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U.S. EXPLOSIVE ORDNANCE

28 MAY 1947

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

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ORDNANCE PAMPHLET 1664

UNITED STATES EXPLOSIVE ORDNANCE

1. Ordnance Pamphlet 1664 describes and illustrates United States Navy projectiles, Army and Navy rockets, pyrotechnics, grenades, land mines, bombs, and guided missiles.

2. This publication contains information on the characteristics of construction and operation of value to the student of ordnance.

3. This publication supersedes the handbooks on American explosive ordnance published by the U. S. Navy Bomb Disposal School, all copies of which shall be destroyed in accordance with applicable security regulations.

4. This publication is CONFIDENTIAL and shall be safeguarded in accordance with the security provisions of U. S. Navy Regulations, 1920, Article 76.

G. F. Hussey Jr.

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Vice Admiral, U.S. Navy,
Chief of the Bureau of Ordnance.

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GENERAL INTRODUCTION

Scope

This publication is a revision and compilation of the handbooks on American explosive ordnance published during World War II by the U.S. Navy Bomb Disposal School. With some exceptions, it should serve as an encyclopedia of U.S. explosive and pyrotechnic ordnance as of February 1946.

Included are: U.S. guided missiles, bombs, rockets, land mines, grenades, pyrotechnics, and Navy projectiles. Not covered are: Army artillery ammunition, demolition explosives and equipment, underwater or floating ordnance, small arms ammunition, or catapult charges, etc.

Such characteristics of construction and operation as are significant to the ordnance student receive thorough treatment. Other technical details are omitted.

Most of the items are grouped according to size; but, where this is impracticable, numerical or type arrangement is employed.

To make the publication more serviceable for peacetime use, practice items are included in their appropriate sections.

Status

Ordnance included was that classified as service, together with some obsolete, obsolescent, and experimental types. The experimental items were those being actively developed in the spring of 1946, with the probability that they would soon be standardized.

Obsolete and obsolescent equipment described was that which might still be in existence in depots or dumps at the time of writing.

Nomenclature

When a Navy ordnance item is approved for testing, it is assigned its Mark number. It retains this Mark number whether finally approved for service use or rejected. Modifications to the original Mark design are treated likewise. Army items under development are assigned "T" numbers. If the item is standardized by the Army's Ordnance Technical Committee, the "T" designation is dropped and an "M" number is assigned. When a modification on a "T" item is made, the change is given an "E" number: for instance, "T1E1". If the modification is adopted as a standard item, the modification gets an "A" number in sequence of change on the standard item: for instance, "M66A1, M66A2". The Army's Chemical Warfare Service uses "E" and "R" designations for experimental items instead of the "T" and "E" numbers, respectively, of the Ordnance Department. For aircraft ordnance there are items which are standardized for both the Navy and the Army. These are given the letters "AN" before their original standard name; thus, AN–Mk 33 or AN–M63A2.

Prior to June 1925, the Army's nomenclature for bombs was by a Mark and a Roman numeral, like the early Naval Mark designations, but the modifications were distinguished by the letter "M" and another Roman numeral (Mk I M II) where the Navy used the abbreviation "Mod", (Mk 1 Mod 2). In 1925, the Army adopted the "M" system. The Army-Navy Standardization Board was created in June, 1941.

American high explosives

Two scales are employed to compare sensitivity of explosives. The first of these is the "Laboratory Impact Sensitivity" in which the ratio of the drop of a given weight necessary to detonate the explosive under discussion to the drop necessary to detonate TNT, is expressed on a percentage basis. TNT will be given as 100. The second is a scale of "Bullet Impact Sensitivity" with RDX rated at 0 and TNT at 100. The other explosives are expressed in relation to these two. Velocity of detonation varies directly with the density to which the explosive is cast or pressed, all other factors being constant. The velocity of detonation will, therefore, be given for a definite density of loading.

TNT (Trinitrotoluol): TNT is powerful, brisant, easy to load by casting since its melting point (Grade A) is 80.2 degrees C., stable under all stowage conditions, insensitive enough to stand all normal handling, and even capable of standing bullet impact when cast. The Navy uses it as a booster in a pressed granular form in which it is more sensitive to detonator action.

The velocity of detonation is 22,300 ft./sec. at a density of 1.55. Its Laboratory Impact Value is 100. Its Bullet Impact Value is 100. Its color is yellow to buff.

Tetryl (Trinitrophenylmethylnitramine): Tetryl, because of its combination of high power, brisance, and sensitivity, is the standard U. S. booster charge, although the Navy still uses an appreciable amount of granular TNT. It has been tried for main charge loads in small caliber projectiles, but has proved too sensitive to withstand the setback in all but 20-mm. It is used as a base charge in compound detonators. This, in effect, makes it a small booster in intimate contact with the initiating explosive. The melting point of Tetryl (130 degrees C.) is too high to allow it to be melted and cast. It is loaded by being mixed with small quantities of graphite or stearic acid which serve to lubricate it while it is being pressed into pellets. Tetryl is quite safe to handle and is extremely stable in stowage. Exposed or loose Tetryl should not be handled, as it may cause dermatitis.

The velocity of detonation is 24,400 ft./sec. at a density of 1.55. Its color is light yellow, but it is usually gray because of the graphite. It is more powerful than TNT. Its Laboratory Impact Value is 45. Its Bullet Impact Value is 61.

Explosive D (Ammonium Picrate): Explosive D is the standard main charge for armor-piercing bombs and projectiles and other Navy projectiles. While its power and brisance are slightly inferior to TNT, it is much more insensitive to shock and will stand impact on armor plate without being deflagrated. It has two other disadvantages: (1) Its melting point is too high for it to be melted and cast, and it is therefore loaded by being pressed into cases by a hydraulic ram; (2) It reacts with metals to form extremely sensitive compounds. This is counteracted by covering the interior of bombs or projectiles with acid-proof lacquer.

Its rate of detonation is 21,300 ft./sec. at a density of 1.48. Its power and brisance are about 95% those of TNT. Its Laboratory Impact Value is 99; its Bullet Impact Value is over 100. Its color is yellow or yellow-orange.

RDX (Cyclonite Cyclotrimethylenetrinitramine): RDX is the most powerful and brisant of the military high explosives, and it is considered much too sensitive to use alone. It seems to be about half way between Tetryl and PETN in sensitivity. RDX is being used extensively in mixtures of other explosives and inerts which reduce the sensitivity to a safe range, while the mixtures have a very high brisance and power due to the RDX. It has excellent stowage qualities, but, because of its sensitivity, it is shipped immersed in water like an initiating explosive. The velocity of detonation is 28,000 ft./sec. at a density of 1.70. Its Laboratory Impact Value is 34. Its Bullet Impact Value is 0. Its color is white.

PETN (Pentaerythritetetranitrate): PETN resembles RDX in its characteristics. It is somewhat more sensitive, but almost equal in power and brisance. It is appreciably more sensitive to percussion and impact than Tetryl and is, therefore, not used alone as a booster, though it is being used as a base charge in some compound detonators in the way Tetryl is. The tendency of PETN to burn is much less than that of similar explosives. Its main use alone in the service is in primacord. When used alone, PETN is combined with a small quantity of wax to desensitize and lubricate it, and is loaded by pressing. It is important to know that PETN in primacord is very insensitive to flame, shock, and friction, and therefore must be detonated by a cap.

The velocity of detonation of PETN is 26,000 ft./sec. The velocity of detonation of primacord is 20,500 ft./sec. Its Laboratory Impact Value is 22. Its Bullet Impact Value, though not given, would be about equal to RDX (0). Its color is white.

Haleite (EDNA, Ethylenedinitramine): Haleite is a new explosive that probably will not be used alone, but will be used in combination with other explosives. It is somewhat more powerful than TNT. Its sensitivity is about the same as Tetryl. It melts at 180 degrees C., but one report states that it may detonate in the manner of an initiating explosive at that temperature or a little lower. If loaded alone, it would be pressed. Its rate of detonation is 25,000 ft./sec. at a density of 1.5. Its Laboratory Impact Value is 46. Its Bullet Impact Value is not available.

Nitroguanidine: Nitroguanidine is the explosive incorporated in the Navy's new double-based propellant powder, SPCG. It is unusual in being a high explosive that is so cool in its reaction that it explodes without flash. It is comparable in strength to TNT, and its sensitivity is of the same order. Its rate of detonation is 24,400 ft./sec. at a density of 150.

Amatol: Amatol, a substitute for TNT, is a mixture of ammonium nitrate and TNT; the percentage of ammonium nitrate, depending upon the availability of TNT, has varied from 40% to 80%. Its power and brisance decrease with the increasing percentages of nitrate, and its sensitivity decreases at the same time. However, it is still a fairly good high explosive, even when the TNT is reduced to 20%. 80/20 cannot be cast, since it is not fluid enough to pour even when TNT is molten, and it therefore must be loaded by extrusion. Amatol has a disadvantage in that it is very hygroscopic and therefore is usually protected by a sealing pour of pure TNT.

The velocity of detonation of 50/50 is 19,700 ft./sec. at a density of 1.54. Its Laboratory Impact Value is 93. Its Bullet Impact Value is about 100. Its color is buff.

Composition B: Composition B is intended to be used as a more powerful replacement for TNT in the loading of some of the large size G.P. bombs, and in fragmentation bombs. It will be used where an explosive with more power and brisance is of tactical advantage and there is no objection to a slight increase of sensitivity.

Composition B1 is a mixture of 59% RDX, 40% TNT, and 1% wax. Composition B2 is a mixture of 60% RDX, 40% TNT. The TNT cuts down the sensitivity of the RDX to a safe range and lowers the melting point to 81 degrees C., allowing the material to be cast-loaded.

Composition B might be detonated at low order by bullet impact, but it is almost as insensitive as TNT in this respect. It has an extremely high shaped-charge efficiency. Its velocity of detonation is 24,500 ft./sec. at a density of 1.60. Its total energy of blast in air is about 116% of that of TNT. Its Laboratory Impact Value is 79. Its Bullet Impact Value is 79. Its color is yellow to brown.

Torpex: Torpex is one of the explosives developed during this war to be used mainly in underwater ordnance. The original Torpex (Torpex 1) was a mixture of 45% RDX, 37% TNT, 18% Aluminum powder (1% wax added). Torpex 2, which is now being used, is 42% RDX, 40% TNT, 18% Aluminum powder (1% wax added). It is used in mines, torpedo war heads, and depth bombs. Torpex is more sensitive than TNT; its bullet impact and drop test sensitivities are of the same order as those of Tetryl. It is quite stable in stowage, though it produces gas, causing pressure in the case. It is insensitive enough to stand all normal handling. Its melting point is low enough for it to be cast-loaded. Its velocity of detonation is 24,000 ft./sec. at a density of 1.72. It is 141% as powerful as TNT. Its Laboratory Impact Value is 53. Its Bullet Impact Value is 48. Its color is slate gray.

DBX (Depth Bomb Explosive): DBX is another aluminized RDX mixture, and its name suggests its intended use. It is 21% RDX, 21% Aluminum Nitrate, 40% TNT, 18% Aluminum. It was designed to replace Torpex, which it closely resembles in sensitivity, strength, brisance, and energy of shock in water, but half of the strategic RDX in Torpex is replaced by Ammonium Nitrate in DBX. It will probably not be used, as the present supply of RDX seems adequate to meet the demand. DBX can be cast, though its melting range of 98–105 degrees C. is about the upper limit. Its velocity of detonation is 22,300 ft./sec. at a density of 1.68. It is 143% as powerful as TNT under water. Its Laboratory Impact Value is not given. Its Bullet Impact Value is 51. Its color is gray.

HBX: HBX is a new mixture designed to replace Torpex in depth bombs. It has been loaded in the Flat Nose Bomb AN–Mk 54 Mod 1. HBX is 40% RDX, 38% TNT, 17% Aluminum powder, 5% desensitizer. Tests indicate that it will be about 98% to 100% as powerful as Torpex, that it will definitely be less sensitive than Torpex in both Laboratory Impact and Bullet Impact, that it will be slightly more sensitive in these respects than TNT, and that it will be about the same order as Composition B.

A difficulty with Torpex and HBX is that they produce gas and build up pressure in the case during stowage. It has been discovered that 0.5% by weight of calcium chloride added to the mixture will absorb all the moisture and eliminate the production of gas. It has been recommended that this percentage be added and that the resulting mixtures be designated Torpex 3 and HBX 1.

Composition A: Composition A is a mixture of 91% RDX and 9% plasticizing oil. The oil content is sufficient to desensitize the mixture and lubricate it enough to allow it to be pressed into A.A. shells, which will probably be its principal use. It is less sensitive than TNT in both drop and bullet impact tests. It is appreciably more brisant and powerful, as is indicated by its velocity of detonation of 27,000 ft./sec. at a density of 1.62. Its Laboratory Impact Value is 105. Its Bullet Impact Value is over 100. Its color may be white or buff, depending upon the color of the oil.

Tetrytol: Tetrytol is a mixture of Tetryl and TNT (70/30 is a frequent ratio.) It is designed to obtain a Tetryl booster that may be cast. This mixture is slightly less powerful and less sensitive than Tetryl. Its particular use is in burster tubes for chemical bombs, in demolition blocks, and in cast shaped charges. It cannot be used where the loaded item is immersed in hot explosive, as are the auxiliary boosters in the loading of Army bombs, because it will be remelted by the heat and separation will result. It is approved for use in all other boosters.

Its velocity of detonation is 24,000 ft./sec. at a density of 1.60. Its Laboratory Impact Value is 45. Its Bullet Impact Value is 65. Its color is yellow.

Pentolite: Pentolite is a mixture of TNT and PETN, usually 50/50. Its chief uses have been in small shell loading, in grenades, and in cast shaped charges. It has a very high shaped-charge efficiency. It is not as stable as TNT in stowage, and separation of PETN may occur. Efforts should be made to keep it cool. Its sensitivity is such that it cannot be drilled, and the fuze cavities in shells that must be drilled are poured with 90/10. It is about the same sensitivity as Tetryl in drop tests, and more sensitive than Torpex to bullet impact. Its brisance and power are equivalent to Composition B. At a density of 1.65, its rate of detonation is 24,000 ft./sec. Its Laboratory Impact Value is 47. Its Bullet Impact Value is 48.

Ednatol: Ednatol is a mixture of 57% EDNA and 43% TNT, designed to ease the shortage of RDX. In the near future, it will be loaded as a substitute for Composition B in large G.P. bombs and fragmentation bombs. It is somewhat more powerful than TNT and comparable in sensitivity. It becomes soft enough to pour at 80 degrees C. and it is, therefore, cast. It is entirely stable in stowage. At a density of 1.60, it has a velocity of detonation of 24,300 ft./sec. Its Laboratory Impact Value is not given. Its Bullet Impact Value is 83. Its color is yellow.

PTX–1: PTX–1 is a new ternary explosive that is undergoing tests and may be adopted for loading in shells, bombs, grenades, mines, demolition blocks, and shaped charges. It is a mixture of 30% RDX, 50% Tetryl, and 20% TNT. This mixture gives a very high explosive equal to Composition B and Pentolite, and superior to Tetrytol and Ednatol. It is less sensitive than Tetrytol and more stable. Its velocity of detonation is 24,200 ft./sec. at a density of 1.66. Its Laboratory Impact Value is 40 (estimated). Its Bullet Impact Value is not given. Its color is yellow.

PTX–2: PTX–2 is another ternary explosive mixture undergoing study for possible future use. It consists of 43.2% RDX, 28% PETN, 28.8% TNT. It is slightly more sensitive in drop and bullet impact tests than Composition B, but a little less sensitive than Pentolite. It is more brisant than any of the binary mixtures now used, which would include Composition B, and is about 10% more effective than Tetryl as a booster. It may be used as a booster, as a main charge for fragmentation ammunition, and as a shaped charge. Its melting point is such that it will be cast. Its velocity of detonation is 26,200 ft./sec. at a density of 1.69. Its Laboratory Impact Value is 50 (estimated). Its Bullet Impact Value is not given. Its color is yellow.

Composition C: Composition C–3 is the only one of the Composition C series now in production, though quantities of the others may be found in the field. It is 77% RDX, 3% Tetryl, 4% TNT, 1% Nitrocellulose, 5% MNT (Mononitrotoluol), 10% DNT (Dinitrotoluol). The last two, while they are explosives, are oily liquids and plasticize the mixture. The essential difference between Compostion C–3 and Composition C–2 is the substitution of 3% Tetryl for 3% RDX, which improves the plastic qualities. Composition C–1 was 88.3% RDX and 11.7% plasticizing oil. The changes have been made in order to obtain a plastic composition that would meet the requirements of an ideal explosive for molded and shaped charges and that would maintain its plasticity over a wide range of temperature and not exude oil.

Composition C–3 is about 1.35 times as powerful as TNT. Its velocity of detonation is 26,000 ft./sec. at a density of 1.58. The Laboratory Impact Value is 98. Its Bullet Impact Value is over 100. Its color is brown.

PEP–3: This is a new plastic explosive being tested for future use. PEP–3 is a mixture of 86% PETN and 14% plasticizing oil. PEP–2 was 85% PETN and 15% oil, but it was a little too soft. PEP–3 is about 90% as powerful and brisant as Composition C, but its stowage stability and plastic range are much better. Its sensitivity is about the same as Composition C, though it has much less tendency to burn.

Picratol: Picratol is a mixture of 52% Explosive D and 48% TNT. It is currently used in the 2000-lb. S.A.P. Bomb M103 and is under consideration for appliance in other Army A.P.'s and S.A.P.'s. Picratol's stability is about equal to that of Explosive D and TNT. It has a rate of detonation of 22,875 ft./sec. at a normal loading density of 1.625. Brisance tests, peak pressure tests, and impulse tests indicate that Picratol's destructive force is somewhat less than that of TNT, but greater than that of Explosive D.

Cyclotol 70/30: Cyclotol 70/30, a mixture of 70% RDX and 30% TNT, closely resembles Composition B except for the altered proportions of the components, and is designed as a replacement for Pentolite. It will not, however, have Pentolite's resistance to flame. Though results of tests are not available, Cyclotol may be anticipated to be more sensitive than Composition B, but considerably less than Pentolite.

Tritonal: Tritonal is composed of 80% TNT and 20% Aluminum powder and is contemplated for use in some 4000-lb. Light-Case Bombs AN–M56, in the JB–2, and in several G.P. bombs (Army 500- and 1000-lb. G.P.'s), where maximum blast effect is desired. Tritonal is cast, segregation of the aluminum being prevented by a pellet loading technique. The Laboratory Impact Value is 89; Bullet Impact Value is 64; and velocity of detonation is 18,000 ft./sec. at a density of 1.70.

Mercury Fulminate: Mercury Fulminate is an initiating explosive that may be used as either a primer or a detonator. It may be detonated by flame, friction, or percussion, and in turn detonate a booster; or it may be mixed with other materials to form a primer composition and used to ignite a propellent charge. Its melting point is much too high for it to be cast, and it is loaded by being pressed into caps. It has one disadvantage for military use in that it will decompose in stowage at tropical temperatures and at the end of about three years may be rendered useless. Compared to high explosives, it has lower power and brisance, a fact which is indicated by its velocity of detonation of 16,500 ft./sec. at a density of 4.00. Its Laboratory Impact Value is 8. Its color is light yellow.

Lead Azide: Lead Azide may be used where a detonation is caused from flame, but Mercury Fulminate is generally preferred where the cap is to be set off by a firing pin. It does have a distinct advantage over Mercury Fulminate in being completely stable in stowage at elevated temperatures. Its rate of detonation is of the same order as Fulminate, 17,500 ft./sec. at a density of 4.00. Its Laboratory Impact Value is 19. Its color is white.

DDNP: This is an initiating explosive which has been used for some time in commercial detonating caps and is now being used to some extent in military types. It is more insensitive to shock than Mercury Fulminate and Lead Azide, though it may be detonated by a sharp blow. It will, therefore, probably be used only where it will be set off electrically or by miner's safety fuse. It has an advantage in being more powerful than other initiating explosives and being comparable in strength to Tetryl. If unconfined, flame will cause it to flash but will not detonate it. This, combined with its insensitivity to shock, makes it much more safe to handle.

Part I

PROJECTILES, PROPELLANTS, AND PROJECTILE FUZES

Chapter I — PROJECTILES

Section I — INTRODUCTION

Existing types

The following types of projectiles may be encountered at activities in the U.S. Naval Service:

Armor-Piercing: These projectiles are designed to penetrate an equal caliber of Class A armor plate, according to test practice. The characteristics:

Over-all color .... Black
Sizes............3", 6", 7", 8", 12", 14", 16"
Explosive filling............... Explosive D
Load factor .... 1.5% to 2.7%
Fuzing..... Base detonating or base ignition

Since it is desirable to keep the center of gravity of a projectile to the rear of (or in the immediate vicinity of) the center of the form, and as a relatively long ogive is conducive to long range, it has been advantageous to adopt light nose pieces or false ogivals termed windshields. The windshield is made of either forged mild steel, steel stamping, or aluminum. It has no special strength other than to prevent destruction during handling and set-back on firing. Windshields are screwed to the cap and are "set" by a center punch.

The armor-piercing cap is secured to the projectile by peening the skirt of the cap into notches cut into the ogive of the body and by soldering the cap to the body with a special solder of low melting point. Such solder prevents the soldering heat from drawing the temper of the body. Caps are made, in general, of the same kind of steel as are the projectile bodies. The cap acts to break down the initial strength of the armor plate, allowing the nose to reach an already strained surface. It also provides powerful circumferential support to the point and nose as they begin to penetrate the hard face, maintaining the support until they are well into the plate. In addition, the characteristically blunt outline of the cap serves to increase the effective angle of obliquity at which the projectile may hit and still penetrate.

The body is of high-quality alloy steel, carefully forged and heat-treated, since it is the part which does the actual penetration. Between the forward bourrelet and the rotating band or rear bourrelet, the diameter of the body is slightly reduced in order to provide a general clearance from the bore of the gun. The bourrelet is the bearing surface of the projectile and rides on the lands of the rifle. This bearing surface is usually about one-sixth caliber in width, and its surface is generally ground to a fine finish to reduce friction and minimize wear on the lands of the gun. With the major caliber projectiles, it has become standard practice to provide a rear bourrelet or bourrelets in addition to the forward bourrelet. Rear bourrelet or bourrelets will be just before and behind the rotating band, providing better support in the gun and during the moment of ejection at the muzzle.

The rotating band has three primary functions: to seal the bore, to position and center the rear end of the projectile, and to rotate the projectile. A secondary function is to hold the projectile in place during loading and elevating for firing. The rotating band is made of commercially pure copper, or of cupro-nickel alloy containing 2.5% nickel, or in some cases a gilding metal consisting of 90% copper, 10% zinc. As a general rule, rotating bands are about one-third caliber in width.

The base plug closes off the explosive cavity and holds the base fuze or base fuze adapter. Both the base plug and the base fuze adapter, if used, are sealed in place with a gas seal ring similar to that used on the base fuze.

The base fuze is inserted through the base plug or base fuze adapter and is designed to detonate the projectile after penetration. After insertion, it is closed with a gas check ring of copper and lead put in under hydraulic pressure to prevent the propelling gases from affecting the explosive filling.

Armor-piercing projectiles and common projectiles having a windshield may carry a spotting dye which colors the water on impact in order that observers may spot the fall of shot. The spotting dye in powder form is placed in the windshield before it is screwed on to the nose of the projectile. Water forces through the inlet holes covered by copper covers, dissolves the dye, and forces it out the outlet holes.

Special Common: The term "Special Common" is not an official designation of the Bureau of Ordnance, which places this and all other types of Common projectiles in a single class. The "Special Common" term, however, is widely employed by ordnance activities to describe those Common projectiles which are equipped with both windshields and hoods for windshield attachment.

These projectiles are designed to penetrate approximately one-third to one-half their caliber of armor. These projectiles differ from Armor-Piercing projectiles in that they do not have an armor-piercing cap and have a larger explosive cavity. Characteristics:

Over-all color	Slate gray
Sizes	4″, 5″, 6″, and 8″
Explosive filling	Explosive D
Loading factor	2.1% to 3.99%
Fuzing	Base detonating

Common: These projectiles are designed to penetrate approximately one-third their caliber of armor. They differ from Armor-Piercing and Special Common projectiles in that they have no cap or hood; the windshield threads directly to the body. Also, the explosive cavity is slightly larger. Characteristics:

Over-all color	Slate gray
Sizes	5″, 6″, and 8″
Explosive filling	Explosive D
Load factor	4.4% to 5.4%
Fuzing	Base detonating

Old types: In addition to these Special Common and Common projectiles described above, certain types of old Common projectiles are still in use in the Naval service. These projectiles have neither cap nor windshield, are colored slate over all; are loaded with Explosive D or black powder/TNT mixture. In the latter case, they are fuzed with a base ignition fuze. This latter type is found in the 1-, 3-, and 6-pounder projectiles and in the 3-, 4-, and 5-inch sizes.

High-Capacity: These projectiles are designed to have a minimum wall thickness, and the largest explosive cavity consistent with the force of set-back. They are assembled, generally, with no-delay base fuzes, tracers, steel nose plugs, and auxiliary detonating fuzes. The steel nose plug may be removed and a point detonating or nose time fuze substituted. These projectiles are used for shore bombardment, for antiaircraft guns, and for use against light ships and surface craft. The 3-inch High-Capacity has no base fuze. Characteristics:

Over-all color	Green
Sizes	3″, 4″, 5″, 6″, 8″, 12″, 14″, 16″
Explosive filling	Explosive D except the 3″, which is TNT loaded
Load factor	7.0% to 12.6%
Fuzing	Only variation from the no-delay base fuzes is the Base Detonating Fuze Mk 48, with a 0.01-second delay, currently being assembled in 8″ through 16″ H.C. projectiles for bombardment. In the 12″, 14″, and 16″ H.C. projectile, there is a TNT booster beneath the auxiliary detonating fuze, requiring an additional adapter ring

Antiaircraft Common: These projectiles are similar in construction to H.C. projectiles, except that a nose time or V.T. fuze is always assembled. It can be used for antiaircraft fire or, with the time fuze set on safe, used for bombardment. Characteristics:

Over-all color .... Green
Sizes .... 5-inch only
Explosive filling.... Explosive D or Composition A
Load factor 13%
Fuzing...... Nose time or V.T. fuze. Auxiliary detonating fuze. No-delay base detonating fuze

Antiaircraft: These projectiles vary from Antiaircraft Common in that no base detonating fuze is used. Characteristics:

Over-all color .... Green
Sizes .... 3-inch only
Explosive filling..... Composition A or TNT
Load factor........................ 5.7%
Fuzing .... Nose time fuze, auxiliary dentonating fuze

Illuminating: These projectiles are for illuminating targets by a parachute flare. Characteristics:

Over-all color......... Light blue with two white stars
Sizes .... 3", 4", 5", and 6"
Explosive filling..... Black powder expelling charge
Fuzing .... Nose time fuze only

The illuminating projectile is a thin case with a very small expelling charge just behind the fuze and an interior assembly of a star or candle with a parachute and a very lightly held base plug. Explosion of the expelling charge forces out the base and the interior assembly.

When the nose time fuze functions, it ignites the black powder expelling charge, which in turn ignites the star or candle. The star or candle is a steel container in which is packed under heavy pressure an illuminating compound. The closed end of the star container is attached to the strand wires of a parachute. The parachute is carefully folded, and, with its strand wires, is rolled so that upon expulsion it opens, thereby suspending the candle or star. Because of the high velocity at which the projectile is traveling when ejection takes place, it is necessary to slow down the star-parachute assembly before the parachute becomes fully open. This is done by a center wire, one end of which secures the center of the parachute nearer to the star than when the parachute is in full release and causes the parachute to spill air, thereby preventing too great an initial strain on the parachute. After the star has burned for a few seconds, the end of the center wire is released from its point of attachment in the star can. This permits the parachute to open fully.

Window: Window projectiles are designed to be fired from naval vessels to disrupt enemy radar operations. The projectile may be used to provide a false screen behind which our ships may maneuver or approach undetected, or to provide a false target for enemy radar. The projectile itself consists of an illuminating projectile body fitted with a nose time fuze and an expelling charge of black powder. Ignition of the expelling charge by the fuze discharges a payload of foil strips which form a reflecting cloud for radar beams. Characteristics:

Over-all color .... Aluminum
Sizes .... 5-inch only
Filling .... Foil strips and black powder expelling charge
Fuzing .... Nose time fuze

White Phosphorus (Smoke): Smoke projectiles are designed for shore bombardment purposes to produce a combination of screening, antipersonnel, and slight incendiary effects. These projectiles may also be used at sea to provide a surface screen behind which vessels may maneuver undetected. The projectile consists of an illuminating projectile body, fitted with a nose time fuze or point detonating fuze and a black powder expelling charge. The ignition of the expelling charge by a fuze discharges a number of white phosphorus filled steel tubes which ignite on contact with the air. Characteristics:

Over-all color.................. Blue gray

Sizes ....5-inch only
Filling........White phosphorus and black powder expelling charge
Fuzing...Nose Time or point detonating fuze

V.T.–fuzed projectiles: These projectiles are specially cavitized to receive the long-stemmed V.T. fuzes. They contain no tracer or nose fuze adapter, and no base fuzes are used except with the 6"/47 H.C. Projectile Mk 34. In all others, the base is sealed with a gas-checked base fuze hole plug. Other than V.T. type nose fuzes may not be employed in these projectiles. New V.T. fuzed projectiles are being filled with Composition A. Characteristics:

(with "V.T.–fuzed projectiles")
Color ....Depending on type of projectile that is V.T.–fuzed. But on all new projectiles the letters V.T. are painted on the band showing the explosive filler
Sizes..........................3", 5", 6"
Filling ....Composition A is being loaded in the new V.T.–fuzed projectiles

Target projectiles: These projectiles are inexpensive productions, with ballistic traits similar to the A.P. projectiles of their caliber. They are unfuzed and contain no explosive. On some types, a dyé is loaded into the windshield, which on impact with the water is funneled out and spread through the water splash, thus distinguishing the origin of the salvo.

Over-all color ....Red
Sizes.............6", 8", 12", 14", and 16"

Gas: The same type of projectile that is used for the smoke round may be loaded with gas for chemical warfare.

Limited-use types: These are summarized in column 2 of this page.

FIELD AND BOMBARDMENT: These projectiles were designed for field use or shore bombardment. They carry point detonating fuzes.

SHRAPNEL: Shrapnel projectiles contain steel balls which are expelled from a shrapnel case by means of a small charge of explosive, the case remaining intact. These projectiles are obsolescent.

FLAT NOSE: Flat nose projectiles are for use against submarines, and are designed to prevent ricocheting on water impact. These projectiles are obsolescent.

TRACER: These are special projectiles designed solely to leave a visible trace in the daytime. They do not have bursting charges. These are obsolescent.

PROOF SHOT: These are special projectiles designed not to ricochet on water impact and are for use in proving-ground work. It is not contemplated that more of these projectiles will be procured when the present stocks are exhausted.

"POUNDER": These are for Coast Guard guns.

Minor caliber projectiles

20-mm ammunition: Two types of 20-mm weapons are at present in service use in the Navy: the Oerlikon antiaircraft gun and the Hispano-Suiza aircraft gun. These types differ widely in construction and functioning; and it is emphasized that the ammunition, though somewhat similar in external appearance, is not interchangeable.

AMMUNITION FOR OERLIKON GUN: The Oerlikon gun and its ammunition are of naval manufacture and design. The ammunition may be distinguished from that designed for the Hispano-Suiza gun by the reduced diameter of the extractor lip at the base of the cartridge case. For identification of individual types of rounds, the body of the projectile is painted a distinctive color, as follows:

TYPE	FILLING	COLOR
H.E. Mk 3	Tetryl	White
H.E. Mk 3	Pentolite	Yellow
H.E.–I. Mk 3	Tetryl and incendiary mix	Red
H.E.–I. Mk 3	Pentolite and incendiary mix	Light pink

Type	Filling	Color
*H.E.–T. Mks 4 and 7	Tetryl and tracer	Light gray
*H.E.–T. Mks 4 and 7	Pentolite and tracer	Blue
A.P.–T.Mk 9	Tracer	Black
B.L. and P. Mk 3	Inert loaded	Dark green
B.L. and T. Mk 7	Inert load and tracer	Dark green with yellow stripe
Drill	Empty	Seal brown
H.E.–I.–T.		Bright green

*When the projectile is assembled with "Dark Ignition" tracers, a ⅛-inch bright red band will be painted around it midway between the bourrelet and the rotating band.

The Mark and Mod, manufacturer's initials or symbol, and lot number are stamped around the body of the projectile.

ABBREVIATIONS IN MINOR CALIBERS

H.E. — High Explosive
I. — Incendiary
T. — Tracer
B.L. — Blind Loaded
P. — Plugged
S.D. — Self Destructive
D.I. — Dark Ignition

AMMUNITION FOR HISPANO-SUIZA GUN: This gun and its ammunition are Army-designed but have been adopted as Naval equipment with the installation of the gun on Naval planes. The ammunition is distinguished from that designed for the Oerlikon gun by the extractor lip on the base of the cartridge, which is the same diameter as the rest of the case. Two series of ammunition for this gun are in use. The "Old Series" consists of unmatched rounds, some adapted from British prototypes, others designed by the Army. The "New Series" is a set of ballistically matched rounds designed by the Army to supersede those of the "Old Series". For identification of specific rounds, the projectile body is painted a specific color, as follows:

Type	Series	Filling	Color
H.E.–I. Mk 1	Old	Tetryl and Incendiary mix	Body–red Bourrelet–yellow Fuze–brass Marking in black
A.P.–T. M75	Old	Tracer and inert load	Black over all Marking in white
Ball, Mk 1	Old	Inert loaded	Black over all
Dummy Drill	Old	Empty	Zinc coated
H.E.–I. M97	New	Tetryl and incendiary mix	Body–red Bourrelet–yellow Fuze–brass Marking in black
Incendiary, M96	New	Incendiary mix	Body–blue gray Nose–light blue Marking in black
A.P.–T. M95	New	Tracer	Black over all Marking in white
Practice, M99	New	Empty	Black over all Marking in white

1.1"/75 ammunition: The body of these projectiles, now obsolete items, were unpainted except for two dots below the fuze, indicating as follows:

Explosive D — Yellow dot
Tracer — Red dot

A newer color marking was proposed for the 1.1-inch ammunition. Some projectiles may be found painted as shown in column 2:

Type	Color
H.E.-T.	Light gray with white band
H.E.-T./S.D.	Dark green with white band
B.L. and P.	Red over all
B.L. and T.	Red over all with white band

40-mm ammunition: These projectiles are identified by distinctively colored bodies, as follows:

Type	Body	Band	Tip	Remarks
A.P.	Black	Black	Black	Plug in tracer
A.P.-T.	Black	White	Black	
H.E.-P.	Green	Green	Green	Plug in base
H.E.-T./S.D.	Green	White	Green	
H.E./S.D.	Green	Black	Green	Dark tracer
H.E.-I.-T./S.D.	Green	White	Red	
H.E.-I.-P.	Green	Red	Red	Plug in base
H.E.-I./S.D.	Green	Black	Red	Dark tracer
H.E.-I.-T.	Green with Black Band	White	Red	S.D. relay not loaded
B.L. and T.	Red	White	Red	Dummy fuze
B.L. and P.	Red	Red	Red	Dummy fuze and plug in base
H.E.-I.-T. (D.I.)-S.D.	Green	White	Red	Dark ignition tracer

The tracer composition is either a red burning mixture in the tracer — "T" rounds — or a non-luminous burning compound in the "Self Destructive" rounds.

"Dark" and "Dark Ignition Tracer": To eliminate the blinding effect on 40-mm and 20-mm gunners from tracer fire at night and also to make the origin of tracer fire less distinct, these tracers were developed toward the close of the war. The dark ignition tracer is invisible until the projectile is 100 to 400 yards from the gun's muzzle, and then it is visible for the rest of its time of flight. Details of these tracers are described with their appropriate projectile and tracer housing.

Description of explosive payloads

Characteristics of the high explosive fillers follow:

Composition A. This is the newest service explosive load. It has a damage-power factor of gain over Explosive D in the 5-inch A.A. projectile of 1.6 to 2.0, thus greatly increasing the force of the burst. A mixture of 91% RDX and 9% wax, Composition A is press-loaded into projectiles. It is a stable, non-hydroscopic explosive with an ignition temperature of 200° C. Continued exposure to temperature of 135° F or higher may cause some exudation of the wax, but this exudate is not explosive. Compared to Explosive D, this filler has about the same impact sensitivity, but is more sensitive to mass detonation and armor-piercing ignition.

Explosive D (Ammonium Picrate): Explosive D is the standard main charge for armor piercing-projectiles and all other Navy projectiles over 3-inch caliber. While its power and brisance are slightly inferior to TNT, it is much more insensitive to shock and will stand impact on armor plate without being deflagrated. Its melting point is too high for it is to be melted and cast; it is loaded by being pressed into cases by a hydrolic ram. It reacts with metals to form extremely sensitive compounds. This is counteracted by covering the interior of the projectiles with acid-proof lacquer.

TNT (Trinitrotoluol) is the filler in 3-inch H.C. and A.A. and 40-mm A.A. projectiles. A powerful, brisant explosive, it is easy to load by casting, since its melting point is 80.2° C. It is stable under practically all stowage conditions and should stand even bullet impact when cast.

Tetryl (Trinitrophenylmethylnitramine): Tetryl, because of its combination of high power, brisance, and sensitivity, has been tried for main charge loads in small caliber projectiles but has proved too sensitive to withstand the set-back in all but 20-mm. The melting point of Tetryl, 130° C, is too high to allow it to be melted and cast. It is loaded by being mixed with small quantities of graphite or stearic acid, which serve to lubricate it while it is being pressed into pellets. Tetryl is quite safe to handle and is extremely stable in stowage. Exposed or loose tetryl should not be handled, as it may cause dermatitis.

Pentolite: Pentolite is a mixture of TNT and PETN, usually 50/50. (PETN is similar in characteristics to RDX. Its color is white.) It is not as stable as TNT in stowage, and separation of PETN may occur. Efforts should be made to keep it cool. It is about the same sensitivity as tetryl in drop tests, and more sensitive than Torpex to bullet impact. This explosive filler is now used only in 20-mm loads.

Qualities of High Explosive Fillers

	"A"	"D"	TNT	TETRYL	PENTOLITE
Velocity of detonation at density factor	27,000 f.s. at 1.62	21,300 f.s. at 1.48	22,300 f.s. at 1.55	24,400 f.s. at 1.55	24,000 f.s. at 1.65
Laboratory impact value	105	99	100	45	47
Bullet impact value	100+	100+	100	61	48
Color	White or buff	Yellow or orange	Straw	Light yellow-gray with graphite	Sand

Black Powder: Not a brisant explosive, black powder is mixed with TNT in the 5-inch, 6-inch, and 8-inch common projectiles and in the "pounder" rounds. It is also the expelling charge in illuminating, W.P., and "window" loads. Sensitive to friction, black powder varies in color from brown to black.

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Inert fillers

Blind Loaded and Plugged (B.L. & P.): A projectile may be loaded with sand or other inert material and sealed with a solid base plug, or the tracer hole (fuze hole) in a base plug may be blanked off.

Blind Loaded and Tracer (B.L. & T.): These projectiles have an inert load, but a tracer is inserted in the fuze hole of the base plug.

White phosphorus: An unstable smoke-incendiary agent, white phosphorus ignites when exposed to air and produces dense white smoke. It also has its incendiary, anti-personnel effect.

Gas: The various types of gas fillings are listed under the subject of "Chemical Filler Markings" on pages 15 and 16.

Color and markings of new projectiles 3-inch and larger

Following are the markings called for in the new specifications (See figure 1):

Explosive indicator

Yellow	Explosive D
Grey	Black Powder
Green	TNT
One-half grey and one-half green band	TNT and Black Powder mix
Red	Inert material or empty
Blue	Composition A

Time fuze stripe: Projectiles having a nose time fuze shall have a ¼-inch white stripe painted longitudinally from the stationary lug on the fuze two inches aft.

Body color

Black	A.P.
Slate grey	Common
Green	AA., H.C., and A.A. Common
Light blue with two white stars	Illuminating
Aluminum	Window
White	Schrapnel
Ocean grey	Smoke, Gas, or Incendiary
Red	Target ammunition

V.T. Fuzed: The letters "V.T." ¾-inch high are stenciled just before the rear edge of the paint indicating the burster charge.

Tracer band: A white band with four dots 90° apart indicates the color of the tracer.

Spotting band: The color indicates the color of the spotting charge.

"Window" mark: This consists of a one-inch high "W" on each side, 180° apart, just abaft the forward bourrelet.

Stencilling on body: The following information is stencilled between the rotating band and the forward bourrelet on new projectiles:

Ammunition lot number
Caliber and type of projectile
Mark and Mod of projectile
Type nose fuze (whether M.T.F., P.D.F., V.T.F., Mk 32 and similar types, or Dummy Nose Plug) — Mark and Mod of fuze — Lot number of fuze (for Mk 32 and similar types only)
Mark and Mod of auxiliary detonating fuze
Mark and Mod of base detonating fuze
Mark and Mod of tracer — Color of Tracer
Mark and Mod of guns in which projectile can be used
Mark and Mod of "Window" load

Stamped on rotating band

Mark and Mod of projectile
Size and type of projectile
Lot number and year of specification
Inspector's seal and initials

Sometimes the manufacturer's name is included here.

Stamped on base or on base plug

Mark and Mod, size, and type of projectile
Lot number, year of specification
Inspector's seal and initial
Manufacturer's name

The serial number of the projectile will also be stamped on the base plug on the side of the body, and on the windshield if present.

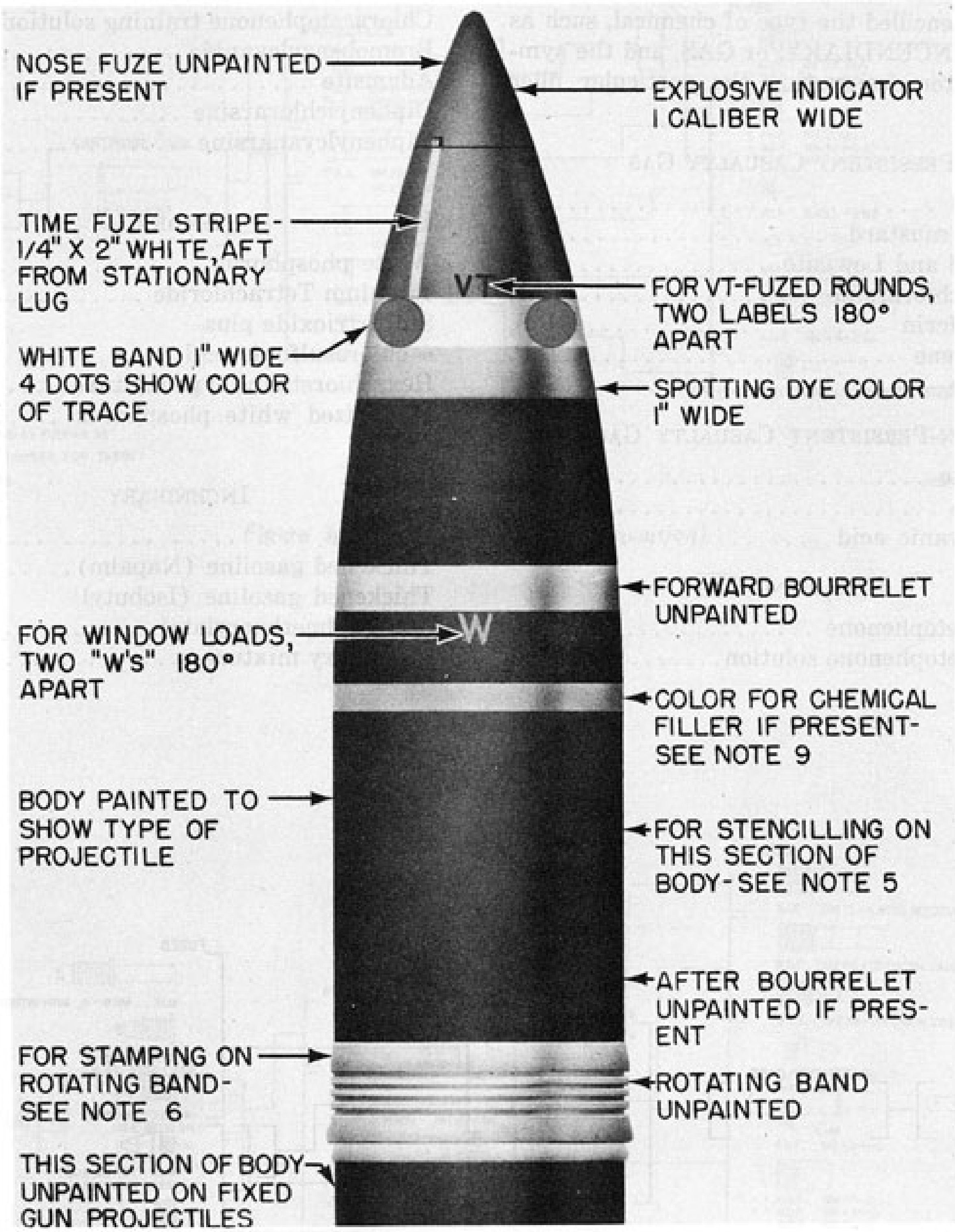


Figure 1. Color and Marking of Projectiles (3-inch and larger)

Chemical Filler Markings

Two green bands ½-inch apart — Persistent casualty gas

One green band — Non-persistent casualty gas

One red band — Harassing gas

One yellow band — Smoke

One purple band — Incendiary

Also, on projectiles having a chemical filler, there is stencilled the type of chemical, such as SMOKE, INCENDIARY, or GAS, and the symbol or letter designating the particular filler as below:

PERSISTENT CASUALTY GAS

Mustard	H.
Purified mustard	H.D.
Mustard and Lewisite	H.L.
Ethyldichlorarsine	E.D.
Chloropicrin	P.S.
Diphosgene	D.P.
Lewisite	L.

NON-PERSISTENT CASUALTY GAS

Phosgene	C.G.
Chlorine	CL
Hydrocyanic acid	A.C.

HARASSING GAS

Chloracetophenone	C.W.
Chloracetophenone solution	C.N.S.
Chloracetophenone training solution	C.N.B.
Bromobenzylcyanide	B.B.C.
Adamsite	D.M.
Diphenylchlorarsine	D.A.
Diphenylcyanarsine	D.C.

SMOKE

White phosphorus	W.P.
Titanium Tetrachloride	F.M.
Sulfurtrioxide plus chlorosulfonic acid	F.S.
Hexachlorethane type mixture	H.C.
Plasticized white phosphorus	P.W.P.

INCENDIARY

Thermite	T.H.
Thickened gasoline (Napalm)	N.P.
Thickened gasoline (Isobutyl Methylmethacrylate)	I.M.
Incendiary mixture	P.T.

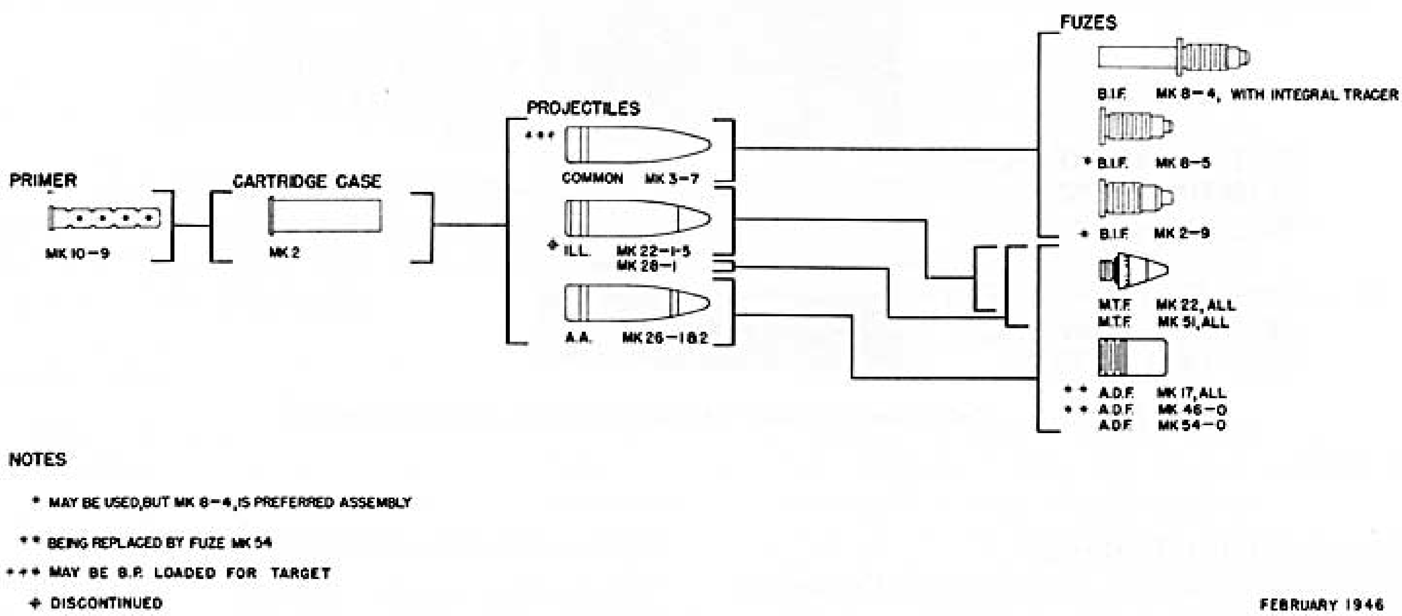


Figure 2. 3"/23 Case Gun (Ammunition)

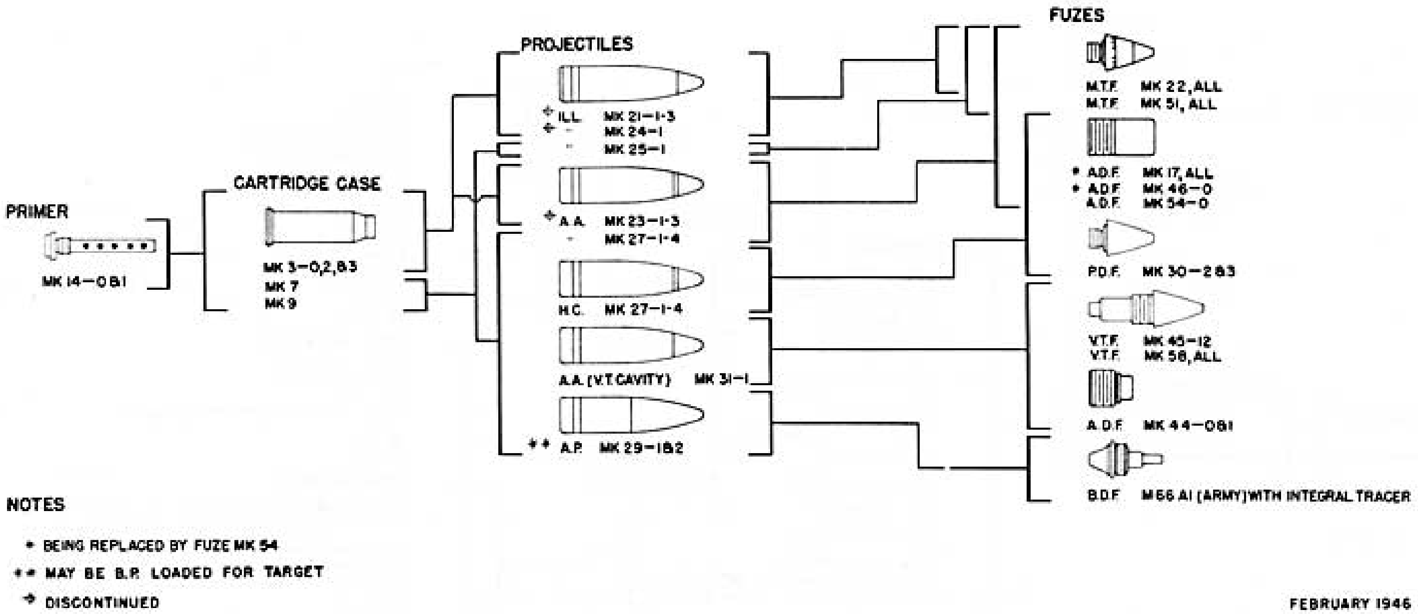


Figure 3. 3"/50 Case Gun (Ammunition)

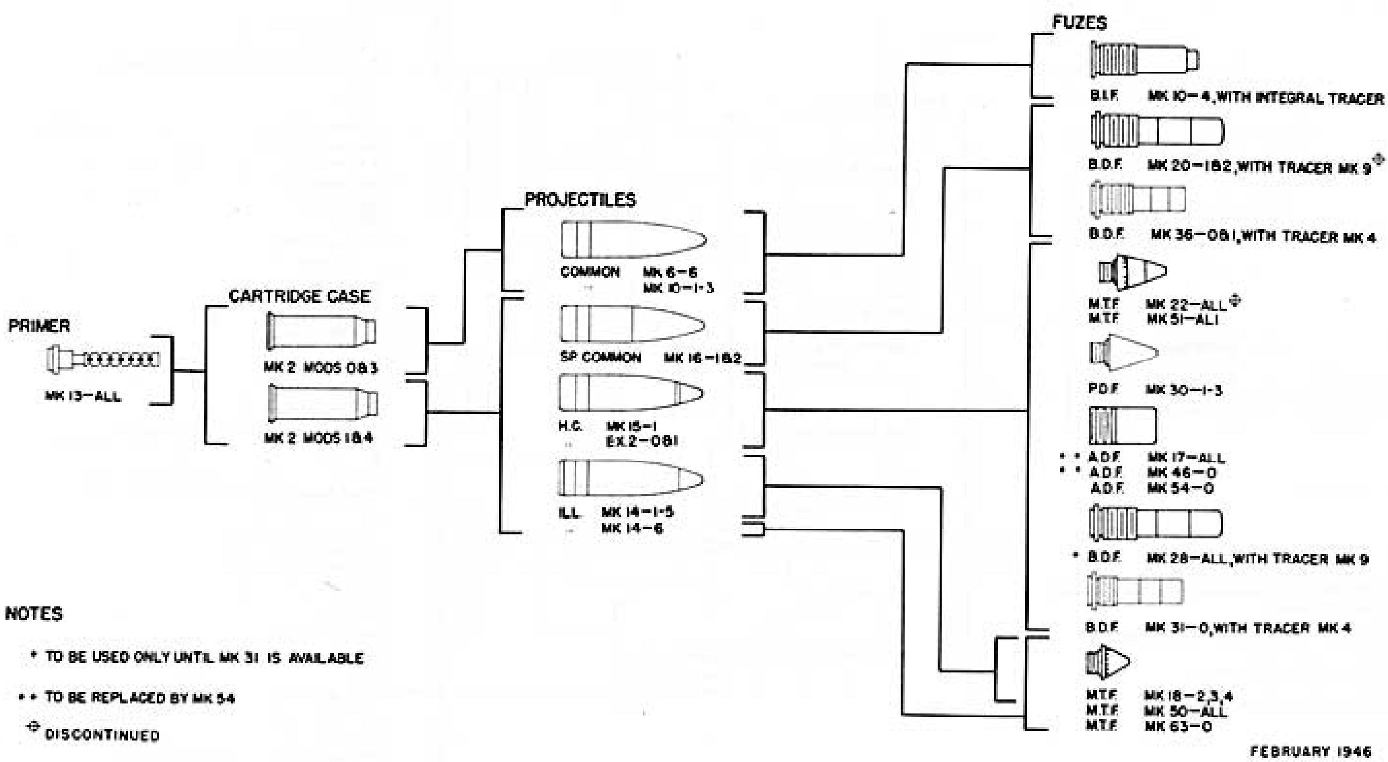


Figure 4. 4"/50 Case Gun (Ammunition)

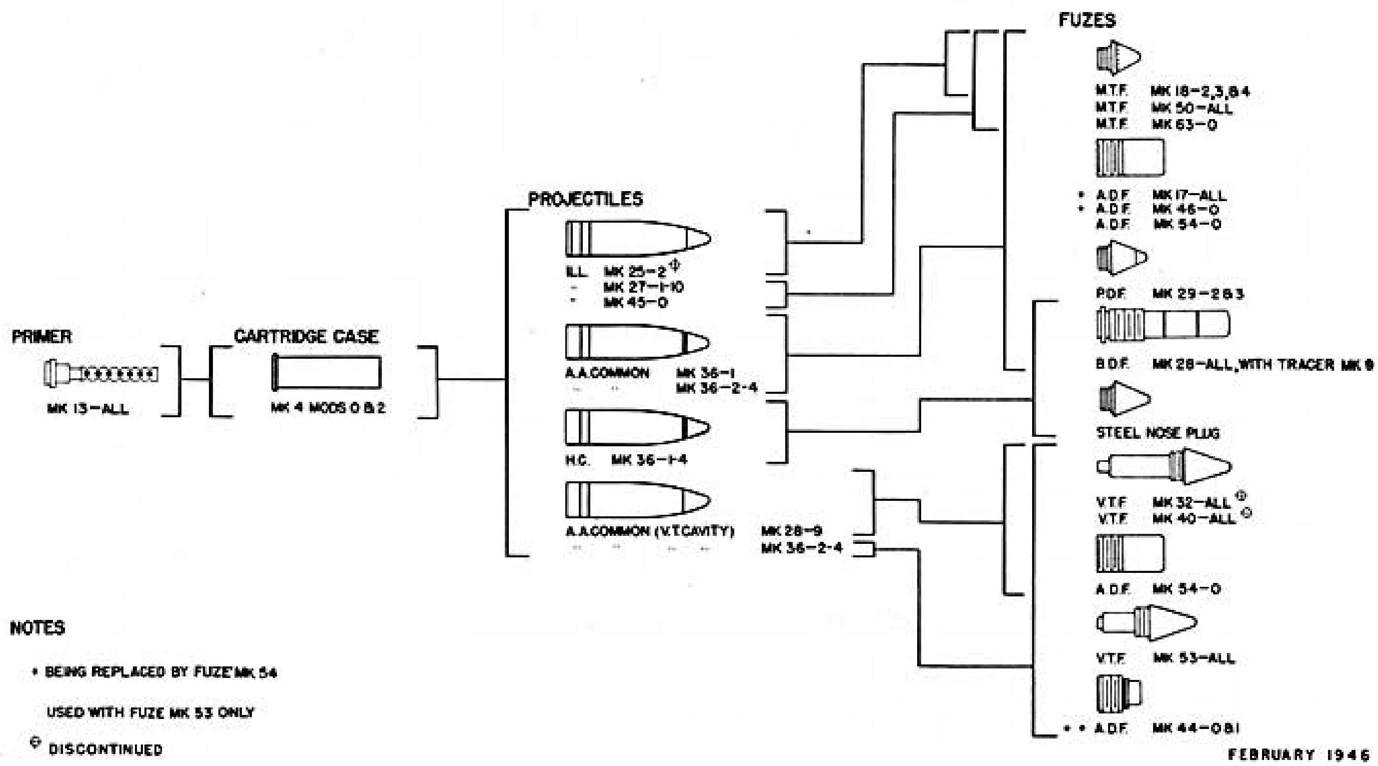


Figure 5. 5"/25 Case Gun (Ammunition)

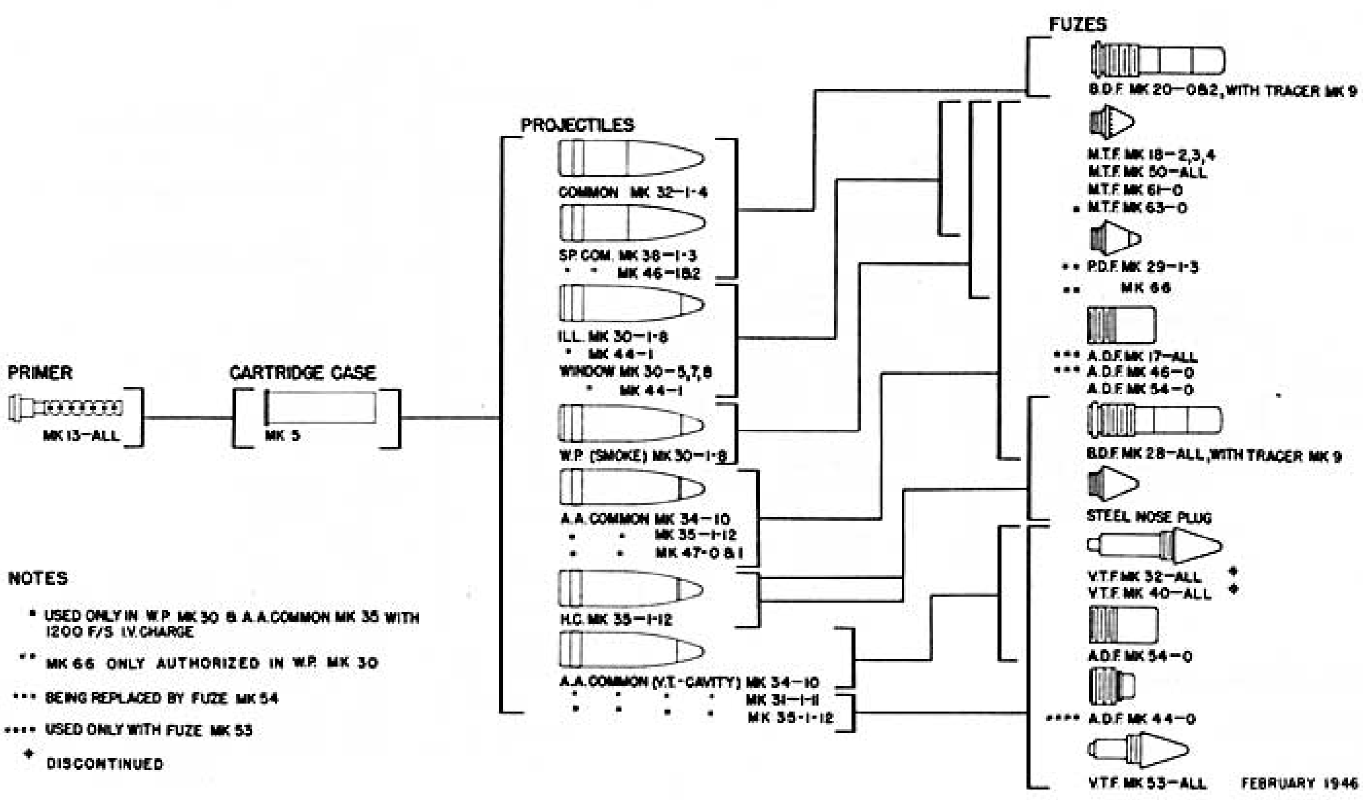


Figure 6. 5"/38 Case Gun (Ammunition)

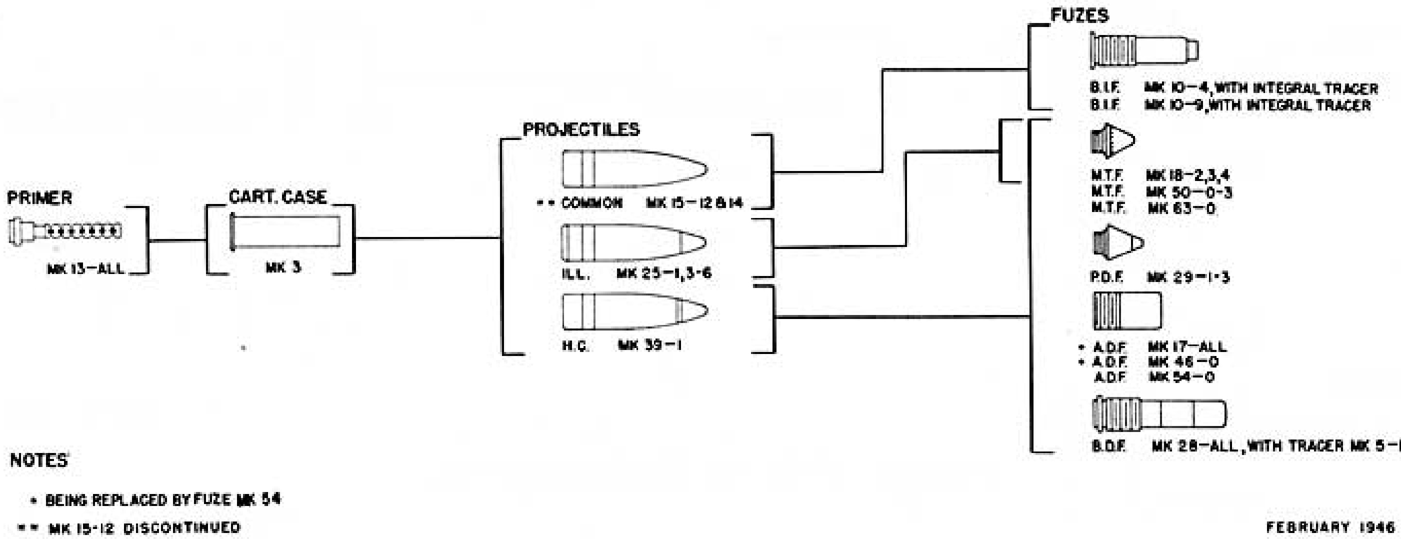


Figure 7. 5"/51 Case Gun (Ammunition)

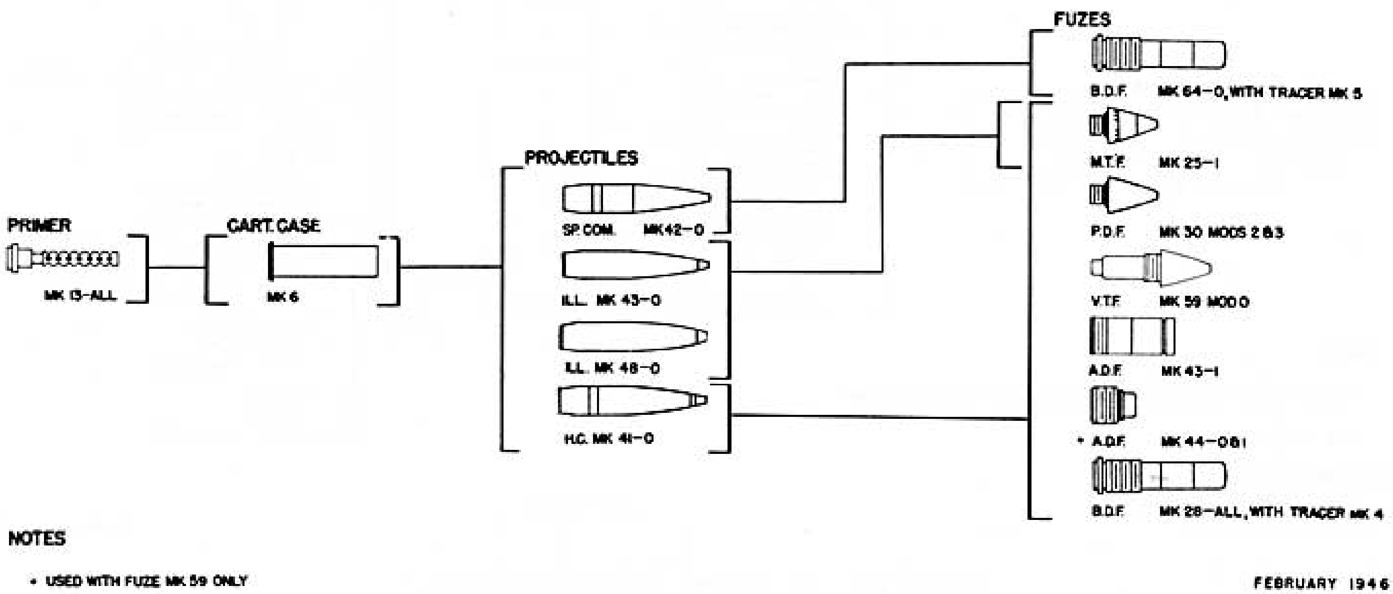


Figure 8. 5"/54 Case Gun (Ammunition)

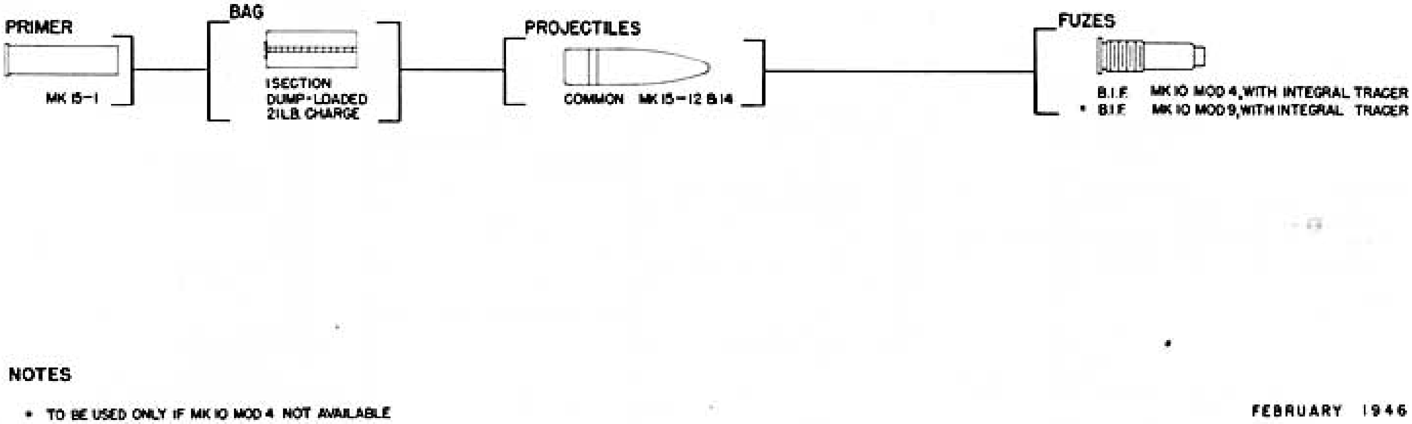


Figure 9. 5"/20 Bag Gun (Ammunition)

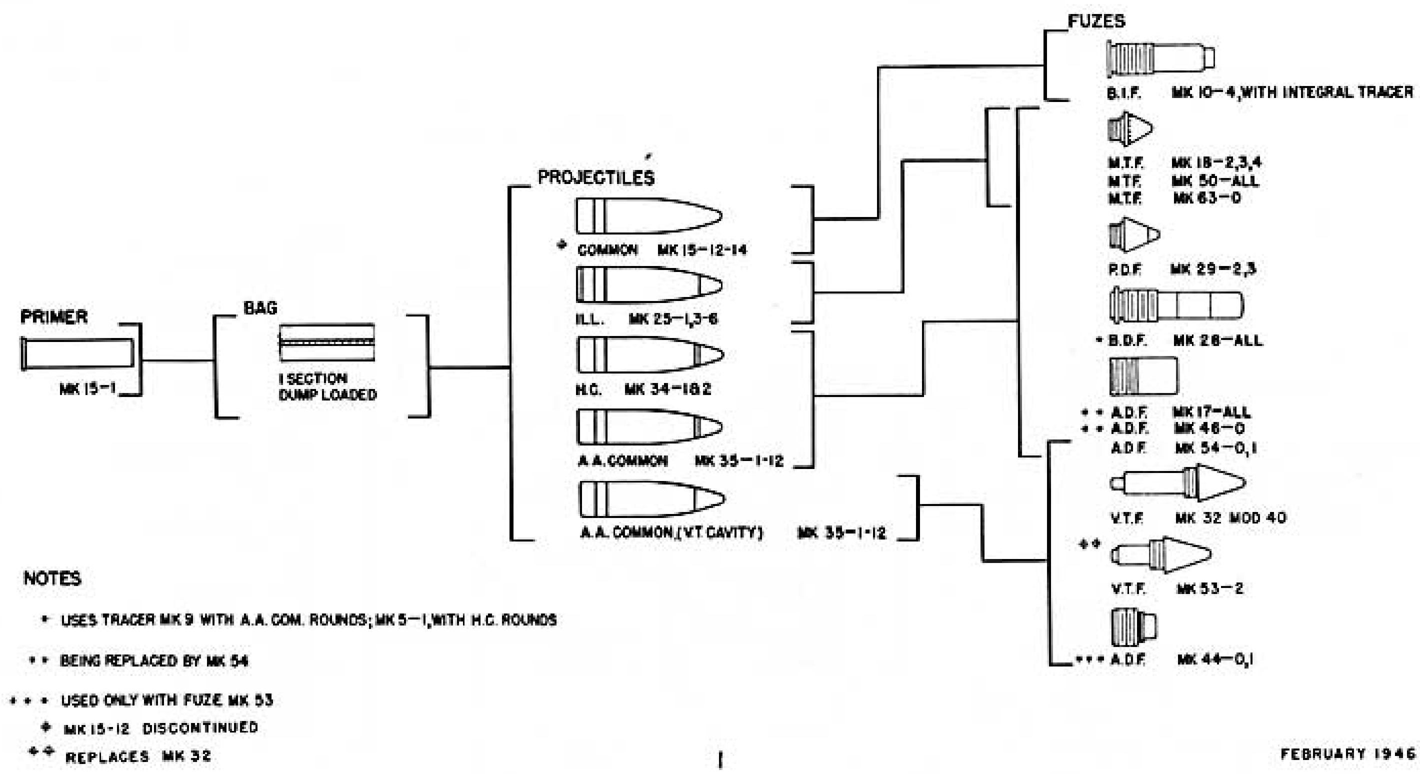


Figure 10. 5"/51 Bag Gun (Ammunition)

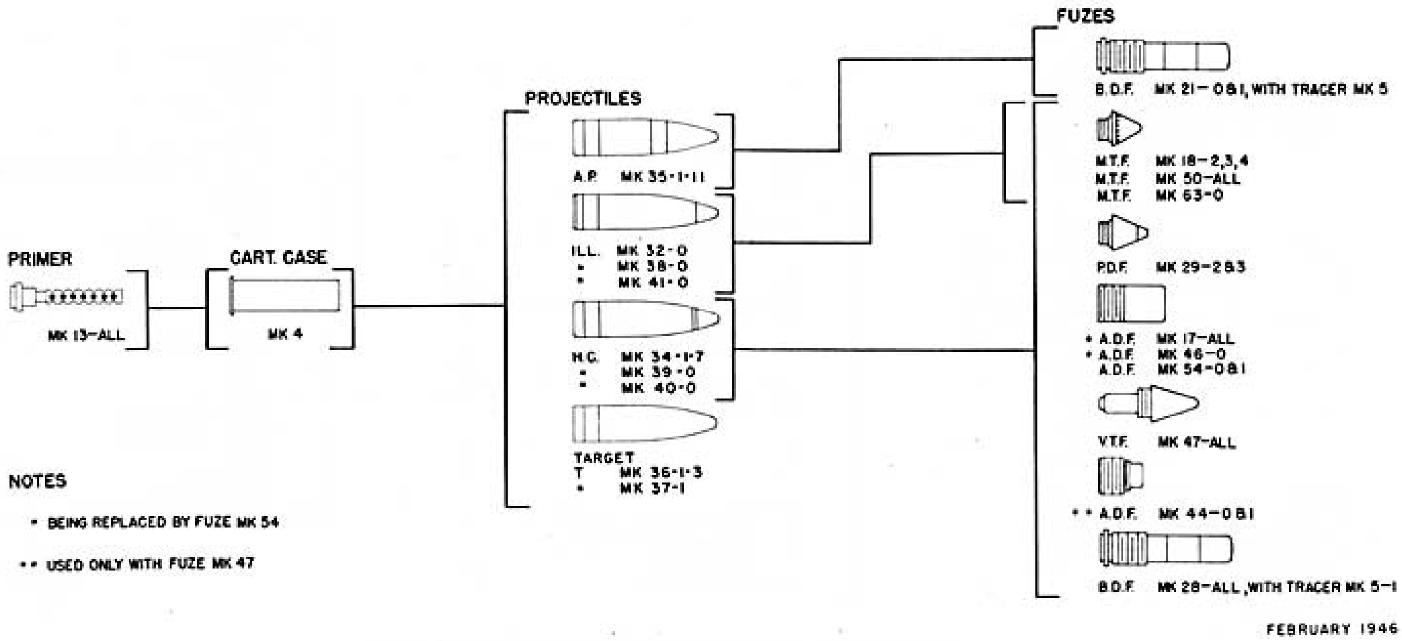
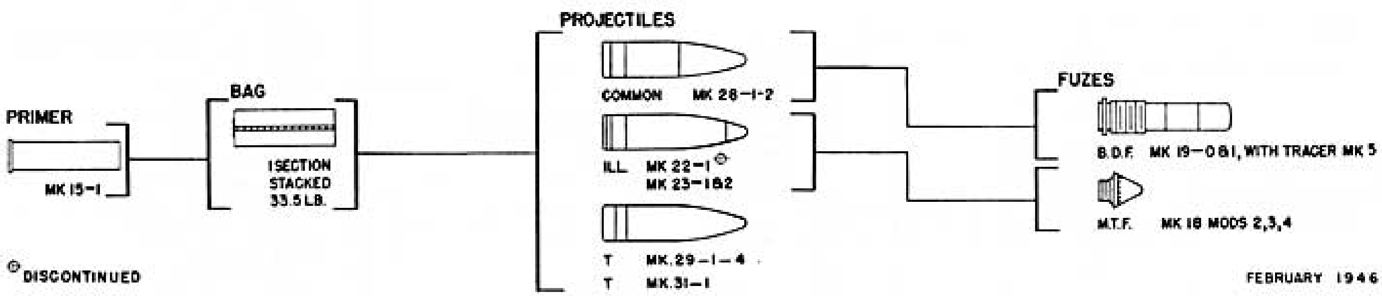


Figure 11. 6"/47 Case Gun (Ammunition)



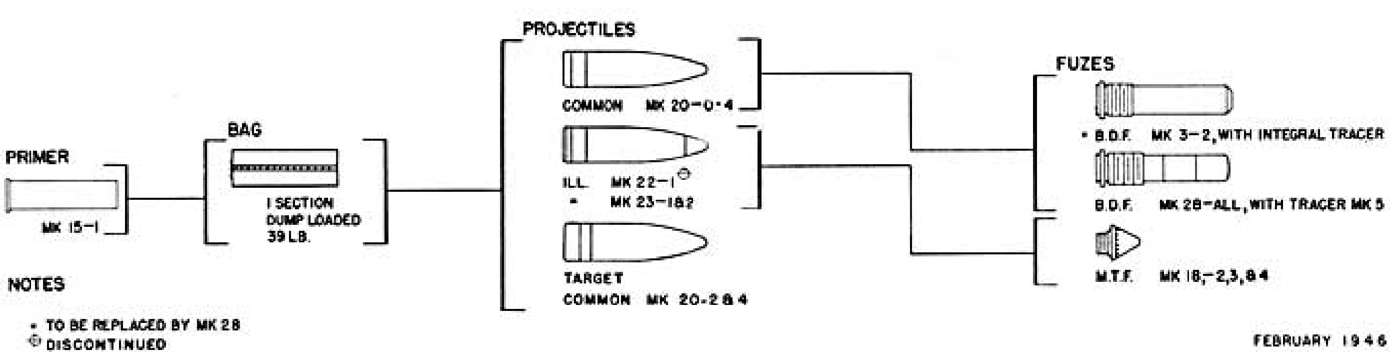


Figure 12. 6"/47 Bag Gun (above) and 6"/50 Bag Gun (below) (Ammunition)

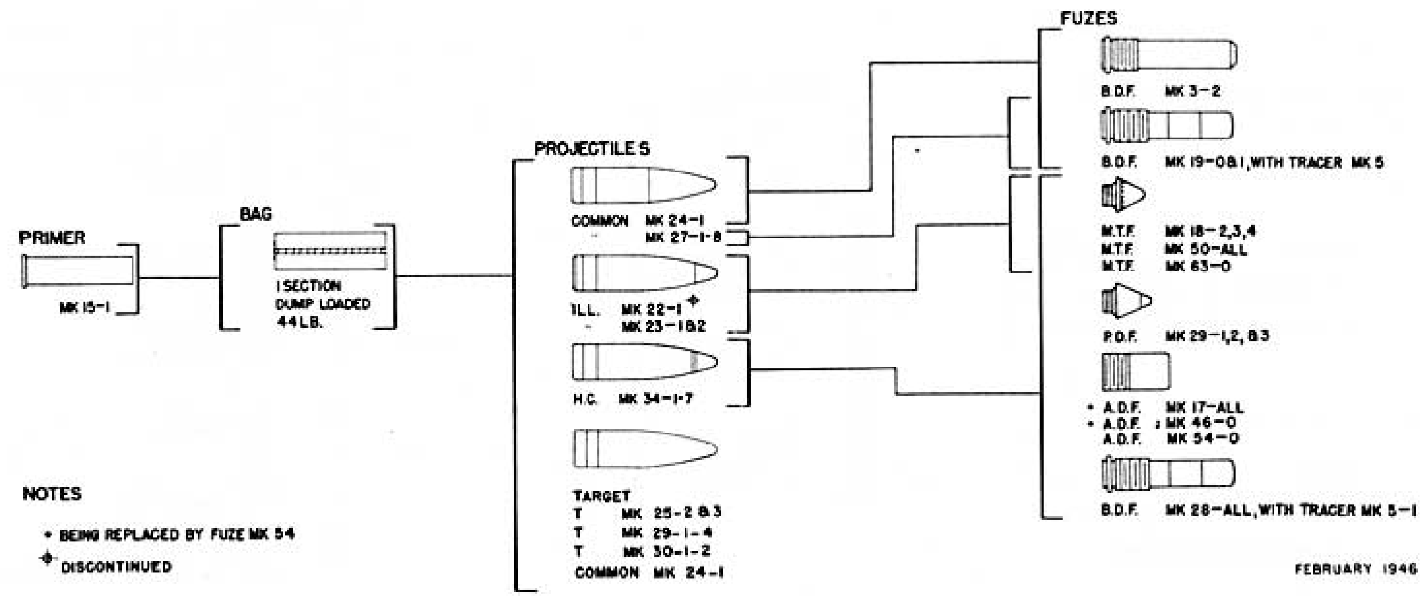


Figure 13. 6"/53 Bag Gun (Ammunition)

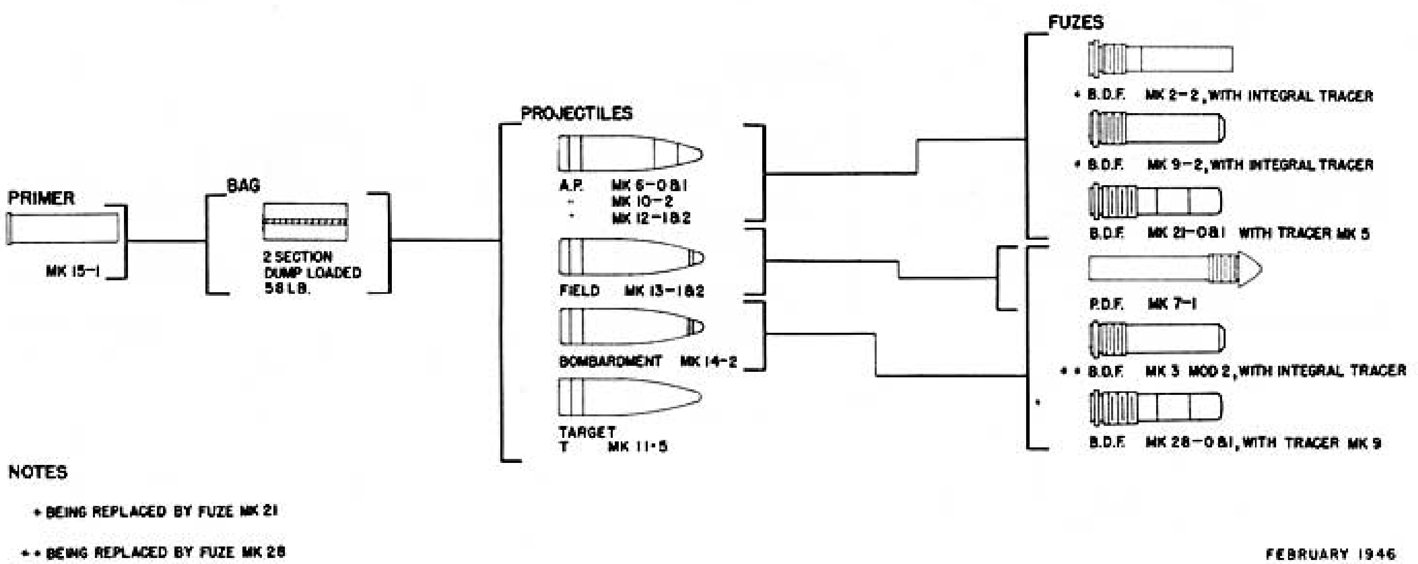


Figure 14. 7"/45 Bag Gun (Ammunition)

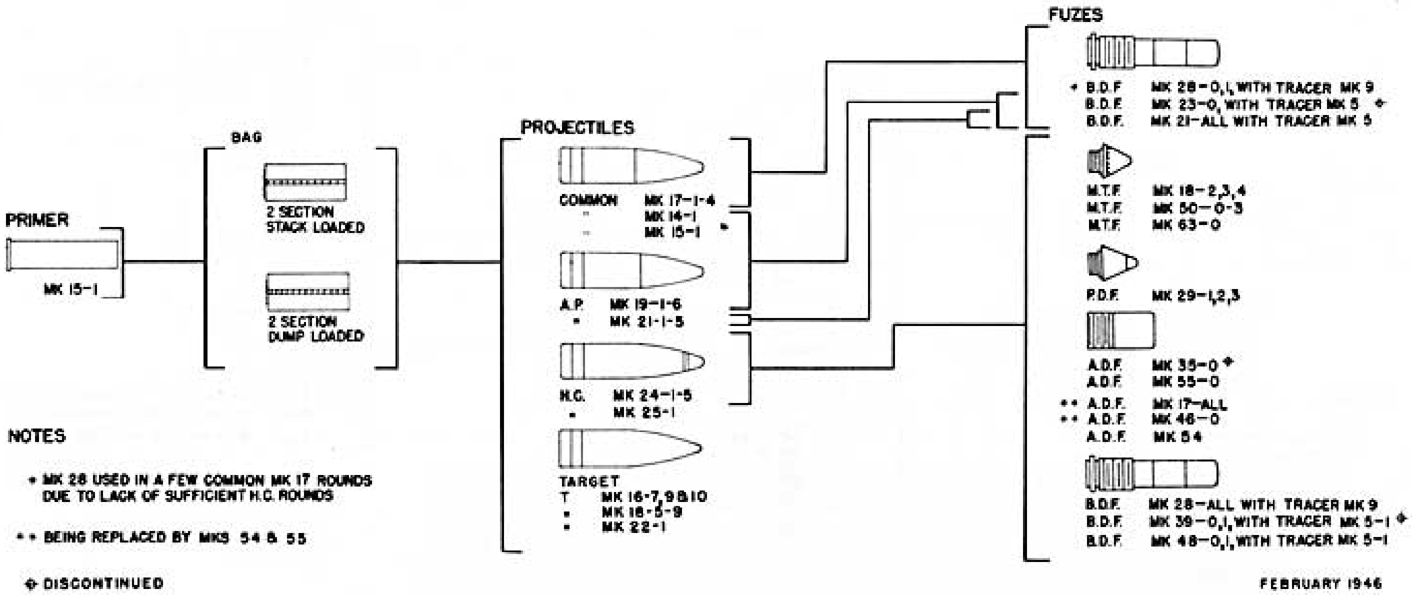


Figure 15. 8"/55 Bag Gun (Ammunition)

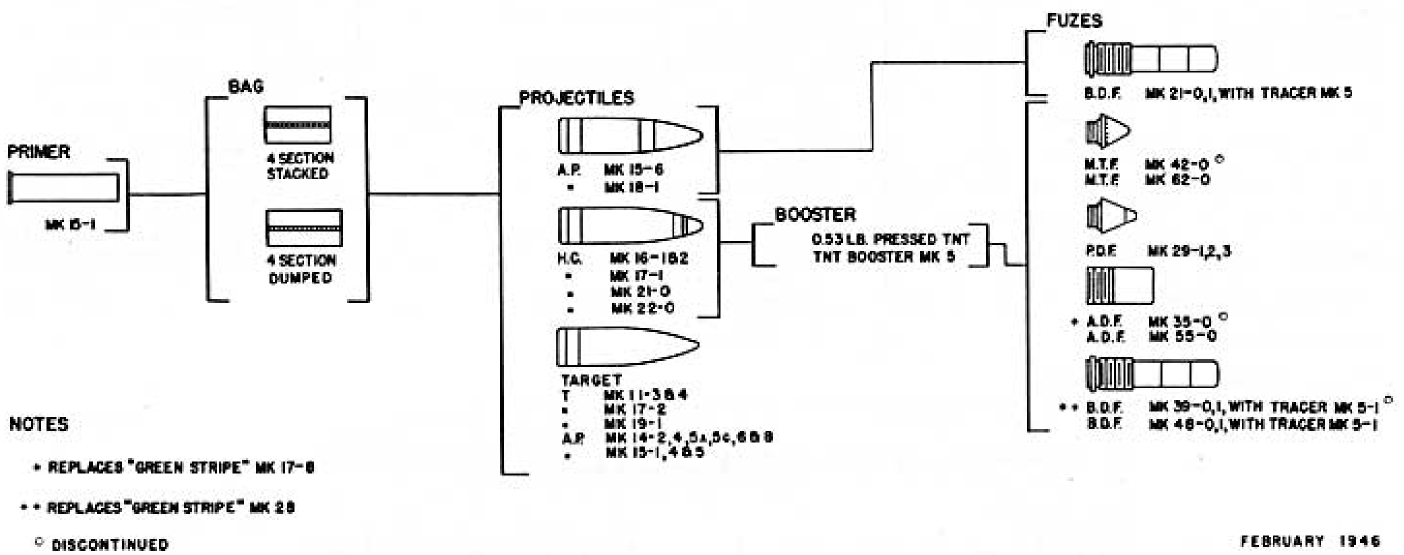


Figure 16. 12"/50 Bag Gun (Ammunition)

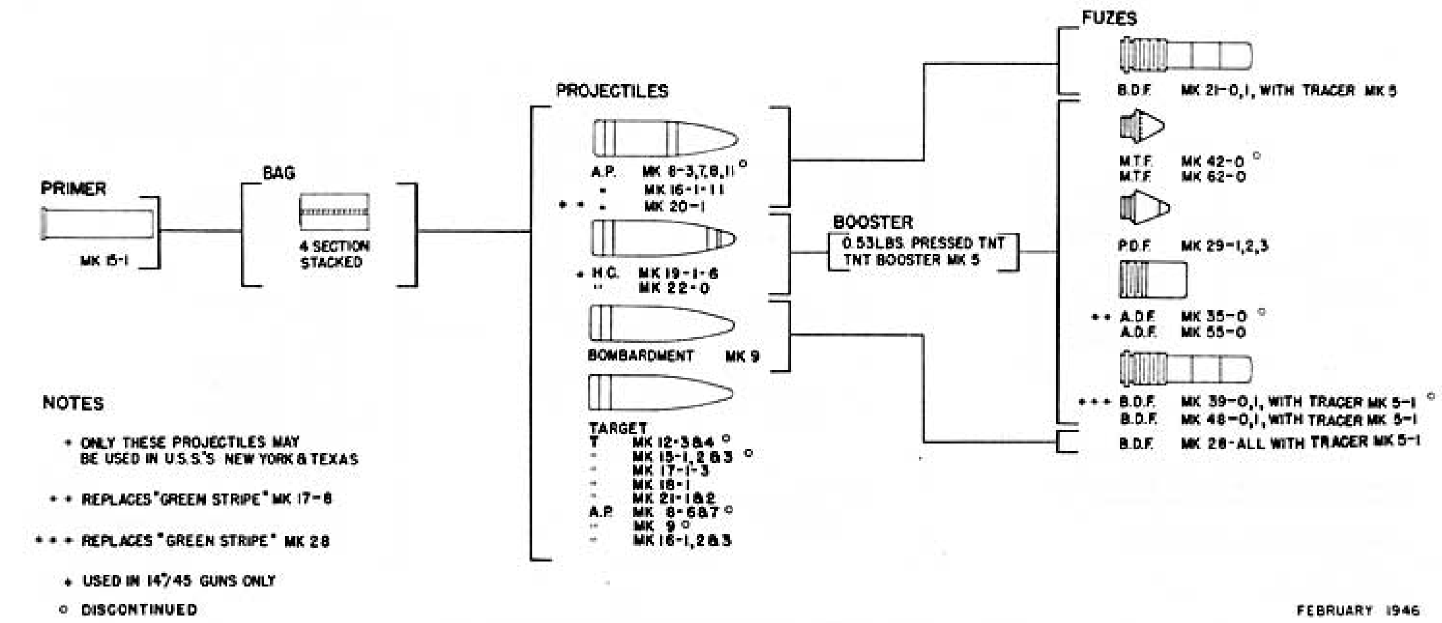


Figure 17. 14"/45 and 14"/50 Bag Guns (Ammunition)

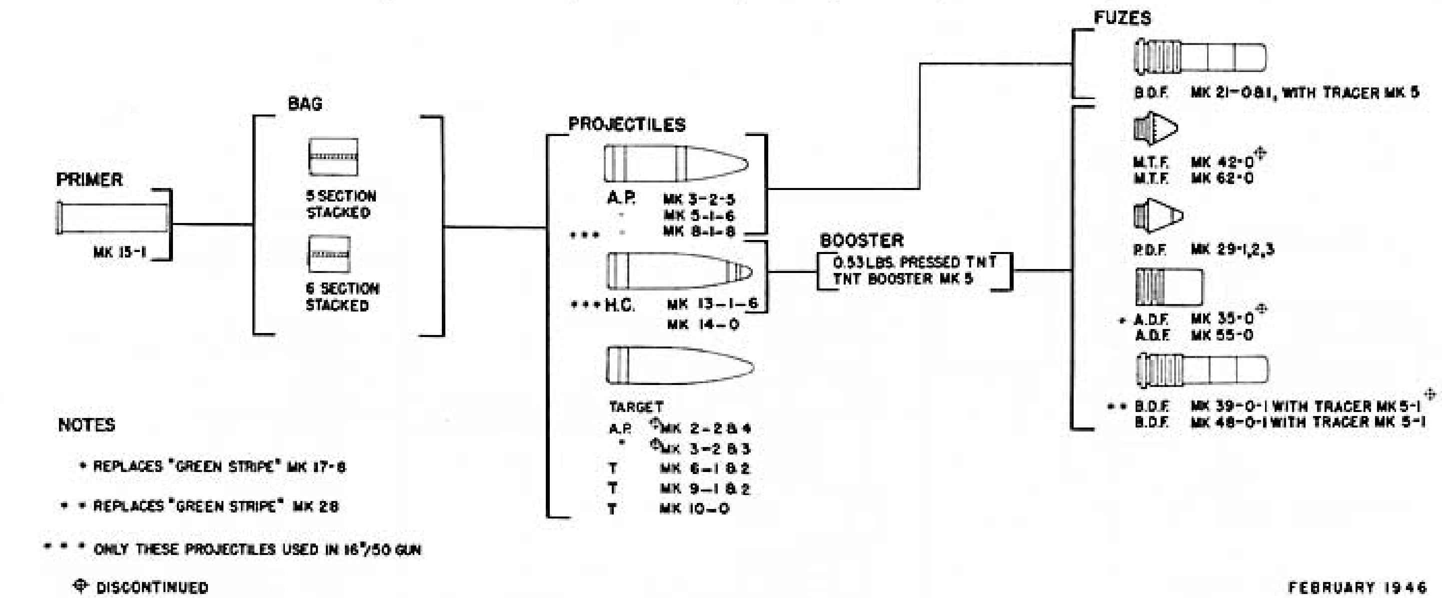


Figure 18. 16"/45 and 16"/50 Bag Guns (Ammunition)

Color and marking of older projectiles 3-inch and larger

In addition to the explosive filler, body color, spotting specifications, and base and band stamping mentioned above, the older projectiles had the following markings:

Tracer band: White band with three dots, indicating tracer color, 120° apart.

V.T. fuzing: One-half inch red band painted one-half inch abaft the nose fuze.

Stencilled on the body

Size, caliber, Mark and Mod of projectile
Mark and Mod of fuzes
Explosive filling and density of loading
Abbreviated name of loading depot
Initials of Chief Inspector
Date of filling and marking; any changes in filling, fuzing, etc.

Stamped on base

Weights before and after filling

3-INCH PROJECTILES

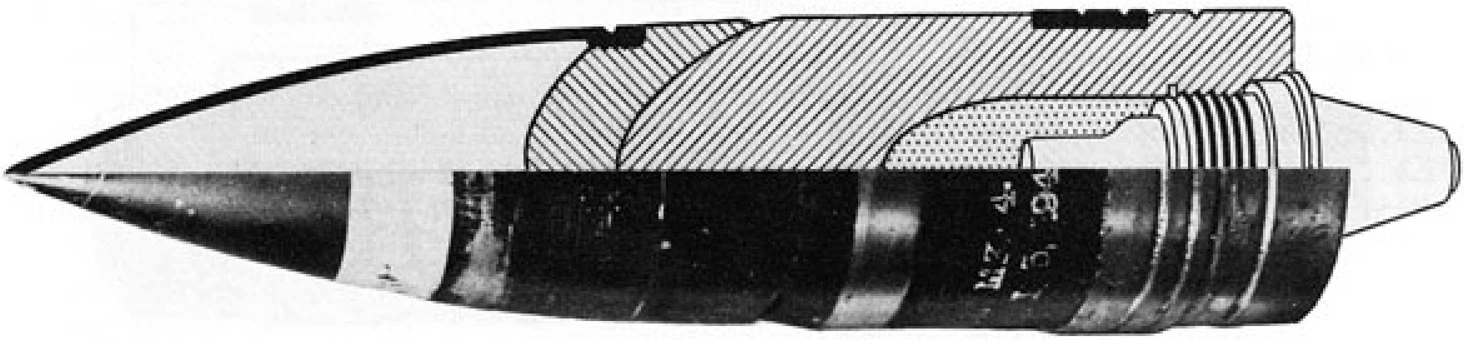


Figure 19. 3–inch A.P. Mk 29 Mods 1 and 2

3-inch A.P. Mk 29 Mods I and 2

Guns used in........................3"/50
Overall length, inches
  With cap & windshield.............12.16
  Without cap & windshield...........6.91
Diameter of base, inches...............2.98
Distance base to band, inches..........1.35
Width of band, inches..................1.0
Diameter at bourrelet, inches.........2.985
Filling ....Explosive D
Weight of filling, pounds...............0.3
Weight of loaded projectile, lb. 13.10
Charge/weight ratio 2.28%
Cartridge Case ....Mk 7 and Mk 9
Primer ....Mk 14, Mk 14 Mod 1
Tracer ....Integral
Fuzes........Army M66A1 in base (B.D.F.)

This projectile was formerly issued without any explosive filling and with the Tracer Mk 4. It is now being loaded and at present is fuzed with the Army Base Fuze M66A1.

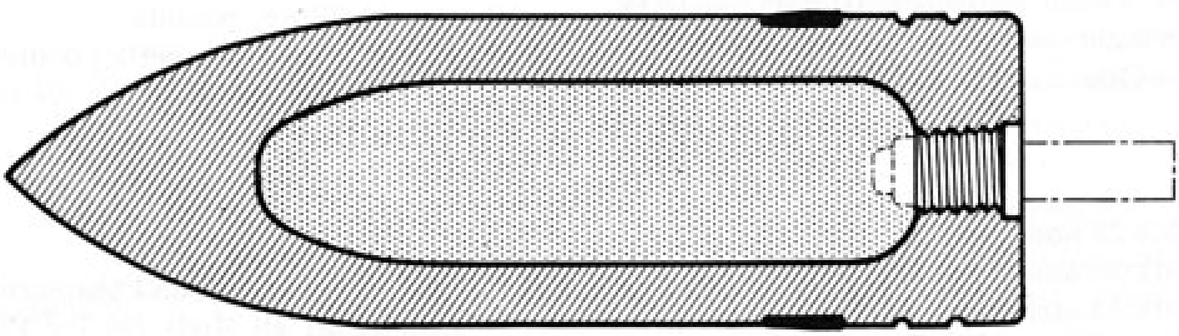


Figure 20. 3–inch Common Mk 3 Mod 7

3-inch Common Mk 3 Mod 7

Guns used in........................3"/23
Over-all length, inches..............10.035
Diameter of base, inches...............2.87
Distance base to band, inches..........1.80
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.97
Filling............Black powder and TNT

Weight of filling, pounds..............0.28
Weight of loaded projectile, pounds......13
Charge/weight ratio 2.15%
Cartridge case ....Mk 2
Primer ....Mk 10 Mod 9
Tracer ....Integral in fuze
Fuzes.......Base Ignition Fuze Mk 8 Mod 4

Base Ignition Fuzes Mk 8 Mod 5 or Mk 2 Mod 9 (without tracers) may be used in this projectile, but the Mk 8 Mod 4 with integral tracer is preferred.

This round may also be issued B.L. & P. or B.L. & T. with the Tracer Mk 7 for target practice.

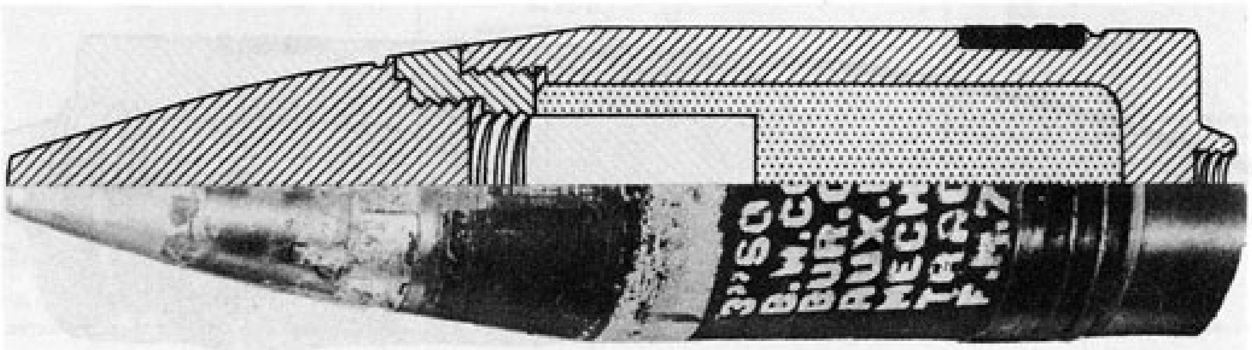


Figure 21. 3-inch A.A. Mk 23 Mods 1—3

3-inch A.A. Mk 23 Mods 1, 2, and 3 (Obsolete)

Guns used in......................3"/50
Over-all length, inches
With nose fuze...................12.13
Without nose fuze..................8.11
Diameter of base, inches...............2.98
Distance base to band, inches..........1.80
Width of band, inches.................0.70
Diameter at bourrelet, inches..........2.98
Filling ....Cast TNT
Weight of filling, pounds..............0.74
Weight of loaded projectile, pounds....13.05
Charge/weight ratio 5.67%
Cartridge Case....Mk 3, Mk 3 Mods 2 and 3
Primer ....Mk 14
Tracer ....Mk 4
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 30 and Mods 1, 2, 3, (P.D.F.)
Mk 51 and Mods (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods or
Mk 46
Mk 54 Mod 0

The Auxiliary Detonating Fuze Mk 54 replaced the Fuzes Mk 17 and Mk 46 in all assemblies. Production of this projectile has been discontinued.

3-inch A.A. Mk 26 Mods 1 and 2

Guns used in......................3"/23
Over-all length, inches
With nose fuze...................12.13
Without nose fuze..................8.11
Diameter of base, inches...............2.97
Distance base to band, inches..........1.80
Width of band, inches.................0.70
Diameter at bourrelet, inches..........2.98
Filling ....Cast TNT
Weight of filling, pounds..............0.74
Weight of loaded projectile, pounds....12.95
Charge/weight ratio 5.71%
Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Tracer ....Mk 4
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 all Mods (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods or
Mk 46
Mk 54 and 0

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and the Mk 46 in all assemblies.

The shape of the 3-inch A.A. Projectile Mk 26 is, for all general purposes, the same as that shown for the Mk 23.

3-inch A.A. Mk 27 Mods 1, 2, and 3

Guns used in . . . . 3"/50
Over-all length, inches
With nose fuze 12.13
Without nose fuze 8.11
Diameter of base, inches 2.98
Distance base to band, inches 1.35
Width of band, inches 1.00
Diameter at bourrelet, inches 2.98
Filling . . . . Cast TNT
Weight of filling, pounds 0.74
Weight of loaded projectile, pounds 13.00
Charge/weight ratio 5.67%
Cartridge case . . . . Mk 7 all Mods, Mk 9 Mod 0
Primer . . . . Mk 14, Mk 14 Mod 1
Tracer . . . . Mk 4
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 30, Mods 1, 2, 3 (P.D.F.)
Mk 51 all Mods (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods
Mk 46
Mk 54 Mod 0

This projectile becomes 3-inch H.C. when the Fuze Mk 30 is substituted for the Mk 22.

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and the Mk 46 in all assemblies.

This projectile's shape is almost exactly similar to that of the Mk 23.

3-inch A.A. Mk 31 Mod 1

Guns used in . . . . 3"/50
Over-all length, inches
With nose fuze 12.22
Without nose fuze 8.50
Diameter of base, inches 2.98
Distance base to band, inches 1.35
Width of band, inches 1.0
Diameter at bourrelet, inches 2.985
Filling . . . . Cast TNT, Comp. A
Weight of filling, pounds 0.54
Weight of loaded projectile, pounds 12.90
Charge/weight ratio 4.1%
Cartride Case . . . . Mk 7, Mk 9
Primer . . . . Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 45 Mod 12 (V.T.F.)
Mk 58 and all Mods (V.T.F.)
Auxiliary Detonating Fuze
Mk 44 Mods 0 and 1

This projectile is specially cavitized to receive V.T. fuzes and their auxiliary detonating fuzes. No other fuzes may be assembled. Since V.T. fuzing is employed, no tracer is assembled; instead, the base is solid, and a special sheet-steel base cover plate is welded on, 0.031 inch thick and 2.50 inches in diameter.

This projectile replaces the original Mk 31 Mod 0, which has been recalled from service use. The Mod 0 was cavitized to receive the V.T. Fuse Mk 45 Mod 11, which differed from the Mod 12 by having a longer stem and has been declared unserviceable.

The V.T. Fuze Mk 58 is currently replacing the Mk 45 Mod 12 in all assemblies.

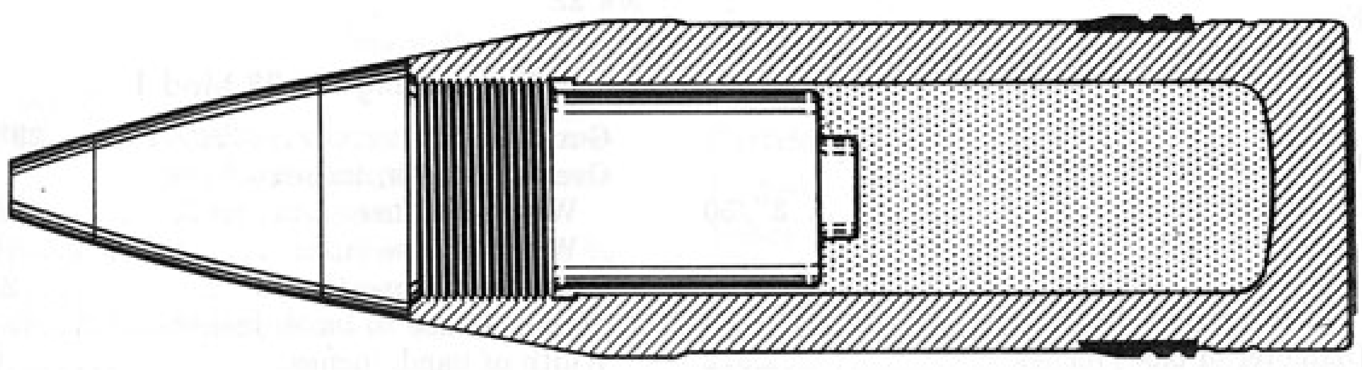


Figure 22. 3–inch A.A. Mk 31 Mod 1

3-inch Illuminating Mk 21 Mods 1, 2, and 3

Guns used in........................3"/50
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.32
Diameter of base, inches..............2.97
Distance base to band, inches............1.8
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98
Filling.....Black powder expelling charge; magnesium flare — Illuminating Contents Mk 3
Weight of filling......Expelling charge, one ounce black powder
Weight of loaded projectile, pounds....13.00
Cartridge Case ....Mk 3 Mods 2 and 3
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 and all Mods (M.T.F.)

3-inch Illuminating Mk 22 Mods 1—5

Guns used in........................3"/23
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.32
Diameter of base, inches..............2.965
Distance base to band, inches...........1.8
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98
Filling......Expelling charge is black powder; flare is magnesium; Illuminating Contents Mk 3
Weight of filling.....Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.00
Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 and all Mods (M.T.F.)

3-inch Illuminating Mk 24 Mod 1

Guns used in........................3"/50
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.35
Diameter of base, inches..............2.972
Distance base to band, inches..........1.80
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98
Filling......Black powder expelling charge; magnesium flare; Illuminating Contents Mk 3
Weight of filling......Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.04
Cartridge Case ....Mk 3, 3–2, or 3–3
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 and all Mods (M.T.F.)

3-inch Illuminating Mk 25 Mod 1

Guns used in........................3"/50
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.35
Diameter of base, inches..............2.962
Distance base to band, inches..........1.35
Width of band, inches..................1.00
Diameter at bourrelet, inches..........2.98
Filling......Expelling charge is black powder; flare is magnesium; Illuminating Contents Mk 3
Weight of filling......Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.07
Cartridge Case ....Mk 7 or Mk 9
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 all Mods (M.T.F.)

Lot numbers 9 through 98 of the Fuze Mk 22 Mods 2 and 3 are authorized for use with Projectile Mk 25 and Mods in the guns Mk 21 and Mk 22.

3-inch Illuminating Mk 28 Mod 1

Guns used in........................3"/23
Over-all length, inches
With nose fuze.................... 7
Without nose fuze..................9.35
Diameter of base, inches..............2.965
Distance base to band, inches...........1.8
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98

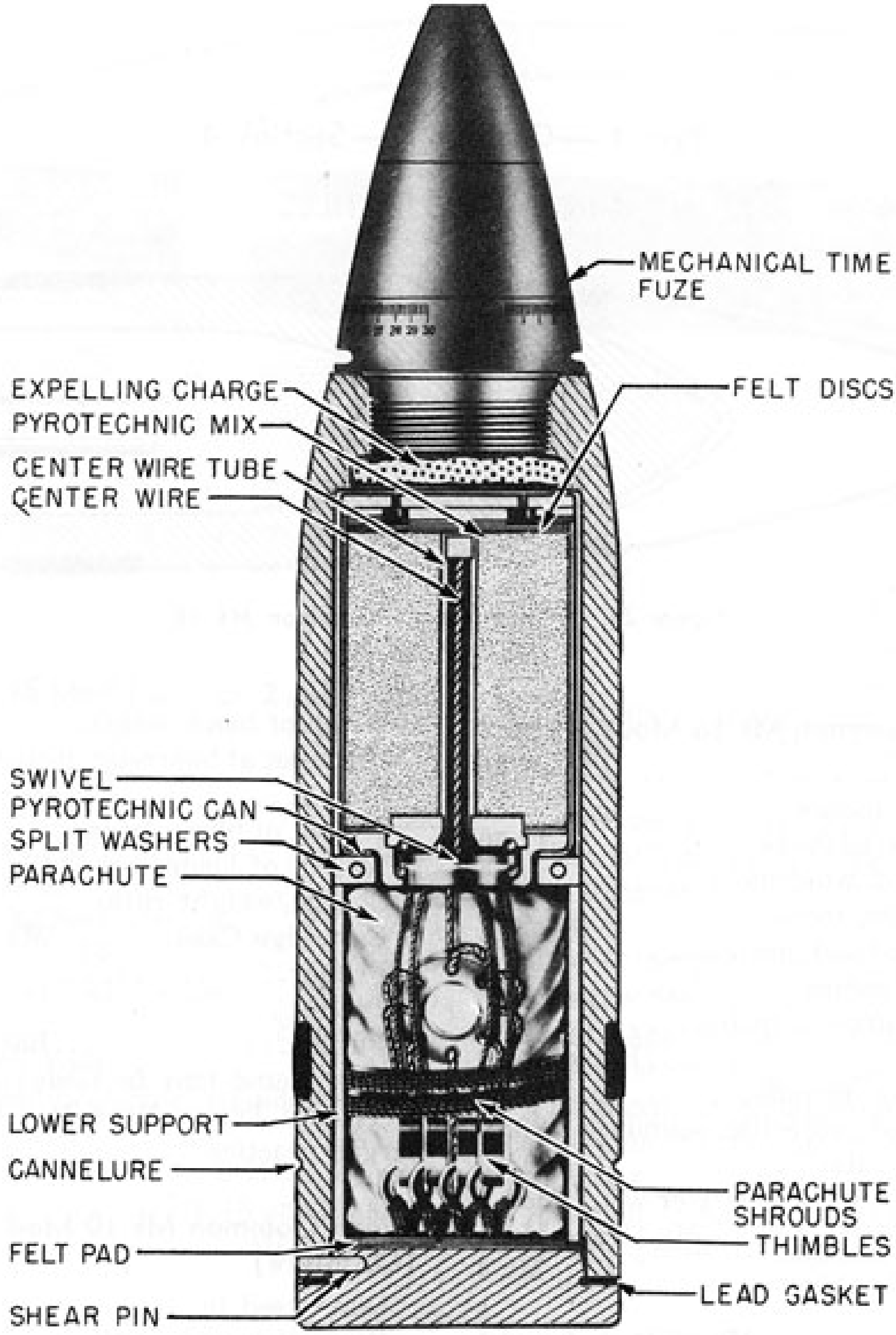


Figure 23. 3–inch Illuminating Mk 28 Mod 1

Filling......Expelling charge is black powder; flare is magnesium; Illuminating Contents Mk 3
Weight of filling......Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.00

Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 all Mods (M.T.F.)

4-INCH PROJECTILES

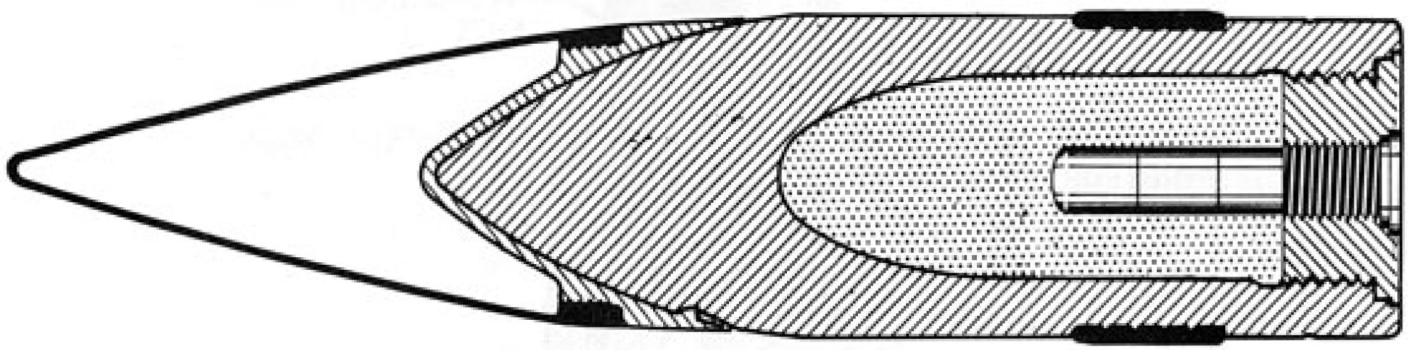


Figure 24. 4–inch Special Common Mk 16 Mods 1 and 2

4-inch Special Common Mk 16 Mods 1 and 2

Guns used in....................4"/50
Over-all length, inches
With cap & windshield..............17.50
Without cap & windshield..........11.42
Diameter of base, inches..............3.96
Distance base to band, inches...........2.25
Width of band, inches..................1.85
Diameter at bourrelet, inches.........3.985
Filling ....Explosive D
Weight of filling, pounds..............1.16
Weight of loaded projectile, pounds....33.00
Charge/weight ratio................3.03%
Cartridge Case..Mk 2 Mod 1 or Mk 2 Mod 4
Primer ....Mk 13 and Mods
Tracer ....Mk 4
Fuzes
Base................Mk 36 Mods 0 and 1
Mk 20 Mods 1 and 2

The Base Fuze Mk 36 is the preferred assembly and is replacing the Mk 20.

This projectile is specially strengthened for extra armor-piercing qualities.

4-inch Common Mk 6 Mod 6 (Obsolete)

Guns used in......................4"/50
Over-all length, inches.................15.8
Diameter of base, inches...............3.96
Distance base to band, inches..........2.90
Width of band, inches.................1.02
Diameter at bourrelet, inches...........3.985
Filling.............Black powder and TNT
Weight of filling, pounds...............1.39
Weight of loaded projectile, pounds.....33.0
Charge/weight ratio 4.21%
Cartridge Case........Mk 2 or Mk 2 Mod 3
Primer..................Mk 13 and Mods
Tracer ....Integral
Fuzes................Base — Mk 10 Mod 4

This round may be issued B.L. & P. or B.L. & T. with Tracer Mk 6 Mod 1 and adapter for target practice.

4-inch Common Mk 10 Mods 1, 2, and 3 (Obsolete)

Guns used in......................4"/50
Over-all length, inches................15.80
Diameter of base, inches..............3.96
Distance base to band, inches..........2.75
Width of band, inches..................1.33
Diameter at bourrelet, inches.........3.985
Filling.............Black powder and TNT
Weight of filling, pounds..............1.39
Weight of loaded projectile, pounds.....33.0
Charge/weight ratio 4.21%
Cartridge Case........Mk 2 or Mk 2 Mod 3
Primer..................Mk 13 and Mods
Tracer ....Integral in fuze

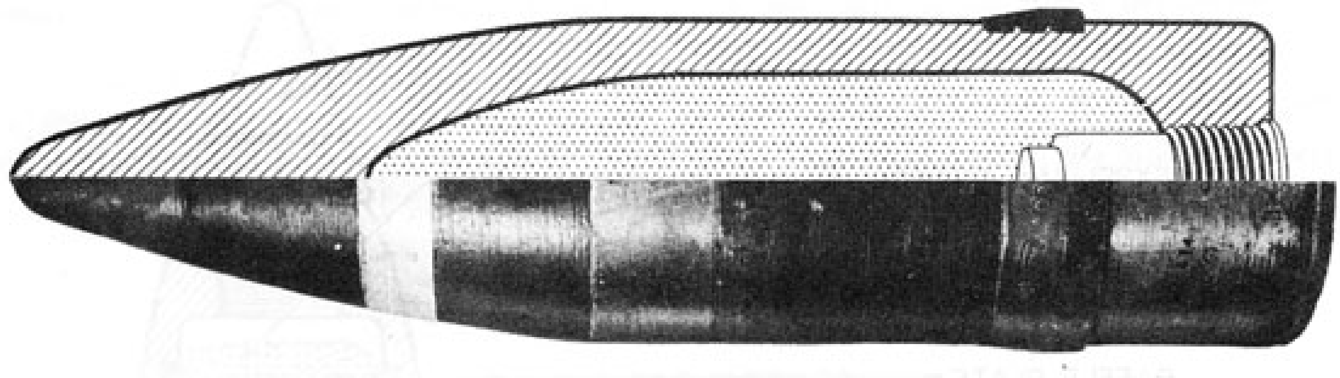


Figure 25. 4–inch Common Mk 10 Mods 1—3

Fuzes.............. Base — Mk 10 Mod 4

For target practice, this round is also issued B.L. & P. or B.L. & T. with adapter and Tracer Mk 6 Mod 1.

4-inch H.C. Mk 15 Mod 1 and Ex-2 and Ex-2-1

Guns used in	4"/50
Overall length, inches	
With nose fuze	18.00
Without nose fuze	14.28
Diameter of base, inches	3.96
Distance base to band, inches	2.25
Width of band, inches	1.85
Diameter at bourrelet, inches	3.985
Filling	Explosive D
Weight of filling, pounds	2.71
Weight of loaded projectile, pounds	33.00
Charge/weight ratio	8.21%
Cartridge Case	Mk 2 Mods 1 and 4
Primer	Mk 13 and all Mods
Tracer	Mk 4 or Mk 9

Fuzes

Base......... Mk 31 or Mk 28 (B.D.F.)

Nose......... Mk 30 Mods 1, 2, 3 (P.D.F.)
Mk 22 Mods 1–5 (M.T.F.)
Steel nose plug
Mk 51 and all Mods (M.T.F.)

Auxiliary Detonating Fuze
Mk 17 or Mk 46
Mk 54 Mod 0

The Base Fuze Mk 31 is preferred for this projectile. The Tracer Mk 4 is used with the Base Fuze Mk 31; the Mk 9, with the Fuze Mk 28.

The 4"/50 Ex-2 and Ex-2-1 are identical to Projectile Mk 15 except they are one pound heavier. Approximately 18,000 of the Ex projectiles were manufactured and issued.

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and the Mk 46 fuzes in all assemblies.

Assembly of the Nose Fuze Mk 22 (M.T.F.) with this projectile has stopped.

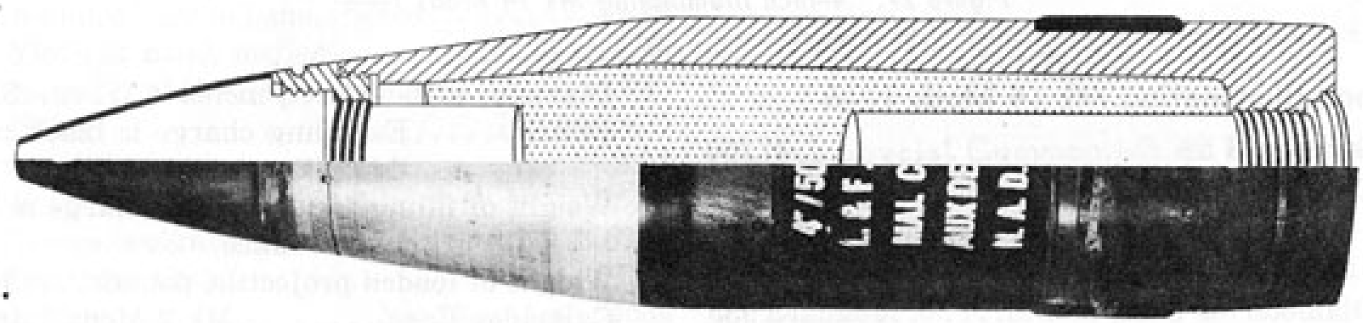


Figure 26. 4–inch H.C. Mk 15 Mod 1

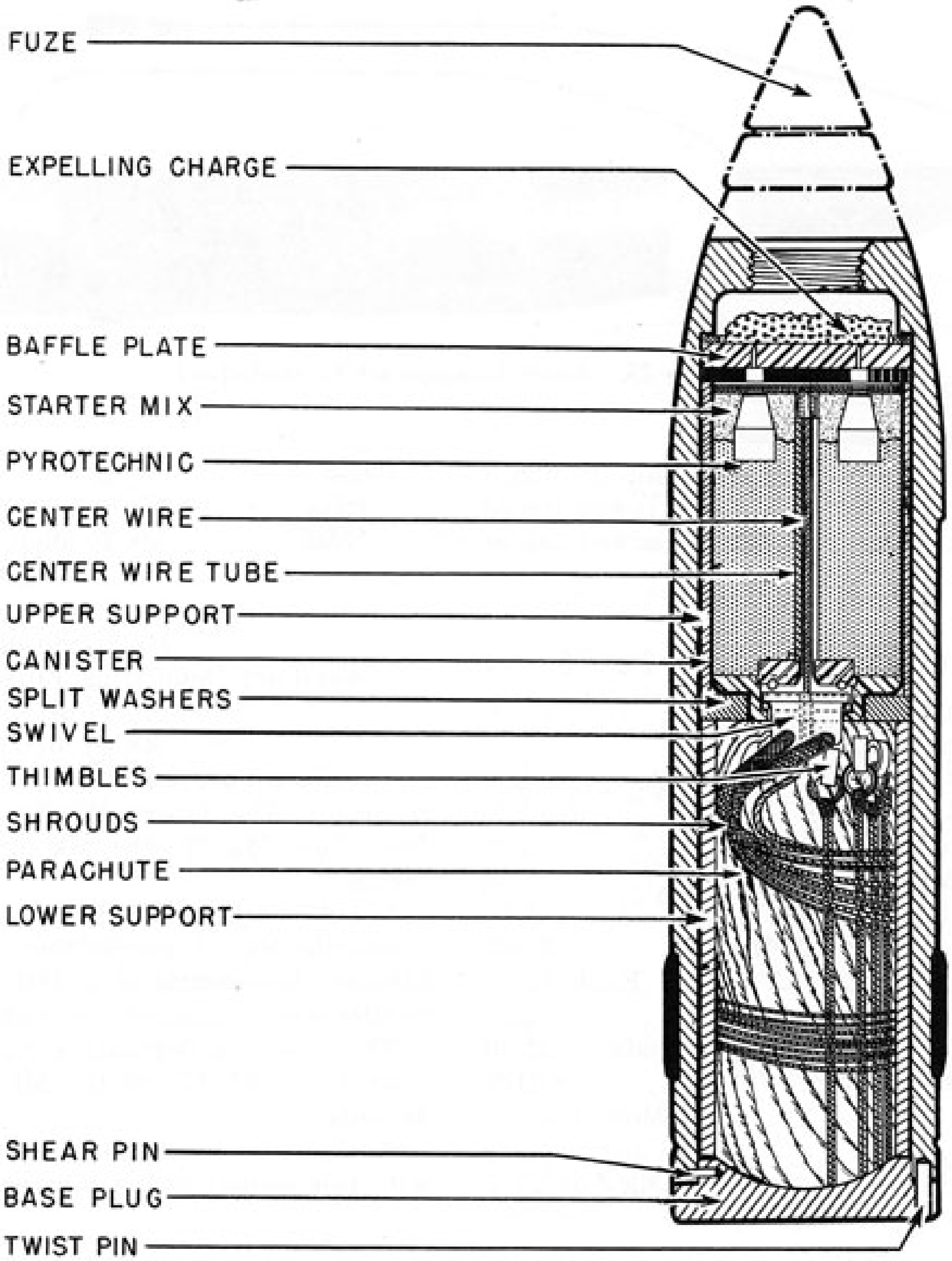


Figure 27. 4-inch Illuminating Mk 14 Mods 1—6

4-inch Illuminating Mk 14 Mods 1—6

Guns used in........................4"/50
Over-all length, inches
With nose fuze...................18.40
Without nose fuze.................14.92
Diameter of base, inches.............3.933
Distance base to band, inches..........2.25
Width of band, inches................1.85
Diameter at bourrelet, inches.........3.985
Filling......Expelling charge is black powder; flare, magnesium
Weight of filling....Expelling charge is 1.25 ounce
Weight of loaded projectile, pounds....34.66
Cartridge Case.........Mk 2 Mods 1 and 4
Primer................Mk 13 and all Mods
Tracer ....None

Fuzes..............Mk 18 Mods 2, 3, and 4
Mk 50 all Mods
Mk 63 Mod 0

The Fuze Mk 18 may be used in all Mods of this projectile; the Fuzes Mk 50 and Mk 63 are used only in the Mod 6 projectile.

Illuminating Contents Mk 3 are used in projectiles Mods 1–5; the Illuminating Contents Mk 4 Mod 4 are used in the Mod 6 projectile.

Part I — Chapter I — Section 4

5-INCH PROJECTILES

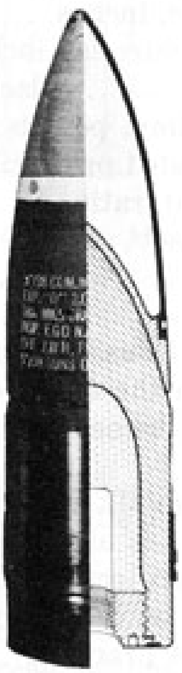


Figure 28. 5–inch Special Common Mk 38 Mods 1—3

5-inch Special Common Mk 38 Mods I, 2, and 3

Guns used in........................5″/38
Over-all length, inches.................20.7
Diameter of base, inches.............4.985
Distance base to band, inches...........2.43
Width of band, inches..................2.25
Diameter at bourrelet, inches..........4.985
Filling ....Explosive D
Weight of filling, pounds..............2.04
Weight of loaded projectile, pounds....55.18
Charge/weight ratio................3.69%
Cartridge Case ....Mk 5
Primer.................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes..........Base — Mk 20 and all Mods

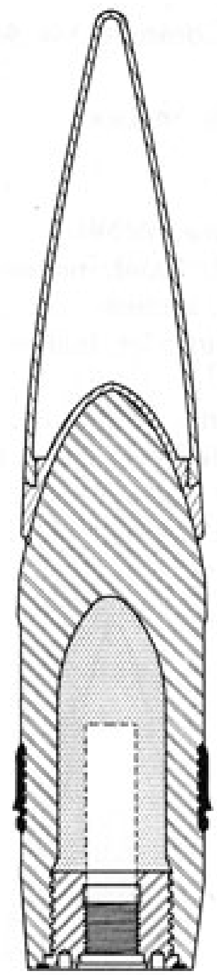


Figure 29. 5–inch Special Common Mk 42 Mods 0 and 1

5-inch Special Common Mk 42 Mods 0 and I

Guns used in........................5″/54
Over-all length, inches.................26.0
Without windshield 15.605
Diameter of base, inches..............4.26
Distance base to band, inches..........3.75
Width of band, inches.................2.25

Diameter at bourrelet, inches 4.985
Filling . . . . Explosive D
Weight of filling, pounds 2.14
Weight of loaded projectile, pounds 70
Charge/weight ratio 3.06%
Cartridge Case . . . . Mk 6
Primer . . . . Mk 13 and all Mods
Tracer . . . . Mk 5 (probably)
Fuzes . . . . Base — Mk 64 Mod 0

The Tracer Mk 9 may possibly be used in this projectile, although the Mk 5 is the preferred assembly.

5-inch Special Common Mk 46 Mods 1 and 2

Guns used in . . . . 5″/38
Over-all length, inches
With cap 20.70
Without cap 12.485
Diameter of base, inches 4.985
Distance base to band, inches 2.43
Width of band, inches 2.25
Diameter at bourrelet, inches 4.985
Filling . . . . Explosive D
Weight of filling, pounds 2.04
Weight of loaded projectile, pounds 55.18
Charge/weight ratio 3.69%
Cartridge Case . . . . Mk 5

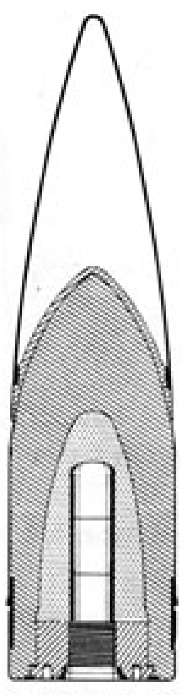


Figure 30. 5–inch Special Common Mk 46 Mods 1 and 2

Primer . . . . Mk 13 and all Mods
Tracer . . . . Mk 9
Fuzes . . . . Base — Mk 20 Mods 0–2

5-inch Common Mk 15 Mods 12—14

(All but Mod 14 are obsolete.)
Guns used in . . . . 5″/50 (bag)
5″/51 (bag)
5″/51 (case)
Over-all length, inches 17.0
Diameter of base, inches 4.96
Distance base to band, inches 0.65
Width of band, inches 1.67
Diameter at bourrelet, inches 4.985
Filling . . . . Black powder and TNT
Weight of filling, pounds 1.70
Weight of loaded projectile, pounds 50.0
Charge/weight ratio 3.46%
Cartridge Case . . . . Bag gun
Primer . . . . Mk 15 Mod 1
Tracer . . . . Integral in fuze
Fuzes . . . . Base — Mk 10 Mod 4 (B.I.F.)

