

# U.S. EXPLOSIVE ORDNANCE



28 MAY 1947

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## GRENADES

## Chapter 11—HAND GRENADES

## General

The design of hand grenades has been confined by several limiting technicalities, as follows: the grenade must be small and light; its range is short; there is no set-back or creep force of significance in the throwing operation; and the grenade must be rugged and safe enough to be carried on the bodies of troops.

Hence, despite the many tactical purposes—anti-tank, anti-personnel, screening, etc.—hand

grenades are generally of the same shape, size, and fuze action.

## Fragmentation Mk II, Mk II A1; also Fuze M204

Over-all length, inches.....	4.5
Diameter, inches .....	2.25
Color .....	Olive drab
Weight, pounds .....	1.40
Filling.....	Flaked and granular TNT
Weight of filling, ounces.....	1.75

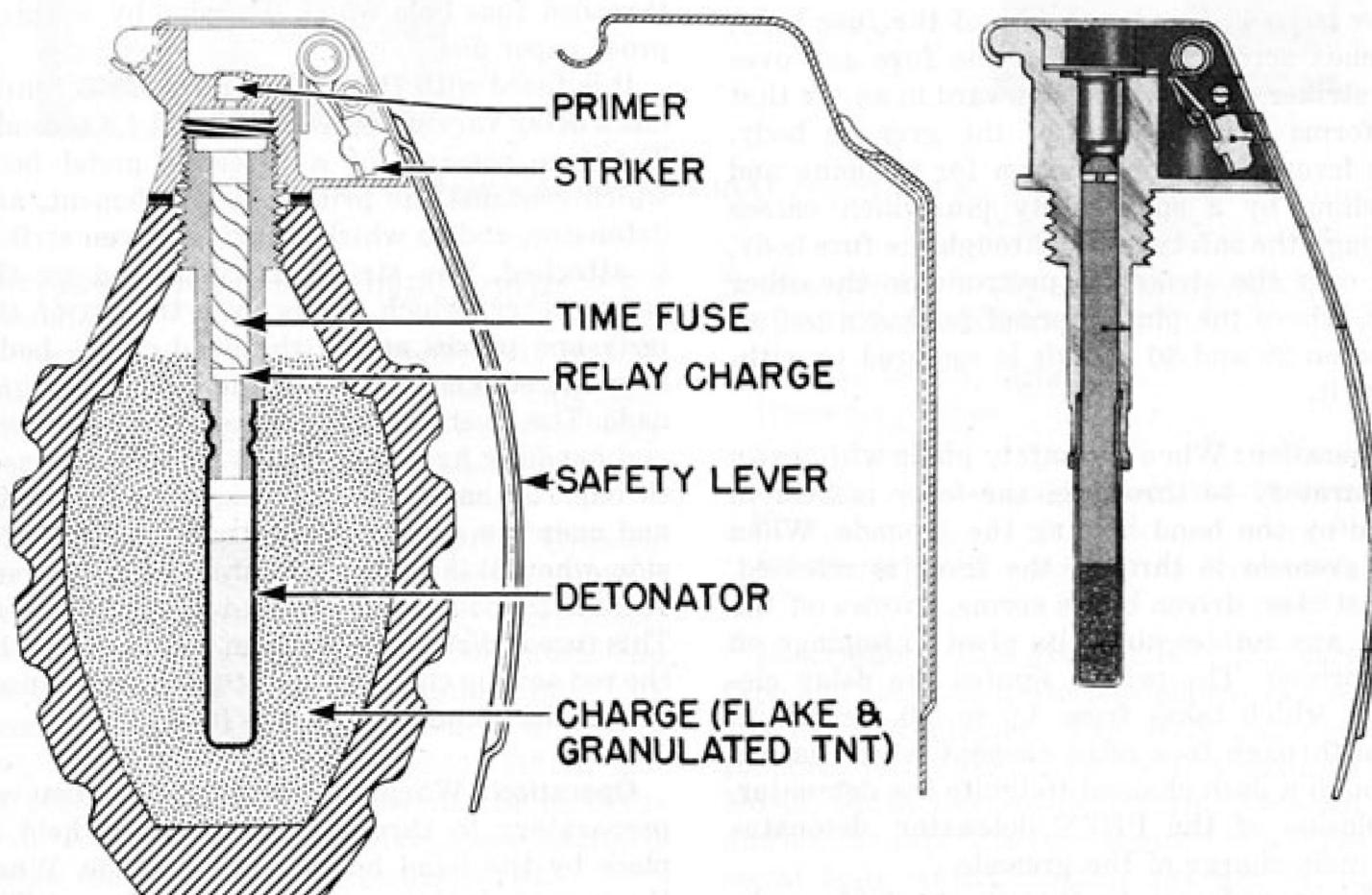


Figure 222. Fragmentation Grenade Mk II with Fuze M204 in place  
(At right is the Fuze M10A3, issued with an earlier model.)

Fuze .....	M204
Delay, seconds .....	4.0 to 5.0

**Description:** The Fragmentation Grenade Mk II has a serrated cast-iron body of the familiar "pineapple" design. The grooves run both horizontally and vertically to assist in the formation of uniform fragments of effective size.

This grenade is issued loaded and fuzed with Igniting Fuze M204. This Fuze M204 produces no noise other than that of the impact of the striker on the primer, and emits no smoke or sparks during its burning. The fuze consists of a body, striker, safety lever, and safety pin. The body of the fuze is cylindrical in shape and is threaded for assembly to the grenade. It contains the primer, a delay element sufficient to give an average delay of 4.5 seconds, and a detonator of PETN. At the top of the body, one side is extended and slotted to form a point of fulcrum for the attachment of the safety lever. The striker is retained by the safety lever. The lever is hooked under the lip of the fuze body, extends across the head of the fuze and over the striker, and curves downward in an arc that conforms to the shape of the grenade body. The lever is held in position for shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker to protrude on the other side, where the pin is spread so that a pull of between 20 and 30 pounds is required to withdraw it.

**Operation:** When the safety pin is withdrawn preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the lever and rotates about its pivot to impinge on the primer. The primer ignites the delay element, which takes from 4.0 to 5.0 seconds to burn through to a relay element which flashes through a flash channel to ignite the detonator. Explosion of the PETN detonator, detonates the main charge of the grenade.

The grenade can be thrown about 35 yards. Effective fragmentation covers an area of 30-yard radius, but fragments may travel as far as 200 yards.

**Earlier models:** This grenade replaces an earlier model, the Mk IIA1, which was identical to the Mk II except for the fuze and the filling, the Mk IIA1 being issued with the Fuze M10A3. The only external difference is that the safety lever fits over rather than under the lip of the fuze body. The Fragmentation Grenade Mk II is filled with  $\frac{3}{4}$  ounce of E.C. powder.

**Offensive Mk IIIA1 and Mk IIIA2; also Fuze M6 and ~~M204A1~~**

Over-all length, inches .....	5.35
Diameter, inches .....	2.125
Color .....	Black
Total weight, pound .....	0.84
Fuze .....	<del>M204A1</del>
Delay, seconds .....	4.5

**Description:** The Offensive Grenade Mk IIIA2 consists of a cylindrical pressed-fiber body and a charge of pressed TNT. The head contains a threaded fuze hole which is sealed by a waterproof paper disc.

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It is fuzed with Detonating Fuze ~~M205~~, which has a delay varying between 4.3 and 4.8 seconds. The fuze consists of a threaded metal body which contains the primer, delay element, and detonator, and to which a spring-driven striker is attached. The striker is restrained by the safety lever, which hooks over the lip of the body and passes across the head of the body, over the striker, and down the side of the grenade. The lever is held in place during shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 10 and 30 pounds is required to withdraw it. This fuze is distinguished from igniting fuzes by the red sealing compound, instead of green, used to seal the detonator into the fuze.

**Operation:** When the safety pin is removed preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the lever and rotates about its pivot to strike the primer. The primer ignites the delay element, which



Figure 223. Offensive Grenade Mk IIIA1 (right) and Mk IIIA2 (left)

takes about 4.5 seconds to burn through to the detonator.

The explosion of the detonator sets off the main charge, producing a blast effect. This blast is not effective against personnel except at very short ranges or in enclosed spaces.

**Earlier models:** The Offensive Grenade Mk IIIA1 differs from the Mk IIIA2 in that the ends of the grenade body are of sheet metal and the grenade weighs 0.875 pound fuzed. The Mk III had metal ends and contained only 0.27 pound of TNT. It was shipped with a wooden plug in the fuze well. The M6A1, M6A2, and the M6A3 models of this fuze may be encountered. These modifications have been declared unsafe for use and should be destroyed.

**Remarks:** The Hand Grenade Mk IIIA2 has been taken out of production, but large quantities of them still exist.

**Smoke (W.P.) M15; also Fuze M6A3, M10A3, and M200A1**

Over-all length, inches.....	5
Diameter, inches .....	2.5
Color .....	Blue grey
Filling .....	White phosphorus
Fuze .....	M6A3
Delay, seconds .....	4.5

**Description:** This grenade is of the bursting type and contains white phosphorus in a sealed cylindrical container. The body corners are rounded. It is fuzed with the Detonating Fuze M6A3, which has a delay varying between 4.3 and 4.8 seconds. The fuze consists of a threaded metal body which contains the primer, delay element, and detonator, and to which a spring-driven striker is attached. The striker is restrained by the safety lever, which hooks over the lip of the body and passes across the head

of the body, over the striker, and down the side of the grenade. The lever is held in place during shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 10 and 30 pounds is required to withdraw it. This fuze is distinguished from igniting fuzes by the red sealing compound, instead of green, used to aid in sealing the

detonator into the fuze. It differs from the Detonating Fuze M10A3 in that the safety lever is straight, while that of the M10A3 is curved. It differs from the Detonating Fuze M200A1 in that the length of the body is approximately four inches, as compared with a body length of two inches for the M200A1. The detonator consists of a seven-grain primer charge and a 13.5-grain tetryl charge.

### GRENADE PARTS

BODY  
FIRST FIRE COMPOSITION  
CHEMICAL CHARGE  
GAS PORT  
TAPE

### FUZE PARTS

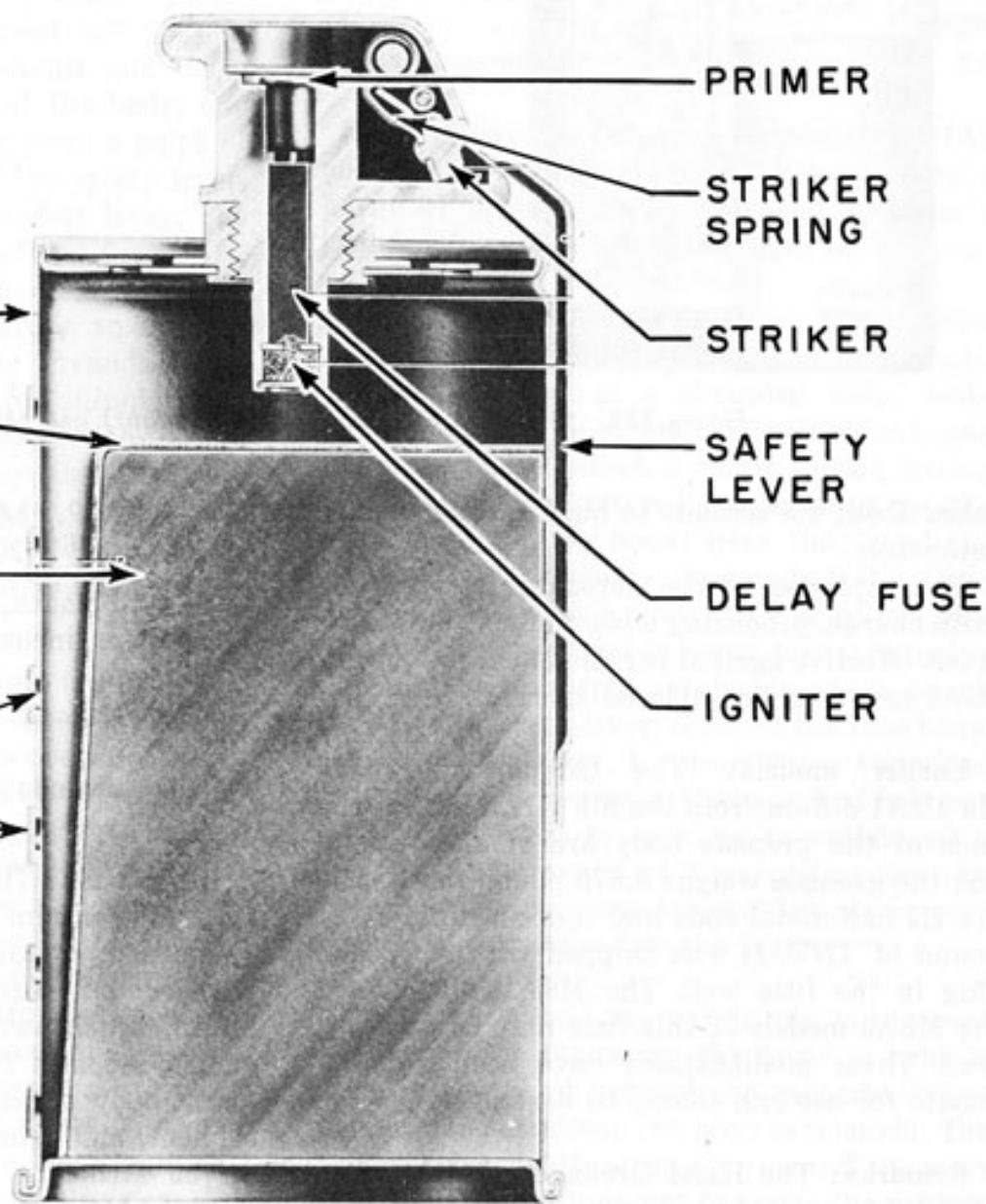


Figure 224. Chemical Grenade

**Operation:** When the safety pin is removed preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the lever and rotates about its pivot to strike the primer. The primer ignites the delay element, which takes about 4.5 seconds to burn through to the detonator.

When ignited by the delay element, the detonator bursts the case and scatters the phosphorus over an area about 25 yards in diameter. The phosphorus ignites spontaneously, and the scattered pieces will burn for about 30 seconds.

**Gas CN-DM-M6, CN-M7, and CN-M7A1; also Fuze ~~M201A1~~ M201A1**

Length, inches .....	5
Diameter, inches .....	2 1/2
Color .....	Blue grey
Filling .....	M6—Chloracetophenone, Diphenylamine, chloraisine, burning mixture M7—Chloracetophenone, burning mixture <del>M201A1</del>
Fuze .....	<del>M200A1</del>
Delay, seconds .....	2

**Description:** These grenades are of the burning type; they do not explode. They have a cylindrical body made of tin plate. The M7A1 has a half-inch gas port in the bottom and four ports in the head, covered by small squares of adhesive tape. A center hole is placed through the CN mixture. At the top and in this hole is the starter mixture. The M6 and M7 have three lines of six gas ports in the body and four ports in the head, covered by small squares of adhesive tape. ~~M201A1~~

The Fuze ~~M200A1~~ threads into the top of these grenades. It is essentially the same as the ~~IGNITING~~ ~~M200A1~~ Fuze M10A3 used in the fragmentation hand grenade. However, there is only a two-second delay element, an igniter, and no detonator. This results in a fuze with a much shorter body. At the top of the body, one side is extended to form a lip for the attachment of the safety lever; the other side forms a hinge to carry the spring-loaded striker. The striker is

restrained by the safety lever. The lever is hooked over the lip of the fuze body and extends across the head of the fuze, over the striker, and down the side of the grenade. The lever is held in position for shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 20 and 30 pounds is required to withdraw it.

**Operation:** When the safety pin is removed preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the safety lever and rotates about its pivot to strike the primer. The primer ignites the delay element, which takes about two seconds to burn through to the igniter. The igniter ignites the starter mixture, which creates enough heat to vaporize the chemical ingredients. The pieces of adhesive tape covering the gas ports are blown or burned off and gas is emitted. The gas generation reaches full volume three seconds after the safety lever is released, and gas is emitted for from 20 to 60 seconds. The M7A1 has an average burning time of 45 seconds.

**Remarks:** The M7A1 is an improved model of the M7, which is now substitute standard. The tendency of the M7 to flame or explode upon ignition has been eliminated in the M7A1, which also produces more than double the concentration of CN smoke and vapor.

**Smoke, White, H.C., AN-M8, and Colored, M18 and M16—also Fuze M201**

Length, inches .....	5
Diameter, inches .....	2.5
Color .....	Blue grey
Filling .....	AN-M8—Hexachlorethane-zinc M18—Colored smoke mixture
Fuze .....	M201
Delay, seconds .....	2

**Description:** These grenades have four smoke ports in the head. These are covered by small squares of adhesive tape. The Grenades M18

produce seven colors of smoke: red, orange, blue, green, black, violet, and yellow. The M16 is a limited standard colored-smoke grenade and differs from the M18 in that it produces smoke for 2½ minutes, while the M18 produces smoke for one minute, and the AN-M8 produces a white smoke for three minutes.

The Fuze M201 threads into the top of these grenades. It is essentially the same as the M10A3 used in the fragmentation hand grenades. However, there is only a two-second delay element, an igniter, and no detonator. This results in a fuze with a much shorter body. At the top of the body, one side is extended to form a lip for the attachment of the safety lever; the other side forms a hinge to carry the spring-loaded striker. The striker is restrained by the safety lever. The lever is hooked over the lip of the fuze body and extends across the head of the fuze, over the striker, and down the side of the grenade. The lever is held in position for shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 20 and 30 pounds is required to withdraw it.

**Operation:** The igniter ignites the starter mixture, which initiates the smoke mixture. The pieces of adhesive tape covering the smoke ports are blown or burned off, and smoke is emitted for approximately 3½ minutes.

The volume of smoke generated by a grenade is generally too small for screening purposes. Although these grenades may be used to patch gaps in a larger screen, the authorization is for signals.

**Remarks:** The presence of moisture will cause these grenades to ignite spontaneously. If a fire should occur in such munitions, an attempt should be made to remove and segregate the burning items. Neither water nor the usual chemical extinguishers should be used in an attempt to extinguish such fires.

The Smoke Grenade M16 is designated as a substitute standard item.

**Smoke, Red, AN-M3; also Modified Fuze M201**

Length, inches .....	5.5
Diameter, inches .....	3
Color.....	Blue grey
Filling.....	Red smoke mixture
Fuze.....	Modified M201
Delay, seconds.....	2

**Description:** This grenade differs from the other smoke grenades in that the body is assembled in a cylindrical outer container. This container has eight smoke-emission ports in its top. It also has three light metal flaps welded to the side, which may be bent outward at right angles to furnish bearing for supporting the grenade in snow, mud, or other soft surface. With the outer container, this grenade is slightly larger than the ordinary smoke grenade.

The Fuze M201 has been modified by shortening the safety lever so that it does not protrude down the side of the grenade. At the top of the body, one side is extended to form a lip for the attachment of the safety lever; the other side forms a hinge to carry the spring-loaded striker.

**Remarks:** This grenade is used for signaling, especially in snow.

**Illuminating Mk I**

Length, inches .....	4.4
Diameter, inches .....	2.1
Total weight, ounces.....	9.5
Delay, seconds.....	7
Burning time, seconds.....	25
Candlepower .....	50,000

**Description:** This grenade is approximately the same size and shape as the fragmentation hand grenade. It consists of two sheet-steel cups joined together by a force fit, and sealed with Petman cement. The lower half contains the illuminating compound and a charge of black powder, which, when ignited by the fuze, blows the grenade apart and ignites the pyrotechnic. The upper half contains the fuze assembly, which is similar in appearance and in operation to that of the fragmentation hand grenade.

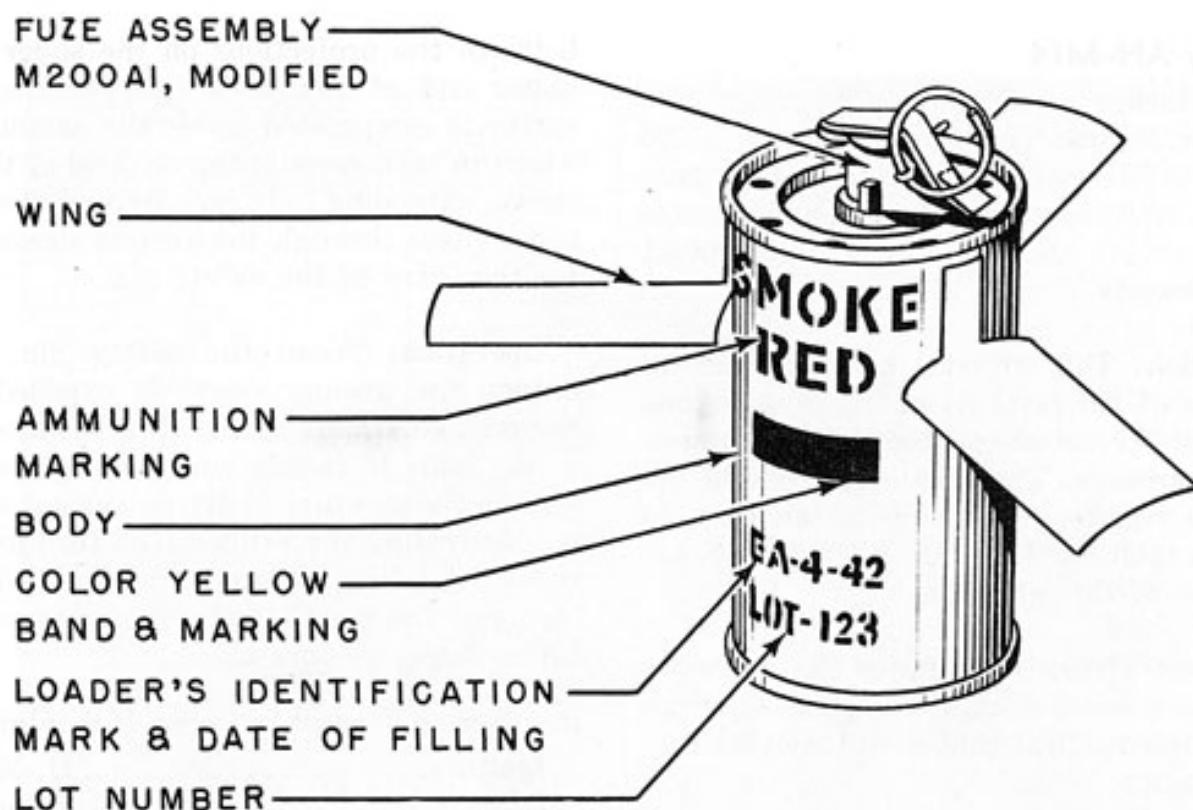


Figure 225. Red Smoke Grenade

**Operation:** For hand launching, the grenade is held in one hand with the safety lever against the palm. The safety pin is removed with the other hand. When the grenade is thrown, the safety lever is released, and the striker, driven by its spring, forces the lever off, swings around its pivot, and strikes the primer. The flame from the primer ignites a delay train which burns through to the charge of back powder. The black-powder charge bursts the case and ignites the pyrotechnic.

For rifle launching, assemble the grenade in the Adapter M1, insert the safety lever into the arming clip, and force the grenade into place between the claws, so that the claws engage the raised portion of the grenade where the upper and lower halves are formed together. When the grenade is fired, set-back will cause the arming clip to come off of the safety lever, and the striker will throw the lever off and hit the primer to activate the grenade.

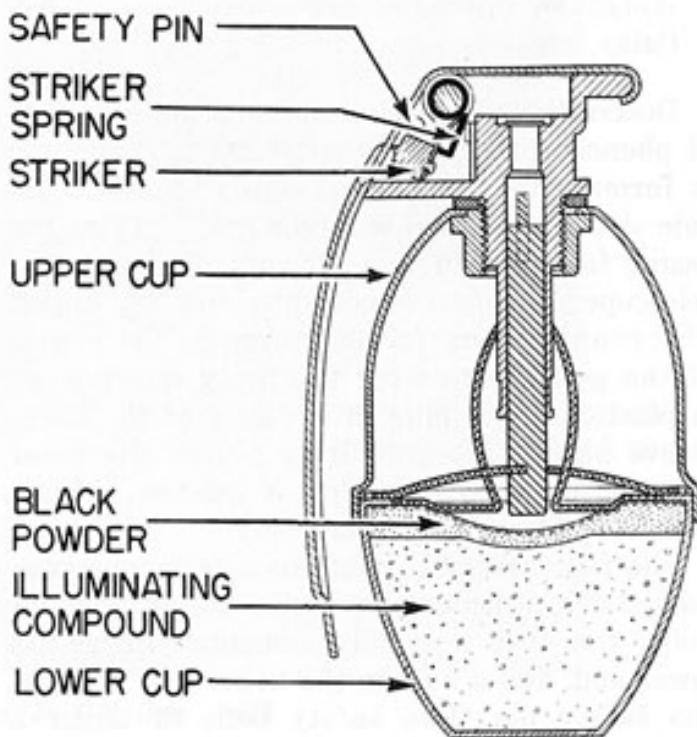


Figure 226. Illuminating Grenade Mk 1

**Incendiary AN-M14**

Length, inches .....	5
Diameter, inches .....	2.5
Color .....	Blue grey
Filling.....	Thermate, thermite, and nitrates
Fuze .....	M200A1
Delay, seconds.....	2

**Description:** This grenade has a cylindrical body made of tin plate. A clamp of flat steel strapping and a nail are packed in the container with each grenade. These are used to hold the grenade in position, as it has a tendency to move upon ignition. The Fuze M200A1 threads into the top of this grenade.

**Operation:** The igniter ignites the thermite, which ignites the thermate. The grenade burns with such intense heat that it will melt its way through steel.

**Riot—CN Gas—M25**

Diameter, inches .....	2.9
Filling .....	Micropulverized chloracetophenone (CN)
Weight of filling, ounces.....	3 $\frac{1}{3}$
Delay, seconds .....	2

**Description:** The Riot Grenade M25 is made of phenolic plastic. It is spherical in shape and is formed from halves cemented together. Inside sleeves, integral with the halves, form the casing for the firing components. These sleeves telescope; the lower is cemented into the upper. The channel thus formed through the center of the grenade receives the firing mechanism. A plastic closure plug in the base of the lower sleeve has an integral firing pin on the inner side. A filling closure plug is located  $\frac{1}{2}$  inch from the firing-pin closure plug.

The fuze assembly contains a primer, a two-second delay element, and a detonator. A slider holds the fuze assembly cemented inside its lower end, and a hole in the upper end receives the safety pin. Two safety balls fit under a projection on the slider and hold it in the unarmed position until released into the grooves when the arming sleeve is expelled. The firing spring fits over the slider and is compressed

between the projections on the slider and the upper end of the lower sleeve. The arming spring is compressed inside the arming sleeve, which in turn rests in the channel of the upper sleeve, extending 5/16 inch beyond the grenade body. Holes through the arming sleeve provide for the entry of the safety pin.

**Operation:** When the safety pin is withdrawn, the arming sleeve is expelled by the compressed arming spring; this permits the two safety balls to recede into the grooves, releasing the slider, which is driven against the firing pin, activating the primer. The fuze provides a two-second delay before detonation. With shattering of the plastic body, the micropulverized CN is dispersed in a cloud.

**Improvised frangible types (Obsolete)**

Igniters.....	M1, M2, or M3
Filler.....	Gasoline and alcohol
	Thickened gasoline
	Smoke
	Hydrocyanic acid
	Gasoline and napalm

**Description:** These are improvised grenades made by simply filling a glass bottle with one of these chemical agents. They may or may not have an igniter, depending upon the filling that is used. If the filling is smoke or hydrocyanic acid, no igniter is required; but if the filling is one of the others mentioned above, an igniter is necessary.

**Igniter M1:** This is a plastic cylinder containing a chemical powder. It is used with grenades containing a mixture of gasoline and alcohol. When the glass container breaks against the target, the powder and liquid come in contact and ignite spontaneously.

**Igniter M2:** This is a paper cartridge, filled with powder, assembled to a pull-wire igniter. This igniter is taped to a frangible grenade filled with thickened gasoline. To operate the igniter, pull the wire, lighting the powder.

**Igniter M3:** This is a simple fuze consisting of a spring-loaded firing pin and a blank cartridge contained in a cylinder, and a metal

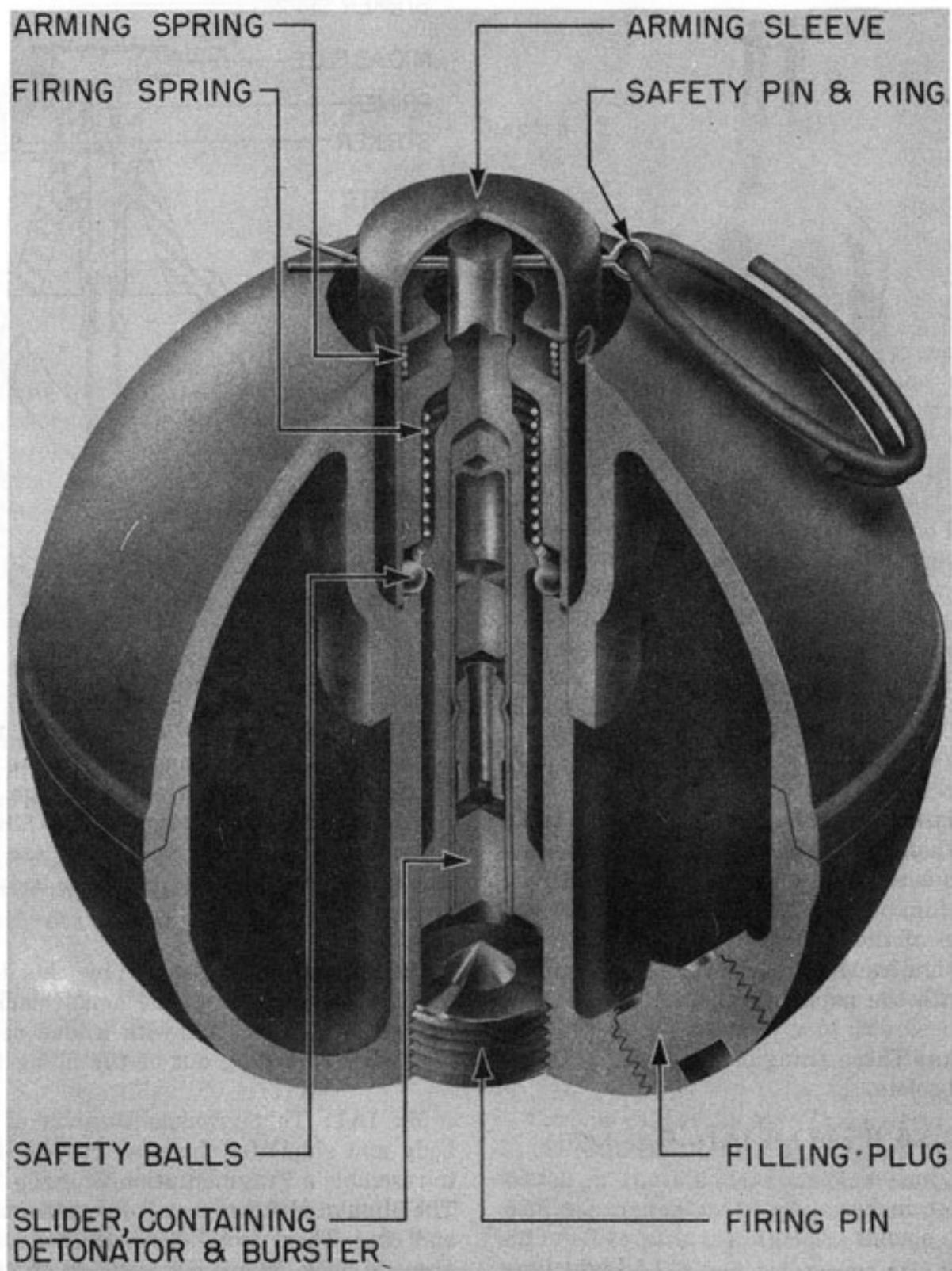


Figure 227. Riot Grenade—CN Gas—M25

clamp to hold the cylinder against the frangible grenade. The clamp has a conical projection which, when the clamp is tightened around the

safety pin which passes through the cylinder, also restrains the firing pin. When the grenade is used, the safety pin is removed and the



Figure 228. Frangible Grenade

grenade is thrown so as to smash against the target. When the bottle breaks, the tension on the clamp is released and the firing pin, driven by its spring, pushes the cone aside and strikes the primer of the cartridge. The flash from the cartridge ignites the grenade filler. This igniter is used with the napalm grenade.

**Remarks:** These frangible grenades are considered obsolete.

#### Practice—Mk II and Mk IA1—Fuze M206

Length, inches .....	4.53
Diameter, inches .....	2.25
Weight, pounds .....	1.28
Color .....	Light blue
Fuze .....	M206 or M19343... <del>M206</del>
Delay, seconds .....	4.0 to 4.8

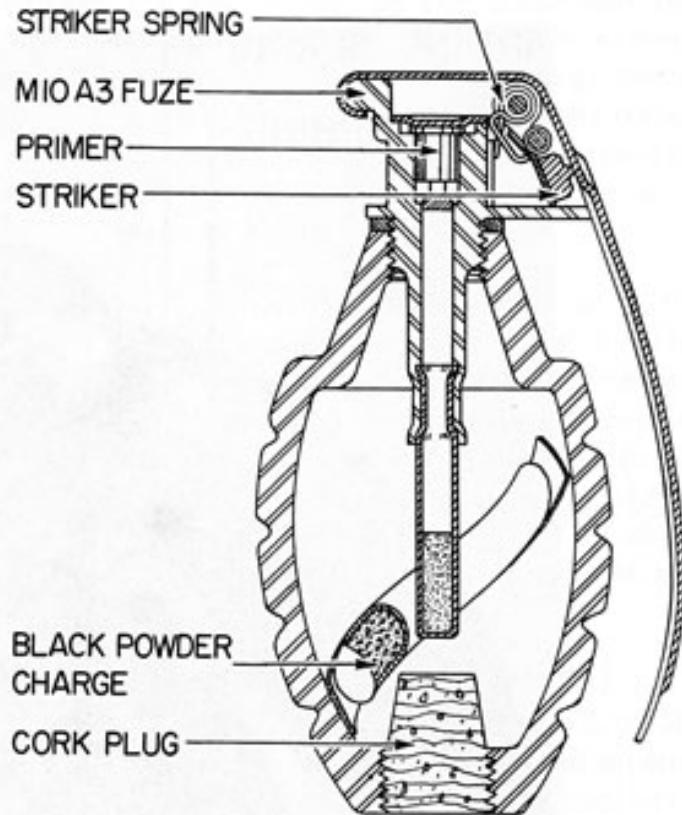


Figure 229. Practice Grenade

**Mk II:** This grenade consists of a fragmentation body with a filling hole in the base, an Igniting Fuze ~~M206~~ M206 or M19343, a small charge of black powder, and a cork plug in the filling hole. Extra fuzes, charges, and plugs are supplied separately, so that the grenade body can be re-used.

**Operation:** When set off by the delay element, the igniter fires the small black-powder charge, which goes off with a loud report and blows the cork plug out of the filling hole.

**Mk IA1:** This grenade consists of an iron body and simulated fuze, all cast in one piece to resemble a Fragmentation Grenade Mk IIA1. The simulated fuze has a removable safety pin and ring. There is a hole in the bottom of the grenade body. There is no charge in either the grenade or the fuze. It is painted black, with a white band at the top.

**RIFLE GRENADES****Section I—INTRODUCTION****General**

Resembling rockets in their shape because of the tube and stabilizing fin on their after end, rifle grenades are designed for about the same tactical purposes as are hand grenades. Rifle grenades have much greater range, however, and, because of their being launched at greater initial velocities, the forces of set-back and creep are employed in the design of their fuzes.

**Launchers**

The launcher, on which the grenade is placed for firing, is an extension to the barrel of the rifle or carbine. A special device, integral with the launcher, attaches it securely to the muzzle of the weapon. U.S. launchers are all of the spigot type; that is, the stabilizer assembly of the grenade fits over the launcher.

**Classification of launchers**

**M1**—U.S. rifles, caliber .30 M1903, M1903A, and M1903A3.

**M2**—U.S. rifle, caliber .30 M1917.

**M7**—U.S. rifle, caliber .30, M1.

M1A3.

The Launcher M7 is secured to the Rifle M1 by a latch which clamps behind the bayonet lug. A valve screw, issued with the launcher, is substituted for the gas-cylinder lock screw. A stud on the launcher protrudes into the valve screw when the launcher is attached, opening the valve and providing for enough gas release to avoid damage to recoiling parts. The valve remains open as long as the launcher is attached to the rifle. The launcher has six gradations for dif-

ferent ranges. The range of the grenade is dependent upon the position of the stabilizer assembly on the launcher. A grenade-retainer spring, slightly larger in diameter than the launcher, holds the grenade at the position on the launcher for the selected range.

The Launcher M8 is similar to the Launcher M7, except that it is secured to the carbine by a simple clamp and wing nut.

If necessity demands, ball cartridges may be fired, even though the launcher is attached, assuming, of course, that no grenade is on the launcher.

**Rifle grenade cartridges**

**Rifle caliber .30 M3:** This cartridge is used in U.S. rifle M1, M1903, M1903A1, M1903A3, and M1917. It is loaded in the standard caliber .30 case. The load consists of five grains of black powder and approximately 49 grains of a progressive-burning smokeless powder; the exact amount is adjusted to give the Anti-Tank Rifle Grenade M9A1 a velocity of 165 feet per second at five feet.

**Carbine caliber .30 M6:** This cartridge is used in the U.S. carbine M1, M1A1, and M1A3. It is loaded in the standard carbine cartridge case with approximately 21 grains of special powder adjusted to give the Anti-Tank Grenade M9A1 a velocity of 145 feet per second at 5 feet.

**Auxiliary Grenade Cartridge M7:** This cartridge, designed to give additional range when used in firing grenades from rifles and carbines, is a caliber .45 case drawn piece loaded with 20 grains of powder and sealed with a paper wad. It is placed in the end of a launcher, a rim on

the base of the case holding the cartridge in place. It functions only in combination with the standard Grenade Cartridge M3 or M6 and fits

the Launchers M1, M2, M7, and M8. When using this cartridge, the rifle or carbine will not be fired from the shoulder.

## Part 4 — Chapter 12 — Section 2

### RIFLE GRENADES (LISTING)

#### Anti-Tank M9 and M9A1

Length, inches .....	11.24
Diameter, inches .....	2.25
Color .....	Olive drab
Weight, pounds .....	1.23
TNT filling, ounces.....	4

**Description:** Anti-Tank Grenade M9A1 consists of a body, a stabilizer assembly, and a fin. The body is cylindrical, the two pieces joined in the middle with rounded ends. The stabilizer is a hollow tube which screws into the base of the body and fits over the launcher; it also carries a shroud fin assembly which aids in stabilizing the flight of the grenade. The body is made of cast metal.

The impact fuze, which consists of a striker held away from a detonator by a creep spring and a safety pin, is assembled integrally with the stabilizer assembly. The safety pin projects through the fuze body and clamps around the stabilizer tube. When the pin is withdrawn, a drop of two feet, nose-first, to a hard surface will cause the fuze to function.

This grenade is designed primarily for use against tanks and other armored or resistant targets. It must strike within 20° or normal to be sure to function. However, the velocity of the grenade itself is not a critical factor, as it incorporates the hollow-charge principle. The danger radius to the rear of the explosion is 50 yards.

**Operation:** The grenade is fired from a rifle by means of a special launcher attachment. A special cartridge is used for propulsion. The grenade must be placed on the launcher before the safety pin is withdrawn. The safety pin is

removed before firing. When the grenade is fired, set-back holds the striker away from the detonator. On impact, the striker overcomes the creep spring and hits the detonator.

**Remarks:** The M9 is an earlier model. It has the same tail assembly, but the head is acorn-shaped and is equipped with a point detonating fuze. It is slightly less sensitive than the M9A1. The safety pin of the M9 is located in the base of the grenade body instead of in the stabilizer tube. Its pull ring is secured to the body with adhesive tape.

#### Fragmentation M17

Length, inches .....	9.775
Diameter, inches .....	2.25
Color .....	Olive drab
Weight, pounds .....	1.47
Filling, E.C. powder, ounce.....	0.77

**Description:** This grenade consists of a fragmentation-type body similar to the Hand Grenade Mk IIA1 assembled to a fuze and stabilizer assembly similar to that for the anti-tank and practice rifle grenades. The stabilizer and fuze assembly threads into the grenade body.

The fuze is a simple impact type. The striker is held away from the detonator by a safety pin and a creep spring. The safety pin projects through the fuze body and clamps around the stabilizer tube. When the pin is withdrawn, a drop of two feet, nose-first, to a hard surface will cause the fuze to explode the grenade. Detonation will not occur upon impact with water, mud, or soft sand. This grenade is designed primarily for use against personnel.

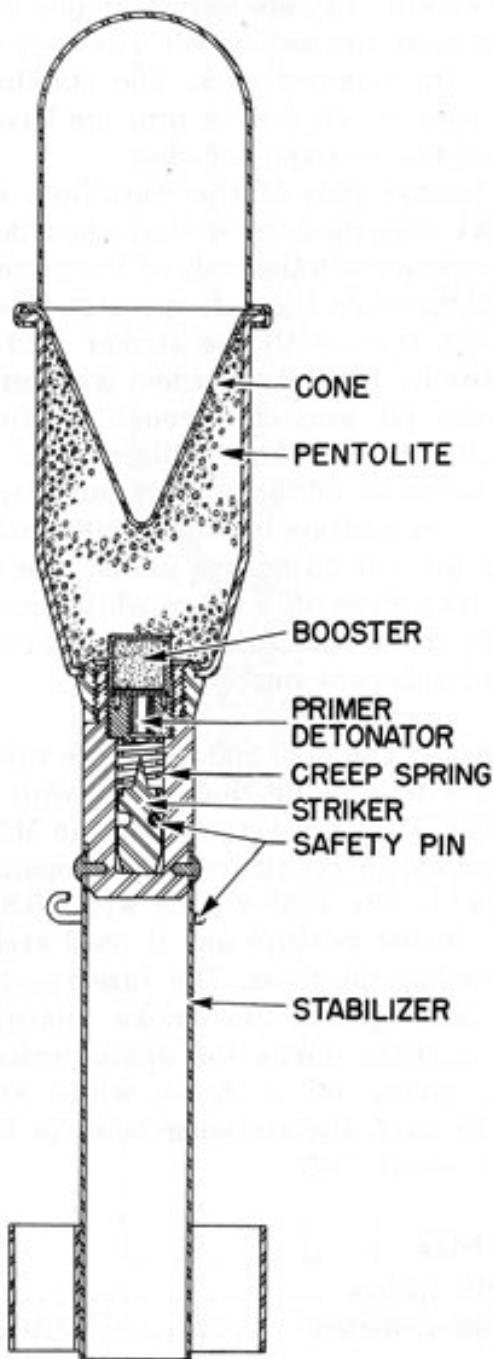


Figure 230. Anti-Tank Rifle Grenade M9A1

**Operation:** The grenade must be placed on the launcher before the safety pin is withdrawn. The safety pin is removed before firing. When the grenade is fired, set-back holds the striker away from the detonator. On impact, the striker

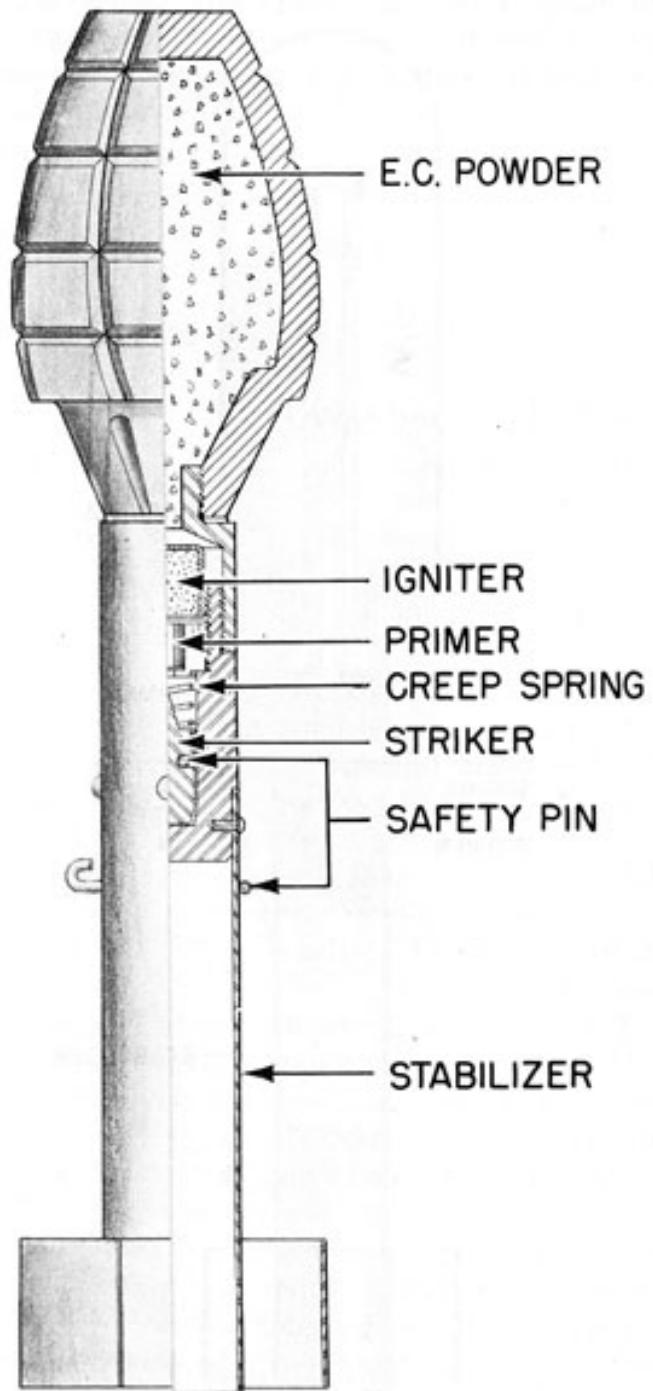


Figure 231. Fragmentation Rifle Grenade M17

overcomes the creep spring and hits the detonator.

**Remarks:** The Fragmentation Grenade M17 is no longer in production; however, large quantities were issued.

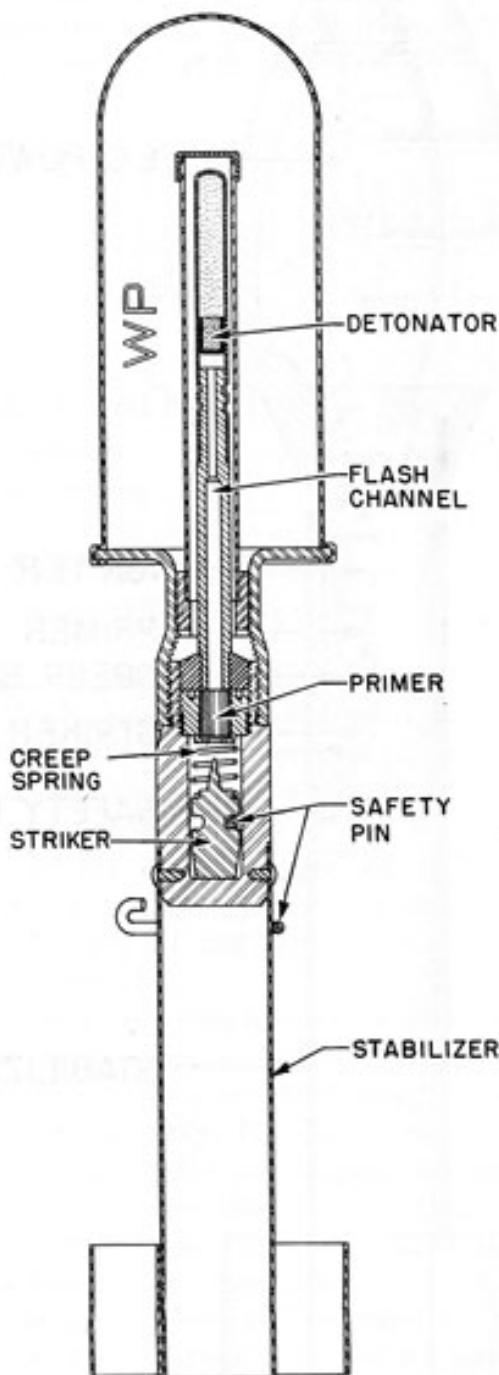


Figure 232. Smoke Rifle Grenade M19A1

#### Smoke M19, M19A1, M20, and T6E1

Length, inches .....	11.31
Diameter, inches .....	2
Color .....	Blue grey
Weight, pounds .....	1.57
Filling.....	White phosphorus

**Description:** In outward appearance, this

grenade is similar to the Anti-Tank Grenade M9A1, except that the body is in one piece and does not have the joining rib. The body is cylindrical, with rounded ends. The stabilizer is a hollow tube which screws into the base of the body and fits over the launcher.

The impact fuze of the Anti-Tank Grenade M9A1 has been modified so that a long detonator which extends into the body of the grenade acts as a burster when the fuze operates. The fuze is an impact type, with the striker held off the detonator by a safety pin and a creep spring. The safety pin projects through the fuze body and clamps around the stabilizer tube.

The explosion of the burster tube breaks the grenade and scatters burning white phosphorus over an area of 25 square yards. The burning phosphorus gives off a dense white smoke. The particles are of incendiary nature and make an excellent anti-personnel weapon.

**Remarks:** The M20 and T6E1 are rifle smoke grenade with a filling that emits white smoke. The T6E1 is  $\frac{1}{4}$  inch longer than the M20. Both are identical in construction and operation to the M19A1. The M20 is filled with 10.8 ounces of H.C. smoke mixture and is used exclusively for screening purposes. The fuze functions on impact and ignites the smoke mixture. The smoke mixture burns for approximately one minute, giving off a dense white non-toxic smoke through the emission holes in the base of the grenade body.

#### Smoke M22

Length, inches .....	10.72
Diameter, inches .....	2
Color .....	Blue grey
Filling .....	Smoke mixture

**Description:** This grenade is similar to the Smoke Grenades M20 and T6E1. In outward appearance, it is similar to the Anti-Tank Grenade M9A1, except that it does not have the joining rib. The nose of the body has a small circular opening which is closed with a light metal cover. The stabilizer contains the Fuze M9A1 Type.

The body is filled through the nose. After

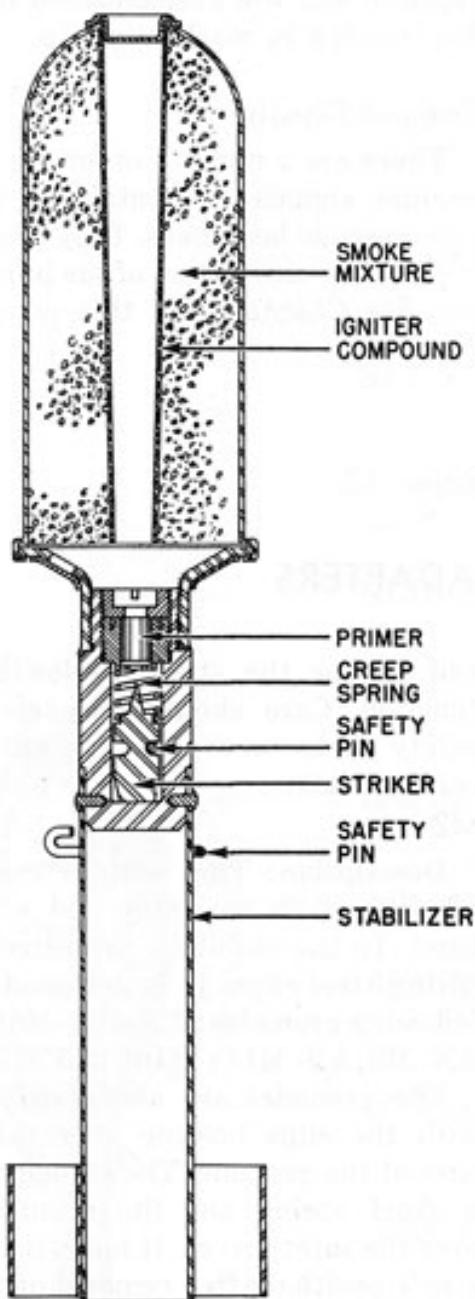


Figure 233. Smoke Rifle Grenade M22

**Operation:** The igniter ignites the igniting mixture, which initiates the burning of the smoke mixture. Smoke is emitted through the emission holes for one to one and one-half minutes.

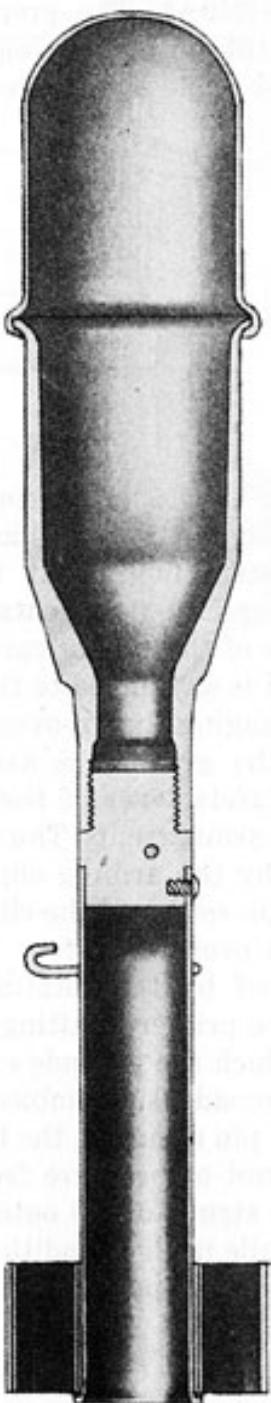


Figure 234. Practice Rifle Grenade M11A3

filling, a tool is inserted longitudinally through this nose opening, and the filling is packed against the sides of the body, leaving a central channel. Then this channel is coated with an igniting composition. The smoke-emission holes are through the base shoulder of the grenade body.

Four colors are issued: red, green, violet, and yellow.

The primary use of the grenade is for signaling.

**Practice M11A2 and M11A3**

Length, inches .....	11.18
Diameter, inches .....	2.25
Color .....	Black

**Description:** This grenade simulates the Anti-Tank Grenade M9A1. The grenade is so constructed that the fin and the ogive assemblies, which are most liable to damage in use, may be

replaced and the grenade used repeatedly. It is for training in marksmanship.

**Ground Signals**

There are a number of smoke and flare pyrotechnic signals in containers launched from rifle-grenade launchers. They are used in signaling and for simulation of air bursts of artillery, etc. See Chapter 9 of this pamphlet.

**Part 4 — Chapter 13****PROJECTION ADAPTERS****M1A1**

**Description:** This adapter consists of a stabilizer and fin assembly to which are attached three spring-steel fingers. It is designed to project the standard fragmentation hand grenade by means of the rifle or carbine. The Hand Grenade Mk II is assembled to the adapter with the fingers engaging the grooves in the grenade body. When the grenade is assembled to the adapter, the safety lever of the grenade is inserted in the arming clip. The safety lever is held in place by the arming clip until the grenade is fired. On set-back, the clip lags and so is removed from over the safety lever, which is then thrown off by the rotating striker. The striker hits the primer, igniting the 4.5-second delay, after which the grenade explodes.

When the grenade is assembled to the adapter and the safety pin removed, the lever bends outward, on account of pressure from the striker. If the lever is struck on its outer surface, near the striker, while in this condition, it is possible that the lever may spring loose from the fuze

and release the striker, allowing the fuze to function. Care should be exercised, once the safety pin is removed, to prevent the lever from being struck.

**M2**

**Description:** This adapter consists of a stabilizer and fin assembly and a metal set-back band. To the stabilizer are attached four short spring-steel clips. It is designed to project the following grenades: CN-DM-M6; CN-M7; H.C., AN-M8; AN-M14; M16; and M18.

The grenades are assembled to the adapter with the clips holding over the ridge at the base of the grenade. The set-back band contains a short spring and fits around the grenade, over the safety lever. It holds the safety lever in a safe position after removal of the fuze safety pin. When the grenade is fired, set-back causes the band to slide off the safety lever toward the base of the grenade. This permits the safety lever to spring outward and the striker to ignite the fuze. The fuze ignites the grenade in approximately one to one and a half seconds.

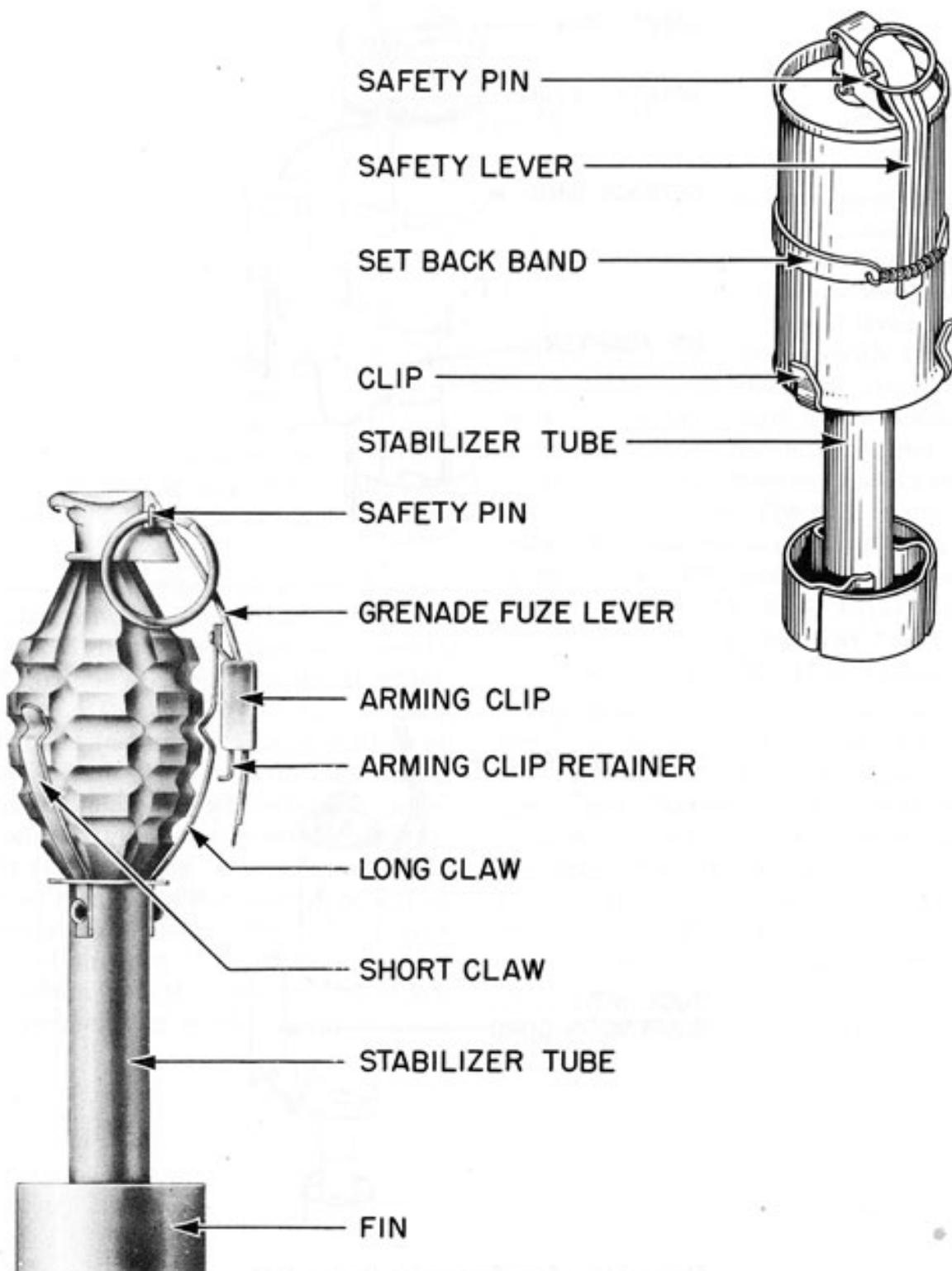


Figure 235. Projection Adapters M1A1 (left) and M2 (right)

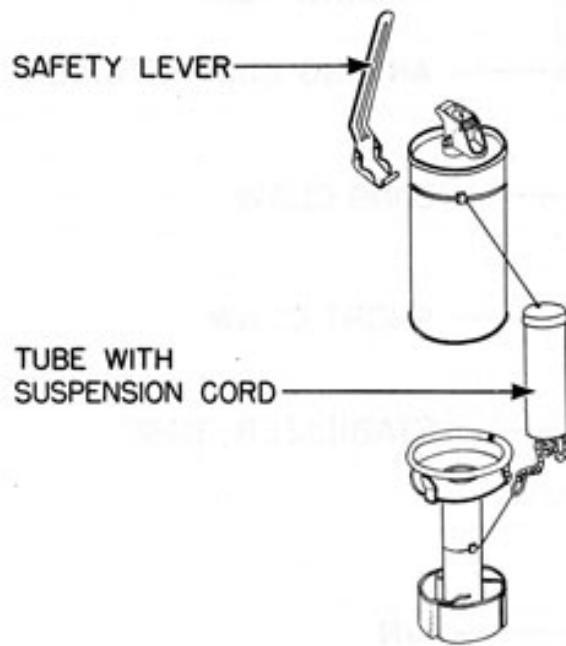
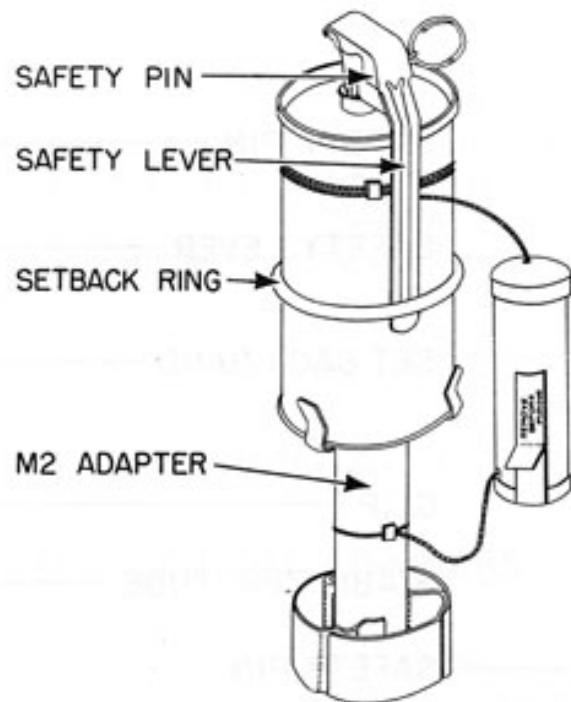


Figure 236. Tree Suspension Device M18  
Assembled (above) and Fired (below)

## TREE SUSPENSION DEVICE

### M18

**General:** The Tree Suspension Device M18 for smoke grenades is designed to provide a quick and simplified means for suspending standard burning-type smoke hand grenades from trees and foliage to permit emission of smoke above forests and foliage, where it is more readily visible to air observers. It must be used with the Chemical Grenade Projection Adapter M2 assembled to any of the following hand grenades: AN-M8, M16, or M18.

**Description:** The device has a small cardboard tube into which is loosely packed about a ten-foot length of heavy rayon line. Attached to each end of this line are two light metal cables, one for fastening to the body of the grenade and the other for fastening to the stabilizer of the Adapter M2. It also has a heavier metal set-back ring to replace the set-back band issued with the chemical grenade projection adapter. This heavier set-back ring retains the grenade safety lever in a safe position after removal of the fuze safety pin, releases the safety lever by set-back action upon being fired, and separates the grenade from the adapter by set-back action against the clips of the adapter, upon being fired.

**Assembly:** The device is assembled for use by slipping the double loop of cable over the grenade body under the safety lever. The set-back ring is slipped over the bottom of the grenade so that it holds the safety lever in place, and the set-back band issued with the grenade is discarded. The grenade is assembled to the adapter, and the single loop of cable is slipped over the adapter fins and secured to the stabilizer tube. The adhesive tape is removed from the cardboard tube. The rifle or carbine is prepared for firing in the usual manner, using positions 3 or 4, at an angle of elevation of 50° or 70° and, normally with the butt of the gun supported by soft earth or other resilient material to avoid the possibility of cracking the stock.

**Operation:** Upon firing, the entire assembly is projected forward, and the set-back ring strikes the clips sharply, separating the grenade from the adapter. Because of the construction of the adapter, it tends to slow down as soon as it is separated from the grenade. In so doing, pulls the rayon line from the cardboard tube. The grenade then flies through the air, with the adapter trailing at the end of the cord. Upon reaching a tree, the cord and adapter become entangled on branches or foliage, suspending the smoking grenade.

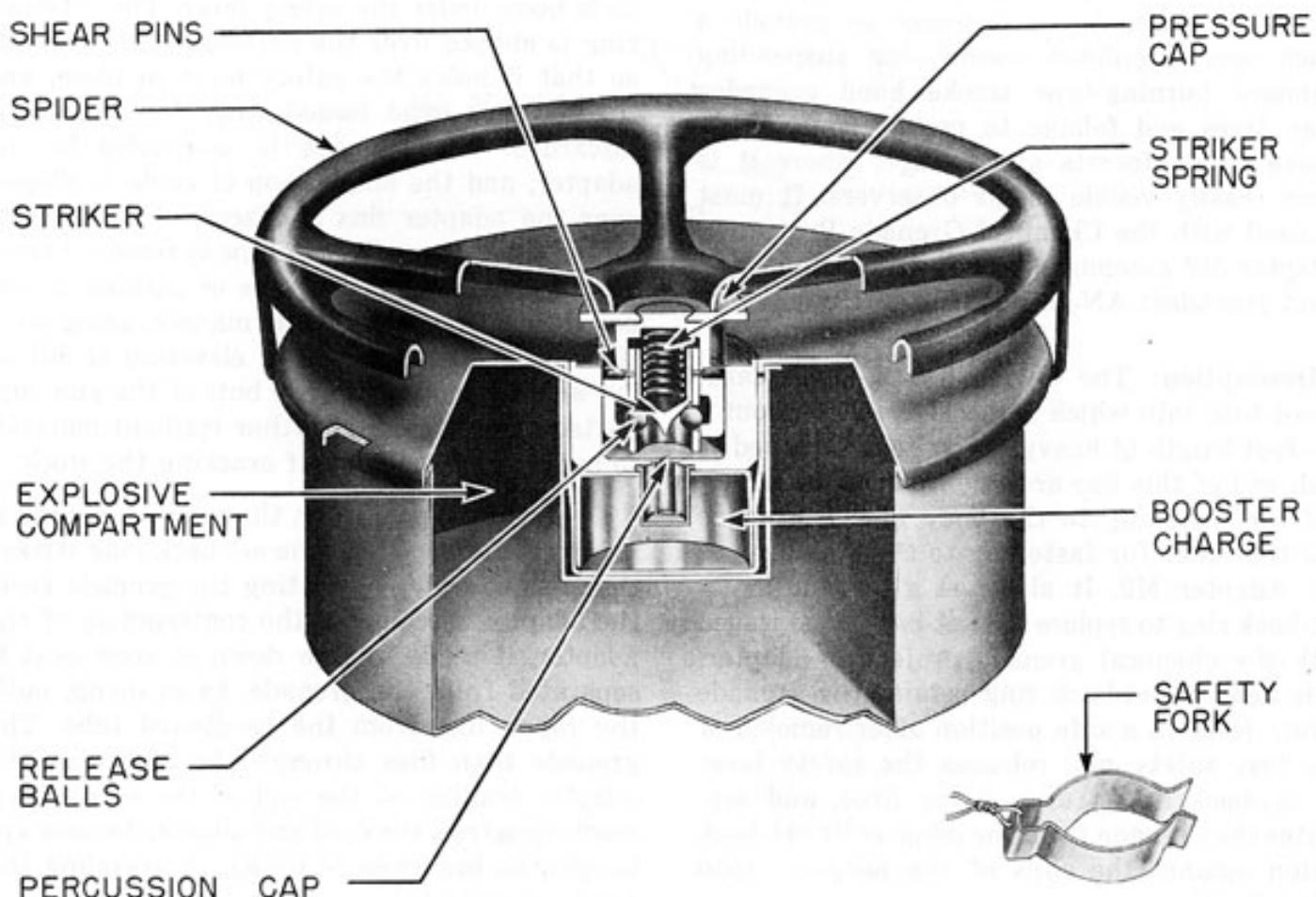


Figure 237. Anti-Tank Mine M1A1

## Part 5

# LAND MINES AND FIRING DEVICES

## Chapter 15 — LAND MINES

### Section I — INTRODUCTION

#### Mine types

There are two common types of land mines: anti-tank and anti-personnel. Anti-tank mines, designed to immobilize track or wheeled vehicles, vary in the amount of explosive they contain, the normal charge being 6 to 12 pounds. They are used in mine fields or road blocks. Anti-personnel mines are used primarily to produce casualties to personnel, and, secondarily, to give local security and warning. The explosive charge varies from  $\frac{1}{4}$  to 4 pounds. Other, less common, mines are classified in the general categories of improvised, dummy, and practice.

#### Firing devices

Firing devices are classified in accordance with the method of their initiation; that is, pressure, pull, tension-release, or pressure-release. The initiating action causes the device to function by chemical reaction, friction, percussion, or the closing of an electrical circuit.

Anti-tank mines generally have a main fuze which is employed as the primary initiating device; however, some anti-tank mines have supplementary activator wells on the side and bottom for booby trapping.

#### Marking

Mines can be identified by their color and markings. Land mines are generally painted lusterless olive drab with a yellow base and black markings, while practice mines are painted blue with white markings and dummy mines are black.

#### Army and Navy types

The Navy does not design land mines, but it has produced three firing devices for use with demolition charges—the Firing Devices Mk 1, Mk 3, and Mk 15. Since these could be adapted for use with mines, they are described in this publication. The Navy also produced the practice firecracker.

## Part 5 — Chapter 15 — Section 2

### ANTI-TANK MINES

#### MIA1 (Obsolete)

Diameter, inches .....	8
Height (with spider), inches.....	4
Height of body, inches.....	2.75

Total weight, pounds .....	10.6
Cast TNT weight, pounds.....	6
Material .....	Steel
Fuzing .....	M1A1, M1A2

**Components:** The metallic Anti-Tank Mine M1A1 has three main components: loaded body, fuze, and spider. The spider fits over the fuze to increase the effective size of its head. The steel body is a squat cylindrical container of light steel filled with high explosive. A carrying ring is attached to its side. The flanged rim around the top is notched for attaching the spider. In the center of the top is the cavity for the fuze and booster; the booster fits into the cavity and locks into place. The spider is a ring with two cross members pressed from a single sheet of metal. Hooks on the spider engage the flange on the mine body, and the center hub of the spider rests on the striker head of the fuze. When the mine is packed, the spider is placed over the bottom of the steel body to save space.

**Fuze M1A1:** This fuze consists of a striker assembly and a body with a primer. The head of the striker assembly protrudes  $\frac{3}{8}$  inch beyond the body of the fuze. Pressure of 500 pounds directly on the fuze head, or 250 pounds on the edge of the spider, depresses the outer sleeve, cutting the shear pins and aligning the holes in the outer sleeve with the steel balls lodged in the inner sleeve. The steel balls are forced into the holes in the outer sleeve, releasing the striker. The striker, thus freed, driven by the striker spring, sets off the percussion cap, detonator, booster, and main charge, in the order listed. For safety of shipping and handling, a safety fork is fitted over the collar between the striker head and the top of the fuze body.

**Fuze M1A2:** This fuze is identical in outward appearance to the M1A1. The detonator is more powerful to insure a high-order explosion.

**Arming:** The safety fork is not removed until after the mine is laid; and, after removal, the fork is left beside the mine, attached to its cord, never between the body and the spider. Before the mine is taken up, the safety fork is replaced.

**Color:** The bottom and  $\frac{3}{4}$  inch of the side are painted yellow; the rest of the mine is painted olive drab.

**Remarks:** The M1, the original model, is no longer being manufactured or issued. The principal difference is that, in the Mine M1, the booster is an integral part of the fuze; in the Mine M1A1 the booster is a separate part and issued assembled in the fuze cup of the mine.

Protective bag covers made of moisture-resistant, mildew-proof fabric are provided with this mine to prevent foreign matter from working between the mine body and the spider. The cover is cylindrical in shape, 8.75 inches in diameter, 9 inches high, and open at one end. The Mine M1A1 is being replaced by the M6.

#### M4 (Obsolete)

Diameter, inches .....	8
Height (with spider), inches.....	4
Total weight, pounds.....	10.6
Cast TNT weight, pounds.....	6
Material .....	Steel

**Components:** The metallic Anti-Tank Mine M4 is identical to the M1A1 type except for the booster, the fuze, and the activator wells. The M4 has one activator well on the bottom and one on the side. Since the booster, after loading, becomes an integral part of the mine, and since the M1A1 and M4 boosters and fuzes are not interchangeable, it is especially important that the Mines M1A1 and M4 and their respective fuzes be kept separate. However, the two mines are assembled, armed, and employed in the same manner. The advantage of the Mine M4 is that the internal construction of the M4 fuze makes it safe to re-use, because it is not made more sensitive by repeated light blows.

**Fuze:** The fuze for the Mine M4 functions on the "cricket" or "oilcan" principle. This means that the firing-pin spring is a convex metal diaphragm which snaps down under pressure to detonate the fuze. The fuze for the Mine M1A1 uses a cocked firing pin spring and shear pins. In appearance, the only difference is that the primer and the detonator of the M4 fuze are contained within the fuze body instead of protruding from the bottom as in the M1A1, and the bottom edge is sharp rather than beveled.

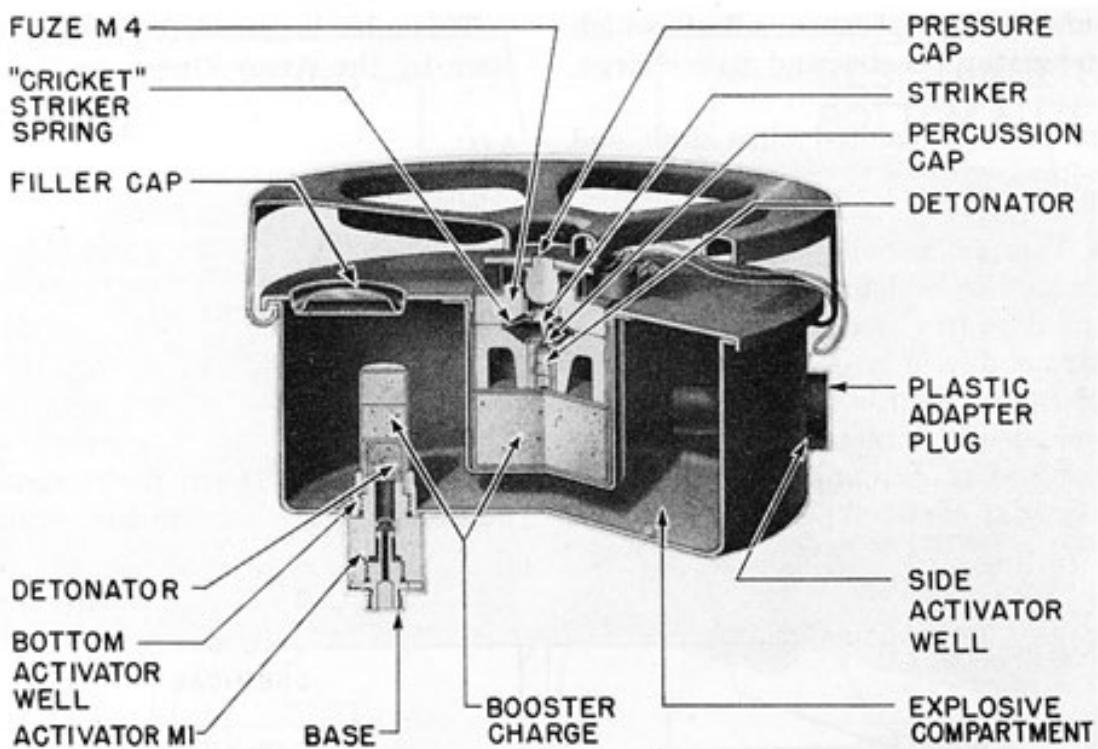


Figure 238. Anti-Tank Mine M4

**Booster:** The M4 booster is identical with M1A1 booster, except that it has a flat top with a crossed scar to insure rupture of the booster shell by the detonator, while the M1A1 booster has a cavity in the top to receive the protruding primer and detonator of the M1A1 fuze.

**Arming:** The safety fork is removed from the fuze by pressure of the thumbs on the prongs.

**Color:** The bottom and  $\frac{3}{4}$  inch on the side are painted yellow; the rest of the mine is painted olive drab.

**Remarks:** The Mine M4 is being replaced by the M6.

The M4 also has a protective cover bag.

## M5

Diameter, inches .....	10
Height, inches .....	5.5
Total weight, pounds .....	14.5
Weight of filler, pounds.....	5.6
Type of filler.....	TNT or Tetrytol
Material.....	Pottery and impregnated felt

**Components:** The cylindrical mine body consists of a ceramic bowl containing the high explosive, with a ceramic plate which acts as the spider. These components are separated by a cushion of rubber or similar material and enclosed in asphalt-impregnated felt and tarred paper. There is a threaded opening in the top of the mine for assembly of the fuze and a bakelite plug in the bottom, which may be removed for the attachment of an anti-removal device.

**Fuze:** The Chemical Fuze M5 consists of a cylindrical body attached to a threaded plug. Instead of a metal safety pin, a bakelite cap is screwed on the base of the fuze body. In addition to this cap, there is a safety ring around the fuze body against the flange of the plug, which prevents the fuze from being screwed into the functioning position in the mine. When the mine is armed, a pressure of 275 to 425 pounds pushes down the upper portion of the mine, overcoming the resistance of the synthetic rubber ring. The glass vial is forced down on the striker, bearing on the wooden anvil, and is broken. Mixture of the chemical in the glass vial with the chemical sub-

stance surrounding the vial causes a flash, which sets off the detonator, booster, and main charge.

**Color:** The mine is painted olive drab and marked in yellow.

**Remarks:** This is a non-metallic mine in order that it may not be detected by an electromagnetic mine detector.

An anti-lifting device may be attached by removing the rubber plug in the bottom of the mine; however, use of a metal device tends to defeat the purpose of designing the mine and fuze with no metal parts.

This mine is considered a substitute standard item by the Army Ordnance Department.

