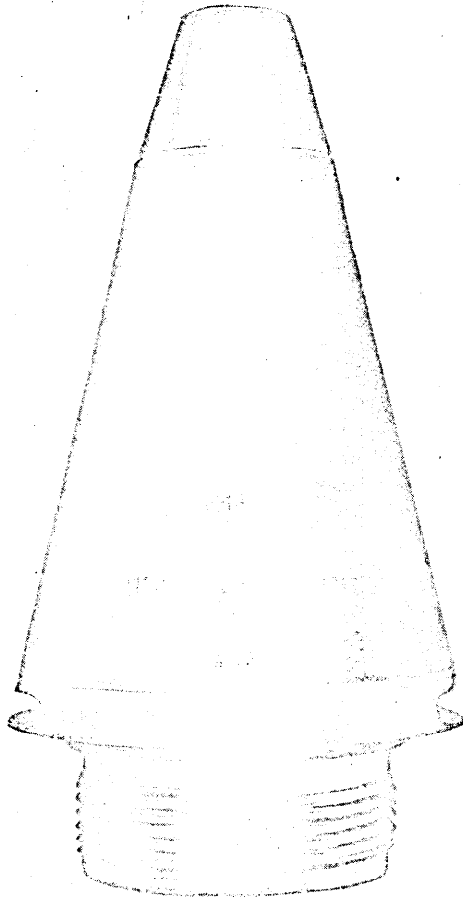


Figure 1—Fuze Mk 30 Mod 3 (Point Detonating), External View, Actual Size (approximately).

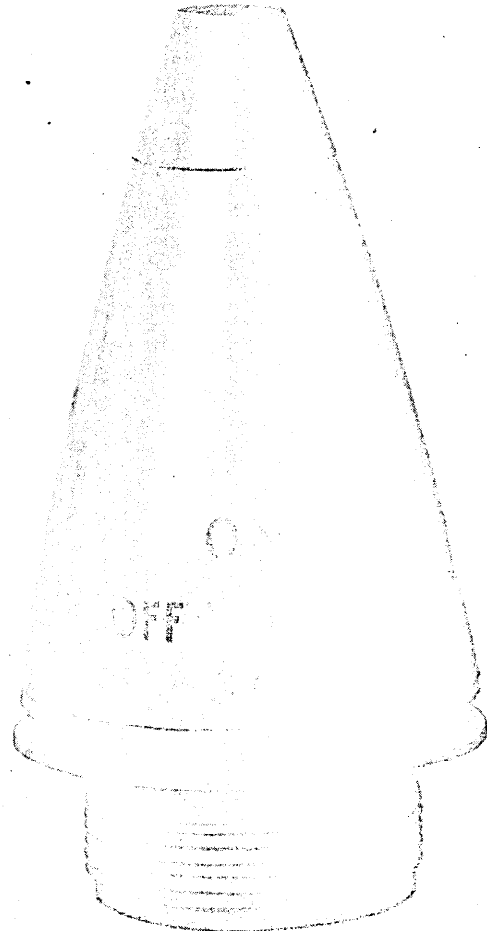


Figure 2—Fuze Mk 30 Mod 4 (Point Detonating), External View, Actual Size (approximately).

Use. Fuze Mk 30 Mods 3 or 4 is used in the 5.0-inch High Capacity Spin Stabilized Surface Rockets (Complete Rounds) Mk 10 Mod 0, Mk 13 Mod 0, and Mk 16 Mod 0 (see OP 1415). The above rockets are used for bombardment purposes.

Functioning mechanism. The fuze consists of four basic units, namely: (1) Body assembly, (2) Plastic or steel ogive, (3) Flash tube, and (4) Head assembly.

The body, located at the base end of the fuze, is threaded to engage the fuze adapter of the rocket head and houses the centrifugally actuated interrupter assembly, the safety disc, the relay detonator, the detonator holder, and the bottom closing screw assembly.

The interrupter assembly consists of a solid cylindrical metal interrupter, a cylindrical setting sleeve with an eccentric bored interrupter guide well, and an interrupter spring bearing against the spring cup and the bottom of the interrupter guide well. The assembly is held in position with a tension spring and setting sleeve retainer.

The interrupter bears against the spring cup and extends slightly into the guide well of the setting sleeve. In the OFF—OFF position the interrupter rests against a narrow shoulder formed by a shallow counterbore in the guide well and is locked in place, blocking the flash channel. When the setting sleeve is rotated through 90 degrees to the ON—SQ position, the interrupter is coaxially aligned with the guide well and is free to move

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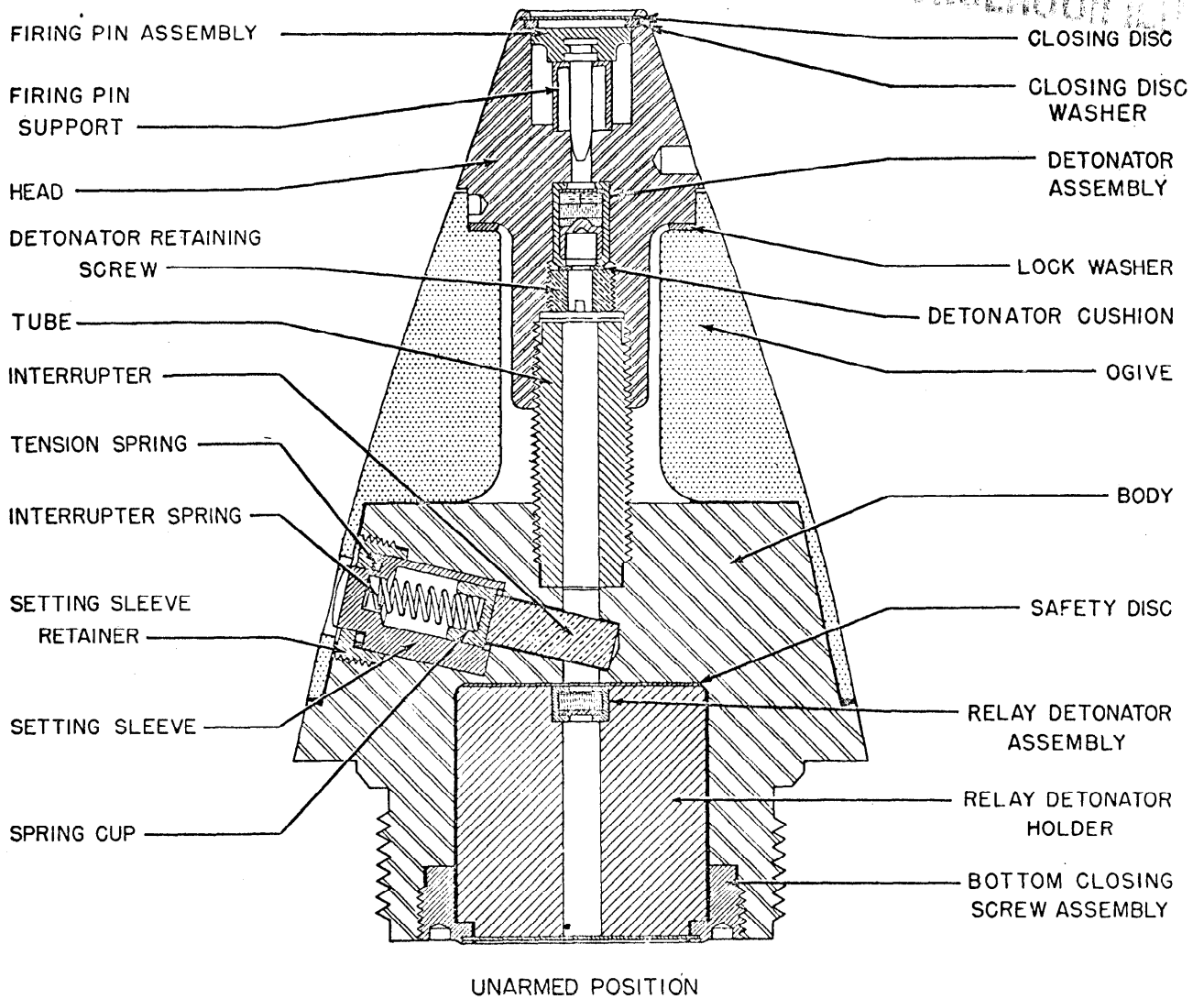


Figure 3—Fuze Mk 30 Mod 3 (Point Detonating), Cross Section View, Unarmed Position.

out of the flash channel against the spring and into the guide well when centrifugal force acts upon the interrupter.

The flash tube, threaded at each end, serves a double purpose in transmitting the flash from the initiating detonator to the relay detonator and in providing a means of assembling and securing the body, ogive, and head. One end of the flash tube is screwed into the body until seated, the ogive is then slipped over the body, and the head is screwed down on the forward end of the flash tube

until the head bears against the lock washer on the plastic or steel ogive.

The head houses a thin metal closing disc, a firing pin, a light metal firing pin support, and a stab type detonator with its retaining screw. The stab type detonator is fired when sufficient force applied at the nose of the fuze deforms the closing disc and drives the pointed firing pin back to collapse the firing pin support and to penetrate the primer mixture.

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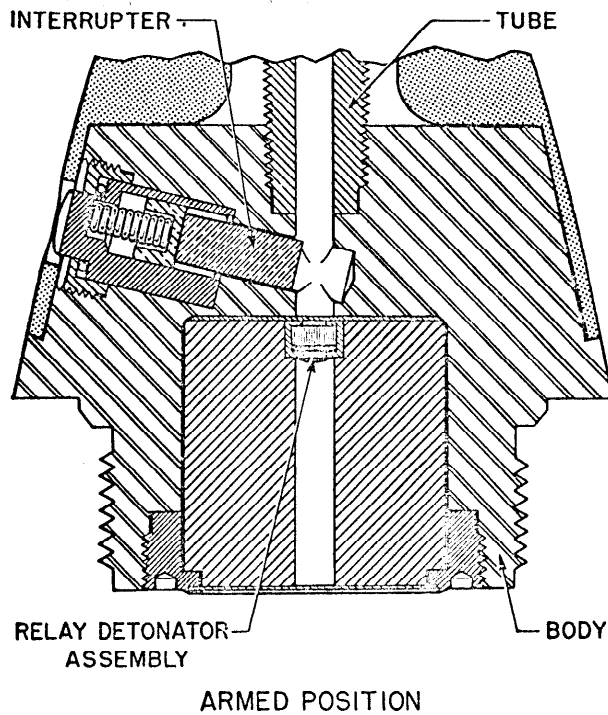


Figure 4—Fuze Mk 30 Mod 3 (Point Detonating), Partial Cross Section View, Armed Position.

3. Functioning

Arming. Prior to firing, the setting sleeve is rotated to the ON—SQ position. When the rocket is fired and it reaches a rotational velocity within the range of 1500 to 2000 rpm, which represents approximately 15 to 25 feet of travel in the rounds in which it is used, the interrupter moves out against the interrupter spring and clears the flash channel thus arming the fuze.

The rotational velocity or spin rate remain sufficiently high to maintain the armed condition until after impact.

Firing. Firing is initiated by impact with any material offering sufficient resistance such as wood, metal, ground, or water. Under the force of impact the closing disc is deformed and the pointed firing pin is driven back to collapse the firing pin support and to penetrate the primer mixture, thus initiating the stab type detonator. The flash from the stab type detonator passes through the flash tube and initiates the relay detonator which fortifies the action required to initiate the auxiliary detonating fuze detonator, which in turn initiates the auxiliary detonating fuze lead-ins, booster charge, and finally the main explosive charge of the rocket head.

Acceptance test data. Sample fuzes chosen at random from each production lot are subjected to routine safety tests and ballistic tests when fired in gun ammunition in accordance with table 1.

For every twentieth lot eight ground impacts are substituted for the water impacts, and fired in 6''/47 DP projectiles. If these are not available, 5''/54 or 4''/50 HC projectiles are used. Angles of fall and striking velocities should duplicate short and long range bombardment by the same type of gun in service. In every twentieth lot 1/8 inch mild steel is substituted for the wood target.

No prematures are allowable. Two duds out of all fuzes fired from each lot are allowed, and in addition to the two duds not more than one failure to give instantaneous action is allowed. Instantaneous action is defined as the destruction of the wood or steel target by blast and fragments of the projectile acting on the side towards the gun, or

Table 1

Caliber	Rounds	Velocity	Material	Obliquity	Range
3''/50	2	2700 f/s	1'' wood	0	400'
3''/50	2	1400 f/s	1'' wood	0	400'
4''/50	2	2900 f/s	1'' wood	0	400'
4''/50	2	1400 f/s	1'' wood	0	400'
3''/50 to 6''/47 DP*	8	Service	Water impact		Various

*Any caliber normally assembled with Fuze Mk 30 is used. 5''/54 caliber and 6''/47 dual purpose is to be used whenever practicable. Gun elevation must exceed eight degrees, and at least two fuzes from each lot are fired at proof (generally 15 percent greater than service pressure) or near proof, preferable in a 3''/50 caliber gun.

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in case of water or ground impacts the apparent burst of the projectile on contact with the ground or water without intermediate ricochet.

Ballistic tests should be frequently conducted in guns in the last third of their normal life.

Sensitivity limits. The fuze will detonate on $\frac{1}{2}$ inch wood, or water, or ground impacts at non-ricochet angles. In the case of ground impacts, functioning is reliable at angles of fall of eight degrees or greater; for water impacts, functioning is reliable in rockets at angles of fall of twelve degrees or greater.

4. Safety Features

Detonator safety. The stab type detonator assembly is always in line, therefore sufficient impact on the nose of the fuze will cause crushing of the firing pin support and permit the firing pin to penetrate the primer mixture. In the event the stab type detonator does fire (should the fuze be subjected to impact during rough handling), the interrupter will block the passage of the flash to the relay detonator. However, to increase the safety in the event that some flash gets around the interrupter, a thin aluminum safety disc (0.010 inch thick) blocks this flash from initiating the relay detonator. Complete arming can only be accomplished after a sustained centrifugal force of the magnitude attained in flight when the setting sleeve is set on the ON—SQ position. Under such conditions, the interrupter moves out of the flash channel, and the safety disc does not appreciably impede the functioning of the detonating train.

Additional safety of the round is brought about by the use of an Auxiliary Detonating Fuze which has both lead-in and detonator out of line and requires a rotational velocity greater than the minimum arming spin of the nose fuze to become fully armed.

During shipping and stowage. Fuze samples from production lots are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure of the samples to pass the tests is cause for rejection of the lot.

Should the stab type detonator function while the fuze is in the unarmed condition, the locked interrupter and safety disc prevent initiation of the balance of the explosive train.

5. Disposal and Servicing (Maintenance)

General. In the event that an unfired fuze is damaged because of rough handling, an examination of the condition of the closing disc in the head assembly will determine the method of disposal of the fuze. If upon examination it is found that the closing disc has been deformed or broken, there is the possibility that either the stab type detonator has been fired and has rendered the fuze inactive or that the detonator has merely been pierced and has not been fired. In either case the fuzed rocket head, or the rocket fuze if not assembled into a rocket head should be disposed of by gently lowering into deep water or by Explosive Ordnance Disposal Personnel in accordance with existing instructions. If upon examination, it is found that the closing disc has not been damaged and the setting sleeve is set to the OFF—OFF position, the fuze may be considered safe to handle, or if the closing disc is not damaged in any manner and the setting sleeve has been set to ON—SQ position, the fuze may be rendered safe for handling by rotating the setting sleeve to the OFF—OFF position.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

1. Remove the nose shipping plug from the rocket head. Inspect the threads and the interior of the rocket head nose fuze cavity. Clean if necessary. Be certain that the auxiliary detonating fuze is present in the rocket head.

2. Remove Fuze Mk 30 Mods 3 or 4 from the container and examine it for damage and setting.

3. Install the fuze into the rocket head and be certain that it seats properly.

4. The fuze is shipped with the setting sleeve set to OFF—OFF position. Before firing, set the setting sleeve to ON—SQ position by inserting a screwdriver or similar tool into the slot on the setting sleeve and turning it so that the slot aligns with the ON—SQ lettering on the ogive.

Removal from round. The fuze may be removed from the rocket head with the proper fuze wrench and returned to the shipping container. The closed shipping container can should in turn be sealed with adhesive tape along the broken sur-

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face. Before removal of the fuze from the round, the setting sleeve shall be returned to the OFF—OFF position. The shipping plug with gasket must be replaced into the rocket head after the fuze is removed.

7. Packing and Marking

Packing. Fuze Mk 30 Mods 3 or 4 is issued in an individual hermetically sealed metal can. Twenty-four individual cans are packed in a wood box 25½ inches by 16½ inches by 6½ inches which represents a total of 1.5 cu. ft. and a total weight of 65 pounds.

Marking. The lettering OFF—OFF and ON—SQ is stamped on the ogive. These markings are at right angles to each other and are spaced around the hole for the setting screw with the fuze nose end up. ON—SQ is positioned vertically and OFF—OFF horizontally.

The fuze is marked or stamped with the letters PDF, the mark, mod, and lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of the loading, the anchor stamp, and the inspector's initials.

**Section B—Fuze Mk 100 Mod 2 (NOSE-SQ AND DELAY)
(Centrifugal Arming, Point Detonating)**

1. General Data

Used in: 5.0-inch Rocket Head Mk 7 (General Purpose).

Overall dimensions and weight of fuze:

- Length 4.15 inches
- Diameter (maximum) . 2.985 inches
- Body threads 1.700 inches—14 NS-1
- Weight 1.60 lbs. approx.

Applicable specification: (To be prepared)

General arrangement drawing: 562303

Sketch list of drawings & specs: 165472

Explosive components:

- A sensitive stab type Detonator Mk 25 (lead azide priming mixture and lead azide) located in the head of the fuze.
- Two Relay Detonators Mk 49 Mod 0 (lead azide)
- Primer Mk 104
- Black powder delay pellet

2. Description

General. Rocket Fuze Mk 100 Mod 2 is a centrifugal arming, impact firing, nose fuze similar in action to the Fuze Mk 30 but with an extended range of useful applications. This fuze was developed by combining the Navy Point Detonating Projectile Fuze Mk 29 and the Army Artillery Fuze M48A2. (The Fuze Mk 29 and the Fuze Mk 30 are identical except for contour and length of flash tube.) The addition of the plunger assembly of the Army Fuze M48A2, containing a delay

element, to the Fuze Mk 29 gives Fuze Mk 100 two fundamental differences over Fuze Mk 30; one being the choice of either instantaneous or delay action, and the other being the added reliability inherent in the fact that the plunger assembly is independent in action and is always active regardless of whether instantaneous or delay action is selected. In the event of failure upon impact of the instantaneous feature, when set for instantaneous action, the plunger assembly will function normally and follow with a delayed detonation.

Fuze Mk 100 arms when the rotational velocity of the round reaches the range of 1,500 to 2,000 rpm and will fire upon impact with any material offering sufficient resistance such as wood, plate, ground, or water targets.

Fuze Mk 100 Mod 2 is always used in conjunction with Auxiliary Detonating Fuze Mk 44 Mod 2.

Use. Fuze Mk 100 is used in the 5.0 inch General Purpose Spin Stabilized Surface Rocket (Complete Round) Mk 7 Mod 2. (See OP 1415.) This rocket may be used effectively against parked aircraft, vehicles, personnel, small buildings, light fortifications, shipping, etc. Since the round has limited penetration characteristics, the effectiveness is dependent on the type of action (instantaneous or delay) selected as well as the nature of the target.

Functioning mechanism. Fuze Mk 100 Mod 2 is basically identical with Fuze Mk 30 Mod 3 or Mod 4 with three exceptions, namely, the addition of the plunger assembly, length of flash tube and a

change in size and shape of the ogive. When the setting sleeve is set to SQ—SQ (superquick), the firing action of the Fuze Mk 100 is identical with that of the Fuze Mk 30; however, when the setting sleeve is set to DELAY—DELAY, the flash channel is blocked (as in Fuze Mk 30 when the setting sleeve is set to OFF—OFF), and the plunger assembly independently initiates the auxiliary detonating fuze after a delay of 0.025 seconds. The manual setting of the setting sleeve on the Fuze Mk 100 is identical with the Fuze Mk 30. However, the SQ—SQ position on the Fuze Mk 100 corresponds to the ON—SQ on the Fuze Mk 30 and the DELAY—DELAY position corresponds to the Fuze Mk 30 OFF—OFF position. The plunger assembly arming mechanism is completely independent of the setting sleeve position and to arm requires only the centrifugal force developed by the rotation of the round.

The plunger assembly is located in a well at the base end of the fuze body and is secured with the bottom closing screw assembly. The plunger assembly consists of a plunger housing, a plunger body assembly, a plunger support, and a plunger restraining spring. The plunger housing, a light metal cup, serves as a housing for the components as well as a base for the delay firing pin. The forward end or bottom of the cup has a central flash hole, three internal punched centering tabs to serve as guides for the plunger support, and an off-center mounted fixed firing pin extending into the cup. The forward end of the plunger support rests between the three centering tabs. 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 (including the delay element), mounts over the plunger support and bears against the rear end of the plunger restraining spring. An aligning pin extending from the side of the plunger rides in a small elongated guide hole in the plunger cap and serves to align the plunger with the fixed firing pin as well as to allow the plunger assembly to float against the plunger restraining spring. The plunger body assembly consists of a cylindrical brass body with a central flash hole, a threaded well to accommodate the delay detonator assembly, a milled slot extending into the flash hole to accommodate the centrifugal pin lock, two dia-

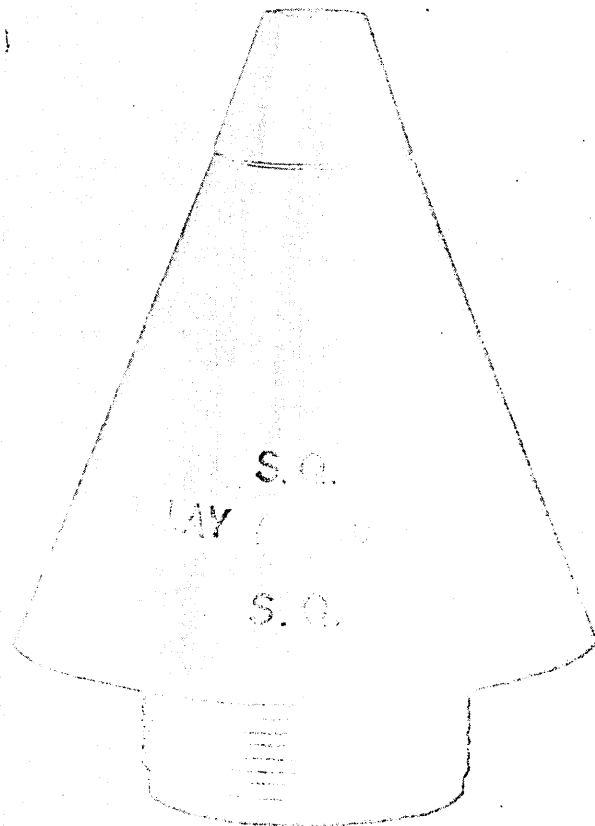


Figure 5—Fuze Mk 100 Mod 2 (Nose-SQ and Delay), External View, Full Size (approximately).

metrically opposite spring loaded centrifugal plunger pins and a secondary relay detonator at the rear end of the flash hole. The delay detonator assembly which consists of the delay primer, the black powder delay pellet, and the primary relay detonator is secured in the detonator well by a threaded retaining bushing. A diagonal flash channel connects the primary relay detonator in the rear end of the plunger assembly. The secondary relay detonator is in line with the stab type detonator in the nose of the fuze. The two centrifugal pins extend partially into the central flash channel of the plunger assembly and serve to prevent the plunger from moving forward on the plunger support.

3. Functioning

Arming. When the rotational velocity of the round reaches the range of 1500–2000 rpm, which

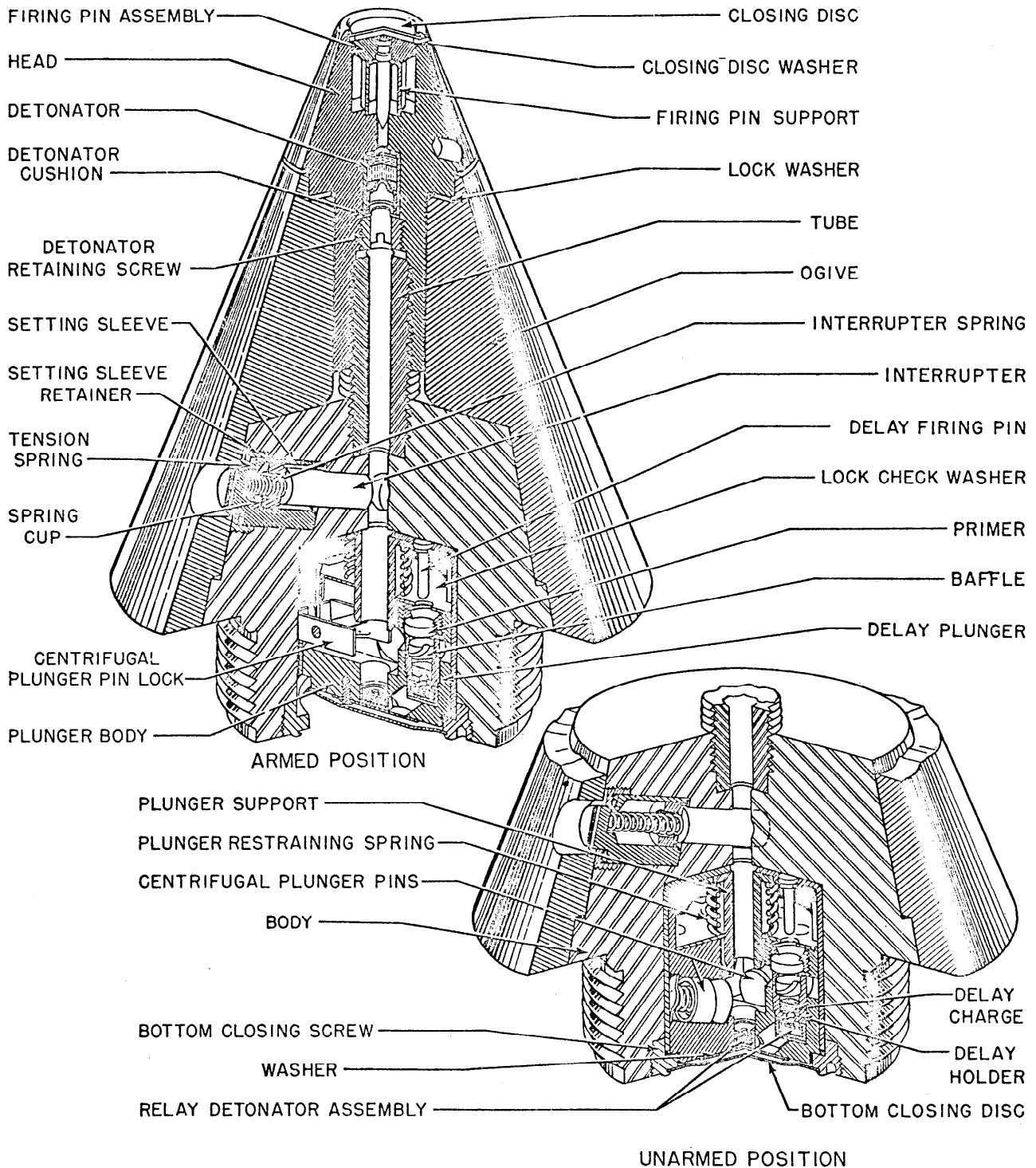


Figure 6—Fuze Mk 100 Mod 2 (Nose-SQ and Delay), Sectional View, Armed and Unarmed Position.

represents approximately 6 feet of travel of the round, sufficient centrifugal force is developed to move the pins out against their springs and unlock the plunger body. The centrifugal plunger pin lock rotates out and locks the centrifugal plunger pins in the outward position. The plunger restraining (anti-creep) spring prevents the plunger body from moving forward when the fuze is acted upon by deceleration such as air resistance or very light impacts. Upon sufficiently high impact the inertia of the plunger body overcomes the plunger restraining spring which allows the percussion primer to be indented and initiated by the round-pointed firing pin.

Firing. Instantaneous or superquick firing upon impact is identical with that of Fuze Mk 30. The plunger assembly also functions upon impact; however, the flash from the stab type detonator reaches the secondary relay detonator and initiates the round (via the auxiliary detonating fuze) before the delay assembly can complete its function. Delay initiation is accomplished by blocking off the action of the stab type detonator in the nose of the fuze with the interrupter and thus allowing the plunger assembly to complete its normal delay firing cycle.

Acceptance test data. The acceptance data for the superquick action of the Fuze Mk 100 Mod 2 is the same as for Fuze Mk 30. The Fuze Mk 100 Mod 2 is a modification of the previous mods to improve performance of the delay action. As of the date of the publication sufficient data had not been accumulated to relate the acceptance data and sensitivity of the fuze when set for delay action.

4. Safety Features

Detonator safety. The stab type detonator in the head assembly is always in line, therefore, sufficient impact on the nose of the fuze will cause crushing of the firing pin support and permit the firing pin to pierce the stab type detonator. However, the fuze must be subjected to rotation in the range of 1500 to 2000 rpm in order to open the detonation train. When the setting sleeve is set to SQ—SQ, the interrupter can only move out of the flash channel when sufficient centrifugal force is developed by the round's rotation. When the setting sleeve is set to the DELAY—DELAY position, the interrupter is blocked from moving out of the flash channel;

however, for the delay assembly to function, the fuze must undergo sufficient rotation to enable the centrifugal plunger pins to move out and to free the plunger body from its locked position. Additional safety of the round is brought about by the use of the Fuze Mk 44 Mod 2 (Auxiliary Detonating) which has both lead-in and detonator out-of-line and requires a rotational velocity of 3000 to 4500 rpm to become fully armed.

During shipping and stowage. The interrupter in the fuze is set on the DELAY—DELAY position during shipping and stowage. The centrifugal plunger pins also prevent the plunger body of the plunger assembly from moving forward. The relay detonators are insensitive to shocks encountered in handling. Fuze Mk 100 Mod 2 may be considered safe during normal shipping, stowage, and handling.

5. Disposal and Servicing (Maintenance)

General. (See Disposal and Servicing—General for Fuze Mk 30 for instructions pertaining to the observation of the closing disc on the fuze which are applicable for Fuze Mk 100 Mod 2.) If it is found that the closing disc has not been damaged and the setting sleeve is set to the DELAY—DELAY position, the fuze may be considered safe to handle, or if the closing disc is not damaged in any manner and the setting has been set to SQ—SQ position, the fuze may be rendered safe for handling by rotating the setting sleeve to the DELAY—DELAY position.

Fuze Mk 100 Mod 2 is unsafe to handle after the round has been launched since the delay assembly, when once armed, remains locked in the armed position. Dud rounds should be treated with extreme caution and should be disposed of by gently lowering base first into deep water, or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. No disassembly of this fuze is permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

1. Remove the nose shipping plug from the rocket head. Inspect the interior of the rocket head nose cavity and check the threads. Clean if necessary. Be certain that the auxiliary detonating fuze is present in the rocket head.

2. Remove Fuze Mk 100 Mod 2 from the container and inspect it for damage and setting.

3. Screw the fuze into the rocket head and be certain that it seats properly.

4. When packed for shipment the fuze is set DELAY—DELAY. The setting sleeve may be turned to the instantaneous position by inserting a screw driver or similar tool into the slot on the setting sleeve and turning it so that the slot aligns with the lettering SQ—SQ on the ogive.

Removal from round. The fuze may be removed from the rocket head with the proper fuze wrench and returned to the shipping container. The closed shipping container can should in turn be sealed with adhesive tape along the broken surface. Before removal of the fuze, turn the setting sleeve to the DELAY—DELAY position. When the fuze is removed from the rocket head, the shipping plug and gasket must be replaced into the rocket head.

7. Packing and Marking

Packing. Fuze Mk 100 Mod 2 will be shipped packed in individual hermetically sealed cans. Twenty-four individual cans are packed in a wood box 25½ inches by 16½ inches by 6½ inches which represents a total of 1.5 cu. ft. and a total weight of 72 pounds.

Marking. The words SQ—SQ and DELAY—DELAY are stamped on the plastic ogive. These markings are at right angles to each other and are placed around the hole for the setting screw with the nose end up. SQ—SQ is positioned vertically and DELAY—DELAY horizontally. The fuze is marked or stamped with the letters NF, the mark, mod, and lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Section C—Fuze Mk 44 Mod 2 (Auxiliary Detonating) (Centrifugal Arming)

1. General Data

Used in:

- 5.0-inch Rocket Head Mk 10 and Mk 12 (High Capacity)
- 5.0-inch Rocket Head Mk 7 (General Purpose)

Overall dimensions and weight of fuze:

Length.....	1.821 inches
Maximum diameter.....	1.5610 inches
Body threads.....	1.5610 inches— 20 NS-2LH
Weight.....	0.50 lb. approx.

Applicable specification: OS 2985

General arrangement drawing: 440406

Sketch list of drawings & specs: 165193

Explosive components:

- Flash type Detonator Mk 37 (lead azide and tetryl)
- Lower rotor lead-in charge (tetryl)
- Booster lead-in charge (tetryl)
- Booster charge (tetryl) approximately 25 grams

2. Description

General. Fuze Mk 44 Mod 2 (Auxiliary Detonating) is identical with Fuze Mk 44 Mod 1 except for a modified cover disc and the inclusion

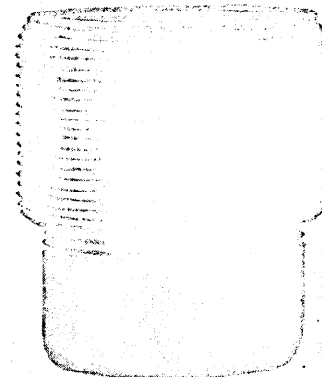


Figure 7—Fuze Mk 44 or Fuze Mk 52 (Auxiliary Detonating), External View, Full Size (approximately).

of a moistureproofing sealing cover. Fuze Mk 44 Mod 2 version of this fuze was designed for use in rocket ammunition. It is essentially a booster which houses two off-center rotors (upper and lower) carrying a detonator and a lead-in respectively which are locked out-of-line (unarmed position) by spring-held detents. Below the rotors are a fixed lead-in and a tetryl booster charge.

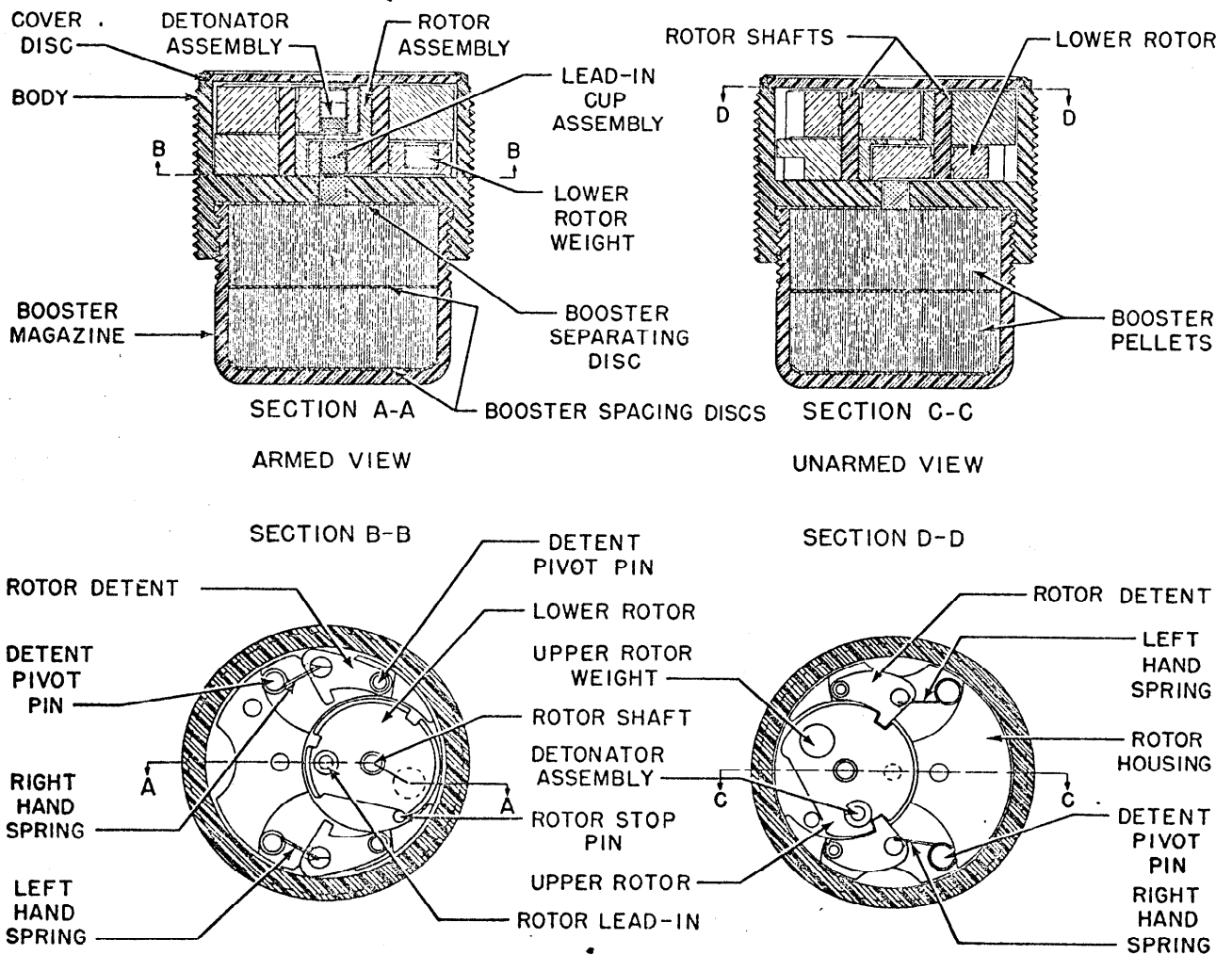


Figure 8—Fuze Mk 44 Mod 0 (Auxiliary Detonating), Cross Section View, Armed and Unarmed Position.