When used in the 5″/51 case gun, Cartridge Case Mk 3 and Primer Mk 13 and all Mods are employed.

The Base Fuze Mk 10 Mod 9 may be used if the Mk 10 Mod 4 is unavailable.

The Mod 14 projectile may be issued B.L. & P. or B.L. & T. with adapter and Tracer Mk 6 Mod 1 for target practice.

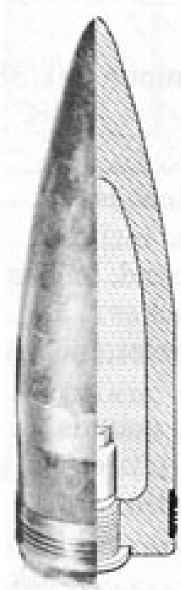


Figure 31. 5–inch Common Mk 15 Mods 12 and 14

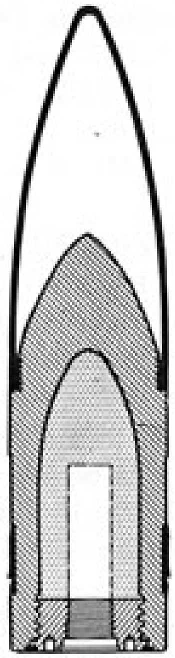


Figure 32. 5–inch Common Mk 32 Mods 1—4

5-inch Common Mk 32 Mods 1—4

Guns used in....................5"/38
Over-all length, inches
  With cap & windshield..............20.7
  Without cap & windshield...........13.6
Diameter of base, inches.............4.973
Distance base to band, inches..........2.43
Width of band, inches..................2.25
Diameter at bourrelet, inches.........4.985
Filling ....Explosive D
Weight of filling, pounds..............2.58
Weight of loaded projectile, pounds....54.00
Charge/weight ratio....................5.0%
Cartridge Case ....Mk 5
Primer..................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes..........Base — Mk 20 and all Mods

5-inch H.C. Mk 39 Mods 1 and 2

Guns used in.......................5"/51
Bag or case gun
Over-all length, inches
  With nose fuze......................17.0
  Without nose fuze...................13.18
Diameter of base, inches..............4.985
Distance base to band, inches...........1.15
Width of band, inches....................2.0
Diameter at bourrelet, inches..........4.985
Filling ....Explosive D
Weight of filling, pounds...............3.65
Weight of loaded projectile, pounds.....50.0
Charge/weight ratio.....................7.0%
Cartridge Case....................Bag gun
Primer......................Mk 15 Mod 1
Tracer.......................Mk 5 Mod 1
Fuzes
  Base.....Mk 28 and Mods
  Nose.....Mk 29 Mods 2 and 3 (P.D.F.)
    Mk 18 Mods 2, 3, and 4 (M.T.F.)
    Mk 50 and all Mods (M.T.F.)
    Mk 63 Mod 0 (M.T.F.)
    Steel Nose Plug
  Auxiliary Detonating Fuze
    Mk 17 and Mods
    Mk 46 Mod 0
    Mk 54 Mod 0 and 1

Only a very few 5"/51 guns are in service in the fleet.

When employed in the 5"/51 case gun, Cartridge Case Mk 3 and Primer Mk 13 and all Mods are used.

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and Mk 46 in all assemblies.

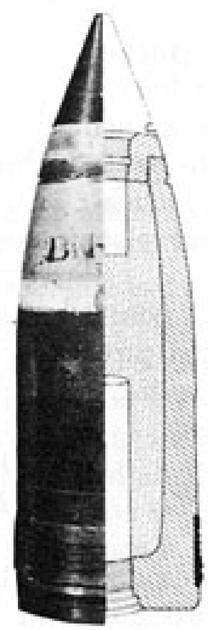


Figure 33. 5–inch H.C. Mk 39 Mods 1 and 2

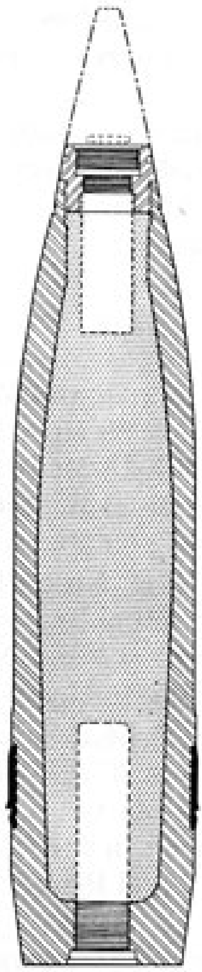


Figure 34. 5–inch H.C. Mk 41 Mod 0

5-inch H.C. Mk 41 Mod 0

Guns used in....................... 5"/54
Over-all length, inches................ 26.0
  Without nose fuze................. 22.28
Diameter of base, inches.............. 4.26
Distance base to band, inches.......... 3.75
Width of band, inches................. 2.25
Diameter at bourrelet, inches......... 4.985
Filling .... Explosive D
Weight of filling, pounds............... 7.59
Weight of loaded projectile, pounds...... 70
Charge/weight ratio............... 10.84%
Cartridge Case .... Mk 6
Primer................. Mk 13 and all Mods
Tracer.................. Mk 9 (probably)
Fuzes
  Base....... Mk 28 and all Mods
  Nose....... Mk 25 Mod 1 (M.T.F.)
    Mk 30 Mods 2 and 3 (P.D.F.)
    Mk 59 Mod 0 (V.T.F.)

Auxiliary Detonating Fuze
  Mk 43 Mod 1
  Mk 44 Mods 0 and 1

The Tracer Mk 5 may be used in this projectile, although the Mk 9 is the preferred assembly.

When the V.T. Fuze Mk 59 is employed, the projectile adapter is removed, and no base fuze or tracer is employed. The base is closed by a gas-checked base-fuze plug.

When the V.T. Fuze Mk 59 is used in this projectile, the Auxiliary Detonating Fuze Mk 44 is used instead of the Mk 43. With all other types of nose fuzing, the Auxiliary Detonator Mk 43 is employed.

5-inch A.A. Common Mk 28 Mod 9 (Obsolete)

Guns used in....................... 5"/25
Over-all length, inches
  With nose fuze.................... 20.70
  Without nose fuze................ 16.945
Diameter of base, inches............. 4.973
Distance base to band, inches.......... 2.43
Width of band, inches.................. 2.0
Diameter at bourrelet, inches......... 4.985
Filling.................. Exp. D, Comp. A
Weight of filling, pounds.............. 7.33

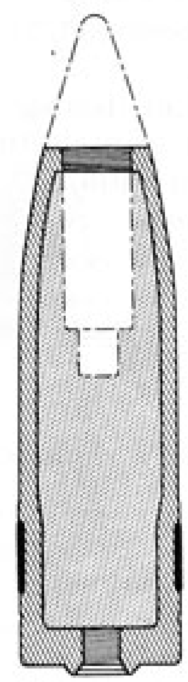


Figure 35. 5–inch A.A. Common Mk 28 Mod 9

Weight of loaded projectile, pounds.....51.7
Charge/weight ratio................14.0%
Cartridge Case......................Mk 4
Primer...............Mk 13 and all Mods
Tracer ....None
Fuzes
Nose............Mk 32 all Mods (V.T.F.)
Mk 40 all Mods (V.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods
Mk 46 Mod 0
Mk 54 Mod 0

This projectile is fuzed with V.T. fuzes only. The projectile adapter is removed, and a gas-checked base plug is inserted. No tracer or base fuze is used with this projectile.

The Fuze Mk 40 and Mods is currently replacing the Mk 32 and Mods in all assemblies. The Auxiliary Detonating Fuze Mk 54 is replacing the Fuzes Mk 17 and Mk 46 in all assemblies.

This round is also issued B.L. & P. or B.L. & T. with the Tracer Mk 6 and adapter, or a cut-off Base Fuze Mk 13 for target practice.

5-inch A.A. Common Mk 31 Mods 1—11

Guns used in.......................5"/38
Over-all length, inches
With nose fuze.....................20.7
Without nose fuze................16.625
Diameter of base, inches...............4.97
Distance base to band, inches..........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches..........4.985
Filling...................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....55.12
Charge/weight ratio...............13.33%
Cartridge Case ....Mk 5
Primer ....Mk 13 and all Mods
Tracer ....None
Fuzes
Nose........Mk 32 and all Mods (V.T.F.)
Mk 40 and all Mods (V.T.F.)
Mk 53 and all Mods (V.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 44 Mod 0 and 1
Mk 46 Mod 0
Mk 54 Mod 0 and 1

The Mk 31 projectile was originally designed to receive the Base Fuze Mk 13, which is now obsolete. The projectile will now be found fitted only with V.T. fuzes and a plug in the base.

The Nose Fuze Mk 40 is replacing the Mk 32 and Mods. With these fuzes, the projectile adapter will be removed, and the Auxiliary Detonating Fuze Mk 54 will be employed, replacing the previously used Auxiliary Detonating Fuzes Mk 17 and Mk 46.

When the V.T. Fuze Mk 53 is used, the projectile adapter is removed and the Auxiliary Detonating Fuze Mk 44 employed.

This projectile is also issued B.L. & P. or B.L. & T. with an adapter and the Tracer Mk 6, or Cut-off Base Fuze Mk 13, for target practice.

5-inch A.A. Common Mk 34 Mod 10

Guns used in.......................5"/38
Over-all length, inches
With nose fuze.....................20.7
Without nose fuze..................17.2
Diameter of base, inches..............4.97
Distance base to band, inches..........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches.........4.985
Filling...................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....55.18
Charge/weight ratio 13.33%
Cartridge Case......................Mk 5
Primer................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes
Base.....Mk 28 and all Mods
Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 Mods 0–4 (M.T.F.)
Mk 29 Mods 2 and 3 (P.D.F.)
Mk 32 and all Mods (V.T.F.)
Mk 40 and all Mods (V.T.F.)
Mk 63 Mod 0 (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 46 Mod 0
Mk 54 Mods 0 and 1

This projectile consists of a Projectile Mk 31 Mod 10 modified to receive a Base Fuze Mk 28.

The Auxiliary Detonating Fuze Mk 54 is replacing the Auxiliary Detonating Fuzes Mk 17 and Mk 46 in all assemblies.

The V.T. Fuze Mk 40 and its Mods are replacing the Mk 32 and Mods. When these fuzes are used in this projectile, no base fuze or tracer is employed. The projectile adapter is removed, and a gas-checked fuze-hole plug is fitted in the base.

5-inch A.A. Common Mk 35 Mods 1—12

Guns used in.................5"/38 (case)
5"/51 (bag)

Over-all length, inches
With nose fuze....................20.70
Without nose fuze................17.225

Diameter of base, inches..............4.973

Distance base to band, inches..........2.43

Width of band, inches.................2.25

Diameter at bourrelet, inches.........4.985

Filling...................Exp. D, Comp. A

Weight of filling, pounds..............7.25

Weight of loaded projectile, pounds....55.18

Charge/weight ratio 13.1%

Cartridge Case ....Mk 5

Primer................Mk 13 and all Mods

Tracer ....Mk 9

Fuzes
Base.....Mk 28 and all Mods
Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 and all Mods (M.T.F.)
Mk 61 Mod 0 (M.T.F.) (See below.)
Mk 29 Mods 2 and 3 (P.D.F.)
Mk 32 and all Mods (V.T.F.)
Mk 40 and all Mods (V.T.F.)
Mk 53 and all Mods (V.T.F.)
Mk 63 Mod 0 (M.T.F.)

Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 44 Mods 0 and 1
Mk 46 Mod 0
Mk 54 Mods 0 and 1

The Nose Fuze Mk 40 is replacing the Mk 32 when used in the 5"/38 gun. With the 5"/51 bag gun, however, Nose Fuze Mk 32 Mod 40, rather than the Nose Fuze Mk 40, is employed. When these fuzes are used, the projectile adapter is removed, a gas-checked base fuze plug, with no tracer, is fitted into the base, and

Figure 36. 5–inch A.A. Common Mk 35 Mods 1—12

the Auxiliary Detonating Fuze Mk 54 is employed.

When the V.T. Fuze Mk 53 is used, the base is fitted with a gas-checked base-fuze plug, with no tracer, the projectile adapter is removed, and the Auxiliary Detonating Fuze Mk 44 is employed.

The Auxiliary Detonating Fuze Mk 54 is replacing the Fuzes Mk 17 and Mk 46 in all assemblies.

With the 1200 f/s I.V. reduced charge for the 5"/38 gun, Nose Fuzes Mk 61 and Mk 29 Mods 2 and 3 with the Auxiliary Detonating Fuze Mk 54 will be employed.

All Mods of this projectile, except Mod 6, may be issued B.L. & P. or B.L. & T. with the Tracer Mk 9 and adapter for target practice.

When these projectiles are used in the 5"/51 bag gun, the Primer Mk 15 Mod 1 is used.

5-inch A.A. Common Mk 36 Mods 1—4

Guns used in.......................5"/25

Over-all length, inches
With nose fuze....................20.70
Without nose fuze................17.225

Diameter of base....................4.973

Distance base to band, inches...........2.43

Width of band, inches.................2.00

Diameter at bourrelet, inches..........4.985
Filling....................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....53.85
Charge/weight ratio 13.5%
Cartridge Case...........Mk 4, Mk 4 Mod 2
Primer.................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes
  Base.....Mk 28 and all Mods
  Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
    Mk 50 and all Mods (M.T.F.)
    Mk 29 Mods 1, 2, and 3 (P.D.F.)
    Mk 32 and all Mods (V.T.F.)
    Mk 40 and all Mods (V.T.F.)
    Mk 53 and all Mods (V.T.F.)
    Mk 63 Mod 0 (M.T.F.)
  Auxiliary Detonating Fuze
    Mk 17 and all Mods
    Mk 46 Mod 0
    Mk 44 Mod 0 and 1
    Mk 54 Mod 0

When the V.T. fuzes are used, the projectile adapter is removed, and a gas-checked base-fuze plug, with no tracer, is fitted into the base.

V.T. fuzes are authorized for use in Mods 2–4 only of this projectile.

The Auxiliary Detonating Fuze Mk 54 is replacing the Auxiliary Detonating Fuzes Mk 17 and the Mk 46. The Auxiliary Detonating Fuze Mk 44 is used only in conjunction with the V.T. Fuze Mk 53.

All Mods of the Projectile Mk 36 are authorized for use with A.P. steel nose caps and for designation as "H.C." projectiles.

All Mods of the Projectile Mk 36 may also be issued B.L. & P. or B.L. & T. with the Tracer Mk 9 and adapter for target practice.

5-inch A.A. Common Mk 47 Mods 0 and 1

Guns used in........................5"/38
Over-all length, inches
  With nose fuze.....................20.70
  Without nose fuze..................52.43
Diameter of base, inches.............4.985
Distance base to band, inches..........1.93
Width of band, inches.................2.25
Diameter at bourrelet, inches..........4.985
Filling ....Explosive D
Weight of filling, pounds..............7.11
Weight of loaded projectile, pounds....55.18
Charge/weight ratio 7.7%
Cartridge Case ....Mk 5
Primer....................Mk 13, all Mods
Tracer ....Mk 9
Fuzes.....................Same as Mk 35

The Mod 1 differs from the Mod 0 in that the band seat has different knurling.

Only a few thousand of these A.A. Common Projectiles Mk 47 were made.

The Mk 47 was made to furnish a heavier projectile for some newer light-weight fuzes, hence maintaining a standard ballistic weight. However, it has been fuzed exactly like the Mk 35 up to the present time.

5-inch Illuminating Mk 25
(a) Mods 1, 3, 4, 5, 6
(b) Mod 2 (Obsolete)

Guns used in......(a) 5"/51 (bag or case)
  (b) 5"/25 (case)
Over-all length, inches
  With nose fuze...................19.975
  Without nose fuze................15.865
Diameter of base, inches..............4.948
Distance base to band, inches...........2.43
Width of band, inches..................2.0
Diameter at bourrelet, inches.........4.985
Filling.......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....54.5
Cartridge Case ...... (a) Mk 3
  (b) Mk 4, Mk 4 Mod 3
Primer.................Mk 13 and all Mods
Fuzes
  Nose..............Mk 18 Mods 2, 3, and 4
    Mk 50 and all Mods
    Mk 63 Mod 0

The Mod 2 projectile, used in the 5"/25 gun, is identical to the Mod 1, except for modification of the rotating band.

When these projectiles are used in the 5"/51 bag gun, the Primer Mk 15 Mod 1 is used, and the Nose Fuzes Mk 50 and Mk 63 may be employed.

Use of the Nose Fuzes Mk 50 and Mk 63 is not authorized with rounds used in the 5"/25 and 5"/51 case guns.

The Illuminating Contents Mk 3 are used with projectiles Mods 1 through 4; projectiles Mods 5 and 6 are assembled with Illuminating Contents Mk 4 Mod 5 when used in the 5"/51 bag gun, Illuminating Contents Mk 3 when used in the 51"/51 case gun.

5-inch Illuminating and 5-inch W.P. Mk 27 Mods 1—10

Guns used in........................5"/25
Over-all length, inches
With nose fuze 20.0
Without nose fuze..................15.8
Diameter of base, inches..............4.968
Distance base to band, inches..........1.93
Width of band, inches..................2.00
Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile
53.65 pounds — Mods 1–4
54.50 pounds — Mods 5–10
Cartridge Case ....Mk 4, Mk 4 Mod 2
Primer................Mk 13 and all Mods
Fuzes
Nose................Mk 63 Mod 0
Mk 18 Mods 2, 3, 4
Mk 50 and all Mods

Mods 1, 2, 3, 4 have a band diameter of 5.10 inches, and Mods 5, 6, 7, 8, 9, and 10 have a band diameter of 5.12 inches.

The Illuminating Contents Mk 4 Mod 5 are used in this projectile.

The 5-inch W.P. projectile utilizes the Mk 27 body with incendiary contents.

5-inch Illuminating Mk 30 Mods 1—8

Guns used in........................5"/38
Over-all length, inches
With nose fuze.....................20.0
Without nose fuze..................15.8
Diameter of base, inches..............4.968
Distance base to band, inches..........2.43
Width of band, inches..................2.25

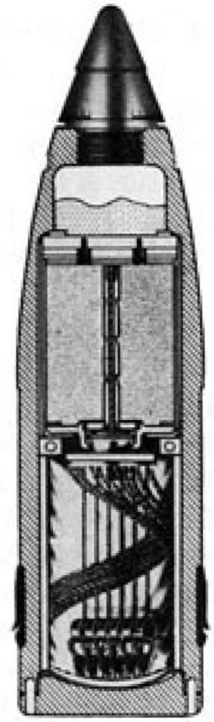


Figure 37. 5-inch Illuminating Mk 30 Mods 1—8

Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....54.5
Cartridge Case ....Mk 5
Primer ....Mk 13 and all Mods
Fuzes
Nose................Mk 63 Mod 0
Mk 18 Mods 2, 3, 4
Mk 50 and all Mods

The Illuminating Contents Mk 4 Mod 5 are used in this projectile.

5-inch Illuminating Mk 43 Mod 0

Guns used in........................5"/54
Over-all length, inches................26.0
Without nose fuze..................22.28
Diameter of base, inches..............4.973
Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds......70
Cartridge Case ....Mk 6

Primer................Mk 13 and all Mods
Fuzes.................Nose—Mk 25 Mod 1

The Illuminating Contents Mk 4 Mod 5 are used in this projectile, modified to use a lengthened spacer sleeve.

This projectile is identical to the 5-inch Illuminating Projectile Mk 48, except that the latter has a double rotating band.

5-inch Illuminating Mk 44 Mod 1

Guns used in......................5"/38
Over-all length, inches
With nose fuze....................19.97
Without nose fuze................16.465
Diameter of base, inches.............4.973
Distance base to band, inches...........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches.........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....54.5
Cartridge Case ....Mk 5
Primer................Mk 13 and all Mods
Fuzes
Nose.............Mk 18 Mods 2, 3, and 4
Mk 50 Mods 0–4
Mk 63 Mod 0

This projectile is currently assembled with the Illuminating Contents Mk 4 Mod 5

5-inch Illuminating and 5-inch W.P. Mk 45 Mod 0

Guns used in......................5"/25
Over-all length, inches
With nose fuze....................19.97
Without nose fuze................16.465
Diameter of base, inches.............4.968
Distance base to band, inches..........1.93
Width of band, inches..................2.0
Diameter at bourrelet, inches.........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....54.5
Cartridge Case..........Mk 4, Mk 4 Mod 2
Primer................Mk 13 and all Mods
Fuzes
Nose.............Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Mk 63 Mod 0

This projectile is loaded with the Illuminating Contents Mk 4 Mod 5.

The W.P. projectile uses the body of the Mk 45 and the incendiary contents of the W.P. shell.

5-inch Illuminating Mk 48 Mod 0

Guns used in......................5"/54
Over-all length, inches................26.0
Without nose fuze.................22.28
Diameter of base, inches..............4.973
Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.

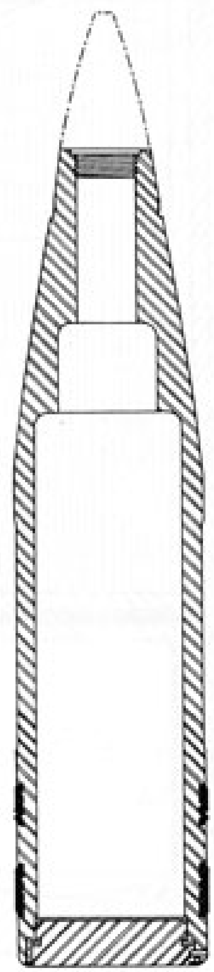


Figure 38. 5–inch Illuminating Mk 48 Mod 0

Weight of loaded projectile, pounds......70
Cartridge Case.......................Mk 6
Primer..................Mk 13 and all Mods
Fuzes..................Nose—Mk 25 Mod 1

The Illuminating Contents Mk 4 Mod 5 are used, modified for a lengthened spacer sleeve.

The projectile is identical in all respects to the Mk 43, except that it has a double rotating band.

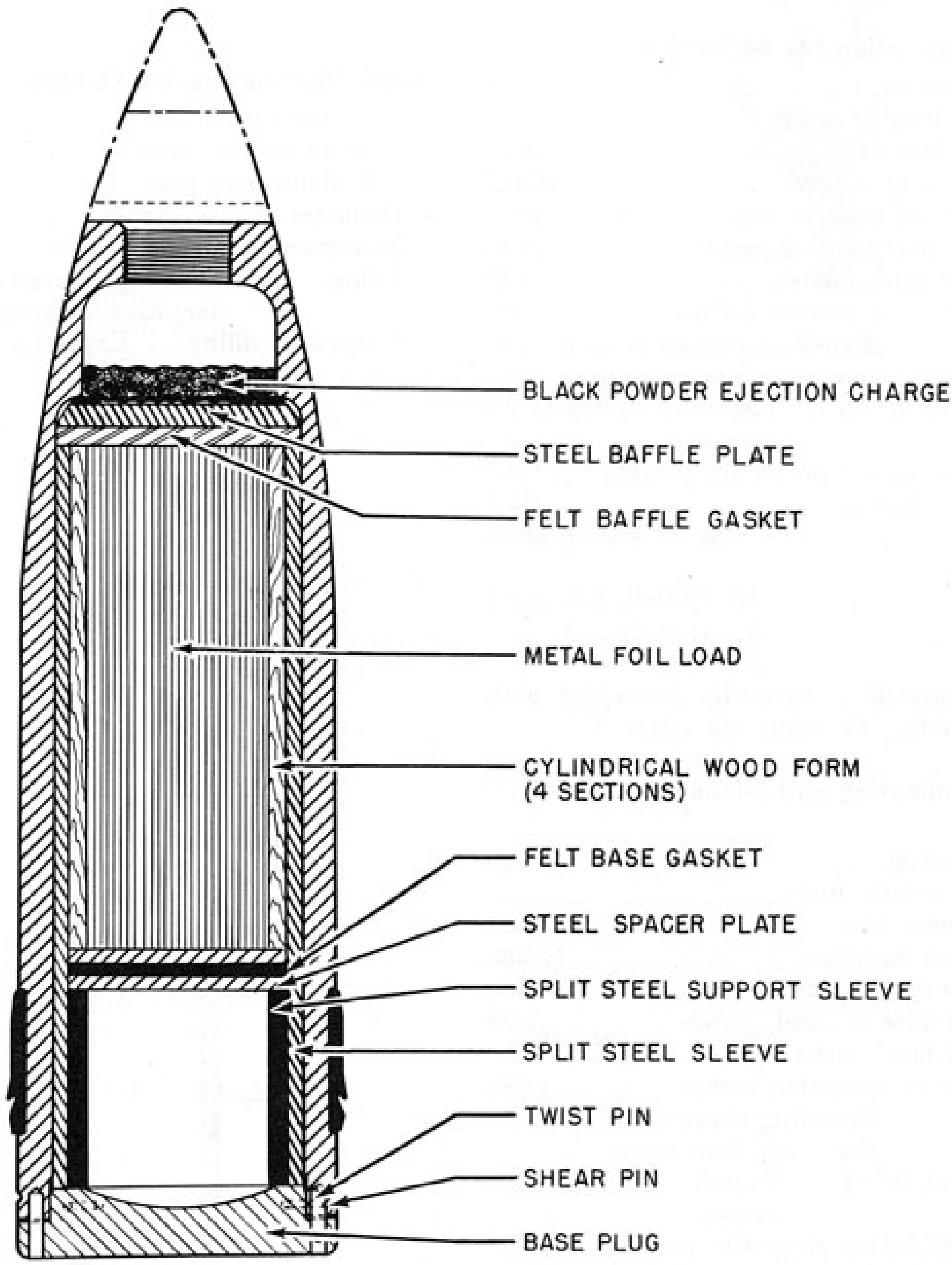


Figure 39. 5-inch Window Projectile—Window Load Mk 1 Mod 1

5-inch Window Projectile

Guns used in........................5"/38
Over-all length, inches
  With nose fuze....................20.0
  Without nose fuze..................15.8
Diameter of base, inches..............4.968
Distance base to band, inches..........2.43
Width of band, inches..................2.25
Diameter at bourrelet, inches..........4.985

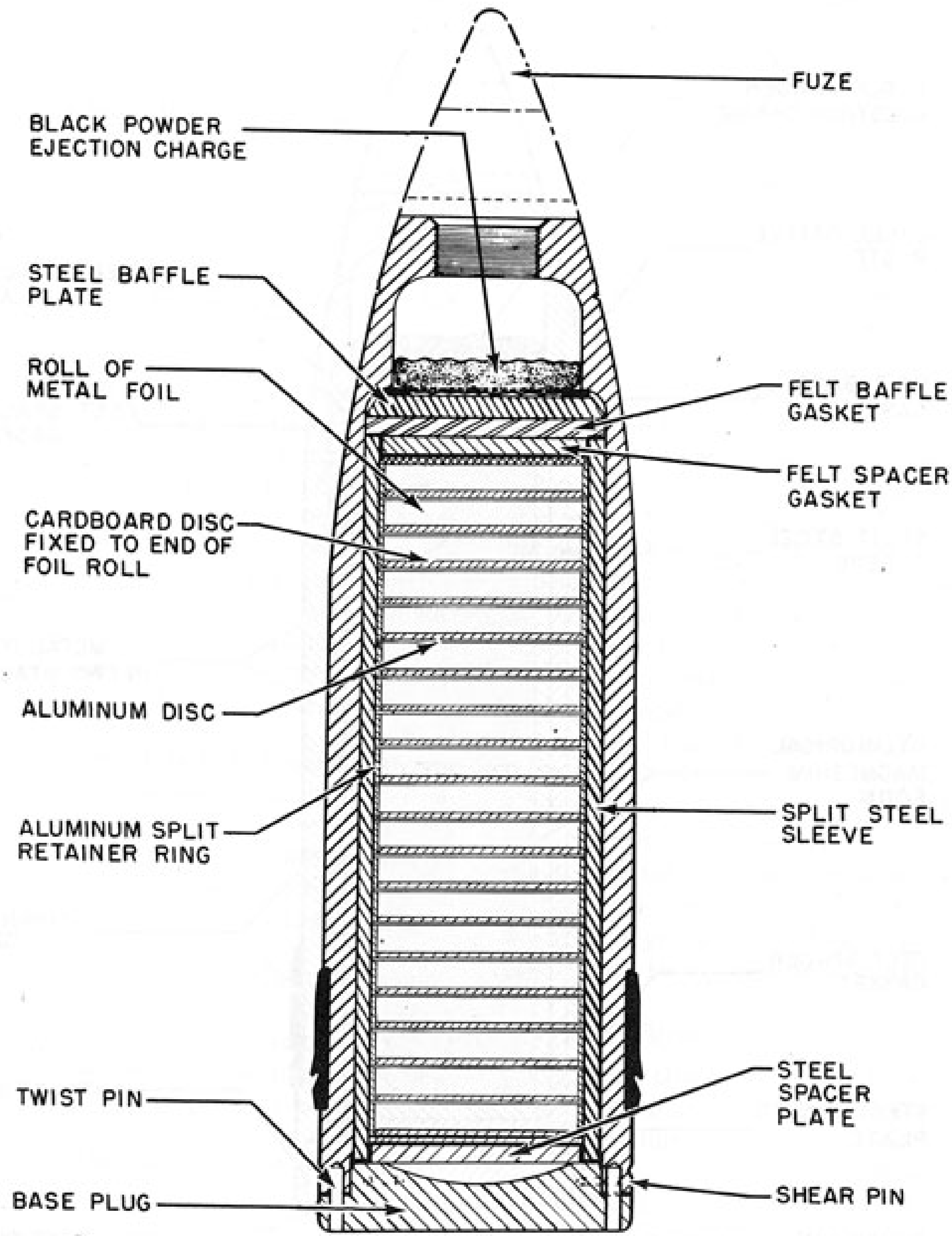


Figure 40. Window Load Mk 2 Mod 0

Filling ......Expelling charge is black powder; flare, magnesium.

Weight of filling....Expelling charge is 2.5 ounces.

Weight of loaded projectile, pounds
Load Mk 1 Mod 1—53.9 (approx.)
Load Mk 2 Mod 0—54.6 (approx.)
Load Mk 4 Mod 0—53.0 (approx.)

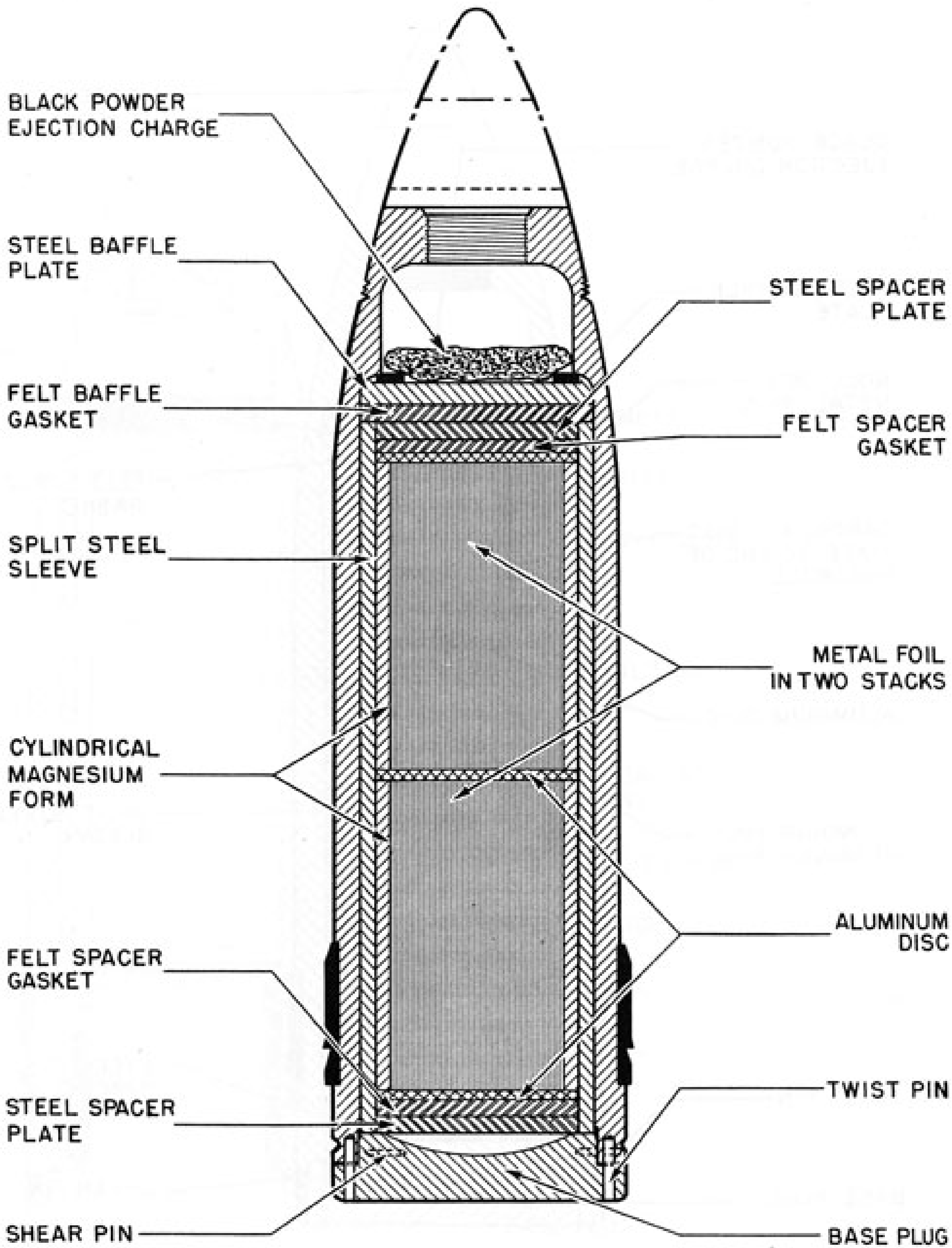


Figure 41. Window Load Mk 4 Mod 0

Cartridge Case........................Mk 5
Primer................Mk 13 and all Mods
Fuzes
Nose..............Mk 63 Mod 0
Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Projectile Body
5-inch Ill. Mk 30 Mods 5, 7, and 8
5-inch Ill. Mk 44 Mod 1

Window Load Mk 1 Mod 1: Consists of about 13,800 aluminum foil strips, each 8 inches long, 3/16 inch wide, and 0.00035 inch thick, backed on either side by 12 pounds of tissue paper, solid glued. The strips are stacked within a four-section cylindrical wood form, which is encased in a split steel sleeve, the whole inserted into the projectile cavity.

Window Load Mk 2 Mod 0: Consists of 19 rolls of aluminum foil stacked within a split steel sleeve. Each roll contains continuous foil 600 feet long, ½ inch wide, and 0.0009 inch thick. One end of the foil is attached to a cardboard disc by a rayon leader 15 feet long, insuring streaming out of the foil roll. The foil rolls, with their cardboard discs, are each encased in a split retainer ring, forming a load unit. The units are separated by aluminum discs when loaded in the split steel sleeve.

Window Load Mk 4 Mod 0: Consists of two stacks of 13,800 aluminum foil strips, each stack separated by an aluminum disc. Each strip is 5.1 inches long by 3/16 in. wide. The strips are stacked within two four-section cylindrical magnesium forms, which are encased in a split steel sleeve.

Operation: The explosion of the black powder ejection charge, initiated by the fuze, exerts a pressure against the baffle plate and forces the split steel sleeve, window load, and base plug out of the base end of the projectile.

5-inch White Phosphorus Smoke Projectile

Guns used in........................5″/38
Over-all length, inches
With nose fuze......................20.0
Without nose fuze...................15.8
Diameter of base, inches.............4.968
Distance base to band, inches...........2.43
Width of band, inches..................2.25
Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....53.0
Cartridge Case.......................Mk 5
Primer.................Mk 13 and all Mods
Fuzes
Nose......Mk 63 Mod 0 (M.T.F.)
Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 and Mods (M.T.F.)
Mk 29 Mod 3 (P.D.F.)
Mk 61 Mod 0 (M.T.F.)—for use with 1,200 f/s initial velocity reduced charge
Mk 66 Mod 0 (P.D.F.)
Projectile Body
5-inch Illuminating Mk 30 Mods 1–8

The projectile body, base plate, and expelling charge are the same as those for the 5-inch Illuminating Projectile Mk 30.

The canister holding the W.P. filled tubes is of 0.03-inch thick sheet steel and measures 12.03 inches long by 3.9 inches in diameter. It is painted olive drab over all. Through the center of the canister is inserted a burster tube containing the ballistite burster charge, with a black powder delay fitted to the upper end of the tube. The canister is divided into four sections internally, with each section containing 42 W.P. filled steel tubes 0.5 inch in diameter and 2.86 inches long, 168 tubes in all. The canister is filled through the base with molten W.P. and closed with two ½-inch pipe plugs.

Type of Filling

Expelling charge......2 ounces black powder
Bursting charge.........14 grams Ballistite
Smoke filling.............7.06 pounds white phosphorus

The black powder expelling charge, ignited by the fuze, initiates the delay element at the upper end of the burster tube and forces off the base plate, ejecting the canister rearward. The delay initiates the burster, which ruptures the canister and scatters the W.P. filled steel tubes. The smoke cloud thus formed is about 30–40 yards in diameter. The projectile combines screening, anti-personnel, and slight incendiary effect.

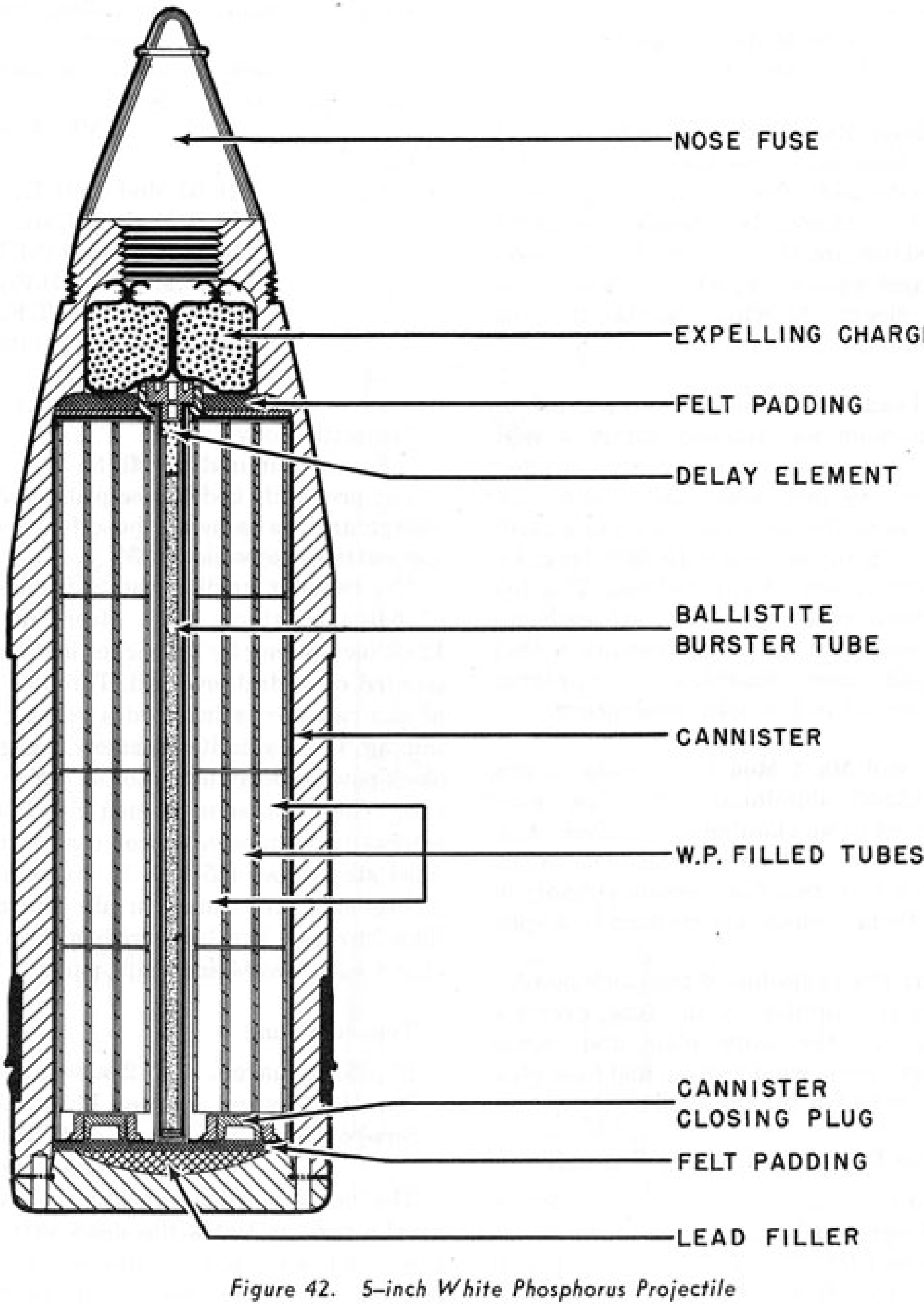


Figure 42. 5–inch White Phosphorus Projectile

6-INCH PROJECTILES

6-inch A.P. Mk 35 Mods 1—11

Guns used in.................6"/47 (case)
Over-all length, inches
  With cap and windshield............27.0
  Without cap and windshield........17.19
Diameter of base, inches..............5.985
Distance base to band, inches..........1.55
Width of band, inches................2.50
Diameter at bourrelet, inches.........5.985
Filling.....................Explosive D
Weight of filling, pounds..............1.95
Weight of loaded projectile, pounds.....130
Charge/weight ratio 1.5%
Cartridge Case ....Mk 4
Primer................Mk 13 and all Mods
Tracer ....Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

6-inch Special Common Mk 27 Mods 1—8

Guns used in........................6"/53
Over-all length, inches
  With cap and windshield............27.0
  Without cap and windshield.........15.95
Diameter of base, inches..............5.985
Distance base to band, inches..........1.55
Width of band, inches.................2.50
Diameter at bourrelet, inches.........5.985
Filling.......................Explosive D
Weight of filling, pounds..............2.20
Weight of loaded projectile, pounds......105
Charge/weight ratio 2.1%
Primer......................Mk 15 Mod 1
Tracer ....Mk 5
Fuzes..........Base—Mk 19 Mods 0 and 1

The 6-inch Special Common Projectiles Mk 27 Mods 2 and 5 have 2.50 pounds of explosive, rather than the 2.20 pounds contained in the other Mods.

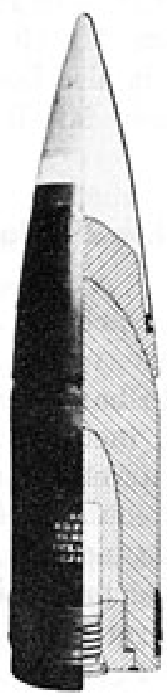


Figure 43. 6–inch A.P. Mk 35 Mods 1—8

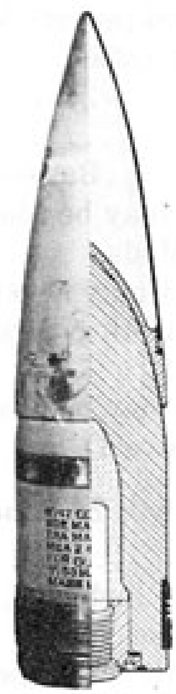


Figure 44. 6–inch Special Common Mk 27 Mods 1—8

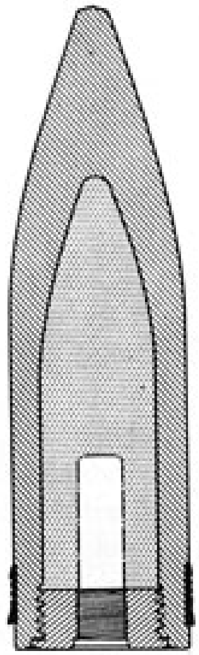


Figure 45. 6-inch Common Mk 20 Mods 0—4

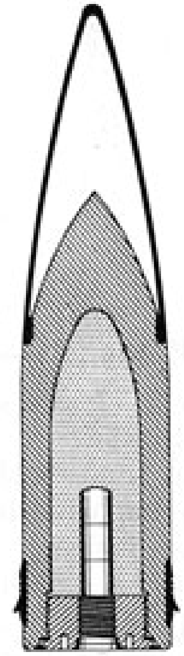


Figure 46. 6-inch Common Mk 24 Mod 1

6-inch Common Mk 20 Mods 0—4 (Obsolete)

Guns used in....................6"/50
Over-all length, inches...............22.70
Diameter of base, inches...............5.94
Distance base to band, inches...........1.0
Width of band, inches.................2.0
Diameter at bourrelet, inches..........5.985
Filling......................Explosive D
Weight of filling, pounds..............7.08
Weight of loaded projectile, pounds......105
Charge/weight ratio 5.97%
Primer.....................Mk 15 Mod 1
Tracer ....Mk 5
Fuzes...........Base—Mk 28 and all Mods

This projectile may be found fuzed with Base Fuze Mk 3 and Mods.

Mods 0, 2, and 4 may also be issued B.L. & T. with adapter and Mk 5 Mod 1 Tracer for target practice.

This projectile may be found loaded with 6.25 pounds of Explosive D.

6-inch Common Mk 24 Mods 1—5

Guns used in.......................6"/53
Over-all length, inches................27.0
Diameter of base, inches.............5.985
Distance base to band, inches...........1.0
Width of band, inches.................2.50
Diameter at bourrelet, inches..........5.985
Filling ....Explosive D
Weight of filling, pounds..............5.73
Weight of loaded projectile, pounds.....105
Charge/weight ratio 5.46%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes..........Base—Mk 19 Mods 0 and 1

This projectile is reserved for submarines.

This projectile may be fuzed with Base Fuzes Mk 3 and Mods. It is to be reloaded and refuzed with the Base Fuze Mk 19.

This projectile is also issued B.L. & T. with adapter and Tracer Mk 5 Mod 1 for target practice.

6-inch Common Mk 28 Mods 1 and 2

Guns used in.................6"/47 (bag)
Over-all length, inches................27.0
Diameter of base, inches.............5.985
Distance base to band, inches..........1.55
Width of band, inches................2.50
Diameter at bourrelet, inches.........5.985
Filling ....Explosive D
Weight of filling, pounds.............5.72
Weight of loaded projectile, pounds.....105
Charge/weight ratio 5.45%
Primer ....Mk 15 Mod 1
Tracer...........................Mk 5
Fuzes ....Base—Mk 19 Mods 0 and 1

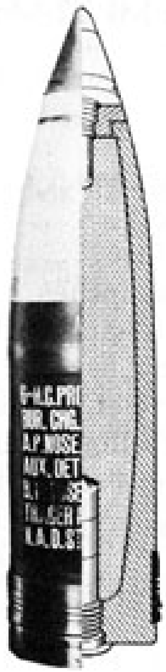


Figure 47. 6–inch H.C. Mk 34 Mods 1—7

6-inch H.C. Mk 34 Mods 1—7

Guns used in . . . . 6″/47 (case)
6″/53 (bag)

Over-all length, inches
- With nose fuze 27.045
- Without nose fuze 22.225

Diameter of base, inches 5.985
Distance base to band, inches 1.55
Width of band, inches 2.50
Diameter at bourrelet, inches 5.985
Filling . . . . Explosive D
Weight of filling, pounds 13.22
Weight of loaded projectile, pounds 105
Charge/weight ratio 12.6%
Cartridge Case . . . . Mk 4
Primer . . . . Mk 13 and all Mods
Tracer . . . . Mk 5, Mk 5 Mod 1

Fuzes
- Base . . . . . . Mk 28 Mods 0 and 1
- Nose . . . . . . Mk 29 Mods 2 and 3 (P.D.F.)
  - Steel nose plug
  - Mk 18 Mods 2, 3, and 4 (M.T.F.)
  - Mk 50 and all Mods (M.T.F.)
  - Mk 63 Mod 0 (M.T.F.)
  - Mk 47 Mod 0 (V.T.F.)
- Auxiliary Detonating Fuze
  - Mk 17 and all Mods
  - Mk 46 Mod 0
  - Mk 54 Mods 0 and 1
  - Mk 44 Mods 0 and 1

A nose cap may be threaded to the projectile body over the nose fuze for moisture-proofing purposes.

When this projectile is used in the 6″/53 bag gun, the Primer Mk 15 Mod 1 is used.

The Auxiliary Detonating Fuze Mk 54 is replacing the Auxiliary Detonating Fuzes Mk 17 and Mk 46 in all assemblies.

A specially cavitized Mk 34 round, designed for use in the 6″/47 gun only, is being produced for assembly with the V.T. Fuze Mk 47. When this fuze is used, the Base Fuze Mk 28 is also employed, without tracer. This feature differs from other V.T. fuzed projectiles, which take no base fuze. The Auxiliary Detonating Fuze Mk 44 will be used only in conjunction with the V.T. Fuze Mk 47.

6-inch H.C., W.P., Illuminating, and Window Mk 39 Mod 0

Guns used in . . . . 6″/47 Dual-purpose

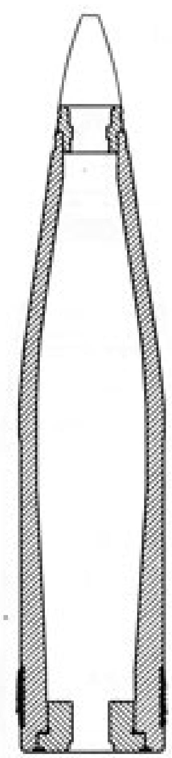


Figure 48. 6–inch H.C. W.P., Illuminating, and Window Mk 39 Mod 0

Over-all length, inches
With nose fuze 30
Without nose fuze.................26.28
Diameter of base, inches...............5.985
Distance base to band, inches...........1.00
Width of band, inches..................2.5
Diameter at bourrelet, inches.........5.985
Filling ....Explosive D
Weight of filling, pounds..............14.09
Weight of loaded projectile, pounds......105
Cartridge Case ....Mk 4
Primer.....................Mk 13, all Mods
Tracer.................Mk 5, Mods 0 and 1
Fuzes
Base .....Mk 28 Mods 0 and 1
Nose.....Mk 25 (M.T.F.)
Mk 30 (P.D.F.)
Mk 47 (V.T.F.)
Auxiliary Detonating Fuze
Mk 43
Mk 44 (with V.T.F.)

This is the H.C. round designed for the new 6"/47 dual-purpose gun. It is a half-caliber longer than the 6-inch H.C. Projectile Mk 34, and will be adaptable for loading of H.C., W.P., Illuminating, or Window fillers.

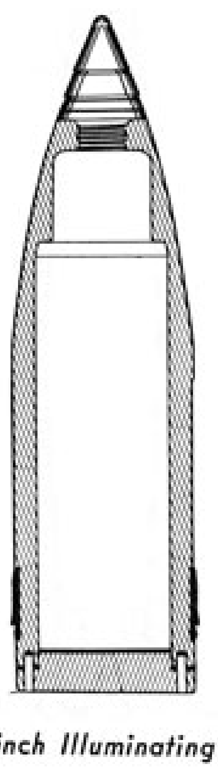


Figure 49. 6–inch Illuminating Mk 22 Mod 1

6-inch Illuminating Mk 22 Mod 1 (Obsolete)

Guns used in ....6"/47 (bag)
6"/50 (bag)
6"/53 (bag)
Over-all length, inches
With nose fuze 23.027
Without nose fuze................18.697
Diameter of base, inches..............5.94
Distance—base to band, inches.........2.35
Width of band, inches.................2.50
Diameter at bourrelet, inches..........5.985
Filling ......Expelling charge of black powder; flare, magnesium.
Weight of filling....Expelling charge is 3.5 ounces.
Weight of loaded projectile, pounds....95.40
Primer ....Mk 15 Mod 1
Fuzes
Nose .....Mk 63 Mod 0
Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods

The Nose Fuze Mk 50 is authorized for assembly in this projectile only when used in the 6"/53 bag gun.

The Illuminating Contents Mk 3 are used in this round.

6-inch Illuminating Mk 23 Mods 1 and 2

Guns used in ....6"/47 (bag)
6"/50 (bag)
6"/53 (bag)
Over-all length, inches
With nose fuze 23.027
Without nose fuze................18.697
Diameter of base, inches..............5.94
Distance base to band, inches..........2.35
Width of band, inches.................2.50
Diameter at bourrelet, inches.........5.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 3.5 ounces.
Weight of loaded projectile, pounds.....96.0
Primer ....Mk 15 Mod 1
Fuzes
Nose .....Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Mk 63 Mod 0

The Nose Fuzes Mk 50 and Mk 63 are authorized for assembly in this projectile only when used in the 6″/53 bag gun.

The Illuminating Contents Mk 3 are used.

6-inch Illuminating Mk 32 Mod 0

Guns used in.................6″/47 (case)
Over-all length, inches
  With nose fuze 23.027
  Without nose fuze 19.517
Diameter of base, inches.............5.94
Distance base to band, inches...........2.05
Width of band, inches.................2.50
Diameter at bourrelet, inches........5.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 3.5 ounces.
Weight of loaded projectile, pounds.....94.5
Cartridge Case ....Mk 4
Primer ....Mk 13 and all Mods
Fuzes
  Nose.....Mk 18 Mods 2, 3, and 4
    Mk 50 and all Mods
    Mk 63 Mod 0

The Illuminating Contents Mk 4 Mod 6 are used in this projectile.

6-inch Illuminating Mk 38 Mod 0

Guns used in.................6″/47 (case)
Over-all length, inches
  With nose fuze.....................26.7
  Without nose fuze 23.225
Diameter of base, inches.............5.975
Distance base to band, inches...........1.0
Width of band, inches.................2.50
Diameter at bourrelet, inches.........5.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of loaded projectile, pounds.....105
Cartridge Case ....Mk 4
Primer ....Mk 13 and all Mods
Fuzes
  Nose.....Mk 18 Mods 2, 3, and 4
    Mk 50 and all Mods
    Mk 63 Mod 0

This projectile was made to provide an illuminating projectile similar in ballistic traits to the 6″ H.C. Projectile Mk 34.

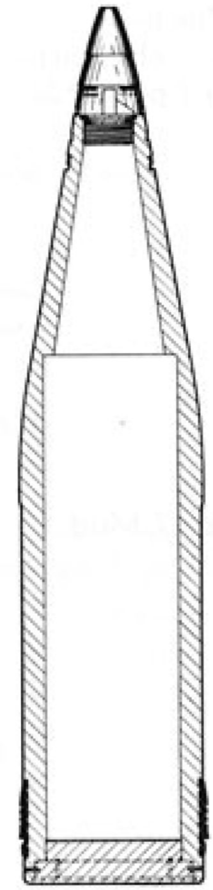


Figure 50. 6–inch Illuminating Mk 41 Mod 0

6-inch Illuminating Mk 41 Mod 0

Guns used in ....6″/47 Dual-purpose
Over-all length, inches 30.00
  Without nose fuze.................26.28
Diameter of base, inches.............5.975
Distance base to band, inches...........1.00
Width of band, inches.................2.50
Diameter at bourrelet, inches.........5.985
Type of filling..Black powder ejection charge
Weight of filling, ounces................2.5
Weight of loaded projectile, pounds....110.0
Cartridge Case ....Mk 4
Primer ....Mk 13, all Mods
Fuzes..............Nose—Mk 25 (M.T.F.)

The Illuminating Contents Mk 4 Mod 6 are used in this projectile.

6-inch Target Mk 36 Mods 1, 2, and 3

Guns used in.................6″/47 (case)
Over-all length, inches..................27
Diameter of base, inches.............5.985
Distance base to band, inches...........1.0

Width of band, inches....................2.5
Diameter at bourrelet, inches..........5.985
Weight of loaded projectile, pounds.....130
Cartridge Case.........................Mk 4
Primer..................Mk 13 and all Mods
Tracer........................Mk 5 Mod 1

This projectile has no spotting dye loaded in the windshield.

The different modifications are to distinguish between manufacturers.

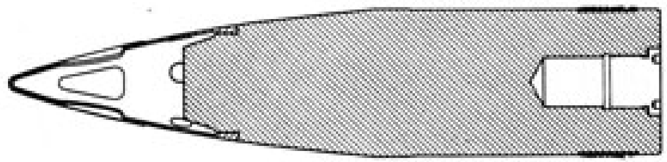


Figure 51. 6–inch Target Mk 37 Mod 1

6-inch Target Mk 37 Mod I

The only difference between this projectile and the 6-inch Mk 36 target round is that the Mk 37 has provision for a spotting dye load.

Part I — Chapter I — Section 6

7-INCH PROJECTILES

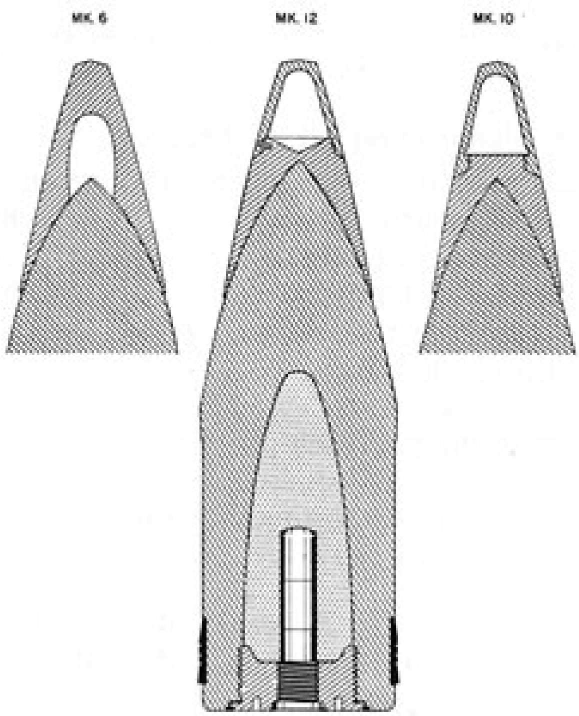


Figure 52. 7–inch A.P. Mks 6, 10, and 12

7-inch A.P. Mk 6 Mod I (Obsolete)

Guns used in........................7"/45
Over-all length, inches
With cap & Windshield.............23.64
Without cap & windshield..........19.79
Diameter of base, inches..............6.94
Distance base to band, inches............1.0
Width of band, inches................2.33
Diameter at bourrelet, inches..........6.99
Filling.......................Explosive D
Weight of filling, pounds...............4.31
Weight of loaded projectile, pounds.....165
Charge/weight ratio................2.61%
Primer......................Mk 15 Mod 1
Tracer..............Integral in fuze; Mk 5
Fuzes
Base.......Mk 2 Mod 2 (B.I.F.)
Mk 9 (B.I.F.)
Mk 21 Mods 0 and 1 (B.D.F.)

The 7"/45 gun is obsolete. This is an old type projectile, without windshield, which is not in common use.

7-inch A.P. Mk 10 Mod 2 (Obsolete)

Guns used in . . . . 7"/45
Over-all length, inches 23.73
Diameter of base, inches 6.94
Distance base to band, inch 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.99
Filling . . . . Explosive D
Weight of filling, pounds 4.31
Weight of loaded projectile, pounds 165
Charge/weight ratio 2.61%
Primer . . . . Mk 15 Mod 1
Tracer . . . . Integral in fuze; Mk 5
Fuzes
  Base . . . . Mk 2 Mod 2 (B.I.F.)
    Mk 9 (B.I.F.)
    Mk 21 Mods 0 and 1 (B.D.F.)

7-inch A.P. Mk 12 Mods 1 and 2 (Obsolete)

Guns used in . . . . 7"/45
Over-all length, inches 23.68
Diameter of base, inches 6.94
Distance base to band, inches 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.985
Filling . . . . Explosive D
Weight of filling, pounds . . . . Mk 1—4.0
  Mk 2—3.5
Weight of loaded projectile, pounds 165
Primer . . . . Mk 15 Mod 1
Tracer . . . . Integral in fuze; Mk 5
Fuzes
  Base . . . . Mk 2 Mod 2 (B.I.F.)
    Mk 9 (B.I.F.)
    Mk 21 Mods 0 and 1 (B.D.F.)

7-inch Field Mk 13 Mods 1 and 2 (Obsolete)

Guns used in . . . . 7"/45
Over-all length, inches
  With nose fuze 29.58
  Without nose fuze 28.0
Diameter of base, inches 6.94
Distance base to band, inches 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.985
Filling . . . . Cast TNT
Weight of filling, pounds 24
Weight of loaded projectile, pounds 152
Charge/weight ratio 15.1%
Primer . . . . Mk 15 Mod 1
Fuzes . . . . Nose—Mk 7 Mod 1 (P.D.F.)

7-inch Bombardment Mk 14 Mod 2 (Obsolete)

Guns used in . . . . 7"/45
Over-all length, inches
  With nose fuze 28.84
  Without nose fuze 24.80
Diameter of base, inches 6.94
Distance base to band, inches 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.985
Filling . . . . Cast TNT
Weight of filling, pounds 24
Weight of loaded projectile, pounds 153.8
Charge/weight ratio 15.6%
Primer . . . . Mk 15 Mod 1
Tracer . . . . Mk 9
Fuzes
  Nose . . . . Mk 7 Mod 1 (P.D.F.)
  Base . . . . Mk 3 Mod 2
    Mk 28 Mods 0 and 1

The bombardment projectile's shape is similar to that of the field projectile.

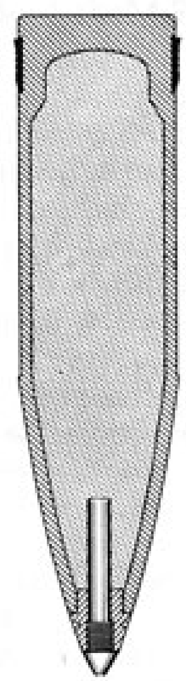


Figure 53. 7–inch Field Mk 13 Mods 1 and 2

8-INCH PROJECTILES

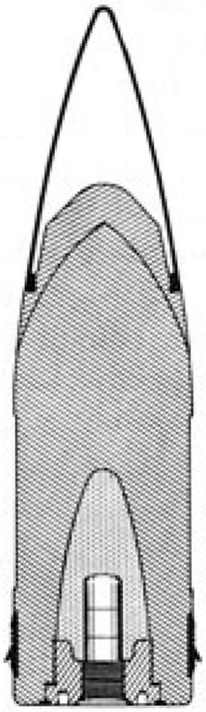


Figure 54. 8–inch A.P. Mk 19 Mods 1—6

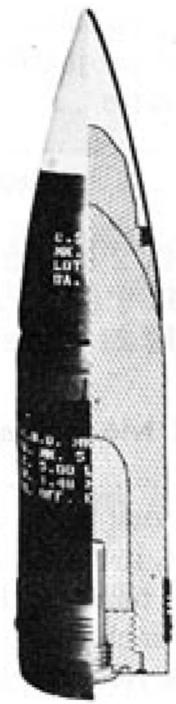


Figure 55. 8–inch A.P. Mk 21 Mods 1—5

8-inch A.P. Mk 19 Mods 1—6

Guns used in........................8″/55
Over-all length, inches
With cap and windshield.............36.0
Without cap and windshield..........19.4
Diameter of base, inches.............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds...............3.64
Weight of loaded projectile, pounds.....260
Charge/weight ratio 1.4%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base..................Mk 21 Mod 0 and 1
Mk 23 Mod 0

Base Fuze Mk 21 is preferred. Mk 23 to be used only when Mk 21 is not available.

8-inch A.P. Mk 21 Mods 1—5

Guns used in........................8″/55
Over-all length, inches
With cap and windshield.............36.0
Without cap and windshield..........24.5
Diameter of base, inches.............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds...............5.03
Weight of loaded projectile, pounds.....335
Charge/weight ratio.................1.5%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base................Mk 21 Mods 0 and 1
Mk 23 Mod 0

Base Fuze Mk 21 is preferred. Mk 23 to be used only when Mk 21 is not available.

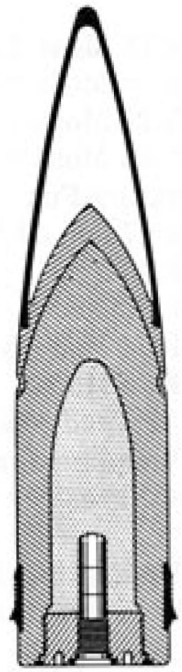


Figure 56. 8–inch Special Common Mk 17 Mods 1—4

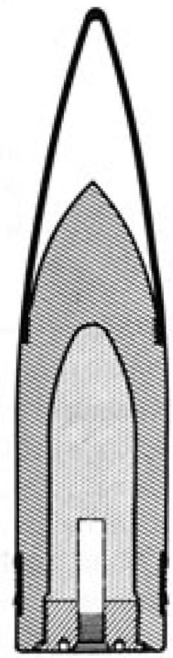


Figure 57. 8–inch Common Mk 14 Mod 1

8-inch Special Common Mk 17 Mods 1—4

Guns used in........................8"/55
Over-all length, inches.................36.0
Diameter of base, inches..............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds............10.38
Weight of loaded projectile, pounds.....260
Charge/weight ratio.................3.99%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base................Mk 21 Mods 0 and 1
Mk 23 Mod 0

The Base Fuze Mk 21 is preferable for this projectile. Several have also been fuzed with the Base Fuze Mk 28 on account of a lack of sufficient H.C. projectiles.

8-inch Common Mk 14 Mod 1

Guns used in........................8"/55
Over-all length, inches
With cap and windshield.............36.0
Without cap and windshield.........26.19
Diameter of base, inches..............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches..........7.977
Filling ....Explosive D
Weight of filling, pounds.............10.91
Weight of loaded projectile, pounds.....260
Charge/weight ratio 4.4%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base................Mk 21 Mods 0 and 1
Mk 23 Mod 0

The Base Fuze Mk 23 is used only when the Mk 21 is not available.

8-inch Common Mk 15 Mod 1

Guns used in........................8"/55
Over-all length, inches
With cap and windshield..............36.0
Without cap and windshield.........26.19
Diameter of base, inches..............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds.............11.46
Weight of loaded projectile, pounds.....260
Charge/weight ratio 4.4%

Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base ....Mk 21 Mods 0 and 1
Mk 23 Mod 0

The Base Fuze Mk 23 is used only when the Mk 21 is not available.

8-inch H.C. Mk 24 Mods 1—5

Guns used in......................8″/55
Over-all length, inches
With nose fuze....................34.56
Without nose fuze.................31.08
Diameter of base, inches..............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds............21.34
Weight of loaded projectile, pounds.....260
Charge/weight ratio 8.21%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5 Mod 1
Fuzes
Base .....Mk 28 and all Mods
Mk 39 Mods 0 and 1
Mk 48 Mods 0 and 1
Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 Mods 0–3 (M.T.F.)
Mk 29 Mods 1, 2, and 3 (P.D.F.)
Mk 63 Mods 0 (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 46 Mod 0
Mk 35 Mod 0
Mk 54 Mod 0 and 1
Mk 55 Mod 0

Base Fuze Mk 48 (and Mods) is the current and preferred assembly for this projectile; however, the Base Fuzes Mk 39 or Mk 28 may be used.

The Auxiliary Detonating Fuze Mk 55 is the preferred assembly in this projectile.

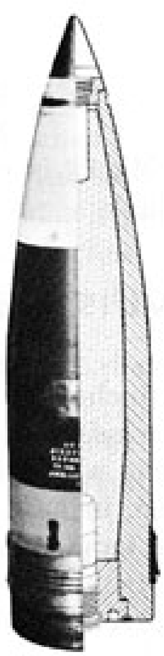


Figure 58. 8–inch H.C. Mk 24 Mods 1—5

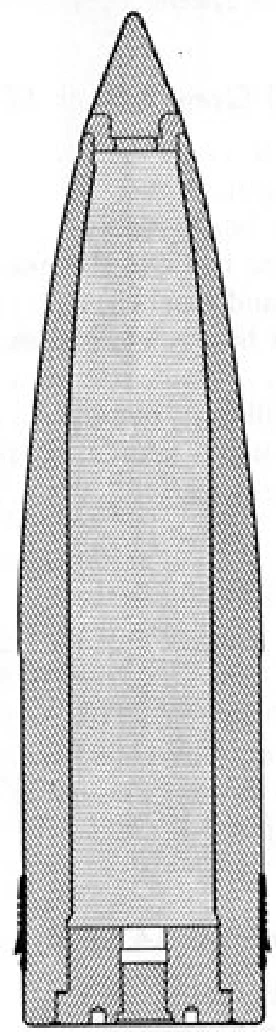


Figure 59. 8–inch H.C. Mk 25 Mod 1

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8-inch H.C. Mk 25 Mod 1

Guns used in........................8"/55
Over-all length, inches
  With nose fuze....................34.605
  Without nose fuze.................31.13
Diameter of base, inches..............7.977
Distance base to band, inches...........2.0
Width of band, inches..................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds.............21.37
Weight of loaded projectile, pounds.....260
Charge/weight ratio 8%
Primer (bag gun).............Mk 15 Mod 1
Cartridge Case ....Mk 1
Primer ....Mk 35
Tracer ....Mk 5
Fuzes
  Base................Mk 21 Mods 0 and 1
  Mk 23 Mod 0

The Base Fuze Mk 21 is preferred.

This projectile is designed so that it may be manufactured by forging from the base end.

Part I — Chapter I — Section 8

12-INCH PROJECTILES

12-inch A.P. Mk 15 Mod 6

Guns used in.......................12"/50
Over-all length, inches...............42.00
Diameter of base, inches..............11.94
Distance base to band, inches...........1.00
Width of band, inches..................4.00
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds...............25.0
Weight of loaded projectile, pounds.....870
Charge/weight ratio................2.87%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

This is an old type projectile, without windshield, which is not in common use.

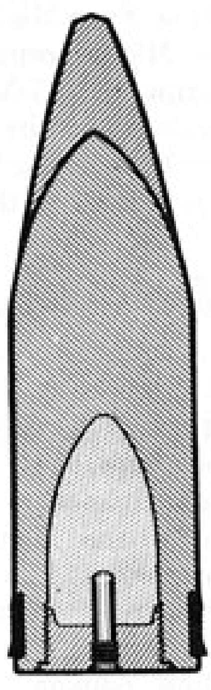

Figure 60. 12-inch A.P. Mk 15 Mod 6

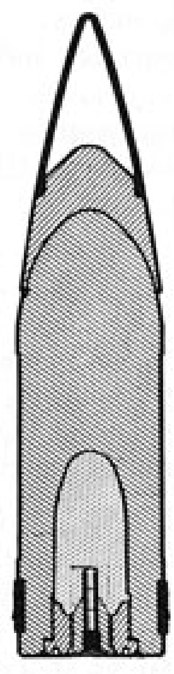

Figure 61. 12-inch A.P. Mk 18 Mod 1

12-inch A.P. Mk 18 Mod 1

Guns used in......................12"/50
Over-all length, inches
With cap and windshield...........54.00
Without cap and windshield.........38.39
Diameter of base, inches............11.977
Distance base to band, inches.........3.10
Width of band, inches.................4.0
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds..............17.4
Weight of loaded projectile, pounds....1,140
Charge/weight ratio................1.52%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes...........Base—Mk 21 Mod 0 and 1

The windshield is threaded to the A.P. cap and held in place by five equally spaced notches which are staked. The A.P. cap weighs 110.98 pounds and is soldered to the nose. In addition to the solder, the cap is also secured by seven crimp caps equally spaced on the periphery of the nose.

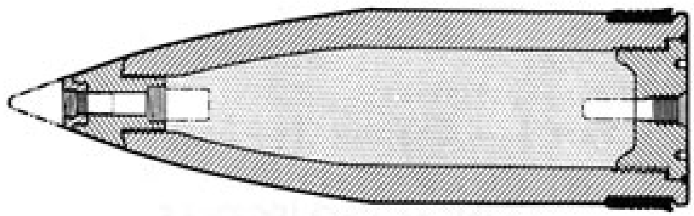

Figure 62. 12–inch H.C. Mk 16 Mods 1 and 2

12-inch H.C. Mk 16 Mods 1 and 2, and Mk 21

Guns used in......................12"/50
Over-all length, inches
With nose fuze 43.76
Without nose fuze................40.285
Diameter of base, inches............11.977
Distance base to band, inches...........1.0
Width of band, inches.................4.0
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds.............58.20
Weight of loaded projectile, pounds.....740
Charge/weight ratio 7.86%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5 Mod 1
Fuzes
Base......Mk 28 "green stripe"
Mk 39 Mods 0 and 1
Mk 48 Mods 0 and 1
Nose......Mk 29 Mods 1, 2, and 3 (P.D.F.)
Mk 42 Mod 0 (M.T.F)
Mk 62 Mod 0 (M.T.F.
Auxiliary Detonating Fuze
Mk 17 Mod 8 "green stripe"
Mk 35 Mod 0
Mk 55 Mod 0
Booster Mk 5, or a special 0.53-pound pressed TNT booster, is also used under the auxiliary detonating fuze

The 12-inch H.C. Projectile is merely a redesignation of the Mk 16.

The Base Fuze Mk 39 replaces the original "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Nose Fuze Mk 62 is the preferred nose time fuze.

12-inch H.C. Mk 17 Mods 1 and 2, and Mk 22

Guns used in......................12"/50
Over-all length, inches
With nose fuze.....................54.0
Without nose fuze.................50.18
Diameter of base, inches.............11.977
Distance base to band, inches...........3.1
Width of band, inches..................4.0
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds.............79.44
Weight of loaded projectile, pounds......940

Charge/weight ratio 8.45%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5 Mod 1
Fuzes
  Base ....Mk 28 "green stripe"
    Mk 39 Mods 0 and 1
    Mk 48 Mods 0 and 1
  Nose.........Mk 29 and Mods 1, 2, and 3 (P.D.F.)
    Mk 42 Mod 0 (M.T.F.)
    Mk 62 Mod 0 (M.T.F.)
    Steel Nose Plug
  Auxiliary Detonating Fuze
    Mk 17 Mod 8 "green stripe"
    Mk 35 Mod 0
    Mk 55 Mod 0

Mk 5 Booster, or special 0.53 pound pressed TNT booster, is used under the auxiliary detonating fuze.

The 12-inch H.S. Projectile Mk 22 is merely a redesignation of the Mk 17.

The Base Fuze Mk 39 replaces the original special "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Mk 62 is the preferred nose time fuze.

The 12-inch H.C. Projectile Mk 17 Mod 2 differs from the Mk 17 Mod 1 in that its base plug threads are 7.85" instead of 7.75".

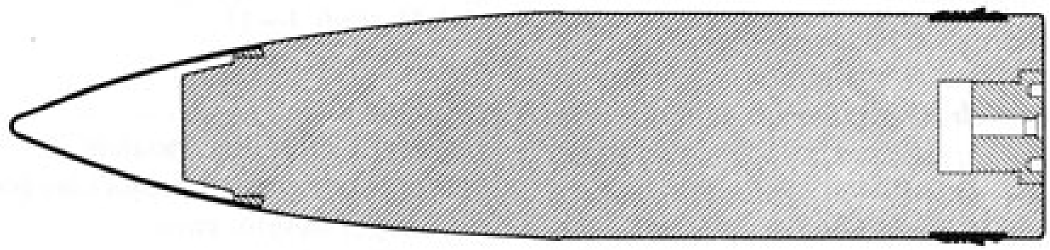

Figure 63. 12–inch Target Mk 19 Mod 1

12-inch Target Mk 19 Mod 1

Guns used in.................12"/50 Mk 8
Over-all length, inches..................54
Diameter of base, inches............11.977
Distance base to band, inches...........2.0
Width of band, inches...................4.0
Diameter at bourrelet, inches........11.977
Weight of loaded projectile, pounds....1,140
Primer.....................Mk 15 Mod 1
Tracer (if loaded).................Mk 5

There is no provision for a spotting dye load in the windshield of this projectile.

Part I — Chapter I — Section 9

14-INCH PROJECTILES

14-inch A.P. Mk 8 Mods 3, 7, 8, and 11 (Obsolete)

Guns used in.......................14"/45
  14"/50
Over-all length, inches...............49.44
  Without cap & windshield..........41.92
Diameter of base, inches.............13.94
Distance base to band, inches...........1.0
Width of band, inches.................4.66
Diameter at bourrelet, inches........13.977
Filling ....Explosive D
Weight of filling, pounds.............34.30
Weight of loaded projectiles, pounds...1,402
Charge/weight ratio...................2.1%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

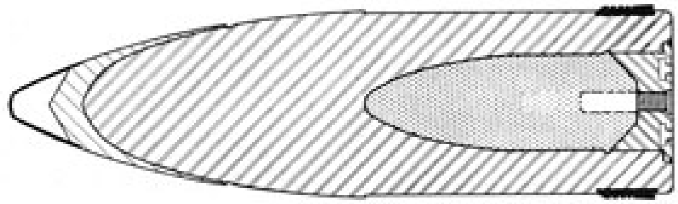

Figure 64. 14–inch A.P. Mk 8 Mods 3, 7, 8, and 11

A special adapter with 1.5-inch diameter outside threads is required to fit Base Fuzes Mk 21 in these projectiles.

The Mod 7 projectile may also be issued B.L. & P. or B.L. & T. with adapter and Tracer Mk 5 Mod 1 for target practice.

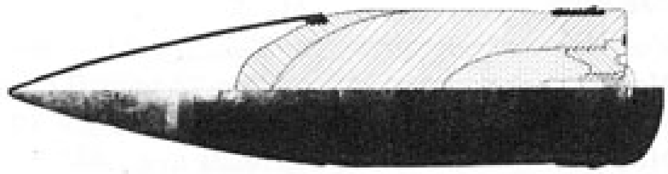

Figure 65. 14–inch A.P. Mk 16 Mods 1—11

14-inch A.P. Mk 16 Mods 1—11

Guns used in....................14"/45
14"/50
Over-all length, inches
With cap & windshield............56.00
Without cap & windshield..........36.72
Diameter of base, inches.............13.977
Distance base to band, inches...........3.46
Width of band, inches.................4.66
Diameter at bourrelet, inches........13.977
Filling.......................Explosive D
Weight of filling, pounds.............22.90
Weight of loaded projectile, pounds....1,500
Charge/weight ratio 1.5%
Primer......................Mk 15 Mod 1
Tracer............................Mk 5
Fuzes...........Base—Mk 21 Mods 0 and 1

The Mod 11 has a slight change in the cap design which moves the windshield threads further forward on the projectile.

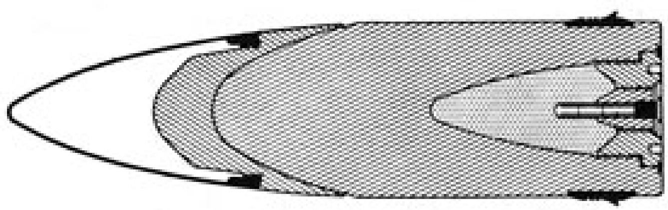

Figure 66. 14–inch A.P. Mk 20 Mod 1

14-inch A.P. Mk 20 Mod 1

Guns used in....................14"/45
Over-all length, inches...............54.38
Diameter of base, inches.............13.977
Distance base to band, inches..........3.46
Width of band, inches.................4.66
Diameter at bourrelet, inches........13.977
Filling.......................Explosive D
Weight of filling, pounds.............22.90
Weight of loaded projectile, pounds....1,500
Charge/weight ratio 1.5%
Primer......................Mk 15 Mod 1
Tracer............................Mk 5
Fuzes...........Base—Mk 21 Mods 0 and 1

This projectile is used only on the battleships New York and Texas. It is the same as the Mk 16 Mod 8, except for a shortened windshield.

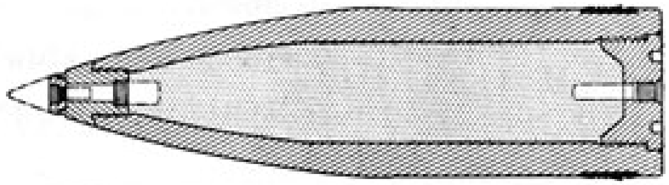

Figure 67. 14–inch H.C. Mk 19 Mods 1—6 and Mod 22

14-inch H.C. Mk 19 Mods 1—6 and Mk 22

Guns used in........................14″/45
14″/50

Over-all length, inches
  With nose fuze........................56.0
  Without nose fuze....................52.18
Diameter of base, inches...............13.977
Distance base to band, inches............3.46
Width of band, inches....................4.66
Diameter at bourrelet, inches..........13.977
Filling..........................Explosive D
Weight of filling, pounds...............104.21
Weight of loaded projectile, pounds.....1,275
Charge/weight ratio.....................8.01%
Primer..........................Mk 15 Mod 1
Tracer...........................Mk 5 Mod 1
Fuzes
  Base......Mk 28 "green stripe"
    Mk 39 Mods 0 and 1
    Mk 48 Mods 0 and 1
  Nose......Mk 29 Mods 1, 2, and 3 (P.D.F.)
    Mk 42 Mod 0 (M.T.F.)
    Mk 62 Mod 0 (M.T.F.)
    Steel Nose Plug

Auxiliary Detonating Fuze
  Mk 17 Mod 8 "green stripe"
  Mk 35 Mod 0
  Mk 55 Mod 0
  Booster Mk 5, or a special 0.53-pound pressed TNT booster, will be used under the auxiliary detonating fuze.

The Base Fuze Mk 39 replaces the original special "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Mk 62 is the preferred nose time fuze.

Projectile Mk 19 Mod 1 only is suitable for use in 14″/45 guns on the battleships New York and Texas.

The 14-inch H.C. Projectile Mk 22 is similar in its dimensions to the Mk 19, except that the rotating band on the Mk 22 is only 2.25 inches from the base.

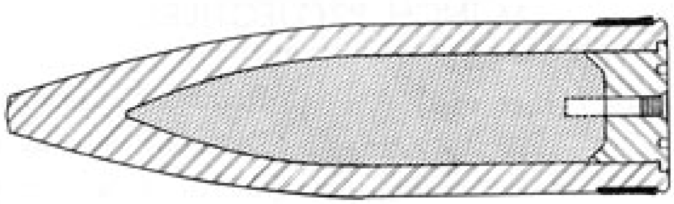

Figure 68. 14–inch Bombardment Mk 9

14-inch Bombardment Mk 9

Guns used in........................14″/45
14″/50
Over-all length, inches..................56.0
Diameter of base, inches................13.94
Distance base to band, inches............1.0
Width of band, inches....................4.66
Diameter at bourrelet, inches..........13.977
Filling..........................Explosive D
Weight of filling, pounds..................105
Weight of loaded projectile, pounds.....1,410

Charge/weight ratio..................7.44%
Cartridge Case.....................Bag gun
Primer.......................Mk 14 Mod 1
Tracer...................Mk 5, Mk 5 Mod 1

Fuzes............Base—Mk 28 and all Mods

The Base Fuze Mk 28 replaces the previously used Base Fuze Mk 3 Mod 2 with integral tracer.

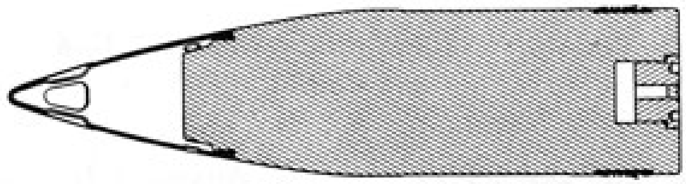

Figure 69. 14–inch Target Mks 17 and 18

14-inch Target Mk 17 Mods 1—3 and Mk 18 Mod 1

Guns used in......................14"/45
14"/50
Over-all length, inches.................56
Diameter of base, inches............13.977
Distance base to band, inches.........2.25
Width of band, inches................4.66
Diameter at bourrelet, inches........13.977
Weight of loaded projectile, pounds....1,500
Primer.....................Mk 15 Mod 1
Tracer (if loaded)..................Mk 5

There is no spotting dye load in the Mk 17 windshield.

The 14-inch Target Projectile Mk 18 Mod 1 has essentially the same dimensions, plus a spotting dye load.

14-inch Target Mk 21 Mod 1

Guns used in......................14"/45
Over-all length, inches...............54.38
Diameter of base, inches.............13.977
Distance base to band, inches..........2.25
Width of band, inches................4.66
Diameter at bourrelet, inches.........13.977
Weight of loaded projectile, pounds....1,500
Primer.....................Mk 15 Mod 1
Tracer............................Mk 5

This target projectile was made to match the 14-inch A.P. Projectile Mk 20 for the U.S.S. Arkansas and Texas guns.

Part 1 — Chapter 1 — Section 10

16-INCH PROJECTILES

16-inch A.P. Mk 3 Mods 2—5 (Obsolete)

Guns used in......................16"/45
Over-all length, inches................56.5
Diameter of base, inches..............15.94
Distance base to band, inches..........3.03
Width of band, inches.................5.30

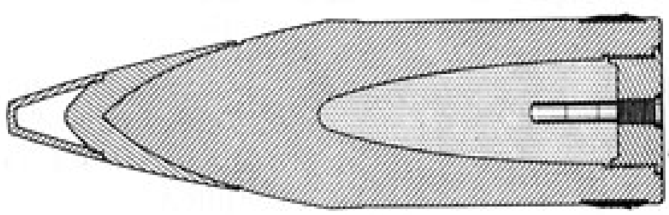

Figure 70. 16–inch A.P. Mk 3 Mods 2—5

Diameter at bourrelet, inches........15.977
Filling........................Explosive D
Weight of filling, pounds..............57.5
Weight of loaded projectile, pounds....2,110
Charge/weight ratio.................2.74%
Primer......................Mk 15 Mod 1
Tracer..............................Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

This projectile was originally issued without windshield, but has since been modified.

The 16-inch A.P. Projectile Mk 3 Mod 2 has been declared unserviceable until caps and windshields have been modified.

Mods 2 and 3 may be blind loaded and plugged or tracered with the Tracer Mk 5 Mod 1 for target practice.

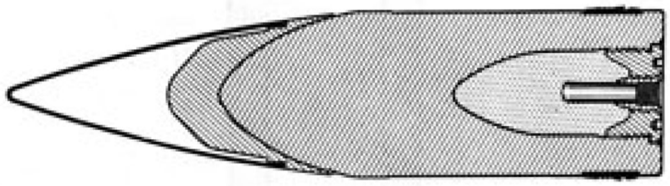

Figure 71. 16–inch A.P. Mk 5 Mods 1—5

16-inch A.P. Mk 5 Mods 1—6

Guns used in.......................16"/45
Over-all length, inches
With cap & windshield...............64.0
Without cap & windshield.........43.387
Diameter of base, inches.............15.977
Distance base to band, inches...........4.03
Width of band, inches..................5.32
Diameter at bourrelet, inches........15.977
Filling........................Explosive D
Weight of filling, pounds..............34.0
Weight of loaded projectile, pounds....2,240
Charge/weight ratio...................1.5%
Primer......................Mk 15 Mod 1
Tracer..............................Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

The 16-inch A.P. Projectile Mk 5 Mod 6 is a modified Mk 12 (designed for Army use) with a special base-plug adapter.

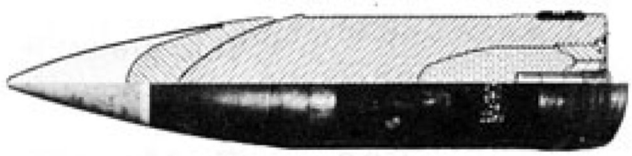

Figure 72. 16–inch A.P. Mk 8 Mods 1—8

16-inch A.P. Mk 8 Mods 1—8

Guns used in.......................16"/45
16"/50
Over-all length, inches
With cap & windshield...............72.0
Without cap & windshield............51.6
Diameter of base, inches.............15.977
Distance base to band, inches..........4.03
Width of band, inches..................5.32
Diameter at bourrelet, inches........15.977
Filling........................Explosive D
Weight of filling, pounds.............40.90
Weight of loaded projectile, pounds....2,700
Charge/weight ratio...................1.5%
Primer......................Mk 15 Mod 1
Tracer..............................Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

The Mod 8 has a heavier cap, blunter nose, and more hardness, from greater heat treatment than the earlier Mods.

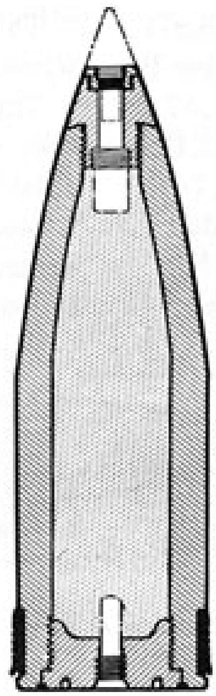

Figure 73. 16–inch H.C. Mk 13 Mods 0—6 and Mk 14

16-inch H.C. Mk 13 Mods 0—6 and Mk 14

Guns used in .... 16″/45
16″/50

Over-all length, inches

With nose fuze 64.0

Without nose fuze 60.18

Diameter of base, inches 15.977

Distance base to band, inches 4.03

Width of band, inches 5.32

Diameter at bourrelet, inches 15.977

Filling .... Explosive D

Weight of filling, pounds 153.6

Weight of loaded projectile, pounds 1,900

Charge/weight ratio 8.08%

Primer .... Mk 15 Mod 1

Tracer .... Mk 5 Mod 1

Fuzes

Base ...... Mk 28 "green stripe"
Mk 39 Mods 0 and 1
Mk 48 Mods 0 and 1

Nose ...... Mk 29 Mods 1, 2, and 3 (P.D.F.)
Mk 42 Mod 0 (M.T.F.)
Mk 62 Mod 0 (M.T.F.)
Steel Nose Plug

Auxiliary Detonating Fuze
Mk 17 Mod 8 "green stripe"
Mk 35 Mod 0
Mk 55 Mod 0
Booster Mk 5, or a special 0.53-pounds pressed TNT booster, will be used under the auxiliary detonating fuze.

This projectile is normally issued with an A.P. nose plug.

The 16-inch H.C. Projectile Mk 13 Mod 1 was originally issued as the 16″ Ex–1.

The Base Fuze Mk 39 replaces the original special "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Mk 14 is simply a different designation to indicate a different manufacturer.

16-inch Target Mk 6 Mod 1 and Mk 7 Mod 0

Guns used in . . . . 16"/45 Mks 6 and 8
Over-all length, inches 64
Diameter of base, inches 15.977
Distance base to band, inches 2.5
Diameter at bourrelet, inches 15.977
Weight of loaded projectile, pounds 2,240
Primer . . . . Mk 15 Mod 1
Tracer . . . . Mk 5

Mk 6 has no spotting dye; Mk 7 does. These target projectiles are designed to use the same ballistic as the 16-inch A.P. Projectile Mk 5.

16-inch Target Mk 9 Mods 1 and 2, and Mk 10 Mod 0

Guns used in . . . . 16"/45 Mk 6 Mod 1
16"/50 Mk 7 Mod 0
Over-all length, inches 72
Diameter of base, inches 15.977
Distance base to band, inches 2.5
Diameter at bourrelet, inches 15.977
Weight of loaded projectile, pounds 2,700
Primer . . . . Mk 15 Mod 1
Tracer . . . . Mk 5

Mods 1 and 2 of the 16-inch Target Projectile Mk 9 are physically the same. Different Mods distinguish products of different contractors. The Mk 9's have no spotting dye.

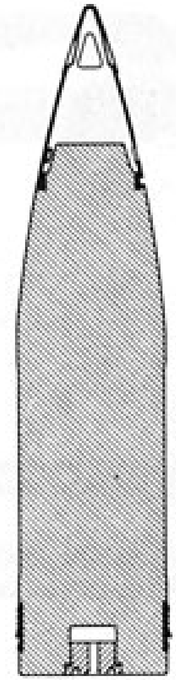

Figure 74. 16–inch Target Mk 9 and Mk 10

Mk 10 is exactly like the Mk 9, except that it contains a spotting load.

These target shells match the 16-inch A.P. Projectile Mk 8 in ballistic traits.

Part I — Chapter I — Section 11

20-mm PROJECTILES

20-mm A.A. H.E., H.E.–I., and B.L. & P. Mk 3 Mods 1—64

Over-all length, inches
With nose fuze 3.275
Without nose fuze 2.625
Diameter of base, inch 0.74
Distance base to band, inch 0.374
Width of band, inch 0.16
Diameter at bourrelet, inch 0.78
Filling
H.E.: . . . . 0.0243 lb. tetryl or pentolite
H.E.–I.: . . . . 0.0072 lb. incendiary mix; 0.0171 lb. tetryl or pentolite
Weight of loaded projectile, pound 0.2714
Charge/weight ratio 8.9%
Cartridge Case . . . . H.E.: Mk 2
H.E.–I.: Mk 2, 3, or 4
Primer . . . . H.E.: Mk 30
H.E.–I.: Mk 30 or 31
Fuzes . . . . Nose—Mk 26 Mods 0 and 1

The explosive filling of the H.E. projectile is press-loaded in three equal increments. The H.E.–I. projectile is similarly loaded, but the first increment consists of an incendiary mixture, the other two of H.E., either tetryl or pentolite.

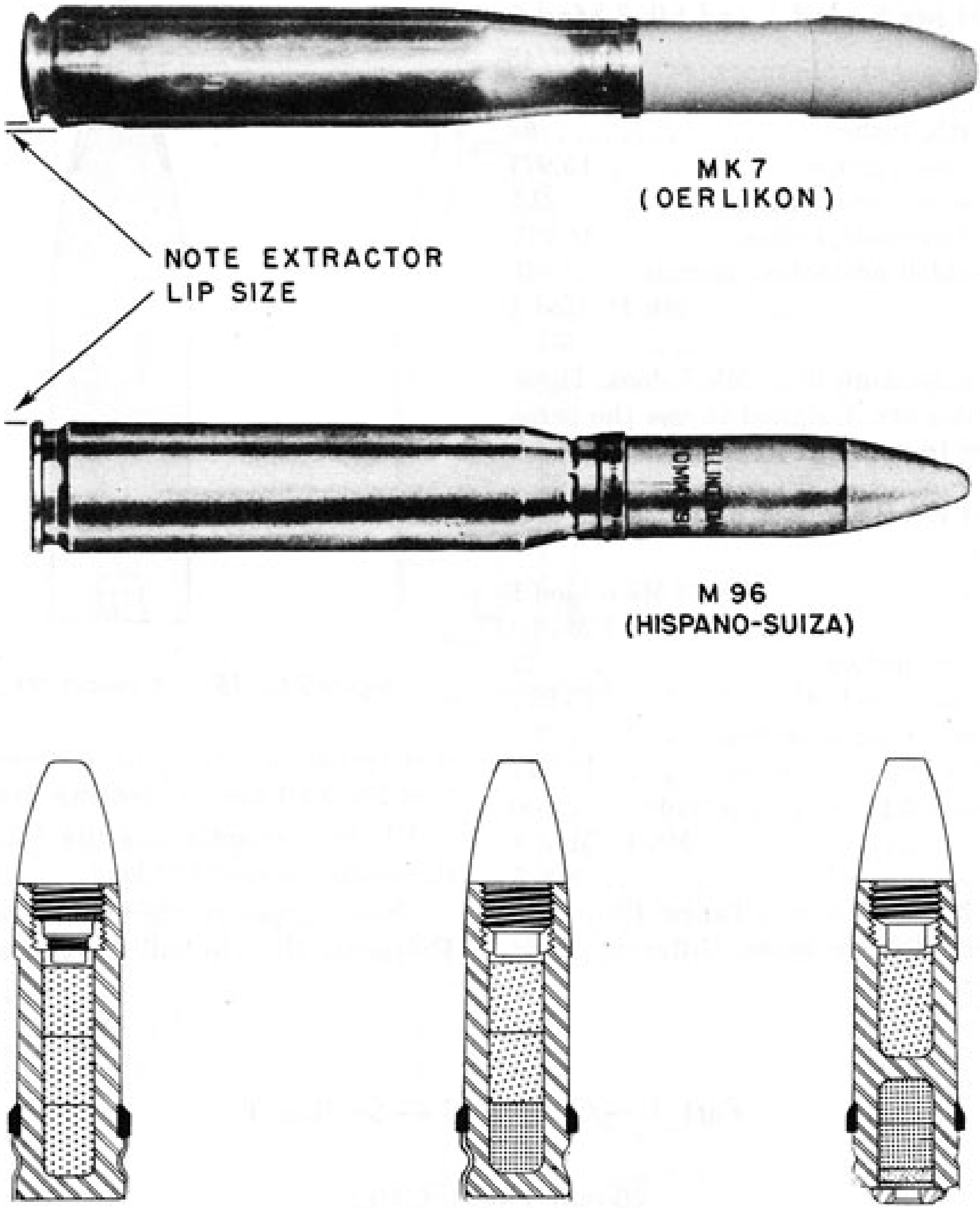

Figure 75 (Part 1). 20-mm Projectiles

This round is also issued B.L. & P., with an inert filler and a dummy nose cap.

Identification—marking and painting

Type	Color
H.E. (Tetryl)	White
H.E. (Pentolite)	Yellow
H.E.-I. (Tetryl)	Red
H.E.-I. (Pentolite)	Light pink
B.L. & P.	Dark gray green

The many modification numbers are to distinguish between products from different contracts.

20-mm A.A. H.E.-T. and B.L. & T. Mk 4 Mods 1—28 and Mk 7

(May have Dark Ignition tracers.)

Over-all length, inches 3.025

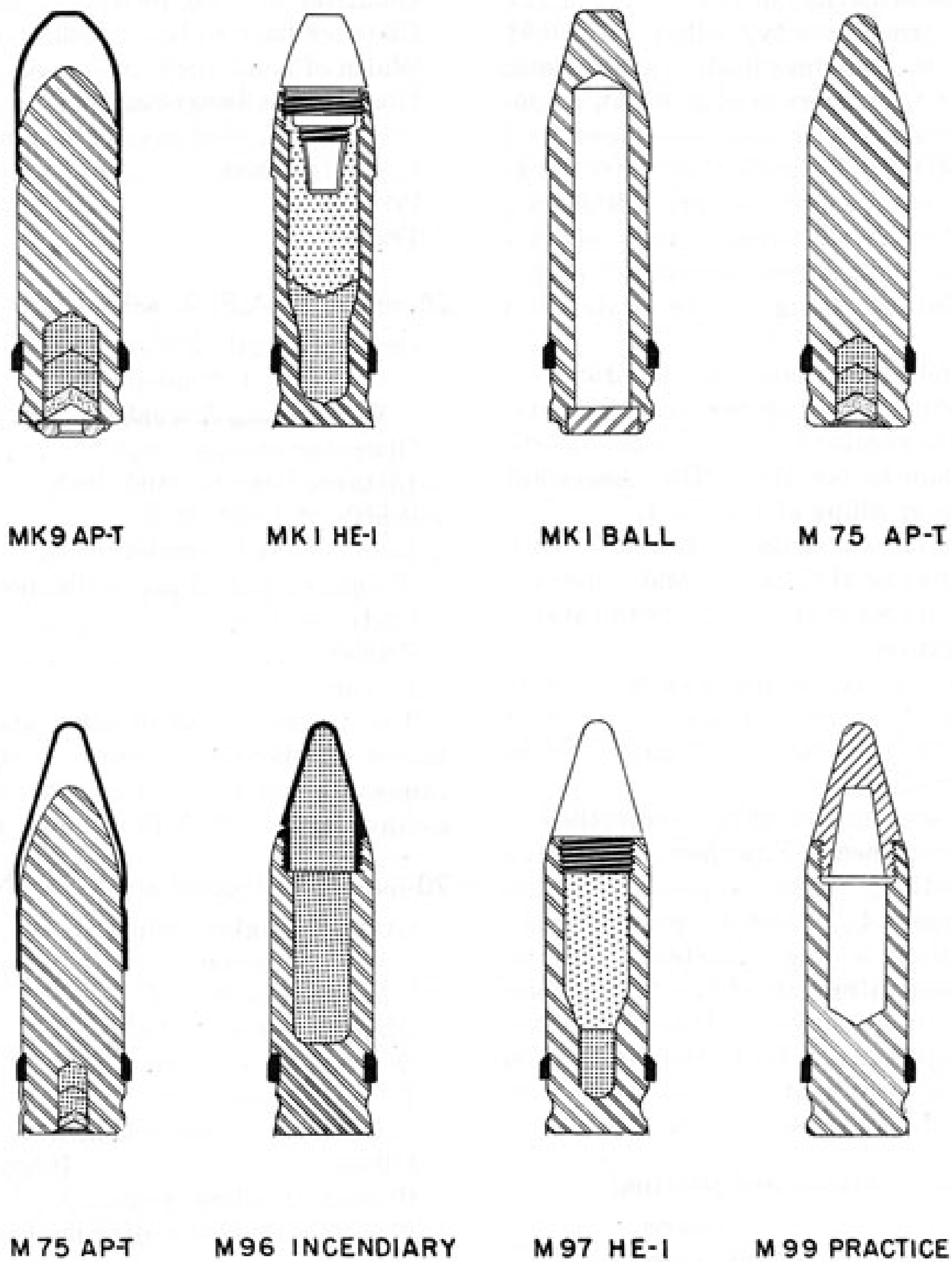

Figure 75 (Part 2). 20–mm Projectiles, continued

Without nose fuze 2.525
Diameter of base, inch 0.74
Distance base to band, inches 0.397
Width of band, inch 0.16
Diameter at bourrelet, inch 0.78
Filling .... Tetryl or Pentolite
Weight of filling, pounds
H.E.: 0.01 lb.
Tracer: 0.0173 lb.

Weight of loaded projectile, pound 0.2621
Cartridge Case .... Mk 2
Primer .... Mk 30
Tracer .... Integral
Fuzes
Nose .... Projectile Mk 4—
Mk 26 Mods 0 or 2
Projectile Mk 7—
Mk 26 Mods 0 or 1

Length of tracer cavity, inches........1.107
Diameter of tracer cavity, inches......0.51

To eliminate the blinding flash characteristic of standard 20-mm tracers fired at night, a special Dark Ignition tracer has been developed which does not light up until about 100 yards from the gun muzzle. Rounds are designated "H.E.-T.-D.I." Over-all burning time of this trace is four seconds; during the "dark" period there is a faint streaking in the projectile's path.

The Mk 4 and Mk 7 rounds are identical except for the dimensions of the tracer cavity, which is slightly greater in diameter and length in the Mk 4 than in the Mk 7. This somewhat reduces the tracer filling of the Mk 7.

The Mk 7 round is also issued B.L. & T. with an inert filler in the H.E. cavity and a dummy nose plug. The tracer cavity contains the standard tracer mixture.

The burster charge of the 20-mm is more sensitive than the usual projectile burster charge. Accordingly, greater caution should be observed in handling.

The tracer element in these projectiles is loaded in two increments. First increment is the tracer composition, which is pressed in the after compartment by hydraulic pressure; the second increment is the "starter" mixture, which is pressed in on top of the tracer composition and is more sensitive than the latter. When the projectile is fired, the heat from the propellent charge ignites the starter which, in turn, sets off the tracer composition.

Identification—marking and painting

Type	Color
*H.E.-T. (Tetryl) ..	Light gray
*H.E.-T. (Pentolite).	Blue
B.L. & T.	Dark gray green, with 1/8-inch yellow band

20-mm A.P.-T. Mk 9

Over-all length, inches
With cap & windshield.............3.051
Without cap & windshield..........2.449
Diameter of base, inch...............0.742
Distance base to band, inch...........0.315
Width of band, inch..................0.154
Diameter at bourrelet, inch...........0.784
Weight of loaded projectile, pound....0.2686
Cartridge Case...............Mks 3 and 4
Primer..........................Mk 31
Tracer ....Integral

20-mm A/C A.P.-T. M95 (New Series)

Over-all length, inches
With cap & windshield..............3.27
Without cap & windshield............2.40
Diameter of base, inch................0.76
Distance base to band, inch............0.39
Width of band, inch.................0.203
Diameter at bourrelet, inch............0.78
Weight of loaded projectile, pound......0.29
Cartridge Case M21A1
Primer M36A1
Tracer ....Integral

The tracer is red in color and burns for a period of about 2.25 seconds, equivalent to a range of about 1,400 yards. This round is superseding the A.P.-T. M75 round of the Old Series.

20-mm A/C Incendiary M96 (New Series)

Over-all length, inches
With nose cap....................3.245
Without nose cap..................2.30
Diameter of base, inch...............0.76
Distance base to band, inch............0.39
Width of band, inch.................0.203
Diameter at bourrelet, inch............0.78
Filling................Incendiary Mixture
Weight of filling, pound.............0.020
Weight of loaded projectile, pound......0.27
Cartridge Case...................M21A1
Primer M36A1

The incendiary mixture fills both the nose cap and the projectile body. No fuze is required, since the functioning is initiated by impact of the nose with the target.

20-mm A/C H.E.-I. M97 (New Series)

Over-all length, inches
With nose fuze....................3.28
Without nose fuze.................2.44
Diameter of base, inch...............0.76

*When assembled with Dark Ignition tracers, a 1/8-inch bright red band will be painted around the projectile midway between the bourrelet and the rotating band.

Distance base to band, inch 0.39
Width of band, inch 0.203
Diameter at bourrelet, inch 0.78
Filling . . . . Tetryl and Incendiary Mix
Weight of filling, pound 0.017
Weight of loaded projectile, pound 0.29
Cartridge Case M21A1
Primer M36A1
Fuzes . . . . Nose—M75

This round is superseding the H.E.–I. Mk 1 round of the Old Series.

20-mm A/C Practice M99 (New Series)

Over-all length, inches
  With nose cap 3.27
  Without nose cap 2.30
Diameter of base, inch 0.76
Distance base to band, inch 0.39
Width of band, inch 0.203
Diameter at bourrelet, inch 0.78
Filling . . . . None
Weight of loaded projectile, pound 0.29
Cartridge Case M21A1
Primer M36A1

This round is superseding the Ball Mk 1 round of the Old Series.

20-mm A/C H.E.–I. Mk I (Old Series)

Over-all length, inches 3.22
Diameter of base, inch 0.770
Distance base to band, inch 0.50
Width of band, inch 0.203
Diameter at bourrelet, inch 0.784
Filling . . . . Tetryl and Incendiary Mix
Weight of filling, pound 0.025
Weight of loaded projectile, pound 0.290
Cartridge Case M21A1
Primer M36
Fuzes . . . . No. 253 Mk 1

This round is to be superseded by the H.E.–I. M97 round of the new ballistically matched series. The H.E.–I. Mk 1 round is to be classified unserviceable by Naval activities as soon as replacement allowances or stocks of the M97 round are received.

20-mm A/C Ball Mk I (Old Series)

Over-all length, inches 3.31
Diameter of base, inch 0.770
Distance base to band, inch 0.50
Width of band, inch 0.203
Diameter at bourrelet, inch 0.784
Filling . . . . None
Weight of loaded projectile, pound 0.28
Cartridge Case M21A1
Primer M36

This round is to be superseded by the practice round M99 of the new ballistically matched series. The Ball Mk 1 round is to be classified unserviceable by Naval activities as soon as replacement allowances or stocks of the M97 round are received.

20-mm A/C A.P.–T. M75 (Old Series)

Over-all length, inches 3.25
Diameter of base, inch 0.770
Distance base to band, inch 0.5
Width of band, inch 0.203
Diameter at bourrelet, inch 0.784
Filling . . . . None
Weight of loaded projectile, pound 0.370
Cartridge Case M21A1
Primer M36
Tracer . . . . Integral

The tracer is red in color and burns for about four seconds, equivalent to a range of about 3,000 yards.

This round is to be superseded by the A.P.–T. M95 round of the new ballistically matched series. The A.P.–T. M75 round is to be classified unserviceable by Naval activities as soon as replacement allowances or stocks of the M95 round are received.

40-mm PROJECTILES

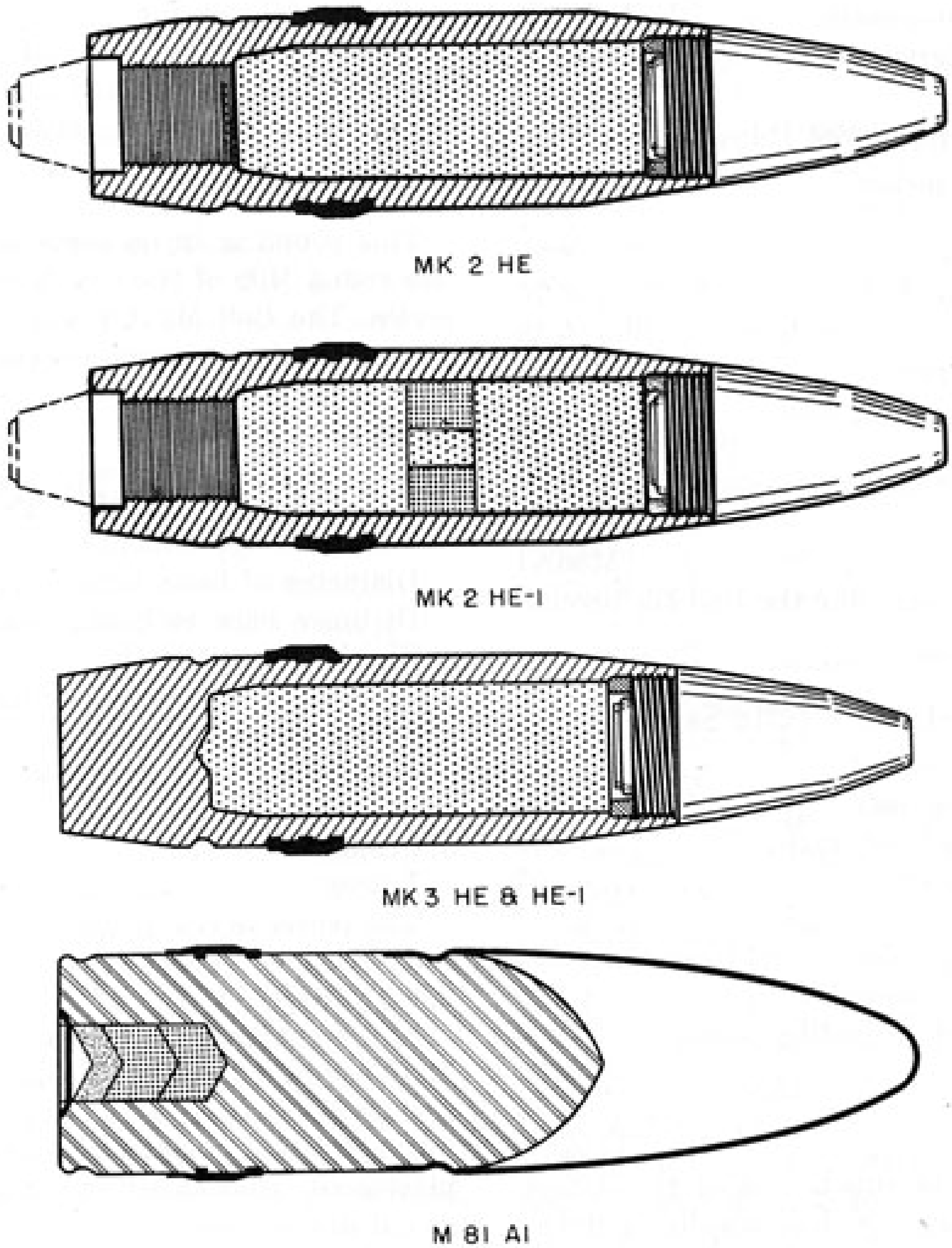

Figure 76. 40–mm Projectiles

40-mm A.A. H.E.-I. (a) Mk 1 Mods 1—24 and (b) Mk 2 Mods 1—35

(May have "Dark" or "Dark Ignition" tracer.)

Over-all length, inches
- With nose fuze 7.1
- Without nose fuze 5.2

Diameter of base, inches 1.3
Distance base to band, inches .... (a) 1.675, (b) 1.730
Width of band, inch 0.6
Diameter at bourrelet, inches 1.57
Filling ... H.E.: Cast TNT; H.E.-I.: Cast TNT and Incendiary
Weight of filling, pound .... (a) 0.148, (b) 0.150
Weight of loaded projectile, pounds 1.985
Charge/weight ratio 5.0%
Cartridge Case .... Mk 1, Mk 2, Mk 3
Primer .... Mk 21 Mods 2 and 3; Mk 22 Mods 0 and 1
Tracer .... Mk 10, Mk 11
Fuzes .... Nose—Mk 27 Mods 0 and 1

See Tracer Mk 11 for "Dark" and "Dark Ignition" developments.

The Mk 1 and the Mk 2 projectiles are both loaded H.E. in three increments. The Mk 2 may also be loaded H.E.-I. with the central increment an incendiary composition. The Mk 2 H.E.-I. round may be issued plugged instead of tracered. Both projectile bodies may be issued B.L. & P. or B.L. & T. for target practice or de-icing.

Tracer Mk 10 has been declared unserviceable and is being replaced by the Tracer Mk 11 in all assemblies.

The 24 Mods of Mk 1 and the 35 Mods of Mk 2 are merely bookkeeping designations.

Identification—Marking and Painting

Type	Body	Color Band	Tip	Remarks
H.E.-P.	Green	Green	Green	Plug in tracer
H.E.-T./S.D.	Green	White	Green	
H.E./S.D.	Green	Black	Green	Non-luminous tracer
H.E.-I.-T./S.D.	Green	White	Red	
H.E.-I.-P.	Green	Red	Red	Plug in base
H.E.-I./S.D.	Green	Black	Red	Non-luminous tracer
H.E.-I.-T.	Green with black band	White	Red	S.D. relay not loaded
B.L. & T.	Red	White	Red	Dummy fuze
B.L. & P.	Red	Red	Red	Dummy fuze and plug in base

40-mm Mk 3

Except for some minor differences in dimensions, the main difference between the Mk 3 projectile and the Mks 1 and 2 is that there is no hole in the base of the Mk 3 for a tracer or plug. This design was developed when the tactical need for non-trace ammunition arose; but with the appearance of "Dark" tracers, the Mk 3 projectile's original purpose was eliminated.

40-mm A.A. M81A1 A.P. and A.P.-T.

Over-all length, inches 6.19
Diameter of base, inches 1.55
Distance base to band, inch 0.803
Width of band, inch 0.64
Diameter at bourrelet, inches 1.55
Weight of loaded projectile, pounds 1.96
Cartridge Case .... Mk 1, Mk 2, Mk 3
Primer .... Mk 21, Mk 22
Tracer .... Integral
Fuzes .... None

This projectile is an Army design manufactured for the Navy to Naval specifications.

The A.P. round has a plug in the tracer cavity; the A.P.-T. has a red tracer.

1.1-INCH PROJECTILES

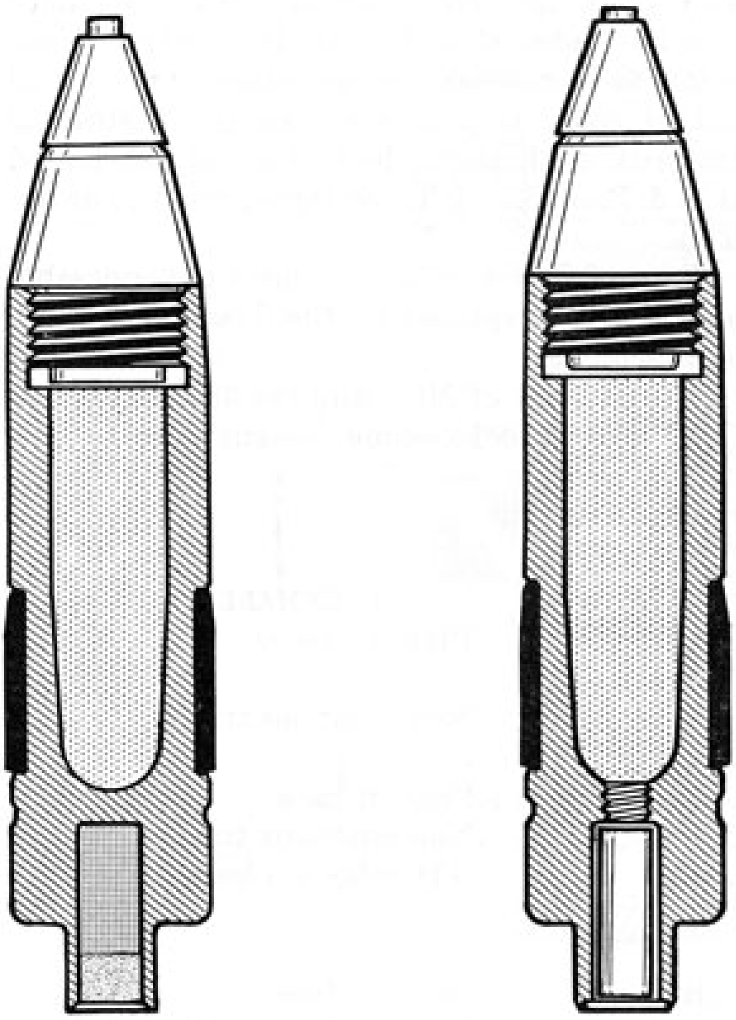

Figure 77. 1.1–inch Projectiles Mk 1 (right) and Mk 2 (left)

1.1-inch A.A. (a) Mk I Mods 0—28, (b) Mk S.D.I

Over-all length, inches
- With nose fuze....................5.8
- Without nose fuze....................4.1

Diameter of base, inches....................1.085
Distance base to band, inch....................0.87
Width of band, inch....................1.0
Diameter at bourrelet, inches....................1.095
Filling....................Explosive D
Weight of filling, pound....................(a) 0.037
(b) 0.034
Weight of loaded projectile, pound....................0.917
Charge/weight ratio....................4.0%
Cartridge Case....................Mk 1
Primer....................Mk 19 and Mods 1, 2, and 3
Tracer.....Divided into two increments and pressed into the recess by hydraulic pressure, the tracer is ignited by the propellant charge from the cartridge case.
Fuzes
- Nose........Modified Mk 12 Mods 2 and 3 (P.D.F.)
  Mk 34 and all Mods (P.D.F.)

The 1.1-inch A.A. gun is not being further developed in the Navy.

The 1.1-inch Mk 1 is not self-destroying; the 1.1-inch Mk S.D. 1 is self-destroying. This is the primary difference between the two projectiles.

The Mk S.D. 1 consists of a Mk 1 projectile body modified for self-destruction by drilling through the wall between the tracer and H.E. cavities.

The Mk 1 projectile may also be issued B.L. & T. for target practice or de-icing.

The 28 Mods are to distinguish among contractors.

1.1-inch A.A. Mk 2 Mods 0 and I

Over-all length, inches
- With nose fuze....................5.7
- Without nose fuze....................4.1

Diameter of base, inches....................1.085
Distance base to band, inch....................0.87
Width of band, inch....................1.0
Diameter at bourrelet, inches....................1.095
Filling....................Explosive D
Weight of filling, pound....................0.034
Weight of loaded projectile, pound....................0.917
Charge/weight ratio....................3.7%
Cartridge Case....................Mk 1
Primer....................Mk 19 and Mods 1, 2, and 3

Tracer.....Divided into two increments and pressed into the recess by hydraulic pressure, the tracer is ignited by the propellant charge from the cartridge case.

Fuzes
 Nose........Modified Mk 12 Mods 2 and 3 (P.D.F.)
 Mk 34 and all Mods (P.D.F.)

The Mk 2 has a self-destroying tracer.

Part I — Chapter I — Section 14

"POUNDER" PROJECTILES

1-Pounder Common Mk 2 Mods 0 and 1

Guns used in.....................1-pdr./40
Over-all length, inches.................3.56
Diameter of base, inches...............1.441
Distance base to band, inch............0.829
Width of band, inch...................0.731
Diameter at bourrelet, inches..........1.445
Filling ....Black powder
Weight of filling, pound...............0.026
Weight of loaded projectile, pounds....1.088
Charge/weight ratio 2.07%
Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Tracer ....Integral
Fuzes..........Base—Mk 8 Mod 4 (B.I.F.)

This ammunition is used in coast guard guns. Their bursting charge is black powder and TNT, or black powder alone. This should be kept in mind when unscrewing the fuze, as some of the powder may have fallen down into the threads and the friction would cause detonation.

The Primer Mk 10 Mod 8 may be used for saluting charges only.

Base Fuzes Mk 2 Mod 9 and Mk 8 Mod 5, without tracers, may be used, but the Mk 8 Mod 4 is the preferred assembly.

This round may be issued B.L. & P. for target practice.

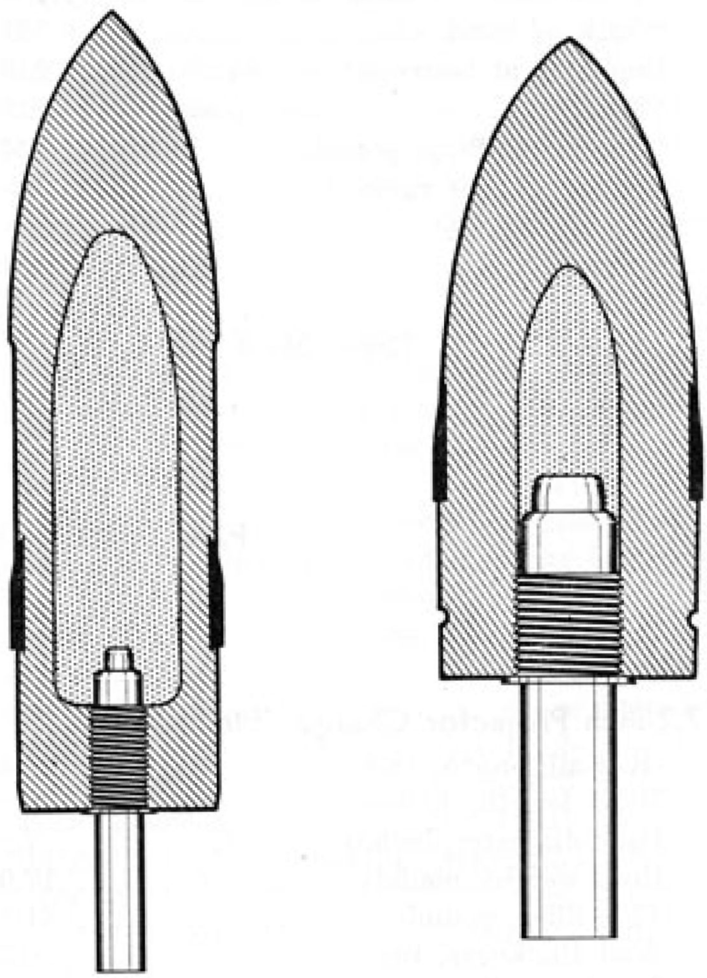

Figure 78. 3–Pounder Common Mk 4 and 1–Pounder Common Mk 2

3-Pounder Common Mk 4 Mod 1 (Obsolete)

Guns used in.....................3-pdr./50
Over-all length, inches................6.681
Diameter of base, inches...............1.75
Distance base to band, inches..........1.185
Width of band, inch...................0.787
Diameter at bourrelet, inches..........1.845
Filling.............Black powder and TNT
Weight of filling, pound.................0.13
Weight of loaded projectile, pounds.....3.30
Charge/weight ratio 3.93%
Cartridge Case ....Mk 1
Primer ....Mk 10 Mod 9
Tracer ....Integral

Fuzes ....Base—Mk 8 Mod 4 (B.I.F.)

Fuzes Mk 8 Mod 5 and Mk 2 Mod 9, without tracers, may be used; but the Fuze Mk 8 Mod 4 is the preferred assembly. See other notes on 1-pounder Common.

6-Pounder Common Mk 3 Mods 3 and 4

Guns used in................6-pdr./40, /42
6-pdr./45, /50
Over-all length, inches................8.45
Diameter of base, inches.............2.224
Distance base to band, inches..........1.493
Width of band, inch.................0.787
Diameter at bourrelet, inches.........2.239
Filling..............Black powder and TNT
Weight of filling, pound...............0.24
Charge/weight ratio 4.00%
Cartridge Case ....Mk 1
Primer.....................Mk 10 Mod 9
Tracer ....Integral
Fuzes..........Base—Mk 8 Mod 4 (B.I.F.)

This round may be issued B.L. & P. or B.L. & T. with the Tracer Mk 7 for target practice. See other notes on 1-pounder Common.

6-Pounder Common Mk 5 Mods 0 and 3

Guns used in.................6-pdr./40,/42
6-pdr./45,/50
Over-all length, inches................8.26
Diameter of base, inches...............2.22
Distance base to band, inches..........1.493
Width of band, inch..................0.787
Diameter at bourrelet, inches..........2.237
Filling.............Black powder and TNT
Weight of filling, pound...............0.23
Weight of loaded projectile, pounds......6.0
Charge/weight ratio..................4.0%
Cartridge Case ....Mk 1
Primer.......................Mk 10 Mod 9
Tracer ....Integral in fuze
Fuzes..........Base—Mk 8 Mod 4 (B.I.F.)

See notes for 6-pounder Common Projectile Mk 3.

Part I — Chapter I — Section 15

7.2-INCH PROJECTILE

7.2-inch Projector Charge "Hedgehog"

Over-all length, inches................38.6
Head length, inches..................19.0
Head diameter, inches..................7.2
Head weight, pounds..................17.9
TNT filler, pounds....................31.1
Wall thickness, inch...................0.2
Tail tube diameter, inches.............1.75
Tail width, inches.....................7.0

General: The projectile consists of a flat-nosed head with a conical tail fairing and parallel sides. The adapter and fuze thread into the nose. The motor unit consists of a smokeless powder cartridge with primer, which is lodged forward in the tail tube, the tube fitting over a firing post. The primer is detonated by electric contacts in the post. This charge is for use on Projectors Mk 10 and Mk 11.

The tail is a steel tube attached to the head by a threaded joint. Tail fins have a 10-degree twist and are attached with a drum support to give a slow rotation and stabilized trajectory.

Remarks: When Torpex is used, the weight is increased by approximately 2.5 pounds.

The above data are based on the 7.2-inch Head Mk 4A and the 1.75-inch P.C. Tail Mk 4A. These are being replaced by the 7.2-inch Head Mk 4 Mod 0 and the 1.75-inch P.C. Tail Mk 6 Mod 0.

Nose Fuzes Mk 136 and Mk 140 are replaced by the Nose Fuze Mk 158.

CARTRIDGE CASES AND BAG CHARGES

Cartridge cases

Propellant charges for small- and medium-caliber guns are assembled with primer and powder enclosed in a brass or steel container, or cartridge case. This assembly of the entire charge in a single, rigid, protecting case increases the ease and rapidity of loading and reduces the danger to personnel from flare-backs. On the other hand, additional care in handling must be exercised with this type of ammunition, since the cartridge case contains the powder charge and the primer.

Fixed ammunition: Guns of smaller caliber use "fixed ammunition," with the cartridge case firmly crimped to the base of the projectile. The following guns employ fixed ammunition: 20-mm, 40-mm, 1.1-inch, 1-pdr., 3-pdr., 6-pdr., 3"/23, 3"/50, 4"/50, and 5"/25.

Semi-fixed ammunition: Guns of larger caliber, for ease of handling, require separate loading of powder and projectile, or "semi-fixed ammunition." With this type of ammunition, the powder and primer are contained in a cartridge case, but the case is not crimped to the projectile. In semi-fixed ammunition, the powder is held firmly in place by a cardboard spacer and/or a cork closing plug. The following guns employ semi-fixed ammunition: 5"/38, 5"/51, 6"/47, and 8"/55.

Gas seal: Besides affording a safe and convenient method of loading, the cartridge case also prevents the escape of gases through the breech of the gun. The cartridge case has a fairly snug fit in the gun chamber and forms an effective gas seal by its expansion when the gun is fired.

High-Capacity, Reduced, and Target charges: To provide more flexibility in fire control when a variety of projectiles is used, a special charge is assembled for use with the light high-capacity projectiles and is known as a "high-capacity" charge. These charges contain less powder than their corresponding full charge. Also containing less powder, but designed mainly for reducing wear on gun chambers in target practice are the "reduced" and "target" charges. Weights and sizes of these particular charges are found in the table of "Existing Service Rounds" accompanying this chapter.

Short cases: When a round fails to be seated fully on ramming into the gun chamber, thus preventing closure of the breech, the projectile can still be fired by extracting the full-sized case and loading a "short" case. These are merely shorter models of regular cases. Their sizes and weights are included in the table of "Cartridge Case Specifications."

Special cases: Aside from the service-loaded, reduced-charge, and "short" cases, certain special types are also in use. These include saluting charges for 3"/23 and 1-, 3-, and 6-pounder guns; impulse charges for torpedoes, depth charges, and projector charges; and charges for line-throwing apparatus. These cases will not be described in this publication, since they are not primarily concerned with projectiles.

Bag charges

Principally because of the difficulty in handling very large cartridge cases, and especially in disposing of empties, the cartridge case in large-caliber guns is replaced by a powder charge assembled in a silk bag. The gas checking is accomplished by the mushroom and pads on the breech plug, and the primer is fired by a lock attached to the breech plug.

Bags used for bag charges are manufactured of pure silk without the admixture of any material other than sizing for the yarn. Heavy cloth is used for the body of the bags; light cloth, for the ignition ends. The ignition end of each bag consists of a red-colored quilted pocket containing an ignition charge of black powder.

Loading: Bag charges are either "dump" or "stack" loaded. In dump loading, the powder, after weighing, is dumped loosely into the bag, and the bag is then rolled and tightly laced to form a compact unit. For larger-caliber guns, stacked bags have almost completely replaced dump-loaded bags. Stacking places the powder grains on end in layers, so that a tight, compact, and uniform charge is obtained. Stacking results in greater ease for loading crews, a smaller charge bundle, a consistently uniform charge, and a longer life for the bag, as there is less chance for the sharp edges of the powder grains to cut the cloth of the bag. The arrangement of rows and number of grains in stacked charges is so fixed that the finished section will be the proper length according to Bureau of Ordnance standards. This arrangement differs with each bag index and is found by actually loading a test charge.

Nomenclature: As the term "Service Charge" has resulted in confusion, the new standard nomenclature is as follows:

FULL CHARGE—for use with H.C. or A.P. projectiles at full velocity.

REDUCED CHARGE—for use with A.P., target, or H.C. projectiles at reduced velocities.

SPECIAL — any charge other than those listed above.

The following types of bag charges may still be found:

SERVICE—for use with A.P. or H.C. projectiles at full velocity.

TARGET—for use with target projectiles.

HIGH-CAPACITY—for use with H.C. projectiles.

Special—any charge other than those listed above.

Charges suitable for use with either H.C. or target projectiles have hitherto been known as "H.C. Special" charges.

Types of powder

In both bag and case charges, the following types of powder are used:

SPD: This is smokeless powder stabilized by the addition of diphenylamine.

SPDN: This is stabilized smokeless powder with the further addition of certain nonvolatile materials to reduce hydroscopicity and increase service life.

SPCG: This is flashless double-base smokeless powder containing nitroglycerine and stabilized with carbamite. A new propellant, this one makes only one-half as much smoke as the older flashless powders. Made in the same physical shape as conventional powder, SPCG is chalk white in color and opaque, becoming slightly yellow with age. It contains only one-tenth the volatile solvent contained in pyro powder and is thus less susceptible to ballistic change from stowage. SPCG powder is governed by the same stowage regulations as SPD, SPDN, etc., except for the surveillance tests.

SPDF: Flashless smokeless powder.

SPDX: Water-dried stabilized smokeless powder.

SPDW: Reworked powder, for target use.

Marking of case and bag charges

Case markings: In addition to the information stamped on the head as shown in figure 79 the following marks are painted on the case:

Flashless powder: In cases loaded with flashless powder, a ¾-inch "F" should be painted in yellow somewhere on the head end. Also, the word "FLASHLESS" is painted on the side of the case.

Fixed and semi-fixed ammunition: Both fixed and semi-fixed ammunition cases have the index number painted in ¾-inch high letters on the head end of the case. In addition, semi-fixed charges also have their ammunition lot numbers painted on in a similar fashion.