### M6

Diameter, inches .....	12.5
Height, inches .....	3.25
Total weight, pounds.....	20
TNT filler, pounds.....	12
Material .....	Steel
Color .....	Olive drab

**Components:** The mine consists of a loaded mine body, fuze, and pressure-plate plug. The

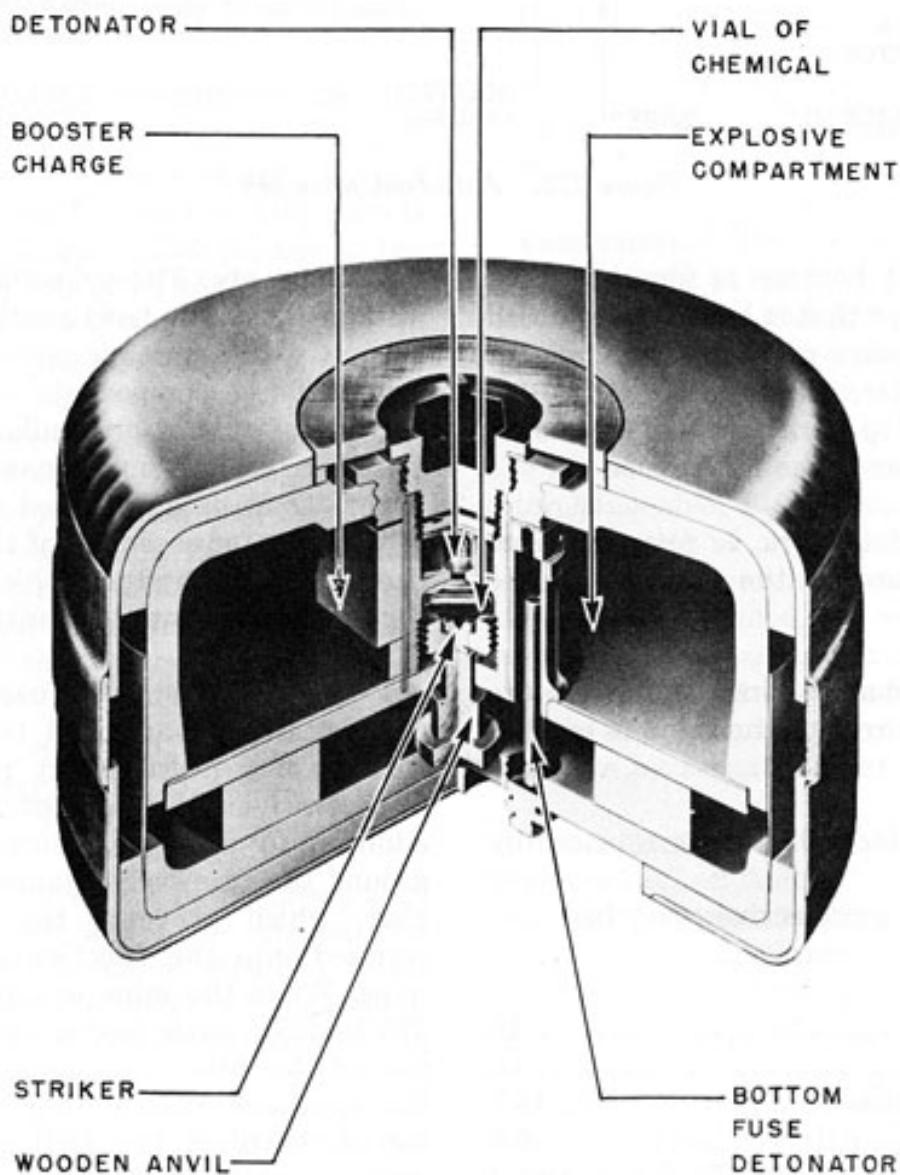


Figure 239. Anti-Tank Mine M5

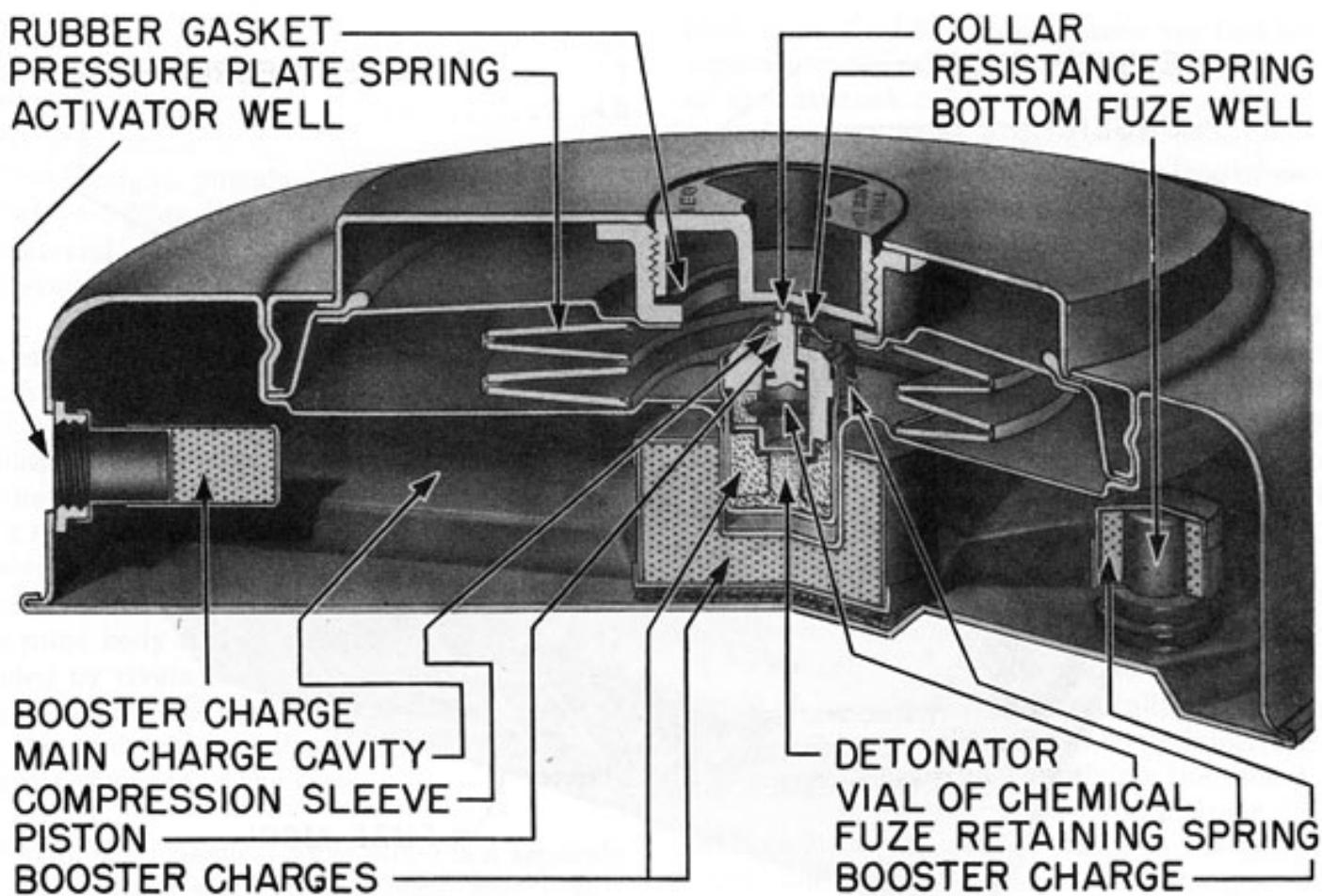


Figure 240. Anti-Tank Mine M6

steel body is cylindrical, with a carrying handle attached to the bottom. Assembled to the mine body is a round pressure plate,  $7\frac{1}{2}$  inches in diameter, containing the reversible pressure-plate plug which covers the fuze well. The pressure plate is supported internally by circular Belleville springs and sealed against moisture by a rubber diaphragm. In addition to the primary fuze well, supplementary fuze wells are located on the side and on the bottom of the mine for use in anti-lifting or booby-trap purposes.

**Fuze:** The Chemical Fuze M600 is a separate unit and consists of the fuze body, piston, safety key, compression sleeve, resistance spring, vial of chemical, detonator, and fuze booster charge. The spring is cut away at either side, and the perforations in the sleeve are large so that the fuze itself may be activated by a force of 190 pounds. When the Belleville spring is inserted

in a Mine M6, a pressure of 300 to 400 pounds is required to overcome its resistance.

When pressure is applied on the pressure plate, it is transmitted to the piston head. As the resistance of the spring is overcome, the compression sleeve is crushed, and the piston moves down to crush the vial of chemical. The chemical reacts with the surrounding mixture to set off the detonator, fuze booster, booster, and main charge.

**Remarks:** For booby traps or anti-removal devices, after the main fuze is installed, any standard firing device may be attached to the supplementary fuze wells by using the Activator M1. This activator is a plastic adapter approximately two inches long, which contains a tetryl booster charge.

This fuze must not be used with the Anti-Tank Mine M7.

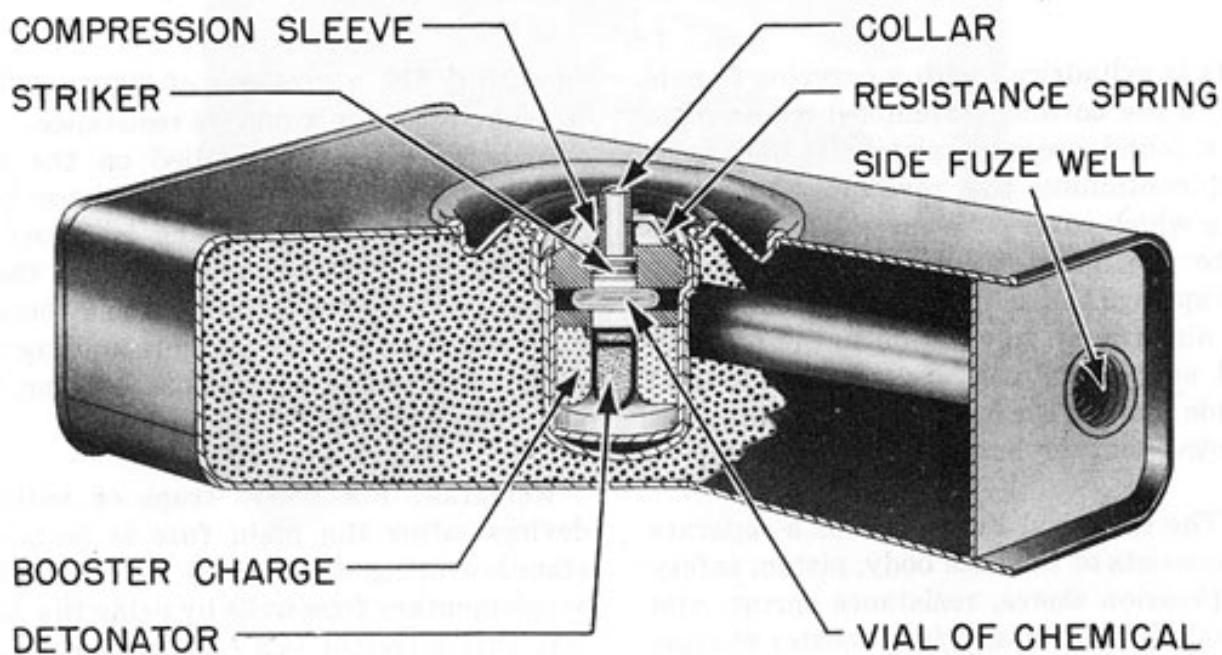
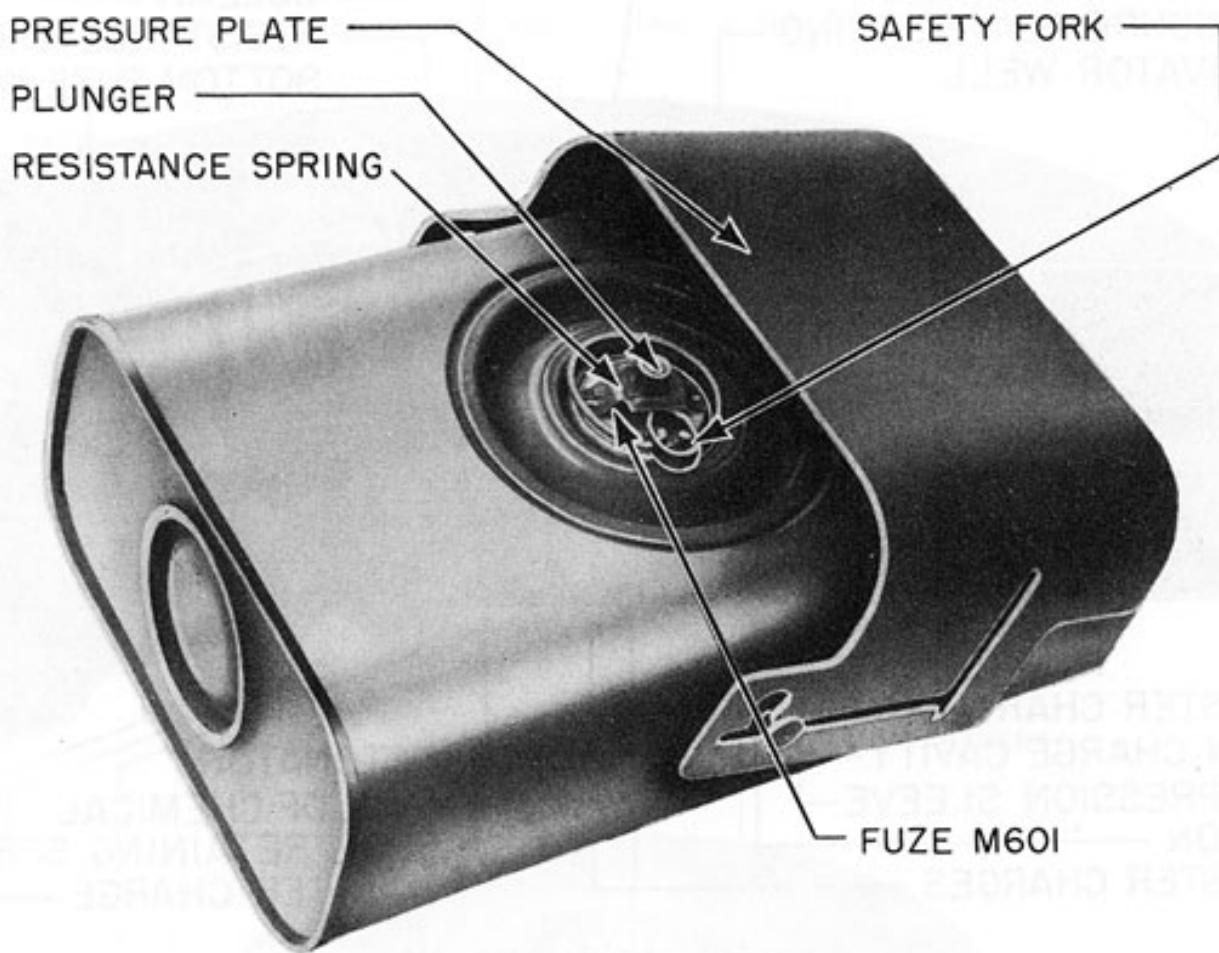


Figure 241. Anti-Tank Mine M7A1

## M7AI

Length, inches .....	7
Width, inches .....	4.5
Height, inches .....	2.5
Total weight, pounds .....	4.5
Tetrytol filler, pounds.....	3.25
Material .....	Steel
Color .....	Olive drab

**Components:** This mine can be used as either an anti-tank or an anti-personnel mine. The body is a rectangular steel container filled with high explosive. The fuze well is located in the center of the top surface, and at one end is an activator well that will accommodate any standard firing device with a Corps of Engineers' blasting cap. The pressure plate is shaped to the contour of the mine body and is slotted so that it may be guided by rivets in the sides of the mine body, into position over the fuze. A small circular pad on the underside of the pressure plate bears against the head of the fuze.

**Fuze:** The Chemical Fuze M600 is a separate unit and consists of the fuze body, safety key, piston, compression sleeve, resistance spring, vial of chemical, detonator, and fuze booster charge.

When pressure is applied on the pressure plate, it is transmitted to the piston head. As the resistance of the spring is overcome, the compression sleeve is crushed, and the piston moves down to crush the vial of chemical. The chemical reacts with the surrounding mixture to set off the detonator, fuze booster, and main charge.

**Remarks:** For a booby trap or anti-personnel mine, any standard firing device may be attached to the side fuze well.

#### Improvised mines

**General:** The bangalore torpedo and the 2.36-inch anti-tank rocket can both be used as anti-tank mines, with slight improvisations.

**Bangalore torpedo:** Special torpedo caps are furnished with each box of ten bangalore, to adapt the bangalore torpedo for use on an anti-

tank mine. Pull-firing detonators are furnished separately. To assemble the bangalore for use as an anti-tank mine, insert detonators in two torpedo caps; place a safety pin through the torpedo-cap ears and the detonator loop of each; and snap a torpedo cap onto each end of the torpedo, so that the detonator fits into the cap well. Lay the torpedo on the ground across a wooden block and drive eight-inch spikes on drift pins into the ground as close to the ends as possible. Pass the detonator wire through each detonator loop, and attach the wire to the spike. Make sure there is no tension on the detonator wire. Withdraw the safety pin. The mine is now armed and ready for use.

**2.36-inch A/T Rocket:** The A/T Rocket M6 may be employed by placing the rocket, nose-up in its container, in a hole about two feet deep, either in a roadbed or horizontally on the side of a cut or bank. It can be set to fire electrically by arranging a circuit containing the rocket, a battery, and an improvised circuit closer. Connections to the rocket are made on the ignition wires: one from the brass ring on the nose, the other from the fins. Ordinary field telephone wire will serve; the battery and connections should be protected from water if necessary.

The container cap is removed and the other end knocked out. The container is thus a guide for the rocket. A hole is punched in the container cap, through which the electric firing-device wires (or trip wire) are run. When connections have been made, the container cap is slid in place over the fins to protect the contacts from fouling. The rocket safety pin is removed; the container tube is slid over the rocket and joined to the cap; and the assembly is placed in the hole. Loose dirt and leaves are then placed over all of the rocket except the nose; the nose is concealed by covering with leaves or light bunches of grass. Care must be taken not to bump the nose, as the rocket is completely armed when the safety pin is removed.

#### Practice types

**General:** Practice mines are used in training. These mines can be identified by their blue color and white markings.

**M1:** The Practice Mine M1 consists of three components: an empty mine body, a spider, and a fuze. The parts are similar in construction to the high-explosive mine, except that the body has five one-inch holes equally spaced around the side. The explosive filling consists of a caliber .32 blank cartridge in the fuze, 100 grains of red phosphorus, and 60 grains of black powder.

**M1B1:** The Practice Mine M1B1 is made of sheet metal and resembles the service mine, except that the filling hole is in the bottom of the mine body. The body is sand-filled to weight before it is issued for use in practice. Four sections are cut out of the top of the body near the

fuze well, to permit the passage of smoke.

**TSE1:** The Practice Mine TSE1 simulates the standard Mine M6. It uses the Practice Fuze T20, which simulates the M600, but gives a puff of smoke instead of detonating the mine. Four sections cut out of the top of the body near the fuze well permit the passage of smoke.

**M10:** The Practice Mine M10 simulates the standard Mine M7A1. It is loaded with 3.4 pounds of inert filler, consisting of Santo wax M, 50%, plaster of paris, 12%, and powdered red iron oxide, 38%. It uses the Practice Fuze T20. Four sections cut out of the top of the body permit the passage of smoke.

## Part 5 — Chapter 15 — Section 3

### ANTI-PERSONNEL MINES

#### M2, M2A1, M2A2, M2A3, M2A3B1, M2A3B2, M2A4, and M2A4B2

##### M2A1

Over-all height, inches.....	6.5
Case diameter, inches .....	2.5
Base diameter, inches .....	5.25
Weight of shell, pounds.....	3
Weight of explosive, pound.....	0.4
Material .....	Steel
Lethal range, feet.....	60

**General:** The M2 is a "bounding" anti-personnel mine, usually activated by a combination firing device. The M2 has undergone several structural modifications to make it watertight. The mine consists of an explosive shell contained in an upright thin-walled steel tube which is riveted to the base plate. A cavity in the base plate contains the propelling charge, which consists of 20 grains of black powder in a small bag. The tube containing the shell is sealed at the top by a metal cap. A  $\frac{1}{4}$ -inch pipe nipple threaded to the base plate serves as a connection for the firing mechanism. Attached to the pipe nipple is a coupling into which is fitted the

primer and igniter assembly. The primer is protected during shipment by a hexagonal cap.

**Modifications:** The Mine M2 has been modified in that the thin-walled steel tube is silver-soldered to the base (M2A1), or stamped (M2A3), instead of being riveted (M2). The Mine M2A3B1 is a modification in which the tube, base, and nipple are cast in one piece. The mine was approved but not issued, being too heavy. The Mine M2A3B2 is a combination of the M2A3 and the M2A3B1, in that the base is cast but the tube and nipple are stamped to the base. In the M2A4, which has two propellant bags, the tube and nipple are welded to the base, while, in the M2A4B2, the tube and nipple are welded to a base which is cast. The M2A2 was a field modification thought to involve the use of a canvas bag.

**Fuzing:** These mines are usually fuzed with the Combination Fuze M2 or M2A1 consisting of the combination firing device M1 with an igniter cap attached, or with the combination Fuze M6.

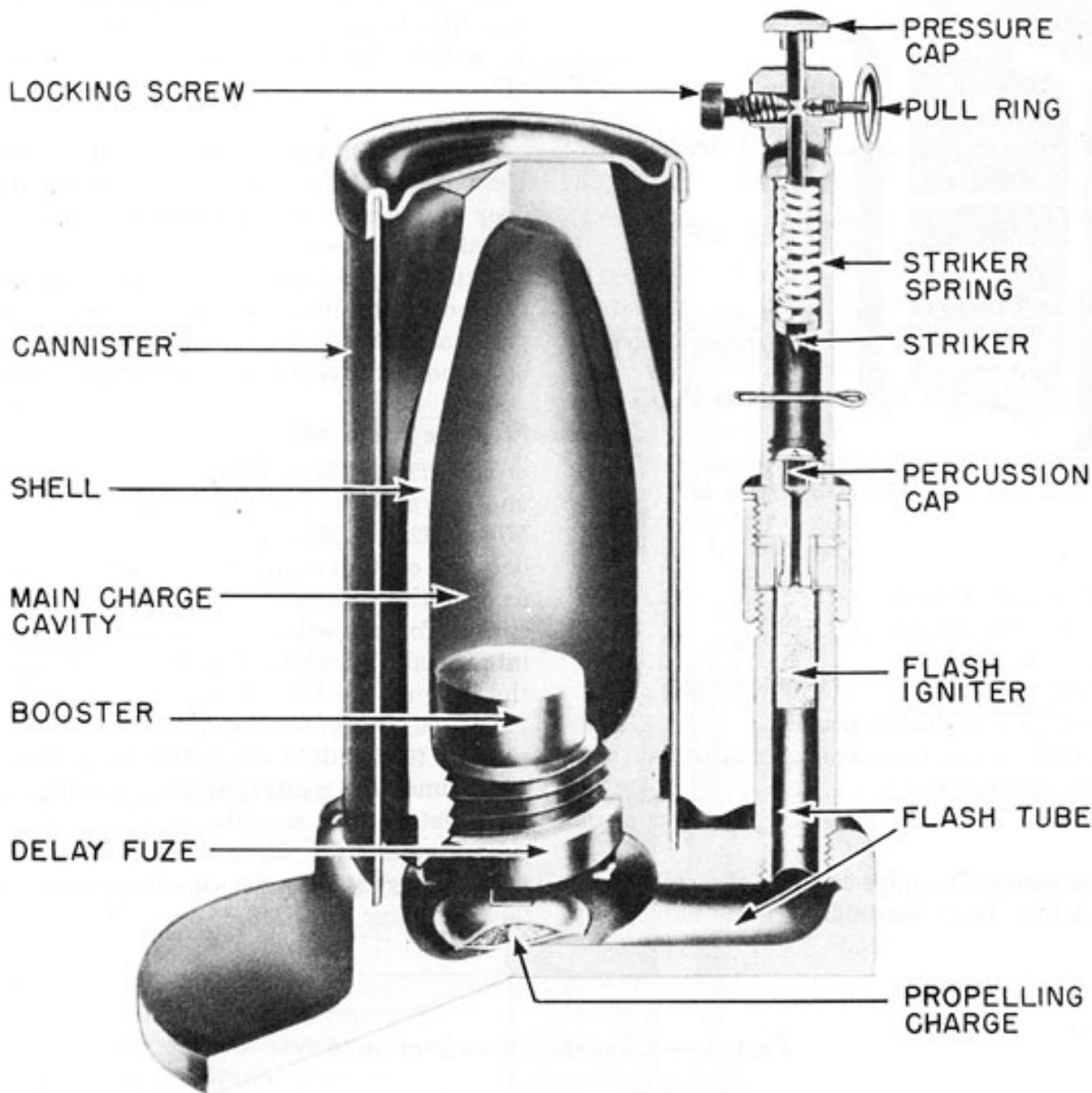


Figure 242. Anti-Personnel Mine M2A1

**Operation:** The mine is similar to a small mortar. When the fuze is actuated, the primer sets off the igniter. The flash from the igniter sets off the propelling charge in the base plate. The propelling charge projects the shell into the air and at the same time ignites the delay fuse in the base of the shell. When the shell is at a height of approximately six feet above the base plate, the delay fuse fires a tetryl booster, which detonates the main charge. The effective lethal

range of the shell is 60 feet.

**Color:** The mine and firing device are dull olive drab in color except for the base flange, which is yellow.

**Remarks:** Each mine is packed in a corrugated paper carton with firing device, attached igniter, and four spools of wire. Markings of "Olive Drab" or "Sand Color" on outside of container refer to the color of the wire.

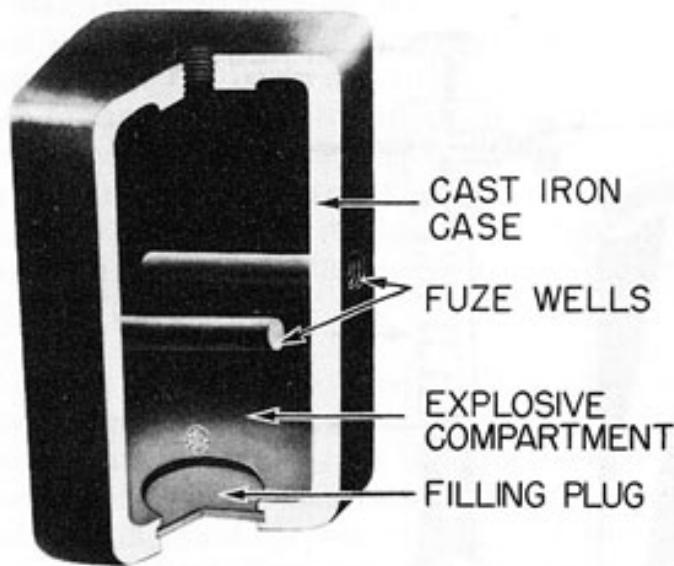


Figure 243. Anti-Personnel Mine M3

### M3

Body length, inches .....	5.4
Body height, inches .....	3.5
Body width, inches.....	3.5
Weight, pounds .....	9.6
Flaked TNT explosive, pound.....	0.9
Material .....	Cast iron
Lethal range, feet.....	30
Color .....	Olive drab

**Components:** The mine consists of a rectangular cast-iron body containing high explosive,

with fuze wells on two opposite sides and one end. The filling hole on the other end is closed by a disc. The mine is activated by the Fuze M7A1.

**Remarks:** On the surface, the lethal range of the mine is 30 feet. If the mine is buried only deep enough to be camouflaged, the effective lethal range is reduced to approximately 10 feet.

Exposure to moisture will not affect the operation of the mine; however, it is not waterproof and should not be planted where it will be immersed in water for more than a few days.

### Practice Mine M8

The Practice Mine M8 is similar in appearance and operation to the M2A3. Obsolete bodies of Mines M2 and M2A1B1 are utilized. This mine does not contain a propelling charge in the base, as does the standard H.E. mine. The propelling charge for projecting the cardboard projectile into the air is contained in the igniter charge on the base of the fuze. The projectile contains a 12-gauge shotgun charge loaded with black powder to simulate the action of a live mine. The primer and igniter, which has a delay of approximately five seconds, is activated by the M10 Combination Mine Fuze. This fuze is a three-pronged firing device similar to the Combination Mine Fuze M6.

## Part 5 — Chapter 15 — Section 4

### TRIP FLARES FOR MINE FIELDS

#### M48 and M49

**General:** Trip flares are used as a warning device in forward edges of mine fields. They can replace or supplement anti-personnel mines, especially when the field is being hastily prepared. The flares give warning of approaching patrols entering the mine field and illuminate the area so that effective fire can be directed at intruder.

**M48:** This is a mortar-type parachute flare

similar in appearance to the M2 series of anti-personnel mine. The flare, weighing a total of five pounds, has a metal case which is painted olive drab. In operation, the functioning of the igniter sets off the propelling charge, which projects the canister into the air and ignites the delay fuse in its base. When the canister is 300 to 500 feet in the air, the delay fuse sets off the propelling charge in its base, which forces the flare and parachute out of the canister and sets off the ignition charge at the base of the flare.

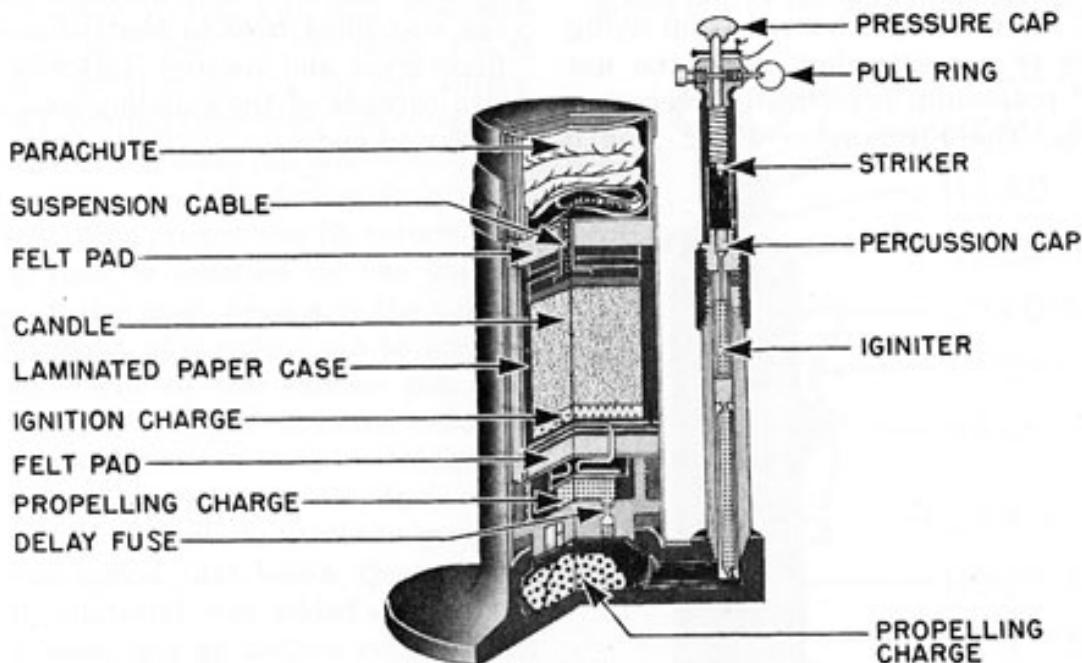
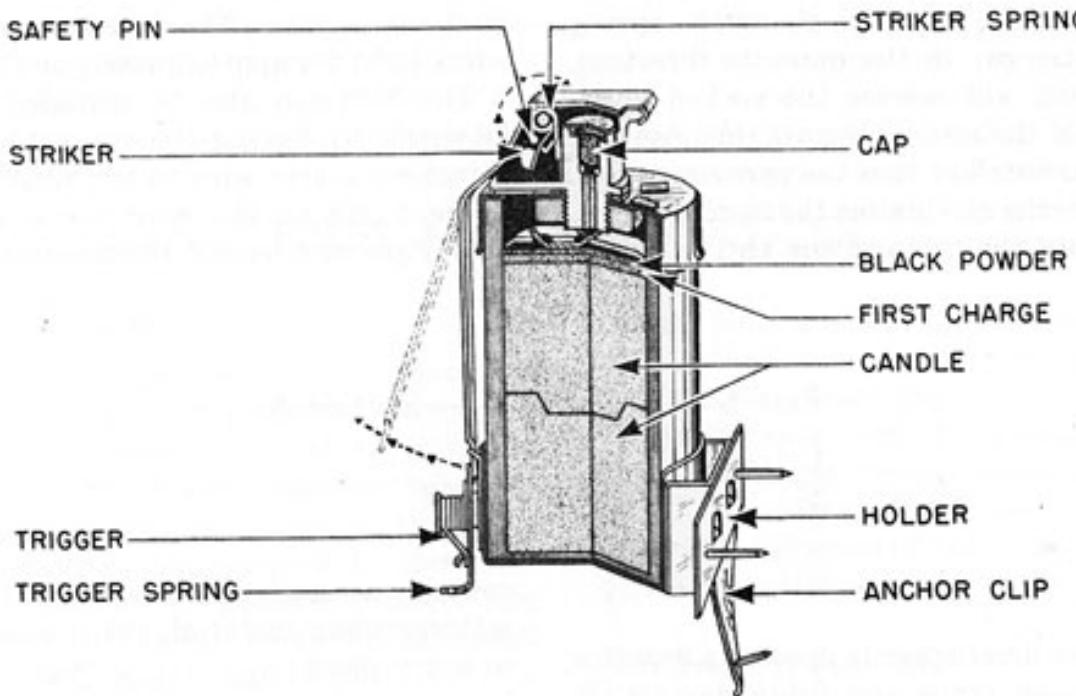


Figure 244. Trip Flares M48 (below) and M49 (above)

The parachute unfolds, and the ignition charge ignites the flare, which burns for 20 seconds. It illuminates effectively a circle of 300 yards radius.

**M49:** This is a candle flare for use above the ground. The flare, weighing a total of 1.4 pounds, has a laminated paper body with metal fittings

which are painted olive drab. Functioning of the flare is similar to that of the Fragmentation Hand Grenade Mk II. The flare is installed with a taut trip wire which holds the trigger in an armed (vertical) position against the pressure of the trigger spring. An additional pull of two to nine pounds on the trip wire pivots the trigger against the pressure of the spring, or release

of the tension in the trip wire allows the spring to pivot the trigger in the opposite direction, either of which will release the cocked lever. The pressure of the striker throws the lever off, and the released striker fires the percussion cap. The flame from the cap ignites the black powder, which blows out the top and ignites the illumi-

nant composition. The flare produces a brilliant white light for approximately one minute.

The M49 can also be installed with a loose trip wire by having the trigger horizontal and attaching a trip wire to the safety pin. A subsequent pull on the wire would withdraw the safety pin and permit the flare to fire.

## Part 5 — Chapter 15 — Section 5

### FIRECRACKER

#### Mk 2 Mod 0

**General:** The firecracker is used as a practice charge for booby traps and firing devices. It produces a loud report accompanied by a bright flash and a considerable quantity of smoke, yet it is designed to reduce the hazard from flying particles such as are attendant upon the use of a standard potassium perchlorate firecracker or flash salute. The Firecracker Mk 2 Mod 0

contains no high explosive. It is coated with a waterproofing material, yet it should be stored in a dry place.

**Installation:** The nipple of 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.

## FUZES AND FIRING DEVICES

## Pull Firing Device M1

**General:** It is a mechanical device designed for firing charges by a trip wire. A direct pull of three to five pounds applied to the ring actuates the device. A spring-driven firing pin sets off the percussion cap, which, in turn, sets off the non-electric cap crimped to the base. This cap detonates the explosive charge. The new model has two safety pins; the old model did not have the positive safety pin.

**Description:** The principal parts are the body, release pin, washer, firing pin, and standard nipple base. The split head of the firing pin is forced against pressure of the striker spring through a small opening formed by the shoulders inside the body. The release pin enters into and expands the split head of the firing pin against these shoulders, thus preventing its return. The release pin is held in position by the loading spring. Holes in the main head and the release pin permit insertion of a safety pin to prevent accidental movement of the release pin. The main head or upper body is threaded onto the lower body. A short piece of wire is attached at the side to be used in anchoring the device.

The new model differs in that the positive safety pin was added just below the striker; water-proofing material was added around the nipple of the base; and an anchor cord is used in place of the wire. The head of the body differs slightly in construction, and the joint is soldered to prevent disassembly.

**Operation:** When the device is set with the blasting cap crimped to the base and inserted in an explosive charge, the top safety pin is removed. After checking the device, the positive safety pin in the lower part of the body is pulled free (new model), and the device is in an armed condition. A pull of three to five pounds on the

release pin is sufficient to overcome the resistance of the loading spring and cause the tapered end of the release pin to be withdrawn from within the split head of the firing pin. The split head, no longer being forced against the internal shoulders of the body, slips through under the influence of the striker spring, which drives the striker down on the percussion cap.

## Pull Friction Fuze M2

**General:** This device is designed for firing explosive charges by means of a trip wire. A direct pull of three to nine pounds will actuate it.

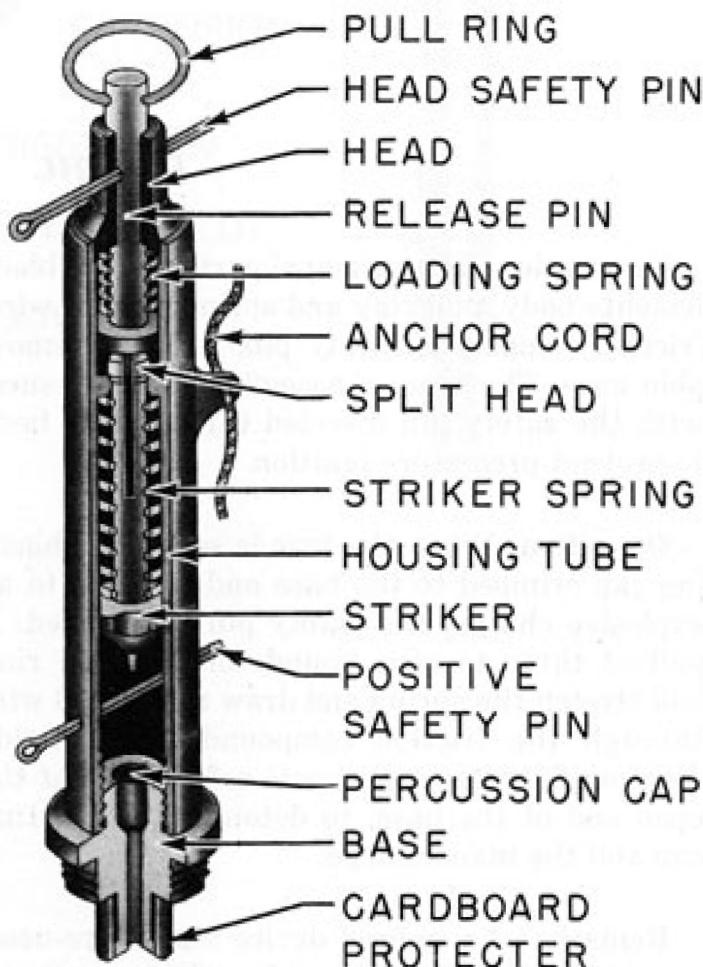


Figure 245. Pull Firing Device M1

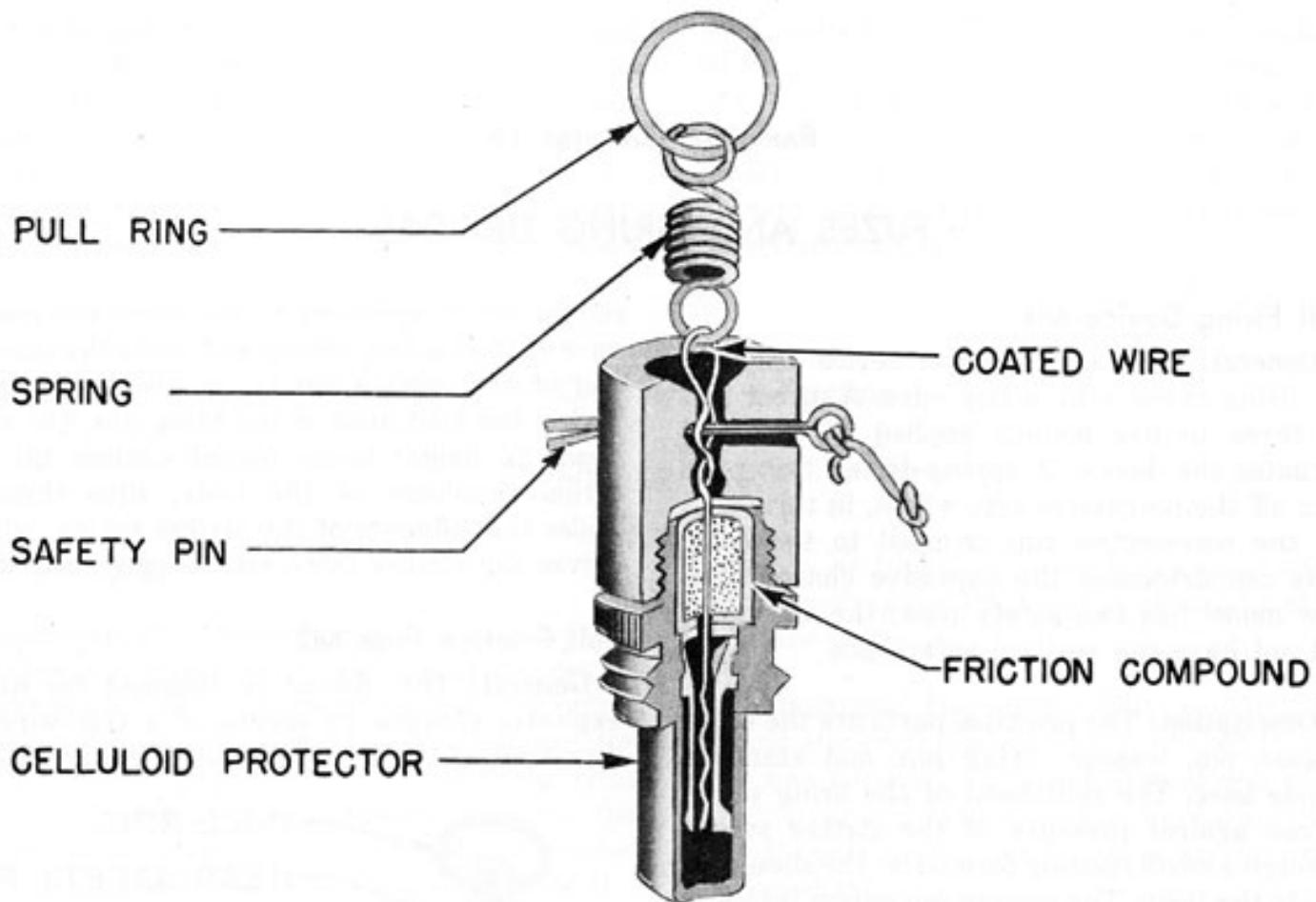


Figure 246. Pull Friction Fuze M2

**Description:** The principal parts are the black bakelite body, pull ring and spring, coated wire, friction compound, safety pin, and non-removable base. The fuze is assembled when issued, with the safety pin inserted through the body to prevent premature ignition.

**Operation:** When the fuze is set with a blasting cap crimped to the base and inserted in an explosive charge, the safety pin is removed. A pull of three to nine pounds on the pull ring will stretch the spring and draw the coated wire through the friction compound. The friction compound ignites and shoots a flame out of the open end of the base, to detonate the blasting cap and the main charge.

**Remarks:** An unfired device may be re-used, provided it has been in a dry place.

Do not attempt to remove the base from the fuze body.

#### Pressure Firing Device M1A1

**General:** This is a mechanical device designed to fire explosive charges by means of pressure. A pressure of 20 pounds or more applied to the trigger pin will actuate the device. Various extensions, for attachment to the pressure head, are issued with the device, in order that it may be adapted to varying circumstances.

**Description:** Principal parts are the body, trigger pin and pressure head, striker spindle, standard nipple base, safety clip, and safety pin. The projection of the trigger pin which extends down into the body has two holes of varying diameter with an inter-connecting slot. The hole toward the bottom of the trigger pin is the smaller. The striker spindle has a circumferential groove around the part that extends through the trigger pin. When the device is set, the trigger pin is held up either by a clip or just by its spring, and the grooved part

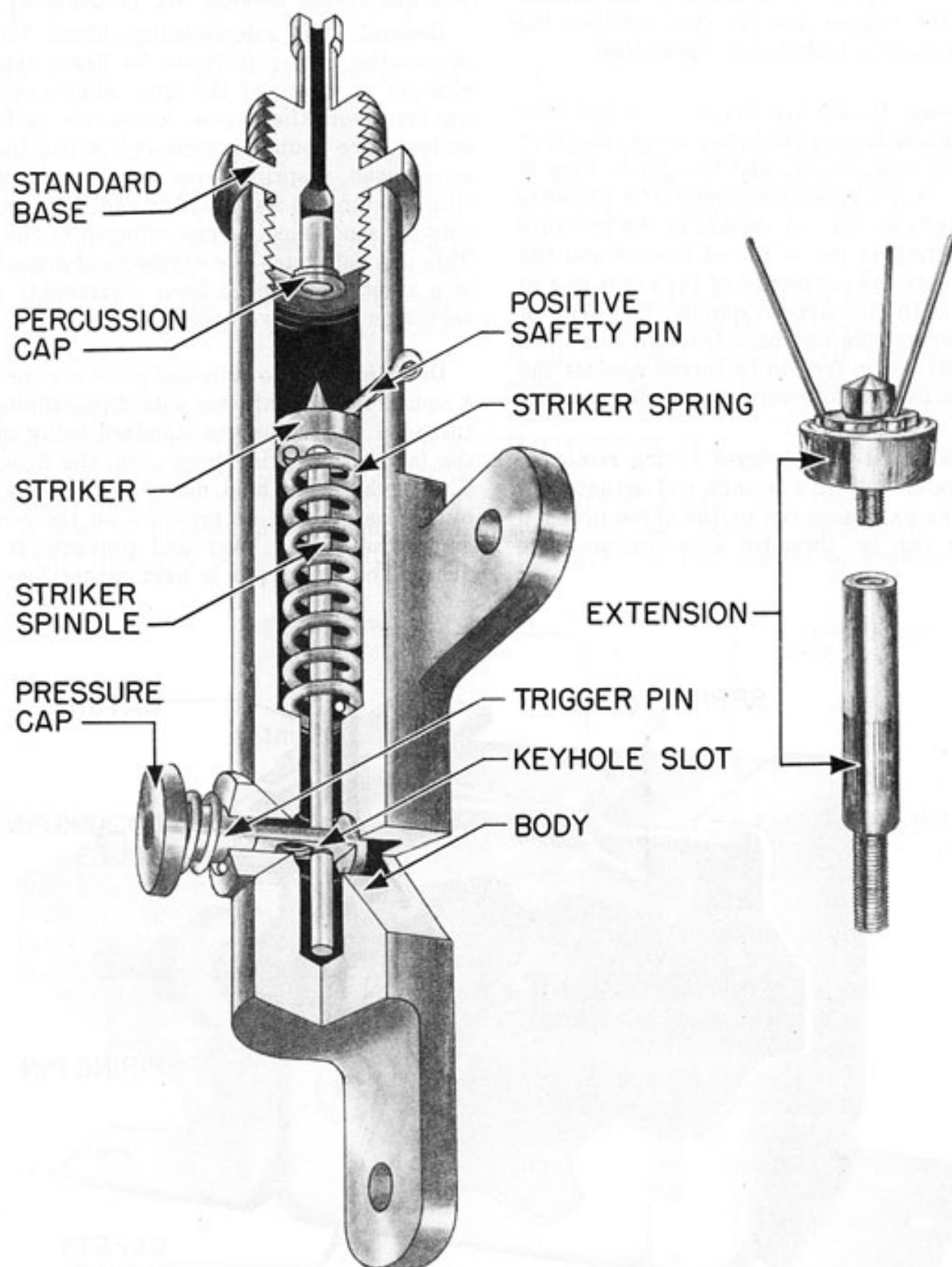


Figure 247. Pressure Firing Device M1A1

of the striker spindle is engaged in the smaller hole on the trigger pin. In this position the striker spindle is locked and cannot fire.

**Operation:** When the device is armed, the striker spindle is engaged in the lower (smaller) hole in the trigger pin, and the pin in turn is held up by the trigger-pin spring. If a pressure of 20 pounds or more is applied to the pressure head, the trigger pin is forced inward and the larger hole in the projection of the pin is moved into line with the striker spindle. The head of the striker spindle can pass through this hole, and the striker is free to be forced against the percussion cap by the compressed striker spring.

**Remarks:** With the trigger spring removed, a pressure of only five pounds will actuate the device. The extension rod or the three-pronged extension can be threaded into the pressure head.

### Release Firing Device M1 (Obsolete)

**General:** The release-firing device M1 is a mechanical device designed for firing explosive charges by means of the removal of a restraining load from the device. A restraining load of at least two pounds is required. When the load is removed, a spring lever strikes a firing pin, which detonates a percussion cap. This, in turn, sets off a non-electric cap crimped to the base. This cap detonates the explosive charge. There is a safety pin, and a lever interceptor which serves as a positive safety pin.

**Description:** The principal parts are the body, a square metal container with a protruding nub threaded to receive the standard firing nipple; the latch; the spring lever; and the firing pin. The latch, when held down against the body by the safety pin or pressure on the box, engages the spring lever and prevents it from firing. The firing pin is held rather loosely in

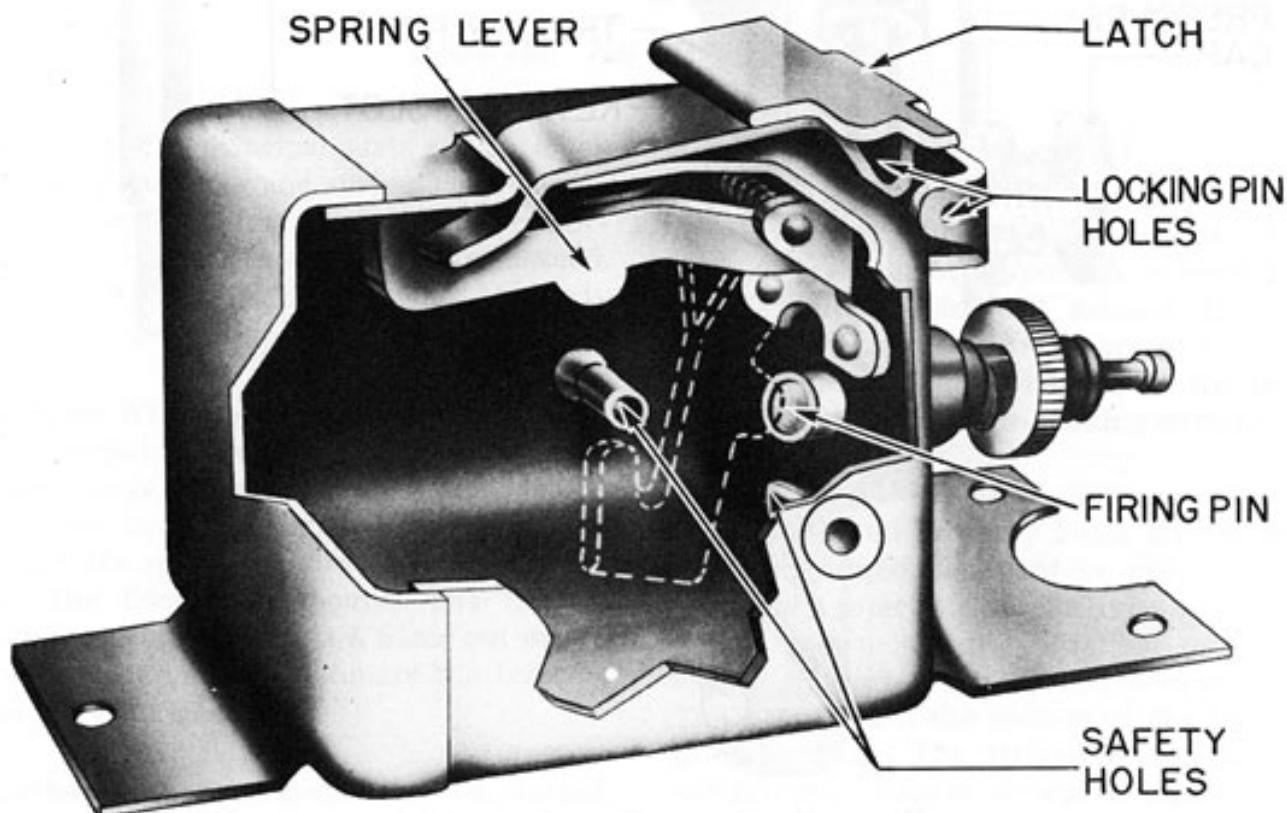


Figure 248. Release Firing Device M1

place, having leeway for slight horizontal motion. When the nipple is threaded on, it forces the firing pin back as far as it can go, the firing pin point resting squarely against the surface of the percussion cap.

**Operation:** When the device is set with a weight on top and both safety pins removed, it is in an armed condition. If the restraining weight is removed, the latch releases the spring lever. The spring lever will then snap down against the firing pin and drive it into the percussion cap in the standard nipple base, setting off the charge.

### Release Firing Device M5

**General:** The Release Firing Device M5 is a mechanical device designed for firing charges by the removal of a restraining load from the device. A load of at least five pounds is required. When the load is removed, a spring-

loaded striker swings over to detonate the percussion cap.

**Description:** The parts are a rectangular metal body and release plate, a striker and spring, a safety pin, and a standard nipple base. The release plate, when held down by the safety pin or by a weight, prevents the striker from swinging over to detonate the percussion cap.

**Operation:** When the device is set with a weight on top and the safety pin removed, it is in an armed condition. If the restraining weight is removed, the release plate is forced up by the striker as it swings over to detonate the percussion cap.

**Remarks:** Because of difficulty in handling, the M5 is considered a temporarily standard item which will ultimately be replaced.

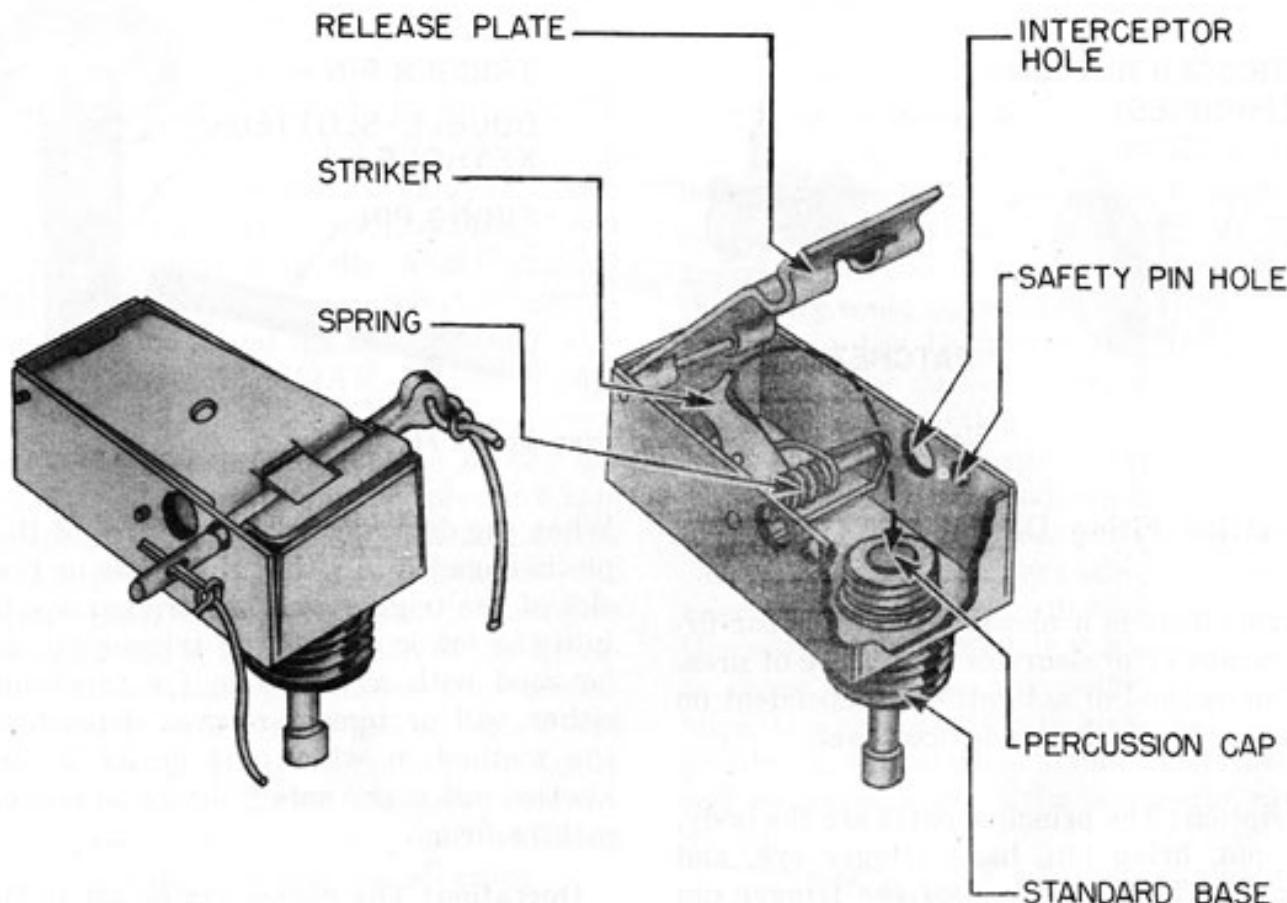


Figure 249. Release Firing Device M5

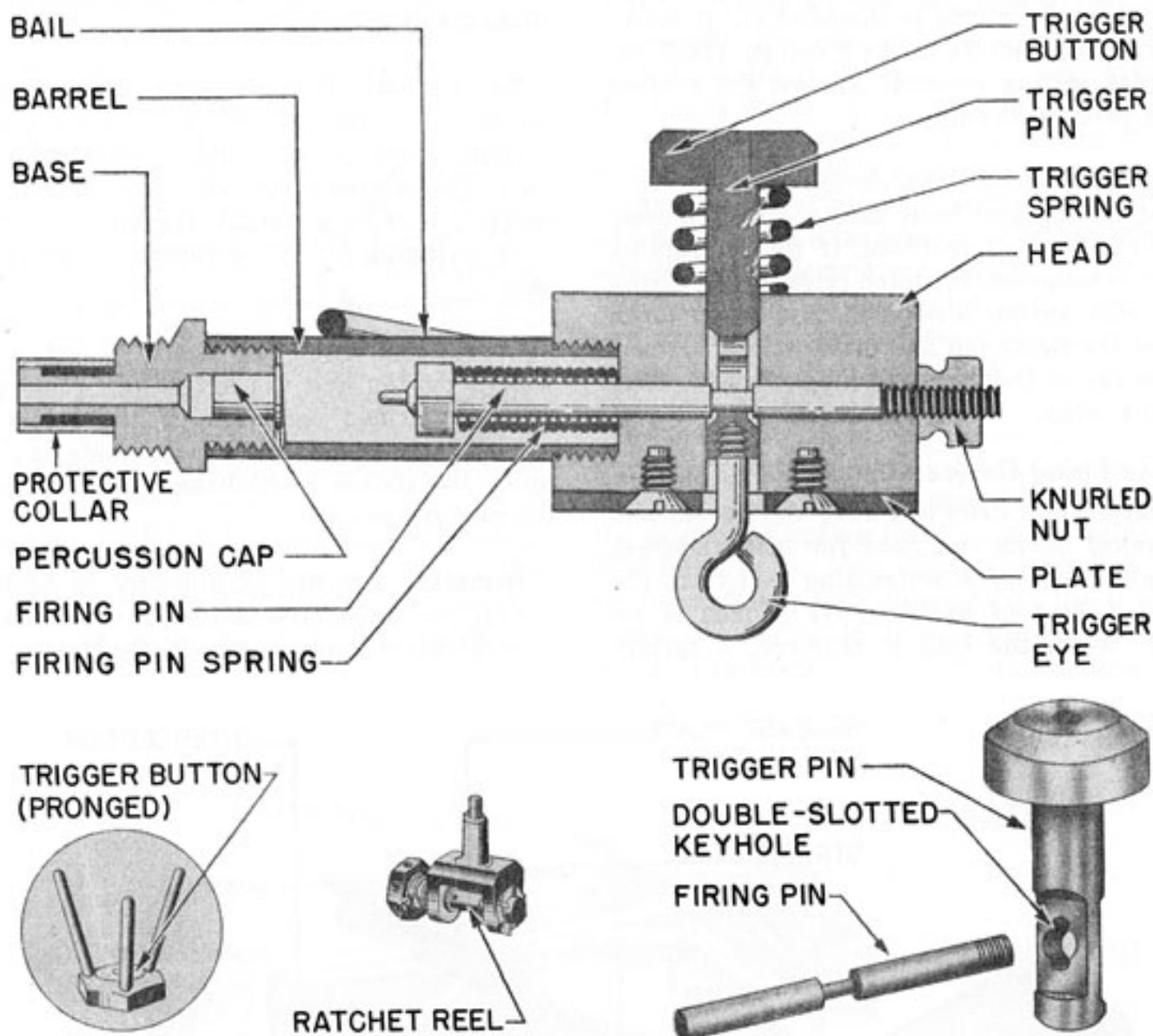


Figure 250. Combination Firing Device Mk 1 Type

### Combination Firing Device Mk 1 Mods 0 and 1

**General:** This is a mechanical device for firing by means of pressure or by release of pressure. The method of activation is dependent on the manner in which the device is set.

**Description:** The principal parts are the body, trigger pin, firing pin, base, trigger eye, and knurled nut. The projection of the trigger pin extending down into the body has two slots with an inter-connecting hole which is large enough to permit the firing pin to pass through.

When the device is set, the groove of the firing pin is engaged in either the upper or the lower slot of the trigger pin. The trigger eye threads into the lower end of the trigger pin and can be used with a trip wire for functioning by either pull or tension-release, dependent upon the method in which the device is set. The knurled nut is the safety device to prevent premature firing.

**Operation:** The device can be set to function either by pressure and pull or by pressure release and tension release. The method of actuation is dependent on whether the trigger pin

is in the "out" or "depressed" position. The trigger pin is moved until the hole is moved in line with the firing pin and releases it. The cocked firing pin is driven on to the percussion cap by the firing-pin spring.

**Mk 1 Mod 1:** Installation and operation of the Firing Device Mk 1 Mod 1 is similar in all respects to the Firing Device Mk 1 Mod 0. Construction differences are as follows: The barrel, head, and plate are die-cast in one piece. A cotter safety pin passes through the barrel between the firing pin and the primer. (This cotter pin is removed after the safety nut has been threaded off. If the pin does not come out easily, the firing pin may have been released.) The trigger eye has been replaced by a removable ratchet reel, so that more accurate adjustment of the trip or tension wire is possible. A three-pronged trigger button is shipped with the device, which may be substituted for the regular trigger button. Actuating pressures for the Firing Device Mk 1 Mod 1 range from 11 to 16 pounds.

#### Combination Firing Device M1 (Obsolescent)

**General:** The Combination Firing Device M1 is designed for firing explosive charges either by means of a trip wire or by pressure. When the device is employed in the Anti-Personnel Mine M2 or M3, an igniter or blasting cap is attached to the base and the assembly is designated Fuze, Mine, M2; M2A1; M3; or M3A1.

**Description:** The principal parts of the device are the body, striker spindle, pressure cap, locking screw, release pin, and standard nipple base. The pressure cap is press-fitted onto the top of the striker spindle, which extends into the body and is under tension of the firing-pin spring. The striker spindle has a circumferential groove to receive the locking screw and release pin, and is drilled to receive the safety pin below the pressure cap. The base, containing the primer, has an extension to which an igniter or blasting cap may be attached.

**Modification:** Bending beyond seven degrees has caused the striker spindle to break at the

point of the groove. To correct this defect, later productions will have the safety pin  $\frac{1}{8}$  inch to  $\frac{3}{16}$  inch below the point of the assembled firing pin instead of through the top portion of the striker spindle.

**Anti-Personnel Mine M2:** When the Firing Device M1 is employed in this mine, an igniter is attached to the base and the assembly is designated Fuze, Mine, Anti-Personnel, M2. The Fuze M2 as modified with the safety pin below the striker spindle is designated Fuze, Mine, Anti-Personnel, M2A1.

**Anti-Personnel Mine M3:** When the Firing Device M1 is employed in this mine, a blasting cap is crimped to the base and the assembly is designated Fuze, Mine, Anti-Personnel, M3. The Fuze M3 as modified with the safety pin below the striker spindle is designated Fuze, Mine, Anti-Personnel, M3A1.

**Operation:** When the igniter or blasting cap has been attached to the base and inserted in the charge, the locking screw is backed off so that it is no longer engaged in the groove in the striker spindle. The safety pin is then removed. If the safety pin binds, it is quite possible that the release pin is not properly engaged in the groove in the arming spindle, and the device must be checked carefully. When the safety pin has been removed, the only thing preventing the striker spindle from being forced toward the percussion cap by its spring is the release pin, which is spring loaded inward. The device is now armed and can be fired either by pressure on the pressure cap or by pull on the release ring. If over 20 pounds of pressure is exerted on the cap, it will be sufficient to force the release pin out against its spring; if a pull of three to six pounds is exerted on the trip wire, the release pin will be pulled free of the groove in the arming spindle and the striker will be forced against the percussion cap by its spring.

**Remarks:** This firing device is used almost exclusively with the Anti-Personnel Mines M2 and M3.

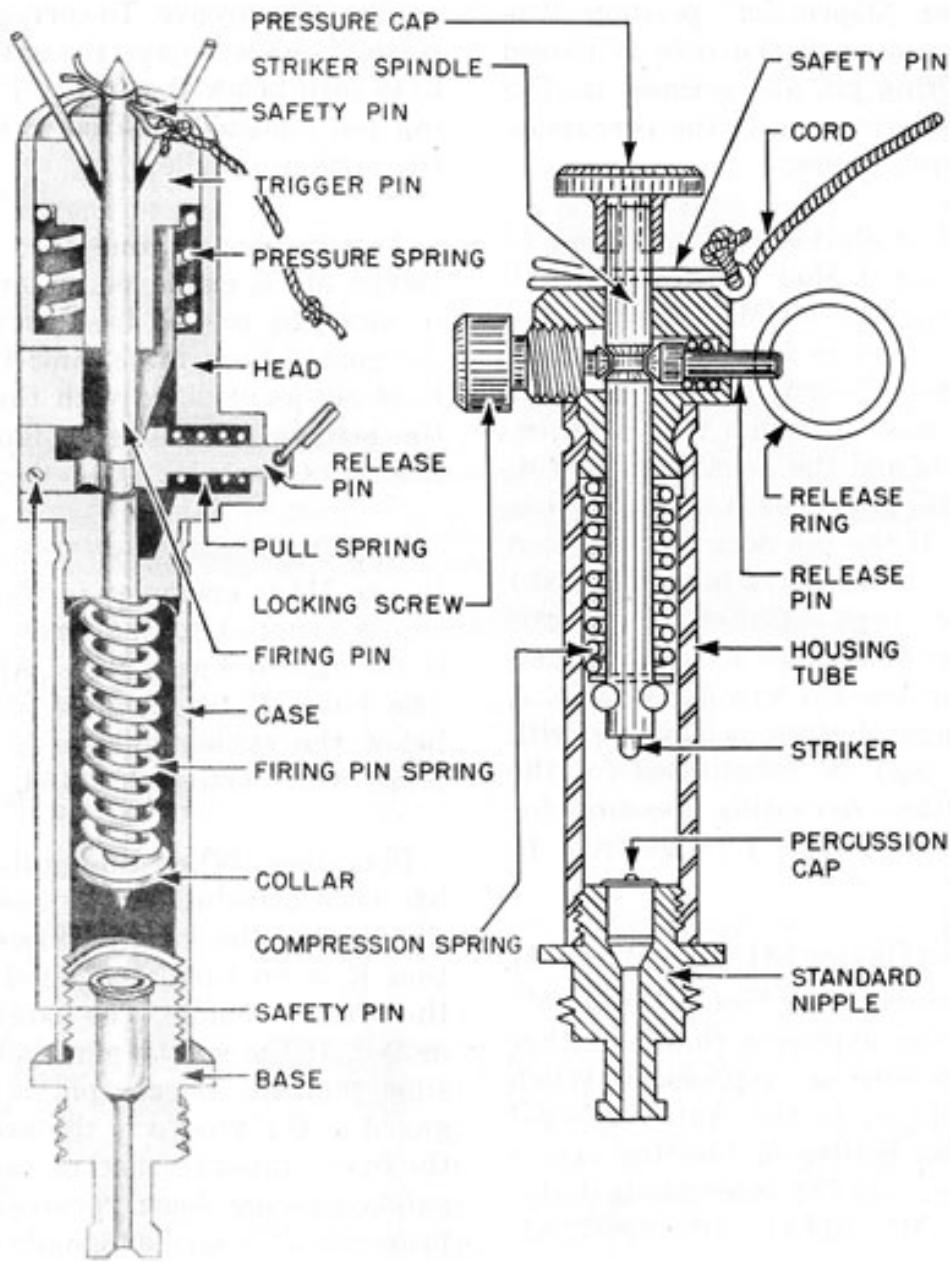


Figure 251. Combination Fuze M6 (left) and Combination Firing Device M1 (right)

### Combination Fuze M6 and M7

**General:** The combination fuses M6 and M7 are designed for firing explosive charges either by means of a trip wire or by pressure. The mechanical construction of the fuses is similar, but they differ in the loading of the base plug.

The M6 is 6.6 inches in length, and the threaded portion of the base is  $\frac{1}{2}$  inch long; the M7 is 7.13 inches in length, and the threaded portion of the base is  $\frac{1}{4}$  inch long. The igniter charge of the Combination Fuze M6 consists of 10 grains of black powder, while the detonator

of the M7 consists of a U. S. Army Special, Type A, blasting cap.

**Description:** The fuze consists of a head and case crimped together, which contain a trigger pin, a release pin, and a firing pin, each with a spring. A small groove in the firing pin is held in the narrow part of a keyhole slot in the release pin, the release pin being provided with a ring for attaching trip wires. The trigger pin has three one-inch-long prongs of stiff steel wire projecting from its head. A wedge is provided on the bottom of the trigger pin which

enters a slot in the release pin. When sufficient pressure is applied to one or more prongs, the release pin is moved aside and the firing pin passes through the large opening of the key-hole slot. Two safety pins are provided, one passing through the firing pin and the other passing through the release pin. The base is a hollow cylinder which contains the primer.

**Use:** The Combination Fuze M6 can be used in the Anti-Personnel Mines M2A1, M2A2, M2A3, or M2A3B2. The Combination Fuze M7 is used in the Anti-Personnel Mine M3.

**Operation:** When the fuze is armed, either

a pull on the release-pin ring of 6 to 10 pounds or a pressure of 10 to 20 pounds on the three prongs (10 to 30 pounds on one prong), depressing the trigger pin  $9/32$  inch, will move the release pin  $3/32$  inch, so that the larger hole is in line with the firing pin. The firing pin is thereby released, and the compressed firing-pin spring will drive the striker down on the percussion cap.

**Remarks:** The Combination Fuze M6 and M7 replaced the Combination Fuze M2, M2A1, M3, and M3A1 in the Anti-Personnel Mines M2 and M3 Series.

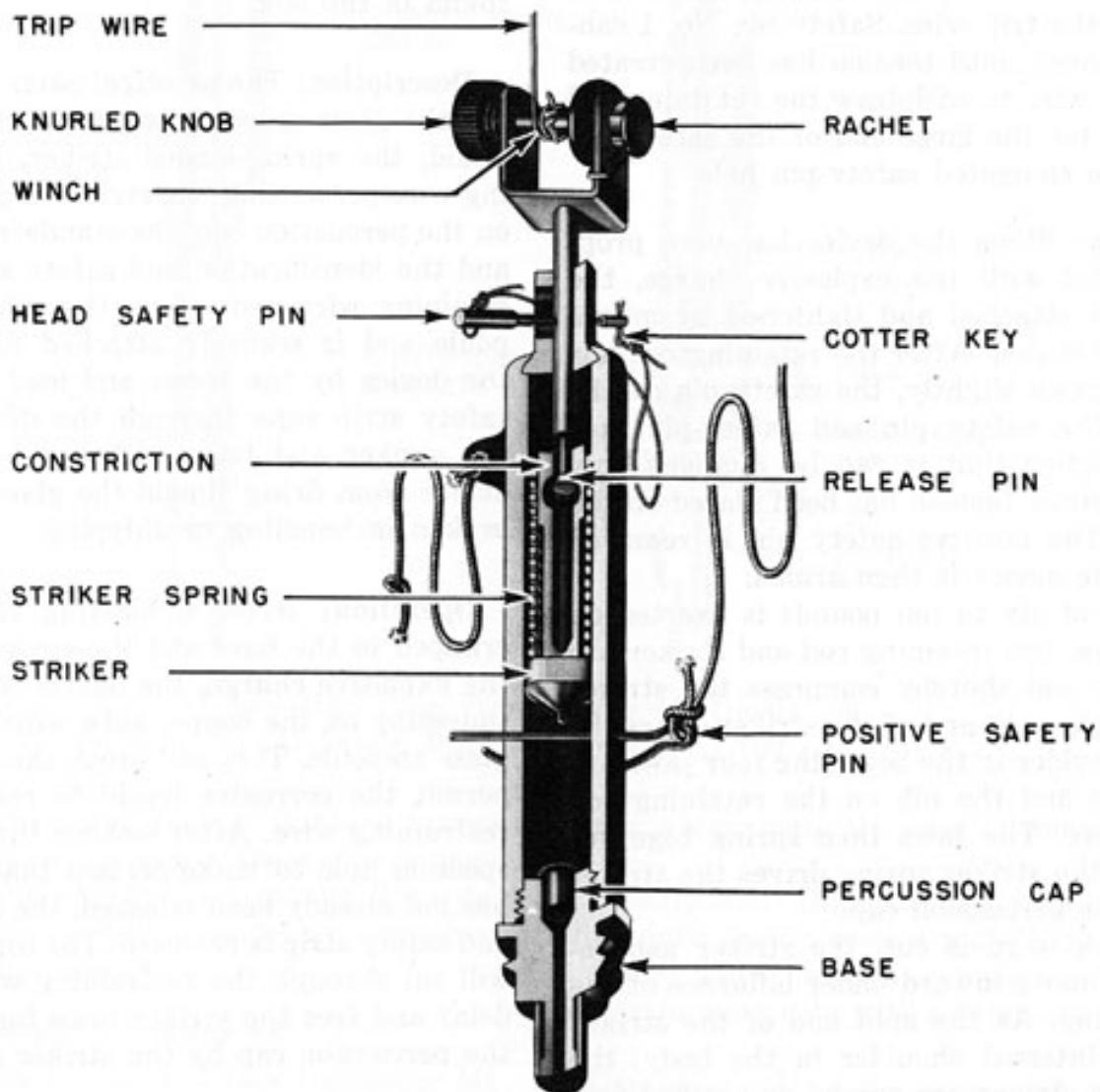


Figure 252. Tension and Release Device M3

### Tension and Release Firing Device M3

**General:** This device is specially designed to be used with a trip wire. Unlike the standard pull firing device, the Firing Device M3 must have the trip wire tightly stretched, so as to exert considerable tension on the retaining rod. The device can be activated by tripping, or by cutting the trip wire.

**Description:** The parts are the body, ratchet reel, retaining rod, striker spring, striker, two safety pins, and standard nipple base. The striker has a split base, forming four jaws which engage the nib on the end of the retaining rod. The ratchet provides a convenient method for tightening and creating the desired tension on the trip wire. Safety pin No. 1 cannot be removed until tension has been created on the trip wire to withdraw the retaining rod, sufficiently for the large end of the safety pin to clear the elongated safety-pin hole.

**Operation:** When the device has been properly installed with the explosive charge, the trip wire is attached and tightened by means of the ratchet reel. After the retaining rod has been withdrawn slightly, the safety pin can be removed. The safety pin and safety-pin hole are so designed that it can be removed only after the proper tension has been placed on the trip wire. The positive safety pin is removed last, and the device is then armed.

If a pull of six to ten pounds is exerted on the trip wire, the retaining rod and striker are pulled back and thereby compress the striker spring. As the split end of the striker clears the internal shoulder in the body, the four jaws are forced open and the nib on the retaining rod is pulled free. The jaws then spring together again, and the striker spring drives the striker down on the percussion cap.

If the trip wire is cut, the striker and retaining rod move inward under influence of the striker spring. As the split end of the striker clears the internal shoulder in the body, the jaws of the striker are spread and pulled free of the nib on the retaining rod by the striker spring, which then forces the striker down on the percussion cap.

**Remarks:** The device must be securely anchored to enable tension to be placed on the trip wire without dislodging the device or explosive charge.

### Delay Firing Device M1

**General:** This device is designed for firing explosive charges by chemical delayed action. They are issued in boxes of ten, with different delays. The delay depends on the concentration of the corrosive liquid in the glass ampoule, the color of the safety tab on each device indicating the delay of that device. In addition, the delay varies with the temperature. A chart with the temperature correction for each device will be found in the box.

**Description:** The principal parts of the device are the glass ampoule containing the corrosive liquid, the spring-loaded striker, the restraining wire preventing the striker from impinging on the percussion cap, the standard nipple base, and the identification and safety strip. The restraining wire runs along the side of the ampoule and is securely attached to the end of the device by the screw and lead washer. The safety strip runs through the device between the striker and base, and would prevent the device from firing should the glass ampoule be broken in handling or shipping.

**Operation:** After a blasting cap has been crimped to the base and the device inserted in the explosive charge, the device is actuated by squeezing on the copper tube which houses the glass ampoule. This will break the ampoule and permit the corrosive liquid to react upon the restraining wire. After looking through the inspection hole to make certain that the striker has not already been released, the identification and safety strip is removed. The corrosive liquid will eat through the restraining wire after the delay and free the striker to be forced down on the percussion cap by the striker spring.