Fuze Mk 44 Mod 2 is always used in conjunction with a nose fuze to provide additional safety and to assure detonation of the main high explosive charge in the head of the rocket. It provides additional safety because it embodies independent safety features, arms independently of the nose fuze, and requires a greater spin to arm than is required for the nose fuze with which it is used. The detonation train of the Fuze Mk 44 Mod 2 (after being aligned through sufficient centrifugal force) is fired by the detonator in the nose fuze.

Fuze Mk 44 Mod 2 is assembled in the rocket head at the rocket loading activity.

Use. Fuze Mk 44 Mod 2 is used in the 5.0-inch High Capacity Spin Stabilized Surface Rockets (Complete Rounds) Mk 7 Mod 2, Mk 10 Mod 0, and Mk 13 Mod 0 (see OP 1415).

There were a number of rocket heads loaded during World War II with the Fuze Mk 44 Mod 0 or Mod 1. Subsequent loadings will utilize the Fuze Mk 44 Mod 2 because of the more reliable performance of the Fuze Mk 44 Mod 2 design.

Functioning mechanism. Fuze Mk 44 Mod 2 consists of a threaded body which holds the rotor housing assembly, the booster lead-in and the booster magazine. It is closed at the forward

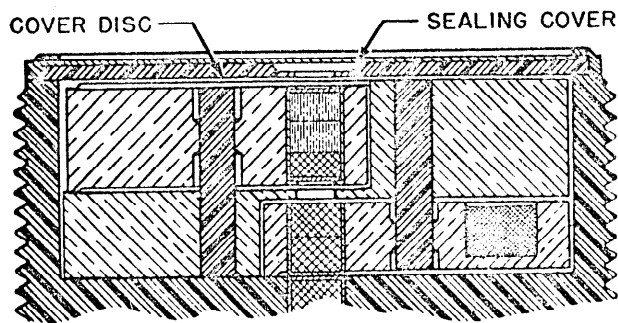


Figure 9—Fuze Mk 44 Mod 2 (Auxiliary Detonating), Partial Cross Section View, Armed Position.

end by a cover disc, which has a hole in the center aligned with the central flash channel of the nose fuze, and an 0.002-inch thick copper sealing cover crimped in place. Near the base end of the body there is a partition between the rotor housing assembly and the booster magazine. The partition has a hole in its center which receives the booster lead-in. The threaded booster magazine containing the booster charge pellet is assembled to the body and the tetryl pellet is separated from the partition by a light paper booster separating disc (washer).

The rotor housing assembly consists of a die cast block with accommodation for an upper and a lower rotor, two upper and two lower torque spring loaded detents, and two rotor shafts. Both rotors are modified semi-cylindrical blocks rotating about the rotor shafts in the eccentric wells 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 stop located in the well so that the rotation of the rotors will be restricted to align the detonator, located in the upper rotor, with the lead-in charge located in the lower rotor. Two detents engage two slots in each rotor to lock it in the unarmed position with the explosive elements out of line. The rotors in the unarmed position act as interrupters in blocking the central flash channel.

3. Functioning

Arming. Fuze Mk 44 arms in two stages. When the rotational velocity of the round reaches the range of 3000 to 4500 rpm, the detents are moved outward against the springs by centrifugal

force and the rotors are unlocked. The rotors then rotate under centrifugal force until they meet the rotor stops. At this point the fuze is fully armed with the upper rotor detonator and the lower rotor lead-in aligned with the flash channel and the booster lead-in.

Firing. The detonator and/or relay detonator of the main fuze initiates the upper rotor detonator which in turn initiates the lead-in in the lower rotor, the booster lead-in, and the booster charge. Firing is practically instantaneous.

Acceptance test data. Sample fuzes from every production lot are tested, assembled in standard service loaded projectiles with ignition fuzes or point detonating fuzes capable of firing the auxiliary detonating fuze and of such known performance that failure of the projectile to burst may be considered a failure of the auxiliary detonating fuze being tested. For acceptance tests all auxiliary detonating fuzes will be located on the axis of rotation of the projectile and must function as high-order detonations when initiated. Two rounds are fired at near proof pressure. At least 90% performance is required.

At the discretion of the Bureau of Ordnance, ten fuzes from any lot are assembled, by means of a proper adapter, $\frac{1}{8}$ -inch off the axis of rotation of the projectile and tested as before, two rounds being fired at near proof pressure. At least 80% performance is required. Failure of this test is sufficient cause for consideration by the Bureau of Ordnance of the acceptability of other lots on which the off-center test was not required. In the event of any lot failing an off-center or an on-center test, twenty additional fuzes from that lot are fired in the same manner and acceptance based on the same percentages as before, for all thirty, i. e., 90% for the on-center and 80% for the off-center tests.

4. Safety Features

Detonator safety. Fuze Mk 44 Mod 2 is detonator safe. The two detents locking each rotor in the unarmed position are displaced diametrically so that they both tend to move out only under centrifugal force developed by the rotation of the round. Any force other than centrifugal force, which might unlock one set of detents would tend to hold the opposite set of detents securely in the locked position.

During shipping and stowage. Samples of fuzes from each production lot are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure of the samples to pass the tests is cause for rejection of the lot.

5. Disposal and Servicing (Maintenance)

General. Any dud round containing a Fuze Mk 44 (which has previously attained the pre-requisite arming spin in flight) may be considered to be fully armed since the rotors do not return to the unarmed position once they have moved into the armed position. This fuze is in itself not considered to be a sensitive dud since it does not incorporate a sensitive primer mix or firing pin. However, the rocket nose fuze may be extremely sensitive which might render the round extremely dangerous. A dud round should be disposed of by gently lowering the round, base

first, into deep water or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. No disassembly of this fuze is permitted except by authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

Rocket heads utilizing the Fuze Mk 30 and Fuze Mk 100 are shipped with the Auxiliary Detonating Fuze installed in the rocket head.

7. Packing and Marking

Packing. The fuze is shipped assembled in the round.

Marking. The fuze is marked with the abbreviated words Aux. Det. Fuze, the mark, mod, and lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Section D—Fuze Mk 52 Mod 2 (Auxiliary Detonating) (Centrifugal Arming)

1. General Data

Used in: 5.0-inch Rocket Head Mk 13 (High Capacity)

Overall dimensions and weight of fuze:

Length.....	1.821 inches
Maximum diameter.....	1.5610 inches
Body threads.....	1.5610 inches → 20NS-2LH
Weight.....	0.50 lb. approx.

Applicable specification: OS 2985 (where pertinent)

General arrangement drawing: 563653

Sketch list of drawings & specs: 165988

Explosive components:

Flash type Detonator Mk 37 (lead azide & tetryl)

Lower rotor lead-in (tetryl)

Booster lead-in (tetryl)

Booster charge (tetryl) approximately 25 grams

2. Description

General. Fuze Mk 52 Mod 2 (Auxiliary Detonating) is identical with Fuze Mk 44 Mod 2

(Auxiliary Detonating) with the one exception that the detent springs in Fuze Mk 52 are weaker to allow the fuze to arm at a lower rotational velocity. Fuze Mk 52 arms at a rotational velocity within the range of 1600 to 1900 rpm which represents approximately 30 feet of travel in the round in which it is used.

Use. Fuze Mk 52 Mod 2 is used in the 5.0-inch High Capacity Spin Stabilized Surface Rocket (Complete Round) Mk 16 Mod 0 (See OP 1415).

Functioning mechanism. (Same as Fuze Mk 44 Mod 2)

3. Functioning

Same as Fuze Mk 44 Mod 2 except that the rotational velocity is 1600 to 1900 rpm.

4. Safety Features

Same as Fuze Mk 44 Mod 2.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 44 Mod 2.

6. Installation Instructions

Same methods as Fuze Mk 44 Mod 2.

7. Packing and Marking

Same as Fuze Mk 44 Mod 2.

BASE FUZES FOR SPIN STABILIZED ROCKETS

Section A—Base Fuze Mk 31 Mod 0 (Centrifugal Arming, Impact Firing)

1. General Data

Used in: 5.0-inch Rocket Head Mk 8 (Common)

Overall dimensions and weight of fuze:

Length.....	4.67 inches
Maximum diameter.....	1.8 inches
Body threads.....	1.5 inches—
	12 NF-3 LH
Weight.....	1.60 lb. approx.

Applicable specification: OS 3429

General arrangement drawing: 423486

Sketch list of drawings & specs: 109344

Explosive components:

DETONATOR PLUNGER—Sensitive Primer Mk 102 (fulminate of mercury priming mixture); Secondary Primer Mk 101 (fulminate of mercury priming mixture); Detonator Mk 33 (lead azide); detonator plunger load (tetryl); plunger lead-outs (tetryl).

FUZE BODY—Booster lead-ins (tetryl); boosters (tetryl). Approximately 3.2 grams.

2. Description

General. Fuze Mk 31 Mod 0 was originally developed for use as a 4"/50 caliber projectile base fuze; however, it has been adopted for use in the spin-stabilized rocket. Fuze Mk 31 Mod 0 is a centrifugal arming, impact firing, base fuze which arms completely when the rotational velocity of the rocket reaches the range of 3000-4500 rpm which represents approximately 30 feet of travel of the rocket. The fuze will fire reliably upon impact with suitable targets.

Use. Fuze Mk 31 Mod 0 is used in the 5.0-inch Common Spin Stabilized Surface Rocket (Complete Round) Mk 24 Mod 0. (See OP 1415). The round is utilized for bombardment purposes and has a maximum range of approximately 10,000 yards.

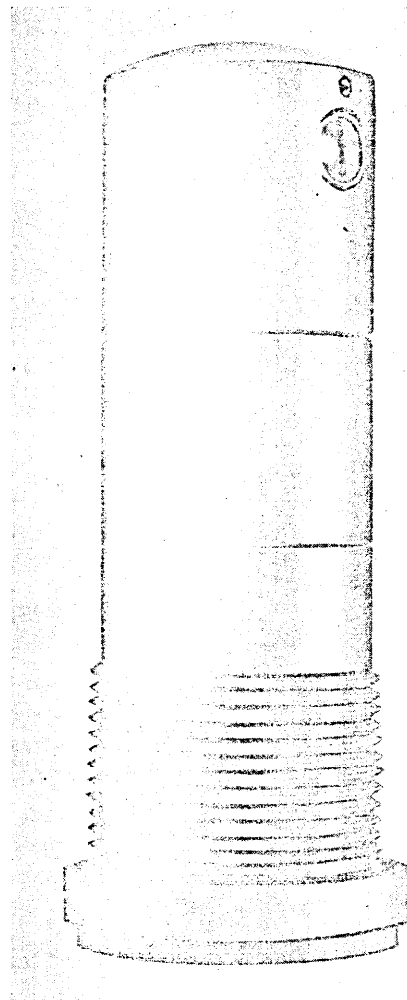


Figure 10—Base Fuze Mk 31 Mod 0, External View, Full Size (approximately).

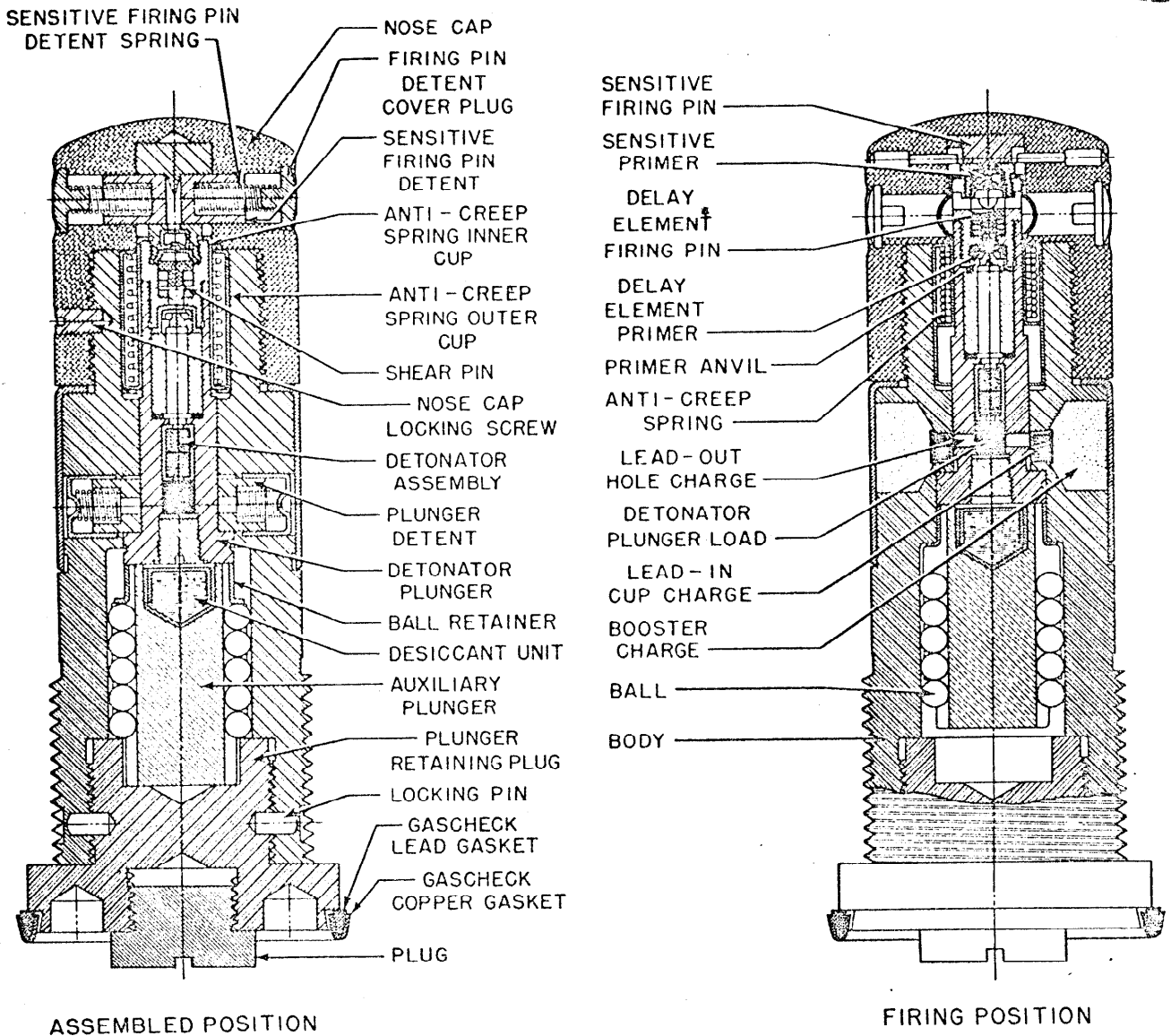


Figure 11—Base Fuze Mk 31 Mod 0, Cross Section View, Assembled and Firing Position.

Functioning mechanism. The external parts of the fuze consist of a fuze body, booster cover, nose cap, and a plunger retaining plug. The steel fuze body is machined to accommodate the auxiliary plunger assembly, the detonator plunger assembly, the two detonator plunger detents, the anti-creep spring assembly, and the entire explosive train from the sensitive primer to and including the two side-wall boosters. The aft end of the

fuze body is provided with external threads to allow installation of the fuze into the rocket head and internal threads to engage the steel plunger retaining plug. The retaining plug integral with the fuze flange is finally secured to the fuze body and held in place by two locking pins peened in position. At the forward end of the body, external threads and a wide shoulder provide for installation of the nose cap which also retains the light metal external booster cover.

The auxiliary plunger, a cylindrical brass inertia block (with a small well at the forward end containing a desiccant mixture), floats on four rows of ball bearings in the auxiliary plunger cavity of the fuze body. The base of the auxiliary plunger bears against the plunger retaining plug while the forward end bears against the detonator plunger. The detonator plunger houses the sensitive primer, the secondary firing pin, the secondary primer, the spacer, the detonator, the detonator plunger charge, and the booster lead-outs. A shoulder at the after part of the detonator plunger bears against the two spring loaded detonator plunger detents. The forward end of the detonator plunger is guided by the anti-creep spring assembly and bears against the firing pin detents in the nose cap. Two aligning pins extend from the wall of the detonator plunger and ride in slots in the fuze body.

The aluminum alloy nose cap houses the sensitive primer firing pin, the spring loaded firing pin detents, and the two firing pin locking pins. The firing pin floats against the two firing pin detents and is positioned in its well by the two locking pins. Two diametrically opposed holes, externally sealed with cover plugs, placed at 90° to and slightly aft of the firing pin detents are for the purpose of locking the detonator plunger in place when firing occurs upon impact. A lock screw or pin is installed in the wall of the nose cap to secure its assembly to the fuze body. The anti-creep spring assembly consists of a light metal tubular inner cup which is lipped at its base to provide a footing for the anti-creep spring, the outer cup which serves as a guide, and the anti-creep spring which bears against the inner cup lip at the aft end and against the outer cup at the fore end. The inner cup is assembled to the detonator plunger at the forward end and is held in position by the sensitive primer holder.

The two boosters and two booster lead-ins are located diametrically opposite in the sidewalls of the fuze body.

3. Functioning

Arming. Fuze Mk 31 arms when the rocket reaches a rotational velocity within the range of 3000 to 4500 rpm which represents a distance of travel of approximately 30 feet. At this point under centrifugal force the firing pin detents and the detonator plunger detents move out against

their respective load springs and allow both the detonator plunger and the auxiliary plunger on its ball bearings to float against the anti-creep spring.

Firing. Upon impact and retardation of the rocket head, the inertia of the auxiliary plunger and the detonator plunger forces them forward to compress the anti-creep spring and impinge the sensitive primer against the sensitive primer firing pin to pierce and fire the sensitive primer. At this point the detonator plunger is forward and the booster lead-outs in the detonator plunger are aligned with the booster lead-ins in the fuze body. As the sensitive primer fires, the expanding gas passing through small ports in the primer and firing pin container creates an internal pressure which bulges the wall of the inner anti-creep spring cup at the points adjacent to the two locking holes in the nose cap. The bulging of the inner anti-creep spring cup locks the detonator plunger in the forward position and assures complete alignment of the explosive train. The shear wire securing the plunger or secondary firing pin is sheared under the gas pressure and the plunger or secondary firing pin is forced into the secondary primer. The functioning of the secondary primer fires the detonator which fires the detonator plunger load and the two booster lead-outs, the two booster lead-ins, and the two boosters which initiate the main explosive charge in the rocket head. The fuze fires with a slight inherent mechanical delay peculiar to all inertia plunger type base fuzes (0.003 seconds approximately).

Acceptance test data. Random sample live-loaded fuzes from each lot are assembled in 4"/50 caliber HC projectiles and fired in accordance with the ballistic acceptance tests in Table 2.

Table 2

Rounds	Velocity	Obliquity	Plate
2	2200 f/s	45°	3/8" m. s.
2	1000 f/s	0°	3/8" m. s.
1 (from 1st and each 5th lot thereafter)	2200 f/s	Water impact at non-ricochet angles	

Detonation of tested samples must take place at not more than four feet behind the plate when the projectile is fired at 2200 f/s velocity and not more than two feet at 1000 f/s velocity. For the plate impact test, an overall performance of 75%

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high-order functioning is required for acceptance of each lot. For the water impact test, satisfactory performance, when combined with the plate impact test, shall be 80% high-order functioning. A premature functioning of any fuze shall cause rejection of the lot.

Sensitivity limits. Fuze Mk 31 Mod 0 will function reliably upon impact with targets offering sufficient resistance such as ground, plate, or wood and upon impact with water at angles of fall of 5° or greater. Tests in rockets have indicated that the fuze will function on 85% of hits on 1/8-inch mild steel plates at angles of obliquity up to 55° when fired in the 5.0-inch Rocket Head Mk 8. On special treatment steel of thickness of one inch or greater, rocket head breakup, generally occurs.

4. Safety Features

Detonator safety. Fuze Mk 31 Mod 0 is detonator safe. The detonator lead-outs and the booster lead-ins are not aligned until the detonator plunger moves forward upon impact after the detonator plunger detents have moved out under centrifugal force.

During shipping and stowage. Fuze samples from production lots are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure to pass these tests shall be cause for rejection of the lot.

5. Disposal and Servicing (Maintenance)

General. Fuze Mk 31 Mod 0 is unsafe to handle after the round has been launched. Any dud around utilizing this fuze should be disposed of by gently lowering it, base down, into deep water or by Explosive Ordnance Disposal Personnel in accordance with existing instructions. No attempt should be made to remove the fuze from the round.

Disassembly. Disassembly of this fuze or the removal of the fuze from the rocket head is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

The rocket head loading activity installs the Fuze Mk 31 Mod 0 in the rocket head and assembles the gas check gaskets. Before assembling the rocket head to the rocket motor, **be certain that the fuze is present, gas checked, and properly installed into the rocket head.**

7. Packing and Marking

Packing. Fuze Mk 31 is shipped assembled into the rocket head.

Marking. The fuze is marked at the base end of the plunger retaining plug with the mark, mod, and lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the inspector's symbol, and the anchor stamp.

Chapter 3

NOSE FUZES FOR 4.5-INCH SURFACE FIN STABILIZED ROCKETS

The fuzes described in this group are as follows:

Section A—Nose Fuze Mk 137 Mods 0, 1, and 2

Section B—Nose Fuze Mk 145 Mods 0 and 1

Section C—Nose Fuze Mk 154 Mods 0, 2, and 3

Section A—Nose Fuze Mk 137 Mods 0, 1, and 2 (Setback and Air Arming, Impact Firing)

1. General Data

Used in: 4.5-inch Rocket Head Mk 3 (High Capacity)

Overall dimensions and weight of fuze:

Length..... 2.9 inches

Diameter (maximum)..... 2.7 inches

Body threads..... 1.50 inches—12 NF-2
RH

Weight..... 0.9 lb. approx.

Applicable specification: OS 2864

General arrangement drawing:

344523 (Mods 0 & 1)

437988 (Mod 2)

Sketch list of drawings & specs:

102930 (Mods 0 & 1)

109467 (Mod 2)

Explosive components:

Detonator Mk 23 (azide primer mixture with lead azide and tetryl) housed in the shutter.

Booster lead-in (tetryl) housed in the lead-in disc.

Booster charge (9 grams tetryl) housed in the booster magazine.

2. Description

General. Fuze Mk 137 Mod 0, or Mod 1 or Mod 2, is a setback and air arming, impact firing, rocket nose fuze. The fuze was designed primarily for use in rounds to be launched from small craft in beach barrage actions; however, its use has been extended to many other tactical applications.

Fuze Mk 137 arms during flight and fires instantaneously upon impact with suitable targets. Fuze Mk 137 Mod 0 has a propeller with eight vanes. Fuze Mk 137 Mod 1 has a propeller with ten vanes and internal changes. Fuze Mk 137 Mod 2 has the modifications of Fuze Mk 137 Mod 1 plus a rivet head stop on the propeller hub in place of an embossed stop.

Use. Fuze Mk 137 Mod 0, or Mod 1 or Mod 2, is used in the 4.5-inch High Capacity Fin Stabilized Surface Rocket (Complete Round) Mk 1 Mod 0. (See OP 1415). The round is utilized for barrage purposes.

Functioning mechanism. Fuze Mk 137 consists of a brass fuze body which provides housing for the threaded firing pin, the setback block with propeller locking pin, the setback spring, the firing pin guide, the spacer sleeve, the shutter with the detonator and locking detent, the lead-in disc with lead-in charge, and the booster magazine with booster charge. The multivane propeller and its hub are mounted externally at the forward end of the threaded firing pin.

The forward section of the fuze body is tapered slightly towards a flat nose surface. At the base of the taper a narrow ledge serves as a mounting support for the propeller guard and as a shoulder for the external installation threads. A deep bore with counterbore provides the internal housing for the fuze elements. The thin nose wall is drilled

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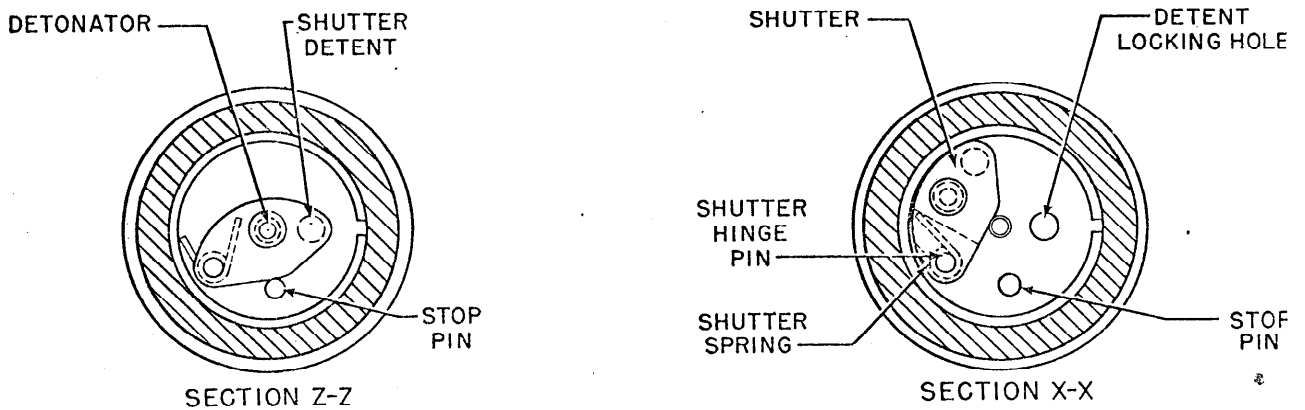
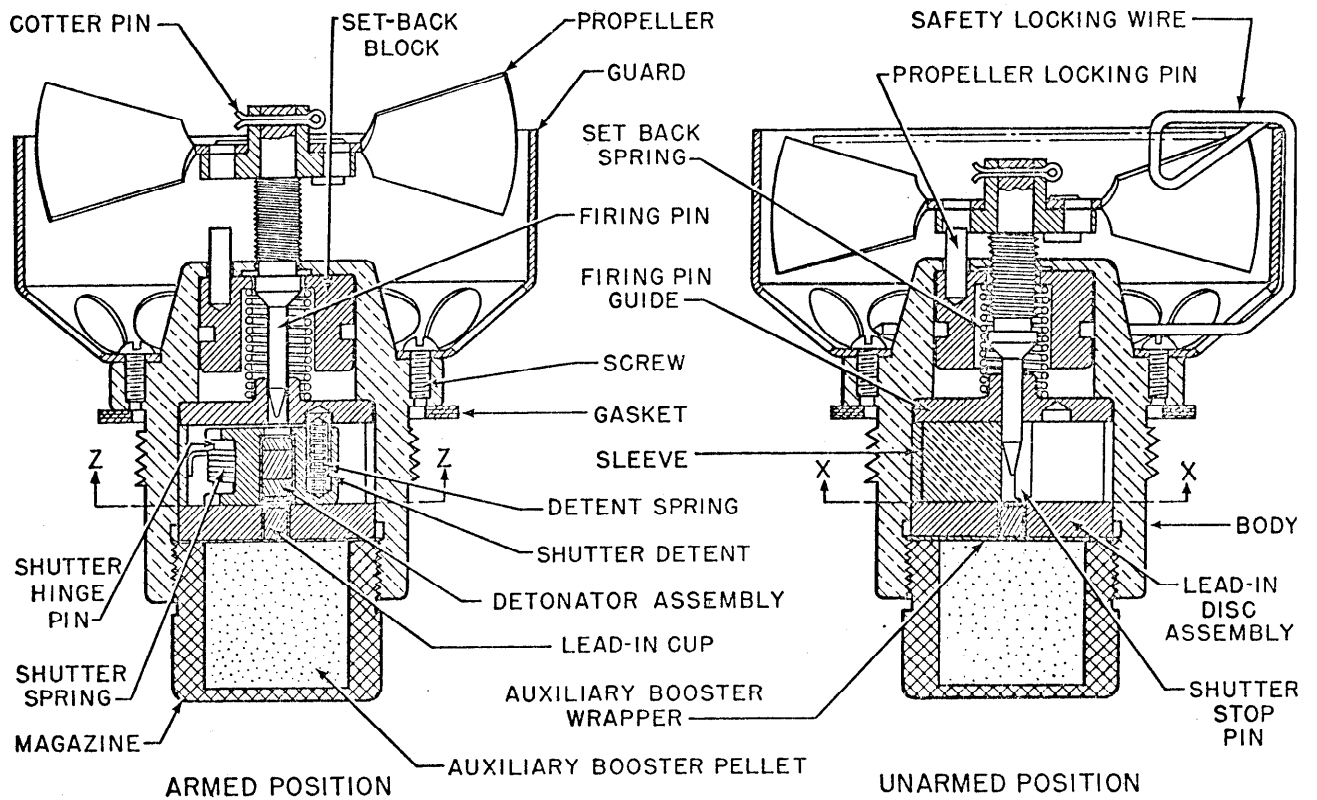


Figure 12—Nose Fuze Mk 137 Mod 2, Cross Section View, Armed and Unarmed Position.

and threaded at the center to receive the firing pin and a second hole is drilled off center to accommodate the propeller locking pin. The counterbore at the base of the fuze is threaded to engage the booster magazine.

The firing pin is secured to the propeller assembly by means of a cotter pin passing through the firing pin shaft and the propeller hub. Below this hub there is a threaded surface on the firing pin which engages the threads in the nose of the body, and beyond the threads a machined shoulder prevents the complete retraction of the firing pin during air arming. The shoulder tapers down toward the base of the firing pin forming a conical surface. An elongated portion of the same diameter as the base of the conical surface extends approximately 1/2-inch and then tapers to a point. The setback block, a steel inertia collar with an integral propeller locking pin, floats around the firing pin on the setback spring and bears against the nose wall. The propeller locking pin which locks the propeller assembly extends from the surface of the setback block through the guide hole in the nose wall to engage a rivet or embossed stop in the arming vane hub. The setback spring at its forward end bears against the setback block and at its base against the firing pin guide. The firing pin guide, a flat steel disc with the center portion raised to align the setback spring and drilled to accept the pointed shaft of the firing pin, bears against the shoulder provided by the fuze body cavity. The bottom surface of the firing pin guide provides the base for the shutter hinge pin and shutter stop pin. The modified semi-circular shutter houses the detonator and rotates about the shutter hinge pin under the force of a torque spring. A small spring-loaded detent in the shutter engages a small well in the firing pin guide after arming. A split ring type spacer called a sleeve, bears against the firing pin guide and positions the lead-in disc with its charge. The booster magazine and charge is installed into the base of the fuze body and bears against the lead-in disc separated by a thin paper booster disc. A removable safety locking wire which clips over the propeller guard passes through aligned holes in the fuze body and engages a slot in the setback block to lock the setback block and propeller locking pin in the forward position.

3. Functioning

Arming. The safety locking wire is withdrawn prior to the firing of the round. When the rocket is fired, setback force, due to acceleration, forces the setback block rearward and compresses the setback spring. This movement withdraws the propeller locking pin from engagement with the propeller hub. The air stream, acting on the propeller, causes it to rotate and thereby unscrew the firing pin forward in the fuze body. The setback force acts on the setback block during the burning of the rocket propellant then the setback spring returns the block to its original forward position. However, the firing pin has in the meantime unscrewed from the fuze body sufficiently to prevent re-engagement of the propeller locking pin with the propeller hub.

Rotation of the propeller continues to unscrew the firing pin until the unthreaded section is reached and the shoulder of the stop on the firing pin contacts the top of the fuze body. Before the firing pin is unscrewed, it holds the detonator shutter to one side so that the detonator is out of alignment with the firing pin and booster lead-in. When the firing pin is unscrewed sufficiently, the shutter is released under influence of the torque spring and the shutter is pivoted until it contacts a stop pin in the firing pin guide. At this instant the shutter detent engages the well in the firing pin guide to lock the shutter in aligned position. The detonator is now aligned with the firing pin and the booster lead-in, and the fuze is completely armed. The arming distance of Fuze Mk 137 is approximately 125 feet.

Firing. On impact, the firing pin is forced back to shear the light screw threads in the nose wall of the fuze body and to pierce and fire the detonator which in turn fires the lead-in charge and the booster charge.

Acceptance test data. Completely live-loaded random sample fuzes from each lot shall be installed in suitable live-loaded rockets and the rockets fired for high order functioning on ground or water impact. All rockets shall be fired from a launcher which is set at an angle of elevation of approximately 45 degrees. Acceptance is based on a cumulative test plan designed to accept (95% of the time) lots in which 95% of the fuzes function satisfactorily: lots poorer than 95% will be subject to rejection with lots 82% effective being

rejected 90% of the time. Based on wartime production acceptance records, Fuze Mk 137 gave better than 97% performance.

Sensitivity limits. Fuze Mk 137 will function instantaneously superquick upon impact with water, plate, or ground targets at angles of fall of 15 degrees or greater.

4. Safety Features

Detonator safety. This fuze is detonator safe. In the unarmed position, the detonator is held out of alignment with the explosive train. Should the detonator function prematurely while the fuze is unarmed, the force of the detonator action will be dissipated forward through a hole in the firing pin guide and away from the remaining explosive components. The fuze is not armed until the setback force withdraws the propeller locking pin and the propeller rotates and withdraws the firing pin to a point where the detonator shutter is released.

During shipping and stowage. Sample fuzes from each production lot are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure to pass these tests is cause for rejection of the lot.

Fuze Mk 137 is provided with a safety locking wire which passes through holes in the fuze body to lock the setback block in the forward position so that the propeller locking pin engages the propeller hub. The locking wire also engages the propeller to prevent it from rotating. The propeller guard gives protection to the propeller during normal handling.

5. Disposal and Servicing (Maintenance)

General. If the fuze becomes accidentally armed, whether assembled into the rocket or not, no attempt should be made to unarm it. If the fuze is armed, turning the propeller counterclockwise will cause the firing pin to pierce the detonator and initiate the booster and main charge. The fuze shall be considered armed if the propeller is out of engagement with the propeller locking pin so that the propeller is free to rotate. Armed fuzes must NOT be installed in rounds for any purpose. To dispose of a fuze or fuzed round, the fuze propeller should first be carefully taped and the fuze or fuzed round, as the case may be, disposed of by gently lowering it, base down, into deep water or by Explosive Ordnance Disposal

Personnel in accordance with existing instructions.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

Examine each fuze before installation in the rocket to check if the propeller has been unscrewed so that the forward tips of the propeller blades extend out beyond the plane of the rim of the propeller guard. If the fuze is found in this condition, it should be considered armed; the propeller should be taped so that it cannot be moved; and the fuze should be disposed of by methods described under paragraph 5, Disposal and Servicing.

After each fuze has been examined as above, and the propeller has been found to be below the rim of the propeller guard, remove the safety locking wire and try to turn the vane in a clockwise direction (when the fuze is viewed from the nose) 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 cannot be turned, replace the safety locking wire, and the fuze is safe for use. 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. Then replace the safety locking wire, and the fuze is safe for use or stowage.

NOTE: The sealed metal containers in which these fuzes are shipped should not be opened for the sole purpose of checking the fuzes. Rather, the checking should be done at the time the sealed cans are opened preparatory to installing the fuze in the rocket body.

After the above examination, proceed as follows:

1. Remove the shipping plug, shipping plug gasket, and paper tube from the rocket body. Inspect the liner and clean if necessary. Be certain that the auxiliary booster is present in the fuze seat liner.

2. Examine the fuze for damage. If defective, (but not armed) repack, seal container with tape, and return to an ammunition depot.

3. With the fuze gasket in place, screw the fuze securely into the nose of the rocket with the proper fuze spanner wrench.

4. As the rocket is placed in the launcher, remove the safety locking wire.

5. If, for any reason, it becomes necessary to remove the rocket from the launcher, the safety locking wire should immediately be replaced, and the fuze may then be removed from the rocket.

7. Packing and Marking

Packing. Each fuze is packed in a hermetically sealed can; 48 cans are contained in a wood box

23¼ inches by 15 inches by 8¾ inches which represents a total of 1.7 cu. ft. The weight of the fuzes and packing is approximately 72 pounds.

Marking. The fuze is marked or stamped to show the letters NF, the mark, mod, and lot number, the manufacturer's initials or symbol, the date of manufacture, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Section B—Nose Fuze Mk 145 Mods 0 and 1 (Setback and Air Arming, Impact Firing)

1. General Data

Used in: 4.5-inch Rocket Head Mk 3 (High Capacity)

Overall dimensions and weight of fuze:

Length.....	3.0 inches
Diameter (maximum).....	2.7 inches
Body threads.....	1.500 inches— 12 NF-2
Weight.....	0.9 lb. approx.

Applicable specification: (to be prepared)

General arrangement drawings:

344601 (Mod 0)

422548 (Mod 1)

Sketch list of drawings & specs:

102957 (Mod 0)

109583 (Mod 1)

Explosive components:

Delay assembly consisting of a Detonator Mk 31 and a Primer Mk 106. Delay is 0.02 second.

Booster lead-in housed in the magazine.

Booster charge (approximately 11.5 grams of tetryl) housed in the magazine.