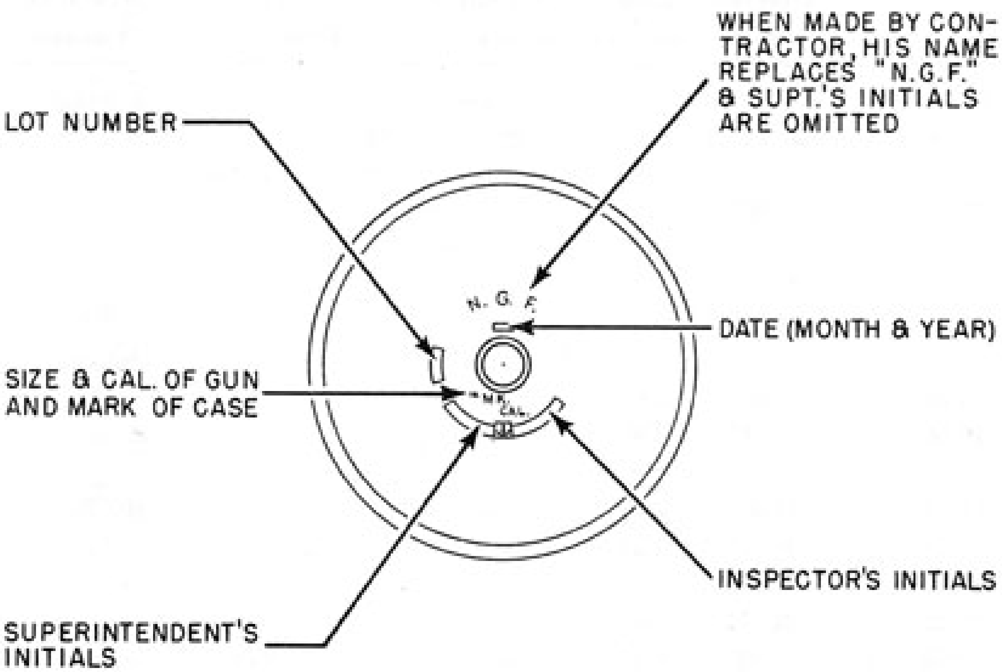

Figure 79. Stamping on Base of Cartridge Cases

Bag charges: These markings are lettered in ⅜-inch black characters on the side opposite to the lacings, with the bottom of the letters toward the ignition end of the bag:

Ammunition lot number

Caliber and length of gun in calibers—type of charge (full, reduced, etc.)

Index number of powder

Weight of powder charge

Number of sections per charge

Initial velocity and weight of projectile with which charge can be used.*

The word "FLASHLESS" in ¾″ high yellow letters if the charge is either flashless-type powder or powder with flashless pellets added.

*If two different initial velocities can be anticipated with different projectiles, the nominal velocity for each different projectile should be indicated, together with each projectile's weight.

CARTRIDGE CASE SPECIFICATIONS

Type	Gun	Over-all Length	Base Diameter	Material of Construction	Weight Empty	Weight of Propellant	Primer
3″ Mk 2	3″/23	9.20″	3.46″	Brass	2.25 lb.	580 gram	Mk 10 Mod 9
3″ Mk 3	3″/50	23.44″	4.30″	Brass	Mods 0 & 3: 7.0 lb.		
Mods 0, 2, & 3					Mod 2: 7.88 lb.	4.0 lb.	Mk 14, Mk 14 Mod 1
3″ Mk 7 & 9	3″/50	22.99″	4.30″	Mk 7: Brass	Mk 7: 7.0 lb.		
				Mk 9: Steel	Mk 9: 6.54 lb.	4.0 lb.	Mk 14, Mk 14 Mod 1
4″ Mk 2 Mod 0	4″/50	34.840″	5.90″	Brass	17.25 lb.	14.5 lb.	Mk 13 & all Mods
4″ Mk 2 Mod 1	4″/50	33.74″	5.90″	Brass	17.0 lb.	14.5 lb.	Mk 13 & all Mods
4″ Mk 2 Mod 3	4″/50	34.84″	5.90″	Brass	15.1 lb.	14.5 lb.	Mk 13 & all Mods
4″ Mk 2 Mod 4	4″/50	33.74″	5.90″	Brass	14.9 lb.	14.5 lb.	Mk 13 & all Mods
5″ Mk 3	5″/51	33.05″	7.40″	Brass	27.38 lb.	24.5 lb.	Mk 13 & all Mods
5″ Mk 5	5″/38	26.75″	6.22″	Brass	12.31 lb.	15.2 lb.	Mk 13 & all Mods
5″ Mk 4 Mod 0	5″/25	24.65″	5.90″	Brass	14.44 lb.	9.6 lb.	Mk 13 & all Mods
5″ Mk 4 Mod 2	5″/25	24.65″	5.90″	Brass	11.4 lb.	9.6 lb.	Mk 13 & all Mods
5″ Mk 6	5″/54	32.93″	6.22″	Brass	13.04 lb.	18.0 lb.	Mk 13 & all Mods
6″ Mk 4	6″/47	38.20″	7.85″	Brass	28.2 lb.	32.0 lb.	Mk 13 & all Mods
8″ Mk 1	8″/55	50.275″	10.55″	Brass	57.0 lb.	90.0 lb.	Mk 35
20-mm Mk 2	20-mm A.A.	4.343″	0.874″	Brass	0.190 lb.	27.7 grams	Mk 30, Mk 31
20-mm Mks 3 & 4	20-mm A.A.	4.343″	0.874″	Mk 3: Steel	0.190 lb.	27.7 grams	Mk 31
				Mk 4: Brass			
40-mm Mk 1	40-mm A.A.	12.24″	2.441″	Brass	1.93 lb.	300 grams	Mk 21
40-mm Mks 2 & 3	40-mm A.A.	12.24″	2.441″	Mk 2: Brass	Mk 2: 1.89 lb.	300 grams	Mk 22
				Mk 3: Steel	Mk 3: 1.53 lb.		
1.1″ Mk 1	1.1″ A.A.	7.83″	1.71″	Brass	0.688 lb.	120 grams	Mk 19 Mod 3
1-pdr. Mk 2	1-pounder	5.389″	1.775″	Brass	0.406 lb.	70 grams	Mk 10 Mod 9
3-pdr. Mk 1	3-pounder	14.843″	2.51″	Brass	1.65 lb.	300 grams	Mk 10 Mod 9
6-pdr. Mk 1	6-pounder	12.09″	2.99″	Brass	2.13 lb.	500 grams	Mk 10 Mod 9

SHORT CASES

Type	Gun	Length	Propellant Weight	Primer
Mk 1 (Modified)	1.1″	5.25″	85 grams	Mk 19 Mods 1, 2, & 3
Mk 2 (Modified)	3″/23	4.9″	385 grams	Mk 10 Mod 9
Mk 3 & Mods 2 & 3 (Modified)	3″/50	18″	3.8 lb.	Mk 14
Mk 2 & Mod 3 (Modified)	4″/50	29″	14.0 lb.	Mk 13 & all Mods
Mk 4 (Modified)	5″/25	21″	9.0 lb.	Mk 13 & all Mods
Mk 5 (Modified)	5″/38	16.25″	9.0 lb.	Mk 13 & all Mods
Mk 3 (Modified)	5″/51	20″	10.0 lb.	Mk 13 & all Mods
Mk 6 (Modified)	5″/34	20″	10.0 lb.	Mk 13 & all Mods
Mk 4 (Modified)	6″/47	25.0″	23.0 lb.	Mk 13 & all Mods
Mk 2 (Not Modified)	8″/55	31.08″	44.0 lb.	Mk 35 Mod 1

BAG AMMUNITION

New Dimensions of Powder Sections

Guns Used In	No. of Sections	Diam. of Ignition Circle	Ignition Charge per Section	Full Charge				Reduced Charge			
				Diam. of Section		Length of Section		Diam. of Section		Length of Section	
				Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
5"/50 Mks 5 & 6	1	4.00"	75	5.10"	6.00"	28.00"	29.25"				
5"/51 Mks 7, 8, & 15	1	4.00"	75	4.50"	6.00"	29.00"	30.00"	4.50"	6.00"	29.00"	30.00"
6"/47 Mk 17	1	5.00"	150	5.25"	6.50"	33.00"	34.00"	5.25"	6.50"	33.00"	34.00"
6"/50 Mks 6 & 8	1	4.50"	100	5.00"	6.35"	38.00"	39.50"	5.00"	6.35"	38.00"	39.50"
6"/53 Mks 12, 14, & 18	1	5.00"	150	5.25"	6.60"	44.50"	46.50"	5.25"	6.60"	44.50"	46.50"
7"/45 Mk 2	2	5.50"	150	6.50"	8.00"	23.25"	24.00"	6.50"	8.00"	23.25"	24.00"
8"/55 Mks 12, 14 & 15	2	6.00"	200	6.60"	7.80"	27.25"	28.00"	7.20"	7.80"	27.25"	28.00"
12"/50 Mk 7	4	8.50"	300	11.20"	12.60"	18.90"	19.90"	9.10"	10.60"	18.90"	19.90"
12"/50 Mk 8	4	9.00"	300	10.40"	11.50"	18.00"	19.00"	9.80"	10.60"	18.00"	19.00"
14"/45 Mks 8, 10, & 12	4	9.50"	300	12.60"	14.00"	18.75"	19.90"	10.50"	11.50"	18.70"	19.70"
14"/50 Mks 7 & 11	4	9.50"	300	12.60"	14.25"	18.50"	19.70"	10.20"	11.20"	18.70"	19.70"
16"/45 Mk 6-1	6	10.00"	290	13.50"	15.30"	13.75"	15.00"	11.80"	13.20"	14.00"	15.00"
16"/45 Mks 6-2, & 8	5	10.00"	350	13.50"	15.30"	16.75"	18.00"	11.80"	13.10"	17.00"	18.00"
16"/50 Mk 7	6	10.00"	350	13.90"	16.00"	16.00"	17.25"	11.25"	12.40"	16.25"	17.25"

EXISTING SERVICE ROUNDS

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Mk	Mod	Velocity (F/S)	Type of Charge	Propellent Powder	Charge Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
16"/50	7	0	2,700	A.P.	8	1–6	2,500	Full	SPD	660	Bag (6 Sec.)	Stacked	Bag, Type 3
			2,700	T.	9	1–2	2,500	Full	SPD	660	"	"	"
			2,700	A.P.	8	1–6	1,800	Target	SPD	420	"	"	"
			2,700	T.	9	1–2	1,800	Target	SPDN	340	"	"	"
			2,700	A.P.	8	1–6	1,800	Reduced	SPD	305	"	Dumped	"
									SPDN				
			2,700	T.	9	1–2	1,800	Reduced	SPCG	325	"	"	"
			1,900	H.C.	13	1–3	2,690	Full	SPD	660	"	Stacked	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPD	305	"	Dumped	"
									SPDN				
			1,900	H.C.	13	1–3	2,075	Reduced	SPCG	325	"	"	"
			1,900	H.C.	13	1–3	1,900	H.C.	SPD	325	"	"	"
16"/45	6	1	2,700	A.P.	8	1–6	2,300	Full	SPD	535	Bag (6 Sec.)	Stacked	Bag, Type 3
			2,700	T.	9	1–2	2,300	Full	SPD	535	"	"	"
			1,900	H.C.	13	1–3	2,525	Full	SPD	535	"	"	"
			2,700	A.P.	8	1–6	1,800	Target	SPD	380	"	"	"
			2,700	T.	9	1–2	1,800	Target	SPDN	335	"	"	"
			2,700	A.P.	8	1–6	1,800	Reduced	SPD	295	"	Dumped	"
									SPDN				
			2,700	T.	9	1–2	1,800	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPD	295	"	"	"
									SPDN				
			1,900	H.C.	13	1–3	2,075	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	1,900	H.C.	SPD	290	"	Stacked	"
			1,900	H.C.	13	1–3	1,900	H.C.	SPDN	310	"	"	"
16"/45	6	2	2,240	A.P.	5	1–5	2,520	Full	SPD	545	Bag (5 Sec).	Stacked	Bag, Type 3
	8	0, 1, 2	2,240	T.	6	1	2,520	Full	SPD	545	"	"	"
			1,900	H.C.	13	1–3	2,635	Full	SPD	545	"	"	"
			2,240	A.P.	5	1–5	1,935	Target	SPD	335	"	"	"
			2,240	T.	6	1	1,935	Target	SPD	335	"	"	"

			2,240	A.P.	5	1–5	1,935	Reduced	SPD SPDN	295	Bag (5 Sec.)	Dumped	Bag, Type 3
			2,240	T.	6	1	1,935	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPD SPDN	.295	"	"	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	2,000	H.C.	SPD	315	"	Stacked	"
			1,900	H.C.	13	1–3	2,000	H.C.	SPDN	335	"	"	"
14″/50	7	1	1,500	A.P.	16	1–10	2,700	Full	SPD	425	Bag (4 Sec.)	Stacked	Bag, Type 3
	11	1, 2, 3, & 5	1,500	T.	12	3–4	2,700	Full	SPD	425	"	"	"
			1,500	T.	15	1–3	2,700	Full	SPD	425	"	"	"
			1,500	T.	17	1–2	2,700	Full	SPD	425	"	"	"
			1,275	H.C.	19	1–5	2,825	Full	SPD	425	"	"	"
			1,500	A.P.	16	1–10	1,935	Target	SPD	280	"	"	"
			1,500	T.	12	3–4	1,935	Target	SPD	280	"	"	"
			1,500	T.	15	1–3	1,935	Target	SPD	280	"	"	"
			1,500	T.	17	1–2	1,935	Target	SPD	280	"	"	"
			1,500	A.P.	16	1–10	1,935	Reduced	SPDN	195	"	Dumped	"
			1,500	T.	12	3–4	1,935	Reduced	SPCG	200	"	"	"
			1,500	T.	15	1–3	1,935	Reduced	SPCG	200	"	"	"
			1,500	T.	17	1–2	1,935	Reduced	SPCG	200	"	"	"
			1,275	H.C.	19	1–5	2,065	Reduced	SPDN	195	"	"	"
			1,275	H.C.	19	1–5	2,065	Reduced	SPCG	200	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (1)	275 (1)	"	Stacked	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (2)	225 (2)	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (5)	260 (5)	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPDN	245	"	"	"
14″/45	8	1, 3, 4, & 6	1,500	A.P.	16	1–10	2,600	Full	SPD	420	Bag (4 Sec.)	Stacked	Bag, Type 3
	10	1			20	1							
	12	Mods	1,500	T.	17	1–2	2,600	Full	SPD	420	"	"	"
					21	1							
			1,275	H.C.	19	1–5	2,735	Full	SPD	420	"	"	"
			1,500	A.P.	16	1–10	1,935	Target	SPD	285	"	"	"
					20	1							
			1,500	T.	17	1–2	1,935	Target	SPD	285	"	"	"
					21	1							

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EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	& Mods	Projectiles Wt. (lb.)	Type	Mk	& Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
14"/45	8	1, 3, 4, & 6	1,500	A.P.	16	1–10	1,935	Reduced	SPDN	205	Bag (4 Sec.)	Dumped	Bag, Type 3
	10	1			20	1							
	12	Mods	1,500	T.	17	1–2	1,935	Reduced	SPCG	210	"	"	"
	(Continued)				21	1							
			1,275	H.C.	19	1–5	2,065	Reduced	SPDN	205	"	"	"
			1,275	H.C.	19	1–5	2,065	Reduced	SPCG	210	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (3)	285 (3)	"	Stacked	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (4)	240 (4)	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPDN	255	"	"	"
12"/50	8	—	1,140	A.P.	18	1	2,500	Full	SPD	275	Bag (4 Sec.)	Stacked	Bag, Type 3
			1,140	T.	19	1	2,500	Full	SPD	275	"	"	"
			940	H.C.	17	1	2,650	Full	SPD	275	"	"	"
			1,140	A.P.	18	1	1,800	Target	SPD	175	"	"	"
			1,140	T.	19	1	1,800	Target	SPD	175	"	"	"
			1,140	A.P.	18	1	1,800	Reduced	SPDN	135	"	Dumped	"
			1,140	T.	19	1	1,800	Reduced	SPDF	135	"	"	"
			940	H.C.	17	1	1,965	Reduced	SPDN	135	"	"	"
			940	H.C.	17	1	1,850	H.C.	SPD	175	"	Stacked	"
			940	H.C.	17	1	1,850	H.C.	SPDN	170	"	"	"
			940	H.C.	17	1	2,435	Special	SPD	245	"	"	"
			1,140	A.P.	18	1	2,300	Special	SPD	245	"	"	"
			1,140	T.	19	1	2,300	Special	SPD	245	"	"	"
			940	H.C.	17	1	1,965	Reduced	SPDF	135	"	Dumped	"
12"/50	7	15–19	870	A.P.	15	6	2,900	Full	SPD	335	Bag (4 Sec.)	Stacked	Bag, Type 3
			870	T.	11	3–4	2,900	Full	SPD	335	"	"	"
					14	2–8							
			740	H.C.	16	1–2	3,000	Full	SPD	335	"	"	"
			870	A.P.	15	6	2,100	Reduced	SPD	225	"	"	"
			870	T.	11	3–4	2,100	Reduced	SPD	225	"	"	"
					14	2–8							
			740	H.C.	16	1–2	2,125	Reduced	SPD	225	"	"	"

8″/55	12	1–2	335	A.P.	21	1–3	2,500	Full	SPD	85	Bag	Stacked	Bag, Type 3
	14	1–2	335	T.	22	2	2,500	Full	SPCG	89	"	"	"
	16	1	260	H.C.	24	1–5	2,700	Full	SPD	85	"	"	"
			260	H.C.	24	1–5	2,700	Full	SPCG	89	"	"	"
			335	A.P.	21	1–3	2,000	Target	SPD	59	"	Dumped	Dwg. 53417
			335	T.	22	2	2,000	Target	SPD	59	"	"	"
			260	H.C.	24	1–5	2,160	Target	SPD	59	"	"	"
			335	A.P.	21	1–3	2,000	Reduced	SPDN	55	"	"	"
			335	T.	22	2	2,000	Reduced	SPDF	56	"	"	"
			260	H.C.	24	1–5	2,220	Reduced	SPDN	55	"	"	"
			260	A.P.	19	1–6	2,800	Full	SPD	89	"	"	"
					16	7,9,10							
			260	T.	18	5–9	2,800	Full	SPCG	92	"	"	"
			260	A.P.	19	1–6	2,300	Target	SPD	66	"		"
					16	7,9,10							
			260	T.	18	5–9	2,300	Target	SPCG	69	"	"	"
			260	H.C.	24	1–5	2,800	Full	SPD	89	"	"	"
			260	H.C.	24	1–5	2,800	Full	SPCG	92	"	"	"
			260	H.C.	24	1–5	2,300	Target	SPD	66	"	"	"
			260	H.C.	24	1–5	2,300	Target	SPCG	69	"	"	"
			260	Com.	14	1	2,800	Full	SPD	89	"	"	"
			260	Com.	15	1	2,800	Full	SPCG	92	"	"	"
					17	1–4							
			260	Com.	14	1	2,300	Target	SPD	66	"	"	"
			260	Com.	15	1	2,300	Target	SPCG	69	"	"	"
					17	1–4							

8″/55	16	0	335	A.P.	21	1–3	2,500	Full	SPD	77	Case	Dumped	Mk 1
									SPDN				
			335	T.	22	1	2,500	Full	SPCG	82	"	"	"
			260	H.C.	24	1–5	2,700	Full	SPD	77	"	"	"
									SPDN				
			260	H.C.	24	1–5	2,700	Full	SPCG	82	"	"	"
			335	A.P.	21	1–3	2,000	Reduced	SPDN	45	"	"	"
			335	T.	22	1	2,000	Reduced	SPDF	46	"	"	"
			260	H.C.	24	1–5	2,220	Reduced	SPDN	45	"	"	"
			260	H.C.	24	1–5	2,220	Reduced	SPDF	46	"	"	"

EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Mk	Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
7"/45	2	Mods	165	A.P.	6	0-1	2,700	Full	SPD	58	Bag	Dumped	Dwg. 53417
			165	A.P.	10	2	2,700	Full	SPD	58	"	"	"
			165	A.P.	12	1-2	2,700	Full	SPD	58	"	"	"
			165	T.	11	5	2,700	Full	SPD	58	"	"	"
			153	Fld.	7	2-3	2,700	Full	SPD	58	"	"	"
			154	Bbt.	7	2	2,700	Full	SPD	58	"	"	"
6"/53	12	3, 5, 7	105	T.	25	2-3	3,000	Full	SPD	44	Bag	Dumped	Dwg. 53417
	14	0			29	1-4			SPDN*				
	18	1-2	105	T.	30	1-2	3,000	Full	SPCG	46	"	"	"
					25	2-3			SPD				
			105	T.	29	1-4	2,300	Tar. or Red.	SPDN	31	"	"	"
			105	T.	30	1-3	2,300	Tar. or Red.	SPCG	33	"	"	"
			105	Com.	24	1	3,000	Full	SPD	44	"	"	"
									SPDN				
			105	Com.	27	1-8	3,000	Full	SPCG	46	"	"	"
			105	Com.	24	1	2,300	Tar. or Red.	SPD	31	"	"	"
									SPDN				
			105	Com.	27	1-8	2,300	Tar. or Red.	SPCG	33	"	"	"
			105	H.C.	34	1-6	3,000	Full	SPD	44	"	"	"
									SPDN				
			105	H.C.	34	1-6	3,000	Full	SPCG	46	"	"	"
			95	S.S.	22	1	3,000	Full	SPD	44	"	"	"
									SPDN				
			95	S.S.	23	1-2	3,000	Full	SPCG	46	"	"	"
6"/50	6	0	106	Com.& T.	20	0,2,4	2,800	Full	SPD*	38	Bag	Dumped	Dwg. 53417
	8	Mods	106	Com.& T.	20	0,2,4	2,800	Full	SPDN	38	"	"	"
			106	Com.& T.	20	0,2,4	2,100	Target	SPD	26	"	"	"
			106	Com.& T.	20	0,2,4	2,100	Target	SPDN	26	"	"	"
			106	Com.	20	1, 3	2,800	Full	SPD	38	"	"	"
			106	Com.	20	1, 3	2,800	Full	SPDN	38	Bag	Dumped	Dwg. 53417
			96	S.S.	22	1	2,800	Full	SPD	38	"	"	"
			96	S.S.	23	1-2	2,800	Full	SPDN	38	"	"	"

6″/47	17	—	105	Com.	28	1–2	2,800	Full	SPD*	34	Bag	Stacked	Mk 3
			105	Com.	28	1–2	2,800	Full	SPDN*	34	"	Dumped	Dwg. 53417
			105	T.	31	1	2,300	Target	SPD*	26	"	"	"
			105	T.	29	1–4	2,300	Target	SPDN*	26	"	"	"
			96	S.S.	22	1	2,800	Full	SPD	34	"	Stacked	Mk 3
			96	S.S.	23	1–2	2,800	Full	SPDN	34	"	Dumped	Dwg. 53417
6″/47	16	0–1	130	A.P.	35	1–8	2,500	Full	SPD*	33	Semi-Fixed	Dumped	Case Mk 4
									SPDN				
			130	T.	36	1–2	2,500	Full	SPCG	34	"	"	"
					37	1, 3			SPD*				
			105	H.C.	34	1–7	2,665	Full	SPDN	33	"	"	"
			105	H.C.	34	1–7	2,665	Full	SPCG	34	"	"	"
			95	S.S.	32	0	2,700	Full	SPD*	33	"	"	"
									SPDN				
			95	S.S.	32	0	2,700	Full	SPCG	34	"	"	"
			130	A.P.	35	1–8	2,050	Target	SPD	25	"	"	"
			130	T.	36	1–2	2,050	Target	SPDN	25	"	"	"
					37	1, 3							
			130	A.P.	35	1–8	2,050	Reduced	SPDN	21	"	"	"
			130	T.	36	1–2	2,050	Reduced	SPDF	22	"	"	"
					37	1, 3							
			105	H.C.	34	1–7	2,160	Target	SPD	25	"	"	"
			105	H.C.	34	1–7	2,160	Target	SPDN	25	"	"	"
			105	H.C.	34	1–7	2,225	Reduced	SPDN	21	"	"	"
			105	H.C.	34	1–7	2,225	Reduced	SPDF	22	"	"	"
5″/54	16	0	70	Com.	41	0	2,650	Full	SPD	18.5	Semi-Fixed	Dumped	Case Mk 6
									SPDN				
			70	Com.	41	0	2,650	Full	SPDF	19	"	"	"
			70	H.C.	42	1	2,650	Full	SPD	18.5	"	"	"
									SPDN				
			70	H.C.	42	1	2,650	Full	SPDF	19	"	"	"
			70	S.S.	43	0	2,650	Full	SPD	18.5	"	"	"
									SPDN				
			70	S.S.	48	0	2,650	Full	SPDF	19	"	"	"

* May have flashless pellets added. If so, will be marked.

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EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks & Mods		Projectiles Wt. (lb.)	Type	Mk & Mod		Velocity (F/S)	Type of Charge	Propellent Charge Powder	Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
5″/51	9	Mods	50	Com.& T.	15	5, 12–14	3,150	Full	SPD* SPDN	25	Semi-Fixed	Dumped	Case Mk 3
			50	Com.& T.	15	5, 12–14	3,150	Full	SPDF	26	"	"	"
			50	H.C.	39	1	2,300	H.C.	SPD* SPDN	15.5	"	"	"
			50	H.C.	39	1	2,300	H.C.	SPDF	15.5	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPD* SPDN	25	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPDF	26	"	"	"
5″/51	7 8	Mods Mods	50	Com.–T.	15	5, 12–14	3,150	Full	SPD* SPDN	25	Bag	Dumped	Dwg. 53417
	15	Mods	50	Com.–T.	15	5, 12–14	3,150	Full	SPDF	26	"	"	"
			50	Com.–T.	15	5, 12–14	2,300	Reduced	SPD* SPDN	15.5	"	"	"
			50	Com.–T.	15	5, 12–14	2,300	Reduced	SPDF	15.5	"	"	"
			47	Com.–T.	15	1 & 5	3,150	Full	SPD SPDN	25	"	"	"
			47	Com.–T.	15	1 & 5	3,150	Full	SPDF	26	"	"	"
			47	Com.–T.	15	1 & 5	2,300	Reduced	SPD SPDN	15.5	"	"	"
			47	Com.–T.	15	1 & 5	2,300	Reduced	SPDF	15.5	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPD SPDN	25	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPDF	26	"	"	"
			55	A.A.Com.	35	1–12	2,600	Special	SPD SPDN	22	"	"	"
			55	A.A.Com.	35	1–12	2,600	Special	SPDF	22	"	"	"
5″/50	5	Mods	50	Com.–T.	15	5,12–14	3,000	Full	SPD	21	Bag	Dumped	Dwg. 53417
	6	Mods	50	Com.–T.	15	5,12–14	3,000	Full	SPDN	21	"	"	"

5″/38	12	0–1	54	Com.	32	1–3	2,600	Full	SPD* SPDN/SPDF	15.2/16	Semi-Fixed	Dumped	Case Mk 5
			54	Com.	38	1–3	2,600	"	"	"	"	"	"
			54	Com.	46	1–2	2,600	"	"	"	"	"	"
			55	A.A.Com.	31	1–11	2,600	"	"	"	"	"	"
			55	A.A.Com.	34	10	2,600	"	"	"	"	"	"
			55	A.A.Com.	35	1–12	2,600	"	"	"	"	"	"
			55	A.A.Com.	31	1–11	1,200	Reduced	SPDN	3.6	"	"	"
			55	A.A.Com.	34	10	1,200	"	"	"	"	"	"
			55	A.A.Com.	35	1–12	1,200	"	"	"	"	"	"
			54.5	S.S.	30	1–8	2,600	Full	SPD SPDN/SPDF	15.2/16	"	"	"
			54.5	S.S.	30	1–8	1,200	Reduced	SPDN	3.6	"	"	"
			53	S.S. (W.P.)	30	1–8	2,600	Full	SPD SPDN/SPDF	15.2/16	"	"	"
			53	"	30	1–8	1,200	Reduced	SPDN	3.6	"	"	"
			54.5	S.S. (W.P.)	30	5, 7–8	2,600	Full	SPD SPDN/SPDF	15.2/16	"	"	"
			54.5	"	30	5, 7–8	1,200	Reduced	SPDN	3.6	"	"	"
5″/25	11	1–2 5–8	54	S.S.	25	2	2,155	Full	SPD/SPDN*	9.6	Fixed	Dumped	Case Mk 4 0–2
			54	S.S.	27	1–10	2,155	"	"	"	"	"	"
			54	S.S.	45	0	2,155	"	"	"	"	"	"
			54	A.A.Com.	36	1–4	2,155	"	"	"	"	"	"
			52	A.A. Com.–T.	28	2–14	2,175	"	"	"	"	"	"
5″/25	13 17	0 0–1	54	S.S.	25	2	2,110	Full	SPD/SPDN*	9.6	Fixed	Dumped	Case Mk 4 0–2
			54	S.S.	27	1–10	2,110	"	"	"	"	"	"
			54	S.S.	45	0	2,110	"	"	"	"	"	"
			54	A.A.Com.	36	1–4	2,110	"	"	"	"	"	"
			52	A.A. Com.–T.	28	2–14	2,130	"	"	"	"	"	"
4″/50	9	5–24	33	Com.	6	6	2,900	Full	SPD SPDN/SPDF*	15/16	Fixed	Dumped	Case Mk 2 Mods 0, 1, 3, 4
			33	Com.	10	0–3	2,900	"	"	"	"	"	"
			33	Com.	16	1–2	2,900	"	"	"	"	"	"
			33	Com.	6	6	2,500	Target	"	13	"	"	"

* May have flashless pellets added. If so, will be marked.

EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Projectiles Mk	Projectiles Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Propellent Charge Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
4″/50	9	5–24	33	Com.	10	0–3	2,500	Target	SPD SPDN/SPDF*	13	Fixed "	Dumped "	Case Mk 2 Mods 0, 1, 3, 4
	(Cont'd)		33	Com.	16	1–2	2,500	"	"	"	"	"	"
			33	H.C.	15	1	2,900	Full	"	15/16	"	"	"
			33	H.C.	15	1	2,500	Target	"	13	"	"	"
			34	H.C.	EX2	0–1	2,900	Full	"	15/16	"	"	"
			34	H.C.	EX2	0–1	2,500	Target	"	13	"	"	"
			35	S.S.	14	1–6	2,900	Full	"	15/16	"	"	"
			35	S.S.	14	1–6	2,500	Target	"	13	"	"	"
3″/50	3	Mods	13+	S.S.	21	1–3	2,700	Full	SPD/SPDN*	4.0	Fixed	Dumped	Case Mk 3;0,2,3 7; — 9; —
	18–22	"	13+	S.S.	24	1	2,700	"	"	"	"	"	"
			13+	S.S.	25	1	2,700	"	"	"	"	"	"
			13+	A.A.	23	1–3	2,700	"	"	"	"	"	"
			13+	A.A.	27	1–4	2,700	"	"	"	"	"	"
			13–	A.A.	31	1	2,700	"	"	"	"	"	"
			13+	A.P.	29	1–2	2,700	"	"	"	"	"	"
3″/23	14	1	13	Com.	3	7	1,650	Full	SPD/SPDN*	580 gms.	Fixed	Dumped	Case Mk 2
			13	S.S.	22	1–5	1,650	"	"	"	"	"	"
			13	S.S.	28	1	1,650	"	"	"	"	"	"
			13	A.A.	26	1–2	1,650	"	"	"	"	"	"
1.1″	1	0–1	0.917	A.A.	1	Mods	2,700	Full	SPDN	120 gms.	Fixed	Dumped	Case Mk 1
40-mm	1	0	1.985	A.A.	1/2	Mods	2,890	Full	SPDN	300 gms.	Fixed	Dumped	Case Mk 1; — 2; 0–1 3; —
			1.96	A.P.	M81	Mods	2,890	"	"	"	"	"	
20-mm	4	0–1	0.2714	H.E.–H.E.I.	3	Mods	2,740	Full	SPDN	27.7 gms.	Fixed	Dumped	Cases Mks 2, 3, 4
			0.2621	H.E.–T.	4	Mods	2,740	"	"	"	"	"	"
			0.2741	H.E.–T.	7	Mods	2,740	"	"	"	"	"	"
			0.2686	A.P.–T.	9	Mods	2,740	"	"	"	"	"	"

* May have flashless pellets added. If so, will be marked.

Part I — Chapter 3

PROJECTILE FUZES

Section I — INTRODUCTION

Time fuzes

A time fuze is a device to detonate a projectile after a predetermined interval of flight. The detonation is accomplished through the burning of a variable length of powder train or through the action of a spring or a centrifugal clock mechanism. Only the clockwork types are currently in use by the U.S. Navy. Powder-train fuzes were previously used but have been declared unserviceable and obsolete.

Proximity fuzes—V.T.

V.T. fuzes are automatic proximity fuzes designed to cause detonation of a projectile at a most advantageous distance from its target. Operating with equal effectiveness in daylight or at night, they require no setting or adjustment before using, eliminating time-of-flight error. They are electrical fuzes which activate the auxiliary detonating fuzes after electrically integrating two factors: (1) nearness to an object, and (2) rate of approach to the object. Both conditions must be fulfilled to a definite degree before an electric impulse in the fuze will discharge a charged condenser through an electric detonator, called a "squib."

V.T. fuzes may be employed for antiaircraft purposes or for barrage fire against land or surface targets where air bursts will be effective against personnel and unarmored structures and equipment.

V.T. antiaircraft fuzes are designed to detonate the projectile at the most advantageous point upon approach to an aircraft, if they pass close enough to insure good probability of lethal fragmentation. The fuzes, moreover, will not normally function until the target is within the umbrella-shaped cone of fragmentation of the round.

An advantage of V.T. fuzing for A.A. work lies in its sensitivity to the presence of its target and the resulting increase of effective target area. The V.T. fuze comprehends a medium bomber as a target about 7,000 square feet in area. The plane presents an actual surface of about 200 square feet.

Wave suppression: One disadvantage encountered with early Mods of the V.T. Fuzes Mk 32 and Mk 45 was their sensitivity to waves or choppy water, causing either premature or non-functioning errors when fired at low elevations at targets near the water. A wave-suppression feature has been incorporated in later models of V.T. fuzes, to eliminate this disadvantage. This feature also makes the fuze less sensitive to large targets, such as land or water, so that detonation will not occur until the fuze is within 10—20 feet of the surface.

Tracer influence: A second disadvantage in the use of V.T. fuzes is that no tracer may be employed, since the burning tracer will influence the fuze to cause functioning upon arming, or to prevent functioning until the tracer has burned out.

Prematures: All V.T. fuzes are subject to random premature bursts along the trajectory after arming but before approaching a target. This makes the fuze somewhat dangerous to use for bombardment fire to cover landing operations, as the prematures will occur over our own forces. However, other advantages of V.T. fuzes for this type of fire are deemed to outweigh this danger. Normal bursts against land installations will be obtained between 10—30 or 50—200 feet above the target respectively, for fuzes with and without the wave-suppression feature. The fuze will automatically adapt itself to varying terrain features.

Safety features: Because of the number and variety of safety features incorporated, V.T. fuzes are among the safest in use as regards handling, bore safety, and freedom from muzzle bursts. In addition to the bore and muzzle safety provided by the auxiliary detonating fuze, a centrifugal clock is incorporated in the V.T. Fuzes Mks 32 and 40. The V.T. Fuze Mk 45 and later models contain mercury short circuits across the squib in place of the centrifugal clockwork mechanism. These mercury unshorters are so designed that handling, tumbling, or shock will not cause them to open. Centrifugal force caused by the projectile rotation must be applied for 0.2—0.4 seconds, depending on the fuze, before the mercury shorts can be opened. Also, these models incorporate a centrifugal switch which prevents charging of the firing condenser except when the round is rotating at or above a certain rate. This is called the "centrifugal handling switch."

All V.T. projectile fuzes, except the V.T. Fuze Mk 32, are powered with reserve batteries, wet batteries with the active ingredients contained in a glass ampoule until the round is fired. Upon set-back, the ampoule is broken, and the battery is automatically activated.

The battery ampoule is the weakest part of the fuze from the handling standpoint. While the complete round may be dropped 40 feet on armor plate without making it unsafe to fire, the fuze cannot be expected to function porperly. Battery ampoules in the V.T. Fuze Mk 53 will withstand a four-foot drop against armor plate in any position without breakage or impaired functioning. Ampoules in the V.T. Fuzes Mk 32 Mod 30 and Mk 40 may be broken by a two-foot drop on armor plate. If the ampoule is broken a considerable time before firing, the round will probably not function. If the ampoule breaks less than 30 seconds before firing, normal functioning may be expected.

V.T. fuzes operate effectively over a temperature range of 10° to 120° F. Outside this range, a higher percentage of malfunctioning will occur.

Storage: Exposure to high humidity conditions in storage reduces the service life of these fuzes. The V.T. Fuze Mk 32 requires special treatment, as it is not a reserve-battery fuze. The V.T. Fuzes Mk 32 Mods 1—20 & Mod 40 are re-energized by special Bureau of Ordnance personnel about every six months.

Supply: V.T. fuzes are supplied in specially cavitized projectiles for Naval use, and the fuzes cannot be interchanged with nose time or point detonating fuzes. V.T. fuzes are ballistically similar to nose time fuzes, so no corrections need be made in practical fire control when V.T. fuzing is employed. Although all V.T. fuzes have formerly been supplied in complete rounds, the V.T. Fuze Mk 58 will be issued to replace previously fitted V.T. Fuzes Mk 45 Mod 12 in 3"/50 A.A. projectiles.

Point, base, and auxiliary detonating fuzes

When classified according to assembled position in the projectile, fuzes are either "point" fuzes, which are assembled in the nose of the projectile, or "base" fuzes. "Auxiliary detonating" fuzes are used in conjunction with point fuzes in all except Illuminating projectiles.

Ignition and detonating fuzes

The differentiation between "ignition" and "detonating" fuzes depends on the method of firing the bursting charge. The operating mechanism of the ignition fuze fires a black-powder magazine, which may ignite the bursting charge of the projectile directly or function through an auxiliary detonating fuze, containing a detonating element. A detonating fuze contains a high-explosive element within its own body.

Delay

The delay elements within impact fuzes consist either of slow-burning powder pellets of fixed size or pellets in which varying lengths burn before the action takes place. The delay element is designed to allow penetration of targets before bursting of the projectile. Delays are always used in armor-piercing projectiles to obtain complete penetration before detonation. Instantaneous fuzes are employed against light armor or material targets for burst before penetration.

Arming

The principal forces used in arming or preparing fuzes for action are (1) set-back, the force of inertia or resistance to linear acceleration of projectiles, and (2) centrifugal force, due to the rotation of the projectile. Many of the Navy fuzes employ a combination of these two forces in arming the fuze. The force of set-back exists only during the acceleration stage of the projectile's flight, which ceases when the projectile leaves the bore of the gun. Centrifugal force, however, exists from the instant that the projectile begins its movement until detonation occurs. Set-back is generally used to shear safety pins, fire percussion elements, and initiate the operation of mechanical clocks. Centrifugal force serves to release detents or locking pins, drive and fire centrifugally operated clocks, revolve rotor blocks, etc., as is explained in detail in the individual fuze sections following.

Part I — Chapter 3 — Section 2

POINT DETONATING FUZES FOR PROJECTILES

Mk 7 Mod 1 (Obsolete)

Projectiles used in	7″/45 Field and Bbt.
Over-all length, inches	7.81
Diameter, inches	Body: 1.12 Base of ogive: 1.62
Threaded length, inches	1.27
Threads	13 R.H.
Material	Steel

Description: This fuze consists of a long, cylindrical body closed at either end by an ogival nose cap and a cylindrical base plug, each threaded into place. The central cavity of the body houses a safety spring, a long percussion rod assembly, a needle striker, a striker retaining sleeve, a detonator, and a ring booster pellet.

The percussion rod is closed at its upper end by a metal cap. The rolled edges of this cap and the safety spring tend to prevent the percussion rod from moving into the upper portion of the body. The long cylindrical portion of the percussion rod is slotted longitudinally to allow the eared striker to slide freely within the rod. The ears of the striker are engaged by the striker retaining sleeve, holding the striker permanently fixed. A detonator is fixed to the lower end of the percussion rod. In the unarmed position, this detonator is not adjacent to the ring booster charge but is encased in a safety chamber in the base of the fuze. Accidental explosion of the detonator in this position would

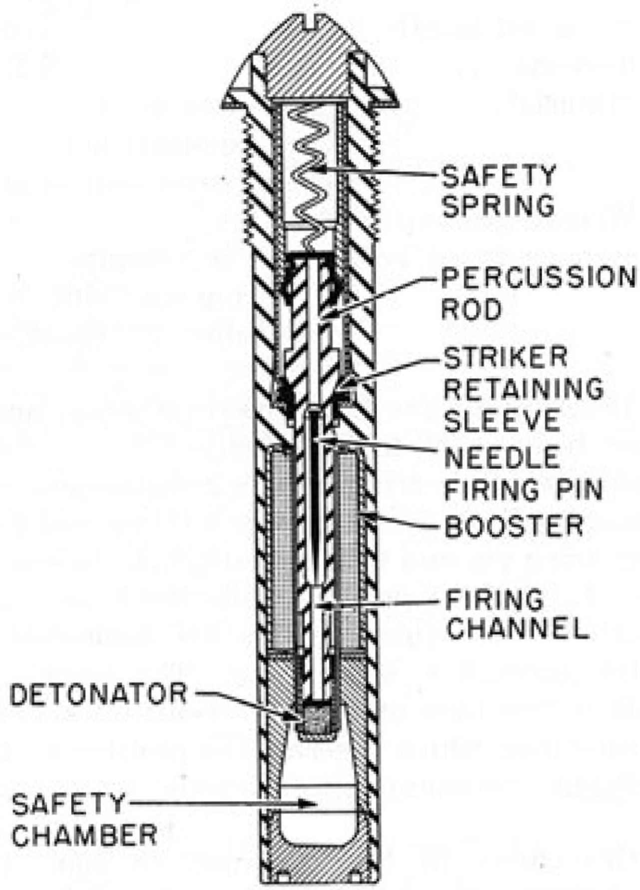


Figure 80. Point Detonating Fuze Mk 7 Mod 1

spend itself harmlessly in the expansion chamber, and the booster charge would not be fired.

Operation: The fuze functions entirely on impact, when the inertia of the percussion rod drives the rolled edges of its upper cap past the shoulder of the cap retaining sleeve. The rod then continues into the upper portion of the fuze body, against the force of the safety spring. This action carries the detonator out of the safety chamber, adjacent to the ring booster, and against the fixed firing pin. The initiation of the detonator fires the booster and the main charge.

Rearward motion of the percussion rod during set-back is prevented by the conical shape of the percussion rod just above the striker retaining sleeve.

Mk 12 Mods 0—3

Projectiles used in................1.1″ A.A.
Over-all length, inches 2.3
Diameters, inch ......Firing pin head: 0.18
Base of ogive: 1.08
Threaded length, inch 0.62
Threads ....7 R.H.
Material.........Nose—aluminum
Base—commercial brass
Booster cover—sheet steel
Weight, grams 85.3
Arming speed, revolutions per minute
Firing pin: 5000–7500
Rotor: 10,000–12,000

Description: The fuze consists of a nose and a fuze body, held firmly together by a metal jacket, which is crimped over at both ends, and separated from each other by a thin metal disc. The firing pin and firing pin detents are assembled in the nose portion, while the lower body portion of the fuze contains the rotor detent, rotor, detonator, and booster. The booster is held in the base of the fuze body by a metal closing disc, which is secured in position by the crimped-over ends of the fuze body.

Operation: In the unarmed position, the striker is held upward by a pair of firing pin detents, and the detonator rotor is held out of alignment with the firing pin and the booster lead-in by a rotor detent. When the projectile is fired from the gun, centrifugal force moves the firing pin and rotor detents outward against their springs, unlocking the firing pin and the rotor. Centrifugal force then causes the rotor to revolve about its pivot until brought up by the stop pin. In this position, the detonator is fully aligned with the firing pin and the booster lead-in. On impact, the exposed firing pin is driven into the detonator, which initiates the booster lead-in and the booster. The fuze is designed to function on light duralumin sheets.

Remarks: The Point Detonating Fuze Mk 12 Mod 1 is identical to the Mk 12, except that an extra striker-support piece is set in a groove in the nose. Mods 0 and 1 are now obsolete. Mods 2 and 3 differ from Mod 1 in that the striker is held in the nose assembly by crimping over the end of the nose. In the modified Mk 12 (Mods 2 and 3), to decrease the sensitivity of the fuze, a washer has been placed above the firing pin, and the firing pin has been crimped above the washer. Thus on impact, both the crimp and the washer must be broken.

Mk 26 Mods 0—2

Projectiles used in......20-mm H.E., H.E.I.,
and H.E.T. (A.A.)
Over-all length, inches................1.016
Diameters, inch......Nose—0.35
At base of ogive—0.80
Threaded length, inch....Mk 26 Mod 0—0.18
Mk 26 Mod 1—0.26
Threads ....Mk 26 Mod 0—4 R.H.
Mk 26 Mod 1—7 R.H.
Weights, grams ....Mk 26 Mod 0—24.67
Mk 26 Mod 1—23.37
Mk 26 Mod 2—28.67
Material...........Mk 26 Mod 0—all brass
Mk 26 Mod 1—zinc body
Mk 26 Mod 2—all brass

Description: Point Detonating Fuze Mk 26 Mod 0 consists essentially of the following parts: The nose or body unit (into which is fitted the rear disc or air channel) and the closing unit, which contains the detonator.

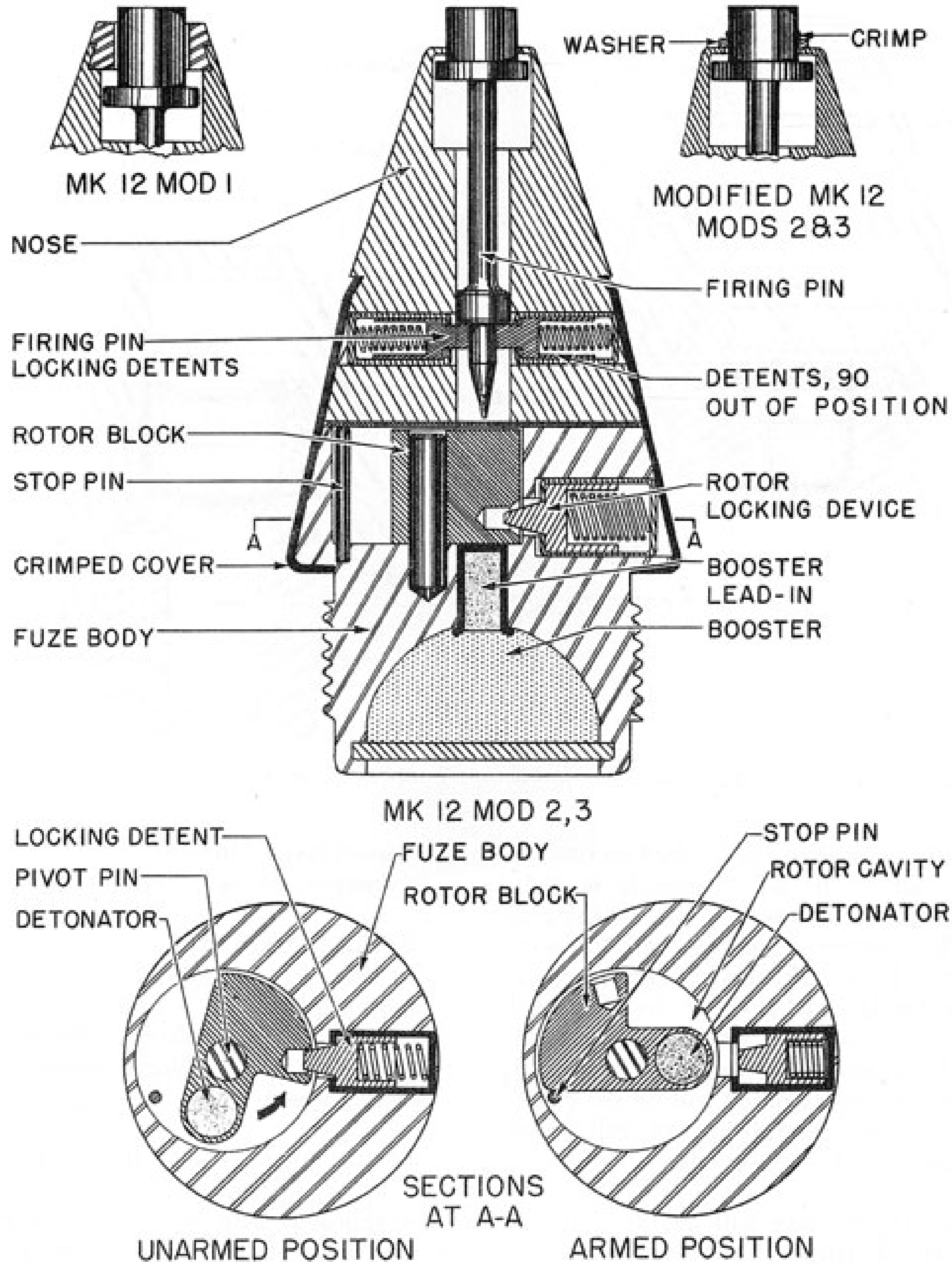


Figure 81. Point Detonating Fuze Mk 12 Mods 0—3

The Point Detonating Fuzes Mk 26 Mods 1 and 2 consist essentially of two pieces: (1) the nose or main body and (2) the magazine, which contains the same detonator used in the Point Detonating Fuze Mk 26 Mod 0 and an additional booster of tetryl below the lead azide detonator.

Operation: The fuze has no safety features in its design, but it will withstand a 40-foot drop onto armor plate without detonation. In the

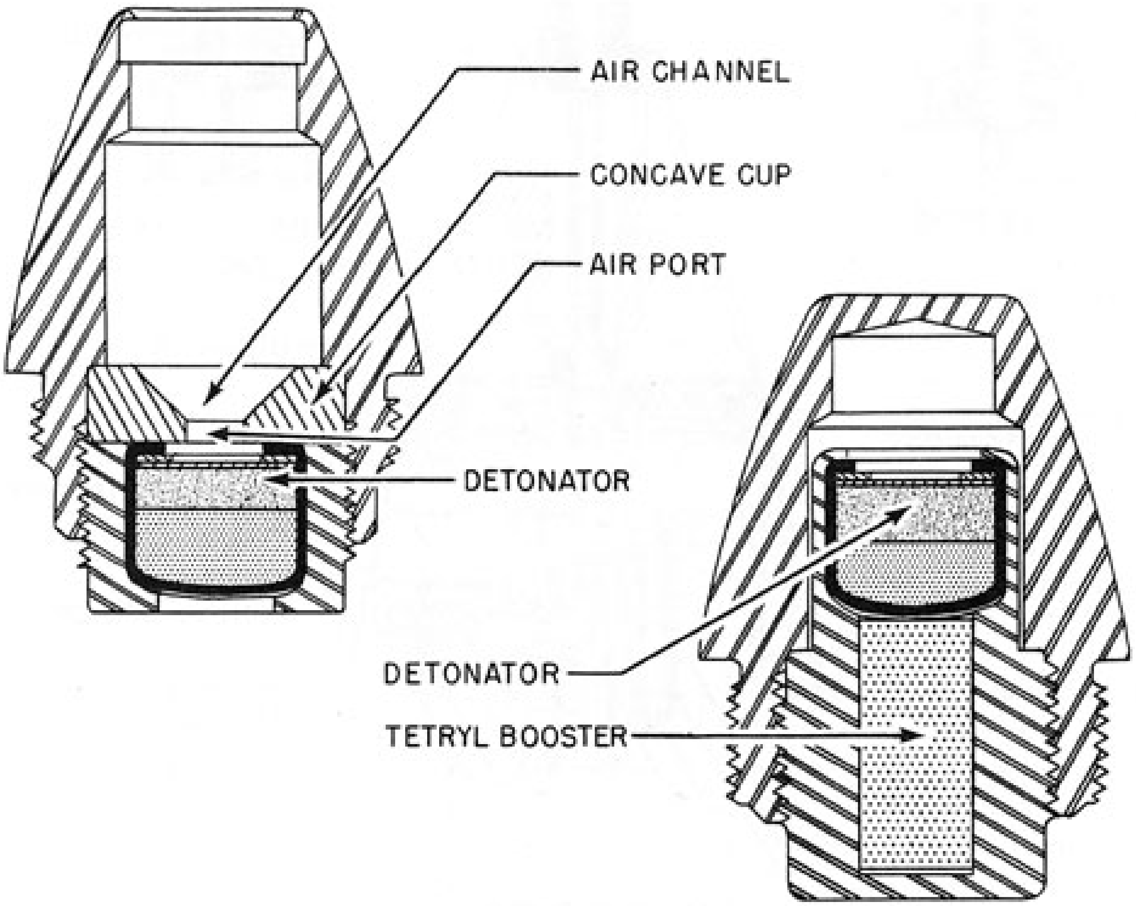


Figure 82. Point Detonating Fuze Mk 26 Mods 0—2

Mk 26 Mod 0, the nose cap is crushed on impact, causing the air in the air channel to be compressed and forced through the hole in the concave disc. This action generates sufficient pressure and heat to set off the very sensitive lead azide detonator beneath the disc. In the Mod 1 and Mod 2, there is no air channel or disc, and the fuze is fired entirely by the shock of impact. The very sensitive detonator will be set off by the shock of impact; and it, in turn, will set off the magazine of tetryl beneath it.

Remarks: These fuzes will not detonate on water impact, but they will detonate on 1/8-inch mild-steel. The Mods 1 and 2 are more sensitive than the Mod 0 to both impact and heat. No more Point Detonating Fuzes Mk 26 Mod 2 are being made.

Mk 27 Mods 0 and 1

Projectiles used in
40-mm A.A., H.E. and H.E.-I.

Over-all length, inches 2.445
Diameters, inches. . . . Nose—0.344
At base of ogive—1.28
Threaded length, inch. 0.307
Threads . . . . 4 R.H.
Weight, grams . . . . 104±2.6
Material. . . . . Body—die-cast aluminum
Magazine—brass or steel
Arming speed, r.p.m. . . . Firing pin:
7,000–20,000
Rotor: 10,000–14,000

Description: Internally, the fuze consists of two major housings: the firing pin housing and the rotor housing. Within the firing pin housing is a metal firing pin held in place by two firing pin detents which are surrounded by a circular copper band acting as a detent spring. Above the firing pin housing is a plastic firing pin extension which serves as a safety feature in the event that the fuze is dropped in the unarmed condition. The rotor housing consists of a

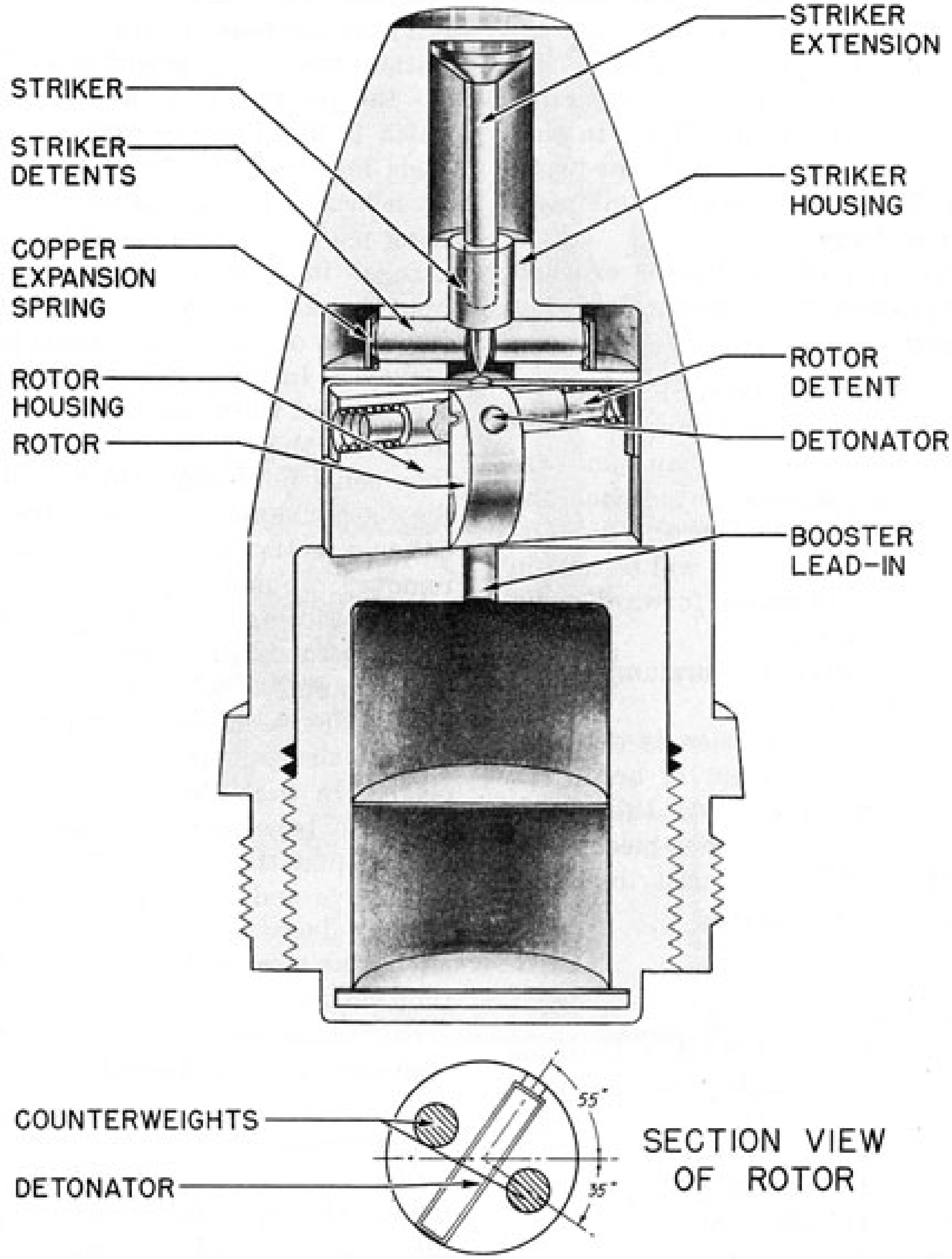


Figure 83. Point Detonating Fuze Mk 27 Mod 0

rotor, with lead counterweights and detonator assembled in a rotor block. The axis of the detonator is inserted at an angle of about 55 degrees to the axis of the fuze. The line of center of the lead counterweights, being perpendicular to the axis of the detonator, is at an angle of about 35 degrees to the axis of the fuze. The rotor is held in this unarmed position by the two rotor detents, the tapered ends of which engage in the holes in the side of the rotor. In this position the detonator is not in line with the firing pin or booster.

Operation: This fuze is armed entirely by centrifugal force which accomplishes three things:

1. The firing pin detents are moved outward against the copper band, thus freeing the firing pin. The copper band is arranged so that the ends of it overlap, allowing room for expansion.

2. The rotor detents are moved back against their spring, freeing the rotor.

3. The lead counterweights are caused to turn the rotor until they are at a maximum radius from the axis of rotation of the fuze. In this position, the detonator is aligned with the firing pin and booster. The rotor is held in this position by centrifugal force.

On impact, the nose of the fuze is crushed and the firing pin extension pushes the firing pin into the detonator.

Remarks: The Point Detonating Fuze Mk 27 Mod 1 differs from the Mod 0 in that the firing pin detents are of a different shape and are known as "hour-glass" detents. On set-back, the firing pin will move back against the detents, and, because of their shape, they will be held in place until the firing pin moves forward again under the influence of creep.

These fuzes will function on duralumin sheet but not on water impact.

The plastic firing pin extension is designed as a safety device in the event of accidental dropping. If the round is dropped, the plastic extension will shatter, wheras a one-piece metal firing pin might force its way past the firing pin detents and initiate the fuze.

Mk 29 Mods 0—3

Projectiles used in
5"/25/38/51 A.A. Common
5"/38 W.P. (Mod 3 only)
5"/51 H.C., 6"/47 H. C.
8"/55 H.C., 12"/50 H.C.
14"/45/50 H.C.
15"/45/50 H.C.

Over-all length, inches 4.15
Diameter at nose, inch................0.55
Diameter at base of ogive, inches.......3.00
Threaded length, inch.................0.80
Threads ....7 R.H.
Weight, pounds ....1.45 ± 0.04
Material............Base—steel
Detonator body—brass
Ogive—plastic
Arming speed, r.p.m.............1,500—2,000

Description: The fuze consists of four principal parts: (1) the base, which contains the relay detonator and holder and the interruptor unit; (2) the nose or detonator assembly, which contains the striker assembly and the detonator; (3) the plastic ogive; and (4) the flash tube, which is fitted in the center of the ogive and holds the nose and the base together. A crush cup is located beneath the firing pin, holding the firing pin away from the detonator, and a centrifugal interruptor separates the detonator from the relay detonator in the base of the fuze. Two types of interruptor assemblies have been employed. In the earlier model, the interruptor bore against the upper blade of a forked setting sleeve in the "Delay" or "Off" position and thus could not move into the sleeve and clear the flash channel. Rotating the sleeve 90° in either direction to the "S.Q." or "On" position removed the end of the forked blade from the interruptor, and centrifugal force could move the interruptor into the sleeve and out of the flash channel. The interruptor system of later models has been slightly altered. A cylindrical setting sleeve with an eccentric bore is employed. In the "Delay" or "Off" position, the eccentric bore is not aligned with the interruptor, and the interruptor cannot move into the sleeve and clear the channel. Turning the setting sleeve to the "S.Q." or "On" position aligns the bore with the interruptor, which can then be moved into the sleeve by centrifugal force. In either case, the end of the setting sleeve carries a slotted setting key.

Operation: When the fuzed projectile is loaded into the gun, the setting key is turned to the "On" or "S.Q." position. On set-back, the interruptor sits down in the flash channel, but when the projectile leaves the gun centrifugal force moves the interruptor into the sleeve and clears the flash channel. On impact, the closing disc above the striker is forced down, the crush cup beneath the striker is crushed, and the striker is driven into the detonator. The flash travels through the open flash channel and initiates the relay detonator in the base of the fuze.

Remarks: The differences between Mods of this fuze are as follows:

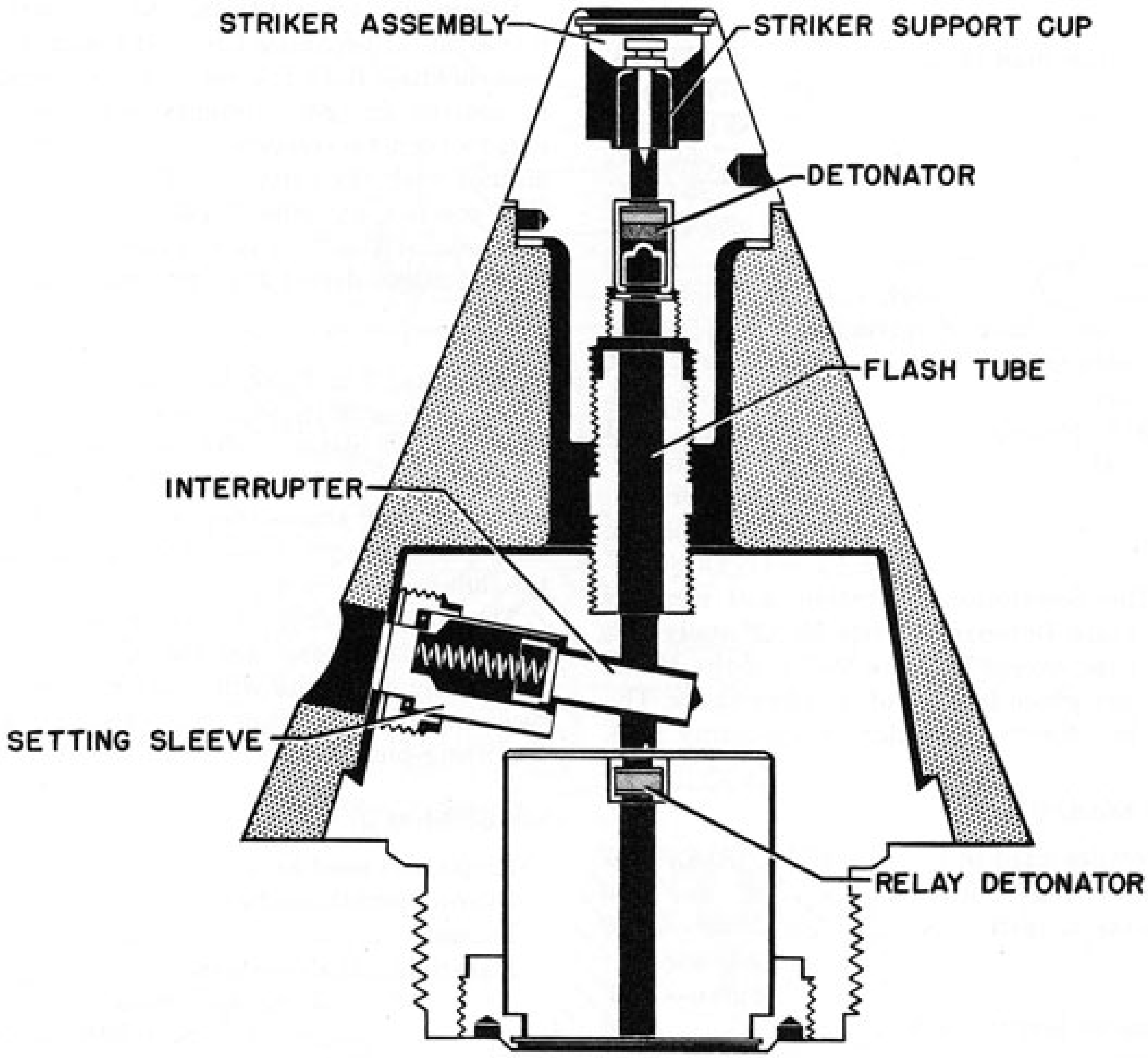


Figure 84. Point Detonating Fuze Mk 29 Mod 0

Mod 0: Dark green ogive, made of easily chipped asbestos plastic, unsuitable for storage and handling. This Mod is obsolete.

Mod 1: Chip-proof, resin-impregnated cloth, yellow plastic ogive.

Mod 2: Same as Mod 1, with strengthened flash channel.

Mod 3: Like Mod 2, with longer nose cap extending to base and giving additional support to flash channel. Brown plastic ogive. A 0.01-inch thick disc is incorporated between the relay detonator and the flash channel of the Mod 3. This prevents gas pressure, which sometimes leaks past the unarmed interruptor, from setting off the relay detonator, if the nose of the fuze is accidentally struck during handling.

This fuze will function on thin plate and on water at angles over 6°.

Mk 30

Projectiles used in	3"/23 A.A. 3"/50 A.A. 3"/50 H.C. 4"/50 H.C. 5"/54 H.C. 6"/47 H.C.
Over-all length, inches	4.55
Diameter at nose, inch	0.55
Diameter at base of ogive, inches	2.4
Threaded length, inch	0.80
Threads	7 R.H.
Weight, pounds	1.51
Material	Base—Steel Head—brass Ogive—plastic

All the description, operation, and remarks on the Point Detonating Fuze Mk 29 apply also to this fuze, except that the Mod 1 of the Mk 30 has a light green instead of a yellow ogive. The Mk 30 is a Navy adaptation of the Army M48.

Mk 34 Mods 0 and 1

Projectiles used in	1.1" A.A., H.E.
Over-all length, inches	2.08
Diameters, inch	Nose—0.300 At base of ogive—1.06
Threaded length, inch	0.46
Threads	7 R.H.
Material	Body—die-cast alloy (zinc base) Magazine—brass Firing pin extension—plastic

Description: This fuze consists of one housing containing the firing pin and rotor units. Above the firing pin is a plastic firing-pin extension. The firing pin is held up by two detents, which are held in place by a circular copper band surrounding them and acting as a spring. Beneath the firing pin is the rotor, with the detonator at an angle of about 55 degrees from the axis of the fuze. The rotor is held in the unarmed position by a set-back block connected by a copper shear wire. In this position, the detonator is out of line with both the firing pin and the booster.

Operation: On set-back, the set-back block moves back, breaking the shear wire that has been holding it to the rotor. Centrifugal force causes the firing-pin detents to move outward and to turn the rotor so that the detonator is aligned with the firing pin. The rotor is held in this position by centrifugal force. On impact, the nose of the fuze is crushed and the firing pin extension drives the firing pin into the detonator.

Remarks: The Point Detonating Fuze Mk 34 Mod 1 differs in that the firing pin detents are "hour-glass" detents. On set-back, the firing pin will move back against the detents, and (because of their shape) they will be held in place until the firing pin moves forward again under the influence of creep.

The plastic firing-pin extension is a safety device. In the event that the round is dropped, the plastic extension will shatter, where a one-piece metal firing pin might force its way past the firing-pin detents and initiate the fuze.

Mk 66 Mod 0

Projectiles used in	5"/38 W.P.
Over-all length, inches	4.408
Thread	1.70"-14NS-1 R.H.
Materials	Body—steel Nose piece—brass Ogive—plastic (cloth base) Rotor assembly—aluminum alloy Magazine—steel
Weight, pounds	1.54

Description: This fuze is very much like the Point Detonating Fuze Mk 29 Mod 3, with the addition of the rotor for detonator safety. It has the firing pin and crush cap in the nose, the flash channel, the interruptor device, the rotor assembly, and the magazine. The rotor contains a lead azide detonator and is held in place by two detents. The booster magazine contains 6.7 grams of black powder in a water-tight vinylite cup. A vinylite cup is cemented onto the base of the fuze to prevent the holes in the metal cover from abrading the silk powder bags in the W.P. load as the fuze is inserted.

An aluminum disk 0.010-inch thick between

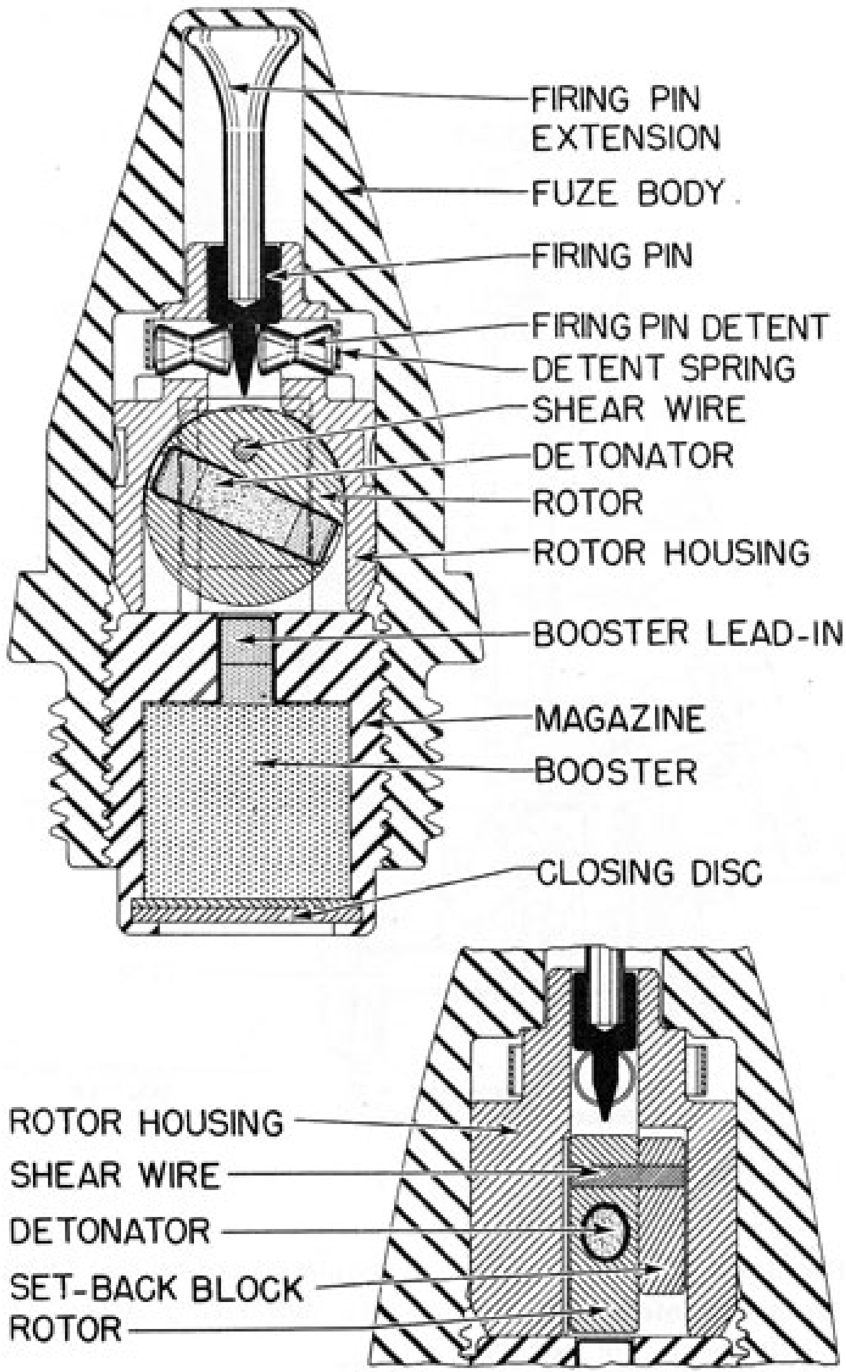


Figure 85. Point Detonating Fuze Mk 34 Mod 1

the relay detonator and the rotor housing is another safety feature. It prevents pressure from an accidental detonation in the nose from getting to the rotor after leaking past the unarmed interruptor—which the gas could do.

Operation: When the projectile is ready to be fired, the setting screw for the interruptor is turned to the ON or SQ ("Super-Quick") position. Up to this time the interruptor, in the OFF position, has blocked the flash channel so that accidental crushing of the cup, setting off the detonator, could not set off the booster charge. On set-back, the interruptor sits down in the flash channel; but, as creep takes over, the centrifugal force moves the interruptor into the sleeve, clearing the flash channel.

Centrifugal force also moves the detents holding the rotor out, allowing the lead counter-

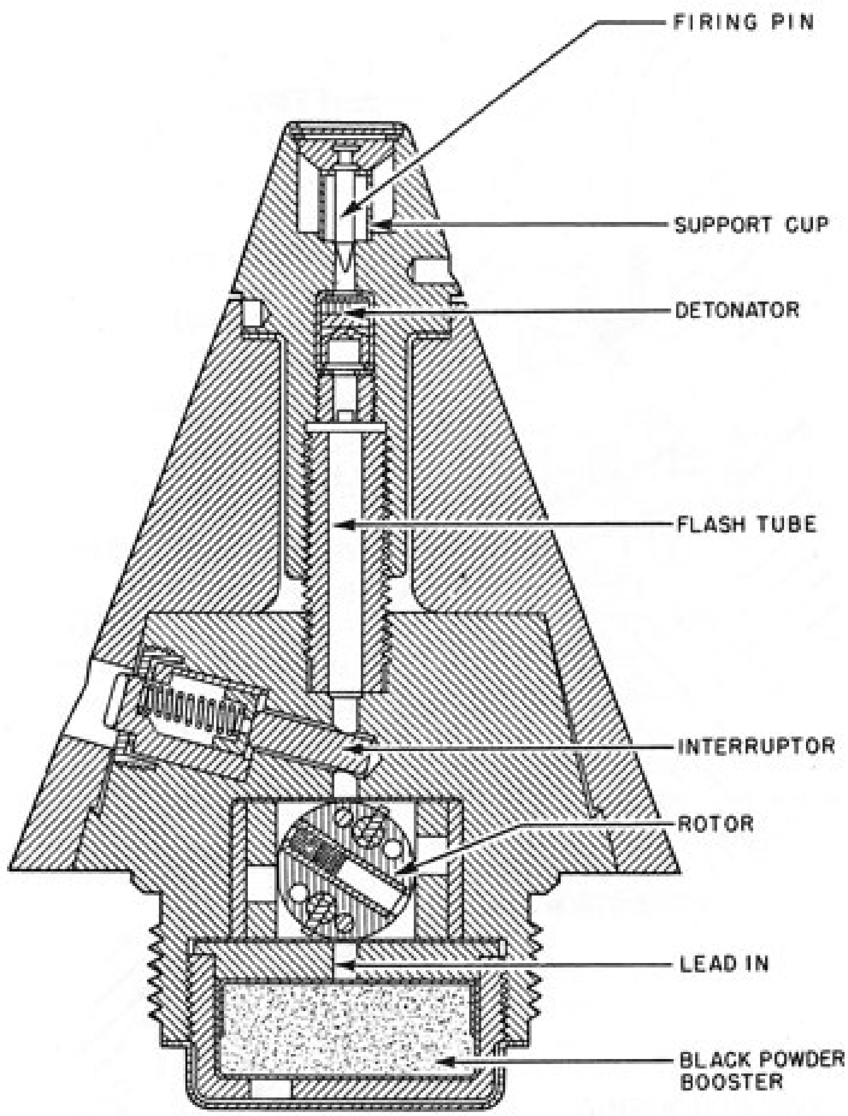


Figure 86. Point Detonating Fuze Mk 66 Mod 0

weights in the rotor, through centrifugal force, to rotate the rotor until the stop pins rest against the edge of the holes in the housing, thus lining up the second detonator under the flash channel. The fuze is now fully armed, and, on impact, the crush cap collapses, allowing the firing pin to set off the detonator, sending the flash down the open tube, which in turn sets off the detonator in the rotor, and finally the black powder charge.

Remarks: The fuze will detonate on impact with ground, ½-inch wood, or ⅛-inch mild steel plate.

The Point Detonating Fuze Mk 66 was developed to give detonator safety in 5"/38 W.P. projectile assemblies, which do not have auxiliary detonating fuzes.

M75

Projectiles used in	20-mm (Army) H.E.–I., M97
Over-all length, inches	1.20
Diameter at base of ogive, inch	0.64
Threaded length, inch	0.20
Threads	7 R.H.
Weight, pound	0.0497
Material	Brass
Filling	Detonator—mercury fulminate Relay charge—lead azide Booster—tetryl

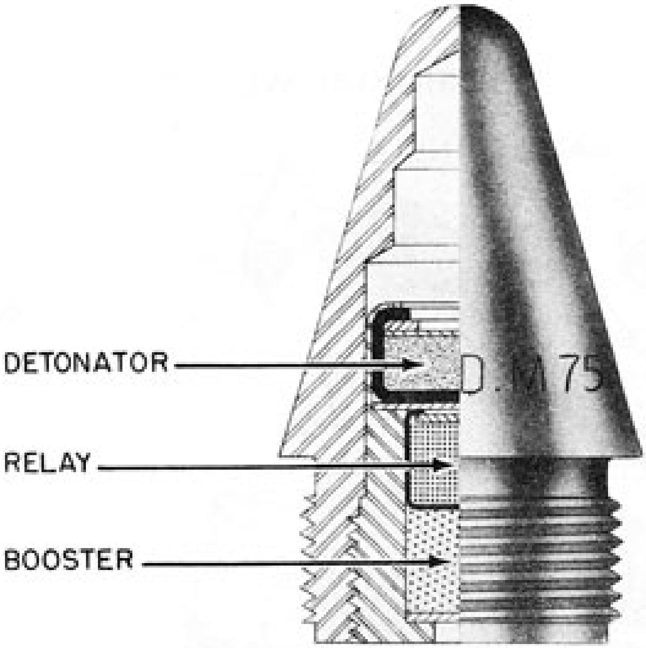


Figure 87. Point Detonating Fuze M75

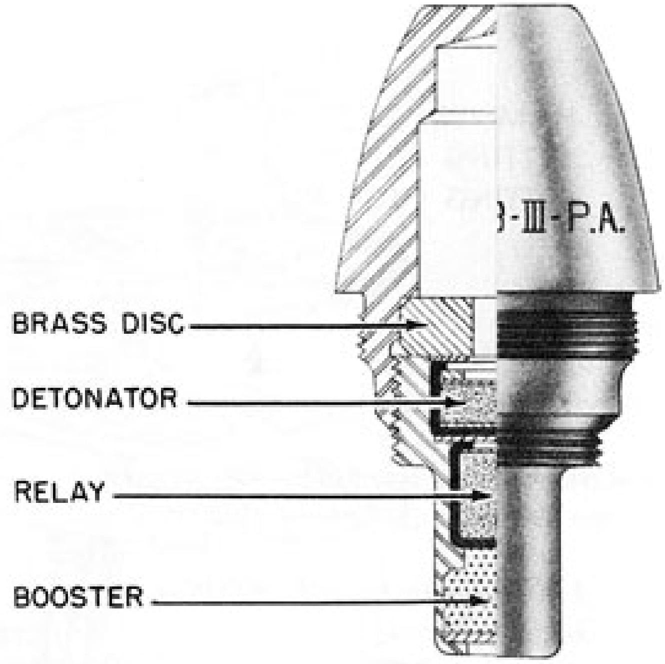


Figure 88. Point Detonating Fuze No. 253 Mk 3

Description: This fuze is designed to function with instantaneous action on impact with light material surfaces. The fuze is initiated on impact by the set-forward motion of the detonator charge, or by pieces of metal from the body striking the detonator charge.

The fuze has two major parts, a body with an air space in the fore part of the fuze, and a magazine containing the explosive train, screwed into the base of the body.

Remarks: The fuze contains no interruptors or other safety devices and is, therefore, sensitive for handling.

No. 253 Mks I—3

Projectiles used in	20-mm (Army) H.E.–I., Mk 1
Over-all length, inches	1.41
Diameter at nose, inch	0.32
Diameter at base of ogive, inch	0.70
Threaded length, inch	0.12
Threads	4 R.H.
Weight, pound	0.058
Material	Brass
Filling	Detonator—mercury fulminate Relay charge—mercury fulminate Booster—tetryl

Description: This fuze is designed to function with instantaneous action on impact with light material surfaces. It is initiated on impact by the set-forward force of the detonator charge, or by pieces of metal from the body striking the detonator charge.

The fuze consists of two major parts, a brass body with an air chamber in its forward part, and a brass mazagine containing the explosive train and externally threaded (L.H.) to screw into the base of the body. The magazine is covered with a brass disc separating the detonator from the air column. In the Point Detonating Fuze Mk 1, this disc is solid, but in the Mks 2 and 3 a small hole is drilled through the center of the disc to increase the fuze's sensitivity. In the Mks 1 and 2 the body cavity was closed at the forward end by a thin brass disc; in the Point Detonating Fuze Mk 3, the brass disc is omitted, and the nose is solid across this area.

Remarks: The fuze contains no interruptors or other safety devices, and is therefore sensitive for handling.

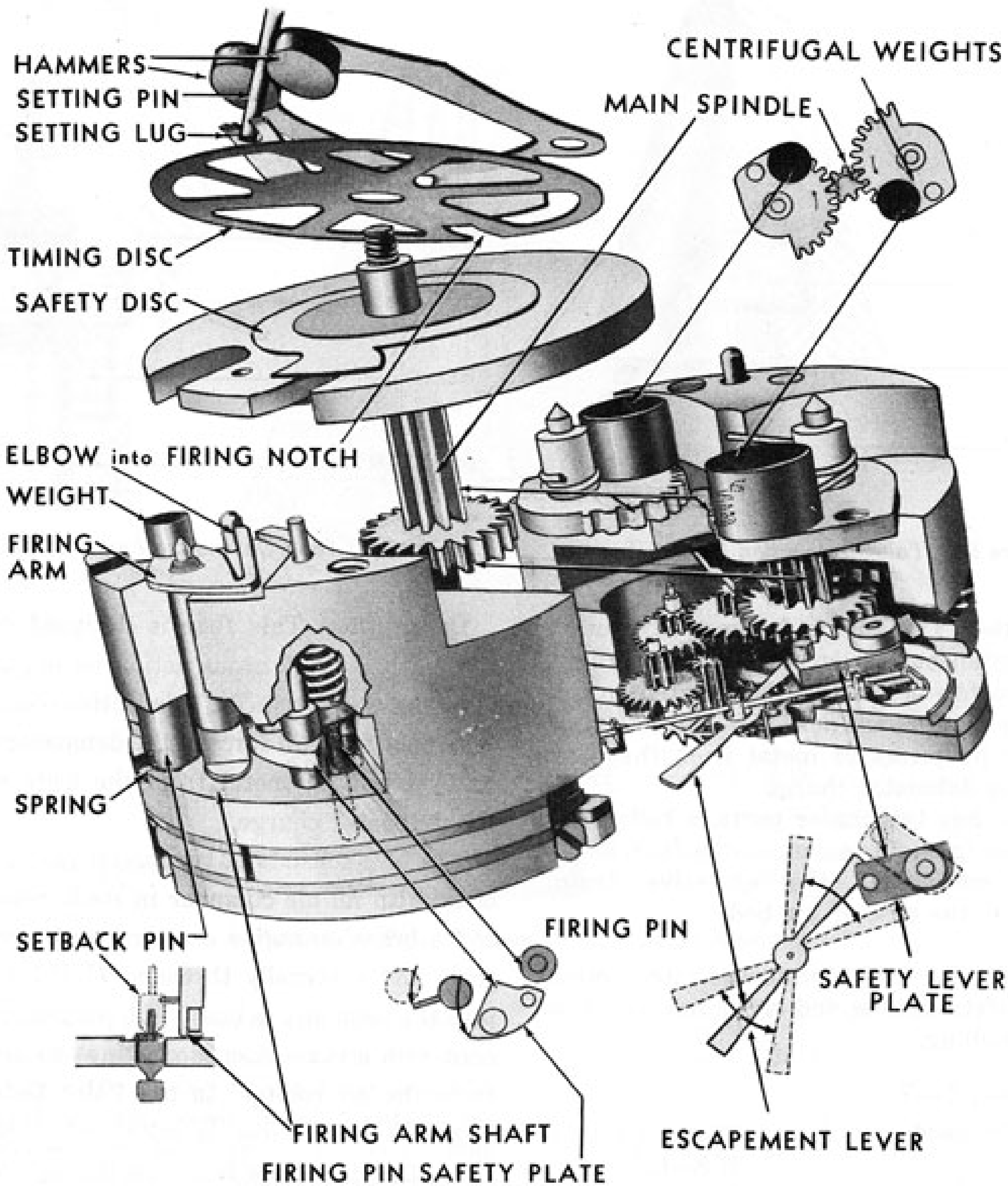


Figure 89. Centrifugal Timing Mechanism

NOSE TIME FUZES FOR PROJECTILES

Mk 18 Mods 0—4 (Obsolescent)

Projectiles used in
4"/50 Illuminating
5"/25/38/51 A.A. Common
5"/25/38/51 Illuminating
5"/38 Window
5"/38 W. P.
5"/51 H. C.
6"/47/50/53 Illuminating
6"/47/53 H.C.
8"/55 H.C.

Over-all length, inches....................3.54
Diameter at base of ogive, inches......3.05
Threaded length, inch...................0.81
Threads ....7 R.H.
Weight, pounds...........................2.52
Material .... Brass
Setting times, seconds
Mods 2, 3, and 4—minimum, 0.6
maximum, 45
Mods 0 and 1 —minimum, 2.4
maximum, 45

Description: In its assembled form, the fuze has a contour which corresponds to that of the Navy medium- and major-caliber projectiles. It consists of four main units, as follows:

1. MOVEMENT ASSEMBLY—The movement assembly is attached to the inside of the body by three holding screws.

2. BODY—The brass body contains the magazine charge, 30 grains of black powder, and the bottom closing screw assembly. It is threaded to fit an adapter, which, in turn, is threaded into the nose of the projectile.

3. LOWER CAP ASSEMBLY—The brass lower cap, or graduated rotative cap, is attached to the body by a joint, consisting of a steel wire leading through grooves in the cap and body. This allows rotative motion between the lower cap and the body, but prevents axial motion between the lower cap and the body. It has a tensioning feature wherein the torsional resistance which restrains rotative motion is adjusted by four screws during assembly of the fuze.

4. UPPER CAP—The brass upper cap screws into the lower cap and completes the nose contour of the assembled fuze.

For purposes of explanation, the movement assembly may be divided into three main parts, as follows:

1. THE TIMING-DISC MECHANISM consists of the timing disc, a setting pin, a spring hammer assembly, and the central drive shaft. The timing disc has a firing notch on one side and, on the other side, a forked setting lug which engages the setting pin located in the top inside shoulder of the lower, rotative, cap. The timing disc is secured to the central drive shaft by a friction clutch, so that it may be turned independently of the central drive shaft. Around the top of the timing disc is a retaining ring which prevents the timing disc from riding forward when the projectile initially seats itself in the gun, and also prevents the hammer from driving the setting lug down too far. Beneath the timing disc is a safety disc, the projection of which bears against the elbow piece of the firing arm. This part is rigidly secured to the central shaft, so that it will rotate out of the way when the clock operates. Its purpose is to provide a safe and a minimum setting.

In setting the clock, the lower cap is rotated to turn the setting pin, which, in turn, will rotate the timing disc to the desired position, since the setting pin is engaged by the setting lug of the timing disc. Disengagement of these two parts is effected by the spring hammer assembly, which is fastened on one end to the top inside shoulder of the lower cap and (on the opposite end) has two small weights.

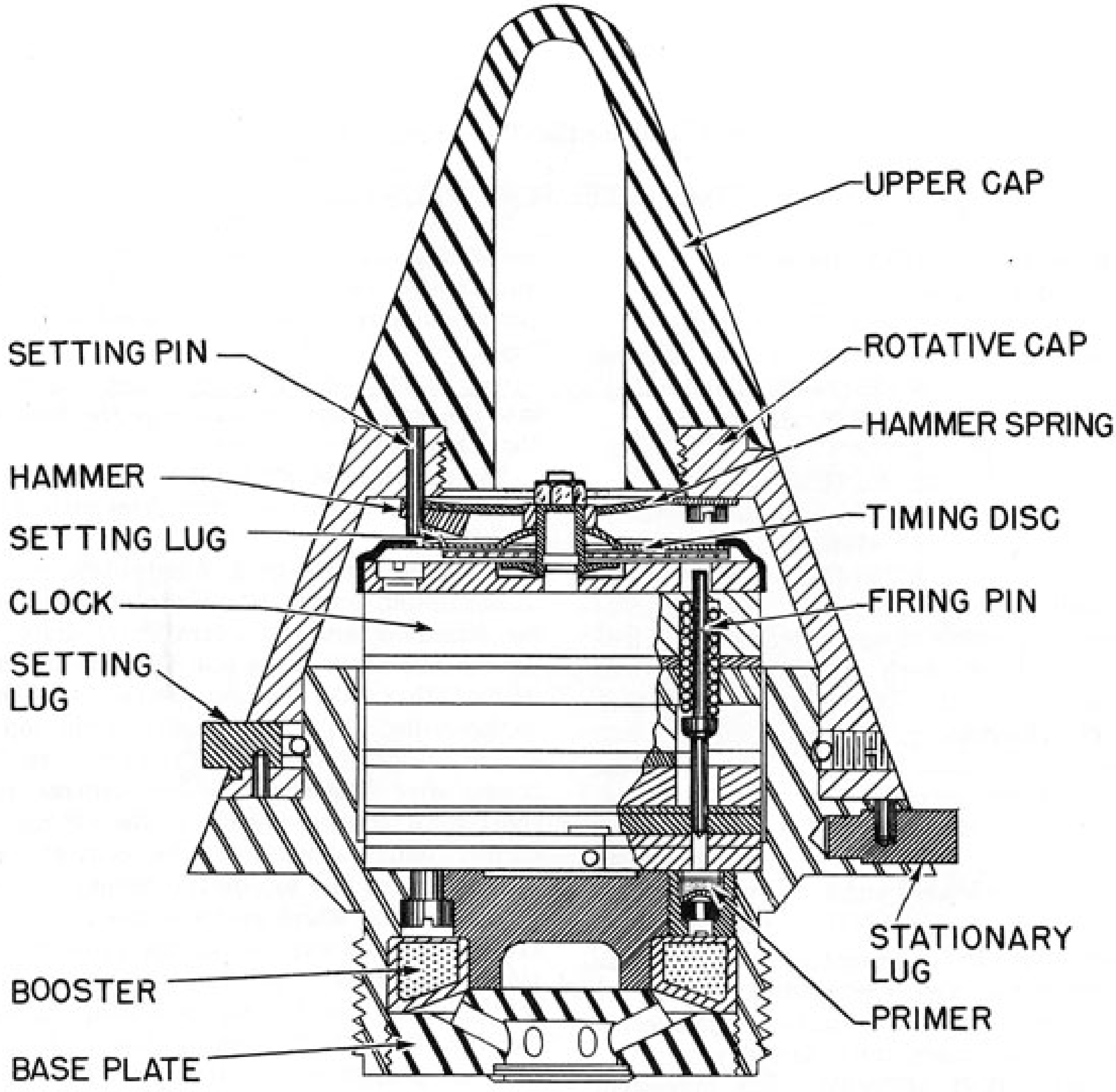


Figure 90. Nose Time Fuze Mk 18

2. THE CLOCK MECHANISM consists of two centrifugal gear arcs, a series of reduction gears, and the escapement mechanism. The centrifugal gear arcs are geared to the central drive shaft and are weighted on one side so that they will turn in a counterclockwise direction, thus turning the central shaft and the timing disc in a clockwise direction. The gear arcs have starter springs on them which serve to prevent the gears from freezing. The reduction gears are similarly geared to the central spindle, and their rotation is governed by the escapement mechanism which is connected to the lowest gear. The escapement mechanism consists of an escapement gear, escapement lever, escapement-lever spring, safety-lever plate, and safety lever plate spring. In the assembled position, the escapement lever is prevented from moving by the safety-lever plate, which has a pin protruding from the bottom of it and engages the escapement lever. The safety-lever plate is pivoted with a weight on one end, and

is held in position by the safety-lever plate spring. The escapement lever acts as a balance wheel and is caused to move back and forth by the escapement-lever spring, which is a hair spring secured at both ends and attached to the escapement lever.

3. THE FIRING MECHANISM consists of the firing arm, firing-arm shaft, set-back pin, firing-pin safety plate, and firing pin. The firing arm is pivoted and has a weight on one end and, on the opposite end, an elbow piece which bears against the outer periphery of the timing disc. Rigidly secured to the firing arm is the firing-arm shaft, which is prevented from turning in the assembled condition by the set-back pin. The set-back pin is held in position by the set-back pin spring and rests in front of a projection of the firing-arm shaft, thus preventing the latter piece from rotating. In the bottom of the firing-arm shaft is a notch. Bearing against the shaft in such a position that it will pass through the notch when the shaft is rotated, is the firing-pin safety plate. This safety plate is also pivoted and is fitting under a shoulder of the cocked firing pin, thus holding it away from the primer beneath it.

Operation: The fuze is armed by set-back, driven by centrifugal force governed by an escapement mechanism, and fired by a spring-driven firing-pin. When the projectile is fired from the gun, the force of set-back accomplishes two things:

1. The set-back pin overcomes its spring and drops into the bottom of the fuze. This action frees the firing-arm shaft for later rotation.

2. The hammer spring assembly pivots down the weights on one end to strike the setting lug, thus depressing it and freeing it from the setting pin. When the force of creep sets in, the spring returns the weights to their original position, in front of the timing disc.

As the projectile rotates, centrifugal force accomplishes four things:

1. The safety-lever plate of the escapement mechanism is pivoted out of the way, thus releasing the escapement lever and unlocking the escapement mechanism. This initial movement causes the escapement lever to oscillate, thus acting as the balance wheel and governing the speed of operation.

2. As soon as the escapement mechanism has been unlocked, the weights on the centrifugal gear arcs tend to move outward, thus causing the arcs to pivot and rotate the central shaft and, consequently, the timing disc. This rotation is slowed down by the series of reduction gears, and its speed is determined by the escapement mechanism. This rotary motion of the timing disc turns the firing notch around to the elbow piece of the firing arm.

3. When the firing notch has been presented to the elbow piece of the firing arm, the weight on the opposite end of the firing arm is moved outward, turning the elbow into the slot and turning the firing-arm shaft. This is now possible, since the set-back pin was depressed when the projectile was initially fired.

4. As the firing-arm shaft rotates, the notch in the bottom of it is presented to the firing pin safety plate, which will pivot through this notch, thus moving out from under the shoulder of the firing pin. The firing pin will then be thrown downward onto the primer by its compressed spring. The primer will then ignite the black powder charge in the base of the fuze.

Remarks: Mods 2, 3, and 4 are identical, but made by different manufacturers.

Mk 22 Mods 0—6 (Obsolescent)

Projectiles used in 3"/23/50 A.A. and Ill. 4"/50 H.C.

Over-all length, inches................4.55
Diameter at base of ogive, inches........2.4
Threaded length, inch..................0.81
Threads ....7 R.H.
Material.......Upper body—zinc/lead alloy
Center body—brass
Base—aluminum
Setting times, seconds
Mods 0–3—minimum, 1.4
maximum, 30
Mods 4–6—minimum, 0.6
maximum, 30

Description: The mechanism for this fuze is very similar to that described for the Nose

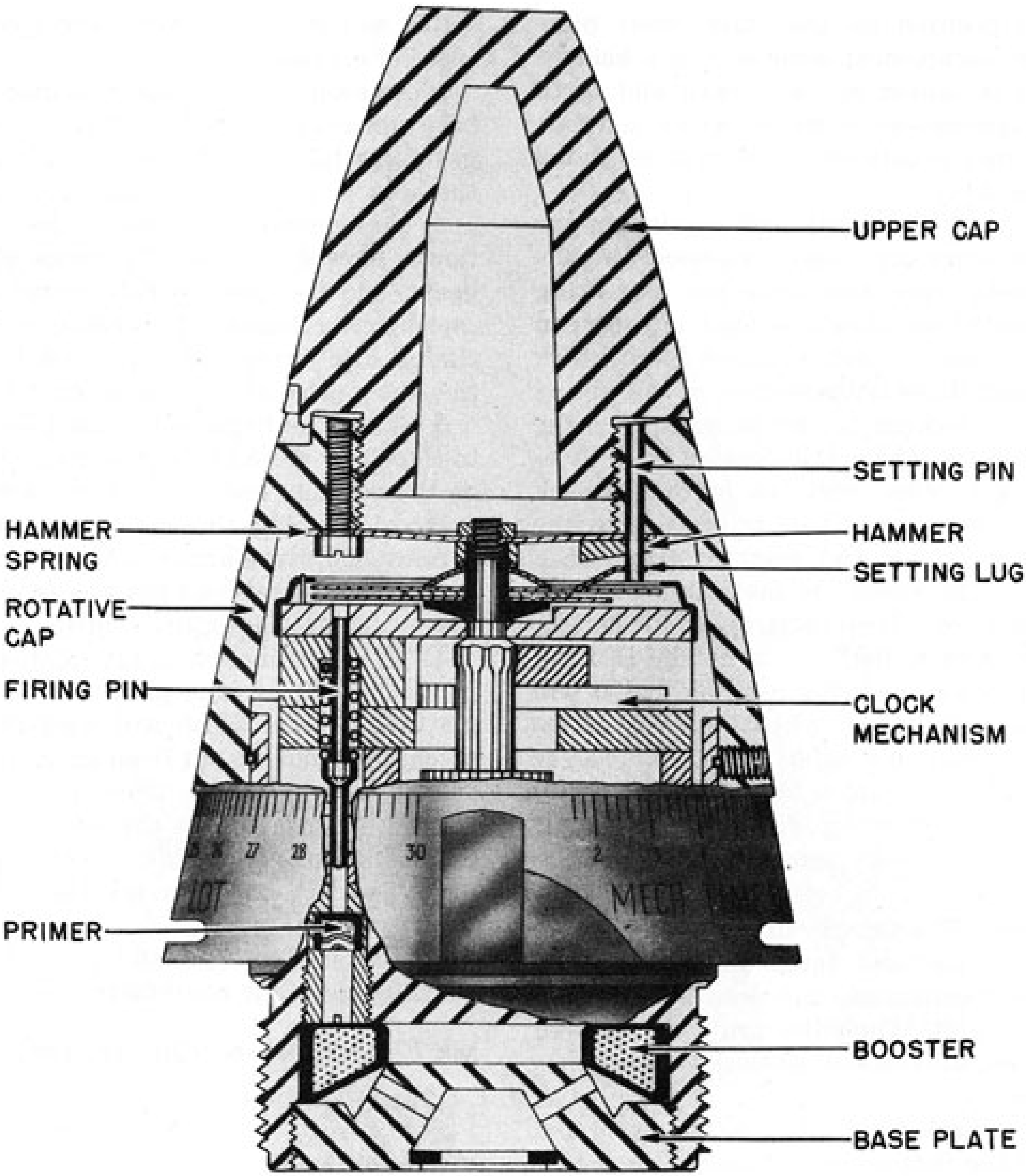


Figure 91. Nose Time Fuze Mk 22

Time Fuze Mk 18. In the Mk 22, however, the centrifugal weights do not have "kick-off" springs, and the Mk 22 is slot-set instead of lug-set, as the Mk 18. Also, the Mk 22 is very similar to the Army M43A3.

Mods 4, 5, and 6 are identical, but are made by different manufacturers.

Mk 25 Mods 0—3

Projectiles used in.......5"/54 H.C. and Ill
6"/47 (D.P.) H.C.

Over-all length, inches................4.55
Diameter at base of ogive, inches......2.40
Threaded length, inch.................0.81
Threads ....7 R.H.
Material...... Nose—die-cast lead-zinc alloy
Body—brass
Base—aluminum
Setting times, seconds........minimum, 0.6
maximum, 45

Description: The Nose Time Fuze Mk 25 is a combination of the Nose Time Fuzes Mk 50 and

Mk 51. It has the shape of the 30-second Nose Time Fuze Mk 51, but contains the 45-second clockwork of the Mk 50. The longer, slimmer shape of the Mk 51 is necessary because of the more streamlined shape of the 5″/54 and 6″/47 D.P. projectiles with which it is assembled. But, since these projectiles are used in long-range guns, they need the 45-second clockwork.

The description of the clockwork in the Nose Time Fuze Mk 18 is equally applicable to the Mk 25.

This fuze has slots cut for the setting mechanism, like the slots on the Mk 22 or Mk 50.

The Mk 25 is a moisture-resistant design, having gaskets placed between the upper and lower caps and between the lower cap and the body, and a silica gel unit in the base cavity to absorb what moisture penetrates the gaskets. This moisture resistance prevents deterioration of the metal parts and the explosive.

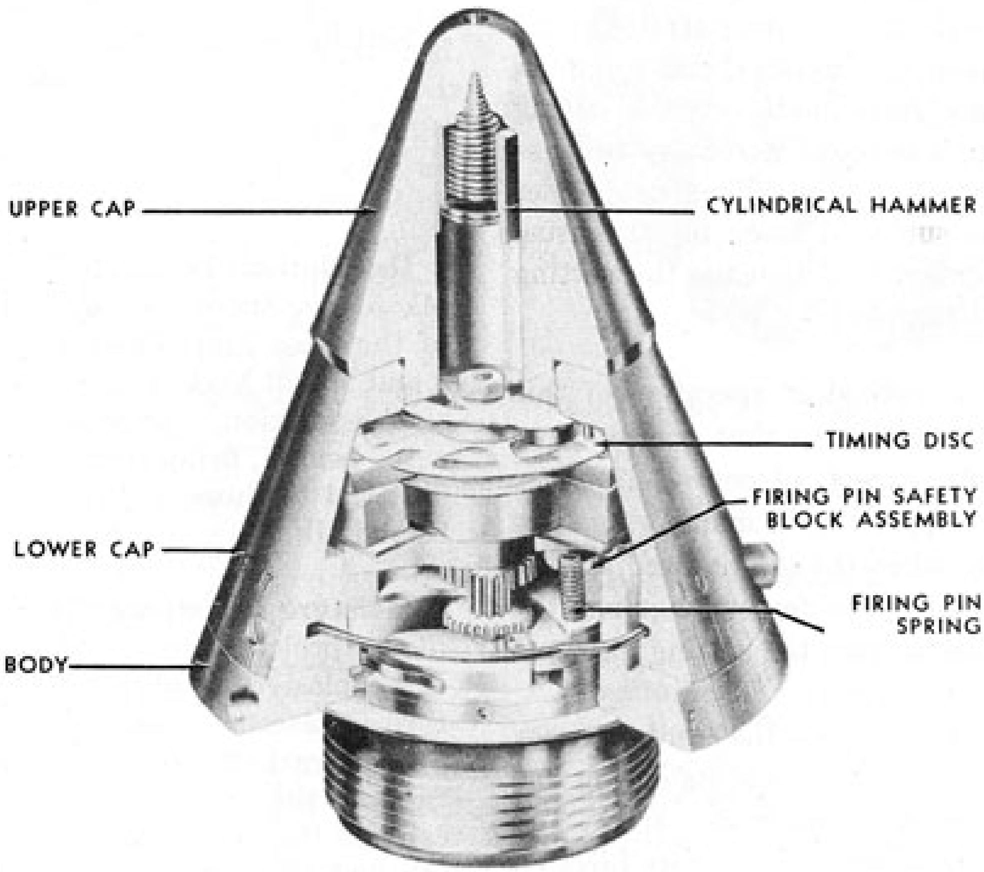


Figure 92. Nose Time Fuze Mk 42

Mk 42 (Obsolete)

Projectiles used in	12″/50 H.C.
	14″/45/50 H.C.
	16″/45/50 H.C.
Over-all length, inches	3.54
Diameter at base of ogive, inches	3.05
Threaded length, inch	0.81
Threads	7 R.H.
Weight, pounds	2.5
Material	Brass
Setting times, seconds	Minimum, 0.6
	Maximum, 45

Description: The Nose Time Fuze Mk 42 was developed to supersede the Mk 18 when used in major-caliber H.C. projectiles, because of the erratic performance of the latter fuze when so employed. The fuze is generally similar to the

Nose Time Fuze Mk 61, differing only in that the primary driving force of the Mk 42 is provided by a heavy mainspring instead of by centrifugal weights. The driving force for the clockwork mechanism thus becomes substantially independent of the rate of spin of the projectile, and is applied during the entire running time of the fuze.

In addition to the spring-driven feature, the Nose Time Fuze Mk 42 also differs from the Mk 61 in that a heavy additional hammer is located in the recess in the nose cap of the fuze. This hammer is attached to the nose cap by a spring. On set-back, this hammer stretches the spring and strikes the conventional hammer, giving it additional force in striking the setting lug. This feature was found necessary because the low set-back of major-caliber projectiles failed to provide sufficient force for the usual hammer arrangement to disengage the setting lug from the setting pin.

Operation: The method of operation of this fuze is generally similar to that of the Nose Time Fuze Mk 61, except, of course, that the driving force is supplied by a mainspring. The force of set-back, when the gun is fired, causes the auxiliary hammer to descend against the main hammer, disengaging the setting lug from the setting pin.

Centrifugal force causes the center arbor detent to move outwards against its spring and out of engagement with the center arbor. The mainspring is then allowed to exert its force on the center arbor, actuating the escapement-controlled clockwork mechanism. All other features of operation are identical to those of the Nose Time Fuze Mk 61.

Remarks: This fuze is now considered obsolete. It was found during functioning trials that the auxiliary hammer did not function properly on set-back. The Nose Time Fuze Mk 62 is designed to supersede this fuze in major-caliber H.C. projectiles.

Mk 50 and Mk 51

Projectiles used in
- Mk 50
  - 4"/50 Illuminating
  - 4"/25/38/51 A.A. Common
  - 5"/25/38/51 Ill.
  - 5"/38 Window
  - 5"/38 W.P.
  - 5"/51 H.C.
  - 6"/47/53 H.C. and Ill.
  - 8"/55 H.C.
- Mk 51
  - 3"/23/50 A.A. and Ill.
  - 4"/50 H.C.

Setting times, seconds
- Mk 50—minimum, 0.6
  maximum, 45
- Mk 51—minimum, 0.6
  maximum, 30

Description: The Nose Time Fuzes Mk 50 and Mk 51 are merely moisture-resistant versions of the Nose Time Fuzes Mk 18 Mods 2, 3, and 4 and Mk 22 Mods 4, 5, and 6, respectively. The size, operation, component parts (except as noted below), firing train, and setting times are identical to those of the Nose Time Fuzes Mk 18 and Mk 22.

Moisture Resistance: The following developments prolong the life of the mechanism and the explosive. A silica gel bag to absorb moisture is placed in the base cavity of the fuze. Special gaskets are placed between the upper cap and the lower cap, and between the lower cap and the body. The joint between the upper cap and the lower cap is coated with bakelite varnish. The primer unit ends are covered with bakelite varnish. Thread luting compound is applied to the joint between the body and the bottom closing screw. The brass disc at the center of the bottom closing screw is crimped in under a washer and then coated with bakelite varnish. All screw heads visible on the outside are coated with glyptol lacquer.

Remarks: Different modifications of these fuzes indicate nothing more than different manufacturers.

Mk 57

Projectiles used in......8"/55 H.C. (for use in 8" Rapid-Fire case gun).
Over-all length, inches................4.305
Diameter at base of ogive, inches......2.983
Threaded length, inch..................0.47
Threads ....7 R.H.
Material ....Brass
Setting times, seconds.... minimum, 0.8–1.0
maximum, 45

Description: This fuze is identical to the Nose Time Fuze Mk 61 in so far as the internal mechanism and method of operation are concerned. The fuze differs from the Mk 61 in that it is provided with external slots for setting, rather than setting lugs. Furthermore, the external contour of the fuze differs considerably from that of the Nose Time Fuze Mk 61. The contour changes were necessary to allow the fuze to continue the more streamline shape of the 8-inch H.C. projectile and to strengthen the fuze body and lower cap sufficiently to accommodate the setting slots.

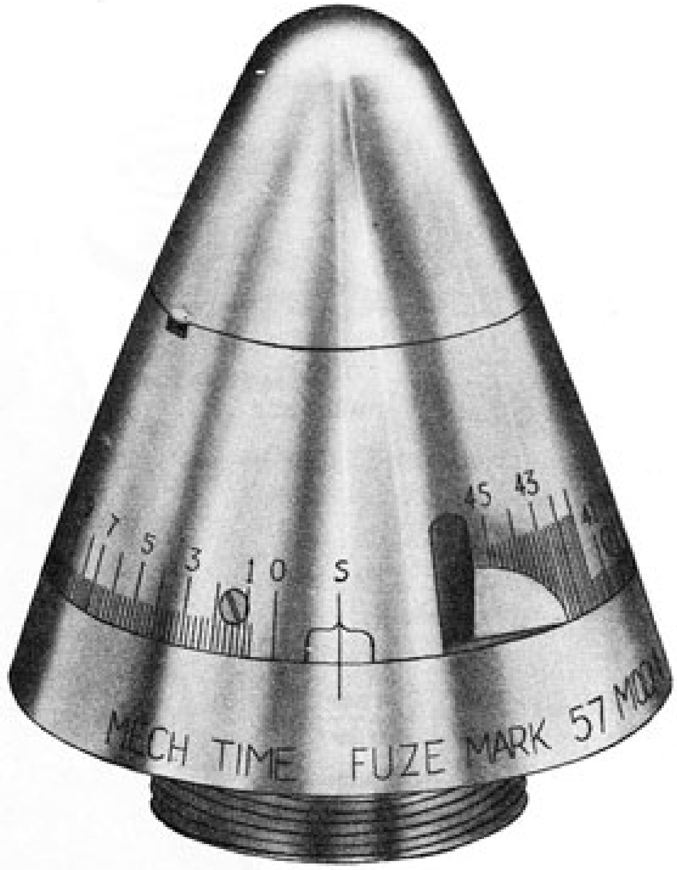


Figure 93. Nose Time Fuze Mk 57

Mk 61, Mk 62, Mk 63

Projectiles used in

Mk 61	5"/38 A.A. Com.
	5"/38 W.P.
Mk 62	12"/50 H.C.
	14"/45/50 H.C.
	16"/45/50 H.C.
Mk 63	4"/50 Ill.
	5"/25/38/51 A.A. Com.
	5"/25/38/51 Ill.
	5"/38 W.P.
	5"/38 Window
	5"/51 H.C.
	6"/47/53 H.C.
	6"/47/53 Ill.
	8"/55 H.C.

Over-all length, inches................3.54
Diameter at base of ogive, inches.......3.05
Threaded length, inch..................0.81
Threads ....7 R.H.
Weight, pounds.......................2.52
Material ....Brass
Setting times, seconds.... minimum, 0.9–1.0
maximum, 45

Description: The Nose Time Fuze Mk 61 is a modification of the mechanical time fuzes of the Mk 18 and Mk 50 type, designed specifically for the 5"/38 projectile when the special reduced charge with initial velocity of 1,200 feet per second is employed. The modifications, allowing the fuze to function at lower rotational velocities and decreased set-back, are as follows:

A weaker hammer spring is used.

The set-back pin has been eliminated.

A centrifugally operated firing-pin safety block has been added under the firing pin.

A centrifugally operated detent or plate, retained by a flat spring, holds the safety-lever plate, which locks the escapement mechanism.

Heavier centrifugal weights are placed on the driving gears to drive the clockwork movement.

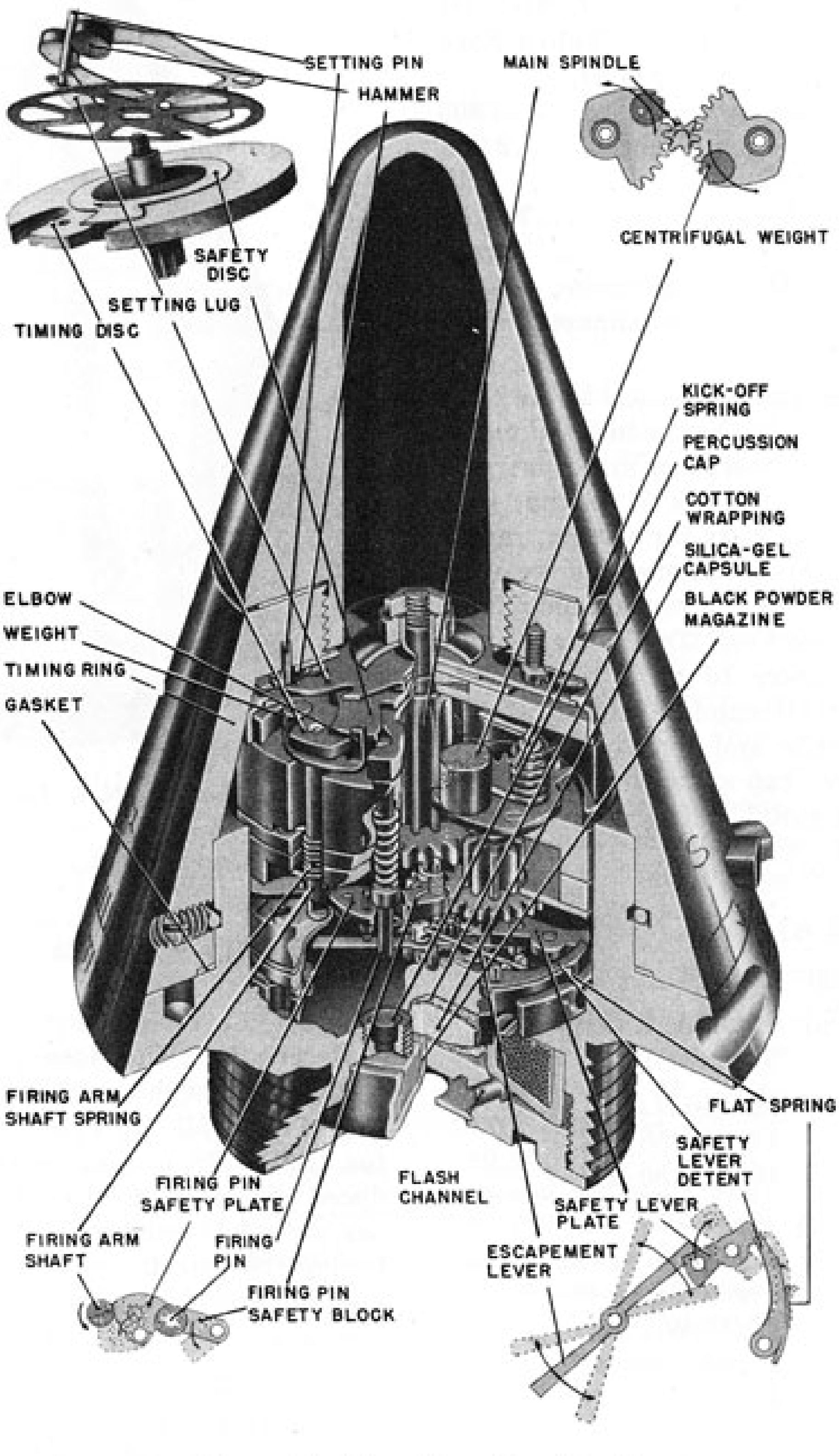


Figure 94. Nose Time Fuse Mk 61

Stronger centrifugal "kick-off" springs are incorporated on the centrifugal gears. These springs are actually driving springs, and exert a strong force throughout the entire cycle.

A spring is added to the firing-arm shaft.

Weight is added to the safety-lever plate.

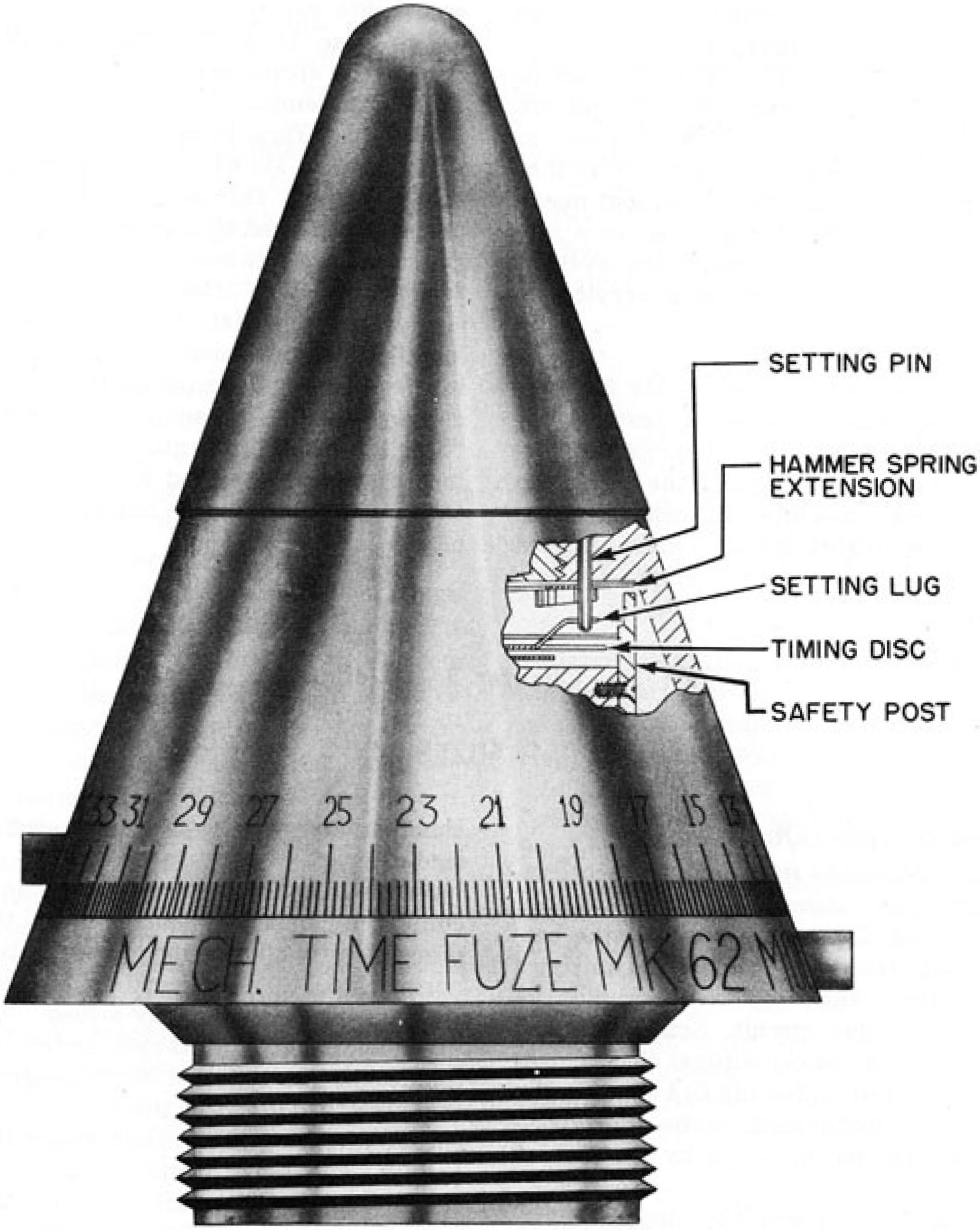


Figure 95. Nose Time Fuze Mk 62

The fuze body is slightly altered to provide clearance for the heavier driving weights.

The safety setting is changed to 0.9–1.0 second.

The Nose Time Fuze Mk 62 is almost identical to the Mk 61, but is slightly further modified to allow its use in the major-caliber H.C. projectiles, where extremely low set-back force on firing is encountered. The additional modifications incorporated in the Mk 62 are as follows:

A still weaker hammer spring is used.

A safety post is provided beneath the hammer spring, preventing arming of the fuze as the result of accidental dropping.

The Nose Time Fuze Mk 63 is designed to replace the Nose Time Fuzes Mk 18 and Mk 50 in all projectiles where the Mk 50 is now in use. Its internal construction is identical to that of the Mk 61, except that the escapement movement has been regulated for a higher spin rate —12,600 revolutions per minute—the average spin rate of the 5"/38 projectile at service velocities.

Remarks: These fuzes, like the Mk 50 type, have complete moisture-resistant features incorporated. These measures include gaskets between the time-setting ring and the upper cap and body assemblies, a silica-gel capsule in the base of the fuze to absorb excess moisture, and joints and openings coated with approved luting or bakelite varnish.

The Nose Time Fuze Mk 62 is designed to replace the spring-driven Nose Time Fuzes Mk 42 in all assemblies.

The Nose Time Fuze Mk 62 differs in operation from the Mk 61 only in the functioning of the safety post. This safety post consists merely of a stud fastened by a screw to the uppermost ring of the clockwork mechanism. With the fuze set on "Safe", this stud is located beneath a projecting end of the hammer spring, preventing the hammer from disengaging the setting lug from the setting pin as the result of accidental dropping. When the fuze is set off the "Safe" position preparatory to firing, the hammer assembly is moved away from above the safety post, allowing the hammer to move down on set-back.

Part I — Chapter 3 — Section 4

V.T. FUZES

Mks 32 and 40 Type (Obsolete)

Operation: When the round is fired, acceleration in the gun causes the three set-back switches to close. This action connects the battery to the electrical mechanism and initiates charging of the firing condenser throught its high-resistance delay circuit. Simultaneously, the set-back pin in the centrifugal clock moves back against its spring, freeing and starting the clock escapement mechanism. In the armed position, the set-back pin is locked by the locking spring.

Centrifugal force drives the clock through its permanent setting of 0.4 to 0.6 second, at which time the tripping lever moves over the spring-loaded arming pin. The arming pin moves forward, withdrawing from the interrupter cavity. This allows the interrupter pin to be moved outward by centrifugal force, thereby clearing the flash channel between the electric primer and the auxiliary detonating fuze, hitting the short-circuit plug, and breaking the short-circuit wire away from the electric primer leads.

Meanwhile, the firing condenser has been accumulating an electric charge. When this charge is sufficient to allow firing of the electric primer, normally 0.6 to 0.8 second in the dry-battery type fuze, the fuze is fully armed.

On approach to a target under the proper conditions, the reflected electromagnetic signal from the target causes the V.T. element to discharge the firing condenser through the electric primer. The blast from the primer operates the auxiliary detonating fuze, which in turn initiates detonation of the projectile.

Operation of the wet-energized fuzes of this type is identical, except that the electrolyte vial in the reserve energizer is broken by acceleration of the round, and centrifugal force distributes the electrolyte throughout the energizer. Charging of the firing condenser is not begun when the set-back switches close, but must wait until the electrolyte is uniformly distributed through the reserve energizer. This normally occurs 0.2 to 0.3 seconds after set-back, thereby delaying complete arming of the unit until 0.8 to 1.1 seconds after set-back.

Mks 45, 47, 53, 58, and 59 Type

Operation: When the round is fired, acceleration in the gun barrel causes the fingers of the crown breaker to open up, allowing the electrolyte vial to break against the bottom of the breaker. Centrifugal force distributes the electrolyte throughout the energizer, activating it in 0.2 to 0.3 second. Centrifugal force also opens the handling safety switch, which previously had been shorting out the firing condenser.

The firing condenser begins to accumulate a charge through its high-resistance electrical delay, and electrical energy is fed to the electric mechanism in the V.T. element. Centrifugal force causes the small globule of mercury in the mercury switch to move through a porous membrane into the lower chamber, thereby removing the electric short circuit across the primer leads. This requires from 0.2 to 0.9 seconds, depending on the fuze and the rate of rotation of the projectile. When the firing condenser has accumulated enough electrical energy to allow firing of the electric primer, 0.6 to 1.0 second, the fuze is fully armed.

Upon approach to a target under proper conditions, the reflected electromagnetic signal from the target causes the V.T. element to discharge the firing condenser through the electric primer. The blast from the primer functions the auxiliary detonating fuze, which, in turn, initiates the detonation of the projectile.

The V. T. Fuzes Mk 53, Mk 47, and Mk 59 are equipped with two mercury switches instead of the single switch incorporated in the Mk 45 and Mk 58. This feature is provided to insure additional safety; in all other respects, these five fuzes are mechanically identical.

The differences in these fuzes lie in dimensions and contour of the head, thread sizes, and electrical characteristics (for slower spin, less set-back, etc.).

Mk 32 Mods 0—20, Mod 30, and Mod 40 (Obsolete)

Projectiles used in	5"/38/25/51* A.A. Common
Over-all length, inches	12 (approx.)
Diameter at base of ogive, inches	3.3 (approx.)
Threaded length, inch	0.6 (approx.)
Threads	6 R.H.
Material	Steel base rings, black plastic nose ogive, aluminum nose cap or button tip
Weight, pounds	6.81
Minimum range, yards	Mods 0–20, 40—600 Mod 30—1,000
Energizer	Mods 0–20, 40—Dry Mod 30—Wet
Wave-suppression feature	Mod 40 only
Self-destructive feature	None

Description: This fuze was designed to initiate detonation when passing within the maximum influence radius of about sixty feet. The Mod 40 has reduced sensitivity against low-flying aircraft because of the wave-suppression feature (for values, see V.T. Fuze Mk 40). Burst heights above water for all Mods without the wave suppression feature will be high at most ranges, averaging 130 feet at 12,200 yards in the 5"/38 projectile, with burst heights varying widely between rounds. Burst heights over water will average lower at shorter ranges, but a wide dispersion in heights will occur. These fuzes are especially affected by water surface conditions. Burst heights of the Mod 40 above water (WSF) will vary between 10 and 50 feet.

Random premature bursts of rounds assembled with this fuze will occur along the trajectory after the fuze is armed but before it approaches a target. With targets at long range, 20 per cent of the rounds may burst before approaching the target, and a somewhat smaller percentage of prematures will occur at shorter ranges. If a target at long range is approached

*Mods 0–20 and 40 of this fuze can be used in the 5"/51 gun at 2600 ft./sec., I.V. reduced charge only. Mod 30 cannot be used in the 5"/51 rounds.

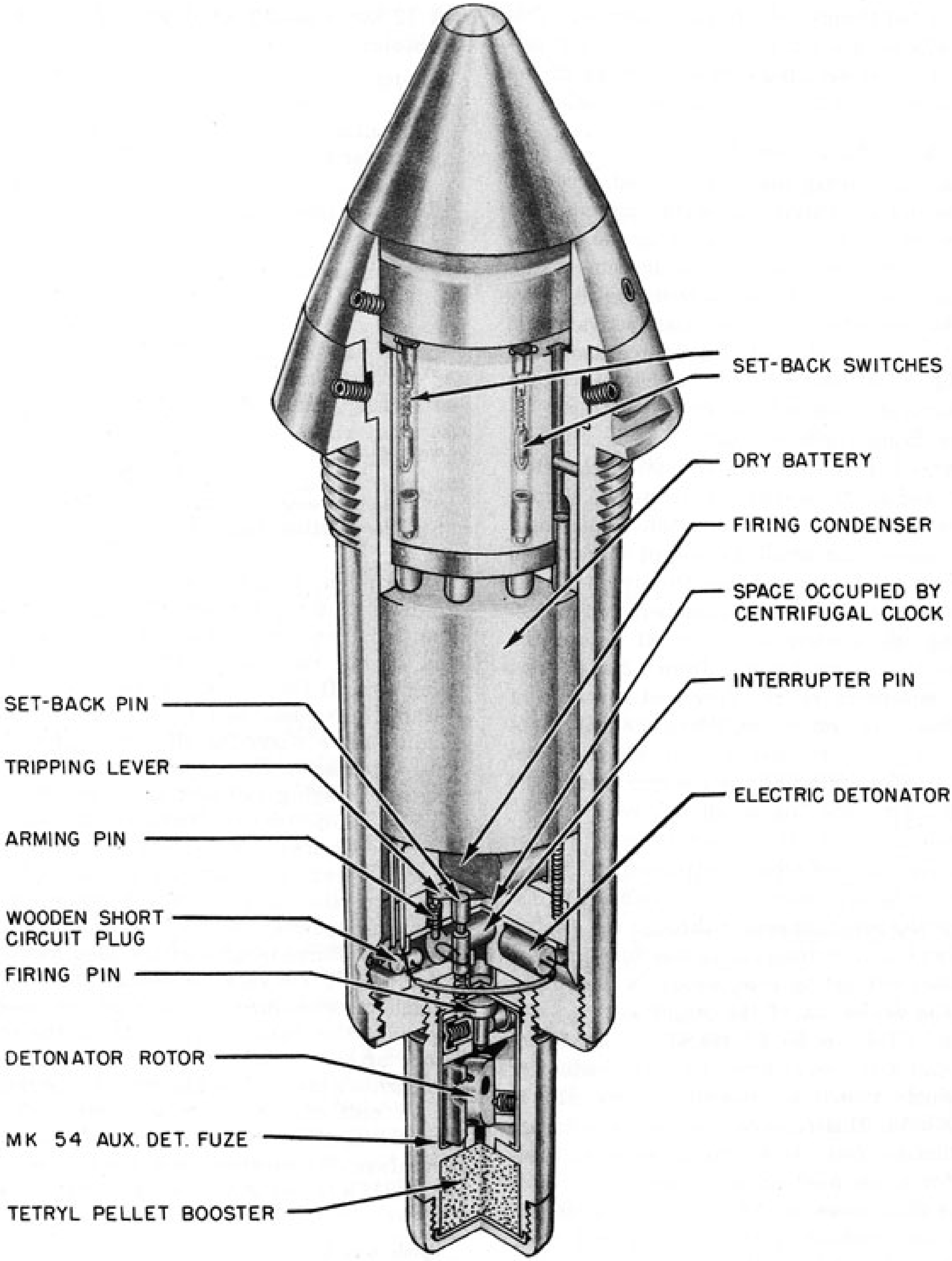


Figure 96. V.T. Fuze Mks 32 and 40 Type

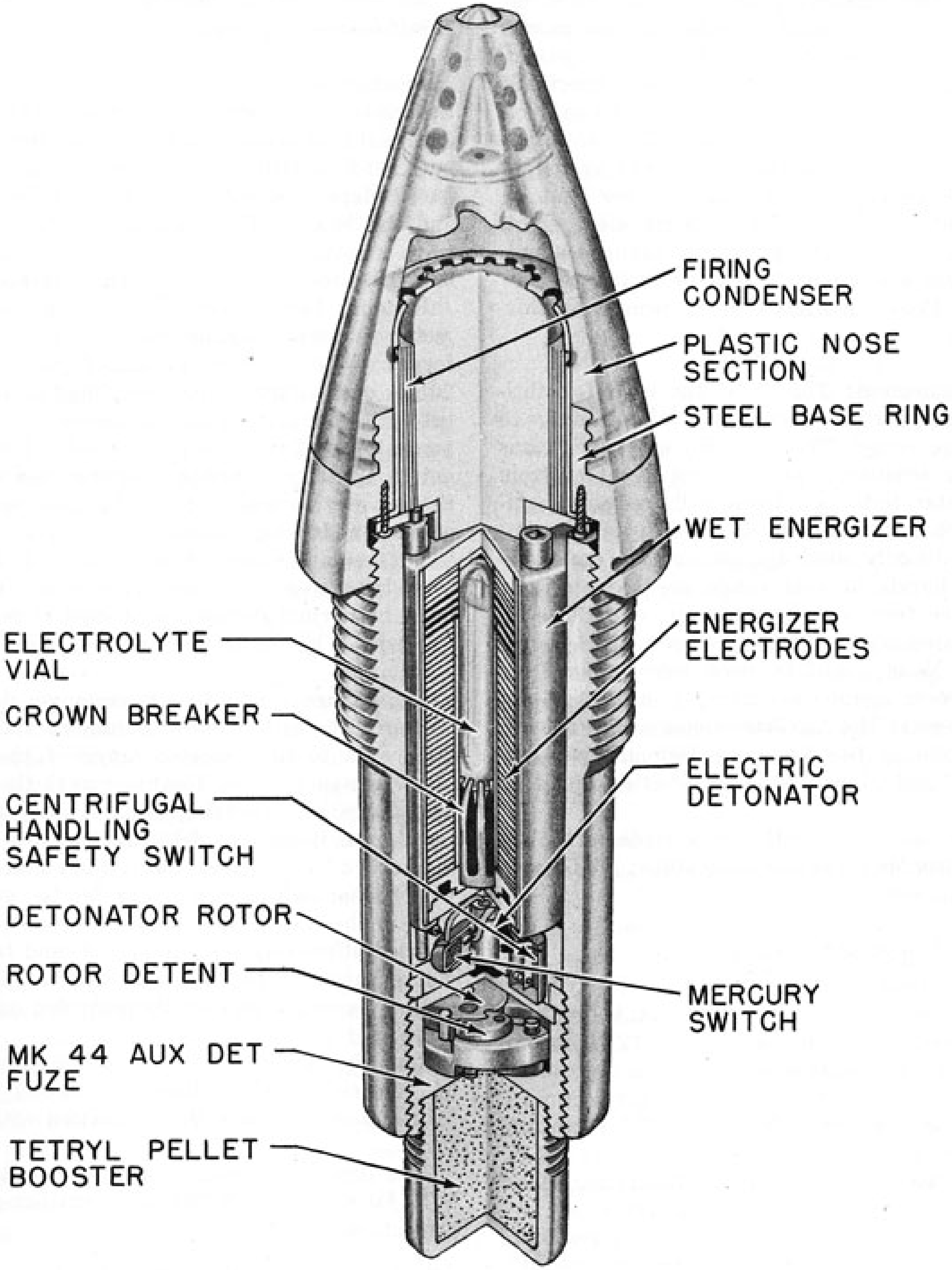


Figure 96A. V.T. Fuze Mk 45 (and above) Type within the sensitivity limits of the fuze, 65 per cent of the rounds should function at the most critical point to throw fragments against the target. The percentage of proper functions at shorter ranges is higher by the amount of decrease in premature functions. The remainder of the rounds will be duds. Because of ageing of the dry energizer, only about 50 per cent of the rounds will function properly after eight months. The dry energizers are changed about every six months by Bureau of Ordnance personnel. Production has been suspended on this item.