**Remarks:** If it is absolutely necessary to disarm, insert the safety pin through the inspection holes.

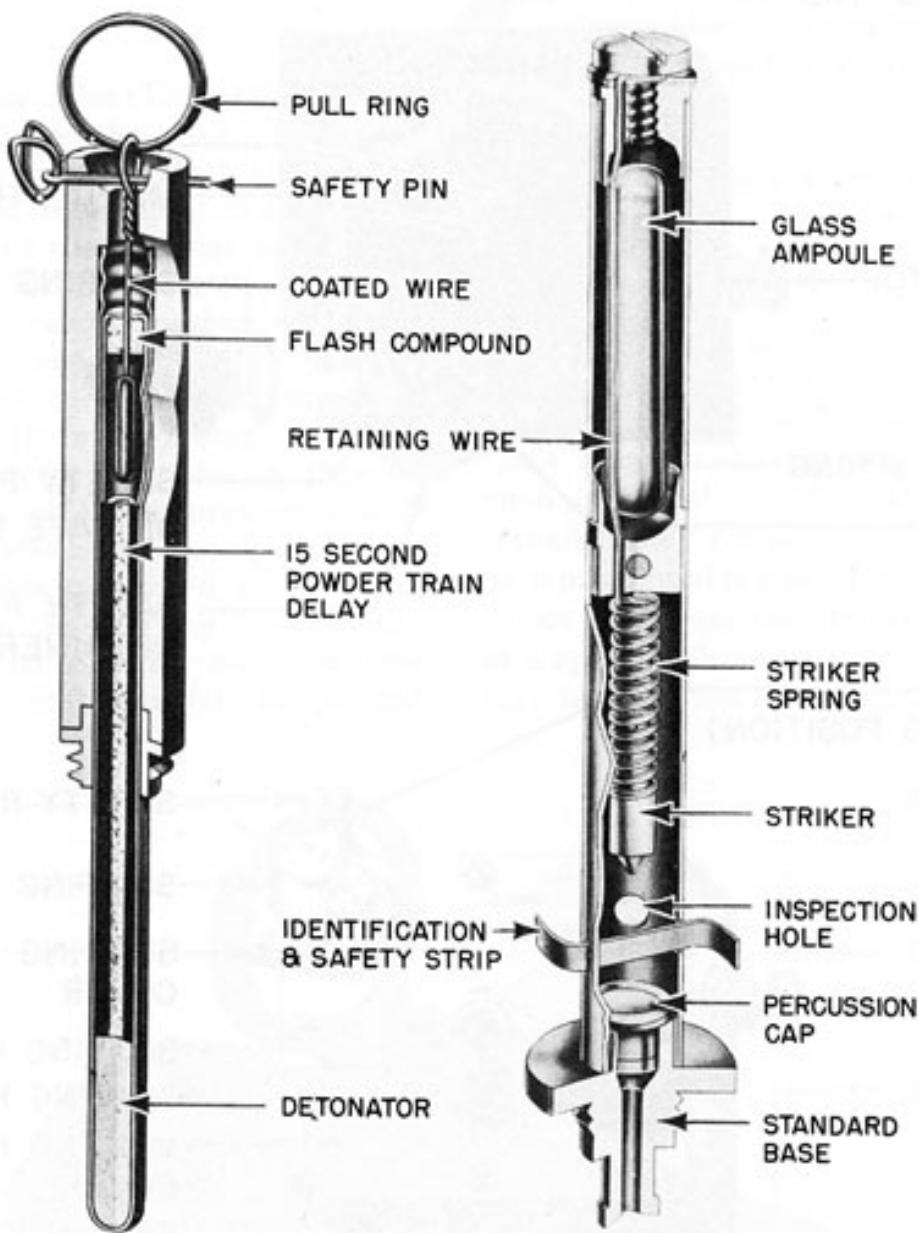


Figure 253. Delay Firing Device M1 (right) and 15-Second Delay Detonator M1 (left)

Troops must not approach an installed charge employing this delay fuze. Areas where they have been installed should be marked. Time delay starts when the tube is squeezed, not when the safety tab is withdrawn.

#### 15-Second Delay Detonator M1

**General:** The 15-Second Delay Detonator M1 does not use the standard nipple, nor is it used with a blasting cap. It is used to obtain delay in firing demolition charges, particularly during assault demolitions. It can be used to fire charges

under water, since the case is waterproof.

**Description:** This detonator consists of an olive drab plastic case, a pull ring attached to a coated pull wire, flash compound, and a powder-train delay tube with a detonator at the end.

**Operation:** When the safety pin is removed, a jerk on the pull ring draws the coated wire through the flash compound. The resultant flash ignites the powder-train delay, which sets off the detonator 15 seconds later.

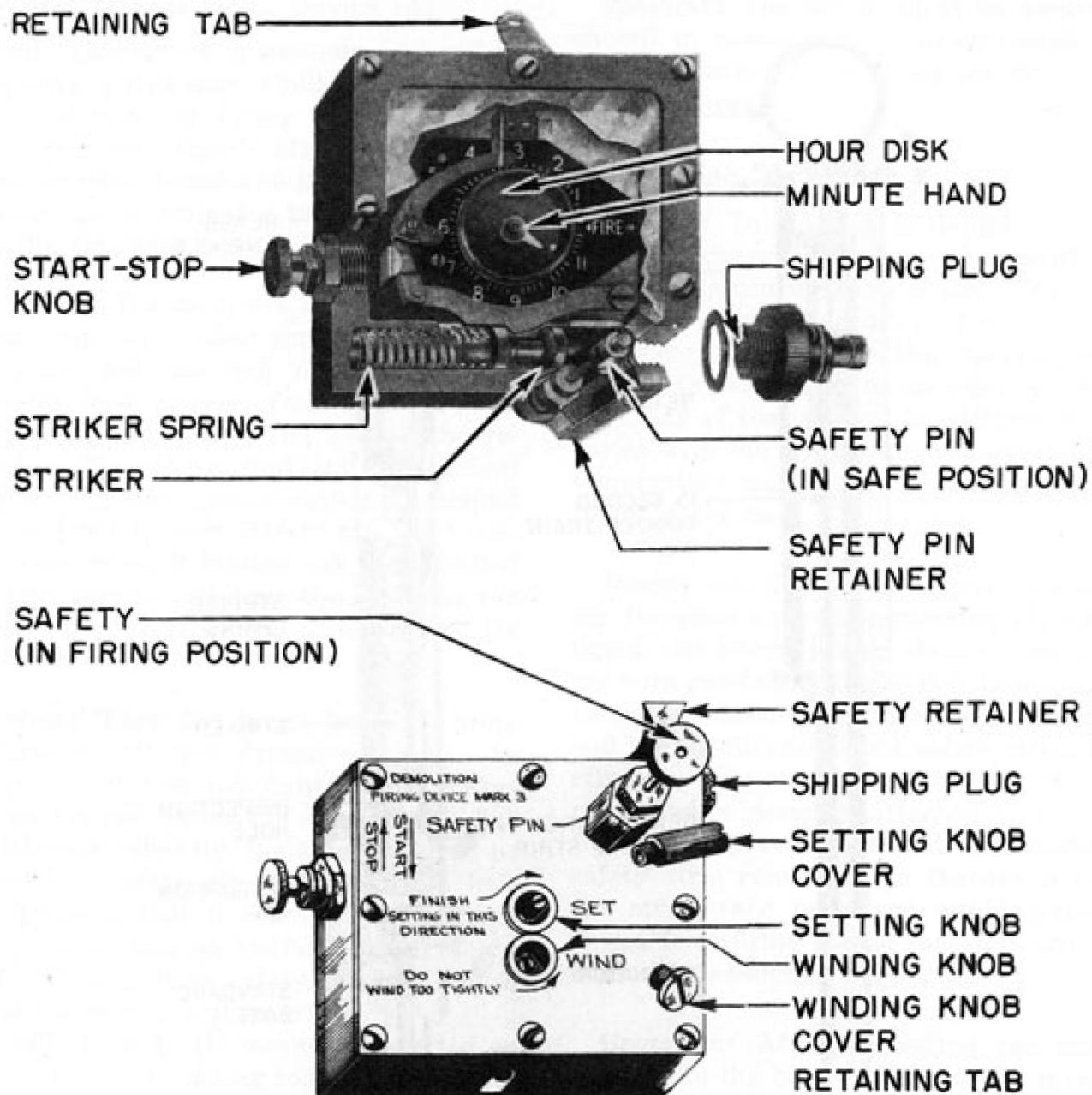


Figure 254. Demolition Firing Device Mk 3

**Remarks:** The pull ring should be jerked sharply. Once the pull ring has been jerked, there is no way to stop the detonator from exploding.

#### Demolition Firing Device Mk 3 (Obsolete)

Length, inches ..... 2.5  
 Width, inches ..... 2.37  
 Thickness, inches ..... 1.37

**Description:** Essentially, the Demolition Firing Device Mk 3 consists of an ordinary watch

movement in which the hour hand is replaced by a cup which is slotted on the outside rim, a release mechanism which carries a bar that rides on the edge of the cup so that the release mechanism will operate as soon as the bar can enter the slot, and a firing pin. The device is waterproof to a depth of 20 feet. Time delay is adjustable up to 11½ hours, with a minimum allowable setting of ten minutes. The luminous dial indicates the time remaining before the device fires; the luminous dot on the slotted cup coinciding with the number of remaining hours.

and the luminous hand indicating the number of remaining minutes.

**Installation and operation:** Unscrew the winding-knob cover and wind the clock in a normal manner. Unscrew the setting knob and set the clock to the desired time, observing the precaution that the clock should never be set for a delay of less than ten minutes. Check to see that the bar on the release mechanism is outside the rim of the cup and has not already slipped inside. Check to insure that the clock starter is completely in the "stop" position. Screw the blasting-cap firing device (Special non-electric, 11.01), which has previously been assembled to other articles such as booster, time fuse, demolition blocks, primacord, etc., onto the cap chamber. Turn the starting knob to the "start" position. Bend back the protective strip from the safety pin; pull the safety pin out and

lock it in place by turning the safety-pin knob counterclockwise as far as possible. The device will then fire when the remaining time has been used up.

**Precautions:** Time starts running out the instant the clock is started; therefore, do not set the clock for less than ten minutes. Excessive delay in pulling the safety pin after the clock is started will not allow a sufficient margin of safety for getting away. Do not attempt to reset the clock without having the safety pin in the "safe" position and without having the starting knob in "stop" position. Until the device is actually ready for use, the shipping plug must be kept screwed in place. Premature firing of the device will cause the striker to be thrown out at a speed sufficiently high to cause serious injury to personnel and equipment.

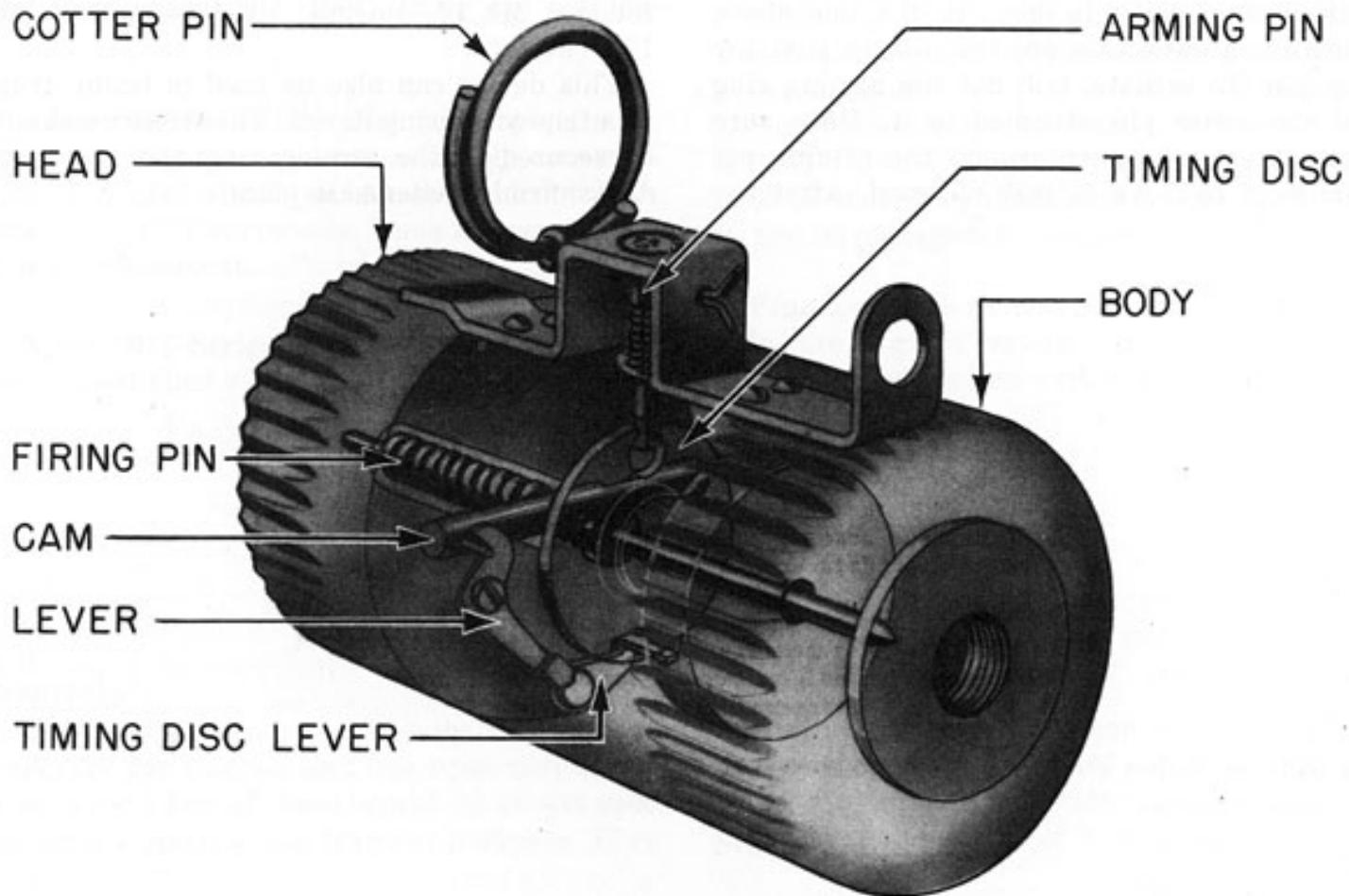


Figure 255. Demolition Firing Device Mk 15 Mod 0

## Demolition Firing Devices Mk 15 Mod 0, Mk 12, and Mk 13

**General:** These devices are clockwork mechanisms designed to fire demolition charges with a time delay, adjustable—depending upon the model—from five seconds to eleven hours. They are designed for firing either activator-well, or detonating-cord charges.

**Description:** The principal parts of this series are the body, head, timing disc, timing-disc lever, cam, firing pin, arming pin, and cotter pin.

**Setting and actuation:** The Mk 12 may be set from 5 to 90 seconds delay; Mk 13, from 1 minute to 1 hour delay; Mk 15, from  $\frac{1}{4}$  to 11 hours delay. Because the Mk 15 is as much as 30% inaccurate for settings beneath one hour, these calibrations are coated with red paint as a warning.

To set, turn the head of the device until the desired time delay is opposite the line above "Delay in Hours." Do not try to turn past the stop pin. To actuate, pull out the arming ring and the cotter pin attached to it. Make sure there is enough space around the arming pin to allow it to move  $\frac{3}{8}$  inch outward. After the

device is actuated, it cannot be stopped.

**Operation:** When the cotter pin is removed, the spring-loaded arming pin moves out of the notch in the timing disc. The timing disc, driven by a pre-wound clock movement, can then revolve until the notch meets the timing-disc lever. The lever position and, therefore, the elapsed time, is changed by rotating the head to the desired time setting. A spring-loaded firing pin, positively locked in place by a series of cams and levers, is released when the timing-disc lever enters the notch. The firing pin penetrates the waterproof diaphragm and fires the percussion cap. The flash of flame which results will detonate the Special Non-electric Cap or the Detonating Cord Initiator Mk 2 Mod 0.

**Remarks:** Tabs have been placed under the screws fastening the head to the body, to make possible identification by feel in the dark, as follows: Mk 12—no tab; Mk 13—one tab; Mk 15—two tabs.

This device can also be used in booby traps as a trip-wire firing device. The trip wire should be secured to the arming ring and the firing device firmly fastened in place.

## Part 6

# BOMBS AND BOMB FUZES

## Chapter 17 — EXPLOSIVE BOMBS

### Section 1 — INTRODUCTION

#### Classification

In this chapter, the bombs have been categorized according to the series in which they were developed. The fundamental characteristics of each series are as follows:

**Army "Modified Mark" Series:** Streamlined and filled with 100% TNT. These are now obsolete.

**Army "M" Series:** Parallel sides, ogival nose, and boat tail; box type-tail assembly construction; and filled with 50/50 Amatol sealed at both ends with TNT surrounds. Some are now classified as obsolescent.

**Navy "Mk" Series:** Similar to design of Army bombs and filled with 100% TNT; discontinued,

with some exceptions, under the standardization program.

**Army-Navy "AN" Series:** Similar to the "M" Series, except: (1) third suspension lug added at center of gravity and 180° removed from other two lugs, and (2) base plate changed to the male type.

Since the development of the "AN" series, there have been two further modifications of the general-purpose (G.P.) bombs within that series, successively the "AN-G.P." and "AN-G.P.A1" modifications. The changes characteristic of these two modifications are dealt with in the introduction to Section 5.

**Practice bombs:** These dummy and special designs are of great variety and have probably received more attention with the advent of peace.

### Part 6 — Chapter 17 — Section 2

## ARMY "MODIFIED MARK" SERIES (OBSOLETE)

#### General

This particular series of bombs was not satisfactory for war use and has been abandoned, except for a few of these bombs which are used for target practice and training purposes. They

are all of the same type and are intended for the same target use, general bombardment. The accompanying chart contains the essential data concerning the bombs of this series.

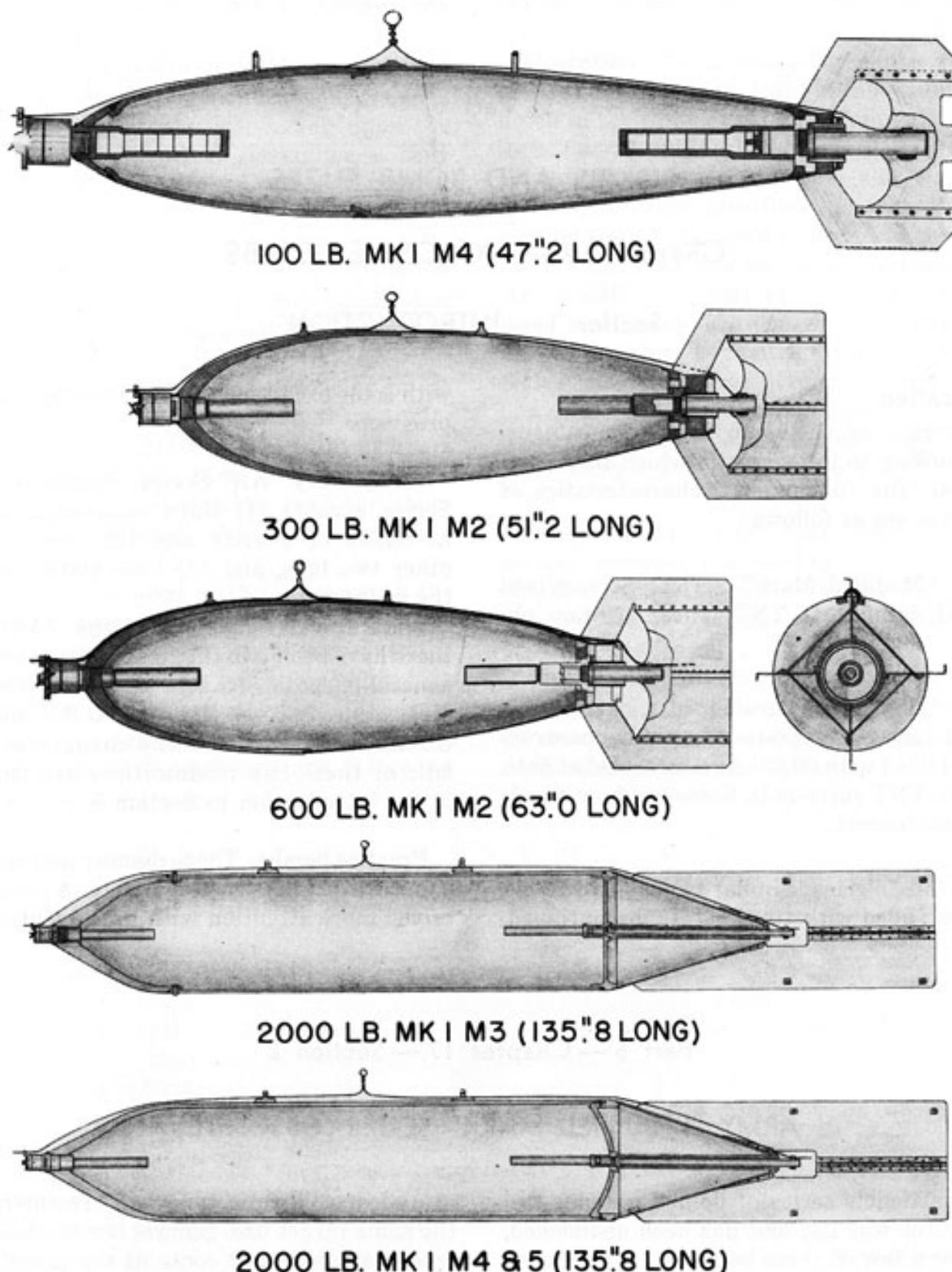


Figure 256. Army "Modified Mark" Series Bombs

**EXPLOSIVE BOMBS ("MODIFIED MARK" SERIES—OBSOLETE)**

**U. S. ARMY "MODIFIED MARK" SERIES BOMBS**

Bombs	100-lb. Mk I MIV	300-lb. Mk I MII	600-lb. Mk I MIII	1,100 lb. Mk III MI	2,000-lb. Mk I MIII & MIV	2,000-lb. Mk I MV			
<b>Fuzes</b>	Nose: M105			Tail: M106					
Overall length	47.2"	51.2"	63.0"	68.5"	135.8"				
Length of body	39.5"	40.6"	52.2"	61.6"	97.0"				
Body diameter	7.9"	12.2"	16.5"	20.8"	18.5"				
Wall thickness	0.16"	0.12"	0.2"	0.15"	0.50"				
<b>Wall material</b>	Steel								
Length of tail	8.5"	12.0"	14.0"	33.5"	49.2"				
Width of tail	11.0"	15.0"	20.5"	28.5"	26.1"				
Material of tail	Sheet steel			Sheet steel with cast-steel tail cone					
Weight of tail	2.6#	6.1#	5.0#	55.0#	140.0#				
Type of filling	Cast TNT								
Weight of filling	65.0#	148.0#	355.0#	650.0#	960.0#				
Total weight	119.4#	285.9#	611.0#	1175.0#	1920.0#	1830.0#			
Charge/weight ratio	54.5%	52.0%	58.0%	55.3%	50.0%	52.4%			
<b>Body construction</b>	Streamlined body formed by welding three cast-steel sections together			Cast-steel nose riveted to seamless steel tubing; rear not tapered	Seamless steel tubing				
<b>Tail construction</b>	A cast-steel sleeve secured to body by a fin locking nut; four fins or vanes; internal box-type struts			Four vanes with bar struts, attached to body by screws	Four vanes riveted to tail cone; two sets of external bar struts to reinforce vanes; cone secured to flange on base plate				
<b>Construction of suspension</b>	Two U-shaped bar-steel eyebolts welded to body along longitudinal axis			Two U-shaped eyebolts on plates secured to body by cap screws					
<b>Type of suspension</b>	Horizontal								
<b>Color and markings</b>	Prior to March 11, 1942, these bombs would have been yellow all over with black manufacturers' markings; but since that date will be olive-drab with one-inch yellow bands around nose and base and a $\frac{1}{4}$ -inch band around center of gravity.								

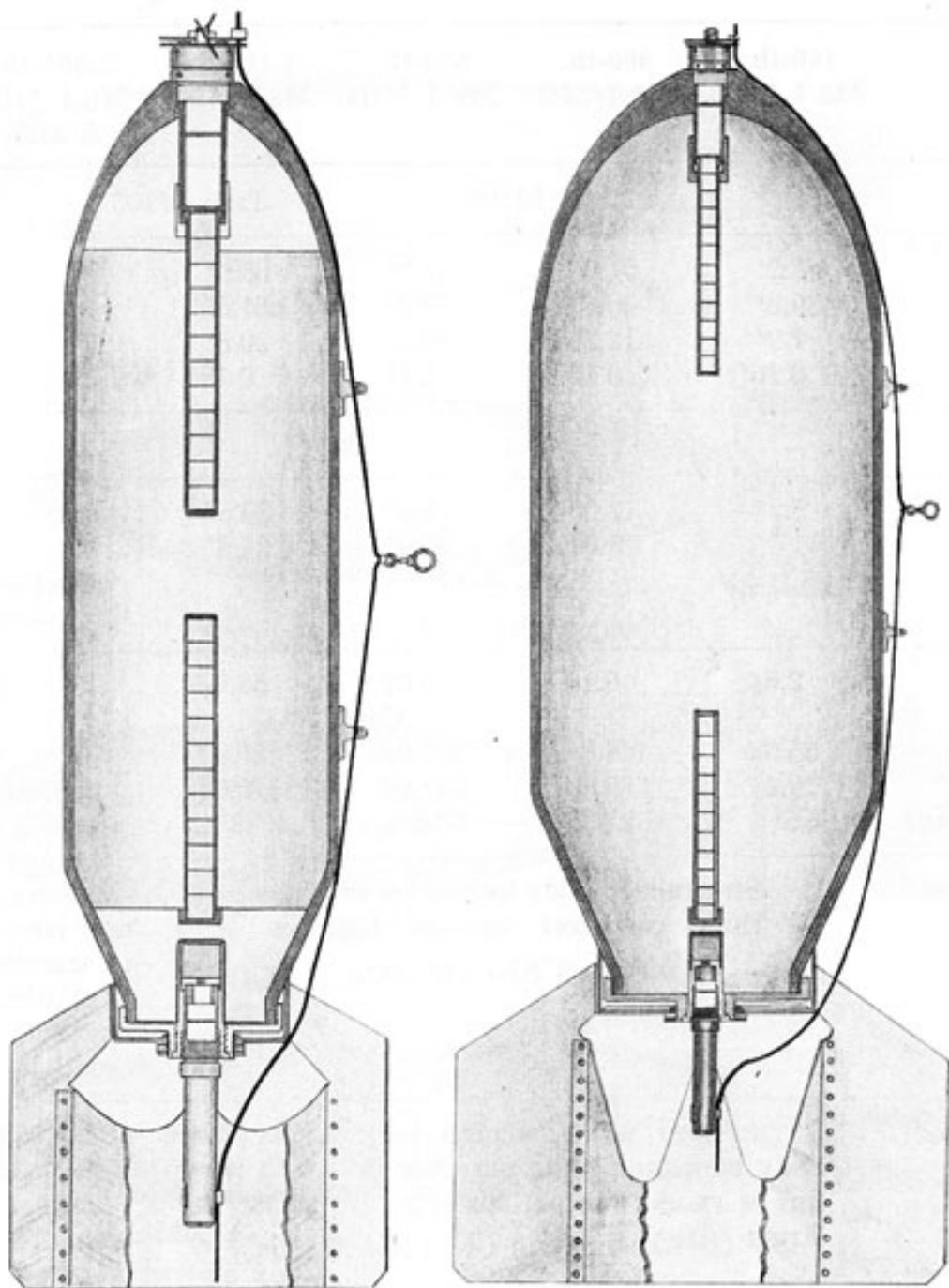


Figure 257. "M" Series Demolition Bombs—600-pound M32 (left) and 1,100-pound M33 (right)

## "M" SERIES

## Introduction

Prior to the organization of the AN Standardization Board in 1941, these bombs were designated as "Demolition H.E." bombs; under the standardization policy they were retitled as "General-Purpose High-Explosive (G.P.H.E.)" bombs.

**Targets:** Ammunition dumps, railway engines, and cars, all types of construction, and aircraft on the ground.

**Body construction:** These bombs may be made by any one of the following methods: (1) From seamless steel tubing in which the nose of the bomb is formed by swaging and the tail by drawing to the necessary diameter; or (2) the case may be forged in one piece; or (3) it may be formed from cast sections welded together. These bombs have female base filling plates.

**Type of suspension:** Horizontally, by dual lugs.

**Construction of suspension lug:** Two eyebolts welded to body along the longitudinal axis of the bomb. The eyebolts are formed from bar steel, shaped in the form of a U, and then welded to the body.

**Color and markings:** Prior to 11 March, 1942, these bombs would have been painted yellow all over, with black manufacturer's markings; since that date they have been painted olive drab with a one-inch yellow band around the nose and

base and a  $\frac{1}{4}$ -inch band around the center of gravity.

**Material of tail:** Sheet steel.

**Tail construction:** This type of tail consists of the following parts: (1) a cast-steel sleeve secured to the body of the bomb by a fin-locking nut; (2) four fins or vanes; and (3) internal box-type struts. One vane and one strut are pressed from one piece of metal, and the four pieces are welded to one another and to the sleeve.

**Type of filling:** (1) 50/50 Amatol. Since Amatol is hygroscopic, TNT surrounds are placed around the nose and tail booster sleeves to seal the Amatol from moisture; (2) 100% TNT, which will be stencilled on the bomb. All of this series except the 100-pound M30 contain two built in Auxiliary Boosters M104, one in the nose and one in the tail, which contain tetryl. The 100-pound M30 has the auxiliary booster in the nose only. The Adapter Booster M102 (tetryl) is threaded to the base plate of all bombs in the series and receives the tail fuze.

Other bombs that carry an "M" designation, although not actually classified in the "M" series, are included in this section because they are obsolescent:

M62 .....	600-pound.....	A.P.-H.E.
M61 .....	800-pound.....	A.P.-H.E.
M60 .....	900-pound.....	A.P.-H.E.
M52 .....	1,000-pound.....	A.P.-H.E.
M63 .....	1,400-pound.....	A.P.-H.E.
M5 .....	30-pound..	Frag. (Obsolete)

## "M" SERIES DEMOLITION

Bombs	100-lb. M30	300-lb. M31
Over-all length	36.0"	48.6"
Length of body	30.0"	40.2"
Diameter of body	8.2"	10.9"
Thickness of wall	0.16"	0.27"
Length of Tail	9.75"	12.1"
Width of tail	11.0"	14.9"
Weight of tail	3.5#	6.0#
Filling	Amatol 50/50	TNT 50/50
Weight of filling	53.3#	54.0#
Total weight	106.3#	272.5#
Charge/weight ratio	50.1%	49.4%
Fuzing		These bombs take the Fuze M103 in the nose

"M" A.P.-H.E. BOMBS  
ARMOR-PIERCING (Obsolete)

Bombs	M62 600-lb.	M61 800-lb.	M60 900-lb.	M52 1,000-lb.	M63 1,400-lb.
Over-all length	62.1"	58.7"	61.7"	70.9"	69.1"
Length of body	46.9"	38.6"	41.3"	50.0"	45.7"
Diameter of body	10.1"	12.4"	12.2"	12.3"	14.3"
Wall thickness	—	—	—	2.3"	—
Length of tail	17.5"	22.7"	22.76"	22.76"	24.0"
Width of tail	13.8"	16.6"	16.6"	16.6"	19.6"
Weight of tail	15.12#	22.4#	22.4#	21.0#	—
Filling	Explosive D	Explosive D	Explosive D	Explosive D	Explosive D
Weight of filling	33.61#	32.68#	43.34#	58.35#	35#
Total bomb weight	634.0#	853.0#	889.0#	1,077.0#	1,412.0#
Charge/weight ratio	5.5%	3.8%	4.8%	5.4%	2.5%

## BOMBS (Obsolescent)

600-lb. M32		1,100-lb. M33		2,000-lb. M34	
59.5"		68.7"		90.4"	
49.5"		54.7"		70.0"	
15.2"		19.8"		23.3"	
0.35"		0.43"		0.5"	
13.9"		18.5"		25.7"	
20.4"		27.0"		31.6"	
12.6#		22.5#		38.6#	
Amatol	TNT	Amatol	TNT	Amatol	TNT
50/50		50/50		50/50	
319.3#	336.0#	588#	618#	1,061#	1,077#
586.5#	621.0#	1,111#	1,141#	1,971#	1,987#
54.4%	54.1%	52.9%	54.1%	53.8%	54.7%

and the Fuze M106 in the tail.

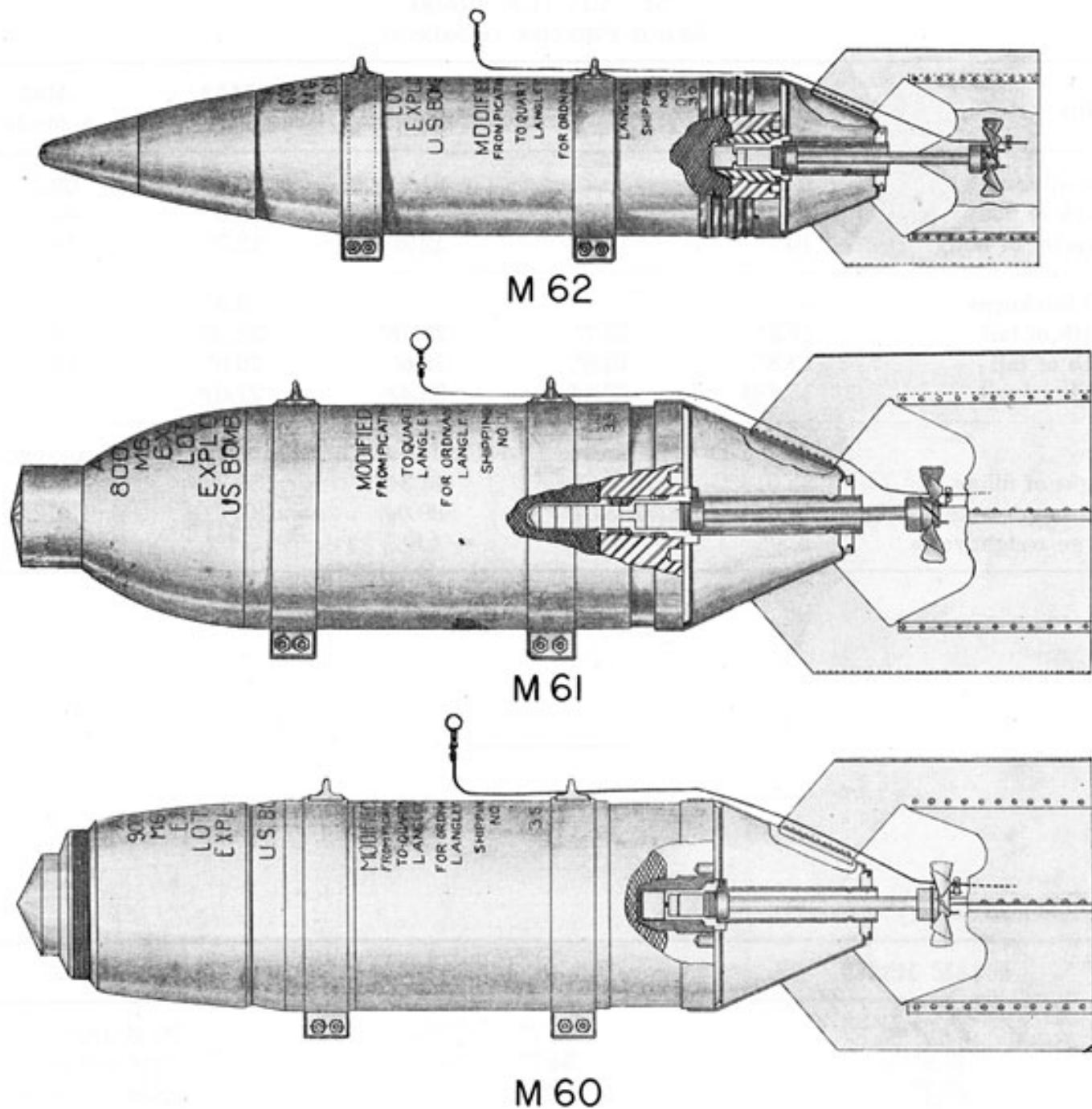


Figure 258. "M" Series A.P. Bombs

### Characteristics of "M" Designated A.P. Bombs

**Target:** Armored naval craft, reinforced concrete, heavy steel construction.

**Fuzes:** M102 or AN-M102, including A1 and A2 modifications.

**Body construction:** These bombs are converted seacoast artillery shells from which the

rotating bands may have been removed. The cases are single-piece steel forgings. The modifications of the M52 and M62 differ only slightly in external dimensions and are all equipped with a nose cap for streamlining.

**Construction of tail:** A truncated tail cone is secured to the bomb base by a locking nut at the top of the fuze body; four fins or vanes are supported by internal box-type struts.

**30-pound Frag. M5 (Obsolete)**

Over-all length, inches .....	25.5
Body length, inches.....	13.05
Body diameter, inches.....	4.2
Wall thickness, inch.....	0.6
Tail width, inches .....	6.5
Type of filling.....	TNT
Weight of filling, pounds.....	4.66
Total weight, pounds.....	29.8
Charge/weight ratio.....	16.3%
Fuzing .....	Mk XIV

**Body construction:** The body consists of a seamless steel tube over which are fitted rings cut from cast-steel pipe. Cast-steel nose and base pieces thread onto this center tube.

**Suspension:** The bombs may be suspended horizontally, vertically, or in a cluster. U-shaped eyebolts are welded to the bomb at the center of gravity and to the rear of the tail. Later issues of bombs were in the Cluster M3, which contained six 30-pound Frag. Bombs M5.

**Tail construction:** Four rectangular sheet-steel vanes are welded to a length of one-inch cast-iron pipe that screws into the base filling plug.

**2,000-pound S.A.P. M103**

Over-all length, inches.....	89.29
Body length, inches.....	68.5
Body diameter, inches.....	18.63
Wall thickness, inches.....	1.3
Tail length, inches.....	25.6
Tail width, inches.....	25.8
Tail weight, pounds.....	52.7
Filling .....	Picratol
Weight of filling, pounds.....	556
Total weight, pounds.....	2,039
Charge/weight ratio .....	27%

**Fuzing:** Unlike smaller S.A.P. bombs, the M103 has a solid nose, permitting tail fuzing only.

REGULAR MISSIONS—AN-M102A2, AN-M102A1, M162.

SPECIAL MISSIONS—M114, M114A1, M117 (minimum altitude bombing), M125, M125A1 (long delay), M134.

**Construction:** The body of the M103 is fabricated from seamless steel tubing, somewhat streamlined in shape and with a semi-pointed nose. No provision is made for nose fuzing in this bomb. Suspension lugs are welded to the case in a manner similar to the G.P. bombs. Trunnions on a band may be fitted for dive-bombing. A box-type tail is employed as on the G.P. bombs.

**Filling:** Picratol, a mixture of 52% Explosive "D" and 48% TNT, is poured as the main charge, with a wax pad in the nose to cushion the explosive against premature detonation on impact with a hard target. The Adapter Booster M115A1 replaces the M102A1 fitted in the S.A.P. Bombs AN-M58 and AN-M59.

**Remarks:** The suspension lugs are 30 inches apart. Suspension bands are under development and will be issued, when available, for installations requiring 14-inch suspension.

**4-pound Frag. "Butterfly" M83**

Over-all length, inches.....	3.0
Body length, inches .....	3.0
Body diameter, inches .....	3.1
Wall thickness, inch.....	0.25
Filling .....	TNT
Weight of filling, pound.....	0.47
Total weight, pounds.....	3.2
Charge/weight ratio .....	15%

**Fuzing:** M129 Air or ground burst, M130 Time, maximum 30 minutes, or M131 Anti-disturbance.

**Body construction:** The bomb body is cylindrical in shape, cast in two halves and welded together. The fuze cavity is situated athwartships in the body, is  $1\frac{3}{4}$  inches in diameter, and is threaded with a left-hand thread. The left-hand thread is to prevent unscrewing of the fuze while the bomb is in flight.

**Arming vane assembly:** The vane assembly consists of four pieces hinged together—two semi-cylindrical surfaces (wings) and two discs (propeller blades) inclined at a slight angle.

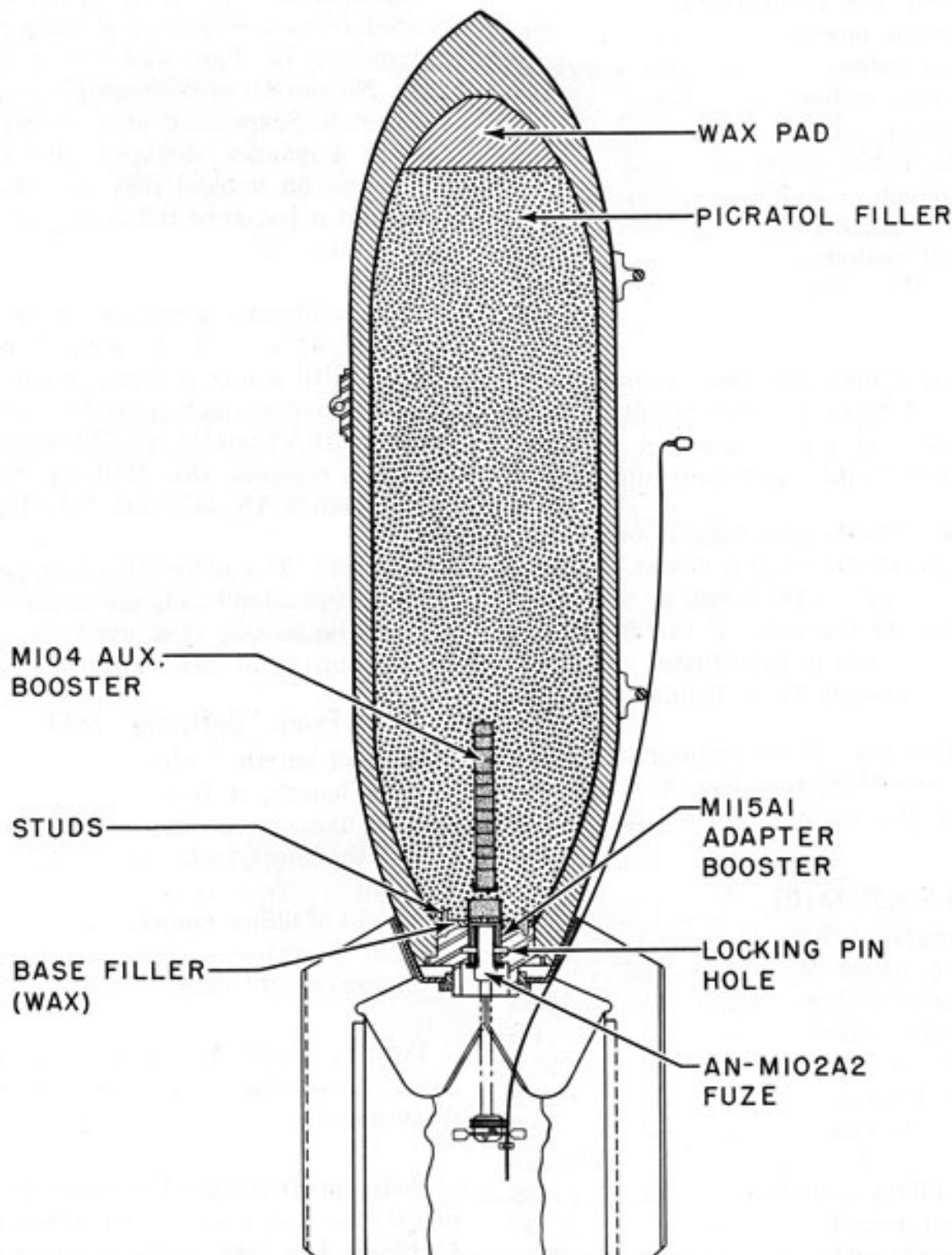
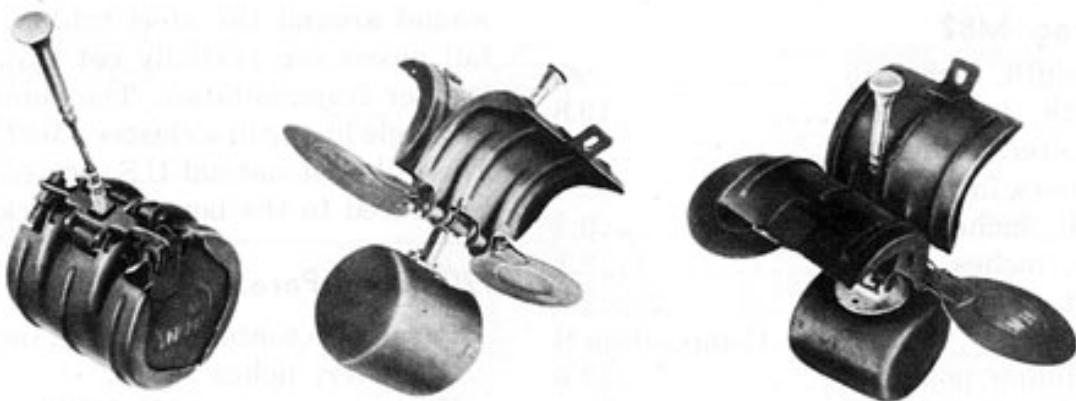


Figure 259. 2,000-pound S.A.P. Bomb M103

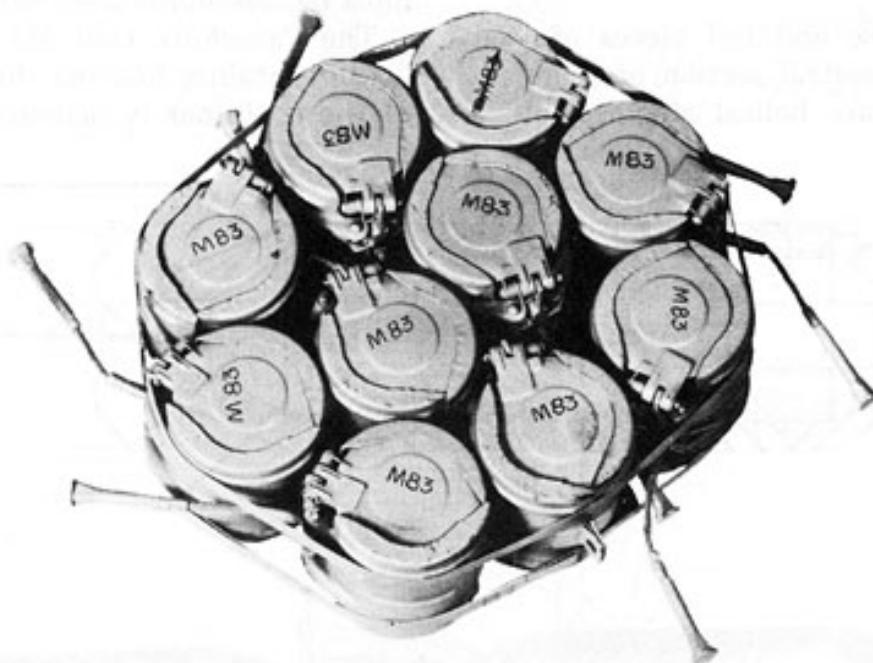
While the bomb is still in the cluster, the vane assembly is folded around the bomb to form a cylindrical casing which can be closed against the pressure of the vane coil springs by means of a safety clip. The arming spindle projects through the bomb casing.

When the bombs are packed in the cluster adapter, the safety clips are removed but the bombs remain in their closed status because of their proximity to each other. When the cluster adapter bursts open, the bombs scatter and the vane assembly on each bomb is spread open by



CLOSED

OPEN



WAFER CLUSTER

Figure 260. 4-pound Frag. "Butterfly" Bomb M83

the force of its coil springs. The vane assembly is forced by air resistance to the top of the arming spindle, where the square head on the spindle engages the square hole in the assembly. The two wings reduce the velocity of descent of the bomb. The two propellers, being set at angles to each other, cause the vane assembly to turn in a counterclockwise direction, thereby

screwing the arming spindle out of the fuze body and permitting the fuze to arm. The arming spindle is not completely withdrawn from the fuze, being retained in the fuze by a collar on the spindle.

**Markings:** The bombs are painted olive drab, with a half-inch yellow band running horizontally around the folded wings.

**90-pound Frag. M82**

Over-all length, inches .....	28
Body length, inches.....	19.8
Body diameter, inches .....	6
Wall thickness, inch.....	0.94
Tail length, inches.....	9.3
Tail width, inches .....	8.1
Tail weight, pounds.....	2.8
Filling .....	Composition B
Weight of filling, pounds.....	12.0
Total weight, pounds.....	91.6
Charge/weight ratio .....	13.1%

**Fuzing:** M103, AN-M103, AN-M103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, M140, AN-M140A1, M149, M163, M164, M165, M166, T82.

**Construction:** Nose and tail pieces of cast steel screw onto a central section of seamless steel tubing. A square helical steel spring is

wound around the steel tubing. The nose and tail pieces are partially cut through, to afford greater fragmentation. The bomb is suspended by single lug or in a cluster (M27) of six bombs. The tail is of normal U.S. box construction and is secured to the bomb by a locking ring.

**120-pound Para.-Frag. M86**

Parachute container length, inches.....	35.5
Diameter, inches .....	6.5
Fuzing .....	AN-M120 or AN-M120A1

**Description:** The M86 consists of the 90-pound Fragmentation Bomb M82, and a Parachute Unit M5 which is screwed to the base of the bomb body in place of the normal tail fin assembly. Both units are issued separately and must be assembled prior to use.

The Parachute Unit M5 consists of a cylindrical container housing the parachute. The lid of the container is fastened by a latch, which

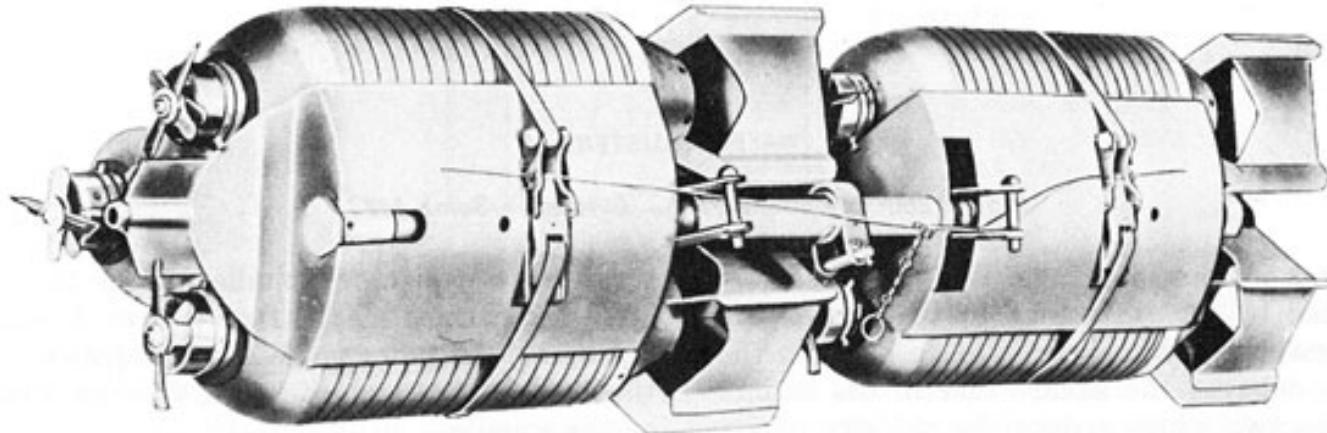
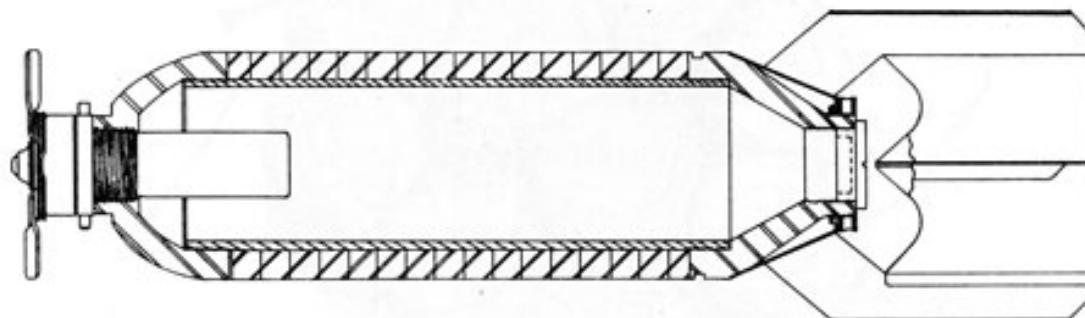


Figure 261. 90-pound Frag. Bomb M82

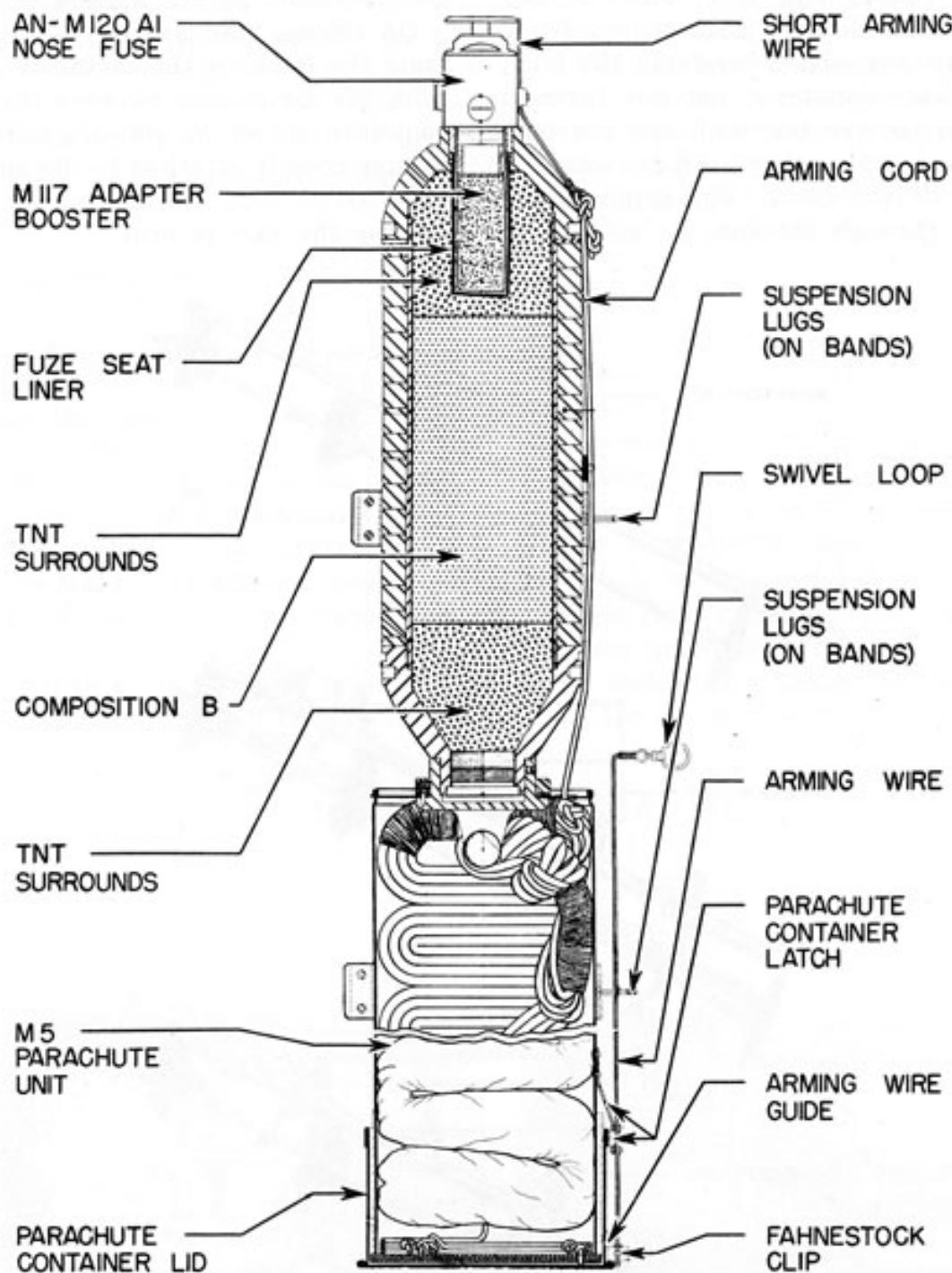


Figure 262. 120-pound Para-Frag. Bomb M86

is secured by the arming wire.

The bomb is fuzed with the Fuze AN-M120 or AN-M120A1 by using the Adapter Booster M117.

**Suspension:** The bomb can be used in a bomb station having the clearance of a 500-pound bomb, and may be suspended singly or as a two-

bomb cluster with the Cluster Adapter M12. One suspension lug is welded to the bomb at the center of gravity, and two suspension bands are issued with the parachute unit. The larger-diameter band is secured on the parachute unit to be used in conjunction with the suspension lug or the smaller-diameter band secured on the bomb body.

**Operation:** The arming wire, which is fastened to the bomb shackle, passes through the lug of the rear suspension band and the latch on the parachute container, but not through the fuze. This secures the latch and prevents the parachute from opening until immediately after release of the bomb. The arming wire which passes through the fuze is fastened to

the parachute by the arming cord.

On release, the arming wire is withdrawn from the latch on the container. As the bomb falls, the air stream removes the lid from the container and allows the parachute to open. The arming cord is attached to the shroud line and is pulled as the parachute opens, thereby permitting the fuze to arm.

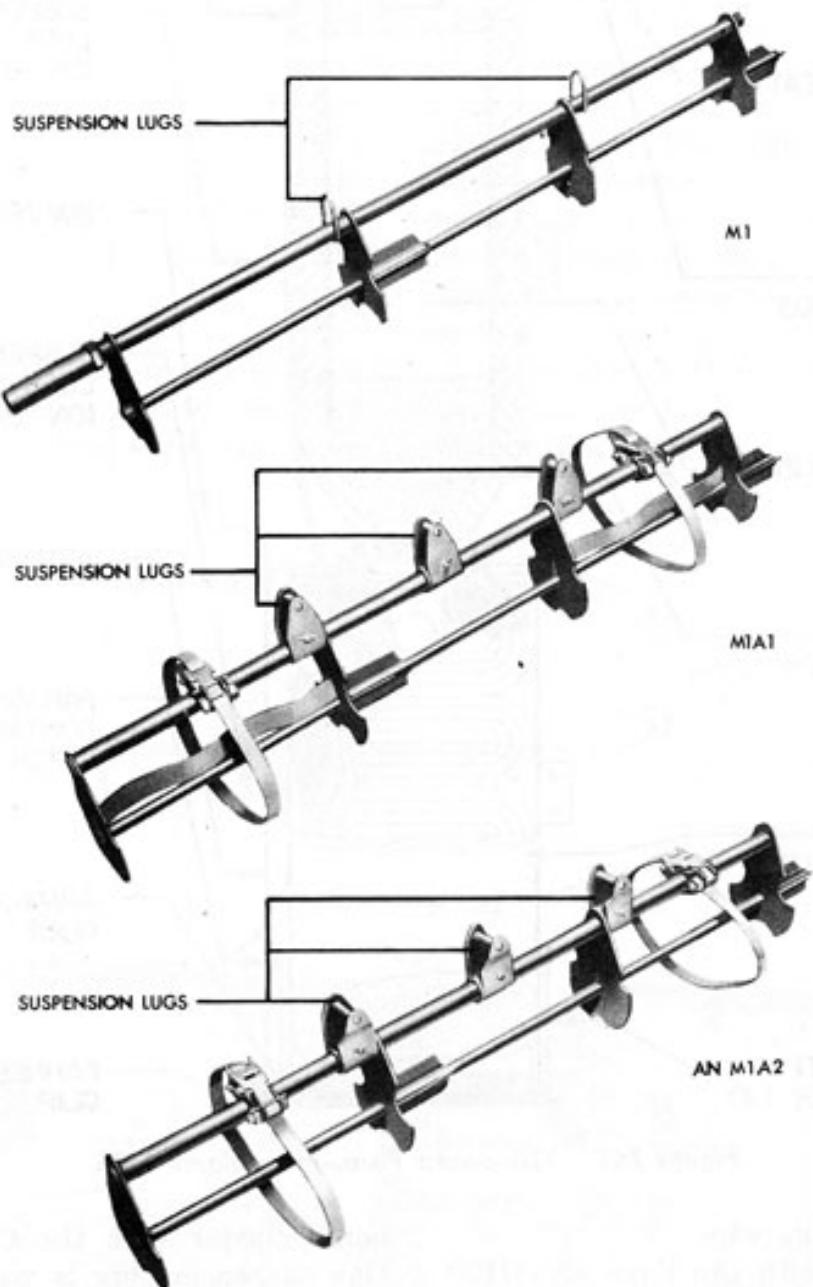


Figure 263. Cluster Adapters M1, M1A1, and M1A2

### Fragmentation Bomb Clusters

**M1—Adapter M1:** 100-pound size for six 20-pound Frag. Bombs AN-M41. It is 46.75 inches long and weighs 125 pounds. It has lugs for double-hook suspension only. The release mechanism operates by means of a cartridge and firing mechanism.

**M27—Adapter M14:** 500-pound size cluster for six 90-pound Frag. Bombs M82. The adapter consists of two longitudinal steel tubes, 56 inches long, to which are welded four steel plates forming the support for the six bombs. The lower tube serves as the backbone of the cluster; and the upper tube carries the suspension lugs, the buckles for the releasing straps, and the adapters for the nose and tail fuzes. The Nose Fuze M111A2 or M155 is used; however, there is no mechanical time fuze in the tail.

The cluster may be adjusted to release the bombs immediately or, through the use of me-

chanical time fuzes, to discharge the bombs 5 to 92 seconds after the release of the cluster from the plane. If it is intended that the cluster is to open immediately, the shear wire is cut after the arming wire is installed, and no fuze is used. The immediate opening of the cluster produces the most favorable impact pattern. The cluster must open at a minimum altitude of 1,000 feet in order that the bomb fuze may arm.

**M28—Adapter M15A1:** 100-pound size for twenty-four 4-pound Frag. Bombs M83. It is a cylindrical sheet-metal case, which opens longitudinally, being hinged at the rear and closed by a nose cup. It is 47.35 inches long and 8 inches in diameter, and weighs 155 pounds loaded. It uses Fuze M155 or AN-M146.

These clusters are released from altitudes of not less than 3,000 feet and not more than 5,000 feet. Fuze settings for function after release are varied from five seconds at minimum

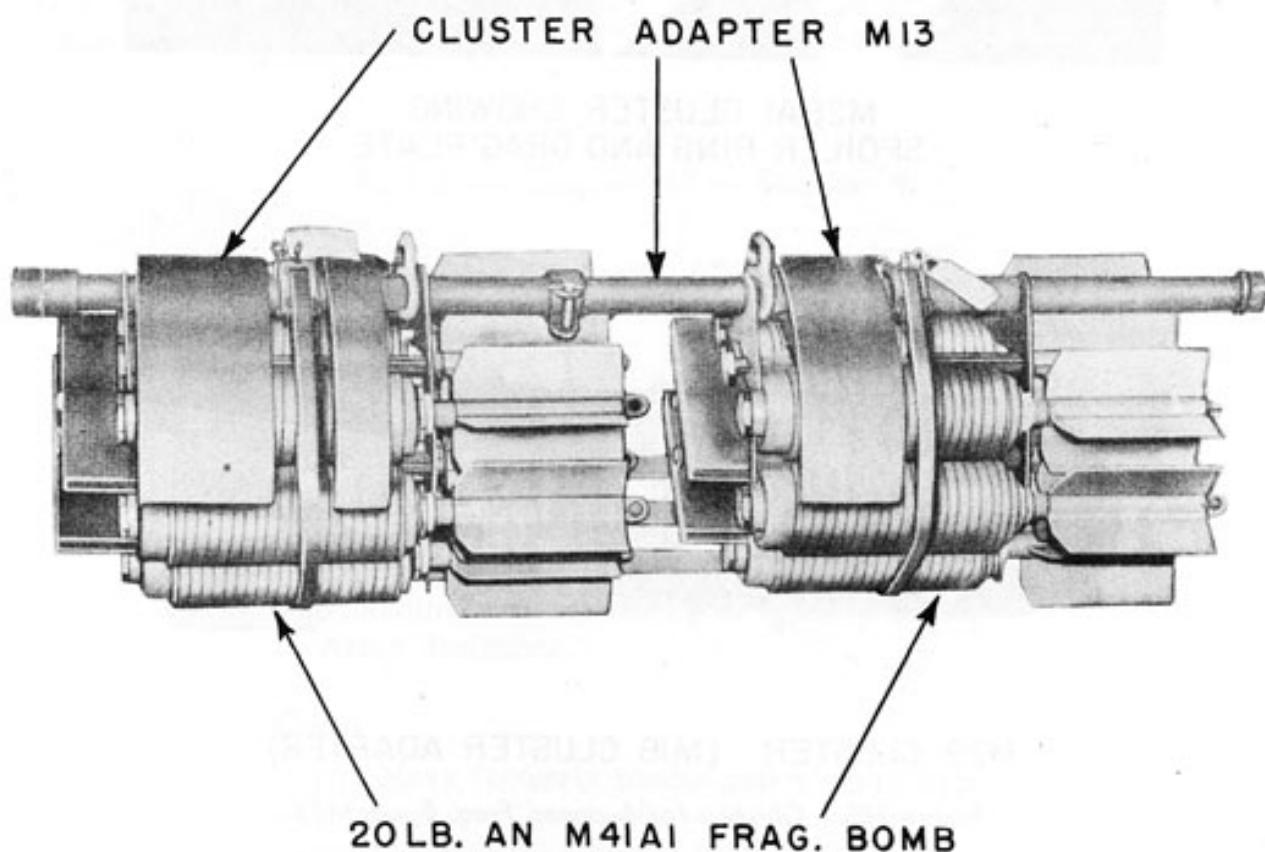
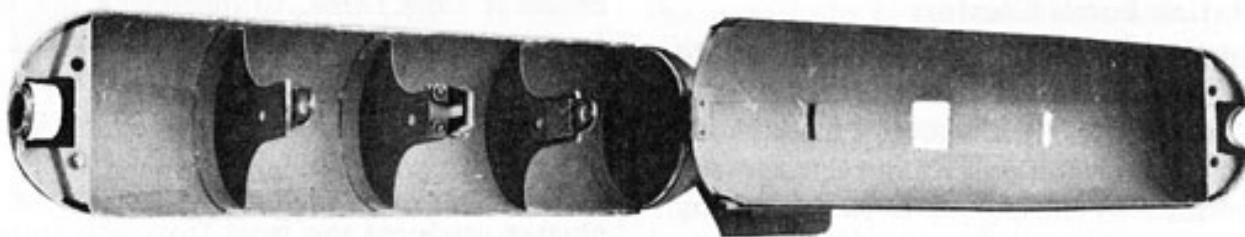
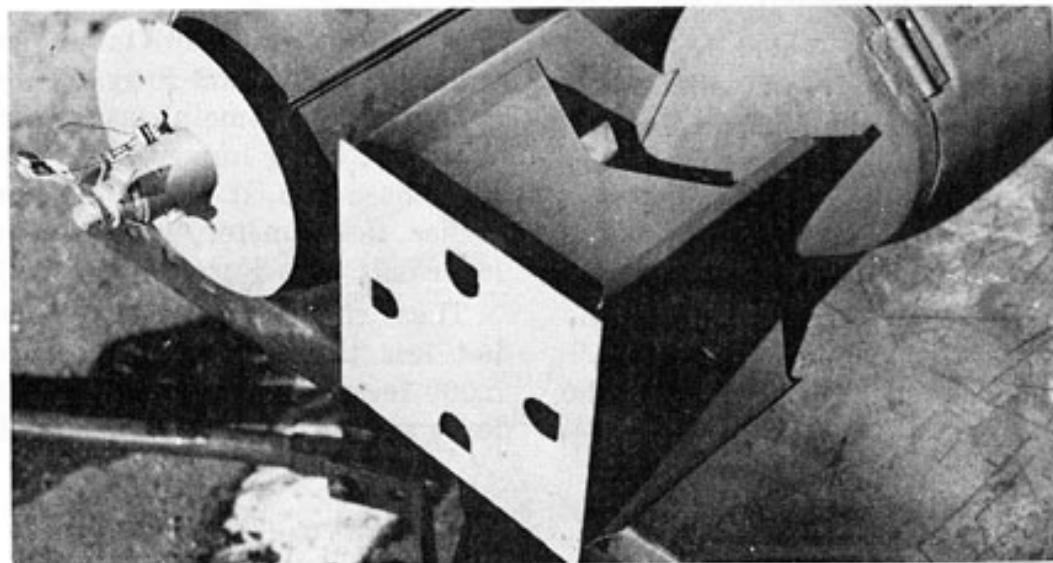


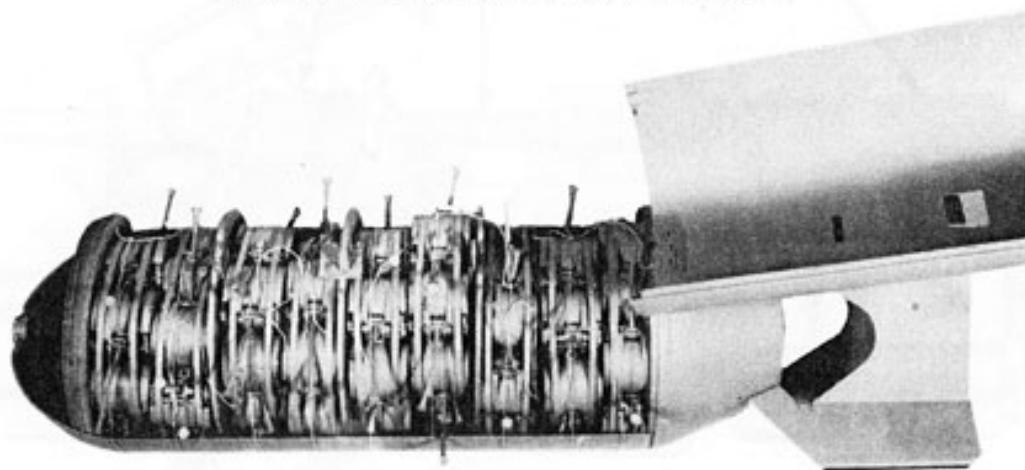
Figure 264. Typical Fragmentation Bomb Cluster  
(Cluster shown is M26. See page 409.)



M28 CLUSTER (M15 CLUSTER ADAPTER)



M28AI CLUSTER, SHOWING  
SPOILER RING AND DRAG PLATE



M29 CLUSTER (M16 CLUSTER ADAPTER)

*Figure 265. Clusters for 4-pound Frag. Bomb M83*

release altitude to eight seconds at maximum release altitude. When the fuze fires, it releases the nose closing cup, allowing the adapter to open and release the bombs. The bombs scatter to form a pattern over an area of approximately 300 by 200 feet.

**M28A1—Adapter M15A1:** The Cluster M28-A1 is the same as the M28, except that it incorporates a spoiler ring around the nose and a drag plate secured to the tail by four screws. These two devices were added because the dropping altitude for the M28 was limited by the high velocity attained by the clusters at high altitudes, resulting in damage to the butterfly when the cluster opened. When drag plates and spoiler rings are used, the recommended release altitude is 1,500 feet with a six-second fuze setting, or any higher altitude which will open the cluster at a height between 1,000 and 2,500 feet.

**M28A2—Adapter M15A2:** This A2 modification has a new locking cup, which is secured to the adapter by two slotted screws. Otherwise, it is the same.

**M29—Adapter M16A1:** 500-pound size for 90 4-pound Frag. Bombs M83. The container is like the M15, except for size. In the Adapter M16, the bombs are loaded in "wafer" assemblies. This cluster has a third single lug for British suspension.

**M29A1—Adapter M16A2:** This A1 modification has the new locking cap, secured to the adapter by two slotted screws. Otherwise, it is the same.

**Remarks:** For Navy usage, the Bureau of Ordnance recommends that the case-locking bushing it has developed be used with all "Butterfly" fragmentation clusters, including the M28, M28A1, M28A2, M29, and M29A1. One end of the bushing screws into the fuze adapter, and the other end is threaded internally to receive the fuze. The locking cup is retained positively by a safety wire which passes through a hole in the locking-cup tab and around a cotter pin placed in the bushing. When the fuze fires, the locking cup is blown into the cluster, shearing the loops of safety wire and allowing the adapter to open.

## Part 6 — Chapter 17 — Section 4

### NAVY "MK" SERIES

#### General

The Navy-designed bombs are generally similar to Army bombs of the same class. Since the formation of the Army-Navy Standard Board, early in 1941, the Navy has concentrated on designing bombs for naval targets and for carrier handling, leaving the other types of bombs to Army designers.

#### Color

The Navy formerly used a yellow paint over all; later, grey over all, with a yellow disc painted between the lugs if the bomb is a high-explosive type. Later productions may be found painted olive drab over all, with yellow bands.

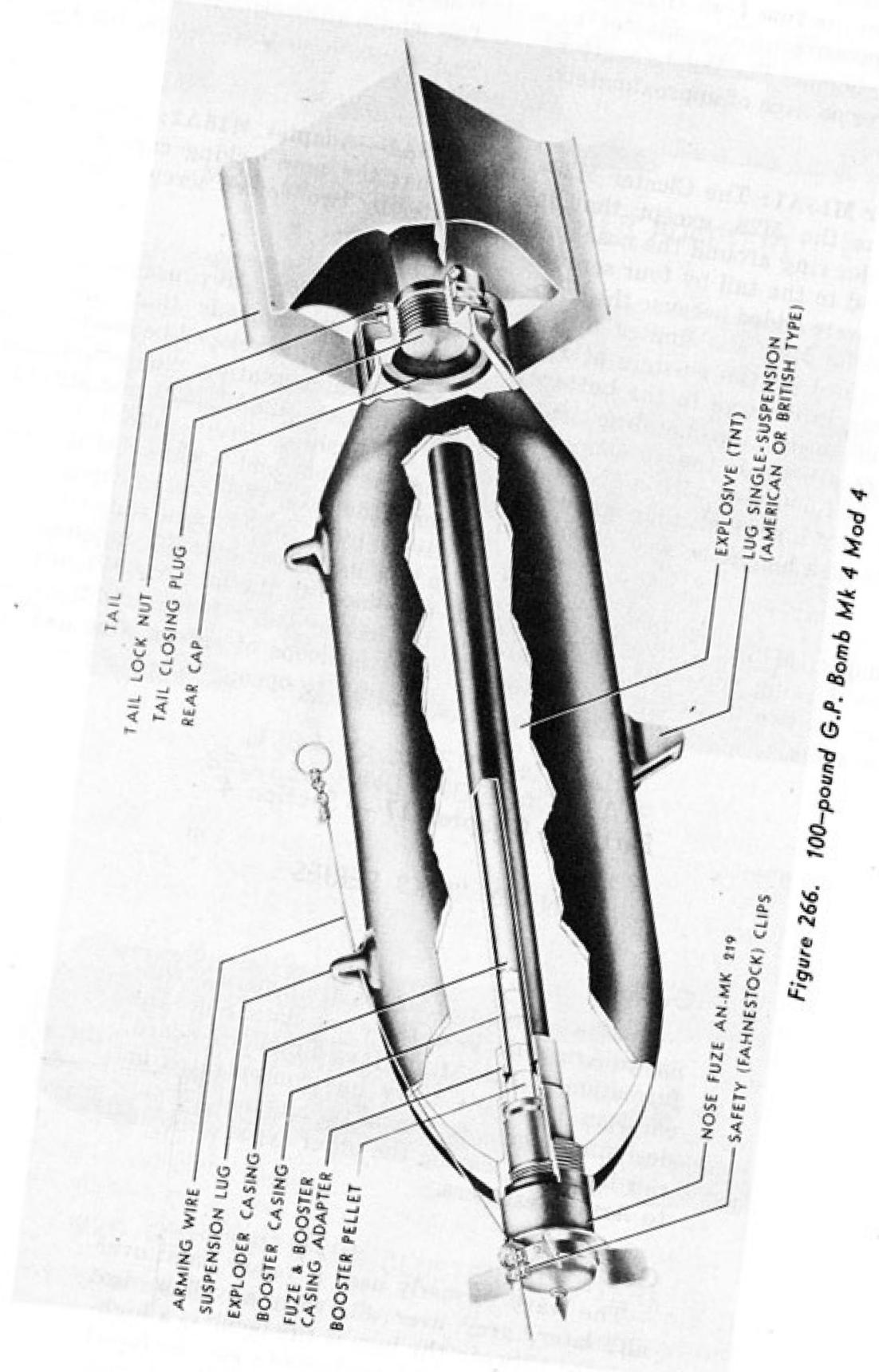


Figure 266. 100-pound G.P. Bomb Mk 4 Mod 4

**100-pound G.P. Mk 1 Mods 2 and 3, Mk 4  
Mods 1-4 (Obsolescent)**

	Mk 1	Mk 4
Over-all length, inches.....	48.8	36.2
Body length, inches.....	—	28.0
Body diameter, inches.....	7.9	8.0
Wall thickness, inch.....	—	0.175
Tail length, inches.....	21.0	9.1
Tail width, inches.....	9.8	11.0
Filling .....	TNT	TNT
Weight of filling.....	65#	55#
Total weight .....	116#	120#, Mod 1 105#, Mod 4
Charge/weight ratio.....	56%	45.8%, Mod 1 52.8%, Mod 4

**Fuzing:** Nose Fuze AN-Mk 219, Nose Fuze Mk 233.

**Body construction:** Mk 1 has two sheet steel castings welded together, the bomb having a "tear drop" shape. Mk 4 is a single-piece steel forging; cylindrical, with ogival nose.

**Suspension:** Mk 1 is horizontally suspended by two lugs welded on the body; it may have single lug or trunnions on the band. Mk 4 has two lugs welded on the body 14 inches apart; with a single lug welded on the opposite side.

**Color and markings:** Grey over all with a four-inch yellow disc between the two lugs, indicating H.E. The color may be yellow over all.

**Tail construction:** Mk 1 has four vanes which pass down over the body and are welded to a tail cone. The vanes are fastened to the body of the bomb by screws and are braced by two sets of bar struts riveted to the vanes. Mk 4 has four vanes welded to a sleeve which is secured to the bomb body with a locking nut. Box-type internal struts are welded to the vanes.