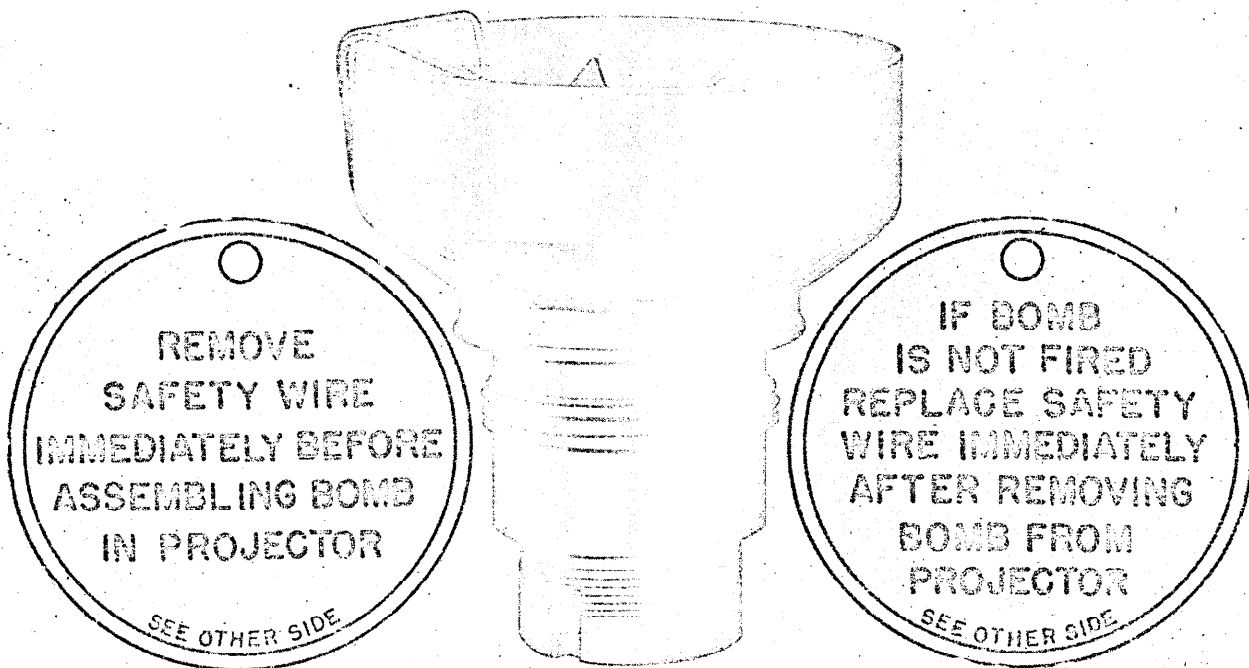


Figure 13—Nose Fuze Mk 145, External View, Full Size (approximately).

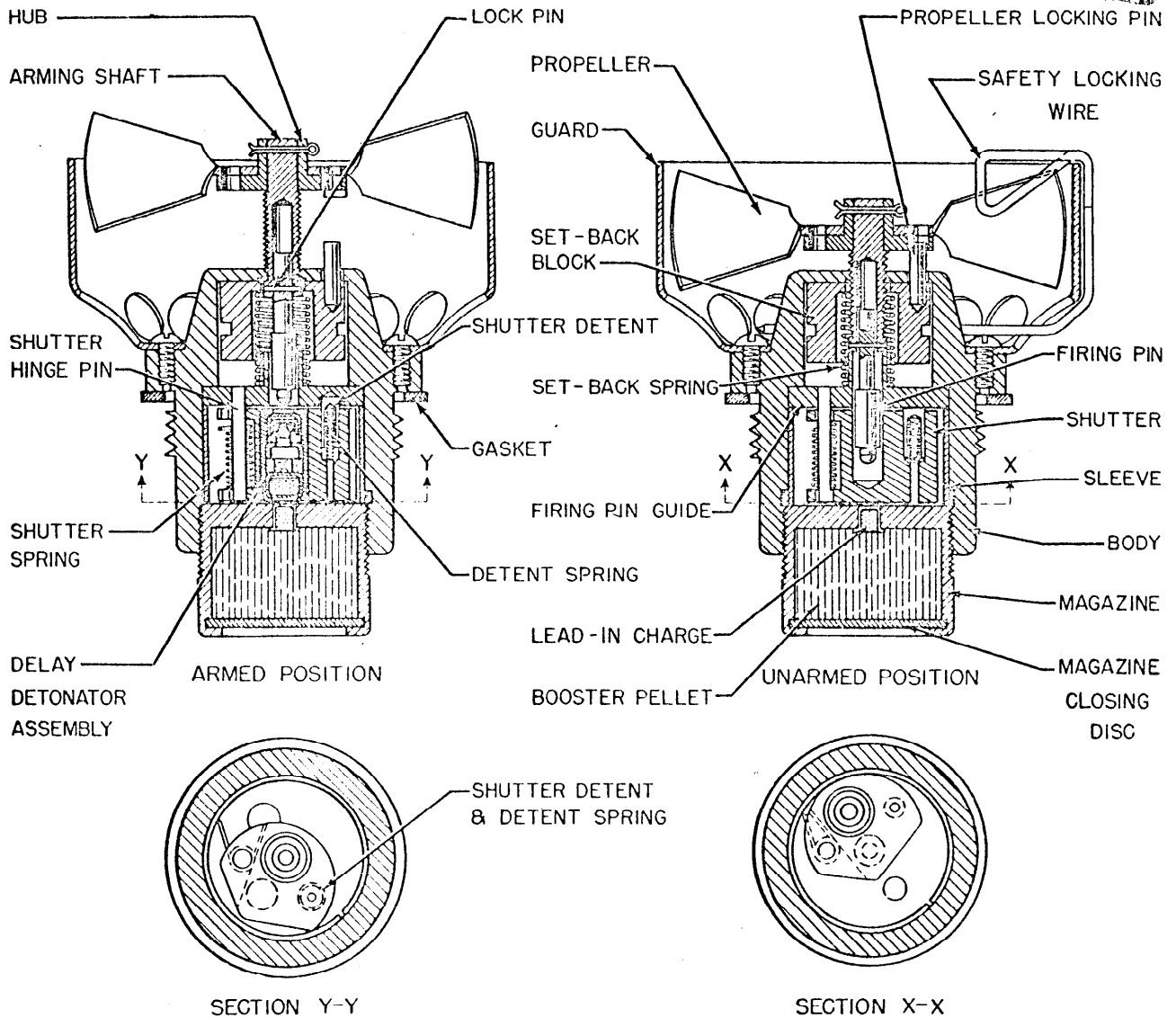


Figure 14—Nose Fuze Mk 145 Mod 1, Cross Section View, Armed and Unarmed Position.

2. Description

General. Nose Fuzes Mk 145 Mods 0 and 1 are rocket fuzes designed principally for rockets launched from small craft to provide a beach barrage prior to landing operations. The fuzes are air arming and impact firing and are similar to the Mk 137, but incorporate a 0.02 second delay in the detonator assembly.

Use. Fuze Mk 145 is used in the 4.5-inch High Capacity Fin Stabilized Surface Rocket (Complete Round) Mk1 Mod 0 (see OP 1415.) This fuze is used when a delay detonation on impact is desired.

Functioning mechanism. The functioning mechanism of Fuze Mk 145 is similar to the mechanism of Fuze Mk 137. The differences incorporated in the mechanism of Fuze Mk 145 are:

1. The arming shaft which mounts the propeller is attached to the firing pin by means of a locking pin. The purpose of the locking pin (which may be sheared upon impact) is to prevent the firing pin from being forced too deeply into the shutter thus disrupting the delay element on heavy impact.

2. The fuze contains a delay element which is initiated by a firing pin with a rounded point.

3. The magazine is designed to receive the booster lead-in which eliminates a separate lead-in disc.

Differences in mods. The Fuze Mk 145 Mod 0 is similar to the Fuze Mk 137 Mod 1 but has a 0.02 second delay. The Fuze Mk 145 Mod 1 is similar to Fuze Mk 137 Mod 2 with a 0.02 second delay.

3. Functioning

Arming. Arming of Fuze Mk 145 is identical with Fuze Mk 137.

Firing. Similar to firing of Fuze Mk 137, but fuze functions with a 0.02 second delay after impact.

4. Safety Features

See Fuze Mk 137.

5. Disposal and Servicing (Maintenance)

See Fuze Mk 137.

6. Installation Instructions

See Fuze Mk 137.

7. Packing and Marking

See Fuze Mk 137.

Section C—Nose Fuze Mk 154 Mods 0, 2, and 3 (Setback and Air Arming, Impact Firing)

1. General Data

Used in: 4.5-inch Rocket Heads Mk 7 and Mk 10 (Smoke)

Overall dimensions and weight of fuze:

Length.....	16.25 inches
Diameter (maximum).....	2.7 inches
Body threads.....	1.5 inches— 12 NF-2
Weight.....	1.40 lbs. approx.

Applicable specification: OS 3577

General arrangement drawings:

- 423844 (Mod 0)
- 423847 (Mod 2)
- 423848 (Mod 3)

Sketch list of drawings & specs:

- 109411 (Mod 0)
- 165110 (Mod 2)
- 165074 (Mod 3)

Explosive components:

- Detonator Mk 23 housed in shutter.
- Booster lead-in housed in lead-in disc.
- Burster charge (approximately 65 grams of tetryl)

2. Description

General. Nose Fuze Mk 154 Mod 0, Mod 2, or Mod 3, is identical with Fuze Mk 137 except a tetryl filled burster tube replaces the booster.

The mods of the fuze differ as follows:

1. Fuze Mk 154 Mod 0 consists of a Fuze Mk 137 Mod 1 with a 14.06-inch long tetryl filled burster tube (0.630-inch diameter) which is rigidly attached to the fuze body.

2. Fuze Mk 154 Mod 1—Never assigned.

3. Fuze Mk 154 Mod 2 consists of a Fuze Mk 137 Mod 2 with a 14.06-inch tetryl filled burster tube which is rigidly attached to the fuze body.

4. Fuze Mk 154 Mod 3 consists of a Fuze Mk 137 Mod 2 with a 14.06-inch tetryl filled burster tube. Its attachment to the fuze body is such that a certain degree of flexibility is obtained. This is accomplished by a steel retaining collar brazed to the upper end of the burster tube. A rubber gasket is inserted between the burster tube collar and the adapter. Between the wall of the burster tube and the inside wall of the adapter a clearance of approximately 0.03 inches exists. This flexibility aids in the assembly of the long fuze into the rocket head burster well when the burster tube is not perfectly concentric with the fuze body threads.

Use. Nose Fuzes Mk 154 Mods 0, 2, and 3 are used in the 4.5-inch Smoke Fin Stabilized Surface Rockets (Complete Rounds) Mk 4 Mod 0, Mod 1, and Mod 2 (see OP 1415). These fuzes are designed to detonate a tetryl filled burster tube and distribute the smoke filler of the rocket head on impact with the surface of the ground or water.

Functioning mechanism. (See Fuze Mk 137)

3. Functioning

Arming. (Same as Fuze Mk 137)

Firing. (Same as Fuze Mk 137)

Acceptance test data. Completely live loaded fuzes are selected from each production lot and are installed in 4.5-inch "FS" loaded rocket heads assembled with 2.25-inch Rocket Motors Mk 9

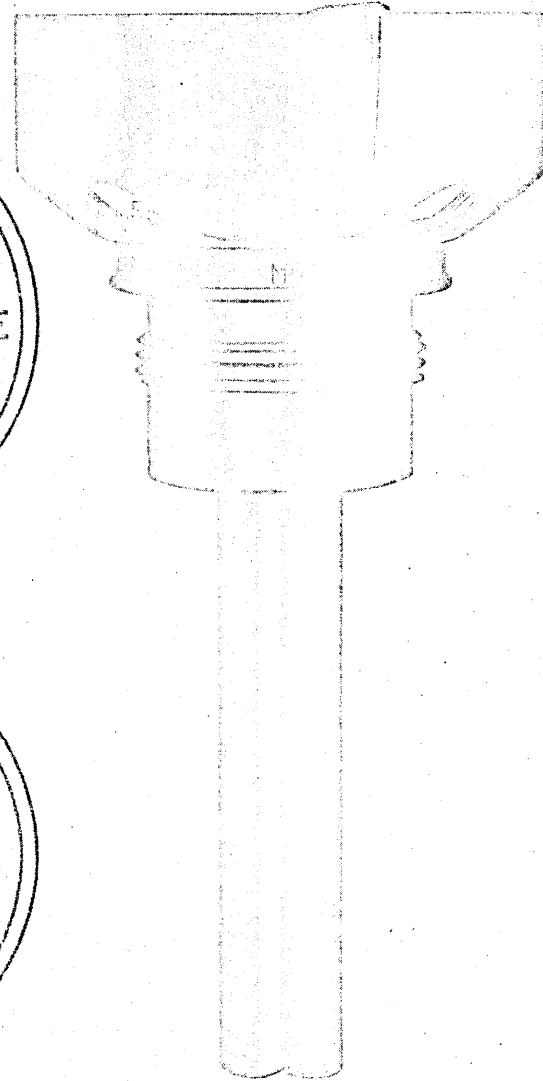
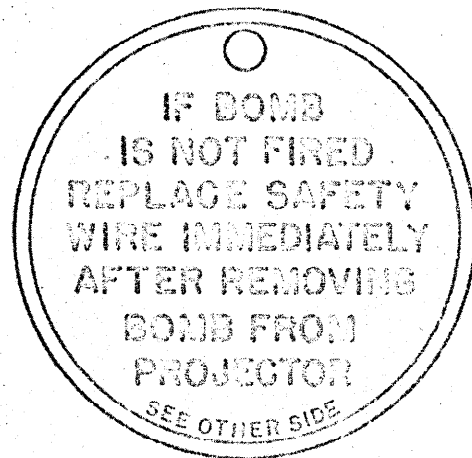


Figure 15—Nose Fuze Mk 154 Mod 3, External View, Full Size (approximately) except for Burster Tube Length.

and fired at 45 degrees quadrant angle. Half of the fuzed rounds are fired for ground impact and the other half for water impact. A 90% high order functioning is considered satisfactory. Any premature shall be cause for rejection of the lot.

4. Safety Features

Same as Fuze Mk 137.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 137.

6. Installation Instructions

No auxiliary booster is present or required in smoke filled rocket heads receiving the Fuze Mk 154. All other installation instructions as related for Fuze Mk 137 are applicable for Fuze Mk 154.

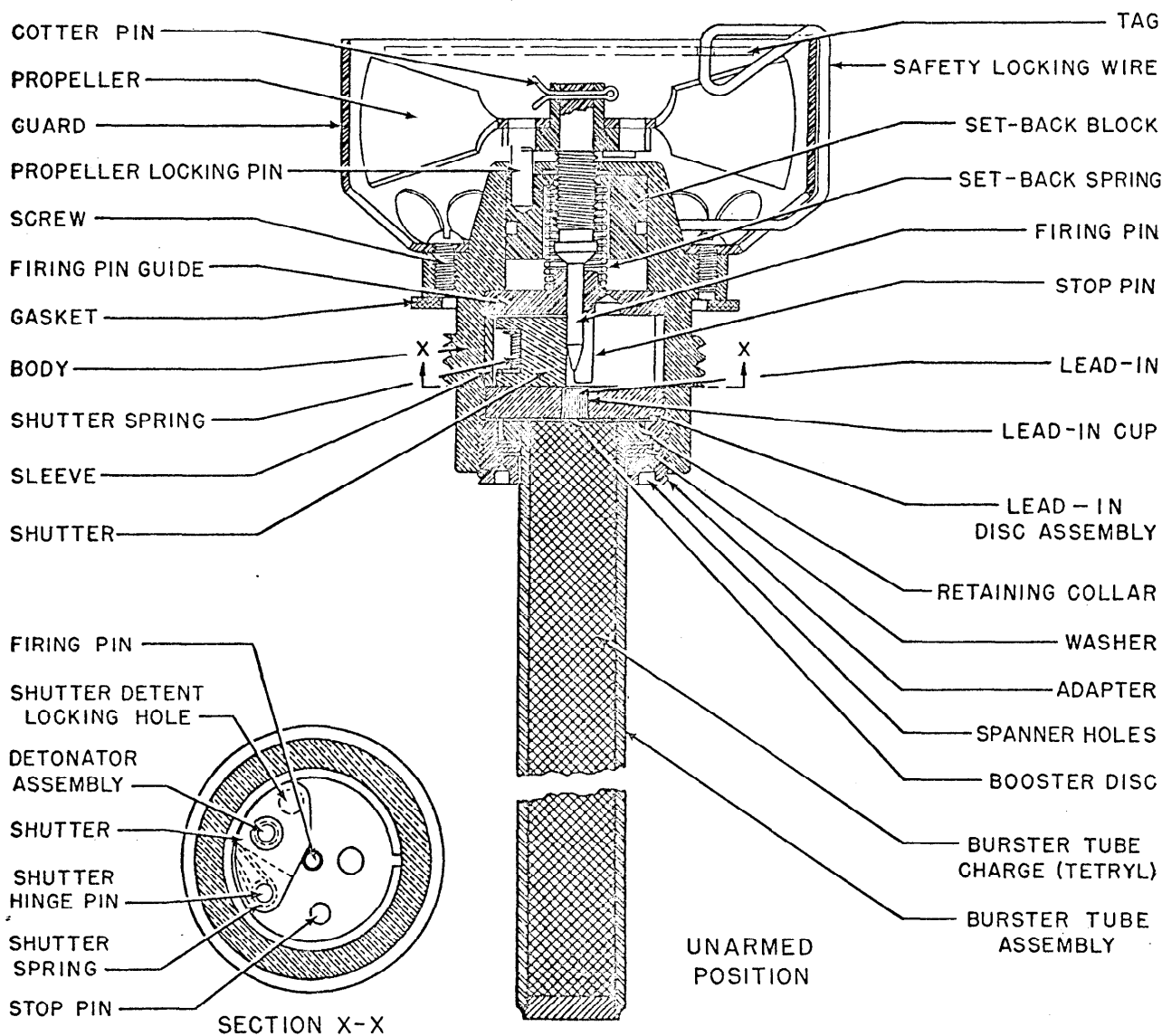


Figure 16—Nose Fuze Mk 154 Mod 3, Cross Section View, Unarmed Position.

7. Packing and Marking

Packing. Fuzes are individually packed in hermetically sealed cans. Twenty-four fuzes are packed in a box 23.3 inches by 15 inches by 19.2 inches which represents a total of 3.9 cu. ft. and a total weight of 83 pounds.

Marking. The fuze is marked or stamped to show the letters NF, the mark, mod, and lot number, the manufacturer's initials or symbol, the date of manufacture, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

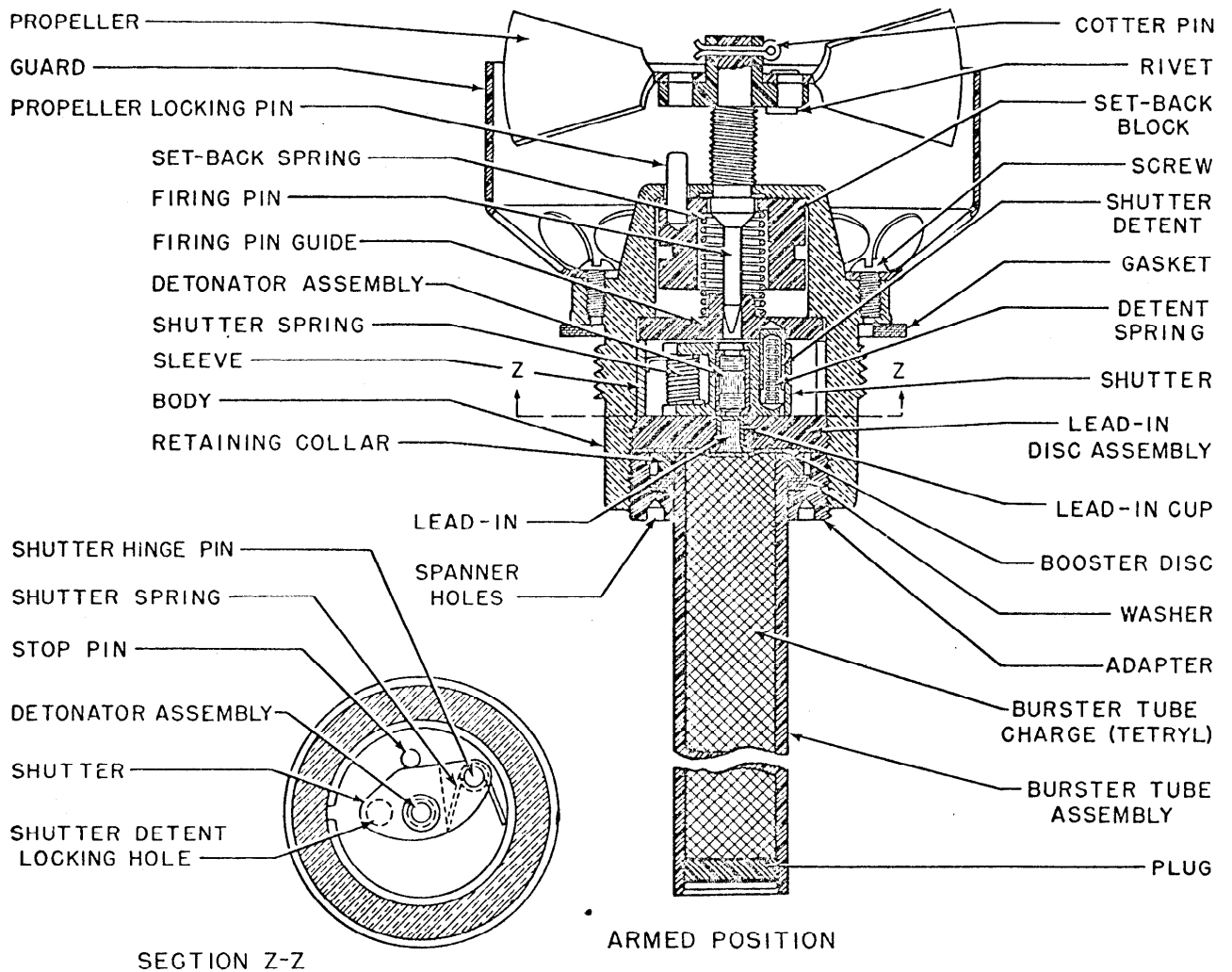


Figure 17—Nose Fuze Mk 154 Mod 3, Cross Section View, Armed Position.

NOSE FUZE FOR 7.2-INCH CHEMICAL ROCKET

Section A—Nose Fuze Mk 147 Mods 0 and 1 (Setback and Air Arming, Impact Firing)

1. General Data

Used in: 7.2-inch Rocket Head Mk 7 (Chemical or Smoke)

Overall dimensions and weight of fuze:

Length.....	16.1 inches (Mod 0)
	16.2 inches (Mod 1)
Diameter (maximum).....	1.750 inches
Body threads.....	1.500 inches— 12 NF-2
Weight.....	1.30 lbs. approx.

Applicable specification: OS 3579

General arrangement drawing:

394940 (Mod 0)

423842 (Mod 1)

Sketch list of drawings & specs:

109548 (Mod 0)

109372 (Mod 1)

Explosive components:

A sensitive stab type compound detonator
Mk 23 Mod 0 (lead azide primer mixture,
lead azide, and tetryl)

Burster lead-in charge (tetryl)

Burster charge (tetryl 65 grams approxi-
mately)

2. Description

General. Fuze Mk 147 Mod 0 or Mod 1 is a nose fuze designed for 7.2-inch chemical rockets. The fuze is setback and air-arming, impact firing. It functions instantaneously upon impact with a suitable target.

Fuze Mk 147 Mod 0 is fitted with a fixed cylindrical guard which protects the propeller from damage. The propeller vanes are bent to an angle of 70°. Fuze Mk 147 Mod 1 has a detachable shipping cap which protects the propeller from damage during shipping and the fuze from weather. Since the air stream is more effective on the Fuze Mk 147 Mod 1, the vanes are bent to an angle of 78° to keep the arming distance the same as for the Fuze Mk 147 Mod 0. The shipping cap on the Fuze Mk 147 Mod 1 is removed as the rocket is loaded on the launcher.

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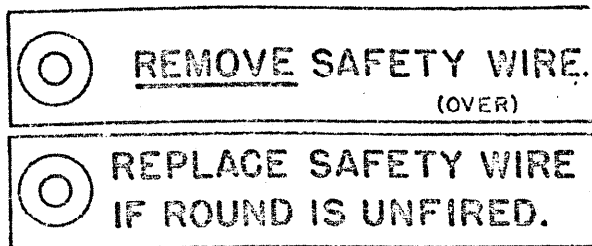
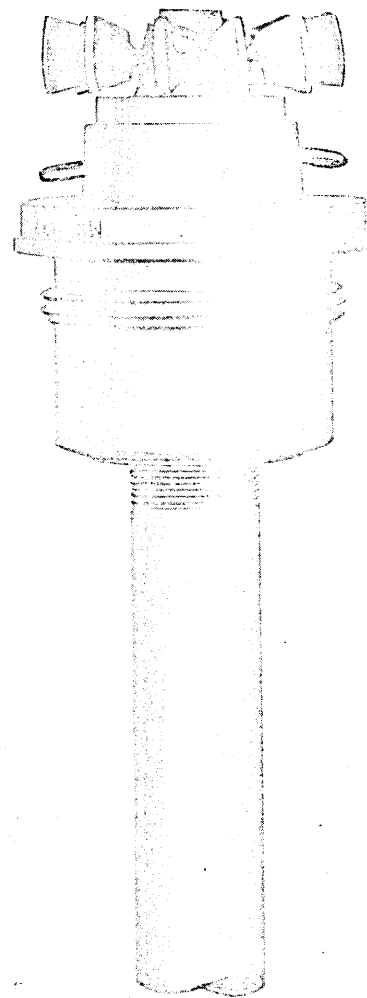


Figure 18—Nose Fuze Mk 147 Mod 1, External View with Guard Removed, Full Size (approximately) except for Burster Tube Length.

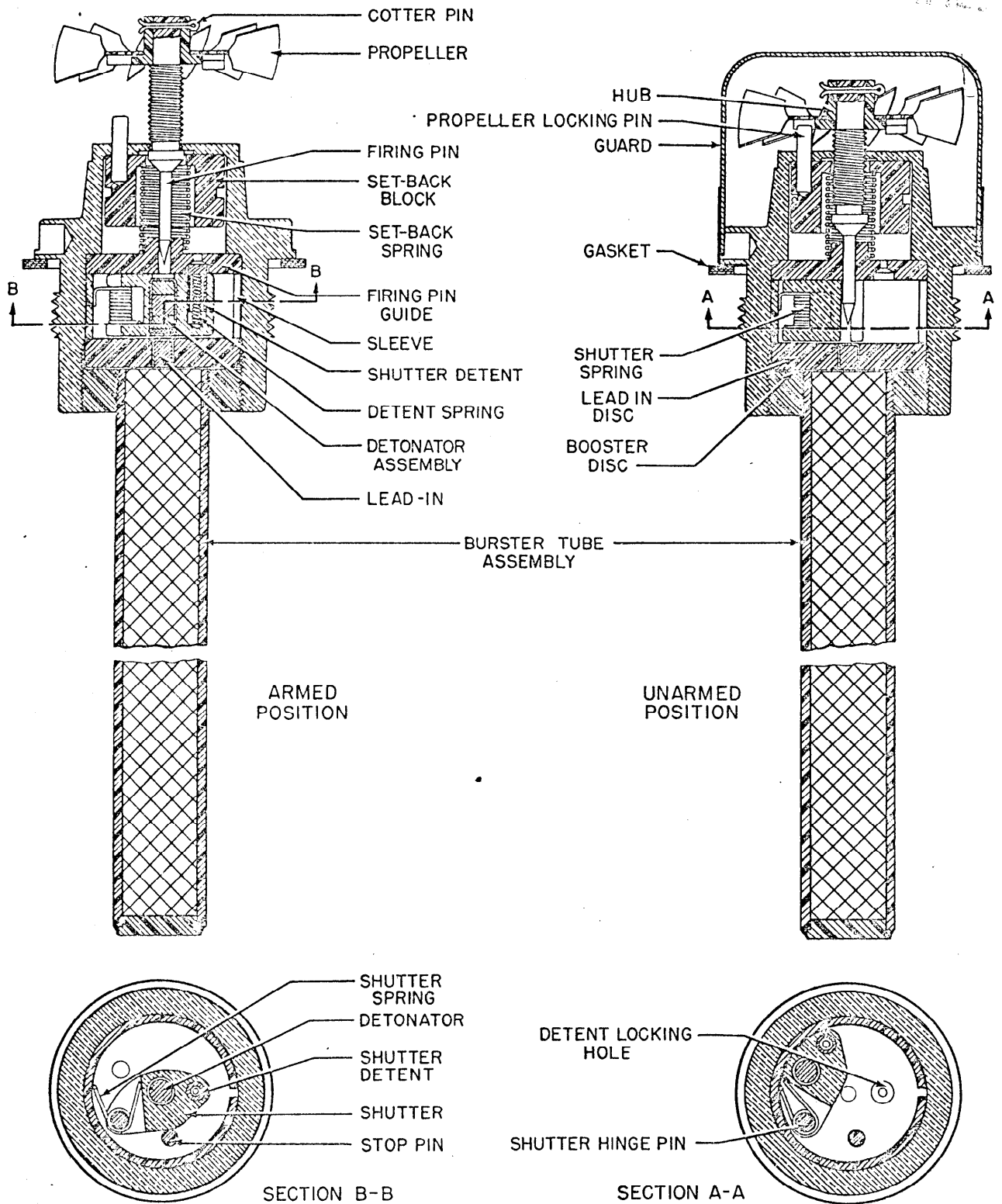


Figure 19—Nose Fuze Mk 147 Mod 1, Cross Section View, Armed and Unarmed Position.

Fuze. Fuze Mk 147 Mod 0 or Mk 147 Mod 1 is used in the 7.2-inch Rocket Head Mk 7 when assembled with the 3.25-inch Rocket Motor Mk 5. The complete round is fin stabilized and surface launched for use in dispersing chemical or smoke agents. It has a maximum range of approximately 3,400 yards.

Functioning mechanism. Fuze Mk 147 consists of a brass fuze body which provides housing for the threaded firing pin, the setback collar with propeller locking pin, the setback spring, the firing pin guide, the spacing sleeve, the shutter with the detonator and locking detent, the lead-in disc with lead-in charge, and the burster adapter with external burster tube and charge. The propeller and its hub are mounted externally at the forward end of the threaded firing pin and are secured in position by means of a cotter pin.

The forward section of the fuze body is tapered slightly towards a nose surface. Below the tapered section the body diameter increases to serve as a mounting support for the vane guard in Fuze Mk 147 Mod 0 and as a shoulder for the external installation threads. A deep bore with counterbore provides the internal housing for the fuze elements. The thin nose wall is drilled and threaded at the center with light shear threads, and a second hole is drilled off center to accommodate the propeller locking pin. The counterbore at the base of the fuze is threaded to engage the burster adapter.

The propeller assembly consisting of the propeller and hub is secured to the firing pin. Below the hub the firing pin is threaded for a short distance and these threads engage the threaded hole in the nose of the fuze body. A shoulder on the firing pin below the threads tapers rearward to form a conical surface which is followed by an elongated section tapered at its end to a sharp point. The shoulder prevents the retraction of the firing pin beyond the threads during arming and the conical surface acts as a stop to control the depth of penetration of the firing pin on impact. The setback block, a steel inertia block with an integral propeller locking pin, floats around the firing pin on the setback spring and bears against the nose wall. The propeller locking pin extends from the forward surface of the setback block through the guide hole in the nose wall to engage a rivet or embossed stop in the propeller

hub which locks the propeller assembly. The setback spring at its forward end bears against the setback collar and at its base against the firing pin guide. The firing pin guide, a flat steel disc with the center portion raised to align the setback spring and drilled to accept the pointed shaft of the firing pin bears against the shoulder provided by the counterbore. The firing pin guide has a hole drilled in its base which receives the shutter hinge pin. The modified semi-circular shutter houses the detonator and pivots by means of the shutter hinge pin under the force of a torque spring after the firing pin has been retracted. A small spring loaded detent in the shutter engages a small well in the firing pin guide after arming. A ring type sleeve bears against the firing pin guide and positions the lead-in disc with its charge. The burster tube and burster adapter are installed into the base of the fuze body and bear against the lead-in disc separated by the thin paper booster disc. With Fuze Mk 147 Mod 0 a removable safety locking wire clips over the propeller guard and passes through aligned holes in the fuze body and also engages a slot in the setback block to lock the setback block and propeller locking pin in forward position. With Fuze Mk 147 Mod 1 the propeller guard is replaced by a removable cap type guard, and the safety locking wire passes through aligned holes in the fuze body and setback block in the same manner as indicated above.

3. Functioning

Arming. After the rocket has been loaded into the launcher, the shipping cap (in Fuze Mk 147 Mod 1 only) and safety wire are removed. When the rocket is fired, the setback force, due to the acceleration of the round acting on the setback block, forces the block back, compressing the setback spring. This movement withdraws the propeller locking pin from engagement with the hub. The air stream acting on the propeller assembly causes it to rotate and unscrew the firing pin from the fuze body. The setback force acts on the setback block only during burning of the rocket motor, after which the setback spring returns the block to its original forward position. However, the firing pin has meanwhile unscrewed from the fuze body sufficiently to prevent re-engagement of the propeller locking pin with the propeller. The propeller is so adjusted that under the least favorable conditions (short burning

distance at maximum service temperature) the firing pin assembly makes the required two complete turns during acceleration of the rocket to advance the firing pin sufficiently to prevent re-engagement of the propeller locking pin with the stops on the hub before the end of burning of the rocket.

Rotation of the propeller continues to unscrew the firing pin, until an unthreaded section is reached and a shoulder on the pin comes up against the top of the fuze body, after which the firing pin assembly rotates freely. Before the firing pin is unscrewed it holds the detonator shutter to one side, so that the detonator is out of alignment with the firing pin and booster lead-in. When the firing pin unscrews, the shutter is released, and the shutter spring rotates the shutter against a stop pin. A shutter detent engages a hole in the firing pin guide and locks the shutter in position. The detonator is now aligned with the firing pin and the booster lead-in, and the fuze is fully armed.

The arming distance for Fuze Mk 147 used in the 7.2-inch chemical warfare rocket is about 200 feet.

Firing. On impact, the firing pin is forced back to shear the light screw threads in the nose wall of the fuze body and to pierce and fire the detonator which in turn fires the lead-in charge and the burster charge.

Acceptance test data. Sample fuzes chosen at random from each production lot are subjected to routine ballistic test when fired in rocket ammunition in accordance with the following procedure: Completely loaded fuzes from each lot shall be installed in "FS" smoke loaded 7.2-inch Rocket Heads Mk 7 with live loaded motors and fired for functioning. Half of the rockets shall be fired for water impact and the other half for ground impact. All fuzes shall be fired at an angle of elevation of approximately 45 degrees. Ninety percent high order functioning shall be considered acceptable. Any prematures shall be cause for rejection of the lot.

Sensitivity limits. This fuze will fire reliably on water and ground impact, except at small angles of impact. The minimum angle of impact on soft ground for consistent firing is 15 degrees.

4. Safety Features

Detonator safety. Fuze Mk 147 is detonator safe. In the unarmed position the detonator is out of alignment with the explosive train. Should the detonator function prematurely, the force of the detonator will be dissipated forward through a hole in the firing pin guide and away from the explosive components. When the fuze is installed in a rocket head, it is locked in the unarmed position by the propeller locking pin. The fuze is not armed until the setback force withdraws the propeller locking pin, and the propeller rotates and unscrews the firing pin to a point where the detonator shutter is released.

During shipping and stowage. Sample fuzes from production are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure to pass the tests is cause for rejection of the lot. Additional safety is provided during shipping, stowage, and until the rocket is loaded into the launcher, by use of a safety wire. The safety wire passing through the fuze body locks the setback block in forward position so that the propeller locking pin engages and locks the hub. The guard or cap protects the propeller from damage during normal conditions encountered in stowage and handling.

5. Disposal and Servicing (Maintenance)

General. If the fuze is accidentally armed, whether assembled in the rocket head or not, no attempt should be made to unarm it. The fuze shall be considered armed if the propeller is out of engagement with the propeller locking pin so that the propeller is free to rotate. If the fuze is armed, turning the arming vane counterclockwise as viewed from the nose will cause the firing pin to pierce the detonator and initiate the burster. **Replacing the safety wire will not render an armed or partially armed fuze safe.** The safety wire merely locks the setback block and propeller locking pin, and if the latter does not engage the propeller, the safety wire serves no purpose. Armed fuzes **must not** be fired from rocket launchers. If the fuze in an assembled round is armed accidentally, the propeller should be carefully taped to prevent further rotation, and the fuze then carefully removed from the rocket taking care not to drop the round or the fuze on its nose or in any way strike the fuze. Dud rounds should be treated

with extreme caution. If the propeller is bent or driven flush with the nose of the fuze body, the fuze is in a fired condition. In such a condition, the firing pin or propeller should not be disturbed, as the firing pin may be imbedded in the detonator and any movement may create sufficient friction to initiate the sensitive detonator. The fuze or fuzed round should be disposed of by gently lowering into deep water or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

1. Remove the dummy nose plug from the rocket head and inspect the liner and clean if necessary.

2. Remove the fuze from the container and examine to see that the gasket is present and the fuze is not damaged. If defective, repack, seal, and return to an ammunition depot.

3. Screw the fuze with gasket securely into the nose of the rocket head, using the proper fuze spanner wrench.

4. After placing the rounds on the launcher, remove the guard (applicable for Fuze Mk 147

Mod 1) and the safety wire. In some launchers this is not possible. For these the safety wire and shipping guard should be removed immediately before loading the round. Do not discard the safety wires until the rounds are fired.

Removal from round. Should it become necessary to remove the rocket from the launcher, the safety wire and shipping guard should, if possible, be replaced first. The fuze may then be removed from the rocket head with proper fuze spanner wrench and returned to its shipping container. The closed shipping can should be sealed with adhesive tape along the broken surface. The shipping plug must be replaced in the rocket head after the fuze is removed.

7. Packing and Marking

Packing. Fuzes are individually packed into hermetically sealed cans. Twenty-four fuzes are packed into a box 23.3 inches by 15.0 inches by 18.1 inches which represents a total of 3.6 cubic feet and a total weight of 89 pounds.