Employment: This fuze was used for antiaircraft work from 600 yards minimum range to extreme range. The Mod 40, with WSF, has normal sensitivity above about 200 feet from the water, but has automatically reduced sensitivity below this level. Mods 0–20 and 30 are not ordinarily used against surface craft, because bursts at long range are too high for effective fragmentation damage, and those on low trajectory have a large dispersion in range. These Mods might be used with reduced effectiveness against low-flying planes.

Remarks: The Auxiliary Detonating Fuze Mk 54, replacing the Auxiliary Detonating Fuzes Mks 17 and 46, is used in conjunction with this fuze.

This fuze is currently being replaced by the V.T. Fuze Mk 53 in new projectiles; Mk 53 cavity is smaller.

Mk 40 (Obsolete)

Projectiles used in . . . . 5"/25/38 A.A. Common
Over-all length, inches . . . . 12 (approx.)
Diameter at base of ogive, inches 3.3 (approx.)
Threaded length, inch . . . . 0.5 (approx.)
Threads . . . . 6 R.H.
Material . . . . Steel base, black plastic ogive; may have button tip.
Weight, pounds 6.81
Minimum range, yards 800
Energizer . . . . Wet
Wave-suppression feature . . . . Present
Self-destructive feature . . . . None

Description: This fuze initiates detonation if the trajectory passes within the maximum influence radius of seventy feet. Against aircraft below 200-foot altitude, operating radius is reduced, depending on the altitude of the plane and the height of the waves, because of the wave-suppression feature. Burst height over land or water may vary between 10 and 30 feet.

Random bursts will occur along the trajectory after arming, but before approaching a target. With a target at 12,200 yard range, 20 per cent of the rounds will function prematurely; and at closer ranges a somewhat smaller percentage will function prematurely. If the target at 12,200-yard range is approached within the sensitivity limits of the fuze, 65 per cent of the rounds will function.

These units have wet energizers of the reserve type; so effectiveness is not greatly diminished by normal storage for at least 18 months. Production has been suspended on this item.

Employment: This fuze is recommended for antiaircraft work from a minimum range of 800 yards to the extreme range of the gun. The wave-suppression feature makes this fuze useful against low-flying aircraft and surface targets, as it will not detonate on water influence above 15 to 20 feet; but it must pass somewhat closer to the target in order to function than in the case of high-flying targets. It may be used effectively for barrage of land targets where bursts at 10 to 30 feet will be effective against personnel and lightly protected installations.

Remarks: The Auxiliary Detonating Fuze Mk 54, replacing the Auxiliary Detonating Fuzes Mks 17 and 46, is used in conjunction with this fuze.

This fuze is currently being replaced by the V.T. Fuze Mk 53 in the new, smaller-cavity projectiles.

Mk 45 Mods 11 and 12 (Obsolete)

Projectiles used in . . . . 3"/50 A.A.
Over-all length, inches . . . . 7.7 (approx.)

Diameter at base of ogive, inches
2.4 (approx.)
Threaded length, inch........1.0 (approx.)
Threads ....12 R.H.
Material.............Plastic ogive molded integral to steel base; perforated nose cap molded into forward end of plastic ogive
Weight, pounds 2.40
Minimum range, yards................600
Energizer ....Wet
Centrifugal handling safety switch..Present

Description: This fuze initiates detonation within the maximum influence radius of fifty feet. Burst heights over water at long range will average around 75 feet, with wide variations in burst height occuring as a result of wave effect and variations in sensitivity between rounds. Burst heights over water at shorter ranges will generally average to lower levels.

Random bursts will occur along the trajectory after arming; so that approximately 30 per cent of the rounds will have burst prematurely before approach to a target at extremely long range. At long range, after 30 per cent of the rounds have functioned prematurely, 50 per cent of the rounds will function when passing the target within the sensitivity limits of the fuze.

These fuzes have wet energizers of the reserve type.

Employment: This fuze is used for antiaircraft work from a minimum range of 600 yards to the extreme range of the gun. The V.T. Fuze Mk 45 is useful for low-level attack against torpedo bombers or surface craft, if it is realized that the fuze functions on approach to water as outlined above. The fuze is less sensitive at shorter ranges.

Remarks: The original V.T. Fuze Mk 45 Mod 11, with longer stem, has been declared unserviceable and recalled, to be replaced by the Mod 12.

The V.T. Fuze Mk 45 Mod 12 is currently being replaced by the V.T. Fuze Mk 58.

The Auxiliary Detonating Fuze Mk 44 is used in conjunction with these fuzes.

Mk 47 Mod 0

Projectiles used in..............6"/47 H.C.
Over-all length, inches........8.9 (approx.)
Diameter at base of ogive, inches
3.3 (approx.)
Threaded length, inch..................0.5
Threads ....6 R.H.
Material..............Plastic ogive molded integral with steel base ring, and steel nose cap molded inside of forward end of plastic ogive
Weight, pounds......................4.28
Minimum range, yards.................800
Energizer ....Wet
Wave-suppression feature..........Present
Self-destructive feature ....None
Centrifugal handling safety switch..Present

Description: This fuze is designed for the H.C. round of the 6"/47 dual-purpose gun. It is expected that its sensitivity against aircraft will be of the same order as that of the V.T. Fuze Mk 53. The Auxiliary Detonating Fuze Mk 44 is used with this fuze.

Mk 53 Mods 0—6

Projectiles used in............5"/25/38/51 A.A. Common
Over-all length, inches........8.9 (approx.)
Diameter at base of ogive, inches
3.3 (approx.)
Threaded length, inch.........0.5 (approx.)
Threads ....6 R.H.
Material............Steel base with integral molded plastic nose; some Mods may have steel insert molded in forward end of plastic nose
Weight, pounds 4.28
Minimum range, yards
Mods 0–2—700
Mods 3 and later—500
Energizer ....Wet

Wave-suppression feature..........Present
Self-destructive feature..............None

Description: This fuze functions within a maximum influence radius of about eighty feet. Sensitivity to aircraft below 200-foot altitude will be somewhat less, depending on the altitude of the plane and the height of the waves, because of the wave-suppression feature. Burst heights above water will vary between 10 and 30 feet.

Random bursts along the trajectory will occur after arming, but before reaching a target. At 12,200-yard range on test firing, approximately ten per cent of the rounds will function prematurely. Upon approaching a target within the sensitivity limits of the fuze at 12,200-yard range, 80 per cent of the rounds will function at the most advantageous point for enveloping the target with fragments. The percentage of normal functioning at shorter ranges will be higher by the amount of decrease of premature bursts. The remainder of the rounds will be duds.

These fuzes have wet energizers of the reserve type.

Employment: This fuze is used for antiaircraft work from a minimum range, as shown above, to the maximum range of the gun at all elevations. It is useful against low-flying aircraft and surface craft where aerial-burst fuze action is desired. It is also effective for barrage work against personnel, light equipment, and land targets. Later Mods may have self-destructive action to initiate detonation at around 10,000 yards to protect outlying friendly ships and troops on the beach.

Remarks: This fuze is replacing the V.T. Fuzes Mk 32 and Mk 40 in all assemblies of new ammunition. The Auxiliary Detonating Fuze Mk 44 is used.

Mods 1, 2, and 3 have been declared unserviceable. Mods 5 and 6 have additional water-resistance and are not interchangeable with the previous Mods.

Mk 58 Mod 0—5

Projectiles used in..............3"/50 A.A.
Over-all length, inches........8.5 (approx.)
Diameter at base of ogive, inches
2.4 (approx.)
Threaded length, inch.........1.0 (approx.)
Threads ....12 R.H.
Material..............Plastic ogive molded integral to steel base; steel cap molded in forward end of plastic ogive
Weight, pounds 1.98
Minimum range, yards.................500
Energizer ....Wet
Wave-suppression feature..........Present
Self-destructive element.........Mod 5 only
Centrifugal handling safety switch..Present

Description: The maximum influence radius varies between 40 and 100 feet for different lots and Mods. Sensitivity to aircraft flying below 200-ft altitude will be reduced by the wave-suppression feature. Burst heights over water will average between 5 and 15 feet.

Random bursts of rounds will occur along the trajectory after arming, so that approximately 20 per cent of the rounds will have functioned before reaching a target at long range. When fired at a target at long range, after 20 per cent of the rounds have burst prematurely, 65 per cent will function.

Employment: This fuze is used for antiaircraft work for ranges of 500 yards to the extreme range. It is useful against low-flying aircraft and surface craft, and in land barrage against personnel and light equipment.

Remarks: The Auxiliary Detonating Fuze Mk 44 is used with this V.T. Fuze.

The V.T. Fuze Mk 58 is currently replacing the Mk 45 Mod 12 in the 3"/50 assembly.

Mods 3, 4, and 5 have additional water-resistance and are not interchangeable with previous Mods.

Mod 5 will have a self-destructive switch to function at a range of 6,000 to 9,000 yards. The switch is not adjustable.

Mod 0 is now obsolete.

Mk 59 Mod 0

Projectiles used in .... 5"/54 H.C.
Over-all length, inches 1-13/16
Diameter at base of ogive, inches 2.71
Threaded length, inch 0.5
Threads .... 6 R.H.
Material .... Capless plastic ogive molded integral with steel base
Weight, pounds 4.05
Minimum range, yards 500
Energizer .... Wet
Wave-suppression feature .... Present
Self-destructive element .... None
Centrifugal handling safety switch .. Present

Description: This fuze is designed for use in the H.C. round of the new 5"/54 guns. It is designed for antiaircraft work from a minimum range of 500 yards to the extreme range of the gun at all elevations. The Auxiliary Detonating Fuze Mk 44 Mod 0 is used.

Part I — Chapter 3 — Section 5

AUXILIARY DETONATING FUZES FOR PROJECTILES

Mk 17 Mods 0—13

Fuzes found with ...... Mk 18 Mods 2–4
Mk 22 and Mods 1–5
Mk 29 Mods 1–3
Mk 30 Mods 1–3
Over-all length, inches 2.5
Diameter, inches 1.38
Weight, grams 348
Threaded length, inch 0.96
Threads .... 10 L.H.
Material .... Steel body, not painted
Arming speed, r.p.m. 3,000–4,500

Description: The fuze is composed of a one-piece body, with a booster cap and plug closing the ends. The body assembly consists of the firing-pin housing and rotor housing, both of which are contained in the sealing cup. In the middle of the closing plug is an obturating cup with a sealing disc between the plug and the firing-pin housing. The firing-pin housing contains a metal firing pin which is held in position by two firing-pin detents. Contained within the rotor housing are a rotor and two rotor detents. The rotor, which contains two lead counterweights and the detonator, is assembled in the housing with the axis of the detonator at an angle of about 55 degrees from the axis of the fuze. The line of centers of the lead counterweights is at an angle of about 35 degrees from the axis. The rotor is held in the unarmed position by the two rotor detents, the tapered ends of which engage in holes in the side of the rotor.

Operation: As the projectile is fired from the gun, centrifugal force moves the firing pin and rotor detents back against their springs. Then centrifugal force, acting upon the lead counterweights in the rotor, will cause the rotor to turn until the detonator assembly is in line with the booster lead-in and firing pin. In this position, the rotor is dynamically balanced, centrifugal force holding the two lead counterweights at a maximum radius from the axis of rotation of the fuze. When the nose fuze functions, the gas pressure from it forces the obturating cup down, shearing the sealing disc adjacent to the firing pin and driving the firing pin down into the primer-detonator assembly which fires the booster lead-in and the booster.

Remarks: This fuze is not designed to function by itself, but will function only by the gas pressure from a nose fuze.

Mods 0–6, representing different manufacturers, were originally assigned for use in 3-inch to 16-inch A.A., A.A. Common, and H.C. projectiles. Later assignments restricted their use to 3-inch to 6-inch projectiles. Mods 0 to 6 were then withdrawn from service and replaced

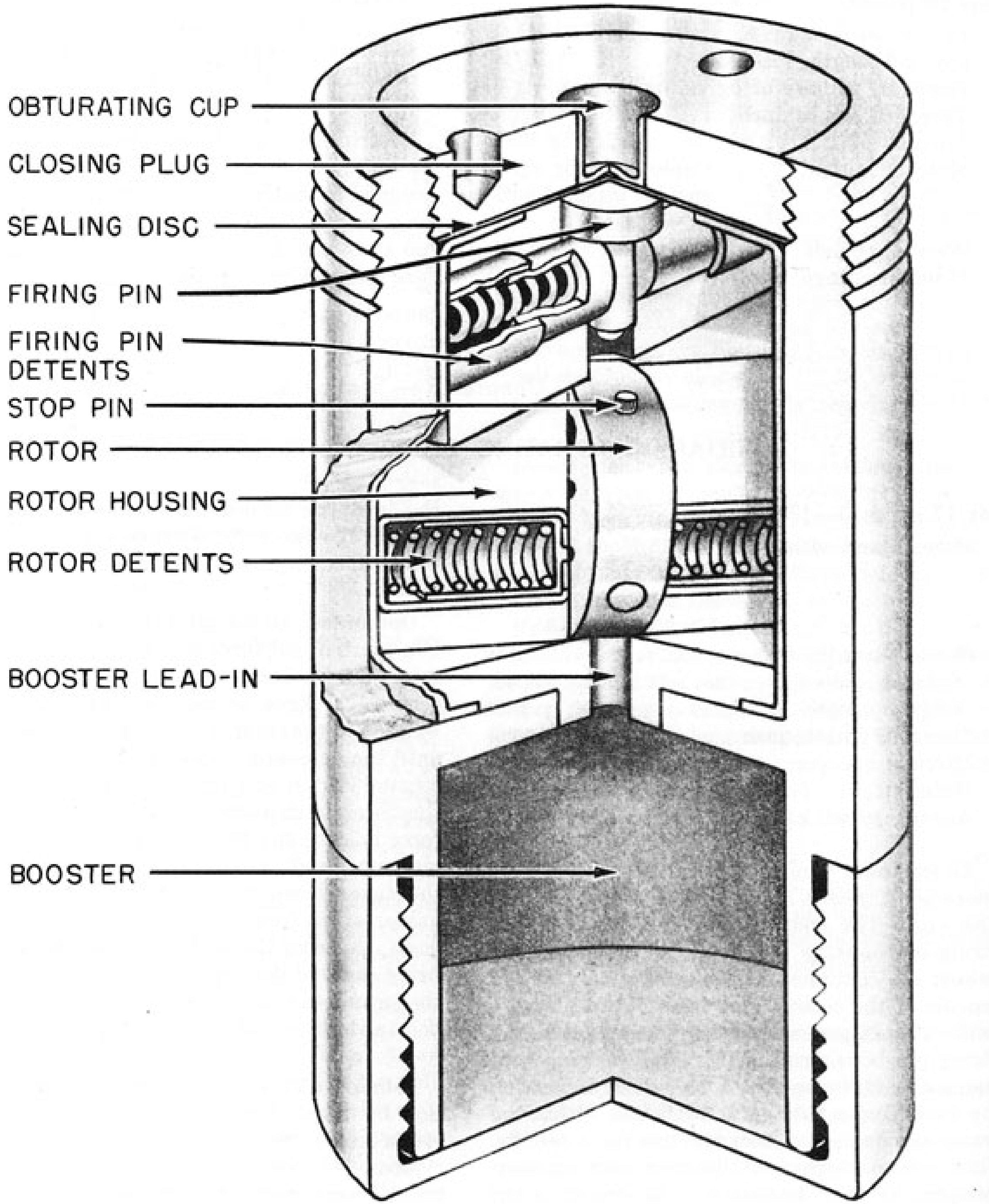


Figure 97. Auxiliary Detonating Fuze Mk 17 Mod 8

by Mods 8–13, later redesignated as the Auxiliary Detonating Fuze Mk 46. A special "green-stripe" Auxiliary Detonating Fuze Mk 17 Mod 8 with weaker detent springs was assigned to be used in major-caliber H.C. ammunition. This fuze was later redesignated the Auxiliary Detonating Fuze Mk 35.

Mods 8–13 of Auxiliary Detonating Fuze Mk 46 differ from Mods 0–6 as follows:

1. To insure positive rotation, two additional lead counterweights were added to the rotor and two holes drilled in the rotor opposite these weights.

2. Two stop pins were added to the rotor, and two holes were cut in the rotor housing to engage the stop pins to prevent further rotation of the rotor after the detonator had become aligned with the firing pin.

Mk 17 Mods 0–11 are considered obsolete.

Mk 35 Mod 0 (Obsolete)

Fuzes found with..........Mk 29 Mods 1–3
Mk 39
Mk 48

This fuze is a redesignation of the Auxiliary Detonating Fuze Mk 17 Mod 8. See "Remarks" on Mk 17.

Mk 43 Mods 0 and 1

Fuzes found with.........Mk 25 and Mk 30
Over-all length, inches.................3.18
Threaded length, inch................0.625
Threads ....11 L.H.

This fuze is like the Auxiliary Detonating Fuze Mk 17 Mods 8–13 (see "Remarks" on Mk 17), except for the dimensions listed above and the fact that it has a pointed firing pin and a lead azide detonator, also an adapter and an additional booster pellet. This extra booster is required because of the long, narrow nose of the 5"/54 and 6"/47 D.P. projectiles, in which this fuze is used.

Mod 0 differs from Mod 1 in that the former has the two-piece body as illustrated, and the latter has a one-piece specially-built body. The Mod 1 is the design which was produced in quantity.

Mk 44 Mods 1 and 2; also Mk 52

Projectiles used in
Mk 44 Mods 1–2....3"/50 A.A.
5"/25/38/51
A.A. Common
5"/54 H. C.
6"/47 H.C.
Mk 52 ....8"/55 H.C.
12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

Over-all length, inches
Rotor housing 1.5
Booster cup 1.25

Description: This fuze is constructed in two parts, a booster cup and a rotor housing into the base of which the booster cup is screwed. The rotor housing contains a double rotor assembly, one rotor located above the other. The upper rotor contains a primer detonator incorporating lead azide. The lower rotor contains a booster lead-in of tetryl. In the assembled position, each rotor is locked by two centrifugal detents so that the components of the firing train are out of alignment.

Operation: The fuze is armed by centrifugal force, which causes the two sets of rotor detents to move outward against their springs, unlocking the rotors. The weighted rotors are then revolved by centrifugal force, until their motion is arrested by the stop pins. At this time the firing train is fully aligned, with the detonator immediately above the booster lead-in, and the fuze is armed. When the nose fuze functions, the gas pressure thus generated forces through the weakened part of the closing disc and fires the detonator, which initiates the booster lead-in and the booster.

Remarks: The Auxiliary Detonating Fuze Mk 52 is completely identical to the Mk 44, except that the rotor detent springs have been considerably weakened, allowing arming at lower rotational velocities than the Mk 44. This alteration was necessitated by the fact that the Mk 52 is employed in the low-spin major-caliber H.C. projectiles.

The Auxiliary Detonating Fuze Mk 44 Mod 1 has a die-cast motor housing; Mod 2 has a hole in the cover plate.

Mk 46 Mod 0 (Obsolete)

The Auxiliary Detonating Fuze Mk 46 is a

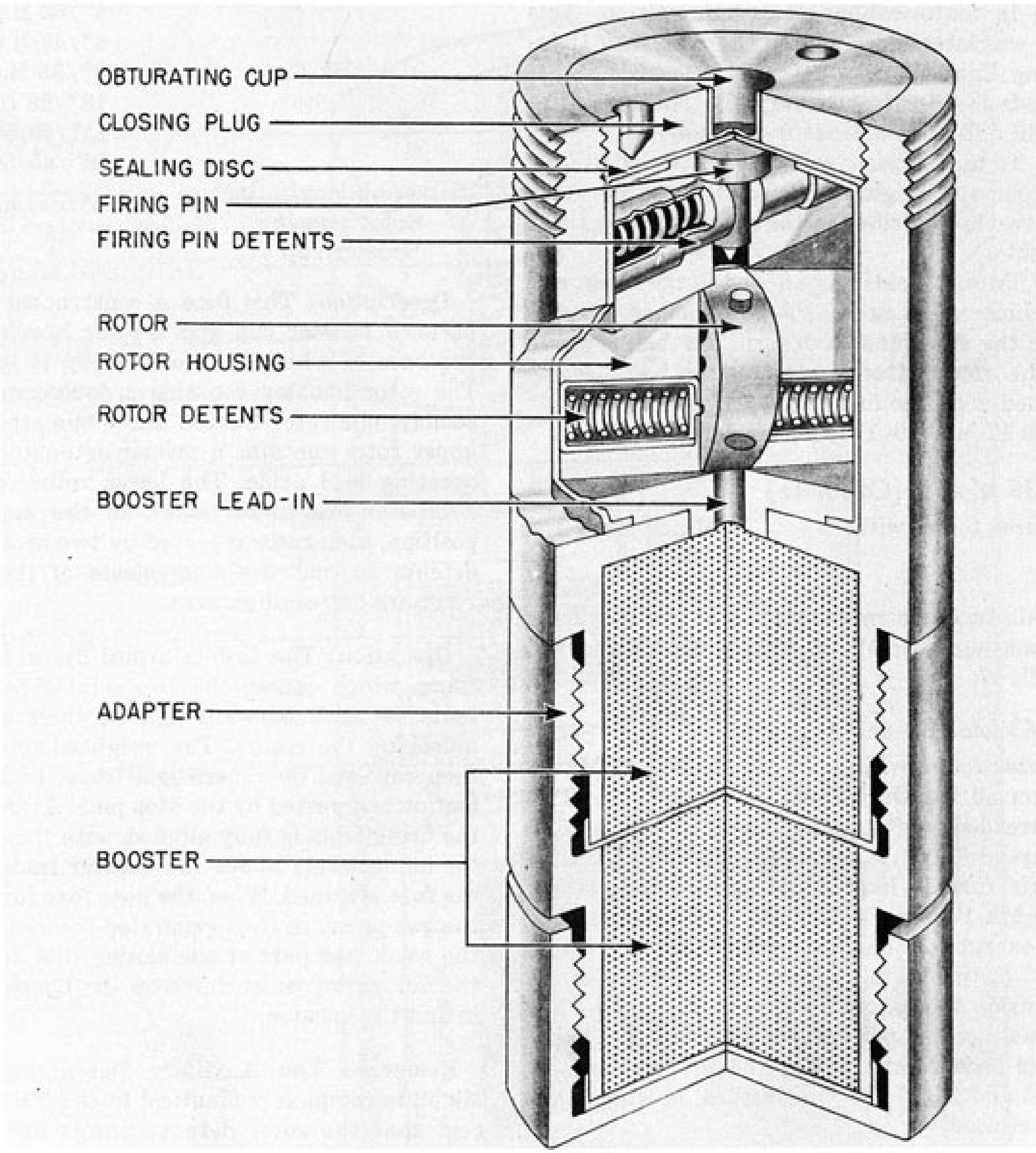


Figure 98. Auxiliary Detonating Fuze Mk 43 Mod 1

redesignation of the Mk 17 Mods 8–13. See Mk 17, "Remarks."

Mk 54 Mods 0 and 1

This fuze is exactly like the Auxiliary Detonating Fuze Mk 46, except that this fuze has a lead azide rather than fulminate of mercury detonator, and also a pointed firing pin instead of a blunt one.

The Mod 1 has an aluminum instead of a steel body, as the Mod 0 has.

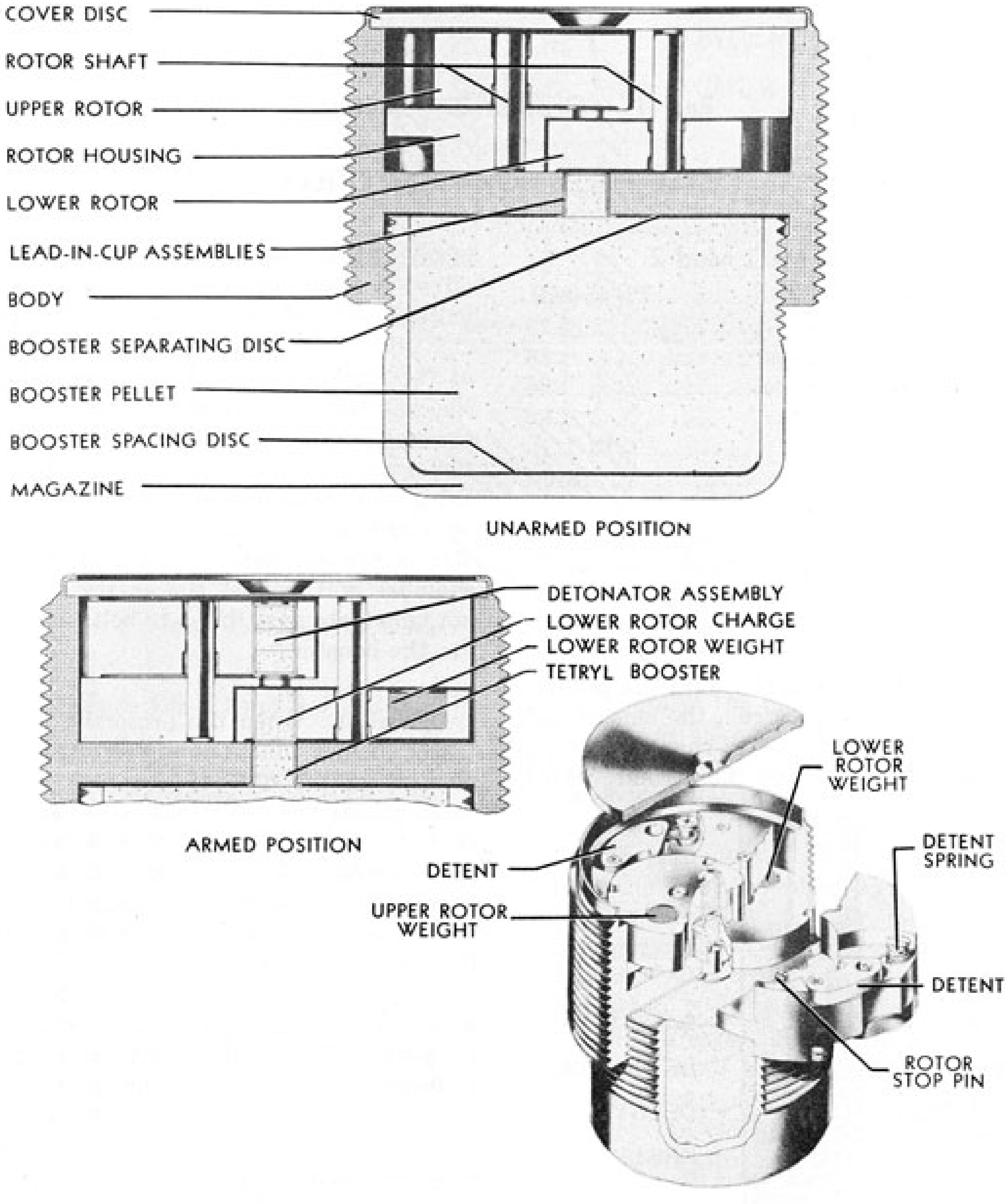


Figure 99. Auxiliary Detonating Fuze Mk 44 Mod 0

Mk 55 Mods 0 and 1

This fuze is exactly like the Auxiliary Detonating Fuze Mk 17 Mod 8 (Mk 35), except that it has a lead azide detonator—for longer life—and a pointed firing pin.

Mod 1 of this fuze has an aluminum body; Mod 0 has a steel body.

BASE FUZES FOR PROJECTILES

Base Detonating Fuze Mk 2 Mod 2

Projectiles used in	7″/45 A.P.
Over-all length, inches	7.25
Diameter of body, inches	1.38
Diameter of head, inches	1.80
Threaded length, inches	1.25
Threads	13 L.H.
Material	Steel

Description: This fuze consists of two major parts: (1) a tracer head, threaded externally to screw into the base of the projectile and containing the tracer primer and pyrotechnic components; (2) the fuze body which houses the Semple striker and carrier unit, the primer-detonator tube, the safety coil, the contrifugal bolt assembly, and the booster charge.

In the unarmed position, the striker, which is pivoted in the striker carrier, is held in the offset position by a pair of centrifugal lock bolts. These bolts are housed in the striker carrier and engage the hole in the weighted end of the striker. Also, in the unarmed position, the detonator is separated from the booster charge by a pair of centrifugal gate bolts. Additional safety is provided by encasing the detonator in a small expansion chamber surrounded by a heavy steel safety coil. Accidental explosion of the detonator will expand itself in the chamber and against the safety coil, and will not penetrate past the gate bolts sufficiently to fire the booster.

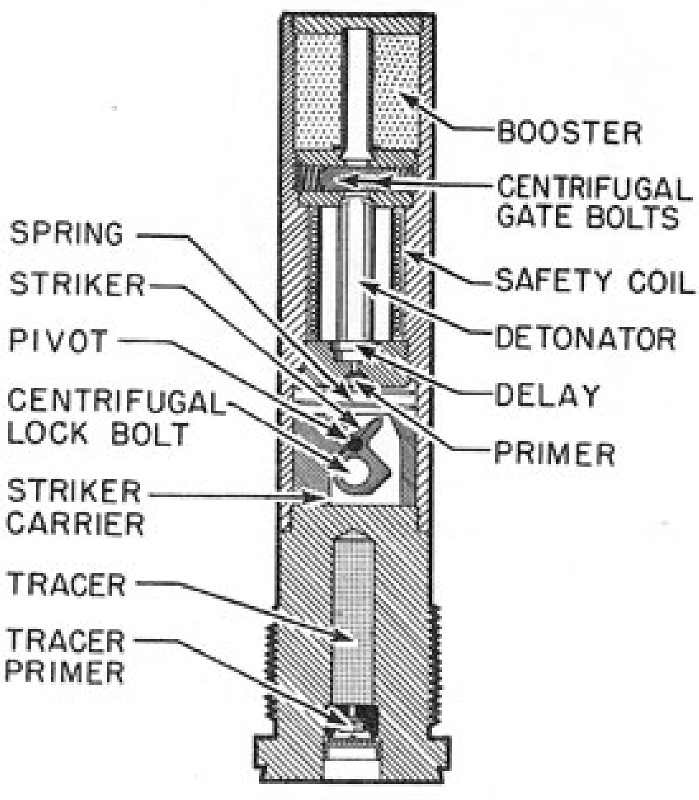


Figure 100. Base Detonating Fuze Mk 2 Mod 2

Operation: When the projectile is fired, the tracer primer functions and ignites the tracer element in the base of the fuze. Centrifugal force causes the centrifugal lock bolts and the centrifugal gate bolts to move outward against their springs. This provides free access between the detonator capsule and the booster charge, and unlocks the pivoted striker. Since the striker is heavily weighted on its lower end, centrifugal force causes the striker to rotate around its pivot and align the striker point with the primer. On impact, the striker carrier moves forward against its spring, bringing the striker against the primer, which fires the delay element and the detonator. The flash from the detonator passes by the open gate bolts and initiates the booster charge, firing the projectile.

Remarks: Because of the shape of the striker, the force of initial acceleration prevents centrifugal force from producing alignment while the projectile is still in the bore of the gun. When acceleration ceases, centrifugal force revolves the pivoted striker to the armed position.

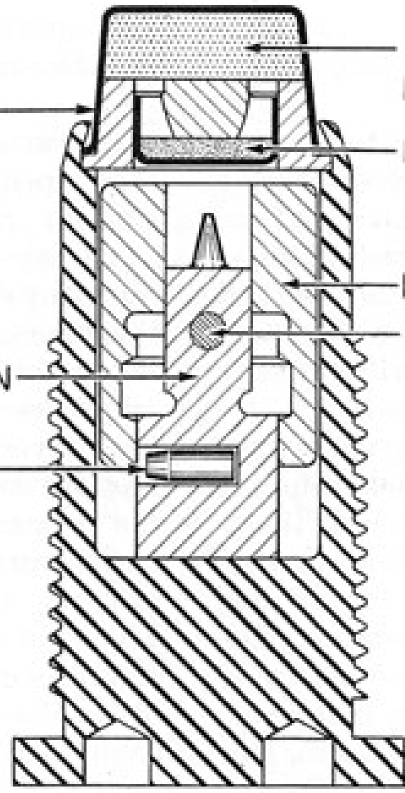


Figure 101. Base Ignition Fuze Mk 2 Mod 9

Base Ignition Fuze Mk 2 Mod 9 (Obsolete)

Projectiles used in
3"/23 Common
1-pdr./40 Common
3-pdr./50 Common
6-pdr./40/42/45/50 Common

Over-all length, inches................1.75
Diameter of head, inch...............0.875
Diameter of body, inch...............0.63
Threaded length, inch...............0.80
Threads ....16 L.H.
Material................Body—brass
Plunger—brass
Firing pin—steel

Description: The fuze consists of a brass fuze body housing a firing pin and a plunger assembly. The firing pin and plunger are locked together by a copper shear pin, in the unarmed position. A primer and black powder magazine are crimped to the upper end of the fuze body.

Operation: When the projectile is fired from the gun, the force of set-back drives the plunger back toward the head of the fuze, shearing the copper pin locking the plunger to the firing pin. When the plunger has moved back sufficiently, the lock pin in the firing pin is caused by centrifugal force to move into the groove cut in the interior of the plunger body. The two units are again locked together, but the plunger is now in the lower position. On impact, inertia forces both the plunger and the firing pin forward, driving the firing pin into the primer and initiating the black powder ignition charge. This fires the black powder/TNT main charge in the projectile.

Remarks: No anti-creep spring is incorporated in the assembly of this fuze. Once set-back has ceased and the plunger and firing pin are locked together by the lock pin, there is nothing present in the fuze to prevent their movement forward toward the primer.

Base Detonating Fuze Mk 3 Mod 2 (Obsolete)

Projectiles used in.....6"/50/53 Common
7"/45 Bombardment
14"/45/50 Bbt.

Over-all length, inches...............6.85
Body diameter, inches...............1.375
Head diameter, inches...............1.80
Weight, pounds 2.58
Threaded length, inches...............1.25

Threads ....13 L.H.
Material ....Steel

Description: This fuze consists of two major parts: (1) a tracer head, threaded externally to screw into the base of the projectile and containing the tracer primer and pyrotechnic components; (2) the fuze body, which houses the Semple firing pin and firing-pin housing, the primer-detonator assembly, the centrifugal half-blocks, the safety coil, and the booster.

In the unarmed position, the firing pin, which is pivoted in its housing, is held offset from the primer by a pair of centrifugal detents. These detents are housed in the firing-pin housing and engage the hole in the weighted end of the firing pin. Also, in the unarmed position, the detonator is separated from the booster by a pair of centrifugal half-blocks. Each half-block is TNT stemmed to form a booster lead-in, but the stemmed portions of the two half-blocks are out of alignment in the unarmed position, providing a safety interruption in the explosive train. Additional safety is provided by encasing the detonator in a small expansion chamber surrounded by a safety coil. Accidental explosion of the detonator will expend its force against the safety coil and will not fire the stemmed half-blocks or the booster.

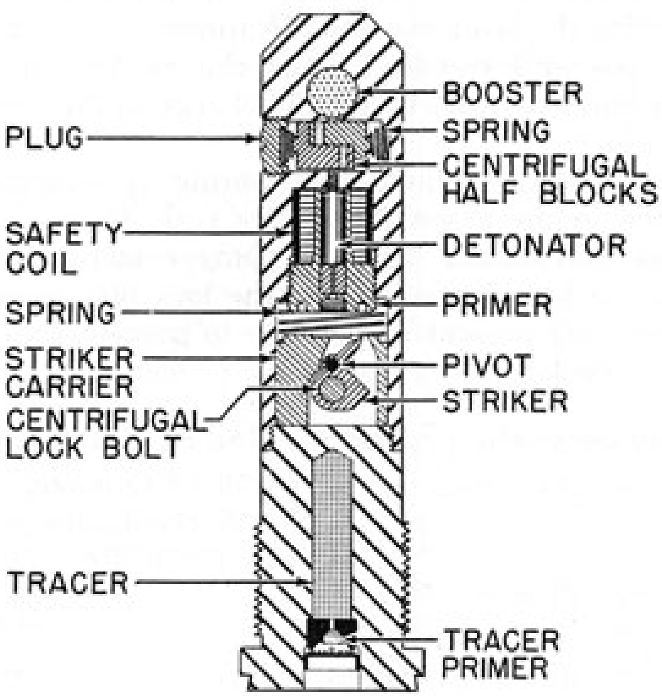


Figure 102. Base Detonating Fuze Mk 3 Mod 2

Operation: When the projectile is fired, the tracer primer functions and ignites the tracer element in the base of the fuze. Centrifugal force causes the centrifugal detents and the centrifugal half-blocks to move outward against their springs. This aligns the booster lead-ins in the half-blocks and unlocks the pivoted firing pin. Since the firing pin is heavily weighted on its lower end, centrifugal force rotates it about its pivot and brings its point into alignment with the primer. On impact, the firing-pin housing moves forward against the anti-creep spring, bringing the firing pin against the primer, which, in turn, fires the detonator. The flash from the detonator initiates the stemmed lead-ins in the half-blocks, the booster charge, and finally the projectile.

Remarks: Because of the shape of the striker, the force of the initial acceleration prevents centrifugal action from aligning the firing pin until after the projectile has left the bore of the gun. When acceleration ceases, centrifugal force revolves the pivoted firing pin to the armed position.

Base Ignition Fuze Mk 8 Mods 4 and 5 (Obsolete)

Projectiles used in....1-, 3-, and 6-pounders
3"/23 Common
Over-all length, inches....Mk 8 Mod 4—3.61
Mk 8 Mod 5— —
Diameter, inch ....Head—0.875
Body—0.625
Weight..........Mk 8 Mod 4—129.7 grams
Mk 8 Mod 5—2.40 ounces
Threaded length, inch..................1.0
Threads ....18 L.H.
Material...Body—brass or bronze
Plunger post and plunger—brass
Striker—cold rolled steel

Description: The body of the fuze contains the plunger and the plunger post which is fitted to the plunger by a shear pin. The striker is attached by a hinge pin to the plunger.

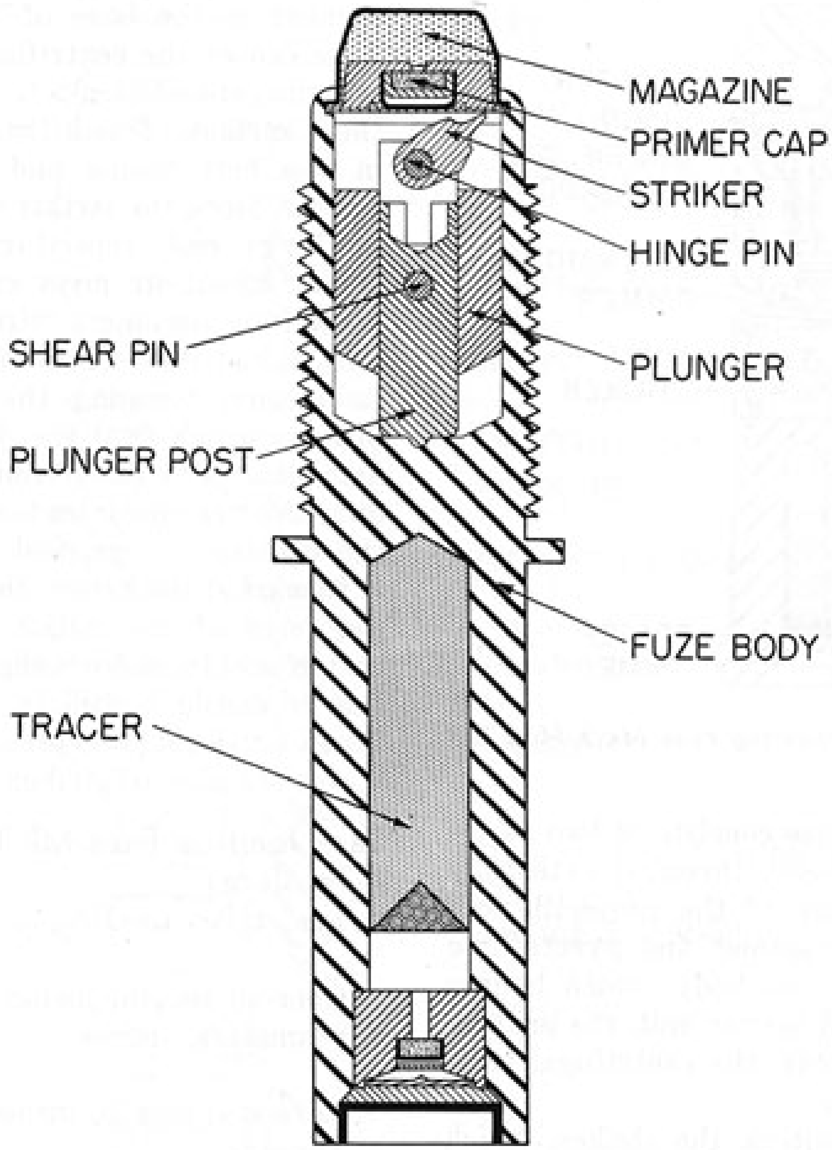


Figure 103. Base Ignition Fuze Mk 8 Mod 4

The primer-magazine unit is held to the body by upsetting the end inward.

Operation: The fuze is assembled with the plunger in the forward position and the striker rotated on the hinge pin, which fastens the striker to the plunger so that it is not aligned with the primer. The force of set-back cuts the shear pin, allowing the plunger to ride back on the plunger post. This motion carries the striker, which straightens out as it enters the recess in the end of the plunger post and then points at the primer cap. On impact the plunger and plunger post go forward together and fire the primer, which ignites the magazine.

Remarks: While this is not a centrifugally actuated fuze, the firing pin is not aligned with the primer until after set-back and cannot be so aligned until the plunger has moved relative to the plunger post.

Base Ignition Fuze Mk 8 Mod 4 differs from Mod 5 only in that it has the longer body with the integral external tracer assembly.

Base Detonating Fuze Mk 9 Mod 2

Projectiles used in	7"/45 A.P.
Over-all length, inches	6.62
Body diameter, inches	1.38
Diameter of head, inches	1.80
Threaded length, inches	1.25
Threads	13 L.H.
Material	Tracer head—steel Fuze body—brass

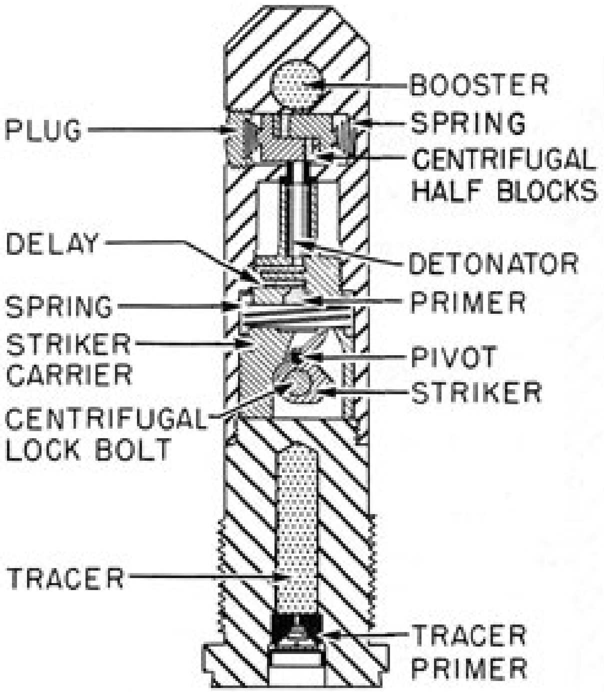


Figure 104. Base Detonating Fuze Mk 9 Mod 2

Description: This fuze consists of two major parts: (1) a tracer head, threaded externally to screw into the base of the projectile and containing the tracer primer and pyrotechnic components: (2) the fuze body, which houses the Semple striker and carrier unit, the primer-delay-detonator assembly, the centrifugal half-blocks, and the booster.

In the unarmed position, the striker, which is pivoted in the striker carrier, is held offset from the primer by a pair of centrifugal lock bolts. These bolts are housed in the striker carrier and engage the hole in the weighted end of the striker. Also, in the unarmed position, the detonator is separated from the booster by a pair of centrifugal half-blocks. Each half-block is TNT stemmed to form a booster lead-in, but the two stemmed portions of the half-blocks are out of alignment in the unarmed position, providing a safety interruption in the explosive train. Additional safety is provided by encasing the detonator in a small expansion chamber. Accidental explosion of the detonator will expend itself in the expansion chamber and will not fire the stemmed half-blocks or the booster.

Operation: When the projectile is fired, the tracer primer functions and ignites the tracer element in the base of the fuze. Centrifugal force causes the centrifugal lock bolts and the centrifugal half-blocks to move outward against their springs. This aligns the booster lead-ins in the half blocks and unlocks the pivoted striker. Since the striker is heavily weighted on its lower end, centrifugal force rotates the striker about its pivot and brings the striker point into alignment with the primer. On impact, the striker carrier moves forward against its spring, bringing the striker against the primer, which fires the delay element and the detonator. The flash from the detonator initiates the stemmed lead-ins in the half-blocks, the booster charge, and finally the projectile.

Remarks: Because of the shape of the striker, the force of the initial acceleration prevents centrifugal force from aligning the striker while the projectile is still in the bore of the gun. When acceleration ceases, centrifugal force revolves the pivoted striker to the armed position.

Base Ignition Fuze Mk 10 Mods 3, 4, and 9 (Obsolete)

Projectiles used in	4″/50 Common 5″/50/51 Common
Over-all length, inches	4.12
Diameters, inches	Body—1.05 Head—1.40
Threaded length, inches	1.40
Threads	9 L.H.
Weight, grams	398
Material	Stock—cold rolled steel Striker carrier—brass Firing pin—sheet brass

Description: This fuze consists of a single body unit containing a striker carrier, an anti-creep spring, and a primer-magazine head. An integral tracer is located in the after end of the fuze body. In the unarmed position, as illustrated, the firing pin is held offset from the primer by a pair of centrifugal lock bolts. The firing pin is pivoted in the movable striker carrier, which is held away from the primer by an anti-creep spring.

Operation: When the projectile is fired, the gases from the propelling charge force a small firing pin into the tracer primer, igniting the tracer-starter mixture, which in turn initiates

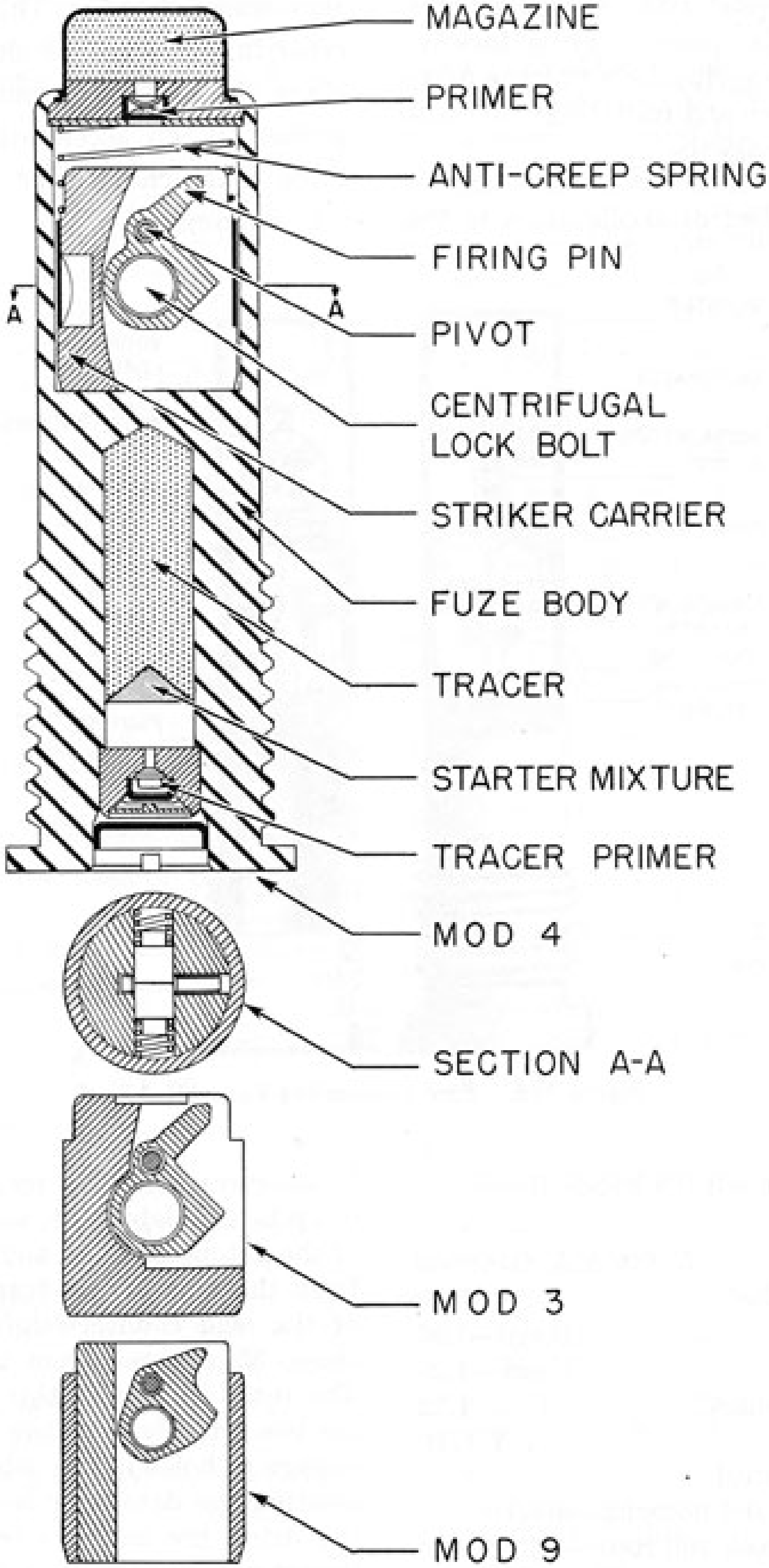


Figure 105. Base Ignition Fuze Mk 10

the tracer pyrotechnic. Centrifugal force causes the two lock bolts to move outward against their spring, unlocking the pivoted firing-pin. The firing pin then rotates into the armed position, where it is aligned with the fuze primer. On impact, the striker carrier moves forward against the anti-creep spring, bringing the firing pin against the primer and initiating the black powder in the fuze magazine.

Remarks: Because of the peculiar shape of the firing pin, the effect of acceleration in the gun causes it to lag. This force is greater than centrifugal force; so during the acceleration stage the striker cannot align itself with the primer. When acceleration ceases, centrifugal force takes charge and rotates the firing pin into alignment.

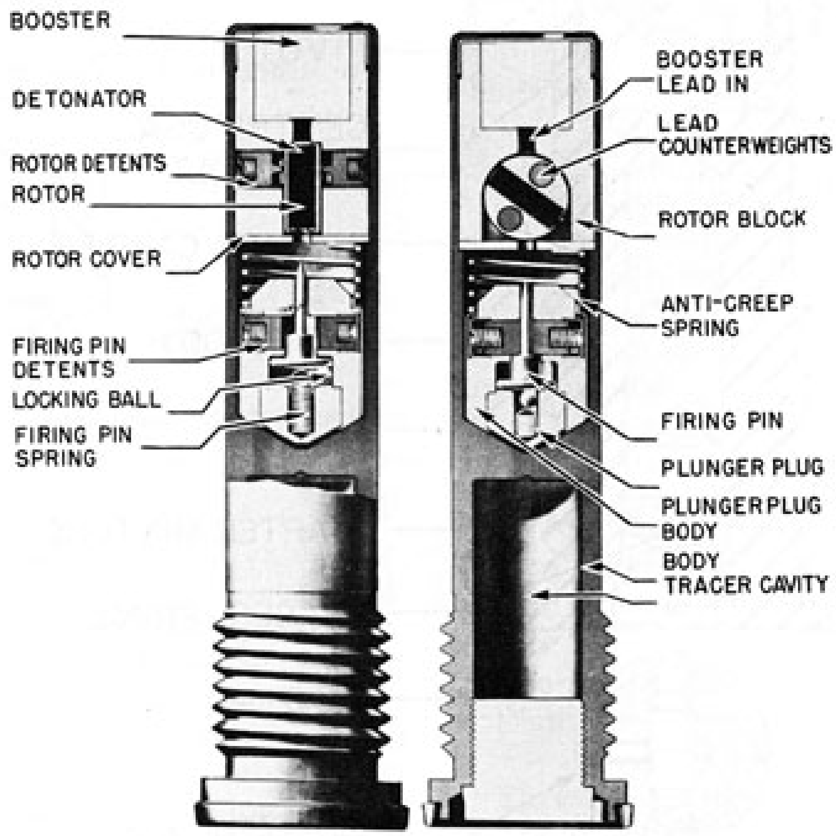


Figure 106. Base Detonating Fuze Mk 13

Base Detonating Fuze Mk 13 Mods 0—7 (Obsolete)

Projectiles used in......5"/38 A.A. Common
Over-all length, inches................5.80
Diameters, inches..............Body—1.05
Head—1.26
Threaded length, inches...............1.22
Threads ....7 L.H.
Material...Body—steel
Striker and housing—steel
Rotor block and rotor—aluminum
Arming speed, r.p.m............3,000–4,000

Description: This fuze consists of a one-piece body which contains two housings, the rotor housing and the firing-pin housing. The rotor housing consists of a rotor, with lead counterweights and detonator, assembled with the axis of the detonator at an angle of about 55 degrees from the axis of the fuze. The line of centers of the lead counterweights is at an angle of about 35 degrees from the axis of the fuze. The rotor is held in this unarmed position by the two rotor detents, the tapered ends of which engage in holes in the side of the rotor. In this position the detonator is out of line with both the firing pin and the booster. The firing-pin housing is free to move and is separated from the rotor housing by a light anti-creep spring. Contained within the housing is a firing pin which is held in position by two firing-pin detents. The point of the firing pin does not protrude from the housing in the unarmed position. Behind the firing pin is a compressed spring and a locking ball tending to throw the firing pin forward.

Operation: When the projectile is fired from the gun, centrifugal force moves the firing-pin detents outward against their springs, thus releasing the firing pin. When the detents are out, the compressed spring moves the firing pin forward and the locking ball moves into the place formerly occupied by the firing pin, thus locking it in a forward position. Centrifugal force also moves the rotor detents back against their springs, thus releasing the rotor. Then centrifugal force, acting upon the lead counterweights in the rotor, causes the rotor to turn until the detonator is in line with the firing pin and booster. In this position the rotor is dynamically balanced, centrifugal force holding the two lead-filled holes at a maximum radius from the axis of rotation of the fuze. Upon impact, the firing-pin housing, being free to move, rides forward against the weak anti-creep spring, causing the firing pin to hit the detonator, which sets off the booster in the base of the fuze.

Remarks: Because of an unacceptable percentage of premature functionings, these fuzes have been recalled.

A cut-off Base Detonating Fuze Mk 13 is occasionally used as a tracer in B.L. & T. projectiles for target practice.

Base Detonating Fuze Mk 19 Mods 0 and 1

Projectiles used in	6"/47/53 Common 6"/53 Sp. Common
Over-all length, inches	6.68
Diameters, inches	Body—1.37 Head—1.80
Threaded length, inches	1.56
Threads	18 L.H.
Material	Body—chrome moly steel Nose cap—duralumin
Delay, second	0.01

Description: The fuze is composed of two major parts, the fuze body and the nose cap. The body contains the auxiliary detonator plunger, the detonator plunger, the detonator-plunger detents, the anti-creep spring assembly, and the firing train. The auxiliary detonator is surrounded by twenty ball bearings and bears against the bottom of the detonator plunger. Fitted over the top of the detonator plunger is the anti-creep spring assembly consisting of an inner and an outer cup separated by an anti-creep spring. The outer cup will not move, and the inner cup is crimped over the top of the detonator plunger and held in position by the sensitive primer holder. The firing train consists of the sensitive primer, secondary firing pin, secondary primer, delay element, detonator, and booster lead-ins and lead-outs which are out of line in the unarmed position.

The nose cap, which is secured to the end of the body by a threaded joint, houses the sensitive firing pin and firing-pin detents. The sensitive firing pin is held in place by two stakes, but is referred to as a "floating" firing pin, since it can move downward slightly. Ninety degrees removed from the two detents are two holes in the nose cap. A locking pin is provided to lock the nose cap in position.

Operation: The force of set-back causes the sensitive firing pin to move down on the firing-pin detents, thus creating friction and holding them in. When the projectile leaves the bore of the gun, creep causes the firing pin to move forward again, thus releasing the firin-pin detents. Centrifugal force will move both sets of detents outward against their springs, and the fuze is then completely armed. The detonator plunger is prevented from moving forward on creep because of the anti-creep spring, but on impact the auxiliary plunger, acting as an inertia weight, pushes the detonator plunger forward. This action moves the inner cup forward, thus compressing the anti-creep spring, and brings the booster lead-ins and lead-outs in line. The sensitive primer in the top of the detonator plunger is carried on to the sensitive firing pin, and the explosion of the sensitive primer accomplishes two things:

1. The gases resulting from the explosion pass through the portholes on the side of the primer container and build up a high pressure, expanding that part of the cup which is adjacent to the holes in the nose cap. This action

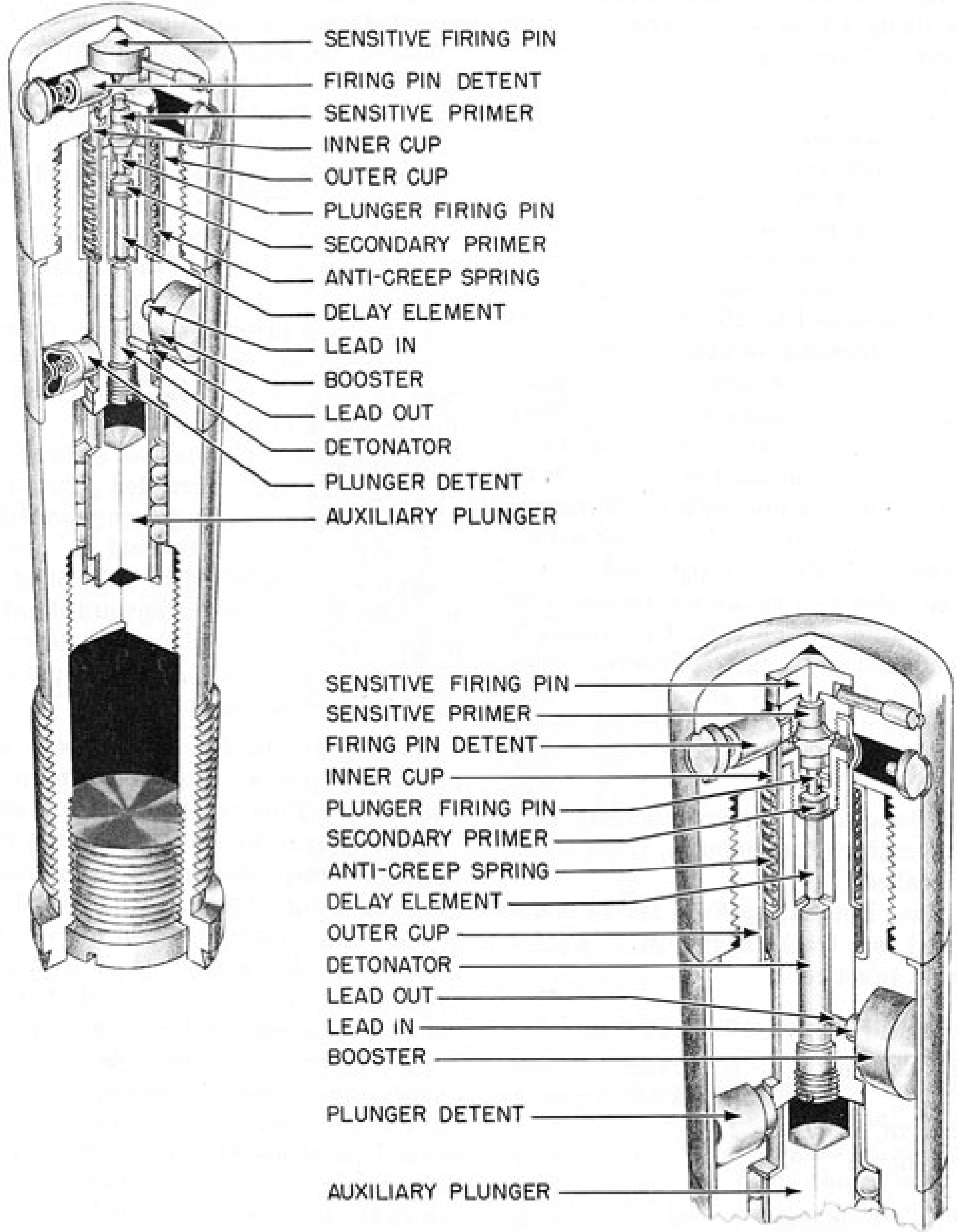


Figure 107. Base Detonating Fuze Mk 19

locks the detonator plunger in the fired position and keeps the firing train lined up.

2. The shear wire that has been holding up the secondary firing pin is broken, and the secondary firing pin is driven down into the secondary primer, thus setting off the delay element of 0.01 second and the detonator and booster elements.

Remarks: This fuze will function on four-inch plate and on water.

The Base Detonating Fuze Mk 19 Mod 1 is

fully moisture-resistant, as described for the Base Detonating Fuze Mk 28. This is its only difference from the Mod 0.

Base Detonating Fuze Mk 20 Mods 0–2

Projectiles used in......4″/50 Sp. Common
5″/38 Sp. Common
5″/38 Common

Threaded length, inch..................0.96

Threads ....11 L.H.

Material ....Body—manganese steel
Nose cap—duralumin

Delay, second 0.01

Except for the dimensions noted above, the Base Detonating Fuze Mk 20 is the same as the Mk 19.

Mods 1 and 2 of this fuze, representing different manufacturers, differ from the Mod 0 only in being fully moisture-resistant.

Base Detonating Fuze Mk 21 Mods 0 and 1

Projectiles used in
6″/47 A.P., 8″/55 Common
7″/45 A.P., 8″/55 Sp. Common
8″/55 A.P.
12″/50 A.P.
14″/45/50 A.P.
16″/45/50 A.P.

Threaded length, inch..................0.96

Threads ....11 L.H.

Material.......... Body—manganese steel
Nose cap—duralumin

Delay, second 0.035

Description: Except for the dimensions noted above, the Base Detonating Fuze Mk 21 is like the Mk 19, and has practically the same operation; however, this fuze is designed with an additional plunger-locking unit. The plunger body is drilled in four places, and four balls are placed in the holes. On forward motion of the plunger and under centrifugal action, the locking balls fly out of their recesses into the forward or larger-diameter portion of the body, locking the plunger in the forward position. This locking feature is provided to insure alignment of booster lead-ins and detonator lead-outs during the long delay period, when the projectile is subjected to violent shocks of penetration.

Remarks: The detent springs in this fuze are considerably weaker than those used in the Base Detonating Fuze Mk 28.

The Mod 1 of this fuze is identical to the Mod 0, except that it is fully moisture-resistant.

Base Detonating Fuze Mk 23 Mod 0 (Obsolete)

Projectiles used in.......8″/55 Common
8″/55 Sp. Common
8″/55 A.P.

Over-all length, inches................7.80

Diameters, inches ....Head—1.8
Body—1.38

Threaded length, inches...............1.25

Threads ....13 L.H.

Weight............2 lb. 7 oz. without tracer

Material ....Cadmium plated steel

Arming speed, r.p.m. 1,200–1,400

Delay, second 0.035

Description: The fuze is composed of three major parts: the head, the body, and the nose cap. The fuze head assembly contains the firing pin, firing pin detents, and two locking balls behind the firing pin. In the assembled position, the point of the firing pin does not protrude from the head. The body contains the detonator plunger, which is spring-loaded downward toward the firing pin by a very heavy firing spring. The firing train—consisting of the sensitive primer, the secondary primer, the delay element, the detonator, and the booster elements—is contained within the detonator plunger. Plunger alignment is maintained by pins in the plunger stock. The nose cap contains the ball retainer, ball retainer detents, and locking balls. The spring-loaded plunger is held up by the locking balls, which are, in turn, held in by the ball retainer. The ball retainer is prevented from moving because of the ball retainer detents.

Operation: When the projectile is fired, centrifugal force causes the firing-pin detents and ball-retainer detents to be moved outward against their springs. When the firing-pin detents have moved out, the firing pin moves forward because of creep, and the locking balls

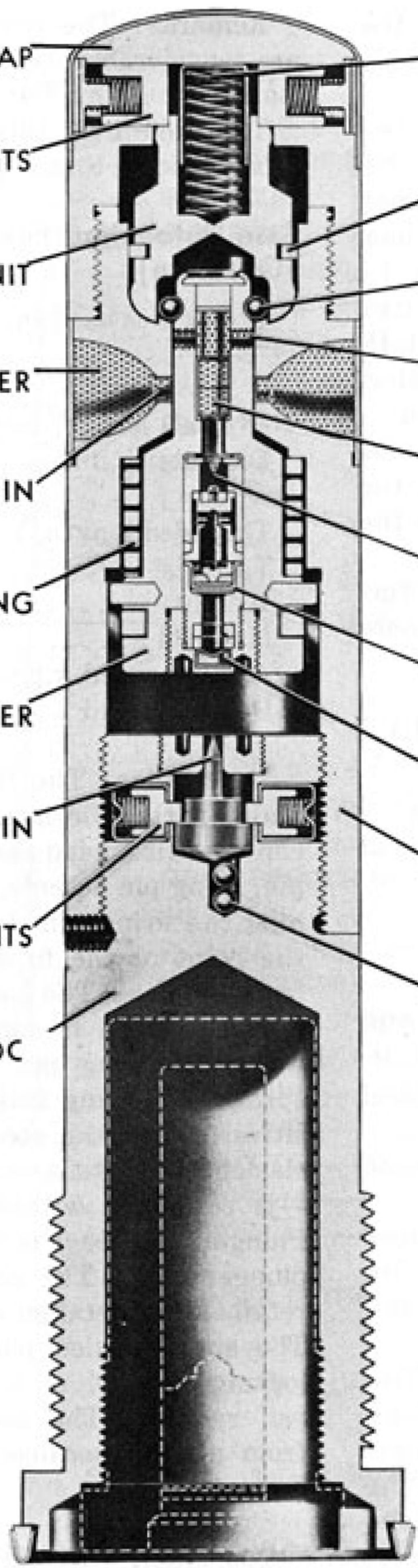


Figure 108. Base Detonating Fuze Mk 23

drop into the space left by the forward movement of the firing pin and will be held outward by centrifugal force, thus locking the firing pin in the forward position. The ball retainer is prevented from moving forward under influence of creep, because of the anti-creep spring behind it. On impact, the ball retainer moves forward until stopped by the nose, and is locked in this position by three split ring segments engaging a shoulder at the end of the body. The plunger-locking balls are released by this forward movement of the ball retainer and are projected outward. When the force of impact has diminished sufficiently to permit the firing spring to propel the plunger to the rear, the sensitive primer in the base of the plunger is thrown down on to the firing pin. When the plunger moves down, it brings the booster lead-ins and lead-outs in line, and the plunger is locked in the rear position by three split ring segments in a manner similar to the ball retainer. When the sensitive primer is fired, the gas from it fires the percussion primer. The flash from the percussion primer passes through and around the baffle and ignites the delay pellet. This defers ignition of the detonator for 0.02 second. The detonator then fires the booster elements.

Remarks: This fuze will detonate on thin plate and on water impact.

Base Detonating Fuze Mk 28 Mods 0—17

Projectiles used in
4"/50 H.C.
5"25/38/51 A.A. Common
5"/51/54 H.C.
6"/50 Common
6"/47/53 H.C.
7"/45 Bombardment
8"/55 H.C. and Sp. Common
14"/45/50 Bombardment
"Green Stripe"
12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

Threaded length, inches................0.96
Threads ....11 L.H.
Weight ....2 lb. 6 oz.
Material ....Body—manganese steel
Nose cap—duralumin (unpainted)
Arming speed, r.p.m............3,000–4,000
Delay ....None

Except for the dimensions and delay noted above, the Base Detonating Fuze Mk 28 is like the Mk 19.

Remarks: The fuze will function on 1/4- to 1/2-inch plate and on water.

The special "green stripe" Base Detonating Fuze Mk 28 was issued for major-caliber H.C. projectiles, but is being replaced by the Mk 39.

Mods 0 to 14 represent different manufacturers.

Mods 15 and 16 are identical to earlier Mods, but are fully moisture-resistant, with a silica gel capsule in the auxiliary detonator plunger and all external joints coated with bakelite varnish over a lacquer base. Mod 17 has an additional booster charge.

Base Detonating Fuzes Mk 31 and Mk 36

Projectiles used in..............4"/40 H.C.
Markings ..............B.D.F. Mk 31 Lot—
Over-all length, inches.................4.68
Delay, second................Mk 36—0.01
Mk 31—None

Remarks: This fuze is moisture-resistant. These fuzes are almost identical to the Base Detonating Fuze Mk 28, differing only in length. Because of the small explosive cavity in the 4-inch projectile, the Base Detonating Fuzes Mk 31 and Mk 36 have been made two inches shorter, with an external tracer.

Mk 31 and Mk 36 differ in the following:

Mk 36 has a delay of 0.01 second; Mk 31, no delay.

Mk 36 has a stronger anti-creep spring.

Mk 36 has a chrome-molybdenum detonator plunger; Mk 31, a pearlite manganese steel one.

Base Detonating Fuze Mk 39 Mod 0 (Obsolete)

Projectiles used in..........8"/55 H.C.
12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

This fuze is a modified Base Detonating Fuze Mk 28, the only change being that the springs behind the detents have been made weaker. It is a Mk 28 with the detent springs of a Mk 21. The reason for this change was as follows. At long ranges in major-caliber guns, there was not sufficient centrifugal force to keep the fuze in an armed condition. It was formerly designated the Base Detonating Fuze Mk 28 Sp. and was identified by a green stripe around the body, but this has been replaced by the new Mark number.

This fuze is being replaced by the Base Detonating Fuze Mk 48.

Base Detonating Fuze Mk 48 Mods 0 and 1

The Mk 48 is exactly like the Mk 39, except that the Mk 48 has a 0.01-second delay element.

Base Donating Fuze Mk 64

Projectiles used in............5"/54 Special Common

In order to incorporate the stronger body of the Base Detonating Fuze Mk 21 Mod 1 with the detonator plunger and the 0.01-second delay of the Mk 36 Mod 0, this fuze is constructed as follows: (1) fuze body, anti-creep-spring outer cup, and plunger-retaining cup of the Base Detonating Fuze Mk 21 Mod 1; (2) detonator plunger assembly of the Mk 36 Mod 0; (3) anti-creep spring and all other components of the Mk 31 Mod 0.

Base Detonating Fuze M66A1

Projectiles used in..............3"/50 A.P.
Over-all length, inches................3.45
Threaded length, inch..................0.5
Threads ....5 L.H.
Total weight, pound....................1.0
Material ....Body—steel
Striker—brass
Delay, second 0.016

Description: This fuze is assembled in two parts, and, when assembled in the projectile, extends from the base of the projectile in the form of a boat-tail. Contained within the body itself is a heavy brass plunger, which acts as a striker; and fitting under the striker is a soft brass washer, which acts as a shear washer. Beneath the striker, and contained in a separate unit which threads into the body, is a container for the delay element, detonator, and booster. The cavity in the head of the fuze houses the built-in tracer element.

Operation: There are no arming principles in this fuze; and on impact the inertia action of the heavy striker collapses the brass washer, allowing the striker to initiate the primer, which sets off the detonator and booster after a short delay period.

Remarks: This is an Army fuze which has been adopted by the Navy. No Navy Mark has been assigned to this fuze, and it is referred to by its "M" designation.

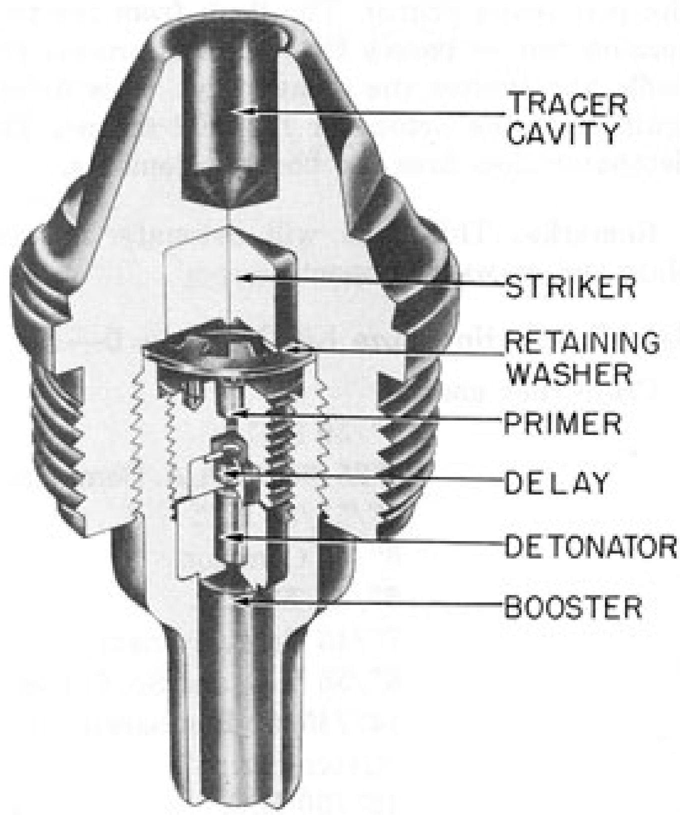


Figure 109. Base Detonating Fuze M66A1

Part I — Chapter 4

PRIMERS AND TRACERS

Section I — INTRODUCTION

Primers

When used in connection with gun ammunition, the term "primer" means the small tube of sensitive explosive which initiates the burning of the propellant charge. Primers are threaded into the base of the cartridge case in case-gun ammunition. For bag guns, the primer is inserted in the primer lock of the breech plug. Primers are classified according to the means of activating them, as follows,

Percussion—impact-fired
Electrical—fired by electricity
Combination—fired by either percussion or electricity

Lock primers: The term "lock" refers to the breech-plug lock of a bag gun; hence, these are bag-charge primers.

Construction: Large-size primers have a main tube, or body; an ignition tube; and a cap, or caps. Activation of the cap, by electricity or percussion, sets off the powder in the ignition tube, which then ignites the powder outside the ignition tube. The ignition tube and the main tube have holes spaced along their length, to provide even burning and ignition over a wider area of the next respective charge.

Percussion caps have a hammer-and-anvil construction to insure impact over a wide area of the explosive.

Electric caps consist of a platinum or other resistance wire "bridge" wrapped with gun cotton. Heat from the bridge ignites the gun cotton for firing.

Charges: The explosive in percussion caps may be a mixture of the following: fulminate of mercury, potassium chlorate, TNT, lead sulfocyanate, antimony sulfide, or pentaerythritol tetranitrate.

In electric caps, black powder is usually packed with the gun cotton.

For the main charge, black powder or a mixture of black powder and cannon powder is the standard.

Tracers

Tracers are devices designed to leave a trace of either smoke or flame, showing the trajectory of the projectile. They are either screwed or pressed into the after end of the projectile, and may be set into the interior of the projectile, in which case they are internal tracers; or they may project from the end of the projectile, in which case they are called external tracers. Tracers may be ignited by the heat from the burning of the propelling charge, or may be equipped with a striker and detonator which ignites the tracer when the force of set-back occurs.

Some tracers are designed to detonate the explosive charge—"self destruction"—in the projectile when the illuminant material has been burned out by the flame from the tracer igniting a detonator, which, in turn, ignites the main charge.

PRIMERS

Percussion Primer Mk 10 Mods 8 and 9

Over-all length, inches 2.21
Diameter of body, inch 0.375
Material .... Brass
How secured .... Push fit
Charge .... 10 grams black powder
26 grams cannon powder
Cap .... Commercial mixture of mercury fulminate, potassium chlorate, and antimony sulfide
Guns used in.... 3″/23; 1-, 3–, and 6-Pounder

Primer Mk 10 Mod 8 is similar to the Mk 10 Mod 9, but is authorized for use with saluting charges only.

Combination Primer Mk 13

Over-all length, inches 9.745
Diameter of body, inch 0.538
Material .... Brass
How secured .... Screwed in case
Charge.... 265 grams black powder in primer
Cap......... Mixture of potassium chlorate, antimony sulfide, and mercury fulminate; also, platinum electric bridge and gun cotton
Guns used in......... 4″/50, 5″/38, 5″/25, 5″/51, 6″/47 case guns

Percussion Primer Mk 14

Over-all length, inches 5.021
Diameter of body, inch 0.55
Material .... Brass
Method of securing.... Screwed into case by 11 R.H. threads
Charge .... Black powder
Cap.......... Mercury fulminate, antimony sulfide, and potassium chlorate
Guns used in .... 3″/50

Lock Combination Primer Mk 15 Mod 1

Over-all length, inches 1.985
Diameter of body, inch 0.492
Material .... Bronze
How secured............. Push-fit in breech plug of gun
Charge .... 30 grams black powder
Cap.......... Mercury fulminate, antimony sulfide, and potassium chlorated; also, platinum bridge and gun cotton for electric firing
Guns used in.................. All bag guns

Percussion Primer Mk 19 Mod 0 (Obsolete)

Over-all length, inches 1.71
Diameter of body, inch 0.54
Material .... Brass
How secured .... Push fit
Charge........ 28 grains Army black powder
Cap............. Mixture of TNT, antimony sulfide, and potassium chlorate
Guns used in .... 1.1″

Percussion Primer Mk 21 Mods 0 and 1 (Obsolete)

Over-all length, inches........ 2.9 (approx.)
Diameter of body, inch 0.54
Material .... Brass
How secured............. Screws into case; R.H. threads
Charge .... 64 grains black powder
Cap........... Mixture of lead sulfocyanate, potassium chlorate, and antimony sulfide
Gun used in........ 40-mm Brass Case Mk 1

Percussion Primer Mk 22

This primer is exactly like the Percussion Primer Mk 21, except that it is secured by a

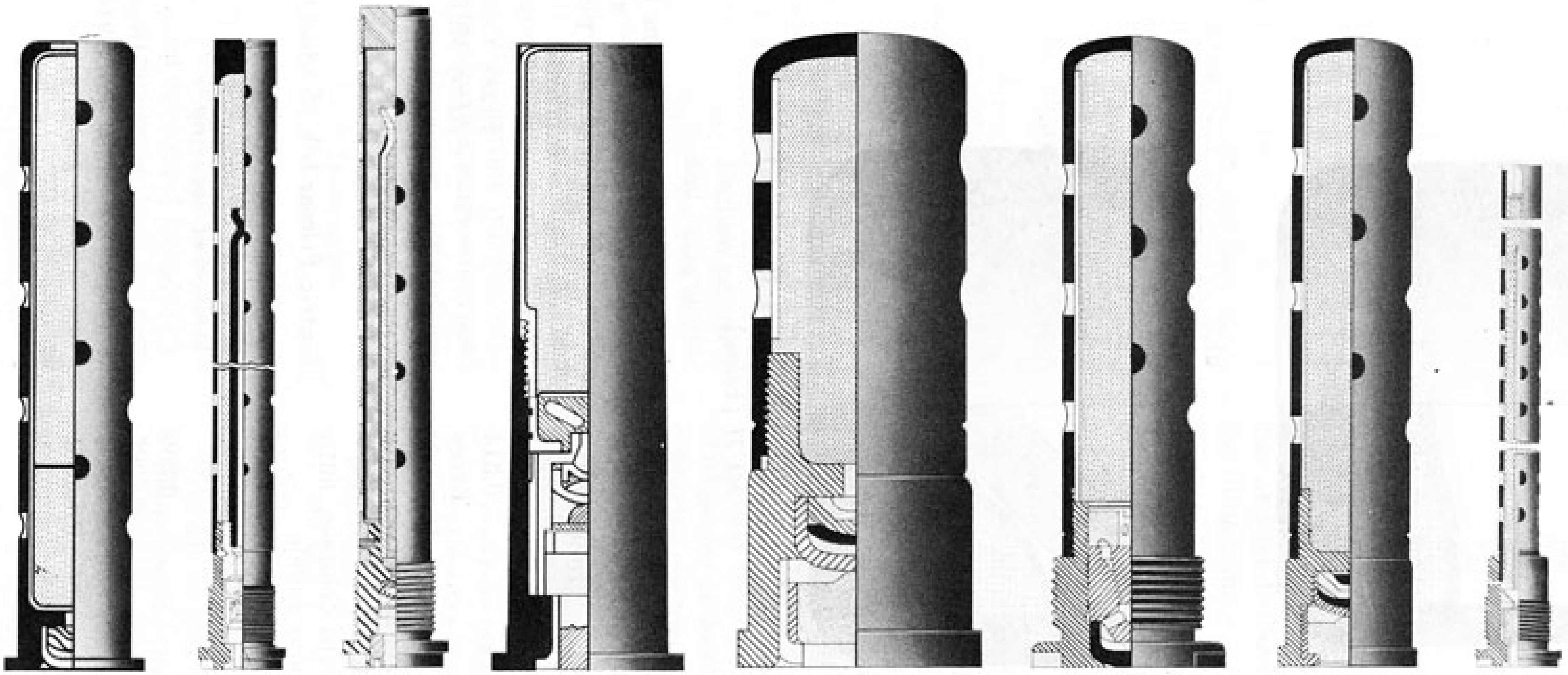


Figure 110. Primers (not proportionate sizes)

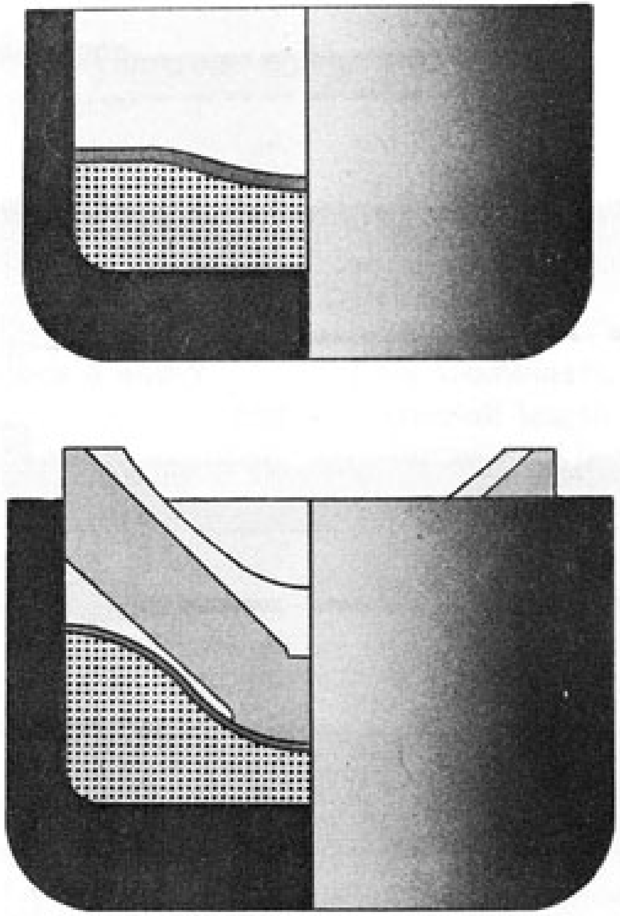


Figure 111. Percussion Primers Mk 30 (above) and Mk 31 (below)

push-fit rather than threads. The Mk 22 is used in 40-mm Brass Case Mk 1 and Steel Case Mk 3.

Percussion Primer Mk 30

Over-all length, inch 0.2
Diameter of body, inch 0.314
Material .... Brass
Method of securing .... Press-fit
Charge .... 2.5 grains fulminate of mercury, potassium chlorate, antimony sulfide
Gun used in .... 20-mm Brass Case Mk 2

Percussion Primer Mk 31

Over-all length, inch 0.250
Diameter of body, inch 0.3325
Material .... Brass
Method of securing .... Press-fit
Charge .... 2.10 grains lead sulfocyanate, antimony sulfide, potassium chlorate, pentaerythritol tetranitrate
Gun used in .... 20-mm Steel Case Mk 3 and Brass Case Mk 4; also in Army M21A1 series cases

This primer is the same as the Army Primers M36 and M36A1

Electric Primer Mk 35 Mod 0

Over-all length, inches 23.601
Diameter of body, inch 0.760
Method of securing .... Screwed into case
Charge .... Black powder
Cap .... None. Platinum electric bridge, plus gun cotton and black powder mixture

TRACERS

Mk 5 Mods 0 and 1

Over-all length, inches.................2.48
Diameter of head, inches..............1.248
Starter pyrotechnic....Barium peroxide and magnesium powder
Illuminant......Sodium nitrate, calcium silicide, charcoal, and linseed oil
Color ....Orange

Hot propellant gases burn through the cellu-in turn, ignites the orange illuminant.

Mk 6 Mods 0 and 1

Over-all length, inches.................2.45
Diameter of head, inch................0.939
Starter pyrotechnic........Barium peroxide and magnesium powder
Illuminant.....Red—strontium nitrate, ammonium perchlorate, magnesium powder, charcoal, and linseed oil
White—barium nitrate, barium peroxide, magnesium powder, aluminum powder, and wax
Colors..............Mod 0—red and white
Mod 1—orange
Projectiles used in
Mod 0—with adapter in 5″/25 A.A. Common Projectiles Mk 28 and 5″/38 A.A. Common Projectiles Mk 31, blind-loaded for target practice
Mod 1—with adapter in 4″/50 Common Projectiles Mk 6 Mod 6 and Mk 10 Mods 1 to 3 and 5″/51 Common Projectiles Mk 15 Mods 5 and 13, blind-loaded for target practice.

Propellant gases burn through the celluloid disc and ignite the starter mixture, which fires the illuminant.

Mk 8 Mod 0 (Obsolete)

Over-all length, inches.................2.12
Diameter of head, inch................0.925
Starter pyrotechnic....Barium peroxide and magnesium powder
Projectiles used in.............40-mm A.A.

Operation: The cap holder, when the shell is fired, sets back, thus overcoming the stirrup spring, and forces itself against the anvil, igniting the tracer and initiating its action, and blowing out the sealing disc abaft the anvil.

Mk 9

Over-all length, inches.................2.48
Diameter of head, inches..............1.248
Starter mixture......Barium peroxide, magnesium powder, barium nitrate
Illuminant....White—aluminum powder and wax
Red—strontium nitrate, ammonium perchlorate, magnesium powder, charcoal, and linseed oil
Projectiles used in..4″/50, 5″/38, and 5″/25

Propellant gases burn through the celluloid disc and ignite the starter, which fires the illuminant

Mk 10 Mod 0 (Obsolete)

Over-all length, inches..................2.9
Diameter of head, inch..................0.93
Starter pyrotechnic
Magnesium powder, barium peroxide, and aluminum
Illuminant......Magnesium powder, strontium nitrate, and ammonium perchlorate

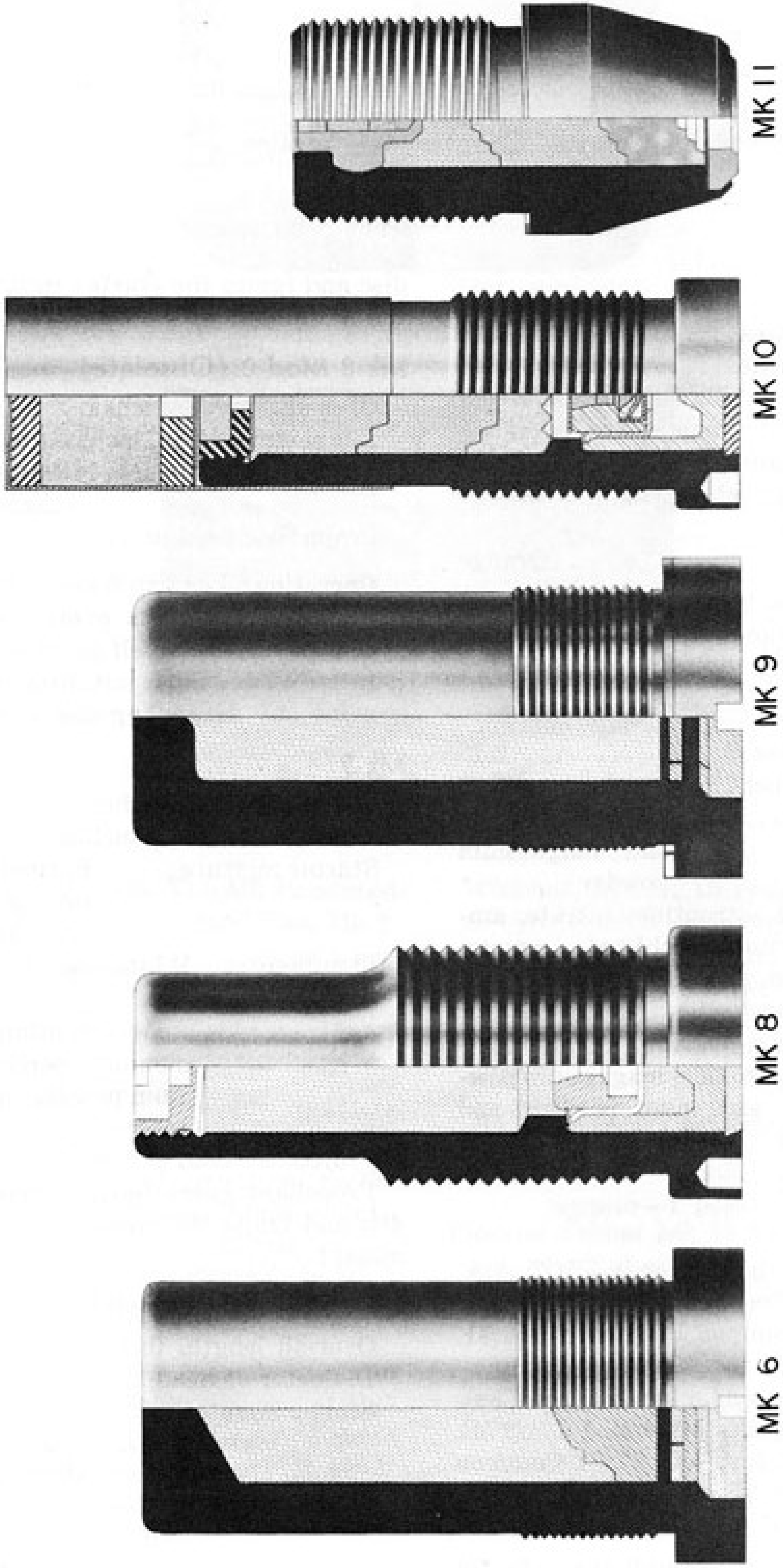


Figure 112. Tracers (not proportionate sizes)

Color ....Red
Projectiles used in....40-mm H.E., H.E.–I., and B.L.

Operation: Set-back forces the primer carrier back, bending the ears on the stirrup spring and bringing the primer against the fixed anvil. The flash from the primer ignites the tracer starter, which initiates the tracer illuminant.

This tracer is self-destroying, containing an igniter pellet of 6 grains of black powder and a 5.7-gram self-destroying black-powder pellet. When the tracer illuminant has burned through, the igniter pellet is fired, initiating the self-destroying element, which, in turn, explodes the projectile.

Remarks: The Tracer Mk 10 is being replaced by the Mk 11 in all assemblies.

Mk 11 Mods 0—3

Overall length, inches..................1.78
Diameter of head, inches......0.925 tapering to 0.65
Starter pyrotechnic....Magnesium powder, barium peroxide, and aluminum
Illuminant......Magnesium powder, strontium nitrate, ammonium perchlorate, charcoal, and wax
Colors ....Red or non-luminous (dark)
Projectiles used in....40-mm H.E., H.E.–I., and B.L.
Ignition method.....Propellant gases heat or burn through the brass closing disc and ignite the starter, which initiates the illuminant

Remarks: The only difference between the various Mods of the Tracer Mk 11 is in the construction of the relay housing:

Mod 0—Housing is threaded.

Mod 2—Housing is a push-fit.

Mod 3—Housing is an integral part of tracer body.

The relay housing contains three black-powder pellets, which are ignited at the end of the burning of the tracer. The pellets, in turn, initiate the main charge of the projectile.

The "dark ignition" loading of the Tracer Mk 11 has the starter pyrotechnic of 65% barium peroxide and 35% powdered silenium. With the substitution of silenium for the magnesium, the tracer does not become visible until some 200 yards from the muzzle. 40-mm ammunition using the "dark ignition" tracer is labeled H.E.–I.–T.–D.I.–S.D.(U.M.).

"Dark" Tracers Mk 11 are non-luminous; hence invisible day or night. They permit time of flight of 8.5 to 10.0 seconds (4,200 to 4,600 yards) before self destruction. A small, intense flash immediately precedes the flash from the bursting projectile. This ammunition was designed for night director-controlled fire. Lots are labeled H.E.I.–S.D.(U.K.).

Mk 14 Mod 0

The Tracer Mk 14 is of the non-self-destroying type. It is made like the Tracer Mk 11, except that, instead of the relay housing, there is only the blanked-off end of the cavity. Only a few of these tracers were ever made.

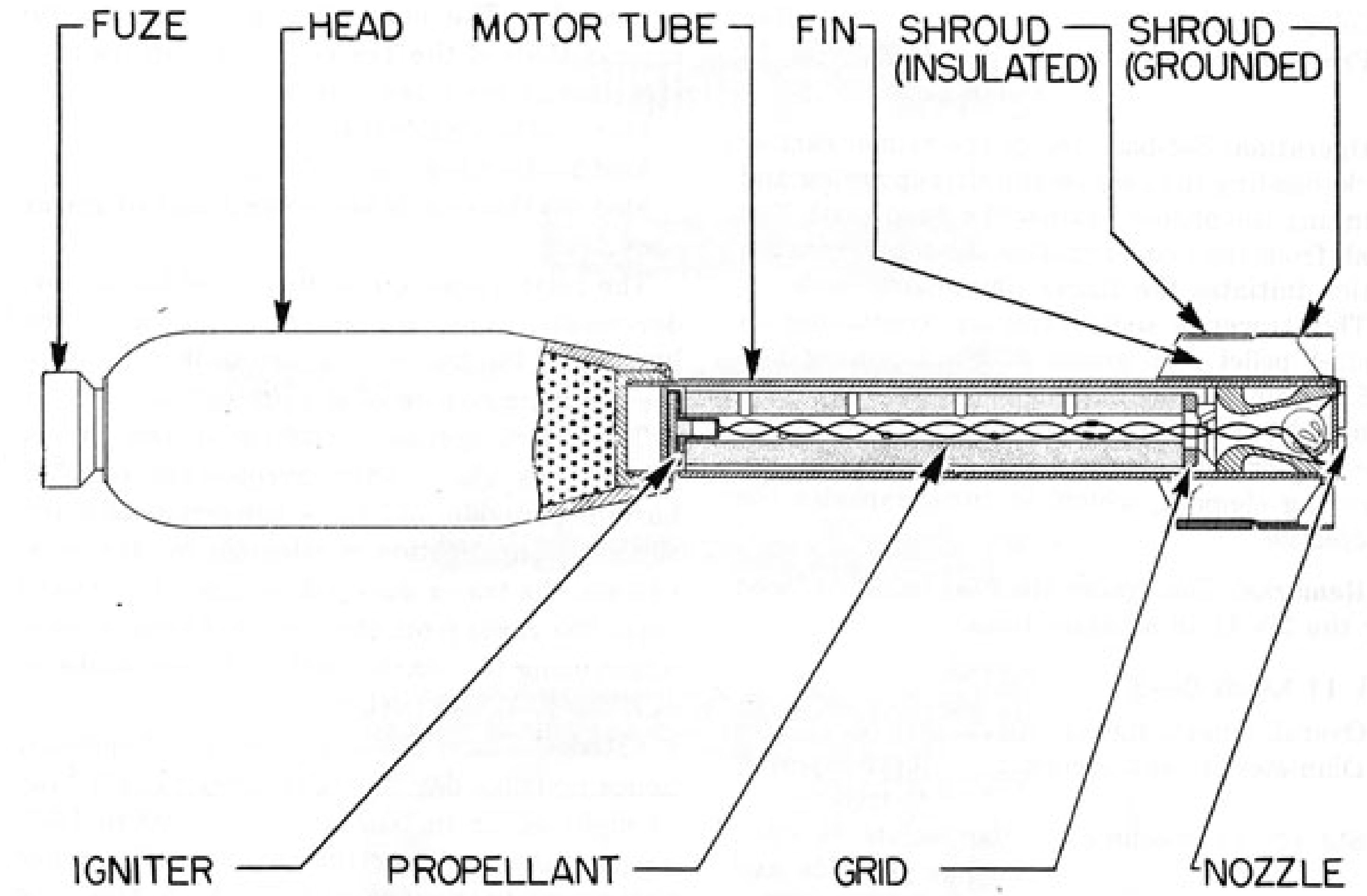


Figure 113. Typical Rocket Components

Abbreviations

The following abbreviations are used in the ensuing chapters:

S.S.—Spin-stabilized
A.R.—Aircraft rocket
H.E.—High explosive
A/T—Anti-tank
D.R.—Demolition rocket
B.R.—Barrage rocket
S.A.P.—Semi-armor-piercing
F.S.—Sulphur trioxide in chlorosulphonic acid
W.P.—White phosphorus
P.W.P.—Plasticized white phosphorus
C.W.R.-N.—Chemical warfare rocket, Navy

Part 2

ROCKETS AND ROCKET FUZES

Chapter 5 — ROCKET BODIES

Section I — INTRODUCTION

General

The propelling unit of the rocket is called the motor and contains the propelling charge. The motor is attached to the head, which contains the payload and the initiating device. The motor is closed on the forward end and partially opened at the after end. The propellant is a relatively slow-burning double-base smokeless powder called ballistite.

As the ballistite is burned, hot gases are generated which expand and exert pressure against the confines of the motor tube. Since the hot gases exert an equal pressure in all directions, the pressures against the side walls counterbalance each other; however, the pressure against the forward closed end of the tube is not counteracted by pressure against the after end, since that end is partially open. The resultant force, then, is a thrust against the closed forward end of the motor, and the rocket is propelled in that direction. In order that the pressure of the gases will not be expended too rapidly, and that the propellant can be retained in flight, the after end of the motor tube is partially closed by the nozzle attachment, which is built into the inside of the tube. This nozzle restricts the ejection of the hot gases and also, by means of its rear taper, furnishes a canted surface against which the rapidly expanding emitted gases may act to increase the forward thrust of the rocket.

The ballistite propellant is ignited by a black-powder charge, the initiating device for which is an electric squib with a small bridge wire of high resistance which, when heated by an electrical current, ignites a violent match composition. The black-powder charge sends a flash over the entire surface of the ballistite and raises the temperature of the ballistite to the ignition point. Upon ignition, the ballistite burns evenly and relatively slowly; this type of burning is necessary to prevent sudden and excessive pressures being exerted against the thin walls of the motor tube. Rocket motors operate at much lower pressures than guns, and correspondingly longer times are required for the complete combustion of the rocket propellant. Burning times of American rockets range from about 0.15 second to as much as 1.5 seconds, depending on the web thickness of the grain and the temperature of the propellant; and burning distances range from a few feet to several hundred feet at high velocities; hence, most of the burning of the rocket propellant occurs after the projectile has left the launcher.

The early productions of rockets were of the fin-stabilized type because of their use by the British and because of the inherent simplicity associated with fin stabilization. Rockets cannot be launched with that degree of accuracy characteristic of gun projectiles. This is a result of many factors, such as the effect of temperature on the burning rate of the propellant, difficulties in controlling to a fine degree the pressures exerted by the expanding gases inside the motor tube, the effect of the expansion of emitted gases against the rear taper of the nozzle, etc. The mean deviation in deflection for most standard land- or shipboard-launched fin-stabilized rockets is 20 to 40 mils, while fin-stabilized rockets launched from aircraft have a mean deviation of about 5 to 10 mils. The increased accuracy of aircraft-launched rockets is attributed to the immediate stabilizing effect given to the fins during the initial stages of flight by the rapid travel of the plane through the air. Fins on rockets exert an appreciable restoring force in flight only at a high velocity, and thus a greater degree of accuracy is achieved if rockets are launched from aircraft or if the acceleration occurs to a large extent on the launcher.

A later development, the spin-stabilized rocket, is now in service use. Stabilization of this rocket depends on the rotation of the round. Although the accuracy of spin-stabilized rockets is not comparable to that of gun projectiles, they are generally more accurate than fin-stabilized rockets at short ranges. The use of spin-stabilized rockets will be particularly advantageous to ground and amphibious forces, inasmuch as the rocket is shorter and the launching gear is more compact, facts which facilitate the loading and stowage problems.

As against their disadvantages, rockets have many advantages over gun-propelled projectiles. The most important is the absence of recoil against the launcher. Since there is no recoil action on the launcher, rockets may be launched from small trucks, amphibious ships, and aircraft which could not withstand the recoil forces exerted by equivalent projectiles fired from guns. Other advantages of rockets are cheapness, simplicity, and portability of the launchers as compared to guns.

Components

Head: This is the part which is functionally similar to a projectile and which contains the payload and the initiating device. This payload may be solid shot, high explosive, chemical, incendiary, window, flare, or a special load.

Motor tube: This contains the propelling charge and the igniter. It is a combustion chamber in which the propellant is burned to provide the motive power for the rocket. It generally threads to the rocket head and is usually shipped separate from the head and fuze. The diameter of the motor is generally less than the diameter of the body with which it is used.

Grid or trap assembly: The Navy refers to the assembly which supports the powder grain as the **grid.** This grid supports the grain in such a position that sufficient clearance is allowed between the grain and the motor tube to allow the gas to flow from the propellant to the nozzle. The Army uses a trap assembly, which is somewhat more complicated than the Navy grid. The trap assembly consists of spacing discs and wires running between them, on which the sticks of ballistite are supported. Such an assembly is necessary where numerous small grains are used.

Nozzle: The number of nozzles varies with the type of motor and method of stabilization. The nozzle has several functions. It directs the gas jet in the desired direction and provides for expansion of the hot gas in the exit cone, thus giving additional thrust (about 33%) over that obtainable from a simple orifice. In spin-stabilized rockets, it imparts a clockwise rotatoin to the rocket when launched.

Fins: During burning, the action of the air against the fins gives a restoring moment against side forces at the nozzle, thus improving the accuracy of fire. When there is a tail shroud, it supports the rear end of the rocket in the launcher and may also provide electrical contacts for firing.

Propellant and igniter: The igniter contains loosely packed black powder and an electric squib with a high-resistance bridge running through a match composition. The propellant is a double-base smokeless powder called ballistite, which burns slowly and uniformly. Production of ballistite differs somewhat for the Army and the Navy, the Army preferring the solvent extrusion process and the Navy specifying the solventless extrusion process. The solvent extrusion process is impracticable for grains having a web of more than 1-1/4 inches.

Grain shapes also vary. Army rockets generally have several small cylindrical grains of ballistite, with an axial hole to increase the burning surface and uniformity of burning. The Navy rockets use either a single solid cruciform grain without perforations or a single cylindrical grain with an axial hole and radial perforations. The latter, used in Navy ground- or shipboard-mounted rockets, is characterized by three ridges 120° removed and running longitudinally along the grain. Inhibitors are not used on this type. The cruciform grain, in Navy aircraft rockets, is a symmetrical cross with rounded ends. If all the exterior surface of this grain were permitted to burn, there would be a gradual decrease of area, and a regressive rate in burning. Hence, a number of slower burning cellulose acetate strips are bonded to parts of the area exposed on the outer curved ends of the arms, to give desired burning characteristics.

Storage

To decrease hazards in handling, rocket bodies and motors are generally shipped and stored separately. Motors with large grains are kept in a non-propulsive state until final assembly is necessary. The seals at both ends of the motors are light and easily displaced by pressure developed inside the tube. Should the igniter and grain ignite, the closures would fail quickly, relieving the pressure without more than a slight movement of the motor.

It is necessary that loaded motors be kept at moderate temperatures as much as possible. Even though spontaneous ignition should not take place, the powder should not be stored where temperatures exceed 100° F, because such conditions tend markedly to decrease the stable life of the propellant. Because of the electric squib, rocket motors should not be stored near radio apparatus or antenna leads.

Although there is very little possibility of a motor firing as a result of falling or rough handling, such treatment is likely to cause malfunctioning of the rounds. Ammunition should be kept in packing containers or ready boxes and should not be handled in a loose condition unless necessary.

Practice rockets

Practice rockets are loaded with plaster of paris or other inert substances to simulate the explosive loads in service rounds. These rockets also have dummy fuzes.

Safe temperatures

The burning rate of propellent powders changes with temperature and pressure—the higher temperatures and pressures causing more rapid burning. If rockets are fired at temperatures higher than those for which they are designed, the pressure may build up faster than the nozzle can release it, perhaps bursting the round. At temperatures below the safety limit, there will be back blasts of flame with burning fragments of powder.

Retro rockets

These were rockets designed to be fired aft from a fast moving ship or plane—the movement aft to compensate exactly for the movement forward of the launching vehicle, thus leaving gravity as the only effective force on the rocket.

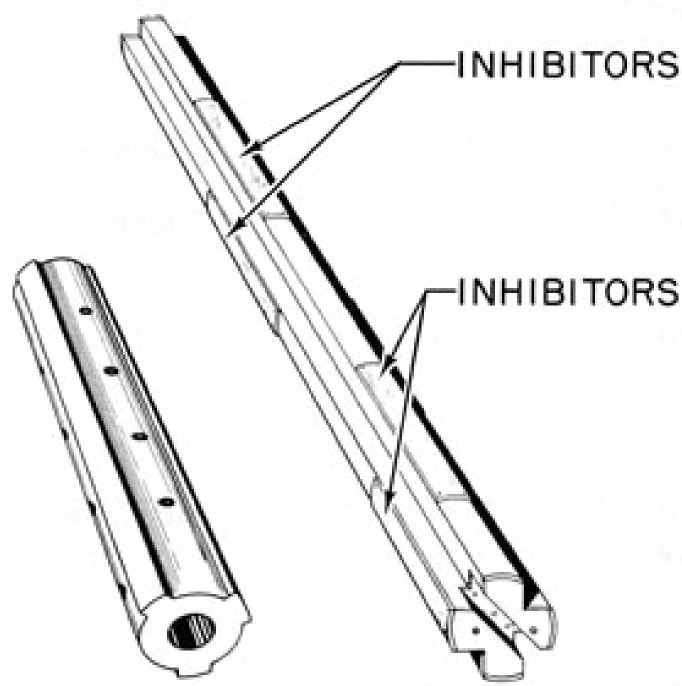


Figure 114. Rocket Propellent Grains

Mark	Mod	Shape	Cruciform U.S. Navy Thickness (inches)	Cruciform Outside Diameter (inches)	Outside Diameter (inches)
1	–	Cylindrical	–	–	1.97
2	–	"	–	–	1.97
3	–	"	–	–	1.97
3	1	"	–	–	1.97
4	–	"	–	–	1.10
4	1	"	–	–	1.10
5	–	"	–	–	1.10
5	1	"	–	–	1.10
6	–	"	–	–	2.95
6	1	"	–	–	2.96
7	–	"	–	–	2.96
7	1	"	–	–	2.96
8	–	"	–	–	2.96
8	1	"	–	–	2.96
9	–	"	–	–	2.96
10	–	"	–	–	1.97
11	–	"	–	–	2.96
11	1	"	–	–	2.96
12	–	"	–	–	1.10
12	1	"	–	–	1.10
13	–	Cruciform	0.990	2.930	–
14	–	Cylindrical	–	–	2.96
15	–	"	–	–	2.96
16	–	"	–	–	1.97
16	1	"	–	–	1.97
17	–	"	–	–	1.97
18	0	Cruciform	1.540	4.530	–
19	0	"	1.540	4.530	–
20	0	"	0.990	2.93	–
21	0	"	1.540	4.53	–
22	0	"	1.540	4.53	–
23	0	"	0.990	2.93	–
24	0	"			
25	0	"			

Cylindrical Inside Diameter (inches)	Body Diameter (inches)	Weight (pounds)	Length (inches)	Motors Used In
0.59	1.70	1.429	11.60	2.25″ R.M. Mks 1. 3, 7, 8, and 9
0.43	1.70	1.551	11.60	2.25″ R.M. Mk 3
0.51	1.72	1.503	11.60	2.25″ R.M. Mk 3
0.51	1.70	1.503	11.60	2.25″ R.M. Mk 3
0.50	0.99	0.207	5.80	
0.53	0.99	0.207	6.10	
0.50	0.99	0.142	4.10	
0.53	0.99	0.142	4.40	
1.41	2.49	1.800	8.06	3.25″ R.M. Mk 1
1.42	2.51	1.800	8.70	3.25″ R.M. Mk 1
1.38	2.49	2.800	13.00	3.25″ R.M. Mk 2
1.37	2.51	2.800	13.00	3.25″ R.M. Mk 2
1.38	2.49	4.140	19.30	3.25″ R.M. Mk 3
1.37	2.51	4.140	19.55	3.25″ R.M. Mk 3
1.42	2.51	1.690	8.15	3.25″ R.M. Mk 4
1.63	1.70	1.397	11.50	2.25″ R.M. Mk 5
1.05	2.55	5.250	20.25	3.25″ R.M. Mk 5
1.03	2.55	5.250	20.25	3.25″ R.M. Mk 5
0.53	0.99	0.298	8.300	1.25″ R.M. Mk 4 and Mk 4 Mod 1
0.53	0.99	0.298	8.800	1.25″ R.M. Mk 4 and Mk 4 Mod 1
–	–	8.83	34.000	3.25″ Mk 7 (Aircraft)
1.03	2.55	3.77	14.600	Rocket Mk 10 (Target)
1.03	2.55	2.60	10.100	Rocket Mk 11
0.26	1.70	1.75	13.287	2.25″ Mk 10
0.26	1.66	1.75	14.037	2.25″ Mk 10, Mk 10–1, Mk 11 and Mods
0.26	1.66	1.12	9.250	2.25″ Mk 12, Mk 13 and Mods
–	–	24.83	39.750	5.0″ Mk 1, Mk 1
–	–	38.00	59.750	11.75″ Mk 1.4 grains required for one assembly
–	–	8.83	34.000	3.25″ Mk 7 (Aircraft)
–	–	10.38	16.750	5.0″ Mk 3 (H.V.S.R.)
–	–	5.83	9.350	5.0″ Mk 4 (H.C.S.R.)
–	–	2.50	9.950	3.50″ S.S. Mk 13 5.0″ S.S. Mk 5 5.0″ S.S. Mk 6

ARMY ROCKETS (SERVICE TYPES)

2.36-inch A/T

Service—M6A1, M6A3, M6A4, M6A5
Practice—M7A1, M7A3, M7A4, M7A6

	M6A1 and M6A3
Over-all length, inches	21.6
Total weight, pounds	M6A1, 3.4 M6A3, 19.4
Head length, inches	8.6
Body length, inches	4.11
Body diameter, inches	2.23
Body wall thickness, inch	0.087
Ogive length, inches	
M6A1 (cone shaped)	4.5
M6A3 (hemispherical)	4.56
Ogive diameter (at flange), inches	2.245
Motor tube length, inches	6.32
Motor tube (inner diameter), inches	1.06
Motor tube wall thickness, inch	0.095
Maximum range, yards	700
Effective range, yards	300
Muzzle velocity, ft./sec.	265
Color	Olive drab
Explosive	Pentolite

General: Pill boxes, tanks, and armored vehicles are prime targets. The rocket can also be used in a stationary emplacement for demolition or as an anti-tank mine or a booby trap. The rocket can penetrate three inches of homogeneous-steel armor plate at all ranges and at angles of impact as low as 30 degrees, employing the shaped-charge explosive.

Launcher: The Rocket Launcher M1A1, commonly called the "bazooka", is an electrically operated weapon of the open-tube type, fired from the shoulder, and weighing 13.26 pounds. Rocket Launcher M9A1 is similar but breaks down into two sections, each 31 inches long, for ease in transporting.

Construction: The 2.36-inch A/T Rockets M6A1 and M6A3 are identical except for difference in the ogive and the tail assembly. In other respects the two rockets are similar, consisting of a hollow ogive crimped onto the body, a body union fitting into the base of the body with internal threads to receive the motor, and a fuze which is located in the forward end of the motor tube. The M6A1 has a conical ogive, whereas the M6A3 has a hemispherical ogive which gives better penetration by forming a stronger standoff piece for the shaped-charge effect of the explosive. M6A4 is like the M6A3, except that it is lighter—being made of high-strength alloys—and also uses the Bore-Safe Fuze M400. The M6A5 uses the Bore-Safe Fuze M401 and has a larger propellant grain, which eliminates the safety disk.

Tail assembly: The M6A1 has six fins (5½ inches long) spot-welded to the nozzle, a steel cup internally threaded at the forward end to screw onto the motor tube. The M6A3 has a different type of tail assembly to obtain fin area and counteract the change of the center of gravity effected by the hemispherical nose. This tail assembly consists of four sheet-steel fins 2-5/16 inches long, each of which is curved over an arc of 90 degrees on its outboard edge to form a blade. Each fin is joined to the other by welding, with an overlap of approximately ½ inch to form a circular drum which is actually nothing more than a continuation of the four fins. The bases of the fins are spot-welded to the nozzle. In the M6A5 and M7A6 the free end of the ignition wire is attached to the shroud tail by a chip-board disk, instead of the tape on earlier models.

Propellant: The propellant consists of five sticks of ballistite. On an average, the propellant weighs approximately 61½ grams, though it is loaded not by weight but rather by length of powder stick, to keep the pressure for various rounds at a relatively constant value. The M6A4 and M6A5 use the Powder M7, which burns at a lower temperature, +120° to −40° F.

Fuze: The fuze for the M6A1 and M6A3 consists of a steel firing pin which slips into the central cavity of the fuze body, where it is held in a rearward position by the firing-pin spring. A circumferential groove midway down the length of the firing pin receives the safety pin, which extends through the motor tube. When the safety pin is removed, the firing pin is free to move forward, restrained only by the action of the firing-pin spring. After the safety pin has been removed, the firing pin will overcome the spring and detonate the rocket if it is dropped over four feet. The fuze body contains the Detonator M18 of lead azide and tetryl, and the booster charge of tetryl.

Remarks: The practice rounds are similar to their accompanying service rounds, except that they are inert-loaded and have a dummy fuze or steel weight to fill the empty fuze space.

The M6A5 and M7A6 have plastic closing plugs, making them waterproof rounds. They also use the Powder M7, which burns at a lower temperature, +120° to −40° F.

The M6A1 and M7A1 are now considered obsolete.

2.36-inch Smoke (W.P.) M10, M10A1, M10A2, M10A3

	M10
Over-all length, inches	17.1
Total weight, pounds	3.4
Length of head, inches	5½
Maximum diameter, inches	2.36
Diameter of head, inches	2.30
W.P. charge, grams	405
Burster charge, grams	4
Effective range, yards	300
Color	Motor—olive drab Head—blue grey

General: This rocket is designed not only as a screening agent, but also to cause casualties.

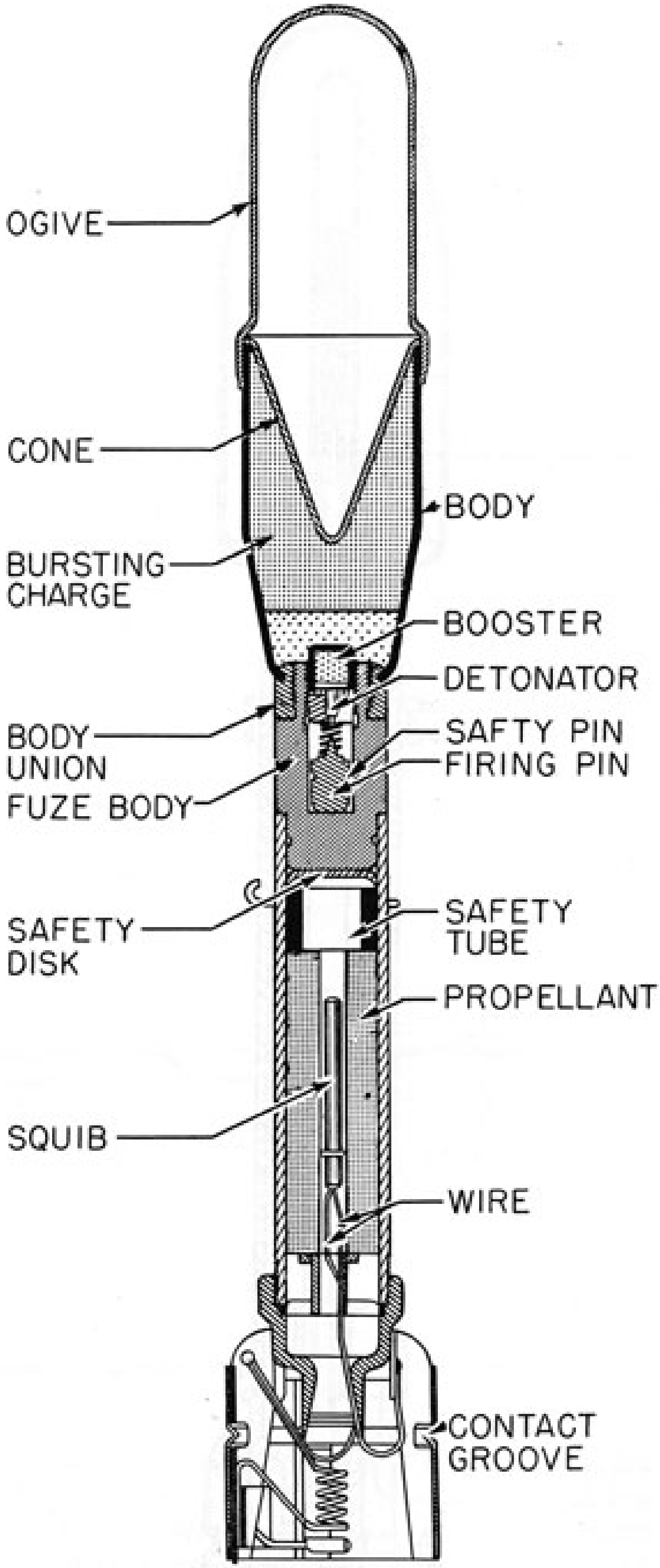


Figure 115. 2.36-inch A/T Rocket M6A1

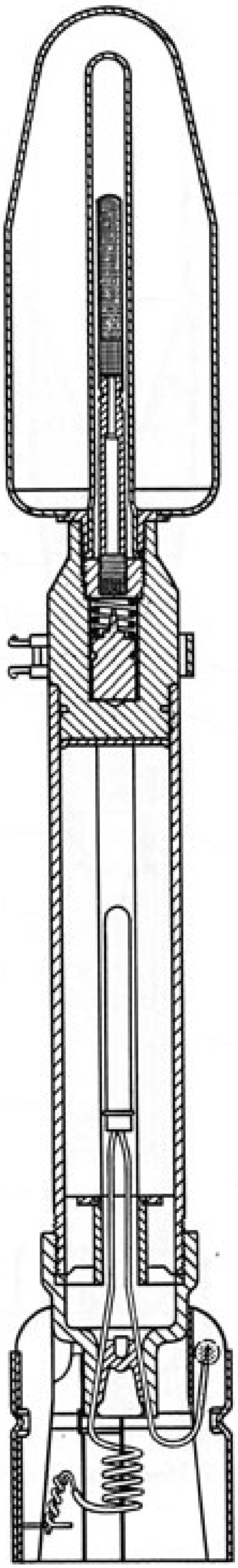


Figure 116. 2.36–inch Smoke Rocket M10A1

White phosphorus in smoke form has little effect upon the human body, but particles cause small burns. This rocket makes an effective weapon for dislodging enemy troops from dugouts and foxholes.

Launcher: The 2.36-inch Smoke Rocket M10 is fired from the Launcher M1A1 or M9, the "bazooka."

Construction: The components of this rocket are the motor and the head assembly. The motor presently used is the M6A1, which is being replaced by the M6A3. As new motors are developed, it is contemplated that this rocket will be modified.

The head assembly consists of a container for the smoke charge with a long burster well containing PETN inserted from its after end. A collar is soldered to the base of the container. The spacer slips over the threads of the collar and is held against the flat surfaces of the collar by the fuze body, forming a joint between the two. The primer holder is threaded into the fuze body.

Tail assembly: The 2.36-inch Smoke Rocket M10 has the standard tail assembly for the M6A1 or M6A3 motors.

Fuzing: The fuze is similar to that used in the A/T Rocket M6A3.

Remarks: The M10A1 and M10A2 differ from the M10 in the type of propellant used. The M10A1 used the T1E1 Salted Powder, with a temperature range of 120° to −20° F. The M10A2 uses the Powder M7, 120° to −40° F. The M10A3 differs from the M10A2 in that it uses the Fuze M401.

2.36-inch Gas M26

Over-all length, inches 17.66

Except for its increased length, the 2.36-inch Gas Rocket M26 is structurally the same as the 2.36-inch M10A2. The M26 is filled with C.K. (phosgene) gas.

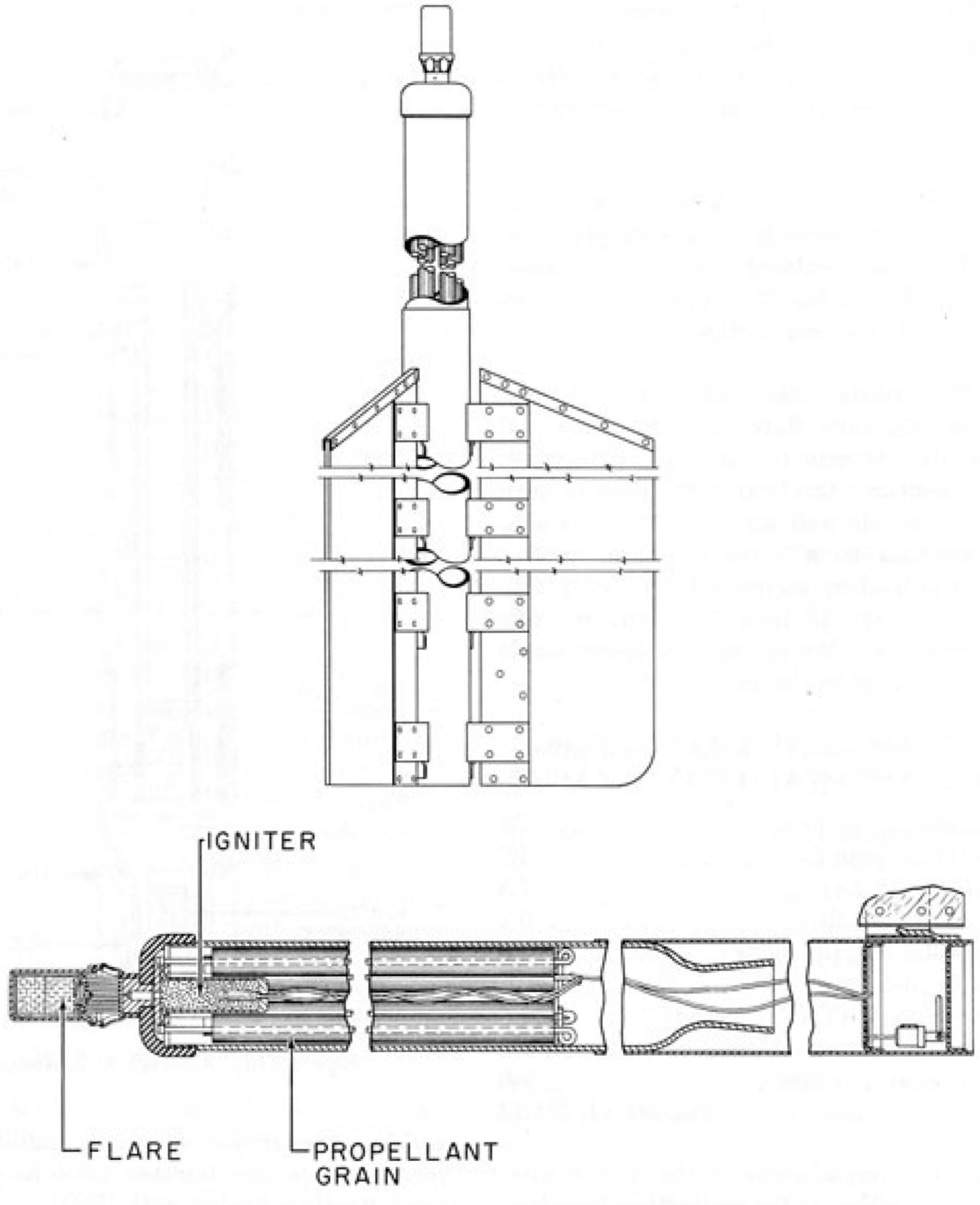


Figure 117. 3.25–inch Target Rocket M2A2

3.25-inch Target M2, M2A1, M2A2

Over-all length, inches 59
Width across fins, inches 24
Weight, pounds 37.5
Propellant weight, pounds 3.2
Range, yards 1,700
Maximum velocity, ft./sec. 530
Burning time of flare, seconds 30

General: This is a high-speed target for firing practice with automatic A.A. weapons.

Propellant: The propellant has grains five inches long and 7/8-inch in diameter, with a 5/16-inch axial hole. It is ignited by an electric squib.

M2A1: When a flare is added to the 3.25-inch Target Rocket M2 for antiaircraft target practice at night, the resulting projectile is designated as the M2A1. The flare burns for 30 seconds from the beginning of flight.

M2A2: This design has a flat nose, to which is threaded a yellow flare for both day and night tracking. It also has a different system for igniter contact: the lead wires pass in turn through the nozzle and an inner fiber closing cup and connect to a household-type service plug, which is held by an outer fiber-board closing cup. There are 18 inches of igniter cable coiled between the closing cups, to allow ample lead for connecting to the launcher.

4.5-inch H.E. M8, M8A1, M8A2, and M8A3; also Practice M9, M9A1, M9A2, and M9A3

Over-all length, inches	33
Total weight, pounds	38
Head length, inches	7.5
Wall thickness, inch	0.2
Burster tube length, inches	15.5
Fin length, inches	4 1/8
Bursting charge (TNT), pounds	4.3
Maximum range, yards	4,500
Muzzle velocity, ft./sec.	840
Fuzing	M4, M4A1, M4A2

General: The initial issue of the rocket went to the Army Air Forces for projection from aircraft launchers against ground targets; but, inasmuch as the rocket was originally designed for use from ground launchers, its use in aircraft has been discontinued.

Construction: The head is a thin-walled high-capacity type, rounded at the nose to form the ogive, threaded at the nose to take the fuze adapter, and threaded externally aft to fit into the motor. A burster tube is fitted to the head and extends down into the motor, a design which utilizes the motor tube for additional fragments, since the burster tube as well as the head itself is loaded with TNT.

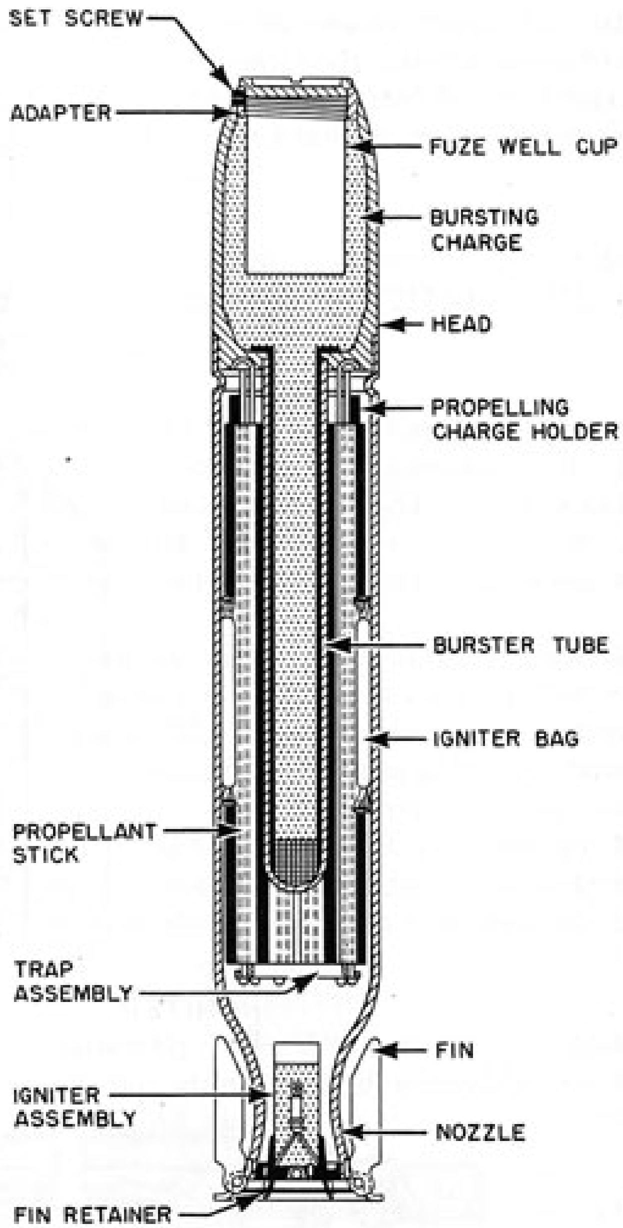


Figure 118. 4.5-inch H.E. Rocket M8

The motor is a steel tube of uniform diameter except at the after end, where it constricts and then flares to form the nozzle. The motor houses the trap assembly, which consists of ten wires running from the trap plate on the forward end to the trap ring on the after end. The trap assembly holds the thirty sticks of propellant and fits around the burster tube. The motor tube is threaded internally forward to take the head, and just abaft this thread is a groove which weakens the tube to provide a safety shear point, should the motor pressure become too great.