**500-pound G.P. Mk 3 Mod 1, Mk 9, and Mk 12 Mods 0-2 (Obsolescent)**

**Mk 12 Mod 2**

Over-all length, inches.....	59.5
Body length, inches.....	42.6

Body diameter, inches.....	14.0
Wall thickness, inch.....	0.36
Tail length, inches.....	20
Tail width, inches.....	19.4
Filling .....	TNT
Weight of filling, pounds.....	256
Total weight, pounds.....	504
Charge/weight ratio .....	50%

**Fuzing**

**NOSE**—AN-Mk 219 (Instantaneous) Requires Mk 219 adapter ring and one additional Auxiliary Booster Mk 1. Mk 221 (0.01 second delay), Mk 243 Mod 0, Mk 244 Mods 0-1, Mk 239.

**TAIL**—Mk 223 (0.01 second delay), Mk 229, Mk 229 Mod 3.

**Body construction:** One-piece steel, forged or drawn; cylindrical with ogival nose.

**Suspension:** Horizontal suspension by two lugs or trunnions on band for dive bombing.

**Color and markings:** Grey over all with yellow disc between lugs, indicating H.E.

**Tail construction:** Four sheet metal vanes are welded to a cone which is attached to the body by a nut which surrounds the fuze. Box-type struts are used.

**Remarks:** The 500-pound G.P. Bomb Mk 12 Mod 2 is still to be found in the field, but is no longer being manufactured. The other Marks are obsolete. The Mk 12 and Mk 12 Mod 1 differ from the Mk 12 Mod 2 as follows: Trunnions are welded to the body. They also have two hoisting lugs welded to the body, a female base plate, and a right-angle fin sleeve instead of the conical type.

In order to get a wider selection of possible tail fuzings, use an Adapter Booster M102 with a 0.47-inch spacer ring, and install any of the following fuzes: AN-M101A2, M113A1 or M116.

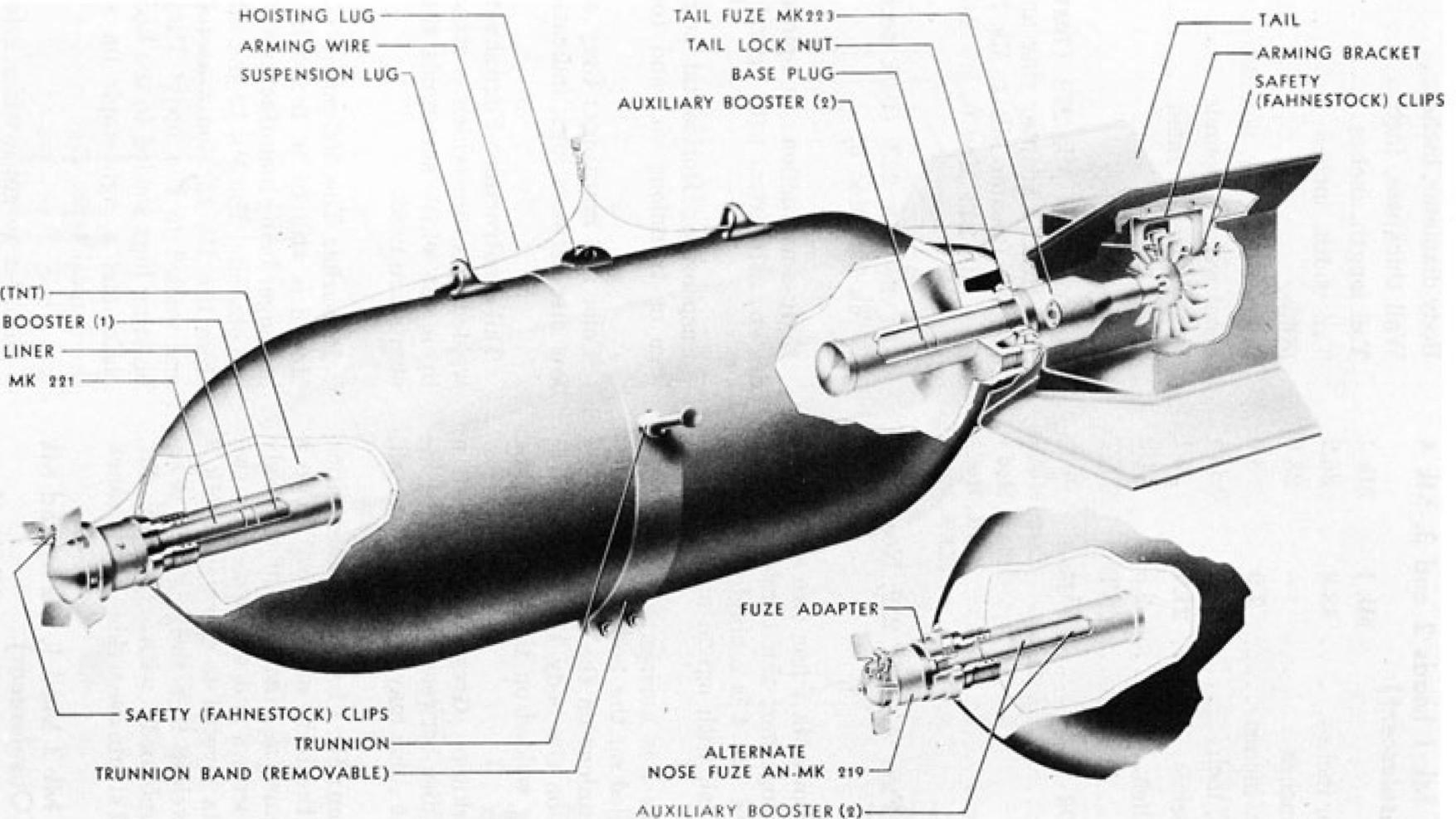


Figure 267. 500-pound G.P. Bomb Mk 12 Mod 2

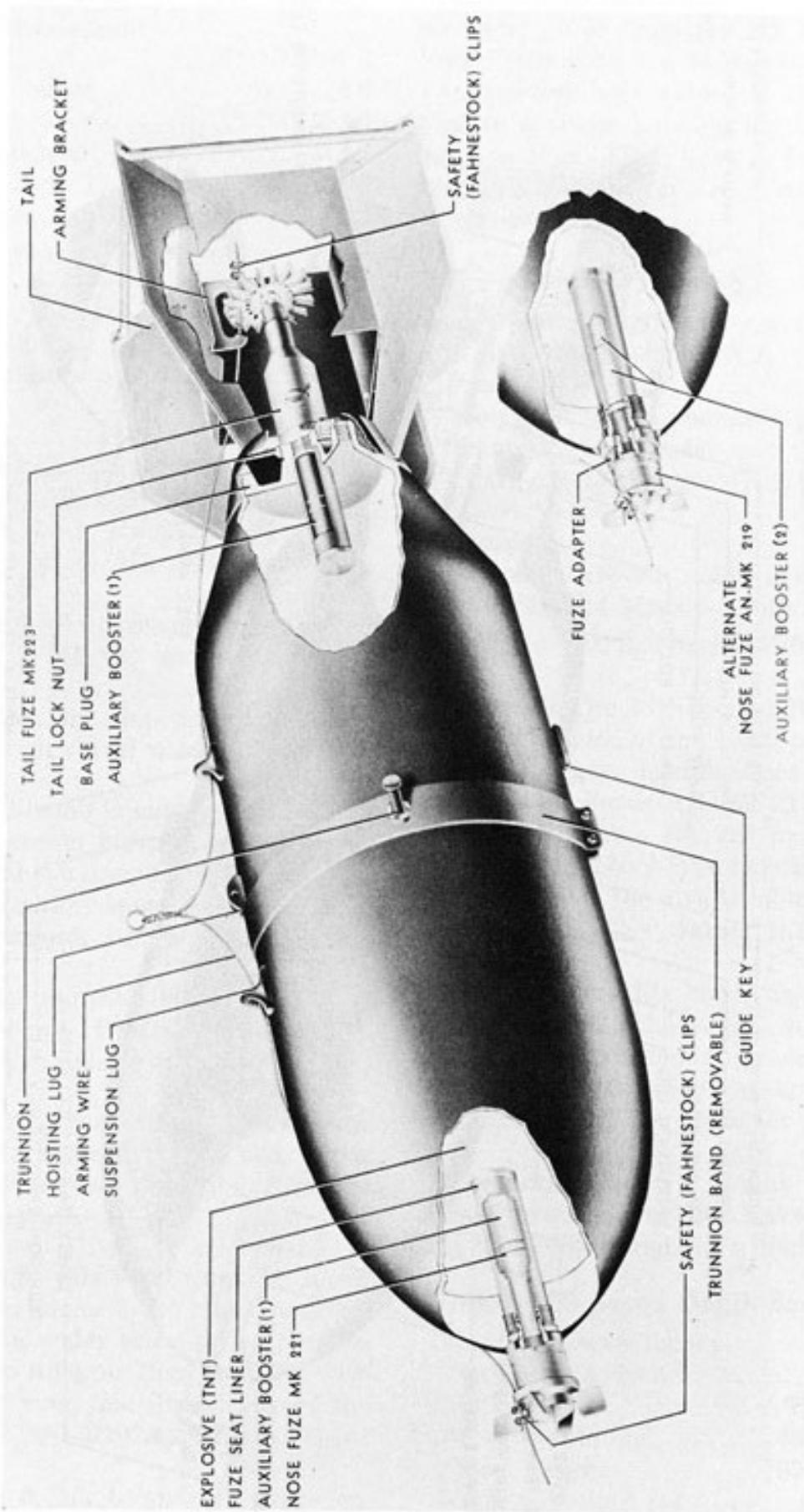


Figure 268. 1,000-pound G.P. Bomb Mk 13 Mod 2

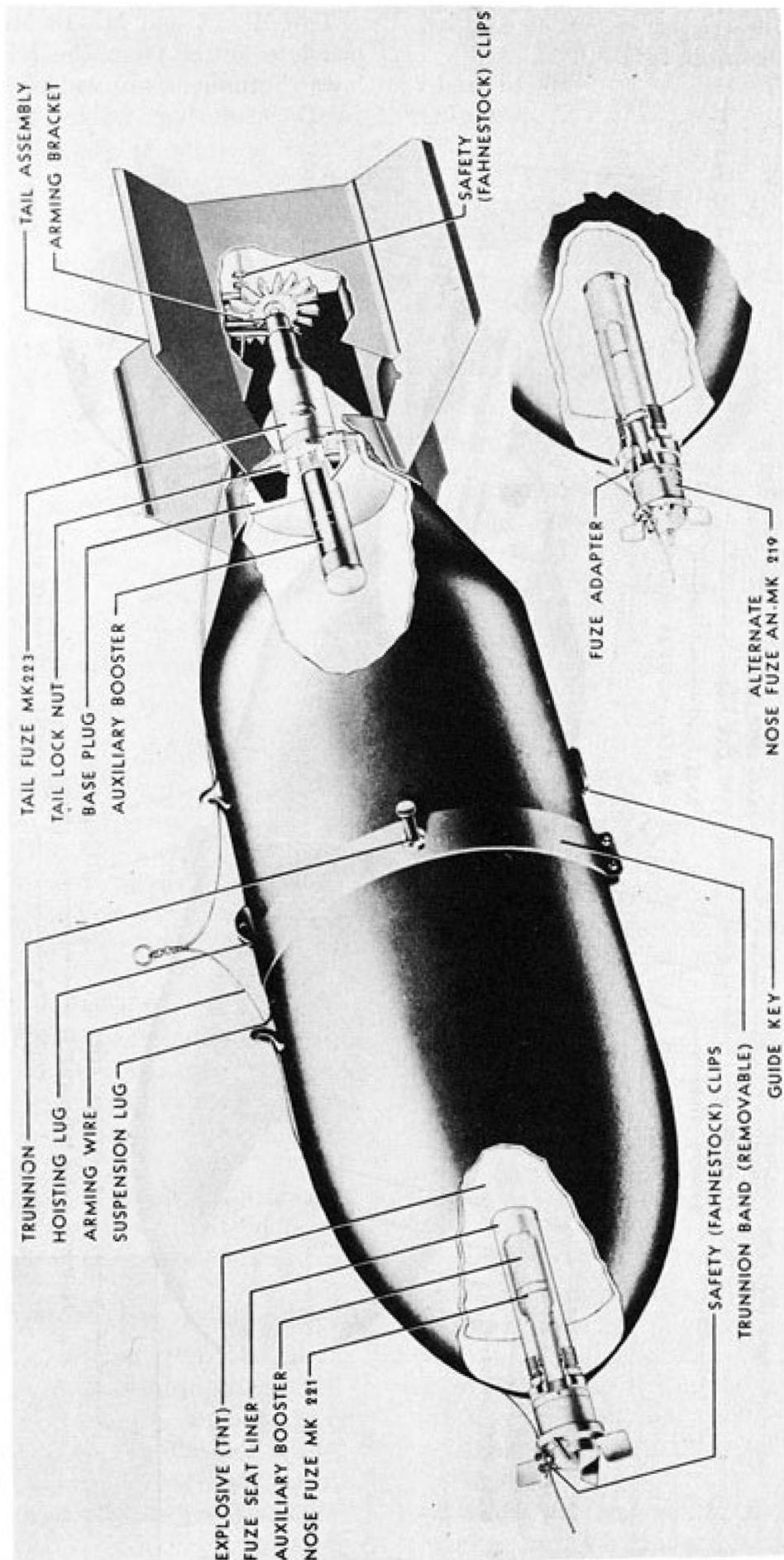


Figure 269. 1,000-pound G.P. Bomb Mk 36

**1,000-pound G.P. Mk 3, Mk 5, Mk 9, and Mk 13 Mods 0—2 (Obsolescent)****Mk 13 Mod 2**

Over-all length, inches.....	72.6
Body length, inches.....	53.0
Body diameter, inches.....	17.7
Wall thickness, inch.....	0.45
Tail length, inches.....	22.3
Tail width, inches.....	23.5
Filling .....	TNT
Weight of filling, pounds.....	511
Total weight, pounds.....	1,005
Charge/weight ratio .....	51%

**Fuzing**

**NOSE**—AN-Mk 219 (Instantaneous). Requires Adapter Ring Mk 219 and one additional Auxiliary Booster Mk 1. Mk 221 (0.01 second delay), Mk 243 Mod 0, Mk 244 Mods 0—1, Mk 239.

**TAIL**—Mk 223 (0.01 second delay), Mk 229; Mk 229 Mod 3, Mk 230 and Mods.

**Body construction:** One-piece drawn or forged steel; cylindrical with ogival nose.

**Suspension:** The bomb is suspended horizontally by two suspension lugs, or by trunnions on the band around the body for dive bombing. A torpedo sling guide key is welded to the bomb for suspension in torpedo slings.

**Color and markings:** The bomb is painted grey over all, with an 11-inch yellow disc between the suspension lugs to indicate H.E.

**Tail construction:** Four vanes welded to the tail cone, which is secured to the body by a locking nut which screws onto the threaded collar of the base plate.

**Remarks:** Though this bomb may be found in the field, it is no longer being manufactured.

In order to get a wider selection of possible tail fuzings, use an Adapter Booster M102 with a 0.47-inch spacer ring, and install any of the following fuzes: AN-M102A2, M114A1, or M117.

The Bombs Mk 3, Mk 5, and Mk 9 are declared obsolete and will be expended in practice.

The Mk 13 and Mk 13 Mod 1, also declared obsolete, differ from the Mk 13 Mod 2 as follows: Trunnions are welded to body. There are two hoisting lugs welded to the body, in addition to a single hoisting lug between the suspension lugs. They have a female base plate and a right-angle fin sleeve instead of the conical type.

**1,000-pound G.P. Mk 36**

Over-all length, inches.....	71.2
Body diameter, inches.....	18.7
Filling .....	TNT
Weight of filling, pounds.....	558
Total weight, pounds.....	1,012
Charge/weight ratio .....	55%

**Fuzing**

**NOSE**—AN-Mk 219, Mk 221, Mk 243 Mod 0, Mk 244 Mods 0—1, Mk 239.

**TAIL**—Mk 223 or Mk 229 Mod 3.

**General:** The 1,000-pound Bomb Mk 36, is a modified version of the 1,000 pound G.P. Bomb, AN-M44. These modifications provide for the use of Nose Fuzes AN-Mk 219 or Mk 221, the use of Tail Fuzes Mk 223 or Hydrostatic Mk 229 Mod 3, a Navy-type hoisting lug and guide key, trunnions for dive bombing, and an explosive filling of TNT, rather than 50-50 Amatol.

**Description:** This bomb has two suspension lugs, spaced 14 inches apart, welded to the bomb body for suspension from double-hook racks and shackles. A guide key is provided on the opposite side of the bomb for sling suspension.

**Remarks:** The G.P. Bomb Mk 36 was designed primarily by the Navy as an alternate for the 1,000-pound G.P. Bomb Mk 13 Mod 2.

**7.0-inch 100-pound Depth Bomb Mk 52**

Over-all length, inches.....	45.9
Body length, inches.....	7.0
Filling .....	TNT or Torpex
Weight of filling.....	45.3#
Total weight .....	99.1#
Charge/weight ratio .....	46% 49%
Fuzing.....	Mk 140

**General:** This is a light-case, fast sinking, round-nose bomb for use by airships. It is carried in a Bomb Rack Mk 53 and, accordingly, has no trunnions, trunnion bands, or suspension lugs. A cylindrical shroud is fastened to the tail section by four vanes. The entire tail assembly is fastened to the rear of the bomb body by six flat-head machine screws. A cast-iron nose, into which is fitted a booster can, is secured to the bomb body. The bomb is filled with either TNT or Torpex. The Nose Fuze Mk 140 will normally function on impact with a solid object below the surface of the water, but will also function upon striking the surface of the water at any velocity greater than approximately 300 feet per second. This velocity may be attained in a free fall from a vertical height of 1,400 feet.

#### 650-pound Depth Mk 29 (Obsolete) and Mk 37 (Obsolete)

	Mk 29	Mk 37
Over-all length, inches.....	70.0	63.0
Body length, inches.....	41.0	41.0
Body diameter, inches.....	17.7	17.7
Wall thickness, inches.....	0.12	0.12
Tail length, inches.....	36	29
Tail width, inches.....	17.7	17.7
Filling .....	TNT	TNT
Weight of filling.....	464#	464#
Total weight .....	657#	659#
Charge/weight ratio .....	70%	70%

#### Fuzing

NOSE—AN-M103 (Instantaneous); AN-M103A1; AN-Mk 219 (Instantaneous); Mk 221; Mk 239.

ATHWARTSHIP—AN-Mk 224 or AN-Mk 234.

TAIL—Mk 229, Mk 229 Mod 3; AN-Mk 230, Mods.

**Body construction:** These bombs are manufactured with a hemispherical nose reinforced with a steel disc. The suspension lugs are reinforced with a steel strip. A flat-nose attachment, in the shape of a bucket and fitting down under the nose of the bomb, can be used

to improve underwater trajectory. The vacant spaces are then filled with plaster of paris. These attachments increase the weight by 72 pounds.

**Suspension:** Horizontal suspension is provided by the usual two suspension lugs, with threaded holes on each side 90° removed to receive trunnion lugs for the displacement gear of dive bombers.

**Color and markings:** The bombs are painted olive drab or grey over all, with an 11-inch yellow disc between the two suspension lugs. They may be light grey over all.

**Tail construction:** Four sheet-steel vanes are welded to the tail cone, which is secured to the body by a locking nut screwing onto the rear of the body. An annular strut is used around the rear of the vanes. The tail of the Mk 37 was shortened by seven inches so that the Tail Fuze Mk 229 could arm more readily. Otherwise, the tail is similar to that of the Mk 29.

**Remarks:** AN-Mk 219 will not arm under 2,500 feet of altitude if the flat-nose attachment is used.

Use Adapter Ring Mk 219 and insert an additional auxiliary booster when using AN-Mk 219.

AN-M103 or AN-M103A1 will not arm with the flat-nose attachment, unless special arming vanes are used.

An extender is supplied with each bomb to permit installation of the Hydrostatic Fuze AN-Mk 224 or AN-Mk 234 in the longer athwartships tube.

The Mk 29 is converted to the Mk 37 by replacing the tail.

Because of numerous instances in water crash landings where depth bombs fuzed with the Athwartship Fuze AN-Mk 224 or AN-Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the Depth Bombs Mk 29 and Mk 37 may be used only if a nose impact fuze is installed.

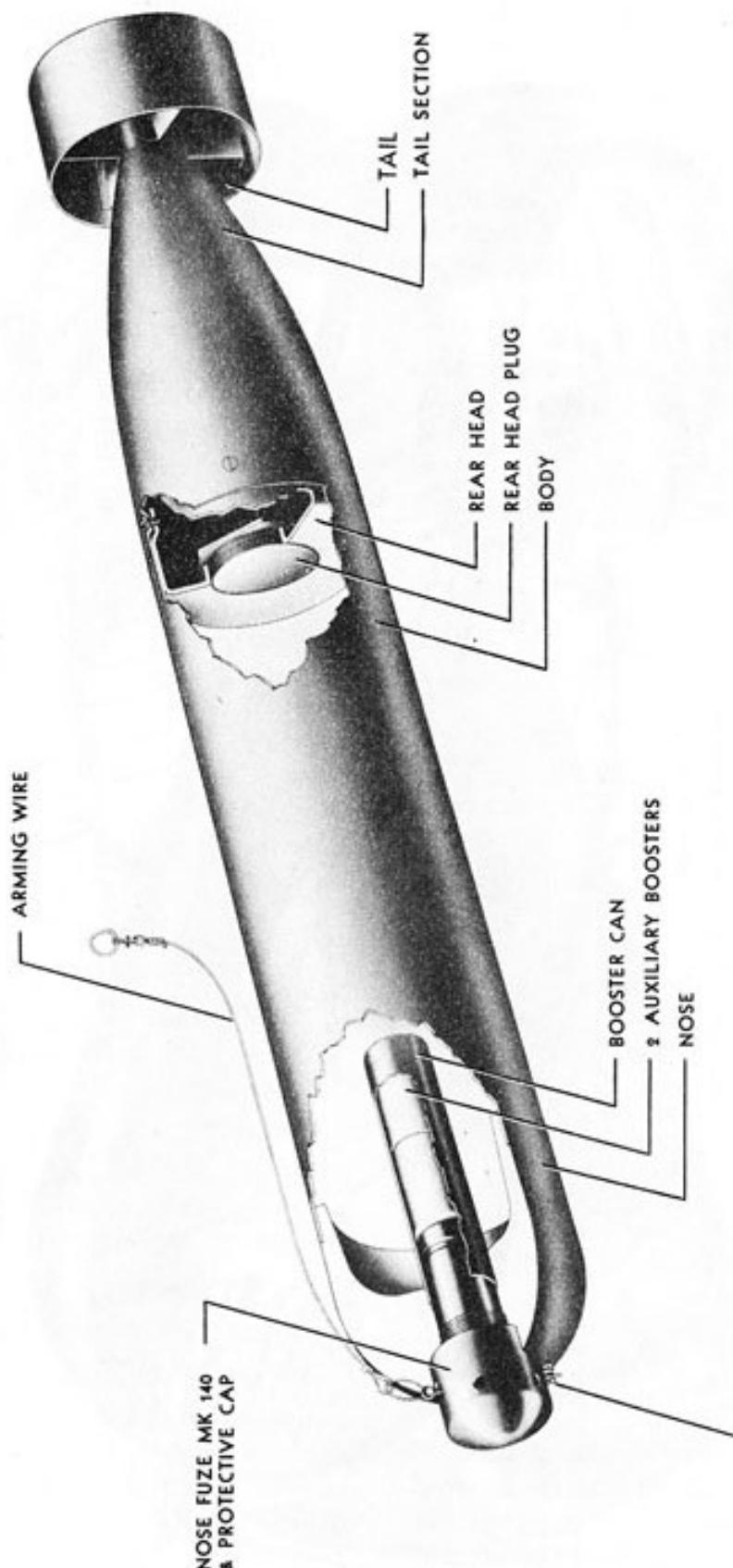


Figure 270. 7.0-inch 100-pound Depth Bomb Mk 52

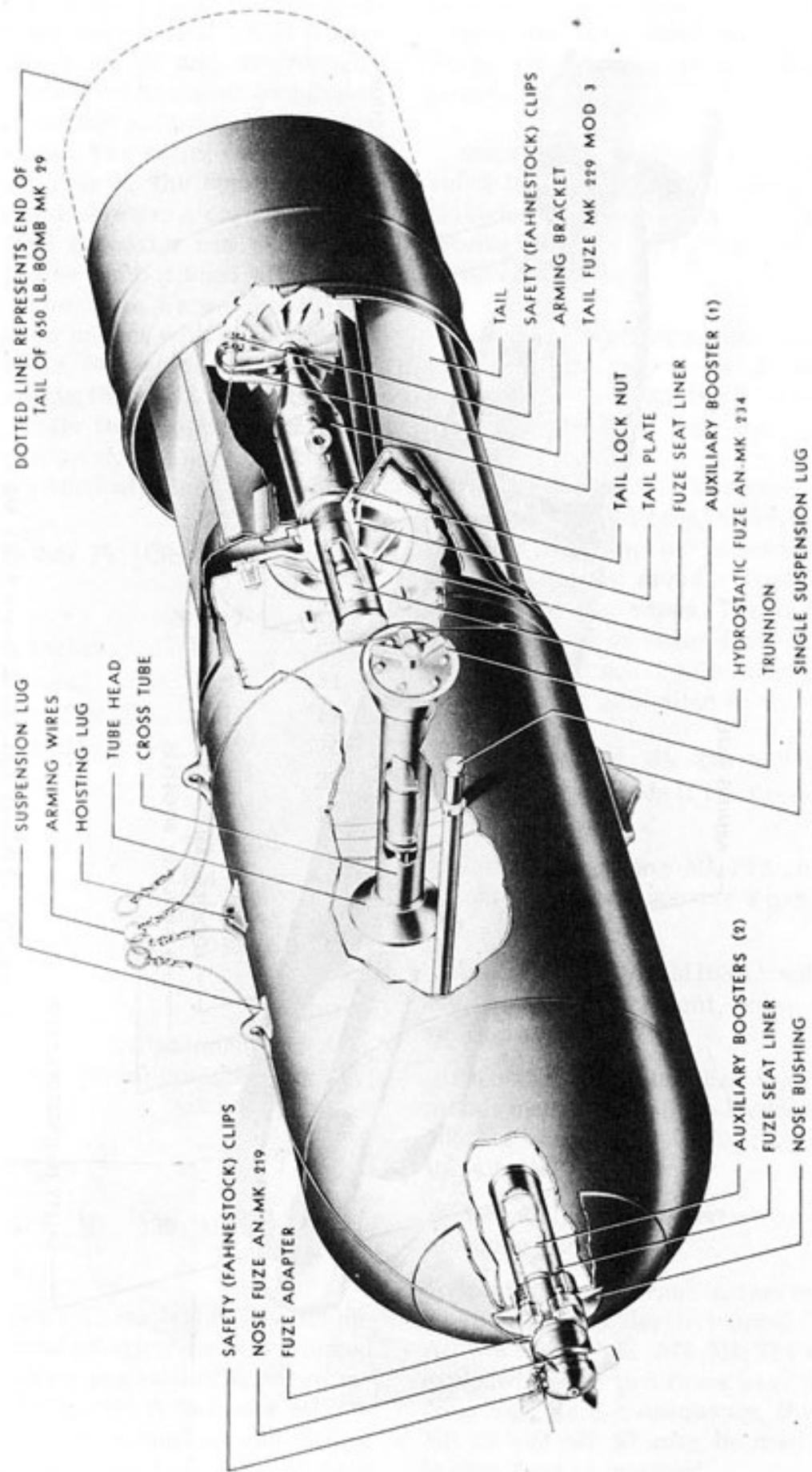
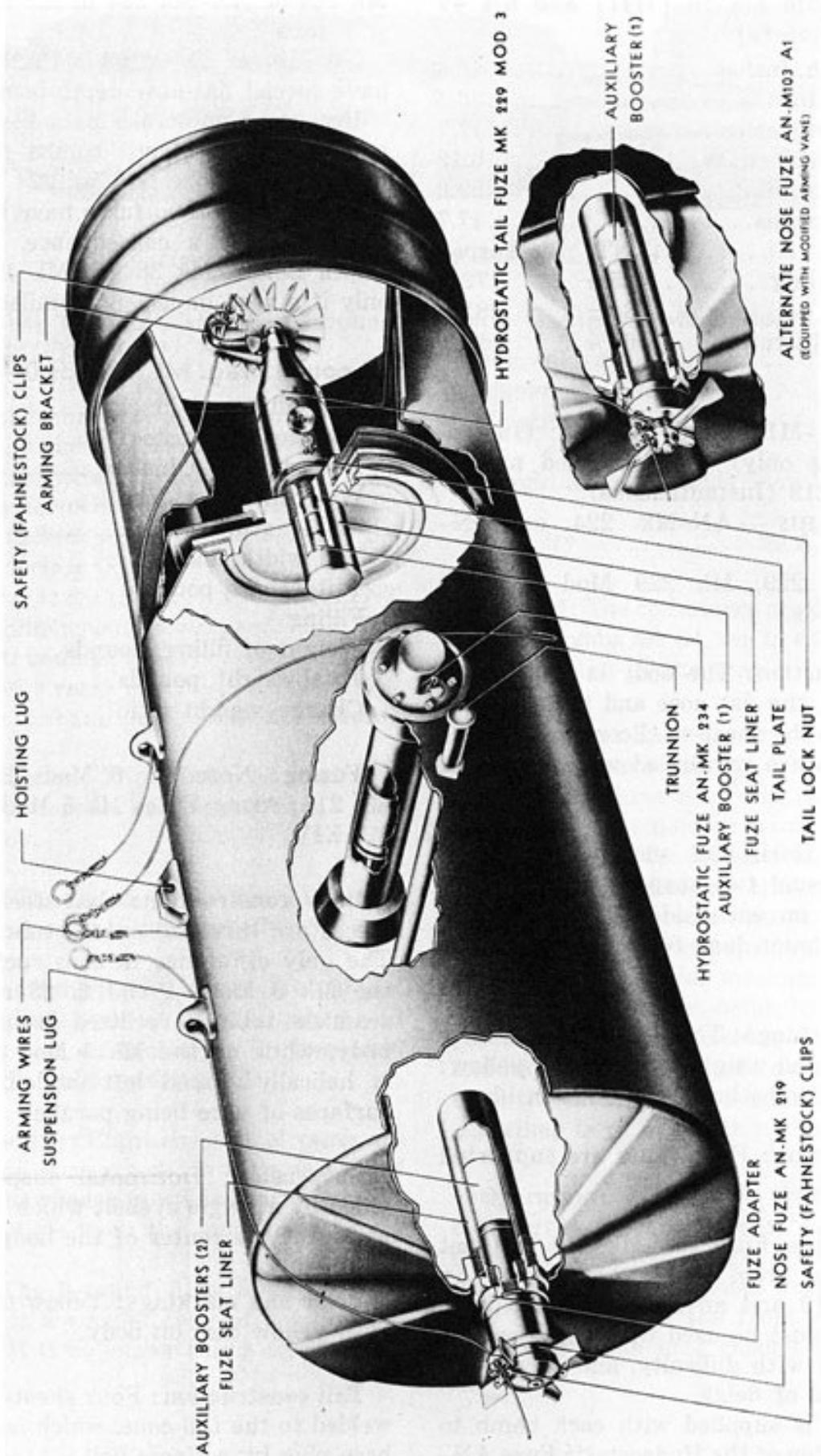


Figure 271. 650-pound Depth Bombs Mk 29 and Mk 37



**650-pound Depth Mk 38 (TNT) and Mk 49 (Torpex) (Obsolete)**

Overall length, inches.....	58.5
Body length, inches.....	36.4
Body diameter, inches.....	17.7
Wall thickness, inch.....	0.12
Tail length, inches.....	29.0
Tail width, inches.....	17.7
Filling .....	TNT
Weight of filling.....	425#
Total weight .....	634#
Charge/weight ratio .....	67%
	69%

**Fuzing**

NOSE—AN-M103; AN-M103A1 (Instantaneous setting only) with modified arming vane. AN-Mk 219 (Instantaneous).

ATHWARTSHIP—AN-Mk 224 or AN-Mk 234.

TAIL—Mk 229, Mk 229 Mod 3; AN-Mk 230 and Mods.

**Body construction:** The body is constructed in three pieces, the flat nose and tail piece being welded onto the sheet-steel center tube. The suspension lugs are reinforced with a strip of sheet steel.

**Suspension:** Horizontal suspension is provided by the usual two suspension lugs, with threaded holes on each side 90° removed to receive the trunnion lugs for suspension from dive bombers.

**Color and markings:** TNT-loaded bombs have Mark numbers and weight stencilled in yellow; Torpex-loaded bombs have markings in blue.

**Tail construction:** Four vanes are supported by a circular strut.

**Remarks:** Nose Fuze AN-Mk 219 will not arm if dropped from under 2,500 feet. An Adapter Mk 219 and an additional Auxiliary Booster Mk 1 must be used with this fuze.

Mk 221 arms with difficulty, and should not be used because of delay.

An extender is supplied with each bomb to permit installation of the Hydrostatic Fuze AN-

Mk 224 or AN-Mk 234 in the longer athwartship tube.

Nose Fuze AN-M103 and AN-M103A1 must have special flat-nose depth-bomb vane.

Because of numerous instances in water crash landings where depth bombs fuzed with the Athwartship Fuze AN-Mk 224 or AN-Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the 650-pound Depth Bombs Mk 38 and Mk 49 may be used only if a nose impact is installed.

**30-pound Frag. Mk 5 Mods 0—3 (Obsolete)**

Over-all length, inches.....	22.2
Body length, inches.....	12.8
Body diameter, inches.....	4.2
Wall thickness, inch.....	0.57
Tail length, inches.....	7.0
Tail width, inches.....	6.5
Tail weight, pounds.....	2.5
Filling.....	Cast TNT
Weight of filling, pounds.....	4.5
Total weight, pounds.....	33.4
Charge/weight ratio .....	13.0%

**Fuzing:** Nose Mk 5 Mods 2 and 3; AN-Mk 219; Army Fuze Mk 5 Mods 0 and 1; and Mk XIV.

**Body construction:** Cast-steel nose and tail pieces are threaded onto a tubular steel body. The only difference in construction is that in the Mk 5 Mods 1 and 2, 23 rings cut from seamless tubing are fitted around the tubular body, while on the Mk 5 Mod 3, a steel wire is helically wound left-handed, the adjacent surfaces of wire being parallel.

**Suspension:** Horizontal suspension is provided by a single eyebolt which is screwed into a ring at the center of the body.

**Color and markings:** Yellow over all or grey with yellow disc on body.

**Tail construction:** Four sheet-steel vanes are welded to the tail cone, which is secured to the base plug by a single bolt.

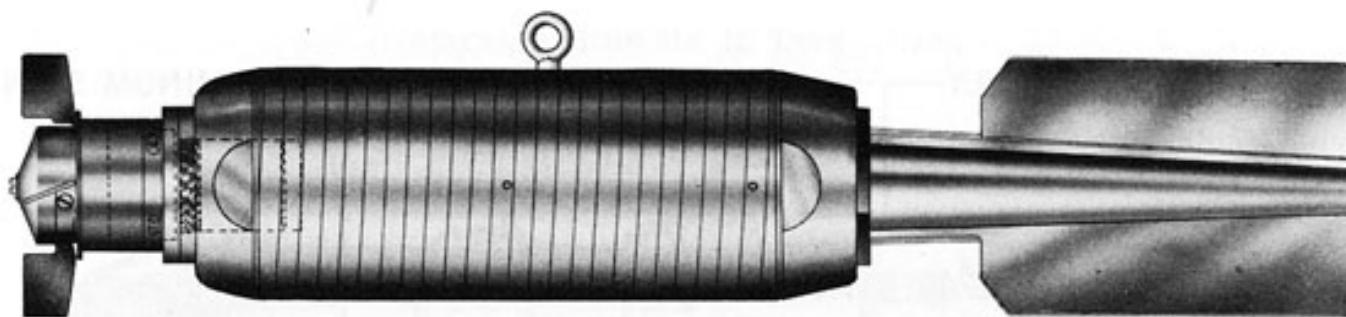


Figure 273. 30-pound Frag. Bomb Mk 5 Mod 3

**5-pound A.A. Mk 34 (Obsolete) and 3-pound Type C Mk 32 (Obsolete)**

**Mk 34**

Over-all length, inches.....	15.0
Body length, inches.....	12.0
Body diameter, inches.....	3.0
Wall thickness, inch.....	0.05
Tail length, inches.....	3.0
Tail width, inches.....	3.0
Filling .....	TNT
Weight of filling, pounds.....	1.9
Total weight, pounds.....	5.5
Charge/weight ratio .....	34.5%
Fuzing.....	Mk 227 (Nose)

**Body construction:** The reinforced steel nose and conical tail section are welded to a cylindrical steel body.

**Suspension:** The Container Mk 3 or Mk 3 Mod 1 is used. Its capacity is 20 Bombs Mk 34.

**Color and markings:** The bombs are painted grey or olive-drab over all. If grey, they will have a yellow disc on the body; if olive-drab, they will have a yellow nose band.

**Tail construction:** Eight sheet-steel vanes are welded to a tail cone which, in turn, is welded to the body. The vanes are welded on the cone at a ten-degree angle from the longitudinal axis.

**Remarks:** The 3-pound A.A. Bomb Type C (Mk XXXII) is a smaller copy of the 5-pound Bomb Mk 34. It is no longer being used.

**Bomb Container Mk 3 Mod 1**

Over-all length, inches .....	51.1
Diameter, inches .....	13.2
Weight unloaded, pounds.....	Mk 3 — 65
	Mk 3-1 — 67
Weight loaded, pounds.....	Mk 3 — 175
	Mk 3-1 — 177
Capacity .....	20 A.A. Bombs Mk 34

**General:** The containers are designed to carry 20 A.A. Bombs Mk 34, ten in the front compartment and ten in the rear.

**Description:** Each housing assembly contains three bomb bays running lengthwise, the outside holding three bombs in each, and the center holding four bombs; a total of ten for each assembly. The bombs are loaded onto three ejector springs that run crosswise of the housing and are anchored on the flange on each side of the housing. These springs eject the bombs after the door-opening mechanism unlatches the doors. After the last bomb has left each compartment, the door-closing mechanism shuts and holds the doors closed under spring tension until the container is re-loaded. The skin of the container is of sheet aluminum.

**Operation:** When the operating switch is closed, the Solenoid Mk 24 or Mk 24 Mod 1, mounted on each of the door-opening assemblies, is energized. The solenoid unlatches the doors. The ten bombs in the front compartment are expelled on the first closing of the operating

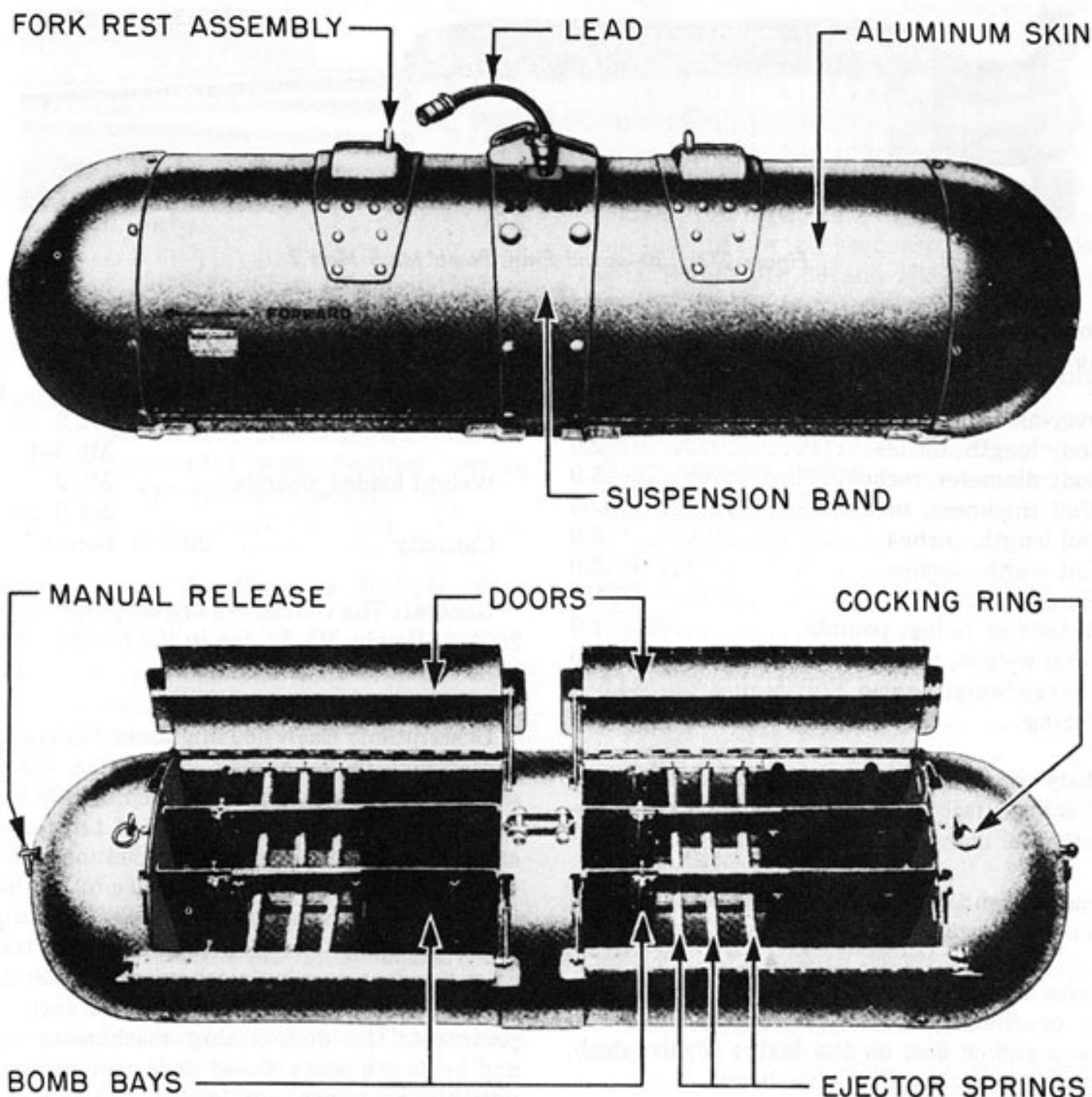


Figure 274. Bomb Container Mk 3 Mod 1

switch, and the ten in the rear are expelled on the second closing of the switch. The container can also be operated manually.

**Remarks:** The Bomb Containers Mk 3 and Mk 3 Mod 1 are identical, with exception of the suspension band, fork rests, and outside skin.

## AIRCRAFT MINE MK 13 TYPE—DATA

Over-all length, inches .....			68.75
Diameter, inches			
Case .....	19.875		
Tail section .....	15.25		
Fins on tail section .....	25.50		
	Mods 0, 3, 4	Mod 5	
Explosive filling .....	TNT	Torpex	TNT
Weight of filling, pounds .....	640	700	700
Total weight, pounds .....	1,030	1,090	1,000
Charge/weight ratio .....	62.0%	63.3%	64.0%
Negative buoyancy, pounds .....	430	490	—
Fuzing for use as mine .....	Athwartship		
Mine mechanisms			
Forward well .....	Extender and booster		
After well .....	Clock starter and clock delay		
Fuzing for use as bomb .....	Nose fuzes AN-M103, AN-M103A1, M135, M135A1, M136, M136A1, M139, F139A1, AN-M139A1, M140, M140A1, AN-M140A1, M149, M163, M164, M165, AN-Mk 219 (by using adapter ring and one Auxiliary Booster Mk 1)		

**1,000-pound Aircraft Mine Mk 13 Mod 0, Magnetic Induction; Mk 13 Mod 3, Magnetic Induction; Mk 13 Mod 4, Magnetic Induction; and Mk 13 Mod 5, Acoustic**

**General:** The Aircraft Mine Mk 13 Type is designed as a ground influence mine, laid offensively by aircraft from altitudes of 100 to 500 feet in 16 to 75 feet of water (40-100 feet for Mk 13 Mod 5) against surface craft and up to 500 feet against submarines. The Aircraft Mines Mk 13 Mods 0, 3, and 4 are magnetic induction mines using the Search Coil Firing Mechanism M4, while the Mk 13 Mod 5 is an acoustic mine utilizing the Acoustic Firing Mechanism A3.

When the mine is dropped as a bomb, the minimum altitude of release is 1,200 feet to insure pilot safety. Because of the shape of the mine, the standard bomb nose fuzes require longer air travel to arm.

**Mine construction:** The body is a cylindrical steel case with a welded hemispherical nose containing a fuze seat liner which houses an

adapter ring and two Auxiliary Boosters Mk 1. The cylindrical tail section is of a smaller diameter and is welded to the body. The dome steel tail cover of the Mk 13 Mod 5 is modified to contain the Microphone MI-2; the rubber diaphragm microphone cover of the Mk 13 Mod 5 is stamped with the word "BRUSH." Horizontal suspension is accomplished by either of three sets of lugs placed 45° apart; each set consists of two standard lugs 14 inches apart.

**Color:** Black over all.

**Remarks:** The extender and clock starter are activated by hydrostatic pressure at a depth of 16 feet or greater. The clock delay runs off in 45 minutes to arm the mine.

The Aircraft Mine Mk 13 Mod 3 is a Mk 13 Mod 0 fitted with the Tail Parachute Pack Mk 1.

In the Mk 13 Mod 4, the extender and clock starter are modified for shallow-water planting, allowing the mine to function in ten feet of water. In other respects the Mk 13 Mod 4 is identical to the Mk 13 Mod 0.

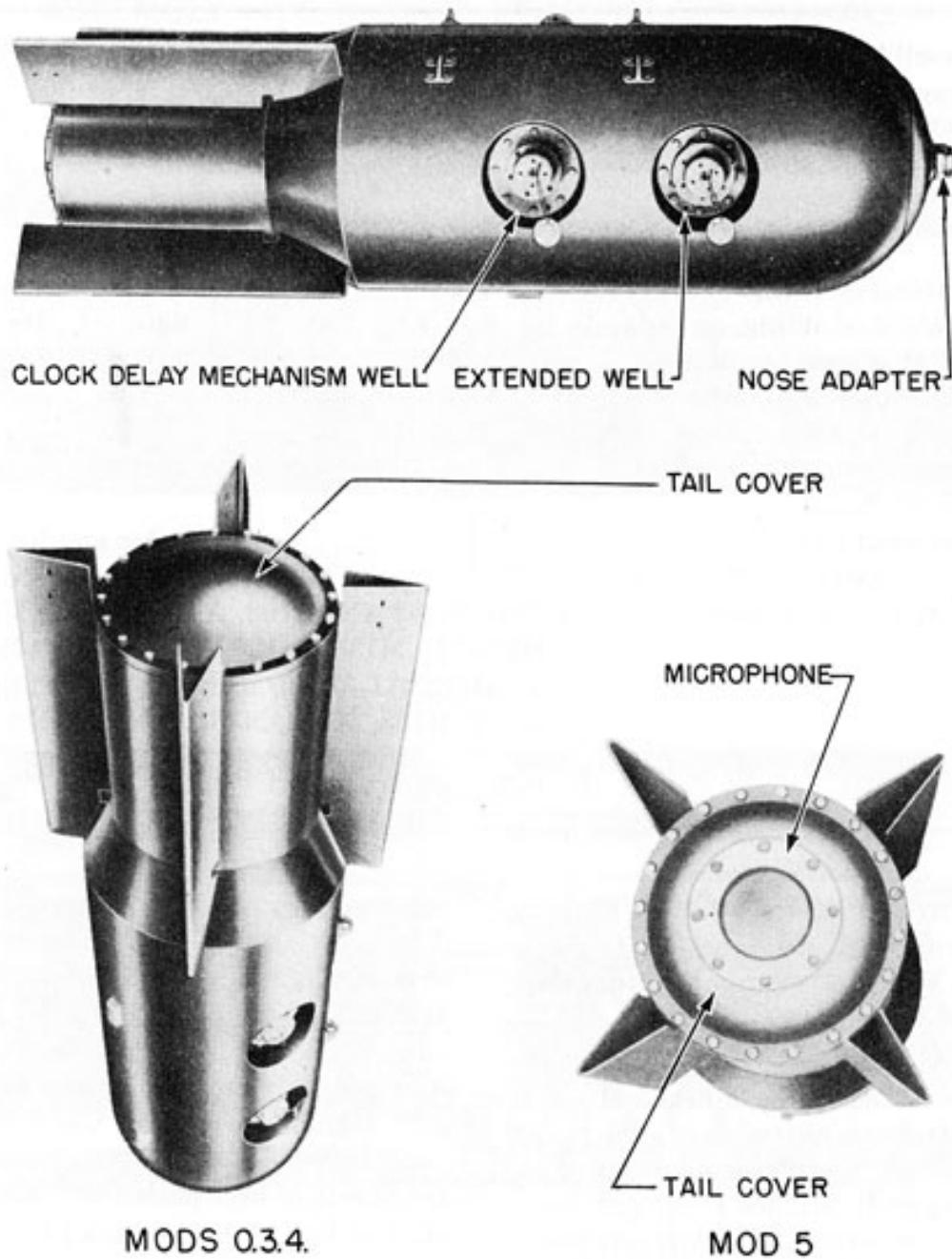


Figure 275. 1,000-pound Aircraft Mine Mk 13

#### Cluster Adapter Mk 3 Mod 0

**General:** The Cluster Adapter Mk 3 Mod 0 is used to cluster three bombs for external suspension on V.B.F.-type aircraft. The purpose of this cluster is to increase the bomb-load capacity of fighter planes. Five types of bombs may be used with this adapter, as outlined below:

#### Bombs

#### Weight of Cluster (pounds)

3—100-pound G.P. AN-M30A1.....	364
3—90-pound Frag. M82 .....	300
3—220-pound Frag. AN-M88 .....	688
3—260-pound Frag. M81 .....	800
3—100-pound Incend. AN-M47A2....	340

The adapter consists of a band incorporating a take-up bolt, a frame assembly, and a delay opening pistol assembly.

**Operation:** When the cluster is dropped, the arming wires are withdrawn and the pistol and tail fuze vanes are free to rotate. After ap-

proximately 45 revolutions of the vanes, the arming screw will thread far enough out to allow the firing-pin release levers to cam in. The firing-pin spring, acting through the firing pin on the firing-pin release levers, will cause the upper portion of the firing-pin release levers to cam in. The lower portion of the firing-pin re-

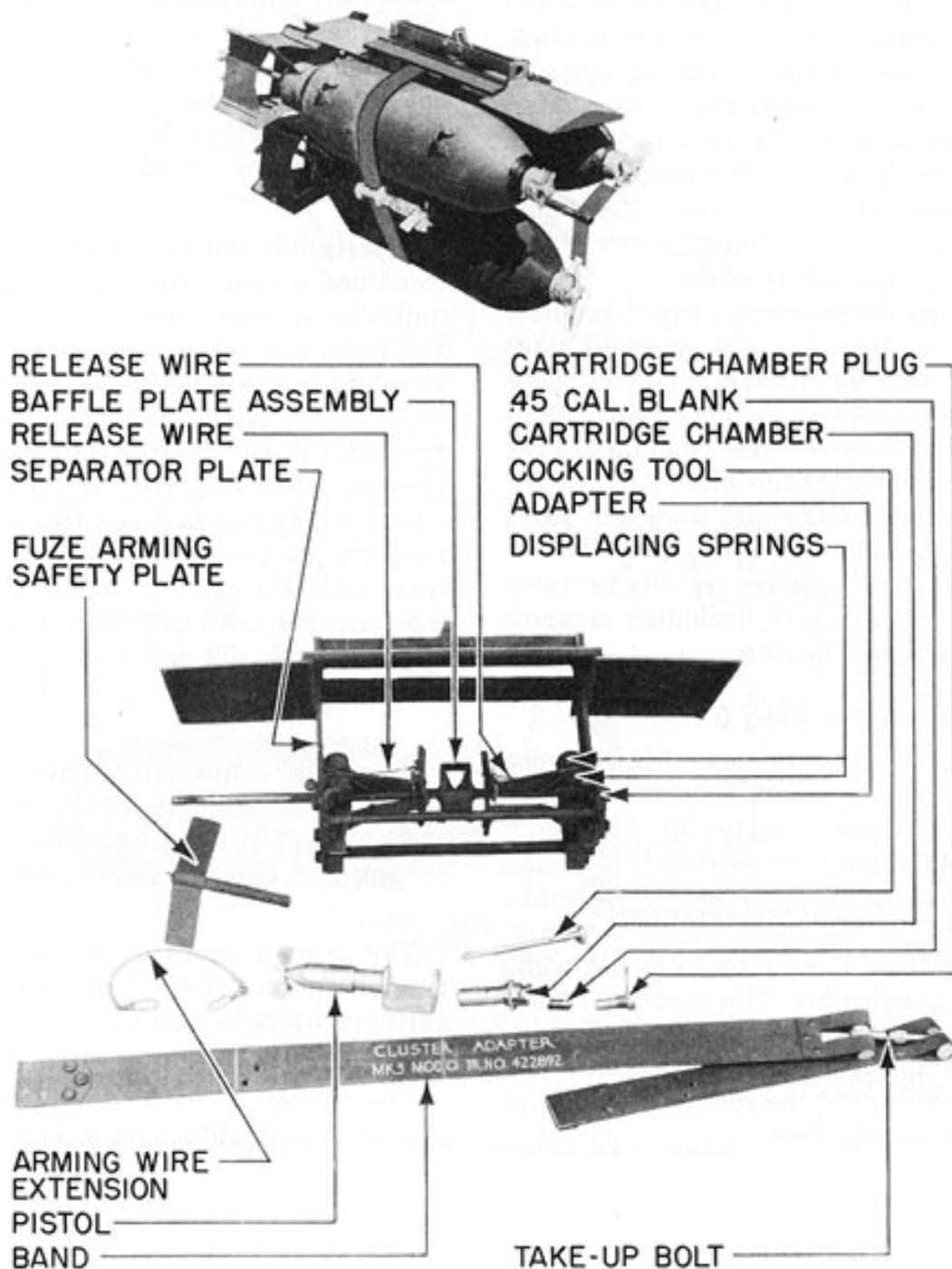


Figure 276. Cluster Adapter Mk 3 Mod 0

lease levers then releases the firing pin, allowing it to move aft under action of the firing-pin spring, to strike the percussion cap of the caliber .45 blank cartridge.

Explosion of the blank cartridge expels the cartridge chamber and cartridge-chamber plug (as a unit) from the pistol cradle, pulling the two cotter pins out as they are ejected. The cluster band clamps were held together by the clamping action between the cartridge chamber and the pistol cradle, and are now free to open. Through the action of the displacing springs, the three bombs are ejected from the cluster. The bomb tail-fuze arming wires are withdrawn when the cluster falls from the plane, and the bomb nose fuzes are free to arm after being ejected from the cluster, freeing their vanes from the fuze arming safety plate.

The air-arming delay-opening pistol requires approximately 45 turns to arm, and will allow the cluster to drop approximately ten feet below the releasing aircraft before functioning. Minimum release altitudes for these clusters are the same as those issued by the Chief of Naval Operations for bombs of the size used and fuzes installed plus twenty-five feet to allow for cluster opening. These clusters are safe for take-offs and landings anywhere, including catapult take-offs and arrested landing.

### Cluster Adapter Mk 4 Mod 0

Bombs..... Two 100-pound G.P. bombs

**General:** The Cluster Adapter Mk 4 is a simplification of the Mk 3. It employs only the band and pistol release device to hold the bombs together. With the bombs clustered together, one of them is then suspended from the bomb rack by its suspension lug. The nose-fuze vanes are held stationary by two clips which are attached to wire springs. These springs are held between the bombs until the cluster opens, after which they are sprung free.

### Cluster Adapter Mk 7 Mod 1

Bombs.....	Eight 20-pound Frag.
	Bombs, AN-M41A1
Total weight, pounds .....	186
Loaded length, inches.....	46.38
Width, inches .....	8.36

**General:** This cluster—250-pound bomb size—uses the same pistol release device to open the cluster as used on the Mk 3; otherwise the mechanism is different. In this cluster, there is not only the release of the steel bands holding the bombs together but a spring-loaded force to push the bombs out of the cluster.

**Description and operation:** The frame has a front and a rear plate separated by the longitudinal members, the upper and lower rods. The lower rod is rigid, but the upper one is free to rotate. To this upper rod are fixed the band hooks. When the cluster is assembled, the hooks are under torque from the tension of the band. However, the band hooks are held stationary by a king pin swung between two supports, which supports are placed between the upper and the lower rods. Firing of the pistol device, seated in the front plate, knocks out this king pin, allowing the upper rod and hooks to rotate, freeing the bands.

When the bands fall off, the springs on the lower rod expand and, acting through the lever arms, push outboard on all the bomb cradles, forcing the bombs away from the cluster.

The arming vanes of the nose fuzes in the fragmentation bombs are kept from turning by safety arms attached to the front plate.

The cluster is suspended by the suspension plates in the middle part of the cluster.

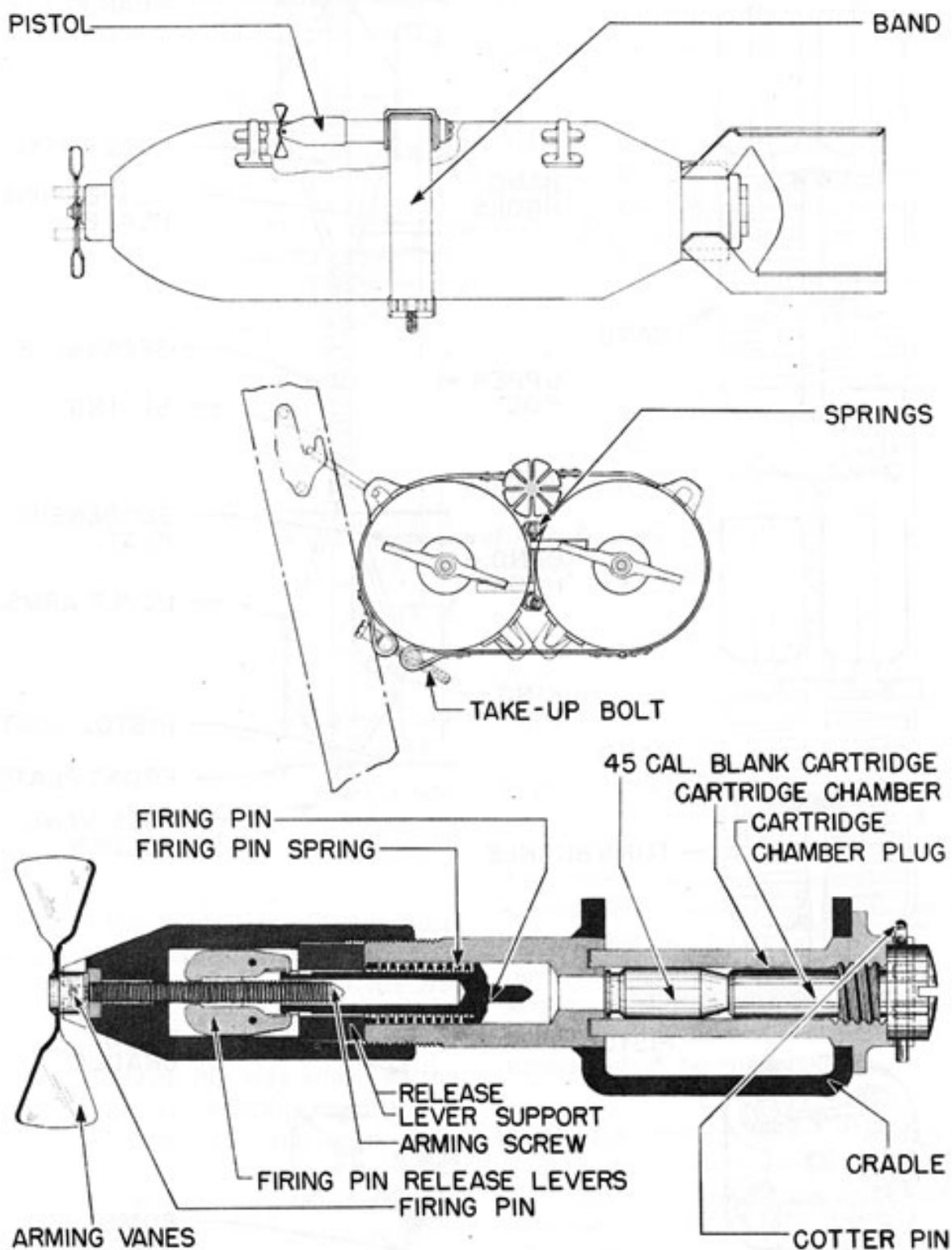


Figure 277. Cluster Adapter Mk 4 Mod 0

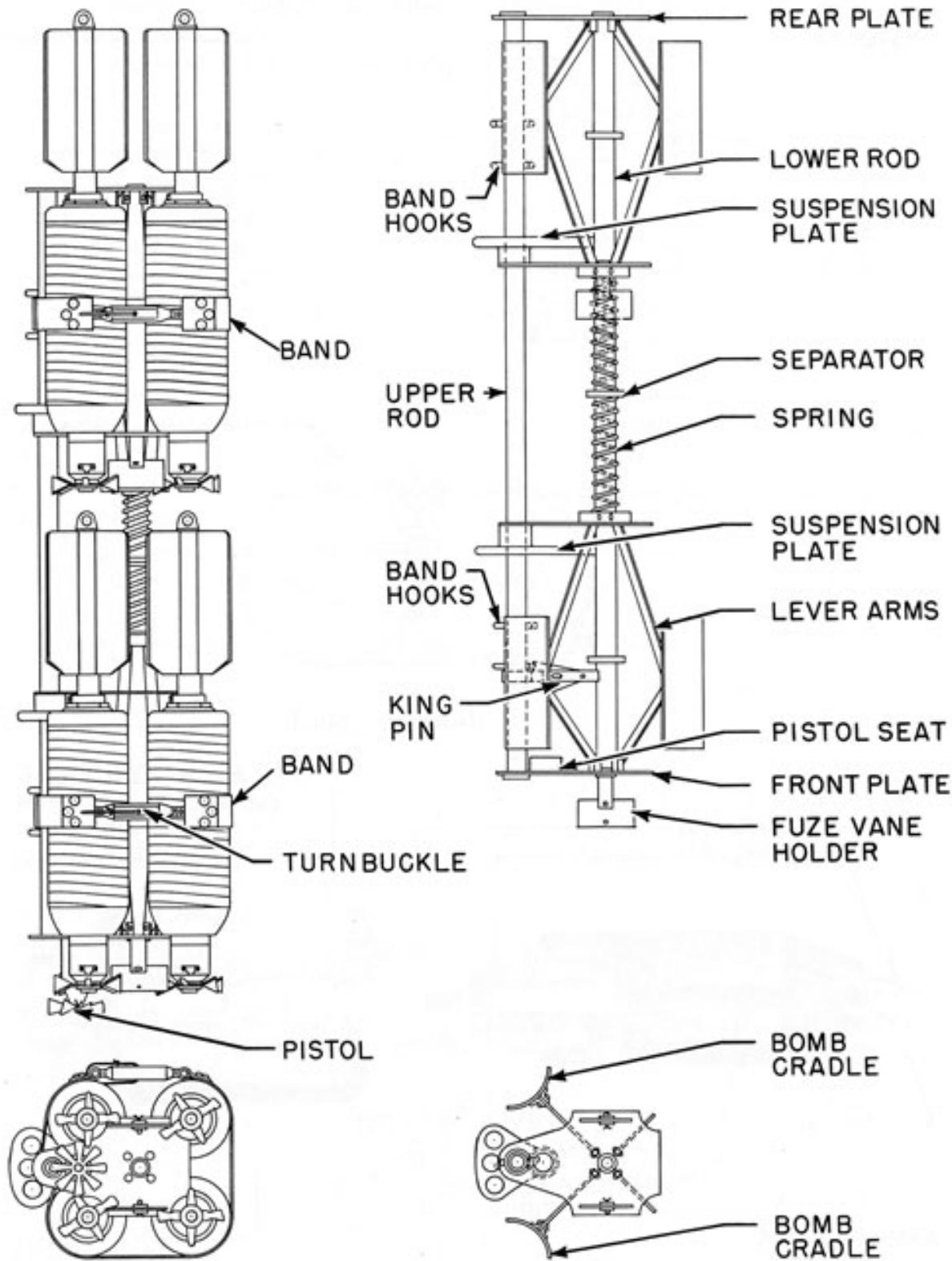


Figure 278. Cluster Adapter Mk 7 Mod 1

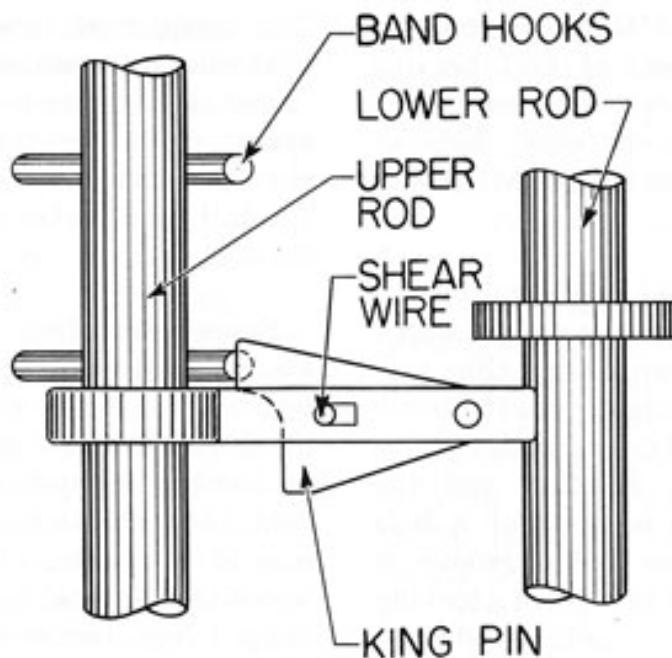


Figure 279. Close-up of King Pin on Cluster Adapter Mk 7 Mod 1

## Part 6 — Chapter 17 — Section 5

### "AN" SERIES

#### Introduction

The creation of the Army-Navy Standardization Board resulted in the standardization of the bombs of these two services into the AN series. This series was very similar to the M series except for these modifications:

1. A third suspension lug was added at the center of gravity and diametrically opposite the dual suspension lugs, to fit British release devices.

2. The base plate was changed to a male plug to increase the strength on low-angle penetration of targets.

3. The bombs were painted an over-all olive-drab with one-inch yellow bands around the nose and base and a  $\frac{1}{4}$ -inch yellow band around the center of gravity.

The bombs in this series included the following weights: 100, 250, 500, 1,000, and 2,000 pounds. These bombs are all general-purpose

high-explosive bombs. Though other types of bombs — armor-piercing, semi-armor-piercing, fragmentation, incendiary, depth, etc.—have been subsequently standardized and given AN designations, it is with the AN general-purpose bombs and their modifications that this introduction shall be concerned.

**AN G.P. Series:** The AN series was subsequently replaced by the AN G.P. series to make it possible for these bombs to be used in anti-submarine work as well as for general bombardment. This modification was incorporated into the 500-, 1,000-, and 2,000-pound bombs only, their new designations becoming AN-M64, AN-M65, and AN-M66, and consisted of a change from the Adapter Booster M102 to the Adapter Booster M115. With the Adapter Booster M115 it became possible to use either standard Army tail fuzes or the Tail Hydrostatic Fuze AN-Mk

230. The standard filling of these bombs was 50/50 Amatol until the supply of TNT became ample in 1943, at which time TNT became the standard filler. At the present time, 25% of the production of these bombs is filled with Composition "B".

**AN G.P. A1 Series:** The A1 modification consists of two steel pins in the base plate which lock the base plate to the main filling, thus preventing removal of the base plate, once the bomb is filled. In this series the adapter boosters have also been modified to the M102A1 and the M115A1. This modification consists of a hole through the adapter booster and a groove in the threads of the base plate to receive a locking pin which is shipped with all anti-withdrawal tail fuzes. Insertion of the pin which is held in by the fuze body prevents withdrawal of the adapter booster. This series is the current production G.P. bomb series and is used jointly by the Army, Navy, and British forces.

The following table will assist in understanding the development of the designations that have been successively applied to general-purpose bombs used by the Army and Navy.

**Body construction:** The body construction of American G.P. bombs may be in one, two, or three pieces. Methods of manufacture include (1) one-piece cast or spun, (2) two-piece cast and welded or (3) three-piece cast and welded.

The ogival nose tapers to join in the thin parallel side walls, which terminate in a boat-tailed shape at the after end. The threaded nose opening is closed by the fuze-seat liner, and the threaded base opening is closed by a male plug, the tail fuze pocket being made by the adapter booster.

**Suspension:** Dual suspension lugs for horizontal suspension are welded directly to the bomb case, being spaced 14 inches apart on bombs up to 2,000 pounds, and 30 inches apart on bombs 2,000 pounds and over. A single horizontal suspension lug is also welded to the bomb case at the center of gravity and diametrically opposite the dual lugs. The lugs are eyebolts, shaped from bar steel and formed in the shape of a U. "M" series bombs could be carried on single suspension racks by using an additional single-suspension lug welded on a band fitting around the bomb body at the center of gravity.

For suspension in dive-bomb displacement gear, trunnions are provided on a separate band which may be one of two types. The first type provides the trunnion only; and the second, a more common type, provides a single hoisting lug in addition to the trunnions. On some of the newer designs of AN bombs of Navy manufacture, the suspension and hoisting fittings are not attached to the bomb case by welding, but are held to the case by threaded bolts fitting into holes tapped and threaded into the body. For

#### GENERAL-PURPOSE BOMB DESIGNATIONS

Weight pounds	M Series	Navy	AN Series	AN G.P. Series	AN G.P. A1 Series
100	M30	Mk 4 Mod 4	AN-M30	AN-M30	AN-M30A1
250	M57		AN-M57	AN-M57	AN-M57A1
300	M31				
500	M43	Mk 12 Mod 2	AN-M43	AN-M64	AN-M64A1
600	M32				
1,000	M44	Mk 13 Mod 2	AN-M44	AN-M65	AN-M65A1
1,100	M33				
2,000	M34		AN-M34	AN-M66	AN-M66A1

suspension in torpedo slings, the torpedo sling guide key found on Navy bombs can be made on AN bombs by using the base of the single suspension lug with the lug removed by gentle hacksawing.

To hoist bombs into Navy planes, the AN bombs not equipped with hoisting lugs must have a hoisting lug furnished by either an expendable band with single or dual lugs, or by a removable hoisting band. The removable band is preferred, since it does not affect the terminal velocity of the bomb. The newest and best of these bands is the Universal Hoisting Band Mk 8. For Army planes, bombs are usually hoisted by canvas slings, which also have the advantage of not affecting air trajectory.

**Tail fin construction:** The tail construction is known as the box-type tail and consists of the following parts: a cast-steel sleeve secured to the body of the bomb by a fin locking nut, and four sheet-steel fins supported by four sheet-steel struts in the shape of a box. One fin and one strut are pressed from a single piece of metal, and the four pieces are then welded to the sleeve. "A" indicates heavier construction for high-altitude bombing.

**Color and markings:** The standard color scheme employed on these bombs since 11 March 1942 has been an olive drab body with yellow bands to indicate the H.E. filler. The banding system for Amatol and TNT fillers is a one-inch yellow band at the nose, a one-inch yellow band at the tail of the bomb body, and a  $\frac{1}{4}$ -inch dotted band at the center of gravity. Because Composition "B" is more sensitive and requires more careful handling, it is given an additional marking consisting of a second one-inch yellow band at the nose and at the tail. On these bands "Comp. B" is stencilled in black paint. Recent production eliminates the  $\frac{1}{4}$ -inch band, since the center of gravity is located accurately enough by the single suspension lug.

The following standard markings are painted on the bomb body in black paint: type, weight, and name of bomb, type of filling, lot number,

place and date of filling, and inspector's initials.

Additional indestructible marking is stamped into the metal of the bomb case on the rear conical surface of the bomb body: type, size, name, maker's initials, lot number, and date (i.e., G.P. 500 lb. AN-M64 CSCO Lot 57 4/42).

**Explosive filling:** The filling of these bombs is accomplished in the following manner. With the nose-fuze seat liner in place, the bomb is placed on end nose-down and an Auxiliary Booster M104 is positioned behind it. The M104 is a bakelite tube containing tetryl pellets. The initial pour of the explosive is sufficient to secure the auxiliary booster when it cools. Then the remainder of the filling, 50/50 Amatol, TNT, or Composition "B", is added until a depth of approximately six inches remains to be filled. A second Auxiliary Booster M104 is then inserted in all bombs except the 100-pound, and the tail surround is added to complete the filling. A wooden former is inserted in the tail-fuze cavity as the filling cools. After cooling, the former is removed and the appropriate adapter booster is inserted. The adapter booster consists of the fuze-seat liner with an additional steel cup containing a tetryl pellet. The Adapter Booster M102 (and M102A1) has an internal thread diameter of 1.50 inches. The adapter Booster M115 has an internal thread diameter of 2.0 inches, and an adapter ring for further reduction of the diameter to 1.50 inches when smaller fuzes are used.

Tests conducted by the Army indicated that the presence or absence of Auxiliary Boosters M104 does not alter the effectiveness of the detonation of bombs. On the basis of these tests, the Army started to eliminate the Auxiliary Boosters M104 from Composition B loaded 500-pound, 1,000-pound, and 2,000-pound G.P. bombs during the latter part of 1944. Elimination of Auxiliary Boosters M104 in TNT and Tritonal loaded G.P. and S.A.P. bombs was started in March (TNT) and June (Tritonal) of 1945. At the present time, all productions of Composition "B," TNT and Tritonal loaded G.P. and S.A.P. bombs, and Composition B loaded Frag. bombs, exclude Auxiliary Boosters M104.

The bombs from which the Auxiliary Boosters M104 are now eliminated are as follows:

G.P.	S.A.P.	Frag.
(Comp. B, TNT or Tritonal Filling)	(TNT Filling)	(Comp. B Filling)
100# AN-M30A1	500# AN-M58A2	220# AN-M88
250# AN-M57A1	1,000# AN-M59A1	260# M81
500# AN-M64A1		
1,000# AN-M65A1		
2,000# AN-M66A2		

Tests conducted by the Army have shown that inert nose and tail surrounds improve safety in handling of G.P. and S.A.P. bombs. On the basis of these tests, the majority of G.P. and S.A.P. bombs loaded at the present time have inert nose and tail surrounds. This covers Composition B, TNT, Tritonal, and Picratol filled bombs. Formerly Composition B loaded bombs had TNT surrounds.

The ingredients of the inert surrounds used at present are as follows: ester gum, 51.0%; castor oil, 10.5%; kaolin, 34.5%; and wax, hydrocarbon, 4.0%.

The thickness of these surrounds is as follows:

G.P. Bombs	S.A.P. Bombs
Nose $1\frac{1}{4}'' + \frac{1}{4}''$	Nose Fills nose cavity and
Tail $\frac{3}{4}'' + \frac{1}{4}''$	extends not more than $\frac{1}{8}''$ beyond the bottom of the fuze seat liner.
	Tail $\frac{3}{4}'' + \frac{1}{4}''$

The thickness of the surrounds is such that most, if not all, of the explosive portion of the adapter booster and that of the nose-fuze booster (surrounded by fuze seat liner) extends into the main filler, with exception of the S.A.P. nose set-up.

**Anti-ricochet attachments:** To give a more nearly vertical impact to 100-pound, 250-pound, and 500-pound G.P. bombs and to break their rapid descent when dropped from low-flying planes, the Anti-Ricochet Devices M16 and M17 have been developed. The device consists of a parachute unit, a modified AN-M112A1 series tail fuze (M151) using an anemometer-type

arming vane, and a fuze adapter.

**Clusters and cluster adapters:** Properly, the cluster adapter is merely the containing device or holder. When the adapter is loaded with bombs, the entire assembly becomes a cluster. In some cases the cluster adapter may closely resemble a bomb in construction (e.g. M15 and M16), while in others the adapter is nothing more than a banding arrangement (AN-M1A1, AN-M4).

#### 100-pound G.P. AN-M30 and AN-M30A1

Over-all length, inches.....	36.0
Body length, inches .....	29.0
Body diameter, inches.....	8.2
Wall thickness, inch .....	0.16
Tail length, inches.....	9.75
Tail width, inches .....	11.0
Tail weight, pounds.....	3.5
Filling.....	50/50 TNT
	Amatol
Weight of filling.....	54.0# 57.0#
Total weight .....	110.0# 115.0#
Charge/weight ratio.....	49% 50%

#### Fuzing—Regular missions

Nose: AN-M103, AN-103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, AN-M140A1, M140, M140A1, M149, M163, M164, M165, Mk 239, Mk 243-0, Mk 244-0.

Tail: AN-M100A2, AN-M100A1, M100, M160.

#### Fuzing—Special missions

Tail: M112, M112A1, (Masthead bombing from land base only).

M115 (Masthead from carrier or land base).

M123, M123A1, M132 (Long-delay time fuze against land targets).

M151 (Anti-ricochet).

Nose: Shipping plug when above fuzes are used in the tail.

#### Fuzing—V.T. missions

Nose: T50E1, M168, M166, T82.

Tail: AN-M100A2 (to insure detonation in event of V.T. fuze failure).