Marking. The fuze is marked or stamped with the letters NF, the mark, the mod, and the lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Chapter 5

NOSE FUZES FOR 7.2-INCH DEMOLITION ROCKETS

The fuzes described in this group are as follows:

Section A—Nose Fuze Mk 152

Section B—Nose Fuze Mk 141 Mod 0

Section A—Nose Fuze Mk 152 (Air Arming, Impact Firing)

1. General Data

Used in: 7.2-inch Rocket Head Mk 5 (High Capacity)

Overall dimensions and weight of fuze:

Length.....	5.5 inches
Diameter (maximum).....	4.75 inches
Body threads.....	1.75 inches— 14 NS-3
Weight.....	4.10 lbs. approx.

Applicable specification: OS 2374 (where pertinent)

Outline drawing: 423659

Explosive components:

A sensitive stab type compound Detonator Mk 21 (pom-pom mixture and mercury fulminate)

Auxiliary booster lead-in (tetryl) 0.11 grams

Booster separator lead-in (tetryl) 0.20 grams

Booster (tetryl) 25.5 grams

2. Description

General. Fuze Mk 152 is identical with Bomb Fuze AN-Mk 219 except that it has been partially armed fifty turns of the arming vanes and a metal band (fork) is inserted between the vane carrier and the fuze body to take up the space left by the prearming process. In addition, the pitch of the vanes has been increased to 40 degrees in contrast to the pitch of the vanes on the AN-Mk 219 of 18 degrees. The fuze is air arming, and its functioning is instantaneous on impact.

Use. Fuze Mk 152 is used in the 7.2-inch High Capacity Fin Stabilized Surface Rockets (Complete Rounds) Mk 1 Mod 0 and Mod 1 (see OP 1415). The complete round is used for demolition purposes in the destruction of beach obstacles.

Functioning mechanism. The vane carrier is unlocked from the striker flange by withdrawal of the arming wire. The vane carrier then rotates by action of the airstream on the vane driving the reduction gearing. The reduction gearing reduces the motion so that 23 turns of the vane carrier are necessary to produce one revolution of the shaft. The gearing is so arranged that the lower gear carrier engages the slot of the inner sleeve. The upper gear, therefore, takes up the rotation and advances the central shaft on its threads until stopped by the shoulder on the shaft screw. At about this instant the lug on the lower gear carrier is disengaged from the slot in the sleeve, allowing the lower gear and carrier to rotate. As the rotation of the shaft and upper gear is stopped, the motion is transferred to the lower gear and carrier which rotate approximately 345 degrees thereby bringing into alignment the firing pin extension, firing pin, and detonator with the booster lead. As this rotation is completed, a locking detent engages the lower gear carrier to maintain proper alignment of the explosive train.

3. Functioning

Arming. The Fuze Mk 152 arms in two stages. During the first stage, the upper gear is free to rotate and the lower gear, being attached to the

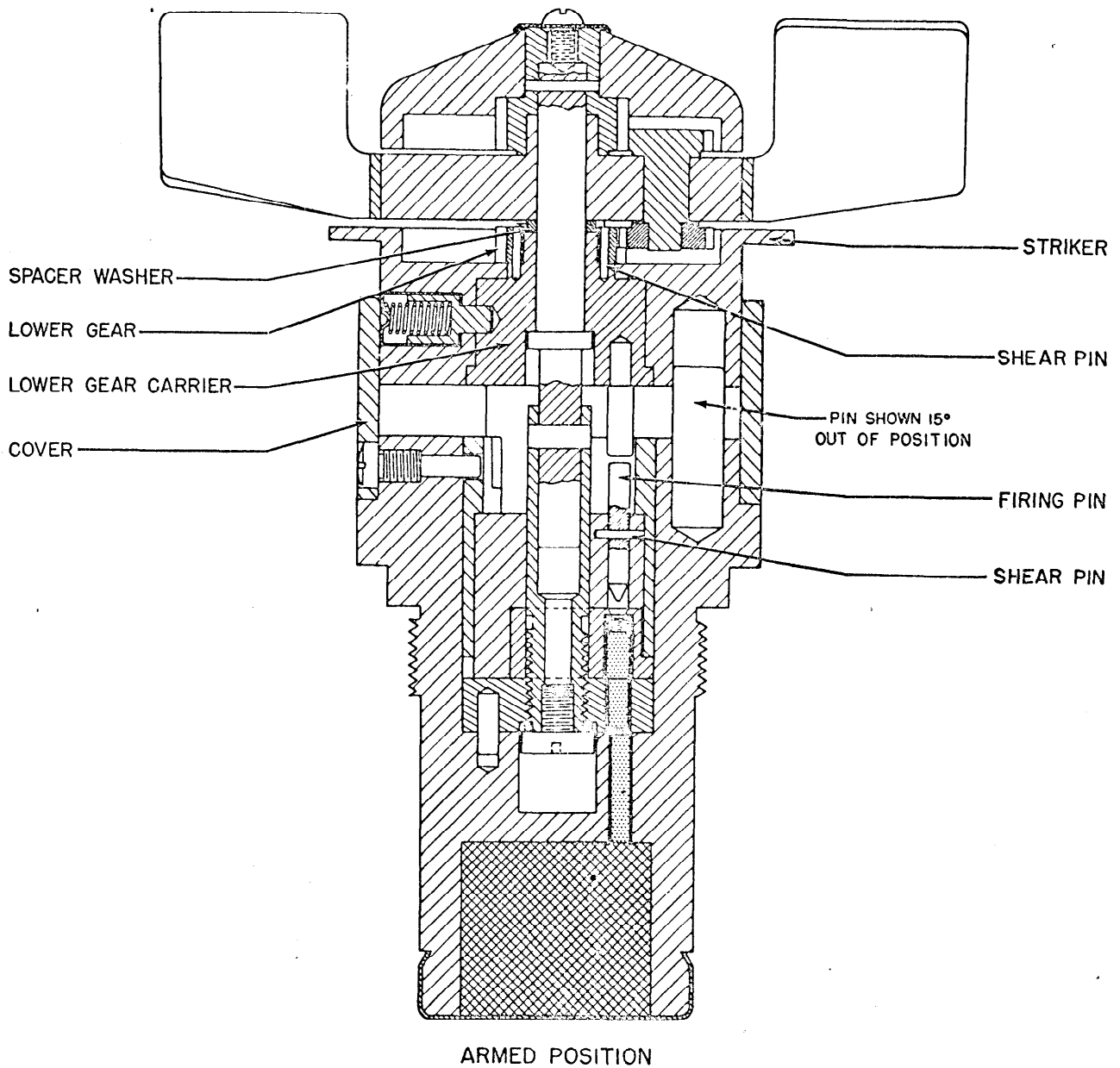


Figure 20—Nose Fuze Mk 152, Cross Section View, Armed Position.

hammer carrier which in turn is locked by the inner sleeve, is held stationary. During the second stage, the hammer carrier has risen to clear the inner sleeve and the lower gear is free to rotate while the upper gear is held stationary as it is attached to the arming shaft which was threaded up until it locked against the shaft extension nut.

First stage. As the rocket is launched, the arming wire is withdrawn and the vanes are free to rotate. Through the system of reduction gears, the upper gear rotates to thread the arming shaft up until the head of the screw on the shaft locks against the shaft extension nut. A collar on the shaft lifts the hammer carrier and the entire arm-

ing assembly. Simultaneously with the locking of the arming shaft and the upper gear, the hammer carrier clears the inner shaft to free the lower gear.

Second stage. The lower gear and hammer carrier are rotated in a counterclockwise direction. The aligning lug on the hammer carrier engages the firing pin carrier, lining up the firing pin extension with the firing pin. Further rotation causes the firing pin carrier to engage the detonator carrier, lining the firing pin up with the detonator. The hammer carrier, firing pin carrier, and detonator carrier continue to rotate until the lip on the detonator carrier engages the inner sleeve. Simultaneously, the spring-loaded detent in the striker snaps into a recess in the hammer carrier, thus locking the firing train components in an armed position. Since the upper and lower gears are both locked, the two copper pins securing the lower gear to the hammer carrier are sheared and the vanes rotate freely. (If the air speed is less than 300 mph, the air pressure will not be sufficient to shear the pins and the vanes will merely cease rotating.) The fuze is armed after approximately 100 revolutions of the arming vane.

Firing. After the above actions the fuze is fully armed. On impact, the entire upper assembly of the fuze is forced inward. The shear wire in the arming shaft is cut as the upper part of the shaft telescopes into the lower part and the shear wire through the firing pin is cut as the firing pin extension forces the firing pin into the detonator. The detonator sets off the auxiliary booster lead-in, booster lead-in, booster, and main charge successively.

Acceptance test data. Since Fuze Mk 152 is a conversion of loaded Bomb Fuzes AN-Mk 219, acceptance tests were previously accomplished on the fuze as an AN-Mk 219. Acceptance tests in rockets were not accomplished.

Sensitivity. Fuze Mk 152, after arming, will detonate the rocket head instantaneously on impact with water or denser medium.

4. Safety Features

Detonator safety. Fuze Mk 152 Mod 0 is detonator safe. The detonator is out of alignment with the booster lead-in, the firing pin is out of alignment with the detonator and the firing pin extension is not aligned with the firing pin. If the detonator should function prematurely

the gases would expand to the space above and would be dissipated away from the explosive components.

During shipping and stowage. A safety pin locks the vane and prevents rotation. Fuzes Mk 152 Mod 0 are packed and the shipping containers marked in such a manner to provide that the fuzes rest on their booster end. This is done to keep the weight of the body of the fuze off the firing pin shear pin, which condition exists if the fuze is resting on its nose in the partially pre-armed condition.

5. Disposal and Servicing (Maintenance)

General. Fuze Mk 152 Mod 0 is completely armed when the striker flange has moved away from the edge of the outer sleeve a distance of $\frac{1}{16}$ inches and the lower gear and carrier rotated about 345 degrees. If the striker flange has moved away from the outer sleeve more than $\frac{1}{16}$ inches, the fuze should be regarded as armed. If it has not moved more than $\frac{1}{16}$ inches, the fuze may be considered as partially armed. If the fuze is accidentally armed, whether assembled in the rocket head or not, no attempt should be made to unarm it except by Explosive Ordnance Disposal Personnel. In the event Explosive Ordnance Disposal Personnel are not available the armed fuze (or rocket head containing an armed or partially armed fuze) should be disposed of by lowering gently into deep water, base downward.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

1. Remove the dummy nose plug from the rocket head nose adapter and inspect the liner and threads and clean, if necessary. The cavity liner is to contain one Auxiliary Booster Mk 2, one Auxiliary Booster Mk 3, and a cardboard spacer approximately $\frac{1}{2}$ inch thick placed below the auxiliary boosters. Tests have indicated that a high order detonation can still be expected if an additional cardboard spacer is used in place of the Auxiliary Booster Mk 2; however, use of the booster is preferred.

2. Remove the fuze from the container and examine to see that the fuze is not damaged. If defective, repack, seal, and return to an ammunition depot.

3. Screw the fuze securely into the nose of the rocket head, using a spanner wrench to tighten.

4. After the round is placed on the launcher, remove the safety band.

5. Check the arming pin to ascertain that it passes through the striker flange and the vane carrier, and that it is secured by a Fahnstock clip resting snugly against the vane carrier.

6. Attach the ring of the arming pin (which extends toward the base of the fuze) to the arming wire.

Removal from round. The fuze may be removed from the rocket head in the following manner:

1. Detach the arming wire from the ring on the arming pin.

2. Replace the safety band.

3. Remove the round from the launcher and remove the fuze with the proper spanner wrench.

4. Place the fuze in its shipping can and seal the can with adhesive tape along the broken surface.

5. Reassemble the dummy nose plug into the rocket head.

7. Packing and Marking

Packing. Each fuze is hermetically sealed in a metal can. Six cans are packed in a metal packing box, and four packing boxes are placed in a shipping box 25.8 inches by 17.6 inches by 15.1 inches which represents a total of 4.0 cubic feet and a total weight of 177 pounds. The shipping cases containing Fuze Mk 152 are marked "For Use In 7.2-Inch Rockets Only".

Marking. Since the Fuzes Mk 152 in stock were prepared by modifying loaded Bomb Fuzes AN-Mk 219, all markings indicating Fuze Mk 219 have been defaced and the lettering N. F. Mk 152 has been substituted.

Section B—Nose Fuze Mk 141 Mod 0 (Air Arming, Impact Firing)

1. General Data

Used in: 7.2-inch Rocket Head Mk 5 (High Capacity)

Overall dimensions and weight of fuze:

Length..... 7.6 inches

Diameter (maximum)..... 3.00 inches (Propeller)

Body threads..... 2.000 inches—
12 NS-2

Weight..... 2.7 lbs. approx.

Applicable specification: OS 3605

General arrangement drawing: 440263

Sketch list of drawings & specs: 165109

Explosive components:

A sensitive stab type compound detonator Mk 23 Mod 0 (lead azide primer mixture, lead azide and tetryl)

Booster lead-in charge (tetryl)

Booster charge (tetryl 54 grams, approximately)

2. Description

General. Fuze Mk 141 Mod 0 was developed by a modification of the Bomb Fuze AN-M110A1 as a replacement for Fuze Mk 152. The fuze is water discriminating and so designed that it will

not fire on impact with water but will be actuated by impact with the earth or soft sand, provided the water travel before impact is not more than twenty feet. Fuze action is instantaneous. Arming is accomplished solely by air travel.

Use. Fuze Mk 141 is used in the 7.2-inch High Capacity Fin Stabilized Surface Rocket Mk 1 Mod 1 (See OP 1415). The complete round is employed primarily for the destruction of underwater beach obstacles.

Functioning mechanism. The fuze is essentially contained in three main assemblies: the body which houses the arming mechanism, the adapter magazine in which the detonator shutter and lead-in disc are housed, and the magazine to which is assembled a threaded adapter for securing the fuze to the rocket head. These three assemblies are threaded in order that they may be assembled together.

A propeller is secured to the arming hub which protrudes through the forward end of the fuze body. To the after end of the arming hub a stationary gear is fixed, so called because it does not move fore or aft. Threaded inside the arming hub is the arming sleeve to which the movable gear is fixed. The firing pin and firing wheel are

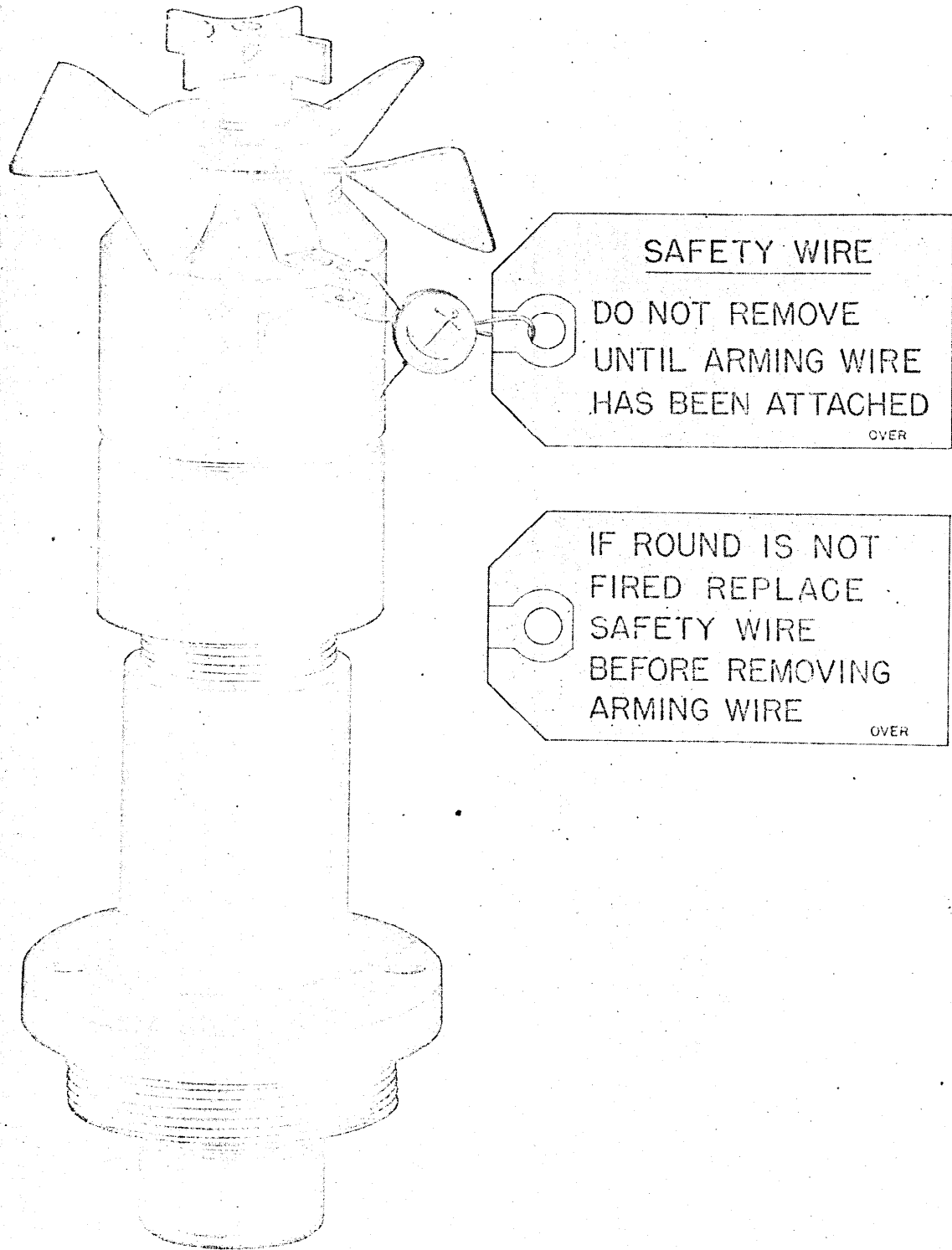


Figure 21—Nose Fuze Mk 141, External View.

secured to the arming sleeve by a copper shear wire and the firing pin extends through the firing pin guide into the detonator shutter cavity. Both the stationary gear and movable gear mesh with a pinion which rotates on a pin fixed to the body.

Extending rearward and secured to the firing pin guide are two projecting pins called a shutter hinge pin and a shutter stop pin. Under influence of a shutter spring the shutter, containing the detonator, is pivoted on the shutter hinge pin into the armed position and is stopped by the shutter stop pin after the firing pin is retracted. The lead-in-disc assembly which is below the shutter is held in place by the magazine and a shoulder in the magazine adapter.

Attached to the body is an arming wire guide. Until such time as the fuze is used a safety wire, passed through a hole in the propeller and through this guide, prevents the propeller from turning. On the launcher an arming wire is used in place of the safety wire.

3. Functioning

Arming. Arming is accomplished in two steps. First, the arming wire is withdrawn as the rocket leaves the launcher, and, in the second step, air travel rotates the propeller to retract the firing pin permitting the alignment of the detonator with the firing pin and booster lead-in.

The propeller, nut, outer ball race, arming hub, and stationary gear rotate as a unit, but cannot move forward or aft because of the collar on the arming hub. The movable and stationary gears mesh with the pinion gear, and, since the movable gear has one more tooth than the stationary gear (33 teeth for the stationary gear and 34 teeth for the movable gear), for each rotation of the propeller, the movable gear lags one tooth thus screwing the arming sleeve into the arming hub. As the arming sleeve moves forward, it moves the firing wheel forward and withdraws the firing pin from the shutter cavity. When the firing pin is withdrawn from the shutter cavity, the shutter is released, and the shutter spring rotates the shutter into position against a stop pin. A shutter detent then engages a hole in the firing pin guide thus locking the shutter in this position. The detonator is now aligned with the firing pin and booster lead-in, and the fuze is fully armed.

The arming distance of Fuze Mk 141 as used in the 7.2-inch Rocket Head Mk 5 is over 300 feet.

Firing. Upon the force of impact the firing wheel is driven rearward which shears the copper shear wire and drives the firing pin rearward to pierce and fire the detonator.

Acceptance test data. Completely live loaded fuzes chosen at random from each production lot are installed in live-loaded 7.2-inch demolition rockets and the rockets fired into shallow water or shore. The angle of elevation of the rocket launcher should be approximately 25 degrees. Acceptance is based on a cumulative test plan designed to accept (95% of the time) lots in which 94% of the fuzes function satisfactorily. Lots poorer than 94% will be subject to rejection with lots 60% effective being rejected 90% of the time.

Sensitivity limits. The fuze is water discriminat-ing and so designed that it will not fire on impact with water, but will be fired by impact with earth or soft sand, provided the water travel before impact is not more than twenty feet.

4. Safety Features

Detonator safety. Fuze Mk 141 is detonator safe. In the unarmed position, the detonator is out of alignment with the explosive train. The detonator is vented through a hole in the firing pin guide, thus should the detonator function prematurely, the force of the detonator will be dissipated away from the explosive components. The firing train cannot be aligned until the safety wire or arming wire, as the case may be, has been withdrawn and the propeller rotated 90 to 130 revolutions.

During shipping and stowage. Sample fuzes from production are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure to pass these tests shall be cause for rejection of the lot. The propeller is kept from rotating by a safety wire which is replaced by the arming wire in preparation for firing.

5. Disposal and Servicing (Maintenance)

General. If the fuze is accidentally armed, whether assembled in the rocket head or not, no attempt should be made to unarm it. If a gap of $\frac{1}{8}$ -inch or more exists between the striker and the arming hub, the fuze should be considered armed. If the fuze is armed, turning the propeller counter-clockwise as viewed from the forward end will cause the firing pin to pierce the detonator and

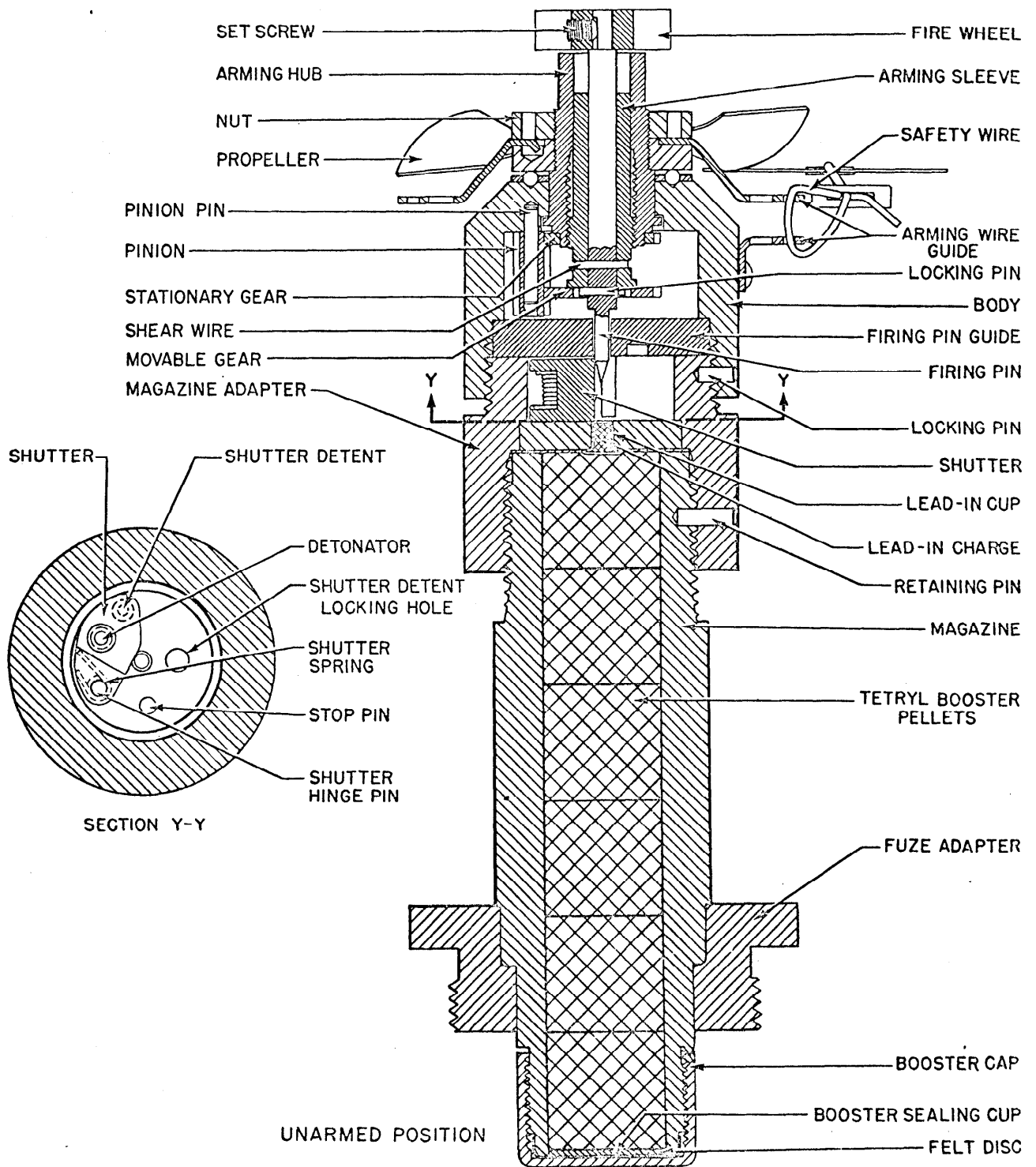


Figure 22—Nose Fuze Mk 141 Mod 0, Cross Section View, Unarmed Position.

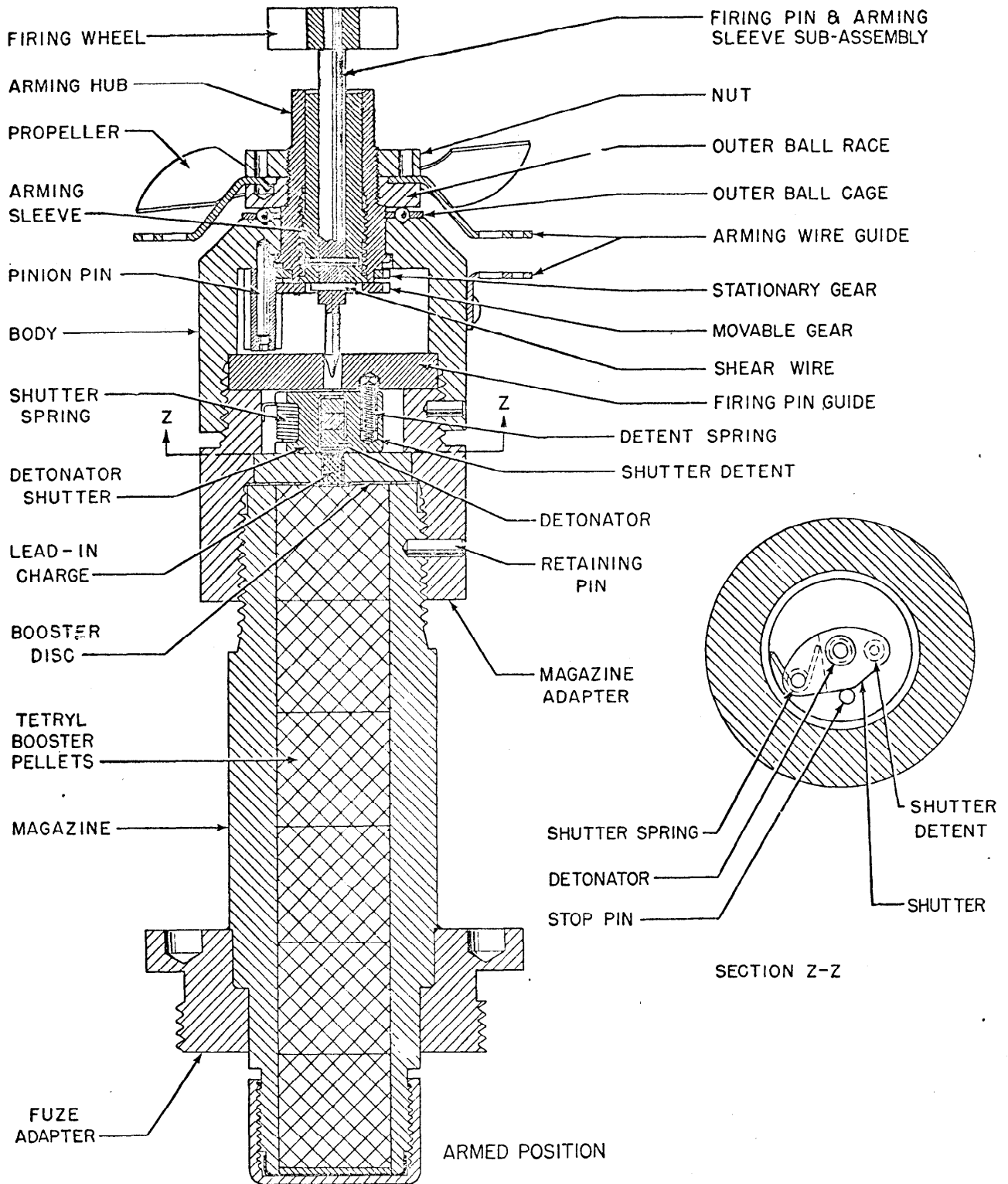


Figure 23—Nose Fuze Mk 141 Mod 0, Cross Section View, Armed Position.

explode the booster. Armed fuzes must not be fired from rocket launchers. If the fuze in an assembled round is armed accidentally, the firing wheel must be positively prevented from moving rearward, during handling by means of placing a spacer between the firing wheel and arming hub, such as to assure the preservation of the gap. Then carefully unscrew the fuze from the rocket taking care not to drop the round or the fuze on its nose or strike the fuze in any way.

Dud rounds should be treated with extreme caution. If the firing wheel is flush with the arming hub, the fuze is in a fired condition. In such a condition, the firing wheel should not be disturbed as the firing pin may be imbedded in the detonator and any movement might create sufficient friction to initiate the detonator. The fuze or round should be disposed of by gently lowering base or tail down into deep water or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

1. Remove the dummy nose plug and spacer from the rocket head and inspect the liner to see that the two auxiliary boosters, or the one booster with cardboard spacer, (the spacer being placed so that the auxiliary booster is against the fuze) are in place.

2. Remove the fuze from the container and examine to see that the fuze is not damaged. If defective, repack, seal, and return to an ammunition depot.

3. Screw the fuze securely into the nose of the rocket head, using a spanner wrench to fit the holes in the adapter.

4. After placing the round on the launcher, insert the arming wire (which has been secured to the launcher) in the hole provided next to the safety wire. Remove the safety wire.

5. Place the Fahnestock clip on the arming wire and adjust the Fahnestock clip so the arming wire is slack and not just tight.

6. Cut off excess arming wire leaving two or three inches projecting out in front of the fuze. Remove any burrs on the end of the arming wire.

Removal from round. The fuze may be removed from the rocket head with the proper fuze wrench and returned to the shipping can. The closed shipping can should in turn be sealed with adhesive tape along the broken surface. Before removal of the fuze from the round the safety wire should be replaced. The dummy nose plug must be replaced in the rocket head after the fuze is removed.

7. Packing and Marking

Packing. Fuzes are individually packed in hermetically sealed cans. Twenty-four fuzes are packed into a box 25.5 inches by 16.5 inches by 9.7 inches which represents a total of 2.4 cubic feet and a total weight of approximately 107 pounds.

Marking. The fuze is marked or stamped with the letters NF, the mark, mod, and lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Chapter 6

NOSE FUZES FOR FIN STABILIZED AIRCRAFT ROCKETS

The fuzes described in this group are as follows:

Section A—Nose Fuze Mk 149 Mod 0

Section B—Nose Fuze Mk 155 Mod 0

Section A—Nose Fuze Mk 149 Mod 0 (Setback and Air Arming, Impact Firing)

1. General Data

Used in:

- 3.5-inch Rocket Head Mk 3 Mod 0 (General Purpose)
- 3.5-inch Rocket Head Mk 5 Mod 0 (General Purpose)
- 5.0-inch Rocket Head Mk 1 Mod 0 (General Purpose)
- 5.0-inch Rocket Head Mk 5 Mod 0 (General Purpose)
- 5.0-inch Rocket Head Mk 5 Mod 1 (General Purpose)
- 5.0-inch Rocket Head Mk 6 Mod 0 (General Purpose)
- 5.0-inch Rocket Head Mk 6 Mod 1 (General Purpose)

Overall dimensions and weight of fuze:

Length.....	4.22 inches
Diameter (maximum).....	2.99 inches
Body threads.....	1.700 inches— 14 NS-1
Weight.....	2.6 lbs. approx.

Applicable specification: OS 3388

General arrangement drawing: 393783

Sketch list of drawings & specs: 109204

Explosive components:

A sensitive stab type compound Detonator Mk 23 (lead azide primer mixture, lead

azide and tetryl) located in the shutter between the firing pin guide and the lead-in disc.

A lead-in assembly charge (tetryl) located in the lead-in disc between the shutter and magazine.

A booster charge (approximately 9 grams of tetryl) located in the magazine at the base of the fuze.

2. Description

General. Fuze Mk 149 Mod 0 was developed to replace the now obsolete Fuze Mk 148. Aerodynamically the external shape of the fuze is generally adaptable to the ogival configurations of the higher velocity rockets. The Fuze Mk 149 Mod 0 is used singly and in combination with the Base Fuzes Mk 157 Mod 0, Mk 159 Mod 0, Mk 159 Mod 1, Mk 164 Mod 0, and Mk 165 Mod 0. A cap, which fits over the propeller on the nose of the fuze, makes the interior of the fuze waterproof and allows the fuze to be carried on the exterior of aircraft without the propeller assembly becoming badly iced. The fuze will fire superquick upon impact with suitable targets. Because of its basically rugged construction, it may be fired in the unarmed condition, when used in combination with base fuzes, and penetrate moderately thick steel plate and reinforced concrete without breaking up the fuze or head in a manner that would impair the effectiveness of the round.

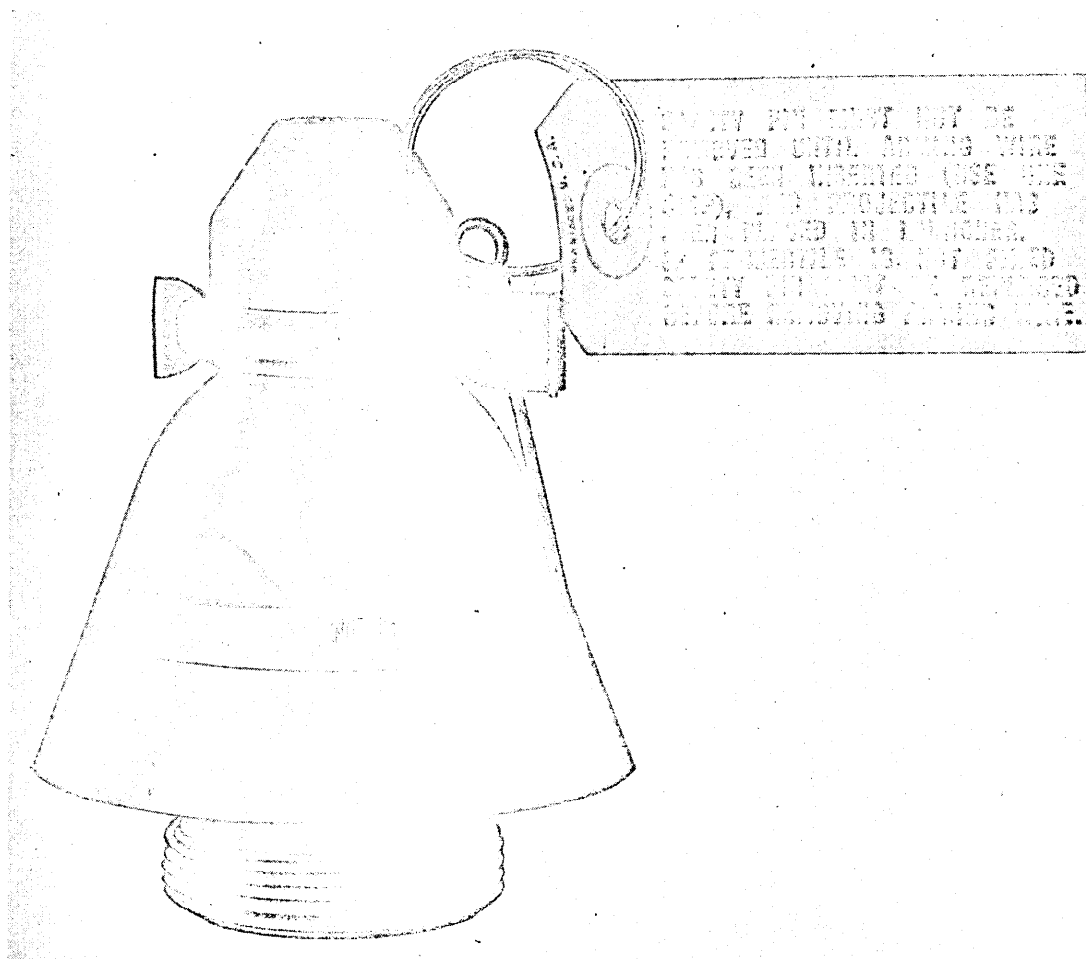


Figure 24—Nose Fuze Mk 149, External View, Full Size (approximately).

Use. The fuze is used in the 3.5-inch General Purpose Fin Stabilized Aircraft Rocket (Complete Round) Mk 8 Mod 0 and in the 5.0-inch General Purpose Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 1 Mod 0, Mk 1 Mod 2, and the Mk 4 Mod 0 (See OP 1415). Fuze Mk 149 Mod 0 is effective against shipping, vehicles, personnel, moderately heavy and light plate, fortifications, parked aircraft, buildings, and beach obstacles.