The fin assembly for the rocket opens and guides the rocket in flight only after the rocket has cleared the launcher. The fins of the assembly are held in place by the fin retainer, which is expelled by the blast of the escaping gas. After clearing the launcher, the fins snap to their outstretched position. There are six fins.

The M8A1 involved a change in the design of the motor tube to strengthen it on the threaded end. The head of the M8 was used by machining new base threads. Tests on the M8A1 indicated that the base of the modified head was weak, and a new head was designed for use with the motor of the M8A1. This rocket, the M8A2, will supersede the M8 and M8A1. The M8A3 is a modification of the M8A2 made by the addition of a locking burr to each fin blade to assist in rigidly maintaining the fin in full open position during flight.

Propellant: The propellant consists of 30 sticks of ballistite. Each stick is five inches long and 7/8 inch in diameter with a 1/4-inch axial hole. Three sticks are placed on each trap wire, and there is sufficient clearance between the sticks and the wire to allow burning of the inner stick wall simultaneously with the burning of the outer wall. Two igniter-bag assemblies are bound on two opposite columns of the propellant. The bags assist the ignition of the propellant by catching the flame of the igniter and, in turn, igniting the upper propellant sticks.

Practice Rockets M9, M9A1, M9A2, M9A3: These rockets are similar in design and construction to the M8 series, lacking only the explosive charge and live fuze. The Fuze M4 and booster may be assembled and used in the M9 as a spotting charge.

4.5-inch H.E. S.S. M16, M16E1, and M16E2; also Practice M17, M17E1, and M17E2; also M20 and M21

	M16
Over-all length, inches	31
Total weight, pounds	42.5
Head length (with burster tube), inches	23.29
TNT charge, pounds	4.3
Range, yards	5,250
Maximum velocity, ft./sec.	830
Fuzing	M81

Description: The head, loaded with high explosive, contains a fuze-well cup and a burster tube. The burster tube projects about 15 inches into the center of the rocket motor to secure additional fragmentation. The motor body is a steel tube threaded at each end to receive the head and the nozzle plate, which contains eight nozzles equally spaced in a circle and one nozzle in the center. The eight nozzles are set at an angle in order to impart rotation to the round when fired. The center nozzle is normally closed by a blowout disc which is designed to fail when the internal pressure in the body surpasses a predetermined limit. The nozzle openings are protected by a plastic sealing disc which remains in place during firing and is blown out by the rocket blast.

Propellant: The propelling charge consists of 30 grains of ballistite strung on wires of a cage-like trap. The igniter consists of a charge of black powder enclosed in a plastic tube attached to the trap and running the length of the charge. The tube also contains an electric squib. The leads of the squib pass through one of the nozzles, one lead being grounded to the motor body and the other connected to a contact ring.

M20: The M20 is similar in design and construction to the M16, differing only in that the ignition wires are attached to spools rather than contact rings.

Practice Rockets M17 and M21: These are similar in design and construction to the H.E. rounds, but lack the explosive charge and the live fuze.

The M16E1 has a deeper fuze cavity for the V.T. Fuze M402 (Mk 173). Shipped with these rockets is a supplementary charge to fill part of this cavity in case the Fuzes M81 or M48A2 are used.

The M16E2 is like the M16E1, except that purge pellets of 411E composition have been added to eliminate chunks in burning.

5-inch A.R.

The Army is currently using the Navy-designed 5-inch aircraft rockets. See Section 4 of this chapter.

7.2-inch Chemical M25 and M27

In the 7.2-inch size, the Army has standardized the chemical round designed by the Navy. See Navy chemical warfare rocket, pages 178 and 179.

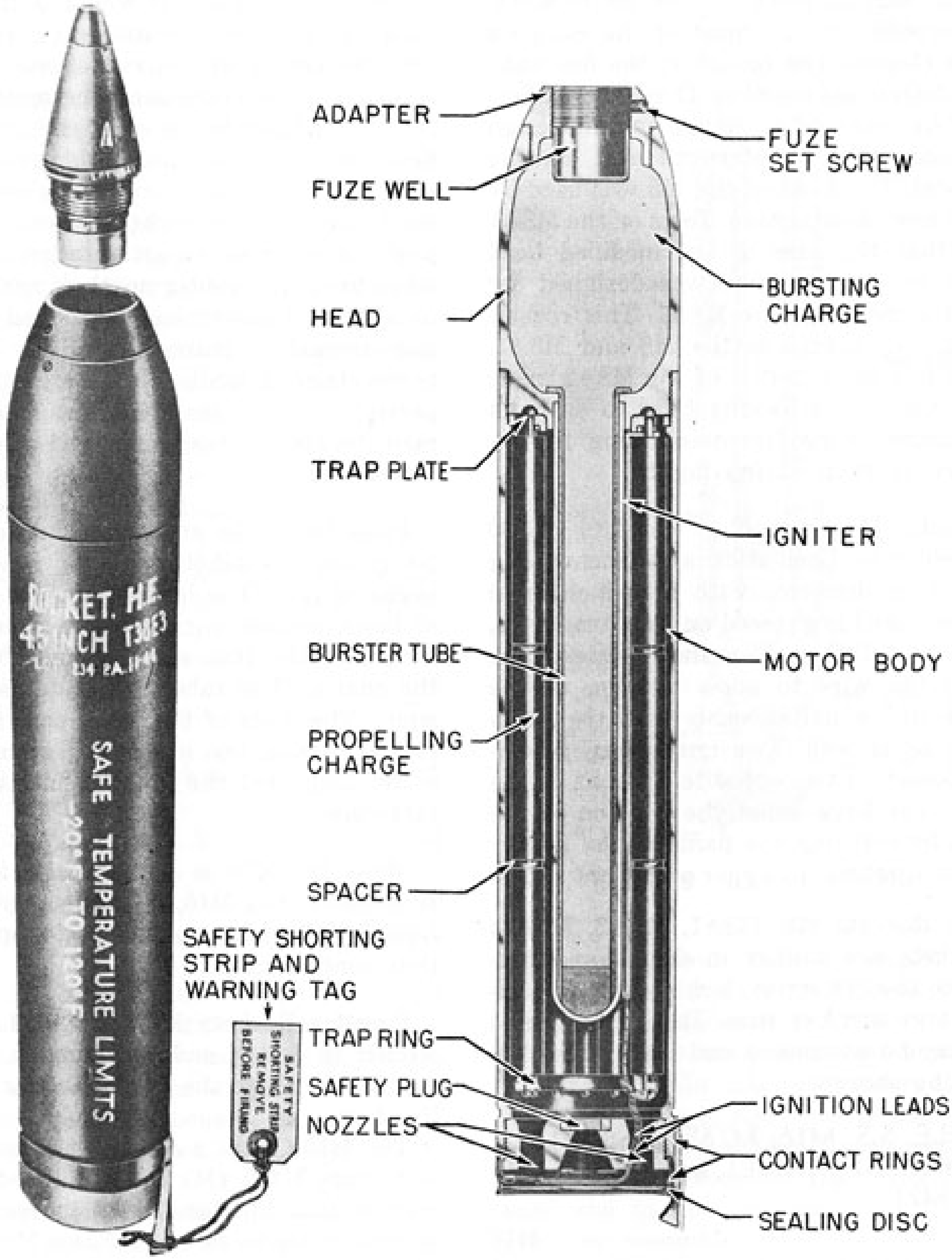


Figure 119. 4.5-inch H.E. S.S. Rocket M16

SOME ARMY DEVELOPMENTAL TYPES

2.36-inch Smoke T–27E1

Over-all length, inches................16.1
Total weight, pounds....................3.4
Length of head, inches.................4.5
H.C. smoke charge, pound...............1.0

General: This rocket is generally similar to the other smoke rockets in this series, differing mainly in its payload. It also differs in that it has a circle of smoke ports in the base of the head, which allow the H.C. smoke to be blown out of the head on impact. Pressure of the H.C. smoke blows out the port covers after the base fuze sets off the H.C. gas. The H.C. smoke will issue for one minute after impact.

2.36-inch Incendiary T31

Over-all length, inches................17.7
Total weight, pounds....................3.4
Length of head, inches.................4.1
Thermite filler, pounds.................1.1

General: The T31 is like the other 2.36-inch chemical load rockets, using the same motor and fuzing as the M10. It has, however, a much shorter head. On impact, it ignites and burns, producing extreme heat. It is currently issued for practice only.

4.5-inch H.E. S.S. T22 and Practice T46

General: These rockets have the heavier shell of the M8A2 and M9A2. Also, the motor tube is further strengthened and the assembly of the fins slightly changed. The igniter is loaded in a tube attached to the trap, extending the length of the propellant charge. Its safe temperature range: −20° to +120° F.

3.5-inch A/T T80 and Practice T85

Over-all length, inches................26.3
Weight of head, pounds..............5.11

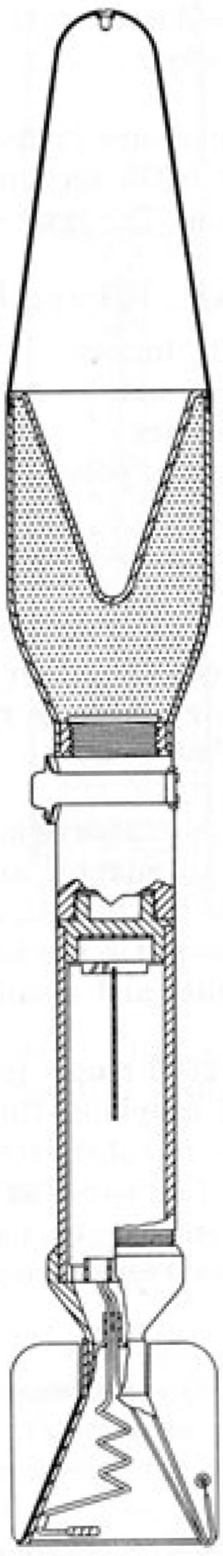


Figure 120. 3.5–inch A/T Rocket T80

65/35 Cyclotal charge, pounds	1.82
Length of motor, inches	15.6
Fuzing	T160E1

General: This design is mainly a larger type of the 2.36-inch A/T model, with improvements. It has the shaped-charge explosive for penetration. It also has a more efficient propellant and an all-ways-action fuze. Performance tests are still being conducted. It is the largest of the shoulder-fired rockets.

Propellant: There are 12 sticks of powder five inches long and 0.375 inch in diameter; total weight, 160 grams. The igniter is conventional.

4.5-inch H.E.–A.R. T83 and Practice T87

Over-all length, inches	75.88
Total weight, pounds	98
Head length, inches	16.68
Weight of charge, pounds	8.8
Range, yards	1,500
Fuzing	Mk 149

General: This is one of the "fixed-fin" type of 4.5-inch rockets, the other being the S.A.P. round. It is a high-velocity rocket, fired from the zero-length launchers.

Head: The high-explosive head T2002 is thin-walled and has an adapter and fuze-seat liner for the Nose Fuze Mk 149. An Auxiliary Booster Mk 3 Mod 1 is shipped in the fuze seat, protected by a chipboard disc and a shipping plug.

Motor: The T2000 motor is connected to the head by a steel coupling, threaded internally. The motor tube is constricted at the rear to form the nozzle. Lug bands are one button-type band and one zero-length band, 45.53 inches and 10.25 inches respectively from the base of the rocket.

Tail: The T2000 tail assembly—four flat fins mounted radially on a metal sleeve—is secured to the nozzle by a threaded retainer coupling.

Propellant: Twelve single-perforated sticks of powder having 7/16 inches inside diameter and 1.22 inches outside diameter, 20.6 inches long, are mounted in two banks of six each on the bars of a cage-like support.

Igniter: An electric squib and 2-¾ ounces of black powder are assembled in a plastic tube 6-¾ inches long and one inch in diameter. This tube is suspended from the end of the propel-

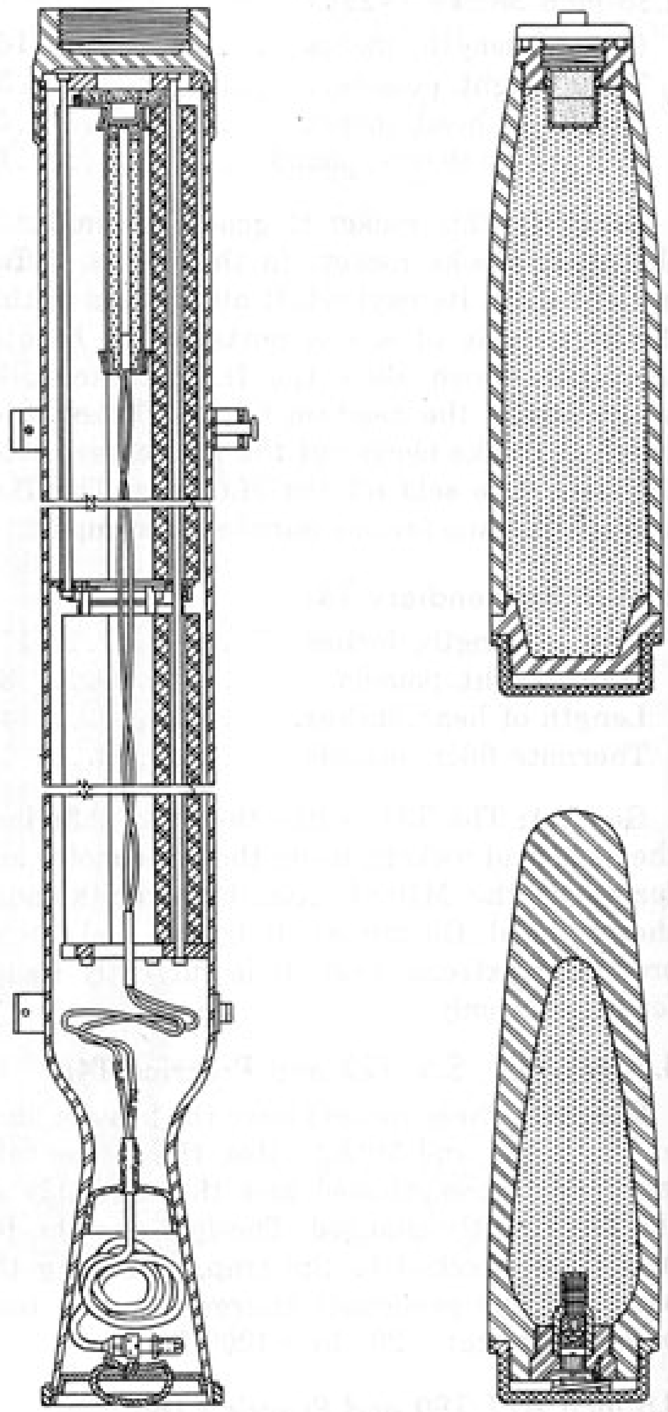


Figure 121. 4.5-inch A.R. —H.E. T83 (above) and S.A.P. T78 (below)

lant in the center of the tube. The ignition wires pass to the rear through a plastic closing cap cemented in the throat of the nozzle. They terminate in a phone-type plug. About two feet of igniter cable are held in the flare of the nozzle by a fiber cap cemented in place.

Practice round: The T87—T2003 head and T2000 motor—is like the T83 except for the live fuze and explosives, for which inert substitutes are provided.

4.5-inch S.A.P.–A.R. T78 and Practice T86

Over-all length, inches	70.89
Total weight, pounds	98
Head length, inches	15.0
Weight of charge, pounds	2.8
Range, yards	1,500
Fuzing	T156

General: This is another "fixed-fin" 4.5-inch rocket. A high-velocity aircraft rocket, it is fired from the zero-length launchers.

Head: This S.A.P. Head T2000 is of heavy-walled construction and threaded at the base to receive the motor tube.

Motor: This round uses the same motor and fin assembly as are found on the T83 round. It also uses the same propellant and igniter. The Practice Round T86, T2001 Head, is inert fuzed and loaded.

4.5-inch H.E. S.S. T160 and Practice T161

Over-all length	
Without fuze, inches	30.07
TNT charge, pounds	6.0
Fuzing	M81 or M402 (V.T.)

General: Because of its more efficient propellant, this round is expected to be a more powerful, longer-range rocket. Except for the propellant, it is of conventional Army design.

Propellant: Seven cylindrical powder sticks, 13.5 inches long and 1.35 inches in diameter, furnish the power. The grid type of support is used instead of the conventional trap, and the igniter is housed against the motor wall,

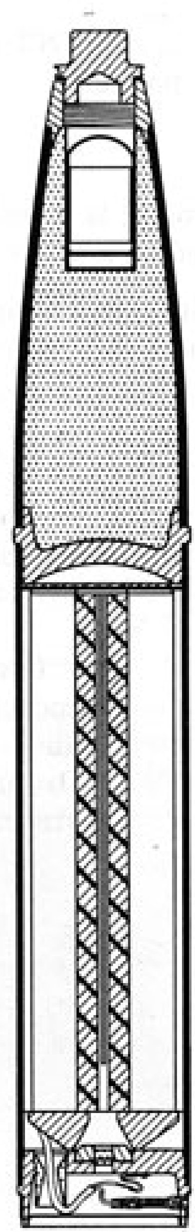


Figure 122. 4.5-inch H.E. S.S. Rocket T160

instead of being placed in the center. Safe temperature limits for this round are from −20° F. to +120° F.

7.2-inch H.E. T24

See Navy 7.2-inch chemical warfare rocket, p. 178.

7.2-inch D.R. T37 and T88

See Navy 7.2-inch demolition rocket, p. 176.

8-inch D.R. T25

Over-all length, inches	60.25
Total weight, pounds	137
Head length, inches	27.5

Filler	TNT or 50/50 Amatol
Weight of filler, pounds	58
Range, yards	550
Fuze	T20

General: This round is a modified 100-pound G.P. bomb fastened to a 4.5-inch rocket motor.

Construction: Suspension lugs and base plug are removed from the standard 100-pound bomb, and a motor adapter substituted for the base plug. The motor is the standard type for the 4.5-inch Army folding-fin type of rocket, modified to take the special box-type fin. The fuze seat in the bomb is modified to receive the Point Detonating Fuze T20.

Launcher: The metal crate in which the round is shipped serves as an expendable launcher.

H.E. S.S. 21-cm T 36 and Practice T45

Over-all length, inches	48.86
Weight, pounds	91.75
Fuzing	M51 (M81)

General: This round is a copy of the German rocket of the same type. At present, performance tests are being conducted by the Army Ordnance Department. It is of conventional structure, with the artillery-type fuze.

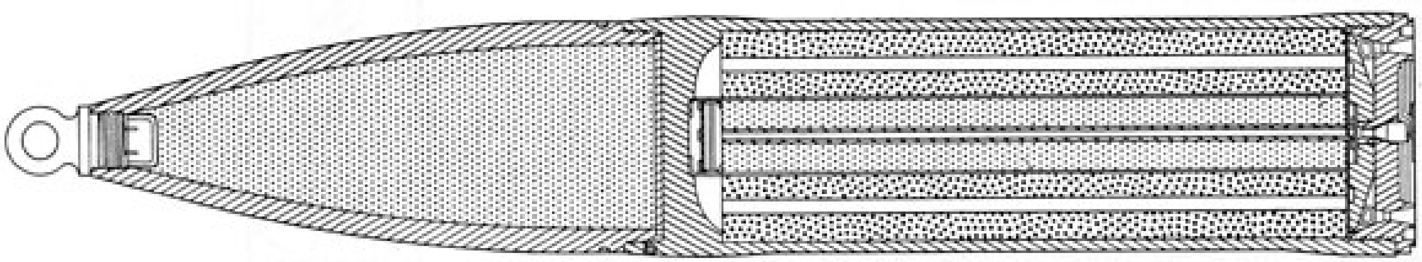


Figure 123. 21–cm H.E. S.S. Rocket T36

NAVY ROCKETS

2.25-INCH ASSEMBLIES

Motor	Head	Velocity	Approximate Trajectory of
2.25″ Mk 10 or 11	2.25″ Mk 1 or 3 (1.6 lb.)	1150 ft./sec.	3.5″ Rocket (3.25″ Motor)
2.25″ Mk 12 or 13	2.25″ Mk 1 or 3 (1.6 lb.)	810 ft./sec.	5.0″ Rocket (3.25″ Motor)
2.25″ Mk 10 or 11	2.25″ Mk 2 (8.6 lb.)	810 ft./sec.	5.0″ Rocket (3.25″ Motor)

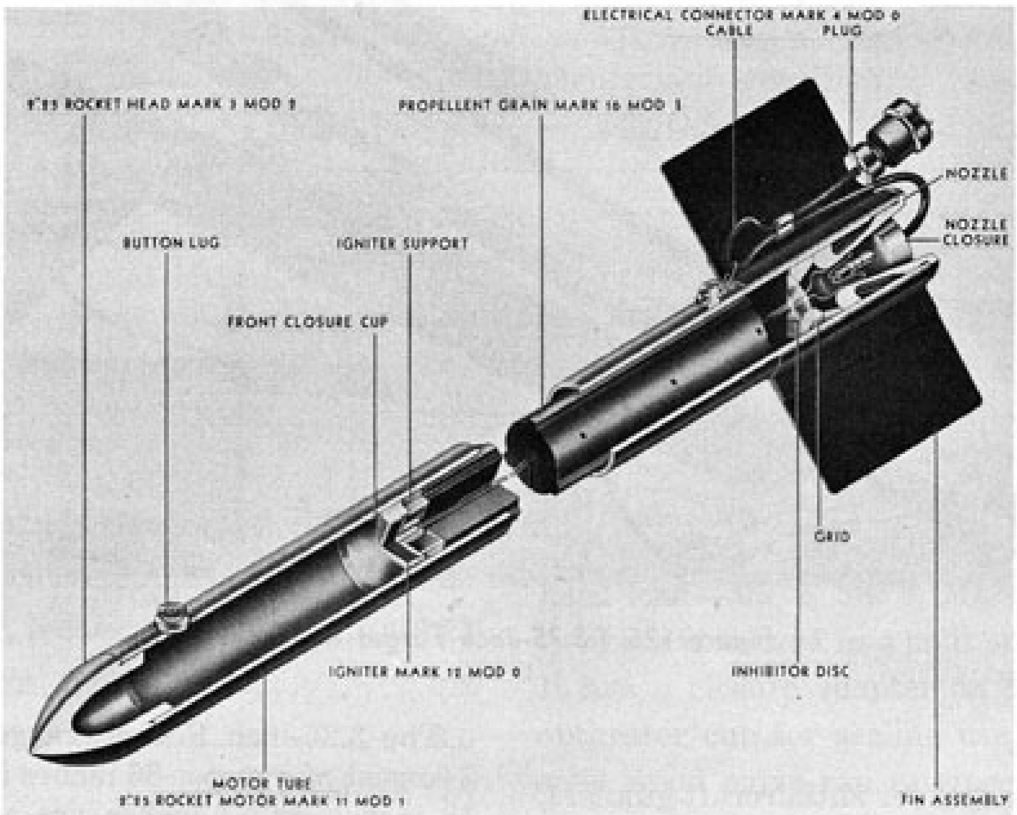


Figure 124. 2.25–inch A.R., Practice

2.25-inch A.R. Practice

General: The 2.25-inch sub-caliber rocket for aircraft was developed for training purposes. Initially, two types were designed to approximate the trajectory of the 3.5-inch and 5.0-inch rockets; however, only the Motor Mk 11 and the Head Mk 3 Mod 2 will be used in future training.

The Mk 1, a California Institute of Technology production, was issued until adopted and issued by Bureau of Ordnance as the Mk 3 Mod 2. The Mk 2, a California Institute of Technology production, was designed as a slow sub-caliber rocket. The complete assembly for the latter is no longer available.

The 2.25-inch Motors Mk 10 and Mk 11 are similar to each other, as are the 2.25-inch Motors Mk 12 and Mk 13. The Motors Mk 10 and Mk 11 differ from the Mk 12 and Mk 13 in that the diameter of the nozzle on the latter is smaller and the weight of the propellant of the Mk 10 and Mk 11 is 1.75 pounds, as compared to the weight of 1.12 pounds in the Mk 12 and Mk 13.

The external dimensions of these rockets are the same. For recognition purposes, the 2.25-inch motors Mk 10 and Mk 11 are painted white with black fins, while the Motors Mk 12 and Mk 13 are grey with black fins.

Motor Mk 11 and Head Mk 3 Mod 2: Over-all length of the rocket is 29 inches. Two button-type lugs are provided on the motor tube, spaced approximately 19 inches apart. Four fins are welded to the after end of the motor tube. The propellant is a cylindrical grain of ballistite weighing approximately 1-¾ pounds.

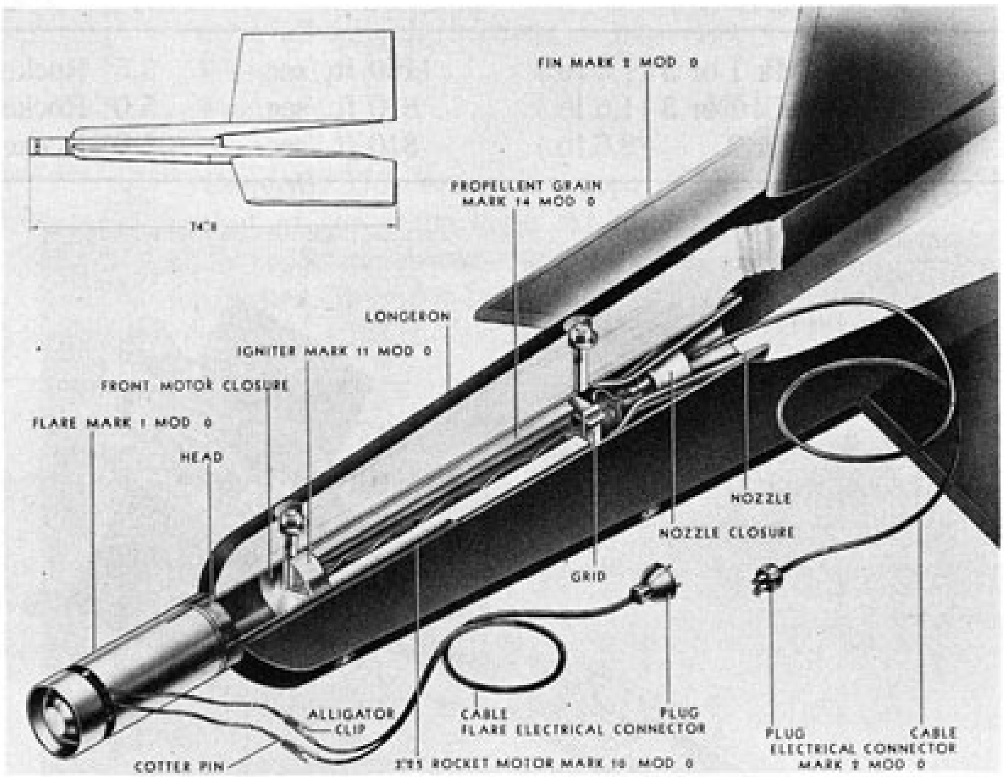


Figure 125. 3.25–inch Target Rocket

3.25-inch Targets

General: As a target for antiaircraft gunners, the rocket is projected with speeds approximating those of an aircraft. It consists of a rocket propulsive unit to which are attached large stabilizing fins, for maximum visibility. Rocket targets are referred to by their assembly number as indicated in the accompanying table. They all consist of a simple rocket motor with three large fins prepared from wooden frames and light-weight fiber board. The fins are 120 degrees apart, each attached by two lugs.

The 3.25-inch Rocket Targets Mk 1 and Mk 2 consist of a motor 36 inches long, to which fins 18 inches by 34 inches are attached. An electrical connection is made by a standard 110-volt plug. The 3.25-inch Target Rocket Mk 1 is standardized at 425 m.p.h. and the Mk 2 at 300 m.p.h. On some models, a screamer is put over the nose end.

The Mks 3 and 4 differ from Mks 1 and 2 in that the motor is heavier and the fins are held on by threaded studs instead of lugs. The ballistics are similar; Mk 3 is like Mk 1, and Mk 4 is like Mk 2.

3.25-INCH TARGET ASSEMBLIES

Mark	Assembly Number	Initial Velocity (m.p.h.)	Range	Maximum Elevation	Motor	Fin	Flare
1	3.25″ RT001	425	——	——	Mk 8	Mk 1	Flare
1	3.25″ RT002	425	——	——	Mk 8	Mk 1	None
2	3.25″ RT003	300	——	——	Mk 9	Mk 1	Flare
2	3.25″ RT004	300	——	——	Mk 9	Mk 1	None
3	3.25″ RT005	425	4500	1600	Mk 10 Mod 0	Mk 2 Mod 0	Mk 1 all Mods
3	3.25″ RT006	425	5000	1750	Mk 10 Mod 0	Mk 2 Mod 0	None
4	3.25″ RT007	300	3100	950	Mk 11 Mod 0	Mk 2 Mod 0	Mk 1 all Mods
4	3.25″ RT008	300	3400	1050	Mk 11 Mod 0	Mk 2 Mod 0	None

3.5-inch Window

Head Mk 10, Motor Mk 12

Over-all length, inches (approx.) 45.1
Weight, pounds 32
Head length, inches 23.2
Head weight, pounds (loaded) 14.25
Motor length, inches 23
Motor diameter, inches 3.25
Width of tail fins, inches 9.2
Length of tail fins, inches 8.0
Fuze . . . . Base Fuze Mk 134

General: The window rocket is designed to be fired from Naval vessels equipped with a modification of the present shipboard launcher. The round carries a payload of paper-coated metal foil strips which are scattered in the air by a delayed-action charge. The payload is ejected at an altitude of 1,200 feet and range of 2,000 yards at 40° elevation.

Description: The window rocket consists of a 3.5-inch Rocket Head Mk 10 Mod 0, Mk 14 Mod 0, or Mk 15 Mod 0 and a 3.25-inch Rocket Motor Mk 12 Mod 0, Mk 14 Mod 0, or Mk 14 Mod 1. The motor uses the propellant grain Mk 7 Mod 1, weighing 2.80 pounds.

The rocket head contains a 3.5-inch rocket-head load—Mk 2, Mk 3, Mk 4, Mk 5, or Mk 8—which is housed in a split steel ejection liner. It has a closure adapter on the after end, an obturator cup for sealing the front end, and a solid wood ogive cap retained by three aluminum rivets in the Mk 10, hollow steel friction fit in the Mk 14 and Mk 15. The closure adapter, which is welded to the after end, carries a copper diaphragm plate with a firing pin, and also serves as a chamber for the Cal. 32 blank cartridge which ignites the fuze. The Fuze Mk 134 consists of a plastic case containing a length of Ensign Bickford fuse and a 20-gram ejector charge of black powder.

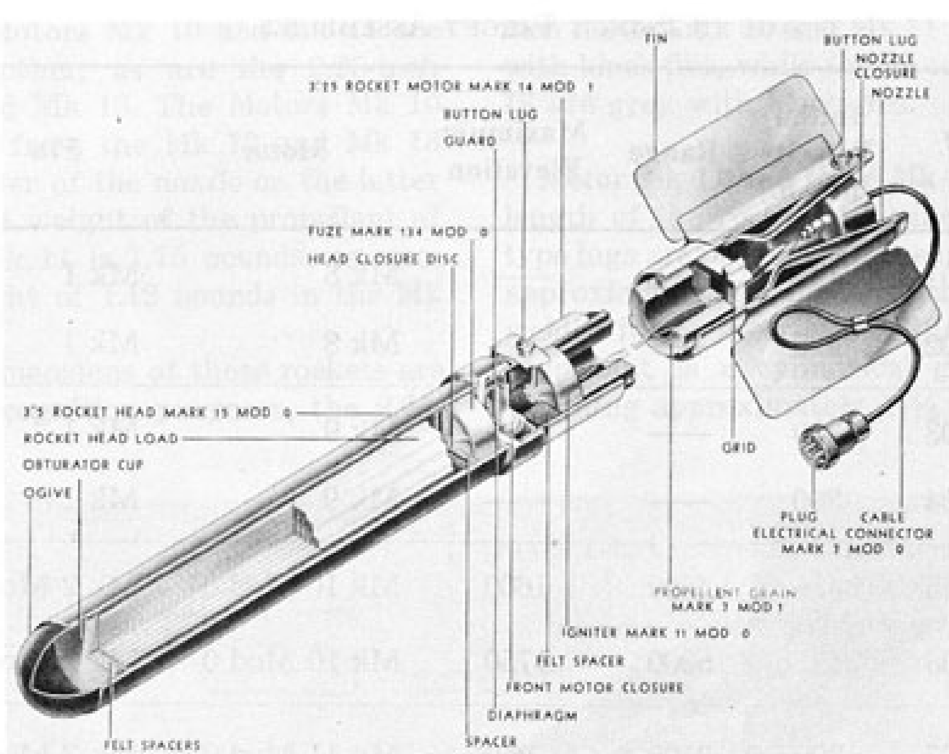


Figure 126. 3.5–inch Window Rocket

Rocket Body Load	Length of Strips	Number of Strips
Mk 1 Mod 0	10″	5,868
	15″	2,904
Mk 2 Mod 0	7.5″	17,544
Mk 3 Mod 0	12.5″	5,310
	15.5″	3,462
Mk 4 Mod 0	6″	11,676
	9″	5,868
Mk 5 Mod 0	1.87″	76,800
Mk 8 Mod 0	400 ft.	12 rolls

All strips are 3/16 inches wide and 0.003 inches thick except the Mk 8, which is ½ inch wide.

Operation: When the rocket is fired, gas pressure blows out the forward closure disc of the motor and exerts force on the diaphragm plate in the base of the motor adapter. The diaphragm collapses, and the firing pin is forced into the primer, firing the blank cartridge. The flash from the cartridge ignites the fuse, which burns for 15 seconds and then ignites the black-powder ejection charge. The firing of the ejector charge forces off the ogive cap and pushes the load forward out of the head. The strips are then dispersed.

Remarks: The Motors Mk 12 Mod 0 and Mk 14 Mod 0 carry adjustable lug bands; the lugs are welded to the Motor Mk 14 Mod 1. The Mk 14 Mod 0 and Mk 14 Mod 1 have a metal base cap during shipping, to protect the electrical connector.

The Head Mk 15 Mod 0 is one inch longer than the Head Mk 14 Mod 0.

3.5-inch Flare

3.5-inch Head Mk 14 Mod 0

Over-all length, inches (approx.)........47
Total weight, pounds..................33.5
Head length, inches.....................23
Head weight, pounds..................16.5
Motor length, inches..................24.5′
Motor diameter, inches...............3.25
Fuze (Head Mk 14).......Base Fuze Mk 134
Fuze (Head Mk 15).......Base Fuze Mk 128

General: The 3.5-inch rocket flare was developed for use from surface ships, particularly motor torpedo boats. The illuminant candle produces an average of 800,000 candle power for approximately twenty-nine seconds. The rocket motor carries the flare out 1,800 yards before ignition.

The flare consists of the following major components: 3.25-inch Motor Mk 12 Mod 0, Mk 14 Mod 0, or Mk 14 Mod 1; 3.5-inch Head Mk 10 Mod 0, Mk 14 Mod 0, or Mk 15 Mod 0; and Body Load (Flare) Mk 7 Mod 0.

Head: All the heads are interchangeable and differ only in minor details. The 3.5-inch Head Mk 10 Mod 0 has a wooden nose piece held in place by three shear pins, while the Mk 14 Mod 0 and Mk 15 Mod 0 have a sheet-metal nose piece press-fitted in place. The Mk 15 Mod 0 is one inch longer than the other two.

The head consists of a 3.25-inch seamless steel tube which incorporates a 3.5-inch diameter closure adapter welded to the after end. This closure adapter carries a copper diaphragm plate with a firing pin, and serves as a chamber for the caliber .32 blank cartridge which ignites the fuze. The balance of the head is taken up by the candle and parachute from the 4-inch illuminating projectile, the composition of the candle slightly changed to increase the candlepower in the shorter burning time.

Motors: The three motors are similar and interchangeable. The principal distinguishing feature of the 3.25-inch Motor Mk 14 Mod 1 is the use of welded-on launcher lugs replacing the lug bands employed on the earlier models. The motor housing is a 3.25-inch seamless steel tube containing a forward closure disc, Igniter Mk 11 Mod 0, Tubular Ballistite Grain Mk 7 Mod 1 (2.8 pounds), steel grid, welded nozzle, and pigtail. Four tail fins, three inches by eight inches, are mounted on a sleeve fixed to the after end. A thread protector on the forward end and shipping cover taped on the after end protect the motor in shipment. The 3.25-inch Motor Mk 12 Mod 0 does not have a shipping cover on the after end.

Operation: This rocket is similar to the Window rocket in operation.

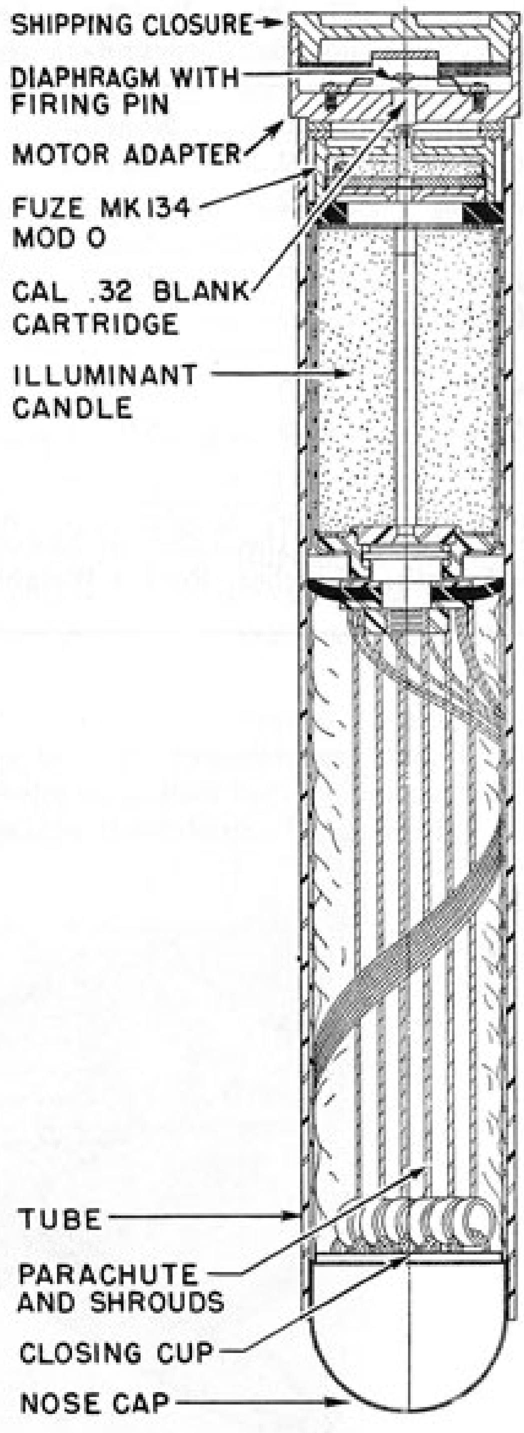


Figure 126A. 3.5-inch Rocket Flare

3.5-INCH AND 5.0-INCH A.R. WITH 3.25-INCH MOTORS—ASSEMBLIES

Head	Head Weight (pounds)	Filling Weight (pounds)	Head Length (inches)	Total Weight (pounds)	Total Length (inches)	Fuzing
3.5″ Mks 1, 2	20.0	None	9.7	53.8	54.7	None
3.5″ Mks 3, 5	19.9	2.2	13.8	53.7	58.9	Mk 148, Mk 149
3.5″ Mk 4	20.2	1.0	13.4	53.9	58.5	Mk 146
3.5″ Mk 6	20.0	9.4	21.2	53.8	68.0	Mk 155
3.5″ Mk 9	20.0	9.4	19.6	53.0	66.5	Mk 149, Mk 148
3.5″ Mk 8	20.0	0.0	11.75	53.8	57.75	None
5.0″ Mk 1	46.5	8.6	19.7	80.3	64.8	Mk 148, Mk 149, Mk 146, Mk 157, Mk 165

Motor: All heads use the 3.25-inch Motor Mk 7.
Rocket Length: 46 inches; **Rocket Weight:** 33.8 pounds

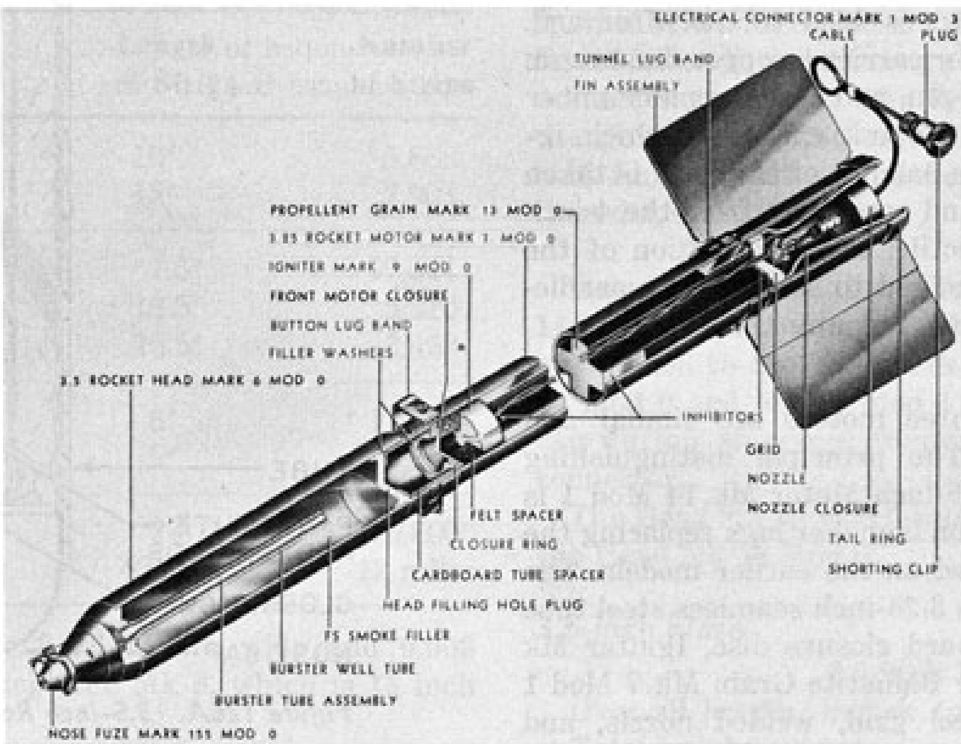


Figure 127. 3.5–inch A.R. (Head Mk 6)

3.5-inch and 5.0-inch A.R. with 3.25-inch Motors

General: The 3.5-inch rockets were designed to be used against smaller targets, such as submarines and tanks. For larger targets, the 5.0-inch rocket was developed from the 5-inch antiaircraft shell. The 3.5-inch Solid Head Mk 8 and the 3.5-inch F.S. and P.W.P. Smoke-Filled Heads Mk 6 are the only ones now being issued. The 3.5-inch H.E. heads were replaced by the 5.0-inch heads. The former were never issued, because of the small load of TNT carried, as compared to the 5.0-inch heads.

Heads

3.5-inch Mks 1 and 2: The head is of solid steel and contains no high explosive or fuze. The shape of the round gives a relatively long underwater travel at shallow depth-of-entry angles (about 20 degrees), and it is used as a semi-armor-piercing projectile against submarines or tanks. The Mk 1 was the California Institute of Technology production which was adopted by Bureau of Ordnance and designated the Mk 2.

3.5-inch Mks 3 and 5: The head is filled with TNT and fitted with an adapter in the nose to take the Fuze Mk 149. With a second adapter, the diameter is reduced to 1.5 inches to take the Fuze Mk 148. These rounds were not issued and were replaced by the 5.0-inch heads, which contain a greater load of high explosive.

3.5-inch Mk 4: The head has a semi-armor-piercing nose and is filled with TNT. This round was not issued, because of the small load of high explosive, and was replaced by the 5.0-inch heads.

3.5-inch Mks 6 and 9: The head is filled with F.S. or P.W.P. smoke. The Mk 9, the initial California Institute of Technology production, was not issued. The Bureau of Ordnance, in adopting this head, increased the length 1-1/2 inches and issued the round as the Mk 6.

3.5-inch Mk 8: The head is of solid steel and contains no high explosive or fuze. The round was developed to give better underwater travel, and replaces the 3.5-inch Head Mk 2.

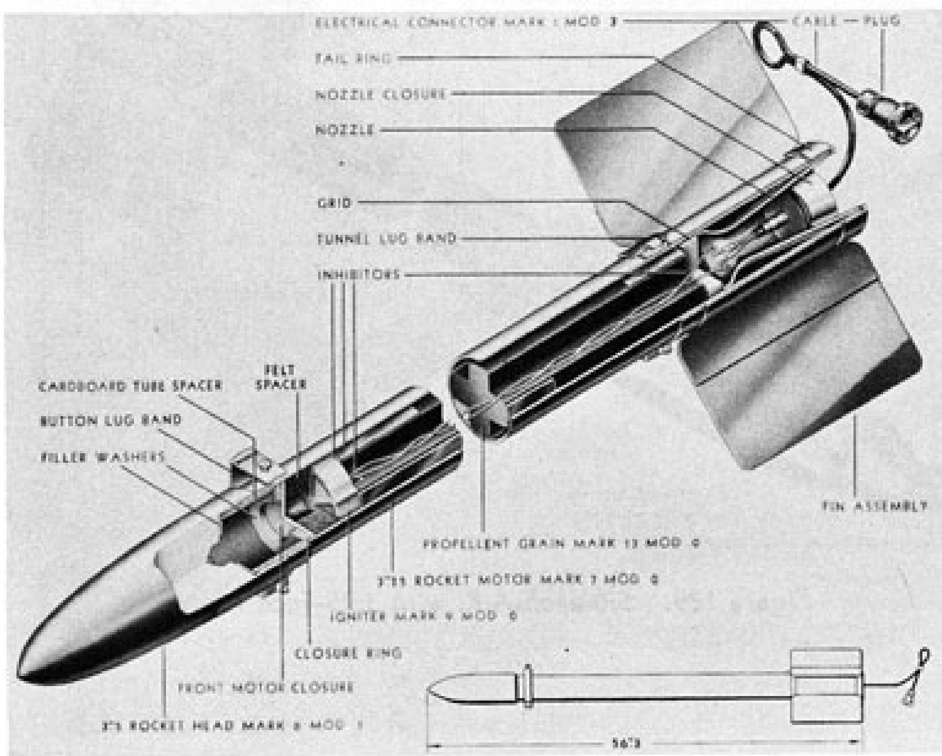


Figure 128. 3.5–inch A.R. (Head Mk 8)

5.0-inch Mk 1 Mod 0: The head is filled with TNT and weighs 46.5 pounds when fitted with a Fuze Mk 143. The same adapter rings are used as on the 3.5-inch Head Mk 5. The head is issued with a nose plug. The nose fuze must always be assembled in the head before firing. Fire with the fuze on "safe" if delay is desired. The head is shipped with the base fuze sealed in place. This base fuze must not be removed.

5.0-inch Mk 1 Mod 1: This head differs from the 5.0-inch Head Mk 1 Mod 0 only in that the nose is especially cavitated to take the Fuze Mk 172 Mod 0, which is larger than the Mk 149 or other nose fuzes and therefore is not interchangeable with them.

Motor

The 3.25-inch Motor Mk 7 is used with the 3.5- and 5.0-inch heads described above. At the forward end of the motor are a black-powder igniter and an electric squib. Two electric leads extend through the motor and out the after end to a cable and plug connection. At the after end of the motor, there are a nozzle and a bag of silica gel which acts as a dehydrating agent in keeping moisture from the ballistite grain. The grain used in the cruciform type with inhibitors, 33 inches long, 2.75 inches in diameter, and weighing 8.5 pounds.

The tail consists of four sheet-metal fins set 90° apart and welded to a central cylinder. The tail is slipped over the after end of the motor and is secured by a tail locking ring, which screws on.

Remarks: The 3.5-inch (H.E. and F.S.) have a maximum velocity of 1,200 ft./sec. exclusive of plane speed, as compared to 800 ft./sec. for the 5.0-inch H.E.

The 3.5-inch Heads Mk 11, incendiary, and Mk 12, gas, were never loaded.

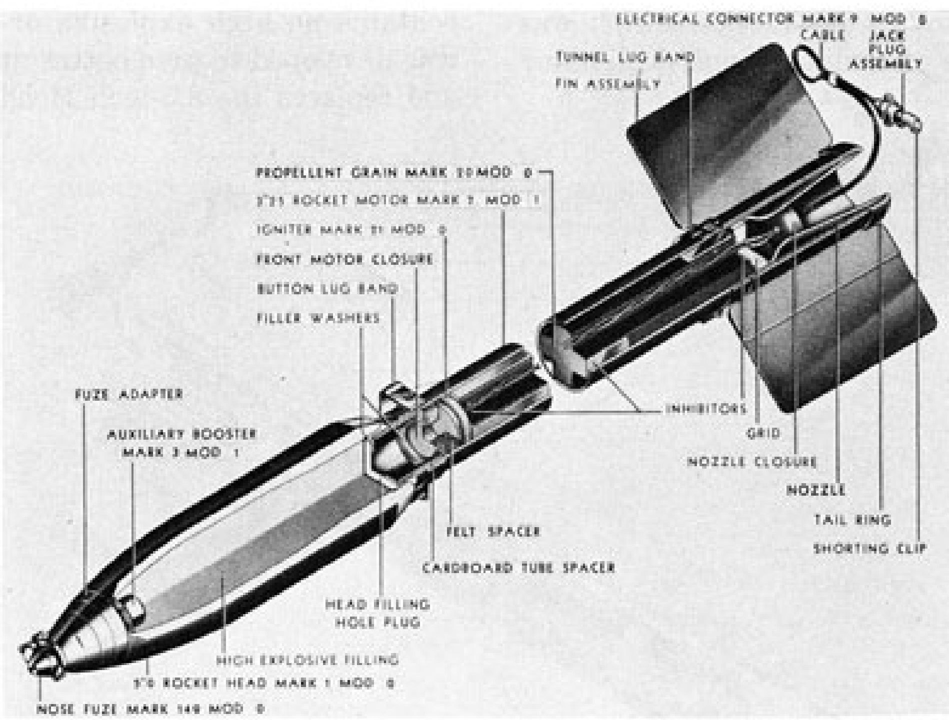


Figure 129. 5.0–inch A.R. with 3.25–inch Motor

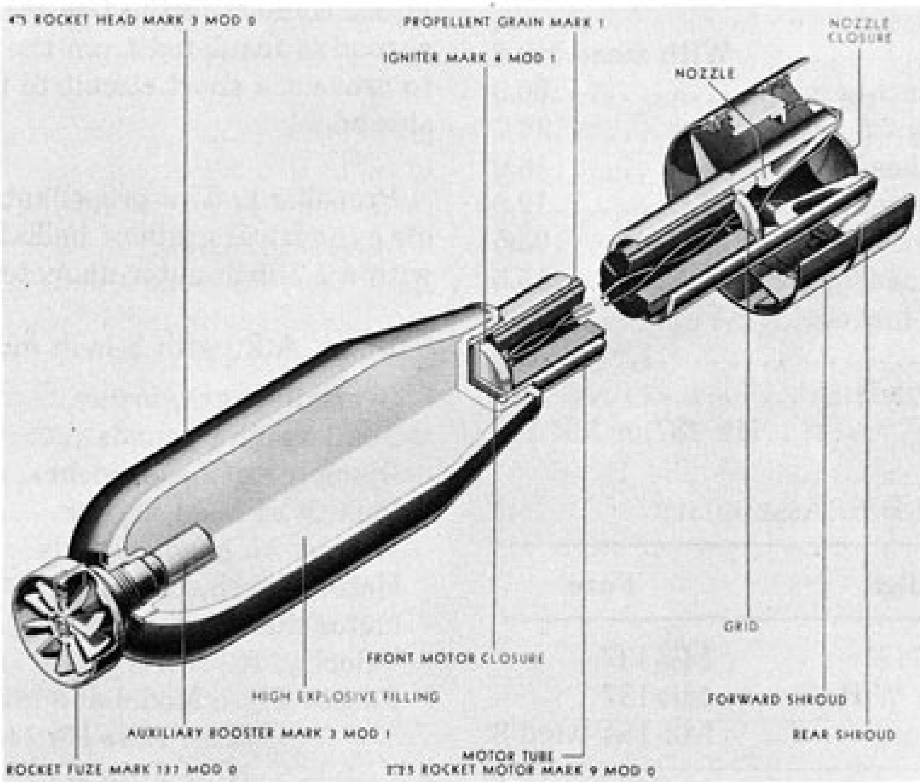


Figure 130. 4.5–inch B.R. (Head Mk 3)

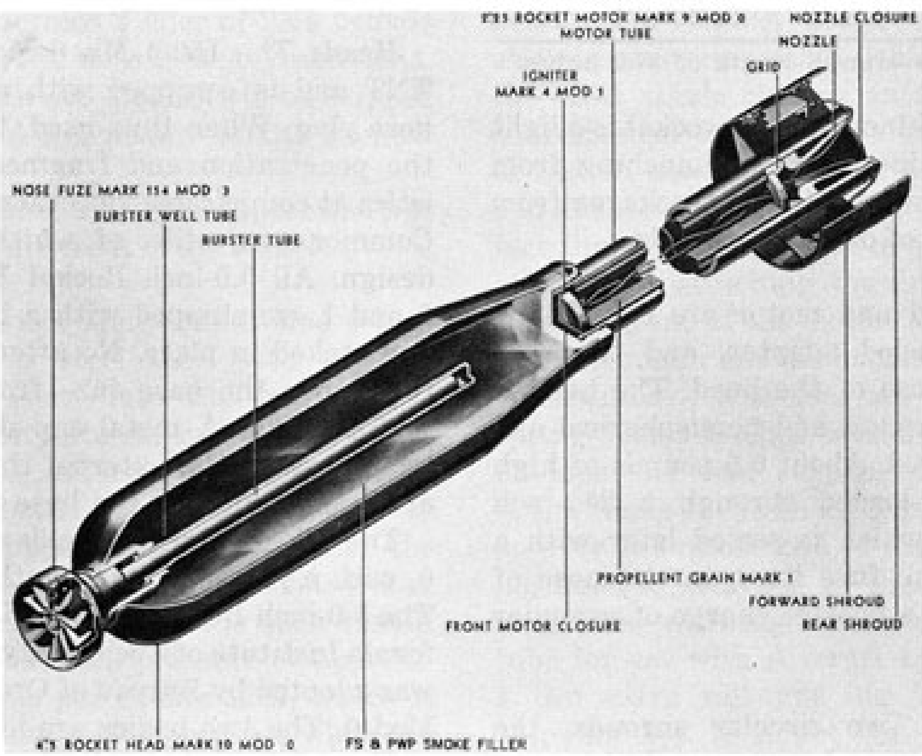


Figure 131. 4.5–inch B.R. (Head Mk 10)

4.5-inch B.R.

With Head Mk 3

Over-all length, inches..................30.0
Total weight, pounds..................28.7
Head length, inches..................13.0
Head weight, pounds..................19.9
Wall thickness, inch..................0.25
Motor length, inches..................15.5
Motor diameter, inches..................2.25
Range, yards 1,000-1,100
TNT charge, pounds..................6.5
Fuzes ....Mk 137 or Mk 145

4.5-INCH B.R. ASSEMBLIES

Head	Filler	Fuze
Mk 3	TNT	Mk 137
Mk 5	F.S., W.P.	Mk 137
		Mk 154 Mod 3
Mk 7*	F.S., W.P.	Mk 137
		Mk 154 Mod 3
Mk 3	TNT	Mk 145
Mk 10	P.W.P.	Mk 154 Mod 3
Mk 11	TNT	Mk 137

*Head Mk 7 makes over-all length of 37.0 inches.

General: The 4.5-inch barrage rocket is a light demolition rocket intended for launching from landing boats, from amphibious trucks, or from portable launchers of one or more rails.

Head: The head and motor are coupled by means of a threaded adapter, and the fuze screws into the nose of the head. The head is cylindrical, the forward and hemispherical and the rear end reduced. About 6.5 pounds of high explosive can be loaded through a 2¾-inch hole in the rear, which is sealed later with a motor adapter. The fuze liner, in the nose of the head, contains a booster charge of granular TNT.

Tail assembly: Two circular shrouds, the same diameter as the body, are attached to supporting fins at the rear of the motor. Two wires brought out through the powder grain and the nozzle connect to the two shrouds. The forward shroud is insulated from the rest of the rocket to prevent a short circuit to the after grounded shroud.

Propellant: The propellant consists of a single cylindrical grain of ballistite 11 inches long, with a 1.7-inch outer diameter.

5.0-inch A.R. with 5-inch motor

Over-all length, inches..................69
Total weight, pounds 140
Diameter of head, inches..................5.0
Length of head, inches..................20.3
Weight of head, pounds..................52
Motor length, inches..................51.4
Motor diameter, inches..................5.0
Velocity, ft./sec. 1,350
Fuzes: Mk 5 Mod 0 and Mk 6 Mod 0
Nose Fuze Mk 148
Nose Fuze Mk 149
Base Fuze Mk 157 Mod 0
Base Fuze Mk 159 Mod 0
Mk 6 Mod 1
Base Fuze Mk 159 Mod 1
Base Fuze Mk 164 Mod 0

Head: The Head Mk 6 Mod 0 is filled with TNT and is equipped with a base fuze and a nose plug. When thus used, the head will have the penetration and fragmentation characteristics at comparable velocities of the 5"/38 A.A. Common projectile, of which it is a modified design. All 5.0-inch Rocket Heads Mk 6 Mods 0 and 1 are shipped with a base fuze installed and staked in place. No attempt shall be made to remove the base fuze from the head prior to the firing. A metal cup-shaped thread protector covers the external threads on the base of the head and on the base fuze.

The Mk 6 Mod 1 is similar to the Mk 6 Mod 0, with a gas seal added to the bomb-fuze seat. The 5.0-inch Body Mk 5 Mod 0 is the initial California Institute of Technology production, which was adopted by Bureau of Ordnance as the Mk 6 Mod 0. The two bodies are identical.

The 5.0-inch Aircraft Common Mk 2 Mod 1 is a new head designed to achieve greater penetration. This penetration is expected to be two

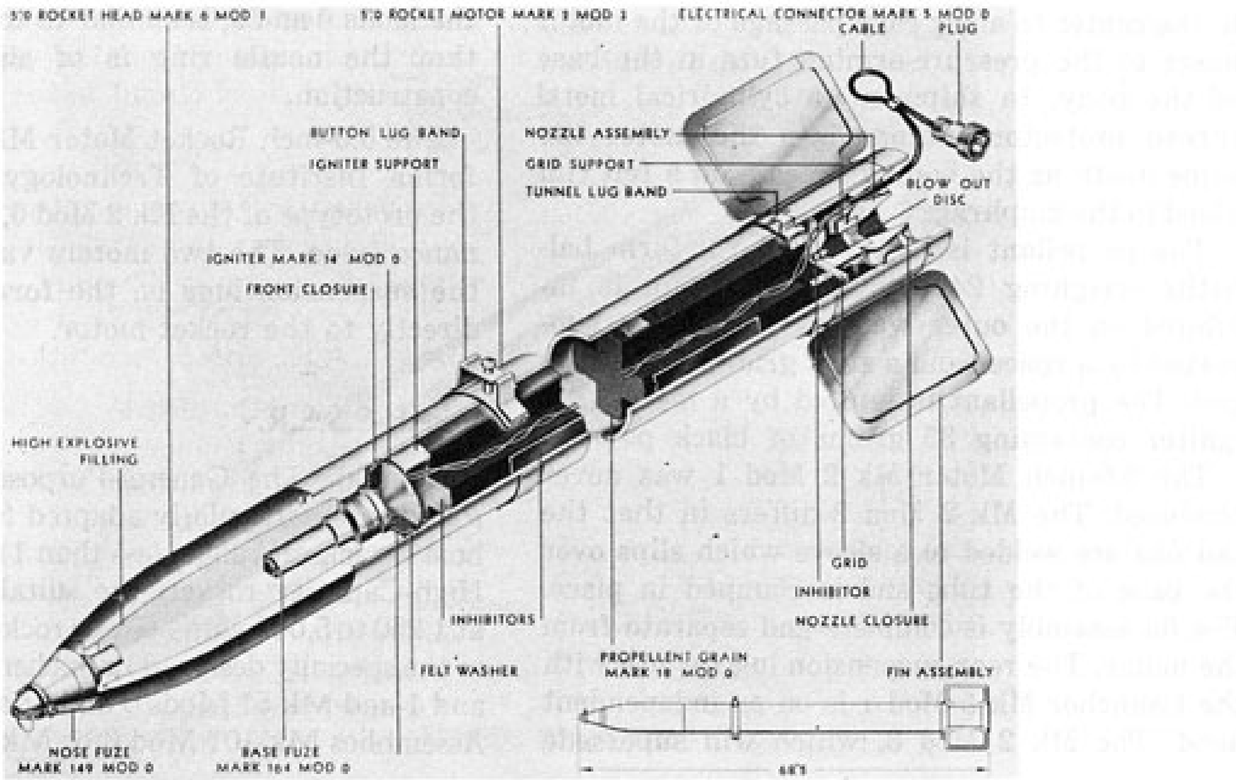


Figure 132. 5.0–inch A.R. with 5.0–inch Motor

to three inches of homogeneous armor plate at launching speeds of 1,500 feet per second. The head has a total weight of 48.1 pounds, is 14 inches long, and contains a filler of 2.66 pounds of Explosive "D." The nose is heavy and solid. A base fuze (the Mk 166 Mod 0) will be shipped installed. This head will fit any of the 5.0-inch motors.

The Head Mk 2 Mod 2 has no adapter and has Acme threads; otherwise it is the same.

Motor: The 5.0-inch Motor Mk 2 Mod 0 consists of a seamless steel tube with internal threads on both ends. Into the rear end is screwed the nozzle plate having eight nozzles arranged in a circle, and a central blow-out nozzle. The central nozzle is closed by a disc of 0.024-inch thick copper, insulated against the heat of the motor by asbestos and hard fiber plugs. The thickness of the disc is such that it shears and blows out at a pressure of approximately 2,400 pounds per square inch, which is the normal maximum motor pressure when the propellant grain is at a temperature of 100° F. If the pressure rises above this, the disc and plug are ejected; this increases the usable temperature range of the rocket by about 40° F.

Seven of the eight nozzles are sealed individually by a light steel cup and sealing compound. The eighth nozzle accommodates the electric connector cable, which is crimped into the steel nozzle closure. In shipment, a dome-shaped steel shipping cap fits into the sleeve of the fin assembly, acting as an auxiliary seal and at the same time serving to enclose and protect the electrical pigtail in shipment.

Lugs for attaching the fins are mounted on the nozzle end of the motor. The fins are shipped with the motor and are attached when the round is assembled. The fins are held in place by spring-loaded latches within the fin itself. The fin lugs and rear suspension lugs are welded to the bands of the fin assembly, which is slipped on over the nozzle end of the motor. The front lug band is strapped to the motor. The motor is shipped with lug attachments on the motor tube for use with Aircraft Launcher Mk 5 Mod 1. An extra rail-type lug is provided in the shipping box to adapt the rocket for use on the Aircraft Launcher Mk 4.

The front end of the motor is sealed by a steel diaphragm equipped with a blow-out disc in the center to allow easy passage of the motor gases to the pressure-arming fuze in the base of the body. In shipment, a cylindrical metal thread protector extends into the motor the same depth as the body and seats on a felt rim glued to the diaphragm seal.

The propellant is a grain of cruciform ballistite weighing 24 pounds. The grain is inhibited on the outer web surface and is supported by a spacer and a steel grid at the nozzle end. The propellant is ignited by a metal case igniter containing 35 grams of black powder.

The 5.0-inch Motor Mk 2 Mod 1 was never produced. The Mk 2 Mod 2 differs in that the tail fins are welded to a sleeve which slips over the base of the tube and is clamped in place. The fin assembly is complete and separate from the motor. The rear suspension lug for use with the Launcher Mk 5 Mod 1 is on an independent band. The Mk 2 Mod 3, which will supersede the Mods 0 and 2, is similar to the Mod 2, except that the nozzle ring is of slightly different construction.

The 5.0-inch Rocket Motor Mk 1 Mod 0, California Institute of Technology production, is the prototype of the Mk 2 Mod 0, Bureau of Ordnance issue. The two motors vary only in that the suspension lugs on the former are welded directly to the rocket motor.

5-inch S.S.S.R.

General: The General-Purpose and Common rounds are particularly adapted for repelling PT-boat attacks at ranges less than 11,000 yards. The High-Capacity rockets are suitable for barrages at 1,250 to 5,000 yards. These rockets must be used in the specially designed Launchers Mk 50 Mods 0 and 1 and Mk 51 Mods 0 and 1; and in Launcher Assemblies Mk 101 Mod 0 or Mk 102 Mod 0.

DATA

	General-Purpose	Common	H.C. (5,000 yds.)	H.C. (2,500 yds.)	H.C. (1,250 yds.)
Head	5.0″ Mk 7 All Mods	5.0″ Mk 8 All Mods	5.0″ Mk 10 All Mods	5.0″ Mk 12 All Mods	5.0″ Mk 13 All Mods
Motor	5.0″ Mk 3 All Mods	5.0″ Mk 3 All Mods	5.0″ Mk 4 All Mods	5.0″ Mk 5 Mod 1	5.0″ Mk 6 Mod 0
Propellant grain	Mk 21 Mod 0	Mk 21 Mod 0	Mk 22 Mod 0	Mk 24 Mod 0	Mk 25 Mod 0
Igniter	Mk 17 Mod 0	Mk 17 Mod 0	Mk 18 Mod 0	Mk 20 Mod 0	Mk 20 Mod 0
Motor length	22.5″	22.5″	15.28″	10.50″	8.845″
Over-all length	31.5″	28.8″	32.2″	32.2″	32.2″
Head weight	20 lb.	20 lb.	24.6 lb.	31.4 lb.	34.35 lb.
Filler	TNT	Explosive "D"	TNT	TNT	TNT
Weight	1.75 lb.	1.68 lb.	9.6 lb.	12.4 lb.	13.6 lb.
Total weight	49.1 lb.	50.8 lb.	50.2 lb.	—	—
Fuzes:					
Nose	Mk 100 Mod 0	None	Mk 30 Mod 3 or Mk 173	Mk 30 Mod 3 or Mk 173	Mk 30 Mod 3 or Mk 173
Base	None	Mk 31 Mod 0	None	None	None
Aux. Det.	Mk 44 Mod 2	None	Mk 44 Mod 1	Mk 44 Mods 1 and 2	Mk 44 Mods 1 and 2
Range	11,000 yd.	11,000 yd.	5,250 yd.	2,500 yd.	1,250 yd.
Velocity	1,530 ft./sec.	1,600 ft./sec.	830 ft./sec.	475 ft./sec.	340 ft./sec.

HEADS

5.0-inch Head Mk 7—General-Purpose: This head is threaded externally at the after end to accommodate the motor. It is threaded internally at the forward end to accommodate the fuze adapter for Rocket Fuze Mk 100 and

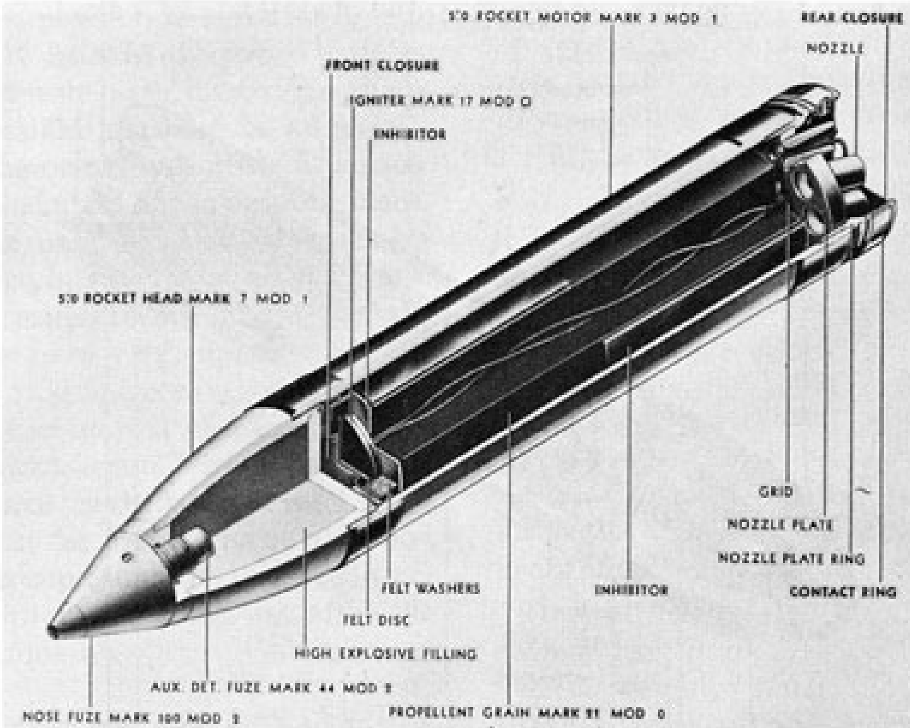


Figure 133. 5.0–inch S.S.S.R. (Head Mk 7 Mod 1)

Mods. Two spanner holes are located in the after end of the head spaced 180° apart to facilitate assembly. The fuze adapter is internally threaded for Auxiliary Detonator Fuze Mk 44 Mod 2. The Nose Fuze Mk 100, all Mods, is screwed in over the Auxiliary Detonating Fuzes. (The fuze adapter and an Auxiliary Detonator Mk 44 Mod 2 are shipped installed in the head.)

5.0-inch Head Mk 8 and Mods—Common: This head is internally threaded at the after end to take Base Fuze Mk 31. It has two spanner holes 180° apart to facilitate assembly operations.

5.0-inch Head Mk 10 and Mods—High Capacity: The nose of this head is internally threaded to fit Nose Fuze Mk 30 Mod 3 and a fuze adapter. It has two spanner holes 180° apart near the base end to facilitate assembly operations. The fuze adapter is internally threaded to hold Auxiliary Detonator Mk 44 Mod 1, and the Nose Fuze Mk 30 Mod 3 fits over the auxiliary detonator.

5.0-inch Head Mk 12 and Mods—High Capacity: The 5.0-inch Head Mk 12 and Mods is 3.125 inches longer than the 5″ Mk 10 head used in the 5,000-yard round. It carries about 2.8 pounds more TNT than the Head Mk 10.

5.0-inch Head Mk 13 and Mods—High Capacity: The 5.0-inch Head Mk 13 and Mods is 4.78 inches longer than the 5.0-inch Head Mk 10. It also carries about four pounds more TNT.

Motors

5.0-inch Motor Mk 3 and Mods: The motor tube is a seamless steel tube with internal threads at both ends. It is machined with a bourrelet ring at each end. The front closure is a steel disc pressed in position near the front end of the motor tube. It seals the front end from moisture, dirt, etc., and retains the igniter and propellant grain in place. A thin felt pad cushions any contact between the front closure and the igniter. The Igniter Mk 17 Mod 0 consists of a flat tin case containing 35 grams of black powder and an electric squib. A felt disc one inch thick protects the grain from accidental shock. It has an eccentrically placed hole which houses and forms a snug fit for the igniter case. The propellant is an inhibited, cruciform grain weighing approximately ten pounds. The nozzle plate assembly consists of eight nozzles and a grid mounted on a nozzle plate. The cylindrical **T**-shaped steel grid is pressed into

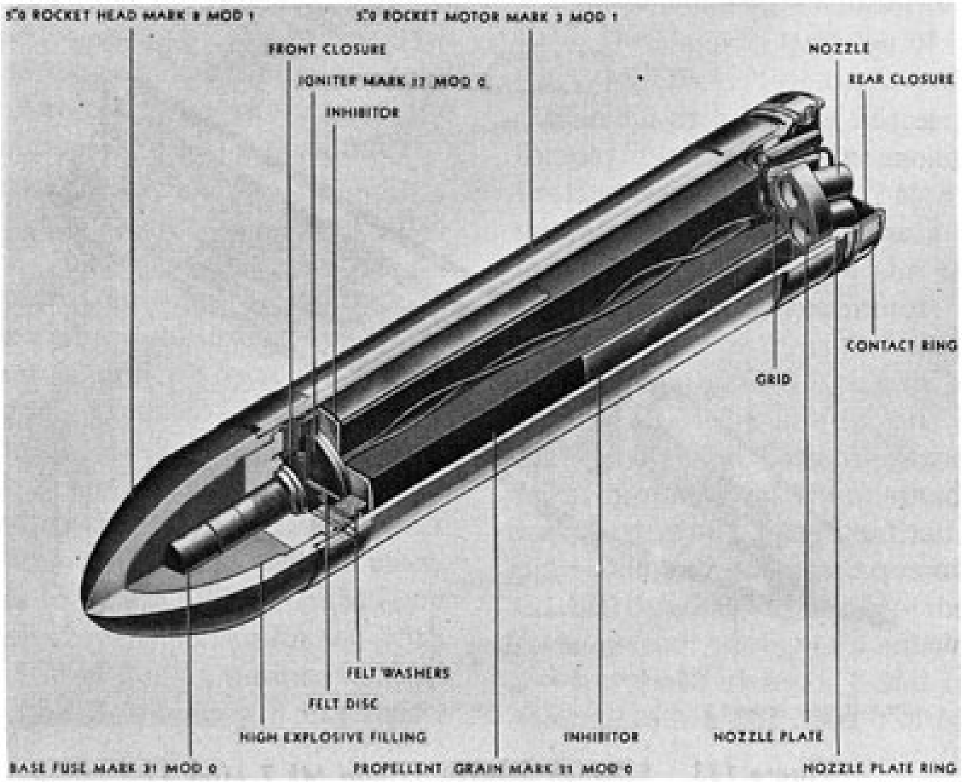


Figure 134. 5.0–inch S.S.S.R. (Head Mk 8 Mod 1)

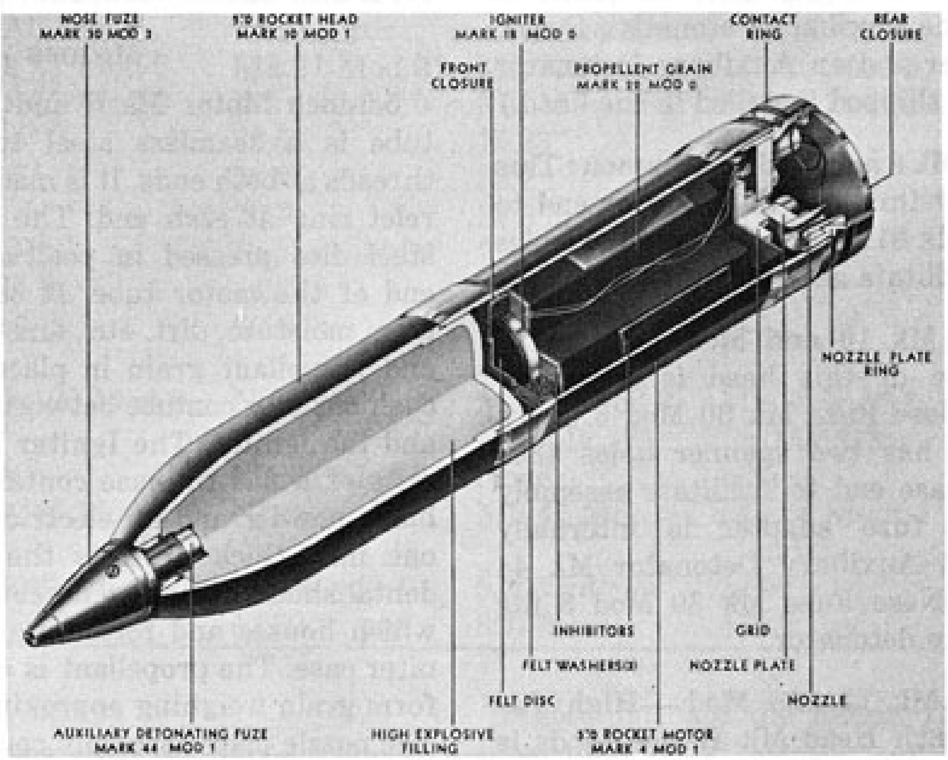


Figure 135. 5.0–inch S.S.S.R. (Head Mk 10 Mod 1)

place and peened in position in a center hole in the nozzle plate. It acts as a spacer between the grain and the nozzle plate, creating a chamber which equalizes the pressure to all nozzles during burning. The nozzles are press fitted into the plate and are canted 12° to give a clockwise rotation. The nozzle-plate ring assembly consists of a nozzle-plate ring and the insulated contact ring. The contact ring is a steel band around the nozzle-plate ring and is insulated from it. The plate ring and contact ring are the two terminals of the ignited electrical circuit. The rings are short circuited by a band. The short-circuiting band must be removed when preparing the rocket for firing. The rear closure is a thin aluminum cup cemented in place in the after end of the motor, and blows out after the motor pressure builds up.

5.0-inch Motor Mk 4 and Mods: The 5.0-inch Rocket Motor Mk 4 is similar to the Mk 3 discussed above, except that the motor tube is seven inches shorter than the Motor Mk 3. The Igniter Mk 18 with shorter leads is used. Propellant Grain Mk 22 Mod 0, shorter and weighing approximately 5.5 pounds, is used. The nozzle in the nozzle-plate assembly has a smaller throat diameter.

5.0-inch Motor Mk 5 Mod 1: The Mk 5 Mod 1 is similar to the Mk 4, except that it is 3.125 inches shorter and the nozzle plate has four instead of eight nozzles. This shorter motor gives a range of 2,500 yards and a maximum velocity of 475 ft./sec., which is suitable for barrage purposes.

5.0-inch Motor Mk 6 Mod 0: The Mk 6 Mod 0 is also similar to the Mk 4 and Mods, except that it is 4.78 inches shorter and the nozzle plate has only four nozzles. The cant of these nozzles has been increased to insure stable flight of the round at slower velocities. This shorter motor gives a range of 1,250 yards and a maximum velocity of 340 ft./sec., which is suitable for barrage purposes.

7.2-inch H.E. "Mouse Trap" and 2.5-inch Practice

Over-all length, inches	38.6
Head length, inches	19.0
Head weight, pounds	17.9
Filler weight (TNT), pounds	31.0
Wall thickness, inch	0.2
Motor length, inches	15.9
Motor diameter, inches	2.25
Motor weight, pounds	8.1
Tail width, inches	7.0
Total weight, pounds	65

General: This rocket was designed for use by patrol vessels against submarines. The most common installation consists of two four-rail Launchers Mk 20, with a fixed elevation of 48°, mounted on the fore deck with firing controlled from the bridge.

COMPLETE ROUNDS

Assembly No.	Head	Filling	Grain	Fuze
7.2″ H.E. 208 (Obsolete)	7.2″ Mk 4	TNT	Mk 3	Mk 131—Mk 156
7.2″ H.E. 211	7.2″ Mk 5	TPX	Mk 3	Mk 131—Mk 156
7.2″ H.E. 212	7.2″ Mk 5	TPX	Mk 3	Mk 140—Mk 156
7.2″ H.E. 213	7.2″ Mk 5	TNT	Mk 10	Mk 131—Mk 156
7.2″ H.E. 216	7.2″ Mk 5	TNT	Mk 10	Mk 140—Mk 156
7.2″ H.E. 217	7.2″ Mk 4	TNT	Mk 3	Mk 140—Mk 156

In addition to the service rounds, there are the Mks 106 and 109 filled with plaster for target practice, and the Mks 206 and 209 filled with plaster for drill.

Head: The projectile consists of a flat-nosed head with a conical tail fairing and parallel sides. The adapter and fuze thread into the nose, and the motor unit threads into the base.

Motor: The Motor Unit Mk 3 contains a long single pellet of smokeless powder which, when ignited by a black-powder primer fired by an electric squib, burns at a pressure of 1,000 to 2,500 pounds per square inch. The gases are forced out aft through the nozzle in the rear end of the motor tube. The burning continues for 0.2 to 0.7 second, during which time the missile travels about 30 feet. At this point, propulsion ceases and the projectile is free in flight. This projector charge is intended for use on the 7.2-inch Rocket Launchers Mk 20, Mk 21, or Mk 22.

Tail: A steel tube attached to the head by a threaded joint has fins with two circular drums attached to the after end. The vanes have a 10-degree twist to give a slow rotation and prevent ruddering. The two vane-support drums also act as contact rings, the wiring from the electric squib passing from the primer aft to the two rings which serve as firing contacts.

Remarks: When Torpex is used, the weight is increased by approximately 2.5 pounds.

The 2.5-inch sub-caliber rocket, consisting of the 1.25-inch Motor Mk 1 and 2.5-inch Head Mk 1, is a miniature of the regular rocket and is used in practice. The motor contains a single tubular powder grain, an igniter, and lead wires. The tail fins, supported by a shroud, are offset five degrees to impart some rotation to the round, to improve underwater travel. The Head Mk 1 has a cavity for a shot-gun shell; the Head Mod 2 Mk 1 is solid.

The Fuzes Mk 131 and Mk 140 are replaced by the Mk 156 in the service rounds.

7.2-inch D.R., also T37 and T88

Head Mk 10

Over-all length, inches 35
Motor diameter, inches 2.25
C–2 explosive, pounds 33
Loaded weight, pounds 60
Maximum range, yards 275
Motor . . . . . 2.25-inch Mk 3
Fuze
Head Mk 5 . . . . . Nose—Mk 152 or Mk 141
Head Mk 10 . . . . Base—Mk 146
Head Mk 10–1 . . Base—Mk 161 Mod 0

General: The 7.2-inch D.R., a modification of the 7.2-inch H.E., was used for demolition of anti-tank obstacles. The 7.2-inch D.R. was projected from a multiple-rail armored launcher

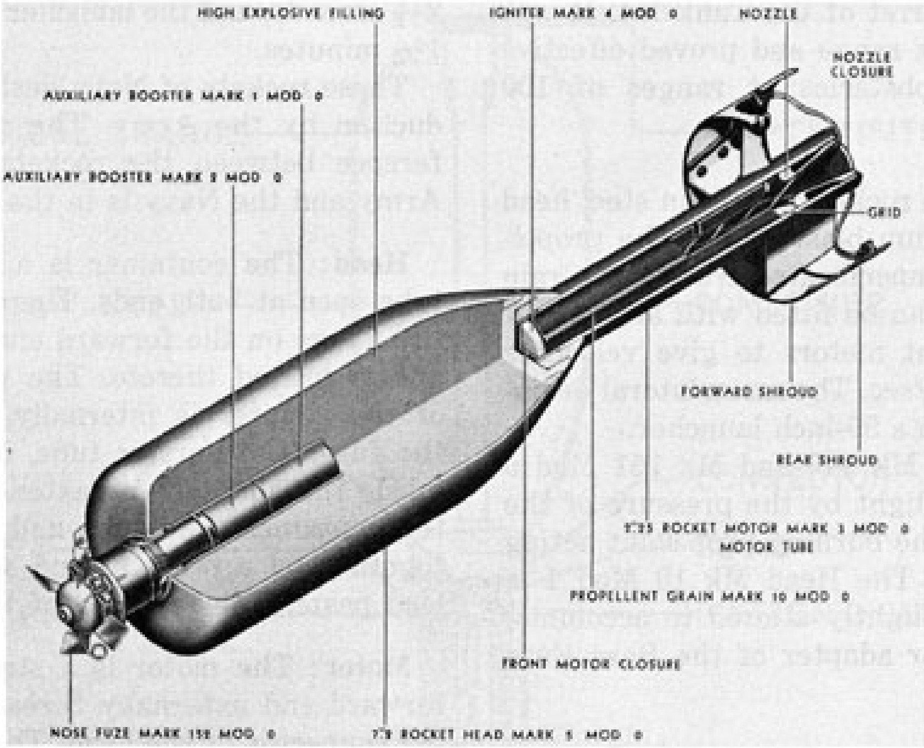


Figure 136. 7.2–inch D.R. (Head Mk 5)

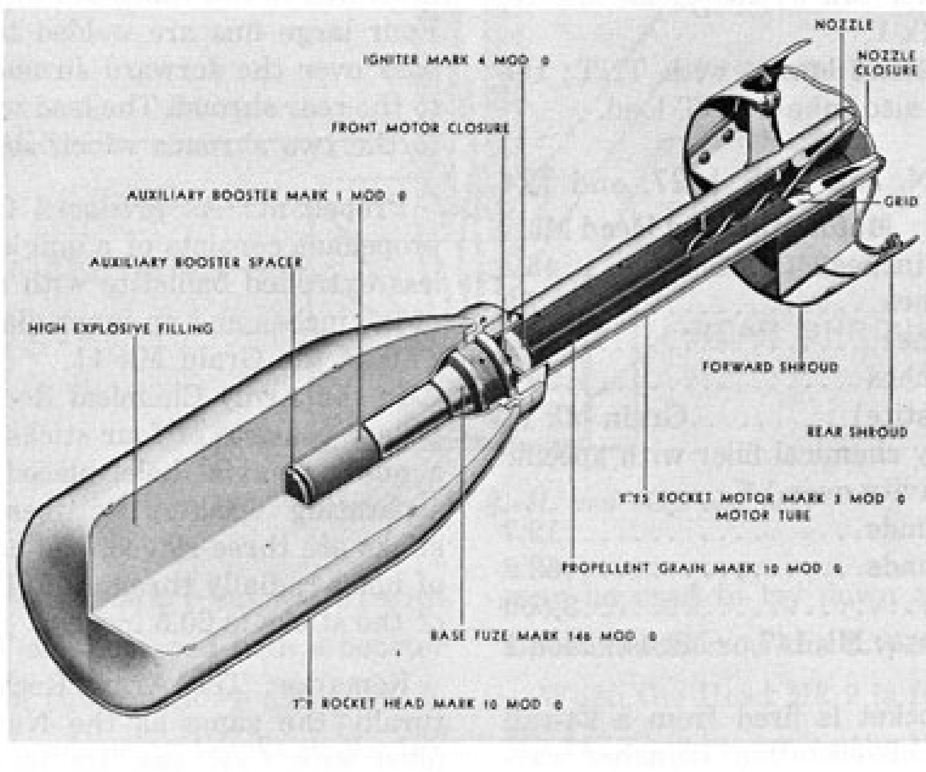


Figure 137. 7.2–inch D.R. (Head Mk 10)

mounted on the turret of the Tank M4. It was fired at point-blank range and proved effective against concrete obstacles at ranges of 100 to 150 feet.

Description: The rocket has a thin steel head to give the maximum blast effect. The propellant is the single unperforated cruciform Grain Mk 10. The body can be fitted with any one of a number of rocket motors to give velocities from 175 to 400 ft./sec. The mean lateral deviation is 10 mils from a 90-inch launcher.

The Base Fuzes Mk 146 and Mk 161 Mod 0 are armed during flight by the pressure of the gas evolved from the burning propellant acting on the diaphragm. The Head Mk 10 Mod 1 is the Head Mk 10, slightly altered to accommodate the new motor adapter of the Base Fuze Mk 161 Mod 0.

Remarks: The Army designates the Head Mk 10 or Mk 10 Mod 1 as the T37.

A smoke-filled round used by the Army is the same size, and has the designation of T88. It is nose-fuzed with either the Fuze Mk 152 or the Fuze Mk 141.

The Head Mk 5 may take either the Booster Mk 1 or the Booster Mk 2; the Head Mk 10, only the Booster Mk 1.

The Heads Mk 5 are loaded with TNT; the Heads Mk 10 may also take a TNT load.

7.2-inch C.W.R.–N. and M25, M27, and T24

	Motor Mk 5 and Head Mk 7
Over-all length, inches	48.1
Head width, inches	7.2
Head length, inches	18.75
Motor length, inches	29.0
Propellant (ballistite)	Grain Mk 11
Filler	Any chemical filler with specific gravity over 1.2.
Filler (F.S.), pounds	19.7
Total weight, pounds	53.2
Range, yards	3,500
Fuzing	Nose: Mk 147 or Mk 147 Mod 1

General: This rocket is fired from a 24-rail demountable, variable-elevation launcher carried in a 2½-ton truck. The salvo is fired in 2½ seconds, and the launcher can be reloaded in 1½ minutes.

These rockets of Navy design are under production by the Army. The only essential difference between the rockets as used by the Army and the Navy is in the propellant.

Head: The container is a bulb-shaped steel tube open at both ends. The adapter fits inside the flange on the forward end of the container and is brazed thereto. The wide forward end of the adapter is internally threaded to seat the fuze. The burster tube, made of steel, fits inside the adapter and extends downward into the container. The tube and adapter are held together by a press fit and sealed with white-lead paste. The rear end of the tube is closed.

Motor: The motor is a steel tube, with the forward end externally threaded to screw into the connector of the head. The nozzle is slipped down through the open end of the motor body, and the end is welded to the inner edge of the motor-body rim.

Tail: The tail assembly has four tail vanes spot-welded in pairs to the motor tube and spot-welded to the rear shroud. The forward shroud is riveted to the vanes but insulated from them. Four large fins are welded to the motor tube, pass over the forward shroud, and are welded to the rear shroud. The lead wires are connected to the two shrouds which serve as contacts.

Propellant: As produced for the Navy, the propellant consists of a single grain of solventless extruded ballistite with an outer diameter of 2.5 inches and an inner diameter of 1.0 inch. This is the Grain Mk 11.

In the Army Chemical Rocket M25, the propellant consists of four sticks of ballistite, with a one-inch axial hole, placed end to end with separating washers between the sticks. The sticks are three-ridged, and each has eight sets of holes radially through it. The over-all length of the sticks is 20.5 inches.

Remarks: The Army Rocket M27 is structurally the same as the Navy rocket, but is filled with C/K gas. Its total weight is 51.8 pounds.

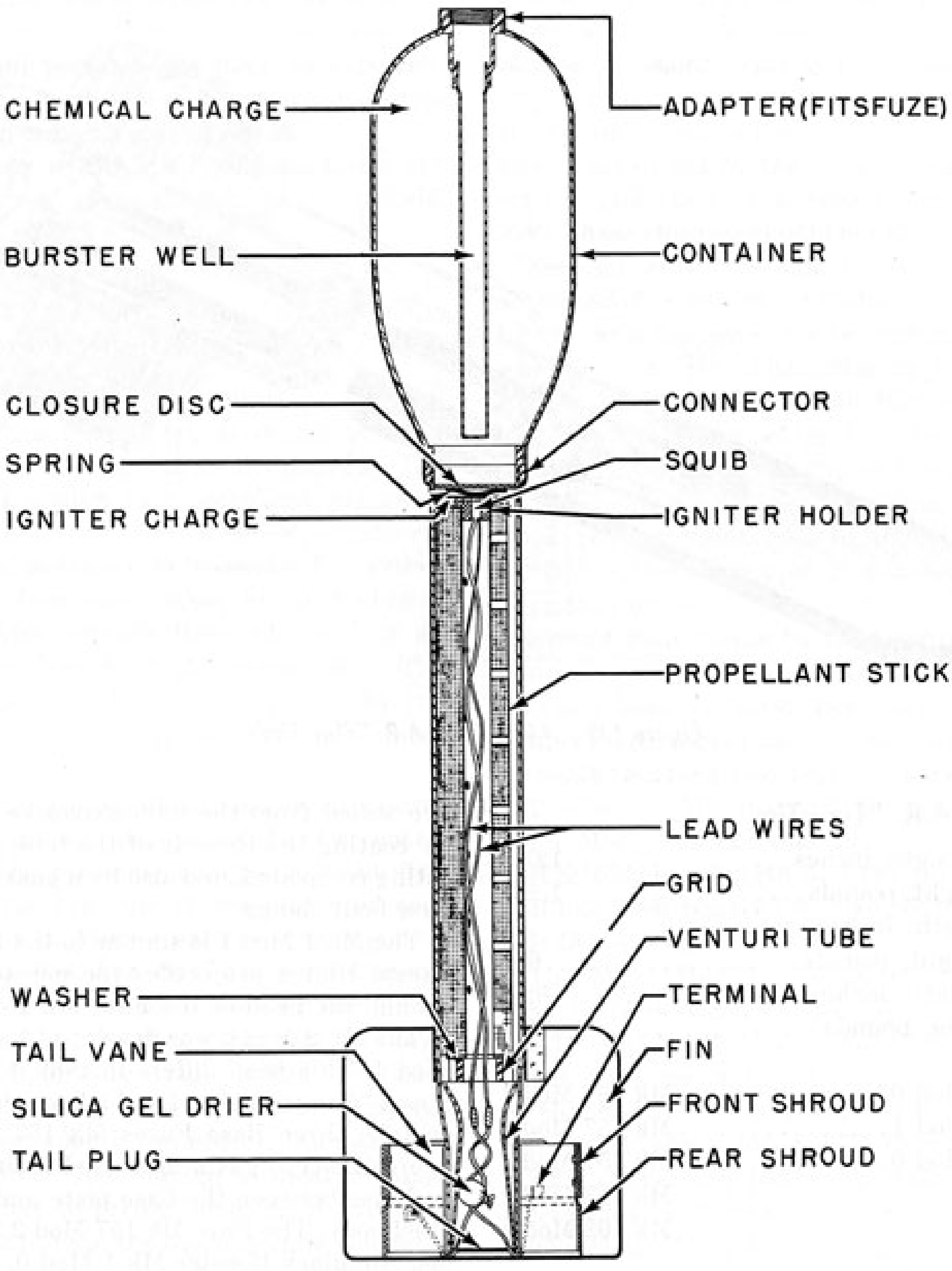


Figure 138. 7.2-inch C.W.R.-N. and M25 and M27

A head similar to the Mk 7 but loaded with 22 pounds of TNT and equipped with a booster instead of a burster tube is known as the Mk 9. It is a demolition head, using the Fuze Mk 137 and the 3.25-inch Motor Mk 5. This combination may be used to lay down a barrage from the same launchers as the C.W.R.-N.

When the Head Mk 9 is fuzed with the Fuze Mk 147, it is known as the Round T24. Its total weight is 51.8 pounds.

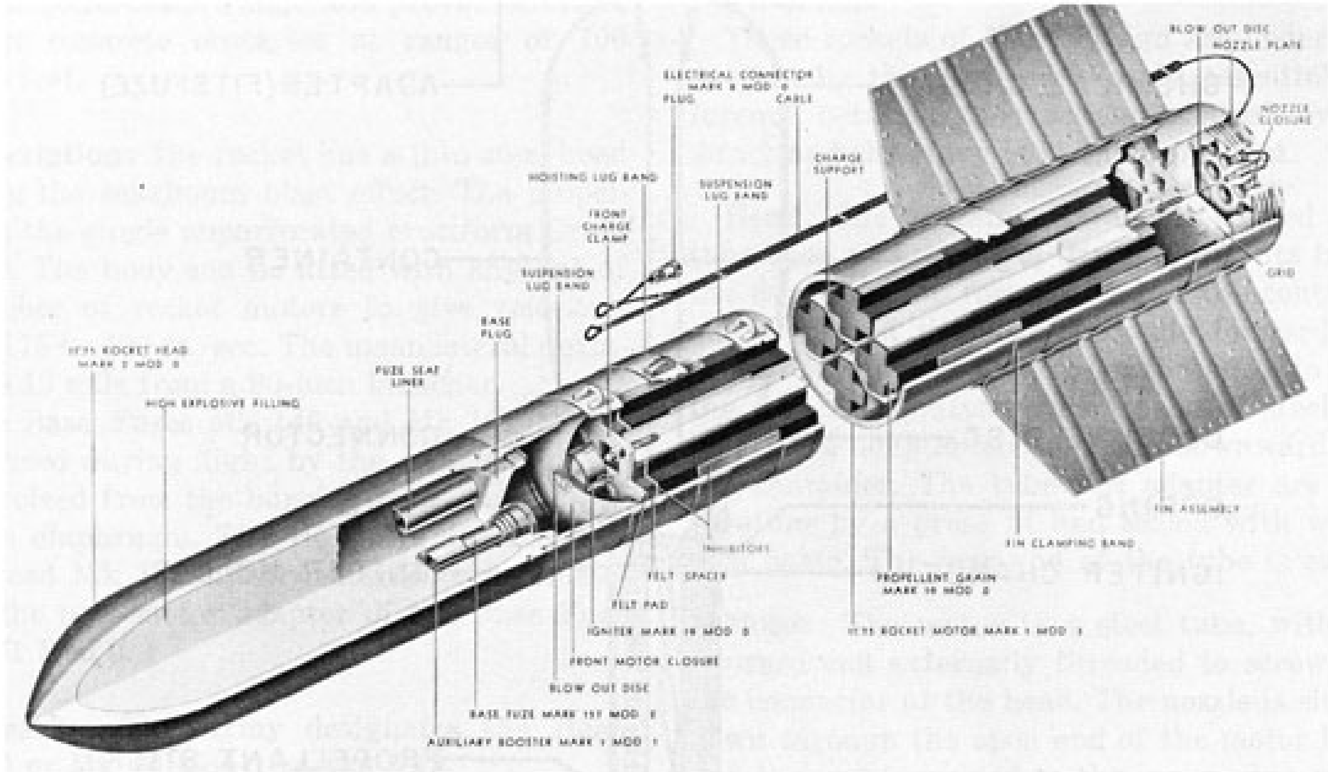


Figure 139. 11.75–inch A.R. "Tiny Tim"

11.75-inch A.R. "Tiny Tim"

Over-all length, inches	123.0
Total weight, pounds	1,253
Head length, inches	47
Head weight, pounds	600
Motor length, inches	82.4
TNT filling, pounds	152.5
Fuzes	
Mk 1 Mod 0	Mk 157 Mod 1
Mk 1 Mod 1	Mk 157 Mod 2
Mk 2 Mod 0	Mk 157 Mod 2
	Mk 163 Mod 0
	Mk 162 Mod 0

Heads: The Mk 1 Mod 0 consists of a standard 500-lb. S.A.P. Bomb AN–M58A1 modified for this particular use. The changes include the removal of the suspension lugs, an increase in the number of threads securing the base plate, the use of a new base plug to take the Fuze Mk 157 Mod 1, and the use of an adapter ring welded around the after end as a means for attaching the rocket motor. The motor gases are sealed from the high explosive in the body by coating the threads of the base plate with a luting compound, and also by a gasket under the fuze body flange.

The Mk 1 Mod 1 is similar to the Mk 1 Mod 0, except that a projectile-type gas seal is added around the head of the Fuze Mk 157 Mod 2.

The Mk 2 Mod 0 was developed from the Mk 1 Mod 1. This head differs in that it has a solid-nosed "Common" head and a base plate modified to take three Base Fuzes Mk 157 Mod 2. The projectile-type gas seal is used around all fuzes and also between the base plate and the forged steel body. The Fuze Mk 157 Mod 2 is used with one Auxiliary Booster Mk 1 Mod 0, or the Fuze Mk 163 Mod 0 with one Auxiliary Booster Mk 19 Mod 0.

The Head Mk 3 Mod 1 was issued for practice to simulate the Head Mk 2 Mod 0.

The Head Mk 4 Mod 0 is slightly lighter and shorter than previous heads. The head weight is 578 pounds, including 152 pounds of TNT. The head length is 46 inches. Three Fuzes Mk 163 Mod 0 or Mk 162 Mod 0 are used in the base.

The penetrative characteristics of this head are the same as those of present types, but slightly better over-all performance may be expected, because of the small increase in velocity resulting from reduction in total weight.

The Practice Head Mk 5 dummies the Mk 4. It is 44.75 inches long and weighs 569 pounds. It has a cavity for a smoke puff.

The heads are shipped loaded and fuzed. A cuff protects the threads on the adapter ring and the fuze during shipment.

Motors: The Mk 1 Mod 0 consists of a steel tube, the after end of which is threaded to receive a plate having twenty-five nozzles. The motor tube contains four propellant grains of solventless extruded ballistite of cruciform cross-section, weighing 147 pounds. The grains are shielded from each other by an X-shaped partition which extends longitudinally for almost the full length of the motor tube. The grains and the partition are supported by the grid and are strapped together by aluminum bands.

In normal operation, the gases from the burning powder do not pass through the central nozzle, which is closed by a copper blowout disc. Only when the pressure in the motor exceeds approximately 22,500 pounds per square inch is this disc expelled, bringing the central nozzle into operation. The use of a blowout disc allows the rocket motor to perform satisfactorily over a greater temperature range. It has one disadvantage, however, in that at motor temperatures of about 100° F., where the normal operating pressure is just enough to shear the disc, it is impossible to predict whether it will blow out or not. If it does, the burning time is lengthened and the gravity drop is increased, so that the rocket may miss the target.

Four black-powder charges of about 0.5 pound each, contained in plastic cases at the front ends of the grains, provide the ignition for the propellant. They are set off by two small electric squibs in each case, which are connected to receptacles in the nozzle plate. The burning of the propellant is markedly affected by its moisture content. Consequently, the motors are sealed at both ends. Each of the 24 peripheral nozzles is sealed with a thin steel cup. The front end is sealed with a thin steel disc having in its center a small blowout window. This window is blown out by the motor pressure, allowing the propellant gases free access to the base fuze. These closures should not be removed.

The Igniter Mk 19 Mod 0 has recently been developed for use in 11.75-inch A.R. motors. Known as a tin-plate case igniter, it consists of a single metal case 3.38 inches in diameter and 1.8 inches deep, with a wall thickness of 0.01 inch. Four clips are soldered to the base of the case, for attachment to the motor charge support. The case contains 230 grams of F.F.F.G. black powder. Contained in the case are two electric squibs connected in parallel to the igniter lead wires.

Motors must never be fired above the rated temperature stencilled on the motor, because they are likely to burst. Below the lower rated temperature, occasional ignition failures and interrupted burning may be experienced.

The Motor Mk 1 Mod 1 is identical to the Mk 1 Mod 0, except that the motor tube is of higher tensile strength and the pigtail connection has been replaced by two receptacles built into the base plate.

The Mk 1 Mod 2 is a design in which the dead space between the forward motor closure and the base of the rocket head has been eliminated. This motor is similar in other respects to the Mk 1 Mod 0, except that the over-all length has been reduced to 75.75 inches and the pigtail connection has been replaced by two receptacles built into the base plate.

The Motor Mk 1 Mod 3 is the Bureau of Ordnance production of the Mk 1 Mod 2.

The Motor Mk 2 Mod 0 weighs 600 pounds and is 72.04 inches in length. Length and weight reduction have been accomplished by improvements in design detail, so that the total amount of propellant in the motor has not been changed. Because of design and construction changes, the Motor Mk 2 Mod 0 may be used only with the Head Mk 4 Mod 0.

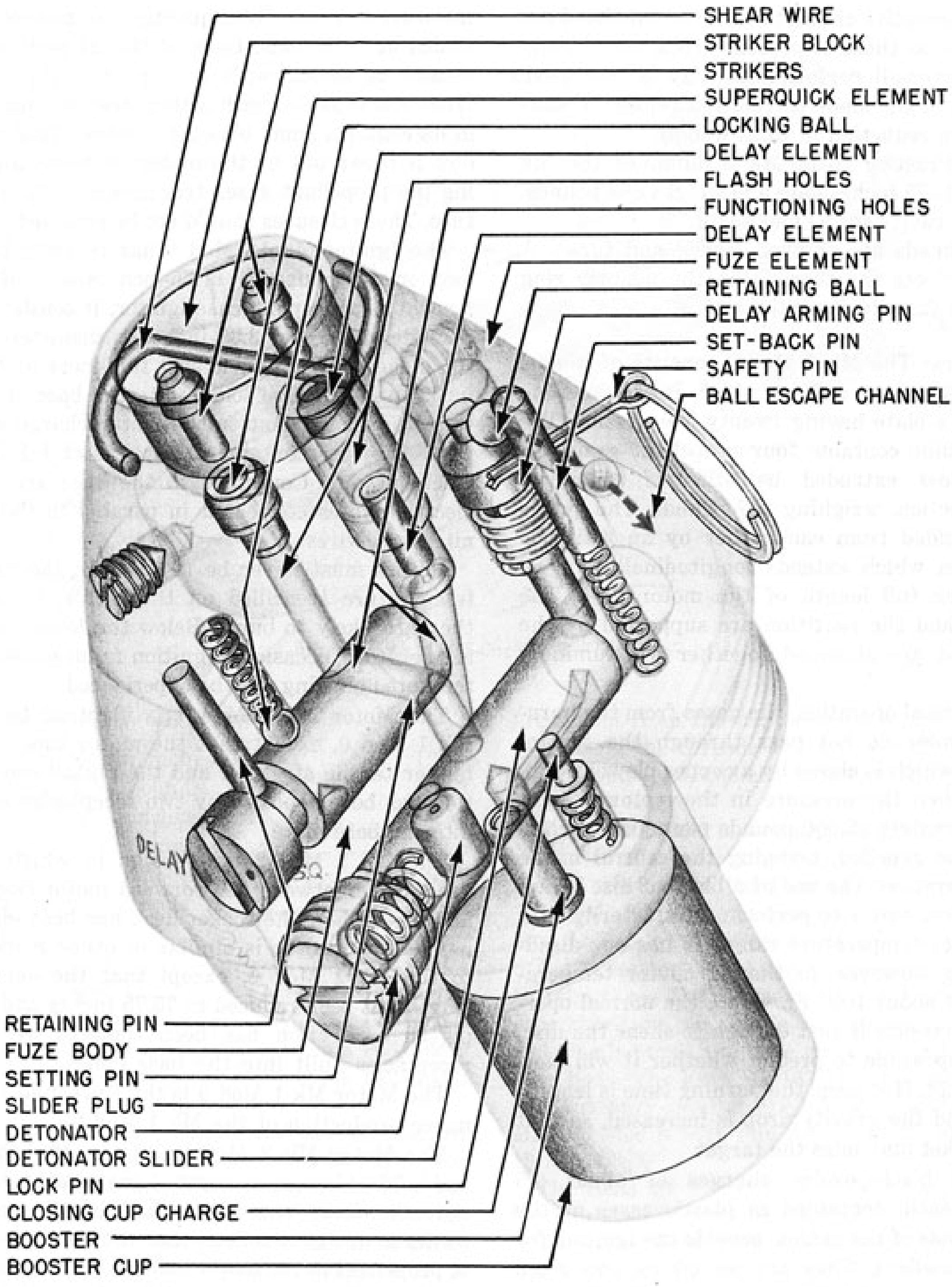


Figure 140. Army Nose Fuze (Rocket) M4A2

ROCKET FUZES

Section 1 — INTRODUCTION

General

Because rocket ballistics have something in common with the ballistics of both projectiles and bombs, their fuze design has borrowed from both of these, and has also initiated devices from its own province, such as using motor gas pressure to arm base fuzes, etc.

The development of rockets during the war was rapid, and adaptations were sometimes thrown into the breech which will now be replaced by more efficient mechanisms. At present, however, there is a great variety of rocket fuzes available.

Dummy fuzes

The Army uses inert or dummy fuzes in its practice rounds. They are designated by different numbers than those on their corresponding service fuzes.

Section 2 — ARMY NOSE FUZES

M4A2 (Discontinued)

Rocket used in	4.5-inch H.E. M8
Functioning	For air, 0.015 sec. delay or instantaneous For ground, 0.1 sec. delay or instantaneous
Arming time	When forward acceleration ceases
Body diameter, inches	3.21
Over-all length, inches	2.51 (without booster)

General: The Fuze M4A2 has been designed to be bore safe for firing from launcher tubes on aircraft or from the ground. There are two different issues of the fuze, identical except for the delay time, which is slightly less in the rockets fired from aircraft because of the increased velocity of those rockets as compared to rockets fired from ground launchers.

Operation: Before the rocket is loaded on the launcher, the fuze is set for either instantaneous (super-quick) action or delay action as desired. This is accomplished by rotating the setting pin. For instantaneous action, the pin is rotated so that the functioning hole (flash channel) in the setting pin mates with the flash hole from the super-quick element. For delay action, the setting pin is rotated 180 degrees, so that the flash hole from the super-quick element is obstructed and the delay firing channel is the only one open. In either position, the setting pin is secured by the spring-loaded locking ball fitting into either of two recesses in the setting pin. The cotter pin is then removed, so that the set-back pin will be free to move back on set-back.

When the rocket is fired, acceleration causes the set-back pin to move rearward, the spring offering sufficient resistance so that the pin reaches its most rearward position only after the rocket has cleared the launcher. This frees the retaining ball to be forced into an escape hole by the spring-loaded delay arming pin as deceleration sets in. As the lower end of the delay arming pin clears the inner end of the detonator slider, the slider is moved over to the armed position by the slider spring. The spring-loaded lock pin rides in a keyway on the underside of the slider and snaps into a recess when the slider reaches the armed position. The firing train is now lined up. On impact, the head of the fuze is crushed, the shear wire is sheared, and both strikers are driven inward, initiating both primers. Thus, both the super-quick and the delay elements are ignited, irrespective of the setting of the fuze. If set for instantaneous action, the flash from the super-quick element ignites the detonator before the delay element functions. If set for delay, the flash from the super-quick element will be obstructed by the setting pin and the flash from the delay element will ignite the detonator 0.015 second later if used in an aircraft-launched rocket, 0.1 second later if used in a ground-launched rocket.

Early designs: The M4A1 had a longer setting pin, with double flash holes, so that the flash from either the super-quick or the delay elements had to pass through the setting pin. Hence, if the setting pin was not rotated to exactly the proper point where the setting-pin flash holes matched with those from the initiating elements, the fuze would not function. In the M4A2, this condition was remedied by the shorter setting pin, so that, even if the pin is not rotated to match with the flash hole from the super-quick element, the delay flash hole will permit firing of the fuze after the slight delay. The M4A1 also had a heavier detonator slider, which occasionally sheared the lock pin and did not stay properly lined up in the armed condition. The M4A2 has a lighter, aluminum slider detonator.

The original M4 had only one issue for both ground- and aircraft-launched rockets with either instantaneous or 0.1-sec. delay settings. The M4A1 had two issues, with either 0.015-second or 0.1-second delays and instantaneous settings. The original M4 also had thicker walls and was consequently heavier, and had stronger springs under the set-back pin and delay arming pin, requiring greater acceleration to arm.

M81, M48A2, or M51

Rockets used in	4.5-inch Spin
Functioning	Instantaneous or 0.05 sec. delay
Over-all length, inches	4.55
Weight, pounds	1.41
Threads	14 N.S.–1

General: The Fuze M81 consists of the Artillery Fuze M48A2 assembled with either the Booster M21A1 or the Booster M24. Depending on where the fuze is assembled, it may be marked M81, M48A2, or M51. Only the 0.05-second delay models of the M48A2 fuzes are loaded in rockets at present.

Description: Much like the Navy's Fuze Mk 29 or Mk 30 in construction, this fuze adds a delay firing train. The choice of instantaneous (super-quick) or delay firing is made on the selector sleeve of the interrupter device—the slot being set parallel to the longitudinal axis of the fuze, or within 15 degrees either side, for super-quick action, and at right angles thereto for delay action.

The interruptor sleeve is thicker on one side than on the other. When set for "Delay," the thick side holds the interruptor in the flash channel, blocking any flash through that tube. When the sleeve is set for "Super-quick," the thin side of the sleeve allows the interruptor to move up into the sleeve by centrifugal stimulus, clearing the flash channel.

The instantaneous action is like that described for the Mk 29. The delay firing train is a separate unit in the base of the fuze. There are two plunger pins or centrifugal detents holding the delay assembly in the unarmed position. When the fuze is armed, there is a firing pin positioned over a primer, which leads to a black-powder delay, and, in turn to a flash pellet.

Operation: No action takes place upon firing until sufficient rotational speed has been established to overcome the resistance of springs and set-back force on the several safety devices. When the fuze is set for super-quick action, after it leaves the muzzle, centrifugal force causes the interruptor to move outward, opening the passage. At the same time, the plunger pins locking the delay assembly in the unarmed position also move outward, releasing that assembly in preparation for impact. The

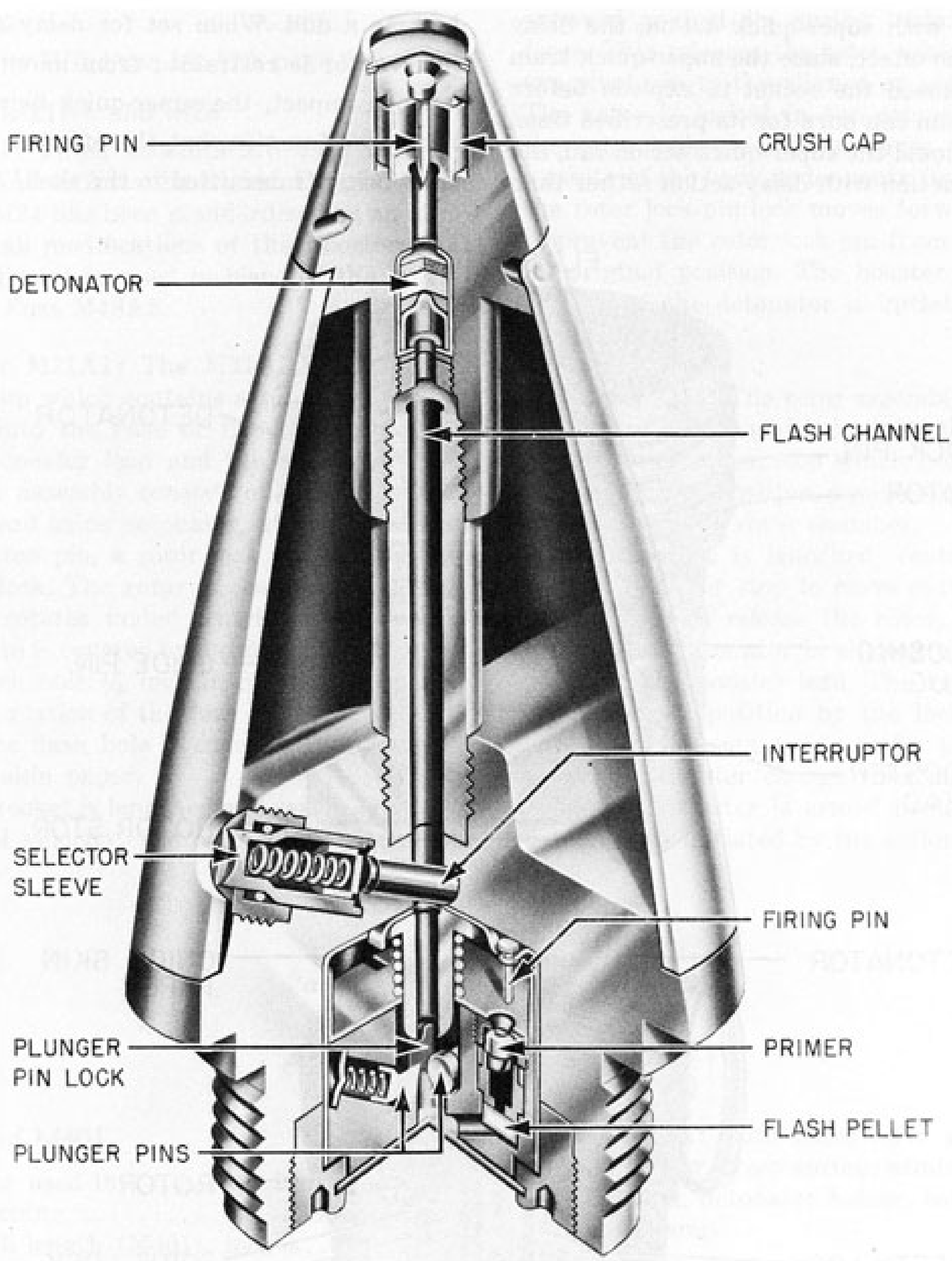


Figure 141. Army Nose Fuze (Rocket) M48A2

plunger-pin lock then swings on its pivot under centrifugal force, placing an arm against the inner end of each plunger pin, preventing the return of the pins to the unarmed position. Upon impact, the firing pin of the super-quick action is driven against the detonator, initiating the super-quick action. Inertia causes the delay-action plunger to move forward, driving the primer against the delay-action firing pin and initiating the delay action. In normal functioning with super-quick action, the delay action has no effect, since the super-quick train will have caused the rocket to explode before the delay train can burn for its prescribed time. However, should the super-quick action fail, the fuze will function with delay action rather than become a dud. When set for delay action, the interruptor is restrained from moving.

Upon impact, the super-quick firing pin and detonator function, but the effect is prevented from being transmitted to the shell.

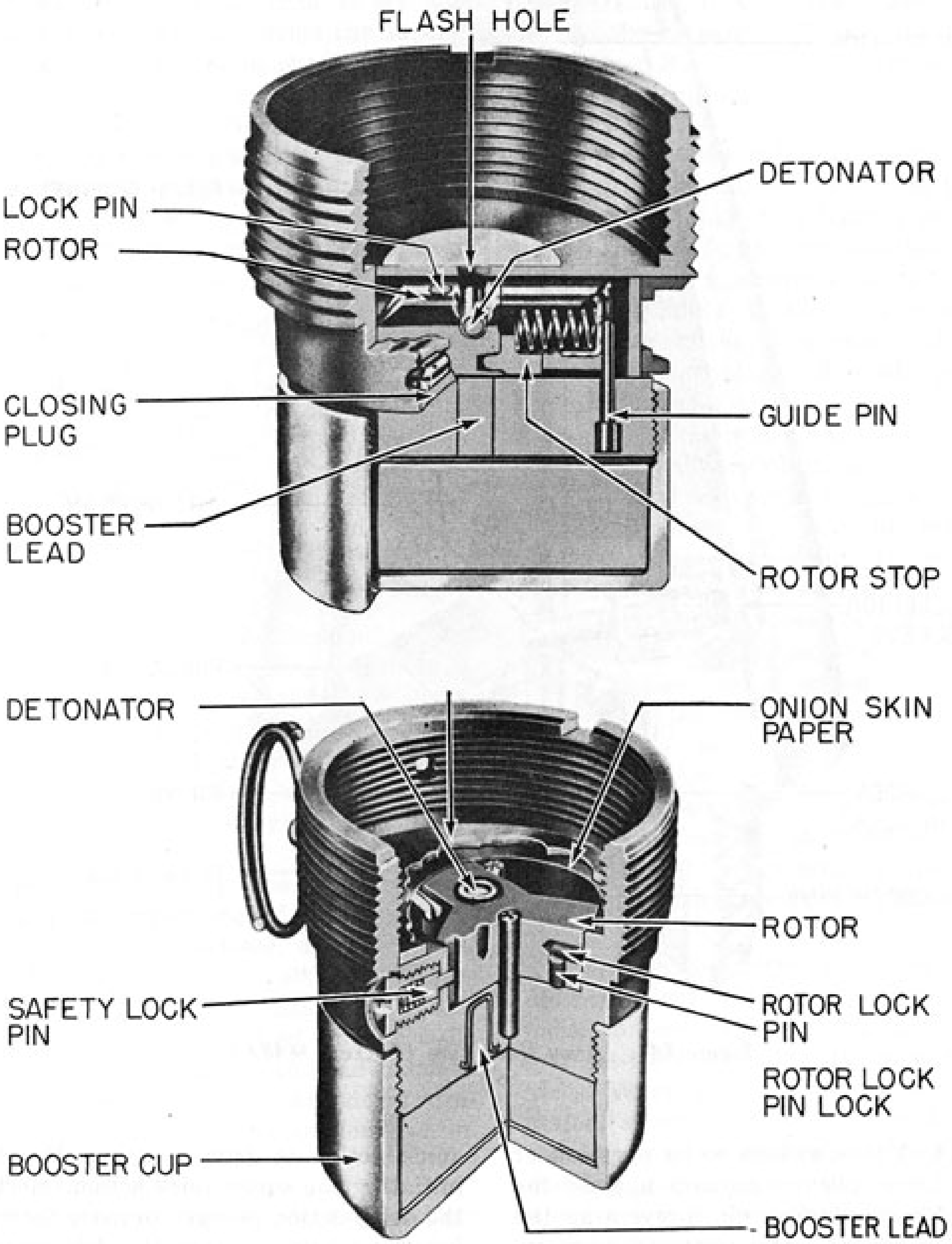


Figure 142. Boosters M24 (above) and M21A1 (below)

V.T. M402

See Navy V.T. Fuze Mk 170, page 209.

Boosters M21A1 and M24

General: These boosters are used with the Fuze M48A2 to form the Rocket Fuse M81. The Booster M24 has been standardized as an alternate for all modifications of the Boosters M21 Type and may be used in place of the M21A1 with the Fuze M48A2.

Booster M21A1: The M21A1 consists of a booster cup which contains a tetryl charge and threads into the base of the body containing a tetryl booster lead and the rotor assembly. The rotor assembly consists of a rotor containing the lead azide detonator, a safety lock pin, a rotor stop pin, a rotor lock pin, and a rotor lock-pin lock. The rotor is seated on the pivot pin and rotates under centrifugal force. The mechanism is covered by a thin brass disc which has a flash hole 1/4 inch in diameter to permit the transmission of the fuze action to the detonator. The flash hole is covered by a thin disc of onion-skin paper.

When rocket is launched and reaches required rotational velocity, the safety lock pin moves outward against its spring under centrifugal force. This releases the rotor, which rotates on the pivot pin to the aligned or armed position. The rotor is locked in the armed position by the rotor lock pin, which moves outward into a cavity of the body under centrifugal force, and the rotor lock-pin lock moves forward by creep to prevent the rotor lock pin from returning to its original position. The booster is armed in flight, and the detonator is initiated by action of the fuze.

Booster M24: The rotor assembly of the M24 consists of a rotor which contains the detonator, a centrifugal rotor stop which holds the rotor in the unarmed position, a guide pin, and a plate which closes the rotor chamber.

When rocket is launched, centrifugal force causes the rotor stop to move outward against the spring and release the rotor, which turns so that the detonator is aligned with the flash hole and the booster lead. The rotor is locked in the armed position by the lock pin, which enters the lock pin cavity as far as the closing plug. The booster charge consists of a tetryl pellet. The booster is armed in flight, and the detonator is initiated by the action of the fuze.

Part 2 — Chapter 6 — Section 3

ARMY BASE FUZES (SERVICE)

M400 and M401

Rockets used in............2.36-inch rounds
Functioning ....Instantaneous
Over-all length (M401), inches..........2.58

General: These fuzes are similar in operation, the differences being in the dimensions and arrangement of the parts. Also, the M400 has a striker guide which is not in the M401. Both these fuzes are considerably safer to handle than the original base fuze in the 2.36-inch rockets, a fuze which had only a safety pin and detonator cover for safety devices.

Description: Both fuzes have a housing, or body, a striker, creep spring, arming pin, slider, slider spring, detonator holder, safety pin, and shipping clamp.

Operation: The shipping clamp can be unlatched and removed when the safety pin is taken out, before loading in the launcher. On set-back, the slider moves back against its spring, which action frees the arming pin from the binding action of the slider. The arming pin is now riding against the inside of the launcher, and, when the round leaves the launcher, the arming pin is shot out by its spring. The firing pin is now held by only the creep spring. On an impact equivalent to a 12-foot drop, it will overcome the spring to strike the detonator.

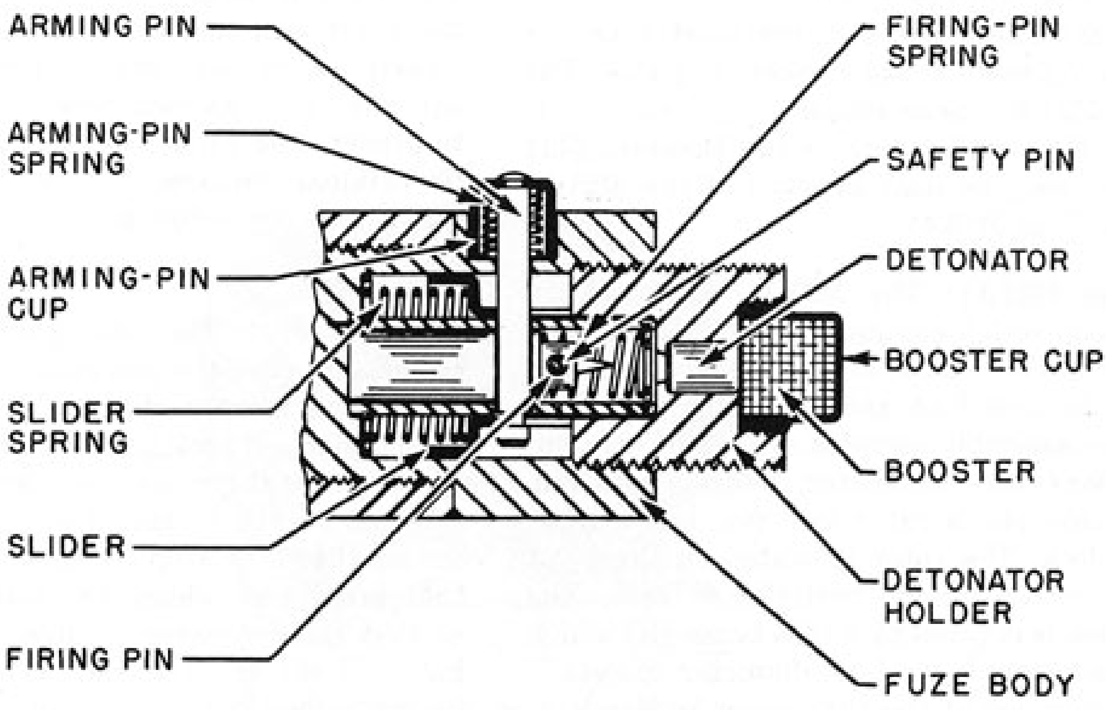


Figure 143. Army Base Fuze (Rocket) M400

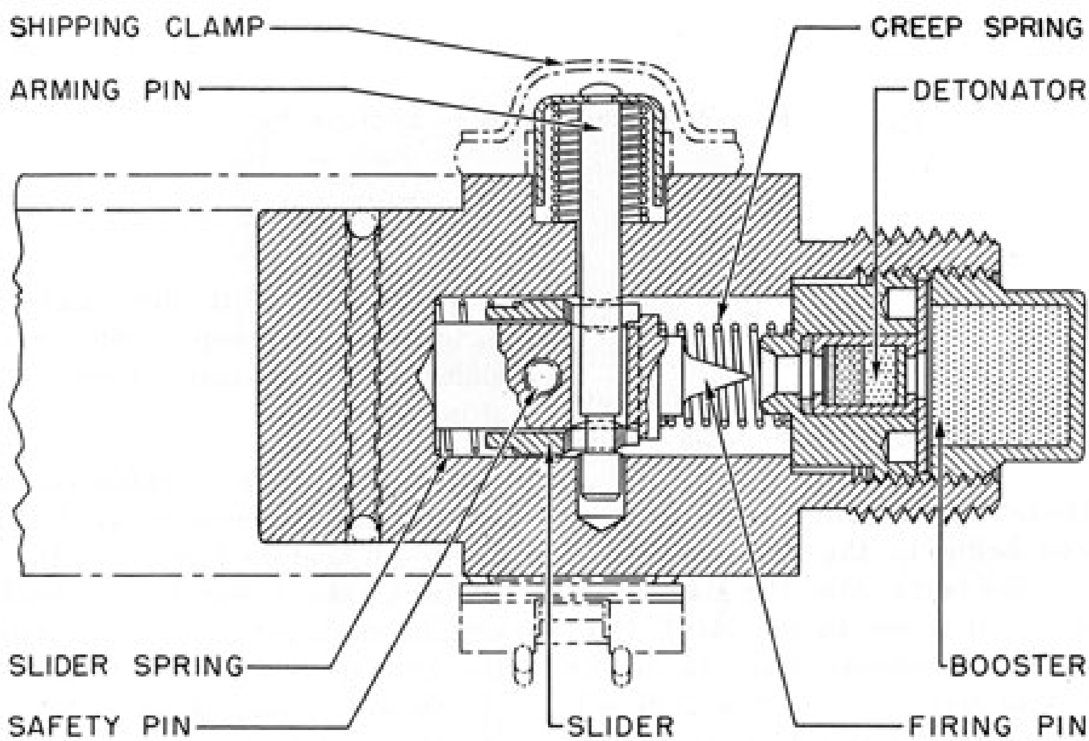


Figure 144. Army Base Fuze (Rocket) M401

ARMY BASE FUZES (EXPERIMENTAL TYPES)

T156

Rockets used in.........4.5-inch S.A.P. T78
Weight, pounds........................1.39
Over-all length, inches..................2.81
Diameter, inches 2.3
Functioning.....0.01-second delay on impact

General: The T156 is a modification of the Artillery Fuze M68, without the tracer and with the retaining spring holding the firing pin block. Also the safety washer is 0.02 inch rather than 0.04 inch thick as in the M68.

Description and operation: The retaining spring, which is slotted and fits around the neck of the firing-pin block, holds the firing-pin block in a safe position, until the spring is removed by the pull ring before affixing the motor to the rocket head. The expansion plug acts to hold the spring in place during shipment.