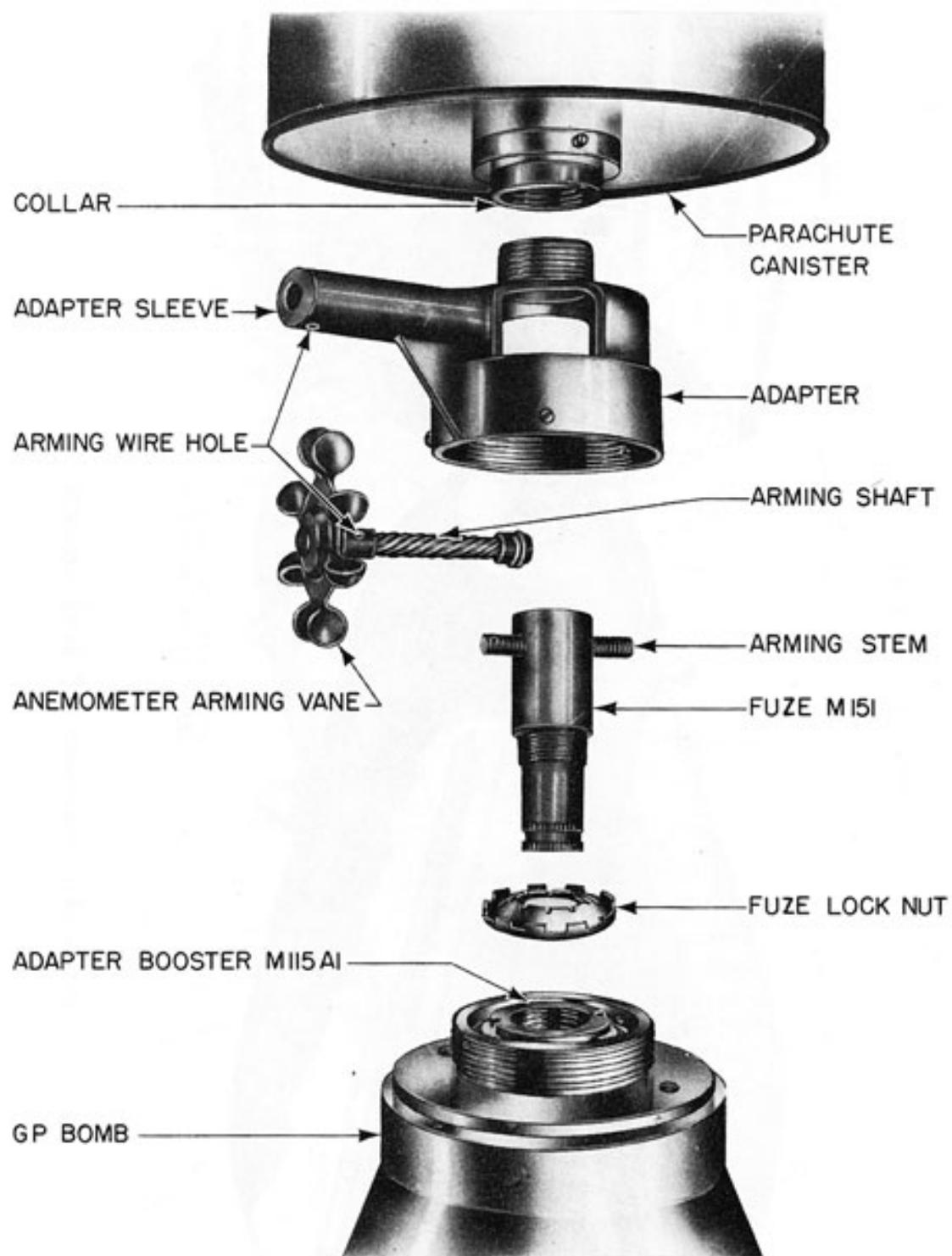


Figure 280. Components of Anti-Ricochet Parachute Assembly

**Remarks:** To overcome the erratic flight of these bombs when dropped from high altitudes by very heavy bombers, the tail assembly of the 260-pound Fragmentation Bomb M81 replaces

the customary tail unit, which is two inches shorter, for such missions.

Use of the Cluster Adapter M22 permits single suspension for four G.P. Bombs AN-M30 or AN-M30A1.

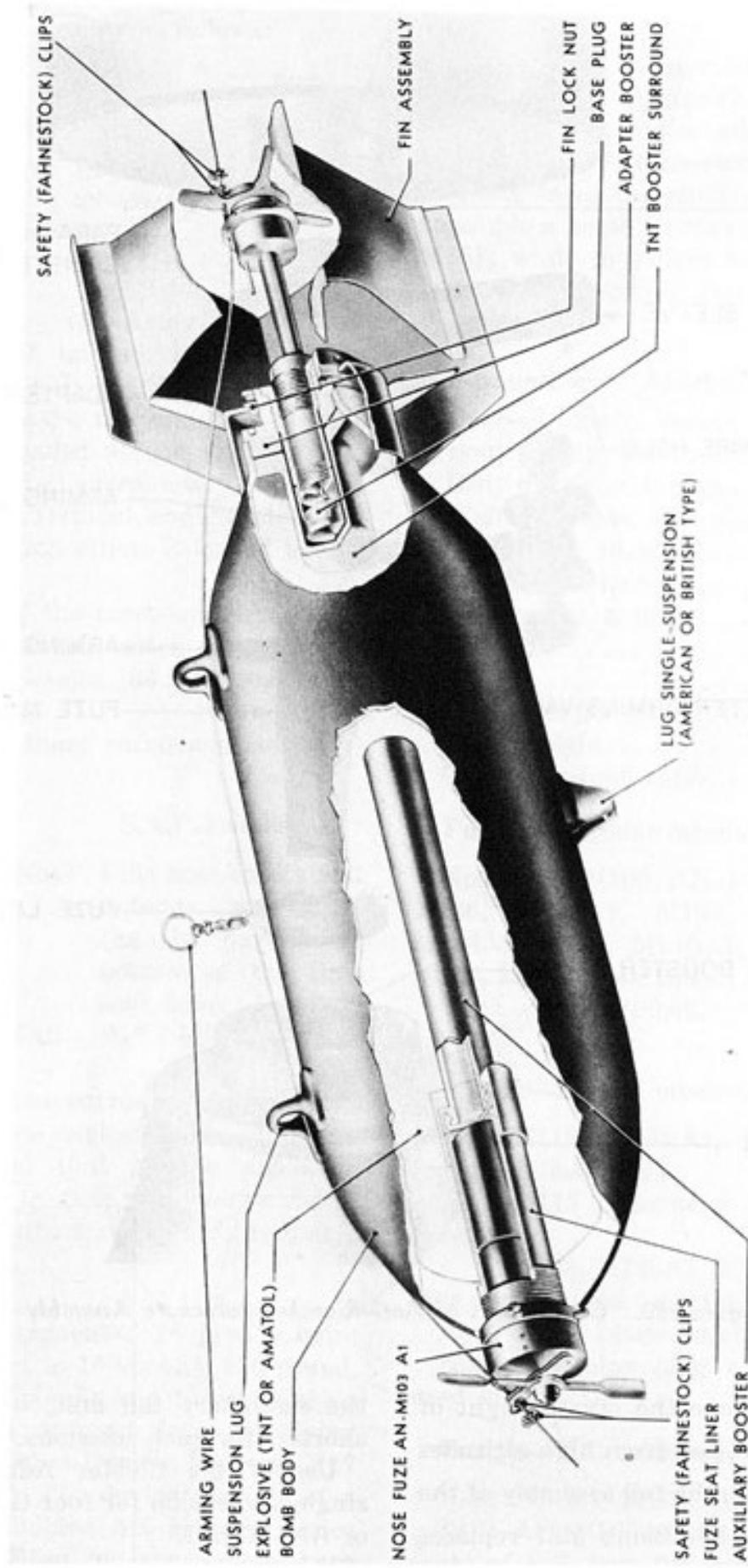


Figure 281. 100-pound G.P. Bomb AN-M30

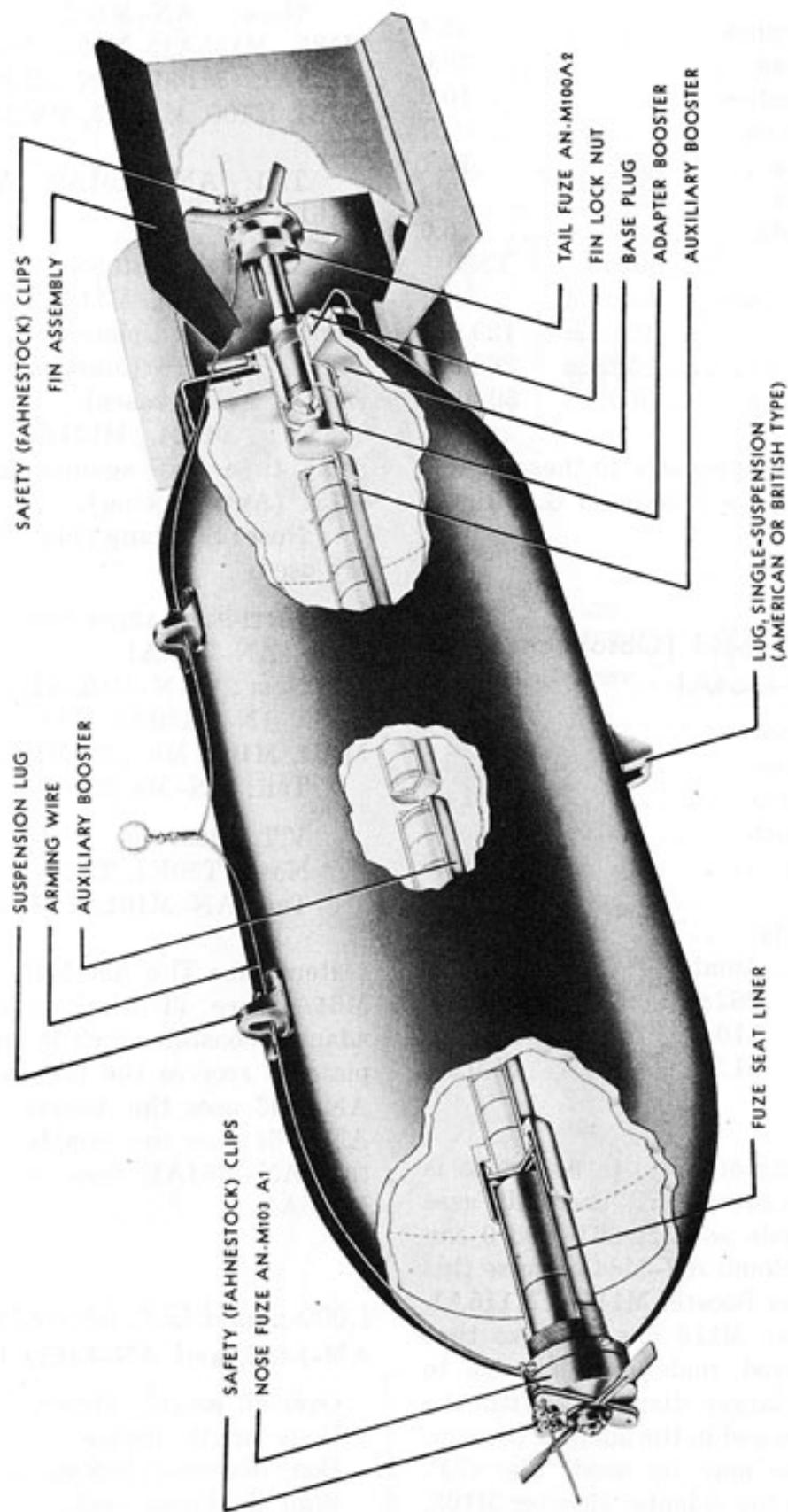


Figure 282. 250-pound G.P. Bomb AN-M57

**250-pound G.P. AN-M57 and AN-M57A1**

Over-all length, inches .....	45.4
Body length, inches.....	36.0
Body diameter, inches .....	10.9
Wall thickness, inch.....	0.27
Tail length, inches.....	12.1
Tail width, inches.....	14.9
Tail weight, pounds.....	6.0
Filling.....	50/50
	TNT
	Amatol
Weight of filling.....	123.7#
Total weight .....	255.9#
Charge/weight ratio .....	48.0% 50.0%

**Fuzing:** Directions applicable to these bombs are the same as for the 100-pound G.P. Bomb AN-30.

**500-pound G.P. AN-M43 (Obsolescent), AN-M64, and AN-M64A1**

Over-all length, inches .....	56.8
Body length, inches .....	45.0
Body diameter, inches .....	14.2
Wall thickness, inch.....	0.3
Tail length, inches .....	13.9
Tail width, inches .....	18.9
Tail weight, pounds.....	12.3
Filling .....	Amatol
	TNT
	Comp. B
Wt. of filling.....	262#
Total weight .....	510#
Chg./wt. ratio .....	51.2% 51.0% 51.0%

**Fuzing:** The fuzing of these three bombs is the same, with these exceptions: The Tail Fuze AN-Mk 230 and Mods and Mk 231 Mod 0 can be used in the G.P. Bomb AN-M64 because this bomb has the Adapter Booster M115 or M115A1. The Adapter Booster M115 has a sleeve that can be easily removed, making it possible to use a fuze with a larger diameter. With the removable sleeve screwed in the adapter booster, any Army tail fuze may be used. The G.P. Bomb AN-M43 uses the Adapter Booster M102, which has no removable sleeve and therefore cannot take the Hydrostatic Fuze AN-Mk 230 and Mk 231.

**REGULAR MISSIONS**

Nose: AN-M103, M103, AN-M103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, M140, AN-M140A1, M149, M163, M164, M165, Mk 243, Mk 244, Mk 239, AN-Mk 219.

Tail: AN-M101A2, AN-M101A1, M101, M161.

**SPECIAL MISSIONS**

Tail: M113, M113A1 (Masthead bombing from land based planes only).

M116 (Masthead bombing from carriers and land bases).

M124, M124A1, Mk 237-0 (Long-delay time fuze against land targets), M133, M151 (Anti-ricochet).

Nose: Shipping plug, when above tail fuzes are used.

**ANTI-SUBMARINE MISSIONS (AN-M64, AN-M64A1)**

Nose: AN-M103A1, AN-M103, M103, M139, AN-M139A1, M140, AN-M140A1, M163, M164, M165, Mk 239, Mk 243, Mk 244-0-1.

Tail: AN-Mk 230-4-5-6, Mk 231-0.

**V.T. MISSIONS**

Nose: T50E4, T82.

Tail: AN-M101A2 (Insurance).

**Remarks:** The AN-M43, AN-M64, and AN-M64A1 are identical types except for the adapter booster which is employed in the base plate to receive the tail fuze. The G.P. Bomb AN-M43 uses the Adapter Booster M102; the AN-M64 uses the Adapter Booster M115; and the AN-M64A1 uses the Adapter Booster M115A1.

**1,000-pound G.P. AN-M44 (Obsolescent), AN-M65, and AN-M65A1**

Over-all length, inches .....	67.1
Body length, inches .....	53.1
Body diameter, inches .....	18.8
Wall thickness, inch.....	0.5
Tail length, inches .....	18.5
Tail width, inches .....	25.4
Tail weight, pounds.....	21.5

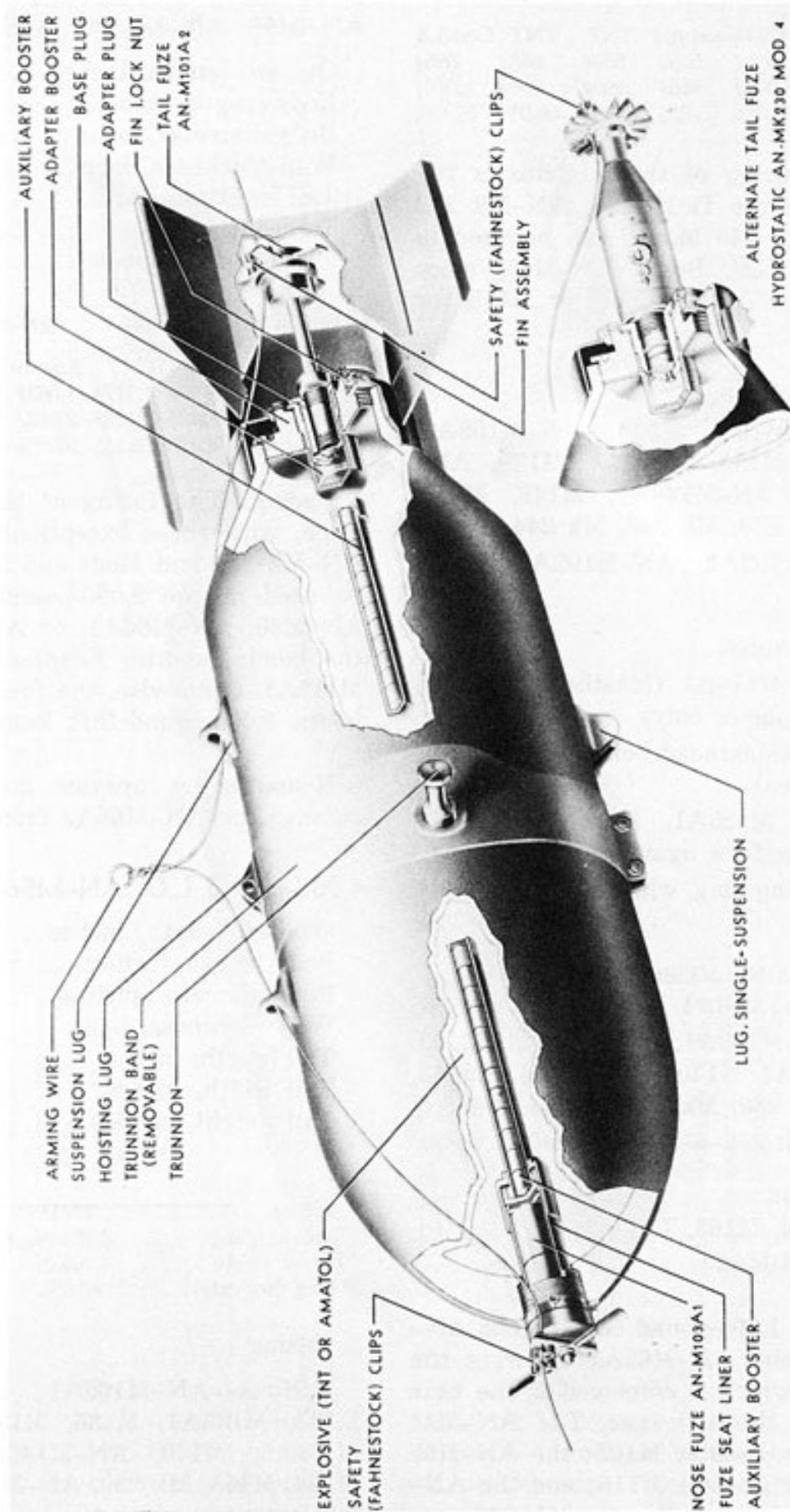


Figure 283. 500-pound G.P. Bomb AN-M64

	AN-M44	AN-M65	AN-M65A1
Filling.....	Amatol	TNT	Amatol
Wt. of filling.....	530#	558#	530#
Total weight.....	964#	990#	965#
Chg./wt.ratio.....	54.9%	56.0%	55.8%
			56.0%
			56.0%
			57.0%

**Fuzing:** The fuzing of these bombs is the same except that the Tail Fuzes AN-Mk 230 and Mods and Mk 240 Mod 0 can be used in the 1,000-pound G.P. Bomb AN-M65, since this bomb has the Adapter Booster M115 (or M115A1).

#### REGULAR MISSIONS

Nose: AN-M103, M103, AN-M103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, M140, AN-M140A1, M149, M163, M164, M165, Mk 239, Mk 243, Mk 244.

Tail: AN-M102A2, AN-M102A1, M102, M162.

#### SPECIAL MISSIONS

Tail: M114, M114A1 (Masthead bombing from land-based planes only).

M117 (Masthead bombing from carriers or land bases).

M125, M125A1, M134, Mk 238-0 (Long-delay time fuze against land targets).

Nose: Shipping plug, when above tail fuzes are used.

#### ANTI-SUBMARINE MISSIONS (AN-M65, AN-M65A1 ONLY)

Nose: AN-M103A1, AN-M103, M103, M139, AN-M139A1, M140, AN-M140A1, M163, M164, M165, Mk 239, Mk 243, Mk 244-0-1.

Tail: AN-Mk 230-4-5-6, Mk 240-0.

#### V.T. MISSIONS

Nose: T50E4, M166, T82.

Tail: AN-M102A2.

**Remarks:** The 1,000-pound G.P. Bombs AN-M44, AN-M65, and AN-M65A1 differ in the adapter booster which is employed in the base plate to receive the tail fuze. The AN-M44 uses the Adapter Booster M102; the AN-M65 uses the Adapter Booster M115; and the AN-M65A1 uses the Adapter Booster M115A1.

#### 2,000-pound G.P. AN-M34 (Obsolescent), AN-M66, AN-M66A1, and AN-M66A2

Over-all length, inches.....	90.4
Body length, inches.....	70.0
Body diameter, inches.....	23.3
Wall thickness, inch.....	0.5
Tail length, inches.....	25.7
Tail width, inches.....	31.6
Tail weight, pounds.....	38.6

#### AN-M34      AN-M66      AN-M66A1

Filling.....	Amatol	TNT	Amatol	TNT	TNT	Comp.B
Wt. of filling.....	1,063#	1,117#	1,063#	1,117#	1,117#	1,142#
Total weight.....	2,049#	2,103#	2,052#	2,106#	2,106#	2,140#
Chg./wt.ratio.....	51.9%	53.1%	52.0%	53.0%	53.0%	53.3%

**Fuzing:** The fuzing of these bombs is the same, with these exceptions: The Tail Fuzes AN-Mk 230 and Mods and Mk 240 Mod 0 can be used in the 2,000-pound G.P. Bomb, the AN-M66, AN-M66A1, or AN-M66A2 because the bomb has the Adapter Booster M115 or M115A1. Otherwise, the fuzing is the same as in the 1,000-pound G.P. Bomb AN-M44.

**Remarks:** A heavier nose section distinguishes the AN-M66A2 from the AN-M66A1.

#### 4,000-pound L.C. AN-M56 and AN-M56A1

Over-all length, inches.....	117.3
Body length, inches.....	94.9
Body diameter, inches.....	34.0
Wall thickness, inch.....	0.37
Tail length, inches.....	28.0
Tail width, inches.....	47.6
Tail weight, pounds.....	95.0

Filling.....	TNT	Amatol	Amatol	50/50
Wt. of filling.....	3,362.0#	3,245#	3,238#	
Total weight.....	4,205.0#	4,095#	4,232#	
Chg./wt. ratio.....	80.0%	79.0%	76.5%	

#### Fuzing

**NOSE**—AN-M103A1, AN-M103, M103, M135, M135A1, M136, M136A1, M139, AN-M139A1, M140, AN-M140A1, M149, M163, M164, M165, Mk 239, AN-Mk 219 (Always set for instantaneous action).

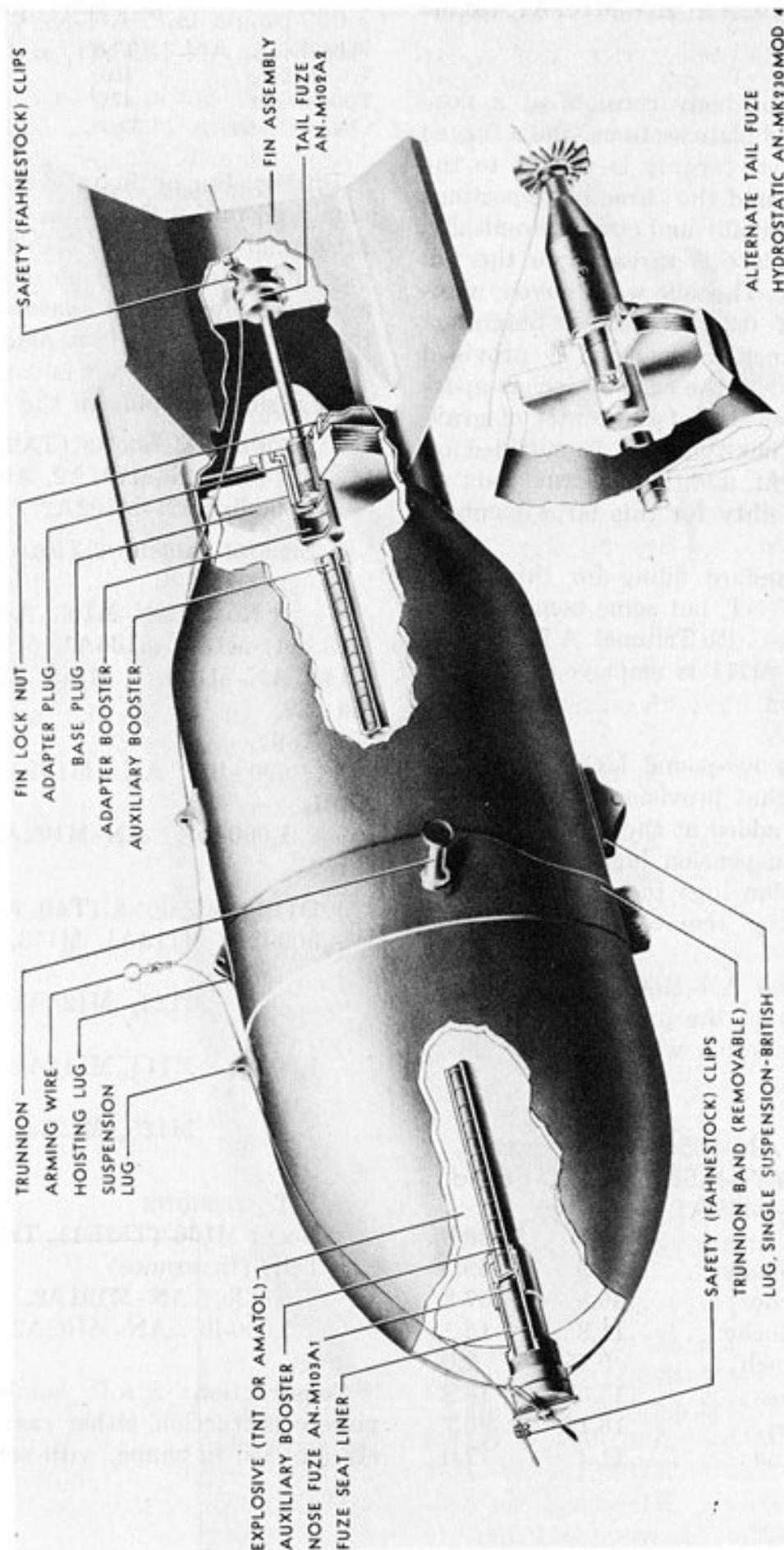


Figure 284. 1,000-pound G.P. Bomb AN-M65

TAIL—AN-M102A2, AN-M102A1, M162 (Non-delay action).

**Construction:** The body consists of a nose forging, three rolled plate sections, and a forged base plate. The nose forging is welded to the first plate section, and the three plate sections are welded longitudinally and circumferentially. The female base plate is threaded to the tail section of the body. The side walls have a minimum thickness of 0.3 inch and a maximum thickness of 0.5 inch. Suspension is provided by two lugs welded to the case 30 inches apart (15 inches on either side of the center of gravity). The normal box-type tail is modified on this bomb by eight additional strut rods to give increased stability for this large bomb.

**Filling:** The standard filling for this bomb at present is cast TNT, but some bombs in the future will be loaded with Tritonal. A full length Auxiliary Booster M111 is employed to insure complete detonation.

**Remarks:** The 4,000-pound L.C. Bomb AN-M56A1 differs in that provision is made for a hoisting lug to be added at the center of gravity between the suspension lugs and also for two other suspension lugs to be screwed into the bomb body,  $22\frac{1}{2}^{\circ}$  removed, for suspension in British planes.

The AN-M56 and AN-M56A1 are not procured by the Navy at the present time.

Any future production will have inert nose and tail surrounds.

**S.A.P. 500-pound AN-M58 (Obsolescent), AN-M58A1, and AN-M58A2; 1,000-pound AN-M59 and AN-M59A1**

500 lb. 1,000 lb.

Over-all length, inches.....	57.8	69.3
Body length, inches.....	46.8	57.3
Body diameter, inches.....	11.8	15.1
Wall thickness, inch.....	0.75	1.0
Tail length, inches.....	15.05	16.8
Tail width, inches.....	16.18	20.7
Tail weight, pounds.....	11.4	17.0

	AN-M58	AN-M58A1	AN-M59
Filling.....	TNT	TNT	TNT
Wt. of filling.....	160 $\frac{1}{2}$	162 $\frac{1}{2}$	320 $\frac{1}{2}$
Total weight.....	472 $\frac{1}{2}$	494 $\frac{1}{2}$	995 $\frac{1}{2}$
Chg./wt. ratio.....	33.9%	33.0%	32.0%

**Fuzing:** For ordinary use, only tail fuzes are employed in S.A.P. bombs, but Nose Fuze AN-M103 and variations of this fuze can be employed for fragmentation effect, in which case a non-delay primer detonator is employed in the tail fuze. Otherwise, in regular missions a short-delay primer detonator is used in the tail fuze, with a shipping plug in the nose.

**REGULAR MISSIONS (TAIL FUZED ONLY)**

500-lb.: AN-M101A2, AN-M101A1, M161.  
1,000-lb.: AN-M102A2, AN-M102A1, M162.

**SPECIAL MISSIONS (FRAGMENTATION EFFECT)**

Nose: AN-M103, AN-M103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, M140, AN-M140A1, M149, M163, M164, M165, Mk 239.

Tail:

500-lb.: AN-M101A2, AN-M101A1, M161.

1,000-lb.: AN-M102A2, AN-M102A1, M162.

**OTHER MISSIONS (TAIL FUZED ONLY)**

500-lb.: M113A1, M113, M116 (minimum altitude).

M124, M124A1, M133 (long-delay).

1,000-lb.: M114, M114A1, M117 (minimum altitude).

M125, M125A1, M134 (long-delay).

**V.T. MISSIONS**

Nose: M166 (T51E1), T82.

Tail: (Insurance)

500-lb.: AN-M101A2.

1,000-lb.: AN-M102A2.

**Construction:** S.A.P. bombs are of single-piece construction, either cast or spun, slightly streamlined in shape, with semi-pointed noses.

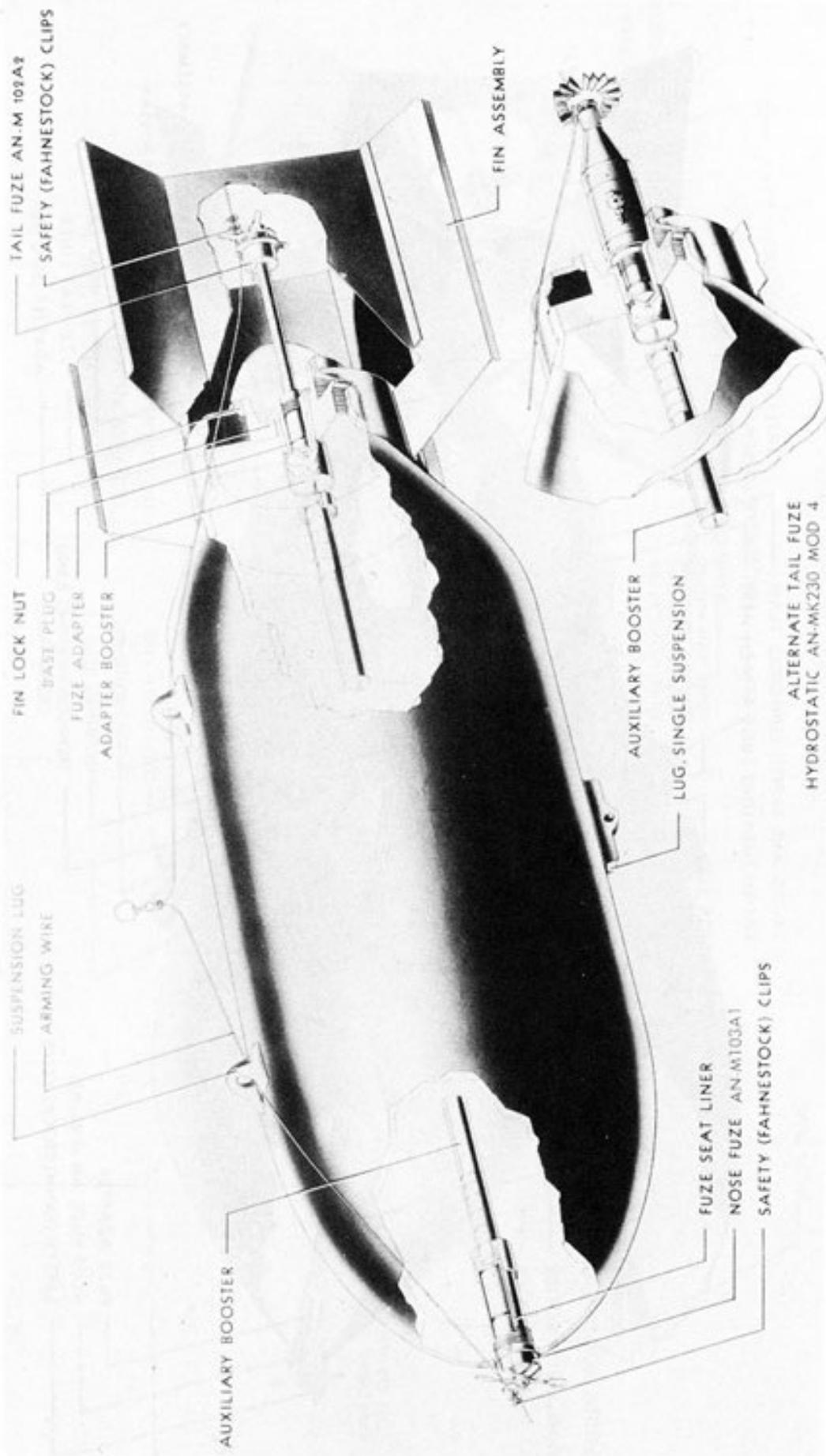
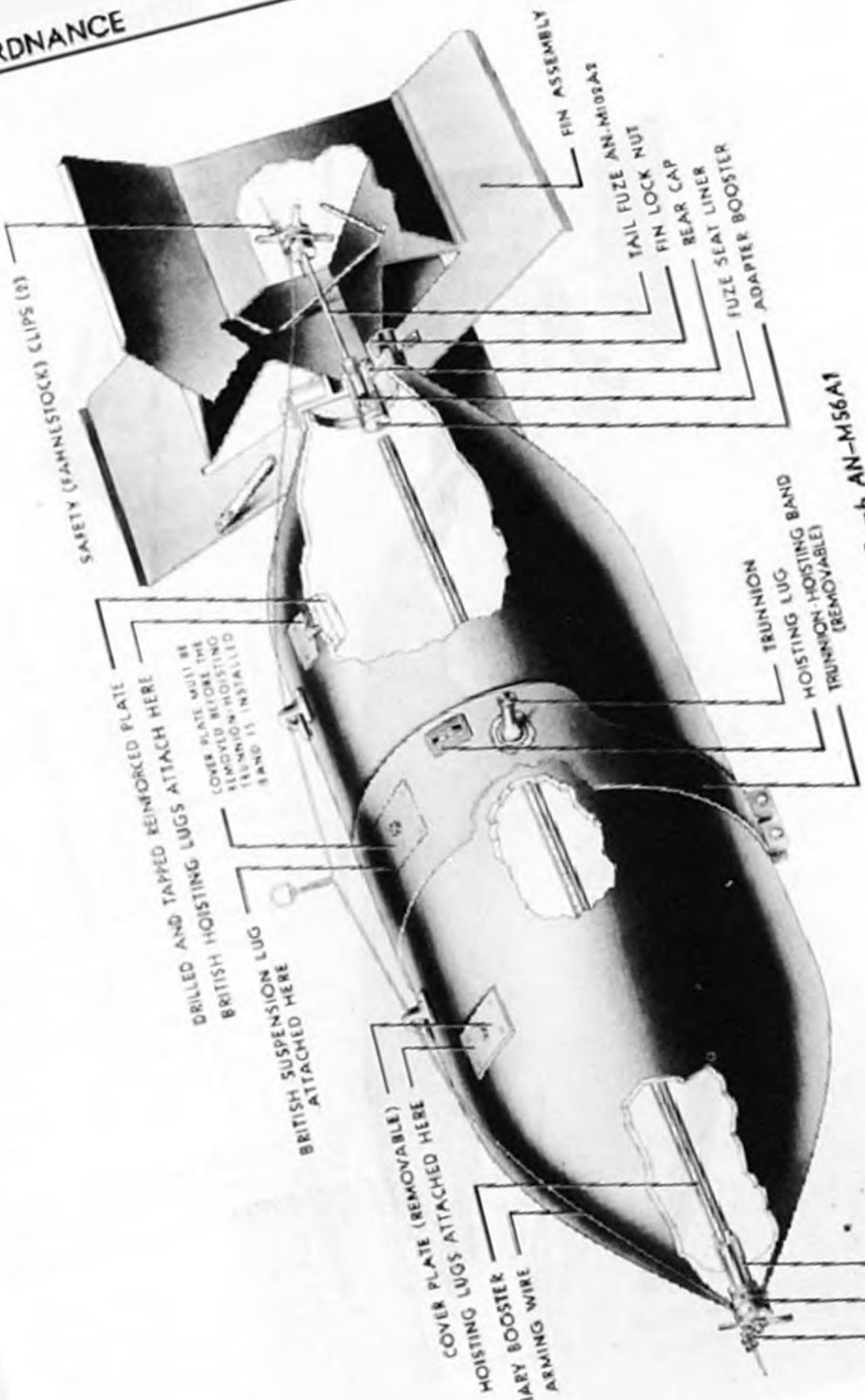


Figure 285. 2,000-pound G.P. Bomb AN-M66

U. S. EXPLOSIVE ORDNANCE

OP 1664



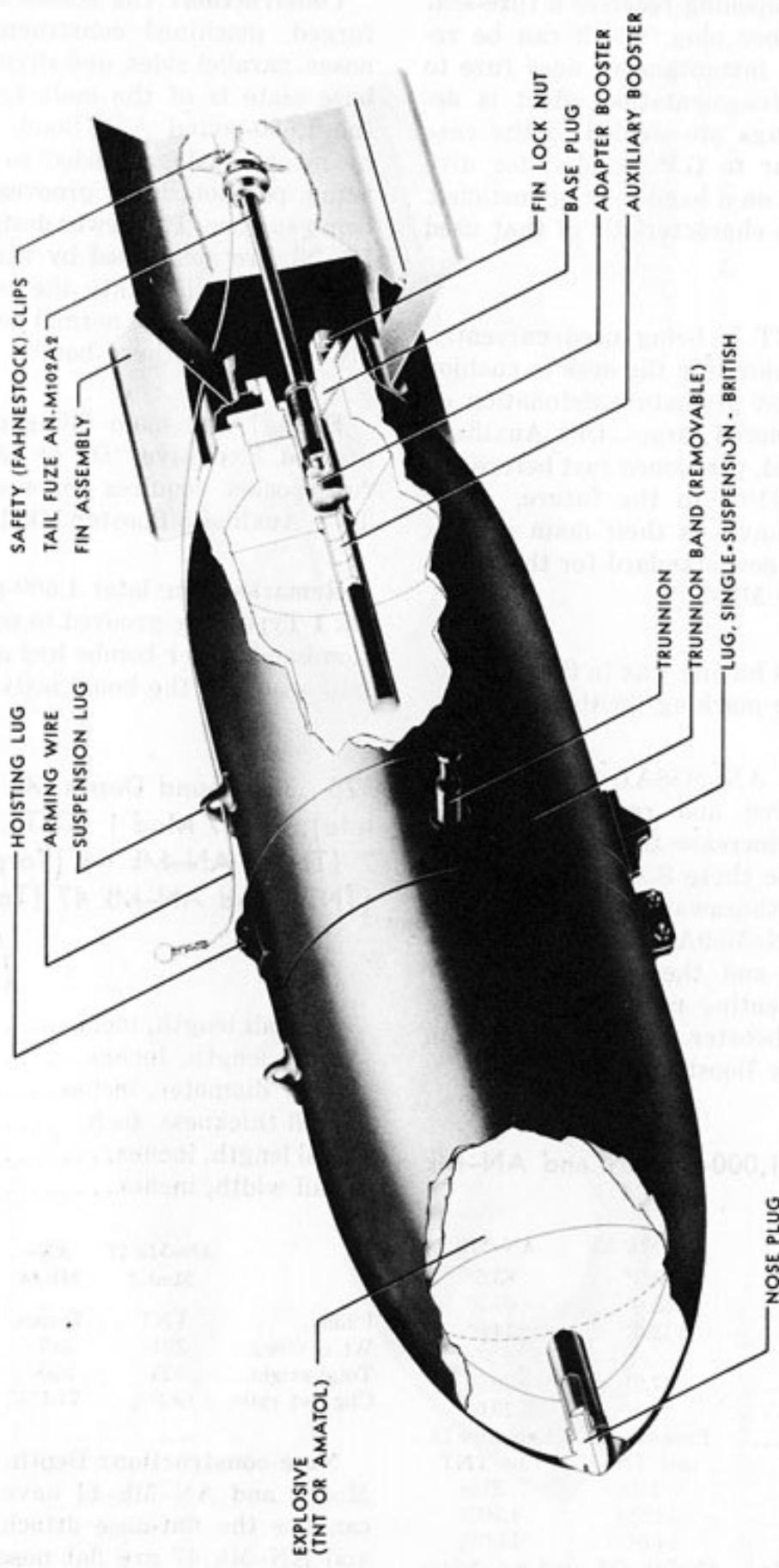


Figure 287. 1,000-pound S.A.P. Bomb AN-M59

The threaded nose opening receives a fuze-seat liner and a steel nose plug, which can be removed, allowing an instantaneous nose fuze to be inserted when fragmentation effect is desired. Suspension lugs are welded to the case in a manner similar to G.P. bombs; for dive bombing, trunnions on a band may be installed. The box-type tail is characteristic of that used on G.P. bombs.

**Filling:** Cast TNT is being used currently, with a wax pad employed in the nose to cushion the explosive against premature detonation on impact with an armored target. One Auxiliary Booster M104 is used, positioned just before the Adapter Booster M102. In the future, Army S.A.P. bombs will have, as their main charge, Picratol, the filling now standard for the 2,000-pound S.A.P. Bomb M103.

**Markings:** Bombs having wax in the nose can be identified by the marking "with pad."

**Remarks:** In the AN-M58A1, 9.5 pounds of Amatol are removed and replaced by 31.5 pounds of steel to increase the penetration of the bomb. To enable these S.A.P. bombs to be used with anti-withdrawal fuzes, the AN-M58A2 and the AN-M59A1 incorporate base-plate locking pins and the Adapter Booster M102A1, thus preventing removal of the base plate and adapter booster. Present production eliminates Auxiliary Booster M104.

#### A.P. AN-Mk 33 (1,000-pound) and AN-Mk 1 (1,600-pound)

	AN-Mk 33	AN-Mk 1
Over-all length.....	73.0"	83.5"
Body length.....	58.0"	69.5"
Body diameter.....	12.0"	14.0"
Wall thickness.....	—	1.3"
Tail length.....	17.0"	20.5"
Tail width.....	16.0"	20.6"
Filling.....	Explosive D. cast TNT	Explosive D. cast TNT
Weight of filling.....	140#	215#
Total weight.....	1.025#	1.590#
Charge/weight ratio.....	14.0%	14.0%
Fuzing.....	Tail—AN-Mk 228 (0.08 sec. delay)	

**Construction:** The bodies are of single-piece, forged, machined construction, with pointed noses, parallel sides, and slight boat tailing. The base plate is of the male type. Suspension in the 1,600-pound A.P. Bomb Mk 1 design was by means of lugs welded to bands, the bands being positioned by grooves on the external bomb surface. The newer designs, AN-Mk 1 and Mk 33, are suspended by fittings which screw into holes drilled into the bomb case and secured by bolts. The normal box-type tail assembly is used on these bombs.

**Filling:** The main filling of these bombs is pressed Explosive "D" or cast TNT. The tail fuze pocket requires the use of the granular TNT Auxiliary Booster Mk 1.

**Remarks:** The later 1,600-pound A.P. Bombs Mk 1 Type were grooved to position the suspension band. Older bombs had a stud which fitted into a hole in the bomb body.

#### 325-, 350-pound Depth Mk 17 (TNT—Obsolete), Mk 17 Mod 1 (TNT), AN-Mk 17 Mod 2 (TNT), AN-Mk 44 (Torpex), AN-Mk 41 (TNT), and AN-Mk 47 (Torpex)

	AN-Mk 17 Mod 2	AN-Mk 41	AN-Mk 47
AN-Mk 44	AN-Mk 47		
Over-all length, inches.....	52.5	49.9	
Body length, inches.....	31.1	27.8	
Body diameter, inches.....	15.0	15.0	
Wall thickness, inch.....	0.06	0.06	
Tail length, inches.....	20.2	24.6	
Tail width, inches.....	20.6	15.4	

	AN-Mk 17 Mod 2	AN- Mk 44	AN- Mk 41	AN- Mk 47
Filling.....	TNT	Torpex	TNT	Torpex
Wt. of filling...	224#	249#	227#	252#
Total weight...	325#	350#	347#	355#
Chg./wt. ratio .....	68.9%	71.1%	65.4%	70.9%

**Nose construction:** Depth Bombs AN-Mk 17 Mod 2 and AN-Mk 44 have round noses, and can use the flat-nose attachment; AN-Mk 41 and AN-Mk 47 are flat nosed.

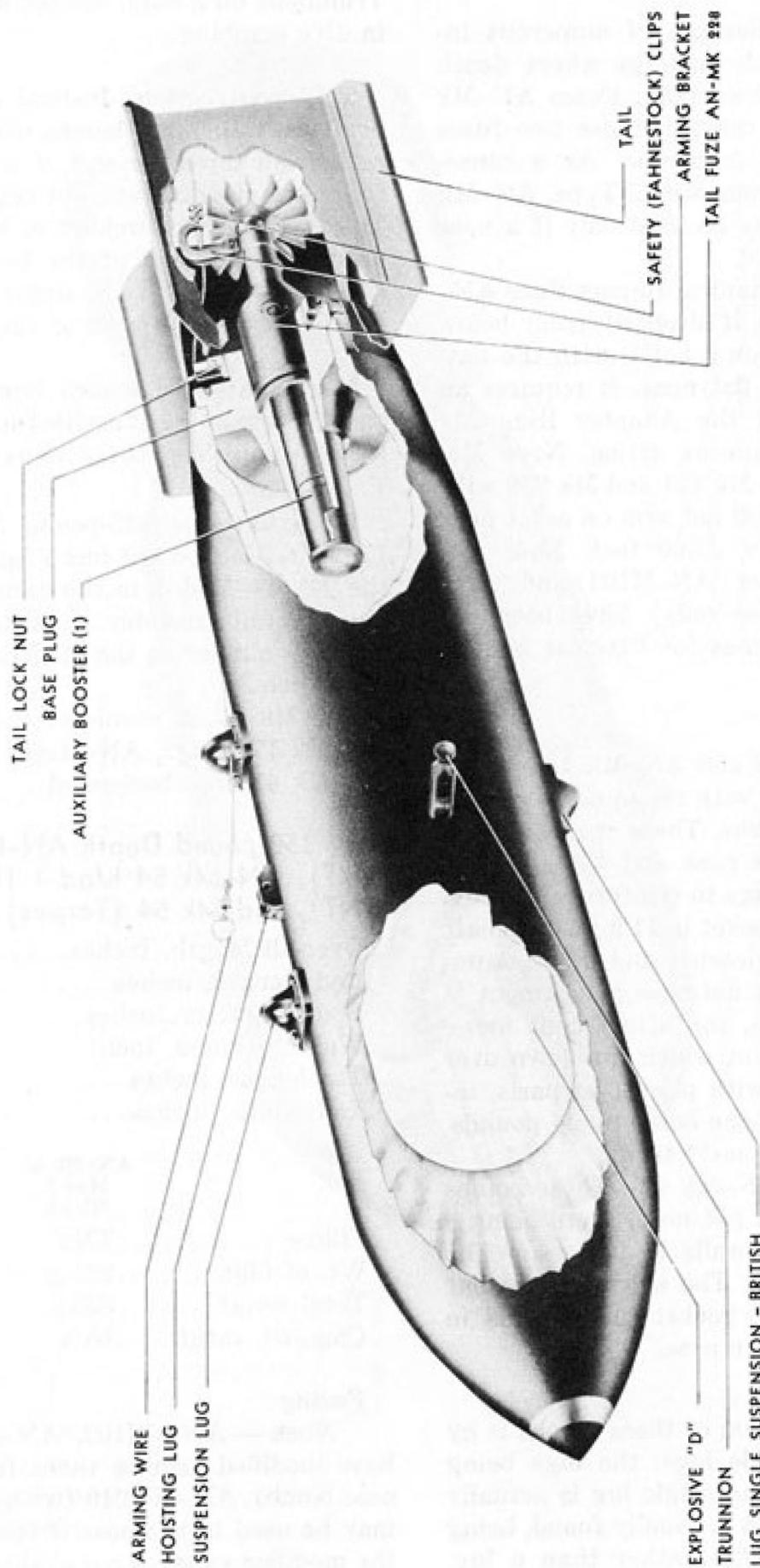


Figure 288. 1,000-pound A.P. Bomb AN-Mk 33

**Fuzing**

**ATHWARTSHIP**—Because of numerous instances in water crash landings where depth bombs fuzed with Athwartship Fuze AN-Mk 224 or AN-Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the Depth Bombs Mk 17 Type, AN-Mk 41 and AN-Mk 44 may be used only if a nose impact fuze is installed.

**NOSE**—Nose Mechanical Impact Fuze AN-Mk 219 will not arm if dropped from below 2,500 feet when used on a bomb with the flat-nose attachment or a flat nose. It requires an auxiliary booster and the Adapter Ring Mk 219. It gives instantaneous action. Nose Mechanical Impact Fuze Mk 221 and Mk 239 with delay of 0.01 second will not arm on a flat nose if dropped from below 2,500 feet. Nose Mechanical Impact Fuze AN-M103 and AN-M103A1 (Instantaneous only) have been designed with special vanes for flat-nose bombs.

**Body construction**

**AN-Mk 17 Mod 2 and AN-Mk 44**—These depth bombs are made with round noses welded to a cylindrical steel tube. There is a strengthening disc around the nose and a steel strip along the suspension lugs to reinforce the body. The transverse fuze pocket is 11.9 inches abaft the nose. To prevent ricochet and improve underwater trajectory, a flat-nose attachment is made for these bombs, the attachment being in the shape of a bucket which fits down over the nose and is filled with plaster of paris, increasing the weight of the bomb by 44 pounds. The bomb case is extremely thin.

**AN-Mk 41 and AN-Mk 47**—These bombs are constructed with a flat nose, there being a slight taper from the walls to the nose. The body is in three pieces. The sides are tubular with a transverse fuze pocket tube welded in place 15 inches abaft the nose.

**Suspension**: Suspension of these bombs is by the usual dual or single lugs, the lugs being welded to the bomb. The single lug is actually somewhat different than is usually found, being in the form of a bracket rather than a lug.

Trunnions on a band are for displacement gear in dive bombing.

**Tail construction**: Instead of employing the box-type tail, these bombs use a drum tail. As seen from the after end, it is circular and has four fins extending at right angles to each other. The fins are spot-welded to a cone which fits over the after end of the bomb. The fins are also spot-welded to the drum shroud. The tail is bolted onto the base of the bomb.

**Markings**: TNT-loaded bombs have weight and Mark number stencilled in yellow; Torpex-loaded bombs have these items stencilled in blue.

**Remarks**: The 325-pound Depth Bomb Mk 17 is TNT-loaded but has a light tail assembly; the Mk 17 Mod 1 is the same, except that a sturdier tail assembly is used. The AN-Mk 17 Mod 2 is similar to the Mod 1, but has a larger filling hole.

The Mk 17 is obsolete; the Mk 17 Mod 1, AN-Mk 17 Mod 2, AN-Mk 44, AN-Mk 47, and AN-Mk 41 are obsolescent.

**325-, 350-pound Depth AN-Mk 53 Mod 1 (TNT), AN-Mk 54 Mod 1 (HBX), Mk 53 (TNT), and Mk 54 (Torpex)**

Over-all length, inches.....	52.5
Body length, inches.....	33.25
Body diameter, inches.....	13.8
Wall thickness, inch.....	0.06
Tail length, inches.....	24.5
Tail width, inches.....	13.9

	AN-Mk 53 Mod 1 Mk 53	AN-Mk 54 Mod 1 Mk 54	
Filling .....	TNT	Torpex	HBX
Wt. of filling.....	225#	250#	250#
Total weight .....	330#	354#	354#
Chg./wt. ratio .....	68%	70.6%	70%

**Fuzing**

**NOSE**—AN-M103, AN-M103A1 (must have modified arming vanes for use with flat-nose bomb). AN-Mk 219 (with an adapter ring) may be used in the nose if the AN-M103 with the modified vanes is not available. The AN-Mk

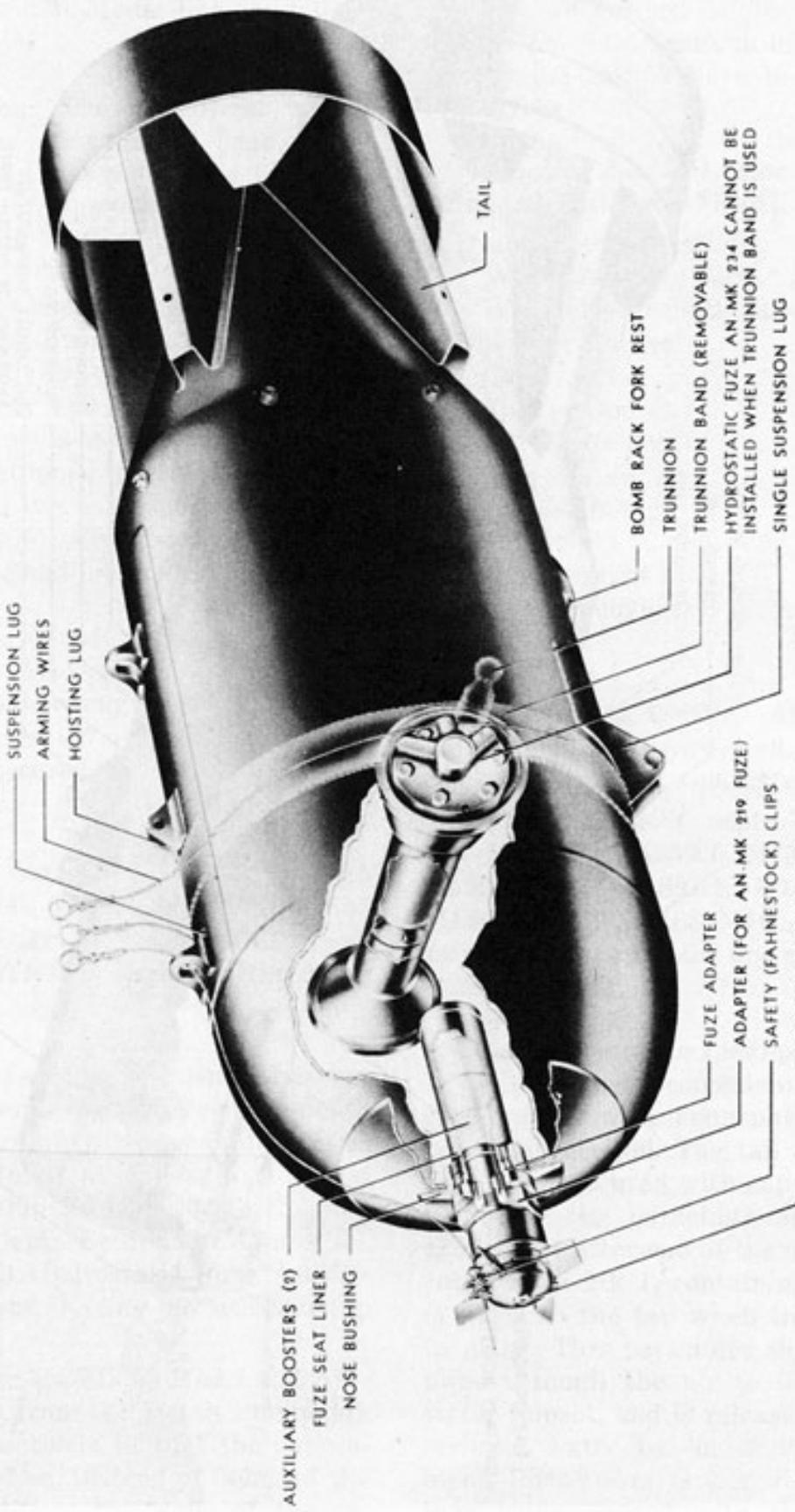


Figure 289. 325-pound Depth Bombs AN-Mk 17 Mod 2 and AN-Mk 44

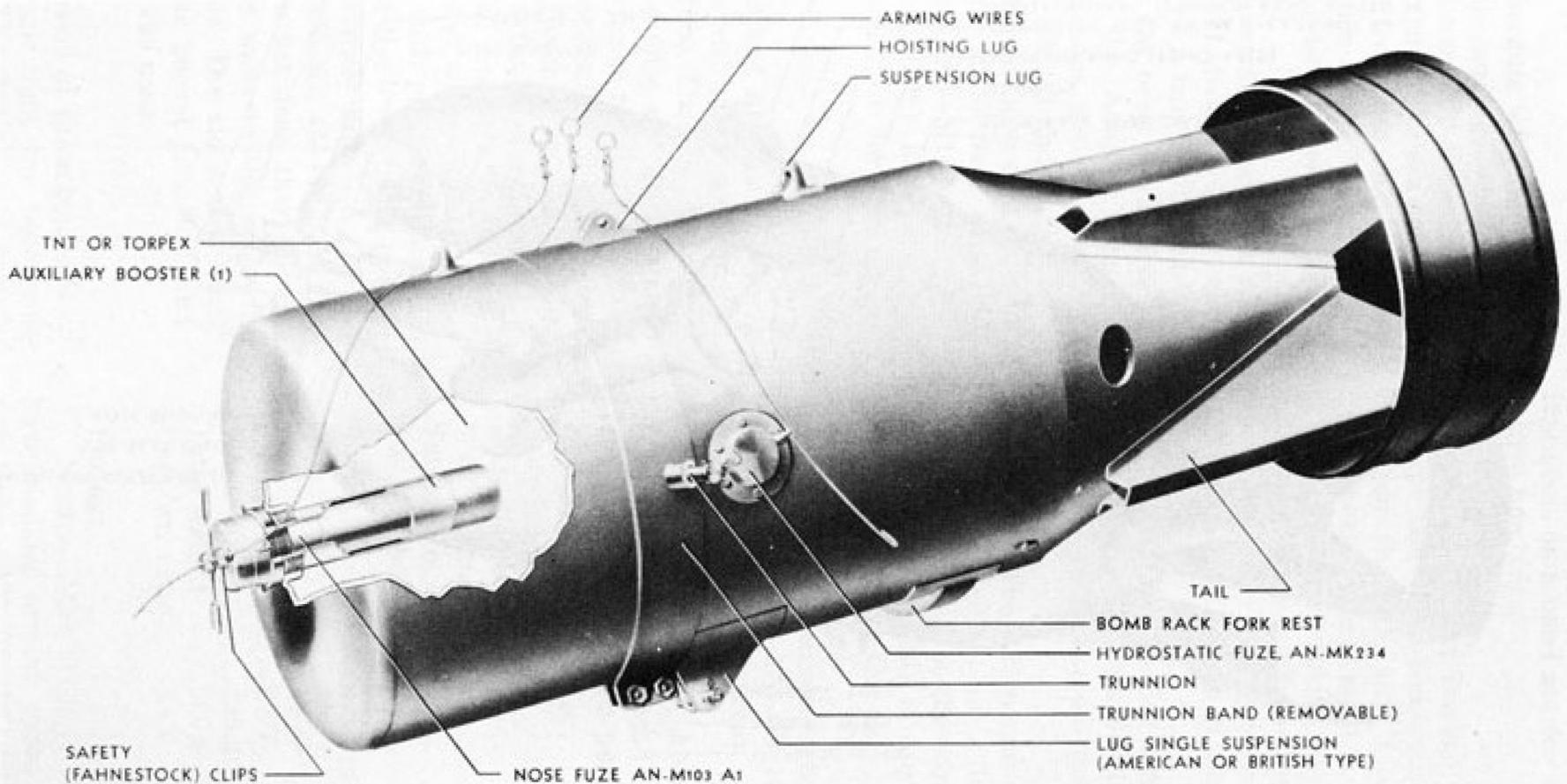


Figure 290. 325-pound Depth Bombs AN-Mk 41 and AN-Mk 47

219 requires 2,500 feet of air travel to arm.

**TAIL**—AN-Mk 230 Mods 4, 5, and 6 or Mk 231 (hydrostatic).

**Body construction:** The cylindrical welded sheet-steel body has a flat nose. A base closing plate is secured to the rear of the bomb by four bolts. A base closing plate is secured to the rear of the bomb by four bolts.

**Suspension:** These bombs are suspended horizontally by two lugs seven inches on each side of the center of gravity, or by a single lug at the center of gravity and 180° removed from the other lugs. There is no external band, the bombs being strengthened internally by a band which is fitted into the bomb at the center of gravity. Trunnions for dive bombing may be threaded to the case and internal strengthening band.

**Tail construction:** Welded to the tail cone are four vanes which are strengthened by interior box-type struts, and an exterior wide ring strut. The tail cone is secured to the base closing plate by four bolts.

**Markings:** Olive drab over all. "Mk 53—325 lb. depth bomb", "Mk 54—350 lb. depth bomb" stencilled on the respective bomb bodies in yellow if the filling is TNT, or in blue if the filling is Torpex.

**Remarks:** These two bombs (identical except for filling) have been designed to replace depth bombs using athwartship fuzes, since difficulties have been encountered at times in the past with the Athwartship Fuzes AN-Mk 224 and AN-Mk 234. The Depth Bombs Mk 53 and Mk 54 will use the Tail Hydrostatic Fuze AN-Mk 230 and a nose fuze, having no athwartship pocket.

The Depth Bombs AN-Mk 53 Mod 1 and AN-Mk 54 Mod 1 differ from the Depth Bombs Mk 53 and Mk 54 respectively in that the suspension lugs are welded on, instead of being of the screw type. In addition, the walls of the explosive cavity of the two bombs are coated with

an asphaltic composition known as Hot Melt. The AN-Mk 54 Mod 1 is loaded with HBX rather than Torpex.

Only the modifications of the Depth Bombs Mk 53 and Mk 54 have been standardized as AN bombs.

### 1,000-pound Aircraft Mine AN-Mk 26 Mod 1 (Ground, Influence-Fired)

#### Over-all length, inches

With parachute pack ..... 68.5

Without parachute pack ..... 64.5

#### Diameter, inches

Case ..... 18.625

Tail section ..... 15.75

Parachute pack ..... 18.50

Filling ..... TNT Torpex

Weight of filling ..... 465# 525#

Total weight ..... 1,000# 1,060#

Charge/weight ratio ..... 46.5% 49.5%

Negative buoyancy ..... 400# 460#

#### Fuzing

**FOR USE AS A MINE**—Athwartship—(Mine Mechanisms: forward well, clock starter and clock delay; after well, extender and booster.)

**FOR USE AS A BOMB**—Nose: AN-M103, AN-M103A1, M135A1, M136, M136A1, M139, M139A1, AN-M139A1, M140, M140A1, AN-M140A1, M149, M163, M164, M165, AN-Mk 219 (with adapter ring and one additional Auxiliary Booster Mk 1).

**Construction:** The 1,000-pound Aircraft Mine AN-Mk 26 Mod 1 consists of a cylindrical steel case welded with hemispherical nose and tapered tail section. The tail is closed by a concave cover secured with cap screws. A ring for mounting the parachute assembly is welded around the after end of the case. The Tail Parachute Pack Mk 1, containing Parachute Mk 2, is fitted to the tail when the mine is installed in plane. This parachute slows the fall of the mine through the air to lessen the shock of water impact, and is released from the case on striking water by an impact release mechanism. Suspension is horizontal, two standard lugs being welded onto the body 14 inches apart and placed 90° from the side pockets.

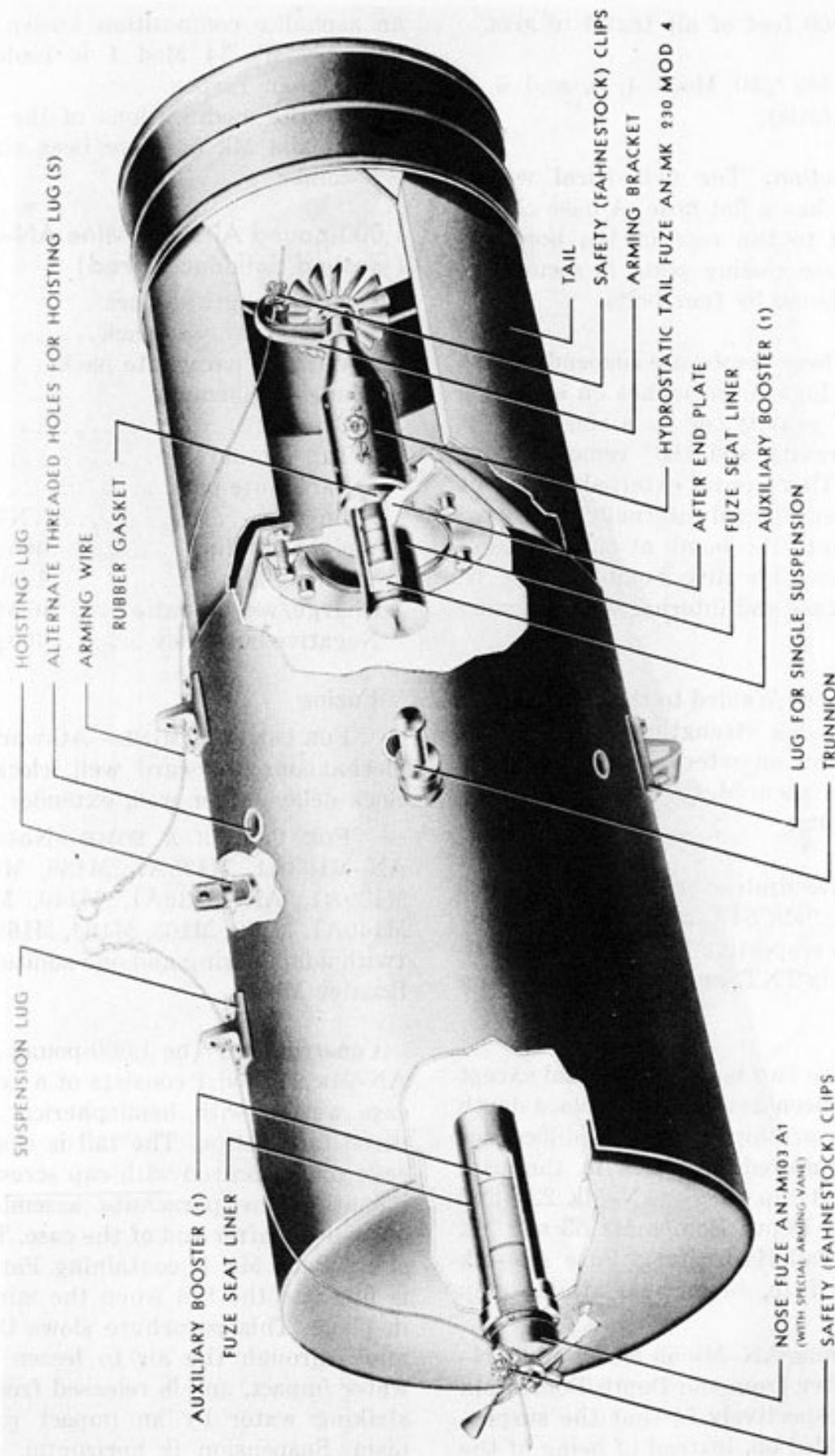


Figure 291. 325-pound Depth Bombs AN-Mk 53 and AN-Mk 54

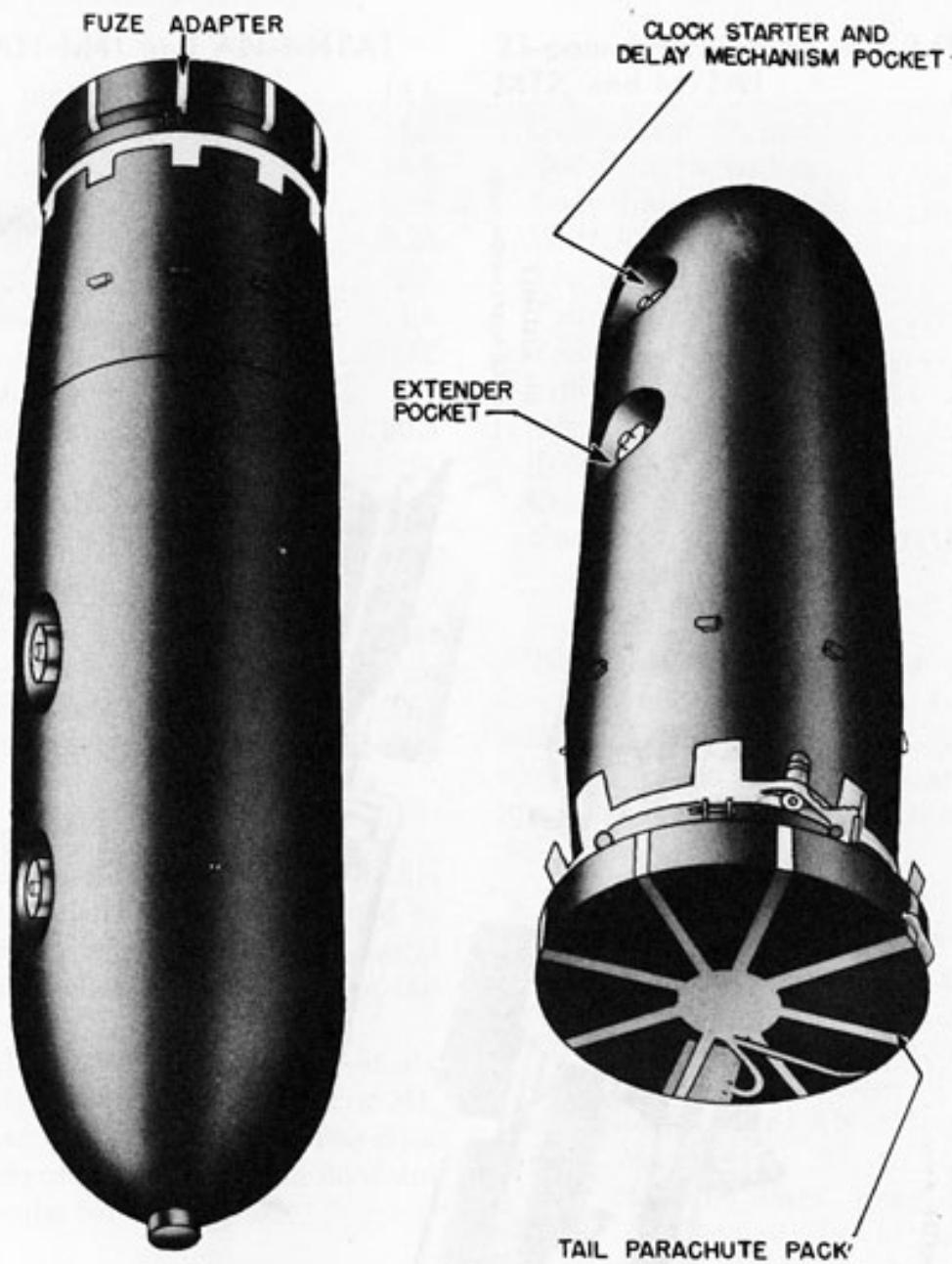


Figure 292. 1,000-pound Aircraft Mine AN-Mk 26 Mod 1

There is a removable British single-suspension lug  $180^{\circ}$  removed.

Color: Black over all.

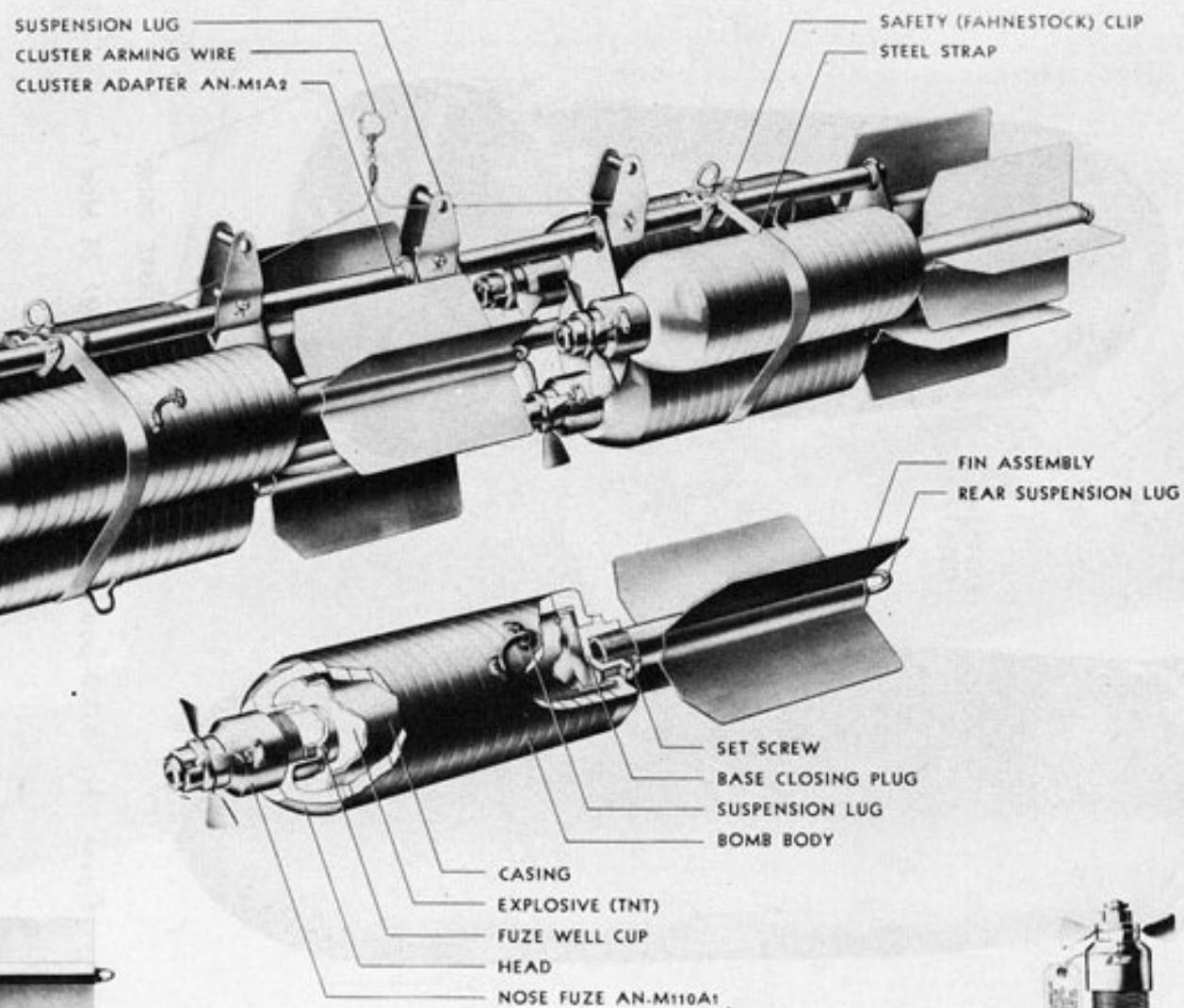
#### Remarks

**NORMAL USE**—As ground, magnetic induction mine (Search Coil Firing Mechanism M-9-1). Aircraft-laid, with parachute (release altitude—200 feet or higher). Laid offensively in depths of water from 16 feet to 120 feet against surface craft, and up to 500 feet against sub-

marines. Extender and clock starter are caused to function by hydrostatic pressure at depths of 16 feet or greater. Clock delay runs off in 170 minutes to arm the mine.

**USE AS BOMB**—This mine is poorly suited for use as a bomb, since accurate dropping by parachute is difficult; and if parachute is not used, the case tumbles. Fuzes require longer air travel to arm than usual, because of the shape of the mine and the manner of fall through the air.

DIMENSION & WEIGHT TABLE	
TOTAL WT. OF CLUSTER AN-M1A1	107.5 LBS.
NUMBER OF BOMBS TO THE CLUSTER	6
WEIGHT OF CLUSTER ADAPTER	
ARM-MAT	7.5 LBS.
OVERALL LENGTH OF CLUSTER	46.5
WIDTH OF CLUSTER	6.75
TOTAL WT. (TNT LOADED) OF AN-M41	87.5
FRAGMENTATION BOMB	
WEIGHT OF EXPLOSIVE (TNT)	9.5 LBS.
OVERALL LENGTH OF BOMB	9.75
DIAMETER OF BOMB	3.75
FUZE, BOMB NOSE	AN-M110A1



BOMB BODY WITH FIN ASSEMBLY, SHOWING  
TYPICAL MARKINGS AND SHIPPING PLUG

20 LB. FRAGMENTATION BOMB AN-M41



NOSE FUZE AN-M110A1

**20-pound Frag. AN-M41 and AN-M41A1**

Over-all length, inches.....	19.5
Body length, inches.....	11.3
Body diameter, inches.....	3.6
Wall thickness, inch.....	0.56
Tail length, inches.....	9.25
Tail width, inches.....	5.1
Tail weight, pounds.....	1.6
Filling .....	TNT
Weight of filling, pounds.....	2.7
Total weight, pounds.....	20.3
Charge/weight ratio.....	13%
Fuzing.....	M158, AN-M110A1, M110, M109

**Body construction:** This bomb is constructed of cast-steel nose and tail pieces, a seamless steel inner tube, and a helically-wrapped drawn steel wire wrapping around the inner tube. The tube is threaded to hold the nose and tail sections.

**Suspension:** For individual suspension of this bomb, a U-shaped eyebolt of steel is welded to the body at the center of gravity for horizontal suspension, and an eyebolt is welded to the tail for vertical suspension.

The bomb may be dropped in a cluster of six bombs in the Cluster Adapter AN-M1A2 or M1, forming the Cluster AN-M1A1 or M1. The cluster adapter is made of sheet steel, and does not use eyebolts of bombs for suspension.

**Tail Construction:** Four rectangular sheet-steel vanes are welded to a length of one-inch cast-iron pipe which screws into the base filling plug.

**Remarks:** This bomb is a high-level fragmentation bomb and should be dropped from a minimum altitude of 400 feet.

The A1 modification of this bomb consists of adding a 1½-inch shoulder around the nose to facilitate clustering with unfuzed bombs. Heretofore, the spacers of the cluster adapter have fitted against the fuze, thereby making it requisite that the bombs be clustered and shipped with fuzes inserted.

**23-pound Para.-Frag. AN-M40, AN-M40A1, M72, and M72A1**

Over-all length, inches.....	26.7
Body length, inches.....	11.3
Body diameter, inches.....	3.6
Wall thickness, inch.....	0.56
Tail length, inches.....	13.9
Tail width, inches.....	4.35
Tail weight, pounds.....	5.3
Filling .....	TNT
Weight of filling, pounds.....	2.7
Total weight, pounds.....	24.5
Charge/weight ratio.....	11.0%
Fuzing.....	M170, AN-M120A1, AN-M120, AN-M104.

**Body construction:** These bombs are constructed of cast-steel nose and tail pieces, a seamless steel inner tube, and a helically-wrapped drawn steel wire wrapping around the inner tube. The tube is threaded to hold the nose and tail sections.

**Suspension:** For individual suspension of these bombs, a U-shaped eyebolt of steel is welded to bomb at the center of gravity.

The 23-pound Para.-Frag. Bombs AN-M40 are always clustered, three of the bombs with the Cluster Adapter AN-M3 forming the Cluster AN-M4.