Functioning mechanism. The internal mechanism of the fuze is housed in a rugged conical steel body. The body cavity is closed at the base by the magazine containing the tetryl booster, and the forward end by the nose plate. The firing pin is threaded into the nose plate from the body cavity

and extends forward out of the plate. A propeller hub is riveted to the forward end of the firing pin and a propeller is riveted to the hub. The firing pin extends rearward, inside the fuze body, through the propeller locking pellet, shutter locking pellet, firing pin guide and into the shutter cavity where it holds a spring actuated shutter in an unarmed position. This shutter, hinged on a pin pressed into the firing pin guide, is located between the guide and the lead-in disc which holds the booster lead-in assembly. The shutter contains a spring loaded detent which locks the shutter to the firing pin guide when the shutter is in an armed position. A propeller locking pin, pressed into the propeller locking pellet, passes through a hole in the nose plate into a hole in the propeller hub and prevents

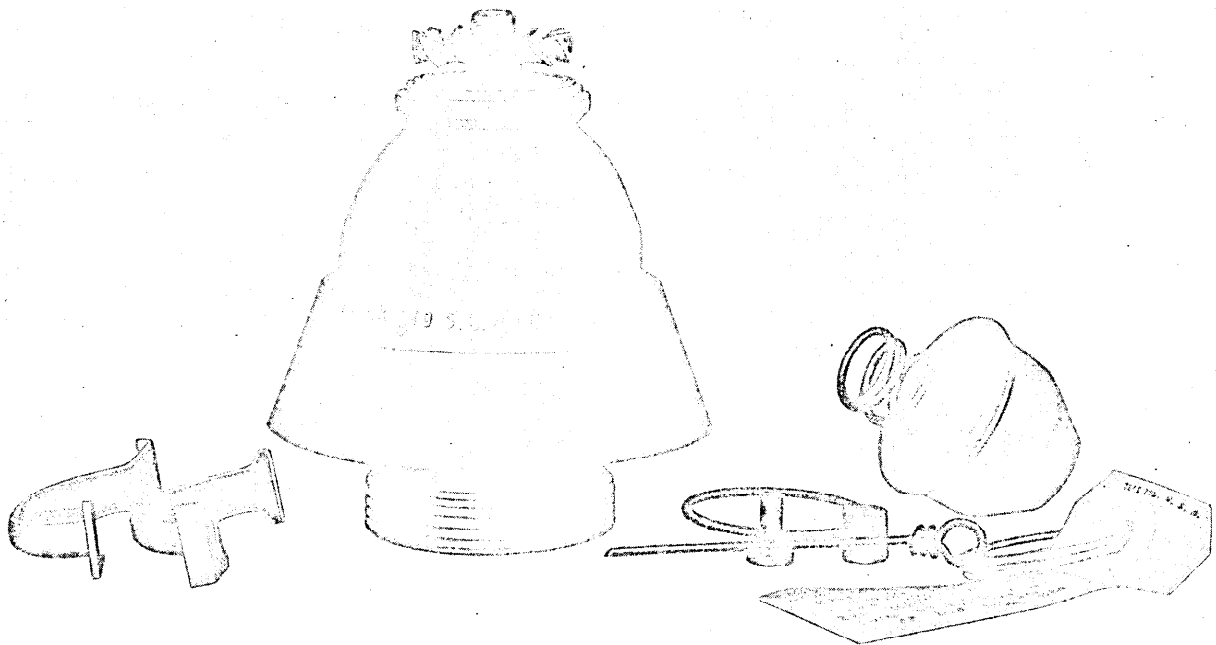
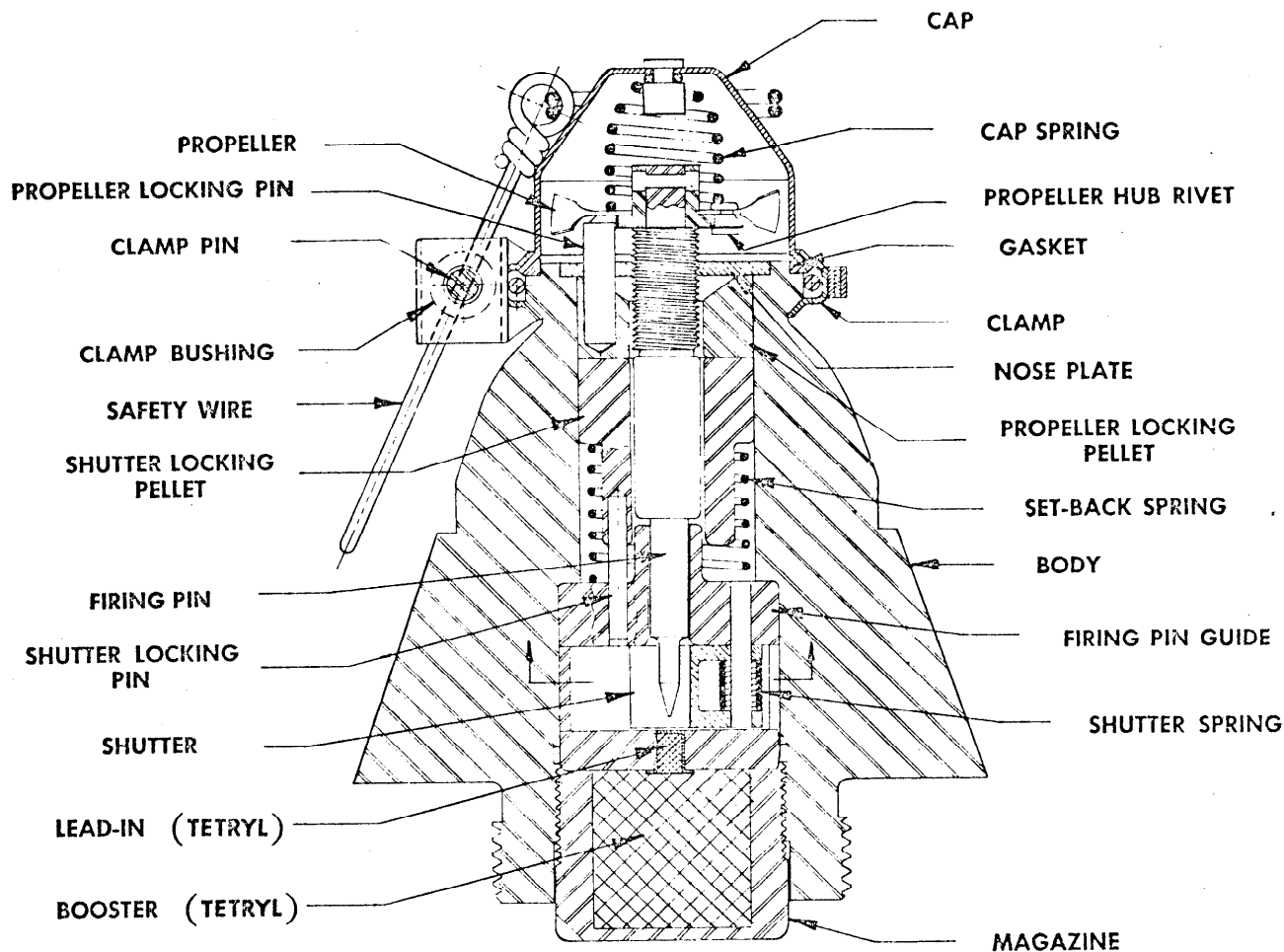


Figure 25—Nose Fuze Mk 149 Mod 0 Showing the Clamp Pin, Clamp Bushing, Clamp, Gasket, Safety Wire, and Protective Cap.

the hub and propeller from turning until a setback force acting on the propeller locking pellet moves it rearward, against the force of a setback spring, and disengages the propeller locking pin from the hub. This setback spring holds the shutter locking pellet and propeller locking pellet against the nose plate until the round is launched. A shutter locking pin, pressed into the after end of the shutter locking pellet, extends into the firing pin guide at a position where it will lock the shutter in an unarmed position as the setback spring is compressed. The fuze is waterproofed at the forward end of the body by a cap assembly. The open end of the cap is pressed against a fiber gasket, called the outer gasket and held in this position by a clamp. The cap assembly consists of a cap, a cap spring, and cap rivet. The cap protects the propeller from damage during handling, the cap spring pushes the cap assembly and clamp away from the propeller during arming, and the cap rivet holds the spring in place and

prevents the firing pin from turning to an armed position while the cap is clamped to the body. The clamp is made up of two half circular steel strips, hinged together. Each edge of each strip is formed to a channel shape that will pull the body and cap together as the clamp is closed and tightened. Each clamp arm, 180° away from the clamp hinge, is flanged away from the center of its half circle. These flanges are drilled and held together by a clamp pin, a bushing and a safety wire. The clamp pin is shaped somewhat like a flat head rivet, the head being too large to go through the drilled holes of the clamp flange. Its shank has two holes drilled to match two holes in the bushing. After the clamp pin is placed in the clamp flange holes, the bushing is placed over the shank of the pin and a safety wire inserted in the outer hole of the bushing and pin. After loading the complete round onto the plane, the arming wire on the plane is placed in the innermost hole of the bushing and then the safety wire is removed.



UNARMED POSITION

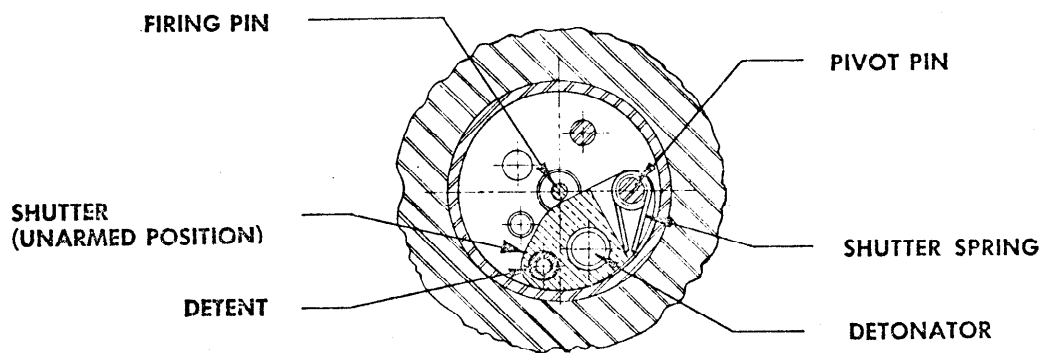


Figure 26—Nose Fuze Mk 149 Mod 0, Cross Section View, Unarmed Position.

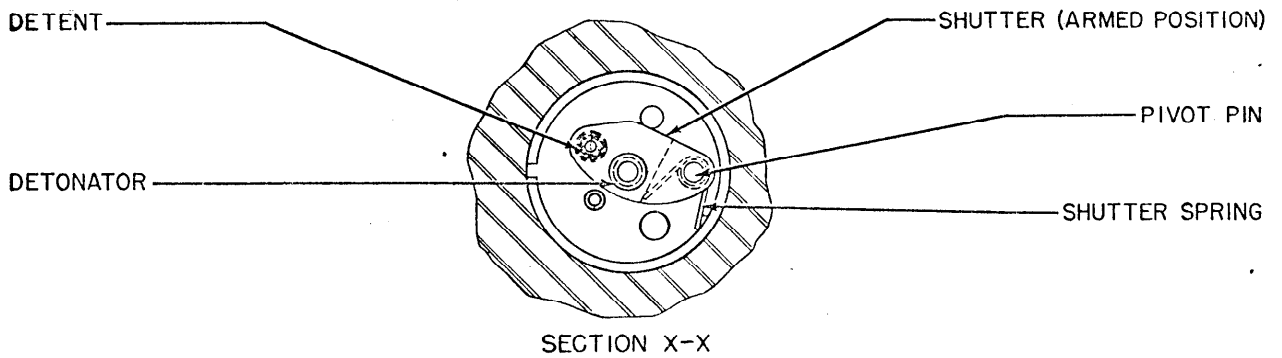
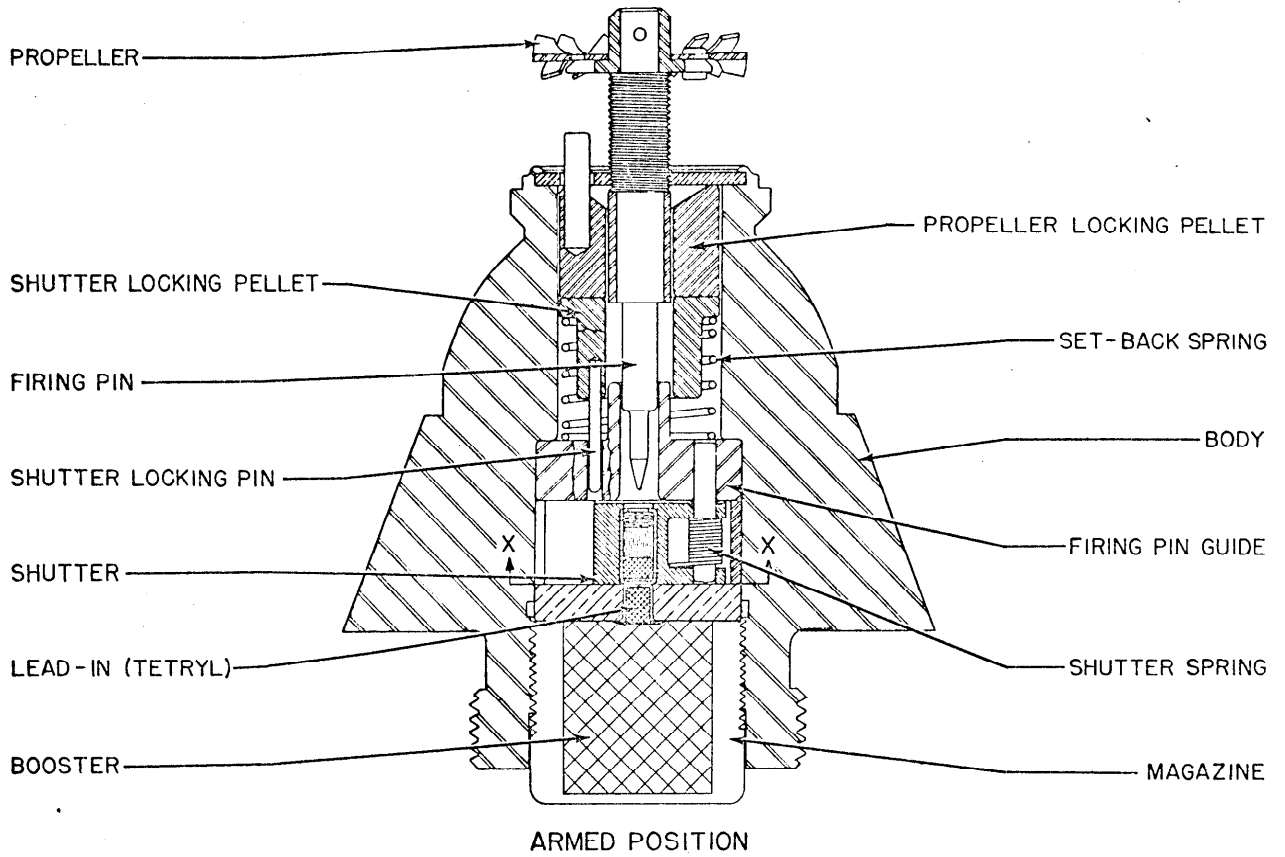


Figure 27—Nose Fuze Mk 149 Mod 0, Cross Section View, Armed Position.

3. Functioning

Arming. When the rocket is fired, the arming wire is pulled from the clamp pin and bushing, allowing the clamp to open. The compressed cap spring then throws the cap and clamp away from the fuze. Inertia forces, incurred by acceleration, cause the two locking pellets to move rearward, thereby unlocking the propeller hub and interposing a shutter lock by means of the shutter locking pin. The firing pin is withdrawn from the shutter after eight revolutions which are accomplished in a short distance, however, the shutter locking pin continues to hold the shutter in an unarmed position until the end of burning. At the end of burning, the setback spring forces the pellet forward, withdrawing the shutter locking pin from the shutter cavity, thus permitting the shutter spring to pivot the shutter against the shutter stop pin where it is secured in the firing position by the shutter detent. The firing pin, detonator, and booster lead-in are now in alignment and the fuze is fully armed. Because the shutter is locked in a safe position during acceleration, arming will not occur until after acceleration. Observations indicate an arming delay of about 0.1 second after acceleration has ended. Therefore, the arming distance in the 3.5-inch AR¹ will vary from about 425 feet to 900 feet, in 5.0-inch AR² from 275 feet to 600 feet, and in the 5.0-inch HVAR³ from 650 feet to 1100 feet, depending upon the temperature at which the rounds are fired. Tests to determine the partial arming distance, that is, the distance at which the firing pin has advanced completely, for rounds fired from aircraft, indicated that this distance is variable, ranging from about 5 feet to 65 feet.

Firing. Upon impact, with a target offering sufficient resistance, the firing pin is driven rearward into the detonator after shearing the nose plate threads. The detonator initiates, consecutively, the booster lead-in and the booster. When the Fuze Mk 149 is used in combination with base fuzes, it is often launched "safe". In this case

¹ 3.5-inch rocket head assembled with a 3.25-inch rocket motor.

² 5.0-inch rocket head assembled with a 3.25-inch rocket motor.

³ 5.0-inch rocket head assembled with a 5.0-inch rocket motor.

the nose cap remains in place and prevents the fuze from arming after the rocket is launched.

Acceptance test data.

1. **FIRE FROM LAND LAUNCHERS.** Completely loaded fuzes from each lot are installed in live loaded 3.5-inch or 5.0-inch aircraft rockets with an arming wire and Fahnestock clip attached and fired from a land launcher as follows:

a. Half of the fuzes are fired for water impact. The rockets are fired at an angle of elevation of approximately 15 degrees. The temperature of the rocket motor at the time of firing is at least 60 degrees Fahrenheit. Only the 5.0-inch motor may be used with the 5.0-inch head for this test.

b. The remaining fuzes are fired in the same manner except the angle of elevation is approximately 45 degrees. Any ambient temperature at the time of firing is satisfactory. Either the 3.25-inch or 5.0-inch motor may be used with the 5.0-inch head for this test.

Ninety percent performance of all test samples in this group is satisfactory. Any premature causes rejection of the lot.

2. **FIRE FROM PLANES.** Completely loaded fuzes from every tenth lot are fired from aircraft for water or ground impact. The angle of fall is at least 15 degrees. Half of the fuzes are assembled in 3.5-inch live loaded aircraft rockets and the balance are assembled in 5.0-inch live loaded aircraft rockets for this test. The prescribed service arming wire arrangement is used. Half of the samples of each caliber are fired for ground impact. A minimum of 87½ percent performance of all test samples is considered satisfactory. Any premature is cause for rejection of the lot.

Sensitivity limits. Sensitivity data is not complete for this fuze, however, it will probably fire consistently on three-sixteenths inch mild steel plate at 0° obliquity, and when aircraft launched, will also fire on ground or water impact when the angle of fall is 15 degrees or greater.

4. Safety Features

Detonator safety. This fuze is detonator safe. When the fuze is unarmed, the detonator is held positively out of line with the booster lead-in by the firing pin which protrudes into the shutter cavity and holds the shutter in an unarmed

position. The firing pin cannot be withdrawn from the shutter cavity until the protective cap is removed, and cannot be rotated out of the shutter cavity until setback takes place. The shutter cannot move the detonator in line with the lead-in until the propeller has turned the firing pin out eight revolutions and, finally until setback has ceased and the setback spring has moved the shutter locking pin out of the shutter cavity.

During shipping and stowage. Sample fuzes from production lots are subjected to rough handling tests which are considered to be more severe than conditions encountered during normal shipping and stowage. Failure to pass these tests shall be cause for rejection of the lot. The propeller cannot turn the firing pin out of the shutter cavity as long as the nose cap is in place. If the nose cap should become accidentally removed from the fuze, it would be necessary for a prolonged setback to take place at the same time that a turning force was applied to the propeller in order to arm the fuze.

5. Disposal and Servicing (Maintenance)

General. If the fuze is accidentally armed, whether assembled in the rocket head or not no attempt should be made to unarm it. If the fuze is armed, turning the propeller counterclockwise as viewed from the nose will cause the firing pin to pierce the detonator and explode the booster. The fuze is safe as long as the cap assembly is held in place by the safety wire, or by the arming wire. If the cap assembly comes off by accident, the fuze is still safe as long as the propeller is engaged by the propeller locking pin. This can be determined by visual inspection. The fuze shall be considered armed if the propeller is out of engagement with the propeller locking pin so that the propeller is free to rotate.

Armed fuzes must not be fired from rocket launchers. If the fuze in an assembled round is armed inadvertently, the propeller should be carefully taped to prevent further rotation and the fuze then carefully unscrewed from the rocket, taking care not to drop the round or the fuze on its nose or strike the fuze in any way. This work should be done by Explosive Ordnance Disposal Personnel if available. The armed fuze should be disposed of by gently lowering into deep water or by the most feasible means, as determined by the circumstances. If for any reason the cap has been

removed from the fuze, but visual observation reveals the fuze to be intact and the propeller positively locked by the propeller locking pin, then the propeller may be securely taped, and the fuze returned to storage. Careful handling will be necessary, however, to avoid propeller damage and future usage will be limited to ground or shipboard launching.

Disassembly. Disassembly of this fuze is not permitted except by authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

1. After the motor has been assembled to the head, remove the nose plug from the rocket head and inspect the fuze seat liner. Clean if necessary. Make sure that the auxiliary booster is present in the bottom of the liner.

2. Remove the fuze from the container and inspect for damage. Check the cap and clamp assembly for corrosion. If slight corrosion exists, grasp clamp and rotate it around body so that it slides freely on body and cap. If the cap and clamp are badly corroded, it is best not to use the fuze. If considered necessary a light coat of vaseline may be applied to the clamp assembly to aid in the prevention of corrosion and icing. If the fuze is defective, repack, and return it to an ammunition depot.

3. Install the fuze into the rocket head using the proper fuze wrench. Be sure that both the fuze and fuze adapter are seated properly.

4. After the assembled round is loaded on the launcher, turn the clamp so that the clamp pin and bushing are on the same side of fuze as the arming wire. Insert the arming wire in the hole provided next to the safety wire. Remove the safety wire. **DO NOT REVERSE THIS ORDER.** Save the safety wire for reinsertion if the round is not fired.

5. Put one Fahnestock clip on the free end of the arming wire and slip it against the clamp bushing. Adjust so that there is just enough slack in the arming wire, between the arming wire release latch (on the aircraft) and fuze, to insure that the arming wire retaining plate does not get pulled out of the catch in the arming wire release. Leave no more slack than necessary.

6. Clip the arming wire off about two or three inches beyond the Fahnestock clip and dress the wire for burr removal.

Removal from round.

1. Before removing the round from the launcher, insert the safety wire in its hole in the clamp bushing. It may be necessary to squeeze the bushing and pin assembly longitudinally with pliers to line up the holes. After the safety wire is in place, remove the arming wire. **DO NOT REVERSE THIS ORDER.**

2. Remove the round from the launcher and unscrew the fuze. Examine the cap and clamp assembly for damage or moisture. Wipe off the

clamp if moist or corroded. Replace the shipping plug in the head.

7. Packing and Marking

Packing. Fuzes Mk 149 are packed in individual, sealed, metal containers. Twenty-four fuzes are packed in a wood box 26 inches by 16½ inches by 6½ inches which represents 1.6 cu. ft. and a total weight of 96 pounds.

Marking. The fuze is marked to show the letters NF, the mark, mod, lot number, manufacturer's initials, date of loading, symbol of loading plant, and the anchor stamp.

Section B—Nose Fuze Mk 155 Mod 0 (Setback and Air Arming, Impact Firing)**1. General Data**

Used in: 3.5-inch Rocket Head Mk 6 Mod 0 (Smoke)

Overall dimensions and weight of fuze:

Length..... 17.44 inches
Diameter (maximum)..... 2.99 inches
Body threads..... 1.700 inches—14 NS-1
Weight..... 3.2 lbs. approx.

Applicable specification: OS 3578

General arrangement drawings: 423845

Sketch list of drawings & specs: 109406

Explosive components:

A sensitive stab type compound Detonator Mk 23 (lead azide primer mixture, lead azide and tetryl) located in the shutter between the firing pin guide and lead-in disc.

A lead-in assembly charge (tetryl) located in the lead-in disc between the shutter and burster tube.

A burster tube charge (approximately 65 grams tetryl) located in the burster tube.

2. Description

General. The Fuze Mk 155 differs from the Fuze Mk 149 only in that it is provided with a burster tube assembly instead of a magazine. The burster tube has a 0.630-inch diameter and is 14.06 inches long.

Use. The fuze is used in the 3.5-inch Fin Stabilized Aircraft Smoke Rockets (Complete Rounds) Mk 3 Mod 0 and Mod 1 (See OP 1415).

Functioning mechanism. The Fuze Mk 155 is exactly the same as the Fuze Mk 149 except a tetryl filled burster replaces the tetryl filled booster at the base end.

3. Functioning

Arming. Same as Fuze Mk 149 Mod 0.

Firing. Same as Fuze Mk 149 Mod 0.

Acceptance test data. Completely loaded fuzes from each lot are installed in "FS" Smoke loaded 3.5-inch Rocket Heads Mk 6 Mod 0, using a 3.25-inch Rocket Motor Mk 7, an arming wire and Fahnestock clip, and fired from a land launcher at 15 degree quadrant angle for water impact. The temperature of the rocket propellant must be at least 60 degrees Fahrenheit. Acceptance is based on a cumulative test plan designed to accept (95% of the time) lots in which 98% of the fuzes function satisfactorily. Lots poorer than 98% will be subject to rejection with lots 91% effective being rejected 90% of the time. Any premature causes rejection of the lot. Eight completely loaded fuzes selected from the combined samples of five production lots are assembled in smoke loaded heads and fired from aircraft for water or ground impact. The prescribed service arming wire arrangement is used. Half the samples are fired for ground impact. Satisfactory performance is considered to be the high order functioning of at least seven of the eight fuzes. Any premature causes rejection.

4. Safety Features

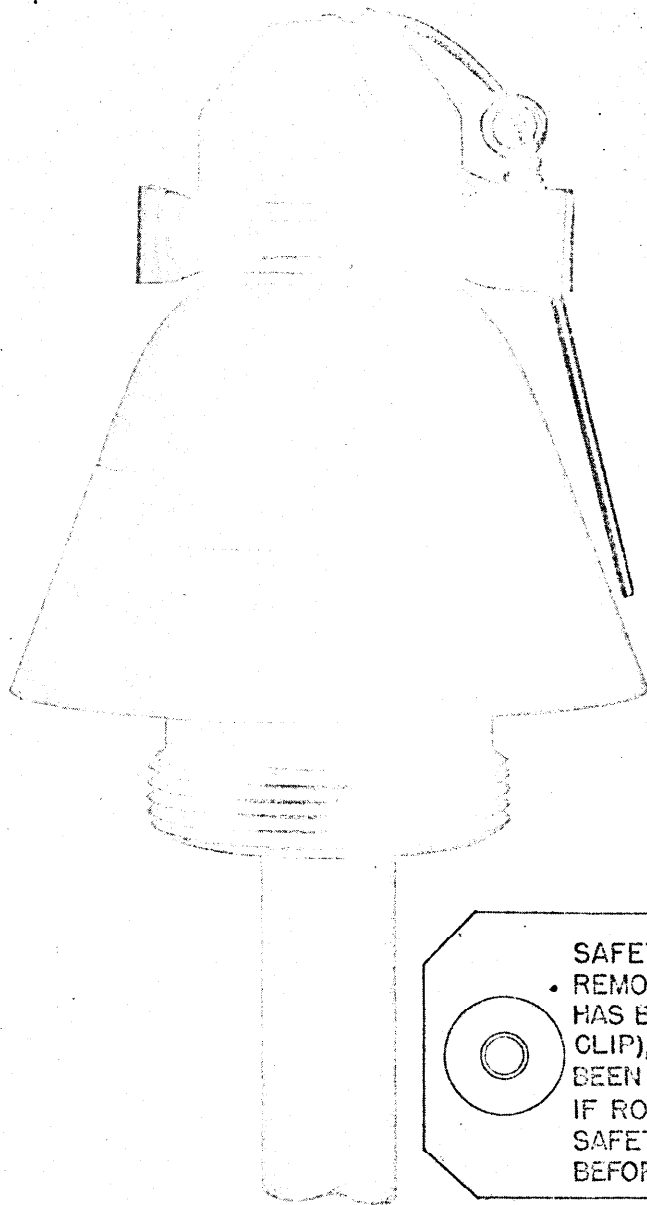
Same as Fuze Mk 149 Mod 0.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 149 Mod 0.

6. Installation Instructions

The assembly of the Fuze Mk 155 into the head differs from the assembly of the Fuze Mk 149 into



SAFETY PIN MUST NOT BE
 • REMOVED UNTIL ARMING WIRE
 HAS BEEN INSERTED (USE ONE
 CLIP), AND ROCKET HAS
 BEEN PLACED IN LAUNCHER
 IF ROCKET IS NOT FIRED
 SAFETY PIN MUST BE REPLACED
 BEFORE REMOVING ARMING WIRE

Figure 28—Nose Fuze Mk 155, External View, Full Size (approximately) except for Burster Tube Length.

the head only in that the burster tube of the Fuze Mk 155 fits into a burster well and no auxiliary booster is used.

7. Packing and Marking

Packing. Fuzes Mk 155 are packed in individual, sealed, metal containers. Twelve fuzes

are packed in a wood box 18 inches by 12.8 inches by 23 inches which represents 3.1 cu. ft. and a total weight of 77 pounds.

Marking. The fuze is marked to show the letters NF, the mark, mod, lot number, manufacturer's initials, date of loading, symbol of loading plant, and the anchor stamp.

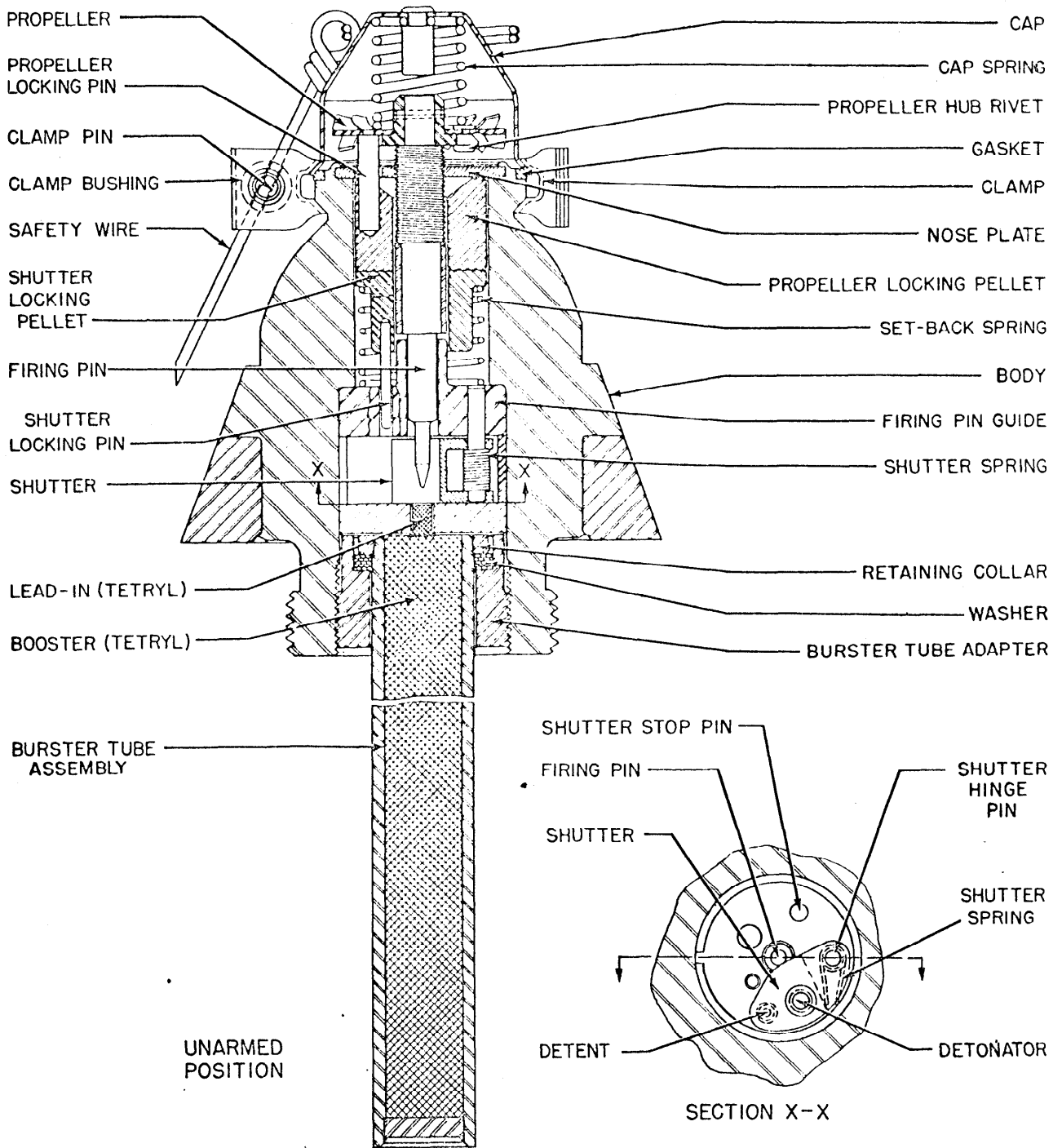
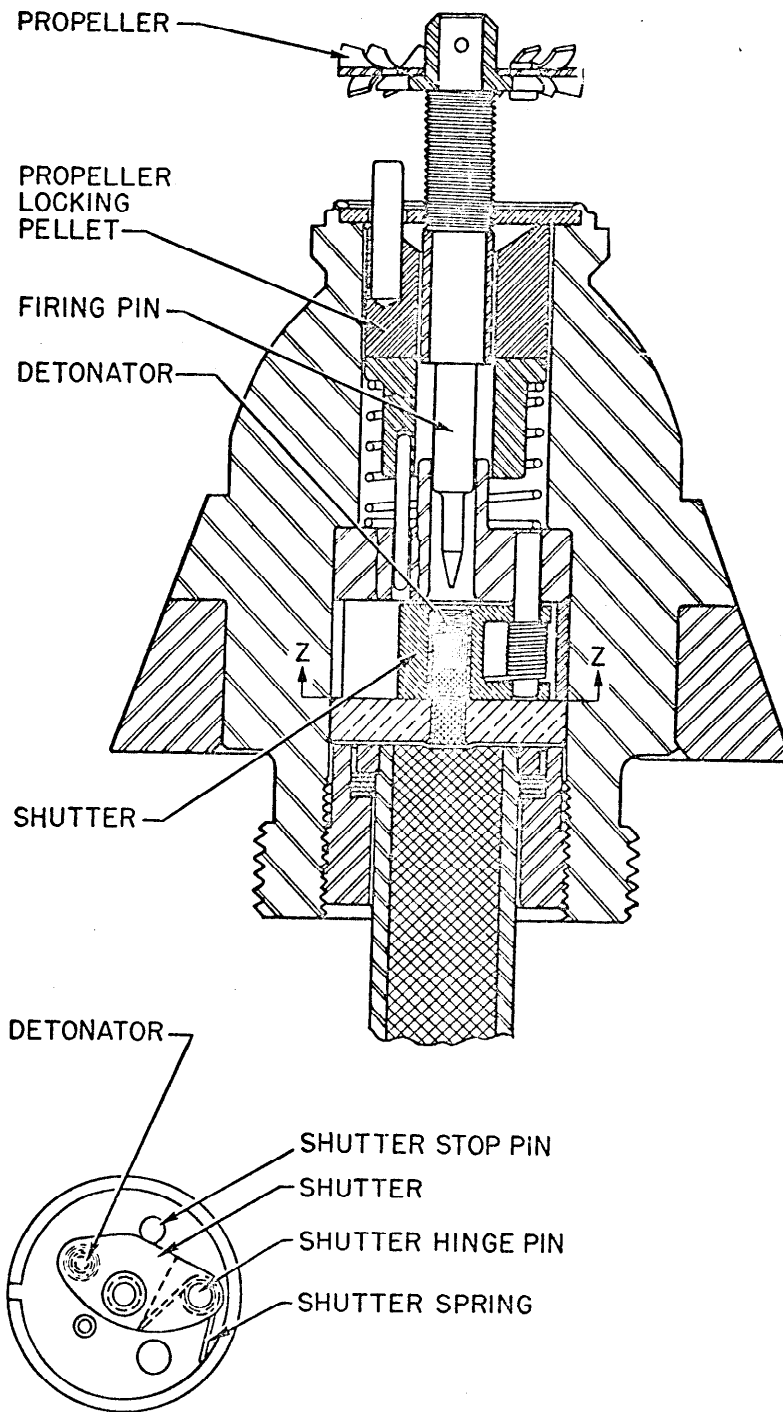


Figure 29—Nose Fuze Mk 155 Mod 0, Cross Section View, Unarmed Position.



SECTION Z-Z ARMED POSITION

Figure 30—Nose Fuze Mk 155 Mod 0, Cross Section View, Armed Position.

Chapter 7

NOSE FUZES FOR 7.2-INCH ANTI-SUBMARINE ROCKETS AND 7.2-INCH PROJECTOR CHARGE AMMUNITION

The fuzes described in this group are as follows:

Section A—Nose Fuze Mk 156 Mod 0

Section B—Nose Fuze Mk 158 Mod 0

Section A—Nose Fuze Mk 156 Mod 0 (Water Travel Arming, Impact Firing)

1. General Data

Used in:

7.2-inch Rocket Head Mk 5 (High Capacity)

7.2-inch Projector Charge Head Mk 4 (High Capacity)

Overall dimensions and weight of fuze:

Length..... 7.385 inches

Diameter (maximum)..... 3.125 inches

Body threads..... 2.00 inches—
12 NS-2

Weight..... 2.8 lbs. approx.*

Applicable specification: OS 3418

General arrangement drawing: 438552

Sketch list of drawings & specs: 109482

Explosive components:

Detonator Mk 23 Mod 0 (lead azide priming mixture and lead azide) contained in shutter assembly.

Booster lead-in charge (tetryl) contained in lead-in disc.

Booster charge (approximately 9 grams tetryl) contained in magazine.