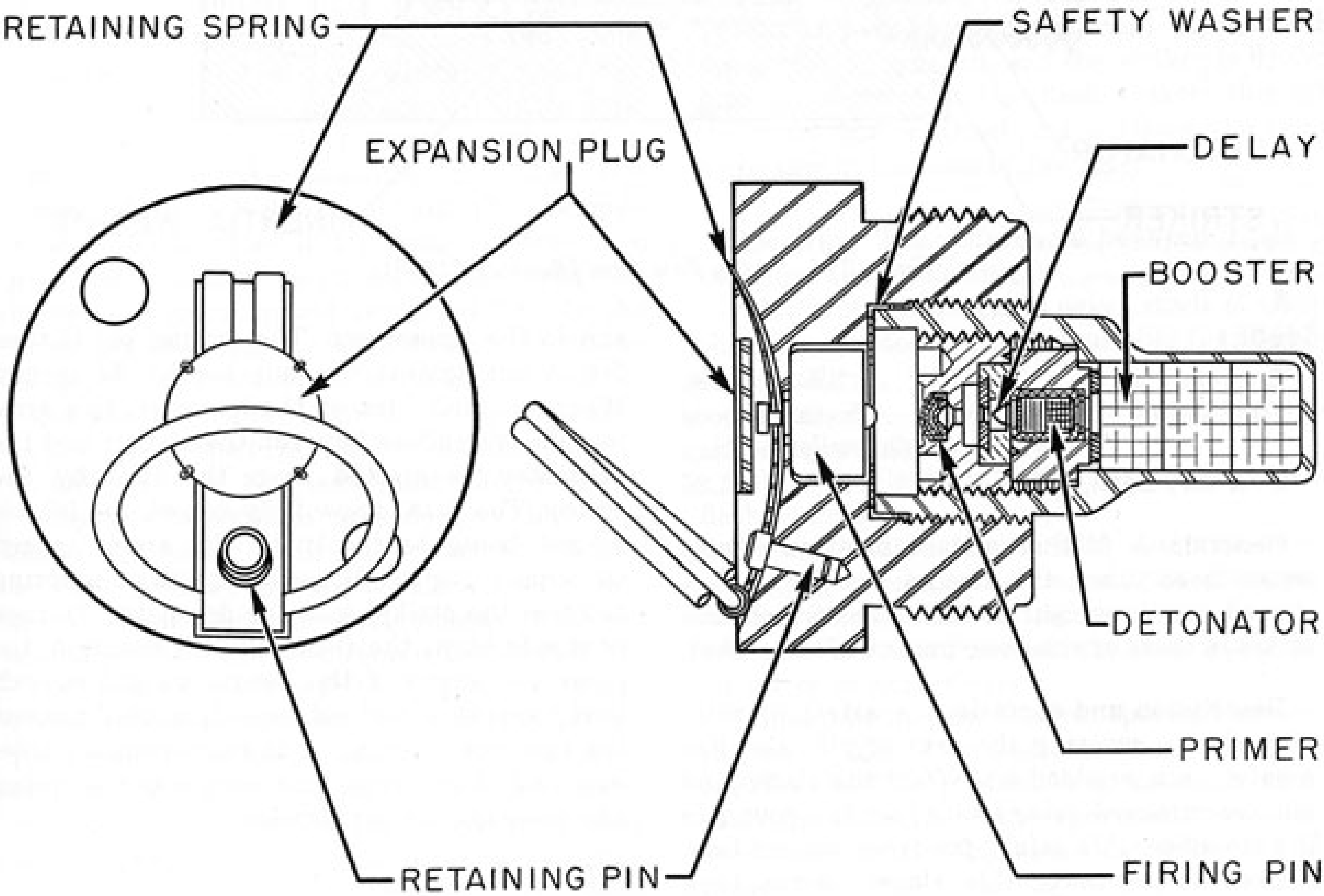


Figure 145. Army Base Fuze (Rocket) T156

On impact of the rocket, the firing-pin block is forced down by inertia on the safety washer, a thin aluminum disc, bending the washer, and striking the primer. The primer sets off the delay pellet (0.01-second) and then the detonator, which, in turn, explodes the booster charge of tetryl.

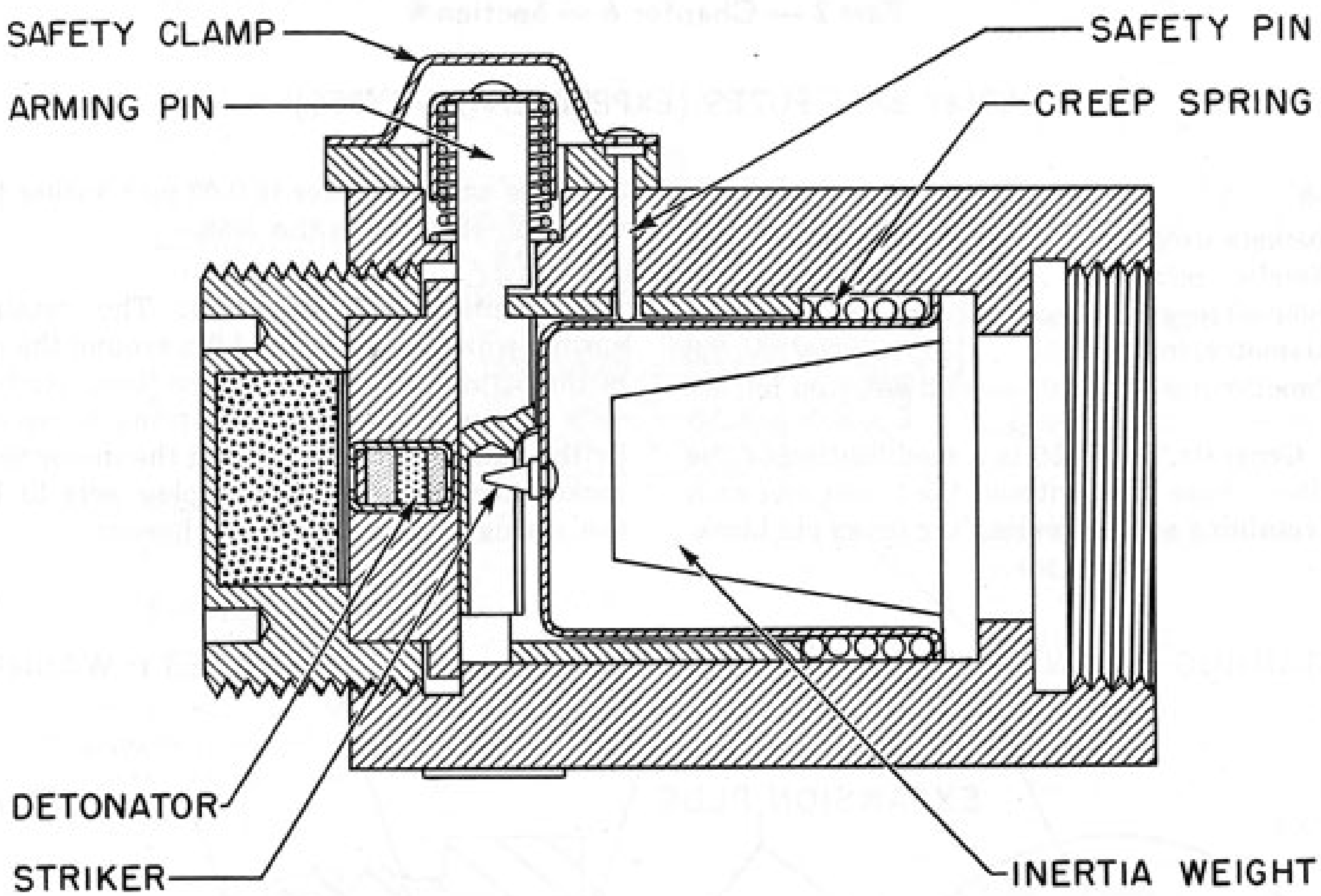


Figure 146. Army Base Fuze (Rocket) T160E1

T160E1

Rockets used in................3.5-inch T80
Functioning ....Instantaneous (All-ways-action)
Over-all length, inches.................3.26

General: A further advancement in simple rocket base fuzes, this design has the wedge-shaped inertia weight to facilitate correct fuze action in cases of side-wise impact of the rocket.

Description and operation: A safety or shipping clamp, covering the arming pin, also has a safety pin bradded on. When the clamp and pin are removed prior to loading the round in the launcher, this safety pin frees the set-back sleeve. On set-back, this sleeve moves back against the creep spring, and comes out of its slot in the arming pin. The arming pin is then forced out against the launcher by its spring. When the round leaves the launcher, this arming pin, which was between the striker and the detonator, is ejected from the fuze by the spring. The fuze is now fully armed, the inertia weight being held only by the creep spring. On impact, the weight moves against the spring to force the striker into the detonator. In case of a side blow, the fuze will still function, because the shape of the inertia weight is such that a side blow will not cause it to bind against the fuze body, but gives it room to move sidewise and at the same time compress the spring and move the striker forward.

T2004 V.T.

See Navy V.T. Fuze Mk 172, page 213.

NAVY NOSE FUZES

Mk 29 Mods 0—3

Rockets used in......5-inch Mk 10 and Mods
Functioning ....Instantaneous
Fuzes found with.....................None
Arming speed, r.p.m...........1,500—2,000
Diameter, inches.......................3.0
Over-all length, inches..................4.15
Weight, pounds..................1.45–0.04

General: The Nose Fuze Mk 29 is used in both projectiles and the 5-inch spin-stabilized rocket. It functions on impact, with no delay.

Description: The fuze consists of four principal parts: (1) the base, which contains the relay detonator and holder and the interruptor unit; (2) the nose or detonator assembly, which contains the striker assembly and the detonator; (3) the plastic ogive; and (4) the flash tube, which is fitted in the center of the ogive and holds the nose and the base together. The firing-pin supporting cup is located beneath the firing pin, holding the striker away from the detonator, and a centrifugal interruptor separates the detonator from the relay detonator in the base of the fuze. Two types of interruptor assemblies have been employed. In the earlier model, the interruptor bore against the upper blade of a forked setting sleeve in the "Delay" or "Off" position and thus could not move into the sleeve and clear the flash channel. Rotating the sleeve 90° in either direction to the "S.Q." or "On" position removed the end of the forked blade from the interruptor, and centrifugal force could move the interruptor into the sleeve and out of the flash channel. The interruptor system of later models has been slightly altered. A cylindrical setting sleeve with an eccentric bore is employed. In the "Delay" or "Off" position, the eccentric bore is not aligned with the interruptor, and the interruptor cannot move into the sleeve and clear the channel. Turning the setting sleeve to the "S.Q." or "On" position aligns the bore with the interruptor, which can then be moved into the sleeve by centrifugal force.

Operation: When the fuzed rocket is loaded into the launcher, the setting key is turned to the "On" or "S.Q." position. When the rocket leaves the gun, centrifugal force moves the interruptor into the sleeve and clears the flash channel. On impact, the closing disc above the striker is forced down, the crush cup beneath the striker is crushed, and the striker is driven into the detonator. The flash travels through the open flash channel and initiates the relay detonator in the base of the fuze.

Remarks: The differences between Mods of this fuze are as follows:

No Mod—Dark green ogive, made of easily chipped asbestos plastic, unsuitable for storage and handling.

Mod 1 — Chip-proof, resin-impregnated cloth, yellow plastic ogive.

Mod 2—Same as Mod 1, with strengthened flash channel.

Mod 3—Like Mod 2, with longer nose cap extending to base and giving additional support to flash channel. Brown plastic ogive.

This fuze will function on thin plate and on water at angles over 6°.

A disc 0.01 inch thick is incorporated between the relay detonator and the flash channel of the Mod 3. This prevents gas pressure, which sometimes leaks past the unarmed interruptor, from setting off the relay detonator, if the nose of the fuze is accidentally struck during handling.

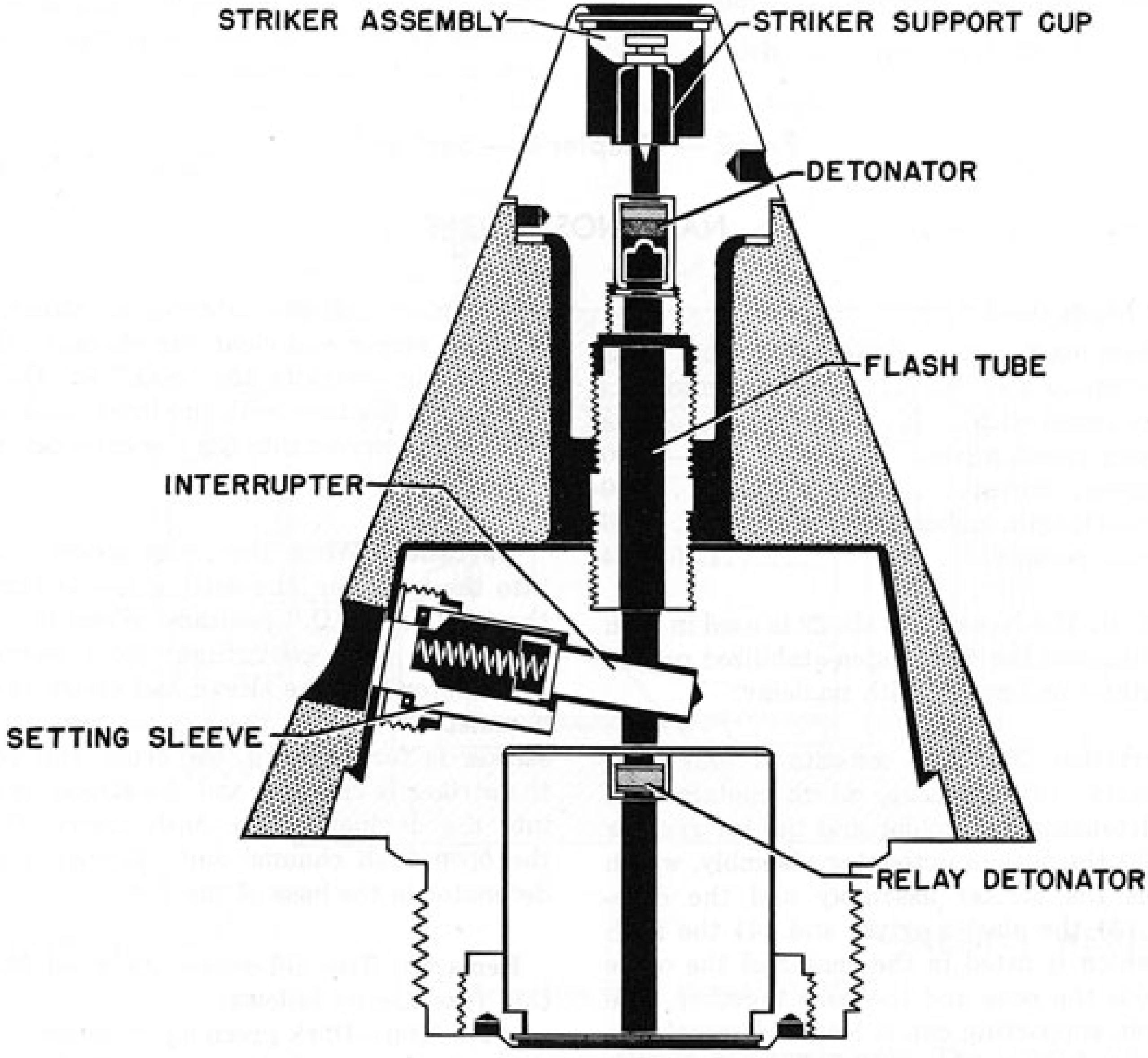


Figure 147. Navy Nose Fuze (Rocket) Mk 29 Type

Mk 30 Mods 3 and 4

Rockets used in........5.0-inch Head Mk 10
Functioning ....Instantaneous
Arming speed, r.p.m..........1,500—2,000
Body diameter, inches................2.4
Over-all length, inches................4.55
Weight, pounds 1.51

General: The Nose Fuze Mk 30 Mod 3 is the point-detonating projectile fuze. It is armed by creep and centrifugal force and used in spin-stabilized rockets. The fuze is designed to function on impact with super-quick action.

Description: The fuze consists of the same principal parts as are in the Mk 29. The fuze is designed for super-quick action on impact. The "Off" setting is a safety feature to prevent premature detonation, and the setting sleeve must be turned to "S.Q." or "On" before the rocket is launched. When the rocket is launched, the interruptor moves outward by creep and centrifugal force to compress the spring and open the flash tube. On impact, the gilded metal cap collapses and the striker is driven into the detonator, the flash of which initiates the relay detonator and the main charge.

Mod 4: Because of inability to procure sufficient plastic ogives for the Point-Detonating Fuze Mk 30 Mod 3, it was necessary to use quantities of steel ogives. These fuzes with steel ogives, designated as Nose Fuzes Mk 30 Mod 4, will be restricted to rockets.

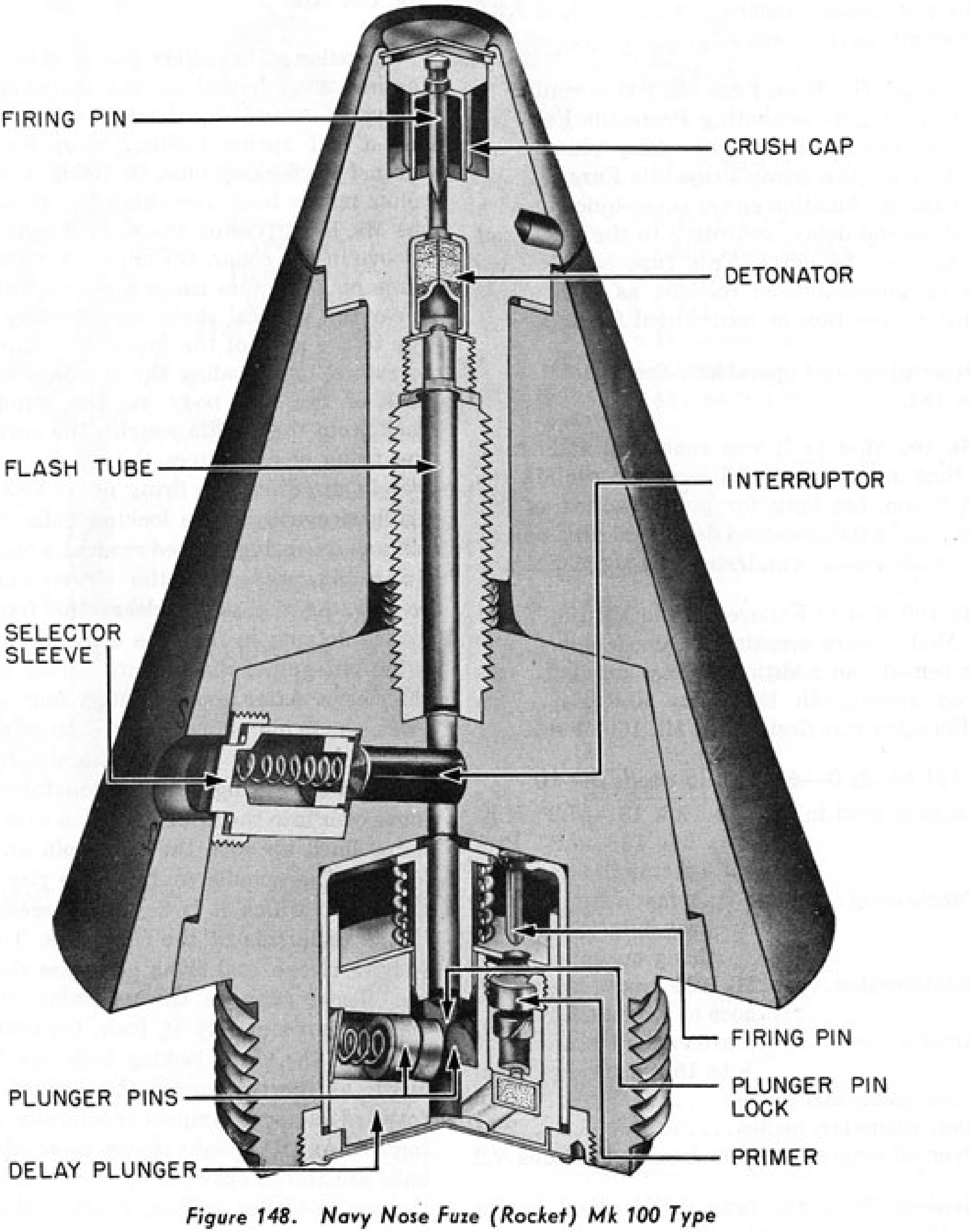


Figure 148. Navy Nose Fuze (Rocket) Mk 100 Type

Mk 100 Mods 0—2

Rockets used in . . . . 5.0-inch Mk 7 S.S.
Functioning . . . . Instantaneous or 0.05-second delay
Arming speed, r.p.m. 1,500-2,000
Body diameter, inches 3.0
Over-all length, inches 4.15

General: The Nose Fuze Mk 100 is similar to the Navy Point-Detonating Projectile Fuze Mk 29, with the addition of the delay plunger assembly from the Army Projectile Fuze M48A2. The fuze can function either super-quick or with a 0.05-second delay, according to the setting of the key on the ogive. This fuze can be used only in spin-stabilized rockets, as the fuze is armed by rotation or centrifugal force.

Description and operation: See Fuze M48A2, page 184.

Mk 100 Mod 1: It was concluded after testing that the delay of 0.05 second in the Mk 100 Mod 0 was too long for proper action of the round, and a 0.025-second delay was substituted. This modification was designated Mk 100 Mod 1.

Mk 100 Mod 2: Failures of the Mk 100 Mod 0 and Mod 1 were occasionally encountered, and as a remedy an additional relay detonator was placed underneath the delay assembly. This modification was designated Mk 100 Mod 2.

Mk 131 Mods 0—6, Mk 136 Mods 0—10

Rockets used in . . . . Mk 131—7.2″ H.E.
Mk 136—7.2″ Projector Charge
Functioning . . . . Arms during water travel, instantaneous firing on impact
Identification . . . . . . Mk 131 has red paint on nose of vane hub
Arming Time . . . . . . 4 to 5 vane revolutions, or 8 to 15 feet water travel
Vane span, inches 3.125
Body diameter, inches 2.25
Over-all length (without booster), inches . 7.2

General: These two fuzes are identical, except that the Nose Fuze Mk 136 has a shear wire through the set-back collar. Both fuzes were to be replaced by the Nose Fuze Mk 140; however, this fuze is being recalled from the field. The Nose Fuze Mk 131 has been replaced by the Mk 156 and the Mk 136 has been replaced by the Mk 158 Mod 0.

Operation: The safety pin is removed when the rocket is loaded on the launcher, leaving the vanes secured by the set-back collar, which has a leaf spring holding it up by pressure against the locking pins. On firing, the set-back collar moves back (breaking the shear wire in the Mk 136), freeing the locking pins from the groove in the collar. On impact with water, the force on the vanes cause a torque sufficient to shear the vertical shear wire holding the vane cup to the neck of the fuze. The vanes are free to rotate, unthreading the spindle through the neck of the fuze body. As the spindle draws back from the inertia weight, the spring under the firing sleeve forces the sleeve and inertia weight up. Since the firing pin is locked to the firing sleeve by three locking balls, the firing pin and its spring, cocked against a collar on the firing pin, rise with the sleeve and inertia weight. As the sleeve clears the four spring-loaded detents in the fuze body just above the firing-pin guide, the detents spring out under the sleeve. After approximately four vane rotations, the firing pin will have been raised by the sleeve sufficiently to clear the shutter cavity, allowing the spring-loaded detonator shutter to move over into the armed position with the detonator lined up with the firing pin and booster lead-in. The spindle continues to rise until the washer to which it is keyed engages a groove in the underside of the fuze neck. The inertia weight, sleeve, and firing pin cease rising when the sleeve engages the retaining ring after rising approximately 1/4 inch. On contact with a target, the three locking balls are forced inward, as inertia causes the weight to move forward on normal impact or laterally on oblique impact. As the weight moves clear, the locking balls are forced outward by the beveled edge of the spring-loaded striker, which is then free to be driven into the detonator.

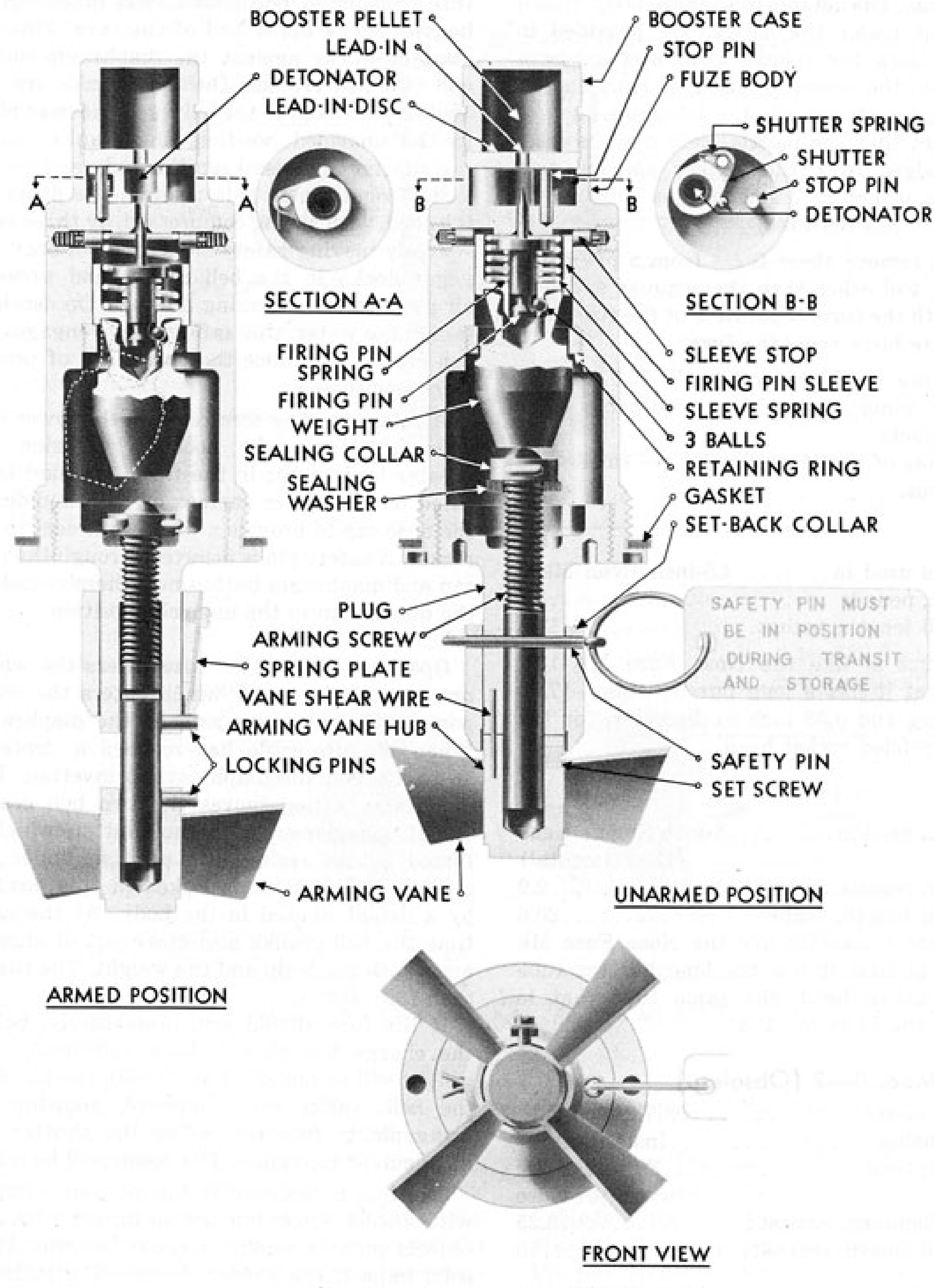


Figure 149. Navy Nose Fuze (Rocket) Mk 131 Type

Remarks: The detents in the fuze body, which spring out under the sleeve, are provided in order to allow the spindle to be screwed back down from the armed position without danger of forcing the striker into the detonator. In view of the fact that the inertia piece may be insecurely lodged over the striker spindle, this procedure is not recommended on any rocket that has once been fired.

Do not remove these fuzes from a projectile with any tool other than the spanner which is issued with the fuze. Separation of the two parts of the fuze body arms the fuze.

Difference in Mods for the Mk 131 and Mk 136 were minor distinctions, some being separate contracts.

Some lots of the Mk 136 will have small-vane shear wires.

Mk 132

Rockets used in........4.5-inch Head Mk 9
Weight, pounds 1.1
Over-all length, inches................19.5

This fuze is like the Nose Fuze Mk 137, except that it has a long burster tube—17.20 inches long and 0.38 inch in diameter, for the incendiary-filled rocket head.

Mk 133

Rockets used in.........5-inch Smoke Head (Experimental)
Weight, pounds 2.9
Over-all length, inches................20.6

The fuze is exactly like the Nose Fuze Mk 149, except that it has the long burster tube for the smoke head, the same tube that is found on the Fuze Mk 132.

Mk 135 Mods 0—2 (Obsolete)

Rocket used in................7.2-inch H.E.
Functioning ....Instantaneous
Arming time ....30 feet static water pressure
Body diameter, inches.................3.25
Over-all length, inches...................5

General: The fuze consists of a nose cap with two water ports which is screwed on the upper fuze housing. A phosphor-bronze diaphragm is housed in the upper end of the fuze. This diaphragm works against the diaphragm button and two bell cranks. The bell cranks are pivoted on pins fixed to the halves of the nose plate. In the unarmed position, the cranks engage the shutter and also keep the body and weight locked together. In this position the firing pin is locked, with spring compressed, by three balls. A freely moving safety sleeve, on set-back, engages hooks in the bell cranks and prevents air pressure from arming the fuze. On deceleration in the water, this safety sleeve engages the bell cranks to reduce the possibility of premature functioning.

A retaining ring screwed into the lower fuze housing secures the booster magazine and booster lead-in disc in the fuze. A gasket is located on the under surface of the shoulder of the nose cap to provide a watertight seat in the rocket. A safety pin is inserted through the nose cap and diaphragm button nut, thereby locking the diaphragm in the unarmed position.

Operation: When the fuze enters the water, pressure of the water which enters the water ports in the nose cap acts on the diaphragm. When the projectile has reached a depth of 15 to 20 feet, the diaphragm is inverted. This diaphragm action moves the two bell cranks out of engagement with the shutter, which is forced by its spring into position under the striker. The shutter is locked in this position by a detent housed in the body. At the same time the bell cranks also move out of engagement with the body and the weight. The fuze is then fully armed.

If the fuze should arm prematurely, before the charge has slowed down sufficiently, the weight will be pulled off by its own inertia when the bell cranks move outward, allowing the firing pin to function before the shutter will have moved into place. The result will be a dud.

The fuze is designed to function upon impact with a solid object but not on impact with soft objects such as muddy or sandy bottoms. Upon solid impact, the sudden deceleration pulls the weight forward, forcing the three balls inward. This frees the weight, allowing it to fall out of

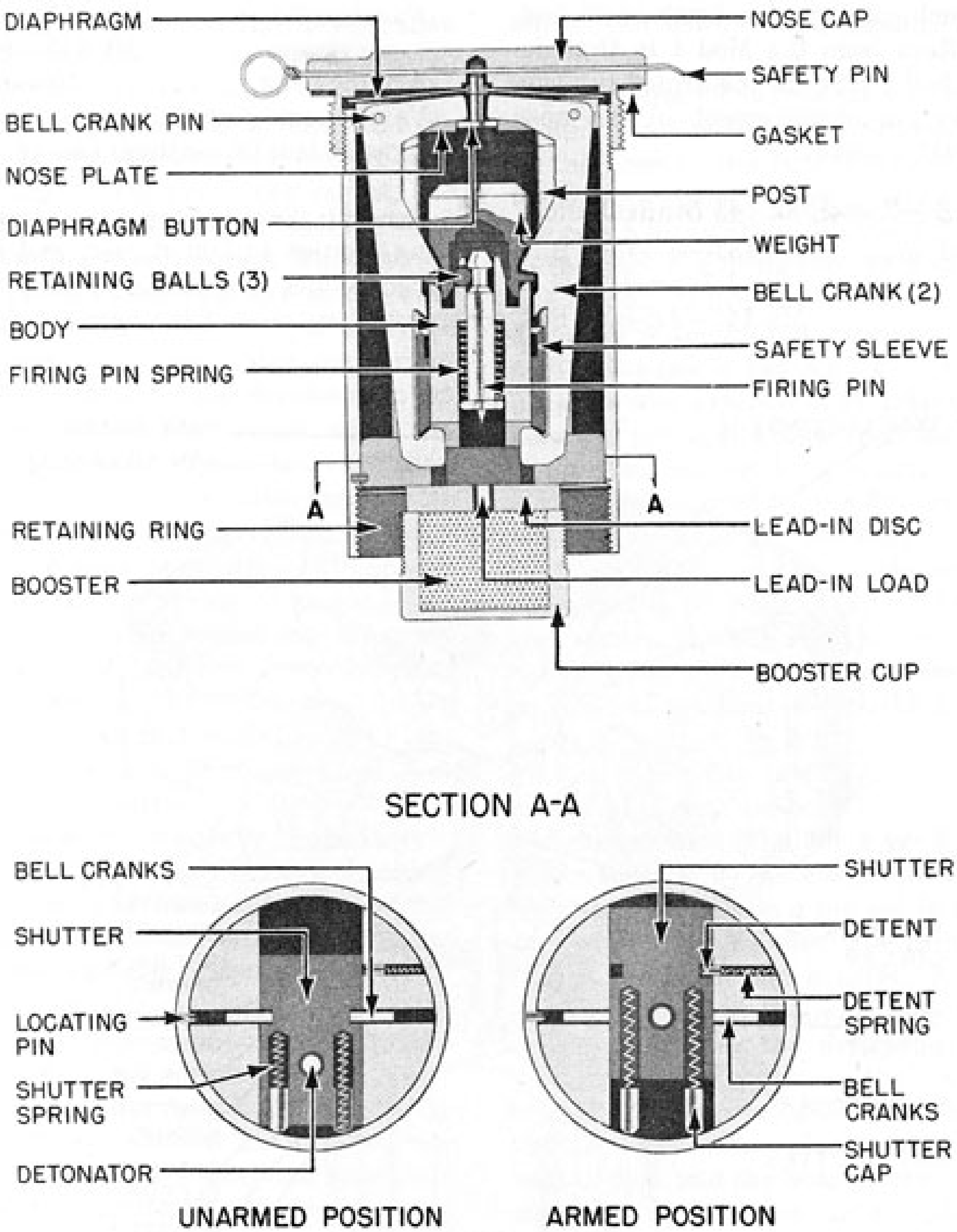


Figure 150. Navy Nose Fuze (Rocket) Mk 135 Type

its engagement with the body. The three balls are then ejected by the force of the firing pin working against its compressed firing-pin spring. The firing pin is now free to be forced by its spring against the detonator, thus actuating the fuze. A glancing blow causes the weight to pivot about a point on the edge, where it is supported against the body and releases the three balls. The sensitivity to forward and sidewise impact is about equal.

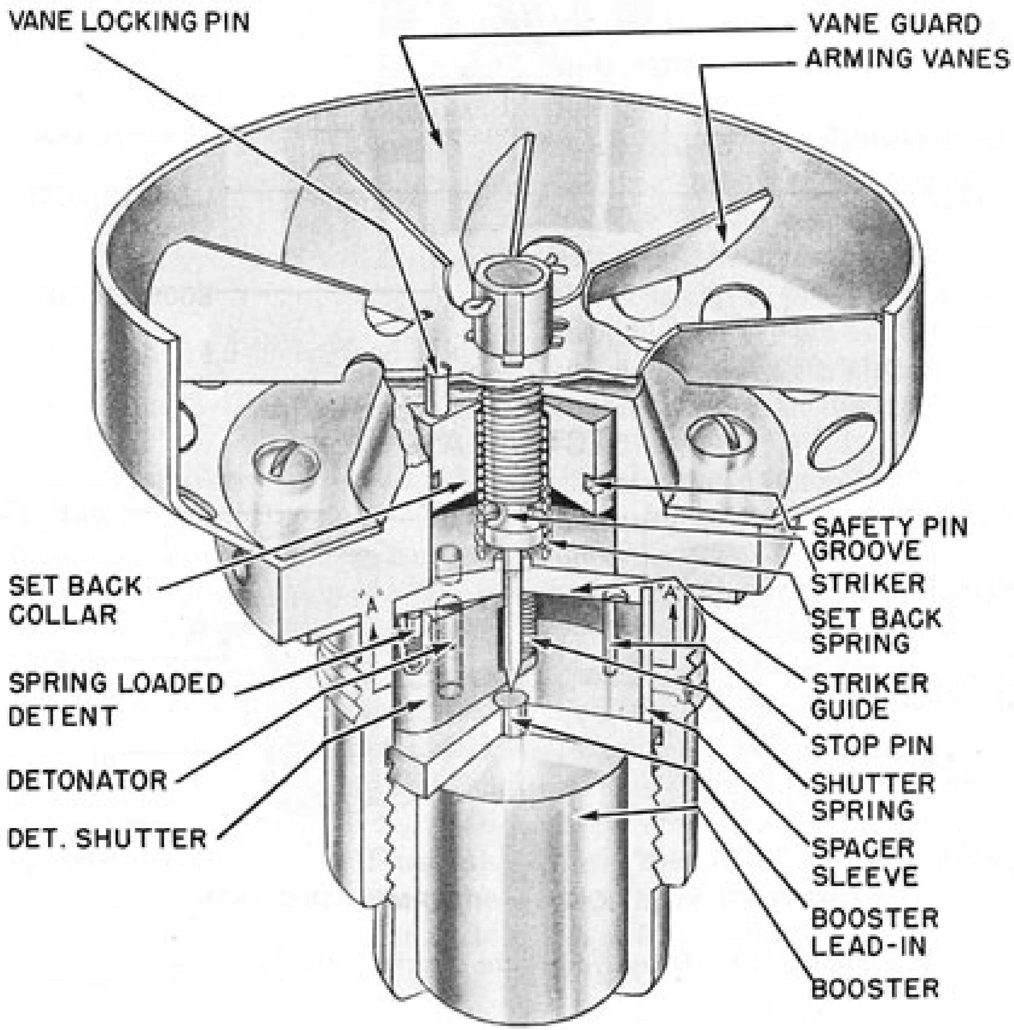
Remarks: The fuze will function under water on angles of impact up to 75°.

Mods 1 and 2 of this fuze are similar to the Mk 135 Mod 0 in general design, except that the sensitivity has been about doubled, and the static pressure to arm has been increased to a head of approximately 50 feet. The fuzes, when fired from launchers, arm at a depth of 20 feet. The Mod 2 differs from the Mod 1 in that detents lock the bell cranks in the armed position and the safety pin arrangement in the nose has been slightly altered.

Mk 137 Mods 0—2 and Mk 145 Mods 0 and 1

Rockets used in......Mk 137—4.5-inch B.R. and 7.2-inch D.R.
Mk 145—4.5-inch B.R.
Functioning ....Mk 137—Instantaneous
Mk 145—0.02-sec. delay
Arming time............10 vane revolutions
Vane guard diameter, inches...........2¾
Over-all length (without booster), inches.2½

General: These fuzes fire upon water impact for velocities of 300 ft./sec. and more, and at impact angles as small as 15° to 20°. They probably will not arm if the burning time is shorter



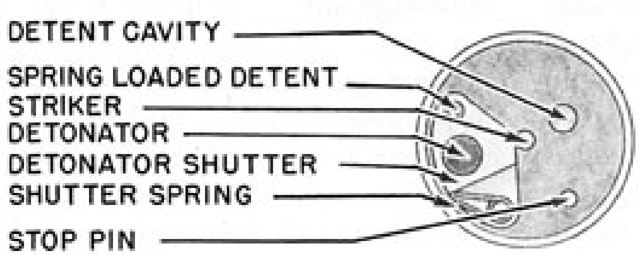


Figure 151. Navy Nose Fuze (Rocket) Mk 137 Type

than 0.2 second, or the velocity is less than 300 ft./sec.

Operation: When the rocket is loaded on the launcher, the safety pin securing the set-back collar is withdrawn. On firing the rocket, the set-back collar is forced back by inertia, compressing the set-back spring and withdrawing the vane locking pin from the hole in the vane boss. The vanes rotate freely, and after three to four rotations have unthreaded the striker spindle sufficiently that, when deceleration occurs, the vane locking pin cannot again engage the vane boss. After about ten vane rotations, the striker spindle is unthreaded sufficiently to free the detonator shutter, which is forced across the shutter cavity by its spring. It is stopped by the stop pin and is locked in the armed position by a spring-loaded detent housed in the shutter, which slips into a recess in the striker guide. When the striker has reached the end of its threads, it rotates freely with the vanes as the striker spindle collar rides in a groove in the underside of the fuze body. On impact, the threads on the fuze body are sheared as the striker is forced into the detonator.

The Mk 137 Mod 1 resembles the Mk 137, but has ten blades on the arming vanes as compared to eight, and also has a split spacer sleeve.

The Mk 137 Mod 2 is similar to the Mk 154 Mod 3. A modified vane lock-pin seat prevents premature arming.

The Mk 145 is similar to the Mk 137 but incorporates a 0.02-second delay in the detonator.

The Mk 145 Mod 1 has a modified vane lock-pin seat preventing premature arming.

Mk 139 (Obsolete)

Rockets used in	7.2-inch and H.E.
Functioning	Instantaneous
Arming time	About ¾ sec. after launching
Body diameter, inches	2.5
Over-all length, inches	4.25

General: This fuze was designed for antisubmarine warfare and was used in rockets projected both from airplanes and from small patrol craft. The fuze functions on impact with a hard object, but not on water impact.

Description: The fuze body encloses the functioning mechanism. A waterproof cap is affixed to the nose of the fuze and is held in position by two bands locked by a safety pin. Beneath the cap, a firing wheel is attached by a setscrew to the end of a firing pin. This wheel is formed like a cross to present less surface and prevent firing on water impact. The slide stop pin, riveted to the cap, engages a leg of the firing wheel. This pin also extends down into the nose plate, where it prevents a slide from moving outward. A flywheel and set-back collar, separated by a spring and secured by the flywheel screw, form a subassembly. This assembly is placed on the shaft of the firing pin. A pin set in the slide engages the set-back collar in order to prevent its rotation. A clock spring, secured on one end to the flywheel and on the other end to a pin on the closure disc, is assembled under tension so as to impart its force to the flywheel. The pin to which the clock spring is attached is anchored to the fuze body to prevent rotation of the closure disc. The firing pin is screwed into shear threads in the closure disc. A detonator shutter is affixed on a pin set in the lower surface of the closure disc. The firing pin extends into a cavity in the shutter. A tightly fitted spacer ring set in the body maintains a spring detent housed in the detonator shutter. This ring, interposed between the closure disc and lead-in disc, provides free movement of the shutter. The lead-in charge is contained in the lead-in disc, and the booster charge in a booster magazine which screws into the fuze body.

Operation: When the arming wire is withdrawn as the rocket is launched, the clamps are unlocked and forced off by the clamp spring. The waterproof cap flies off by the action of its compressed springs. Set-back causes the set-back collar to move back against its spring. This movement releases the slide pin in the nose cap, permitting the flywheel assembly to be rotated by the force of the clock spring. This rotation is transmitted to the firing pin, causing it to screw outward, thereby withdrawing the firing pin from engagement with the detonator shutter, which is forced by its spring into alignment with the firing pin. Once the shutter moves into the armed position, it is locked by a spring-loaded detent.

On impact of the firing wheel with a solid object, the firing pin is driven backward and shears the shear threads of the closure disc. It then pierces the detonator, setting off the explosive train.

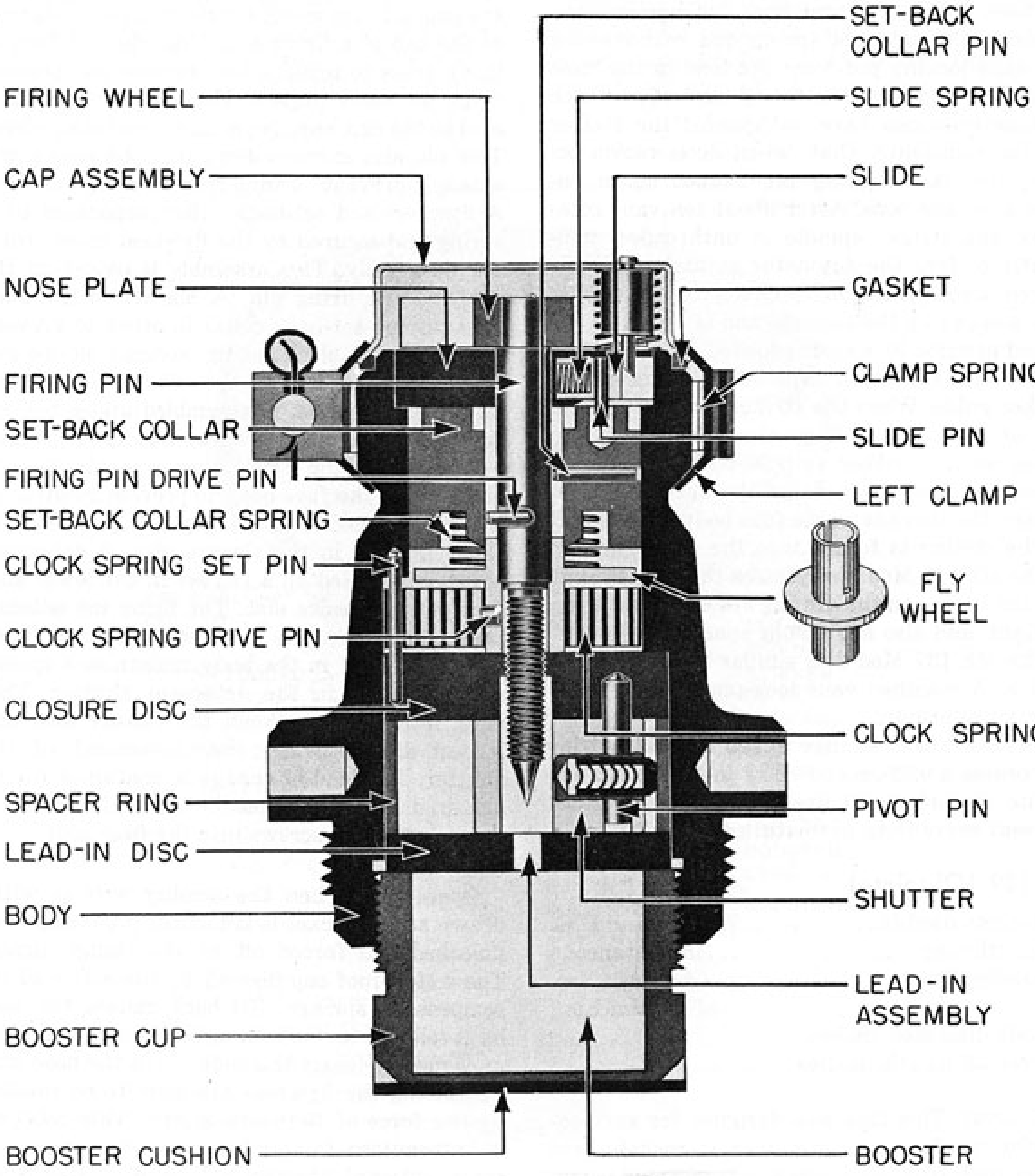


Figure 152. Navy Nose Fuze (Rocket) Mk 139

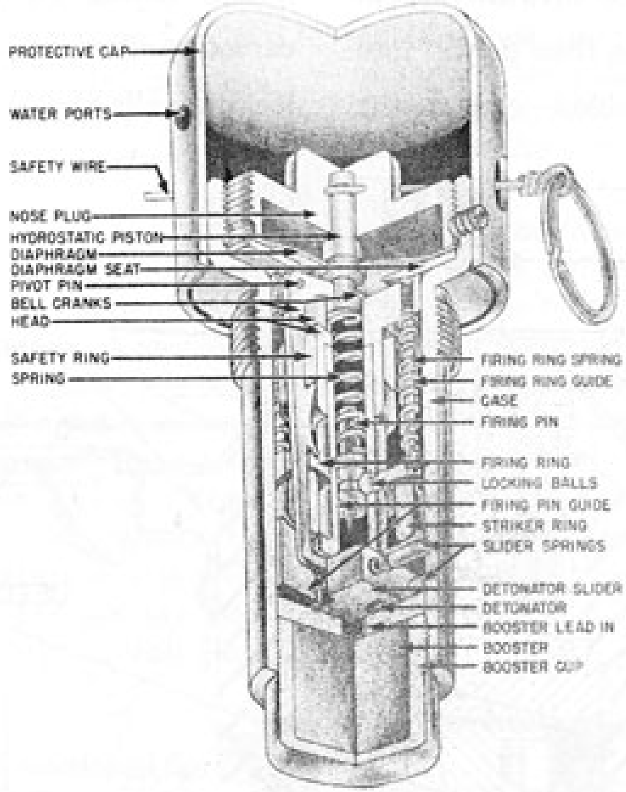


Figure 153. *Navy Nose Fuze (Rocket) Mk 140*

Mk 140 (Recalled)

Rockets used in..........7.2-inch Mousetrap and Hedgehog
Functioning ....Instantaneous
Arming time ....Static pressure of approximately 30 feet of water
Body diameter, inches..................2.7
Over-all length, inches.................4.5

General: This fuze was developed and issued to replace the Nose Fuzes Mks 131 and 136 in the 7.2-inch Mousetrap and Hedgehog. It arms by hydrostatic pressure and has safety features which prevent it from firing either on set-back or on impact with the water. Its sidewise sensitivity is 1/6 to 1/4 of the nose sensitivity, and a glancing blow permits the fuze to function. Orders have been issued that this fuze is not to be used, and it will be recalled. The fuze can be used by blimps in 7.2-inch heads with the inert motor, when dropped as bombs.

Operation: When the rocket is fired, the arming wire is pulled. On set-back, the safety ring is forced down over the upper hooks on the two bell cranks, preventing them from spreading out and releasing the detonator slider. On impact with the water, the firing ring slips down a slight amount and engages the lower hooks on the bell cranks, thus preventing the bell cranks from spreading to release the detonator slider on water impact; the hooks on the crank also prevent the firing ring from dropping free of the locking balls. As the rocket travels through the water, water enters the ports in the protective cap and through the holes in the nose plug which formerly received the arming wire. After reaching a depth of from 8 to 15 feet, the pressure of the water will invert the phosphor-bronze diaphragm, which presses down on the inner ends of the bell cranks. Since the bell cranks are pivoted about pivot pins, they swing clear of the detonator slider, which is forced over to the armed position by two springs, and locked there by a spring-loader detent. On impact with a hard surface, the firing ring is forced by inertia against its two firing-ring springs, which are coiled around two guide pins. This action of the firing ring frees the locking balls, which are forced outward by the spring-loaded striker, which is then driven into the detonator. A glancing blow causes the loosely fitting striker ring to move sidewise, camming the firing ring forward, releasing the locking balls and firing the fuze.

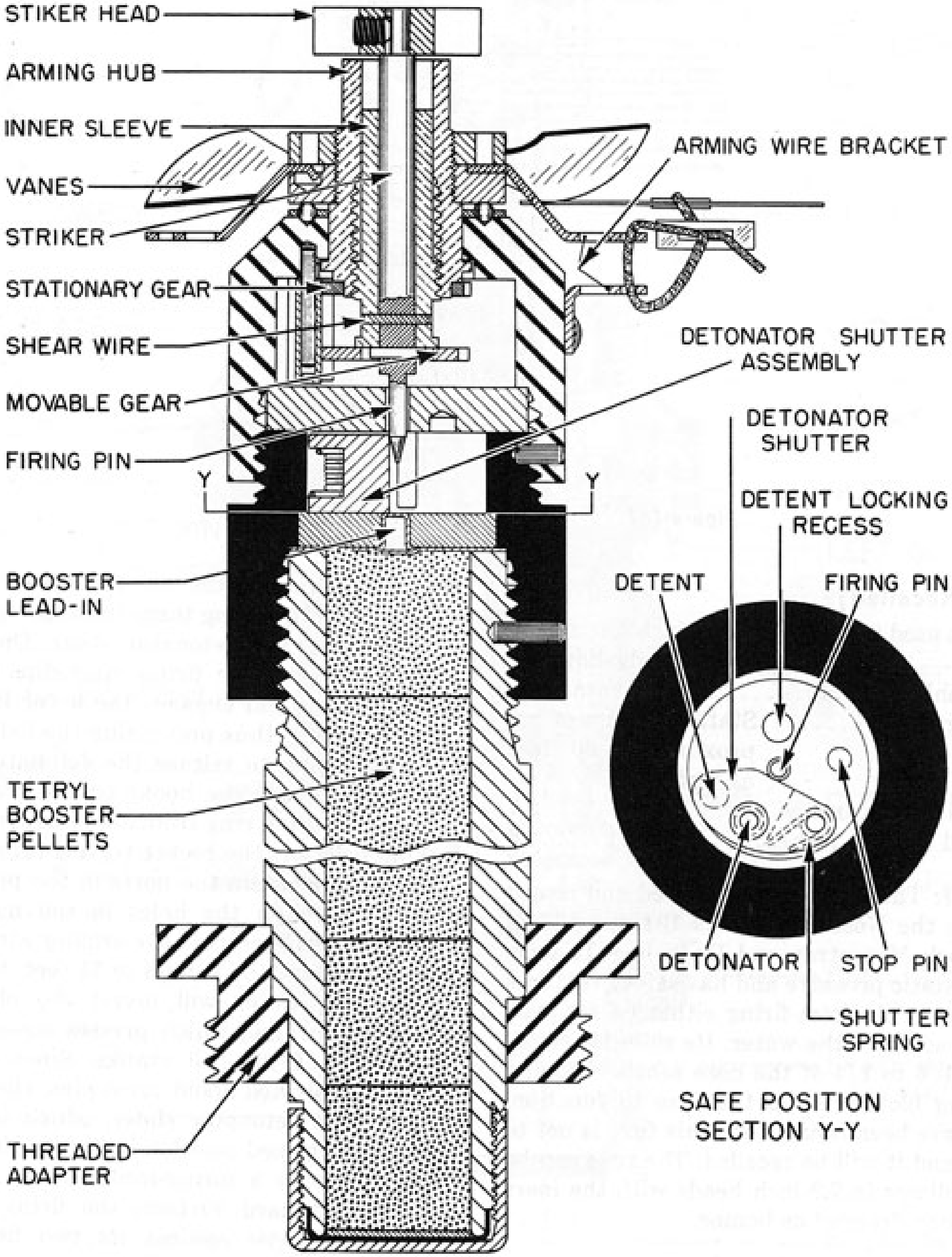


Figure 154. Navy Nose Fuze (Rocket) Mk 141 Mod 0

Mk 141 Mod 0

Rockets used in	7.2-inch D.R.
Functioning	Instantaneous
Arming time	90—130 vane revolutions
Body diameter, inches	1.75
Over-all length, inches	8.5

General: The Nose Fuze Mk 141 Mod 0 is issued to amphibious groups for use in destroying beach obstacles. 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. The water-discriminating feature is obtained by use of a copper shear wire. The Mk 141 Mod 0 will replace the Mk 152 in the 7.2-inch Demolition Rocket, Head Mk 5.

Description: The fuze was developed from the Bomb Nose Fuze AN–M110A1 and retains the upper body and gear-reduction system used in that fuze. To obtain detonator safety, a pivoted detonator shutter has been added below the firing pin. The shutter is held in the safe position by the firing pin, and, when the fuze is armed, the shutter is locked in position by a spring-loaded detent. The safety block of the bomb fuze has been replaced by the arming hub, an integral extension of the stationary gear which locates the cross-shaped striker head in the safe position. The movable gear in the Mk 141 Mod 0 acts to thread the striker assembly forward and out of the fuze body, thus withdrawing the firing pin from the detonator shutter slideway, releasing the shutter to move into the armed position, and moving the striker head away from the arming hub. The striker and firing pin are mounted, by a copper shear wire, in the inner sleeve which forms the threaded hub of the movable gear. The arming wire bracket of the bomb fuze has been retained and, in shipment, a safety wire ties the vanes to this bracket. To insure proper air flow past the fuze vanes, an elongated booster chamber has been added to the fuze. This cavity, loaded with tetryl increments, extends the tip of the fuze six inches beyond the rocket head. At the lower end of the booster chamber a threaded adapter has been fixed to adapt the 1½-inch diameter fuze to the 2-inch diameter fuze pocket. Two Auxiliary Boosters Mk 1 Mod 0 are required in the fuze pocket.

Operation: When the rocket is fired, the arming wire is pulled, and the vanes are free to rotate. The rotation of the vanes acts through the reduction gears to thread the inner sleeve up in the arming hub and thereby withdraw the firing pin from the detonator shutter. The shutter is forced across the shutter cavity by its spring and is locked in the armed position by the spring-loaded detent. On impact, the striker is driven down, shearing the copper shear wire, and fires the detonator, booster lead-in, and booster.

Mk 147 Mod 1 and Mk 148

	Mk 148
Rockets used in	3.5-inch Heads Mks 3, 5, and 9 5.0-inch Head Mk 1
Functioning	Instantaneous
Arming time	8 vane revolutions
Vane span, inches	1½
Body diameter, inches	1¾
Over-all length (without booster), inches	2¼

General: The Nose Fuze Mk 148 is similar to the Mk 137, but has smaller vanes, and, instead of a vane guard, is shipped with a protective cap which is removed when the rocket is loaded on the plane. It fires at impact angles as low as 5° and 10° for water or land targets, allowing slight penetration. On hard targets, it fires at impact angles not less than 20° to 25°.

Operation: The weather cap is removed when the rocket is loaded on the launcher. After the rocket is loaded on the launcher, the safety wire is withdrawn and the arming wire is installed through the arming-wire guide. Two Fahnestock clips secure the arming wire. When the propellant is ignited, the forward motion of the rocket pulls the arming wire free and the force of inertia causes the set-back block to set back against the set-back spring. Since the vane lock-

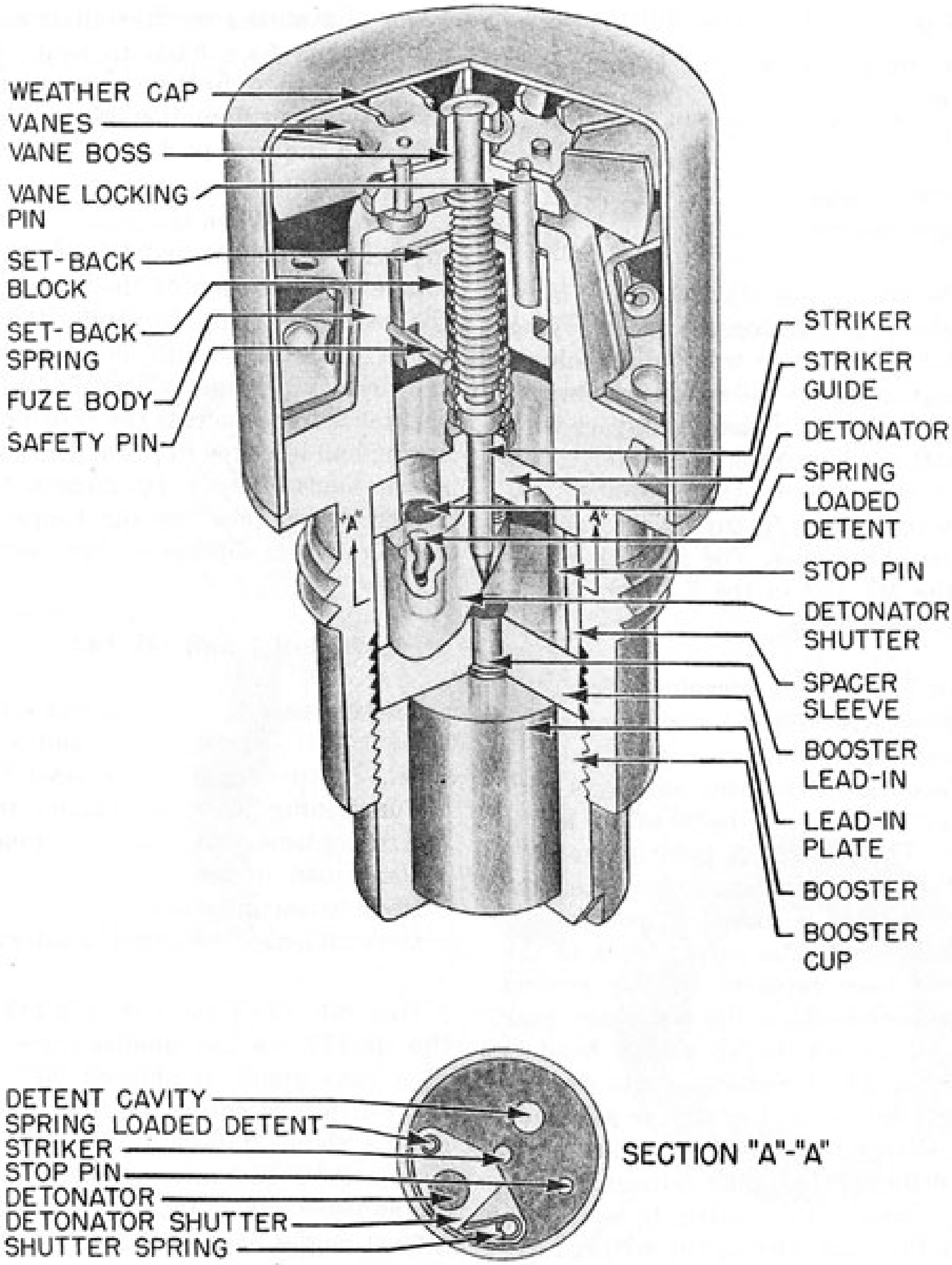


Figure 155. Navy Nose Fuze (Rocket) Mk 148

ing pin is positively attached to the set-back block, it is thus withdrawn to a position flush with or below the top of the fuze body. This frees the vanes to rotate, unscrewing the striker as they rotate. The vanes must make from three to four rotations during acceleration to unscrew the striker sufficiently to prevent re-engagement of the vane locking pin as the set-back spring gradually forces the set-back block and locking pin up. After eight or nine rotations of the vanes, the striker will have unthreaded sufficiently to free the spring-loaded detonator shutter. The latter is then rotated by the shutter spring into the armed position, where it is stopped by the stop pin, lining the detonator up with the striker and booster lead-in. As the shutter reaches the armed position, a spring-loaded detent carried in the shutter is forced into a recess in the striker guide, locking the shutter in the armed position. After an additional rotation or two, the end of the threads on the striker spindle is reached, and the vanes rotate freely as the collar at the end of the threads rides in a groove in the fuze body. On impact, the striker is forced in, shearing the threads in the nose of the fuze body, and is driven into the lead azide detonator.

Mk 147 Mod 0: This fuze is used in the 7.2-inch chemical warfare rocket and is similar to the Mk 148, except that it has no arming wire guide like the Mk 148, and no booster. Instead of the booster, there is an adapter which receives a burster tube to break open the rocket and eject the chemical filler. The fuze has a vane guard which consists of a cylindrical tube open at the top, with perforations around the tube just above the top of the fuze body.

Mk 147 Mod 1: This fuze is identical to the Mod 0, with the exception of the vane guard, which has been replaced on the Mod 1 by a protective cap.

Mk 149 and Mk 155

	Mk 149
Rockets used in	3.5-inch A.R., Heads Mks 3, 5, and 9 5.0-inch A.R., Heads Mks 1, 5, 6, and 6 Mod 1
Functioning	Instantaneous
Fuzes used with	Alone, or with Mk 146, 157, 159, 159 Mod 1, 164, or 165
Arming time	8 vane revolutions
Vane span, inches	$1\frac{1}{8}$
Body diameter, inches	3
Over-all length (without booster), inches	$3\frac{1}{2}$

General: The working parts of the fuze are very similar to those of the Nose Fuze Mk 148, which it is replacing. The essential changes are the addition of a second set-back block, a shutter locking pin, a nose cap and clamp, and smaller but less sharply pitched vanes. The fuze body itself is more streamlined. The addition of the spring-loaded weather cap over the vanes protects the vanes from icing up during flight of the aircraft at high altitudes. This cap does not spring off until the arming wire is pulled from the clamp when the rocket is fired.

Operation: When the rocket is fired, the arming wire is pulled free from the clamp pin and the compressed weather-cap spring forces the weather cap up, spreading the clamp until the weather cap is free. The force of inertia causes the two set-back blocks to fall back against the pressure of the set-back spring. This accomplishes two things: First, the vane locking pin is freed from the vane boss and the vanes are free to rotate and screw the striker upward. Second, the lower set-back block forces the shutter locking pin down into the shutter cavity, preventing the shutter from moving over and lining up under the striker as long as the rocket is accelerating (i.e. as long as the rocket motor is burning). After eight vane revolutions, the point of the striker will have risen clear of the shutter; and, upon reaching the end of the threads, the spindle stops as the striker collar rides in the groove in the fuze body. After the rocket propellant has ceased burning, deceleration occurs and both set-back blocks are forced up by the set-back spring. The shutter locking pin is thus lifted from the shutter cavity and the shutter moves across the fuze under influence of its spring until stopped by the stop pin. A spring-loaded detent in the detonator shutter springs up into a recess in the striker guide, locking the shutter in the armed position. On impact, the striker shears the body threads and is driven into the detonator, setting off the booster lead-in and booster in succession.

Mk 155: The Nose Fuze Mk 155 is used in the F.S. or P.W.P. smoke-filled 3.5-inch Heads Mk 6. The fuze is similar to the Nose Fuze Mk 149, with a burster tube instead of a booster charge.

Mk 152

Rockets used in	7.2-inch D.R. (Head Mk 5)
Functioning	Instantaneous

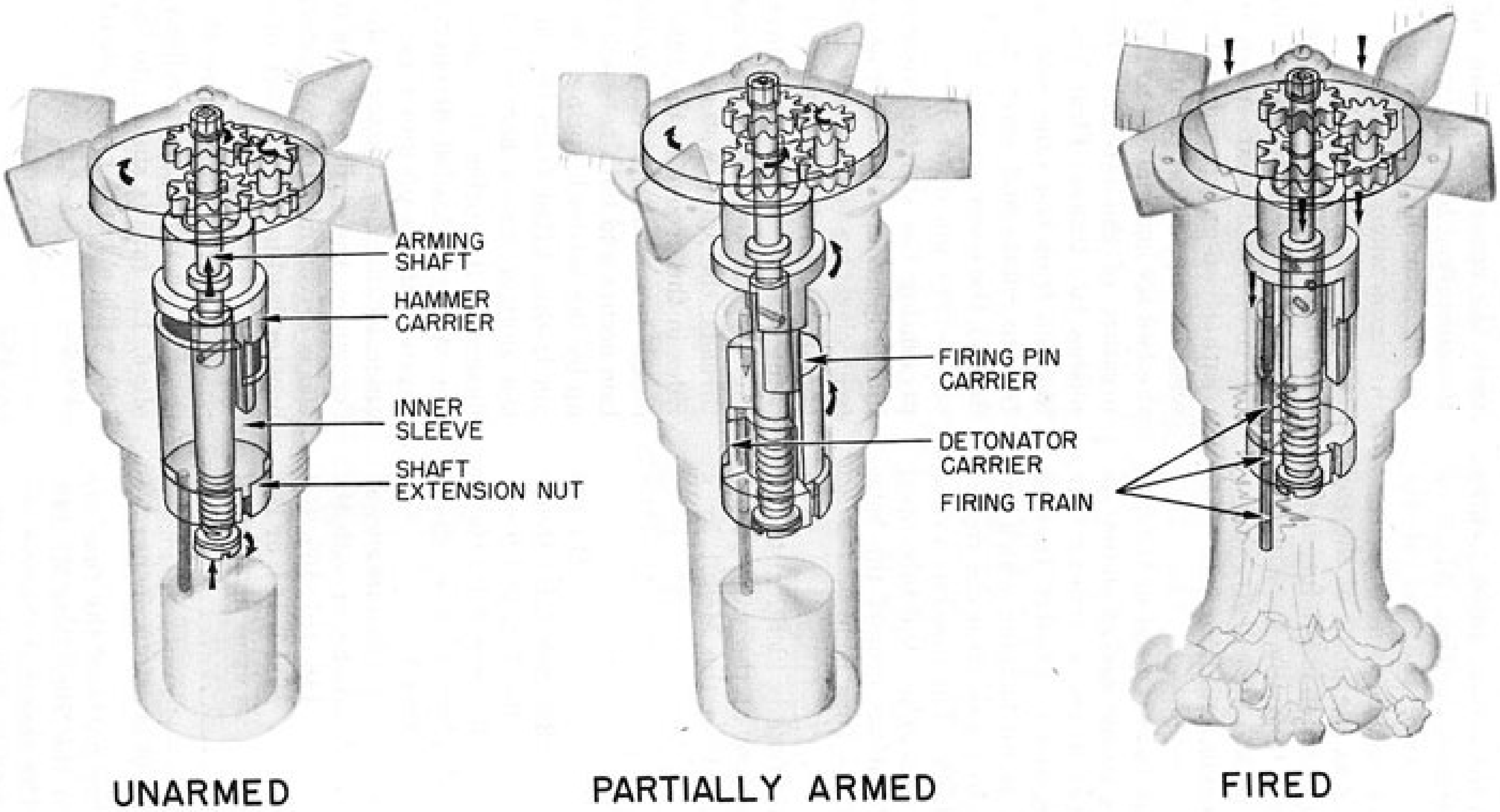


Figure 156. Navy Nose Fuze (Rocket) Mk 152

Arming time..........120 vane revolutions
Vane span, inches......................4.75
Body diameter, inches..................2.75
Over-all length, inches.................5.5

General: This fuze is identical to the Bomb Fuze AN–Mk 219, except that it has been partially armed fifty turns of the arming vanes and a metal fork has been inserted between the vane carrier and the fuze body to take up the space left by the pre-arming process. This fork must be removed before launching the fuzed rocket. In addition, the pitch of the vanes has been increased to 40 degrees instead of the 18 degrees on the AN–Mk 219.

The Bomb Fuze AN–Mk 219 must not be used in place of the Rocket Fuze Mk 152, and vice versa.

When installing the Fuze Mk 152 in a demolition rocket, be sure to use a regular adapter ring for the Bomb Fuze AN–Mk 219, the same as when installing the Bomb Fuze AN–Mk 219 in the nose of a depth bomb. The fuze cavity in the rocket body is deep enough to necessitate the addition of the following with the Fuze Mk 152: Auxiliary Booster Mk 2 (two inches long); Auxiliary Booster Mk 1 (three inches long); and one cardboard spacer approximately ½ 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.

When the rocket is placed in the launcher, an arming wire, one end of which is attached to the launcher, replaces the safety pin. This assembly prevents fuzes of other rockets in the launcher from arming as a result of the blast from rockets already launched. Both safety pin and arming fork must be replaced if the rocket is not fired.

Operation: There are two stages of arming. During the first stage, the upper gear is free to rotate and the lower gear, being attached to the hammer carrier 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 arming assembly. Simultaneously with the locking of the arming shaft and the upper gear, the hammer carrier clears the inner sleeve 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 through 180 degrees, 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 now 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 m.p.h., the air pressure will not be sufficient to shear the pins, and the vanes will merely cease rotating.

The fuze is now 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.

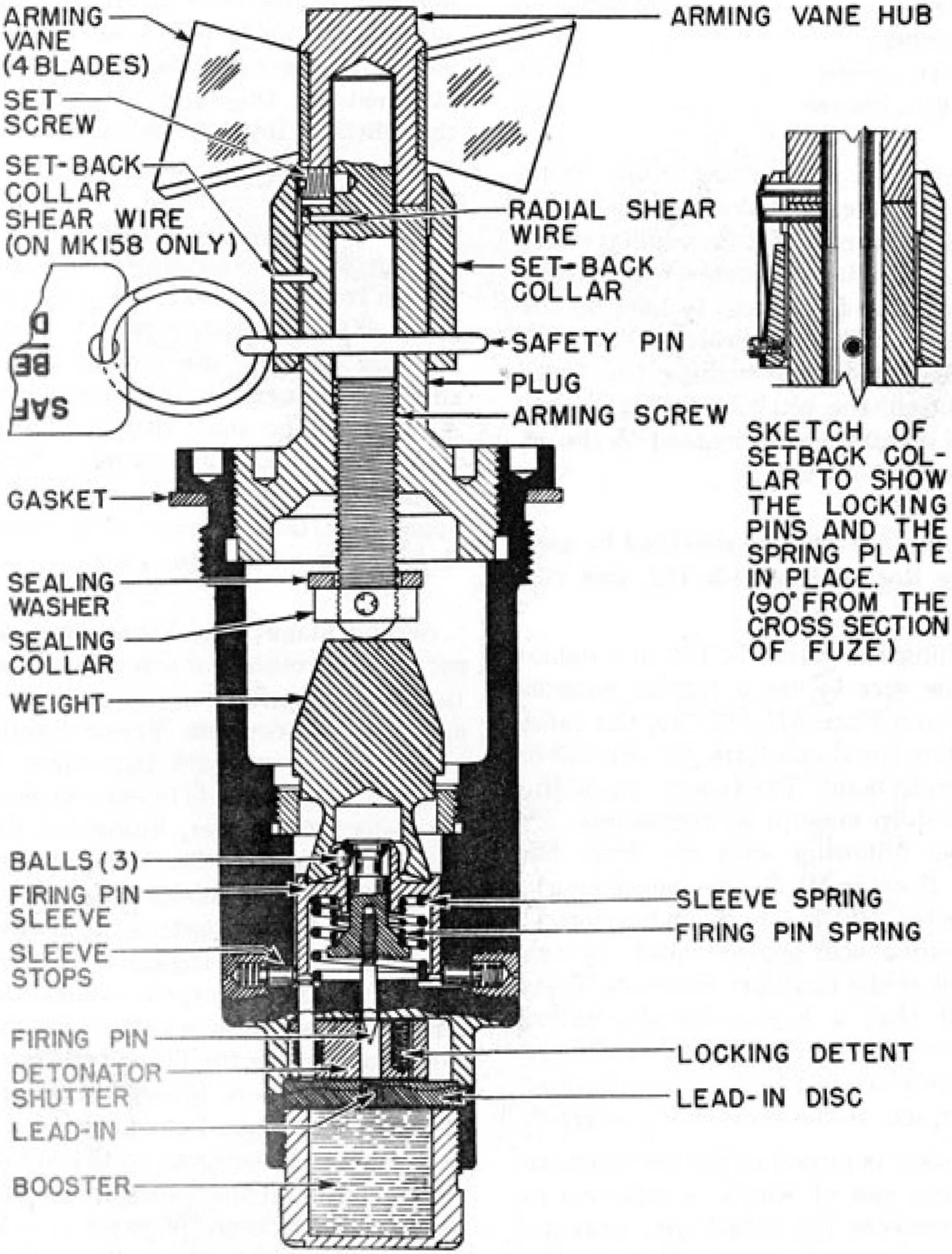


Figure 157. Navy Nose Fuzes (Rocket) Mk 156 and Mk 158

Mk 156 and Mk 158

Rockets used in...... Mk 156—7.2-inch H.E.
Mk 158—7.2-inch Projector charge

Functioning............ The Mk 156 has red point on nose of vane hub

Arming time......... 4 to 5 vane revolutions
Vane span, inches..................... 3.125
Maximum body diameter, inches........ 2.25
Over-all length (without booster), inches. 6.9

General: The two fuzes are identical, except that the Nose Fuze Mk 158 Mod 0 has a shear wire in the set-back collar. These fuzes were designed to replace the Nose Fuzes Mk 131 and Mk 136 respectively.

Operation: The safety pin is removed when the rocket is loaded on the launcher, leaving the vanes secured by the set-back collar, which has a leaf spring holding it up by pressure against the locking pins. On firing, the set-back collar moves back (breaking the shear wire in the Nose Fuze Mk 158), freeing the locking pins from the groove in the collar. On impact with water, the force on the vanes causes a torque sufficient to shear the radial shear wire holding the vane cup to the neck of the fuze. The vanes are free to rotate, unthreading the spindle through the neck of the fuze body. As the spindle draws back from the inertia weight, the spring under the firing sleeve forces the sleeve and inertia weight up. Since the firing pin is locked to the firing sleeve by three locking balls, the firing pin and its spring, cocked against a collar on the firing pin, rise with the sleeve and inertia weight. As the sleeve clears the four spring-loaded sleeve stops in the fuze body just above the firing pin guide, they spring out under the sleeve. After approximately four vane rotations, the firing pin will have been raised by the sleeve sufficiently to clear the shutter cavity, allowing the spring-loaded detonator shutter to move over into the armed position with the detonator lined up with the firing pin and booster lead-in. The detonator shutter is locked in position by a spring-loaded detent. The spindle continues to rise until the washer to which it is keyed engages a groove in the underside of the fuze neck. The inertia weight, sleeve, and firing pin cease rising when the sleeve engages the retaining ring. On contact with a submarine or other underwater obstruction, inertia causes the weight to move forward on normal impact or laterally on oblique impact, thereby allowing the three locking balls to jump out and release the spring-loaded firing pin.

Remarks: The sleeve stops in the fuze body which spring out under the sleeve are provided in order to allow the spindle to be screwed back down from the armed position without danger of forcing the striker into the detonator. In view of the fact that the inertia piece may be insecurely lodged over the striker spindle, this procedure is not recommended on any rocket that has once been fired.

Do not remove these fuzes from a projectile with any tool other than the spanner which is issued with the fuze. Separation of the two parts of the fuze body arms the fuze.

Mk 154 Mod 3

Rockets used in........4.5-inch B.R. Smoke
Functioning ....Instantaneous
Arming time ....100 vane revolutions
Vane guard diameter, inches............2¾
Over-all length, inches...............16.56

General: This fuze consists of a Nose Fuze Mk 137 Mod 2 fuze plus a tetryl burster tube 14.06 inches long. A steel collar is brazed to the upper end of the tube. A rubber gasket is inserted between the burster-tube collar and the burster retaining disc. Between the wall of the burster tube and the inside wall of the burster retaining disc is left a clearance of approximately 0.03-inch. This clearance, in addition to the rubber gasket, allows the burster tube a certain degree of flexibility, which is desirable when installing the complete fuze assembly in the fuze adapter of the rocket body.

Remarks: No disassembly of this fuze is authorized.

V.T. Mk 170 Mods 0 and 1, V.T. Mk 173 Mods 1—5, and V.T. M402

Rockets used in..Mk 173—Head Mk 10 (S.S.)
Mk 170—4.5-inch Mk 16 (S.S.)
Functioning........20- to 60-ft. aerial burst when fired 15° to horizontal
Over-all length, inches..................8.5
Materials.............Nose section—plastic
Base ring—steel
Body—steel

Description: The V.T. Fuzes Mk 170 and Mk 173 Series are for spinner rockets. The Army

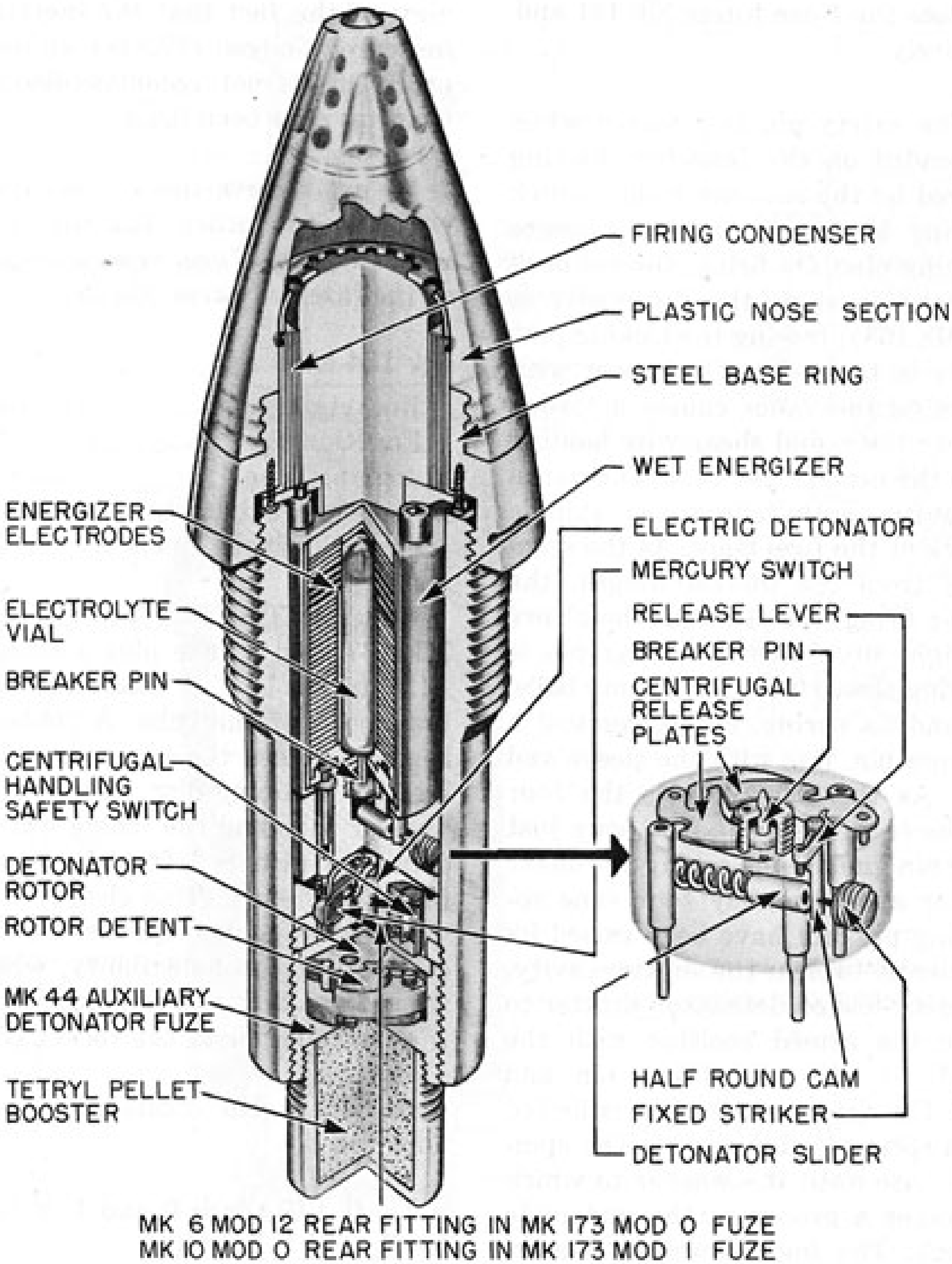


Figure 158. V.T. Fuzes Mk 170, Mk 173, and M402

designates the Mk 170 Mod 1 as the M402.

Bursting heights will depend on the angle of approach to the target and the type of target, as in all V.T. fuze operation. When the rockets are fired at a 15-degree angle from the horizontal, bursting heights over average land targets will be 20 to 60 feet, while bursting heights will be 40 to 80 feet when the rockets are fired at a 45-degree angle of elevation.

Minimum range for the V.T. Fuze Mk 173 in the Navy 5.0-inch S.S. rocket is 2,500 yards, at which point only 26% of the fuzes will operate properly upon approach to the target. Best results are obtained at ranges between 3,000 yards minimum and 5,000 yards maximum—maximum effective range of the rocket. In these limits, 75 to 80% of the fuzes should function properly upon approach to the target.

It has been found necessary to use a very long arming delay on these V.T. fuzes to give assurance that the fuze will not be armed until the after-burning of the rocket motor is no longer a hazard. If the fuze were armed earlier, after-burning would cause the V.T. fuze to function prematurely, thereby wasting the round.

Minimum range of the V.T. Fuze Mk 170 or M402 in the 4.0-inch Army rocket is 2,500 yards, at which point 50 per cent of the fuzes will function properly upon approach to the target. Effective range limits are 3,000 yards to 5,000 yards, for full operability. Bursting heights are about the same as for the V.T. Fuze Mk 173 in the Navy rocket.

Operation: After the rocket is fired, when spin has reached 25 to 30 revolutions per second, the centrifugal release plates in the spin breaker swing outboard simultaneously against their hair springs, thereby freeing the release lever. This lever swings outboard, freeing the half-round cam which is rotated counterclockwise by the spring-loaded detonator slider, releasing it. The detonator slider is snapped against the fixed striker, firing the detonator. The force of the explosion is exerted against the head of the breaker pin, forcing it upward through a hole in the bottom of the wet energizer and into the electrolyte vial, breaking it. Centrifugal force distributes the electrolyte, energizing the powder supply. Electrical energy is supplied to the V.T. element.

In the meantime, the rocket has attained its terminal spin velocity of about 140 revolutions per second, and the mercury in the mercury switch in the rear fitting is forced outboard through the porous membrane. After a delay of two to eight seconds, depending upon the rate of spin and the temperature, the short circuit across the squib caused by the mercury is relieved and the squib is armed.

When spinning of the rocket starts, the rotor detents of the auxiliary detonating fuze swing outboard, but the rotors are prevented from lining up by their friction against the bottom of the housing, caused by acceleration. When burning is over, the unbalanced rotors swing into position, arming the auxiliary detonating fuze.

When spinning of the rocket starts, the reed contact in the centrifugal handling safety switch is forced outboard, allowing the firing condenser to start accumulating a charge through a high-resistance circuit as soon as the wet energizer is activated. In about five seconds after the beginning of charging, sufficient charge has been accumulated to allow firing of the electric detonator and the fuze is armed.

Upon approach to the earth, the V.T. element completes the firing circuit and discharges the firing condenser through the electric detonator. The force of the explosion detonates the auxiliary detonating fuze, which initiates detonation of the main charge.

In the V.T. Fuze Mk 173 Mod 1 or the V.T. Fuze Mk 170 Mod 1, if the V.T. element does not function upon approach to the target, the Rear Fitting Mk 10 Mod 0 will cause instantaneous operation upon impact.

Remarks: A rear fitting containing the safety and arming features common to V.T. fuzed rounds will be the Rear Fitting Mk 6 Mod 12 in the V.T. Fuze Mk 173 Mod 0 or Mk 170 Mod 0. It contains a mercury switch across the squib, which unshorts as a result of spin, and a centrifugal handling safety switch which allows a charge to be accumulated on the firing condenser only while the round is spinning.

The Rear Fitting Mk 10 Mod 0 is used in the V.T. Fuzes Mk 173 Mod 1 and Mk 170 Mod 1 and, in addition to the components of the standard Rear Fitting Mk 6 Mod 12 described above, also contains a mechanical impact firing feature consisting of a fixed striker and a movable detonator with approprite detents and anti-creep springs to give adequate safety.

V.T. Fuzes Mk 173 Mods 2, 3, 4, and 5 are waterproofed fuzes. Mk 173 Mods 0, 1, 2, and 3 are not under procurement by the Bureau of Ordnance. Mods 0 and 1 had no auxiliary detonating fuze waterproofing; Mods 2 and 4 are like the Mod 0 in that the Rear Fitting Mk 6 Mod 0 is used. Mods 1, 3, and 5 have the impact detonator. The Mod 5 is the one being manufactured in quantity to supply the fleet.

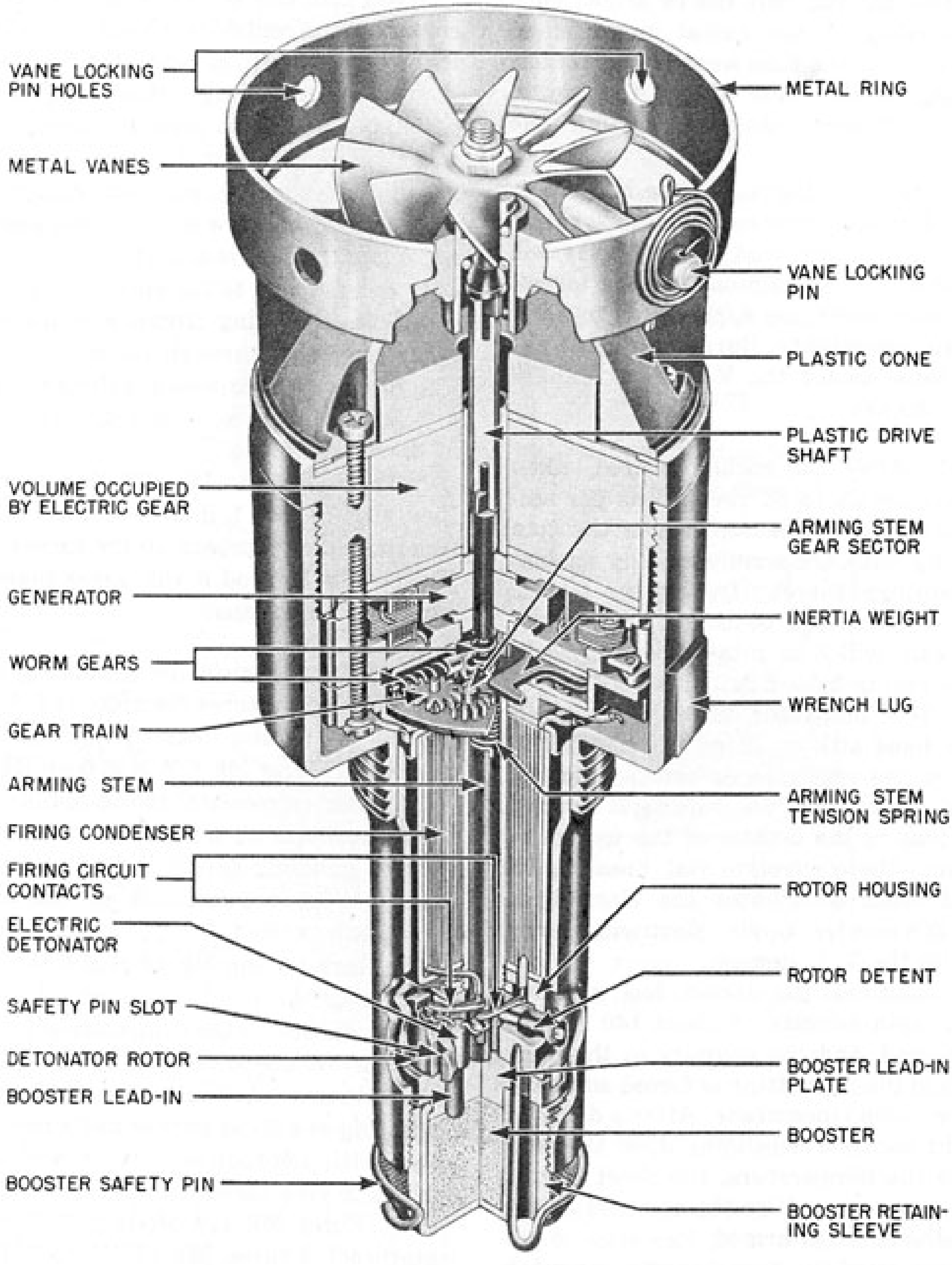


Figure 159. V.T. Fuzes Mk 171, Mk 172, and T2004

V.T. Mk 171, Mk 172, and T2004

Rockets used in	5.0-inch A.R. Mk 1 Mod 1 Head
Functioning	By impulse on approach to target
Fuzes used with	Mk 157 Mod 0 or Mk 165 Mod 0
Arming distance	340 yd. at 0° F. 255 yd. at 110° F.
Launched at 300 knots	1030 yd. at 0° F. 810 yd. at 110° F.
Body diameter, inches	3.4
Over-all length, inches	10.4

General: The Mk 172 is a V.T. fuze for Navy-type-fin stabilized rockets. The complete round is designated as Rocket Assembly Mk 1 Mod 5.

Description: In appearance, the V.T. Fuze Mk 172 is the same as the V.T. Ring-Type Bomb Fuze T50. The fuze may also be marked as the T2004 for use in Army rockets. Internally, the fuzes are also similar, except that a set-back has been added in the V.T. Fuze Mk 172 Mod 0.

Operation: When the rocket is launched, the arming wire is withdrawn from the vane locking pin, which in turn is forced out by its spring to free the vanes. At the same time, the set-back produced by the sudden acceleration forces the hinged inertia weight back against its spring. The hinged inertia weight forces the locking dog from the arming-stem gear sector by means of its lever linkage, freeing the gear train. The vanes rotate, driving the electric generator and the gear train. After approximately 100 vane revolutions, the gear sector on the arming stem has rotated 25 degrees clockwise to move clear of the gear train. As the gear sector clears the gear train, the tension spring snaps it 75 degrees clockwise, where it is detained by the stop pin on the hinged inertia weight. Since the arming stem and detonator rotor are integral with the gear sector, they also move 25 degrees by vane rotation and 75 degrees by spring action. The vanes continue to rotate, driving the generator and the gear train, which is disconnected from the arming stem. As acceleration ceases at the end of burning of the motor, the spring forces the hinged inertia weight forward, pulling the stop pin and freeing the gear secor. The tension gear snaps the gear sector 90 degrees clockwise into the armed position, lining up the detonator with the booster lead-in and making electrical connection to the firing circuit. The detonator is locked in position by a spring-loaded detent in the detonator rotor. When the electric detonator is connected to the firing circuit, the firing condenser is charged. After 0.7 to 1.4 seconds, the condenser has stored up sufficient power and the fuze is armed. On approach to a target, the V.T. element activates the firing circuit, which discharges the condenser through the electric detonator which initiates the explosive train.

Remarks: Each V.T. Fuze Mk 172 Mod 0 is shipped as a complete unit including a seal wire and booster safety pin. It will be recalled that the booster safety pin in this application, like that on the bomb fuzes, gives a visual indication that the detonator rotor is in its original or safe position, if, upon removal of the pin, it can be fully reinserted. If it cannot be reinserted, the detonator rotor will have moved out of position and, hence, the fuze should be disposed of.

The V.T. Fuze Mk 172 Mod 0 has neither self-destructive nor impact-functioning features. However, if the V.T. fuze is a complete dud, the Base Fuze Mk 157 Mod 0 will cause detonation after impact. While the V.T. Fuze Mk 172 Mod 0 is designed primarily for air-to-ground firing, it could be used, though less effectively, for air-to-air firing. In this application, the rocket would have to come within 20 feet of the aircraft target in order to function.

A seal wire through a hole in the arming pin inserted at the factory prevents the vanes from rotating and insures that the arming mechanism is in the proper position. Any turning of the vanes, unless accompanied by set-back, will cause the rotor system to jam, stripping its gears, so that the fuze will be a dud. For this reason, the fuze cannot be pre-armed.

If the seal wire is broken when the fuze is originally removed from the container, do not use the fuze. Fuzes in this condition could be disposed of in accordance with security regulations by lowering in deep water or by explosive demolition.

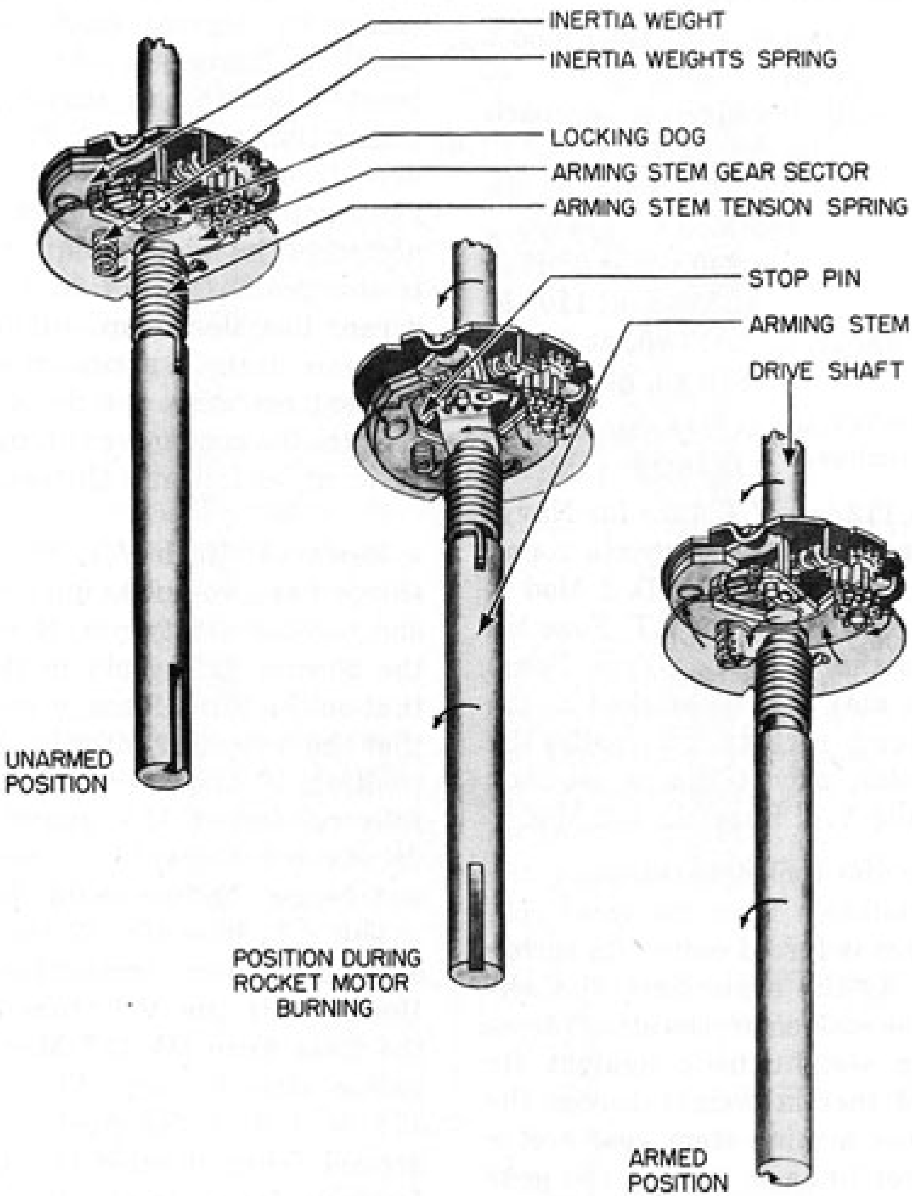


Figure 160. V.T. Fuze Mk 172 Mod 0 — Mechanical Arming Device

High-speed rotation of the vanes is necessary to produce the current to fire the fuze. Therefore, the fuze is actually armed only when in flight on the rocket at speeds in excess of 80 knots. Damaged fuzes may hold the electrical charge in the condenser for quite some time. For this reason, damaged fuzes and duds found on the ground should preferably be handled with care.

No disassembly of the V.T. Fuze Mk 172 Mod 0 is authorized by field personnel.

The V.T.Fuze Mk 171, four times as sensitive as the Mk 172, was designed for plane-to-plane firing; but, because of poor results in this technique of firing, few of these fuzes were produced.

NAVY BASE FUZES

Mk 31 and Mk 36

Rockets used in	5.0-inch Mk 8
Functioning	Mk 31—non-delay Mk 36—0.01 sec. delay
Body diameter, inches	1.8
Over-all length, inches	4.68

General: The Navy Rocket Base Fuze Mk 31 is identical to the Navy Base-Detonating Projectile Fuze Mk 31. This fuze is armed by centrifugal force and thus can only be used in spin-stabilized rockets. The fuze is designed for instantaneous action on impact. It is shipped installed in the base of the rocket body.

Description: The fuze is composed of two major parts: the fuze body and the noze cap. The body contains the auxiliary detonator plunger, the detonator plunger, the detonator-plunger detents, the anti-creep spring assembly, and the firing train. The auxiliary detonator plunger is surrounded by twenty ball bearings and bears against the bottom of the detonator plunger. Fitted over the top of the detonator plunger is the anti-creep spring assembly consisting of an inner and outer cup separated by an anti-creep spring. The outer cup will not move, and the inner cup is crimped over the top of the detonator plunger and held in position by the sensitive primer holder. The firing train consists of the sensitive primer, plunger firing pin, secondary primer, detonator, and booster lead-ins and lead-outs, which are out of line in the unarmed position.

The nose cap, which is secured to the end of the body by a threaded joint, houses the sensitive firing pin and firing-pin detents. The sensitive firing pin is held in place by two stakes, but is referred to as a "floating" firing pin, since it can move downward slightly. Ninety degrees removed from the two detents are two holes in the nose cap. A locking pin is provided to lock the nose cap in position.

Operation: The force of set-back causes the sensitive firing pin to move back on the firing pin detents and hold them in by friction. When the motor burns out, creep causes the firing pin to move forward and release the detents. Centrifugal force will move both sets of detents outward against their springs, and the fuze is then completely armed. The detonator plunger is prevented from moving forward on creep because of the anti-creep spring; but on impact the auxiliary plunger, acting as an inertia weight, pushes the detonator plunger forward. This action moves the inner cup forward, thus compressing the anti-creep spring, and brings the booster lead-ins and lead-outs in line. The sensitive primer in the top of the detonator plunger is carried on to the sensitive firing pin, and the explosion of the sensitive primer accomplishes two things:

1. The gases resulting from the explosion pass through the port holes on the side of the primer container and build up a high pressure, expanding that part of the cup which is adjacent to the holes in the nose cap. This action locks the detonator plunger in the fired position and keeps the firing train lined up.
2. The shear wire that has been holding up the secondary firing pin is broken, and the secondary firing pin is driven down into the secondary primer, and the flash sets off the detonator and booster elements.

Remarks: The Base Fuze Mk 36 differs from the Mk 31 only in that it has a 0.01 second delay element housed in the space which is the flash channel in the Mk 31.

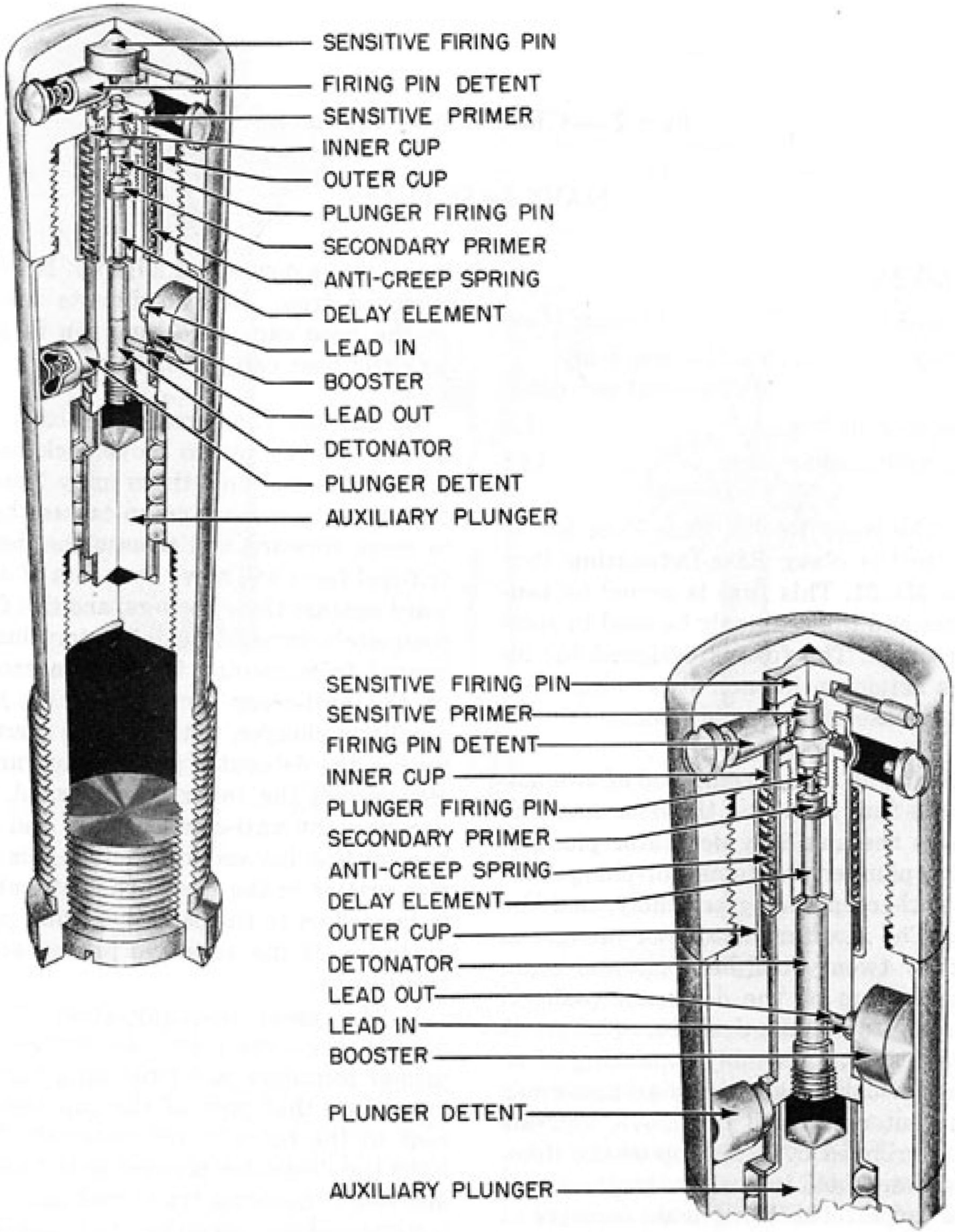


Figure 161. Navy Base Fuzes (Rocket) Mk 31 and Mk 36

Mk 134

Rockets used in. . 3.5-inch Window and Flare
Over-all length, inches. 1.28
Diameter, inches. 2.875
Material . . . . Plastic
Fuzes used with. . . . . None
Functioning. . . . Safety-fuze delay 15 seconds

Descriptions: The Base Fuze Mk 134 consists of a molded plastic case in which a length of Ensign Bickford safety fuse is coiled with a cap on one end and a 20-gram charge of black powder on the other.

Operation: Blast from the motor impinges and fires the cap. The cap sets off the fuse which burns for 15 seconds before the burning gets to the black-powder charge. Explosion of the black powder expels the window load through the forward end of the rocket.

Mk 146 and Mk 146 Mod 1

Rockets used in	3.5-inch Head Mk 4 5.0-inch Head Mk 1 7.2-inch D.R. Head Mk 10
Functioning	Non-delay
Fuzes used with	Alone or with Mk 149 or Mk 148
Arming Time	From ignition of propellant to 0.1 second after acceleration ceases
Body diameter, inches	2.88
Over-all length, inches	5.50

General: The fuze head screws into an adapter fixed in the base of the rocket body, and the gasket and luting on the threads make a gas-tight seal. The top of the fuze is exposed to the front end of the rocket motor. The Base Fuze Mk 146 Mod 1 differs in that it has a more sensitive firing train. These fuzes are being replaced in the 5.0-inch rocket by the Base Fuze Mk 157 Mod 0. The Base Fuze Mk 146 Mod 1 is being replaced in the 7.2-inch Demolition Rocket Head Mk 10 Mod 1 by the Mk 161 Mod 0. The fuze is shipped assembled in the base of the rocket head, and is not to be removed.

Operation: When the rocket is fired, gas under considerable pressure from the rocket motor passes through the inlet screen underneath the inlet screw and enters the pressure chamber. As the gas pressure builds up, the diaphragm bears against the arming plunger, breaking the shear wire and forcing the arming plunger inward. The locking ball, which is preventing the rearward movement of the striker block, is forced over by the pressure of the spring-loaded striker block into the narrow portion

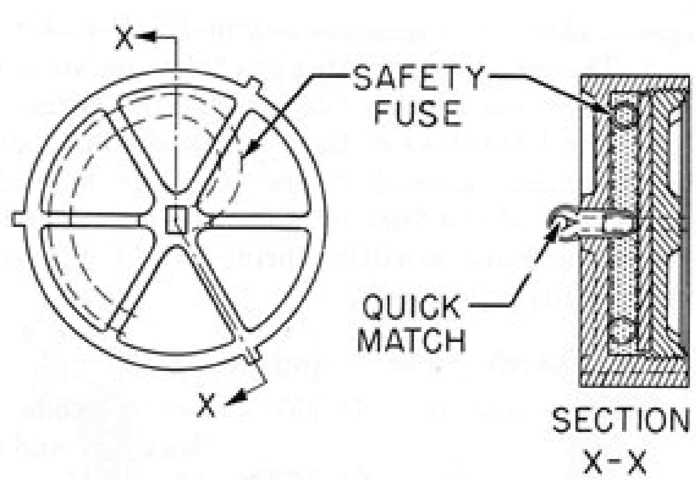


Figure 162. Navy Base Fuze (Rocket) Mk 134

of the arming plunger. The striker spring forces the striker block rearward, retracting the firing pin from the detonator shutter. The shutter is still prevented from moving across the fuze by action of its spring until after deceleration begins, since the force of set-back thrusts the shutter back and causes the shutter locking pin to engage in a recess in the firing-pin guide. After burning of the propellant ceases and deceleration begins, the shutter rides forward, disengaging the locking pin from the guide. The shutter spring forces the shutter across the shutter cavity, where it is locked in the armed position by a detent which is housed in the firing-pin guide and which engages a recess in the shutter. On impact, inertia drives the striker block forward against its spring, the firing pin striking the detonator.

Remarks: A few of the early experimental models incorporated a delay of 0.02 second to allow penetration. The Base Fuze Mk 157 was developed from these. The later models of this fuze have undergone the following modifications:

1. The inlet shield has been modified. The two outside legs are slightly longer than the flat base of the shield, so that the inlet screen will not be crushed when the inlet screw is tightened.

2. The ball retaining plug, staked in place, has replaced the screw plug.

3. A safety pin has been fitted below the

spacer sleeve to facilitate assembly operations.

4. The detonator shutter has taken on an oval shape, eliminating the former squared corners.

5. The latest lots of Base Fuzes Mk 146 have been further altered to increase the over-all sensitivity of the fuze by using a weaker creep spring, a more sensitive primer, and a more tapered firing point.

Mk 157 Mods 0 and 1, and Mk 159

Rockets used in...Mk 157—5.0-inch Heads Mks 1, 5, and 6
Mk 157 Mod 1—11.75-inch Head Mk 1

Functioning......Mk 157—0.02-second delay on impact

Arming time........Armed 0.1 second after acceleration ceases

Body diameter, inches.............2-15/16

Over-all length, inches...............5-1/2

General: The Base Fuze Mk 157 Mod 0 is essentially similar to the Base Fuze Mk 146, with the following differences: (1) a 0.02-second delay detonator replaces the non-delay detonator of the Mk 146; (2) the firing pin and the firing-pin body are pinned together by a thin lock wire. The Base Fuze Mk 157 Mod 0 has been developed to afford greater penetration of the target than was possible with the non-delay detonator of the Base Fuze Mk 146. The Base Fuze Mk 157 Mod 0 is being replaced by the Mk 165 Mod 0,

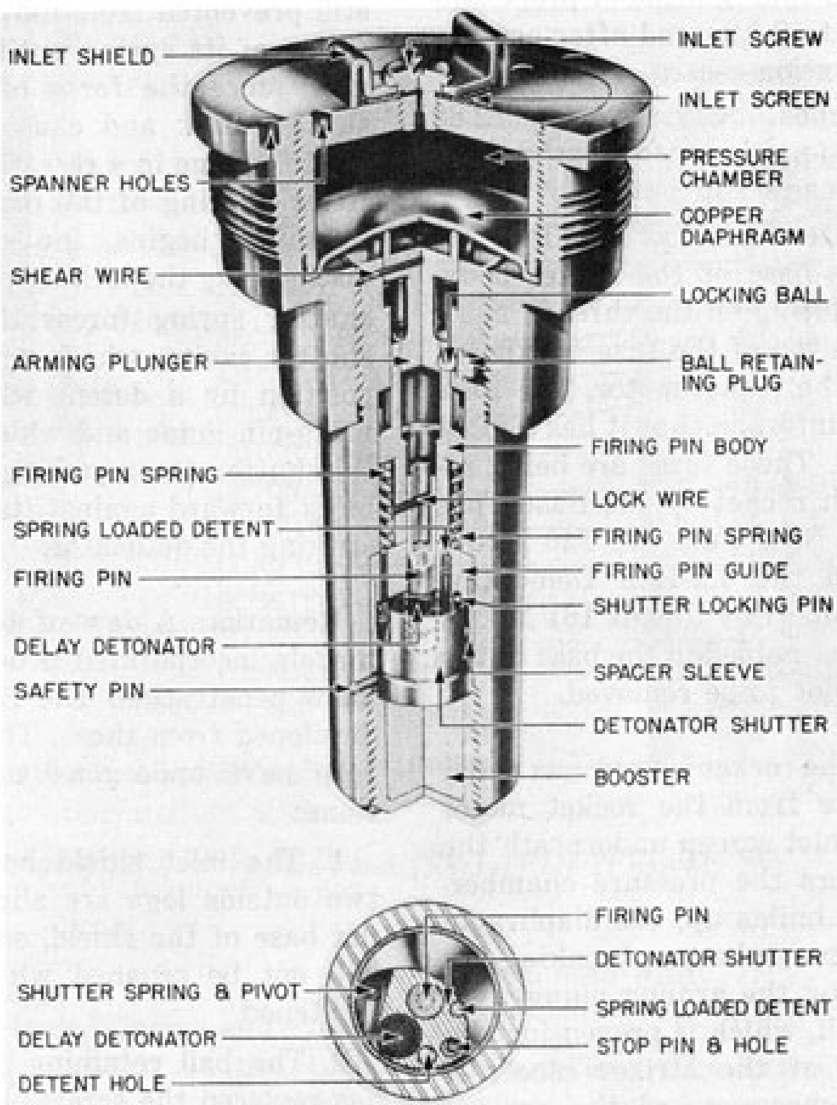


Figure 163. Navy Base Fuze (Rocket) Mk 157 Type

which consists of the Mk 157 Mod 0 with a motor adapter and an improved detonator-shutter locking arrangement.

The Base Fuze Mk 157 Mod 1 differs from the Mk 157 Mod 0 in that the material for the fuze body has been considerably strengthened, and the number of external threads has been approximately doubled. In all other respects, the fuzes are identical.

Mk 159: The Base Fuze Mk 159 is similar to the Mk 157, except that the delay time has been changed to 0.015 second. The fuze is used in the base of the 5.0-inch Rocket (5.0-inch Motor—Heads Mks 5 and 6). Other minor structural changes have been made as follows: (1) a slightly heavier shear wire is used; (2) the inlet screen and inlet washer have been replaced by a brass washer having one side flat and the other radially serrated (the radially serrated side faces the fuze head, so that the motor gases can enter the fuze diaphragm chamber); (3) the number of external threads on the body has been increased and "run out" just below the flange to afford a snug fit for the sealing washer, and (4) the fuze has been completely waterproofed. The Base Fuze Mk 159 is shipped to the field installed in the base of the rocket head.

Remarks: The sensitivity of the Base Fuze Mk 157 Mod 0 is somewhat less than that of the Base Fuze Mk 146, since the percussion-type primers used in delay explosive trains are inherently less sensitive than the "stab"-type primer caps used in instantaneous detonators.

The Base Fuzes Mk 157 Mod 0 and Mk 157 Mod 1 are always shipped to the field installed in the base of the rocket.

No attempt should ever be made to remove this fuze from the assembled round for any purpose prior to firing, e.g., to clean the fuze or substitute a base plug for the fuze. Anything less than a perfect seal between the fuze and the adapter in the base of the rocket body will allow the gases from the rocket motor to seep into the body and contact the H.E. filling. Premature explosion of the rocket is then highly probable.

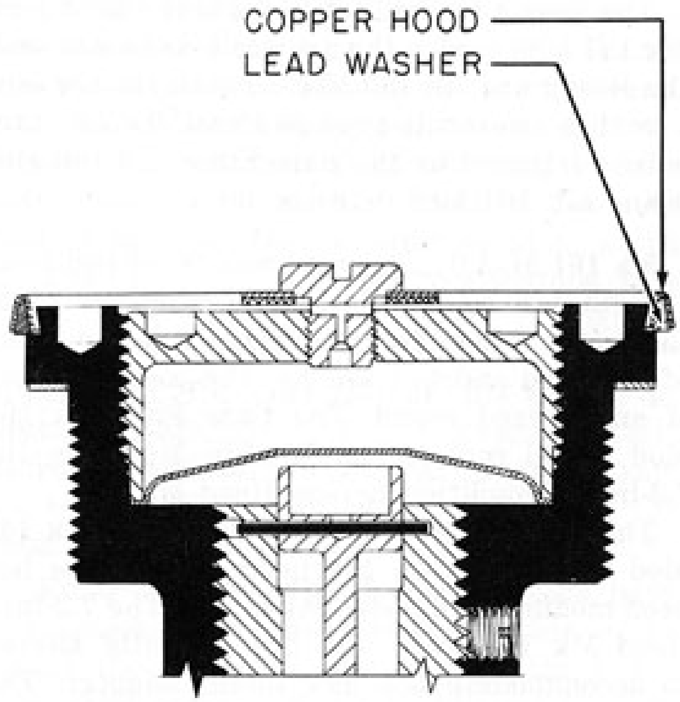


Figure 164. Gas Check for Navy Fuzes Mk 157 Mod 2, Mk 159 Mod 1, Mk 163, and Mk 164

Mk 157 Mod 2, Mk 159 Mod 1, Mk 161, Mk 163, Mk 164, and Mk 165

Rocket heads used in:

Mk 157 Mod 2. . . . 11.75" Mk 1 Mod 1, Mk 2
Mk 159 Mod 1. . . . 5.0" Mk 6 Mod 1
Mk 161 Mod 0. . . . 7.2" D.R. Mk 10 Mod 1
Mk 163 Mod 0. . . . 11.75" Mk 1 Mod 1, Mk 2
Mk 164 Mod 0. . . . 5.0" Mk 6 Mod 1
Mk 165 Mod 0. . . . 5.0" Mk 1

Functioning:

Mk 157 Mod 2, Mk 163 Mod 0, Mk 165 Mod 0 . . . . 0.2 sec. delay
Mk 159 Mod 1, Mk 164 Mod 0 . . . 0.015 sec. delay
Mk 161 Mod 0. . . . . Non-delay

Mk 157 Mod 2 and Mk 159 Mod 1: In order to secure a more adequate sealing for the protection of the explosive in the 11.75-inch and 5.0-inch rocket heads from the hot gases during the burning of the motor, the base fuzes were modified in that a projectile-type gas check was added around the fuze body ahead of the threads. The fuzes are shipped assembled in the base of the head. The lead washer with copper hood is pressed into place at the loading activity, and is not to be disturbed in the fields.

The Base Fuze Mk 157 Mod 2 is the Base Fuze Mk 157 Mod 1 with the projectile-type gas seal; the Base Fuze Mk 159 Mod 1 is the Mk 159 Mod 0 with a projectile-type gas seal. These fuzes will be replaced by the Base Fuzes Mk 163 Mod 0 and Mk 164 Mod 0 respectively.

Mk 161 Mod 0: This fuze was developed from the Mk 146 Mod 1 to secure better sealing of the motor gases from the high-explosive filling of the head and to eliminate the possible firing of an unfuzed round. The Base Fuze Mk 161 Mod 0 will replace the Mk 146 Mod 1 in the 7.2-inch Demolition Rocket Head Mk 10.

The Mk 161 Mod 0 differs from the Mk 146 Mod 1 only in that the head of the fuze has been modified to receive the motor. The 7.2-inch Head Mk 10 Mod 1 has been slightly altered to accommodate the new motor adapter. The 3.25-inch motor will thread into the fuze, and a threaded reducer is supplied to permit use of the 2.25-inch motor.

Mk 163 Mod 0 and Mk 164 Mod 0: The Base Fuze Mk 163 Mod 0 is similar to the Mk 157 Mod 2, and the Mk 164 Mod 0 is similar to the Mk 159 Mod 1. In addition to retaining the projectile-type gas seal previously mentioned, the Base Fuzes Mk 163 Mod 0 and Mk 164 Mod 0 have an improved detonator-shutter locking arrangement. Formerly, the shutter was retained in the safe position by a projection which locked in a recess of the body during set-back, and was held in that position by the force of acceleration during the burning of the motor. This allowed the detonator upward movement as well as rotation, which contributed to the malfunctioning of the earlier fuzes.

The new design has removed the projection and replaced it with a shutter lock pin which is mounted in a set-back block. The block is retained in position by a set-back block spring. As the rocket is launched, the force of set-back moves the block back to compress the set-back block spring. The lock pin moves up to contact the detent, to move upward and compress the detent spring. As the motor burns, the firing pin is withdrawn from the shutter, to leave only the lock pin to prevent the shutter from pivoting. As the motor burns out and deceleration sets in, the set-back block spring and the detent spring force the set-back block forward, thereby withdrawing the lock pin from the shutter. This frees the detonator shutter, and the spring acts to pivot the shutter over in the cavity and align the firing train.

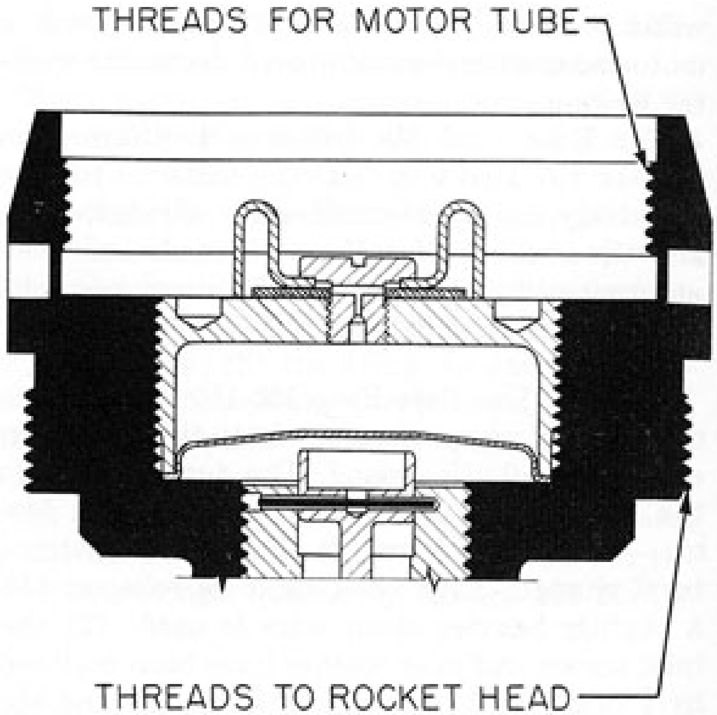


Figure 165. Motor Adapter in Fuzes Mk 161 and Mk 165

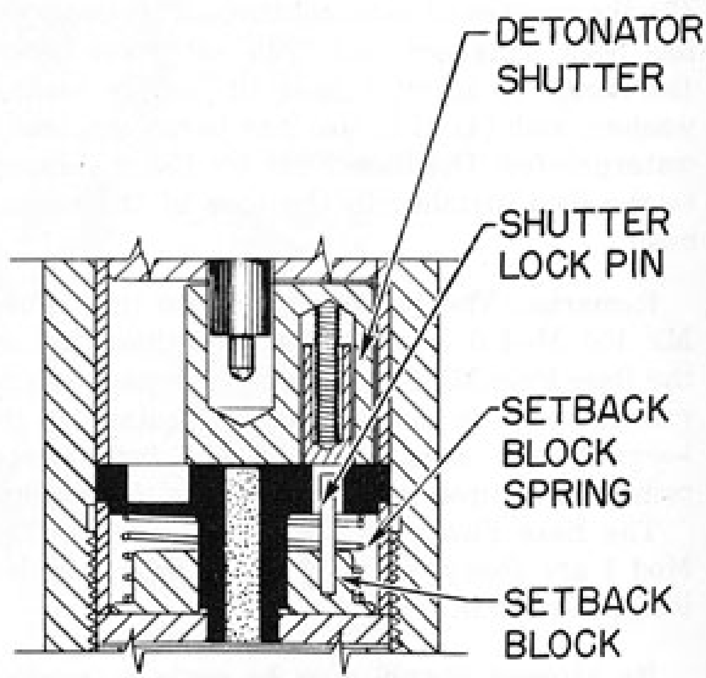


Figure 166. Modified Detonator Shutter Lock for Fuzes Mk 163, Mk 164, and Mk 165

Mk 163 Mod 1: This fuze differs from the Mod 0 in that the diameter of the inlet orifice has been decreased and the diameter of the shear wire increased, to increase the arming pressure to 350 pounds per square inch.

The Base Fuze Mk 163 Mod 0 will replace the Mk 157 Mod 2 in the 11.75-inch Heads Mk 1 Mod 1 and Mk 2; the Base Fuze Mk 164 Mod 0 will replace the Mk 159 Mod 1 in the 5.0-inch Head Mk 6 Mod 1.

Mk 165 Mod 0: This fuze differs from the Base Fuze Mk 157 Mod 0 only in that the head of the fuze has been modified to receive the motor and the booster is approximately 0.3 inches longer, to incorporate the improved detonator-shutter locking arrangement described under the Base Fuzes Mk 163 Mod 0 and Mk 164 Mod 0.

The adapter in the fuze head is threaded to receive the 3.25-inch Motor Mk 7, and the Base Fuze Mk 165 Mod 0 will replace the old motor adapter in the base of the 5-inch Head Mk 1, as well as the Fuze Mk 157 Mod 0.

Mk 162 and Mk 166

Rockets used in	Mk 162—11.75″ A.R. Mk 166—5.0″ Head Mk 2 Mod 2
Functioning	Mk 162—pyrotechnic delay of 0.01 sec. Mk 166 — Instantaneous explosive train
Arming distance, feet	Mk 162—420 to 550 Mk 166—450 to 580
Over-all length, inches	Mk 162—6.800 Mk 166—6.490
Body diameter, inches	Mk 162—2.750 Mk 166—2.125

General: These fuzes were designed primarily to be used against marine targets. They will not detonate immediately after impact with water, but will allow the rocket to continue on its underwater trajectory. If the rocket strikes the hull of a ship above water or under water, the fuze will detonate the rocket after penetration of the hull is completed. If the rocket misses the ship, however, the fuze fires after approximately 150 to 200 feet of underwater travel. Upon penetration of very heavy fortifications, the fuze does not function after fixed pyrotechnic delay but automatically varies the delay in firing mechanically, so that it does not fire until penetration of the target is completed or, if the target is too heavy, until the rocket stops. It is in this manner that the fuze is discriminating.

Operation: The operation of this fuze is divided into five stages: (1) gas pressure effect; (2) rotation causing alignment of firing train in a vertical plane; (3) creep; (4) impact; (5) firing.

First stage—After the round has been fired, gases from the burning motor enter through the inlet filter, pass through the orifice in the inlet screw, and exert sufficient force to open the inlet valve. The gases accumulate and build up pressure in the upper chamber. Because of the differential pressure between upper and lower chambers, the gases seep through a small orifice in the baffle cup into the lower chamber. Upon the completion of burning of the motor, the pressure of the gases in the upper chamber is above the remaining motor pressure, and therefore forces shut the inlet valve. The gases from the upper chamber continue to seep into the lower chamber, tending to equalize the pressure between chambers. When the pressure in the lower chamber is sufficient, the diaphragm collapses, forcing the arming sleeve forward and shearing the shear wire.

Second stage—The rotor, which has been kept from turning by the shear wire, is now free to rotate under the force of the rotor spring. The detonator plunger is attached to the rotor through a detonator-plunger pin, which rides in a vertical groove in the rotor. The trigger block likewise is attached to the rotor through trigger-block rotating pins. Thus, as the rotor turns in a clockwise direction, so do the detonator plunger and trigger block assemblies. Rotation continues for 90°, at which point the rotor is stopped by the rotor stop pin. This aligns the firing train in a vertical plane. The grooves in the detonator plunger are now aligned with two stop pins.

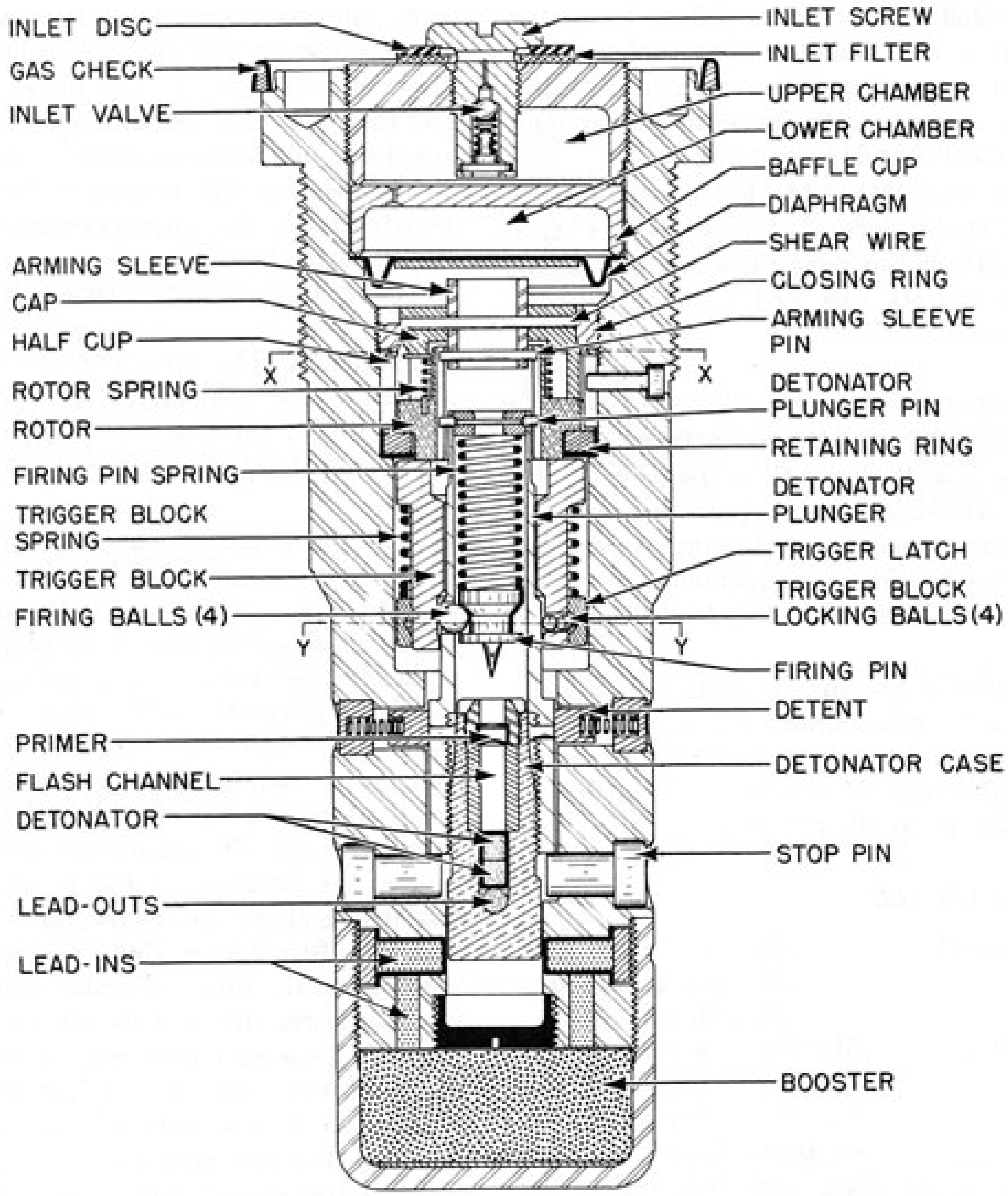


Figure 167. Navy Base Fuze (Rocket) Mk 166 (Assembly)

THIRD STAGE—Upon the completion of burning of the rocket motor and completion of the rotation of parts discussed in the second stage, the force of creep causes the detonator plunger and trigger block assembly to move forward, the rotor being held in position by the retaining ring. The trigger block continues to move forward until it engages a shoulder in the fuze body. As the detonator plunger is attached to the trigger block by four firing balls, further movement of the detonator plunger also ceases as the trigger block engages the fuze body. The firing train is prevented from getting out of line in a vertical plane by the stop pins which ride in grooves in the detonator plunger and prevent further rotation of the detonator plunger. Up to this point of the operation, the lead-outs are not yet in complete alignment with the lead-ins in a horizontal plane.