The 23-pound Para.-Frag. Bomb M72 is a slightly modified version of the AN-M40. It is adapted for individual suspension and can be carried in vertical cellular racks by several types of Army planes.

**Tail construction:** The 23-pound Para.-Frag. Bombs AN-M40 and M72 are fitted with cylindrical sheet-steel parachute housings which have end caps at the rear end and contain a white silk parachute. The Parachute Unit M3 is used in the Para.-Frag. Bombs AN-M40 and AN-M40A1; the Parachute Unit M4 in the Para.-Frag. Bombs M72 and M72A1.

**Remarks:** The AN-M40 and M72 are low-level fragmentation bombs and should be dropped from a maximum altitude of 400 feet.

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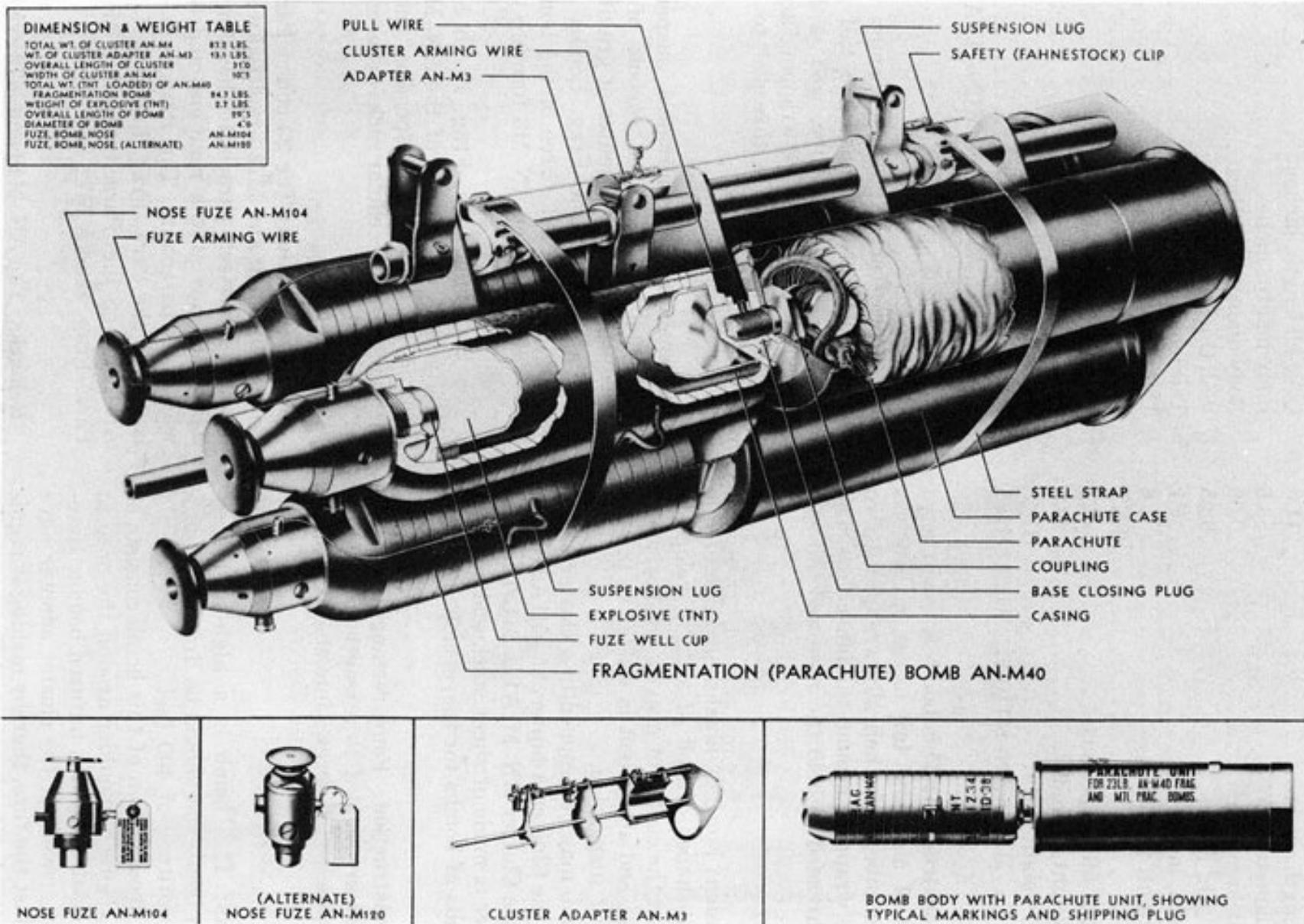


Figure 294. 23-pound Frag. Bombs in Cluster AN-M4

The A1 modification of these bombs consists of adding a 1½-inch shoulder around the nose of the bomb to facilitate clustering with unfuzed bombs. Heretofore, the spacers of the cluster adapters have fitted against the fuze, thereby making it requisite that the bombs be clustered and shipped with the fuzes inserted. Bombs with this modification are designated the 23-Pound Para.-Frag. Bombs AN-M40A1 and M72A1.

#### Fragmentation clusters and cluster adapters

**Cluster AN-M1A1, Cluster Adapter AN-M1A2:** This cluster, consisting of the Cluster Adapter AN-M1A2 or M1 and six Fragmentation Bombs AN-M41, is made of sheet metal and does not use eyebolts for suspension.

**Cluster AN-M1A2, Cluster Adapter AN-M1A3:** With the modification of Fragmentation Bombs AN-M41 to permit fuzing in the field, the following changes are made in the Cluster Adapter AN-M1A2: (1) flat springs are substituted for the fuze lock plates; and (2) the suspension lugs are changed from a strip type to a type similar to those on G.P. bombs. The new lugs were designed to permit suspension of the clusters in all existing types of bomb racks. The modified cluster adapter becomes the AN-M1A3, forming, with six Fragmentation Bombs AN-M41A1, the Cluster AN-M1A2.

If the modified Cluster Adapter AN-M1A3 is used with unmodified Fragmentation Bombs AN-M41; or the unmodified Cluster AN-M1A1 is used with modified Fragmentation Bombs AN-M41A1; or the unmodified Cluster Adapter AN-M1A1 is used with unmodified Fragmentation Bombs AN-M41, no change will be made in the designation of the Cluster AN-M1A1. The bombs, in these latter cases, will be fuzed when the bombs are clustered at the loading plant.

The unmodified Fragmentation Bomb AN-M41 with Cluster Adapter AN-M1A1 is not suitable for Navy use. The modified Adapter AN-M1A2 can be used, and the cluster is designated S1ZVL.

**Cluster AN-M4, Cluster Adapter AN-M3:** The Cluster Adapter AN-M3 and three Fragmentation Bombs AN-M40 form the Cluster AN-M4.

**Cluster AN-M4A1, Cluster Adapter AN-M3:** When Para.-Frag. Bombs AN-M40A1 are clustered, the Cluster Adapter AN-M3 is still used without any alteration in design, but the designation of the cluster is AN-M4A1.

**Cluster M26, Cluster Adapter M13:** The Fragmentation Bomb Cluster M26 consists of a Cluster Adapter M13 to which are secured twenty 20-pound Fragmentation Bombs AN-M41A1, in two groups of ten. See figure 264, page 361. The cluster is 53½ inches long, 14½ inches wide, and 13¾ inches high. The cluster adapter is a steel framework consisting of a tubular suspension bar to which the suspension lugs are fitted, steel separator plates, and two metal straps secured by release buckles. The separator plates located before each group of the bombs are built with arming vane stops for the Nose Fuzes M110A1 used in the individual bombs. The cluster can be adapted for either quick or delayed opening.

Quick opening is accomplished by the arming wires, which are fed through the release buckles and are withdrawn on the release of the cluster from the plane. In delayed opening, a Mechanical Time Nose Fuze M155 (T71) or M111A2 is screwed to the fuze adapter in the forward end of the tubular suspension bar. When the fuze detonates at the preset delay, the explosion drives a steel slug rearward to cut the shear wires in both the forward and the after release buckles, thereby permitting the cluster to open.

Tumbling of the Cluster M26 prevents the Nose Fuze M111A2 from arming correctly, and therefore the fuze has been modified by the substitution of an anemometer-type arming vane for the standard vane. So modified, the fuze is known as the T77. Modification can be accomplished in the field by kits now being issued.

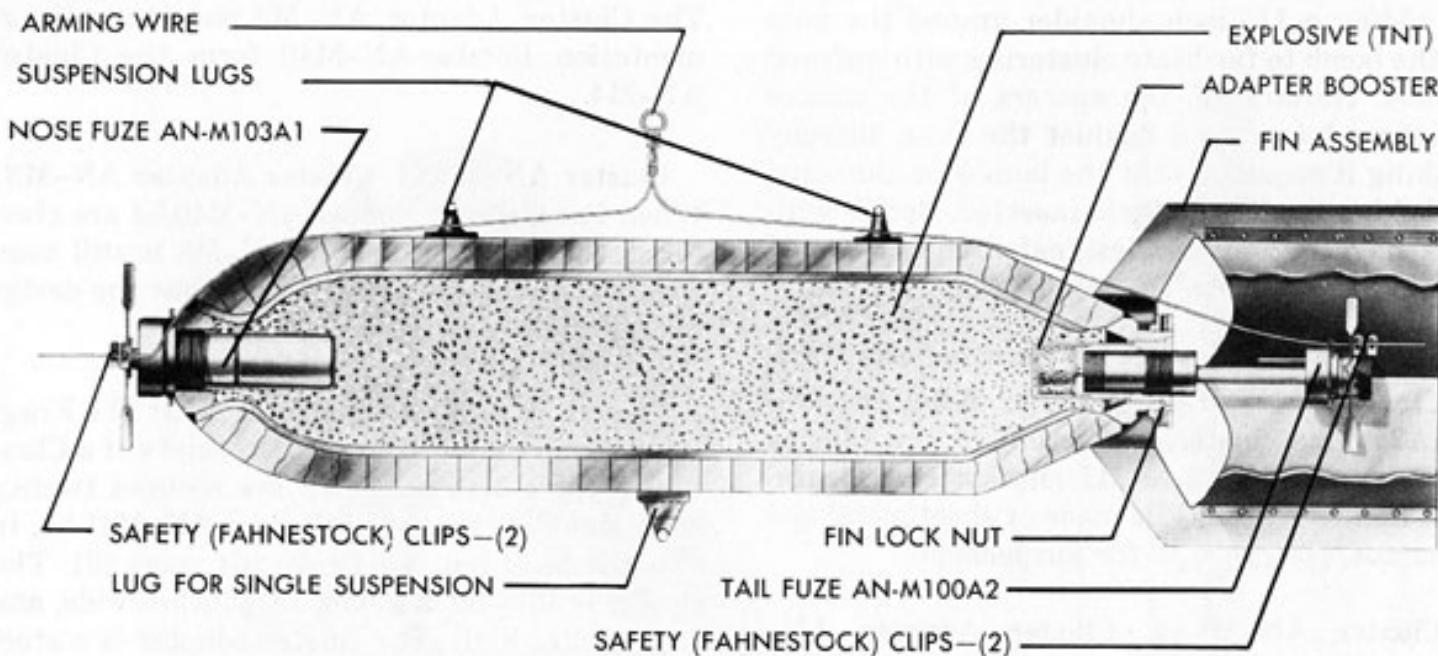


Figure 295. 260-pound Frag. Bomb AN-M81

### 220-, 260-pound Frag. AN-M88 (220-lb.) and AN-M81 (260-lb.)

	AN-M81	AN-M88
Over-all length.....	43.7"	43.7"
Body length.....	32.8"	32.8"
Body diameter.....	8"	8"
Wall thickness.....	1"	1.25"
Tail length.....	11"	11"
Tail width.....	11.5"	11.5"
Tail weight.....	4.1 lbs.	4.1 lbs.
Filling .....	Comp. B	Comp. B
Weight of filling.....	34.1#	46.69#
Total weight.....	260.0#	216.17#
Chg./wt. ratio .....	14.0%	21.6%

#### Fuzing

NOSE — AN - M103, AN - M103A1, M139, AN-M139A1, M140, AN-M140A1 (All instantaneous setting), M135, M135A1, M136, M136A1, M163, M164, M165, M166, T82, M149, T50E1, T89, T91.

TAIL — AN - M100A2 or AN - M100A1, M160. (A non-delay Primer Detonator M14 must be used.)

**Construction:** The Fragmentation Bomb AN-M88 differs from the M81 only in that it has a 0.75-inch steel coil around the body instead of

the one-inch coil. Both bombs are constructed in these two ways. In initial production, nose and tail pieces are of cast-steel construction and screw onto a central section of seamless steel tubing. A square helical steel spring is wound around the steel tubing. The nose and tail pieces are partially cut through to afford greater fragmentation (this is similar to the M82, except for the provision for tail fuzes and the Auxiliary Booster M104 in the larger bombs). The majority of AN-M88's and M81's however, have a one-piece steel tubing, and the helical steel spring is wound around the steel tubing, for the entire length of the body.

Suspension is horizontal; two eyebolts are welded to body along the longitudinal axis of the bomb, 14 inches apart. A third eyebolt is welded to the body at the center of gravity 180° removed from the other eyebolts. The tail is the normal box type, secured to the bomb by a locking ring.

**Remarks:** The initial bombs were filled with TNT; later productions are filled with Composition B with TNT surrounds.

Present production of these bombs does not include the Auxiliary Booster M104, as this was found unnecessary.

## ARMY EXPERIMENTAL TYPES

## 4,000-pound G.P. T8

Over-all length, inches.....	119
Body length, inches.....	85
Body diameter, inches.....	28
Wall thickness, inch.....	0.875
Explosive weight, pounds	
TNT .....	1,856.8
Tritonal .....	2,002.2
Total weight, pounds.....	4,030
Fuzing	
Nose.....	M103 series
Tail.....	M102 series

**General:** This is a design for a 4,000-pound G.P. bomb of the same general construction as others in this class.

**Suspension:** Standard lugs 30 inches apart.

**Filling:** Tritonal or TNT with a larger booster, the T21, which is like the M115 except for its increased size.

## 12,000-pound G.P. T10

Over-all length, feet.....	21
Body length, feet.....	10.33
Body diameter, feet.....	3.17
Wall thickness, inches.....	1.25
Tail length, feet.....	11
Tail width, feet.....	3.75
Tail weight, pounds.....	175
Filling .....	Torpex      Tritonal
Weight of filling.....	4,980#      5,500#
Total weight.....	11,630#      12,448#
(w/o tail)	
Chg./wt. Ratio .....	42%      44%

**Fuzing:** British Tail Pistol No. 58 Mk I is used at present, but these will eventually be replaced with the Air-Arming Fuzes T723, placed 120° apart in the base plate. The fuze delays which

were used operationally with this bomb in the war were 0.05-second, 0.25-second, 0.5-second, 3-seconds, 11-seconds, 24 to 30 minutes, and one hour.

**Body construction:** The body is manufactured in two different ways. The British-produced model is of cast steel, with a solid nose plug and with three exploders fitted 120° apart in the tail. The bomb bodies are issued with exploders inserted, and the exploder tubes are sealed with shipping plugs. The eventual American T10 will consist of five sections welded together. These sections are a solid nose forging, two body forgings, a rolled plate body section, and a base ring forging. The base plate, which is a forging, is held to the base ring by means of 20 studs.

The tail is attached to the after end of the bomb body by 12 studs. A cylindrical metal cowling, placed between the bomb body and the tail cone, enhances the streamlining of the bomb.

**Tail construction:** The special Tail Unit, No. 78 Mk I is constructed of light alloy and consists of a cone to which are attached four fins of streamline cross-section. The fins are set at an angle of 5° to the axis of the tail cone, giving a slight right-hand spin to the bomb as it falls. The tail fits over twelve  $\frac{7}{16}$ -inch studs fitted into the bomb body, and is securely fastened to the studs by Simmonds nuts. Three hand-holes in the tail cone give ready access to the three tail pistols, and an additional hole is provided for arming wires.

**Suspension:** The bomb is suspended in the plane by twin suspension slings.

**Filling:** The bomb body contains an explosive filling of Torpex with a one-inch layer of TNT topping added to the after end. Four inches of

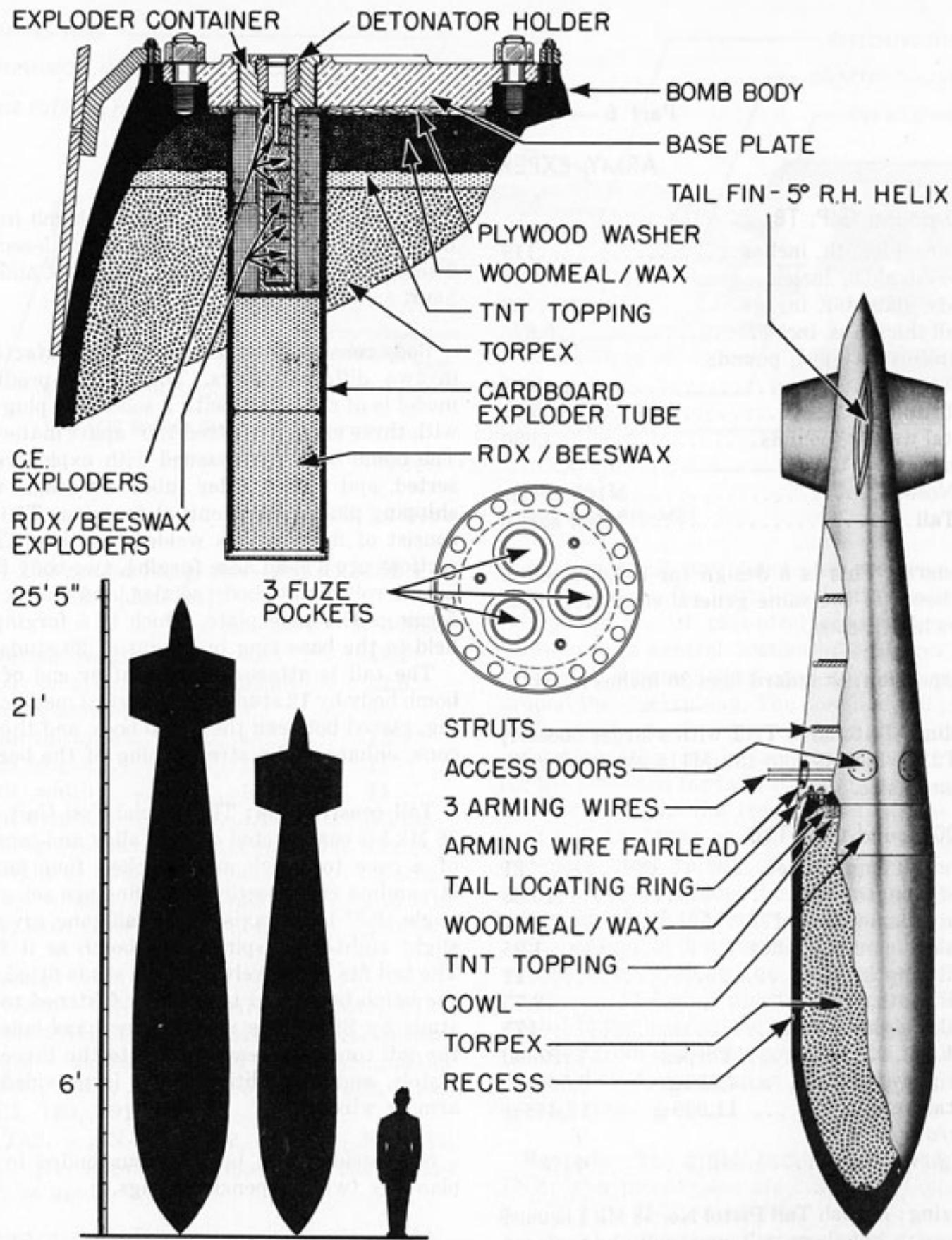


Figure 296. 12,000-pound Bomb T10 "Tall Boy" and 22,000-pound Bomb T14 "Grand Slam"

woodmeal/wax composition is then added, and the filling sealed with a  $\frac{1}{2}$ -inch plyboard washer. The three exploders pass through holes in this washer and are held in place by a heavy base plate, which is secured by bolts to the bomb body.

The American bomb will be filled with Tritonal, with an inert tail surround.

**Remarks:** This bomb is designed for limited operational use, and its employment will be restricted to specially adapted very heavy bombers. Although designated a G.P. bomb, the T10 is essentially a deep-penetration bomb (though not armor- or concrete-piercing) depending for its effect upon the production of heavy shock waves as a result of the explosion of its main charge deep within the earth.

The T10 is the American designation for the British 12,000-pound D.P. (Deep-Penetration) "Tallboy" bomb. Except for size and fuze pocket arrangement, it is similar to the 22,000-pound G.P. Bomb T14.

#### 22,00-pound G.P. T14

Over-all length, feet.....	25.41
Body length, feet.....	12.50
Body diameter, feet.....	3.83
Wall thickness, inches.....	1.75
Tail length, feet.....	13.33
Tail width, feet.....	4.48
Tail weight, pounds.....	287
Filling .....	Torpex
Weight of filling.....	9,200#
Total weight.....	21,875#
(w/o tail)	22,155#
Chg./wt. ratio.....	42%
	43%

**Fuzing:** Three British Tail Pistols No. 58 Mk I are used at present, but these will eventually be replaced with the Air-Arming Fuze T723, placed in a straight line across the base plate.

**Body construction:** The body is manufactured in two different ways. The British-produced model is of cast steel, with a solid nose plug and with three exploders fitted  $120^{\circ}$  apart in the tail. The bomb bodies are issued with exploders inserted, and the exploder tubes are sealed with

shipping plugs. The eventual American T14 will consist of five sections welded together. These sections are a solid nose forging, two body forgings, a rolled plate body section, and a base ring forging. The base plate, which is a forging, is held to the base ring by means of 20 studs.

The tail is attached to the after end of the bomb body by 12 studs. A cylindrical cowling, placed between the bomb body and the tail cone, enhances the streamlining of the bomb.

**Tail construction:** The special Tail Unit No. 82 Mk I is constructed of light alloy and consists of a cone to which are attached four fins of streamline cross-section. The fins are set at an angle of  $5^{\circ}$  to the axis of the tail cone, giving a right-hand spin to the bomb as it falls. The tail fits over twelve  $\frac{1}{16}$ -inch studs fitted into the bomb body, and is securely fastened to the studs by Simmonds nuts. Three hand-holes in the tail cone give ready access to the three tail pistols, and an additional hole is provided for arming wires.

**Suspension:** The bomb is suspended in the plane by twin suspension slings.

**Filling:** The bomb contains an explosive filling of Torpex with a one-inch layer of TNT topping added to the after end. Four inches of woodmeal/wax composition is then added, and the filling sealed with a  $\frac{1}{2}$ -inch plyboard washer. The three exploders pass through holes in this washer and are held in place by a heavy base plate, which is secured by bolts to the bomb body. The American bomb will be filled with Tritonal, with an inert tail surround.

**Remarks:** This bomb is designed for limited operational use, and its employment will be restricted to specially adapted very heavy bombers. Although designated a G.P. bomb, the T14 is essentially a deep-penetration bomb (though not armor- or concrete-piercing) depending for its effect upon the production of heavy shock waves as a result of the explosion of its main charge deep within the earth.

The general arrangement of this bomb is identical to that of the 12,000-pound Bomb T40. The

two bombs are identical, except that the T14 has three in-line fuze pockets instead of pockets placed  $120^\circ$  apart as in the T10, and the T14 is

an enlarged version of the T10.

The T14 is American designation for the British 22,000-pound D.P. "Grand Slam" bomb.

## CHEMICAL, INCENDIARY, AND SMOKE BOMBS

## Section I — INTRODUCTION

**Chemical**

In general, the chemical bombs are of two types, classified according to case construction. The light-case bombs have the advantage of higher charge/weight ratio, whereas the heavy-case bombs have better stowage and handling characteristics. Both types have full-length burster charges to split the bomb case and disperse the filling over the area to be contaminated. Fuzing must always be instantaneous or aerial burst to maintain maximum dispersion of contents. Various fillings can be employed for different effects.

**Incendiaries**

Incendiaries in use at the present time are classified by their construction and use into two types. The intensive type burns as a unit, confining its intense heat to a relatively small area. The bombs are small in size and are always dropped in clusters to give area coverage. They are normally employed against targets having a high percentage of roof coverage, such as industrial establishments and crowded residential areas. Since the bombs have heavy nose plugs and substantial case strength, some penetration can be expected, and the high burning temperature of the filling will be effective in industrial areas.

The scatter type is usually a larger bomb which disperses small chunks of its burning material over a large area to ignite many small fires. It is normally employed against readily inflammable targets such as frame construction, material storage, and grain fields. These bombs explode on impact, to throw burning fragments of gasoline gel or other sticky emulsions against the target.

**Screening smokes**

Only the screening smokes will be considered in this chapter, signalling and illuminating smokes being treated under Pyrotechnics. This division follows in large part the allocation of responsibility for smoke munitions made between the Chemical Warfare Service and the Ordnance Department of the Army. C.W.S. supervises matters relating to screening smokes, and the Ordnance Department performs the same functions for signalling and illuminating items.

**Color and markings**

Chemical bombs have different markings from other types of ordnance. The bomb body is painted light grey, and colored bands indicate the nature of the filling. The bands are located between the dual suspension lugs and before the center of gravity. One band indicates a non-persistent filler. Two bands indicate a persistent filler. Green indicates casualty agents; red, harassing agents; yellow, smoke or screening agents; purple, incendiaries.

Incendiary bombs may follow the scheme of chemical bombs, with light grey body color and a purple band. More recently, an olive drab body color with a purple band has been standardized.

All these items represent a different type of hazard from high-explosive-filled bombs. They are particularly susceptible to fire, and proper precautions should be observed. In handling several of the pyrotechnics and incendiaries, remember to avoid friction such as would be caused by rolling or dragging the missile.

**Suspension**

Heavy-case chemical bombs are suspended in

the same manner as G.P. bombs; that is, by dual lugs or by a single lug welded to the bomb case. The light-case chemical bombs are suspended by lugs welded to bands which fit around the bomb body. Incendiary bombs of the large scatter type have the same suspension as the chemical bombs. The smaller incendiary bombs are always clustered, and for maximum packing efficiency are hexagonal in shape. The clusters employed on incendiaries are of two types, the quick-opening variety and the aimable type with a cluster opening controlled by an aerial burst fuze. The quick-opening clusters come in two sizes—100-pound and 500-pound. The cluster adapters for 4-pound intensive incendiaries will carry 34 bombs in the 100-pound size or 128 bombs in the 500-pound size. The adapters for 6-pound scatter incendiaries carry 14 bombs or 60 bombs. The cluster adapters consist of steel tubes supported by plates, with the bombs assembled around the tubes. The bombs are held in place by spring-steel bands secured by an arming wire running through a buckle at the end of the band. Removal of the arming wire assembly as the cluster drops releases the buckles, and the bands open to release the bombs immediately.

The aimable clusters are relatively new. They fit a 500-pound bomb station and are designed

for precision bombing from high altitudes. To give the cluster the desired ballistic properties, a standard box-type tail assembly is attached by a single bolt to the after plate of the cluster adapter. A strip of primacord (PETN) running full-length along the side of the cluster serves to break the spring steel bands and allow the bombs to scatter when the aerial-burst nose fuze functions. The 500-pound Aimable Cluster AN-M17A1 is filled with 110 4-pound Incendiary Bombs AN-M50A2 and AN-M50XA3. The Cluster Adapter E6R2 (500-pound) contains Incendiary Bombs AN-M69 or M74. The Aimable Cluster Adapter M23 (500-pound) contains 38 bombs, either Incendiary Bomb AN-M69, Incendiary Bomb M74, or Smoke Bomb M77.

#### Jettisonable fuel tanks—"Fire bombs"

Fuel tanks filled with a gasoline-Napalm mixture for incendiary purposes and fitted with igniters were developed during the war. At present, however, this practice has been discontinued.

#### Clusters, cluster adapters

Because of the number and variety of clusters for this type of ordnance, the clusters are described with the appropriate bomb instead of separately.

## Part 6—Chapter 18—Section 2

### "M" SERIES

#### 10-pound Incendiary M74

Overall length, inches.....	19.4
Body length, inches.....	19.4
Body diameter, inches.....	3.0
Tail length, inches.....	6.3
Tail width, inches.....	2.5
Filling.....	PT 1 or NP
Fuzing.....	M142, M142A1, M3

**Construction:** This bomb has the same type of construction as the 6-pound Oil Incendiary Bomb AN-M69, with a sheet-steel leak-proof

casing and a nose cup housing the fuze. A small chemical container, located immediately behind the dome of the nose cup, is filled with white phosphorus, to aid ignition of the incendiary composition and produce smoke. In bombs with NP, the filling is enclosed in a cheesecloth sock; if PT 1 is used, it is loaded directly into the bomb. The Incendiary Bomb M74 has a telescope-type tail which fits inside the tail cup and is ejected under spring pressure when the bomb is released from the cluster. A well inside the tail cup holds the tail sleeve when the assembly is compressed in the cup.

**Suspension**

CLUSTER	ADAPTER	SIZE	BOMBS
E29	E6R2	500# Aimable	38 M74
E48	M23	500# Aimable	38 M74
E61	M23	500# Aimable	38 E5R8

**Operation:** The striker of the Fuze M142 or M142A1 ignites the primer, which sets off the booster and main ejection charge. This activates the auxiliary ejection-ignition charge. Expanding gases rupture the dome-shaped ejection diaphragm, which forces the WP-filled cup, incendiary filling, tail cup, and tail assembly out of the bomb casing.

**Remarks:** Do not reinsert arming pin after it has been ejected, as it may cause the fuze to function.

The experimental bombs of this type with other fillings are designated the E5 series. The experimental bomb with a white phosphorus filling has been rejected; however, the one with the mustard filling, E5R8, is still under development. This bomb will be carried in the Cluster E61 holding 38 bombs (Cluster Adapter M23).

**Cluster Adapter E6R2**

Over-all length, inches.....	59.06
Body diameter, inches.....	14.69
Tail width, inches.....	16 to 18
Fuzing.....	M138, AN-M145

**General:** The cluster adapter has a thin steel body that is shaped like a bomb, except the nose is not rounded off to make a full hemisphere. A standard-type bomb fin is affixed to the rear of the adapter, and a fuze fits in the nose. Hoisting and suspension lugs are located at the top. Internally, the adapter is equipped with cluster bars for positioning of the bombs when loaded. An L-shaped angle bar runs the entire length of the adapter along the bottom cluster bar. Into the angle bar is fitted a light steel tube which encloses a length of primacord that extends from the nose fuze to the other end of the cluster adapter. When the cluster is filled, the bombs

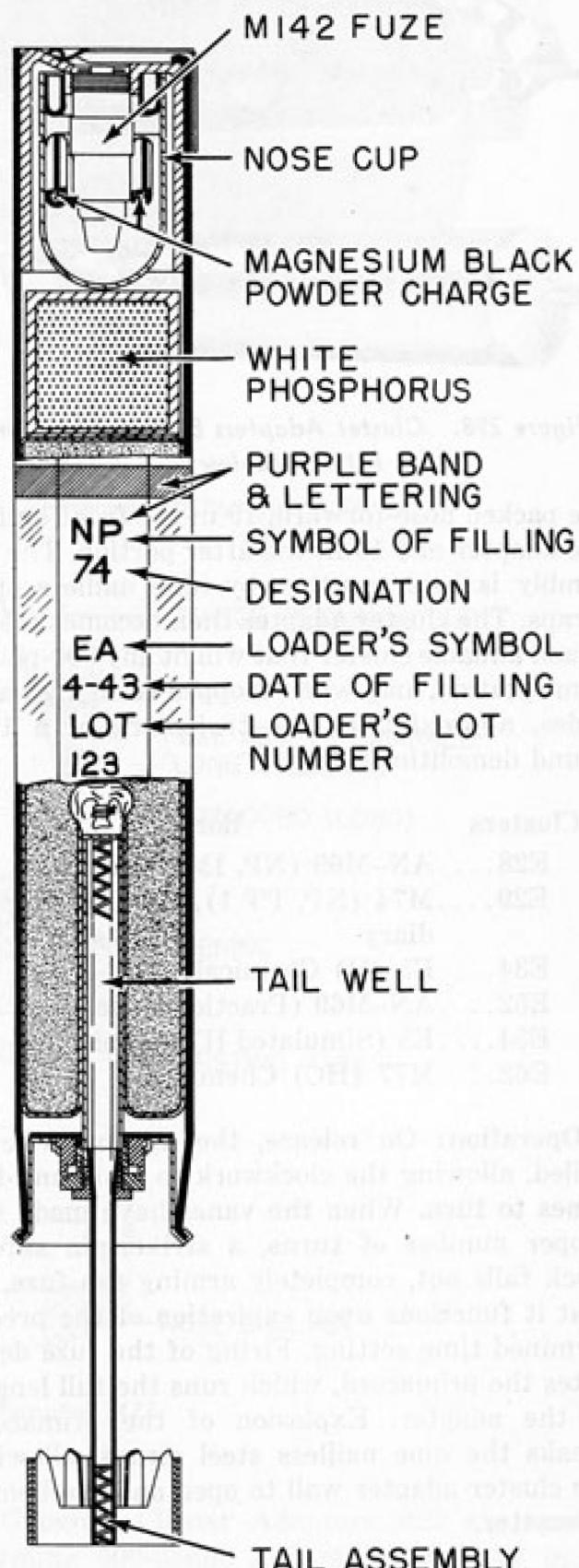


Figure 297. 10-pound Incendiary Bomb M74

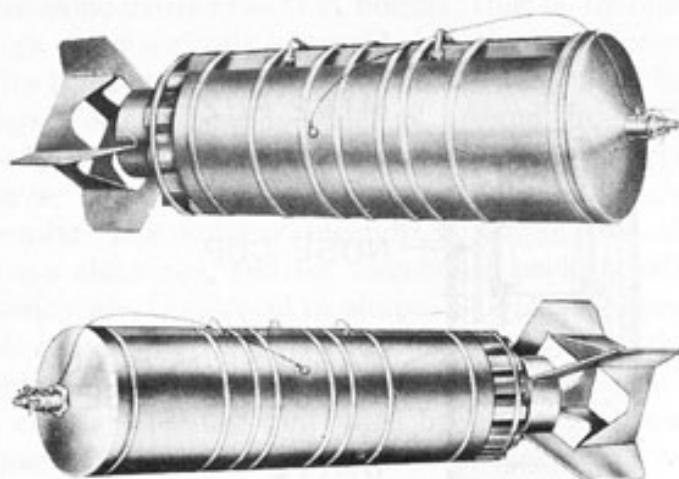


Figure 298. Cluster Adapters E6R2 (above) and M10A1 (below)

are packed nose-forward, 19 in the front half of the adapter and 19 in the after portion. The assembly is held together by nine nailless steel straps. The cluster adapter then becomes a 500-pound aimable cluster that will fit any 500-pound bomb station, and, when dropped from high altitudes, approximates the trajectory of a 100-pound demolition bomb.

Clusters	Bombs
E28 . . .	AN-M69 (NP, IM) Incendiary
E29 . . .	M74 (NP, PT 1), E5 (IM), Incendiary
E34 . . .	E5 (H) Chemical
E52 . . .	AN-M69 (Practice) Incendiary
E54 . . .	E5 (Simulated H) Chemical
E62 . . .	M77 (HC) Chemical

**Operation:** On release, the arming wire is pulled, allowing the clockwork to start and the vanes to turn. When the vanes have made the proper number of turns, a striker-pin safety block falls out, completely arming the fuze, so that it functions upon expiration of the predetermined time setting. Firing of the fuze detonates the primacord, which runs the full length of the adapter. Explosion of the primacord breaks the nine nailless steel straps, allowing the cluster adapter wall to open and the bombs to scatter.

**Remarks:** If desired, the cluster adapter may be kept intact during the entire period of flight,

bursting open on impact.

This adapter is being replaced by the Cluster Adapter M23.

#### Cluster Adapter M10A1

Over-all length, inches . . . . .	56.0
Diameter, inches . . . . .	15.3
Fuzing . . . . .	AN-M128

**General:** The cluster adapter is streamlined in shape, and, when filled, it becomes a 500-pound aimable cluster designed to be carried by any plane equipped to carry a 500-pound bomb. Clusters formed with this adapter are the AN-M14, which contains 104 Incendiary Bombs AN-M50TA2, four AN-M50XA3 Type A, and two AN-M50XA3 Type B; and the AN-M17A1, which contains 88 Incendiary Bombs AN-M50A2, 16 AN-M50XA3 Type A, and six AN-M50XA3 Type B.

The cluster adapter consists of a thin metal case with a channel bar extending through the center, and a standard tail fin fixed to the after end plate by means of a single heavy bolt. At the forward end, a rounded nose fairing is fastened to the forward end plate. From the fuze seat, a length of primacord extends through a thin metal tube to the after end of the adapter. The adapter is equipped with three suspension lugs, the center lug added for use in British planes. When the cluster adapter is loaded, the bombs are packed around the channel bar and the assembly is held in place by nine metal straps.

**Operation:** On release, the arming wire is pulled, allowing the fuze to arm and fire at the pre-set time. When the fuze fires, the primacord is detonated, breaking the metal straps holding the assembly together and allowing the bombs to fall free.

**Remarks:** The Cluster Adapter M10A1 is similar in appearance to the E6R2, but differs internally. The bombs in the M10A1 are packed around a channel bar, while in the E6R2 the cluster bars surrounding the bombs hold them in place.

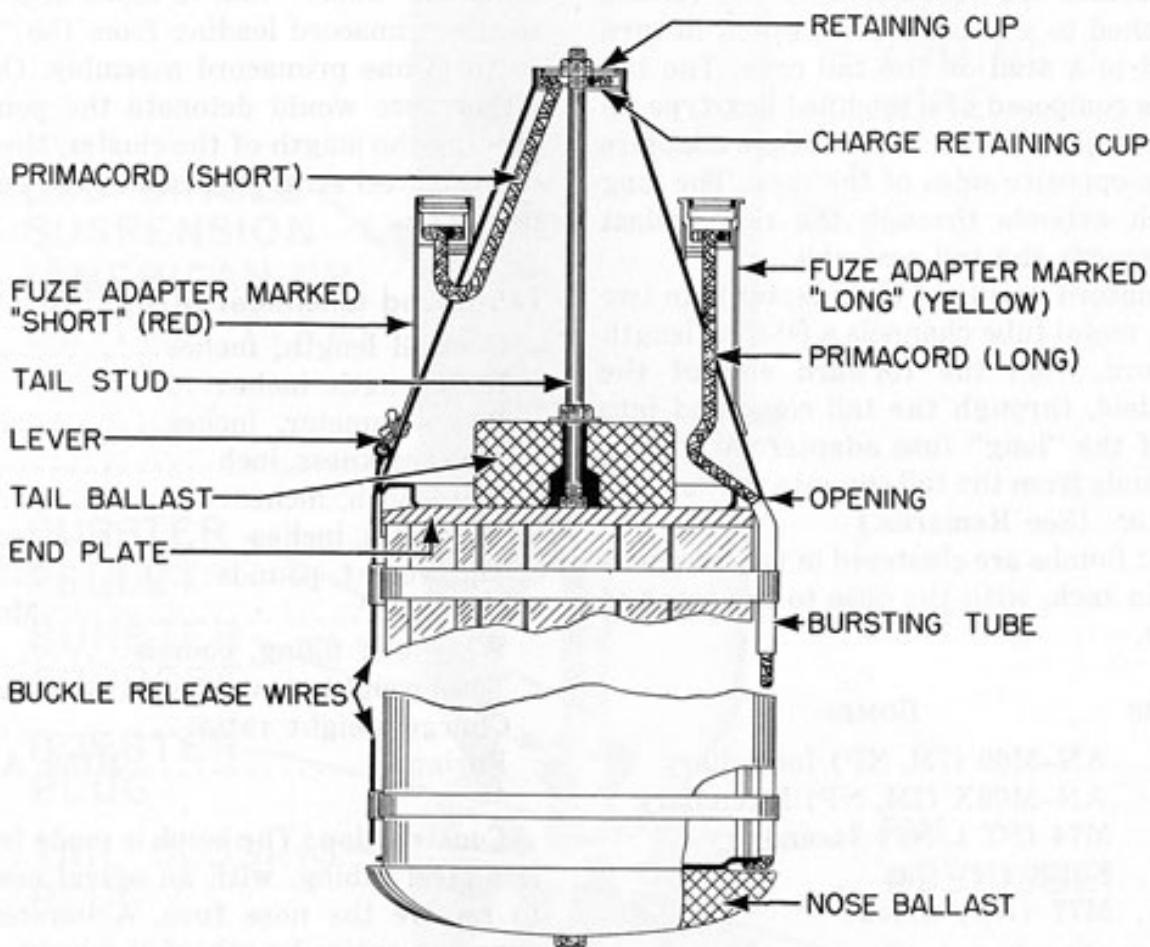
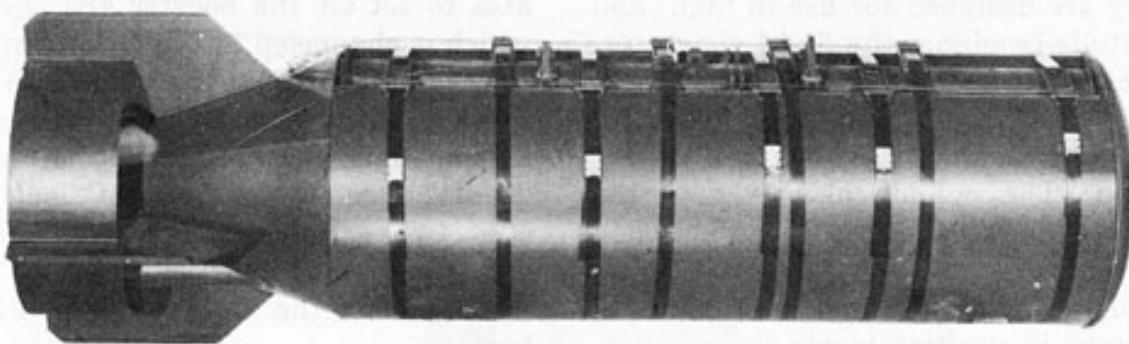


Figure 299. Cluster Adapter M23

### Cluster Adapter M23

Over-all length, inches.....59.5  
 Body diameter, inches.....14.75  
 Tail width, inches.....19.0

**General:** Cluster Adapters M23 are used in forming 500-pound aimable clusters of incendiary or chemical bombs. Clusters may be carried by planes equipped to handle 500-pound

bombs. They are designed for use in high- and medium-altitude bombing, the flight characteristics resembling those of the Practice Bomb M38A2.

**Description:** The cylindrical halves of the cluster wall are joined at the top by a suspension bar and at the bottom by a burster-shield support bar. Cluster bars, fitted into the end plates, hold the bombs in position inside the adapter. Ballast weights are bolted by studs to the front and rear of the adapter's end plates. Nine steel straps, drawn tight and fastened by a metal connector, are attached to release buckles which are placed on alternate sides of the suspension bar. The buckles are held closed by two release wires attached to a release lever, which in turn is attached to a stud on the tail cone. The tail assembly is composed of a modified box-type fin on a conical support, with two tail-fuze adapters attached to opposite sides of the cone. The long stud, which extends through the rear ballast weight, supports the tail assembly.

The primacord wiring of the adapter is in two sections. A metal tube channels a 60-inch length of primacord from the forward end of the burster shield, through the tail cone, and into the base of the "long" fuze adapter. A 31-inch length extends from the tail cup into the "short" fuze adapter. (See **Remarks**.)

**Clusters:** Bombs are clustered in two sections, 19 bombs in each, with the nose to the front of the cluster.

## CLUSTERS

## BOMBS

- M19....AN-M69 (IM, NP) Incendiary  
 M21....AN-M69X (IM, NP) Incendiary  
 E48....M74 (PT 1, NP) Incendiary  
 E61....E5R8 (H) Gas  
 E67....M77 (HC) Smoke

**Fuzing:** Two mechanical time fuzes are used, one being placed in the "long" and one in the "short" fuze adapters. Two Fuze M153 are now used, but are being replaced by two Fuze M152.

**Operation:** On release, the arming wires are withdrawn and the two fuzes arm. Upon expiration of the time setting, the "short" fuze oper-

ates to set off the booster and the primacord, which is channeled to the fin-retaining cup. The cone is blown off by the primacord detonation, thereby withdrawing the buckle release wires and opening the cluster. Upon failure of the "short" fuze to function, the "long" fuze operates two seconds later. This detonates the primacord extending the length of the cluster, which shears the steel straps and releases the bombs.

**Remarks:** Some lots of adapters were shipped without buckles and release wires, the release of the bombs being dependent on the severing of the steel strapping bands. The primacord from the "short" fuze is taped at a right angle to the primacord leading from the "long" fuze, to form one primacord assembly. Operation of either fuze would detonate the primacord extending the length of the cluster, thereby severing the steel strapping bands and releasing the bombs.

### 115-pound Chemical M70

Over-all length, inches.....	48.7
Body length, inches.....	40.4
Body diameter, inches.....	8.1
Wall thickness, inch.....	0.224
Tail length, inches.....	12.9
Tail width, inches.....	10.9
Tail weight, pounds.....	3.5
Filling.....	Mustard (H)
Weight of filling, pounds.....	57.1
Total weight, pounds.....	122.5
Charge/weight ratio.....	46.6%
Fuzing.....	M159, AN-M110A1

**Construction:** The bomb is made from a seamless steel tubing, with an ogival nose threaded to receive the nose fuze. A burster-well tube runs the entire length of the body, fitting into a positioning cup at the rear. The tail assembly consists of four fins welded to a sleeve, which is secured by a locking nut threading into the tail closing block. The fins are supported by box-type struts.

**Suspension:** The bomb is carried horizontally by dual lugs seven inches on either side of the

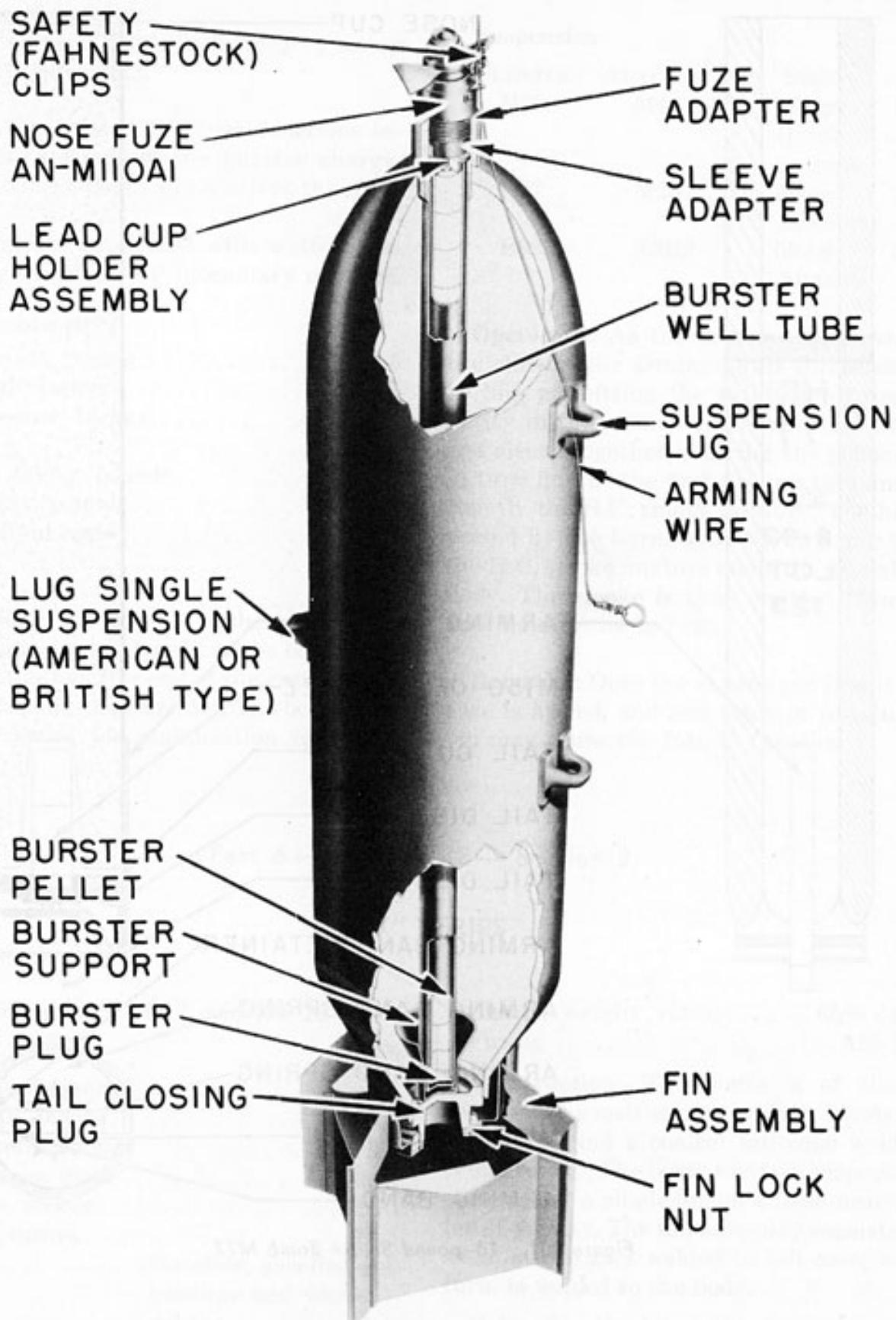


Figure 300. 115-pound Chemical Bomb M70

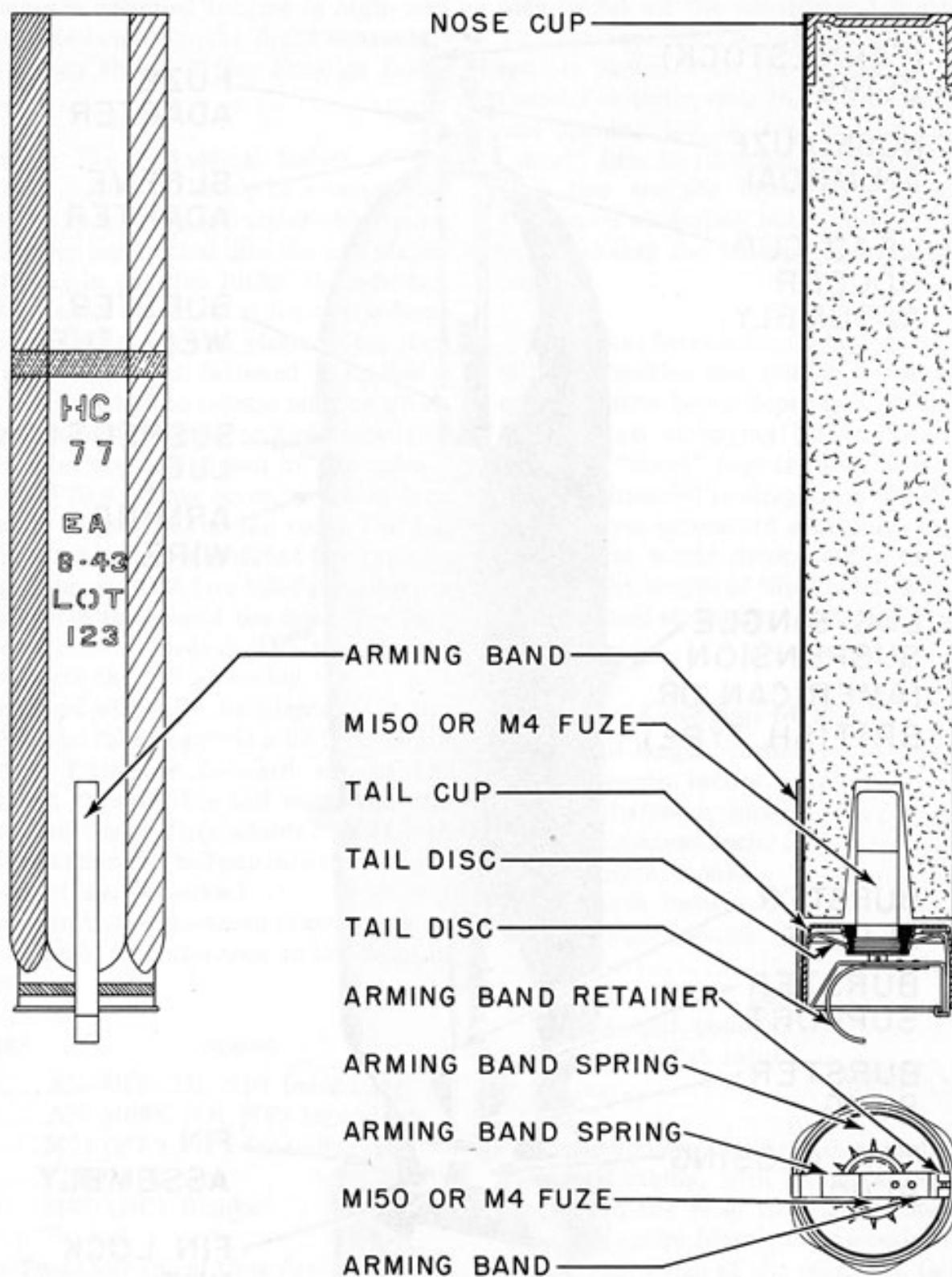


Figure 301. 10-pound Smoke Bomb M77

center of gravity, or a single lug 180° removed at the center of gravity.

A cluster of four M70's is formed by using the Cluster Adapter M22.

**Remarks:** On impact, the fuze functions instantaneously, setting off the burster charge, which explodes the bomb and scatters the main filling.

The M70 can also be filled with white phosphorus, or with IM or NP incendiary mixture.

### 10-pound Smoke M77

Over-all length, inches.....	19.5
Body length, inches.....	19.5
Body diameter, inches.....	2.9
Filling .....	HC
Weight of filling, pounds.....	9.5
Total weight, pounds.....	13
Charge/weight ratio.....	73%
Fuzing .....	M150

**Construction:** The body is a sheet-steel casing extending the entire length of the bomb. The tail cup fits into the after end of the casing, having a dome housing the Fuze M4. The bomb does not have a device for stabilization in flight;

therefore, an all-ways fuze is employed.

### Suspension

CLUSTER	ADAPTER	SIZE	BOMBS
M25	M4	100#	14 M77
		Quick opening	
E67	M23	500#	38 M77
		Aimable	
E62	E6R2	500#	38 M77
		Aimable	

**Operation:** As the bombs are released from the cluster, the arming pin is forced out by its spring, permitting the safety pin to enter the cavity in the striker. Impact forces the striker and sleeve together, piercing the primer, which in turn ignites the first fire mixture and subsequently the H.C. smoke mixture. The heat generated by the burning of the first mixture and the H.C. smoke mixture melts the zinc-alloy fuze body. The smoke is then emitted through the fuze hole in the tail cup.

**Remarks:** Once the arming pin jumps out, the fuze is armed, and any attempt to reinsert the pin may cause the fuze to function.

## Part 6 — Chapter 18 — Section 3

### "MK" SERIES

#### 100-pound Incendiary Mk 1 and Mk 28 (Obsolete)

Over-all length, inches.....	45.5
Body length, inches.....	33.7
Body diameter, inches.....	8.0
Wall thickness, inch.....	0.05
Tail length, inches.....	11.75
Tail width, inches.....	11.3
Filling.....	Gasoline, gasoline-gel, gasoline and waste, rubber
Weight of filling, pounds.....	42 to 45
Total weight, pounds.....	65 to 68

Charge/weight ratio.....	65% (approx.)
Fuzing .....	AN-M126A1

**Construction:** The bomb is of three-piece sheet-steel construction, with a hemispherical nose piece and a conical tail cone welded to a tubular body. The bomb has two suspension lugs on bands or a single lug on a band near the center of gravity. The tail assembly consists of four sheet-steel vanes welded to tail cone, which, in turn, is welded to the body.

**Color:** The bomb is painted grey over all, with a bright red disc, four inches in diameter, in the middle of the body.

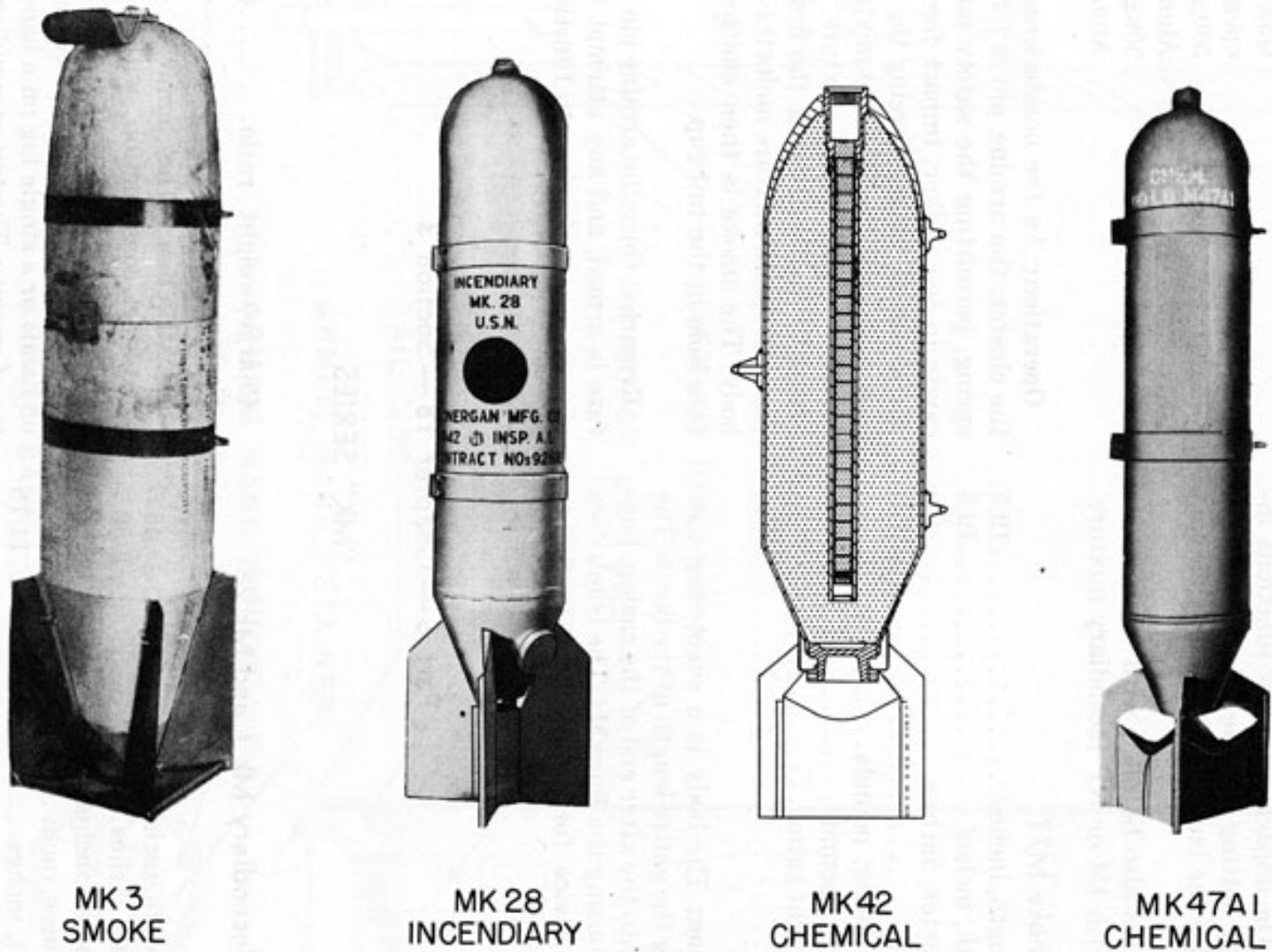


Figure 302. Navy 100-pound Smoke, Incendiary, and Chemical Bombs

CONFIDENTIAL

**Remarks:** This bomb is similar to the 100-pound Incendiary Bomb AN-M47A2, except that it is equipped with a filler cap. Both bombs are prone to leak and should be examined frequently.

There is also a 100-pound Incendiary Bomb Mk I, which is almost identical to the old Army M47, both of which are obsolete.

### 100-pound Chemical Mk 42

Over-all length, inches.....	39.43
Body length, inches.....	27.70
Body diameter, inches.....	8.0
Wall thickness, inch.....	0.17
Tail length, inches.....	9.46
Tail width, inches.....	11.0
Filling .....	Mustard
Weight of filling, pounds.....	43
Total weight, pounds.....	86.5

### 50-, 100-pound Floating Smoke (Obsolescent) Mk 3 Mod 0 (100-lb.), Mk 1 Mod 1 (50-lb.), Mk 1 Mod 2 (50-lb.)

Mk 3 Mod 0	Mk 1 Mod 2
Over-all length....	48.5"
Body diameter....	10.25"
Tail length.....	13"
Tail width .....	14.25"
Filling .....	HC mixture
Weight of filling....	59#
Total weight.....	102#
Chg./wt. ratio.....	57.8%
Fuzing .....	Mk 3 Mod 1
	Mk 3 Mod 1

**Construction:** An aluminum nose casting, carrying a pyrotechnic charge, is attached to a hollow wood float which provides buoyancy. The nose carries a water-impact fuze, and at the tail of the float is a valve cap with the valve to prevent water from leaking into the interior of the bomb. The rear of the bomb is conical in shape, and the aluminum nose is hemispherical. The tail consists of four fins bolted to the rear of the bomb, with four tubular struts bolted to the fins. The fins do not extend upon the rear end of the bomb.

Charge/weight ratio..... 50%  
Fuzing .....

**Construction:** The steel tube is swaged aft. An adapter screws into the nose and is threaded to receive the fuze. A burster tube containing TNT, running the length of the bomb, screws into the after end of the adapter. The after end of the body is closed by a male base plate, which is threaded for the tail assembly to be fitted. The bomb is filled through the nose. Suspension is by two lugs seven inches on either side of the center of gravity or a single lug 180° removed and at the center of gravity. The bomb has a box-type, four-fin tail, secured by a locking nut.

**Markings:** The bomb is painted olive drab over all, with two green bands  $\frac{1}{2}$  inch wide and  $\frac{1}{2}$  inch apart abaft the nose.

**Suspension:** Two movable suspension bands are used on the Floating Smoke Bomb Mk 3 Mod 0; the Mk 1 Mods 1 and 2 may have either one or two suspension bands. The latest issue has one band and one attached lug, so that the bombs may be suspended from the single- and double-hook racks.

**Action:** Impact operates the firing mechanism in the nose, detonating the primer, which in turn ignites a length of time fuse giving a delay of 18 seconds, during which time the smoke bomb is returning to and becoming stable on the surface of the water. The time fuse ignites the quick match which, in turn, ignites the starting mixture and this initiates the action of the smoke mixture. Gas pressure formed by the burning smoke mixture breaks the vent discs and opens the valve cap at the tail end of the wooden float. The bomb then evolves a dense white smoke for about 7.5 minutes in the Mk 3 Mod 0; 2.5 to 5 minutes in the Mk 1 Mod 1 and 5 to 7.5 minutes in the Mk 1 Mod 2.

**Remarks:** This bomb should be dropped from an altitude of over 500 feet and should not be dropped in less than 40 feet of water where the bottom is soft enough to cause the bomb to stick.

and fail to return to the surface. While designed for use over water, the bomb may also be effective if dropped over ordinary loam soil, if dropped from an altitude under 2,000 feet. If dropped from over 2,000 feet or if dropped from any altitude onto very hard rocky ground, the bomb will usually deflagrate. The HC mixture is a pressed powder, safe under any normal storage or handling conditions. The smoke, while

harmless in the concentrations found in smoke screens in the open, is toxic in more concentrated form.

The 50-pound Floating Smoke Bomb Mk 1 Mod 2 differs from the Mod 1 in that it has a longer burning time, with a maximum of 7.5 minutes, as in the 100-pound Mk 3 Mod 0, and a minimum of 5 minutes.

## Part 6 — Chapter 18 — Section 4

### "AN" SERIES

#### 2-pound Incendiary (Obsolete) AN-M52,

#### AN-52A1, and AN-M52XA1

Over-all length, inches.....	14.22
Body length, inches.....	9.13
Body diameter, inches.....	1.68
Wall thickness, inch.....	0.35
Tail length, inches.....	5.79
Tail width, inches.....	1.68
Filling .....	Thermate
Weight of filling, pound.....	0.4
Total weight, pounds.....	2.0
Charge/weight ratio.....	20%

**Construction:** The hexagonal cast-magnesium alloy body weighs 1.13 pounds. The bore is one inch shorter than the body length, thus making a solid nose. There are three vent holes below the primer cap assembly, to assist in initial burning. The hexagonal sheet-metal tail is secured to the body with three screws.

#### Suspension

Cluster	Adapter	Size	Bombs
M10	M5	100#	42 AN-M52A1 9 AN-M52XA1
M11	M8	500#	153 AN-M52A1 39 AN-M52XA1

**Filling:** Thermate is a composition of 80% Thermite and 20% first fire charge:

THERMITE	FIRST FIRE CHG.	(a)	(b)
Iron oxide 76%	Sodium nitrate	50%	
Aluminum powder 24%	Aluminum		
	powder	45%	75%
	Sulphur	4%	
	Boiled linseed oil	1%	
	Black powder		25%

**Action:** The spring-loaded safety plunger is depressed by the adjacent bomb; upon release from the cluster, it jumps out, leaving a thin brass cross holding the striker. On impact, the striker breaks free from the cross, igniting the primer, the first fire charge, and the thermate. The thermate burns, igniting the magnesium alloy case. The total burning time is eight minutes.

**Remarks:** In the Incendiary Bomb AN-M52A1, a primer of heavier metal is used, and the composition of the first fire charge is altered. The AN-M52XA1 incorporates an explosive charge; otherwise it duplicates the AN-M52A1.

#### 4-pound Incendiary AN-M50 Series

##### AN-M50A1 (Obsolete)

Over-all length, inches.....	21.3
Body length, inches.....	13.4
Body diameter, inches.....	1.69
Tail length, inches.....	8.7

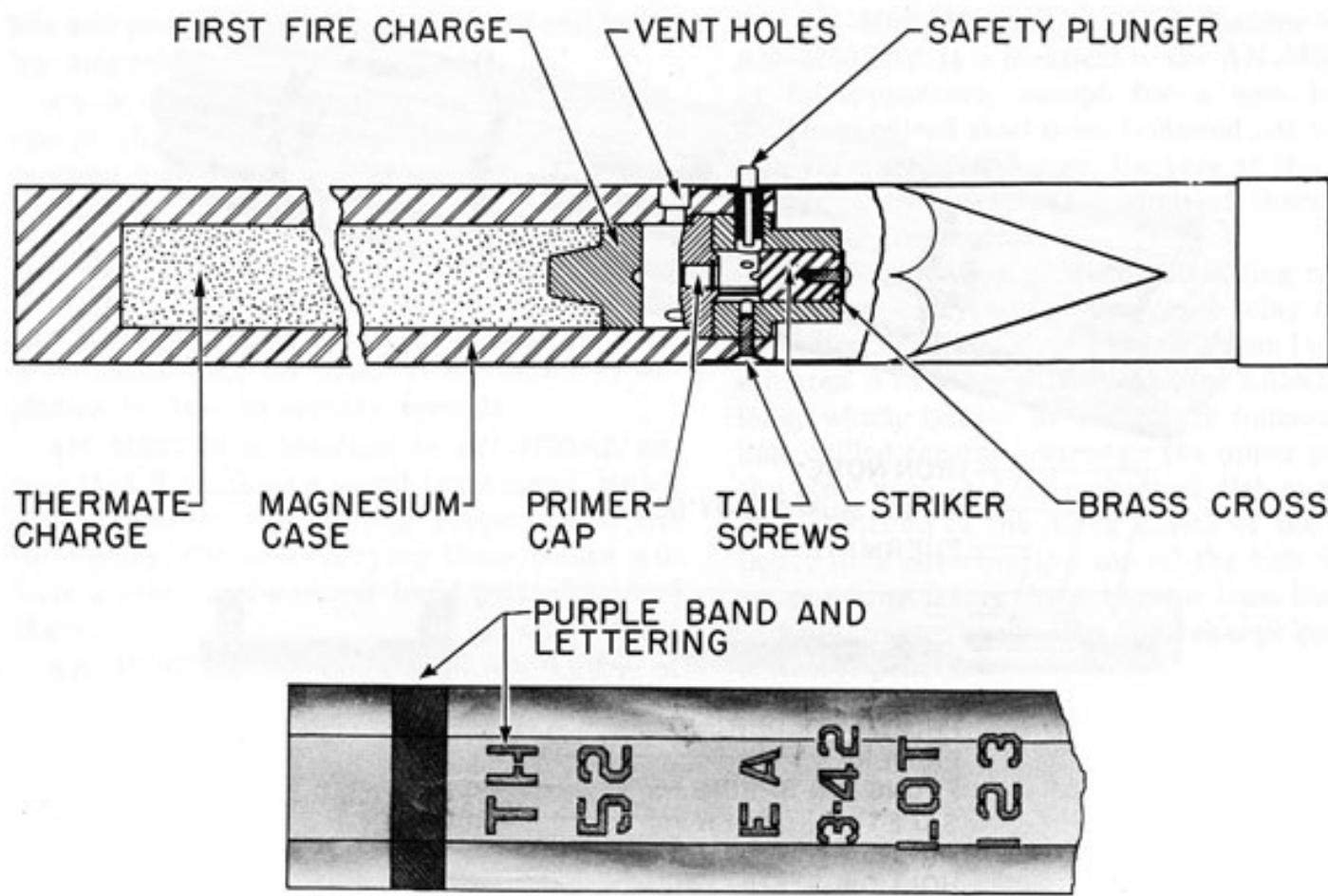


Figure 303. 2-pound Incendiary Bomb AN-M52

Tail width, inches.....	1.69
Filling .....	Thermate
Weight of filling, pound.....	0.63
Total weight, pounds.....	3.6
Charge/weight ratio.....	17%

**Construction:** The hexagonal body of magnesium alloy, weighing 1.25 pounds, has an iron nose plug. There are three vent holes below the primer cap assembly, to assist in initial burning. The hexagonal sheet-metal tail is secured to the body with three screws.

**Operation:** The spring-loaded safety plunger is depressed by the adjacent bomb; upon release from the cluster, it jumps out, leaving a thin brass cross holding the striker, which breaks free on impact and ignites the primer. The thermate burns, igniting the magnesium alloy case. The total burning time is 9.5 to 10.5 minutes.

#### Suspension

Cluster	Adapter	Size	Bombs
AN-M6	M5	100#	28 AN-M50A2
			6 AN-M50XA3
E31	M5	100#	34 AN-M50TA2
M7	M6	500#	102 AN-M50A2
			26 AN-M50XA3
AN-M14	M10A1	500#	104 AN-M50TA2
			6 AN-M50XA3
AN-M14A1	M10A1	Aimable	22 AN-M50TXA3
			88 AN-M50TA2
M17	M10	500#	88 AN-M50A2
			22 AN-M50XA3
AN-M17A1	M10A1	500#	88 AN-M50A2
			22 AN-M50XA3

**Remarks:** AN-M50XA1, (Army: limited standard; Navy: obsolescent) contains 170 grains of black powder in a steel capsule at the nose, replacing a portion of the thermate. The bomb burns approximately 1.5 minutes, until the black powder explodes, scattering burning magnesium over a wide radius.

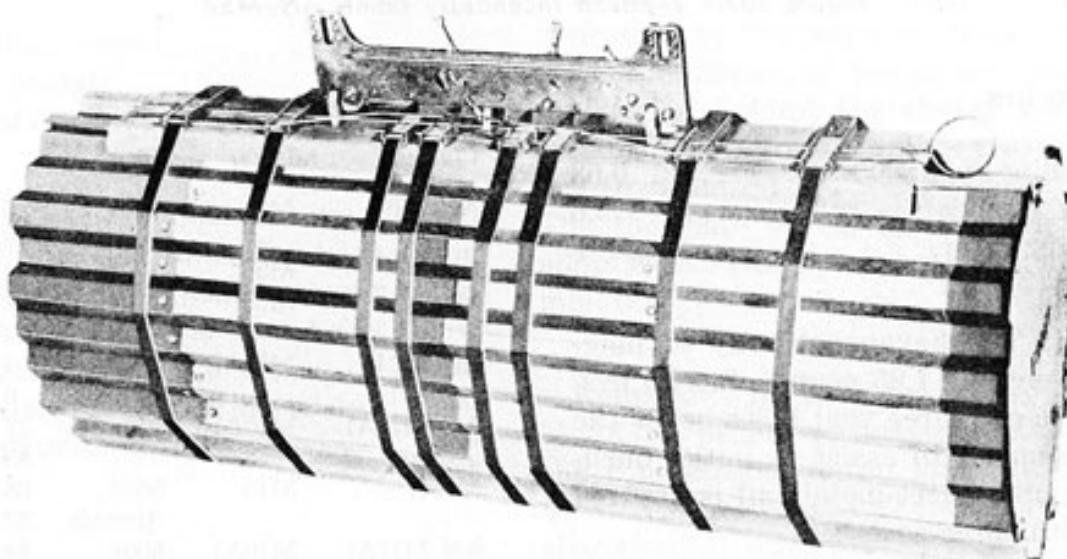
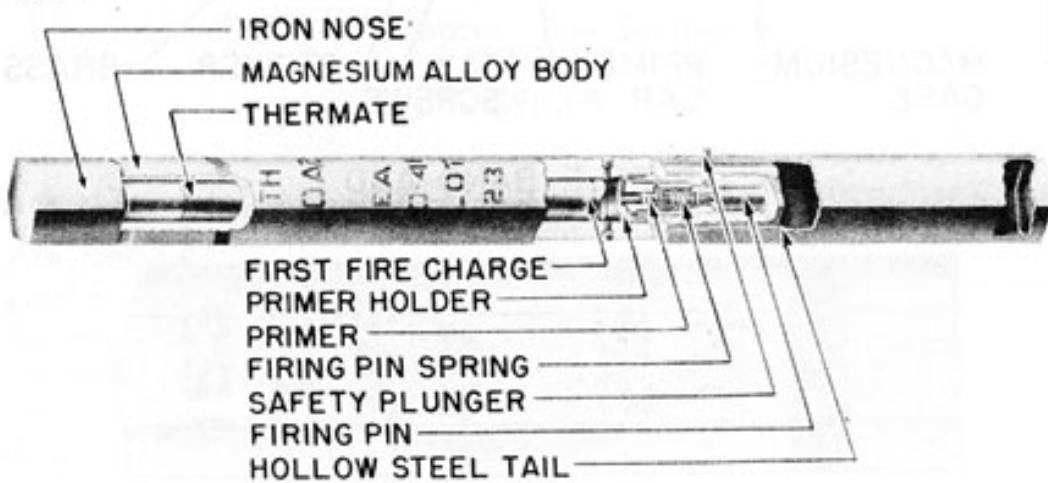
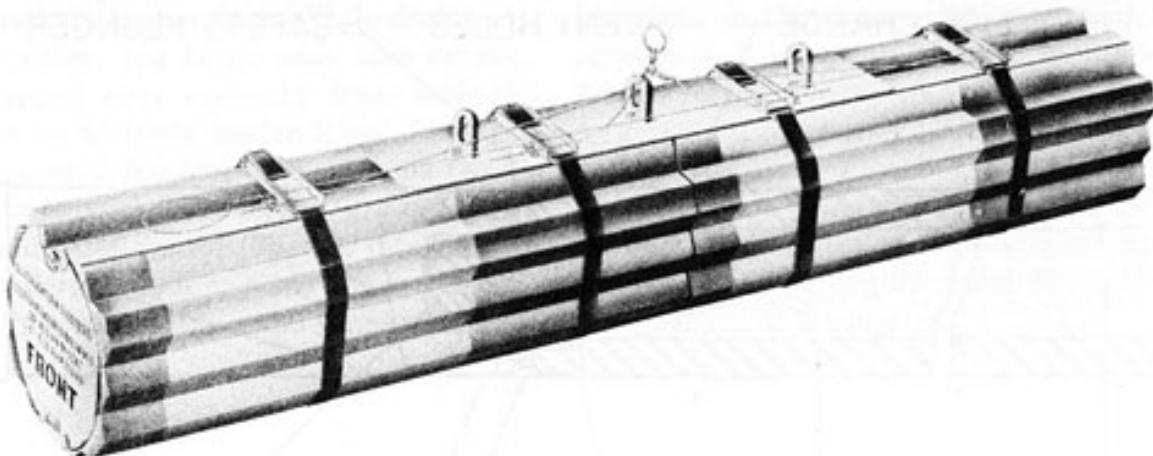


Figure 304. 4-pound Incendiary Bomb AN-M50A2

AN-M50A2, similar to AN-M50A1, is waterproofed around the primer cap and first fire charge.

AN-M50XA2, similar to AN-M50XA1, has

an explosive head consisting of a steel nose cap which houses three tetryl pellets, a detonator, and a delay fuse. The delay fuse is ignited and sets off the detonator, exploding the tetryl pel-

lets and projecting fragments of steel and burning magnesium.

AN-M50XA3 is identical to AN-M50XA2, except that the assembly around the primer cap and first fire charge is waterproofed.

**TYPE A AND TYPE B**—AN-M50XA2 and AN-M50XA3 each have a Type A and a Type B. Type A indicates that the delay from impact to explosion is two to four minutes; Type B indicates that the delay from impact to explosion is sixty to seventy seconds.

AN-M50TA2 is identical to AN-M50A2, except that it contains a secret toxic agent, which does not affect the burning properties of the incendiary. Clusters carrying these bombs will have a green and a purple band painted around them.

AN-M50TXA3 combines the toxic feature of

the AN-M50TA2 with the H.E. feature of the AN-M50XA3. It is identical to the AN-M50TA2 as to appearance, except for a new longer, double-mortised steel nose, hollowed out to contain the explosive charge. Because of the extra length of the nose, the column of therm-64C is  $1\frac{1}{8}$  inches shorter.

The M50TXA3 is produced according to only one design or type, which gives a delay on the explosion of the H.E. charge of from  $1\frac{1}{2}$  to 6 minutes. A heat-sensitive detonator 2.556 inches long, which ignites at  $300^{\circ}$  C. is housed in a hole drilled centrally through the upper part of the steel nose. A 1/16-inch steel disk is placed in the bottom of the filling cavity of the bomb body, thus covering the top of the hole in the nose and insulating the detonator from the heat of the burning bomb. The H.E. charge consists of tetryl pellets.