2. Description

General. The Rocket Nose Fuze Mk 156 Mod 0 is very similar to its predecessor, Fuze Mk 131, except that it incorporates numerous changes found desirable after extensive tests. It is a very sensitive contact fuze which depends on setback in air and passage through water to arm. After

arming the fuze functions instantaneously upon impact with any underwater obstruction and the mechanism is so constructed that either normal or oblique impact will cause functioning. Arming is accomplished by four to eight vane revolutions which occur within 15 to 25 feet of water travel.

Use. Fuze Mk 156 Mod 0 is used in 7.2-inch High Capacity Surface Fin Stabilized Rockets (Complete Rounds) Mk 1 Mod 0 and Mk 1 Mod 1 (see OP 1415). The fuze is used exclusively against submarines and its aerodynamic characteristics limit its use to low velocity rounds.

Functioning mechanism. The fuze housing consists of the fuze body, plug, and magazine. The steel fuze body is machined to accommodate the lead-in disc, shutter assembly, and firing assembly. The forward end of the body is provided with external threads to engage the rocket head when the fuze is installed and internal threads to engage the plug.

The steel plug is machined out and provided with internal threads to accommodate the arming screw. The aft end has external threads to engage the fuze body.

The arming vane and arming vane hub are secured to the arming screw by a set screw. A setback collar is fitted over the plug neck and the arming vane hub which provides a means of locking the arming vane until the rocket is fired.

SAFETY PIN MUST
BE IN POSITION
DURING TRANSIT
AND STORAGE

SAFETY PIN
TO BE REMOVED
BEFORE FIRING

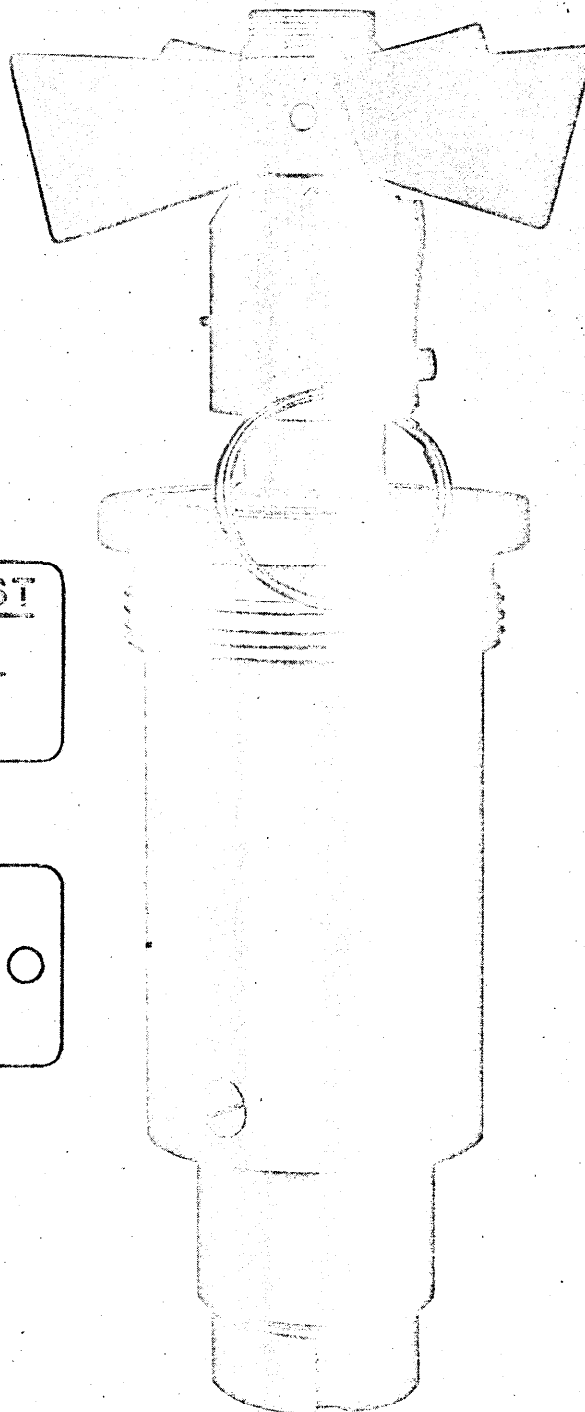
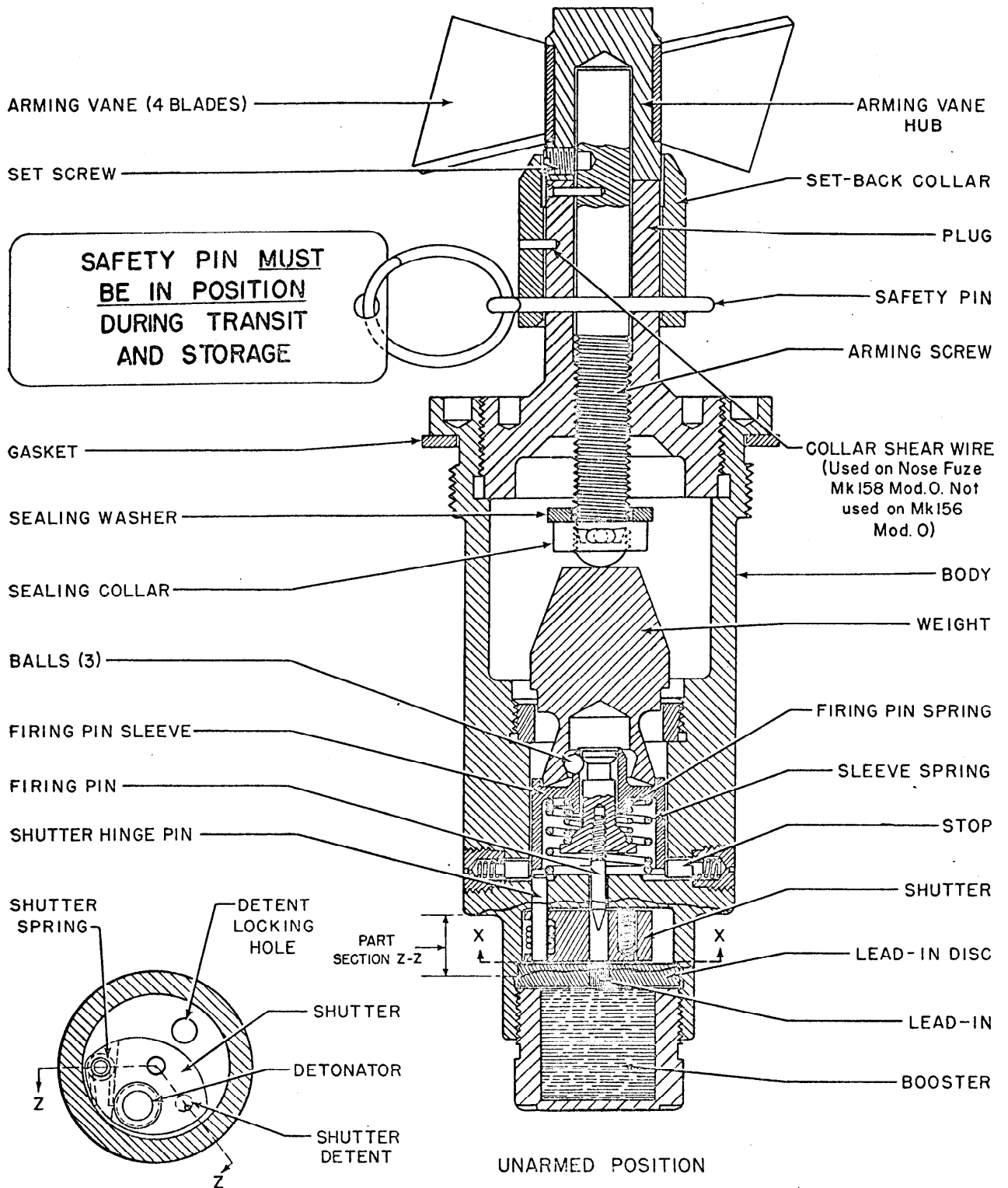


Figure 31—Nose Fuze Mk 156 and Mk 158, External View, Full Size (approximately).



SECTION X-X

Figure 32—Nose Fuze Mk 156 Mod 0 or Mk 158 Mod 0, Cross Section View, Unarmed Position.

Locking pins in the arming vane hub and the plug, respectively, fit into a slot in the setback collar, positively locking the arming vane until the setback force causes the setback collar to move backward on the plug. The setback collar is maintained in the forward position by the tension of the flat spring plate on the locking pins.

An internal radial 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 air travel.

The firing assembly located in the body cavity, consists of the firing pin, the firing pin spring, the firing pin sleeve, the sleeve spring, the firing pin head, the weight, the retaining ring, and three balls. When the fuze is unarmed, the firing assembly is held in place by the arming screw and the firing pin rests in a well in the shutter retaining it in the unarmed position. With the firing assembly in the unarmed position, the firing pin is held in the cocked position, with the firing pin spring compressed, by three steel balls which are wedged between the firing pin head and the angular lip on the weight. The force of the firing pin spring under compression keeps the wedging action constant until the arming screw is withdrawn and impact forces the weight forward.

The shutter is located immediately below that portion of the body which forms the firing pin guide. The shutter contains a spring loaded detent which locks it in the armed position. A torsion spring rotates the shutter into the armed position as soon as the firing pin is withdrawn from the shutter cavity.

A lead-in disc containing a tetryl lead-in is inserted immediately below the shutter and the booster magazine containing a tetryl charge is screwed into the base of the fuze body.

3. Functioning

Arming. When the rocket with the fuze installed is fired from a launcher, setback forces at the instant of firing cause the setback collar to move backward and unlock the arming vane. The setback collar is prevented from moving forward again by the flat spring plate dropping down behind the locking pin in the plug. The internal radial shear wire between the vane hub and the plug prevents the air stream from turning the

arming vane and arming the fuze during air travel. Upon impact with the surface of the water, the impact force causes the arming vane to rotate and shear the radial shear wire. Continuing rotation of the arming vane withdraws the arming screw and arms the fuze. The firing assembly moves with the arming screw under force of the sleeve spring until the firing pin sleeve meets the retaining ring. At the end of travel of the arming screw, the rubber sealing washer is jammed between the plug and the sealing collar, which is fastened to the arming screw by a cotter pin, thereby sealing the fuze.

As the firing assembly moves forward, the firing pin is withdrawn from the shutter cavity, releasing the shutter. The shutter spring rotates the shutter against the stop pin thus aligning the detonator in the shutter with the booster lead-in and with the firing pin. Two pairs of sleeve stops are pushed inward by the stop springs, one pair just before the firing pin releases the shutter, and the other pair just after the release.

Firing. Firing is initiated (after the fuze has armed) by impact with any underwater obstruction offering sufficient resistance. Inertia causes the weight to move forward on normal impact or laterally on oblique impact, thereby allowing the three balls to move out and release the spring driven firing pin. The firing pin pierces and initiates the detonator which in turn initiates the lead-in and magazine charge and in turn the main explosive charge in the rocket head.

Acceptance test data. Sample fuzes selected at random from each production lot are subjected to routine safety tests and ballistic tests when fired in rocket ammunition in accordance with the following procedure:

1. **PREMATURE AND BLADE TEST**—Fuzes from each lot, completely loaded except for inert boosters, shall be assembled in 7.2-inch rockets. Half the rounds shall be launched at a striking velocity of 170 feet per second, and the balance at 190 feet per second, into 25 feet of water with the round attached to a line and spring arrangement. All the rounds shall be recovered by suitable nets before striking the bottom, and the fuzes shall be fully armed but not fired. Failure of any fuze to pass this test shall cause rejection of the lot. All of the fuzes used in this test shall be saved for the "Functioning Test" described in the next paragraph.

2. **FUNCTIONING TEST**—The fuzes used for the Premature and Blade Test shall be reused in this test. The fuzes shall be assembled in 7.2-inch rockets (inert loaded to a weight of 65 pounds). The rockets shall be fitted with a retarding disc suitable to limit the underwater terminal velocity to 22 or 23 feet per second. The fuzes shall be prearmed by the Premature and Blade Test and dropped in water so that the terminal velocity is reached, and the nose of the fuze strikes No. 1 grade fir battens 1¼-inch x 3-inch laid flat with ¾-inch spaces between them on supports two feet apart. The slats shall be firmly fastened to supports which have a solid foundation. Ninety percent high order functioning shall be considered satisfactory.

Sensitivity limits. Fuze Mk 156 Mod 0 is equipped with a spring driven firing pin and will fire after arming upon impact with any underwater obstruction which creates sufficient deceleration to move the weight either forward on a normal impact or laterally on an oblique impact. Obstructions such as the steel surface or the wooden deck gratings of a submarine will consistently function the fuze.

4. Safety Features

Detonator safety. The fuze is detonator safe. The firing pin, protruding into the shutter cavity when the fuze is unarmed, holds the detonator out of alignment with the tetryl lead-in and booster charge. Premature functioning of the detonator while the fuze is unarmed will not detonate the booster lead-in and booster.

During shipping and stowage. Sample fuzes from production lots are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and handling. Failure to pass the tests is cause for rejection of the lot. The setback collar prevents rotation of the water arming vane until the setback forces, acting on the collar at the instant of firing, cause it to move backward on the plug, thereby freeing the arming vane (except for the radial shear wire). A safety pin, which is inserted through the setback collar, a plug, and an arming screw, prevent movement of the setback collar during transportation and stowage. The radial shear wire, in addition to its primary function of preventing the vane from turning during the air travel after being fired, also provides a safety

feature. The arming vane will not be rotated, even if the setback collar has moved back on the plug, unless considerable force is applied to the vane.

5. Disposal and Servicing (Maintenance)

General. This fuze is very dangerous to handle when armed, therefore, disposal and handling under such circumstances is considered most hazardous. Accordingly, the precautions below are to be rigidly followed:

1. **The safety pin must be in place through the setback collar at all times and not removed until just prior to the firing of the round.** In case the salvo 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 manually retracted under any operating conditions.**

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

To install the fuze in the rocket:

1. Remove the steel fuze cap and the shipping plug from the nose of the charge.

2. Remove the cardboard shipping spacer from the fuze seat liner.

3. Make sure that the auxiliary booster shipped with the charge is properly located.

4. Remove the fuze from its sealed container and make sure that the safety pin is securely in place.

5. Screw the fuze into the nose of the rocket head, making sure that the gasket between the fuze and the fuze seat liner is in place. Tighten with a spanner wrench so that the joint is water-tight. (NOTE: The pins of the spanner wrench used (BuOrd Sk 119862) shall be fitted into the holes in the fuze body and **not** into the holes in the plug; that is, they shall be fitted into the outer pair of holes.) **Do not grasp the fuze by the arming vane or use a pipe wrench or any other tool on the plug, setback collar, or arming vane when installing the fuze in a rocket.** If this precaution is not followed, the plug may be unscrewed and/or the arming vane turned, thereby arming the fuze. There is on record a serious accident caused by the use of improper tools.

6. Replace the fuze cap over the fuze, for protection against the weather and safety in handling. This completes the installation for ready ammunition.

7. After the rockets are placed on the launcher, and just prior to firing, remove the fuze cap and the safety pin through the setback collar. Save the safety pins, so that they can be reinserted into the setback collars in case the salvo is not fired. Daily inspections should be made of all fuzed rounds to make sure that the fuze is in a safe condition and that the safety pin is present.

It is important that the following points be checked:

1. That the correct fuze is installed in the proper rocket and used with the proper launcher.
2. That the fuze cap and safety pin are removed just prior to firing of the round.
3. That the setback collar is in the forward position, with the spring plate over the vane locking pins after installation.
4. Daily inspections should be made of any fuzed rounds which are on the launcher rails to see that the safety pins are correctly installed and the fuzes have not been partially or fully armed by some accidental means.

Removal from round. Should it become necessary, the fuze may be removed from the rocket head and returned to its container. However, first be sure that the safety pin through the setback collar is in place. The fuze should be removed from the

round if for any reason the round is to be taken below decks. Use a spanner wrench (BuOrd Sk 119862) to remove the fuze. (NOTE: The spanner wrench should fit the holes in the fuze body and not the holes in the plug; that is, it should fit the outer pair of holes.) **Do not grasp the fuze by the arming vane or use a pipe wrench or any other tool on the plug, setback collar, or arming vane when removing the fuze from the rocket.** If this precaution is not followed, the plug may be unscrewed and/or the arming vane turned, thereby arming the fuze.

7. Packing and Marking

Packing. One fuze is packed in a sealed cylindrical metal container $3\frac{7}{16}$ inches nominal diameter, and 8.0 inches nominal length. The weight of the fuze and container is 3.36 pounds. A scored metal tear strip facilitates opening of the container. The container is stamped with the mark and mod of the fuze.

Twenty-four fuzes, packed in the fuze containers, are packed in a wooden shipping box 25.5 inches by 16.5 inches by 9.7 inches representing 2.3 cu. ft. The weight of the box and fuzes is approximately 108 pounds.

Marking. The fuze body is marked or stamped with the mark, mod, and lot numbers, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Section B—Nose Fuze Mk 158 Mod 0 (Water Travel Arming, Impact Firing)

1. General Data

Used in: 7.2-inch projector charge Head Mk 4 (High Capacity) with Projector Charge Tail Mk 6.

Overall dimensions and weight of fuze:

Length.....	7.385 inches
Diameter (maximum).....	3.125 inches
Body threads.....	2.00 inches— 12 NS-2
Weight.....	2.8 pounds

- Applicable specification:** OS 3418
- General arrangement drawing:** 438552
- Sketch list of drawings & specs:** 109483
- Explosive components:** Identical with Fuze Mk 156 Mod 0.

2. Description

General. Fuze Mk 158 Mod 0 is identical with Fuze Mk 156 Mod 0 in all respects except that Fuze Mk 158 Mod 0 has a setback collar shear wire through the setback collar and the plug as an added safety feature. Fuze Mk 158 Mod 0 is used only in the 7.2-inch Head Mk 4 when assembled with the Projector Charge Tail Mk 6. The projector charge round (which is not a rocket) as fired from a Projector Mk 10 or Mk 11 is subjected to considerable setback which permits the use of a setback collar shear wire. The propellant in the 7.2-inch rocket, incorporating a Fuze Mk 156, does not impart sufficient setback to sever a collar shear wire.

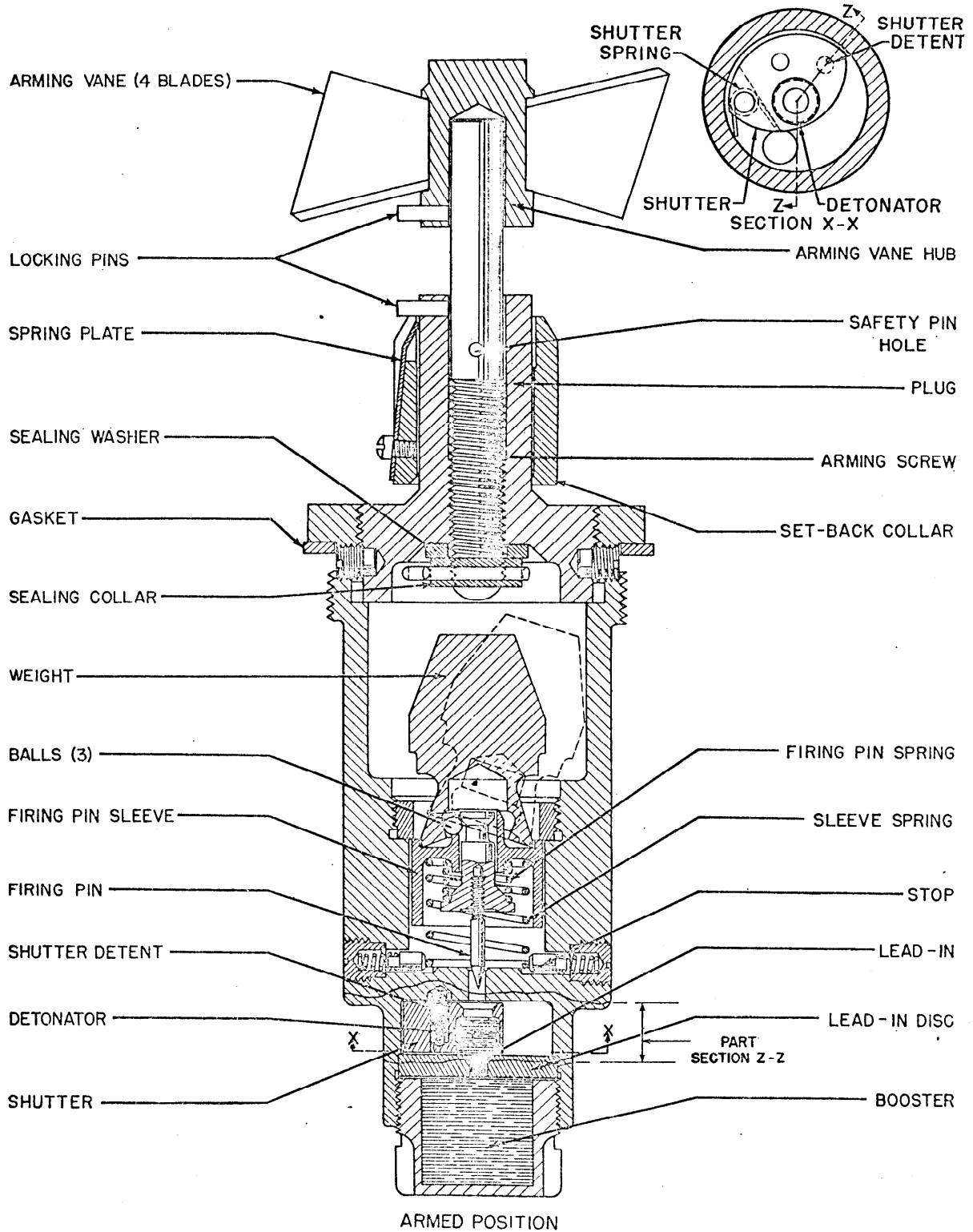


Figure 33—Nose Fuze Mk 156 Mod 0 or Mk 158 Mod 0, Cross Section View, Armed Position.

The description and all instructions outlined for Fuze Mk 156 Mod 0 apply to Fuze Mk 158 Mod 0. The addition of the setback collar shear wire does not change the functioning of the fuze in any way except that it requires a greater initial setback force to initiate arming.

Use. Fuze Mk 158 Mod 0 is used in the 7.2-inch High Capacity Projector Charge Head Mk 4 assembled with the 2.25-inch Projector Charge Tail Mk 6.

3. Functioning

Firing. Instantaneous or superquick firing upon impact is identical with Fuze Mk 156 Mod 0.

Acceptance test data. The acceptance data for Fuze Mk 158 Mod 0 are the same as for Fuze Mk 156 Mod 0 except that in the Premature and Blade Test half of the fuzed rounds are launched at 130 feet per second and the balance are launched at 150 feet per second instead of at 170 feet and 190 feet per second. In addition a collar shear wire test is required on the Fuze Mk 158 Mod 0. This requires that inert fuzes from every tenth lot be

assembled in 7.2-inch Heads Mk 4, inert loaded, with loaded Projector Charge Tails Mk 6 and fired at a propellant temperature of approximately 0°F. for ground impact from a Projector Mk 10. The fuzes are suitably protected by a reinforced cap to prevent mutilation of the fuze and inspection is made to ascertain that the collar shear wire has been sheared. Failure shall cause rejection of the lot.

4. Safety Features

See Fuze Mk 156 Mod 0 and substitute Projector Charge for Rocket.

5. Disposal and Servicing (Maintenance)

See Fuze Mk 156 Mod 0 and substitute Projector Charge for Rocket.

6. Installation Instructions

See Fuze Mk 156 Mod 0 and substitute Projector Charge for Rocket.

7. Packing and Marking

See Fuze Mk 156 Mod 0 and substitute Projector Charge for Rocket.

Chapter 8

BASE FUZES FOR FIN STABILIZED AIRCRAFT ROCKETS

The fuzes described in this group are as follows:

- Section A—Base Fuzes Mk 157 Mods 0*, 1*, and 2
- Section B—Base Fuzes Mk 159 Mods 0* and 1
- Section C—Base Fuzes Mk 163 Mods 0 and 1
- Section D—Base Fuze Mk 164 Mod 0
- Section E—Base Fuze Mk 165 Mod 0

*Base Fuzes Mk 157 Mods 0 and 1 and Mk 159 Mod 0 have been withdrawn from service and issue.

Section A—Base Fuze Mk 157 Mods 0, 1, and 2 (Pressure Arming, Impact Firing)

1. General Data

Used in:

- Mk 157 Mod 0 in 5.0-inch Rocket Heads Mk 1 and Mk 1 Mod 1 (General Purpose)
- Mk 157 Mod 1 in 11.75-inch Rocket Head Mk 1 (Common)
- Mk 157 Mod 2 in 11.75-inch Rocket Heads Mk 1 Mod 1 and Mk 2 (Common)

Overall dimensions and weight of fuze:

Length:

- 6.170 inches (Mod 0 & 1)
- 6.196 inches (Mod 2)

Diameter (maximum):

- 2.938 inches (Mod 0 & 1)
- 3.200 inches (Mod 2)

Body threads..... 2.750 inches—14 NS-2

Weight:

- 3.40 lbs. approx. (Mod 0 & 1)
- 3.50 lbs. approx. (Mod 2)

Applicable specification: OS 3535

General arrangement drawings:

- 438015 (Mod 0)
- 439629 (Mod 1)
- 439630 (Mod 2)

Sketch list of drawings & specs:

- 109475 (Mod 0)
- 165111 (Mod 1)
- 165123 (Mod 2)

Explosive components:

Delay detonator assembly (adapted from the delay detonator assembly of Fuze Mk 145.) The assembly consists of a mercury fulminate Percussion Primer Mk 106, an expansion space, the 0.020 second black powder delay element and the lead azide Relay Detonator Mk 31 Mod 0 all in a single case closed by a crimp and located in the shutter.

Booster lead-in charge (tetryl) located in lead-in disc.

Booster charge (approximately 12 grams tetryl) located in magazine.

2. Description

General. Fuze Mk 146, which is now obsolete, was originally developed for use in the 5.0-inch Aircraft Rocket¹. Service use of the 5.0-inch Aircraft Rocket soon indicated that a longer delay than that inherent in Fuze Mk 146 was necessary in order to obtain the desired penetration of targets before detonation. For this reason Fuze Mk 146 was modified to incorporate a 0.020 second

¹5.0-inch rocket head assembled with a 3.25-inch rocket motor.

delay detonator and designated Fuze Mk 157 Mod 0. Since the delay detonator has a percussion primer, the stab type firing pin of Fuze Mk 146 is replaced by a firing pin with a rounded point.

Fuze Mk 157 Mod 1 differs from Fuze Mk 157 Mod 0 in that the head and body are manufactured from pearlitic manganese steel for additional strength, also the 2.75-inch diameter threads on the fuze head extend the full length of the head. Fuze Mk 157 Mod 2 is identical with the Fuze Mk 157 Mod 1 except that it provides for external gas checking by means of the copper and lead gaskets.

Use. Fuze Mk 157 Mod 0 is used in the 5.0-inch General Purpose Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 1 Mod 2, Mk 1 Mod 4, Mk 1 Mod 5, and Mk 4 Mod 0 (see OP 1415). Rockets employing these fuzes are used against shipping, light fortifications, such as pill boxes, and personnel. Fuzes Mk 157 Mod 1 and Mod 2 are used in the 11.75-inch Common Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 3 Mod 0 and Mk 3 Mod 1 (see OP 1415). The 11.75-inch Aircraft Rockets utilizing Fuzes Mk 157 Mod 1 and Mod 2 are used against shipping and heavy fortifications. Fuze Mk 157 and Mods will fire with a 0.020 second delay upon impact with suitable targets.

Functioning mechanism. Two parts called the head and body house the fuze mechanism. The head contains a gas chamber formed by the plug and the diaphragm. Gases from the rocket motor are permitted to flow slowly into the gas chamber through an orifice in the inlet screw, after first being filtered by the inlet screen. Immediately beneath the diaphragm and in the body, an aluminum arming plunger is held in position by a shear wire.

In the unarmed position the arming plunger holds a locking ball in such a position as to lock the firing pin body and firing pin in the forward position, compressing the firing pin spring. While in the forward position, the firing pin extends through the firing pin guide and into a cavity in the shutter. This cavity in the shutter is so positioned that when engaged by the firing pin the delay detonator assembly is out of alignment with the tetryl booster lead-in and the firing pin. Rotation of the shutter to bring the explosive

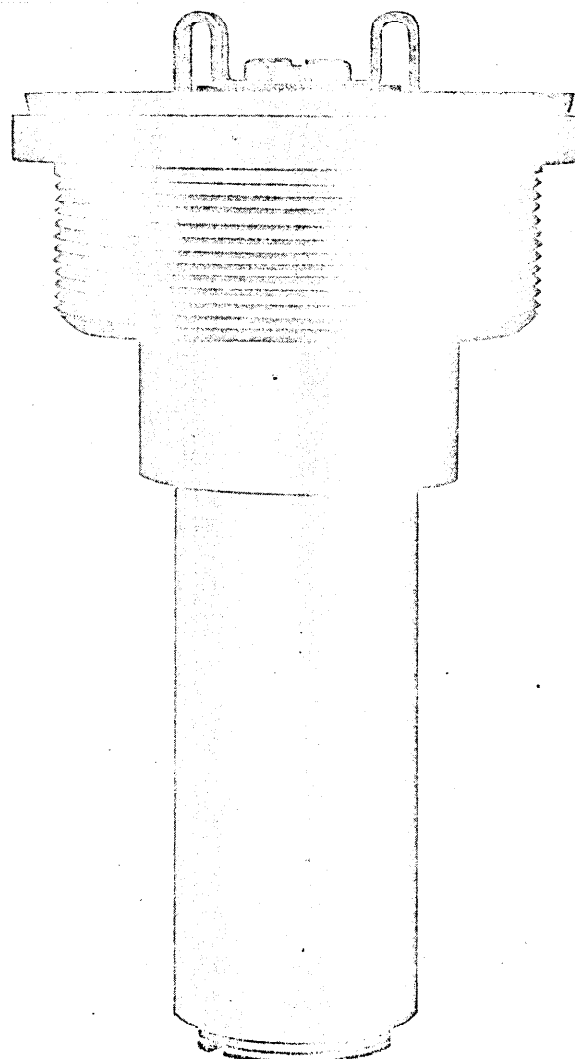


Figure 34—Base Fuze Mk 157 Mod 2, External View Full Size (approximately).

elements in line, when released by withdrawal of the firing pin, is accomplished by means of the shutter spring. Since the firing pin must not puncture the cover of the percussion primer, the firing pin is made so as to shoulder against the face of the detonator case so that the point will indent the proper distance into the primer. To avoid crushing of the detonator case by the weight of both the firing pin and firing pin body on heavy impacts, the firing pin is secured in the firing pin body by means of a shear wire. On heavy impacts the inertia of the firing pin body shears

the wire holding the firing pin, and the two parts telescope.

A lead-in disc containing a tetryl lead-in charge is inserted in the fuze body between the shutter and the tetryl magazine charge.

3. Functioning

Arming. The fuze head screws into an adapter fixed in the base of the rocket head. The gasket and the luting on the threads of Fuze Mk 157 Mods 0 and 1 or the projectile type gas check used with Fuze Mk 157 Mod 2, are provided to make a gas tight seal in the adapter between the rocket motor and the interior of the rocket head. The rear end of the fuze (the exterior surface of the plug) is exposed to the front end of the rocket motor. The fuze arms in two stages:

1. Gases from the rocket motor, at pressures ranging from 300 to 1600 psi for the 3.25-inch Motor Mk 7 and 800 to 2350 psi for the 11.75-inch Motors Mk 1, enter the pressure chamber in the head of the fuze through a small orifice in the inlet screw. Debris from the rocket motor is filtered out by the inlet screen. When pressure in the chamber has reached a value of 275 to 325 psi, which is delayed by the small orifice until approximately half the propellant burning time is consumed, the diaphragm collapses, forcing the arming plunger down and shearing the shear wire which holds the arming plunger in place. Movement of the arming plunger releases the locking ball, which, in the unarmed condition, locks the firing pin body in place, and allows the latter to move toward the rear under the force of the firing pin spring and the inertia of the firing pin body due to acceleration. The firing pin, attached to the firing pin body, is thus withdrawn from the detonator shutter, which it normally locks in the safe position.

2. When the rocket accelerates, the inertia of the shutter forces it back against the firing pin guide, compressing the shutter spring and engaging the shutter locking pin in a hole in the firing pin guide. About midway during acceleration, the firing pin is withdrawn from the shutter; but the shutter, held by the shutter locking pin, remains locked in the safe position.

When acceleration is over, the shutter spring forces the shutter forward against the lead-in disc disengaging the shutter locking pin from the hole in the firing pin guide. The shutter spring then

swings the shutter into the armed position (detonator assembly in line with firing pin and lead-in) where it is locked by the detent. (See paragraph 4 for arming distance of Fuze Mk 157 and Mods.)

Firing. The fuze fires upon impact with any material offering sufficient resistance. Under the force of impact the inertia of the firing pin body drives the firing pin forward, striking and initiating the percussion primer in the detonator assembly. The percussion primer initiates the explosive train in the detonator assembly (i. e., black powder delay and relay detonator). The detonator assembly in turn initiates the tetryl lead-in and tetryl booster, which detonates the main explosive charge of the rocket head, either directly or through the auxiliary booster.

Acceptance test data. Sample fuzes selected at random from each production lot are subjected to routine safety tests and ballistic tests when fired in rocket ammunition in accordance with the following procedures:

1. Completely live-loaded fuzes from each lot shall be assembled in explosive loaded 5.0-inch Rocket Heads Mk 1 fitted with flat nose shipping plugs and 3.25-inch Rocket Motors Mk 7 and shall be fired at angles of elevation from 8 to 11 degrees for noticeable delayed action high order functioning after water impact. Satisfactory performance for this test shall be considered 90% delayed action high order functioning.

2. Completely live-loaded fuzes from each of the first twenty lots and from the 25th, 30th, 35th, etc., lots thereafter shall be assembled in explosive loaded 5.0-inch Rocket Heads Mk 1 fitted with pointed steel nose plugs and 3.25-inch Rocket Motors Mk 7 and fired for impact against $\frac{1}{4}$ -inch, $\frac{3}{8}$ -inch, $\frac{1}{2}$ -inch, $\frac{5}{8}$ -inch, and 1-inch STS plates at the discretion of the Naval Proving Ground for the purpose of adding to the present knowledge of the plate performance of this fuze. Performance of the fuzes in this test shall be reported but shall not be an essential criterion in determining the acceptance of the lot.

Sensitivity limits. Because the percussion primer is less sensitive than the stab type sensitive primer, Fuze Mk 157 is less sensitive than Fuze Mk 146. Tests of Fuze Mk 157 against plate indicated that functioning on mild steel plate targets less than $\frac{1}{2}$ inch in thickness is unreliable.

4. Safety Features

Detonator safety. Fuze Mk 157 Mods 0, 1, or 2 is detonator safe. In the unarmed position, the detonator assembly is out of alignment with the explosive train. Should the detonator assembly function prematurely, the force of the detonation will be dissipated upward through a hole in the firing pin guide and away from the balance of the explosive train. Because of the delay in admission of gas from the rocket motor to the pressure chamber, the first stage in arming does not occur until approximately one-quarter to one-half of the rocket propellant burning time is completed. Because of this delay, if the rocket motor blows up before it leaves the launcher, the fuze should not arm. Arming is not completed until after acceleration has dropped to a value corresponding to nine g. The burning distance, and therefore the arming distance, will vary with the temperature. On the average, arming is completed about 0.1 second after the end of burning. Approximate arming distances for Fuze Mk 157 and Mods in the 5.0-inch and the 11.75-inch aircraft rockets are:

Temperature.....	0 F.	70 F.	135 F.
5.0-in. AR (3.25-in. Mk 7 Motor).....	575 ft.	350 ft.	250 ft.
11.75-in. AR (11.75-in. Mk 1 Motor).....	670 ft.	450 ft.	350 ft.

During shipping and stowage. Sample fuzes from each production lot are subjected to rough handling tests which are considered more severe than conditions encountered during normal shipment and stowage. Failure to pass these tests shall be cause for rejection of the lot.

5. Disposal and Servicing (Maintenance)

General. From an examination of the exterior of the fuze, it is impossible to tell whether or not the fuze is armed. If, for any reason, it is

thought that the fuze may be armed, it should be treated as an armed and sensitive fuze. No attempt should be made to remove the fuze from the rocket body. The complete fuzed round should be disposed of by gently lowering it, tail first, into deep water, or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. Disassembly is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

The fuze is shipped installed in the base of the rocket head. A safety wire is not necessary and no preparations are required to ready the fuze for use. A shipping plug or shipping cap protects the exposed end of the fuze and the outside threads of the head. The shipping plug or the shipping cap should be kept in place until the round is assembled and should be promptly replaced if the round is disassembled. Before assembling the rocket head to the rocket motor **be certain that the fuze is in place in the base adapter**, and that the gas check gaskets are properly installed where required.

7. Packing and Marking

Packing. Fuzes will be shipped assembled in the rocket heads and protected by a shipping plug which screws into the base adapter or by a shipping cap which screws over the outside threads of the head.

Marking. The fuze is marked or stamped with the mark, mod, and lot number; the date of loading; the manufacturer's initial or symbol; and the initials or symbol of the loading facility; the month and year of loading; the anchor stamp; and the inspector's initials.