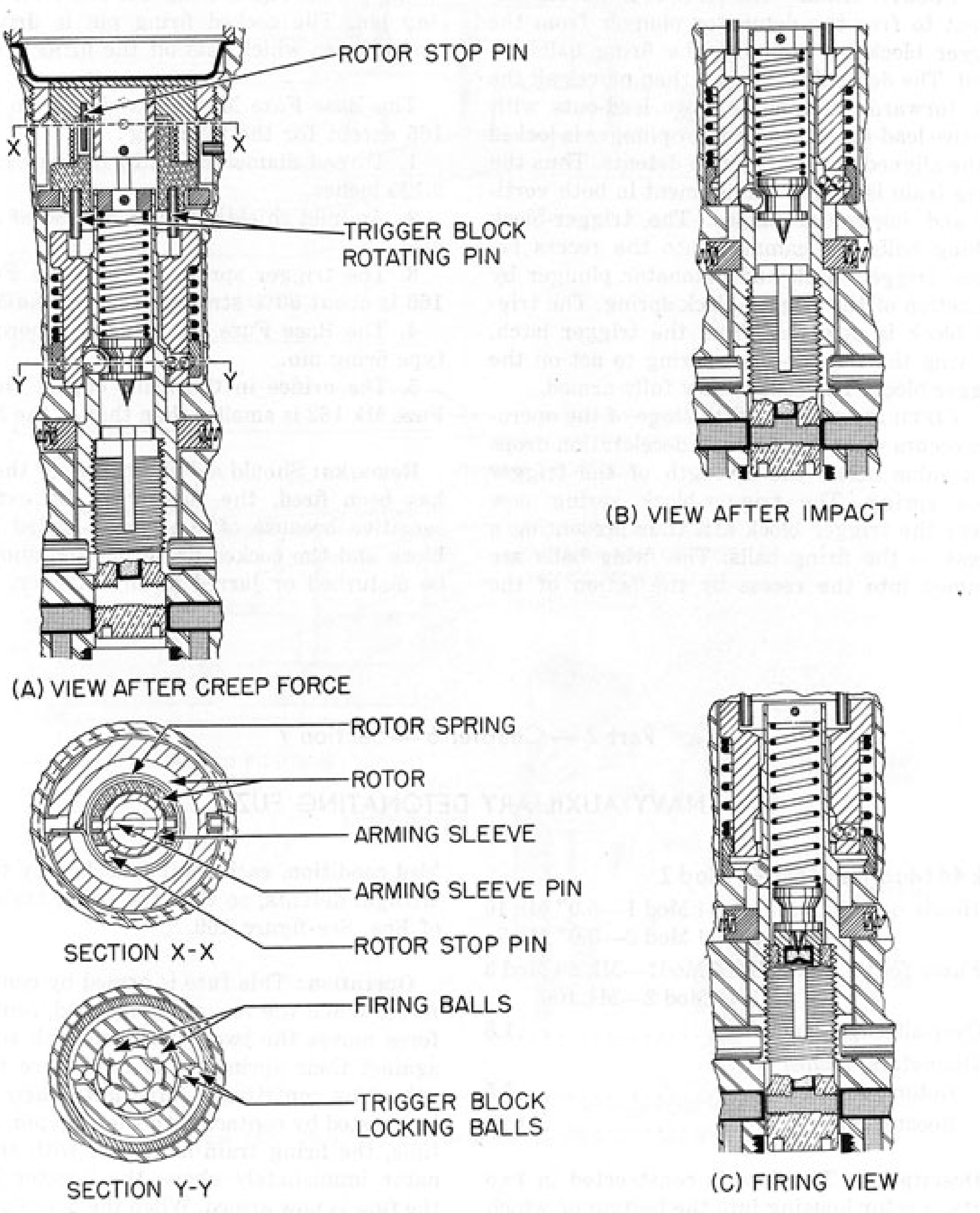


Figure 168. Navy Base Fuze (Rocket) Mk 166 (Details)

FOURTH STAGE—The force of impact is sufficient to free the detonator plunger from the trigger block by camming the firing balls inward. The detonator plunger then moves all the way forward, aligning the two lead-outs with the two lead-ins. The detonator plunger is locked in the aligned position by two detents. Thus the firing train is locked in alignment in both vertical and horizontal planes. The trigger-block locking balls are cammed into the recess between trigger block and detonator plunger by the action of the trigger-block spring. The trigger block is now free from the trigger latch, allowing the trigger-block spring to act on the trigger block. The fuze is now fully armed.

FIFTH STAGE—The fifth stage of the operation occurs when the force of deceleration drops to a value below the strength of the trigger block spring. The trigger-block spring now forces the trigger block aft, thus presenting a recess to the firing balls. The firing balls are cammed into the recess by the action of the firing-pin spring, freeing the sensitive-type firing pin. The cocked firing pin is driven into the primer, which sets off the firing train.

The Base Fuze Mk 162 is similar to the Mk 166 except for the following:

1. Thread diameter of 2.75 inches instead of 2.125 inches.
2. An inlet shield is issued instead of an inlet disc.
3. The trigger spring of the Base Fuze Mk 166 is about 50% stronger than in the Mk 162.
4. The Base Fuze Mk 162 has a percussion-type firing pin.
5. The orifice in the baffle cup of the Base Fuze Mk 162 is smaller than that of the Mk 166.

Remarks: Should a dud occur after the round has been fired, the fuzes may be extremely sensitive because of the spring-loaded trigger block and the cocked firing pin and should not be disturbed or jarred in any manner.

Part 2 — Chapter 6 — Section 7

NAVY AUXILIARY DETONATING FUZE

Mk 44 Mod 1 and Mk 44 Mod 2

Heads used in.....Mk 44 Mod 1—5.0″ Mk 10
Mk 44 Mod 2—5.0″ Mk 7

Fuzes found with. Mk 44 Mod1—Mk 30 Mod 3
Mk 44 Mod 2—Mk 100

Over-all length, inches..................1.8

Diameters, inches
Rotor housing 1.5
Booster cup 1.25

Description: The fuze is constructed in two parts, a rotor housing into the bottom of which is screwed a booster cup. The rotor housing contains a double rotor, one rotor above the other. The upper rotor contains a primer detonator incorporating lead azide. The lower rotor contains a booster lead-in of tetryl. In the assembled condition, each rotor is locked by two centrifugal detents, so that the firing train is out of line. See figure 169.

Operation: This fuze is armed by centrifugal force. When the rocket is launched, centrifugal force moves the two detents on each rotor out against their springs. The rotors are then revolved by centrifugal force until their motion is arrested by contact with the stop pin. At that time, the firing train is in line, with the detonator immediately above the booster lead-in; the fuze is now armed. When the nose fuze functions, the gas pressure generated at that time forces through the weakened part of the closing disc to fire the detonator. The firing train is then as follows: booster lead-in, booster, and main charge.

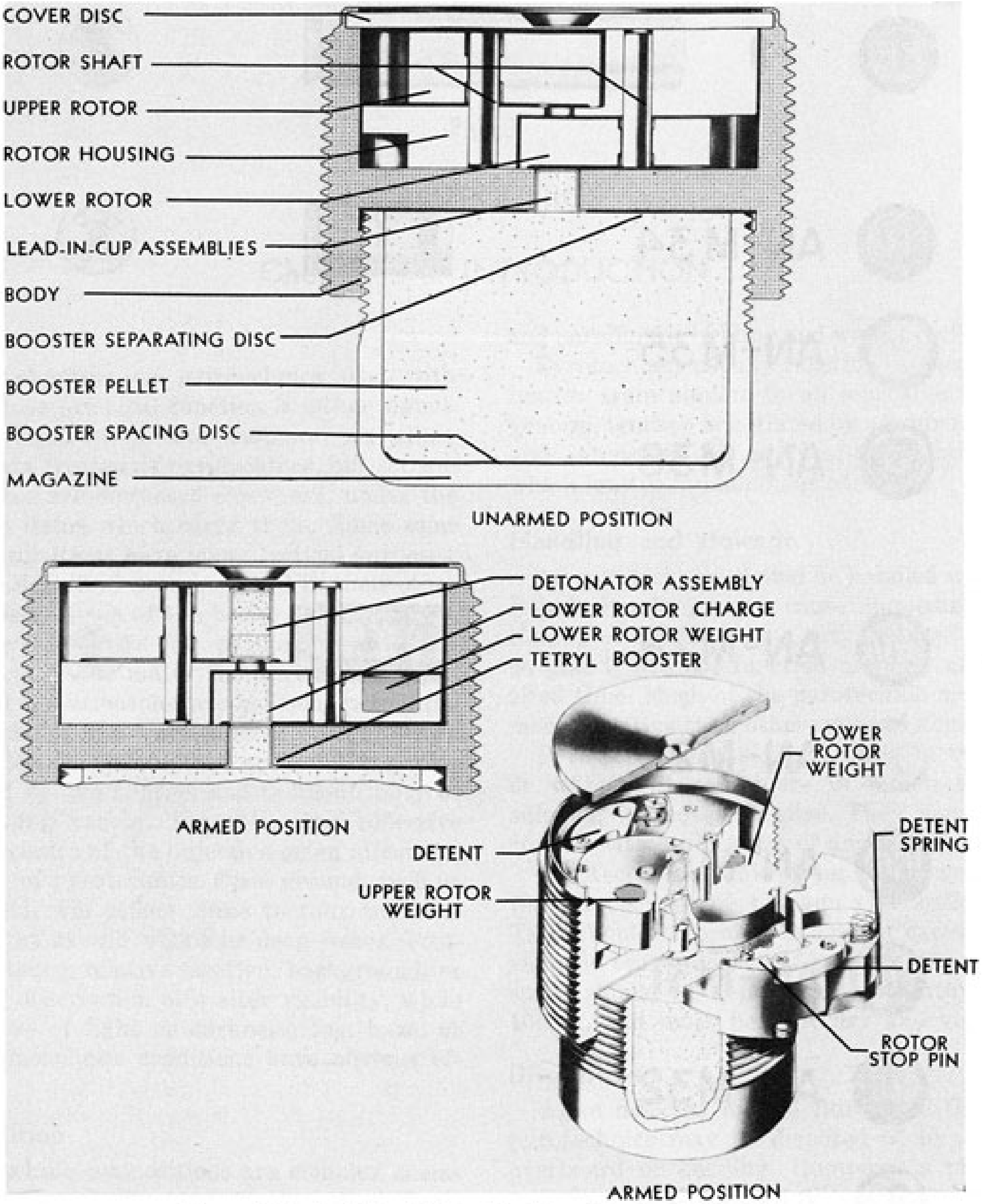


Figure 169. Auxiliary Detonating Fuze (Rocket) Mk 44 Type

Mk 44 Mod 2: The Auxiliary Detonating Fuze Mk 44 Mod 2 is the same as the Mk 44 Mod 1, except that the hole in the closing disc over the detonator is drilled completely through and a copper sealing disc, 0.02 inch thick, is placed over the closing disc.

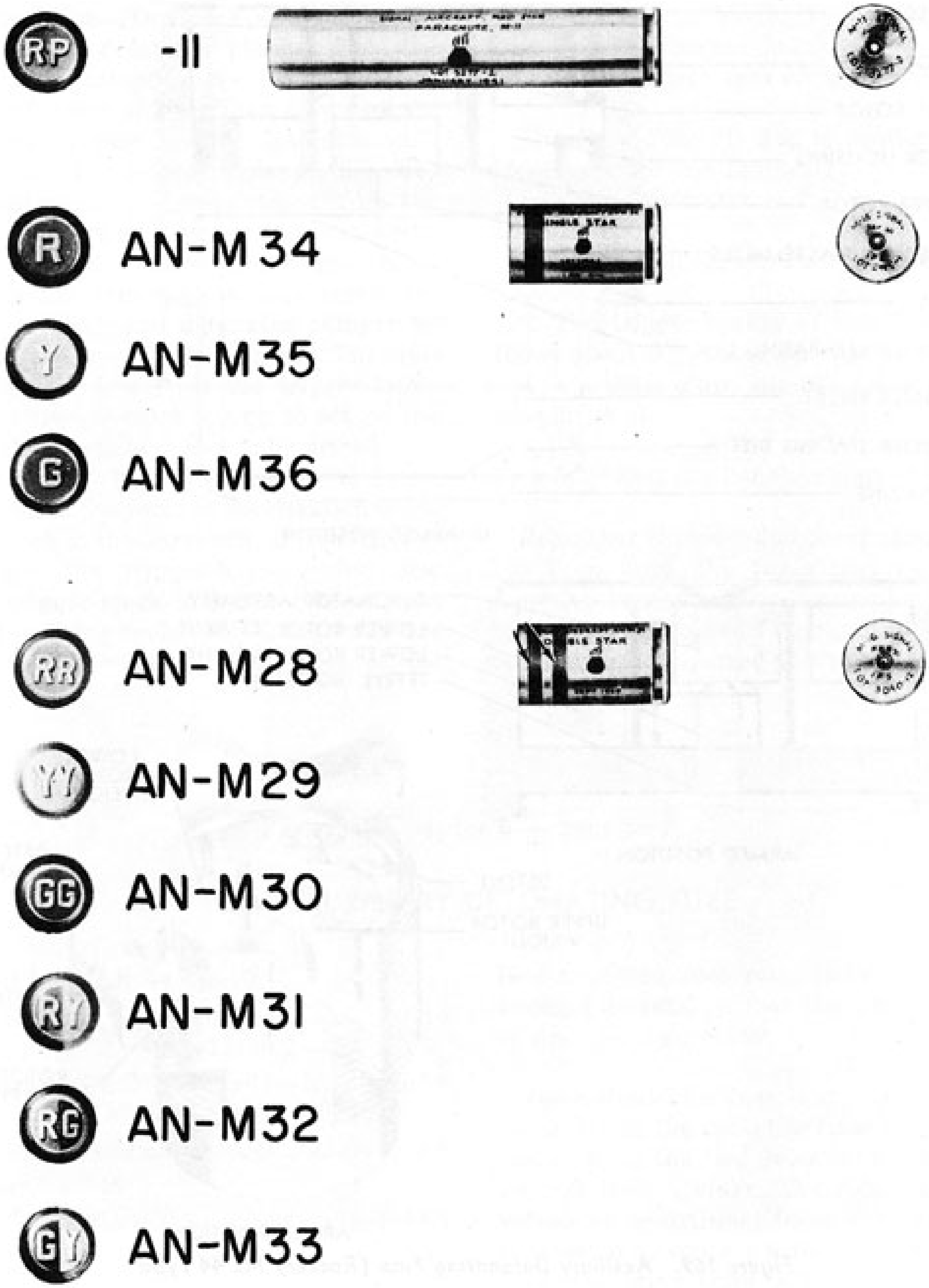


Figure 170. Cartridge Signals M11 and AN–M28 to 33 Series

Part 3

PYROTECHNICS

Chapter 7 — INTRODUCTION

General

These chapters on pyrotechnics deal with items whose principal function is either signalling or illuminating. For instance, signalling smokes are treated as pyrotechnics, but screening smokes are discussed elsewhere, under the ordnance items which carry them. Since some pyrotechnic items have many tactical purposes, they are described both here and in their other applicable sections of the book.

The effectiveness of pyrotechnics is dependent on three major factors: design, position, and the atmospheric conditions prevailing at the time of use. Variations of design govern the candlepower of the flare or signal, the color produced by the charge, and the continuity of the burning candle. The color and reflective characteristics of the objective often affect the visibility of pyrotechnics. Open ground, such as an airfield, will reflect three to four times as much light as will woods or deep water. Position, distance, relative position, background, or angle of observation also alter visibility, while the degree of light or darkness, fog, haze, or other atmospheric conditions have obvious effects.

Composition

Pyrotechnic compositions are complex chemical mixtures. On burning, they produce illuminations ranging in intensity from the "dark fire" used as an element of blinker signals to the brilliant flash produced by the photoflash bombs. Standard pyrotechnics, in general, consist of compounds to provide oxygen for burning, such as chlorates and nitrates; aluminum or magnesium for fuel; salts of barium, copper, or strontium for color; and agents such as asphalt and paraffin for binding and waterproofing.

Pyrotechnics usually function by means of an igniter train similar to an explosive train. In general, ignition is initiated by a primer mixture and intensified by a "first-fire" composition which ignites the luminous candle.

Handling and stowage

All pyrotechnics should be handled with care. Rough handling may cause immediate functioning of the item, or it may damage the item so that it will not function properly at the desired time. Much of the pyrotechnic material is more sensitive than other types of ammunition.

Pyrotechnics should be stowed in the boxes or watertight containers in which they are shipped, whenever possible. They must not be stowed with other types of ammunition.

Pyrotechnics should never be stowed where the direct rays of the sun can strike them. They should be protected against excessive and variable temperatures. If possible, the stowage space should be kept at a temperature below 100°F., and must be kept dry and ventilated.

Disposition

When directed by the Bureau of Ordnance, pyrotechnics may be disposed of by dumping overboard or burning. Dumping is preferred, and must be done ten miles off shore and in water at least 100 fathoms deep. Certain items must always be dumped, while other items may be either dumped or burned.

Methods of projection

Aircraft pyrotechnics

1. PYROTECHNIC PISTOL AN–M8—This pistol is used on aircraft with the Mount M1 and fires

through an opening, in the fuselage. It can also be detached from its mount and fired by hand. It is generally used for signalling from aircraft in flight, to troops on the ground or to other aircraft.

2. HAND PROJECTORS MK 3 AND MK 4—These projectors are fired by holding the barrel in one hand and pulling back on the firing pin handle with the other. They are used to fire Very's Signal Light Mk 2.

3. SIGNAL PISTOL MK 5—This is a single-action, single-loading pistol that fires the Very's Signal Light Mk 2.

4. VERY PISTOL M5—This is a single-action, single-loading pistol that fires the Very's Signal Light Mk 2. It is not procured by the Navy.

5. PYROTECHNIC DISCHARGER AN–M5—This is a double-action, multi-barrel (6) discharger used on aircraft when installation of pistols is not practicable. It is used for the same purpose as the Pyrotechnic Pistol AN–M8. It is not procured by the Navy.

6. HAND PYROTECHNIC PROJECTOR M9—This is a single-action, single-loaded projector which is fired by striking the firing pin with the hand or by striking the firing pin on the ground. It is used for projecting signals from the ground to aircraft in flight. It is not procured by the Navy.

7. PYROTECHNIC DISCHARGER M10—This is a metal cylinder with a mushroom firing mechanism and a hinged locking stem. It is used to fire the Red Star Signal M73.

Ground pyrotechnics

1. GROUND SIGNAL PROJECTOR M1A1—This is a single-loaded, manually operated projector used to fire the High-Bursting-Range Ground Signal M27.

2. GROUND SIGNAL PROJECTOR M3—This is a single-loaded, manually operated projector that is fired by holding the projector in the hand and striking the base on the ground. It is used to fire Signals M17 through M22.

3. GROUND SIGNAL PROJECTOR M4—This projector is similar to the M3 and is replacing it.

4. GRENADE LAUNCHERS M1, M2, M7, AND M8—This type of launcher is an extension to the barrel of a rifle or carbine. It is used to fire ground signal M17A1 through M22A1, M51A1, and M52A1.

5. TREE SUSPENSION DEVICE T1, FOR SMOKE GRENADE—This is a cardboard attachment containing about ten feet of suspension cord. It is attached to a standard smoke grenade that is launched from a carbine or rifle. The device is used to cause grenades to become entangled in trees or foliage, to permit emission of smoke above dense forests and foliage where it is readily visible to air observers.

Ship and submarine pyrotechnics

1. SIGNAL PROJECTOR MK 1 AND MK 1 MOD 1—This is a barrel, about 30 inches in length, which fits into a tube mounted on a three-legged stand. The firing pin is part of a metal disc which acts as a valve. It is used to fire Ship's Emergency Identification Signals Mks 1, 2, 3, and 4.

2. SUBMARINE ROCKET PISTOL—This is a single-loaded, breech-loaded pistol used to fire pistol rocket signals.

3. SUBMARINE EMERGENCY IDENTIFICATION SIGNAL EJECTOR—This ejector is similar to a miniature torpedo-tube arrangement. It is used to fire Submarine Emergency Identification Signals, Submarine Float Signal Mk 1, Mk 1 Mod 1, or Mk 2 Mod 0, and False Target Shell, Mk 1.

4. OTHER PROJECTORS—These include Hand Projectors Mk 2 and Mk 4, and pyrotechnic Pistol AN–M8, which are described above under Aircraft Pyrotechnics. There is also a High-Altitude Mortar Mk 20 being developed, to which official nomenclature-is being assigned.

AIRCRAFT PYROTECHNICS

Section I — PISTOL AND HAND-SIZE SIGNALS

Parachute Star M11, also M10, M14, M15, and M16

Length, inches	7.69
Diameter, inches	1.58
Burning time, seconds	30
Intensity, candlepower	20,000
Color	Red
Height, feet	200—250

Use: This is a distress signal from grounded planes.

Projection: The Pyrotechnic Pistol AN–M8 or Hand Projector M9 is used for firing the flare.

Description: The cylindrical, aluminum outer case has an extraction groove at the end containing the primer. A press-fit identification top is cemented to the end opposite the primer and has the embossed letters "R.P." for night identification. This cartridge is classified by the Army as the rimless type.

Operation: The firing pin of the pistol sets off the primer, igniting the propelling charge. The propelling charge ignites the delay fuse and propels the inner case outward. The delay fuse burns for 2.5 seconds and ignites the expelling charge, which in turn ignites the candle and expels the candle and parachute from the inner case.

Remarks: The Army has other parachute signals which are similar to the M11. These are obsolete or limited standard items:

	Embossed Letters
White Star, Parachute, M10	WP
White Star, Blinker Parachute, M15	WB
Green Star, Blinker Parachute M16	GB
Red Star, Cluster, M14	RS

Double-Star AN–M28 to AN–M33 Series (Obsolete)

Length, inches	3.02
Diameter, inches	1.58
Burning time, seconds	7
Altitude, feet	250

Use: Double-star aircraft signals are used as emergency identification by aircraft.

Projection: The Pyrotechnic Pistol AN–M8 or Projector M9 is used for firing the signal.

Description: The signal cartridge has an aluminum, plastic, or steel barrel with an extraction groove at the closed end which houses the primer. A press-fit identification top is cemented into the opposite end, finished with embossed letters to identify the colors of the stars. Appropriately colored bands around the outer case also identify the colors of the stars. In addition, the identification top is appropriately colored. These signals are also classified by the Army as the "Rimless Type."

	Color of Stars	Embossed Letters
AN–M28	Red-Red	RR
AN–M29	Yellow-Yellow	YY
AN–M30	Green-Green	GG
AN–M31	Red-Yellow	RY
AN–M32	Red-Green	RG
AN–M33	Green-Yellow	GY

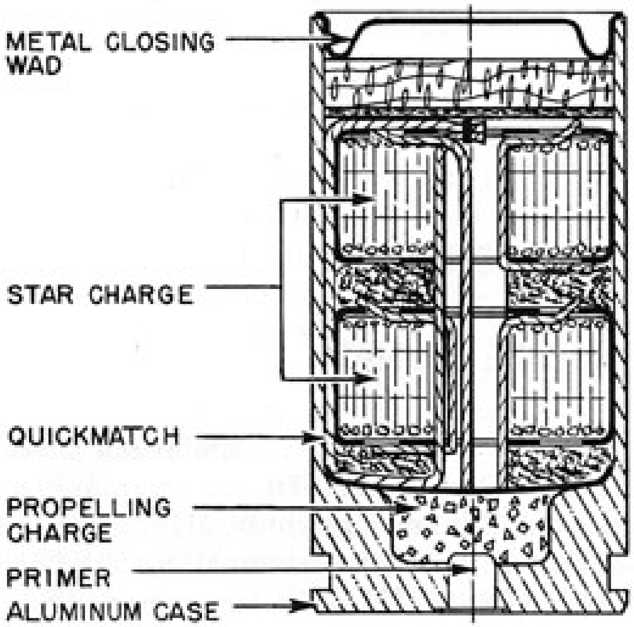


Figure 171. Cross Section of Cartridge Signal AN–M31

Operation: The firing pin of the pistol strikes the primer, igniting the propelling charge. As the stars are expelled from the pistol, they are ignited by the propelling charge through the quickmatch. The stars reach full brilliance after traveling 40 or 50 feet, and rise to a height of approximately 250 feet.

Single-Star AN–M34 to AN–M36 Series (Obsolete)

Description: This series has the single star instead of the double star of the AN–M28 to AN–M33 series, but the dimensions are the same.

	Color of Star	Embossed Letter
AN–M34	Red	R
AN–M35	Yellow	Y
AN–M36	Green	G

Remarks: This series is not procured by the Navy.

Aircraft Signals AN–M37 to AN–M42 and AN–M37A1 to AN–M42A1 Series

Length, inches	3.85
Diameter, inches	1.54
Burning time, seconds	7
Altitude, feet	250

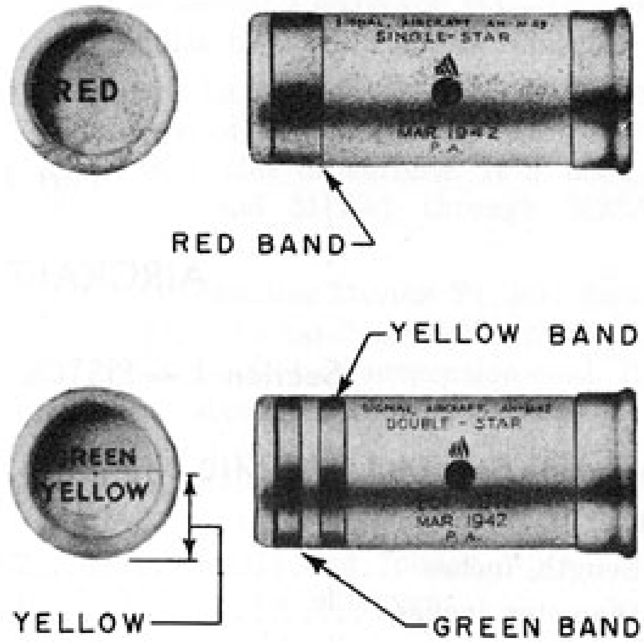


Figure 172. Aircraft Signals AN–M37 to 42 Series

Use: These signals are used for emergency identification of aircraft.

Projection: The Pyrotechnic Pistol AN–M8 is used to fire this signal.

Description: A metal or plastic head containing the primer is crimped to the paper board or metal case, the opposite end of which is closed with a cardboard wad. The colors of the stars are printed and painted on this wad, there being no means of night identification. Colors of stars are also indicated by the appropriately colored bands on the case near the forward end. These signals are classified by the Army as the Cartridge Type.

	Color of Bands and Top
AN–M37	Red-Red
AN–M38	Yellow-Yellow
AN–M39	Green-Green
AN–M40	Red-Yellow
AN–M41	Red-Green
AN–M42	Green-Yellow

Operation: These signals are similar to the AN–M28 to AN–M33 series in operation.

Remarks: The A1 series has an aluminum case.

Single-Star AN-M43 to AN-M45 and AN-M43A1 to AN-M45A1 Series

Description: This series has a single star instead of the double star of the AN-M37 to AN-M42 series; dimensions are the same.

	Color of Star and Top
AN-M43	Red
AN-M44	Yellow
AN-M45	Green

Two-Star Cartridge Mk 3 Mod 3

Description: These are interchangeable with the AN-M37 to AN-M42 series. There is no means of night identification. Color combinations available are: red-red, yellow-yellow, green-green, red-yellow, red-green, or green-yellow.

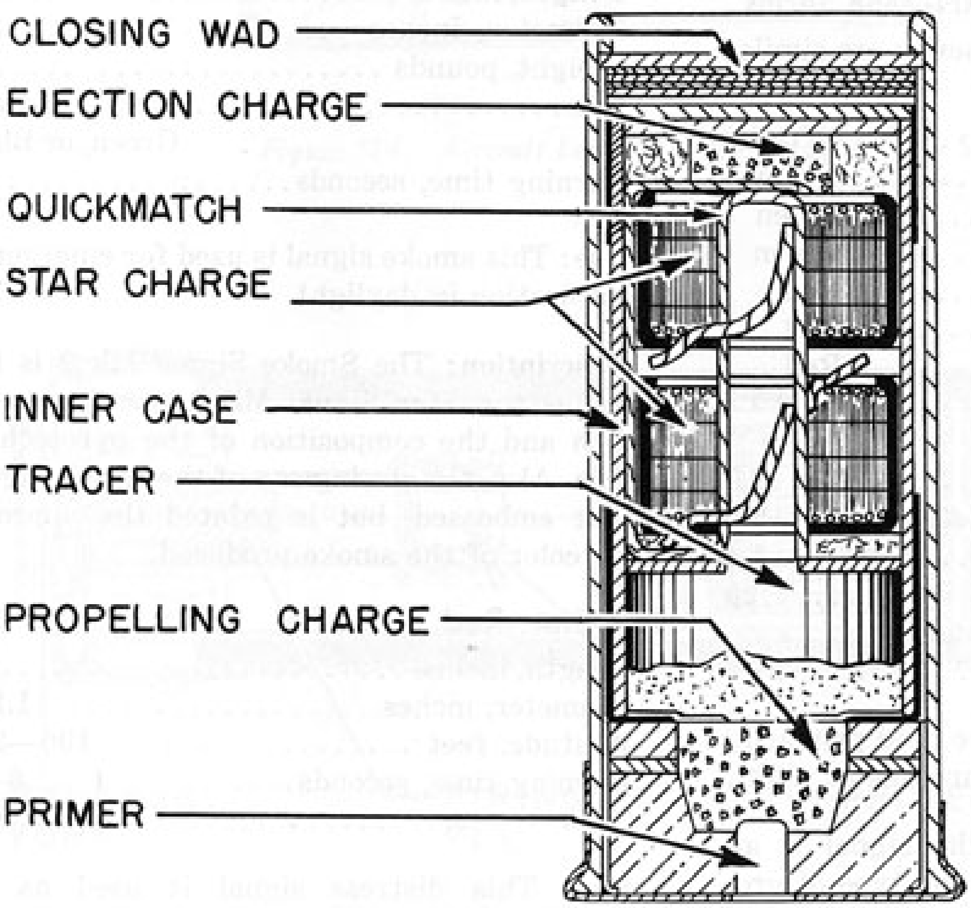
Tracer With Two Stars Mk 4 Series

Length, inches	3.85
Diameter, inches	1.52
Burning time, seconds	5
Burning time of tracer, seconds	3—4
Altitude, feet	250

Use: Double-star signals are used as a method of emergency identification of aircraft.

Projection: The Pyrotechnic Pistol AN-M8 is used to fire the signal.

Description: The outer case is similar to that of the Mk 3. The star charges are contained in an inner case which also houses an ejector charge and tracer element. Star color bands are the same as the bands on the Mk 3 and, in addi-



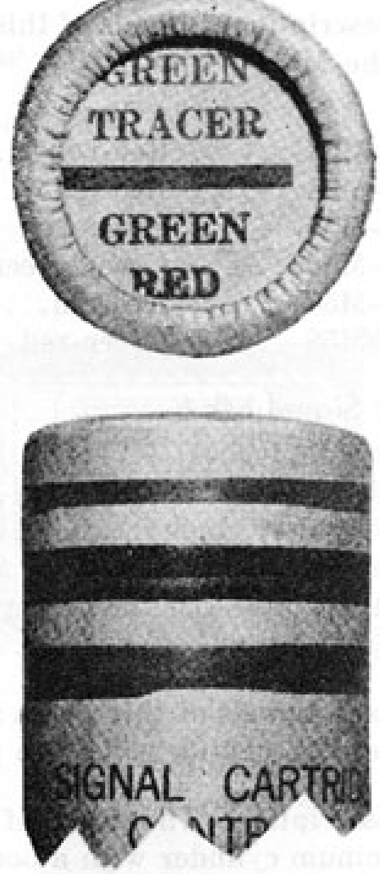


Figure 173. Tracer with Two Stars Mk 4

tion, a narrower band, before the star identification bands, indicates the color of the tracer. Color combinations are:

Red-red with red tracer
Green-green with red tracer
Red-red with green tracer
Red-yellow with yellow tracer
Red-green with red tracer
Red-green with green tracer

Operation: The firing pin strikes the primer, igniting the propelling charge, which, in turn, ignites the tracer in the inner case and expels the inner case from the barrel. The tracer becomes visible after traveling about twenty feet. At approximately 250 feet altitude, the tracer ignites the ejection charge through the quick match, the stars being ignited by the ejection charge through the quick match as they are expelled from the inner case.

Aircraft Signal AN–M53 to AN–M58 Series

Description: Signals of this series are similar to the Mk 4 series.

	Star	Tracer
AN–M53	Red-yellow	Yellow
AN–M54	Red-red	Green
AN–M55	Green-red	Green
AN–M56	Green-green	Red
AN–M57	Red-red	Red
AN–M58	Green-red	Red

Star Signal Mk 6

Length, inches	6.0
Diameter, inches	2.5
Weight, pounds	1.4
Burning time, seconds	25
Interval between launching and suspension, seconds	2.75

Use: Signals of this series are used primarily for emergency identification purposes at night.

Description: The body of the signal is an aluminum cylinder with a bouchon type of grenade-firing mechanism on one end and a metal cap on the other. Contained in the body are the ejection charge, the pyrotechnic candle, and a silk, rayon, or paper parachute. The type and color of the signal star are printed on the side of the cylinder. The closing cap on the lower end of the signal is embossed for night identification as follows: red star, one dot; white star, straight line; and green star a wide "V".

All three signals have an arc of a circle, one inch in length, embossed near the edge of the cap.

Operation: The signal is initiated in the manner prescribed for all bouchon-fuzed grenades. The 2.75-second delay, having been ignited by the primer, ignites the ejection charge. The ejection charge pushes off the closing cap, expelling the pyrotechnic candle and the parachute, at the same time igniting the starting mixture through a quick match. The parachute opens and suspends the candle, which burns for 25 seconds.

Smoke Signal Mk 7

Length, inches	10.0
Diameter, inches	2.5
Weight, pounds	2.5
Color	Red, Yellow, Green, or Black
Burning time, seconds	25

Use: This smoke signal is used for emergency identification in daylight.

Description: The Smoke Signal Mk 7 is the same as the Star Signal Mk 6, except for its length and the composition of the pyrotechnic candle. Also, the closing cap of the smoke signal is not embossed, but is painted the approximate color of the smoke produced.

Two-Star, Red, AN–M75

Length, inches	5.0
Diameter, inches	1.125
Altitude, feet	100—200
Burning time, seconds	6—8
Color	Red

Use: This distress signal is used as an emergency rescue signal.

Description: The signal is contained in a cylinder which houses the stars and the firing

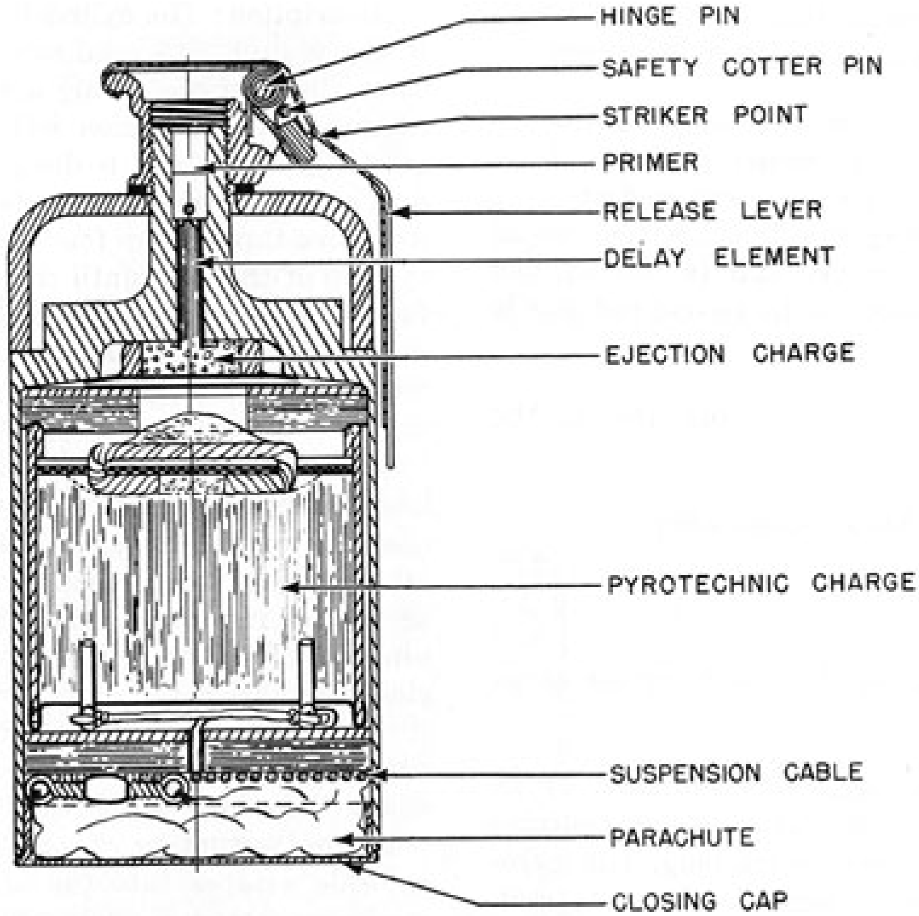


Figure 174. Aircraft Emergency Identification Star Signal Mk 6

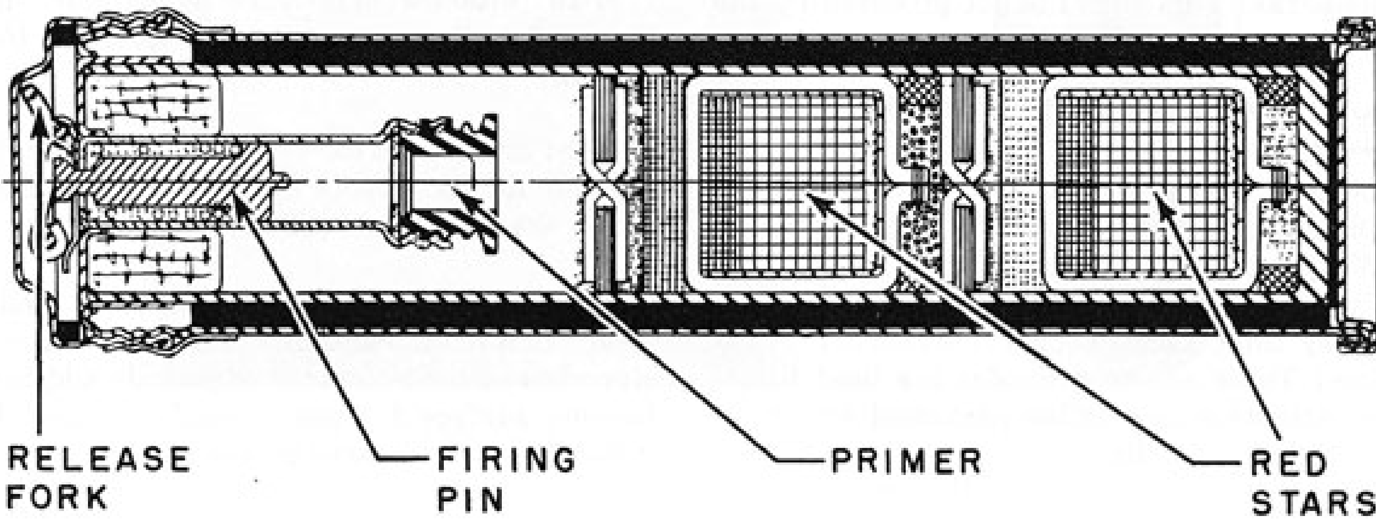


Figure 174A. Distress Signal, Two-Star, Red, AN–M75 mechanism. This mechanism consists of a pull release fork and a spring-loaded firing pin.

Operation: The tape is removed from the top cover and the cover is removed. The release fork is pulled; the firing pin is released and hits the primer, initiating the delay. After two to four seconds, the first red star is ejected, and after three to five seconds the second red star is ejected.

Remarks: This signal is not procured by the Navy.

Single-Star, Red, M73 (Obsolete)

Length, inches 2.25
Diameter, inches 1.0
Altitude, feet 200

Use: This signal was intended for use as an emergency signal.

Description: The signal is composed of an aluminum cylinder, one end of which contains a primer and the other a cork plug. The pyrotechnic composition is located below the cork plug.

Operation: The firing pin of the Pyrotechnic Discharger M10 strikes the primer, and the signal star is projected to the altitude of 200 feet.

Remarks: This signal is not procured by the Navy.

Smoke Grenades AN–M8, M16, M18, and AN–M4

Length, inches 5.7
Diameter, inches 2.57
Weight, pounds 1.68
Burning time, minutes..................3.5
Delay time, seconds 3

Use: These smoke grenades are used to attract attention to aviation personnel who have made a forced landing.

Description: The cylindrical sheet-metal case is nearly full of a solid smoke mixture. A circular zinc cup containing a starting mixture is located in a depression left in the top of the smoke mixture, and is designed to be initiated by a bouchon type of grenade-firing mechanism. Adhesive tape covers four quarter-inch holes in the top of the case until the signal is ready for firing. The grenade is painted gray and marked in yellow with one band, the symbol of the filler, "H.C.", and the word "smoke".

Operation: The release lever cotter pin having been removed, the release lever is freed by the operator as the grenade is thrown, and is forced off by the striker, which is at all times under tension of its spring. The striker moves on its hinge and fires the primer, which ignites a delay element that in turn ignites the starting mixture. The starting mixture burns through the zinc cup and starts a chemical reaction in the smoke mixture, generating considerable heat with the formation of zinc chloride. The zinc chloride escapes into the air as a gray-white smoke composed of finely divided solid particles. These particles are highly hygroscopic and become very obscuring liquid particles. The grenade burns for about three and a half minutes at full volume.

M-16 (obsolescent): Same as AN–M8—may have red, yellow, green, orange, violet, or black smoke.

M18: Same as M16, with burning reduced to one minute for a more dense smoke. Available colors are red, green, yellow, violet.

AN–M4: Has a shorter fuze lever and is issued in a metal container with three flaps designed to be bent outward to provide additional bearing surface for use in mud or snow. The AN–M4 is not procured by the Navy.

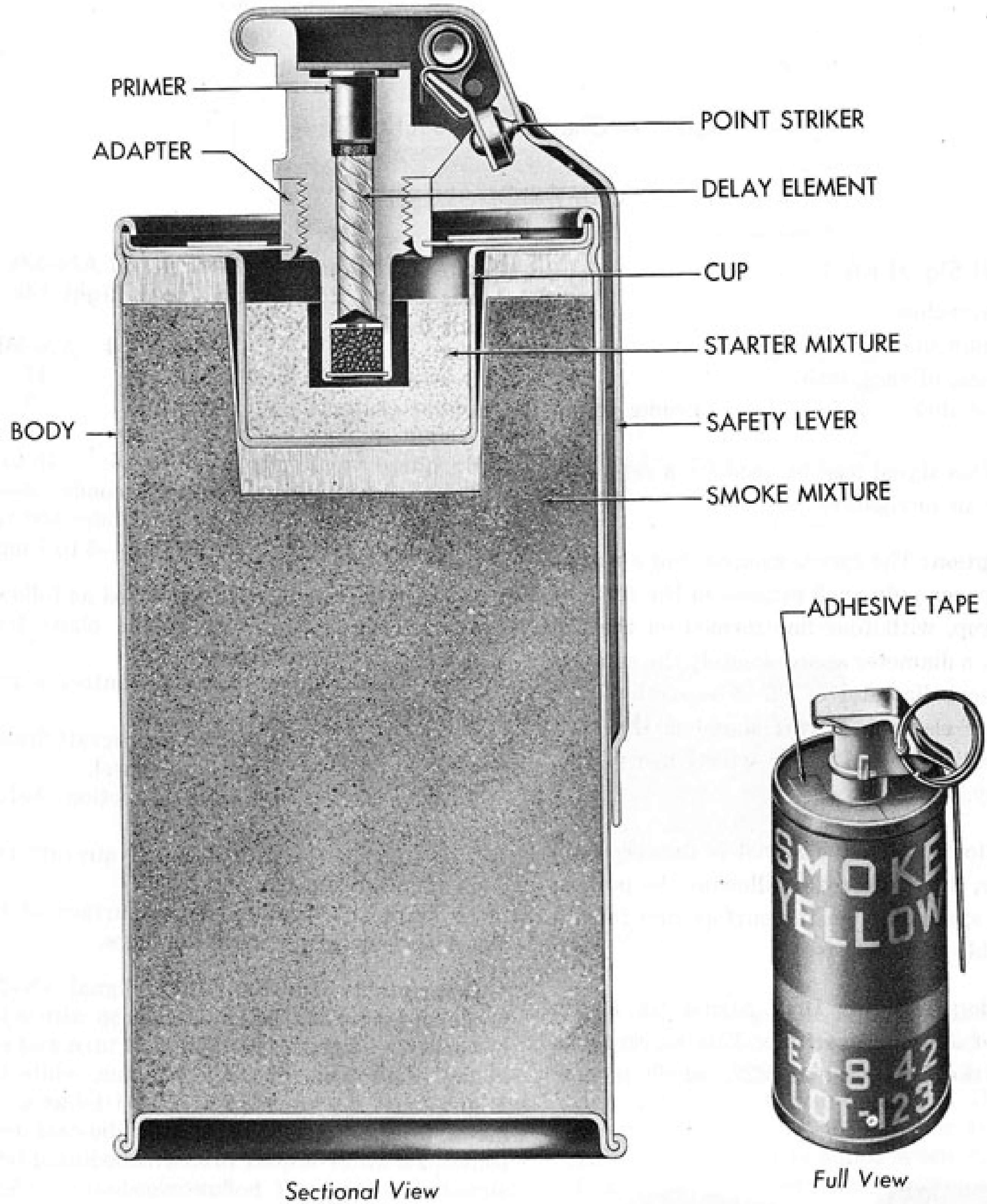


Figure 175. Smoke Grenades AN–M8 and M18

DRIFT SIGNALS

Day Drift Signal Mk 1

Length, inches	10.0
Maximum diameter, inches	3.5
Thickness of case, inch	0.07
Color of slick	Chrome yellow

Use: This signal may be used for a reference point for air navigation.

Description: The case is composed of a waterproofed paper pulp shell pressed in the form of a tear drop, with four fins formed on the tail cone with a diameter approximately the same as the greatest diameter of the nose section. The only other element of this signal is the very fine metallic powder filling which nearly fills the cavity.

Operation: When the signal is dropped into the water, the shell breaks, allowing the powder filling to spread out on the surface and form a slick visible to 15,000 feet.

Remarks: The Day Drift Signal Mk 1 is a Bureau of Aeronautics item. This marker has replaced the Drift Signal M25, which is now obsolete.

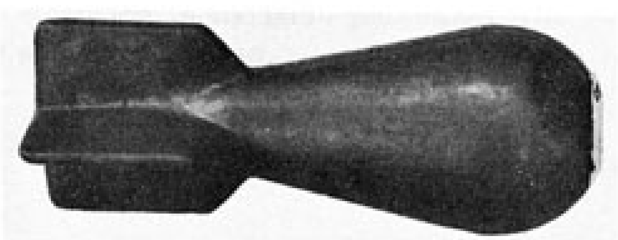


Figure 176. Day Drift Signal Mk 1

Night Drift Signals AN–Mk 4 and AN–Mk 5 Mods 1 and 2; Aircraft Float Light Mk 6 Mods 0—2

	AN–Mk 4	AN–Mk 5
Over-all length, inches	13	19
Diameter, inches	3	3
Weight, pounds	2	4
Burning time, minutes	3 to 3.5	15 to 17
Time from impact to ignition, seconds	8—12	
Release altitude	Under 500 feet	
Visibility	Night—6 to 7 miles	

Uses: These signals are employed as follows:

To determine the drift of the plane from which the signal was dropped.

To mark the initial point of contact with a submarine.

To mark an object to which an aircraft desires to call attention of a surface vessel.

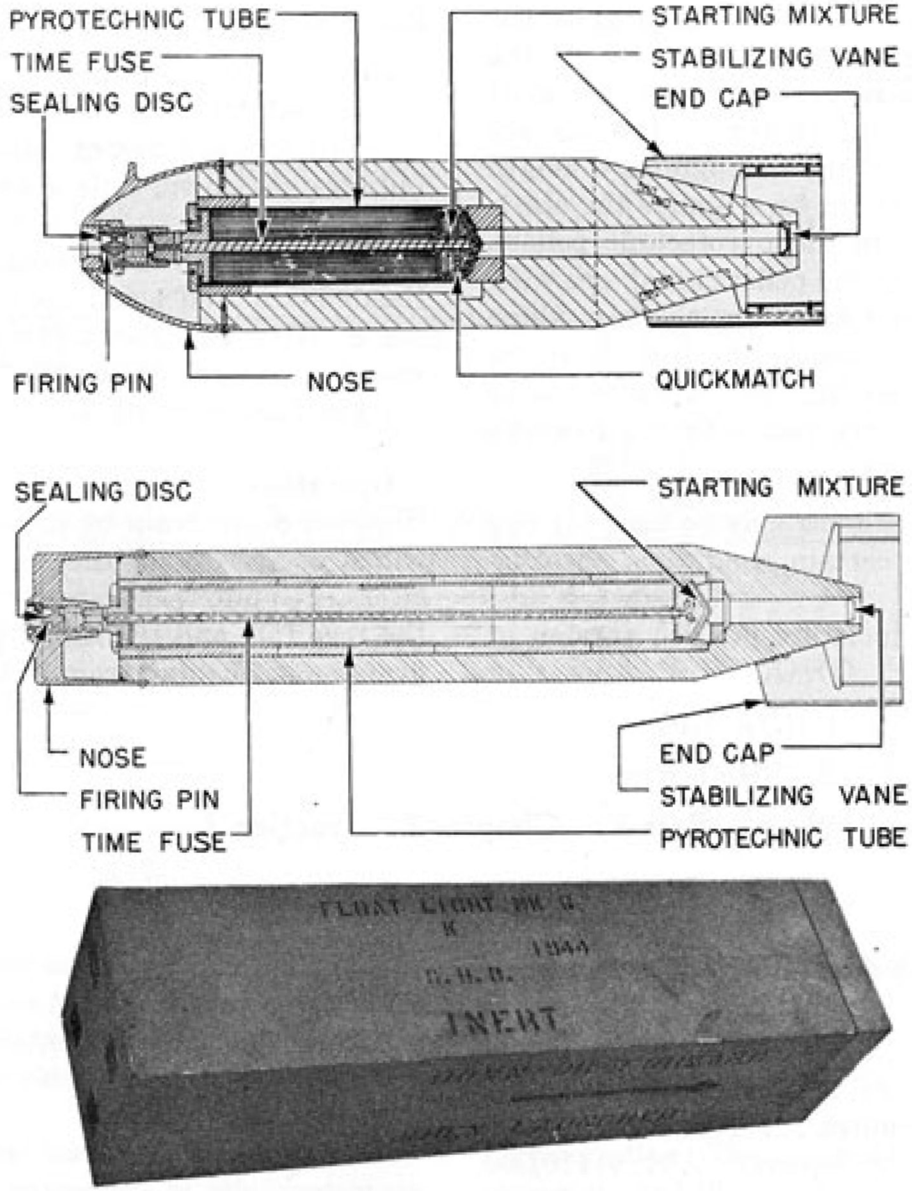
To determine the wind direction before landing.

To mark the landing deck on aircraft carriers for night landings.

To mark the location of the surface of the water for emergency night landings.

Description: The Night Drift Signal AN–Mk 4 has an ogival shaped, die-cast nose with a lug on one side so that the signal will turn and not strike the bottom in shallow water, while the Night Drift Signal AN–Mk 5 Mod 1 has a flat die-cast nose. In both cases the die-cast nose contains a water-impact fuze. The bodies of both signals are made of hollow wooden cylinders, with one end tapered, on which the tail assembly is mounted.

The pyrotechnic mixture is formed into pellets approximately four inches long and 1.25 inches in diameter, with a 0.022-inch hole concentric with the longitudinal axis through which the delay fuse passes. One pellet is used in the



100
AN Mk 4

Figure 177. Night Drift Signals

AN–Mk 4, and three pellets are used in the AN–Mk 5 Mod 1. The pellets are enclosed in a pyrotechnic tube to keep the hygroscopic material from absorbing moisture through the wooden body. Originally, pure tin was used for this purpose; but in recent lots lead and zinc have been substituted. The nose end of the signal is closed with a paraffin-treated sealing disc, while the tail is sealed with a metal cap.

Aircraft Float Light Mk 6 Mod 0 consists of four Drift Signals AN–Mk 5 Mod 1 which are contained in a square wooden body and burn successively. The box is 20.25 inches long and 5.125 inches square. The weight is 16 pounds, and the burning time is 45 minutes. The float light is released by hand from an altitude of from 300 to 5,000 feet. It gives off a grey smoke and a flame 10 or 12 inches high. The Aircraft Float Light AN–Mk 6 Mod 2 is ignited by a pull igniter which is pulled when released. The light can be dropped from an altitude over 5,000 feet.

Operation: When launched from aircraft, the drift signal falls nose-down. On impact with the surface of the water, the paraffined paper sealing disc is broken and the water drives the firing pin up against the primer. The flame from the primer ignites the time fuse which runs the length of the hole through the center of the pyrotechnic pellets in order to give the drift signal enough time to return to the surface and right itself. The time fuse ignites a length of quick match which, in turn ignites the starting mixture and then the pyrotechnic pellets. The gases evolved by the pellets break open the pyrotechnic tube and force out the cap which seals the discharge tube in the tail. A bright flame 12 to 15 inches high and a white smoke are produced. These are visible for six to seven miles on a clear night.

Remarks: These signals may be used for day signals, but under certain conditions observation is difficult.

The Mod 2 is a moisture-proofed version of the Mod 1.

Retro-Rocket Drift Signals

General: These 3-inch rockets are designed to be fired aft from a plane to eliminate the effect of forward motion, allowing the signal to fall straight down. This is called retro-firing.

Description: The rockets have the 3-inch Heads Mk 5 Mod 1 and use the Motors Mk 2 or Mk 3. With the Motor Mk 2, they weigh 4.8 pounds; with the Motor Mk 3, 4.6 pounds. They use the Launcher Mk 2.

Operation: Firing of the rocket motor initiates a delay train in the signal in the head, which delay sets off the flare 10 to 20 seconds later. The motor separates from the head during the free fall, and the signal hits the water and floats on it, burning from 10 to 15 minutes.

Part 3 — Chapter 8 — Section 3

NAVY FLARES

1½ Minute Parachute Flare

Length, inches	18.75
Diameter, inches	2.44
Weight, pounds	4.31
Burning time, minutes	1.5
Light intensity, candlepower	110,000
Color	White
Maximum release altitude, feet	1,200
Rate of fall after ignition, ft./min.	550

Use: It is used to illuminate an area for emergency night landings by certain commercial-type aircraft in use by the Navy.

Description: The flare is issued in a hermetically sealed aluminum case called a projector tube. One end of this tube is closed by a metal cap and sealed by a gasket. The other end narrows down into a small knob with an electrical terminal in the extreme end. The tube is cylindrical for most of its length.

The projector tube contains an inner case and a propelling charge of black powder. The inner case contains an ejection charge, the pyrotechnic candle, and a parachute. The ejection charge is in the after end of the inner case, and the delay fuse and interrupter mechanism are mounted on the outside of the same end of the inner case.

The electrical terminal at the end of the projector tube is connected through a toggle switch in the pilot's compartment to the lighting system of the plane.

Releasing: The projector tube, which is constructed as an integral part of the flare, is fixed by clamp bands to a bracket in the after end of the fuselage, where the firing circuit is connected when the flares are loaded. The projector tube remains in the bracket when the flare is released or expelled by closing the switch in the cockpit.

Operation: When the electrical circuit is completed in the cockpit, the propelling charge is ignited and the inner case is forced out of the projector tube. The propellant ignites the delay fuse, which burns until the inner case is approximately 40 feet from the plane and then,

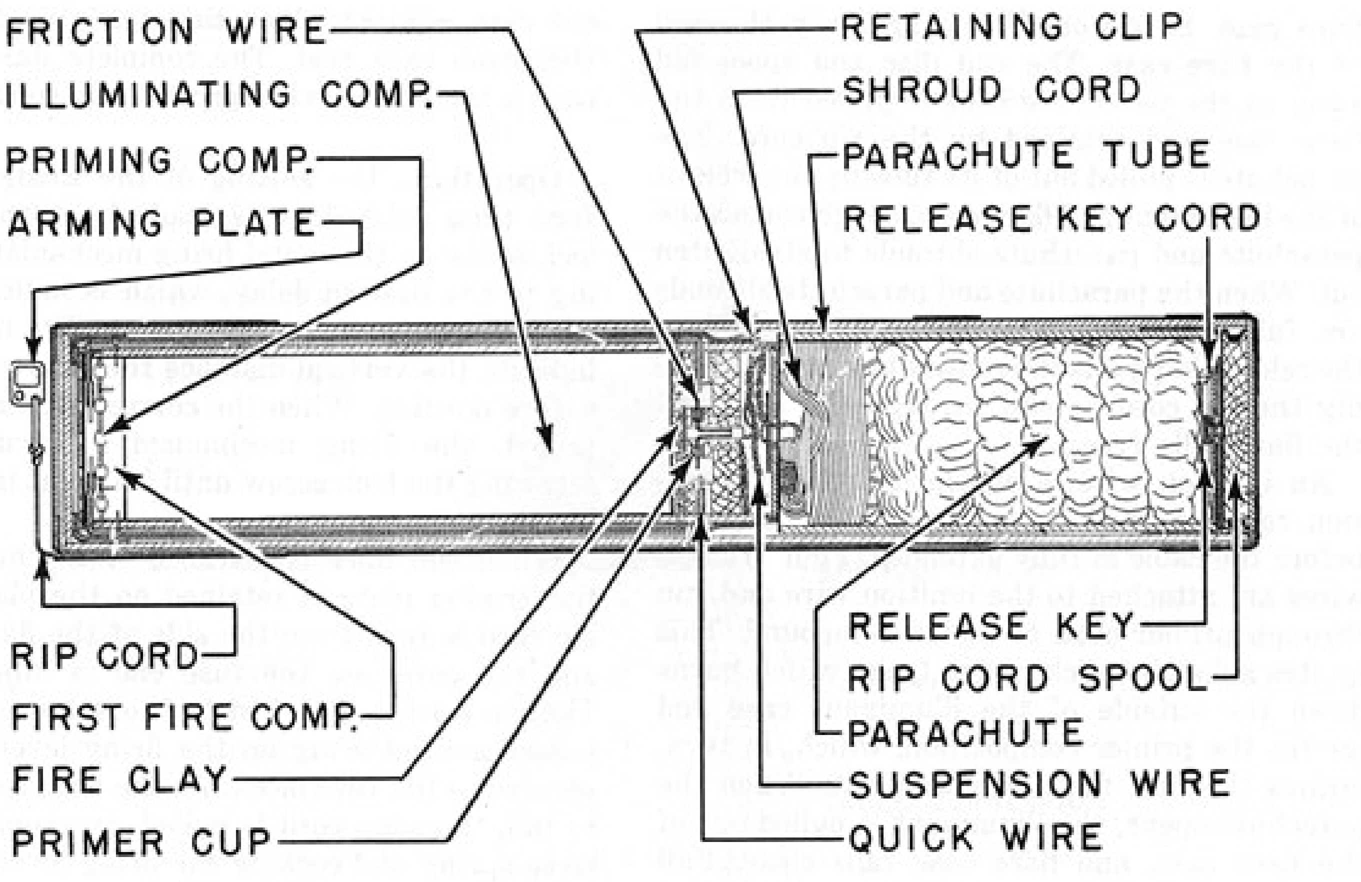


Figure 178. Flare Mk 4 Type

through an explosive lead-in, ignites the ejection charge which, in turn, forces the pyrotechnic candle and attached parachute from the inner case. Simultaneously, the ejection charge ignites the candle.

An interrupter mechanism between the delay fuse and the ejection charge in the inner case prevents the functioning of the flare until the inner case has left the projector tube and is clear of the plane.

Remarks: A proprietary item, this flare has a commercial designation of "1½ Minute Parachute Flare Mk 1 Mod 1", but this Mark designation is not that of the Navy.

Mk 4 and Mods

Length, inches	25
Diameter, inches	4.75
Weight, pounds	18
Burning time, minutes	3
Intensity, candlepower	300,000
Color	White
Releasing altitude, feet	1,200—5,000
Rate of fall after ignition, ft./min.	350

Use: Primarily, this flare is used to illuminate an area to permit the landing of aircraft. Occasionally, it is used for reconnoitering, bombing, and blinding antiaircraft defenses.

Description: The complete flare consists of a parachute and illuminant contained in a shellac-impregnated chip-board tube closed at the ends by chip-board discs which are held in place by gummed cloth and sealed with paraffin. There are two metal steadying bands fastened around the case, against which the steadying forks of the bomb rack rest. The complete flare is isued in a waterproof metal container.

Operation: The Navy Flare Mk 4 may be released from bomb racks or shackles, from an adapter, or manually. As the flare is dropped from the plane, the arming plate of the rip cord is retained by the plane and the rip cord is pulled from the side of the flare case to which it is fastened by gummed cloth tape. As the flare continues to fall, the rip cord, which is wound around a wooden spool inside the end of the flare case, is unwound, tearing away the end of the flare case. The end disc and spool fall away as the parachute tube is pulled from the flare case and retained by the rip cord. The parachute is pulled out of its tube by the weight of the illuminant and flare case, which causes the parachute and parachute shrouds to straighten out. When the parachute and parachute shrouds are fully extended, a small cord attached to the release key pulls the release key down, allowing the rip cord to slip through the key, and the flare falls free.

An ignition wire is attached to the suspension cable in such a manner that it is pulled before the cable is fully extended. Four friction wires are attached to the ignition wire and run through primer cups of match compound. This ignites a double quick-match train, which burns down the outside of the illuminant case and ignites the primer composition, which, in turn, ignites the first fire and illuminant. When the parachute opens, the illuminant is pulled out of the flare case, and flare case falls clear. Full suspension and ignition occur about 30 to 50 feet below the plane.

Mk 5 and Mods

Length, inches 27
Diameter, inches 4.75
Weight, pounds.........................18
Burning time, minutes..................3
Intensity, candlepower 750,000
Color ....Mk 5 and Mk 5 Mods 1 and 2 are white; Mk 5 Mods 3—7, yellow
Release altitude, feet.........3,500—15,000
Rate of fall after ignition, ft./min.......450

Use: The Navy Flare Mk 5 illuminates an area for reconnoitering, bombing, or landing.

Description: The complete flare consists of a parachute, an illuminant, and an impregnated chip-board case. It is closed on the parachute end by several layers of chip-board discs held in place by gummed cloth tape and sealed with paraffin, and on the fuze end, which contains the Ensign Bickford fuse, by a metal cover. There are two metal steadying bands fastened around the case, against which the steadying forks of the bomb rack rest. The complete flare in its case is issued in a waterproof metal container.

Operation: The setting of the Ensign Bickford time delay fuse is made by turning the lock screw on the metal firing mechanism housing to the desired delay, which is indicated on the bevel of the fuze-setting ring. The numbers indicate the vertical distance the fuze will drop before igniting. When the correct setting is obtained, the firing mechanism is secured by screwing the lock screw until its point is buried in the flare case.

When the flare is released from the plane, the arming plate is retained on the plane, the rip cord is torn from the side of the flare case, and the cover on the fuse end is flipped off. The rip cord is attached to the snap cord that passes around a lug on the firing lever and is secured to the fuse block. As the flare continues to fall, the snap cord is pulled, overcoming the lever spring and cocking the firing lever. When a tension of approximately 38 pounds is reached in the snap cord, it breaks, releasing the firing lever and the lever spring, then driving the firing lever back against the fulminate of mercury primer. The flare now falls free.

The primer ignites the black-powder pellets in the fuze plunger. The expanding gases from the burning black powder propel the sharp point of the plunger radially outward into the Ensign Bickford time fuse. There are three small holes near the point of the plunger which allows some of the flame to escape from the inside of the plunger into the powder of the Ensign Bickford fuse that causes its ignition. The time fuse burns its predetermined length at the rate of approximately 12 inches per 60 seconds, and ignites the quick match under the firing block.

The flash produced by the quick match ignites the firecracker fuse stapled to the ignition composition. The gases evolved when the ignition composition begins to burn force the end discs out at the parachute end, then expel the parachute and illuminant. The parachute tube, which is of split construction, falls away; the parachute opens; and the retention cable slides through the trigger snap on the end of the

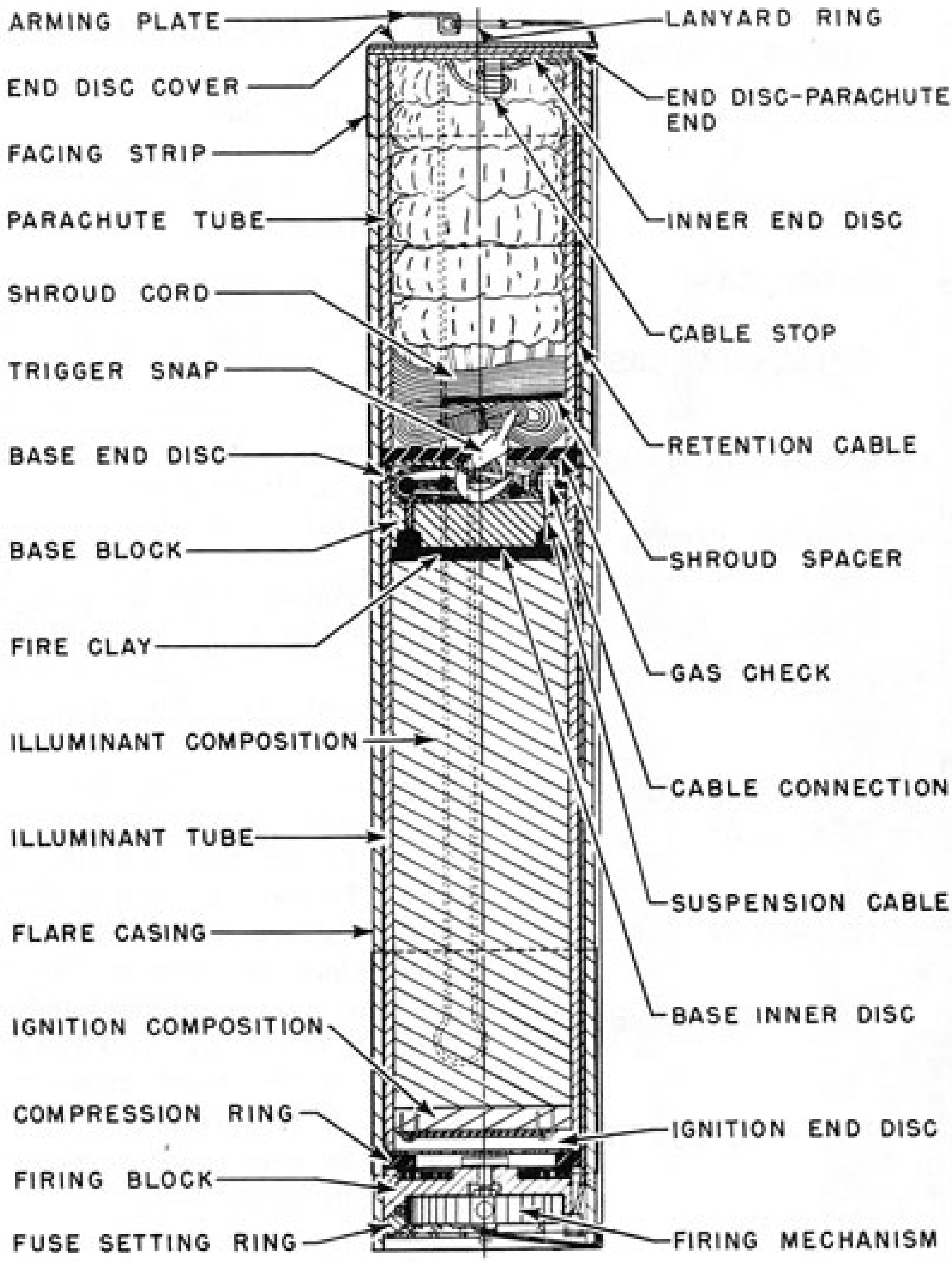


Figure 179. Flare Mk 5 Type

shroud lines until it reaches the cable stop. A short length of cable on one side of the cable stop suspends the flare case, and a longer length on the other side suspends the illuminant. This keeps the case from dropping as a missile hazard. The sudden shock caused by the contact of the cable stop with the trigger snap is taken up by a shock absorber. This is done by pulling a cable containing lead balls, called snubbers, through a hole which is of smaller diameter than the diameter of the snubbers. As each snubber passes through the hole, part of it is sheared off, thus absorbing part of the shock. The last ball is of much greater diameter and acts as a stop.

Remarks: In later models a new type of shock absorber eliminates the use of lead snubbers. The cable pulls through a connection in which friction absorbs the shock of the parachute opening.

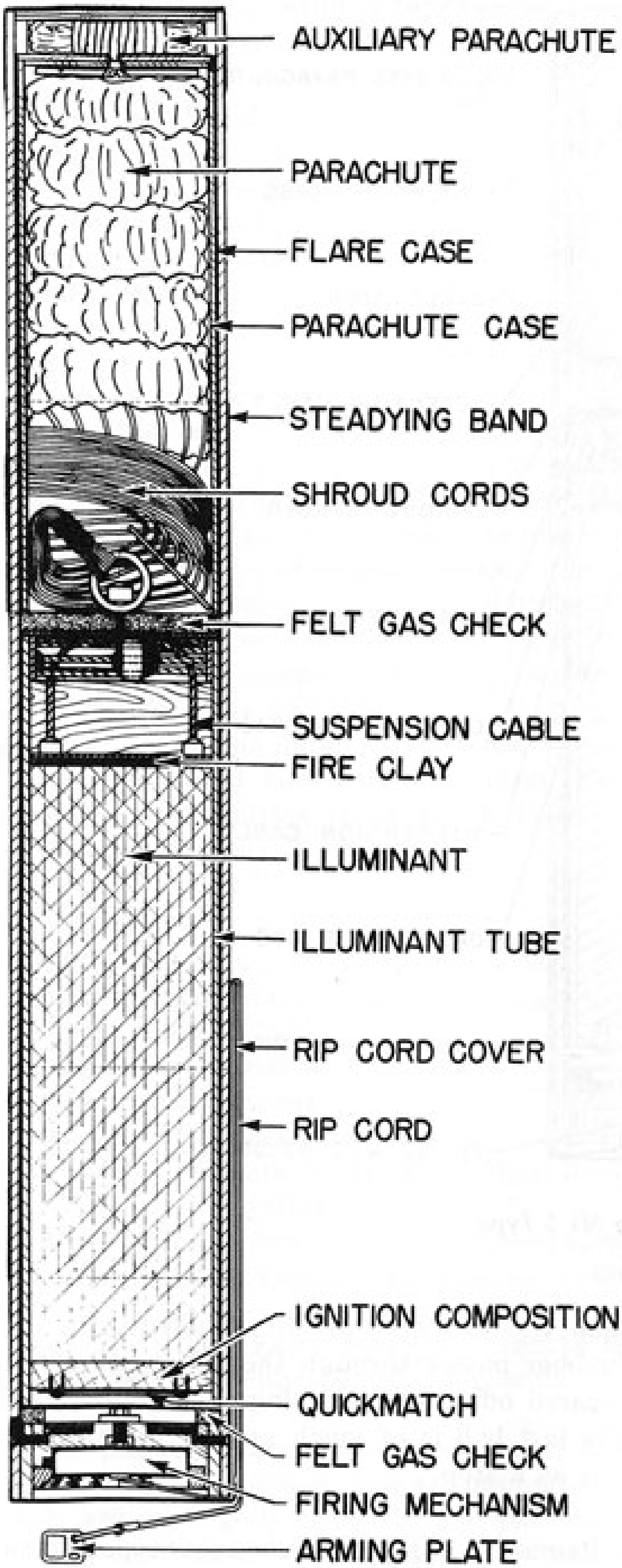


Figure 180. Flare Mk 6 Type

Mk 6 and Mods and AN–Mk 6 Mod 5

Length, inches	37.75
Diameter, inches	5.4
Weight, pounds	30
Burning time, minutes	3—3.5
Intensity, candlepower	1,000,000
Color	Yellow
Release altitude, feet	3,500—15,000
Rate of fall after ignition, ft./min.	450

Use: These flares are used to illuminate a large area for reconnoitering and bombing, and also as a blinding effect on the operators of antiaircraft weapons.

Description: The complete flare consists of the illuminant, a parachute, and an auxiliary parachute contained in a shellac-impregnated chip-board case. The case is closed on the parachute end by several layers of chip-board discs held in place by gummed cloth tape and sealed with paraffin, and on the illuminant end by an Ensign Bickford time fuse and a metal cover. To the snap cord of the Ensign Bickford fuse is attached the rip cord, which is taped down along the side of the flare case. There are two metal steadying bands around the case, against which the steadying forks or sway braces of the bomb racks rest. The flare is issued in a waterproof metal container, and should be kept there at all times when not installed in an aircraft.

Operation: When the flare is released, the arming plate is retained by the plane and the rip cord is torn from the side of the case, flipping the metal cover off the Ensign Bickford fuse. The operation of the fuse is the same as given in the Navy Flare Mk 5.

The gases evolved when the ignition composition begin to burn, force the end out of the flare case. Next, they expel the auxiliary parachute, the parachute in its case, and the illuminant. The flare case falls clear. The auxiliary parachute opens and retards the parachute in its case, to which it is attached, and the illuminant pulls the parachute out of its case. The auxiliary parachute and parachute case fall away, and the parachute opens.

Remarks: This flare also incorporates a shock absorber as used in the Navy Flare Mk 5, with either lead balls passing through a hole of smaller diameter than the lead balls, or a special connection utilizing friction to absorb shock of the parachute opening. *See Operation, p. 240.*

The Flare AN–Mk 6 Mod 5 differs from the Mk 6 and Mods in that the arming wire has swivel loops instead of an arming plate.

Flare Container Mk I Mod 0

Use: The Flare Container Mk 1 Mod 0 is an electrically operated jettisionable container for carrying six aircraft parachute flares of the Mark 6 type only, which may be released one at a time by electrical impulses from a 24-volt battery. The container may be suspended from any standard single or double-hook bomb rack.

Construction: It is necessary to cock the mechanism manually before the container can be loaded or unloaded. The container holds six flares, three on each side of the vertical panel, one above the other. The dividing panel assembly supports the flares by metal arms or chocks. The flares are loaded with the fuze end aft, and the end of the lanyard is secured to the container. The energy for the operation of the container is stored in torsional springs and released by a solenoid. By wiring in series, several containers can be operated to secure an uninterhupted release of a series of more than six flares.

Operation: When the solenoid is energized, the spring-loaded plunger, which is linked mechanically to the release rack, retracts completely, thereby effecting the release of one flare. The solenoid plunger will remain retracted so long as the current is on. To release another flare, the circuit must be broken long enough to allow the spring-loaded plunger to return to the normal position before applying the next impulse. The maximum rate of release is about 10 flares per second, which is the highest rate practicable in order to prevent interference between the individual flares.

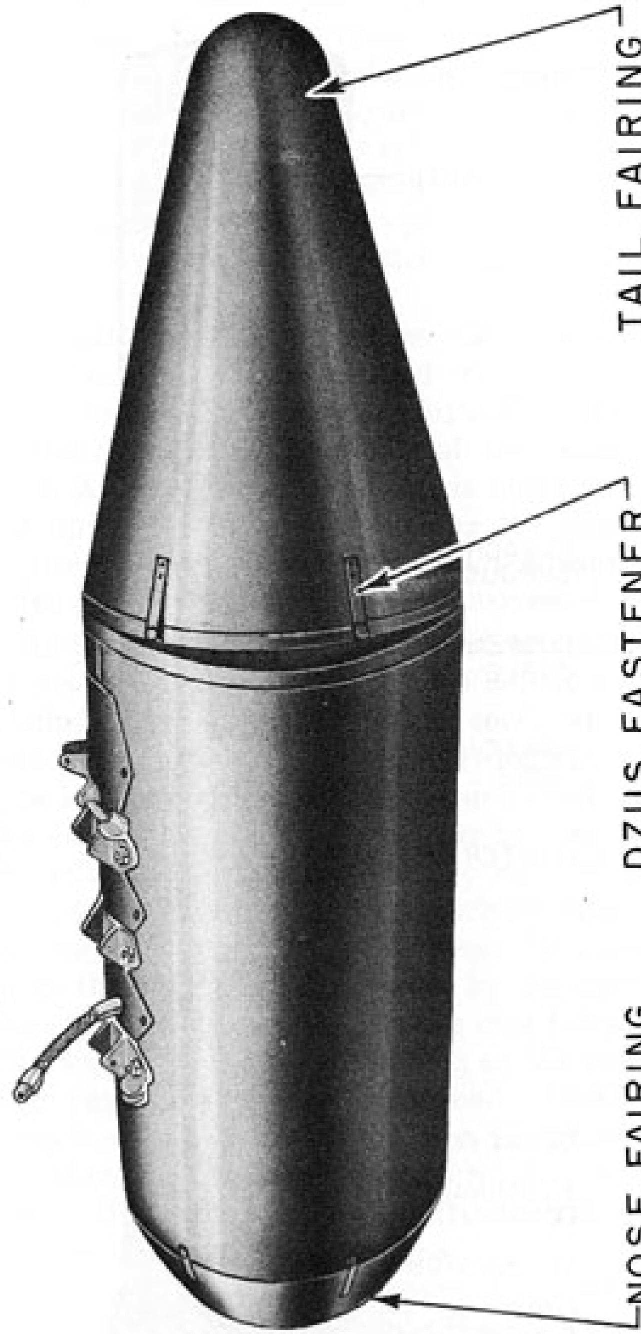


Figure 181. Flare Container Mk 1 Mod 0

The cocking lever should always be in the "safety" position when on the ground, and only switched over to the "operational" position before the plane takes off. Correctly loaded flares are a fire hazard, since they are always armed.

Remarks: When the container is used in a bomb bay, it is intended that it be used without the nose and tail fairings. If desirable, the spring doors may also be removed.

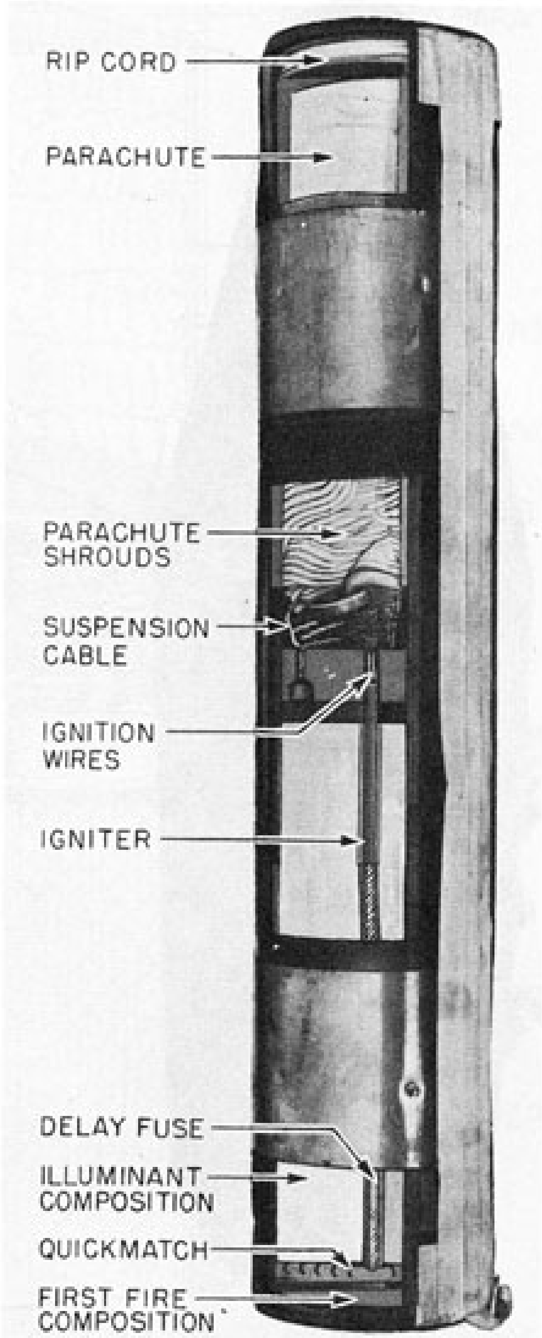


Figure 182. Flare AN–Mk 8 Type

AN–Mk 8 and Mods

Length, inches	25.0
Diameter, inches	4.75
Weight, pounds	16.0
Burning time, minutes	3—3.5
Color	Yellow (pale)
Intensity, candlepower	600,000
Minimum release altitude, feet	2,500
Rate of fall after ignition, ft./min.	500

Use: This flare was developed specifically for night antisubmarine warfare.

Description: This flare is the same as the Navy Flare Mk 4, except that the over-all length is two inches shorter and the illuminant in the Mod 0 and Mod 1 has a 90-second delay fuse through its center or a 120-second delay fuse in the Mod 2.

Operation: This flare is similar to the Navy Flare Mk 4, except that, when the ignition wire attached to the suspension cable is pulled, it pulls the friction wires in the Ensign Bickford fuse igniter, igniting the delay fuse running through the center of the illuminant. When the parachute opens, the illuminant is pulled out of the flare case, and the flare case falls away. The sudden shock caused by the opening of the parachute is taken up by a shock absorber of the solder balls and aperture type employed on the Flare Mk 4. Full suspension of the flare occurs approximately 30 to 50 feet below the plane, and 90 or 120 seconds later the first fire of the illuminant is ignited by the delay.

Remarks: The Flare Mk 8 Mod 1 and Mod 2 can be launched at speeds up to 220 knots, but the Flare Mk 8, which does not have the snubbers for the shock-absorber effect, should not be launched at speeds greater than 150 knots.

Mk 10 Mod 0

Length, inches	37.75
Diameter, inches	5.4
Weight, pounds	30
Burning time, minutes	4.5
Intensity, candlepower	750,000
Color	Pale yellow
Release altitude, feet	3,500—15,000
Rate of fall after ignition, ft./min.	450

Use: This flare is employed to illuminate an area for reconnoitering, bombing, or landing.

Description: The Navy Flare Mk 10 Mod 0 has the same dimensions as the Mk 6 and Mods. The internal construction is similar to the Mk 5 and Mods, except that the Mk 10 Mod 0 has a metal suspension cup to which the suspension cable and pyrotechnic candle are fastened, and the Mk 5 and Mods has a wooden suspension-base block.

Operation: The operation is similar to that of Navy Flare Mk 5 and Mods.

Remarks: Though this flare has a specified light intensity of 750,000 candlepower, tests have shown that it has a light intensity of 800,000 to 850,000 candlepower. In the future it may be manufactured so as to have a light intensity of approximately 1,000,000 candlepower.

Mk 11 Mod 0

Length, inches	37.75
Diameter, inches	5.37
Weight, pounds	30
Burning time, minutes	3
Color	Pale yellow
Intensity, candlepower	1,000,000
Delay, seconds	90—180
Minimum release altitude, feet	2,500—4,000

Use: The Navy Flare Mk 11 will supplement the AN–Mk 8 for night antisubmarine warfare.

Description: The shellac-impregnated chip-board case of this flare has two metal steadying bands fastened to it and is closed at the parachute end by a chip-board disc held in place by a gummed cloth and sealed with paraffin. The rip cord is wound around a spool at the parachute end of the flare, and is attached to the parachute tube through a release key. The parachute and parachute shrouds are enclosed in the parachute tube. The shrouds are attached to a suspension cable, which is attached to the illuminant assembly.

The fuze end of the flare is closed by a metal fuze and a cover which must be removed when setting the fuze. Immediately below the cover is a firing lanyard with a swivel loop on one end and a clip-type loop on the other.

The selective-delay ignition device is similar to the fuze used in the Mark 5 and Mark 6 types of aircraft parachute flares, the chief difference being that the fuze is initiated by a pull cord running through the center of the illuminant instead of by a firing lanyard. The pull cord is attached to the suspension cable. A safety screw keeps the firing lever of the fuze in position during shipping. A friction-type snubber is employed at the lower end of the suspension cable.

Operation: The metal fuze-end cover is removed and the firing lanyard withdrawn. The clip-type loop or the metal lanyard is attached to the arming wire retainer of the launching gear. A selective delay setting is made by pulling up on the index pin, turning the indicator to the required delay, and then releasing the index pin. The safety screw is removed.

As the flare falls away from the aircraft, the swivel loop of the firing lanyard is held by the arming-wire retainer. The rip cord, which is fastened to the metal lanyard through the clip-type loop, unwinds from the wooden spool inside the end of the flare casing, thus tearing away the end of the flare casing. The rip cord then pulls out the spool and the parachute tube containing the parachute. The spool falls away. Since the parachute tube is held by the rip cord, the pyrotechnic candle and flare case fall away. The weight of the candle pulling on the suspension cable and parachute shrouds draws the parachute out of the tube. When the parachute and shroud lines are fully extended, the release-key cord becomes taut and pulls one end of the release key down. This allows the rip cord to pull through the key and become detached from the parachute and the tube, which falls clear. The rip cord and metal lanyard are retained by the aircraft. The parachute opens and suspends the flare 30 to 50 feet below the aircraft. The parachute pulls the candle out of the flare case, which falls free.

The selective-delay ignition device functions in a manner similar to the fuze used in the Flares Mk 5 and Mk 6. The fuze is initiated by a wire pull cord which passes through a hole through the center of the candle. The pull cord is attached to the suspension cable in such a manner that it is pulled away from the primer and then released, striking the primer and

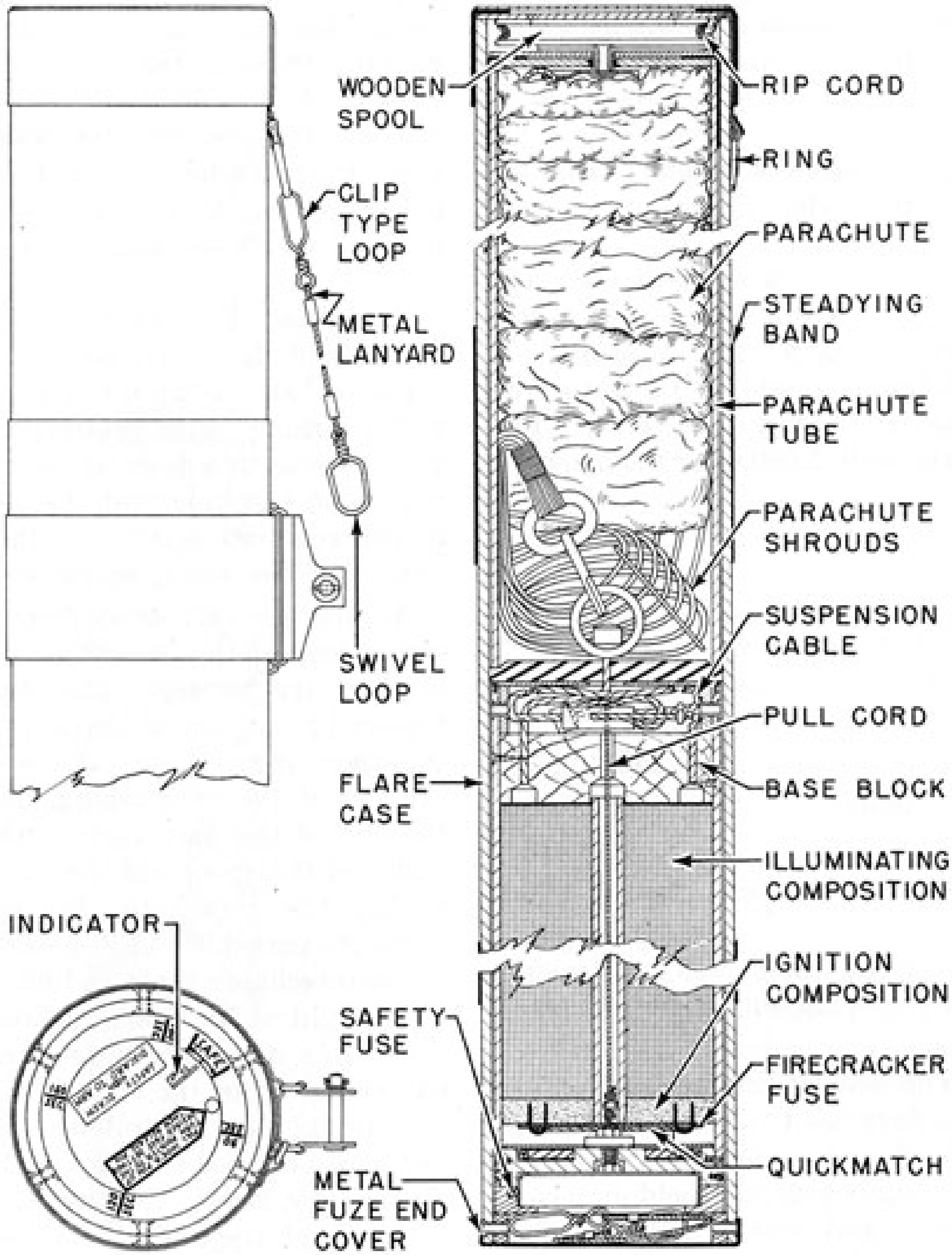


Figure 183. Flare Mk 11 Mod 0

igniting the powder pellets in the fuze plunger. The burning powder forces the pointed end of the plunger into the Bickford Fuse which is ignited by flame through holes in the plunger. The time fuse ignites the quick match under the fuze block, which in turn ignites the quick match and firecracker fuse stapled to the ignition composition. The ignition composition ignites the candle. The gases generated by the burning candle blow the fuze assembly off from the end of the pyrotechnic candle, and the fuze falls clear.

Remarks: This flare differs from the AN–Mk 8 and Mods in that there is a selective delay between the opening of the parachute and ignition of the pyrotechnic candle. The selective delay allows a single patrol plane to drop a flare near the target and then get into position for the attack before the flare discloses his position.

Float Flare Mk 17 Mod 0 and Mod 1

Length, inches	60.75
Diameter, inches	9.5
Weight, pounds	88.0
Color	Yellowish white
Intensity, candlepower	1,000,000
Burning time, minutes	4.5—5
Delay, minutes	Mod 0—1
	Mod 1—5.5

Use: This flare is used to illuminate enemy surface craft.

Description: The flare case is a cylindrical body of sheet metal tapered at one end from 9½ inches to approximately 4 inches, which section has a lead weight and four membrane-covered ports approximately two inches in diameter. The after end of the flare case is closed by a canvas bag containing a parachute. The candle is in a central tube so mounted as to keep the burning mixture at the top of the flare by spring action.

Operation: When the flare is removed from the box, the adhesive tape on the cover is pulled off and membranes covering the ports in the nose are punctured. The flare is loaded into the bomb rack with the pointed end of the flare toward the forward end of the plane. Sufficient static line is pulled from the pocket in the parachute canvas bag to allow the ring attached to the end of the line to be secured to the arming-wire retainer on the rack or shackle. On launching, a combination-type fuze causes a delay before the pyrotechnic candle burns.

Remarks: Flares having a one-minute delay setting may be released at elevations between 100 and 4,000 feet; 5½-minute delays may be released from greater altitudes. Descent is at a rate of between 80 and 100 feet per minute.

A continuous illumination of nine minutes' duration may be obtained by dropping a Mod 0 and a Mod 1 together.

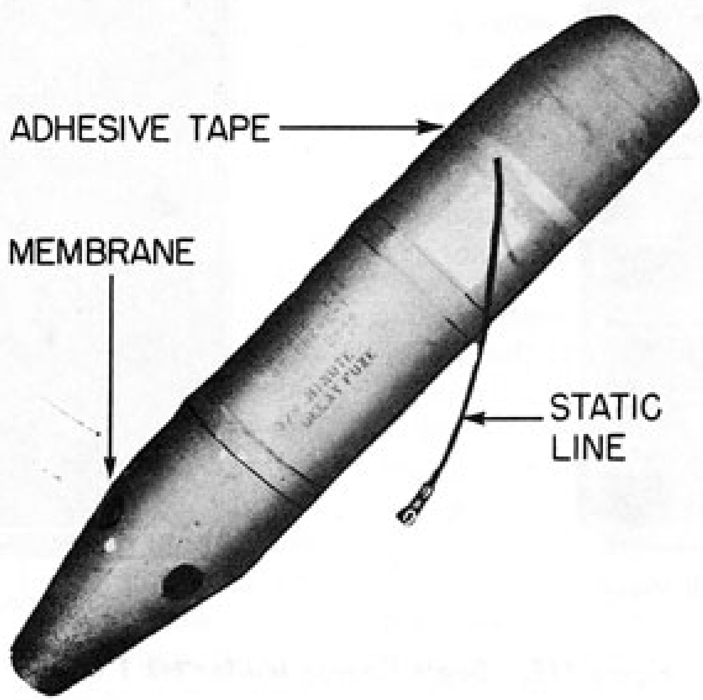
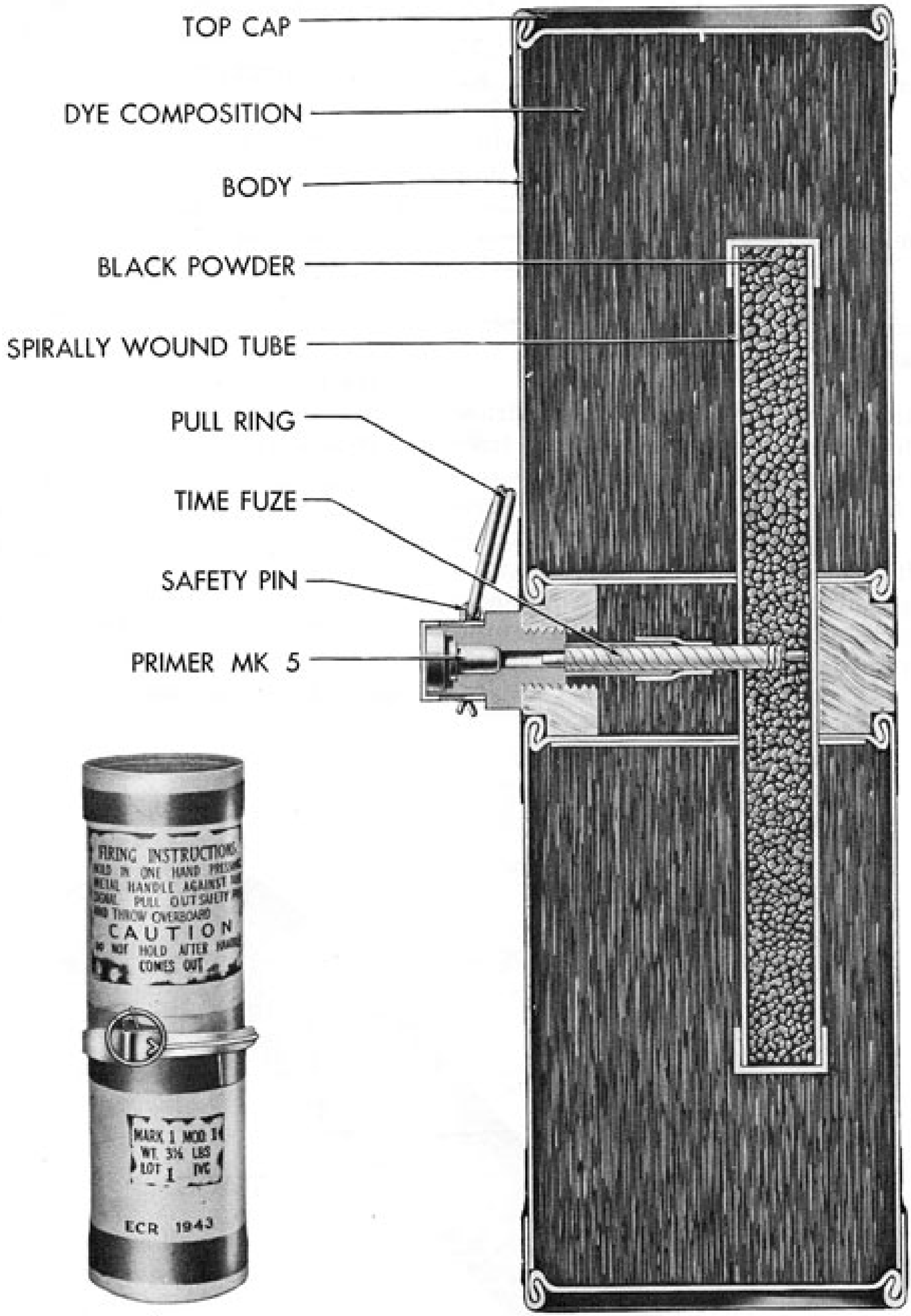


Figure 184. Float Flare Mk 17 Type



Full View

Sectional View

Figure 185. Depth Charge Marker Mk 1 Mod 1

DEPTH CHARGE AND SLICK MARKERS

Day Depth Charge Marker Mk I Mods I and 2

Over-all length, inches 11.88
Diameter, inches 3.46
Weight, pounds 3.5
Weight of dye, pounds 2.75
Weight of bursting charge, grams 30
Effective releasing altitude . . . . . Up to 1,000′
Visibility . . . . . . 3,000 yards from deck of ship
5 miles from aircraft

Use: The marker is used to indicate the initial point of contact with submarines and provide a reference point for further search and attack during day operation.

Description: The marker consists of a circular wooden block on which is mounted a grenade-firing mechanism with a 15-second delay. Fluorescein dye is contained in two cylindrical paper cans, one attached to each flat side of the wooden block; and a celluloid tube containing the black-powder bursting charge is attached to the delay element and extends through the wooden block into the paper cans. The dye is rusty red in color when dry, but a water solution of the dye is yellow-green.

Operation: The operator clasps the marker firmly in one hand, being sure that the release lever is held against the body of the marker. With the other hand, he pulls the safety ring which is attached to the safety cotter pin and launches the marker by throwing it over the side. When the marker is released, the spring-loaded striker forces the release lever off. The striker, rotating about a hinge pin, hits the primer that ignites the 15-second delay fuse. The delay gives the marker sufficient time to reach the water and float on the surface, and then ignites the bursting charge. The gases evolved from the charge burst the dye containers and spread the dye on the water, forming a yellow-green slick about 40 feet in diameter. The slick lasts for 45 to 60 minutes.

Night Depth Charge Marker Mk 2

Over-all length, inches 7
Diameter, inches 5
Weight, pounds 2.5
Effective releasing altitude . . . . . Up to 3,000′
Visibility . . . . 4 miles from deck of ship
10 miles from aircraft
Burning time, minutes 55
Ignition time (after impact) . . 70—90 seconds

Use: The marker is employed to indicate the initial point of contact with submarines and provide a reference point for further search and attack during night operations.

Description: The marker is a sealed, cylindrical, metal container that has a centrally located tube, sealed on both ends by tear strips with a pull ring attached, and containing calcium phosphide. The main charge is calcium carbide that surrounds the central tube and is held in one end by a screen. This produces a concentration of weight at one end and allows the marker to float in an upright position.

Operation: After the two tear strips are pulled off, the marker is launched by throwing it overboard. Water enters through the small holes in the bottom and reacts both with the calcium carbide (producing an inflammable gas, acetylene) and with the calcium phosphide (producing a spontaneously ignited gas, phosphine). Both gases escape from the small holes in the top and ignite within 70 to 90 seconds after impact with the water. In extremely cold weather, the ignition delay may be somewhat longer. The resulting flame is about nine inches high. If it should be put out by rough water, the gases will ignite again.

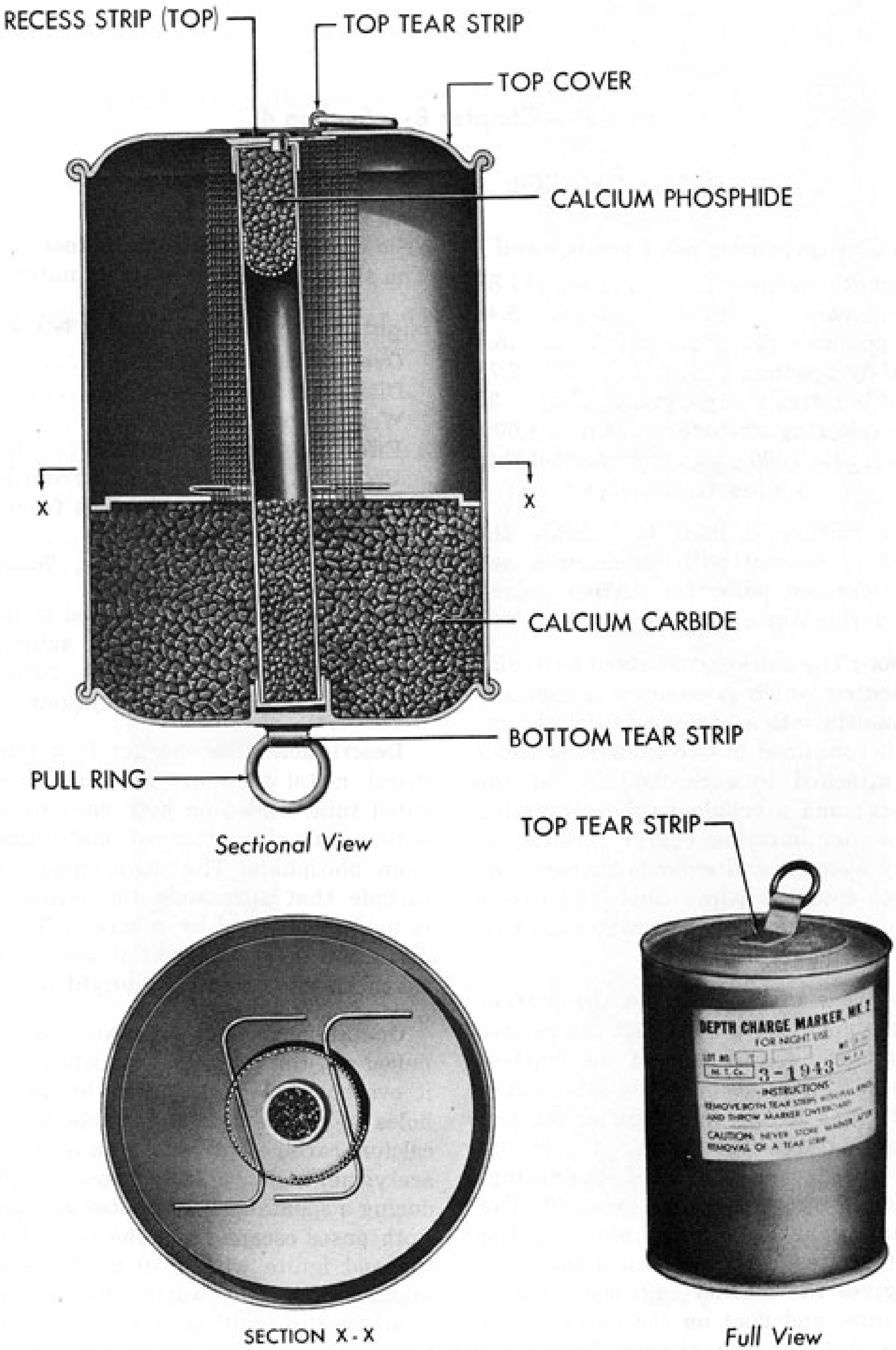


Figure 186. Depth Charge Marker Mk 2

Slick Marker Cartridge AN–Mk I

Length, inches	3.8
Diameter, inches	1.5
Muzzle velocity, ft./sec.	300
Weight of dye, grams	28

Use: This marker is used primarily to provide reference points for aircraft engaged in antisubmarine warfare.

Description: The cartridge is composed of a shotgun-type case containing a primer, a black-powder propelling charge, and the projectile. The projectile has a thin aluminum case and contains 28 grams of fluorescein dye and a black-powder bursting charge initiated by a Bickford type fuse.

Launching: The marker cartridge is fired in the Pyrotechnic Pistol AN–M8, which may be held in the hand or mounted in the Mount M1.

Operation: When the cartridge is fired, the black powder in the head of the case propels the projectile from the pistol and at the same time ignites the Bickford fuse. The fuse burns for about eleven seconds before igniting the bursting charge which expels the fluorescein dye out into the water. The projectile has a positive buoyancy and will remain near or at the surface until a small, bright green slick is created.

Remarks: This cartridge should not be fired from altitudes greater than 500 feet, because the cartridge must be in the water when it bursts.

Slick Marker AN–M59

Length, inches	10.875
Diameter, inches	3.375
Weight, pounds	2.9

Use: This is the standard all-purpose sea marker for daylight use: to provide reference points; to aid in determining drift; and to provide practice bombing targets on water.

Description: This marker consists of a paper composition case filled with a fluorescein dye. It is protected by a cylinder of papier-mâché, which does not interfere with its function.

Launching: The marker is dropped by hand from a plane.

Operation: Upon impact with water, the case shatters and the dye spreads upon the surface.

Part 3 — Chapter 8 — Section 5

ARMY FLARES

M8 and M8A1

Length, inches	25.5
Diameter, inches	4.25
Weight, pounds	18.0
Intensity, candlepower	350,000
Color	Yellow
Burning time, minutes	3
Rate of fall after ignition	500 ft./min.

Use: The flares are used in emergency night landings.

Description: Each flare consists of a cylinder containing an unshaded candle.

Operation: Army Flares M8 and M8A1 are similar in operation to the Flares AN–M26, except that the hang wire pulls the parachute directly from the case.

Remarks: The M8 is similar ot the M8A1, except that the latter flare burns with a white light of approximately 250,000 candlepower.

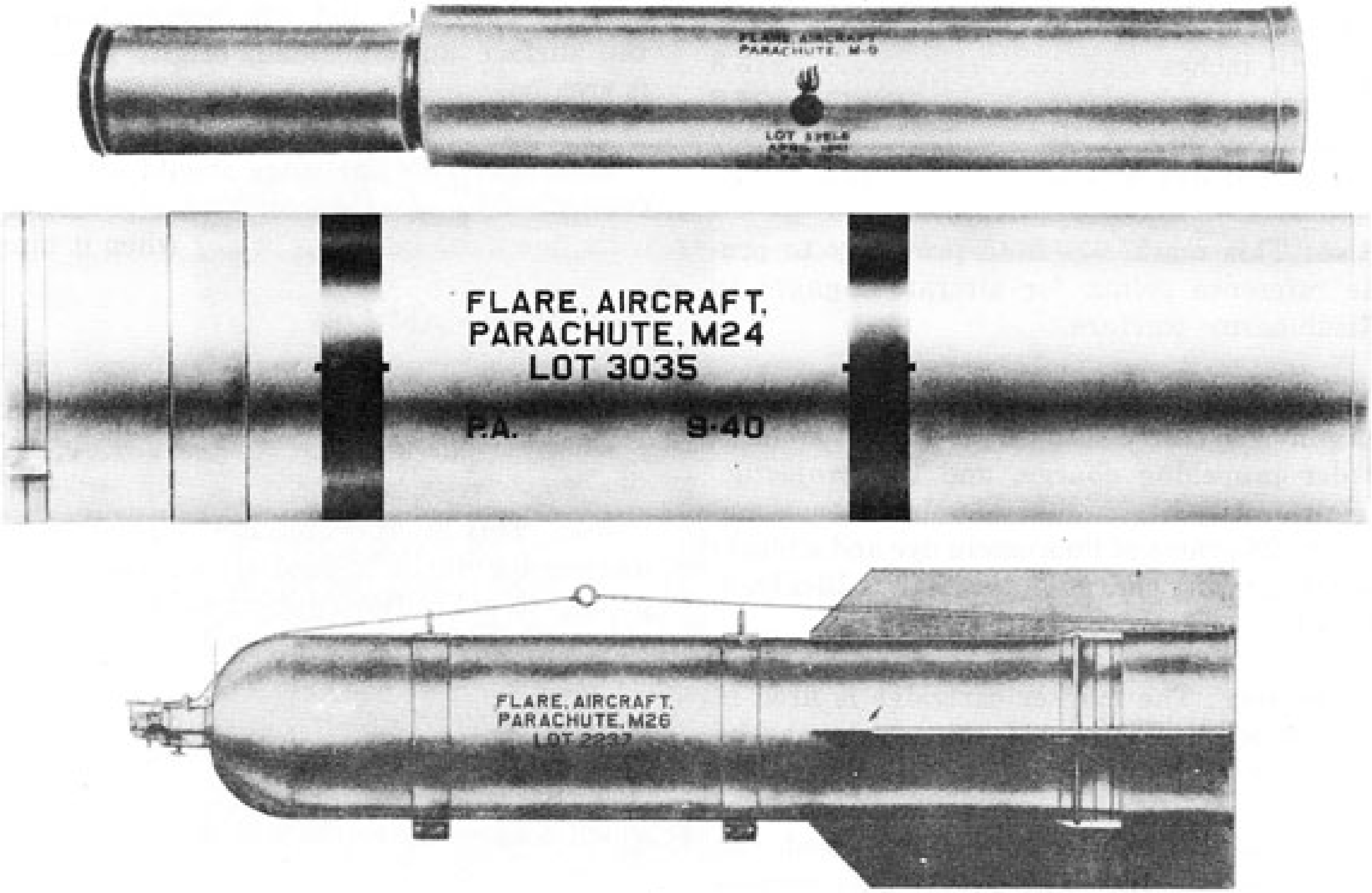


Figure 187. Army Flares M9 (top), M24 (middle), and M26 (bottom)

M9 and M9A1

	M9	M9A1
Length, inches	13.8	15.05
Diameter, inches	2.0	—
Weight, pounds	1.9	2.1
Intensity, candlepower	60,000	—
Color	Yellow	—
Burning time	1 minute	—
Rate of fall after ignition	400 ft./min.	400 ft./min.

Use: This flare was designed to satisfy the requirements for a small parachute flare for reconnaissance.

Description: The flare consists of a cylinder containing a candle, designed to be projected with the Pyrotechnic Pistol AN–M8.

Operation: The flare is discharged from the pistol and the delay fuse is ignited. The fuse burns for 2.5 seconds and ignites the expelling charge, which expels the candle and parachute, simultaneously igniting the candle.

Remarks: This flare is not procured by the Navy.

M24 (Obsolete)

Length, inches	37.0
Diameter, inches	8.0
Weight, pounds	47.0
Burning time, minutes	3
Intensity, candlepower	800,000
Color	Yellow
Release altitude, feet	2,500—3,000
Speed of release	Not over 200 m.p.h.
Rate of fall after ignition, ft./min.	700

Use: The flare is a substitute standard for night observation and bombardment.

Description: It consists of a simple cylinder without hemispherical nose or tail fins; otherwise, it is similar throughout to the AN–M26, without the nose time fuze.

Operation: The flare is similar to the AN–M26 except that the hang wire acts directly to pull the parachute from the flare case.

Remarks: This flare was not procured by the Navy.

M26 and AN–M26

Length, inches	50
Diameter, inches	8
Weight, pounds	53
Burning time, minutes	3—3.5
Intensity, candlepower	800,000
Color	White light
Releasing altitude, feet	4,000—25,000
Rate of fall after ignition, ft./min.	700

Use: These flares are used to provide illumination for night bombardment; also may be used to blind antiaircraft defenses.

Fuzing: AN–M146, M155, M144.

Description: The flare is enclosed in a metal cylindrical case with a rounded nose and tail fins. In the nose is a mechanical time fuze. The tail end is closed with a shipping cover that has a handle attached and sealed by a strip of tape. The case is equipped with two suspension lugs 14 inches apart.

Operation: When the flare is dropped, the arming wire is pulled, allowing the vanes of the nose fuze to rotate. The hang wire is retained and pulls off the cover of the stabilizing-sleeve compartment. As the flare continues to drop, the tear wire and tear-wire cord pull out the stabilizing sleeve, and the cover-lock cord attached to the shrouds of the stabilizing sleeve unlocks and pulls out the cover lock. When the sleeve is fully extended, the tear wire breaks, allowing the flare to fall free, stabilized in flight by its fins and stabilizing sleeve.

When the nose fuze functions, the gases of the black-powder booster force the releasing-cup cover out of the detachable cover, releasing the retaining pins from the groove in the flare case and freeing the detachable cover. As the detachable cover is pulled out by the stabilizing sleeve, a pull-out cord pulls out the parachute. When the parachute opens, the flare stops with a jerk, breaking the pull-out cord (which allows the stabilizing sleeve assembly to fall free) and pulling the entire flare assembly out of the flare case (which then falls away). The sudden stop also pulls the friction wires through the igniters, starting the six-second delay through the center of the candle, which allows full opening of the parachute.

The shock caused by the opening of the parachute is taken by the shock absorbers, made of copper tubing in a spiral or coiled shape. They straighten out in absorbing the shock. After the parachute is opened, the delay ignites the first fire, which ignites the candle. When the first fire is ignited, the gases formed by burning force the rib retainer down, and the spring-loaded ribs jump out, opening the glass-cloth shade.

Remarks: The Flare AN–M26 can be dropped at air speeds up to 240 knots, but above that the stabilizing sleeve is apt to tear away. The Flare M26 cannot be dropped at air speeds greater than 130 knots, for the same reason.

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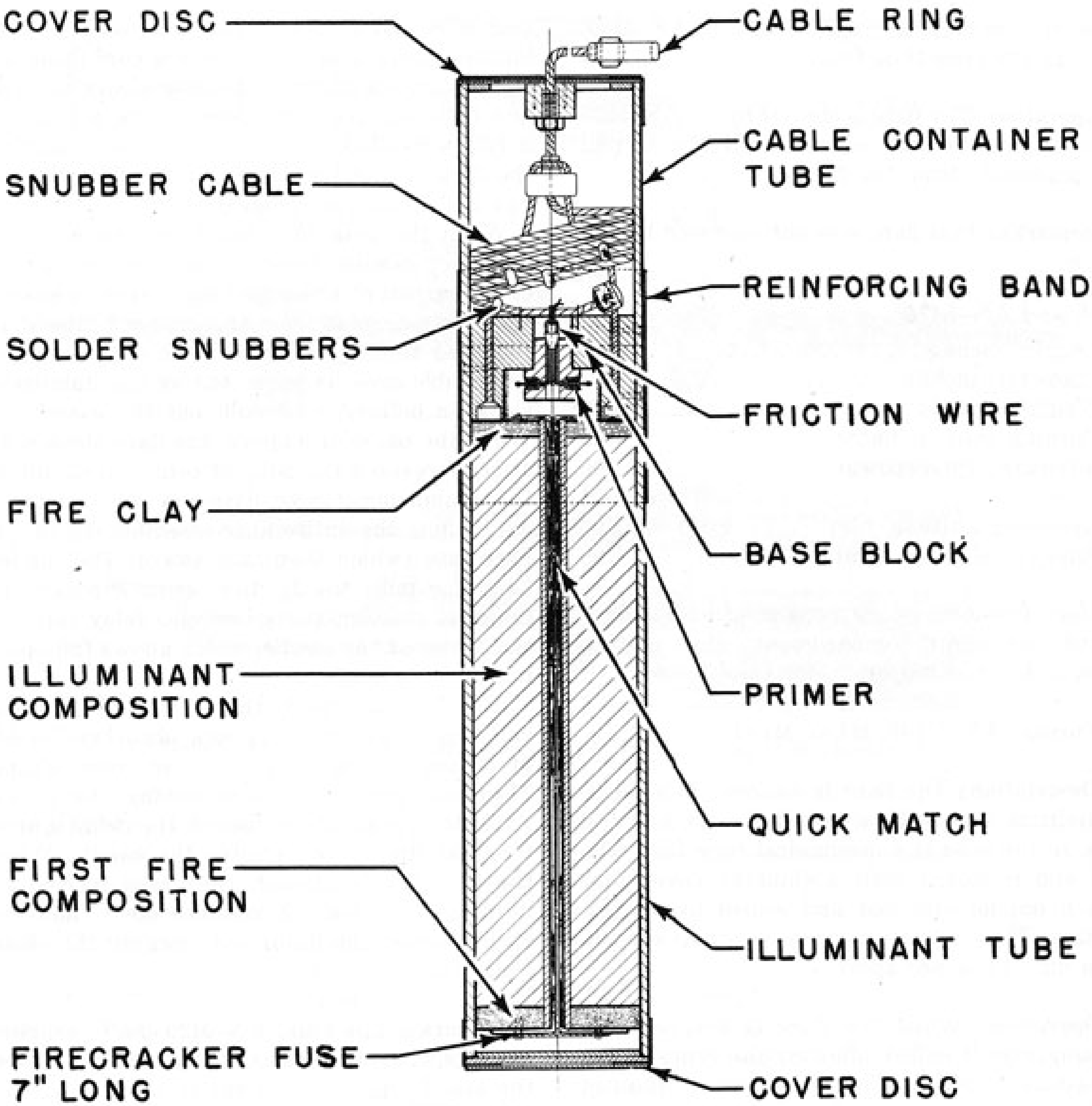


Figure 188. A.A. Target Flare Mk 1

A.A. TARGET FLARES

Mk I (Obsolete)

Length, inches	21.4
Diameter, inches	3.8
Weight, pounds	12
Burning time, minutes	3
Intensity, candlepower	280,000

Use: The flare provides a target for both day and night practice firing of antiaircraft guns.

Description: The flare consists of an illuminant tube and a cable-container tube made of rocket paper. These are joined end-to-end under the external metal reinforcing band. Both ends are closed by chip-board discs held in place with tape. The cable ring is attached to the snubber cable at the end which protrudes through the cover disc of the flare assembly. The snubber cable is attached to the base block with staples.

Friction wire is attached to the end of the snubber cable and extends through the primer composition, which is adjacent to the quick match which runs through a cardboard tube in the center of the illuminant. At the end of the quick-match tube is a firecracker fuse terminating in the first fire composition, which is in contact with the main illuminant charge.

Streaming: The flare may be streamed from any plane from which an aircraft or antiaircraft target reel can be mounted.

Operation: The flare slides back along the tow cable until the cable ring is stopped by the target release mechanism. Force exerted on the snubber cable pulls off the end of the cable-container tube, and the five solder snubbers are stripped off. The staples holding the snubber block to the base block are withdrawn by the pull exerted. Friction wire attached to the end of the snubber block is pulled through the primer. The flame from the primer ignites the quick match, which in turn ignites the firecracker fuse igniting the first fire charge. The first fire composition ignites the illuminant.

M50, M77, M78, and M79

	M50	M77	M78	M79
Length, inches	22.8	23.5	—	—
Diameter, inches	2.5	4.25	—	—
Weight, pounds	7.13	21.1	—	—
Color	White	Red	Amber	Green
Intensity, candlepower	50,000	207,000	80,600	108,500

Use: Target Flare M50 has the same use as Target Flare Mk 1. Target Flares M77, M78, and M79 are assembly markers from which succeeding elements of a forming squadron or group of aircraft can form a target under conditions of poor visibility and congested traffic patterns.

Description and operation: These are the same as for Target Flare Mk 1.

Remarks: These flares are not under procurement by the Navy at present.

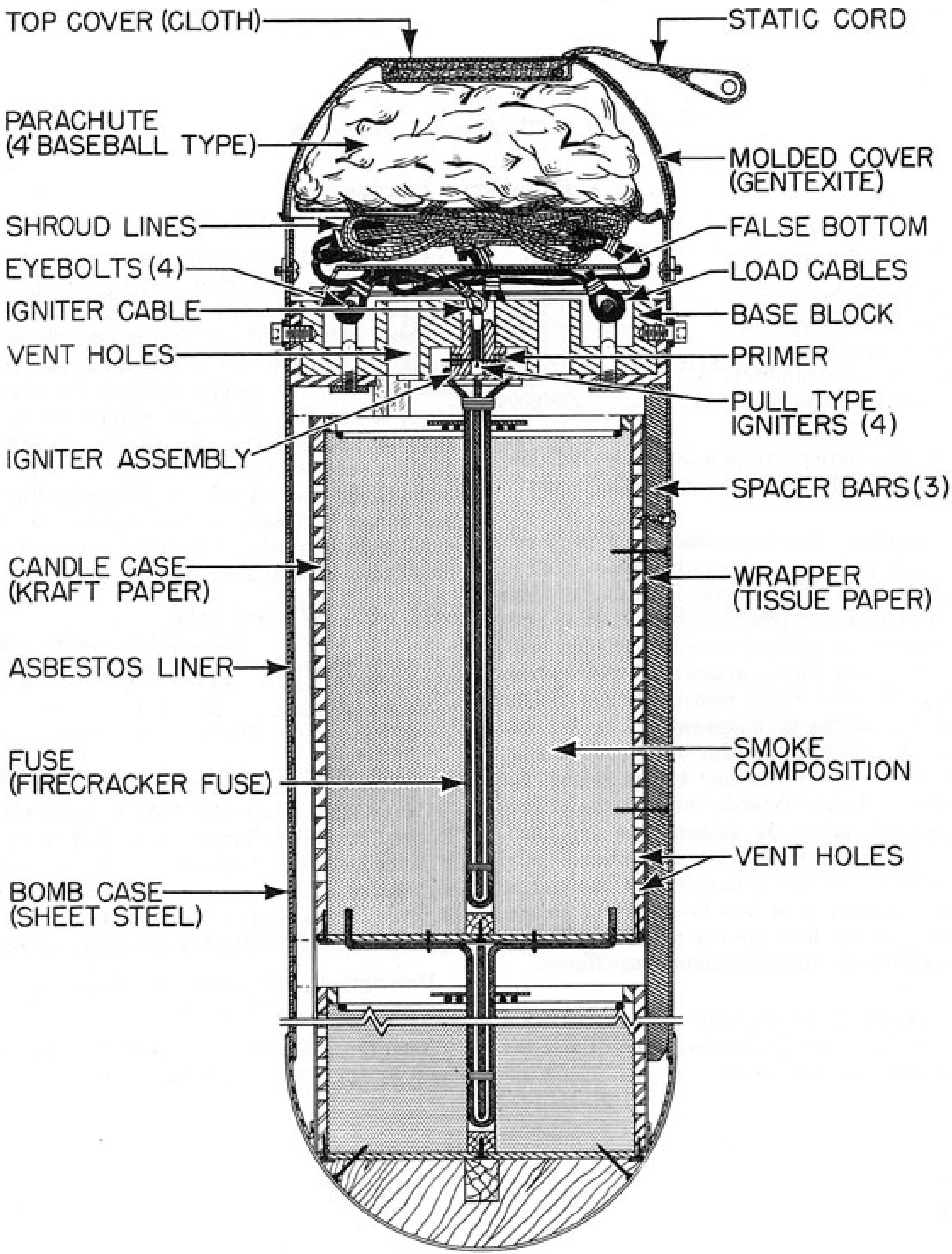


Figure 189. Target Identification Bomb Mk 72 Mod 1

TARGET IDENTIFICATION BOMBS

Mk 72 Mod 1

Length, inches	36
Diameter, inches	8¾
Filling	Smoke Composition (68% fire orange dye, 15% lactose, 12% potassium chlorate, and 5% asbestos shorts)
Total weight, pounds	45
Fuzing	4 pull-type igniters

Construction: This target identification bomb consists of two units, a sheet-steel bomb body casing and a parachute assembly packed in a molded container or pack which is attached to the bomb body by means of four bayonet joints. The parachute pack houses a four-foot baseball-type parachute, the chute shroud lines, the load cables, the igniter cable, and a static cord which extends out of the top of the pack. Bomb body casing contains a base block in the tail which incorporates the igniter assembly, 12 vent holes, and four eye bolts. Load cables are attached to the eye bolts; igniter cable is attached to the pull-type igniters. Between base block and the nose are the upper and lower candle assemblies.

Suspension: Horizontal suspension is provided by two lugs 14 inches apart, welded onto suspension bands which are bolted to the bomb case.

Operation: Upon release of the bomb, the static cord is retained by the rack or shackle to which it is attached. The static cord, through a series of short lines inside the pack, removes the molded cover of the pack and pulls the parachute out. After the parachute is out, the static cord separates from the parachute and is retained by the rack or shackle. As parachute opens, the igniter cable jerks out the four pull igniters, which ignite the primers. The primers ignite the firecracker fuse running through the upper candle, which in turn ignites the candle The candle burns from the inside toward the outside, evolving colored smoke that permeates holes in the candle case and escapes through vent holes in the bomb case. The lower candle is ignited by the firecracker fuse about the time the upper candle burns out.

The total burning time is approximately five minutes, during which time the bomb produces a red-orange smoke in sufficient volume to be seen at 15,000 feet for 10 miles, under normal conditions.

Remarks: Target Identification Bomb Mk 72 Mod 1 is used by air-coordinator planes or by scout planes from battleships to pin-point shore targets.

This colored smoke marker is for use over land only, as the bomb does not float.

Greatest accuracy can be obtained by releasing the bomb from altitude of 500 to 1,000 feet.

This bomb can be carried on all external double-suspension racks and shackles. In addition to the use of this bomb on double-suspension racks or shackles, it can be suspended from the Bomb Adapter Mk 5 Mod 0 (used with Launchers Mk 5 and Mods) when that item is available. These bombs have been successfully released from external suspension on all types of planes in any flight attitude. They can successfully withstand catapult launching and arrested landings.

M75A1 and M84A1

Over-all length, inches	53.1
Body length, inches	39.0
Body diameter, inches	8.2
Wall thickness, inch	0.06
Tail length, inches	12.9
Tail width, inches	10.9

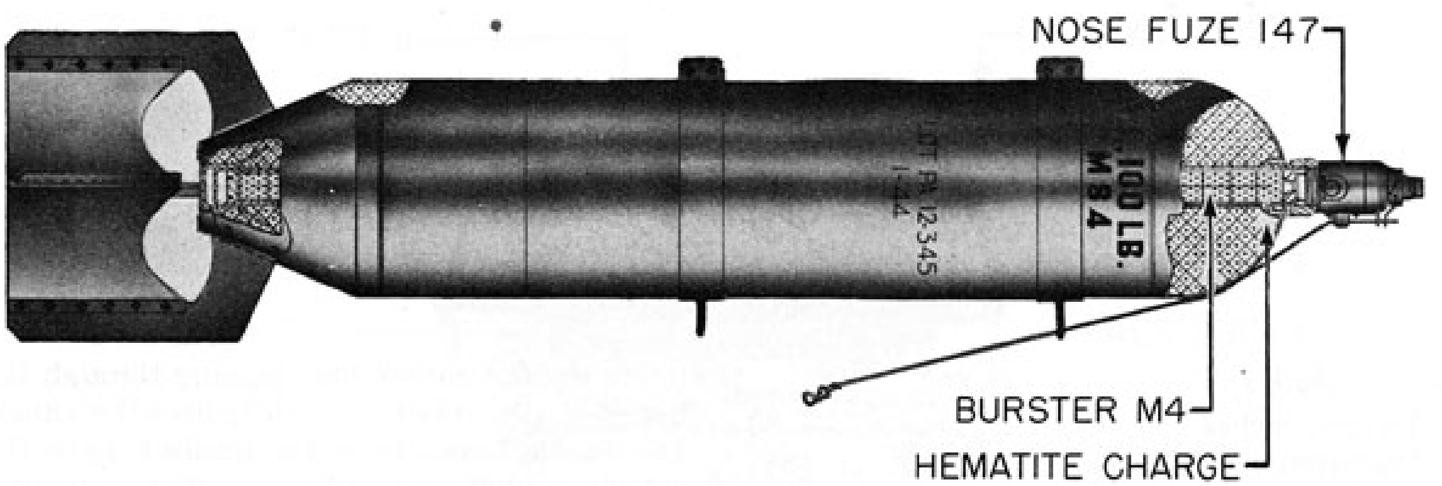


Figure 190. Target Identification Bomb M84

Filling	Red iron oxide (hematite)
Weight of filling, pounds	72
Total weight, pounds	102
Fuzing—M84A1	AN–M147
M75A1	M108

Construction: Target Identification Bombs M84A1 and M75A1 are identical with the exception of the fuze, and the two bombs are similar in construction to the Chemical Bomb AN–M47A2. The body is of sheet metal with box-type tail fins welded to the conical section. The Burster M4 runs through the entire length of the bomb and is closed at the forward end by a closing plug. A filling plug is placed in the fin cone of the bomb body, to facilitate loading the hematite charge (red iron oxide). The fuze fits into the forward end of the burster.

Remarks: The Target Identification Bomb M84A1 is intended for release by the lead or "pathfinder" plane to indicate the bomb-release line for bombers in formation when operations are carried out above an overcast and ground targets are not visible. The bomb was designed to produce a red smoke cloud which would remain at the bursting point for a period of ten minutes under normal air conditions and would be visible for a distance of 15 miles at an altitude of 25,000 feet.

The M75A1 is used for target identification in practice, to mark targets on snow-covered bombing ranges.

M89, M90, M91, M98, and M100

Over-all length, inches	51.8
Body length, inches	35.8
Body diameter, inches	10.8
Wall thickness, inch	0.27
Tail length, inches	15.7
Tail width, inches	14.9
Type of filling	61 pyrotechnic candles (red, green, or yellow)
Weight of filling, pounds	95
Total weight, pounds	240—265
Fuzing	AN–M146, M144

Construction: The body is a modified 250-pound G.P. Bomb AN–M57 body with a metal closing cup riveted to the base. An integral booster of four ounces of black powder is placed immediately behind the fuze-seat liner and serves as an expelling charge. A wooden nose piece fits around this booster, and a steel piston, in turn, is seated in the base of the nose piece. A steel tube or piston stem is welded through a hole in the piston and extends from the black-powder booster to the plywood ignition disc in the center of the bomb. Six wooden thrust members reach from the piston plate to the tail closing cup and serve to transmit stress to this cup without imposing any of the force on the candles. Felt 1/8 inch in thickness lines the entire interior cylindrical surface of the bomb. The 61 candles are in two banks of 30 and 31, and have their ignition ends facing toward the quick-match strands stapled on the ignition disc which separates the two banks.

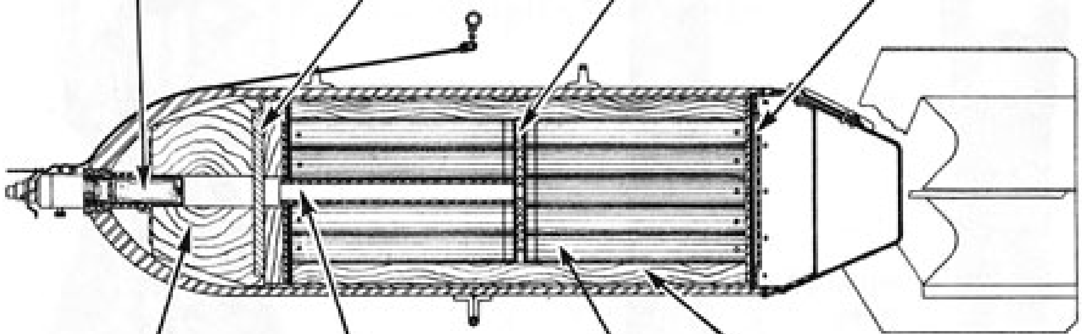


Figure 191. Target Identification Bombs M89, M90, M91, M98, and M100

Tail construction: The tail, in appearance, is a standard box-type tail. It is attached to the bomb by means of four spring latches fitting into cut-outs in the tail closing cup and can be locked in place by stamped steel strips pivoting over the ends of the springs.

Suspension: Horizontal suspension is provided by standard lugs, 14 inches apart.

Operation: When the aerial-burst fuze functions, the fuze booster ignites the black-powder booster or expelling charge in the bomb. The force of the expending gases from the booster, acting through the piston and thrust members, throws off the fin assembly and expels the candles.

Simultaneously, flash from the booster passes through the piston stem to the plywood ignition disc and the quick match, igniting the candles.

Remarks: The bombs are used to form a pattern of red, green, or yellow colored light approximately 100 yards in diameter around or on a target; the light should be visible fom altitudes of 25,000 to 35,000 feet day or night. They are used to spot individual targets, once the general target area has been marked by flares dropped by pathfinder planes. The explosive charge in the Candles M105 is ignited by the flare composition at the end of burning. These charges serve to prevent any removal of the candles by the enemy, once the candles are on the ground.

The M89 contains 61 Non-Delay Candles M103.

The M90 contains 57 Non-Delay Candles M103 also; two Exploding Candles M105, burning for one minute, and two exploding candles burning for two minutes.

The M91 has 16 Non-Delay Candles M103, 15 red 2¾-minute Delay Candles M104, 15 4-minute Delay Candles M104, and 15 5¼-minute Delay Candles M104.

The M98 contains 31 Non-Delay Candles M103, 10 Exploding Candles M105, burning for one minute, 10 Exploding Candles M105, burning for 1.5 minutes, and 10 Exploding Candles M105, burning for two minutes.

The M100 contains Two-Color Combination Candles M104.