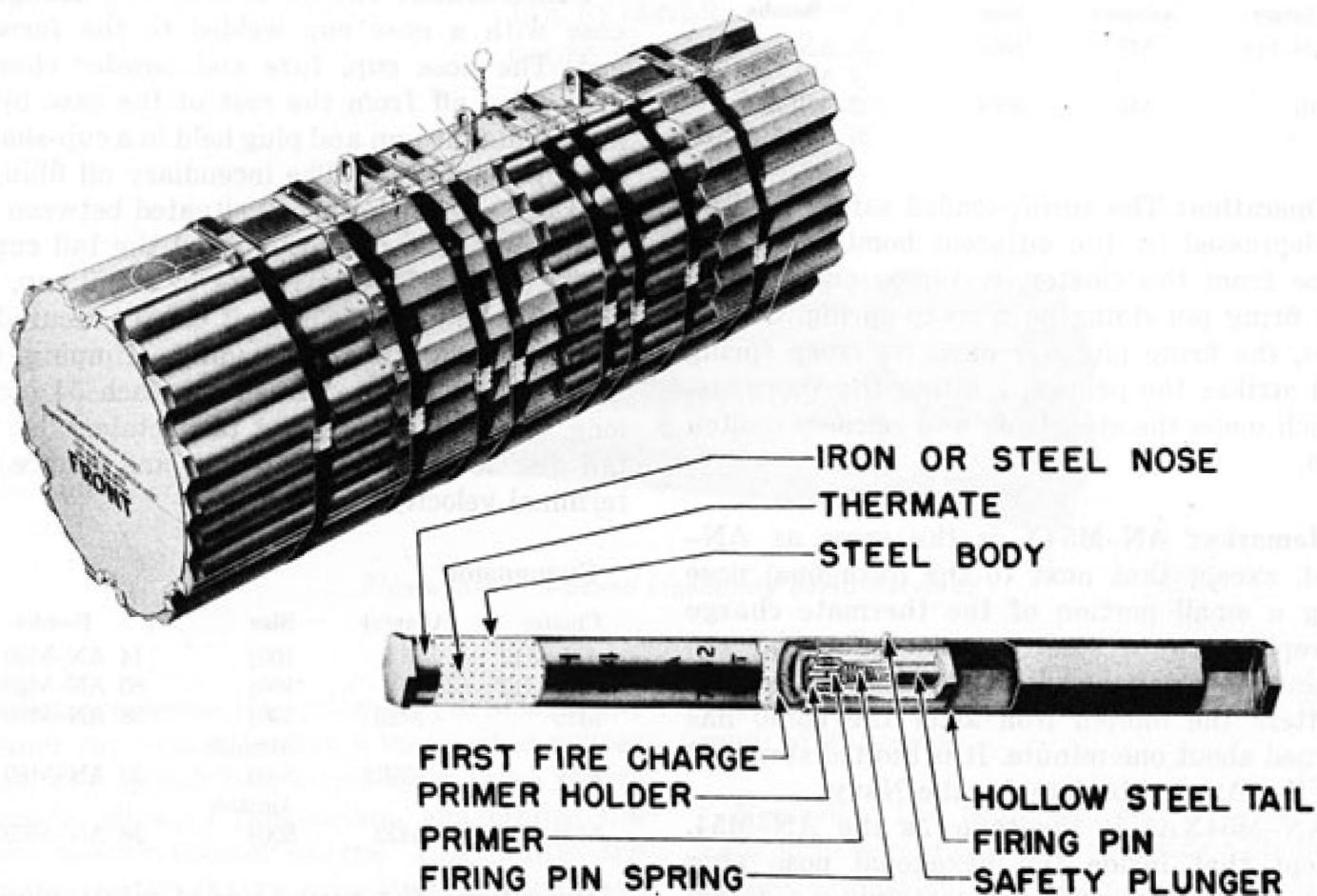


Figure 305. 4-pound Incendiary Bomb AN-M54

### 4-pound Incendiary AN-M54 Series (Obsolete)

#### AN-M54

Over-all length, inches.....	21.35
Body length, inches.....	13.6
Body diameter, inches.....	1.69
Tail length, inches.....	10.0
Tail width, inches.....	1.69
Filling .....	Thermate
Weight of filling, pounds.....	1.6
Total weight, pounds.....	4.0
Charge/weight ratio.....	40%

**Construction:** The bomb body is a steel cylinder having a hexagonal nose plug. The fuze is installed in the tail plug assembly. There are three vent holes below the primer cap assembly, to assist in initial burning. There is a hexagonal hollow sheet-metal tail.

#### Suspension

Cluster	Adapter	Size	Bombs
AN-M8	M5	100#	27 AN-M54 7 AN-M54XA1
M9	M6	500#	102 AN-M54 26 AN-M54XA1

**Operation:** The spring-loaded safety plunger is depressed by the adjacent bomb; upon release from the cluster, it jumps out, leaving the firing pin riding on a creep spring. On impact, the firing pin overcomes its creep spring and strikes the primer, igniting the thermate, which melts the steel body and releases molten iron.

**Remarks:** AN-M54X is the same as AN-M54, except that next to the hexagonal nose plug a small portion of the thermate charge is replaced by a steel capsule containing 170 grains of black powder, which explodes and scatters the molten iron after the bomb has burned about one minute. It is limited standard for the Army, obsolete for the Navy.

AN-M54XA1 is the same as the AN-M54, except that inside the hexagonal nose plug there is a steel cylinder containing a tetryl high-explosive charge with a delay fuse and a detonator. A thin spacer of magnesium is be-

tween the thermate and the fuse opening of the explosive cylinder. After one minute of burning, the fuse is ignited, exploding the tetryl. These bombs are no longer being procured for naval service, and should not be used except when Incendiary Bombs AN-M50A2 or AN-M69 are not available. It is limited standard for the Army, obsolete for the Navy.

### 6-pound Incendiary AN-M69 and AN-M69X

Over-all length, inches.....	19.5
Body length, inches.....	19.5
Body diameter, inches.....	2.87
Wall thickness, inch.....	0.042
Tail length (streamer), inches.....	54.0
Filling .....	Gelled gasoline (NP or IM)
Weight of filling, pounds.....	2.8
Total weight, pounds.....	6.0
Charge/weight ratio.....	46%
Fuzing .....	M1

**Construction:** The bomb body is a hexagonal case with a nose cup welded to the forward end. The nose cup, fuze and powder charges are sealed off from the rest of the case by an impact diaphragm and plug held in a cup-shaped sealing diaphragm. The incendiary oil filling is held in a cheesecloth sock situated between the forward sealing diaphragm and the tail cup.

The tail assembly consists of a tail cup, tail retainer, and disc. The tail cup is secured to the hexagonal case by beading, crimping, and heating. Four gauze streamers, each 54 inches long, are attached to the tail retainer by the tail disc to stabilize the bomb and reduce the terminal velocity.

#### Suspension

Cluster	Adapter	Size	Bombs
AN-M12	M4	100#	14 AN-M69
AN-M13	M7	500#	60 AN-M69
M19	M23	500#	38 AN-M69
		Aimable	
E28	E6R2	500#	38 AN-M69
		Aimable	
M21 (E74)	M23	500#	38 AN-M69X

**Operation:** The spring-loaded safety plunger jumps out of the Fuze M1 upon release from the cluster, arming the fuze. On impact, the

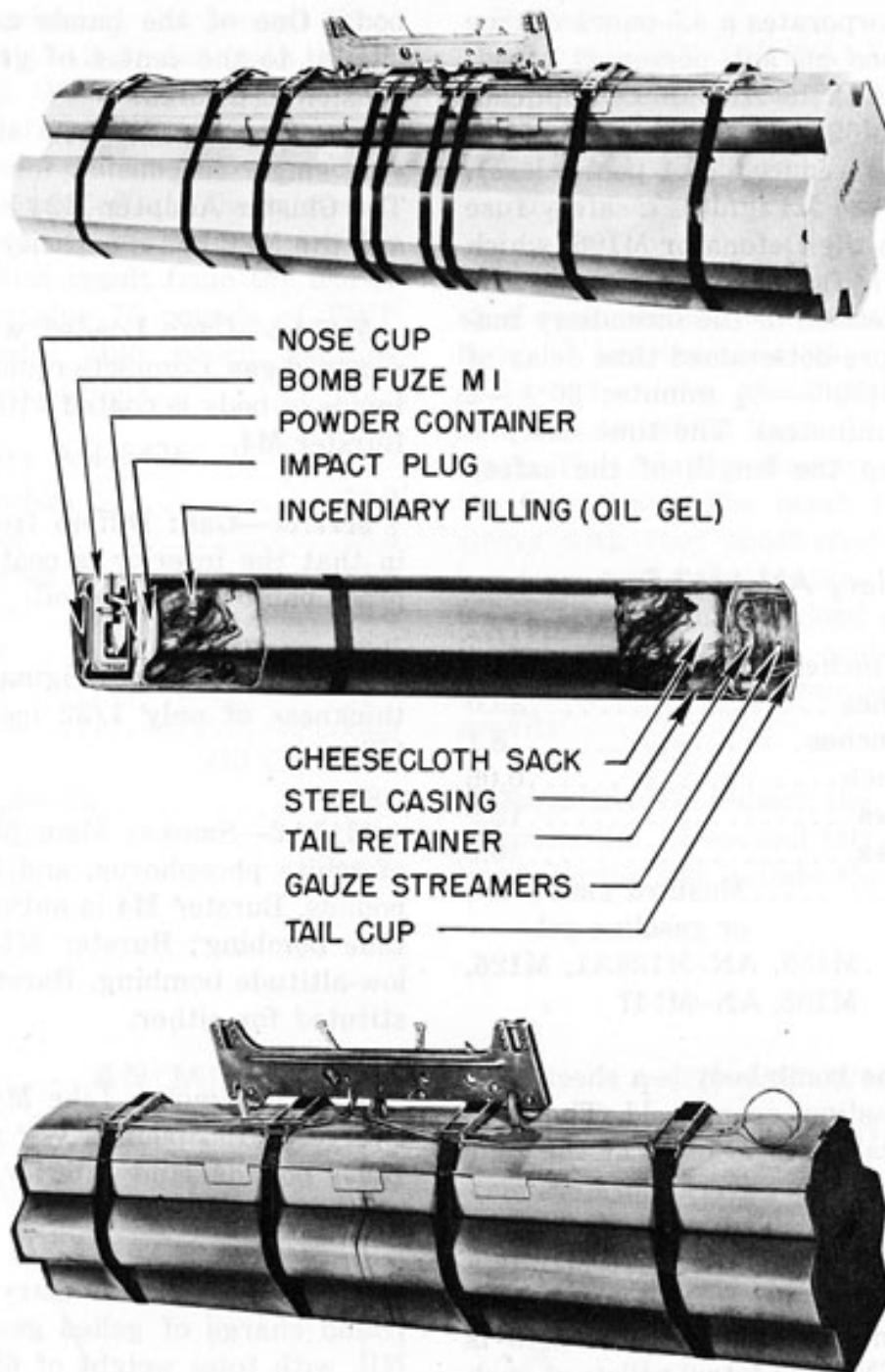


Figure 306. 6-pound Incendiary Bomb AN-M69

striker overcomes its spring and detonates the primer cap, which ignites a lead-coated spitter fuse. The spitter fuse burns from three to five seconds, allowing penetration, and ignites the black-powder booster charge. This ignites the igniter-ejector charge consisting of two bags of black powder and oiled magnesium powder. The combustion blows off the tail cup, ignites

the incendiary filling and ejects it for a maximum of 75 yards.

**Remarks:** The bomb and the delay are calculated to permit penetration inside a structure before detonation. The incendiary oil filling is of a very sticky composition and will normally adhere to any object, including vertical walls.

The AN-M69X incorporates a 4.5-ounce charge of tetryl to produce an anti-personnel effect. Over-all dimensions of the AN-M69X duplicate those of the AN-M69, but the amount of incendiary mixture is reduced (0.4 pound less). Operation of the Fuze M1 ignites a safety fuse lead terminating in the Detonator M106, which explodes the tetryl, fragmenting 65% of the bomb case after ejection of the incendiary material, following a pre-determined time delay of 0.5 to 6 minutes (30%—1/2 minute; 30%—2 minutes; 40%—6 minutes). The time delay is varied by adjusting the length of the safety fuse.

#### 100-pound Incendiary AN-M47 Series

##### AN-M47A2

Over-all length, inches.....	48.9
Body length, inches .....	39.0
Body diameter, inches.....	8.1
Wall thickness, inch.....	0.06
Tail length, inches.....	12.9
Tail width, inches.....	10.9
Filling.....	Mustard gas, W.P., or gasoline gel
Fuzing.....	M159, AN-M126A1, M126, M108, AN-M147

**Construction:** The bomb body is a sheet-steel tube with a longitudinal seam weld. The nose end is hemispherical. A base plate at the rear end is welded to the tube. Several bursters may be used interchangeably. The burster runs the length of the bomb. The Burster AN-M12 is a tube containing a 50-50 mixture of black powder and magnesium. The Burster AN-M13 is a tube containing TNT and tetryl pellets at each end, and is used in conjunction with the Igniter AN-M9 (WP or Na). The Na igniter will permit use over water. Four vanes are welded to a truncated cone with box-type interior struts to form the tail.

**Suspension:** Horizontal suspension is provided by two eyebolts formed by holes in each half of the two suspension bands, the halves then being crimped together to form a complete band. The bands are secured to the bomb body by tightening the bolts on the underside of the

body. One of the bands can be loosened and slipped to the center of gravity if single suspension is desired.

Two clusters are now standardized to provide single suspension for four to six bombs. The Cluster Adapter M24 holds six AN-M47's; and the M22 has a capacity of four AN-M47's.

**M47A2—Gas:** Loaded with 68.5 pounds of mustard gas. Complete round weighs 98 pounds. Inside of body is coated with oil. Equipped with Burster M4.

**M47A1—Gas:** Differs from the M47A2 only in that the interior is coated with black acid-proof paint instead of oil.

**M47—Chemical:** Original design, has wall thickness of only 1/32 inch. Not used for H filling.

**M47A2—Smoke:** Main filling is 100 pounds of white phosphorus, and total weight is 127 pounds. Burster M4 is authorized for high-altitude bombing; Burster M18 is authorized for low-altitude bombing. Burster M7 may be substituted for either.

**M47A1—Smoke:** Like M47A2—Smoke, with charge of 103 pounds WP and total weight of 129.5 pounds, and interior coated with black acid-proof paint.

**AN-M47A2 — Incendiary:** Loaded with 40-pound charge of gelled gasoline, either IM or NP, with total weight of 68.6 pounds. Burster AN-M13 and Igniter AN-M9 (WP or Na) authorized for this bomb.

**M47A1—Incendiary:** Like AN-M47A2, with interior coating of acid-proof paint instead of oil.

**AN-M47A3 — Incendiary:** Identical to AN-M47A2, except that tail assembly is three inches longer.

**AN-M47A4—Incendiary:** On this modification, the suspension lugs are strengthened.

The Navy is procuring, at the present time, Incendiary Bombs M47A2 loaded with PWP. PWP consists of 75% WP and 25% plasticizer; it is more effective than WP, since it gives longer burning, reduces pillaring effect, and increases the anti-personnel effect. The increased smoke efficiency is due to the larger particles of controlled size which result from the use of PWP. The bomb contains 75 pounds of PWP and requires a Burster M20, which contains  $\frac{3}{4}$ -inch-diameter tetryl pellets.

### 500-pound Incendiary AN-M76

Over-all length, inches.....	59.2
Body length, inches.....	45.3
Body diameter, inches.....	14.0
Wall thickness, inch.....	0.3
Tail length, inches.....	13.9
Tail width, inches.....	14.8
Tail weight, pounds.....	12.3
Filling .....	Oil Gel PT 1
Weight of filling, pounds.....	180
Total weight, pounds.....	475
Charge/weight ratio.....	38%

### Fuzing

NOSE — AN-M103A1, AN-M103, M103, M135A1, M136, M136A1, M139, M139A1, AN-M139A1, M140, M140A1, AN-M140A1, M163, M164, M165, M166, T82.

TAIL—AN-M101A2, AN-M101A1, M161.

**Construction:** The body is of one-piece cast-steel construction, with a base plate welded to body. A burster tube 3.5 inches in diameter, 35.75 inches long, running through the center of bomb, is welded to the nose and to the base plate. The Adapter Booster M115 screws into the base plate. The bomb tail is a cast-steel sleeve with four sheet-steel fins and internal box-type struts. Suspension is accomplished by two suspension lugs welded on the body seven inches on each side of center of gravity and by a single lug,  $180^{\circ}$  removed at the center of gravity.

**Operation:** On impact, the fuzes function and detonate the 1.25-pound tetrytol burster in the burster tube and initiate the nine-pound white

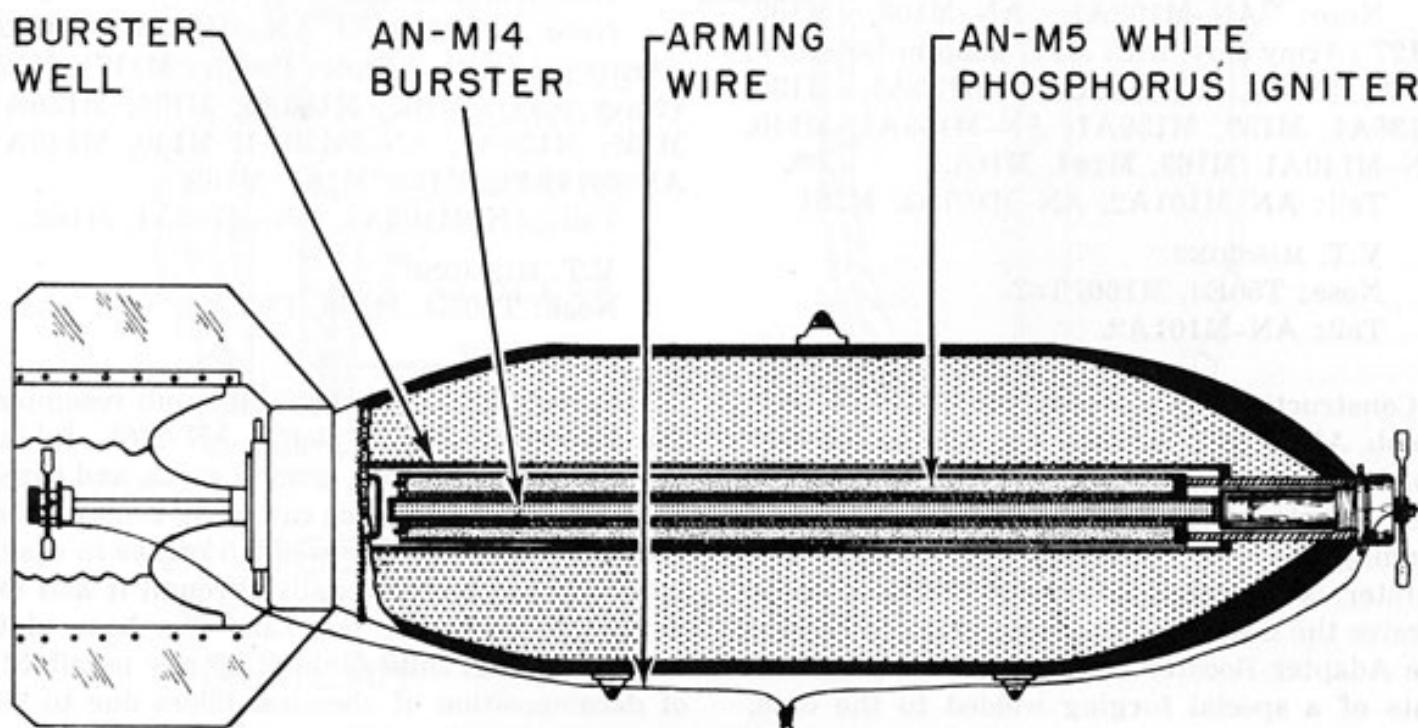


Figure 307. 500-pound Incendiary Bomb AN-M76

phosphorus igniter, which, in turn, ignites the main filling. The bomb has a dispersal area of about 300 by 600 feet.

**Remarks:** White phosphorus is present in the igniter, and proper precautions should be taken in disposing of these bombs. The incendiary mixture, PT 1, consisting essentially of paste of magnesium, gasoline, and a thickener, liberates heat at about four times that given off by the usual incendiary mixture IM.

### 500-pound Chemical AN-M78

Over-all length, inches.....	59.25
Body length, inches.....	46.7
Body diameter, inches.....	14.0
Wall thickness, inch.....	0.3
Tail length, inches.....	13.9
Tail width, inches.....	18.9
Tail weight, pounds.....	12.3

Filling.....	Hydrocyanic acid (AC)	Phosgene (CG)	Cyanogen Chloride (CK)
Wt. of filling....	100#	205#	165#
Total weight....	383#	488#	448#
Chg./wt. ratio..	26.1%	42.0%	36.8%

### Fuzing

#### REGULAR MISSIONS

Nose: AN-M103A1, AN-M103, M103, M127 (Army only, with M117 adapter booster); M128 (Navy only), M135, M135A1, M136, M136A1, M139, M139A1, AN-M139A1, M140, AN-M140A1, M163, M164, M165.

Tail: AN-M101A2, AN-M101A1, M161.

#### V.T. MISSIONS

Nose: T50E4, M166, T82.

Tail: AN-M101A2.

**Construction:** In construction, the Chemical Bomb AN-M78 resembles the 500-pound G.P. Bomb AN-M64. The body is of one-piece cast-steel construction with a Burster M15 well running the entire length of the bomb. The burster is threaded internally at the nose to receive the nose fuze and at the rear to receive the Adapter Booster M115. The base plug consists of a special forging welded to the case, containing the Needle Valve M1. The tail is a standard box-type fin assembly secured to the

bomb by a locking nut which threads onto the base plug. Suspension is by two lugs seven inches on either side of the center of gravity, or by a single suspension lug 180° removed at the center of gravity.

**Remarks:** The Adapter Booster M117 is used in conjunction with the Nose Fuze M127. This nose fuze is required for aerial bursts with persistent gas agents.

### 1,000-pound Chemical AN-M79

Over-all length, inches.....	69.5
Body length, inches.....	53.6
Body diameter, inches.....	18.6
Wall thickness, inch.....	0.38
Tail length, inches.....	18.5
Tail width, inches.....	25.4
Tail weight, pounds.....	21.5

Filling.....	Hydrocyanic acid (AC)	Phosgene (CG)
Wt. of filling.....	185#	404#
Total weight.....	707#	926#
Chg./wt. ratio.....	26.0%	44.0%

### Fuzing

#### REGULAR MISSIONS

Nose: AN-M103A1, AN-M103, M103, M127 (Army only with Adapter Booster M117), M128 (Navy only), M135, M135A1, M136, M136A1, M139, M139A1, AN-M139A1, M140, M140A1, AN-M140A1, M163, M164, M165.

Tail: AN-M102A2, AN-M102A1, M162.

#### V.T. MISSIONS

Nose: T50E4, M166, T82.

**Construction:** This chemical bomb resembles the 1,000-pound G.P. Bomb AN-M65, taking the same tail assembly, arming wires, and fuzes. The body is of one-piece cast-steel construction and has a steel burster well 2.5 inches in diameter which is placed axially through it and expanded in both the nose and the base plate before welding, thus eliminating any possibility of decomposition of chemical fillers due to the presence of crevices. The base plate differs from that of the standard G.P. bomb in that it is a

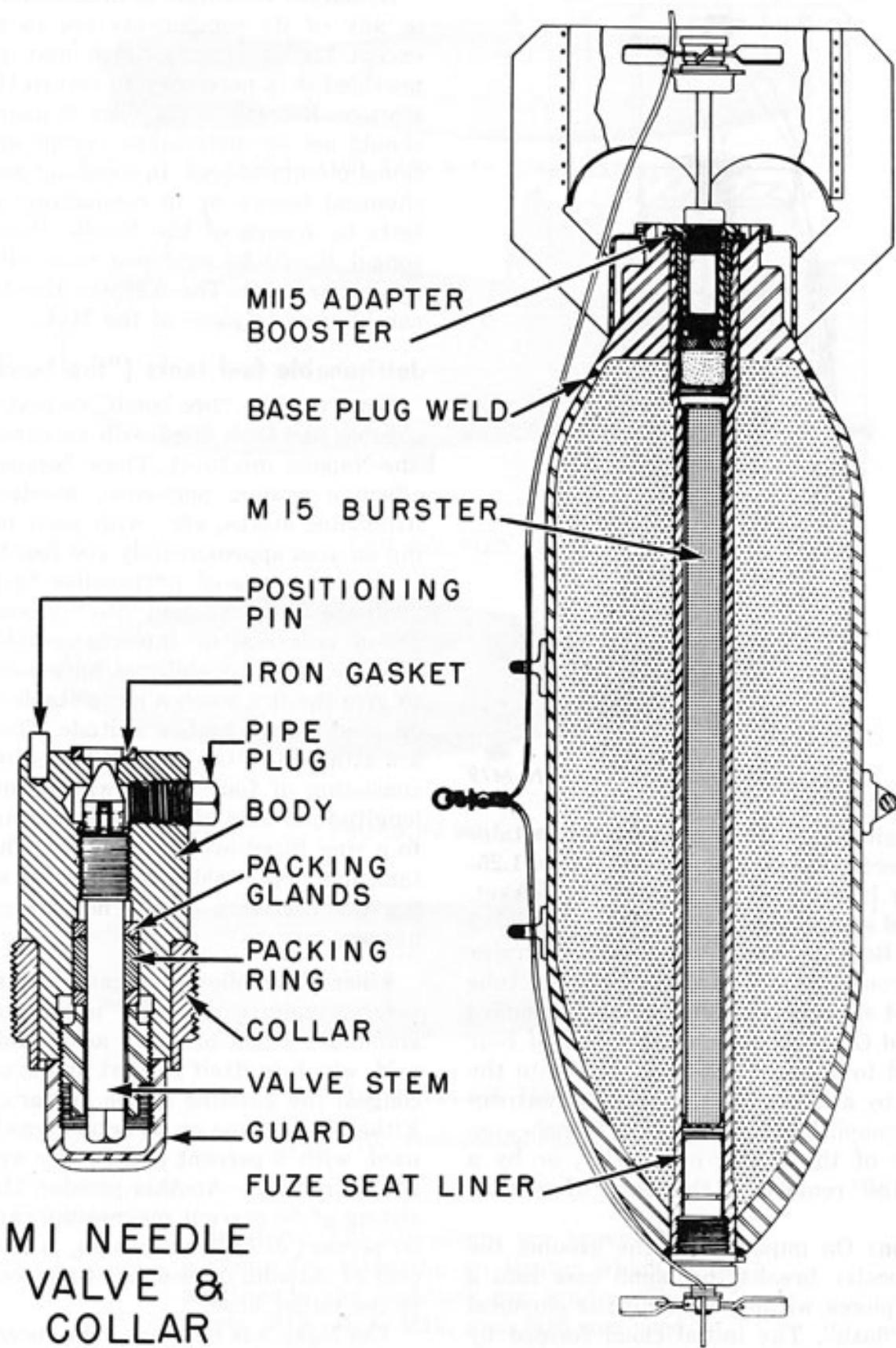


Figure 308. 500-pound Chemical Bomb AN-M78

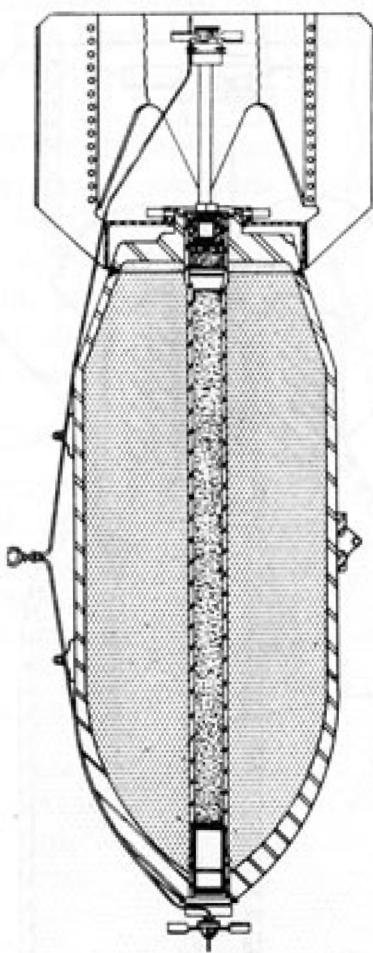


Figure 309. 1,000-pound Chemical Bomb AN-M79

special forging welded to the case and containing the Needle Valve M1. It also has a 1.25-inch filling hole closed by a soft iron gasket, a hard steel gasket plug, and a threaded closing plug. The Booster M16 is used in the burster well and consists of a waterproof fiber tube filled with 4.45 pounds of tetrytol. The standard 1,000-pound G.P. tail assembly consists of four fins welded to a sleeve which is held onto the base plate by a locking nut. Horizontal suspension is accomplished by dual lugs 7 inches on either side of the center of gravity, or by a single lug 180° removed at the center of gravity.

**Operation:** On impact with the ground, the tetrytol booster breaks the bomb case into a few large pieces without causing the chemical agent to "flash". The initial cloud formed by the burst of this bomb, when filled with CG, covers an area of 100 yards in diameter within approximately eight to ten seconds.

**Remarks:** Attempts to disassemble the bomb or any of its components are to be avoided, except for the fuzes, which may be removed provided it is necessary to return the bomb to storage. Release of the filler is dangerous, and should not be undertaken except under exceptional circumstances. In handling any damaged chemical bombs or in conducting surveillance tests by means of the Needle Valve M1, personnel should be equipped with rubber gloves and a gas mask. The Adapter Booster M115A1 can be used in place of the M115.

#### Jettisonable fuel tanks ("fire bombs")

**General:** The "fire bomb" consists of a jettisonable fuel tank filled with gasoline gel (gasoline-Napalm mixture). These bombs have been effective against personnel, wooden piers, inflammable stores, etc., with each bomb covering an area approximately 100 feet by 300 feet.

Various types of jettisonable fuel tanks are available for conversion into fire bombs. A 150-gallon universal or interchangeable tank has been produced. Stabilizers have been designed to give the fire bomb a more stable flight when dropped from a higher altitude. The stabilizers are attached to the present tanks by a harness consisting of four cables which run along the longitudinal axis of the tank and are attached to a ring fitted around the nose. The universal tank has clips welded to the after end, obviating the necessity of the nose ring and cable harness.

**Filler:** The filler is a gasoline-Napalm mixture. Napalm consists of a mixture of basic aluminum soaps of fatty acids and napthenic acid, which in itself is inert and is used only to congeal the gasoline to the proper consistency. Either 100 octane or 80 octane gasoline can be used, with 6 percent Napalm by weight added for the mixture. Another powder, Marinco, consisting of 50 percent magnesium carbonate and 50 percent calcium carbonate, is added (7 percent of Napalm by weight) to prevent clogging in the outlet hose.

The Navy has developed the Incendiary Mixers Mk 1 Mod 0 and Mk 1 Mod 1, which mix the gasoline and Napalm in the correct proportions.

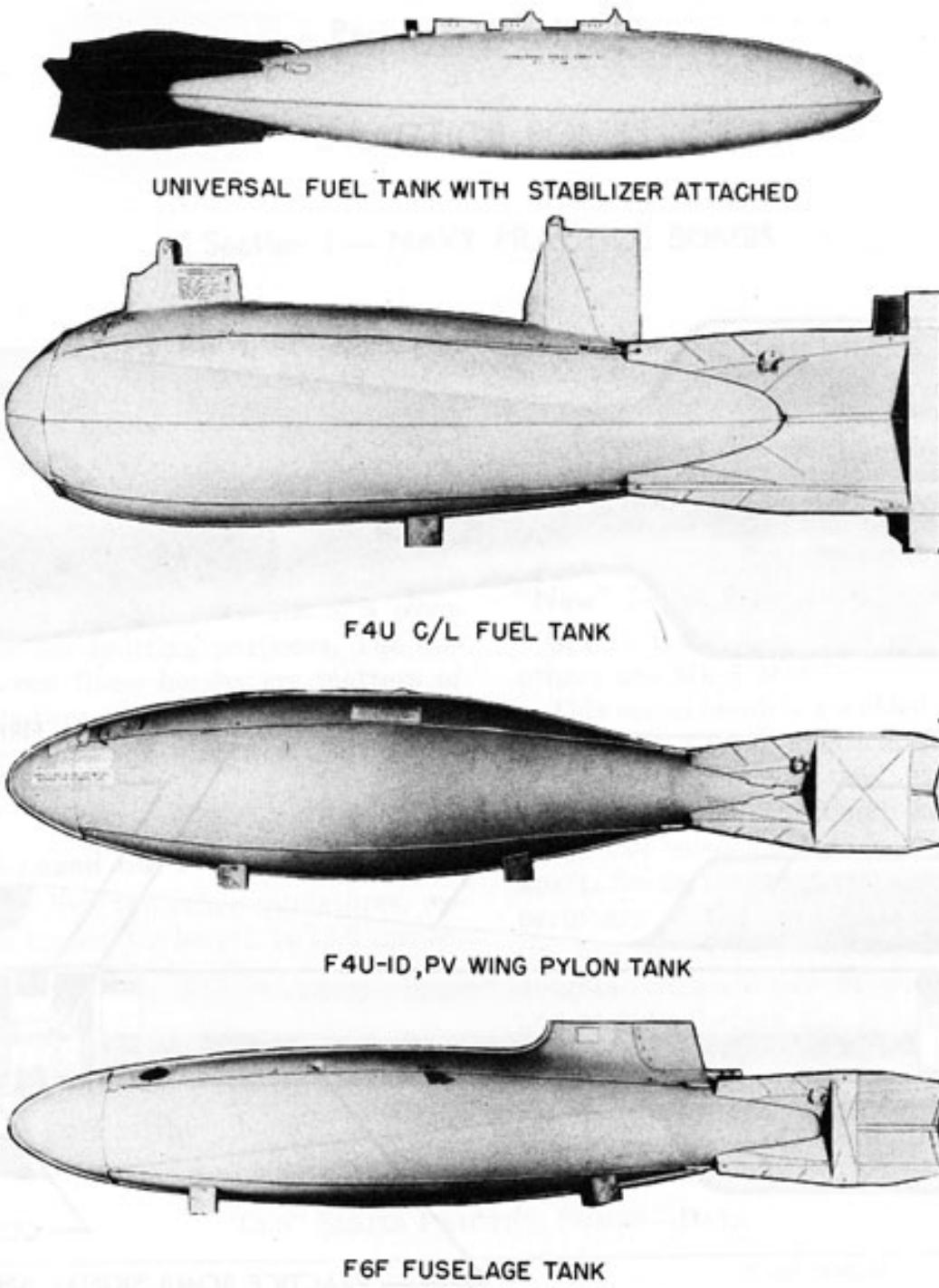


Figure 310. Jettisonable Fuel Tanks

**Igniters:** The stabilizers are provided with a clamp for attaching an igniter which is in addition to the fuel-tank cap igniter. The Igniters M13, M14, M15, and M16 are used.

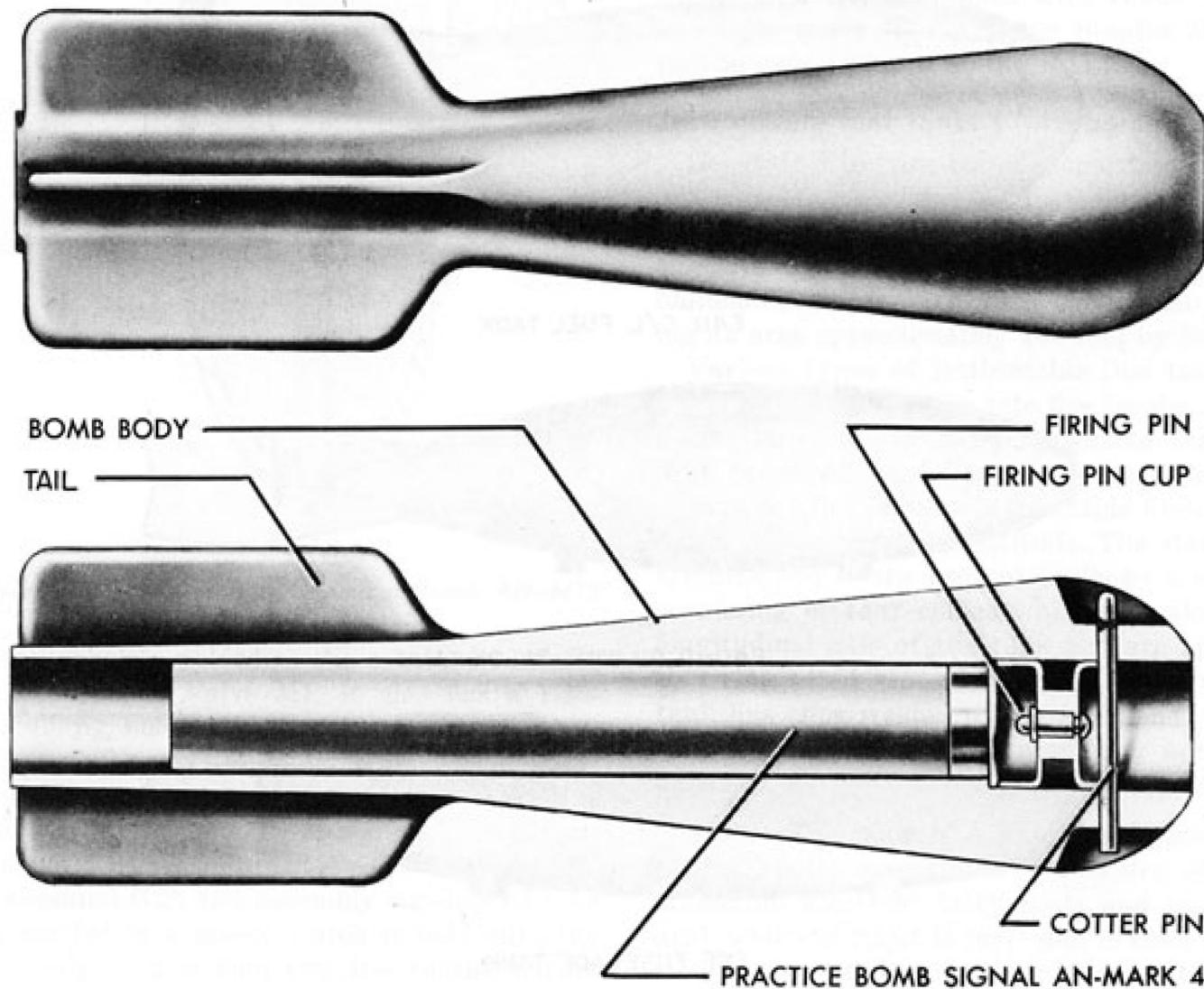


Figure 311. 4.5-pound Miniature Practice Bomb AN-Mk 4

## PRACTICE BOMBS

## Section I—NAVY PRACTICE BOMBS

**Miniature 3-pound Mk 3, Mk 4, AN-Mk5, and AN-Mk 23; and 4.5-pound AN-Mk 43**

Over-all length, inches.....8.25  
 Diameter, inches.....2.18  
 Color.....Unpainted

These small, cast-alloy bombs have a tube along their longitudinal axis which houses the Signal Cartridge AM-Mk 4 or Mk 5, a pyrotechnic charge for spotting purposes. The differences between these bombs are matters of size. The Miniature Practice Bomb AN-Mk 43 weighs 4.5 pounds; the others of this series weigh 3.0 pounds.

**Miniature 13-pound Mk 19 or Mk 19 Mod 1**

This bomb is like the other miniatures, except that it is larger. Its length is 13.0 inches, while its weight is 13.0 pounds.

**"Old" Series Practice Bombs (Obsolete or being replaced)**

No fuzes are used in these bombs, and they

contain no spotting charge, being filled either with water or with wet sand. The filling is usually stencilled on the body of the bomb. To prevent freezing and splitting of cases at high altitudes, anti-freeze is added. To improve spotting of hits, a spotting dye is also used.

**"New" Series Practice Bombs**

Mk 15 Mod 3 uses Spotting Signal Mk 7; the others use Mk 6 Mod 0.

This series bomb is a welded sheet-steel light-case design having identical dimensions to AN standard G.P. bombs, and uses AN standard G.P. bomb tails. The bomb has, welded to its body, two suspension lugs spaced 14.0 inches apart. Seven threaded recesses, located on the periphery at the approximate center of gravity, are for various hoisting conditions. At 90 degrees, on each side of the suspension lugs and slightly before the hoisting recesses, are threaded openings to receive trunnions.

By means of a strap, the appropriate practice bomb signal, Mk 6 or Mk 7, may be at-

**"OLD" SERIES PRACTICE BOMBS—DATA**

		Length	Diameter	Color	Total Weight	
					Water-Filled	Wet-Sand-Filled
100-lb.	Mk 7	41.2"	8.0"	Black	48.5 #	83.0 #
100-lb.	Mk 15 Mod 2	41.2"	8.0"	Black	56.0 #	95.0 #
500-lb.	Mk 5	67.3"	16.0"	Black	360.0 #	500.0 #
500-lb.	Mk 11	61.8"	15.0"	Black	268.0 #	448.0 #
500-lb.	Mk 21	61.8"	15.0"	Black	273.0 #	489.0 #
1,000-lb.	Mk 7	80.0"	19.0"	Black	580.0 #	1,000.0 #
1,000-lb.	Mk 22	79.0"	19.0"	Black	573.0 #	1,013.7 #

## "NEW" SERIES PRACTICE BOMBS—DATA

		Length	Diameter	Water-Loaded	Sand-Loaded
100-lb.	Mk 15 Mod 3	41.2"	8.0"	64.25 #	100 #
500-lb.	Mk 65 Mod 0	56.6"	14.0"	220.0 #	388.0 #
1,000-lb.	Mk 66 Mod 0	67.0"	18.6"	474.0 #	834.0 #
2,000-lb.	Mk 67 Mod 0	90.15"	23"	...	733.0 #

tached to the tail assembly with the forward end of the signal seated in a recess in the after end of the bomb body.

A flat-nose attachment has been designed for use with the Practice Bomb Mk 15 Mod 3 for anti-submarine bombing practice. The flat nose is installed by removing the nose-filling cap, slipping the attachment over the nose of the bomb, and then screwing the filling cap down tightly by hand to hold the attachment in place. The flat nose will prevent ricochet at entrance angles as low as 9°.

The 2,000-pound-size container was designed for an incendiary or practice filler but, thus far, it is approved by the Bureau of Ordnance for practice filling, sand, only. As designed for incendiary loads, it would take a nose fuze, the Burster Mk 1, and the Igniter Mk 40; however this is subject to change before Bureau approval of the bomb as an incendiary. The Mk 67 has standard suspension lugs and provision for trunnions.

### Practice Bomb Signals (Navy)

**AN-Mk 4 and AN-Mk 5:** For the miniature practice bombs, these signals allow observers to spot the impact of salvos. The Practice Signal Cartridge AN-Mk 4 is an extra long 10-gauge shotgun shell which is inserted in the nose of the bomb. On impact, the cartridge is fired, expelling a large puff of black smoke from the tail of the bomb. The firing device consists of two shallow cups separated by a spacer, the firing pin extending through the bottom of one cup. The Signal Cartridge Mk 5 is the same size but

filled with fluorescein, which stains the water, giving a spot of longer duration than the AN-Mk 4.

**Mk 6 Mod 0 and Mk 7 Mod 0:** These signals are essentially cans of black powder fitted with the Fuze Mk 247. The Mk 6 is used in the Practice Bombs Mk 65 and Mk 66; the Mk 7 in the Bomb Mk 15 Mod 3. They are attached to the rear of the bomb by brackets or a strap arrangement. The Signal Mk 7 is 13.08 inches long and 2 inches in diameter. It has a total weight of 2.5 pounds. It has a filling of one pound of black powder. The Mk 6 is generally the same, except that the fuze is mounted off-center and the black-powder filling weighs two pounds.

The Fuze Mk 247 consists of an inertia weight held by a jump-out pin and a creep spring. The detonator is a blank caliber .38 cartridge. When the signal is placed in the bomb, the firing pin assembly is unscrewed and a blank caliber .38 cartridge inserted in the cartridge chamber. The firing assembly is then re-inserted and secured by means of a lock nut. At the time of loading the bomb into the plane, the arming wire is inserted through the jump-out pin, and the safety pin is then removed. Upon release from the plane, the arming wire is withdrawn, allowing the jump-out pin to be thrown free, arming the signal. Upon impact, the weighted firing pin overcomes the creep spring and impinges upon the primer of the caliber .38 blank cartridge, which, in turn, ignites the main black-powder charge.

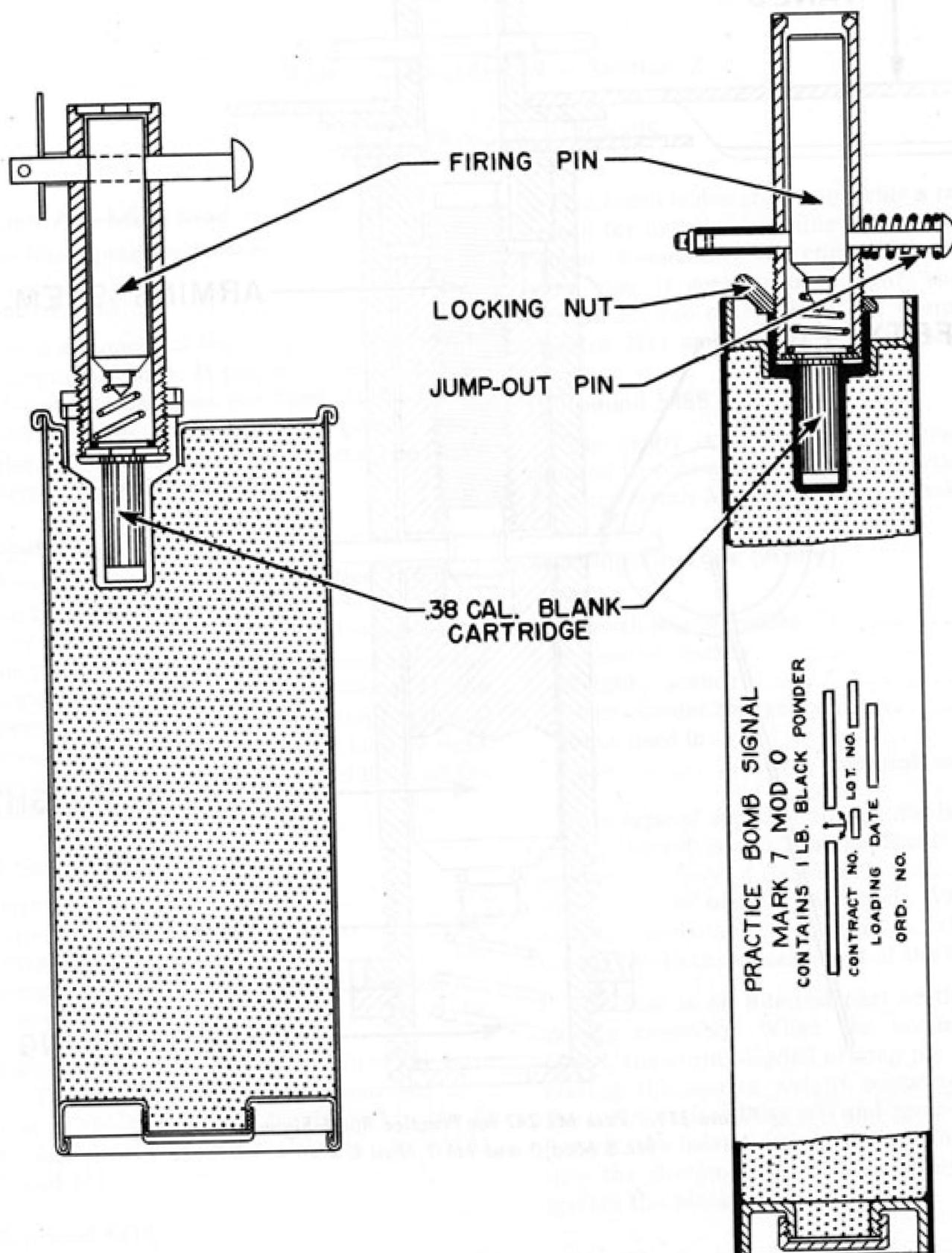


Figure 312. Practice Bomb Signals Mk 6 Mod 0 (left) and Mk 7 Mod 0 (right)

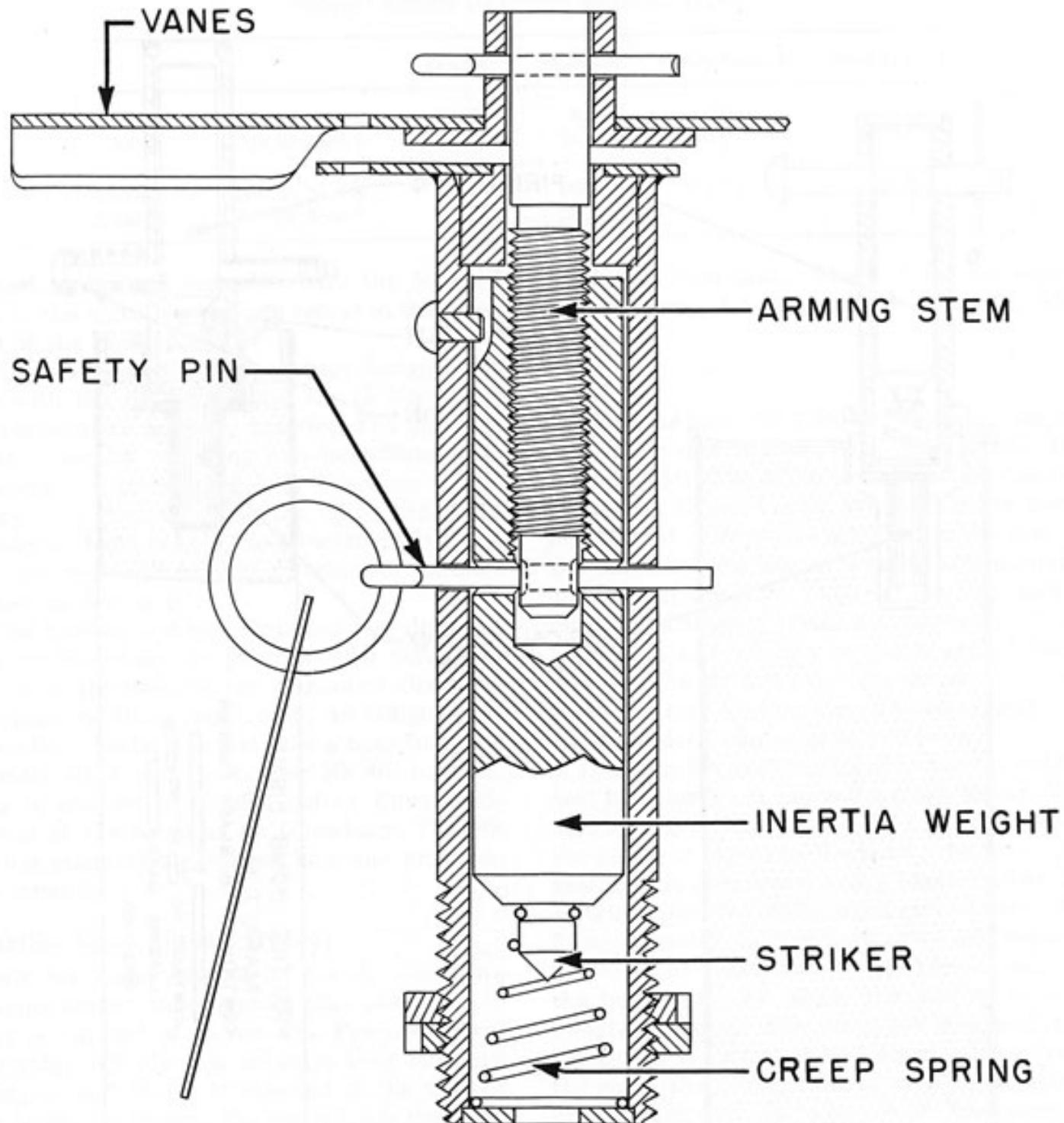


Figure 313. Fuze Mk 247 for Practice Bomb Signals  
Mk 6 Mod 0 and Mk 7 Mod 0

## ARMY PRACTICE BOMBS

**3-pound AN-Mk 5 Mod 1**

See Navy practice bombs.

**20-pound M48**

This is a dummy of the 20-pound Fragmentation Bomb AN-M41. It has a two-ounce black-powder charge and uses the Fuze M110 or AN-M110A1 in the nose. It is 21.8-inches long; weighs 19.7 pounds. It is issued in practice bomb clusters M2 and M2A1.

**23-pound M71 and M71A1**

These are parachute-type practice fragmentation bombs for clustering. They do not have a fuze or spotting charge, because of the presence of the parachute. The parachute assembly is the M3, modified from the M4 by removal of the suspension assembly, hand assembly, and pull wire container. M71 is 26.8 inches long; weighs 21 pounds. M71A1 differs by the addition of the shoulder to the bomb nose.

**100-pound M38A2**

Over-all length, inches.....	47.5
Diameter, inches .....	8.13
Weight, empty, pounds.....	15.7
Weight, sand-loaded and spotting charge, pounds .....	100

This bomb simulates a G.P. bomb of the same size. The spotting charge is assembled in a sleeve at the base of the bomb, within the fin box. Authorized spotting charges are M1A1, M3, and M4.

**100-pound M75**

Length, inches.....	47.0
Diameter, inches.....	8.0
Filler, hematite, pounds.....	72
Total weight, pounds.....	101.3

This bomb is designed to provide a target reference for practice bombing over snow-covered ranges. Resembling the chemical bomb of the same size, it consists of a light, sheet-metal case; a charge of red iron ore (hematite); a Burster M4; and a Fuze M108 in the nose.

**100-pound M85**

This model is a reinforced concrete design ordered to relieve a temporary shortage of the Practice Bomb M38A2 during the war.

**Spotting Charges (Army)****M1A1**

Over-all length, inches.....	11.18
Diameter, inches.....	3.43
Weight, pounds.....	4.25
Black-powder charge, pounds.....	3.0
Bomb used in.....	M38A2
Fuze.....	Integral inertia-type

This type of spotting charge fits in the after end of the 100-pound Practice Bomb M38A2. It produces a flash of flame and white smoke for observation of bombing accuracy. When assembled in the bomb, the can of the charge protrudes two to three inches out of the bomb body.

The fuze is an integral part of the spotting charge assembly. When the arming wire is pulled, the spring-loaded arming pin jumps out, leaving the inertia weight supported only by the combination firing pin and creep spring. On impact, the inertia weight drives this firing pin into the shotgun-type primer, which, in turn, ignites the black powder.

**M3:** The Spotting charge M3 has a  $2\frac{1}{3}$ -pound dark smoke filling and a black-powder igniter. It is  $\frac{5}{8}$  inch longer than the Spotting Charge M1A1, but otherwise is like it. The M3, with

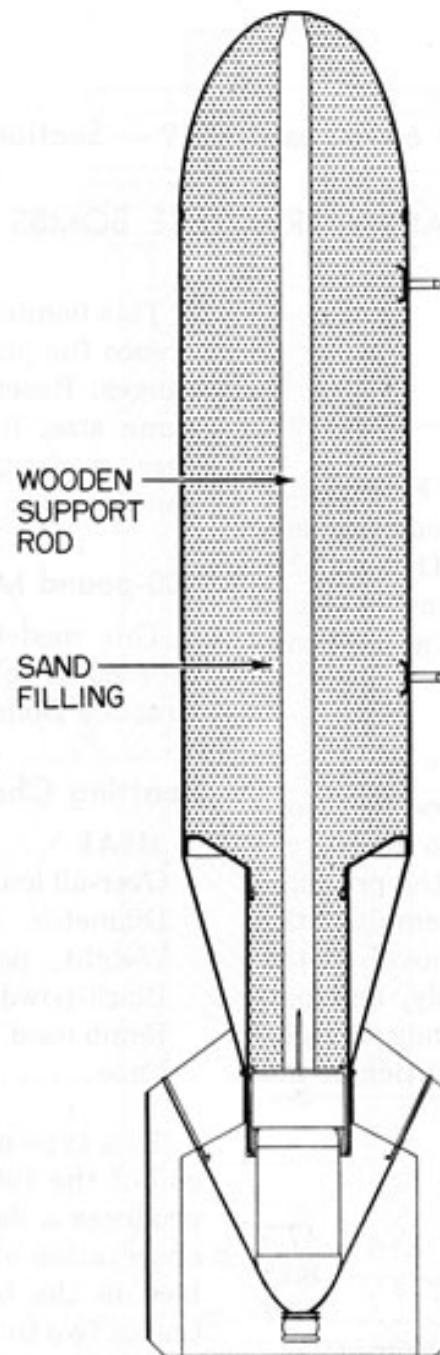


Figure 314. 100-pound Practice Bomb M38A2

its dark smoke filler, is well adapted for bombing practice over snow-covered terrain. The black-powder igniter charge contains approximately 425 grains. It is used in the Practice Bomb M38A2.

#### M5

Over-all length, inches.....7.37  
Diameter, inches.....2.95

Material .....	Glass
FS filler, fluid ounces.....	14.4

The Spotting Charge M5 consists of a glass bottle filled with FS smoke mixture. An ordinary bottle cap seals the mixture. The bottle is held to the Practice Bomb M38A2 by a wire twisted around the neck of the bottle and attached to the tail vanes. The charge assembly weighs 2.54 pounds.

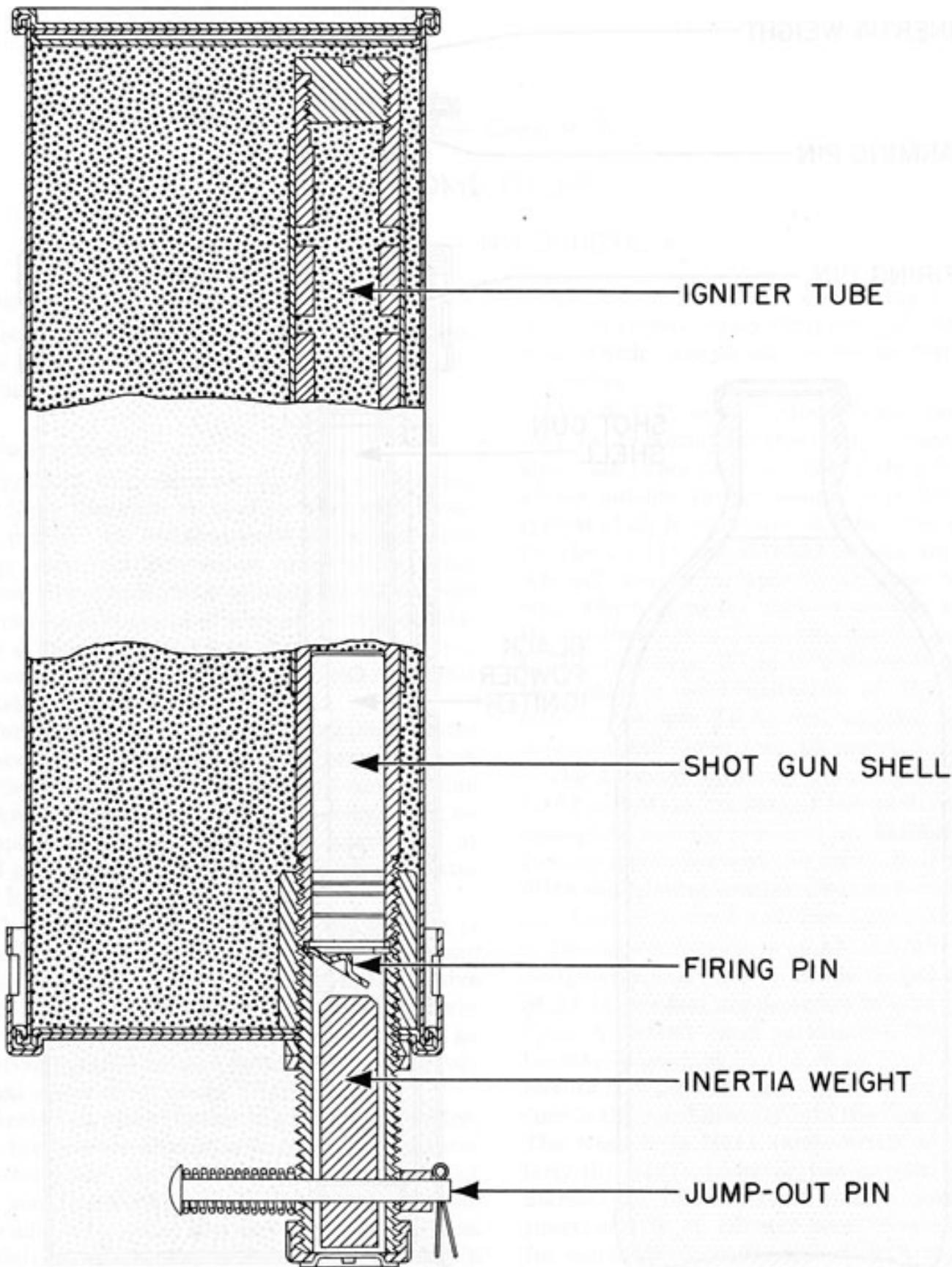


Figure 315. Spotting Charge M1A1

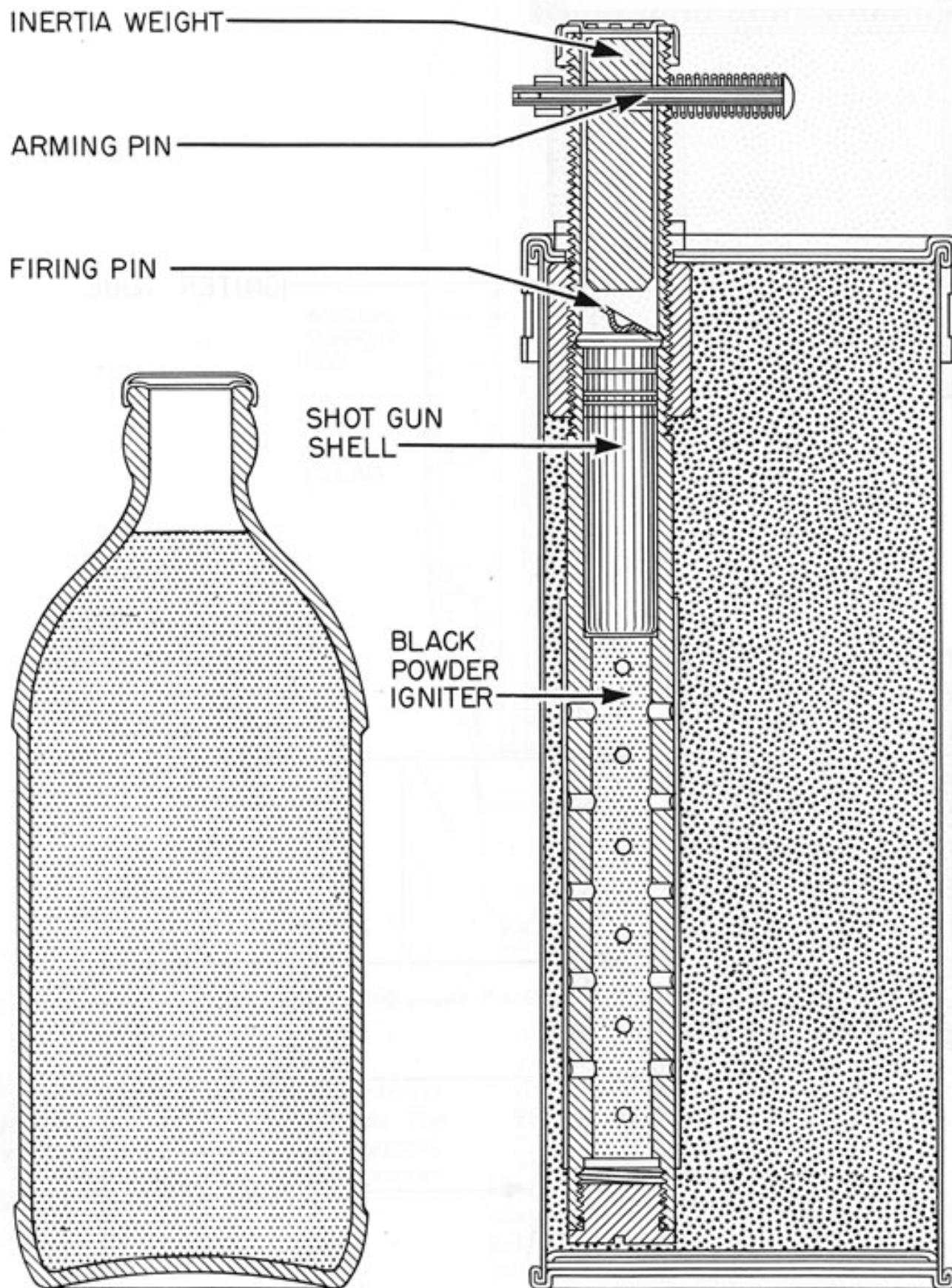


Figure 316. Spotting Charges M3 (right) and M5 (left)

## BOMB FUZES

### Section I — INTRODUCTION

#### General

Because of the nature of their development, it is necessary to classify bomb fuzes in this publication as either Army or Navy items.

#### Explosive train

Typical firing trains employed in both Army and Navy fuzes use pointed strikers with sensitive primers for instantaneous action and blunt firing pins and percussion primers for delay action. The simple instantaneous explosive train in nose fuzes consists of a sensitive primer mixture of lead azide and lead styphnate, an upper detonator of lead azide, and a lower detonator of tetryl.

For a short delay, the blunt firing pin initiates a mercury-fulminate percussion primer, which sends a flash through a chamber of compression to ignite a pressed black-powder delay. This, on completion of burning, flashes a relay pellet of lead azide and lead styphnate, which detonates the lower detonator of tetryl.

The explosive train, including the booster, is usually incorporated in all Navy fuzes and Army nose fuzes; but in Army tail fuzes the explosive train does not include the booster, and may have the remainder of its explosives contained in an interchangeable primer detonator to allow optional selection of short delays.

Army tail fuzes contain the primer detonator, but the booster charge is housed in an adapter booster which is considered an integral part of the bomb base plug and should not be removed. The adapter booster also serves to seat the fuze.

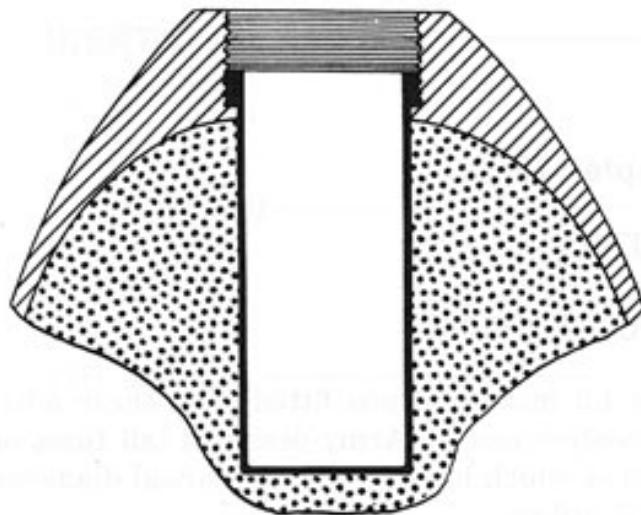
Four standard adapter boosters are found in the base plugs of Army bombs; the M102, M102A1, M115, and the M115A1. Since the inside thread diameter of the M102 and M102A1

is 1.5 inches, bombs fitted with these adapter boosters receive Army-designed tail fuzes only, all of which have an outside thread diameter of 1.5 inches.

In AN G.P. bombs, the adapter booster is modified to permit the insertion of Navy hydrostatic tail fuzes (AN-Mk 230 Mods 4, 5, and 6) whose outside thread diameter is 2.0 inches, typical of all Navy-designed fuzes. The Adapter Boosters M115 and M115A1, which are used in AN G.P. bombs incorporate an inner sleeve or ring, which gives the adapter booster an inside thread diameter of 1.5 inches, permitting Army-type fuzing only. When this sleeve is removed, the inside thread diameter of the adapter booster becomes 2.0 inches, and the Navy hydrostatic tail fuzes may be inserted.

The A1 modification on the Adapter Boosters M102 and M115 consists of the addition of two base-plate locking pins and an adapter-booster locking pin to prevent the removal of the base plate and adapter booster when anti-withdrawal tail fuzes are employed. See figure 317.

The nose fuze pockets of AN and other Army-designed bombs have an inside thread diameter of 2.0 inches and are designed to take the Nose Fuze AN-M103 (and variations). No adapter booster is used, since the Nose Fuze AN-M103 has its booster built into the fuze body and the fuze is threaded directly into the fuze seat liner. The Nose Fuze M111 (and variations, particularly the M127), however, has an outside thread diameter of 1.5 inches and must be used in conjunction with an adapter booster when desired for employment in AN and other Army bombs. This adapter booster, the M117, has an inside thread diameter of 1.5 inches to receive the smaller fuzes and an outside thread diameter of



NOSE FUZE SEAT LINER

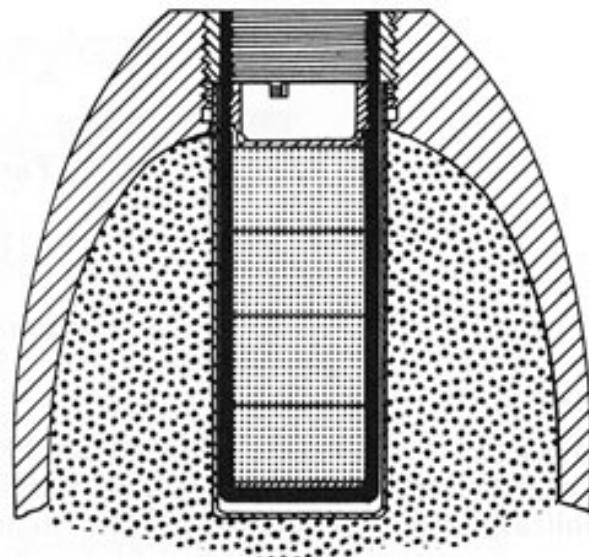
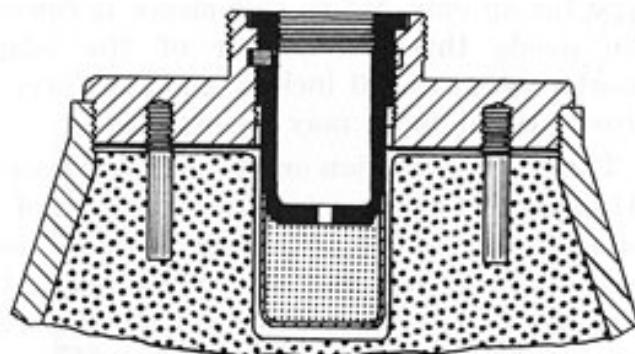
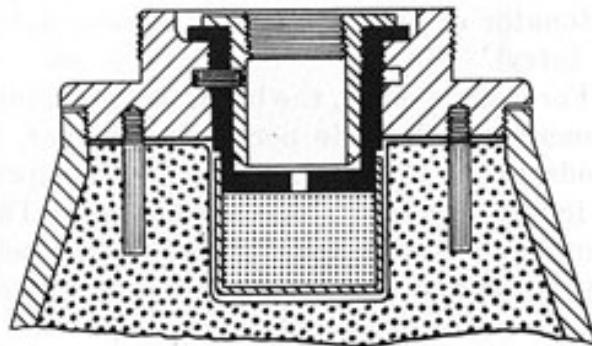
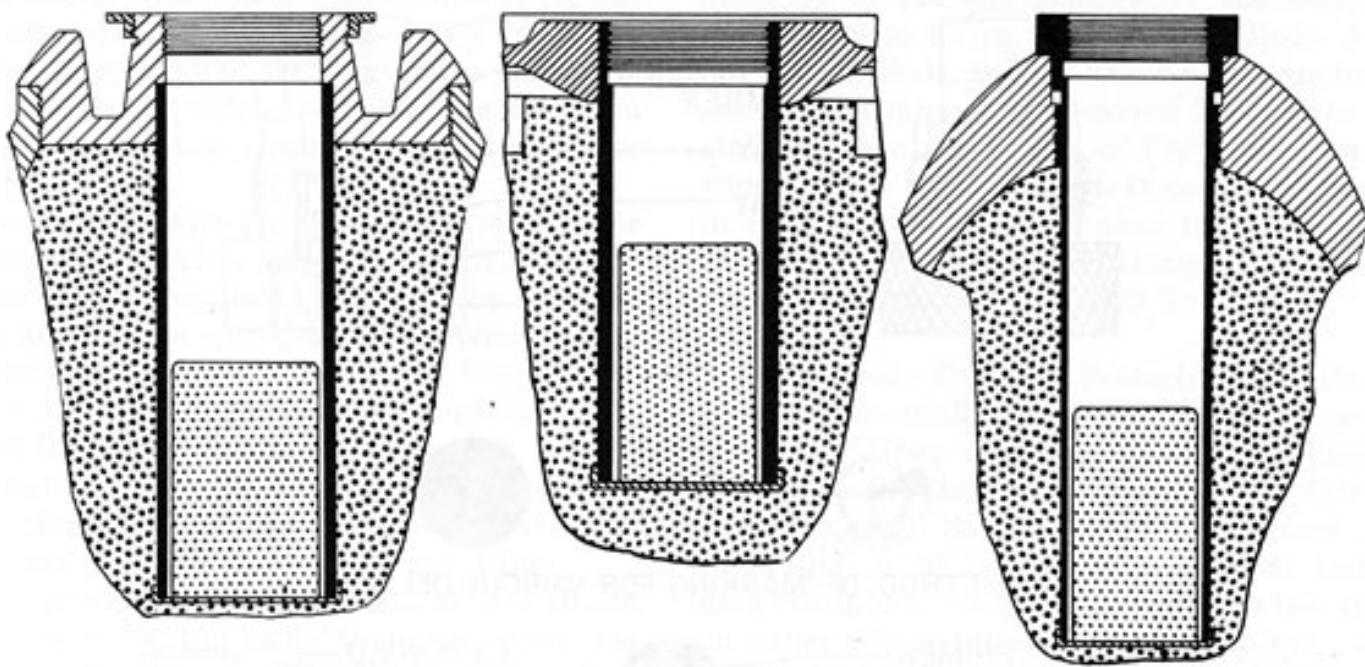
NOSE FUZE SEAT LINER  
WITH M117 ADAPTER BOOSTERTAIL, WITH M102 A1  
ADAPTER BOOSTERTAIL, WITH M115 A1  
ADAPTER BOOSTER

Figure 317. Army Fuze Seat Liners and Adapter Boosters

2.0 inches to fit the fuze seat liner. It converts the nose fuze pockets of G.P., S.A.P., L.C., 260-pound fragmentation, 90-pound fragmentation, 500-pound incendiary, and 500-, 1,000-, and 2,000-pound chemical bombs for use with the Nose Fuze M127.

The function of the Army adapter booster is performed in Navy bombs by the fuze seat liner

and the auxiliary booster. The fuze seat liner is an integral part of the bomb, and the auxiliary booster is slipped into position as shown in figure 318. The Auxiliary Booster Mk 1 is used in the fuze seat liners of all Navy G.P., A.P., and depth bombs. One extra Auxiliary Booster Mk 1 is required to adapt the standard Navy nose fuze seat liner for the Fuze AN-Mk 219. The Auxiliary Booster Mk 2, which is designed pri-



**TAIL FUZE  
SEAT LINER**  
FOR ALL EXCEPT  
MARK 53 AND MARK  
54 DEPTH BOMBS

**TAIL FUZE  
SEAT LINER**  
FOR MARK 53 AND  
MARK 54 DEPTH  
BOMBS

**NOSE FUZE  
SEAT LINER**  
FOR ALL EXCEPT  
MARK 4

*Figure 318. Navy Fuze Seat Liners*

marily for insertion in rocket heads, can be adapted for Navy G.P. and depth bombs fuzed with the Tail Hydrostatic Fuze AN-Mk 230 by fitting a  $\frac{1}{4}$ -inch wooden disc spacer on the bottom of the fuze seat liner and placing two Auxiliary Boosters Mk 2 above the spacer. When it is desired to use the Nose Impact Fuze AN-Mk 219 in Army bombs, the Auxiliary Booster Mk 4 is inserted in the fuze seat liner.

#### Fuze Extension M1

The Fuze Extension M1 may be used in any bomb adapted for the Nose Fuze AN-M103. It comes in 6-, 9-, 12-, 18-, 24-, 30-, and 36-inch sizes, and consists of a burster support and a burster assembly. The burster support is a steel tube, 2.375 inches in outside diameter, which has a male thread at one end and a female thread at the other. The former screws into the adapter in the nose of the bomb; the latter receives the Nose Fuze AN-M103. The burster assembly con-

sists of an asphalt-impregnated chipboard tube which has a recessed metal cap crimped to one end and a plain metal cap cemented to the other. The tube is filled with cast tetrytol. A shake-proof lock washer is supplied with each assembly.

#### Arming wires

The Navy is now procuring four standard arming wires for all bombs now in naval use, replacing the varied types previously in service. They will fit any bomb up to and including 2,000-pounds; and, by adding an arming-wire extension which is part of the new system, can be used in bombs up to 4,000 pounds.

The new wires come straight and are packed in hermetically sealed metal tubes, protecting them from corrosion. Depending on type, the tubes contain from 50 to 100 wires, including their clips and extra clips. The wires are cut, when installed, to fit the bomb.