Section B—Base Fuze Mk 159 Mods 0 and 1 (Pressure Arming, Impact Firing)

1. General Data

Used in:

- Mk 159 Mod 0 in 5.0-inch Rocket Head Mk 6 Mod 0 (General Purpose)
- Mk 159 Mod 1 in 5.0-inch Rocket Head Mk 6 Mod 1 (General Purpose)

Overall dimensions and weight of fuze:

- Length:
 - 5.812 inches (Mod 0)
 - 5.813 inches (Mod 1)
- Diameter (maximum):
 - 2.965 inches (Mod 0)
 - 3.200 inches (Mod 1)

Body threads..... 2.750 inches—14 NS-2

Weight:

3.4 lbs. approx. (Mod 0)

3.5 lbs. approx. (Mod 1)

Applicable specification: OS 3585

General arrangement drawings:

422550 (Mod 0)

439631 (Mod 1)

Sketch list of drawings & specs:

109605 (Mod 0)

165124 (Mod 1)

Explosive components:

Delay detonator assembly (adapted from the delay detonator assembly of Fuze Mk 157. The assembly consists of a mercury fulminate Percussion Primer Mk 106, an expansion space, the 0.015 second black powder delay element and the Relay Detonator Mk 31 Mod 0 (lead azide) assembled in a single case closed by a crimp contained in shutter.

Booster lead-in charge (tetryl) contained in the lead-in disc.

Booster charge (approximately 12 grams tetryl) contained in magazine.

2. Description

General. Fuze Mk 159 is a modification of Fuze Mk 157 to satisfy the fuze requirements for a higher velocity fin-stabilized rocket employing a 5.0-inch rocket motor and a 5.0-inch rocket head. Accordingly the arming constants were adjusted to the burning characteristics of the 5.0-inch Rocket Motor Mk 1 and 2. The major changes incorporated in Fuze Mk 159 are as follows:

1. Diameter of inlet orifice—0.0145 inches.
2. Diameter of shear wire—0.064 inches.
3. Grooved inlet-washer used instead of screen.
4. Fuze must arm between 325 and 375 psi.
5. Delay of 0.015 second.

Fuze Mk 159 Mod 0 is sealed in the rocket head by a copper gasket under the fuze head flange. Fuze Mk 159 Mod 1 has the flange head diameter increased to 3.2 inches and a projectile type gas check is used.

Use. Fuze Mk 159 Mod 0 is used in the 5.0-inch General Purpose Fin Stabilized Aircraft Rocket (Complete Round) Mk 4 Mod 0 (see OP 1415). Fuze Mk 159 Mod 1 is used in the 5.0-

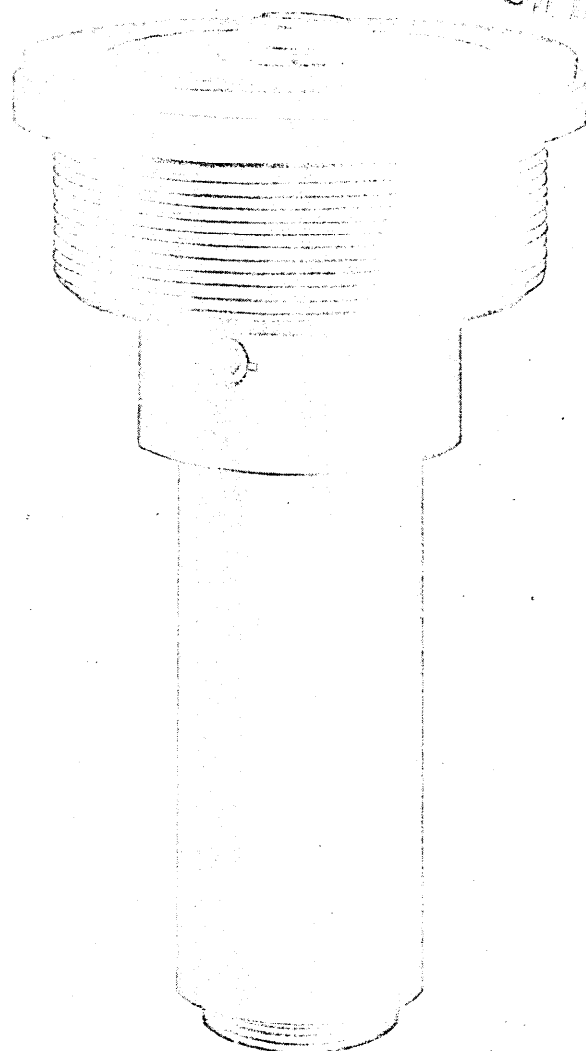


Figure 35—Base Fuze Mk 159 Mod 1, External View, Full Size (approximately).

inch General Purpose Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 4 Mod 0 and Mk 26 Mod 0 (see OP 1415). Just prior to assembly of the round on aircraft, a Nose Fuze Mk 149 is usually installed in the head. The latter fuze can be fired instantaneous or safe, depending upon the target. This permits the use of a round with selective fuze action (instantaneous or 0.015 second delay) at the time of firing. The above rockets are used against light fortifications, tanks, locomotives, and similar targets.

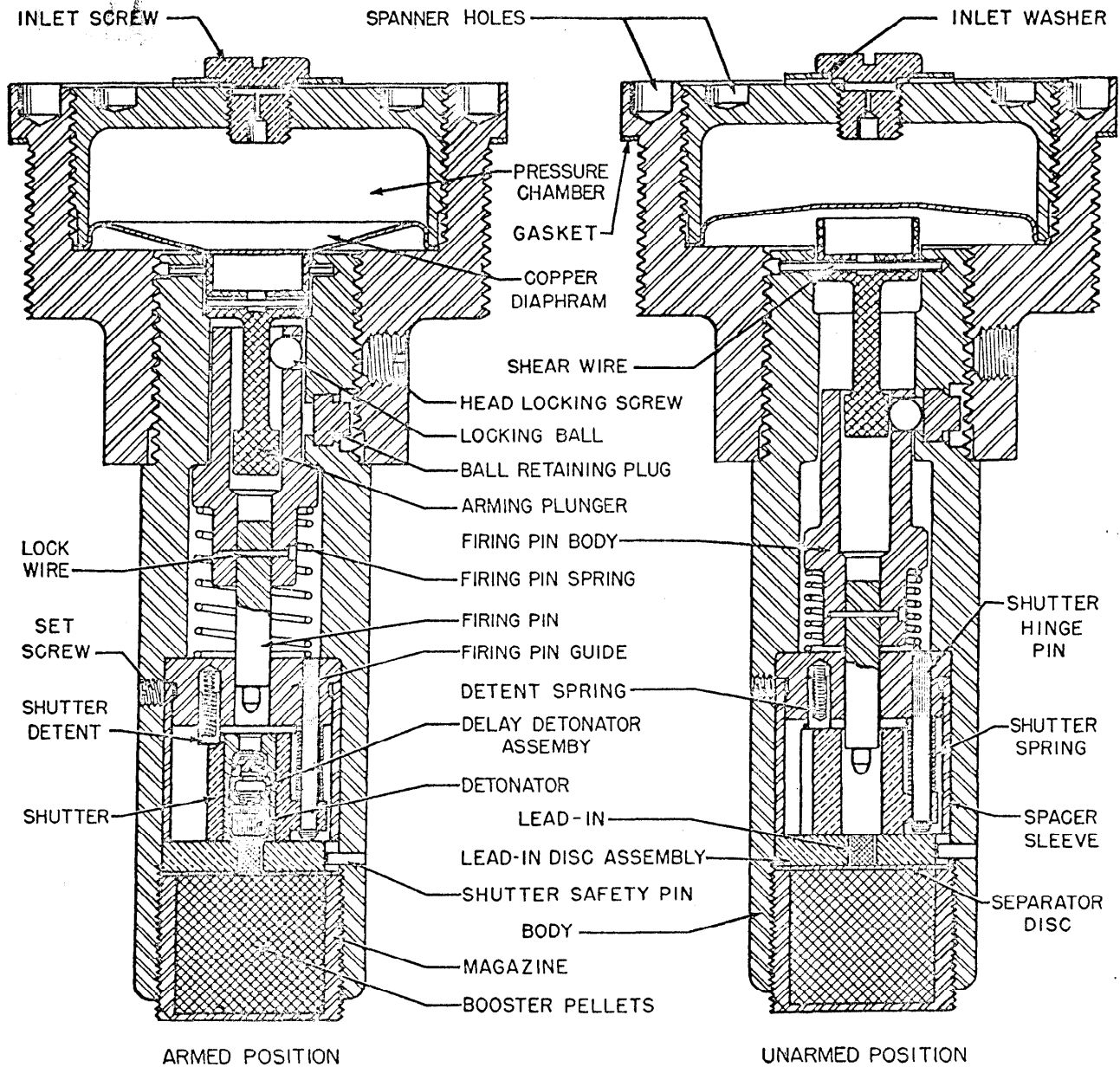


Figure 36—Base Fuze Mk 159 Mod 0, Cross Section View, Armed and Unarmed Position.

Functioning mechanism. Same as Fuze Mk 157 except as previously noted above.

3. Functioning

Arming. Arming is identical with Fuze Mk 157.

Firing. Firing upon impact is identical with Fuze Mk 157.

Acceptance test data. Those fuzes selected for functional test are assembled in the proper rocket head fitted with a flat nose shipping plug and a 5.0-inch Rocket Motor Mk 2 and fired from a surface launcher at 15 degrees elevation for water impact. Acceptance is based on a cumulative

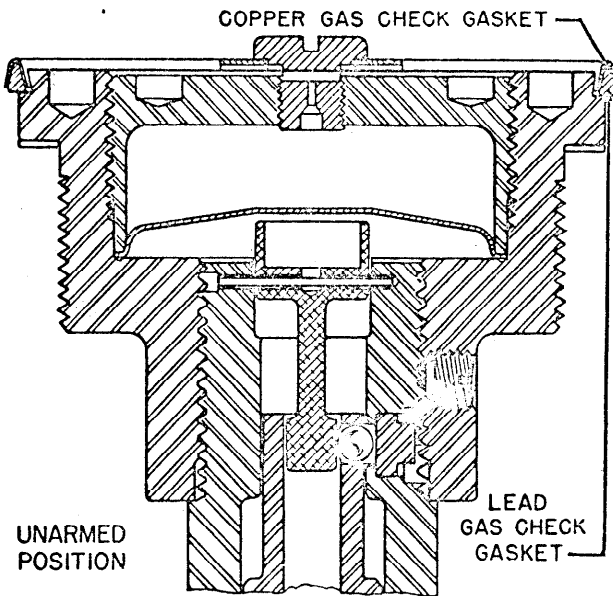


Figure 37—Base Fuze Mk 159 Mod 1, Unarmed Position Showing Gas Checking.

test plan designed to accept (95% of the time) lots in which 95% of the fuzes function satisfactorily; lots poorer than 95% will be subject to rejection with lots 80% effective being rejected 90% of the time.

Sensitivity limits. The sensitivity of Fuze Mk 159 is the same as for the Fuze Mk 157.

4. Safety Features

Same as Fuze Mk 157.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 157.

6. Installation Instructions

Same as Fuze Mk 157.

7. Packing and Marking

Same as Fuze Mk 157.

Section C—Base Fuze Mk 163 Mods 0 and 1 (Pressure Arming, Impact Firing)

1. General Data

Used in: 11.75-inch Rocket Head Mk 1 Mod 1 and Mk 2 Mod 0 (Common)

Overall dimensions and weight of fuze:

- Length..... 6.49 inches
- Diameter (maximum)..... 3.2 inches
- Body threads..... 2.75 inches—
14 NS-2
- Weight..... 3.4 lbs. approx.

Applicable specification: OS 3699

General arrangement drawing: 561459

Sketch list of drawings & specs:

- 165238 (Mod 0)
- 165442 (Mod 1)

Explosive components:

Delay detonator assembly (adapted from the delay detonator assembly of Fuze Mk 157. The assembly consists of a mercury fulminate Percussion Primer Mk 106, an expansion space, the 0.020 second black powder delay element and the Relay Detonator

Mk 42 Mod 0 (lead azide) assembled in a single case closed by a crimp and contained in shutter.

Booster lead-in charge (tetryl).

Booster charge (approximately 12 grams tetryl) contained in magazine.

2. Description

General. The Base Fuze Mk 163 Mods 0 and 1 was developed by modifying Fuze Mk 157 Mod 2. It has essentially the same functioning mechanism with the following modifications included to improve the performance on heavy oblique impacts:

1. A setback block and setback spring is included in the lead-in and shutter lock assembly which takes the place of the lead-in disc in Fuze Mk 157. The setback block with the shutter lock pin attached provides a more positive setback operated, arming delay. During acceleration of the rocket, the setback spring is compressed by the inertia of the setback block, and the shutter-lock pin engages the detent hole in the shutter. When acceleration is over, the shutter-lock pin is

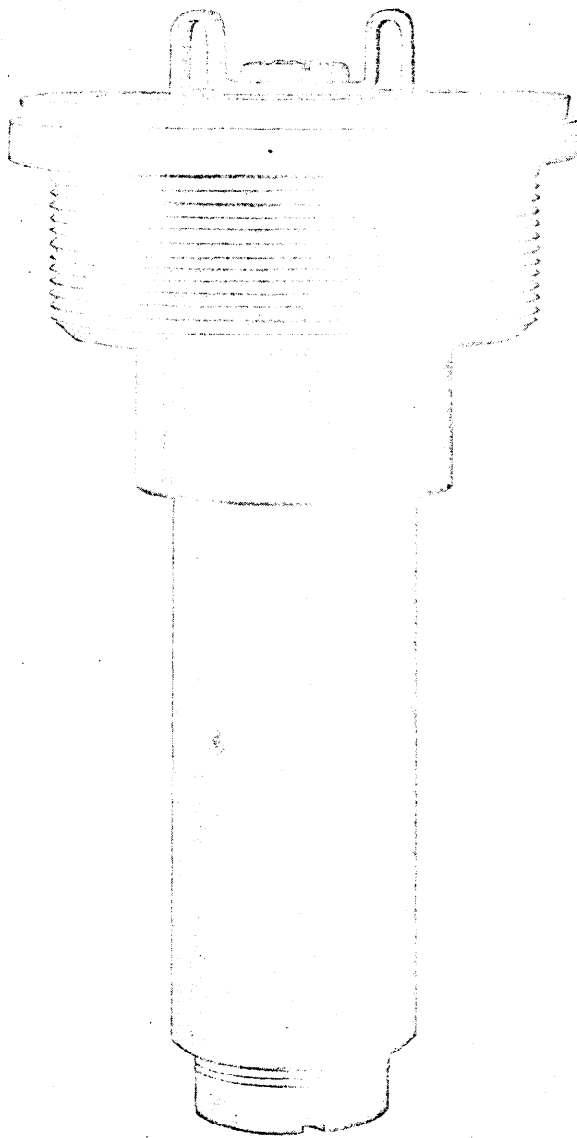


Figure 38—Base Fuze Mk 163, External View, Full Size (approximately).

withdrawn, releasing the shutter, which in turn is then rotated into the armed position by the shutter spring.

2. The possible gap of 0.058 inches between the detonator and lead-in is reduced to 0.025 inches, for more positive assurance of high order functioning.

3. The shutter is hinged at both ends of the hinge-pin, and another detent is added. The use of two detents reduces the probability of the

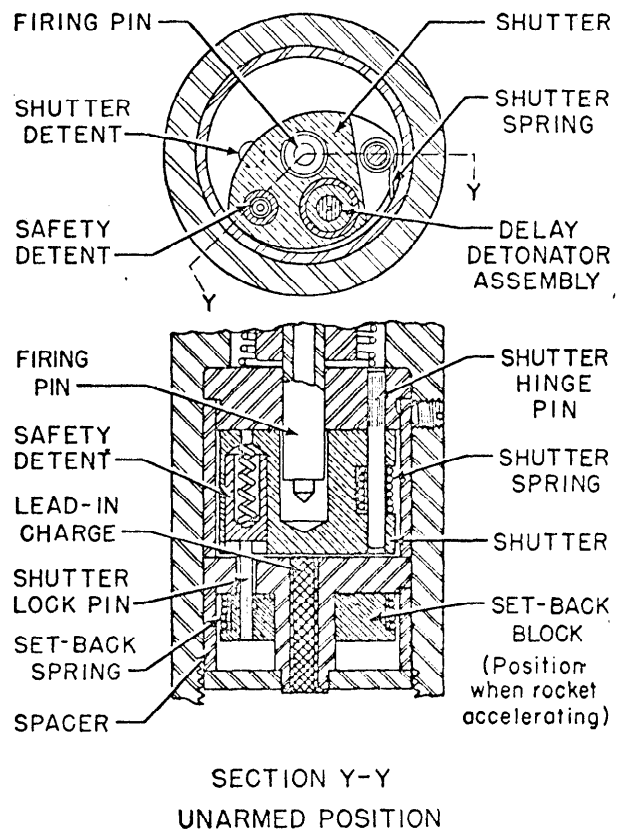
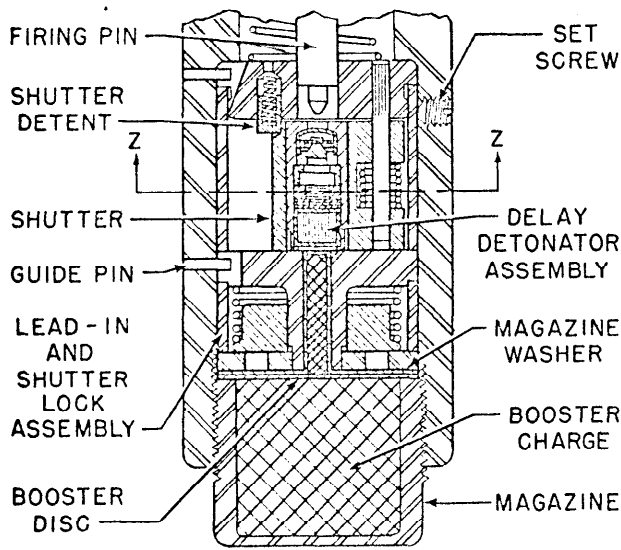


Figure 39—Base Fuze Mk 163 Mod 1, Partial Cross Section View Showing the Operation of the Setback Block when Rocket Accelerating.

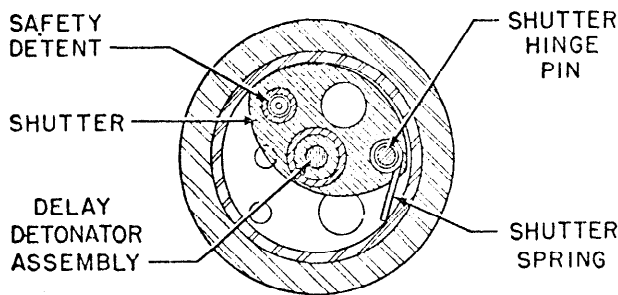
shutter being knocked out of position by an oblique impact. The shutter spring functions only as a torsion spring and not as a compression and torsion spring as in Fuze Mk 157.

The overall length of Fuze Mk 163 is approximately 0.33 inches greater than that of Fuze Mk 157 Mod 2. The additional length requires a deeper fuze cavity in the head filler.

Fuze Mk 163 Mod 0 has arming constant the same as the Mk 157 Mod 2. When the inlet screen was replaced by a filter formed by compressing Inconel wire mesh and the inlet orifice and shear wire were replaced by those from the Fuze Mk 159 Mod 1, the fuze was designated the Mk 163 Mod 1. These changes increased the arming pressure (310 to 375 psi) and partial arming delay.



ARMED POSITION



SECTION Z-Z

Figure 40—Base Fuze Mk 163 Mod 1, Partial Cross Section View, Armed Position.

Use. Fuze Mk 163 Mods 0 and 1 is used in the 11.75-inch Common Fin Stabilized Aircraft Rockets (Complete Rounds) Mks 3 Mod 0 and Mk 3 Mod 1 (see OP 1415). The 11.75-inch Rocket

Head Mk 2 Mod 0 contains three Mk 163 Fuzes. The complete round is used against shipping and heavy fortifications. Fuze Mk 163 will fire with 0.020 second delay upon impact with a suitable target.

Functioning mechanism. The functioning mechanism in Fuze Mk 163 is the same as in Fuze Mk 157 except as noted in paragraph 1, General.

3. Functioning

Arming. Arming of Fuze Mk 163 is identical with Fuze Mk 157 except that the shutter is kept from rotating into the armed position by the shutter locking assembly until acceleration has ceased.

Firing. Firing upon impact is essentially the same as with Fuze Mk 157.

Acceptance test data. Those fuzes selected for functional tests are assembled in explosive loaded 5.0-inch Rocket Heads Mk 6 Mod 1 fitted with a flat nose shipping plug and 5.0-inch Rocket Motors Mk 2. The rounds are fired from a ground launcher at an angle of elevation of approximately 15 degrees for water impact. Acceptance is based on a cumulative test plan designed to accept (95% of the time) lots in which 92% of the fuzes function satisfactorily; lots poorer than 92% will be subject to rejection with lots 78% effective being rejected 90% of the time.

4. Safety Features

Same as Fuze Mk 157.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 157.

6. Installation Instructions

Same as Fuze Mk 157.

7. Packing and Marking

Same as Fuze Mk 157.

Section D—Base Fuze Mk 164 Mod 0 (Pressure Arming, Impact Firing)

1. General Data

Used in: 5.0-inch Rocket Head Mk 6 Mod 1 (General Purpose)

Overall dimensions and weight of fuze:

Length..... 6.18 inches
Diameter (maximum)..... 3.2 inches

Body threads..... 2.75 inches—
14 NS-2
Weight..... 3.40 lbs. approx.

Applicable specification: OS 3675
General arrangement drawing: 561460
Sketch list of drawings & specs: 165239

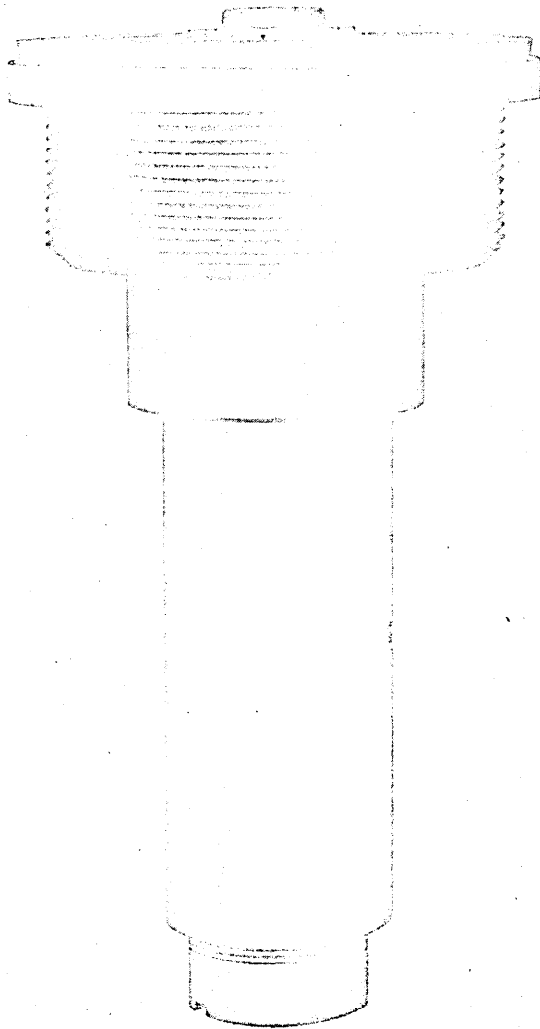


Figure 41—Base Fuze Mk 164 Mod 0, External View, Full Size (approximately).

Explosive components:

Delay detonator assembly (adapted from the delay detonator assembly of Fuze Mk 157. The assembly consists of a mercury fulminate Percussion Primer Mk 106; an expansion space, the 0.015 second black powder delay element and the Relay Detonator Mk 42 Mod 0 (lead azide) assembled in a single case closed by a crimp and contained in shutter.

Booster lead-in charge contained in the lead-in and shutter lock assembly (0.243 grams tetryl).

Booster charge (approximately 12 grams tetryl) contained in magazine.

2. Description

General. The Fuze Mk 164 Mod 0 is essentially the same as Fuze Mk 159 Mod 1 with the following exceptions:

1. The lead-in and shutter lock assembly of Fuze Mk 163 replaces the lead-in disc of Fuze Mk 159.

2. The shutter is hinged at both ends of the hinge-pin and two detents are used as in Fuze Mk 163.

3. The possible gap of 0.058 inches between the detonator and the lead-in is reduced to 0.025 inches for more positive assurance of high order functioning.

4. The Fuze Mk 164 uses an Inconel mesh filter covered by a plain flat washer.

Use. Fuze Mk 164 is used in the 5.0-inch General Purpose Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 4 Mod 0 and Mk 26 Mod 0 (see OP 1415). A Nose Fuze Mk 149 which can be fired instantaneous or safe is usually assembled in the nose of the rocket head to provide pre-selective fuze action of either instantaneous or 0.015 second delay. The complete round is used against tanks, locomotives, gun emplacements, and similar targets.

Functioning mechanism. The functioning mechanism of Fuze Mk 164 is the same as Fuze Mk 163.

3. Functioning

Arming. Arming of Fuze Mk 164 is identical with Fuze Mk 163.

Firing. Firing upon impact is identical with Fuze Mk 163.

Acceptance test data. Same as Fuze Mk 163.

4. Safety Features

Same as Fuze Mk 157.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 157.

6. Installation Instructions

Same as Fuze Mk 157.

7. Packing and Marking

Same as Fuze Mk 157.

Section E—Base Fuze Mk 165 Mod 0 (Pressure Arming, Impact Firing)

1. General Data

Used in: 5.0-inch Rocket Head Mk 1 and Mk 1 Mod 1 (General Purpose)

Overall dimensions and weight of fuze:

Length.....	6.97 inches
Diameter (maximum).....	3.885 inches
Body threads.....	3.625 inches— 12 NS-2
Weight.....	5.3 lbs. approx.

Applicable specification: OS 3817

General arrangement drawing: 561458

Sketch list of drawings & specs: 165240

Explosive components:

Delay detonator assembly (Same as Fuze Mk 163 Mod 0 and 1)

Booster lead-in charge contained in the lead-in and shutter lock assembly.

Booster charge (approximately 12 grams tetryl) contained in magazine.

2. Description

General. Fuze Mk 165 Mod 0 is a modification of Fuze Mk 157 Mod 0. The functioning mechanism is essentially the same except that it contains the improved shutter and lead-in and shutter lock assembly from Fuze Mk 163. The fuze head and fuze-to-motor adapter are made in one piece to improve the seal between the rocket motor and the interior of the rocket head.

Use. Fuze Mk 165 Mod 0 is used in the 5.0-inch General Purpose Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 1 Mod 2, Mk 1 Mod 4, and Mk 1 Mod 5 (see OP 1415). The rocket is normally fired with a Nose Fuze Mk 149 assembled in the rocket head to permit pre-selective fuze action of instantaneous or 0.020 second delay. The round is used against personnel and light targets.

3. Functioning

Arming. The arming of Fuze Mk 165 is identical with Fuze Mk 164.

Firing. Firing upon impact is identical with Fuze Mk 164.

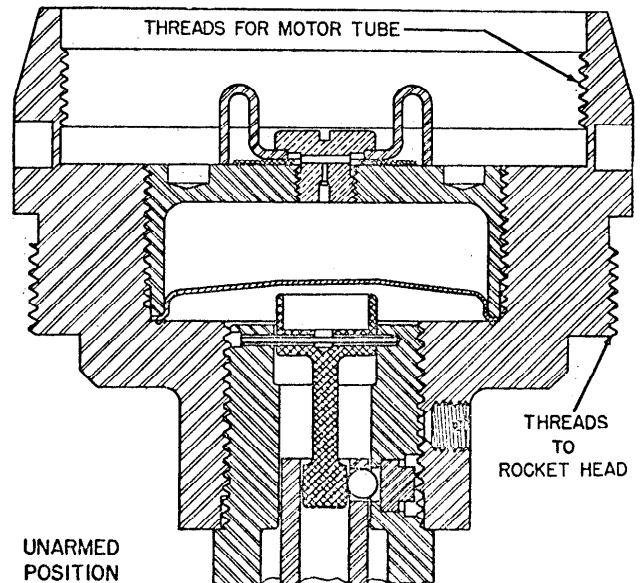


Figure 42—Base Fuze Mk 165 Mod 0, Partial Cross Section View, Unarmed Position.

Acceptance test data. Fuzes selected for functional test are assembled with explosive loaded 5.0-inch Rocket Heads Mk 1 fitted with flat nose shipping plugs and 3.25-inch Rocket Motors Mk 7 and fired from a surface launcher at approximately 15 degrees elevation for water impact. Acceptance is based on a cumulative test plan to accept (95% of the time) lots in which 92% of the fuzes function satisfactorily; lots poorer than 92% will be subject to rejection with lots 78% effective being rejected 90% of the time.

4. Safety Features

Same as Fuze Mk 157.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 157.

6. Installation Instructions

Same as Fuze Mk 157.

7. Packing and Marking

Same as Fuze Mk 157.

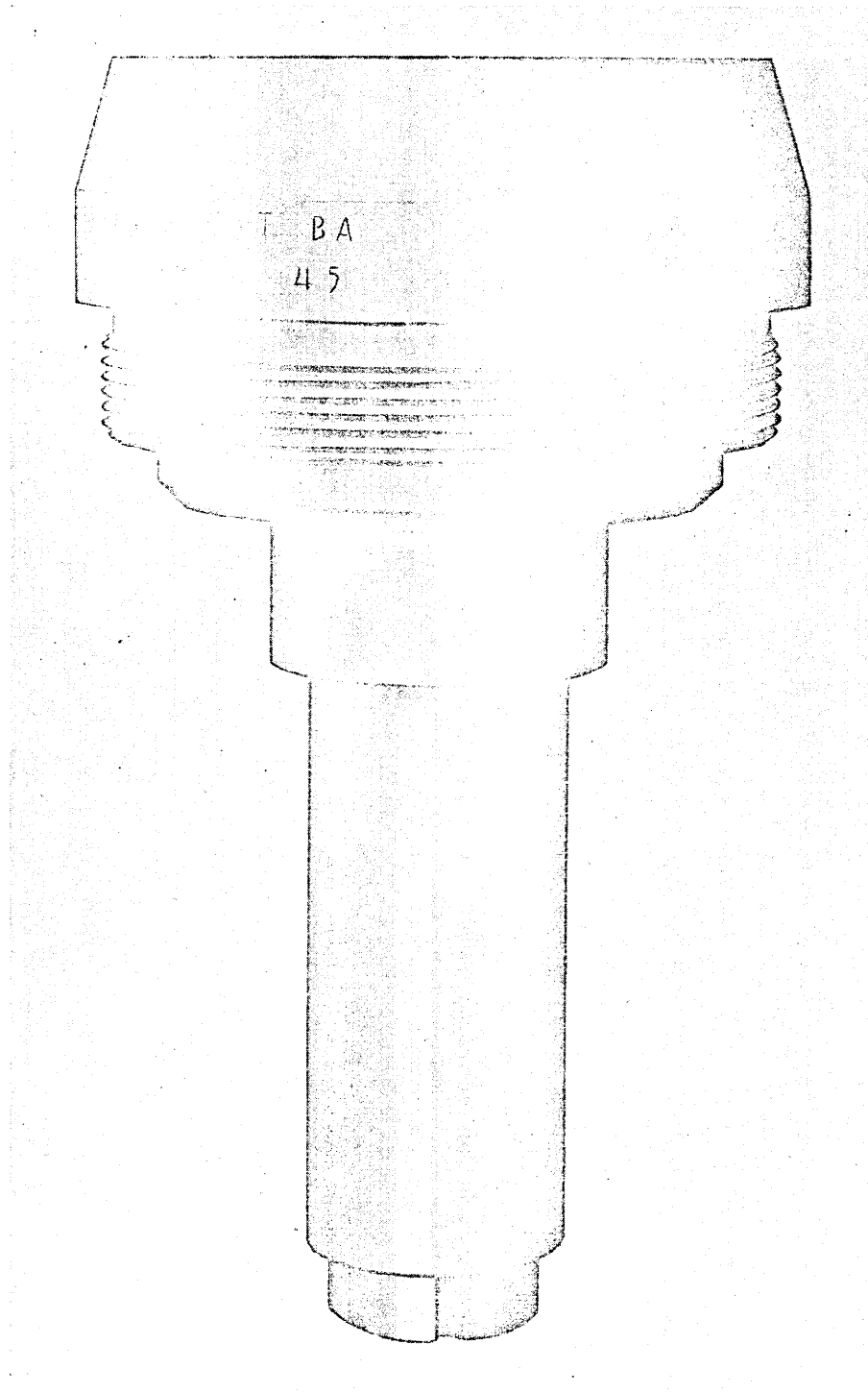


Figure 43—Base Fuze Mk 165 Mod 0, External View, Full Size (approximately).

Chapter 9

DECELERATION DISCRIMINATING BASE FUZES FOR FIN STABILIZED ROCKETS

Fuzes Mk 162 and Mk 166 constitute the fuzes in the group known as Deceleration Discriminating Rocket Fuzes. These fuzes in their cycle of functioning depend on pressure arming from rocket motor gases, deceleration in air (creep), and deceleration after impact. The latter permits discrimination of targets until the deceleration reaches a certain amount in accordance with the fuze design.

The complex nature of the fuze requires that a considerable variety of tests be made to establish the complete details of performance. Most of these tests were performed. However, rocket fuze design and development for the Bureau of Ord-

nance was accomplished almost entirely by the California Institute of Technology. Inasmuch as these fuzes were amongst the latest fuzes designed by that activity, the end of the war and consequent termination of fuze activities prevented the completion of some additional tests that appeared desirable. For these reasons and because of fuze safety problems that were encountered in the design by Bureau production contractors, the Fuzes Mk 162 Mod 0 and Mk 166 Mod 0 are not considered fully developed as of the date of this publication. Bureau projects, now under way, have been instituted to develop a more reliable fuze under all conditions of use and testing.

Section A—Base Fuze Mk 162 Mod 0 (Pressure Arming, Deceleration Firing)

1. General Data

Used in: 11.75-inch Rocket Head Mk 2 Mod 1
(Common)

Overall dimensions and weight of fuze:

Length.....	6.798 inches
Diameter (maximum).....	3.200 inches
Body threads.....	2.75 inches— 14 NS-2
Weight.....	4.90 lbs. approx.

Applicable specification: OS 3856

General arrangement drawing: 561465

Sketch list of drawings & specs: 165244

Explosive components:

- A Percussion Primer Mk 101 (mercury fulminate primer mixture) located in the primer holder at the aft end of the detonator case.
- A 0.010 second black powder delay element, located in the delay pellet container in the detonator case.

A Detonator Mk 33 Mod 1 (lead azide) located in the detonator case.

Two detonator case lead-outs (tetryl) located in the detonator case.

Two body lead-ins (tetryl) located in the body.

Two body lead-outs (tetryl) located in the forward end of the body.

A booster (approximately 28 grams tetryl) located in the magazine at the forward end of the body.

2. Description

General. Fuze Mk 162 is designed to detonate the round as it nears the end of its stable underground or underwater trajectory, or at any point within this trajectory after an impact, or after passing through a target backed by air. The fuze fires after the deceleration of the round has dropped below about 45 g. This corresponds to a distance of approximately 200 feet of unobstructed underwater travel when the striking velocity of the round is 1300 feet per second.

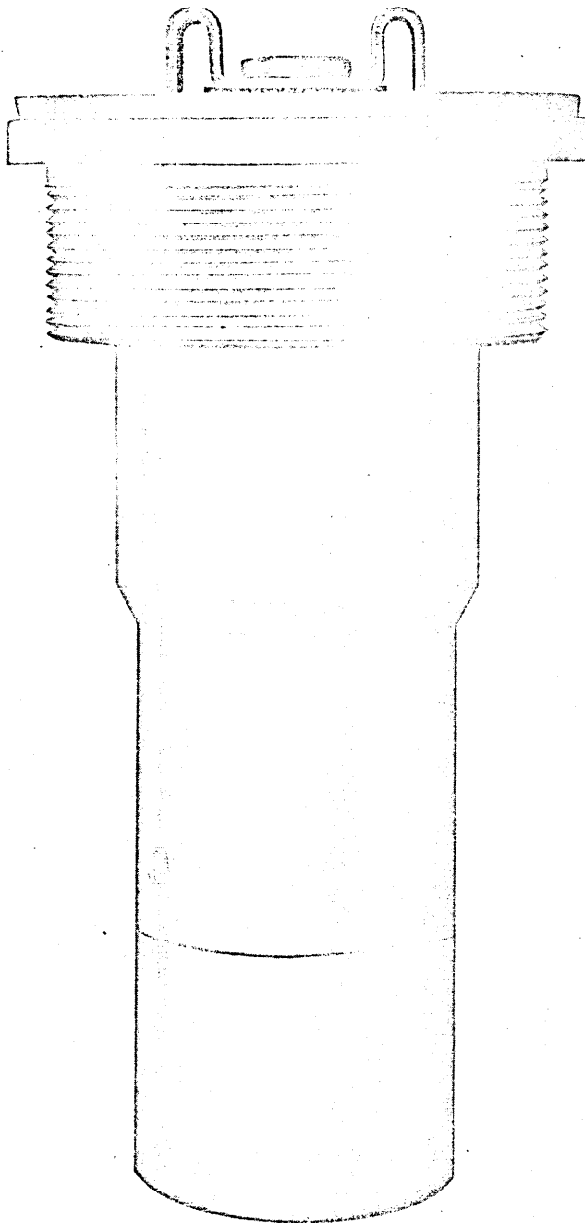


Figure 44—Base Fuze Mk 162 Mod 0, External View, Full Size (approximately).

Use. The fuze is used in the 11.75-inch Common Fin stabilized Aircraft Rocket (Complete Round) Mk 3 Mod 2 (see OP 1415). The round is

particularly effective against shipping, earth covered pill boxes or bunkers, light and heavy fortifications, and very heavy vehicles and structures.

Functioning mechanism. The fuze housing consists of a steel body, the forward end of which is closed by a booster magazine and the after end of which is closed by a gas chamber plug.