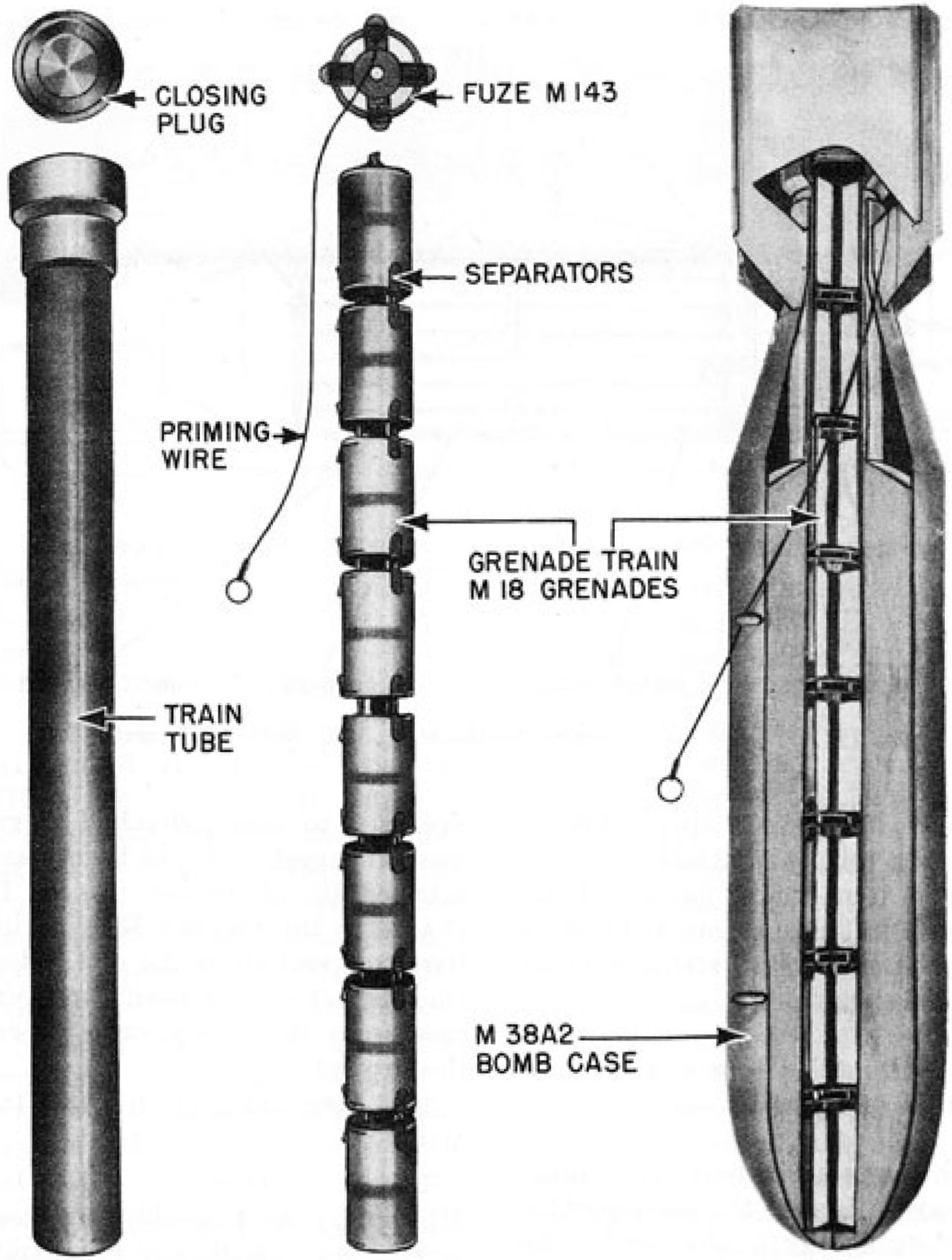


Figure 192. Smoke Streamer Bomb T29

SMOKE STREAMER BOMBS

T29

Over-all length, inches..................47.5
Body length, inches.....................40.5
Body diameter, inches....................8
Wall thickness, inch...................0.06
Tail length, inches.....................11.5
Tail width, inches.....................10.75
Filling......8 Modified Smoke Grenades M18
Total weight, pounds...................100

Fuzing: The Fuze M143 consists of a fuze body support mounting four bouchon grenade-type fuzes and an arming washer, and is threaded to fit the fuze adapter of the tube train. The arming washer is 2.5-inch in diameter and has four arms 0.75-inch wide and one inch long. The arming wire holds the arming washer over the bouchon levers until it it withdrawn.

Construction: The bomb body consists of a sheet-steel case with a filling plug in the base. The four tail vanes are welded to the truncated cone with box-type interior struts. The complete body assembly consists of this Practice-Bomb Case M38A2, a train tube, a grenade train, a closing plug, and a fuze. The train tube is a seamless steel tubing three inches in diameter and 40 inches long, with a fuze adapter brazed to the after end. Eight modified Grenades M18 filled with fast-burning mixture are inserted into the tube to form the grenade train. Each grenade is modified by cutting a center hole in its base, and the bouchon fuze is omitted. The top of each grenade is coated with a starter compound which acts as the igniter for the adjacent grenade. Four strands of quick match are knotted and inserted in the center hole of the top grenade in such a manner as to leave the knot and loose ends at the top to receive the fuze flash. The eight grenades are held apart by spring steel separators. A threaded closing plug seals the tube and protects the grenade train from moisture. This plug must be removed just prior to use. The bomb is brought up to the weight of approximately 98 pounds by filling the balance of the internal space with sand.

Operation: When the arming wire is pulled, the bouchon springs throw off the arming washer and handles, allowing the bouchons to fire. This action ignites the quick match in the center hole of the top grenade, which in turn is ignited, and the flash is simultaneously transmitted to all the grenades.

Remarks: The colored streamer smoke bomb is used as a visual signal to be dropped by the lead plane of a bomber formation when the target has been determined. Smoke emission begins approximately one second after release from the plane and continues for approximately 7,000 to 10,000 feet.

PHOTOFLASH BOMBS

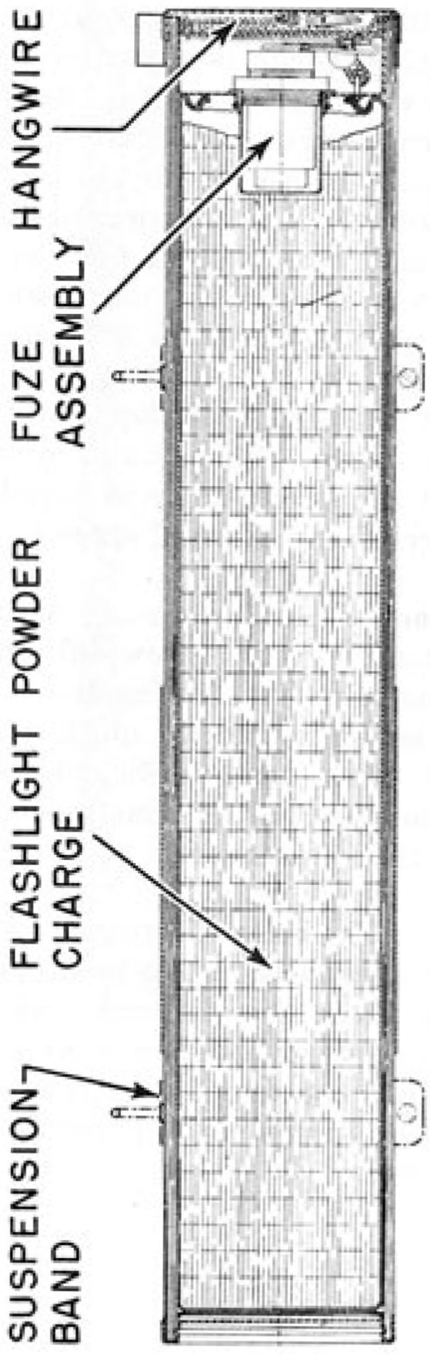


Figure 193. Photoflash Bomb M23A1

M23A1 (Obsolete)

Over-all length, inches	25.4
Diameter of case, inches	4.25
Weight, pounds	10.6
Weight of flash powder, pounds	7.75
Fixed delay, seconds	15
Duration of flash, second	0.20
Intensity of flash, candlepower	150,000,000
Release altitude, feet	4,000—7,000

Use: This bomb is used to provide light of high intensity and short duration for night photography from low altitudes.

Description: The bomb case is made of cardboard and closed with metal ends, one of which is marked "Front" to insure proper loading in the rack. This end contains the hang-wire assembly just before the Fuze Assembly M23A1. The fuze assembly is made up of the friction wires attached to the hang wire, match composition, quick match, delay element, upper and lower rings, and base ignition charge immediately adjacent to the flashlight powder charge. The hang wire is attached to the arming-wire retainer.

Operation: When the bomb is released, the hang wire remains attached to the arming-wire retainer. As the bomb drops, the hang wire pulls the friction wires through the match composition of the fuze. The hang wire also pulls out the hang-wire container, allowing both the hang wire container and the bomb to fall free. The flame from the match composition ignites a piece of quick match, which in turn ignites a delay element. After 15 seconds, the delay element ignites the base charge of the fuze, which sets off the flashlight powder charge. The flash lasts a fifth of a second.

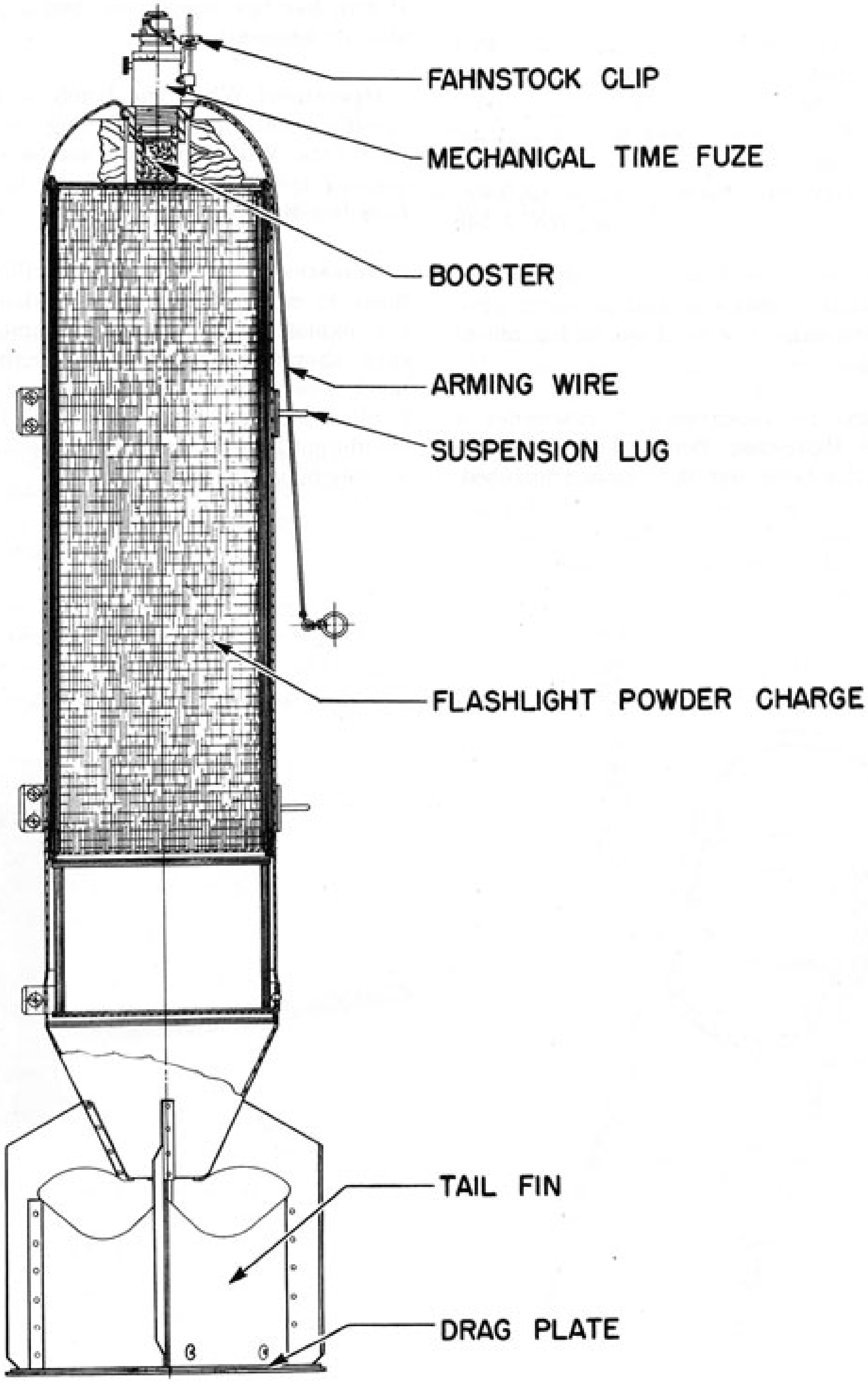


Figure 194. Photoflash Bomb AN–M46

AN–M46

Over-all length, inches	48.4
Diameter, inches	8
Weight, pounds	51.9
Weight of flash powder, pounds	25
Burning time, seconds	0.20
Peak intensity, candlepower	500,000,000
Fuzing	M111A2, AN–M146

Use: The Photoflash Bomb AN–M46 was developed so that planes engaged in night photography reconnaissance need not be limited to low altitudes.

Description: In appearance it resembles a conventional light-case bomb. Uses a Fuze M111A2 in the nose, but it is issued unfuzed. It also has two suspension bands for rack and shackle suspension.

Operation: When the bomb is dropped, the arming wire is pulled, starting the mechanical time fuze. When the time set on the fuze has elapsed, the flashlight powder is ignited by the fuze booster.

Remarks: Because of the brilliance of the flash, it is detrimental to the vision to watch the explosion of photoflash bombs. Extreme care should be exercised in handling these bombs, because the charge is very sensitive to friction, shock, and temperature. These bombs should not be jettisoned over friendly territory, as they may function on impact.

Part 3 — Chapter 9

GROUND PYROTECHNICS

Section I—SIGNALS

One-inch Salute Mk I Mod 0

Length, inches 1.75
Diameter, inch 0.75

Use: This salute is used by the Marine construction battalions and amphibious training commands to simulate battle sounds of loud report and bright flash.

Description: Essentially a commercial-type firecracker, this salute is a spirally-wound paper tube closed at both ends with paper cups. It uses the regular firecracker filling and fuse.

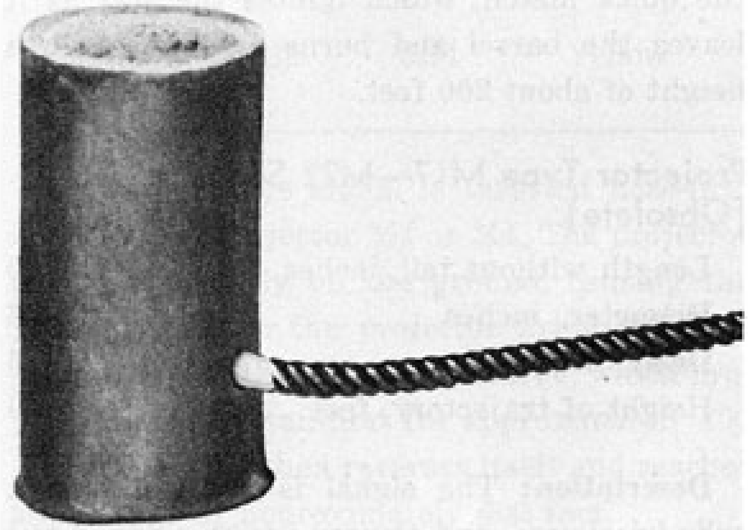


Figure 195. One–inch Salute Mk 1 Mod 0

Firecracker Mk 2 Mod 0

General: This firecracker is used as a practice charge for booby traps and firing devices. It produces a loud report, bright flash, and smoke. It is designed to reduce the hazard of flying particles attendant upon use of a standard potassium perchlorate firecracker. It is classified as fireworks, since it contains no high explosive. Although coated with a waterproofing material, it should be stored in a dry place.

Installation: The coupling base of any standard firing device is pushed through the wax-filled hole in the hollowed end of the firecracker and rotated clockwise until at least two threads of the coupling base are inside the hollowed end.

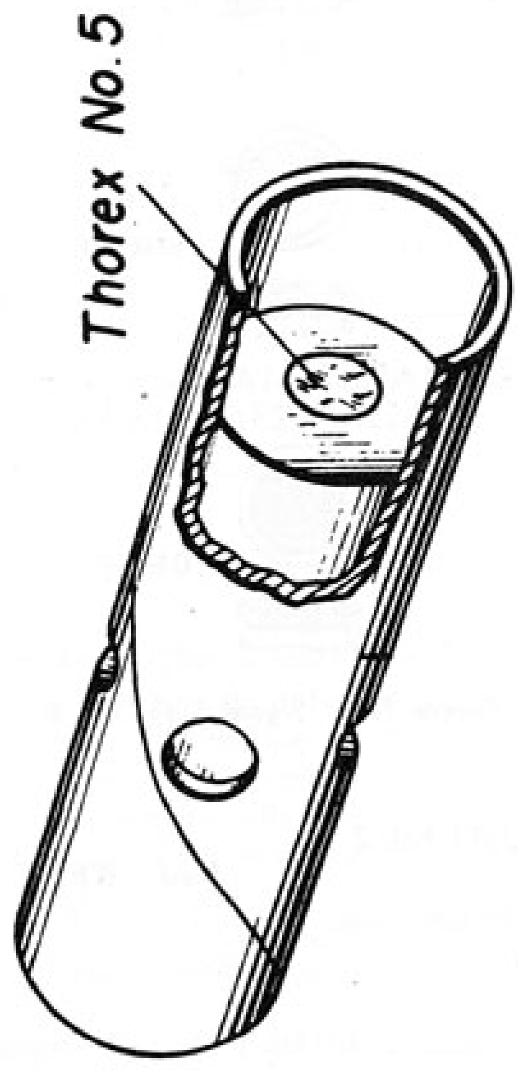


Figure 196. Firecracker Mk 2 Mod 0

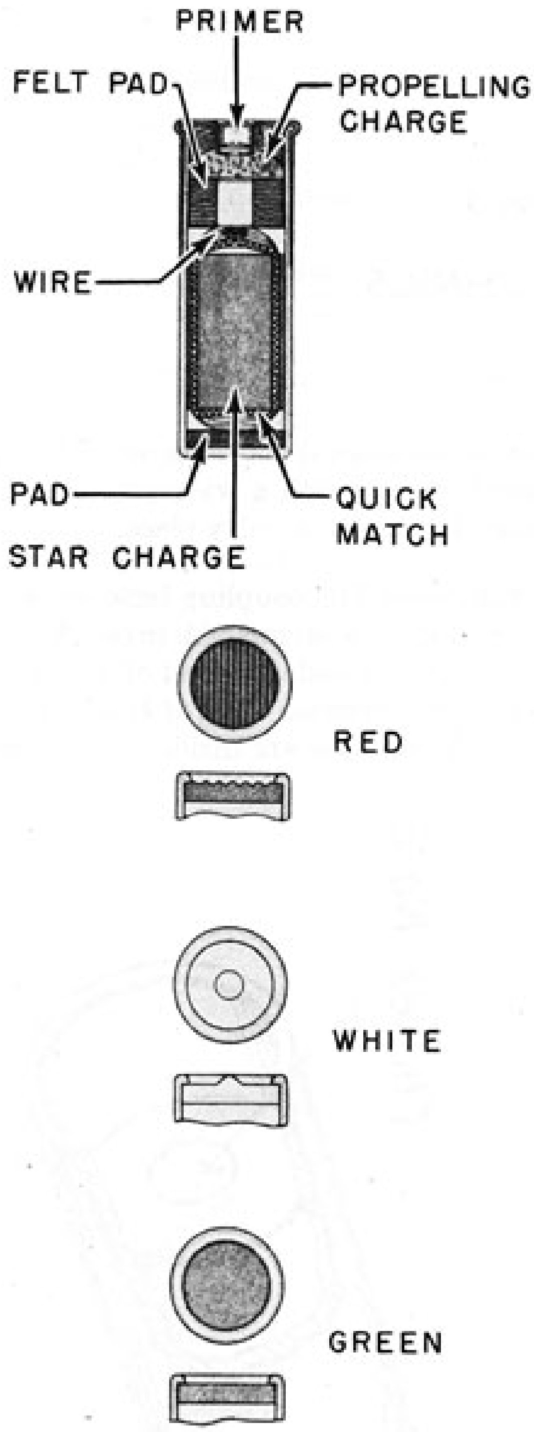


Figure 197. Signal Light Mk 2

Signal Light Mk 2

	Red	White	Green
Burning time, sec.	7	6	5
Candlepower	300	250	600

Use: Signal Light Mk 2 is used primarily as a distress signal.

Description: The cartridge, sometimes called the Very signal, is similar in appearance to a 10-gauge shotgun shell. The star charge is a tightly-packed cylinder of pyrotechnic material reinforced with wire and wrapped with quick match. The propelling charge is composed of about 25 grains of black powder separated from the star charge by a hard felt pad.

Identification of the three types

RED STAR—Paper wrapping is red; closing wad is corrugated.

WHITE STAR—Paper wrapping is white; closing wad has a small cone in the center.

GREEN STAR—Paper wrapping is green; closing wad is smooth.

Operation: The Signal Pistol Mk 5 may be used, as well as the Hand Projector Mk 3 or Mk 4.

The primer ignites the propelling charge, expelling the star out of the projector and igniting the quick match, which ignites the star as it leaves the barrel and burns as it rises to a height of about 200 feet.

Projector Type M17—M22 Series (Obsolete)

Length without tail, inches	6.0
Diameter, inches	1.6
Delay, seconds	6
Height of trajectory, feet	600

Description: The signal is assembled in a cylindrical case, and equipped with a finned tail assembly for stabilization purposes. The primer is located in the head of the signal, and the propelling charge is contained in a small cavity under the head. The end opposite the primer is closed by a press-fit cap to which the tail assembly is attached. The signal has a solid tail stem and an **X**-shaped fin. Embossed letters on the fin indicate the color and type of star(s).

Figure 198. Signal, Ground, White Star, Parachute, M17

IDENTIFICATION OF M17—22 SERIES

	Weight (pounds)	Fin	Embossed Letters	Star(s)
M17	0.68	White	WP	White—parachute-supported star
M18	0.74	White	WS	White—cluster of five stars
M19	0.66	Green	GP	Green—parachute-supported star
M20	0.76	Green	GS	Green—cluster of five stars
M21	0.64	Yellow	AP	Amber—parachute-supported star
M22	0.71	Yellow	AS	Amber—cluster of five stars

Operation: The signal is inserted nose-first into Ground Projector M3 or M4. The projector is struck smartly on the ground, causing the primer to strike the projector firing pin. The primer ignites the propelling charge, which projects the signal tail-first for approximately 100 feet. The signal then reverses itself and reaches an altitude of approximately 600 feet.

High-Bursting Range Signal M 27

The Range Signal M27 is similar to the projector-type signals, except that it has no tail assembly. It is fired only from the Ground Signal Projector M1A1. The signal explodes at the top of its rise, producing a flash and a puff of smoke.

Launcher Type M17A1—M22A1; M51A1; M52A1; and M17A1B2—M22A1B2

Length, inches 10.5
Diameter, inches 1.6
Delay, seconds 6
Height of trajectory, feet.............. 600

Description: The signal is assembled in a cylindrical case and equipped with a finned tail assembly for stabilization purposes. It is similar to the projector type, but modified to be fired from a service rifle or carbine. This type has a hollow stem, which is closed by a cork plug and a wheel-shaped fin. The "A1B2" series is the same as the "A1" series, except that the former indicates steel construction. Special cartridges are used to ignite the propelling charge. Embossed letters on the closing cap indicate color and type of star(s).

Figure 199. Signal, Ground, White Star, Parachute, M17A1

IDENTIFICATION OF M17A1 THROUGH M22A1 SERIES, M51A1, AND M52A1

	Weight (pounds)	Fin	Embossed Letters	Star(s)
M17A1	1.04	White	WP	White—parachute-supported star
M18A1	1.10	White	WS	White—cluster of five stars
M19A1	1.02	Green	GP	Green—parachute supported star
M20A1	1.10	Green	GS	Green—cluster of five stars
M21A1	1.00	Yellow	AP	Amber—parachute-supported star
M22A1	1.07	Yellow	AS	Amber—cluster of five stars
M51A1	1.02	Red	RP	Red—parachute-supported star
M52A1	1.02	Red	RS	Red—cluster of five stars

Operation: Remove the cork plug from the tail and place the signal on a rifle launcher. Place the butt of the rifle on the ground as far away as practicable. When the rifle is fired, the cartridge fires the primer, which in turn ignites the propelling charge. The signal travels approximately 100 feet and then reverses itself and reaches an altitude of approximately 600 feet.

High-Bursting Range Signal M27A1B1

Length, inches 8.37
Diameter, inches 1.5
Weight, ounces 9.25
Height of trajectory, feet.............. 700

This signal has the standard tube and fin assembly as the launcher types. It is used in training maneuvers to simulate the air burst of an artillery shell. It produces a flash and puff of smoke, and a noise audible for at least 2,000 yards.

Flash and Sound Signal M74

General: The Flash and Sound Signal M74 is designed for simulation of air burst of artillery fire in training troops. It is fired from the Hand Projector M9 or the Pyrotechnic Pistol AN–M8.

Description: The signal consists of an outer case, an expelling charge, and an inner cylindrical case containing the delay fuze and bursting charge. The outer case resembles those of the aircraft double-star type. A percussion primer in the base of the outer case extends into the expelling charge. The expelling charge sets off the delay fuze.

Operation: When fired, the primer ignites the expelling charge. This ignites the delay fuze and propels the inner case out of the outer case. After a delay of about two and a half seconds, the fuze ignites the burster charge which, in exploding, produces a bright flash and a loud noise.

Remarks: With the pistol or projector at 45° elevation, the signal will reach a height of about 100 feet for its burst. Helmets should be worn by exposed personnel.

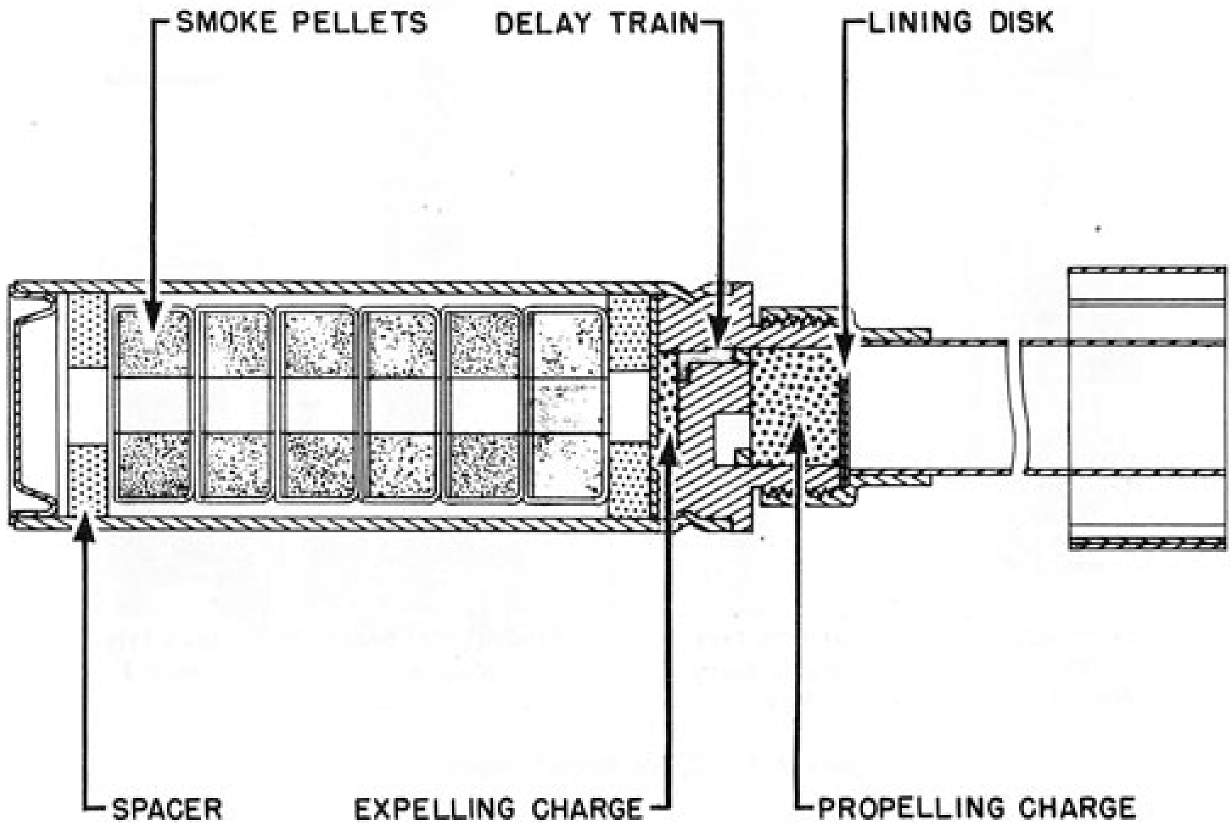


Figure 200. Smoke Signals M62, M64, M65, and M66

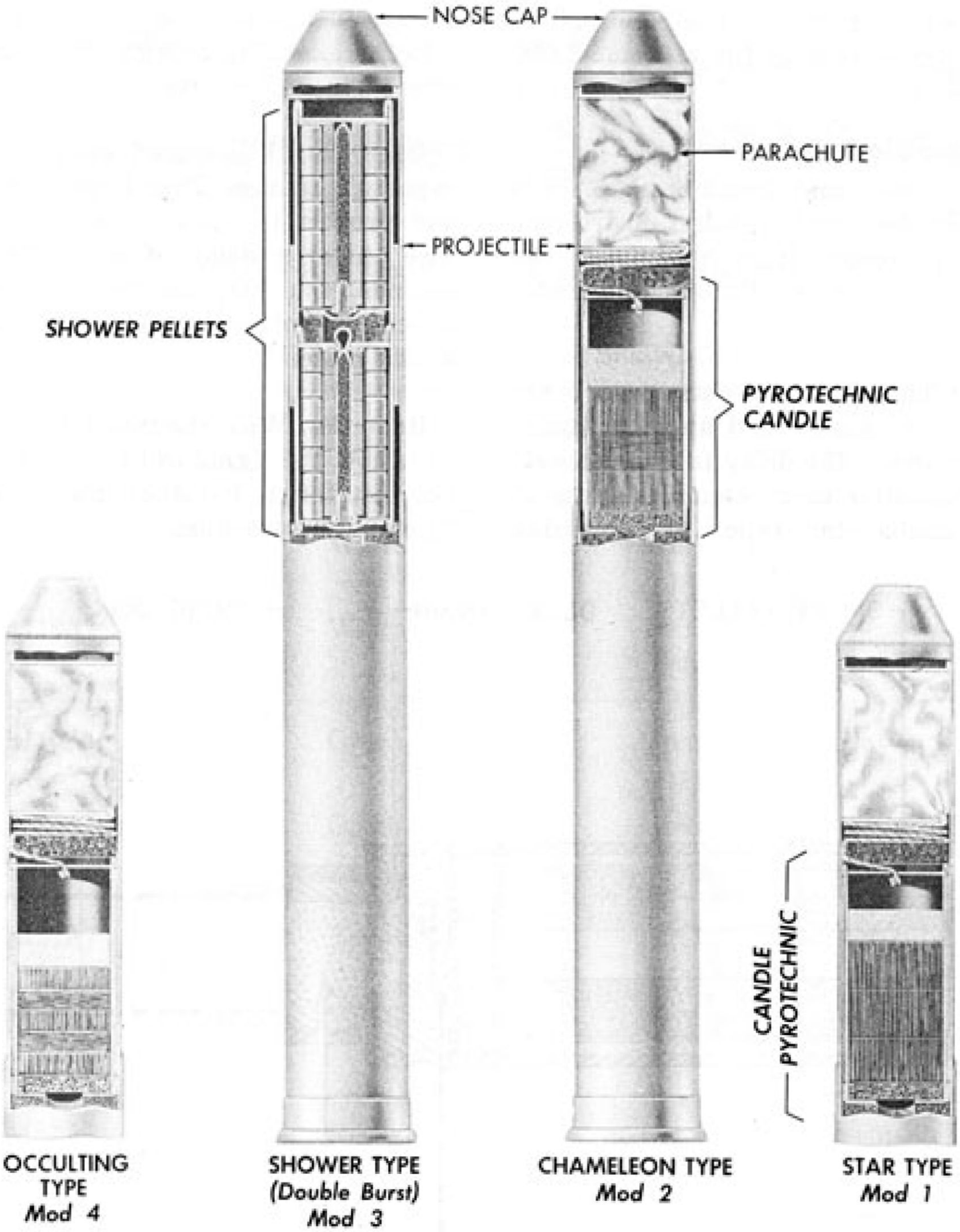
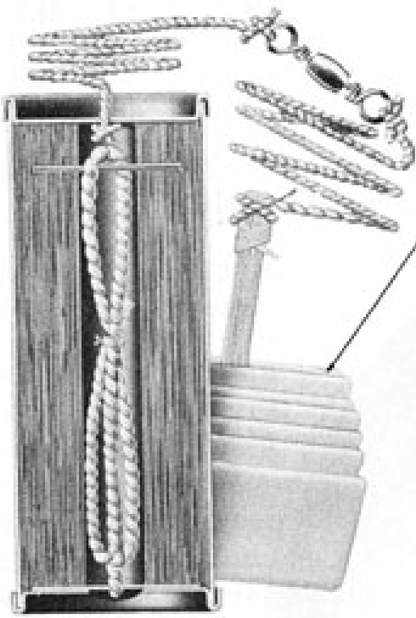
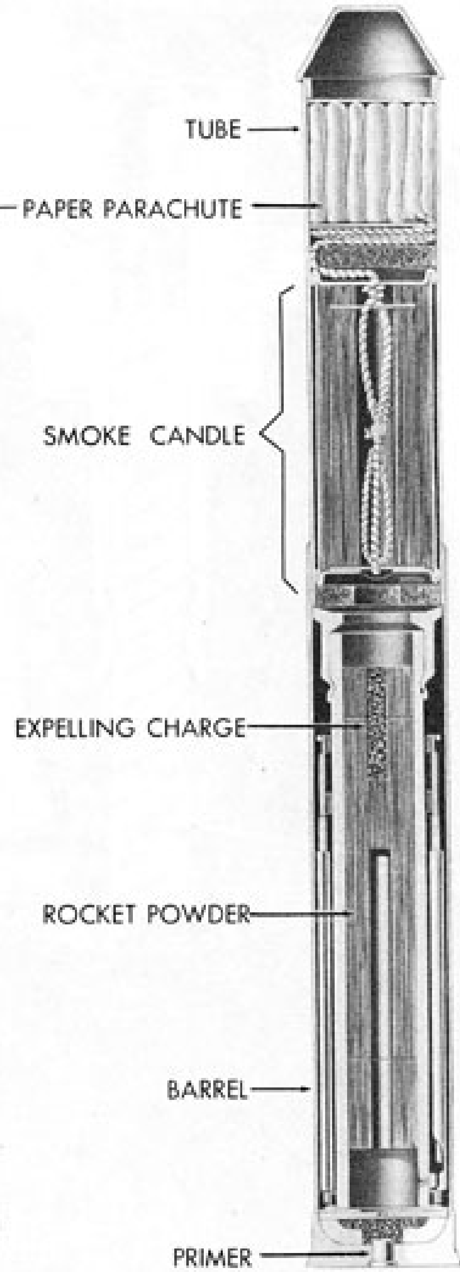


Figure 201. Pistol Rocket Signal Mk 1



Smoke Container Assembly

Full View Showing Waterproof Container



Sectional View

Figure 202. Pistol Rocket Signal Mk 2

Smoke Signals M62, M64, M65, and M66

Length, inches	10.15
Diameter, inches	1.88
Bursting altitude, feet	600
Colors—M62	Red
M64	Yellow
M65	Green
M66	Violet

Use: These signals are employed by artillery observers to signal or lay in a line of fire.

Description and operation: The signal is launched in the same manner as the M17A1 series. The fuze delay ignites an expelling charge, which expels and ignites the six smoke pellets at an altitude of 600 feet. The pellets burn and fall, leaving a colored smoke trail.

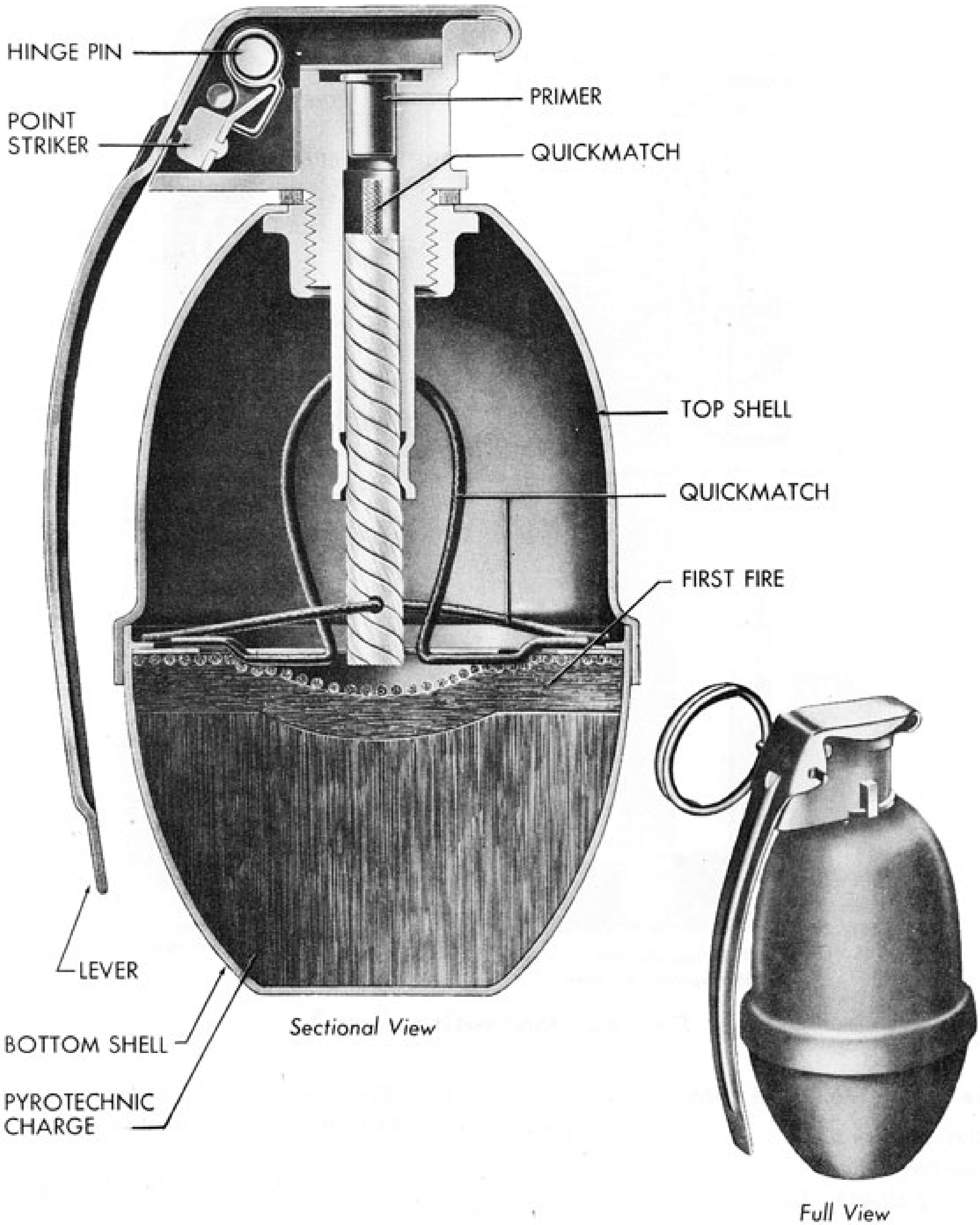


Figure 203. Illuminating Hand Grenade Mk 1

Pistol Rocket Signals Mk I Mod 2 and Mk 2 Mod I

Length, inches	14.0
Diameter, inches	1.5
Burning time, seconds	21
Weight, pound	1

Use: These signals are for identification on other signaling between ground troops.

Description: Similar in construction to the submarine signal, Pistol Rocket Signal Mk 1 Comet, the Pistol Rocket Signal Mk 1 Mod 2 produces a chameleon signal consisting of three parachute-borne stars which burn successively in three colors. Each star burns for approximately seven seconds before the next color ignites. The Pistol Rocket Signal Mk Mod 1 is a smoke signal, a parachute-borne smoke candle, but is generally the same construction as the Mk 1 Mod 2.

Operation: The signals are fired from the Submarine Rocket Pistol Mk 1 Mod 0 or the Pyrotechnic Pistol AN–M8. The primer ignites the one-gram auxiliary expelling charge, which projects the upper section of the signal to a height of 30 feet, where the rocket powder ignites, sending the signal on up to 650 feet. There the pyrotechnic element—chameleon or smoke—ignites. As the signal leaves the projector or pistol, the spring-loaded vanes fold out into place, stabilizing the flight of the signal.

Illuminating Hand Grenade Mk I

Length, inches	4.3
Diameter, inches	2.1
Weight, ounces	9.2
Intensity, candlepower	60,000
Delay, seconds	7
Burning time, seconds	25

Description: The grenade consists of two metal shells pressed together and sealed. The upper shell contains a Bouchon igniter and a delay fuse. The bottom shell contains the illuminant composition, first fire charge, ignition charge, quick match, and disc.

Operation: Pull the release pin and throw the grenade. When the lever is released, the firing pin is freed to fire the primer. The primer ignites the delay fuse, which burns for seven seconds and then ignites the ignition charge. The ignition charge sets off the first fire composition, which in turn ignites the illuminant composition. The gases from the ignition charge and first fire force the two shells apart, thus leaving the illuminant composition of the bottom shell free for burning.

Part 3 — Chapter 9 — Section 3

FLARES

Parachute Trip Flare M48

Diameter of flare tube, inches	2.5
Height of trajectory, feet	300—500
Burning time, seconds	20
Intensity, candlepower	100,000
Color	White to yellowish
Effective illumination	Circle of 300 yards radius

Use: The flare is used to give warning of enemy marauders or infiltrating hostile troops; also, for illumination or signaling.

Description: The flare consists of a ¼-inch pipe and a steel tube approximately 2.5 inches in inside diameter, which are attached to a base plate that contains a 75-grain propelling charge. The steel tube contains a delay fuse, an expelling charge, a candle, and a parachute assembly. The 0.25-inch pipe and the firing mechanism are joined by a coupling, and the pipe is

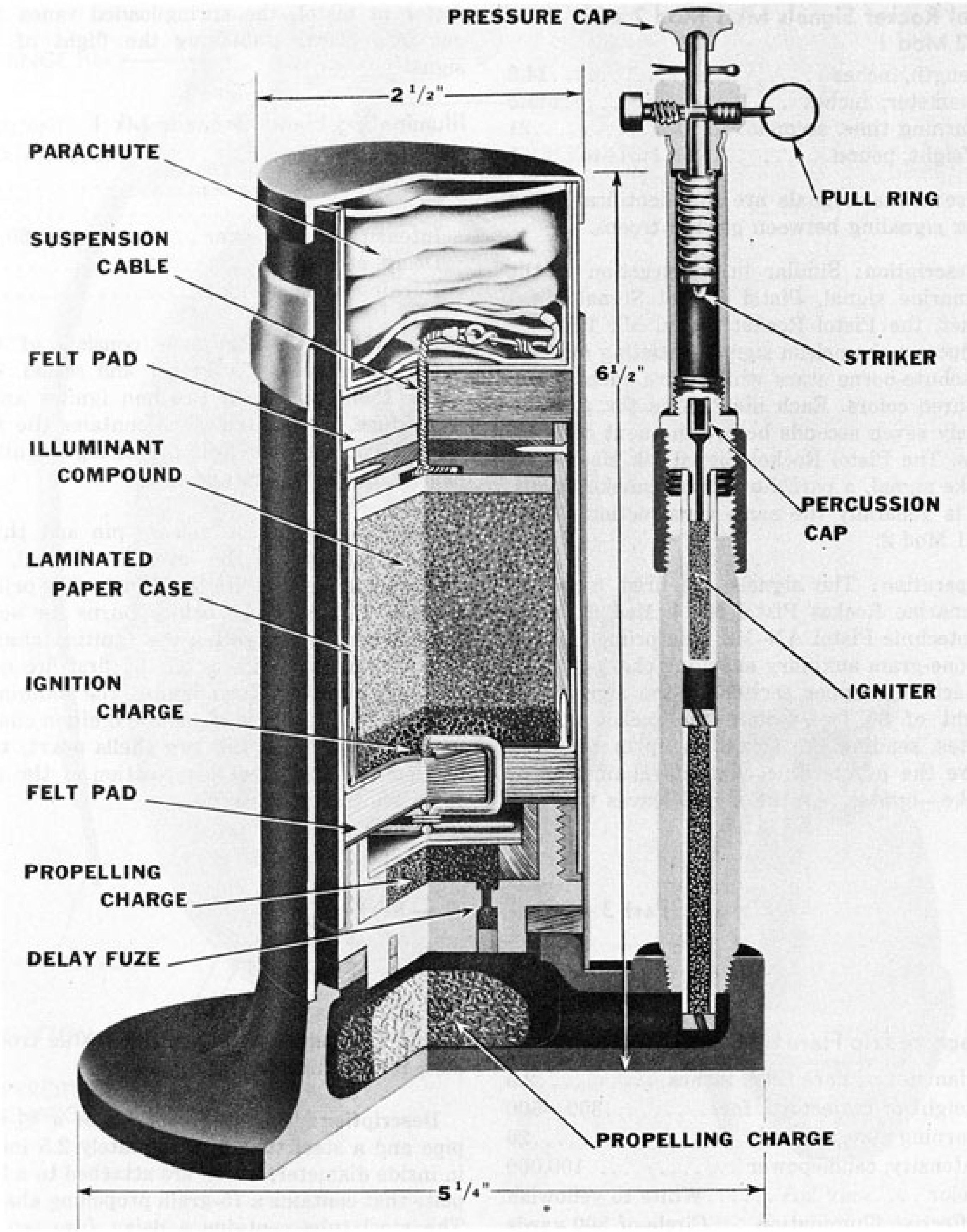


Figure 204. Parachute Trip Flare M48

threaded to the base plate. The firing train is composed of a primer, an igniter, and a relay charge. The firing mechanism contains the pressure cap, pull ring and pin, safety screw, safety cotter pin, and spring-loaded firing pin.

Operation: A 20- to 30-pound pressure on the pressure cap or a tension of four to six pounds on the pull pin releases the firing pin and fires the primer. The primer initiates the igniter, which, in turn, starts the relay charge. The relay charge sets off the propelling charge, which projects the illuminating shell through the large steel tube to a height of 300 to 500 feet. The propelling charge ignites a three-second delay fuse in the shell. The delay fuse ignites an expelling charge which expels a parachute-supported candle from the shell.

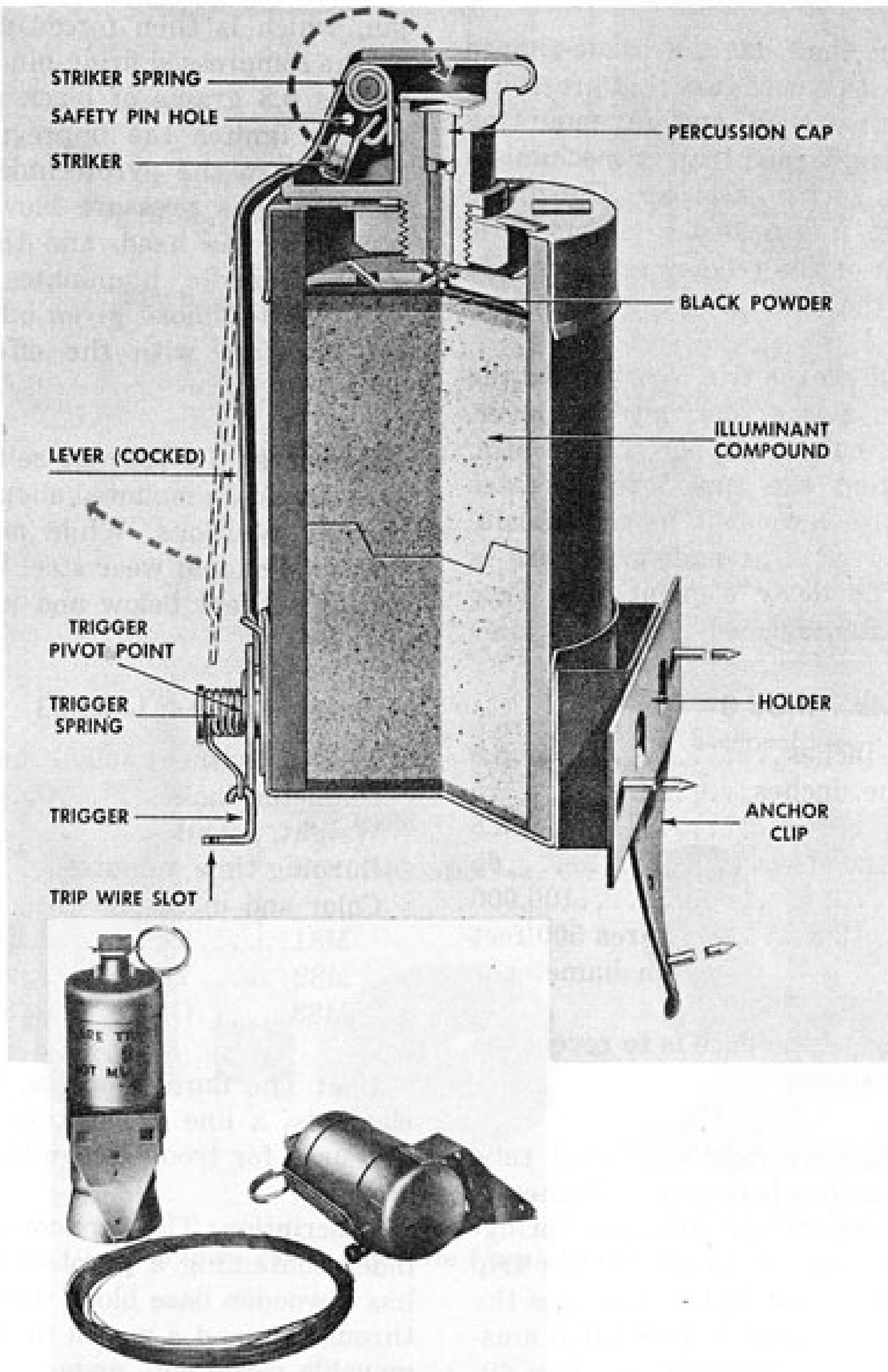


Figure 205. Trip Flare M49

Trip Flare M49

Length, inches	3.8
Diameter, inches	2.5
Burning time, minute	1
Intensity, candlepower	40,000
Color	White to yellowish

Use: The Trip Flare M49 has the same uses as the Parachute Trip Flare M48.

Description: The flare has a grenade-shaped cylindrical body, with a nose fuze that protrudes 0.875-inch from the head end. A mounting bracket and a spring-loaded trigger mechanism are mounted on a metal base cap. The upper arm of the trigger is attached to a trip wire, and the lower arm of the trigger restrains the safety lever after the removal of the safety pin.

Operation: A pull on the trip wire rotates the upper trigger arm away from the fuze lever. If the trip wire is cut, the upper trigger arm, which is restraining the fuze lever, rotates away from the fuze lever but in an opposite direction from above. A grenade-type fuze is used, but it has no delay element. The fuze ignites the flare instantaneously.

Trip-Wire Flare Mk 1 Mod 0

Length of tube, inches	5.5
Diameter of tube, inches	2.5
Weight, pounds	3.5
Burning time, seconds	65
Candlepower	100,000
Effective illumination	Area 500 feet in diameter

Use: The purpose of the flare is to reveal the approach of enemy troops.

Description: The flare case is a steel tube approximately 5.5 inches long and 2.5 inches in diameter. Fixed to one end is a pull-type, spring-actuated firing mechanism to which the trip wire is attached. Enclosed in the tube are the primer, black-powder charge, impregnated muslin disc, and pyrotechnic composition. Two 40-foot lengths of wire are available, making it possible to have two trip wires running in opposite directions. A web belt secures the flare to a tree.

Operation: A tug of three pounds or more on the trip wire draws the plunger and firing pin away from the primer and compresses a spring which surrounds the firing pin. As the plunger is pulled away from the firing mechanism, its notched end disengages from that of the firing pin, which is then forced against the primer by the compressed firing-pin spring. The primer ignites 0.3 grams of black powder. The black powder ignites the impregnated muslin disc, and in turn the pyrotechnic composition. The resultant gas pressure blows out the closure disc from the head, and the flame from the burning candle illuminates the surrounding area. White smoke given off by the flare does not interfere with the effectiveness of illumination.

Remarks: To prevent self illumination, the flare should be mounted about 125 yards before friendly positions. While mounting the flare, personnel should wear steel helmets, and heads should be kept below and away from the top of the flare.

Ground Flare M81—M83

Length (without spike), inches		7.75
Diameter, inches		1.75
Weight, pound		0.88
Burning time, minutes		2
Color and intensity		
M81	Red	20,000 candlepower
M82	Yellow	25,000 candlepower
M83	Green	35,000 candlepower

Use: The flare indicates, to cooperating air elements, a line of position or direction. It is also used for troop-recognition purposes.

Description: The flare consists of a paper cylinder containing a pyrotechnic composition. It has a wooden base block with a 20-penny spike through it, and a match head covered by a removable metal cap, under which lies a wooden disc. A plastic film seals the metal cup to the

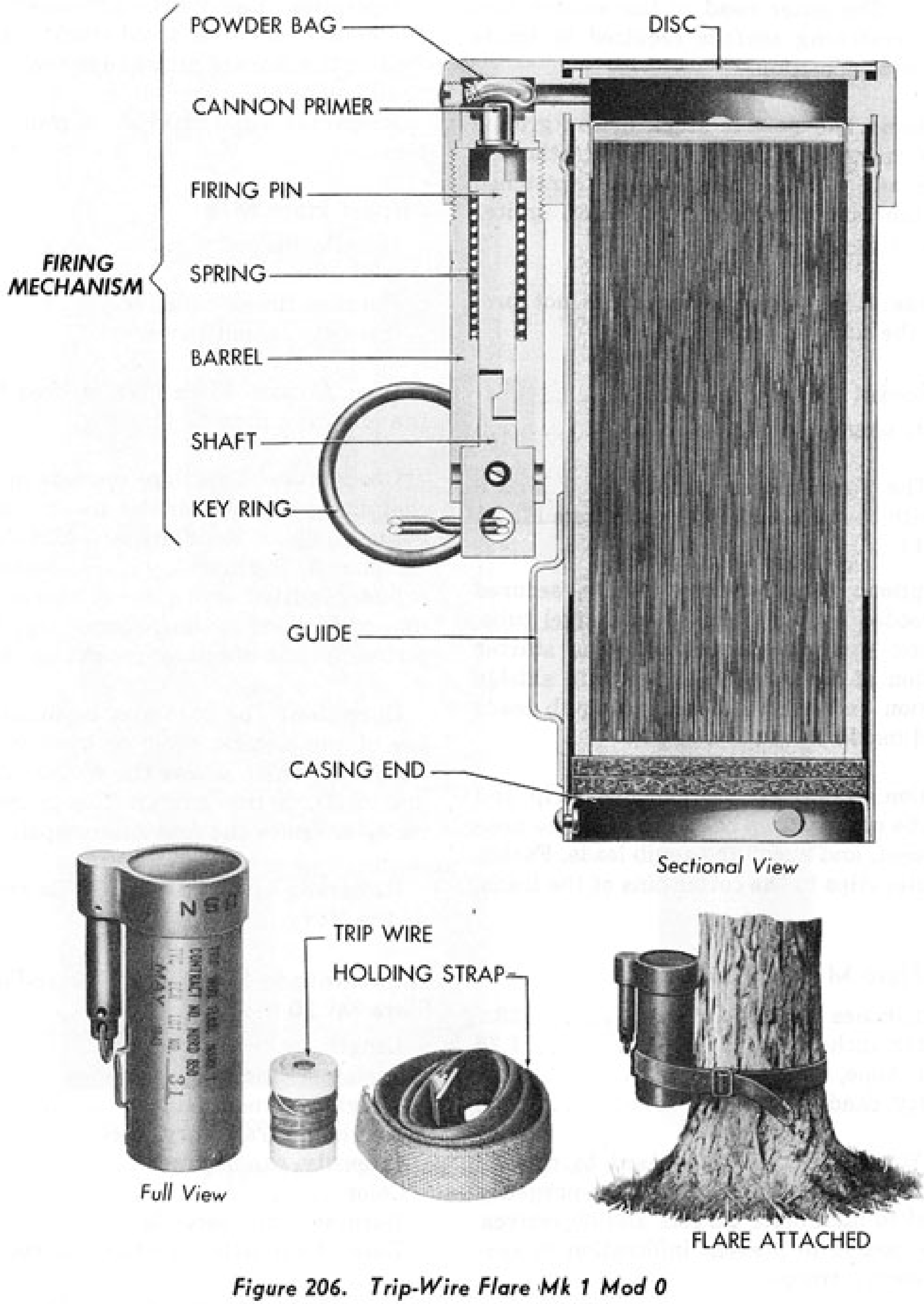


Figure 206. Trip-Wire Flare Mk 1 Mod 0

flare body. The outer head of the wooden disc has the scratching surface required to ignite the match composition.

Operation: The flare is stuck in the ground with the spike as a support. The plastic seal is pulled off and the wooden disc scratched against the match composition, which ignites the flare.

Remarks: These ground flares are not procured by the Navy at present.

Target Rocket Flare Mk I Mod 0

Weight, pounds 3

Use: The Target Rocket Flare Mk 1 Mod 0 is used with the 3.25-inch Rocket Targets Mk 10 and Mk 11.

Description: A pyrotechnic candle, secured into a wooden body, is housed in a steel tube. An electric squib is located over the starter composition of the candle. A steel cup shields the ignition end of the flare, and squib leads are coiled inside the nose cap.

Operation: Tear off the adhesive strip and remove the cover. Place the flare over the nose of the rocket, and uncoil the squib leads. Fasten the alligator clips to the cotter pins of the leads, and fire.

Airport Flare M13 (Obsolete)

Length, inches 23.1
Diameter, inches 1.75
Burning time, minutes.................. 3
Intensity, candlepower 40,000

Use: Airport Flare M13 is used to provide illumination for airplane landing at emergency fields, and to illuminate targets and objectives. A further use is to prevent infiltration or surprise by enemy troops.

Description: The flare consists of a cylinder; the top cover sealed with a strip of adhesive tape, and a seven-inch hollow chip-board tube mounted to one end of the cylinder.

Operation: Remove the adhesive tape and slip the hollow tube over a rod stuck in the ground. Pull on the lanyard attached to the ignition wire to fire the flare.

Remarks: This flare is not procured by the Navy.

Airport Flare M76

Length, inches 32.0
Diameter, inches 6
Burning time, minutes 6.5
Intensity, candlepower 800,000

Use: Airport Flare M76 is used to indicate the end of a runway in a fog.

Description: This flare consists of a cylinder containing a candle similar to—but larger than—the candle of the Flare AN–M26 described in Chapter 8, Section 5, of this pamphlet. The cylinder is fitted with a socket base arrangement into which four channel-shaped legs may be inserted to hold the flare upright on the runway.

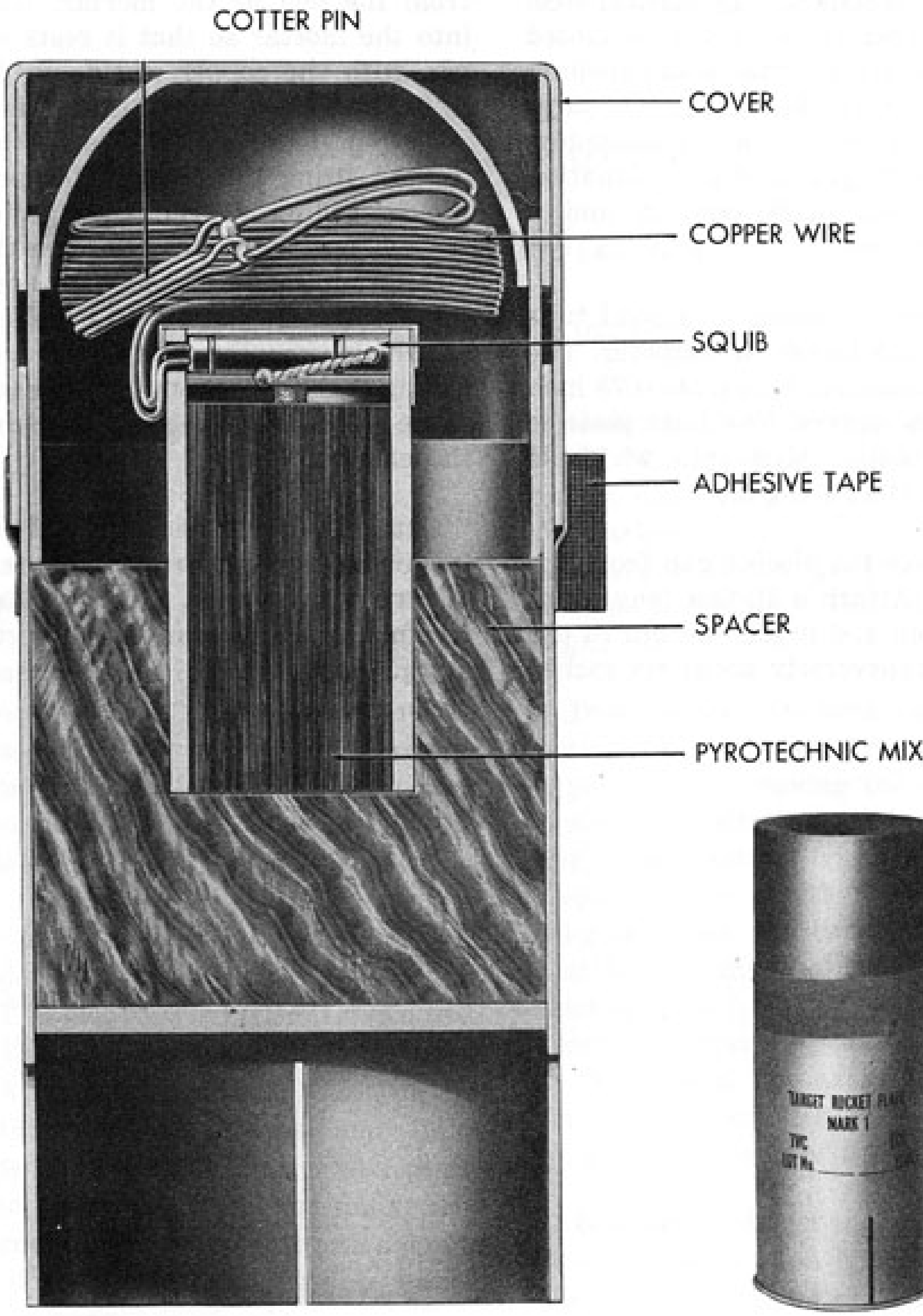
Operation: The flare may be initiated by the use of the electric squib or by pull on the release fork which allows the spring-loaded firing pin to strike the primer. The primer acts directly to ignite the first fire compsition.

Remarks: Airport Flare M76 is not procured by the Navy.

High-Altitude Parachute Mortar-Fired Flare Mk 20 Mod 0

Length, inches 10.75
Diameter, inches 2.5
Weight, pounds 5
Height of trajectory, feet............ 1,000
Intensity, candlepower 85,000
Color .... White
Burning time, seconds 60
Rate of fall after ignition, ft./sec........ 16

Use: This high-altitude flare is used to illuminate seaplane landing areas at night, and to illuminate an island base when low ceilings do not permit proper visibility from normal flying levels.



Sectional View *Full View*

Figure 207. Target Rocket Flare Mk 1 Mod 0

Flare: The flare consists of a cylindrical steel tube body with a copper cup welded to the closed end of the tube. The body contains an expelling charge, a pyrotechnic candle, and a silk parachute. The copper cup contains a fuse assembly, a propelling charge, 25 grams of a combination smokeless powder and black powder, and a standard shotgun primer.

Mortar: The mortar consists of a steel tube 36 inches long and 2.8 inches in diameter. The tube is screwed into a steel base plate 0.75 inch thick and 12 inches square. The base plate is provided with a central stud into which is pressed a hardened steel firing pin.

Operation: Remove the closing cap from the end of the mortar. Attach a 30-foot lanyard to the brass release pin and insert the pin in the two holes drilled transversely about six inches from the end of the mortar. Insert the flare into the mortar so that it rests on the release pin, with the copper end down. Fire the flare by pulling the lanyard, thus removing the release pin. The flare falls to the bottom of the mortar, firing the primer. The primer sets off the propelling charge and ignites the delay fuse. The expanding gases force the copper cup away from the flare and fill the bore of the mortar. The flare is propelled 1,000 feet into the air, at which time the delay fuse ignites the expelling charge. The pyrotechnic candle and parachute are expelled, the expelling charge igniting the candle.

Remarks: A suitable barrier should be erected to shield personnel firing the flare. In case of a misfire, wait at least three minutes before disassembling the mortar. Clean mortar tube after firing.

SHIPBOARD PYROTECHNICS

Section I — SURFACE VESSEL ITEMS

Distress Smoke Hand Signal AN–Mk 1 Mods 0 and 1

Length, inches	3.875
Diameter, inches	1,625
Weight, pound	0.37

Description: The signal is encased in a metal cylindrical body, one end of which is closed by a soldered cap and pull ring. The case can be held comfortably and safely in the bare hand during the burning period. The signal contains a pyrotechnic smoke mixture and is watertight.

Operation: The sealing tape around the end of the cylinder is torn off and the paper cap is removed. The pull ring is brought down over the rim of the can and pressed down, using the ring as a lever to break the seal. The cylinder is pointed away from the face; and a quick pull is exerted on the pull ring, which comes out of the can, thereby igniting the smoke mixture. The signal should be held at arm's length at an angle of about 30°, so that drippings will not fall on the hand.

Remarks: This signal is to replace the White Smoke Grenade, H.C., AN–M8, for emergency kits in life rafts and aircraft.

Signal, Distress—Day and Night—Mk 13 Mod 0

Length, inches	5.12
Diameter, inches	1.62
Weight, ounces	6.4

General: Adapted for both day and night use, Hand Signal Mk 13 contains both the orange smoke canister for daylight and a flare pellet for darkness. Like the Smoke Signal AN–Mk 1 in appearance and operation, the Signal Mk 13 is small and is easily stowed in life-vest pockets, flight suits, or life rafts.

Description: The metal outer case is closed at both ends by a soldered cap to which is attached a pull ring. Removing the soldered cap pulls a brass wire attached to its bottom through a cup coated with a friction igniting compound. Depending on whether the "day" or "night" ring is pulled, the two ends of the case being distinctly so marked, the smoke mixture or the flare is ignited. Smoke emission time is approximately 18 seconds; flare burning time is 18 to 20 seconds. The average candlepower of the flare is 3,000 candles. Paper cups cover the pull rings on each end of the signal.

Operation: After the paper cup is removed from desired end, a quick pull is given on the ring. If the soldered cap fails to come off, bring the pull ring down over the side of the can, and use the ring as a lever to break the seal. Hold the signal at arm's length and 30° elevation while burning. After one end is used, the signal should be doused in water to cool the metal parts. It should then be retained for possible use of the other end. Each end is insulated and waterproofed from the other.

Remarks: Both ends of the Signal Mk 13 should never be ignited at the same time.

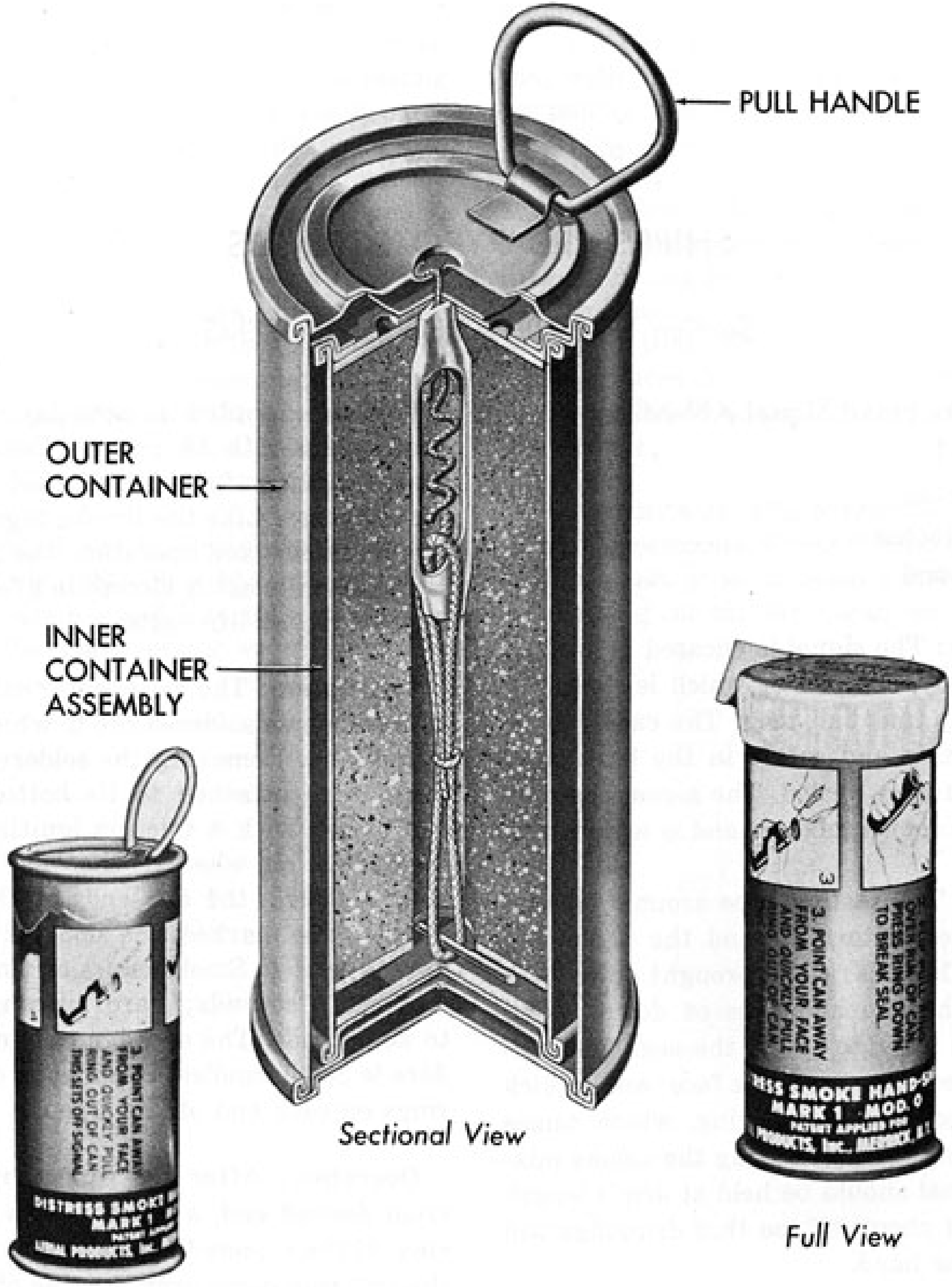


Figure 208. Distress Smoke Hand Signal AN–Mk 1 Type

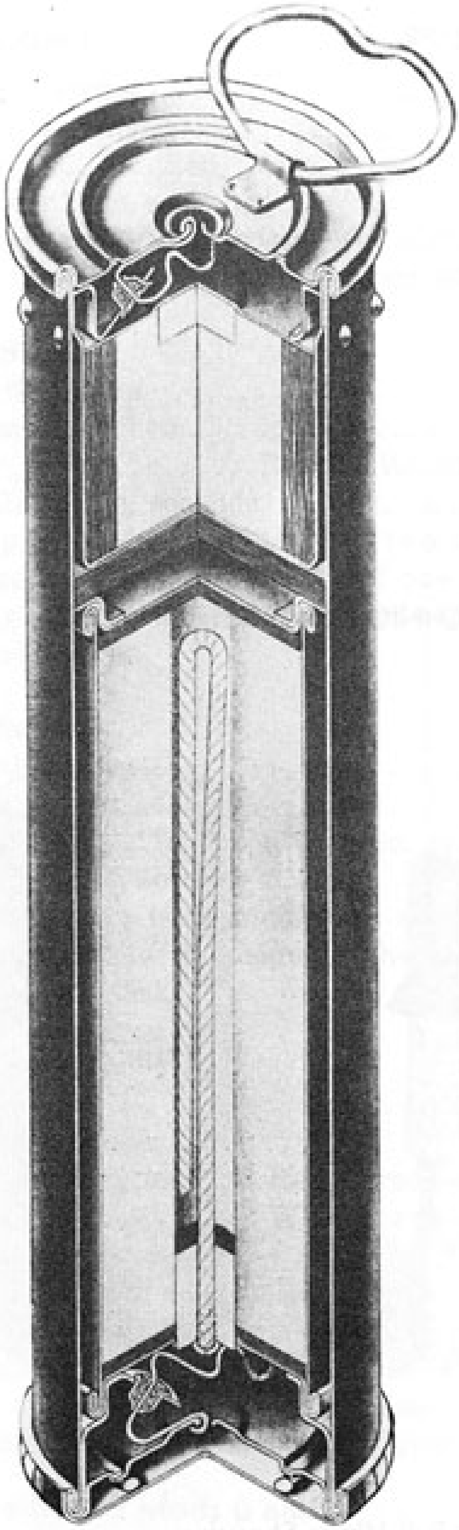


Figure 209. Signal, Distress—Day and Night—Mk 13 Mod 0

Navy Red Light Mk I and Navy Blue Light Mk I Mod I

Length, inches	12.0
Diameter, inches	1.25
Burning time, minutes	Blue—1 to 1.5
	Red—2.5 to 3

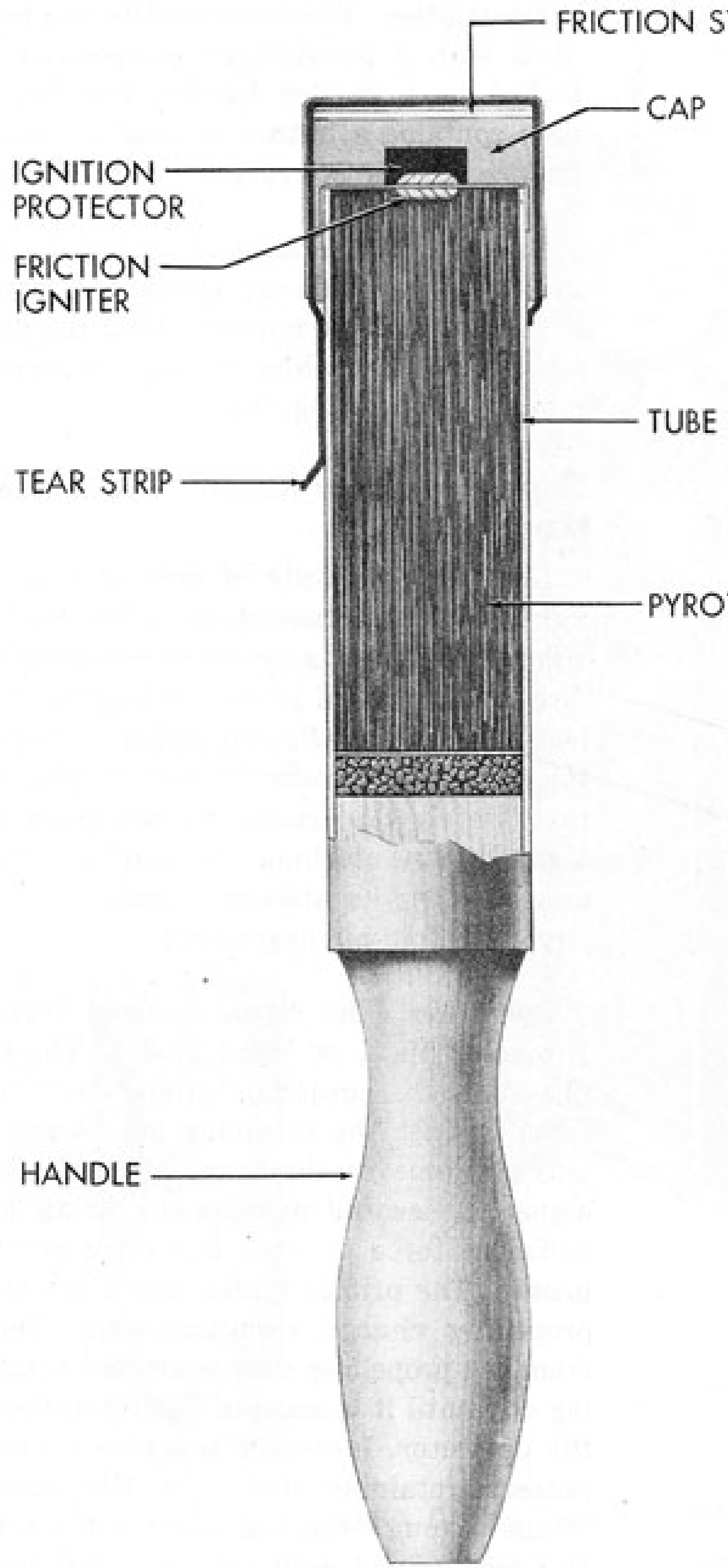
Description: The flare consists of a paper tube filled with a pyrotechnic composition and attached to a wooden handle. The top of each flare contains a button of ignition material. A friction striker is provided with each signal.

Operation: The flare is ignited by scraping the top of the inside cap against the forward end of the pyrotechnic mixture. Hold the flare in an inclined position while burning, to prevent drippings from burning the hand.

Ship's Emergency Identification Signals Mks I—4

General: The body of each of these signals varies in length according to its design. Each signal consists of a pressure-retaining disc and disc-locking nut, a primer, a four-gram smokeless-powder propelling charge, a copper obturating cup, a delay train, an ejection charge of approximately 1.1 grams of black powder, and a signal of pyrotechnic composition. All signal cups except the shower signals have a parachute for mid-air suspension.

Operation: The signal is fired from Signal Projector Mk 1 or Mk 1 Mod 1. The signal is placed in the projector primer-first, where it rests against the retaining pin. A pull on the lanyard removes the firing pin and allows the signal to descend against the firing pin with sufficient force to close the valve and fire the primer. The primer ignites the delay train and propelling charge simultaneously. The gases from the propelling charge expand the obturating cup until it is secured tightly in the bore of the projector. Increased pressure ruptures the pressure-retaining disc, and the gases then escape through the openings in the retaining-disc locking nut into the projector bore. The gases propel the signal approximately 600 feet. The ignited delay train burns until the signal reaches approximately the zenith of its trajectory, and then ignites the ejection charge. The ejection charge ejects and ignites the signal pyrotechnics through a quick match and first fire composition.



Sectional View

Full View Showing

Figure 210. Navy Red Light and Navy Blue Light

Mk 1 (Star)

Length, inches 5.124
Diameter, inches 2.49
Color . . . . Red, white, green, or yellow
Burning time, seconds . . . . 25±5

The closing cup is embossed for night identification. The star is parachute-suspended.

Mk 2 (Shower)

Length, inches 6.374
Diameter, inches 2.50
Color . . . . Red, white, or green
Burning time, seconds 5

This signal is designed to give two distinct bursts, one with a short delay and one with a long delay. The closing cup is embossed for night identification.

Mk 3 (Smoke)

Length, inches 9.124
Diameter, inches 2.49
Color . . . . Red, black, green, or yellow
Burning time, seconds . . . . 25±5

The closing cap is painted with same color that is produced by the signal. The signal is parachute suspended.

Mk 4 (Chameleon)

Length, inches 5.124
Diameter, inches 2.49
Color combinations . . . . Red—green—white
White—red—green
Green—white—red
Burning time of each color, seconds 9
Delay between colors, second 1

The signal is parachute-suspended and designed to change color while burning. Otherwise, the signal is similar to the Signal Mk 1.

Float Flare Mk 15 Mods 0 and 1

Length, inches 37.2
Diameter, inches 6.5
Weight, pounds 26
Burning time, minutes 5
Intensity, candlepower 100,000
Delay before ignition, minutes 5

Use: Float Flare Mk 15 Type is used by PT boats in illuminating enemy ships.

Description: The flare consists of a wooden body housing a pyrotechnic column and having a metallic base to provide flotation stability. The top of the flare is closed by a cone-shaped adapter which contains a bouchon grenade-firing mechanism attached to a celluloid disc. Enclosed is a 3.5-foot length of time fuse. The starter composition is attached to the flash end of the time fuse. The illuminant composition is next to the starter composition.

Operation: The flare is held horizontally, with the right hand firmly grasping the bouchon lever and the left hand supporting the nose cap. The safety key is pulled and the flare is tossed overboard. When the bouchon lever is released, the firing pin is forced by the firing-pin spring to impinge upon the primer. The primer ignites the time fuse. The time fuse flashes into a booster bag of starter composition, which, in turn, ignites the flare.

Remarks: It is recommended that one man hold the flare while a second man pulls the safety ring.

Mod 1 is like the Mod 0, except that it has a mechanical clockwork timing device—for settings from one to 30 minutes—instead of the time-fuse device.

Rocket, White, Marine Type, Mk 1 Mod 0

Length, inches 12.0
Diameter, inches 1.5
Weight, pounds 2
Burning time, seconds 5

Use: This is a merchant marine rocket issued by the Navy.

Description: This rocket signal consists of the rocket body, star pellets, propelling charge, clay heading, and closing cap.

Operation: The rocket is fired by the Pyrotechnic Pistol AN–M8 and reaches a height of 250 feet. At the height of its trajectory, the rocket bursts. The falling particles burn for five seconds.

Remarks: This signal will be replaced by the Rocket Pistol Signal Mk 3 Mod 0 (Shower).

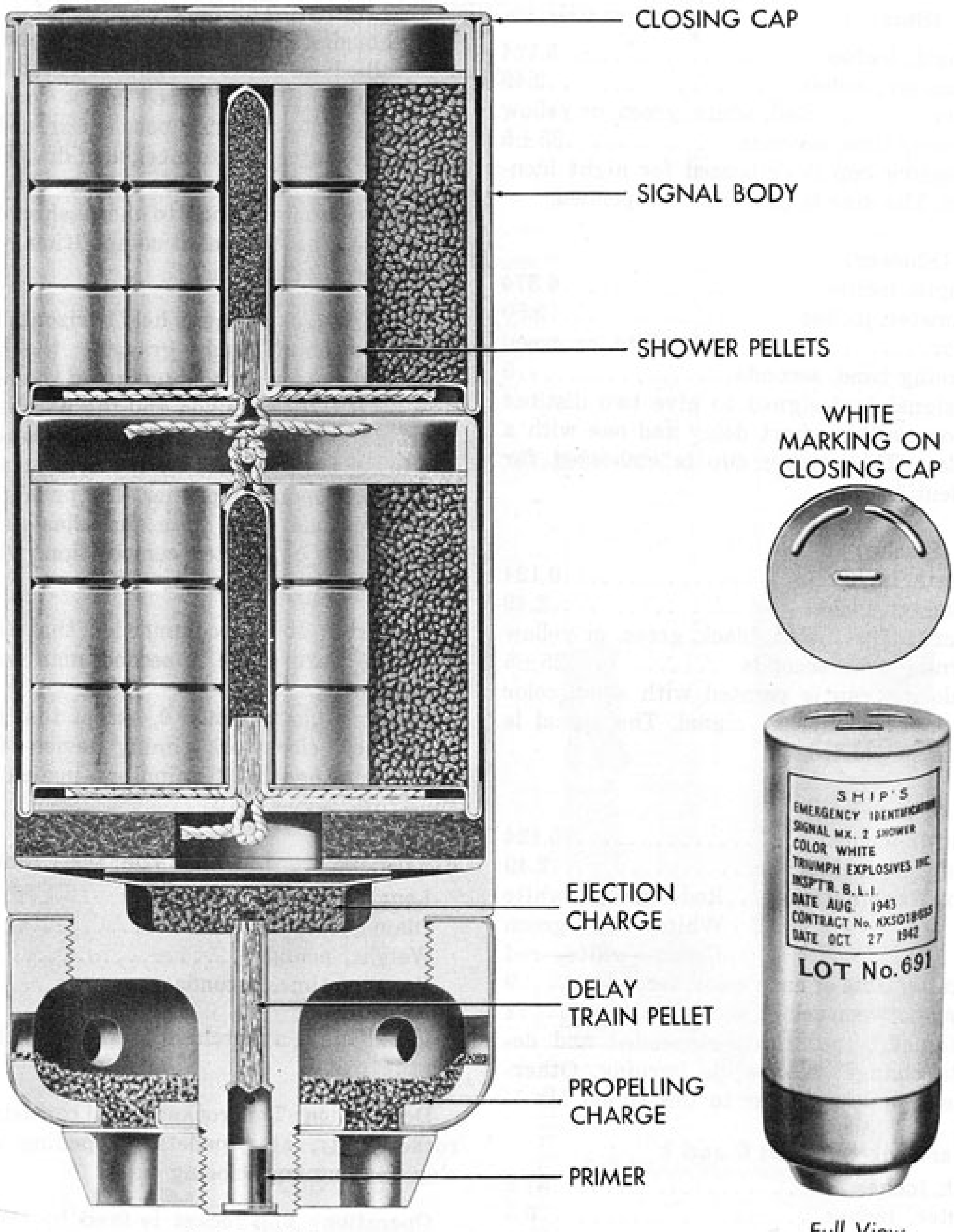


Figure 211. Ship's Emergency Identification Signal Mk 2 (Shower)

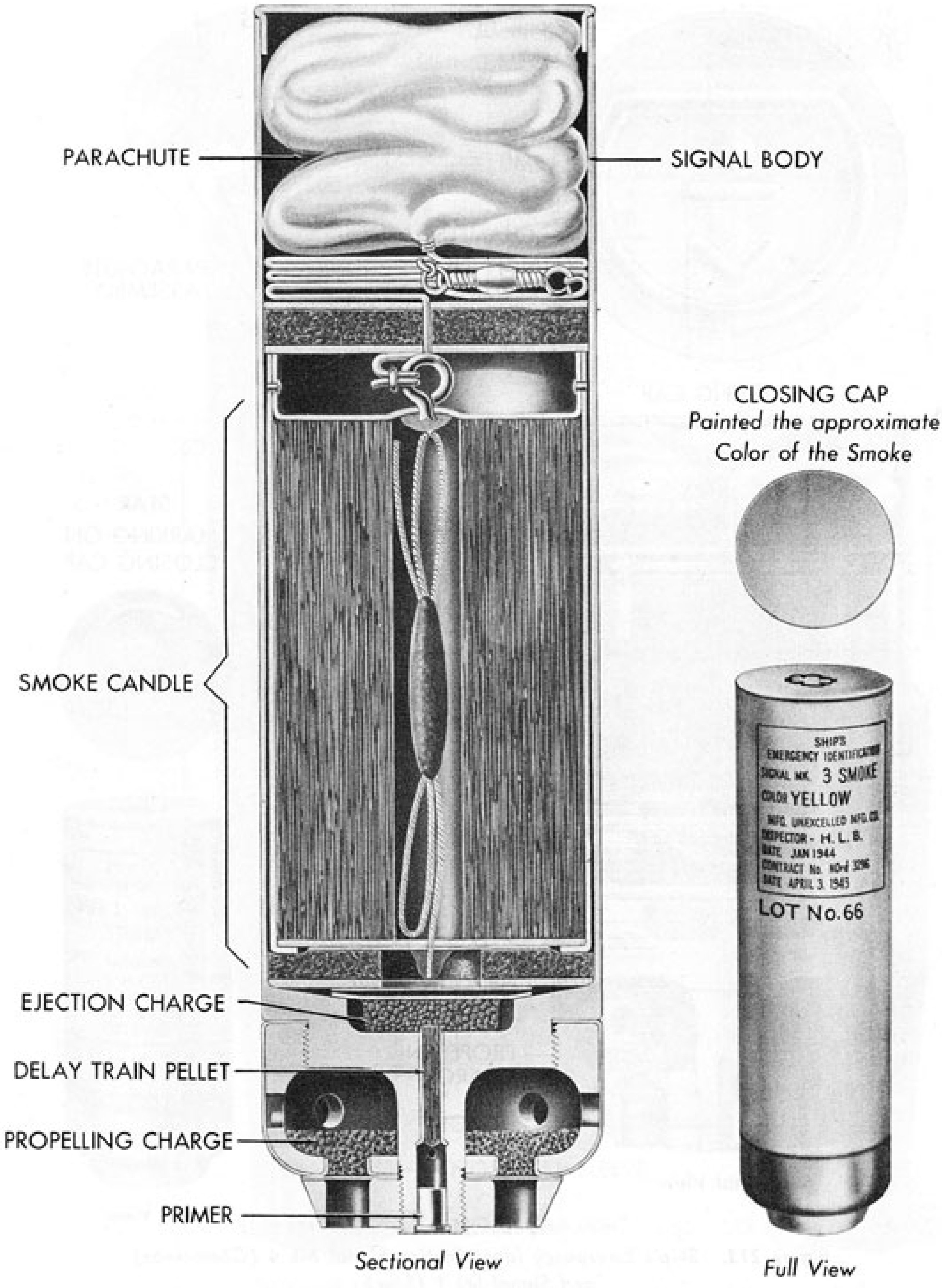


Figure 212. Ship's Emergency Identification Signal Mk 3 (Smoke)

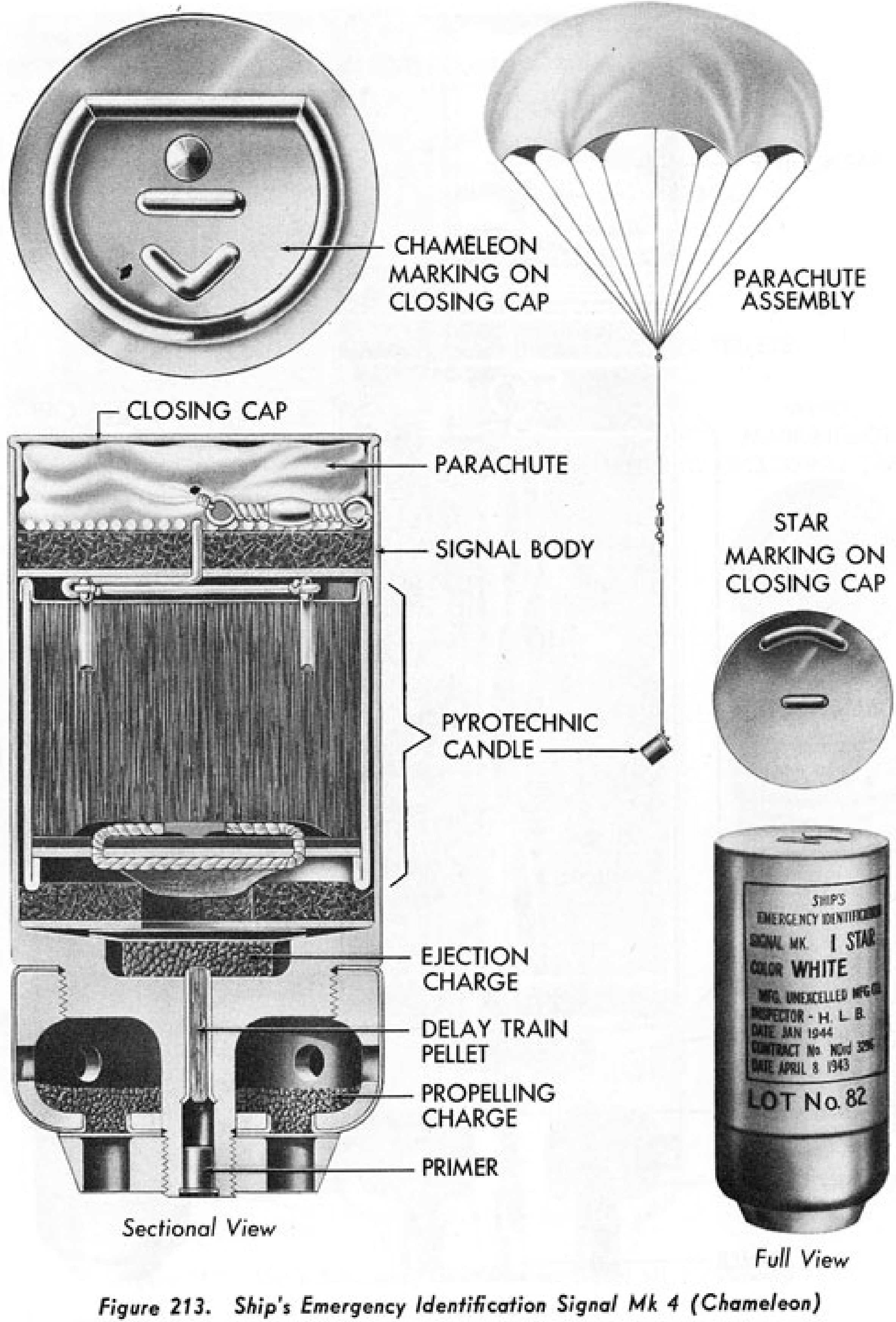
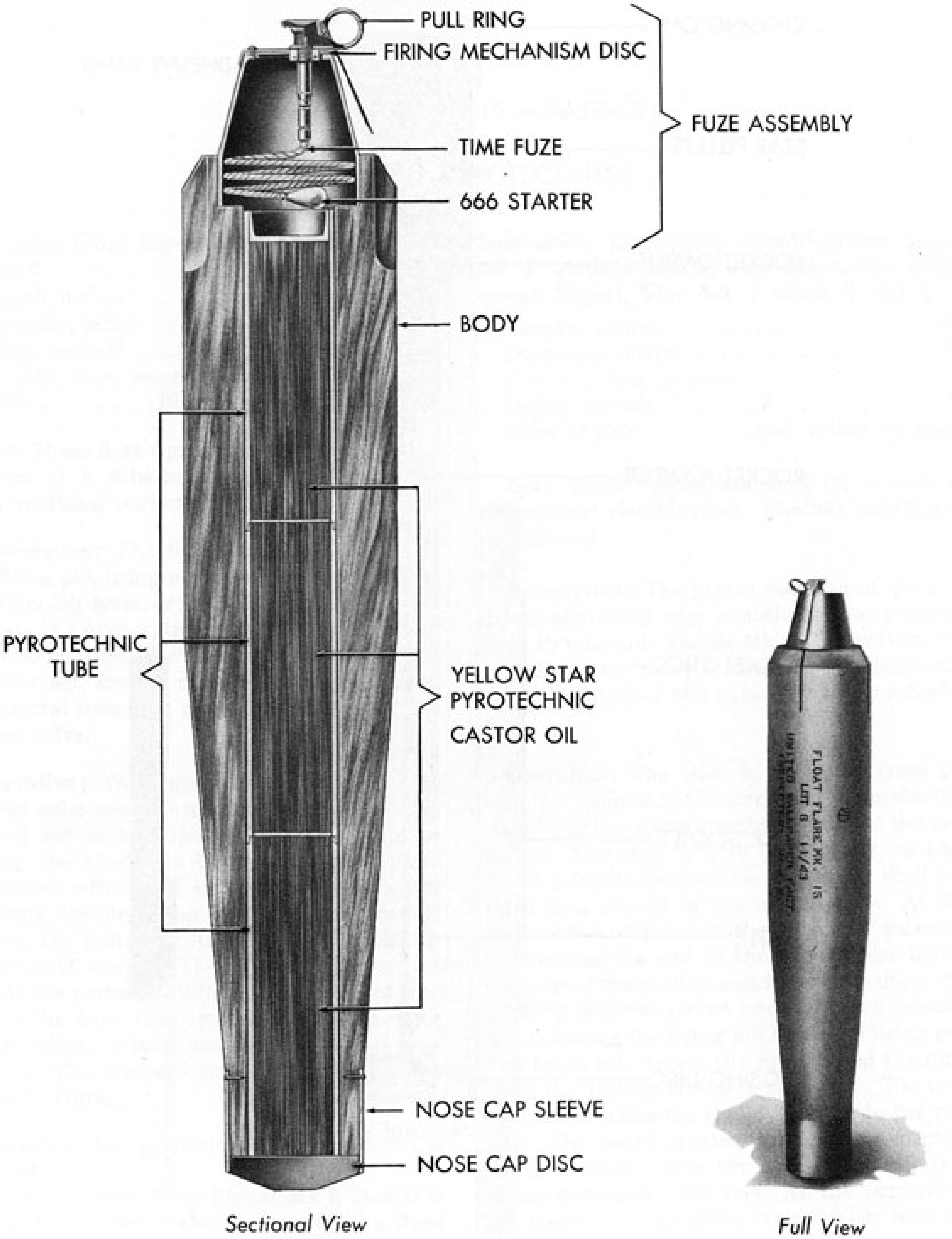


Figure 213. Ship's Emergency Identification Signal Mk 4 (Chameleon) and Signal Mk 1 (Star)



Sectional View

Full View

Figure 214. Float Flare Mk 15 Type

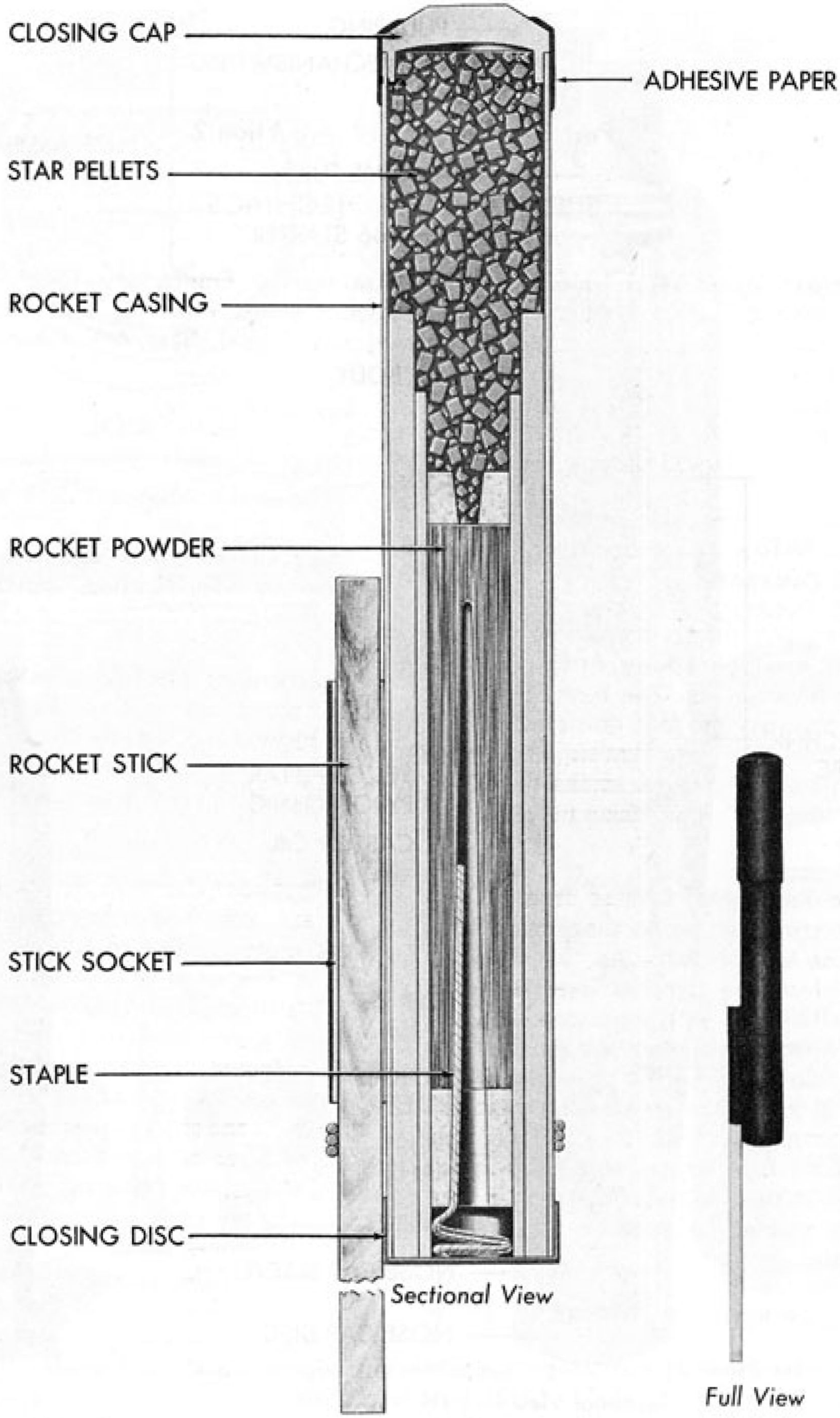


Figure 215. Rocket, White, Marine Type, Mk 1 Mod 0

SUBMARINE PYROTECHNICS

Submarine Float Signal Mk 1 Mod 1 and Mk 2 Mod 0

Length, inches	18.75
Diameter, inches	3.0
Delay, seconds	27
Burning time, seconds	15
Color	Black, yellow, green, or red

Use: These float signals are used to mark the position of a submerged submarine, and for other marking purposes.

Description: The firing mechanism consists of a firing pin, firing-pin spring, firing-pin lever, and tripping lever or lug. The ignition system consists of a primer, time fuse, quick match, and a starter mixture. The aluminum signal contains a smoke pot, smoke mixture, smoke pot-cover, and central tube. The signal has a nose cap and release valve.

Operation: The signal is fired from a submerged submarine, through a tube, using compressed air as a propellant. As the signal is leaving the ejector, a tripping lever is raised by contact with a lug in the gun, cocking and releasing the firing-pin lever, which fires the primer. The primer ignites the time fuse, which burns for 27 seconds. The signal is buoyant and rises to the surface within the 27 seconds of fuse delay. The time fuse ignites a piece of quick match, which, in turn, initiates the starter composition. The starter composition sets off the smoke mixture.

Remarks: The maximum launching depth is 162 feet.

The Submarine Float Signal Mk 2 Mod 0 is similar to the Mk 1 Mod 1, except for a fixed delay of 54 to 59 seconds, a maximum launching depth of 285 feet, and sturdier construction.

Submarine Emergency Identification Signal Mk 2 Mods 1 and 2; also Submarine Emergency Signal, Star, Mk 3 Mods 0 and 1

Length, inches	18.0
Diameter, inches	3.0
Burning time, seconds	25
Delay, seconds	27
Color of star	Red, yellow, or green

Use: These signals are used for submarine emergency identification, whether submerged or surfaced.

Description: The signal consists of a cylindrical aluminum case containing the grenade-type Pyrotechnic Candle Mk 3. The bottom end contains two delay elements. A single-star candle is attached to a parachute by an asbestos cord.

Operation: The shell is projected from the standard submarine emergency identification signal ejector, using compressed air as the propellant. The shell is fired by a lug at its base which projects beyond the side of the shell and rides in a groove in the ejector tube. As the shell is forced through the tube, the extended lug reaches the end of the groove just before the base of the shell passes the muzzle door. The tripping lever is pulled back, thereby cocking and releasing the firing pin lever and firing pin. The firing pin strikes the primer, and the flash from the primer ignites a time fuse. The time fuse burns while the signal is rising to the surface. The delay ignites the grenade-ejection charge, which ejects the signal to a distance of approximately 250 feet. At the summit of the trajectory, the delay train flashes into the signal-ejection charge and causes the parachute-suspended star to be ejected.

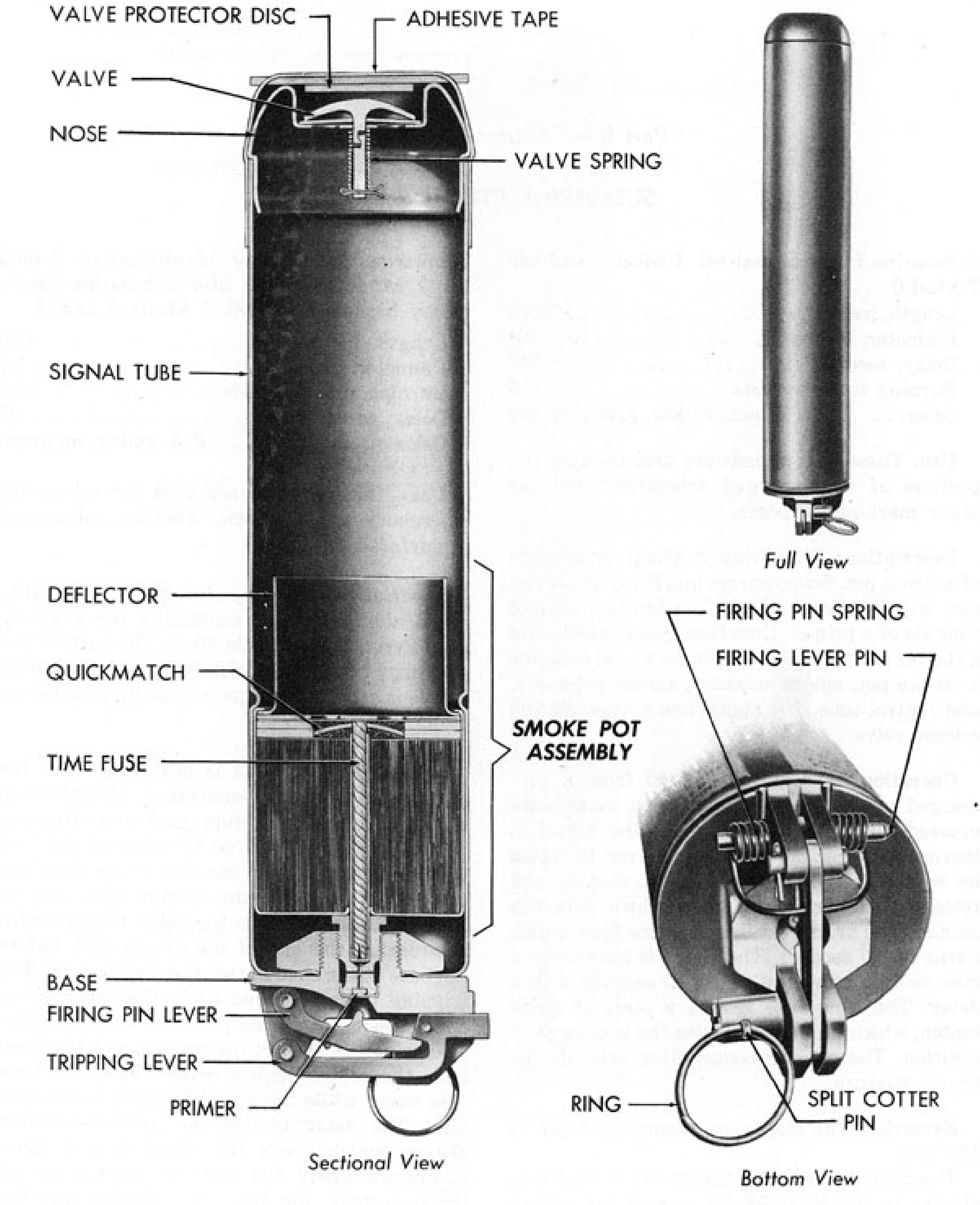


Figure 216. Submarine Float Signal Mk 1 Mod 1

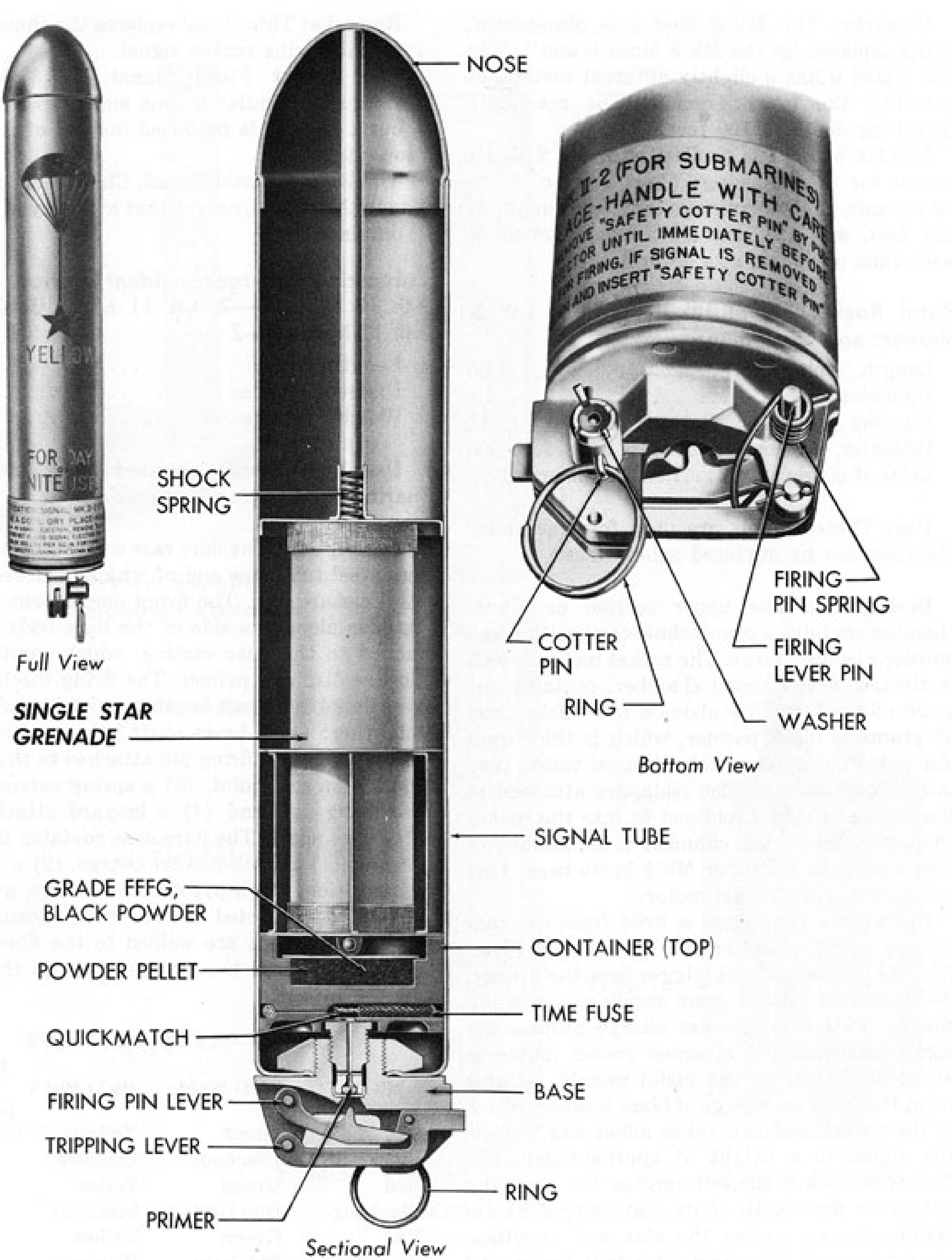


Figure 217. Submarine Emergency Identification Signal Mk 2 Mod 2

Remarks: The Mk 2 Mod 2 is obsolescent, being replaced by the Mk 3 Mods 0 and 1. The Mk 3 Mod 0 has a slightly different method of expelling the inner grenade. The maximum launching depth is 160 feet.

The Mk 3 Mod 1 is similar to the Mk 2 Mod 1 except for the following: (1) a delay of 54 to 59 seconds, (2) a maximum launching depth of 285 feet, and (3) a sturdier construction to withstand pressures at a lower depth.

Pistol Rocket Signal Mk 1, Comet; Mk 3, Shower; and Chameleon

Length, inches	14.0
Diameter, inches	1.5
Burning time, seconds	11
Intensity, candlepower	60,000
Color of single star	Red, green, or yellow

Use: These signals are used for emergency identification by surfaced submarines.

Description: The upper section or signal chamber contains a pyrotechnic composition and powder-ejector charge. The rocket motor, which is riveted to the signal chamber, contains one gram of black powder above a felt washer and 58 grams of black powder, which is the rocket element. Four spring-loaded hinged vanes, four inches long and one inch wide, are attached to the rocket tube and fold and fit into the rocket chamber. The rocket chamber is an aluminum container with a Primer Mk 5 in its base. This unit receives the rocket motor.

Operation: The signal is fired from the submarine rocket pistol or the Pyrotechnic Pistol AN–M8. Release of the trigger fires the primer, which ignites the one-gram auxiliary propelling charge. This black-powder charge propels the signal chamber and attached rocket motor to about 30 feet from the pistol muzzle. At this point the 58-gram charge of black powder, which is the rocket element, takes effect and propels the signal to a height of approximately 650 feet. The rocket element ignites the expelling charge at the zenith of its trajectory. The expelling charge ignites the star and simultaneously ejects it. The single star falls freely, and burns out just before hitting the water.

Remarks: This signal replaces the chameleon-type submarine rocket signal.

The Rocket Pistol Signal Mk 3 Mod 0 (Shower) is similar to this signal, except that a burst shower is produced instead of a single star.

The Rocket Pistol Signal, Chameleon, is similar to this signal, except that a variety of colors is obtained.

Submarine Emergency Identification Flares Mk 10 Mods 0—2, Mk 11 Mods 0—2, and Mk 12 Mods 0—2

Length, inches	9.75
Diameter, inches	2.00
Weight, pounds	3.2

Use: These signals are used by surfaced submarines to identify themselves.

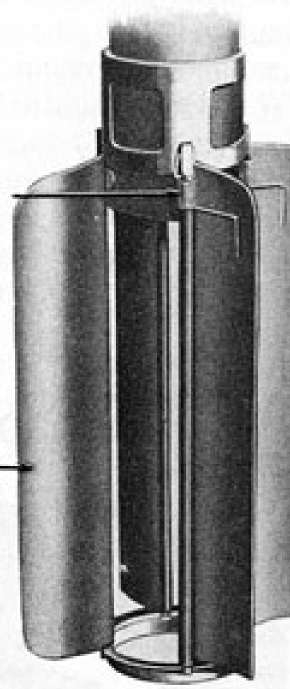
Description: The flare case consists of a seamless steel tube, one end of which is closed by a steel closure disc. The firing mechanism, which extends along the side of the flare body, is attached to the base casting, which carries the closure disc and primer. The firing mechanism is enclosed in a brass housing which contains the following: (1) a brass shaft held in place by a cotter pin, (2) a firing pin attached to the brass shaft by a sear joint, (3) a spring surrounding the firing pin, and (4) a lanyard attached to the brass shaft. The flare case contains the following: (1) a black-powder charge, (2) a starter composition, (3) a pyrotechnic charge, and (4) a steel cup riveted to the case, closing one end. Two clamps are welded to the flare body for mounting on the bracket fixed to the submarine bridge.

COLORS—FLARES MK 11 TYPE

Mk 11	Mk 11 Mod 1	Mk 11 Mod 2	Burning Time (seconds)
Red	Green	Yellow	10
Blackout	Blackout	Blackout	5
Red	Green	Yellow	10
Blackout	Blackout	Blackout	5
Red	Green	Yellow	10
Blackout	Blackout	Blackout	5
Red	Green	Yellow	10

Full View Showing Waterproof Container

COMET TYPE
Sectional View



Tail Vane Assembly
Full View

Figure 218. Pistol Rocket Signal Mk 1, Comet

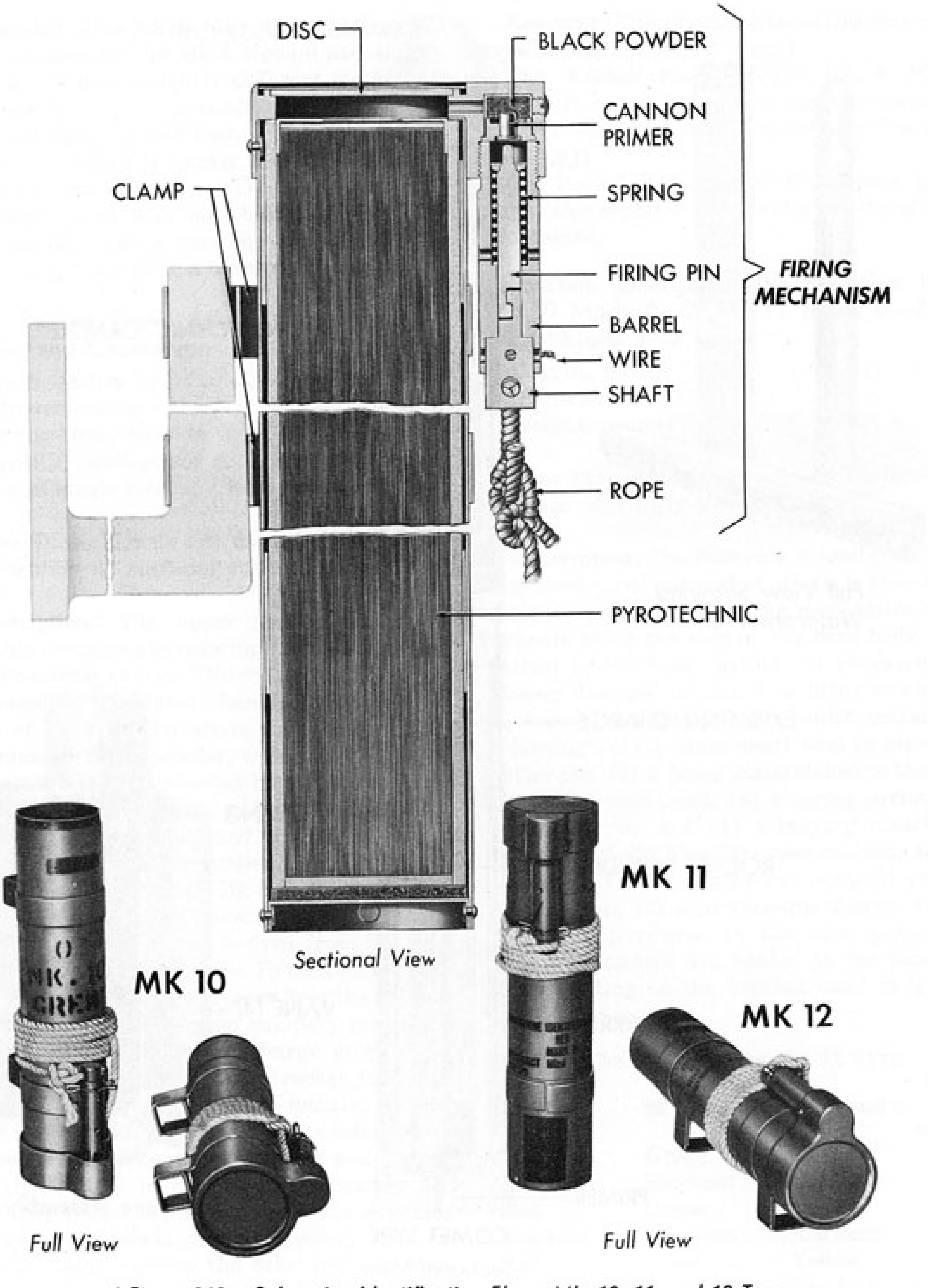


Figure 219. Submarine Identification Flares Mks 10, 11, and 12 Type

COLORS—FLARES MK 12 TYPE

Mk 12	Mk 12 Mod 1	Mk 12 Mod 2	Burning Time (seconds)
Red	Red	Green	10
Blackout	Blackout	Blackout	5
Green	Yellow	Yellow	10
Blackout	Blackout	Blackout	5
Red	Red	Green	10
Blackout	Blackout	Blackout	5
Green	Yellow	Yellow	10

Operation: Mount the flare so that the firing mechanism points toward the deck. A vertical pull on the lanyard forces the brass shaft up, compressing the firing-pin spring. The sear joint between the shaft and firing pin is broken when the shaft is pulled approximately 0.5 inches. The firing pin strikes the primer, which ignites a small charge of black powder. The flash from the black powder ignites the starter composition, which, in turn, ignites the pyrotechnic candle. The flare burns in four increments of 10 seconds duration and intervening blackout increments of five seconds.

Remarks: Flares that have been submerged below periscope depth should be thrown overboard at the first opportunity.

The possibility of detonation in any of the flares, and particularly in those with green pyrotechnics, should never be lost sight of. For this reason, personnel in the vicinity of the flares should be adequately shielded prior to firing.

Submarine Emergency Identification Flares Mk 10 and Mods are similar to the Flares Mk 11 and Mods and Mk 12 and Mods, except that these burn with only one uninterrupted color—Mod 0, red; Mod 1, green; and Mod 2, yellow.

False Target Shell Mk 1 Mod 0

Length, inches 18.0
Diameter, inches 3.0
Delay, seconds 27
Persistence of echo, minutes .... 4 to 18

Use: This shell is used to confuse and disrupt enemy underwater echo ranging.

Description: The external appearance is similar to the Submarine Emergency Signal Mk 2 Mod 2. The shell holds six metal cups 2.75 inches in diameter and 1.875 inches in depth, filled with a lithium hydride paraffin mixture. The base of the shell contains a primer, time fuse and 20-gram charge of smokeless powder. Attached to the base is a firing mechanism which is used with the standard emergency identification signal ejector.

Operation: The shell is projected from the standard emergency identification signal ejector, using 200 pounds per square inch air pressure if possible. The shell is fired by a lug at its base which projects beyond the side of the shell and rides in a groove in the ejection tube. As the shell is forced through the tube, the extended lug reaches the end of the groove just before the base of the shell passes the muzzle door. The tripping lever is pulled back, thereby cocking and releasing the firing pin lever and firing pin. The firing pin strikes the primer, and the flash from the primer ignites a length of time fuse coiled in the base of the shell. The time fuse burns for 27 seconds, and then ignites the 20-gram charge of smokeless powder, which ejects the six cups of lithium hydride. When the lithium hydride touches the water, a chemical reaction occurs which yields fine hydrogen bubbles. The hydrogen bubbles return an echo of the same order and magnitude as that returned by a submarine.

Remarks: False target shells should be segregated from pyrotechnics and other ammunition components, and should be kept in a dry atmosphere.

When visibility is such that surface disturbance may be a hazard, false target shells should not be released from depths less than 150 feet, because small bubbles or a surfaced canister may result.

False Target Can Mk 2 Mod 0

Length, inches 19.3
Diameter, inches 3.0

Use: False Target Can Mk 2 Mod 0 has the same use as False Target Shell Mk 1 Mod 0.

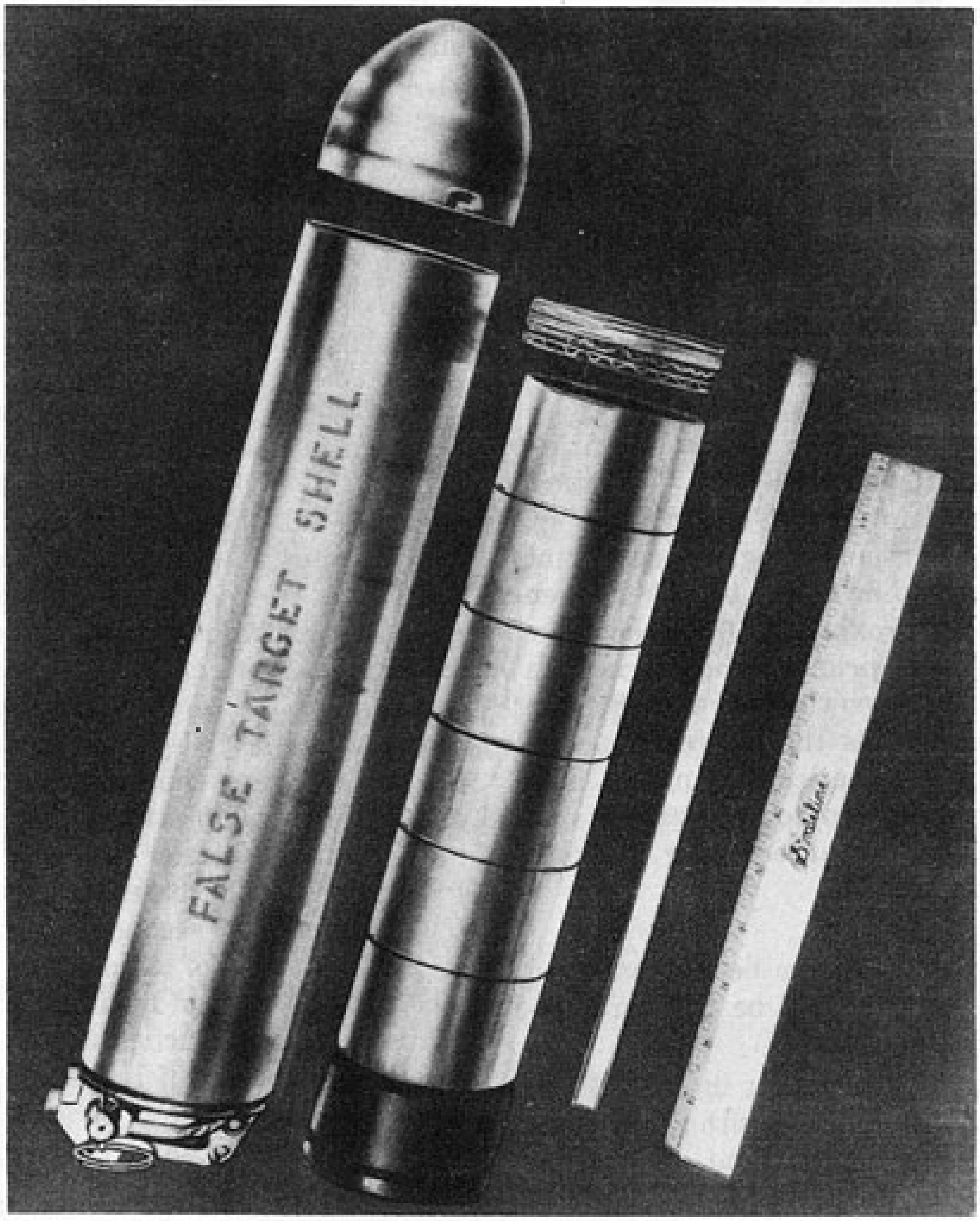


Figure 220. False Target Shell Mk 1 Mod 0

Description: Generally similar to the False Target Shell Mk 1 Mod 0, this can is a tube of sheet steel sealed at both ends, containing nine metal cups filled with a lithium hydride composition. These cups can be released individually at any desired rate when used with the new hydraulic-type air-operated signal ejector. The cups are separated by aluminum discs, and a one-inch metal spacer separates the end caps of the outer tube from the top and bottom inner cups. Tear strips are provided at either end to open the can.

Operation: The tear strips, the end caps, the spacers on either end, and the corrugated paper disc at the top end are removed, with the can in a horizontal position to prevent dropping one of the cups. Insert one end into the breech of the ejector about one inch. Put a rammer in the other end of the can and push the cups toward the muzzle of the ejector, until the spring detent near the top of the barrel drops behind the last cup. Remove the empty tube. Place the firing valve on "Vent". Close the breech door and flood the barrel from the sea through the flood line, allowing air to escape through the vent line. When no air escapes the vent or firing valve, close these valves and open the muzzle door. Make the pressure in the volume tank 50 pounds greater than sea pressure, and throw the firing valve into the "Fire" position.

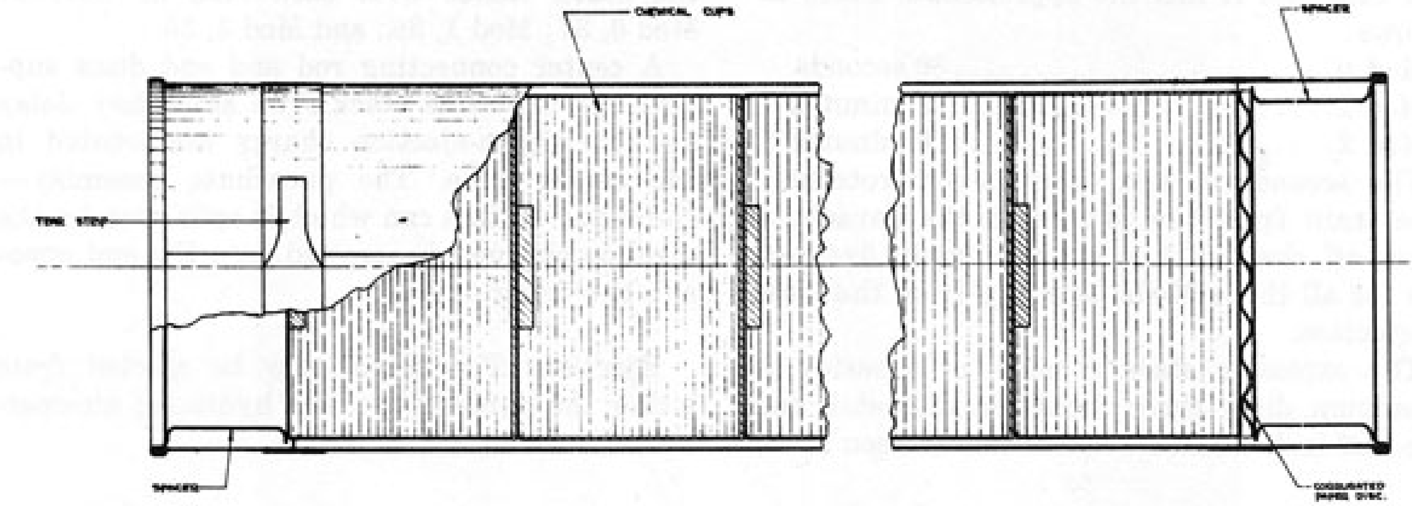


Figure 221. False Target Can Mk 2 Mod 0

Signal (Pepper) Mk 14 Mods 0—2 (Production suspended)

Length, inches	27.5
Diameter, inches	3.0
Weight, pounds	19 (approx.)

General: The Signal (Pepper) Mk 14 is an expendable explosive noisemaker for underwater use. It consists of a series of aluminum discs, each of which has sixteen small explosive charges around its periphery. Each disc contains a gasless fuse train which ignites the charges at one-half second intervals and then communicates the ignition to the succeeding discs. Approximately five minutes of noise can be produced. Parachute suspension is used to retard the sinking rate. A firing device ignites two delay-fuse trains. The initial delay train ignites the first of the explosive discs, and the secondary delay train fires a small black-powder charge which ejects the parachute. The Signal (Pepper) Mk 14 is supplied as Mods 0, 1, and 2, having 30-second, 2-minute, and 6-minute initial delays respectively. Mods 0, 1, and 2 are identical, except that one explosive disc in Mod 1, and two in Mod 2, have been replaced by initial time-delay discs. The effective firing time is the same in all three Mods, for practical consideration.

Tests on the initial production of this device show that about 75% of the units may be expected to operate to completion. It is recommended that, wherever possible, two or more units be fired in quick succession to insure functioning.

Description: The signal consists of the following components: firing device, initial time delay, secondary time delay, a stack of explosive-loaded discs, a center connecting tube and end discs to support the explosive stack, parachute knock-off charge, parachute assembly, and packing container.

The firing device is identical in operation to the firing device used on the Submarine Emergency Identification Signals. It consists of a support, firing lever, tripping lever, safety pin, and safety cotter pin. When the safety cotter pin is pulled, it allows the safety pin to be forced back by its spring, releasing the tripping lever. On ejection, the tripping lever is forced back by the end of the tripping groove. The tripping lever lifts the firing lever against the firing spring and then releases it to fire the primer. The primer ignites both the initial and the secondary time delays.

The initial time delay is a pyrotechnic fuse train from the primer to the first of the explosive capsules. It has the approximate times as follows:

Mod 0	30 seconds
Mod 1	2 minutes
Mod 2	6 minutes

The secondary time delay is a pyrotechnic fuse train from the primer to the parachute knock-off charge. It is approximately five secons for all three Mods, starting from the time of ejection.

The explosive stack consists of a series of aluminum discs three inches in diameter and one-half inch thick. Each disc has sixteen small explosive-loaded capsules inserted radially around the periphery. The capsules are connected by an internal ring fuze train which is timed to fire the charges at the rate of two shots per second. The number of explosive discs in the stack varies with each Mod as follows: Mod 0, 37; Mod 1, 36; and Mod 3, 35.

A center connecting rod and end discs support the explosive stack. The secondary delay and parachute-ejection charge are located in the center tube. The parachute assembly—chute packed in a can which is split open by the ejection charge—is screwed onto the end opposite the firing device.

Ejection: The signal may be ejected from either the hand or the new hydraulic air-operated ejector at any depth.

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