The mechanism is contained in the fuze body, the after end of which contains a double chamber formed by the plug, the baffle cup, and the diaphragm. Gas from the rocket motor, utilized in arming the fuze, enters these chambers through the inlet valve. The diaphragm seals off the remainder of the fuze body cavity. Immediately beneath the diaphragm an aluminum arming sleeve is held in position by a shear wire. A pin through the arming sleeve engages the rotor, which is spring loaded by a torsion spring. The axial slots inside the rotor, which engage the arming sleeve pin, also engage the detonator plunger pin of the detonator plunger, and two pins pressed into the trigger block engage the rotor. A spring loaded firing pin is contained in the detonator plunger, to which is attached the detonator case containing the Primer Mk 101, the 0.010 second delay, Detonator Mk 33 Mod 1, and the detonator case lead-outs.

In the unarmed position the detonator case lead-outs are so oriented that the detonator plunger assembly must be rotated 90° and also moved forward to line up the lead-outs with the body lead-ins. In the unarmed position the detonator plunger assembly is constrained from moving forward by the stop pins in the side of the fuze body. The locating pin in the fuze body serves to orient the detonator plunger assembly and rotor cap assembly with respect to the fuze body. The spring loaded firing pin is held cocked by four lock balls, which are held in place by the trigger block. The trigger spring is compressed between the trigger latch and a shoulder on the trigger block. The trigger latch balls, bearing against the detonator plunger and a groove in the trigger latch, lock the trigger latch with respect to the trigger block. The closing plug serves to obturate and close the end of the fuze body cavity, and the magazine containing a tetryl booster pellet covers the end of the fuze body.

3. Functioning

Arming. The arming schedule utilizes the following forces: 1. Forces due to motor gas pressure, 2. Spring force, 3. Creep force, 4. Impact forces. The four principal steps of arming occur in the following manner:

1. Fuze arming is initiated by gas from the rocket motor, which enters the fuze through the inlet valve. Residue associated with burning of the propellant is filtered out by the inlet valve filter, which is made of Inconel wire mesh. Gas entering through the inlet orifice impinges on the inlet valve ball, forcing it forward off its seat to compress the inlet valve spring, and permit the gas to enter the first pressure chamber slowly. The gas is then allowed to flow more slowly into the second pressure chamber through a smaller orifice drilled in the baffle cup. When the pressure in the second chamber reaches a value of approximately 525 psi, the diaphragm collapses, forcing the arming sleeve forward and shearing the shear wire. The time at which the gas pressure in the second pressure chamber reaches the arming pressure value of 525 psi is dependent upon the pressure of the propellant gases in the rocket motor, which in turn depends upon initial propellant temperature.

2. When the shear wire has been sheared, the arming sleeve and rotor are free so that the torsion spring can turn the rotor. The rotor, which also engages the detonator plunger pin and the trigger block (by means of the trigger block locating pins), rotates the detonator plunger trigger block assembly 90° until the rotor is stopped by the rotor-stop pin. The lead-outs in the detonator case are then lined up along the axis of the fuze with the lead-ins in the fuze body, but are still off-set with respect to them along the fuze axis.

3. Slots in the end of the detonator plunger and stop pins in the body are also aligned by the rotation so that the detonator plunger trigger block assembly is free to move forward under the action of creep force until the trigger block rests against the shoulder in the fuze body.

4. Friction of the firing-pin lock balls on the trigger block prevents the detonator plunger from moving farther forward until impact. Upon impact the detonator plunger moves forward until it is stopped by the shoulder in the fuze

body. At this point the slots of the plunger engage the stop pins, the detonator case lead-out is aligned with the body lead-ins, and the plunger is locked by the detents. At the same time the trigger-latch lock balls fall in behind the shoulder on the detonator plunger, releasing the trigger latch, which was formerly locked with respect to the trigger block, which renders the trigger spring active. The trigger spring is then effectively compressed between the shoulder on the trigger block and the shoulder in the fuze body cavity and tends to force the trigger block toward the rear.

Firing. As long as deceleration of the round is high, the inertia of the trigger block keeps the trigger spring compressed, but as soon as the deceleration is reduced below approximately 45 g, the spring overcomes friction forces and the inertia of the trigger block forces the trigger block to the rear off the firing-pin lock balls. The balls thus released move outward and release the spring-loaded firing pin. The firing pin initiates the primer, which initiates the black powder delay pellet (0.010 seconds) which in turn initiates the detonator and thus causes detonation of the explosive train of the fuze and the explosive filler in the head.

Acceptance test data. Loaded fuzes from each lot are assembled in explosive loaded 5.0-inch sphere ogive rocket heads fitted with 5.0-inch Rocket Motors Mk 1 or Mk 2. The rockets are fired from a ground launcher into smooth water so that the angle of impact with the water is approximately 5°. Impact with the water is at a distance from the launcher that is greater than the maximum burning distance of the rocket motor. The water into which the rocket is fired is at least 30 feet deep at the point of impact. The round shall detonate high order after more than 50 feet of underwater travel as measured along the surface. Acceptance is based on a cumulative test plan designed to accept (95% of the time) lots in which 95% of the fuzes function satisfactorily; lots poorer than 95% will be subject to rejection with lots 82% effective being rejected 90% of the time.

Sensitivity limits. Very little information on the plate sensitivity of the Fuze Mk 162 has been obtained.

4. Safety Features

Detonator safety. Fuze Mk 162 is detonator safe. The detonator lead-outs and the booster lead-ins are out of alignment until after arming and impact. The lead-outs and lead-ins are both longitudinally and angularly out of alignment until after the first two arming steps have taken place. A large longitudinal displacement remains until after creep action is completed and lesser displacement exists until after impact forces become effective.

During shipping and stowage. Sample fuzes from each production lot are subjected to rough handling tests which are considered to be more severe than conditions encountered in normal stowage and shipping. Failure of the fuzes to pass the tests shall be cause for rejection of the lot.

5. Disposal and Servicing (Maintenance)

General. This fuze becomes quite sensitive after arming is completed and can be detonated rather easily. If an extremely light impact has resulted after gas pressure force, spring force and creep force have taken place, the fuze may be fired by an additional slight jar. A fuze which remains unfired after heavy impact is also very sensitive, inasmuch as it may be expected that the firing pin has struck the detonator, and that subsequent friction between the firing pin and detonator, as

incurred by rough handling, may fire the fuze. In any event, it is recommended that the fuze or fuzed round be disposed of by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

General. The fuze is shipped installed in the rocket head. No safety wire is provided, and no preparations are required to ready the fuze for use. The shipping cap, protecting the rocket head base, protects the fuze also. This cap should remain in place until assembly of the round begins and should be replaced on disassembly. Before assembling the rocket head to the rocket motor be certain that the fuze is present and properly installed, and that the assembly is properly gas checked.

7. Packing and Marking

Packing. The fuze is shipped assembled into the base of the rocket head.

Marking. The fuze is marked or stamped with the mark, mod, and lot number, the manufacturer's initials or symbol, the initials or symbol of the loading facility, the month and year of loading, the anchor stamp, and the inspector's initials.

Section B—Base Fuze Mk 166 Mod 0 (Pressure Arming, Deceleration Firing)

1. General Data

Used in: 5.0-inch Rocket Head Mk 2 Mod 2 (Common)¹

Overall dimensions and weight of fuze:

Length.....	6.492 inches
Diameter (maximum).....	2.475 inches
Body threads.....	2.125 inches-12 NS-2
Weight.....	3.90 lbs. approx.

Applicable specification: OS 3906

General arrangement drawing: 562011

¹Stability of the rocket is absolutely essential to the performance of the Fuze Mk 166. Since the above head is very likely unstable underwater, new head designs with special contours are being developed for use against underwater targets.

Sketch list of drawings & specs: 165443

Explosive components:

A sensitive Primer Mk 102 (mercury fulminate primer mixture) located in the sensitive primer holder at the aft end of the detonator case.

A Detonator Mk 33 Mod 1 (lead azide) located in the detonator case.

Two detonator case lead-outs (tetryl) located in the detonator case.

Two body lead-ins (tetryl) located in the body.

Two body lead-outs (tetryl) located in the forward end of the body.

A booster (approximately 28 grams tetryl) located in the magazine at the forward end of the body.

2. Description

General. Fuze Mk 166 is identical with Fuze Mk 162 except as noted under Functioning Mechanism. Fuze Mk 166 Mod 0 fires after the deceleration of the round has dropped to about 75 g. This corresponds to a distance of approximately 180 feet of unobstructed underwater travel when the striking velocity of the round is 1700 feet per second.

Use. Fuze Mk 166 is used in the 5.0-inch Common Fin Stabilized Aircraft Rockets (Complete Rounds) Mk 23 Mod 0 and Mk 23 Mod 1 (see OP 1415). The 5.0-inch Rocket Head Mk 2 is not considered to maintain the required stability after water or ground impact to assure reliable fuze action, therefore, new head designs are under development.

Functioning mechanism. Fuze Mk 166 has the same functioning mechanism as Fuze Mk 162 except:

1. The external configuration of the body differs in that the maximum diameter of Fuze Mk 166 is less than that of Fuze Mk 162, and the external body thread diameter is correspondingly reduced.

2. Fuze Mk 166 utilizes a washer and an Inconel wire mesh combination as a gas chamber inlet filter whereas Fuze Mk 162 utilizes an inlet shield and wire mesh combination as the filter.

3. The baffle cup inlet orifice to the second stage of the pressure chamber is larger for Fuze Mk 166. The larger orifice promotes a reduced arming time which is in keeping with the higher velocity characteristics of the 5.0-inch round versus the 11.75-inch round.

4. The creep force or air-drag force on the 11.75-inch Aircraft Rocket is much less than for the 5.0-inch High Velocity Aircraft Rocket. The sensitivity of Fuze Mk 166 must be reduced to compensate for this. The sensitivity is reduced by the addition of a slight shoulder on the forward inner diameter of the trigger block which increases the force necessary to pull the trigger block off the firing pin lock balls.

5. The 5.0-inch High Velocity Aircraft Rocket experiences a larger deceleration underwater than does the 11.75-inch Aircraft Rocket. The trigger spring of Fuze Mk 166 is therefore stronger than the trigger spring of Fuze Mk 162.

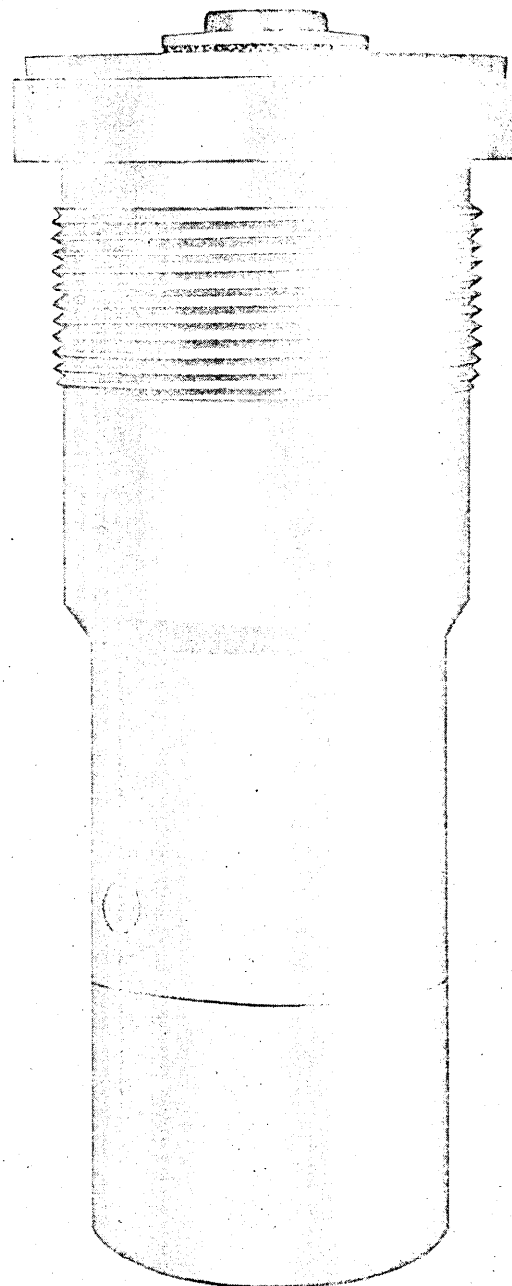


Figure 45—Base Fuze Mk 166 Mod 0, External View, Full Size (approximately).

6. The detonator case explosive trains of the fuzes differ in that in Fuze Mk 166 the Primer Mk 102 replaces the Primer Mk 101 of Fuze Mk 162, and that no delay element is used in Fuze Mk 166.

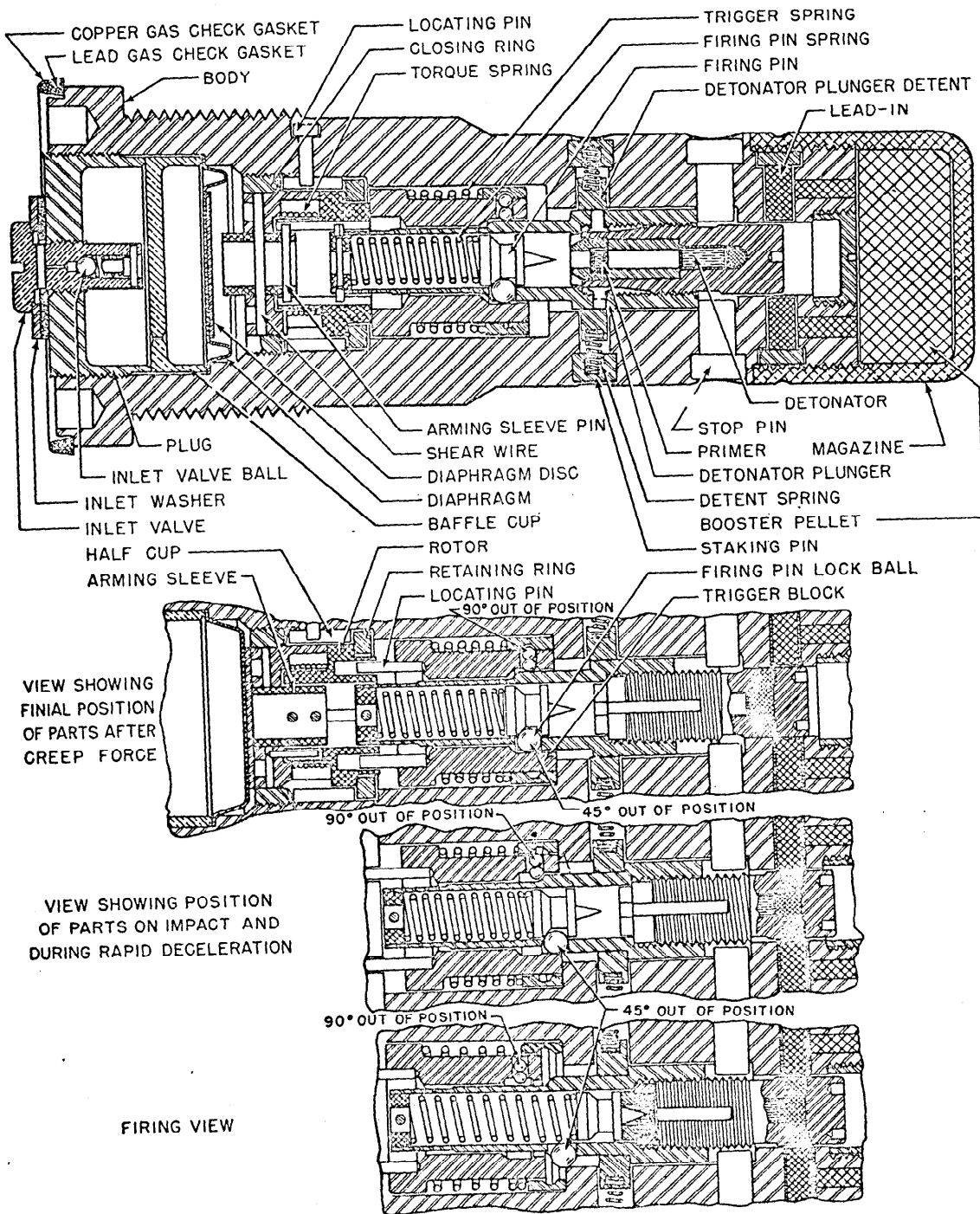


Figure 46—Base Fuze Mk 166 Mod 0, Cross Section View Showing Unarmed Position, Position of Parts after Creep, Position of Parts after Rapid Deceleration and Firing.

7. The firing pin of Fuze Mk 166 is a pointed stab type firing pin suitable for use with Primer Mk 102 rather than the round pointed firing pin used to initiate Primer Mk 101 in Fuze Mk 162.

3. Functioning

Arming. The arming of Fuze Mk 166 is identical with Fuze Mk 162. The fuze will arm at from 450 to 580 feet from the launcher.

Firing. As long as deceleration of the round is high, the inertia of the trigger block keeps the trigger spring compressed, but as soon as the deceleration is reduced below approximately 75 g, the spring overcomes friction forces and the inertia of the trigger block forces the trigger block to the rear off the firing pin lock balls. The balls thus released move outward and release the spring-loaded firing pin. The firing pin initiates the

primer which in turn initiates the detonator and thus causes detonation of the explosive train of the fuze and the explosive filler of the head.

Acceptance test data. The acceptance plan and method of test are the same as for Fuze Mk 162.

Sensitivity limits. Fuze Mk 166 should fire reliably on plate as light as ¼-inch mild steel at obliquities ranging from 0° to about 60°.

4. Safety Features

Same as Fuze Mk 162.

5. Disposal and Servicing (Maintenance)

Same as Fuze Mk 162.

6. Installation Instructions

Same as Fuze Mk 162.

7. Packing and Marking

Same as Fuze Mk 162.

Chapter 10

BASE FUZE FOR THE 7.2-INCH DEMOLITION ROCKET

Section A—Base Fuze Mk 161 Mod 0 (Pressure Arming, Impact Firing)

1. General Data

Used in: 7.2-inch Rocket Head Mk 10 Mod 1
(High Capacity)

Overall dimensions and weight of fuze:

Length.....	6.661 inches
Diameter (maximum)....	3.885 inches
Body threads.....	3.625 inches— 12 NS-2

Weight..... 5.2 lbs. approx.

Applicable specification: (To be prepared)

General arrangement drawing: 440295

Sketch list of drawings & specs: 165126

Explosive components:

A sensitive primer and detonator assembly consisting of the Primer Mark 102 (mercury fulminate) and the Detonator Mk 23 Mod 0 (lead azide primer mixture, lead azide, and tetryl) assembled into a single case closed by a crimp. The assembly is contained in the shutter between the firing pin guide and the lead-in disc.

A lead-in charge (tetryl) contained in the lead-in disc between the shutter and the magazine.

A booster charge (approximately 12 grams tetryl) contained in the magazine at the aft end of the fuze.

2. Description

General. Fuze Mk 161 Mod 0 is a base detonating fuze which is armed by the pressure of the gases from the rocket motor. The design was adopted from the obsolete Fuze Mk 146 Mod 1 except that the fuze head and base fuze-to-motor adapter are made in one piece.

Use. Fuze Mk 161 Mod 0 was designed to replace the Fuze Mk 146 for use in the 7.2-inch High Capacity Fin Stabilized Surface Rocket (Complete Round) Mk 1 Mod 2. The complete round is called a 7.2-inch demolition rocket which is used for short range land firing from launchers installed on tank turrets. Firing action is instantaneous upon impact with suitable targets.

Functioning mechanism. Two pieces, called the head and body, house the fuze mechanism. The head is machined out in two bores and each step is supplied with internal threads. The first bore or largest inside diameter takes the place of the motor adapter and the second bore accommodates the diaphragm and plug. The insertion of the diaphragm and plug into the head forms a gas chamber into which the gases from the rocket motor flow. The gases flow through the inlet screw after first being filtered by the inlet screen. The outside diameter of the head is supplied with external threads to engage the mating threads in the rocket head. The forward end of the fuze head contains internal threads to accommodate the fuze body.

The body consists of a thick walled steel tube with an external threaded section which engages the internal threads in the forward end of the fuze head. The forward end of the body has internal threads into which the magazine is screwed.

Within the body is contained the firing mechanism which consists of an aluminum arming plunger located immediately below the diaphragm. The plunger is held in place by a shear wire inserted through it and extending into two diametrically opposite recesses in the body.

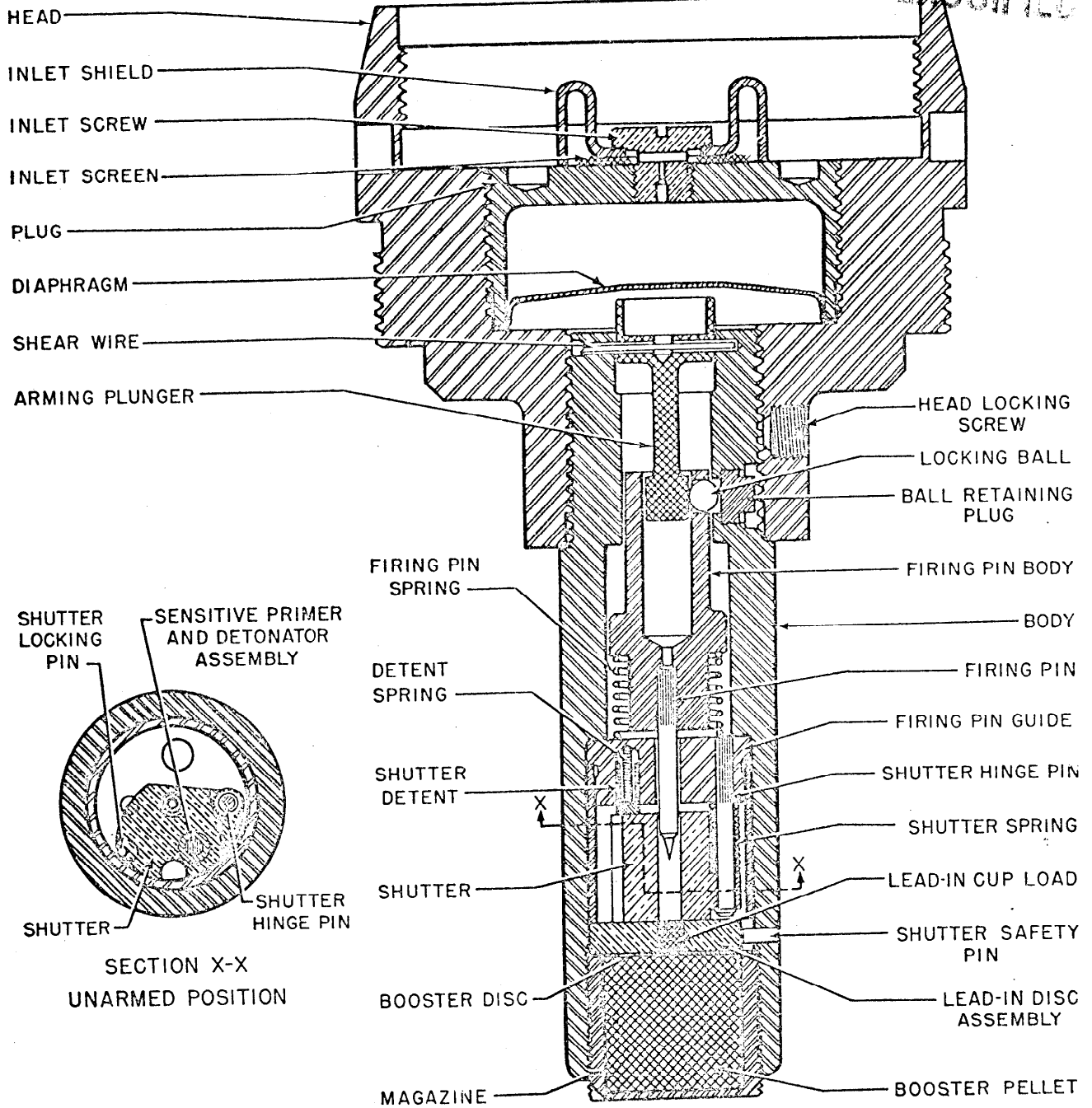


Figure 47—Base Fuze Mk 161, Cross Section View, Unarmed Position.

In the unarmed position the arming plunger holds a locking ball in such a position as to lock the firing pin body and the firing pin in the forward position, compressing the firing pin spring. While in the forward position, the firing pin extends

through the firing pin guide and into a cavity in the shutter. This cavity in the shutter is so positioned that when engaged by the firing pin the detonator assembly is out of alignment with the tetryl booster lead-in and the firing pin. Rotation

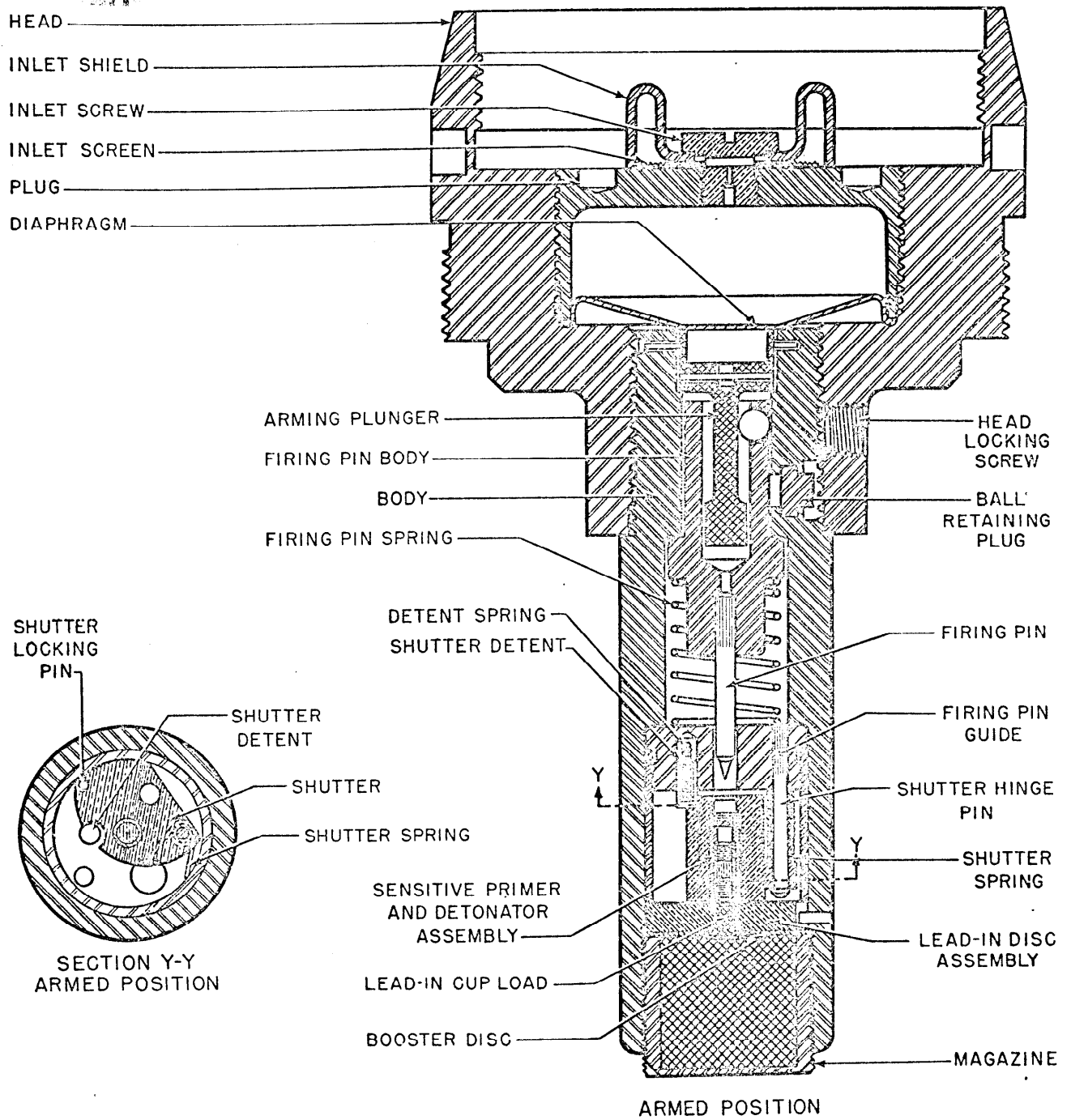


Figure 48—Base Fuze Mk 161, Cross Section View, Armed Position.

of the shutter to bring the explosive elements into line when released by the firing pin is accomplished by torsional force of the shutter spring.

A lead-in disc containing a tetryl lead-in charge

to transmit the explosive force from the detonator assembly to the magazine charge, is contained in the fuze body between the shutter and the tetryl magazine charge.

3. Functioning

Arming. The fuze screws into the base of the rocket head. Inasmuch as the fuze head and base fuze-to-motor adapter are manufactured in one piece, it is not necessary to use any seal between the fuze and the rocket head. The exterior surface of the plug is exposed to the forward end of the rocket motor. The fuze arms in two stages:

1. Gases from the rocket motor at pressures ranging from 900 to 2200 psi enter the pressure chamber in the head of the fuze through a small orifice in the inlet screw. Debris from the rocket motor is filtered out by the inlet screen. The small orifice for the entrance of gas delays the build-up of the pressure until approximately half the burning time has passed. Then, when the pressure in the chamber reaches a value of 275 to 325 psi the diaphragm collapses, severing the shear wire, and forcing the arming plunger down. Movement of the plunger releases the locking ball, which, in the unarmed condition, locks the firing pin body in place; this allows the firing pin body to move toward the rear under its own inertia force, due to acceleration, and the force of the firing pin spring. The firing pin, which is attached to the firing pin body, is thus withdrawn from the detonator shutter, which it normally locks in the safe position.

2. When the rocket accelerates, the inertia of the shutter forces it back against the firing pin guide, compressing the shutter spring and engaging the shutter locking pin in a hole in the firing pin guide. About midway during acceleration, the firing pin is withdrawn from the shutter; but the shutter, held by the shutter locking pin, remains locked in the safe position.

When the acceleration is over, the shutter spring forces the shutter forward against the lead-in-disc, disengaging the shutter locking pin from the hole in the firing pin guide. The shutter spring then swings the shutter into the armed position (detonator assembly in line with firing pin and lead-in) where it is locked by the detent.

Firing. The fuze fires on impact with any material offering sufficient resistance. Under the force of impact the inertia of the firing pin body drives the pointed firing pin forward piercing and initiating the sensitive primer in the detonator assembly. The detonator assembly initiates the tetryl lead-in and the tetryl booster.

The fuze functions with a slight inherent delay, equivalent to the time required for the firing pin body and firing pin to move forward to strike the primer.

Acceptance test data. Acceptance tests have not yet been established due to the fact that the fuze was not produced for service issue.

Sensitivity limits. Firing tests with the Fuze Mk 146, which has the same functioning mechanism as the Fuze Mk 161, in the 7.2-inch demolition rocket, indicated that the fuze functions on both ground and water impacts, but does not function consistently at very low angles of impact.

4. Safety Features

Detonator safety. Fuze Mk 161 Mod 0 is detonator safe. In the unarmed position the detonator assembly is out of alignment with the other increments of the explosive train. Should the detonator assembly function prematurely, the force of the detonation will be dissipated upward through a hole in the firing pin guide and away from the balance of the explosive train.

Because of the delay in admission of gas from the rocket motor to the pressure chamber, the first stage in arming does not occur until approximately one-half the burning is over. Because of this delay, if the rocket motor blows up before it leaves the launcher, the fuze should not arm. Arming is not completed until after acceleration has dropped to a value corresponding to 9 g. The burning distance, and therefore the arming distance, will vary with the temperature. On the average, arming is completed within 0.1 second after the end of burning. Approximate calculated arming distances for the 7.2-inch demolition rocket are:

Temperature (°F.).....	0	70	135
7.2-inch Demolition Rocket (2.25-			
inch Motor Mk 3) (ft.).....	65	50	35

During shipping and stowage. The light weight aluminum arming plunger and the 0.057-inch phosphor-bronze shear wire make the fuze safe from arming by accidental dropping in a full weight projectile from heights up to at least 40 feet.

5. Disposal and Servicing (Maintenance)

General. From an examination of the exterior of the fuze, it is impossible to tell whether or not the fuze is armed. If, for any reason, it is thought

that the fuze may be armed, it should be treated as an armed and very sensitive fuze. (No attempt should be made to remove the fuze from the rocket body.) The complete fuzed round should be disposed of by gently lowering it, tail first, into deep water, or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. Disassembly is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

The fuze is shipped installed in the base of the rocket head. A safety wire is not necessary and no preparations are required to ready the fuze for

use. A shipping plug protects the exposed end of the fuze and the threads of the fuze-to-motor adapter. The shipping plug should be kept in place until the round is assembled and should be promptly replaced if the round is disassembled.

7. Packing and Marking

Packing. Fuzes will be shipped assembled in the rocket heads and protected by a shipping plug which screws into the fuze-to-motor adapter.

Marking. The fuze is stamped with the mark, mod, lot number, date of loading, the manufacturer's initial or symbol, and the initials or symbol of the loading facility.

Chapter 11

MISCELLANEOUS

Section A—Fuze Mk 134 Mod 0 (Ejector Delay)

1. General Data

Used in:

- 3.5-inch Rocket Head Mk 10 (Window)
- 3.5-inch Rocket Head Mk 14 (Window)
- 3.5-inch Rocket Head Mk 15 (Window)
- 3.5-inch Rocket Head Mk 15 (Flare)

Overall dimensions and weight of fuze:

- Length..... 1.28 inches
- Diameter (maximum)..... 2.97 inches
- Weight..... 0.20 lb. approx.

Applicable specification: OS 3541

General arrangement drawing: 447337

Sketch list of drawings & specs: 165013

Explosive components:

- 20 grams of black powder
- Ensign Bickford Fuse with quickmatch

2. Description

General. Fuze Mk 134 Mod 0 consists of a closed plastic case containing 20 grams of black powder and a length of Ensign Bickford Fuse having one end exposed. The Ensign Bickford Fuse is sheathed in Irvolute tubing; one sheathed end is inserted in the base of the plastic container so it projects approximately $\frac{3}{16}$ of an inch, and the other end is surrounded by the black powder in the case. The exposed end of the tubing is cemented in place to the plastic case, and the projecting fuse is slit and receives a length of quickmatch. The fuse and quickmatch are clamped together with a fuse clamp.

Use. Fuze Mk 134 Mod 0 is used in the 3.5-inch Window Fin Stabilized Surface Rockets (Com-

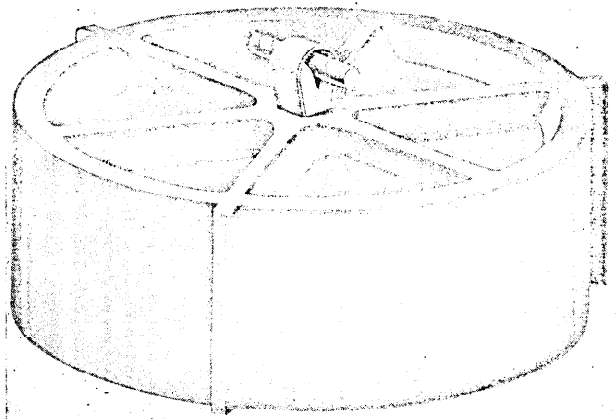


Figure 49—Fuze Mk 134 Mod 0 (Ejector Delay), External View.

plete Rounds) Mk 4 Mod 1, Mk 4 Mod 2, Mk 4 Mod 3, Mk 4 Mod 4, Mk 4 Mod 5, and Mk 4 Mod 8 (see OP 1415).

3. Functioning

Firing. The 3.5-inch Rocket Heads Mk 10, Mk 14, or Mk 15 have at their base a closure-adaptor which receives the 3.25-inch rocket motor. This closure-adaptor also serves to carry the ignition system which ignites the Fuze Mk 134 Mod 0.

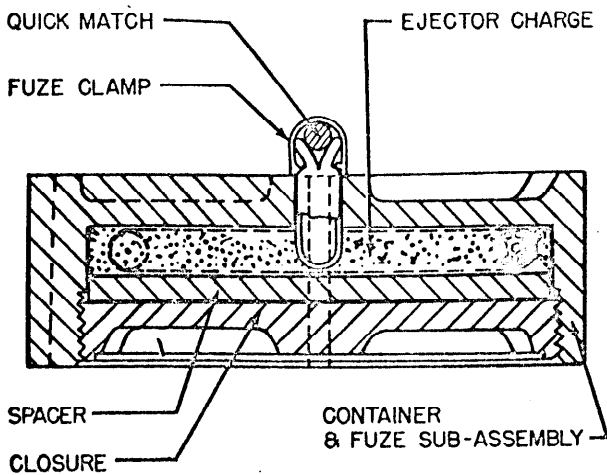


Figure 50—Fuze Mk 134 Mod 0 (Ejector Delay),
Cross Section View.

The ignition system consists of a copper diaphragm, to the center of which is fixed a small firing pin. Pressure from the burning of the rocket motor propellant, upon ignition, forces the diaphragm forward and the firing pin strikes the primer of a modified .32 caliber blank cartridge. The flash from the .32 caliber cartridge ignites the exposed end of the Ensign Bickford Fuse. After this fuse

burns for approximately 15 seconds, it ignites the black powder and ejects the rocket head load.

4. Safety Features

General. The collapse of the diaphragm is necessary to initiate the fuze. Fuze Mk 134 Mod 0 is considered safe during normal handling and stowage.

5. Disposal and Servicing (Maintenance)

General. Since the Fuze Mk 134 Mod 0 is assembled within the rocket head there is no way of determining its condition by external observation. Damaged rocket heads containing Fuze Mk 134 shall be disposed of by lowering into deep water or by Explosive Ordnance Disposal Personnel in accordance with existing instructions.

Disassembly. Disassembly of this fuze is not permitted except at authorized activities when directed by the Bureau of Ordnance.

6. Installation Instructions

The Fuze Mk 134 Mod 0 is installed in the rocket head by the loading activity.

7. Packing and Marking

Packing. The fuze is shipped assembled in the rocket head.

Marking. Each Fuze Mk 134 Mod 0 is marked or stamped with the mark, mod, lot number, the date of loading, and the symbol of the loading activity.

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