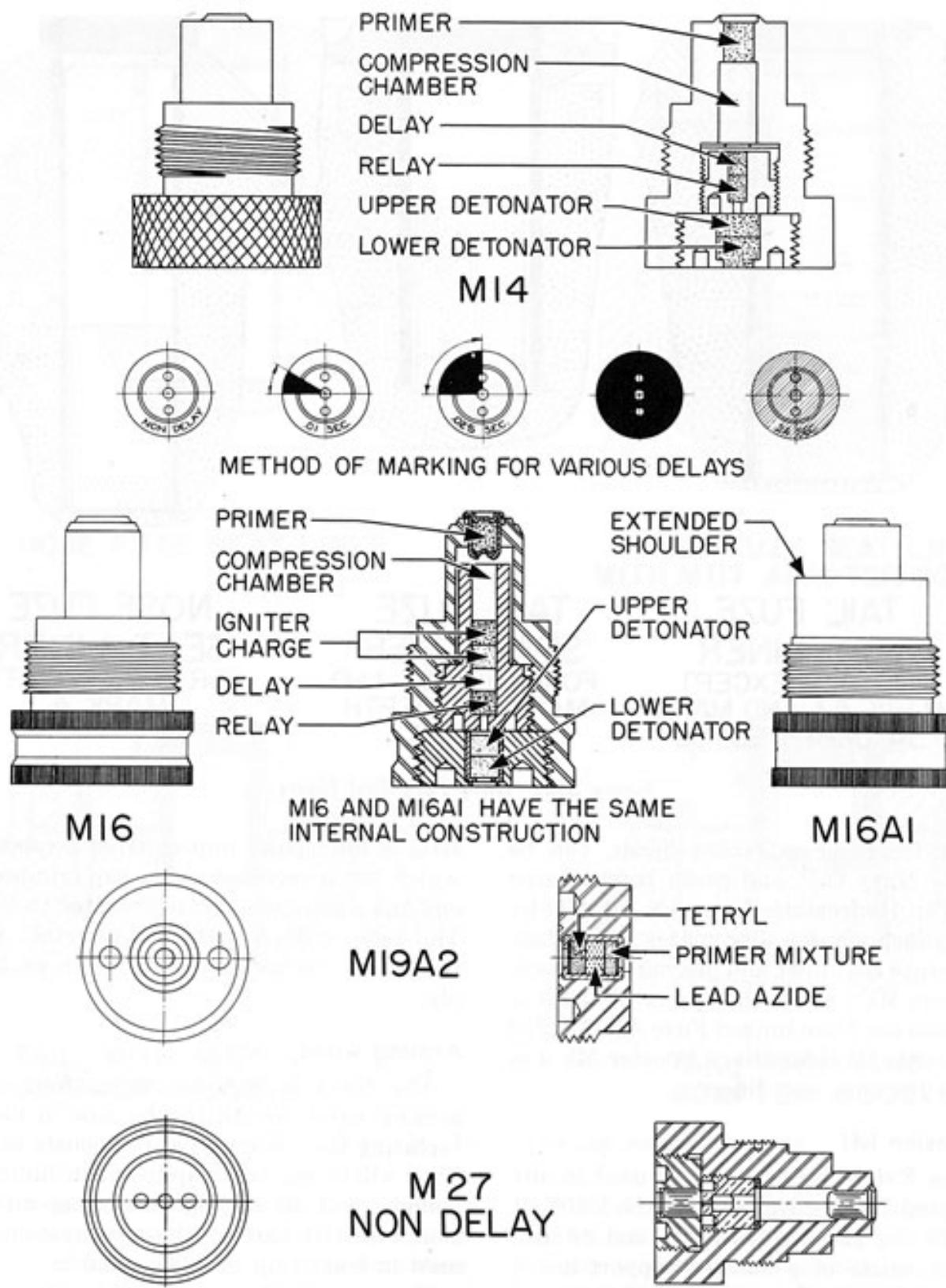


Figure 319. Some Primer Detonators

The Arming Wire Mk 1 is a single-strand bronze wire, 57 inches long and 0.064 inches in diameter, joined to a swivel and loop. This as-

sembly can be used on all bombs expended with a single fuze, up to and including 2,000-pound bombs. The Bureau of Ordnance recommends

using two of these Mark 1 assemblies to rig out the athwartship hydrostatic fuzes of depth bombs. One hundred Arming Wires Mk 1, together with 300 safety clips, are packed in an airtight metal tube (includes an extra clip for each wire).

The Arming Wire Extension Mk 1 is a flexible steel cable 16 inches long and 0.0625 inches in diameter. It incorporates a swivel loop arrangement and a brass spring clip. The Arming Wire Extension Mk 1 may be used with two Arming Wires Mk 1 to install arming for the 4,000-pound light-case bomb. In addition, it is used to lengthen wires on fragmentation or incendiary clusters. One hundred of these extension wires are packed in an airtight metal tube.

The Arming Wire Mk 2 is a double-strand bronze wire of the same type, diameter, and length as the Arming Wire Mk 1. It is used on all bombs expended with a nose and tail fuze, up to and including 2,000-pound bombs. Fifty Wires Mk 2, together with 300 safety clips, are packed in an airtight metal tube.

The Arming Wire Mk 3 is a single-strand steel wire 57 inches long and 0.033 inches in diameter. The Arming Wire Mk 3 can be used anywhere the 0.036-inch diameter Navy-type wire was used, and in addition can be used in all jump-out-pin type Fuzes M111A2 in which a stronger wire is needed. One hundred Arming Wires Mk 3, together with 100 safety clips, are packed in an airtight metal tube.

The new standard assemblies do not replace special assemblies on any clusters, either fragmentation or incendiary, but the Wire Extension Mk 1 is used with such clusters so that their wires, which are too short for proper fitting, can be connected.

Arming wires are subjected to considerable wear from vibration. For that reason, tubes are supplied to protect a wire at its point of maximum wear. Use of these tubes on all bombs equipped with arming-wire brackets is mandatory. All old AN-type arming wires on hand and pre-cut to length for a bomb should be returned to the Army.

### Fuze Protector Mk 1 Mod 0

**General:** The Fuze Protector Mk 1 Mod 0 is

designed to prevent damage by the catapult bridle to Nose Fuzes AN-M103, all Mods, AN-Mk 219, all Mods, and Mk 243, when these fuzes are in 500-pound or 1,000-pound G.P. bombs installed on the wing racks of F6F-type aircraft which are to be catapulted. It can also be used in connection with mechanical time fuzes and the modified case-locking bushing for Fragmentation Clusters M28 and M29 Type.

**Description:** The Fuze Protector Mk 1 Mod 0 consists essentially of two pieces of 16-gauge steel five inches wide, bent into semicylinders of seven-inch diameter and one center plate of 16-gauge steel. Each semicylindrical piece has three slots 0.562 inches wide and 1.562 inches deep cut into it. At the bottom of the two slots on either side of the center slot, a  $\frac{1}{2}$ -inch piece of metal is bent inward to form a stop. When installed, the two semicylindrical pieces are joined together by hinges (arming wires act as hinge pins) to form a cylinder.

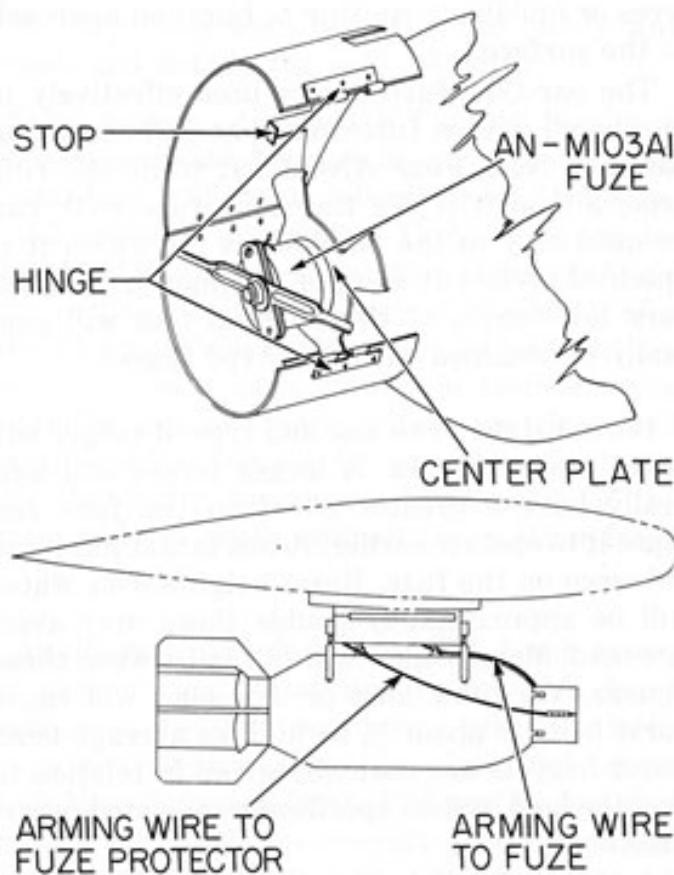


Figure 320. Fuze Protector Mk 1 Mod 0

**Operation:** The protector remains in place until the bomb is released. The arming wires are then pulled from the piano hinges of the protector. The two semicylindrical pieces then fall away from the bomb. The center plate remains in place between the fuze and the bomb.

### V.T. bomb fuzes

Two types of V.T. bomb fuzes are in use: the ring type and the bar type. They are similar in operation, but somewhat different in behavior. The ring type is more sensitive to passing targets and generally gives lower bursts upon direct frontal approach to a target. The bar type is quite sensitive to targets directly in front of it and correspondingly less sensitive to passing targets. This gives the possibility of selecting a fuze to give burst heights where desired for a specific target. The ring is excellent for defoliating trees, because it is more sensitive to tree tops; it is also good for roof top bursts against tall city buildings. The bar type gives higher bursts over flat ground and tends to pass tall trees or buildings, waiting to burst on approach to the surface.

The bar-type fuze can be used effectively in any bomb with a fuze well that will accommodate the Nose Fuze AN-M103; while the ring type, although it fits the same fuze well, can be used only in the bomb sizes for which it is specified. When it is used in improper bombs, very low bursts of three to ten feet will generally be obtained with ring-type fuzes.

**Burst height:** The size and type of target will affect burst heights. A larger target will naturally have a greater effect on the fuze and cause it to operate earlier. A wet target has more influence on the fuze. Burst heights over water will be approximately double those over average land. Marshy land will fall in between these figures. Very dry land or dry sand will cause burst heights about  $\frac{2}{3}$  as high as average land. Burst heights are normally given in relation to average land, unless specifically indicated otherwise.

A mass of tall trees or large buildings will increase burst heights over land in their vicinity, but the increase in burst height will be

somewhat less than the height of the objects, the degree of influence being dependent on the density of the object.

The size of the bomb in which the fuze is used will vary burst heights widely, but in no predictable pattern. Burst heights are tabulated for various bomb sizes with different V.T. fuzes, and the tables must be followed in predicting burst heights.

The height of release and air speed at time of release affect burst heights by controlling the rate and angle of approach of the fuze to the target. In general, the ring-type fuzes are influenced by angle and rate of approach, while the bar-type fuzes are rather insensitive to these differences. Bursts with ring-type fuzes are generally lower as the angle of approach nears the vertical. However, burst heights of ring-type fuzes increase with approach speed up to a certain point. By balancing these factors of approach speed and approach angle, fairly constant burst heights have been obtained for straight bombing at altitudes of less than 10,000 feet. At altitudes of release above 10,000 feet, burst heights are reduced somewhat. However, for any given altitude of release on level bombing runs, bursts will be higher with greater plane speeds when using ring-type fuzes, because the approach angle will be less vertical.

The air travel necessary to cause a V.T. bomb fuze to arm is designated as S.A.T. (safe air travel). Min. S.A.T., the minimum safe air travel, of any fuze in a lot is stencilled as part of the ordnance nomenclature on each fuze of the lot. No fuze will arm at less air travel in any bomb than the figure specified as Min. S.A.T. on the fuze. These figures of Min. S.A.T. are obtained from test droppings of representative samples of the lot in 100-pound bombs. All fuzes of the lot will be armed in a spread of 600 feet after Min. S.A.T. That is, if a Min. S.A.T. of 3,600 feet were specified on a lot of fuzes, none would be armed at 3,600 feet of air travel, and they would all be armed at 4,200 feet. Min. S.A.T. will be longer for larger bomb sizes, because of reduced air-stream velocity over the vanes. These increases are as follows for various bomb sizes: 260-pound AN-M81, 3%; 250-pound AN-M57, 12%; 500-pound AN-M64,

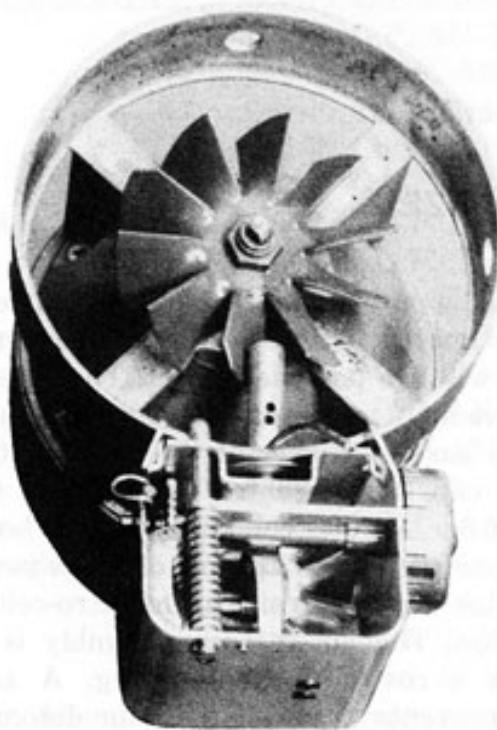


Figure 321. Air Travel Arming Delay M1

24% ; 1,000-pound AN-M65, 33% ; 2,000-pound AN-M66, 43%.

Under certain conditions, it is desirable to delay the arming of V.T. fuzes longer than the Min. S.A.T. provided in the fuze. When planes are flying in stack formation with other units of the formation flying 2,000 feet or more below, or with a large fighter cover working below, if the fuzes were armed in the normal time and passed near the lower friendly aircraft, influence bursts would occur, causing casualties to friendly craft. To prevent this, **mechanical arming delays** for attachment to these fuzes have been developed. These Air Travel Arming Delays M1 are so installed that they prevent the spring-loaded arming pin from releasing the fuze vanes for a pre-set air travel distance.

The start of fuze arming may be delayed by use of this device through air travel distances up to 20,000 feet.

These fuzes are not to be partially pre-armed by turning the vanes to make possible use from lower release altitudes. Casualties to the carrying aircraft will usually result. Bombs fuzed

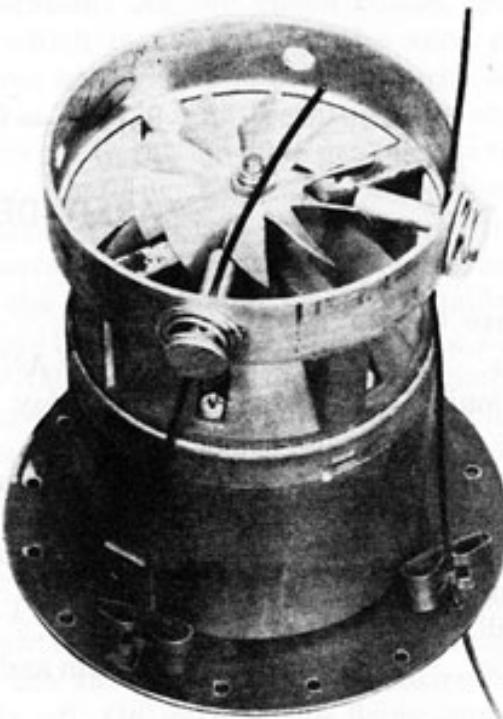


Figure 322. Auxiliary Safety Device for V.T. Bomb Fuzes

with V.T. fuzes may be jettisoned safely unarmed, and detonation will not occur.

Salvo release of armed V.T.-fuzed bombs is not recommended, because an early functioning of one fuze will cause detonation of all bombs of the group by interaction. These fuzes are designed to function upon a sudden change in their surroundings, and detonation of one bomb of a salvoed group will cause them all to function. For the same reason, minimum train spacing should be greater than 50 feet for 100-pound bombs and 100 feet for 500-pound bombs to assure that early functions of one bomb of the group will not cause interaction on other fuzes of the "stick."

**Auxiliary safety device for V.T. bomb fuzes:** To prevent accidental arming of V.T.-fuzed bombs mounted on exposed wing racks, the additional arming wire assembly, plate, and fahnestock clips shown in figure 322 may be installed on the Fuze M168. For aircraft to be catapulted, the Fuze Protector Mk 1 Mod 0 is used instead, since this device protects the fuze and also secures the arming wires.

## ARMY-DESIGNED BOMB FUZES

## M1 (Nose Inertia Type)

Bombs.....6-pound Incendiary AN-M69  
 Functioning....3 to 5 seconds delay after impact  
 Armed condition.....Safety plunger is out.  
 Fuzes used with.....None  
 Arming time.....Instantaneous  
 Body diameter, inches.....1.125  
 Over-all length, inches.....2.5  
 Material.....Die-cast aluminum and steel

**General:** The Nose Fuze M1 is screwed into the side of the nose of the Bomb AN-M69. When assembled, the two arrows on the top of the fuze

case must be parallel to the longitudinal centerline and point aft. This is necessary in order that the fuze will fire on nose impact. The fuze consists of five main parts; namely, a die-cast aluminum fuze base, a striker of the same material, a primer cap, a lead-coated spitter fuse (60% black powder—40% collodion) and a booster charge consisting of 1.2 grams of black powder. The booster cup is a transparent nitro-cellulose composition. The entire fuze assembly is contained in a cover of steel tubing. A safety plunger prevents the striker from detonating the primer cap while the bomb is clustered.

**Operation:** Upon release from the cluster, the spring-operated fuze safety plunger in each bomb moves outward, thereby arming the fuze. Upon impact, the momentum of the striker carries it forward and causes the striker pin to detonate the primer cap, which, in turn, ignites the lead-coated spitter fuse. The latter requires from three to five seconds to burn. The spitter fuse ignites the booster charge of black powder contained in a celluloid cup in the end of the fuze case. This ignites the igniter-ejector charge of black powder and oiled magnesium powder in the nose cup of the bomb.

**Remarks:** See figure 306, Bomb AN-M69, showing the Fuze M1 assembled in the bomb.

**AN-M100A2, AN-M101A2, AN-M102A2  
 (Tail Mechanical Impact) and (Obsolete)  
 M100 and AN-M100A1 Series**

Bombs used in

AN-M100A2....100-lb. G.P. AN-M30  
 250-lb. G.P. AN-M57  
 220-lb. Frag. AN-M88  
 260-lb. Frag. M81

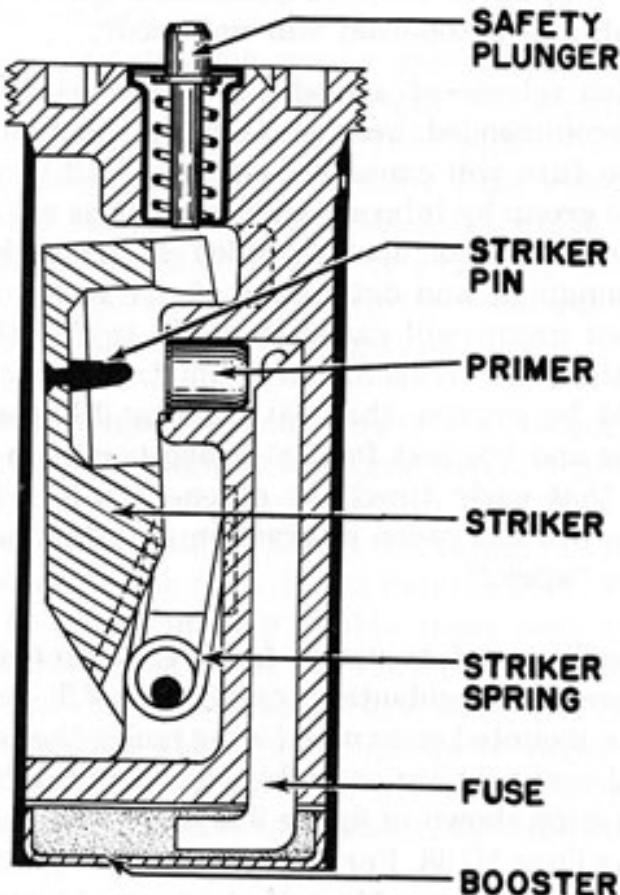


Figure 323. Nose Inertia Fuze M1

AN-M101A2 . . . . .	500-lb. G.P. AN-M43
	500-lb. G.P. AN-M64
	500-lb. S.A.P. AN-M58
	500-lb. Incend. AN-M76
	500-lb. Chem. AN-M78
	600-lb. G.P. M32
AN-M102A2 . . . . .	1,000-lb. G.P. AN-M44
	1,000-lb. G.P. AN-M65
	1,000-lb. S.A.P. AN-M59
	1,000-lb. Chem. AN-M79
	1,100-lb. G.P. M33
	2,000-lb. G.P. AN-M34
	2,000-lb. G.P. AN-M66
	2,000-lb. S.A.P. M103
	4,000-lb. L.C. AN-M56
Functioning . . . . .	Interchangeable Primer Detonator M14 with delays of 0.01, 0.025, 0.1, or 0.24 second or non-delay
Armed condition . . . . .	When gear carrier stop protrudes less than 1 inch below vane cup
Fuzes used with . . . . .	AN-M103 normally, M139, AN-M139, M140, AN-M140A1, M163, M164, M165, M135, M135A1, M136, M136A1, M166, Mk 243, T50E1, T50E4, T82, M168
Arming data	
	Minimum
	Air
Vane	Travel
	Revs. (feet)
	Vertical
	Drop
	(feet)
AN-M100A2 . . . . .	150-170 . . . . . 445-485 . . . . . 40-50
AN-M101A2 . . . . .	150-170 . . . . . 555 . . . . . 60-70
AN-M102A2 . . . . .	150-170 . . . . . 465-665 . . . . . 85
Vane span, inches . . . . .	5 (4 vanes)
Body diameter, inches . . . . .	1.5
Over-all length, inches . . . . .	AN-M100A2—9.6 AN-M101A2—12.6 AN-M102A2—16.6
Material . . . . .	Cadmium plated steel with some brass parts

**General:** These three fuzes are identical except for the length of the arming stem. Larger bombs require a longer arming stem, so that the vanes can catch the air slip from the bomb.

**Operation:** As the vanes rotate, the pinion gear which is attached to the vane assembly revolves around the stationary gear. Since the movable gear has 30 teeth and the stationary gear 29 teeth, the movable gear is rotated clockwise one tooth per revolution of the pinion gear. The arming stem is secured by a cotter pin to the movable-gear sleeve, and hence unthreads from the firing plunger as the movable gear is rotated. In unthreading, the arming stem lifts the movable gear, and, since the stationary gear is held by a collar threading into the lower extension of the movable gear sleeve, the stationary gear is lifted also. After 150 to 170 revolutions of the vanes, the double-threaded arming stem will have unthreaded from the firing plunger and the fuze will be armed. Further air travel will unthread the arming stem from the fuze body, and the entire assembly will fly off. On impact, the firing plunger will overcome the creep spring, and the striker will activate the primer detonator.

**Early designs:** The M100, M101, and M102 fuzes had a fixed delay of 0.1 second, and had 24 single threads on the arming stem. They had eight broad vanes with less pitch, and required approximately 720 vane revolutions to arm. AN-M100A1, AN-M101A1, and AN-M102A1 incorporated the interchangeable Primer Detonator M14. The A2 modification then reduced the number of vanes to four, and the number of threads to 16 double threads, thus decreasing the arming time to approximately 150 to 170 vane revolutions.

**Remarks:** When these fuzes are used in the 260-pound Frag., 500-pound Incendiary, 500-pound, 1,000-pound, and 2,000-pound Chem., and 4,000-pound L.C. bombs, the Primer Detonator M14 should have non-delay functioning. On G.P. and S.A.P. bombs, the length of the short delay will be governed by the tactical use. The 0.24-second delay primer detonator was developed for these fuzes for use in connection with the Nose Fuze Mk 243. Fuzes equipped with this primer detonator will function at a depth of 25 feet and are more accurate than the Tail Hydrostatic Fuze AN-Mk 230, especially on high-velocity impact.

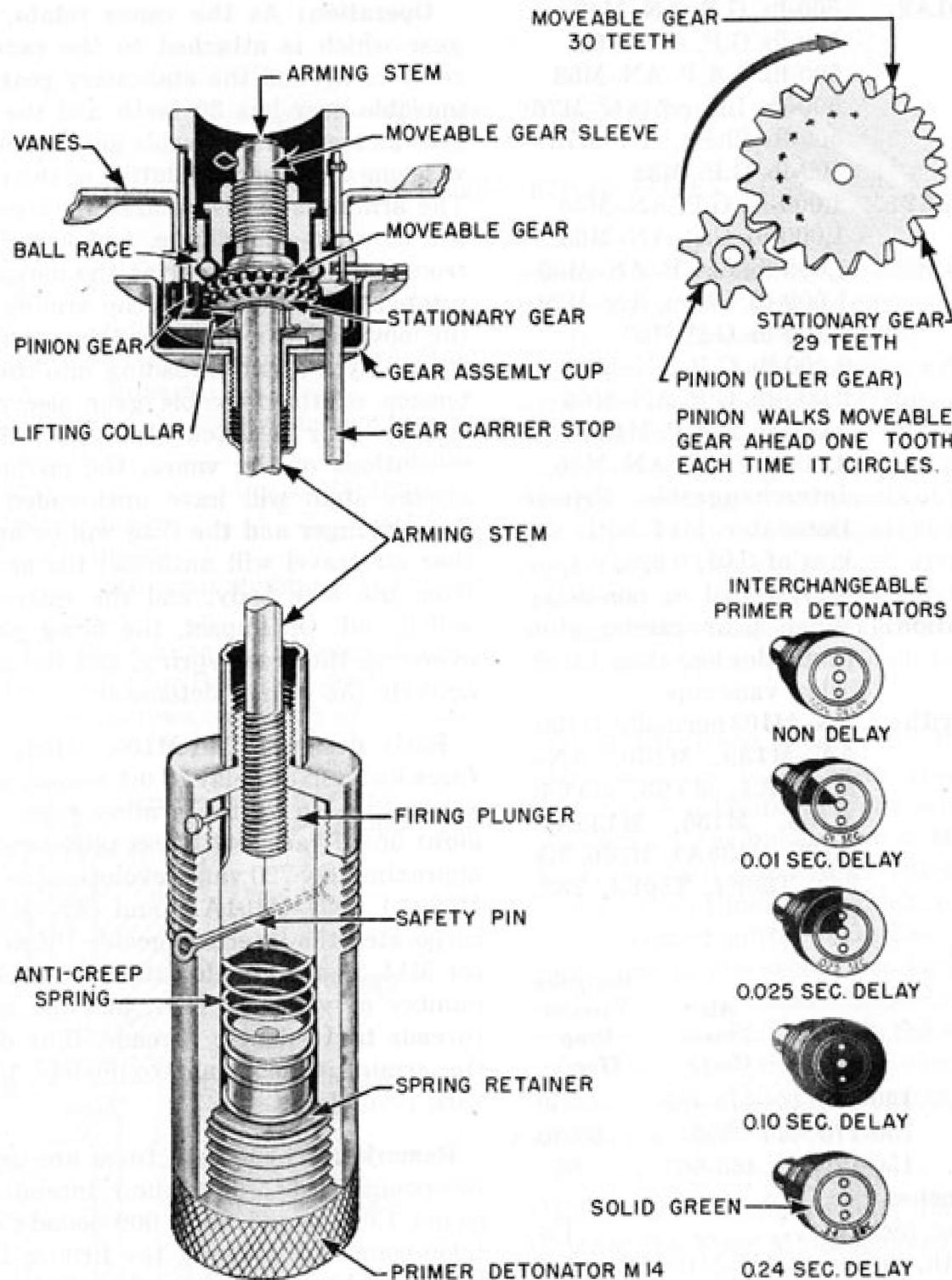


Figure 324. Tail Fuzes AN-M100 and M160 Series

**M160, M161, M162 AN-M100A2C, and AN-M101A2C (Tail Mechanical Impact) Bombs**

M160.....100-lb. G.P. AN-M30  
250-lb. G.P. AN-M57  
220-lb. Frag. AN-M88  
260-lb. Frag. M81

M161....500-lb. G.P. AN-M64 (AN-M43)  
500-lb. S.A.P. AN-M58  
500-lb. Incend. AN-M76  
500-lb. Chem. AN-M78  
600-lb. G.P. M32  
M162...1,000-lb. G.P. AN-M65 (AN-M44)  
1,000-lb. S.A.P. AN-M59

1,000-lb. Chem. AN-M79			
1,100-lb. G.P. M33			
2,000-lb. G.P. AN-M66 (A1, A2)			
2,000-lb. S.A.P. M103			
4,000-lb. L.C. AN-M56			
Functioning . . . . .	Primer Detonator M14 with delays of 0.01, 0.025, 0.1 and 0.24 seconds and non-delay		
Armed condition . . . . .	When gear carrier stop protrudes less than one inch below vane cup		
Fuzes used with . . . . .	M163, M164, M165 normally, AN-M103A1, AN-M103, M139, M139A1, AN-M139A1, M140, M140A1, AN-M140A1, Mk 243		
Arming data			
	Minimum		
Vane	Air	Vertical	
Revs.	Travel	Drop at 200 m.p.h.	
	(feet)	(feet)	
M160 . . . . .	720 . . . . .	1,780-1,950 . . . . .	650
M161 . . . . .	720 . . . . .	1,910-2,230 . . . . .	805
M162 . . . . .	720 . . . . .	1,710-2,680 . . . . .	1,130
Vane span, inches . . . . .		5 (four vanes)	
Body diameter, inches . . . . .		1.5	
Over-all length, inches . . . . .		M160—9.6	
		M161—12.6	
		M162—16.6	
Material . . . . .		Cadmium-plated steel; some brass parts	

**General:** The Mechanical Impact Tail Fuzes M160, M161, and M162 are similar to the AN-M100A2, and AN-M102A2 respectively, except for the arming stem, which has finer threads (28 single threads to the inch against 20 double threads in the AN-M100 series) and a longer engagement with the firing plunger (0.75-inch against 0.50-inch). The M160 series fuzes are distinguished externally from the AN-M100 group by a yellow band three inches wide painted around the arming-stem case.

The slower arming is desired in order to prevent the premature explosion of bombs within the range of releasing aircraft. This has been caused in the past by bombs bumping each other after being dropped in clusters or in salvo at high altitudes by very heavy bombers. In addi-

tion, the bomb bays of the B-29's are subjected to considerable air turbulence, distorting the fall of the bombs, thereby increasing the hazard of premature explosion and dictating the need for slower arming.

**Operation:** The operation is similar to the fuzes of the AN-M100 series, except for the incorporation of a longer arming time in the M160 series.

**Remarks:** When these fuzes are used in the 260-pound Frag. Bombs M81, the 220-pound Frag. Bombs AN-M88, the 500-pound Incendiary Bombs AN-M76, the 500-pound Chemical Bombs AN-M78, the 1,000-pound Chemical Bombs AN-M79, and the 4,000-pound L.C. Bombs AN-M56, the Primer Detonator M14 should have non-delay functioning.

The first of the slower-arming tail fuzes produced were designated as the AN-M100A2C series. These have the same number of threads per inch as the M160 series, but have the shorter engagement of the AN-M100 series fuzes. The yellow band is painted on, as in the M160 series fuzes.

#### AN-M103 (Obsolescent) and M103 (Obsolete) (Nose Mechanical Impact)

Bombs . . . . All G.P. bombs except Mk 4 Mod 4. The depth bombs for land targets, Chemical, Frag., and Incendiary bombs. May be used in S.A.P. for fragmentation effect, but result is not too consistent.

Functioning . . . . Instantaneous or 0.1-second delay alternative settings

Armed condition . . . When safety discs are out  
Fuzes used with . . . . . AN-M100 series (normally)

Arming time . . . . Instantaneous setting, 330 vane revolutions; 0.1 sec. delay setting, 220 vane revolutions

Vane span, inches . . . . . 6 (2 vanes)  
Body diameter, inches . . . . . 2.7  
Over-all length, inches . . . . . 7  
Material . . . . . Cadmium-plated steel; some brass parts

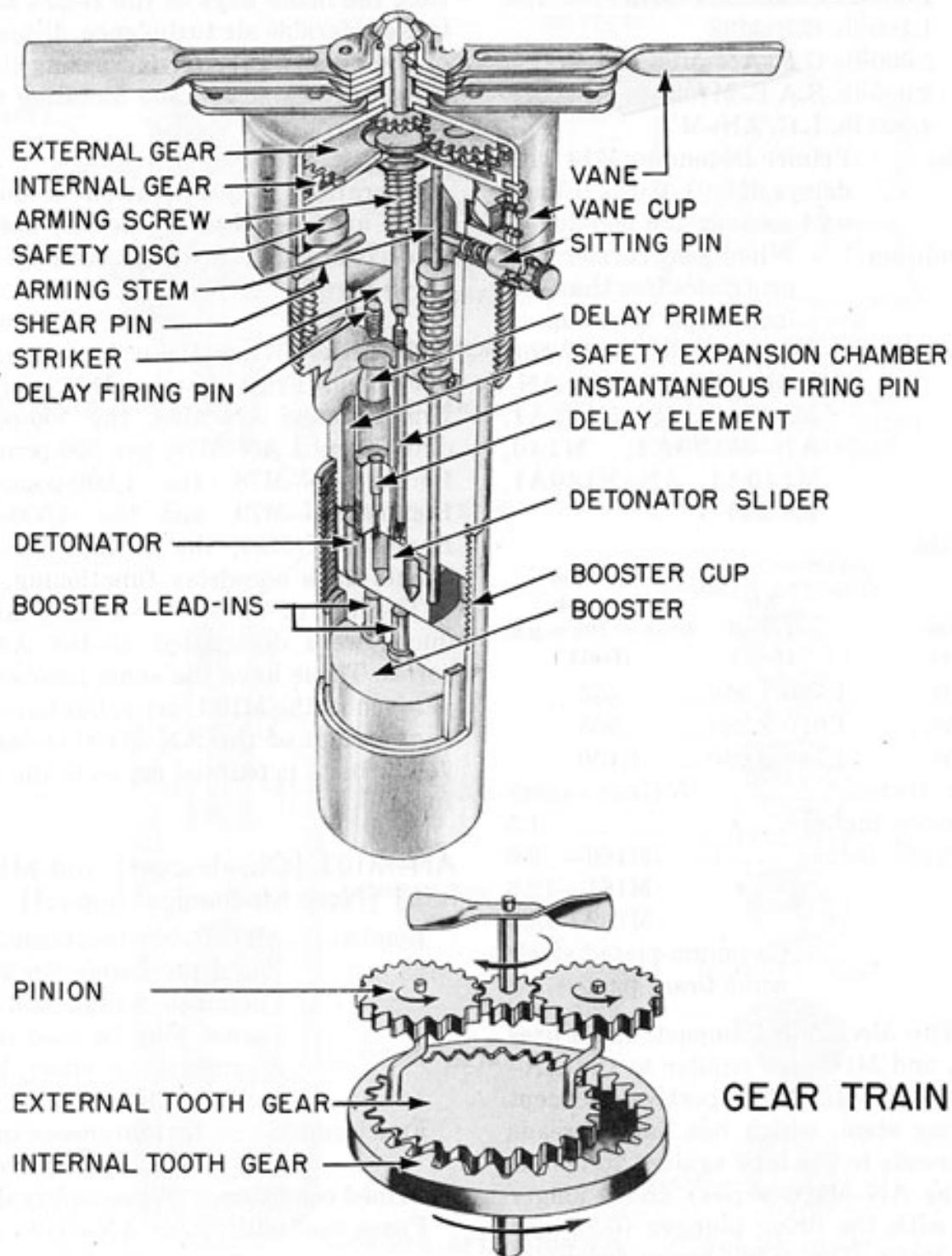


Figure 325. Nose Fuze AN-M103

**General:** The AN-M103 was the standard nose fuze in service. When shipped, the fuze is set for delay action. One auxiliary booster is required when this fuze is used in Navy bombs. When used in light-case, fragmentation, chemical, incendiary, and aircraft depth bombs, the fuze should be set for instantaneous action to

prevent breaking up of the bomb case before detonation occurs.

**Operation:** When bomb is dropped, the arming wire is pulled and the vanes rotate. The two pinion gears are rotated counterclockwise, their off-center hubs walking the external-tooth gear

backwards around the teeth of the internal-tooth gear, which is thus cranked in a counter-clockwise direction. The outboard edge of the internal-tooth gear is grooved and rides screws projecting through from the vane cup, maintaining an even position. The arming screw, being positively attached to the base of the internal-tooth gear, is gradually unthreaded from the striker. As it unthreads, it lifts the entire vane assembly, including the vane cup. After 220 revolutions of the vanes, the vane cup will clear the safety discs, which spring free, leaving the striker secured only by the shear wire and the setting pin. The spring-loaded arming stem will rise as the vane assembly rises, being retained only by the base of the internal-tooth gear. If the setting is for delay action, however, the setting pin will be depressed into the deep slot and will protrude into the channel of the arming stem to engage the collar on the arming stem after it has risen only sufficiently to clear the step in the detonator slider, lining the detonator up with the delay firing train.

On impact, the force of inertia will cause the striker body to shear the shear pin and setting pin, and the delay firing pin will impinge on the delay primer, setting off the flash which ignites the delay pellet, relay, primer, detonator, booster lead-in, and booster in succession. The instantaneous firing pin will merely protrude into the empty channel positioned to receive it. If the fuze is set for instantaneous action, the setting pin will be in the shallow slot and will not protrude into the arming-stem channel. After an additional 110 revolutions of the vanes (330 total), the vane cup will have been lifted high enough to have the arming stem moved out of the slider cavity, allowing the slider to align the primer detonator beneath the instantaneous firing pin. The slider is motivated by two springs and is locked in the armed position by a spring-loaded detent. On impact, the firing pin will impinge directly on the primer, setting off the detonator, booster lead-in, and booster in succession. Even though an instantaneous setting is used, the delay striker will impinge on the delay primer, setting off the delay pellet. It is thus possible that the fuze would function on delay, even though set for instantaneous action,

if it failed to function instantaneously.

**Early design:** The Nose Mechanical Impact Fuze M103 had 32 single threads per inch on the arming screw, instead of 28 double threads per inch on the AN-M103, resulting in an arming time of 850 vane revolutions for instantaneous firing and 525 vane revolutions when set for delay action. The M103 had larger and weaker vane construction.

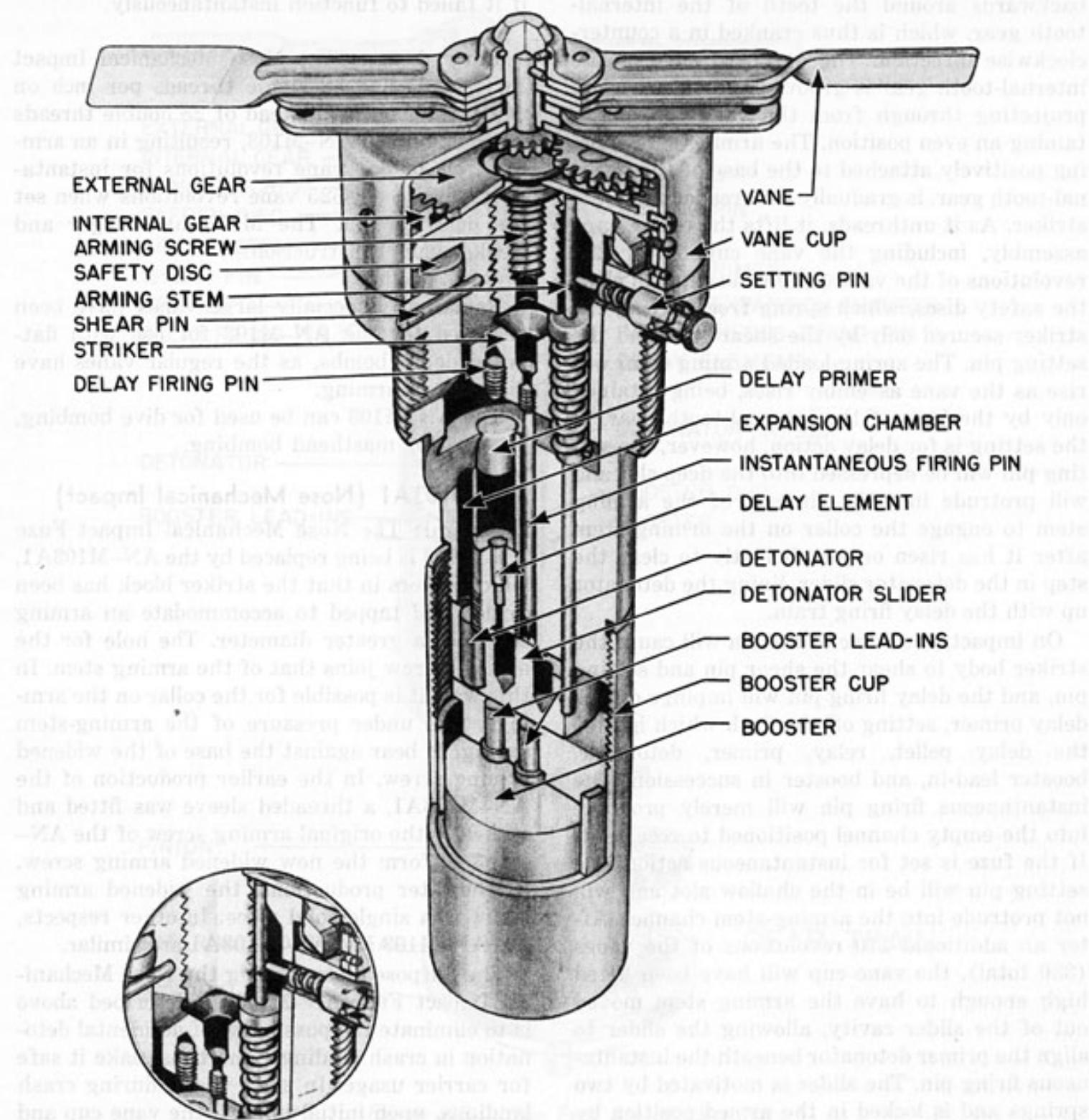
**Remarks:** Especially large vanes have been designed for the AN-M103 for use with flat-nosed depth bombs, as the regular vanes have difficulty in arming.

The AN-M103 can be used for dive bombing, but not for masthead bombing.

#### AN-M103A1 (Nose Mechanical Impact)

**General:** The Nose Mechanical Impact Fuze AN-M103 is being replaced by the AN-M103A1, which differs in that the striker block has been drilled and tapped to accommodate an arming screw of a greater diameter. The hole for the arming screw joins that of the arming stem. In this way, it is possible for the collar on the arming stem, under pressure of the arming-stem spring, to bear against the base of the widened arming screw. In the earlier production of the AN-M103A1, a threaded sleeve was fitted and staked to the original arming screw of the AN-M103 to form the new widened arming screw. In the later productions, the widened arming screw is a single solid piece. In other respects, the AN-M103 and AN-M103A1 are similar.

The purpose of modifying the Nose Mechanical Impact Fuze AN-M103 as described above is to eliminate the possibility of accidental detonation in crash landings, and thus make it safe for carrier usage. In some cases, during crash landings, upon initial impact, the vane cup and head of the AN-M103 were sheared off, allowing the arming stem to jump out, and the slider to align itself below the firing pin. On subsequent nose impact, the fuze fired. The AN-M103A1 increases the safety primarily because the arming stem cannot jump out on accidental shearing of the vane cup assembly, as the arming screw overlaps the arming-stem collar.



### SOLID ARMING SCREW OF LATER AN-M103A1 PRODUCTION

Figure 326. Nose Fuze AN-M103A1

Wiring diagram and circuit analysis

**Operation:** The operation of the AN-M103A1 is the same as that of the AN-M103 except that,

in the former, the arming stem, in addition to bearing against the internal gear, has its collar

bearing against the arming screw. As the arming screw moves out, the arming stem follows it until the arming-stem collar bears against the setting pin for delay action, or against the top of the cavity for instantaneous action. In a crash landing, if the vane cup and head of the fuze shear off, the arming stem is held in place by the arming screw; hence, the slider cannot move over and the fuze will not fire.

**Remarks:** Air travel to arm the AN-M103A1 is the same as the AN-M103, since the AN-M103 has 28 double threads per inch on the arming screw while the AN-M103A1 has 14 single threads per inch.

#### AN-M139A1, AN-M140A1, M139, and M140 (Nose Mechanical Impact)

Bombs used in..... All bombs receiving  
AN-M103A1  
Functioning.... M139, AN-M139A1 instantaneous or 0.01-second delay alternative settings. M140, AN-M140A1 instantaneous or 0.025-second delay alternative settings

**General:** The M139 and the M140 are identical in construction to the standard AN-M103, with the exception that the amount of the delay element has been changed to decrease the functioning delay time from 0.1 second (AN-M103) to 0.01 (M139) or 0.025 (M140). All these fuzes have the alternative instantaneous setting.

In order to distinguish these fuzes from the AN-M103, the vane cups have segments painted on them. One eighth of the vane cup of the M139, and one quarter of the vane cup of the M140 is painted black. These markings correspond with those on the Primer Detonator M14. The M139A1 and the M140A1 are the same as the M139 and M140 respectively, except that they incorporate the widened arming screw found in the AN-M103A1.

**Operation:** M139, M140—Same as AN-M103. AN-M139A1, AN-M140A1—Same as AN-M103A1.

**Remarks:** The AN-M139A1 and AN-M140A1 are current production and replace the M139 and M140 respectively.

All these fuzes were developed as companion fuzes for the AN-M100A2 series, which uses the Primer Detonators M14 with delays of 0.01 second or 0.025 second.

#### M148 (Nose Mechanical Impact)

Bombs used in.....	Captured Japanese navy bombs
Fuzes used with.....	None
Over-all length, inches.....	9.3

**General:** The Nose Mechanical Impact Fuze M148 is the same as the AN-M103, except that the booster cup has been modified so as to have the contour of the standard Japanese Navy type gaine. In addition, the threads on the fuze body have been modified to fit Japanese navy bombs—1.84-inch, 10 Whitworth thread.

#### M163, M164, and M165 (Nose Mechanical Impact)

##### Functioning

M163.....	Instantaneous; 0.1-sec. delay
M164.....	Instantaneous; 0.01-sec. delay
M165.....	Instantaneous; 0.025-sec. delay

##### Fuzes used with

M160, M161, or M162 normally;
AN-M100A2 series

##### Arming data

	Inst.	Delay
Revolutions.....	750 (approx.)	500 (approx.)
Air travel .....	1,710-3,625 ft.	1,140-2,420 ft.
Minimum vertical drop at		
200 m.p.h.....	1,775 ft.	915 ft.

**General:** The Nose Mechanical Impact Fuzes M163, M164, and M165 correspond to the AN-M103A1, AN-M139A1, and AN-M140A1 respectively, except for the arming screw of the M163 series, which has 32 single threads per inch as against 14 single threads to the inch in the earlier fuzes. Although the length of the M163 arming screw is reduced to 0.5 inch, the crash-proof feature is retained in the new series by

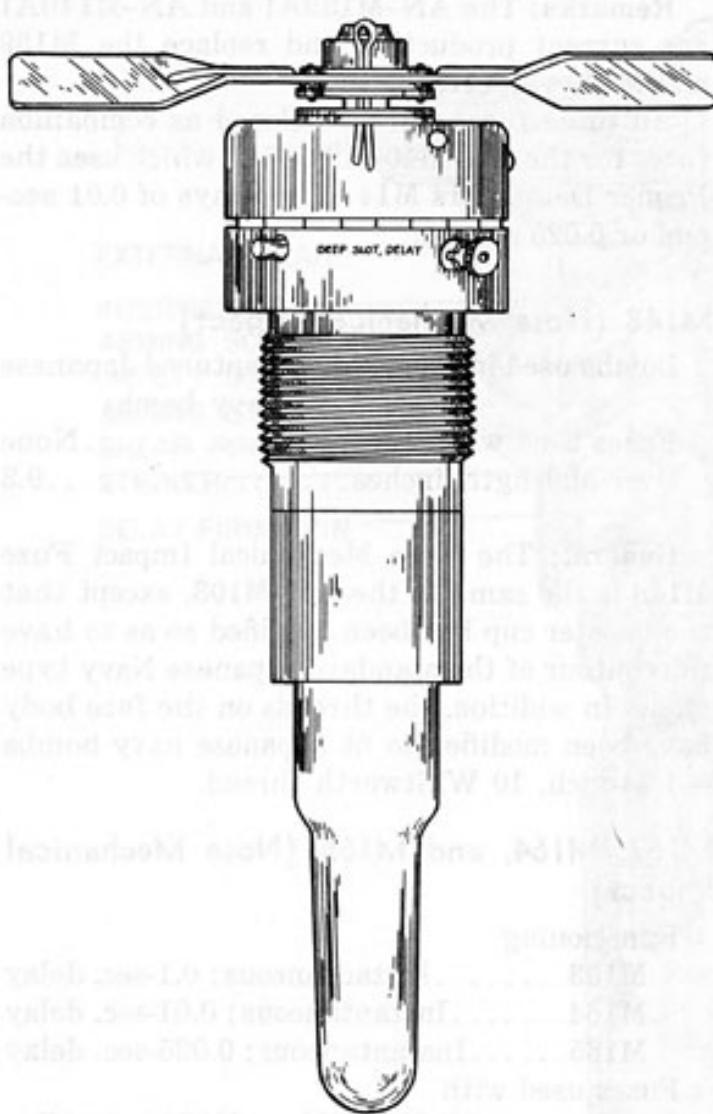


Figure 327. Nose Fuze M148

the addition of a second shoulder, higher up on the arming stem, which bears against the bottom of the arming screw.

This series of fuzes is designed as a companion group for the M160, M161, and M162; and serves to eliminate the difficulties discussed with reference to the M160 series.

To distinguish the new series from their prototypes, the following markings are employed: the top of the M163 vane cup is painted completely yellow; and, in the M164 and M165, the vane cup is painted yellow except for the black sections indicating the delays.

### T32E1 and T33E1 (Nose Mechanical Impact)

Bombs.....	G.P. bombs which receive AN-M103 — Skip-bomb size
Functioning .....	T32E1 — 4- to 5-second delay T33E1 — 11- to 14-second delay
Armed condition.....	Safety discs out

Fuzes used with..... M113, M113A1, M116

**General:** A nose fuze for minimum-altitude bombing, this design changes the Nose Mechanical Impact Fuze AN-M103 to give the necessary long delay. The T32 and T33 differ only in the amount of pyrotechnic delay. The delay feature is accomplished by drilling axially through the fuze body—two tubes for the powder train and a third for an expansion chamber. A larger axial hole houses the rotor containing the detonator, and provides detonator safety for this fuze. There is no instantaneous firing train.

**Operation:** Rotation of the vanes makes the arming spindle and the striker block move upward, with the assistance of the spring, until the safety discs are flung out by the leaf spring which is located inboard of them. As the arming spindle rises, it allows the rotor stem, which is spring-loaded downward, to turn the rotor, bringing the detonator in line with the lower end of the delay train. The fuze is now fully armed. On impact, the striker block is forced down, mashing the firing pin into the primer and setting off the delay powder train. The powder is in the two lower small tubes, and burns from the primer down to the detonator, in the rotor, then to the booster lead-in, and finally at the booster. The uppermost small tube is an expansion chamber, to prevent pressure from the burning delay powder from causing a malfunction.

### AN-M104 (Obsolescent) and M109 (Obsolete) (Mechanical Impact)

Bombs.....	AN-M104—23-lb. Frag. AN-M40 M109—20-lb. Frag. AN-M41
Functioning .....	Instantaneous
Armed condition.....	When delayed arming disc is out

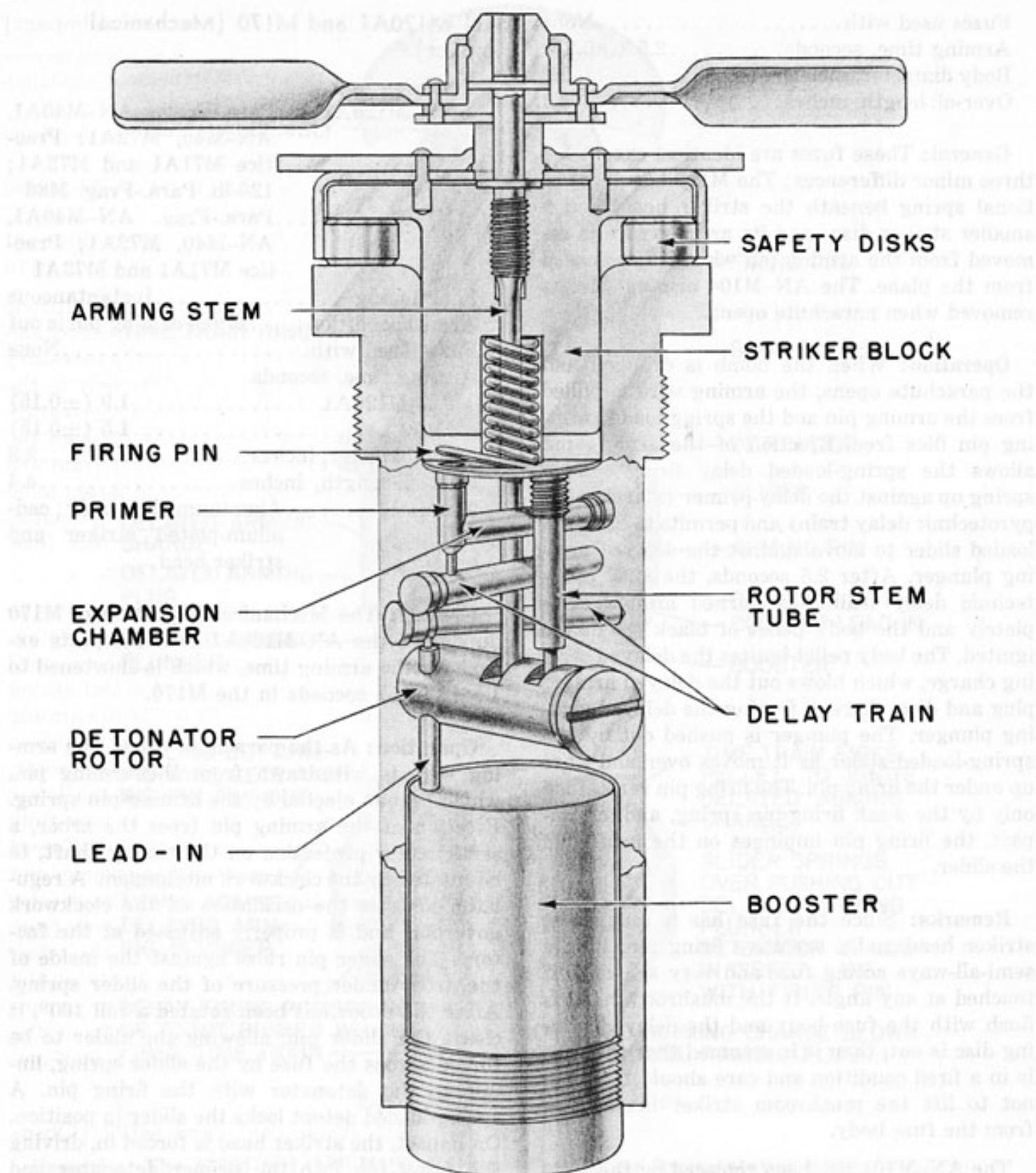


Figure 328. Nose Fuzes T32E1 and T33E1

Fuzes used with.....	None
Arming time, seconds.....	2.5 ( $\pm 0.25$ )
Body diameter, inches.....	2.2
Over-all length, inches.....	4.4

**General:** These fuzes are identical except for three minor differences: The M109 has an additional spring beneath the striker head, and a smaller striker disc; and its arming wire is removed from the arming pin when it is released from the plane. The AN-M104 arming wire is removed when parachute opens.

**Operation:** When the bomb is dropped and the parachute opens, the arming wire is pulled from the arming pin and the spring-loaded arming pin flies free. Ejection of the arming pin allows the spring-loaded delay firing pin to spring up against the delay primer (starting the pyrotechnic delay train) and permits the spring-loaded slider to move against the delayed arming plunger. After 2.5 seconds, the 326° pyrotechnic delay train has burned around completely and the body pellet of black powder is ignited. The body pellet ignites the delayed arming charge, which blows out the delayed arming plug and disc, thereby freeing the delayed arming plunger. The plunger is pushed out by the spring-loaded slider as it moves over and lines up under the firing pin. The firing pin is retained only by the weak firing-pin spring, and, on impact, the firing pin impinges on the primer in the slider.

**Remarks:** Since the fuze has a mushroom striker head and a sensitive firing pin, it is a semi-all-ways acting fuze and very sensitive if touched at any angle. If the mushroom head is flush with the fuze body and the delayed arming disc is out, then it is assumed that the fuze is in a fired condition and care should be taken not to lift the mushroom striker head away from the fuze body.

The AN-M104 has been replaced by the AN-M120A1; and the M109, by the AN-M110A1.

### AN-M120A1 and M170 (Mechanical Impact)

#### Bombs

AN-M120A1.....	Para.-Frag. AN-M40A1, AN-M40, M72A1; Practice M71A1 and M73A1; 120-lb. Para.-Frag. M86
M170 .....	Para.-Frag. AN-M40A1, AN-M40, M72A1; Practice M71A1 and M73A1
Functioning .....	Instantaneous
Armed condition.....	When arming pin is out
Fuzes used with.....	None
Arming time, seconds	
AN-M120A1 .....	1.9 ( $\pm 0.15$ )
M170 .....	1.5 ( $\pm 0.15$ )
Body diameter, inches.....	2.2
Over-all length, inches.....	4.4
Material.....	Aluminum alloy body; cadmium-plated striker and striker head

**General:** The Mechanical Impact Fuze M170 duplicates the AN-M120A1 in all respects except for the arming time, which is shortened to 1.5 ( $\pm 0.15$ ) seconds in the M170.

**Operation:** As the parachute opens, the arming wire is withdrawn from the arming pin, which is then ejected by the arming-pin spring. Ejection of the arming pin frees the arbor, a semicircular projection on the timing shaft, to be rotated by the clockwork mechanism. A regulator controls the oscillation of the clockwork governor, and is properly adjusted at the factory. The slider pin rides against the inside of the arbor under pressure of the slider spring. After the arbor has been rotated a full 160°, it clears the slider pin, allowing the slider to be forced across the fuze by the slider spring, lining up the detonator with the firing pin. A spring-loaded detent locks the slider in position. On impact, the striker head is forced in, driving the firing pin into the primer detonator and detonating the bomb.

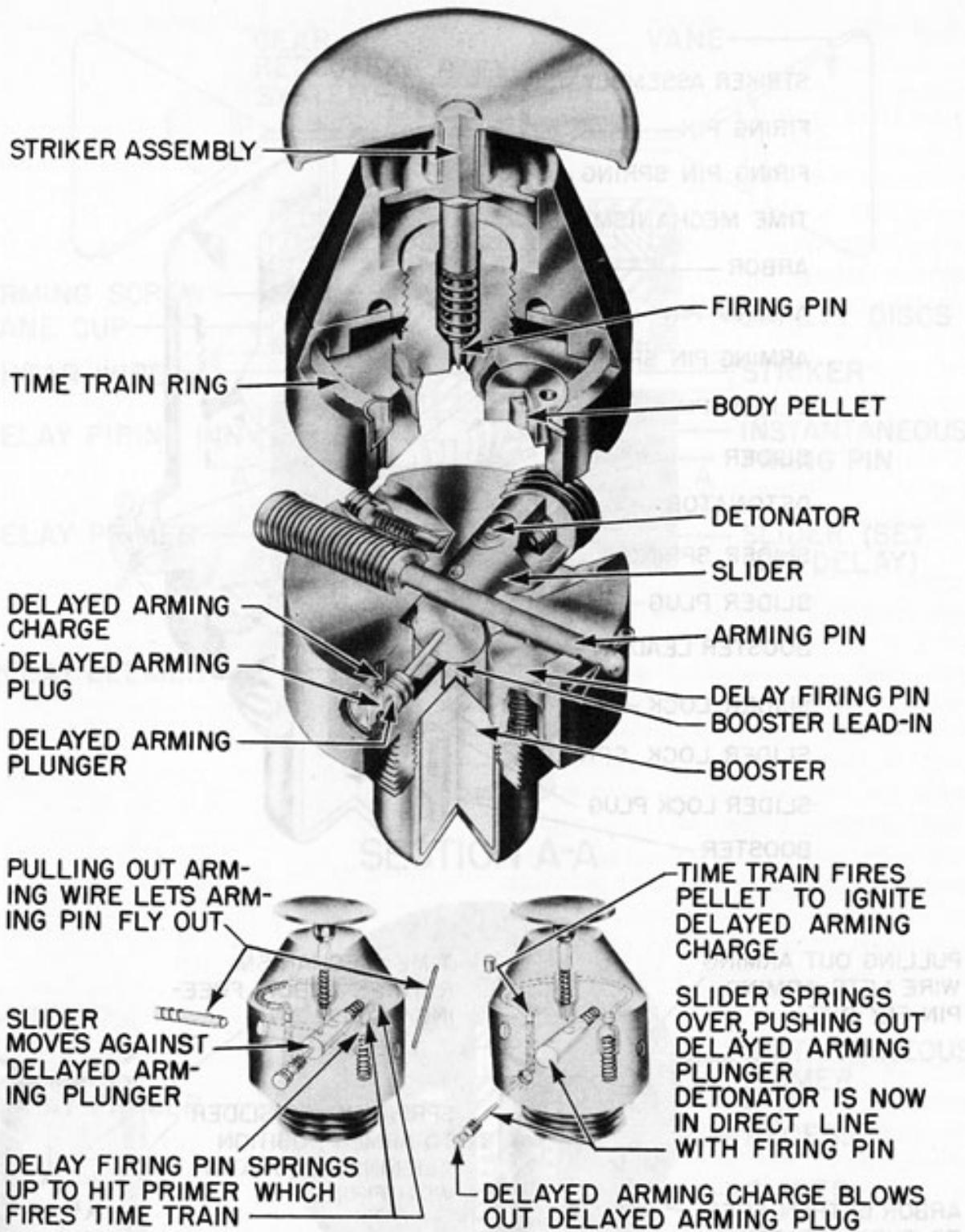


Figure 329. Nose Fuze AN-M104

**Remarks:** The M120 and AN-M120 did not have the clockwork regulator, and had an arming time of 2.5 ( $\pm 0.25$ ) seconds; hence, attacks had to be made at higher levels. External appearance of all designs is the same.

This fuze is replacing the AN-M104 in the

parachute fragmentation bomb.

The M170 is designed to supplant the AN-M120A1 in all bombs receiving the AN-M120A1, except for the 120-pound Para.-Frag. Bomb M86, which will continue to use the older fuze.

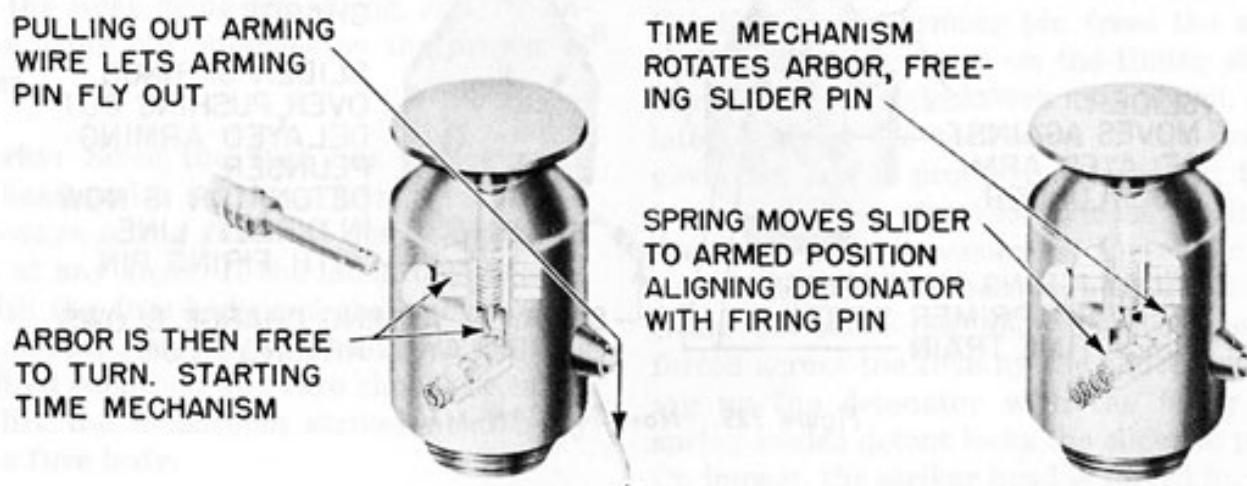
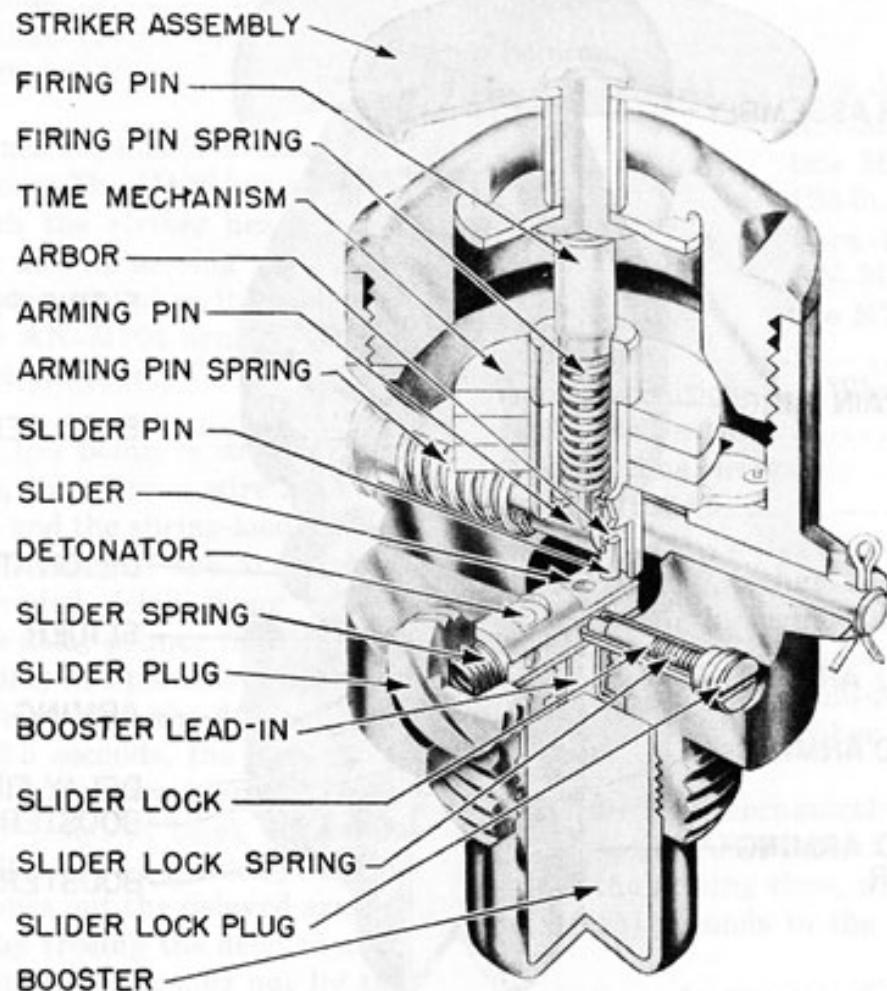


Figure 330. Nose Fuze AN-M120A1

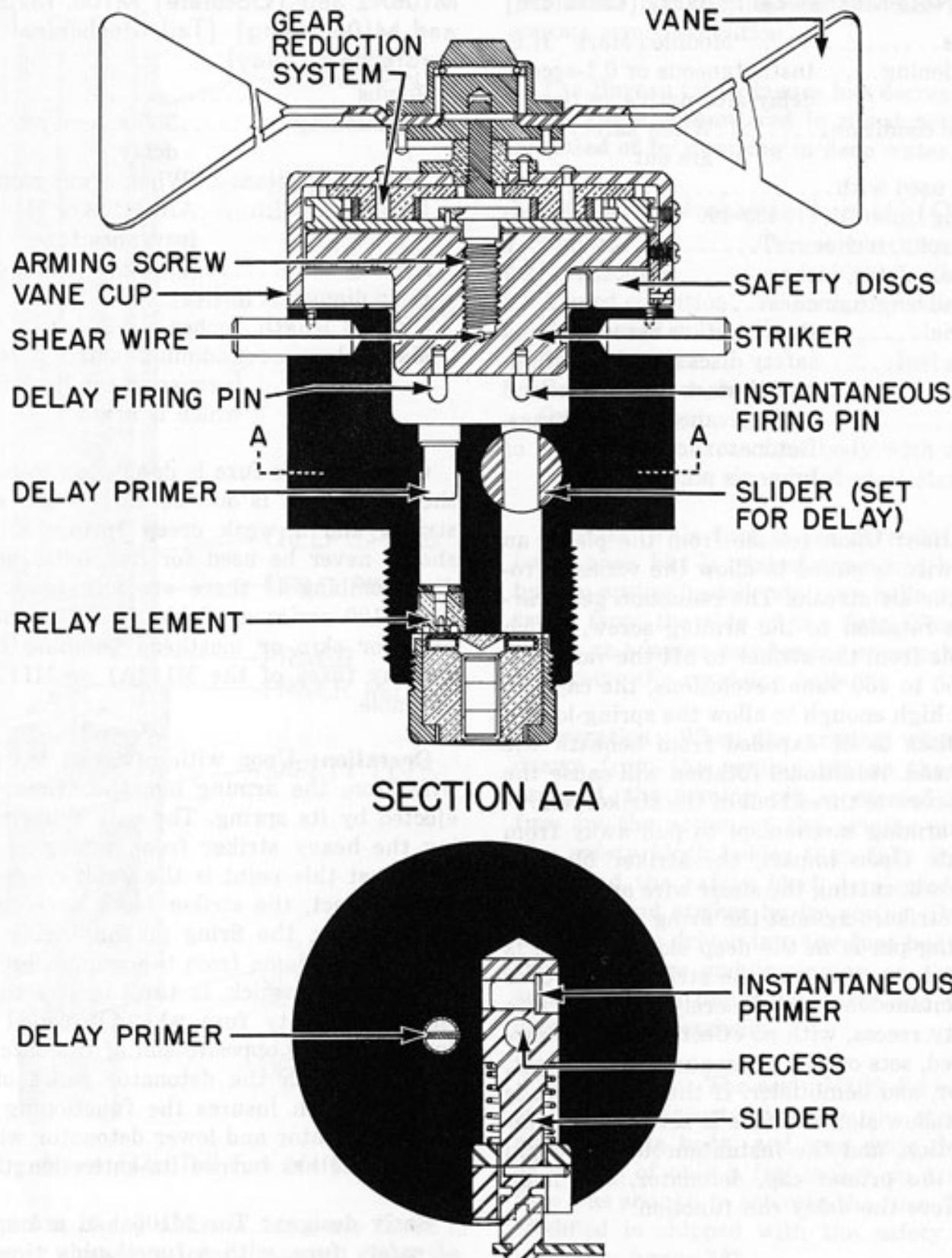


Figure 331. Nose Fuze M-105

<b>M105 (Nose Mechanical Impact) (Obsolete)</b>	
Bombs.....	"Modified Mark" H.E.
Functioning.....	Instantaneous or 0.1-second delay alternative settings
Armed condition.....	When safety discs are out
Fuzes used with.....	M106
Arming time.....	450-460 vane revolutions
Vane span, inches.....	6
Body diameter, inches.....	2.7
Over-all length, inches.....	4.3
Material.....	Body, striker assembly, and safety discs are of cadmium-plated steel. Gear train and arming vane hub is of brass. Detonator cup may be of brass or plated steel.

**Operation:** Upon release from the plane, an arming wire is pulled to allow the vanes to rotate in the air stream. The reduction gear carries this rotation to the arming screw, which unthreads from the striker to lift the vane cap. After 450 to 460 vane revolutions, the cap will be lifted high enough to allow the spring-loaded safety discs to be expelled from beneath the striker head. Additional rotation will cause the arming screw to thread out of the striker, allowing the arming mechanism to pull away from the bomb. Upon impact, the striker block is forced down, cutting the shear wire and forcing the two strikers against the firing assembly. If the setting pin is in the deep slot, the fuze is set for delay action and the striker point over the instantaneous channel merely protrudes into the empty recess, with no effect; the delay cap, being fired, sets off the delay and relay element, detonator, and bomb filler. If the setting pin is in the shallow slot, the fuze is set for instantaneous action, and the instantaneous firing pin sets off the primer cap, detonator, and main filler, before the delay can function.

**Remarks:** No. 4 primer caps are used to initiate both trains of explosive. The delay channel and detonator assembly are as follows: delay train of 0.32 grains of black powder, the relay charge of 1.47 grains of lead azide.

<b>M106A2 and (Obsolete) M106, M106A1, and M106 (Long) (Tail Mechanical Impact Pyrotechnic Delay)</b>	
Bombs .....	G.P.
Functioning.....	3-5 second pyrotechnic delay
Armed condition.....	When arming pin is out
Fuzes used with.....	AN-M103 or M105, as an insurance fuze
Arming time.....	Instantaneous
Body diameter, inches.....	1.5
Over-all length, inches.....	9.4
Material.....	Cadmium-plated steel except percussion cap housing, which is brass

**General:** This fuze is dangerous to handle if the arming pin is out, because it has a heavy striker and a weak creep spring. This fuze should never be used for horizontal, glide, or dive bombing if there are any fuzes of the AN-M100 series available. It should never be used for skip or masthead bombing if there are any fuzes of the M112A1 or M115 series available.

**Operation:** Upon withdrawal of the arming wire from the arming pin, the arming pin is ejected by its spring. The only thing preventing the heavy striker from impinging on the primer at this point is the weak creep spring. Upon impact, the striker block overcomes the creep spring, the firing pin impinging on the primer. The flame from the primer ignites the primer pellet, which, in turn, ignites the short length of safety fuse which is coiled in the fuze body. The opposite end of the safety fuse is primed with the detonator pellet of black powder, which insures the functioning of the upper detonator and lower detonator when the safety fuse has burned its entire length.

**Early designs:** The M106 had a longer coil of safety fuse, with a functioning time of 45 to 60 seconds. The M106A1 had a reduced functioning time of 8 to 11 seconds, for masthead bombing. M106, Long, was used in the Modified Mark series 2,000-lb G.P. bomb, having an overall length of 31.3 inches.

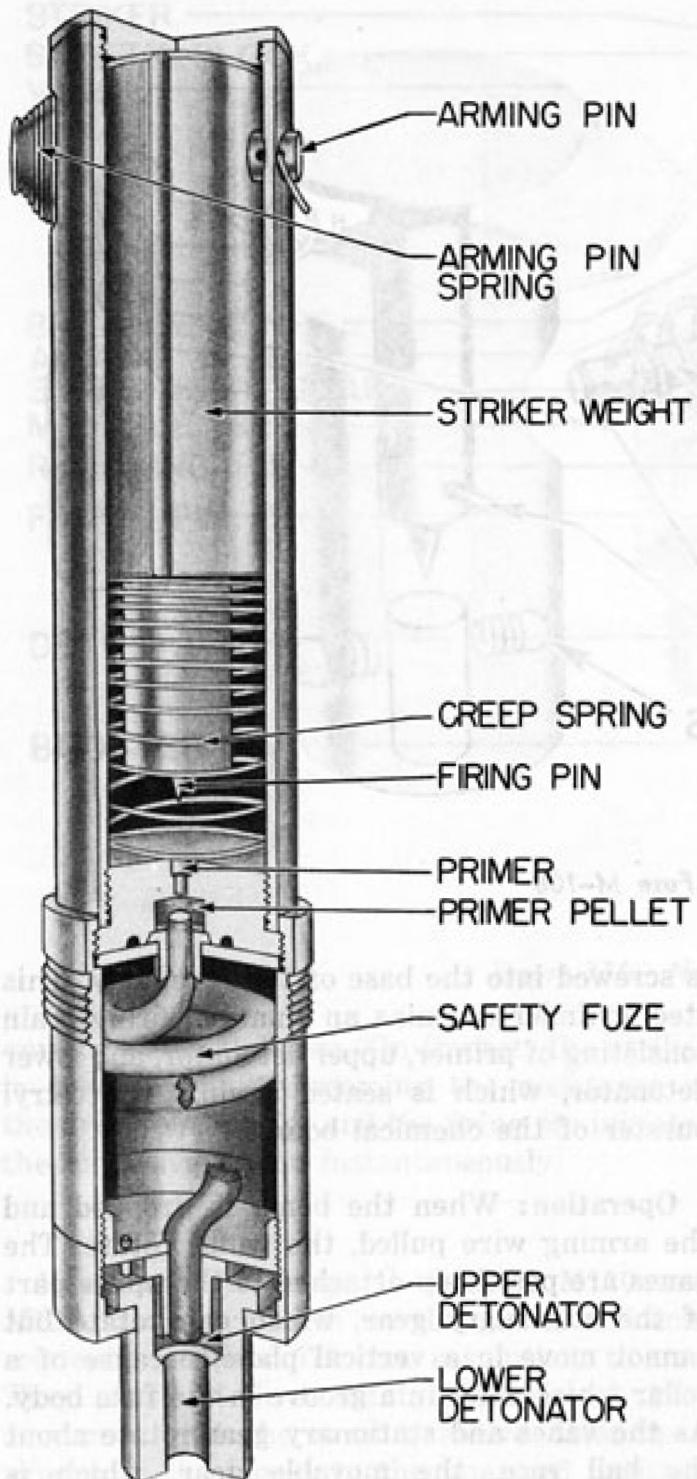


Figure 332. Tail Fuze M-106

**Remarks:** If any of these fuzes are found in storage or elsewhere in an unarmed condition, they should be carefully checked to ascertain that the wire clip preventing the arming pin from being ejected by its spring is in good condition and not rusted or weak. Should this clip or wire rust through and give way, the arming

pin would pop out, leaving the fuze in a dangerous armed condition.

The Bureau Of Ordnance has decreed that all these fuzes encountered in naval activities be disposed of by dumping in deep water.

**M108 (Nose Mechanical Impact) (Obsolete)**

Bombs.....	Target Identification M75
Functioning .....	Instantaneous
Armed condition..	When safety block is gone
Fuzes used with.....	None
Arming time.....	Instantaneous
Body diameter, inches.....	1.3
Over-all length, inches.....	2.6
Material.....	Brass fuze body with cadmium- or zinc-plated steel striker

**General:** This fuze is not threaded into the bomb nose, but is pushed down and held there by two spring-loaded retaining balls which protrude from the side of the fuze. The fuze requires an adapter ring having an annular groove to receive the retaining balls.

**Operation:** When the arming wire is withdrawn from the arming pin as the bomb is dropped, the arming pin is ejected from the fuze by the action of the arming-pin spring. The safety block holder then falls free of the fuze, and the safety block is ejected clear of the fuze and striker by its spring. On impact, the striker is driven into the fuze body, cutting the shear wire and impinging on the primer, setting off the upper detonator and the lower detonator successively.

**Early design:** The early M108 did not have a safety block inserted between the striker head and the fuze body, and was quite dangerous, as a drop of only a few inches on a hard surface was enough to activate the fuze. The M108 Modified is shipped with the safety block as shown in figure 333.

**Remarks:** This fuze was designed for use in the 100-pound Incendiary Bomb M47. It is being replaced by the AN-M126A1 in all bombs except the Target Identification Bomb M75.

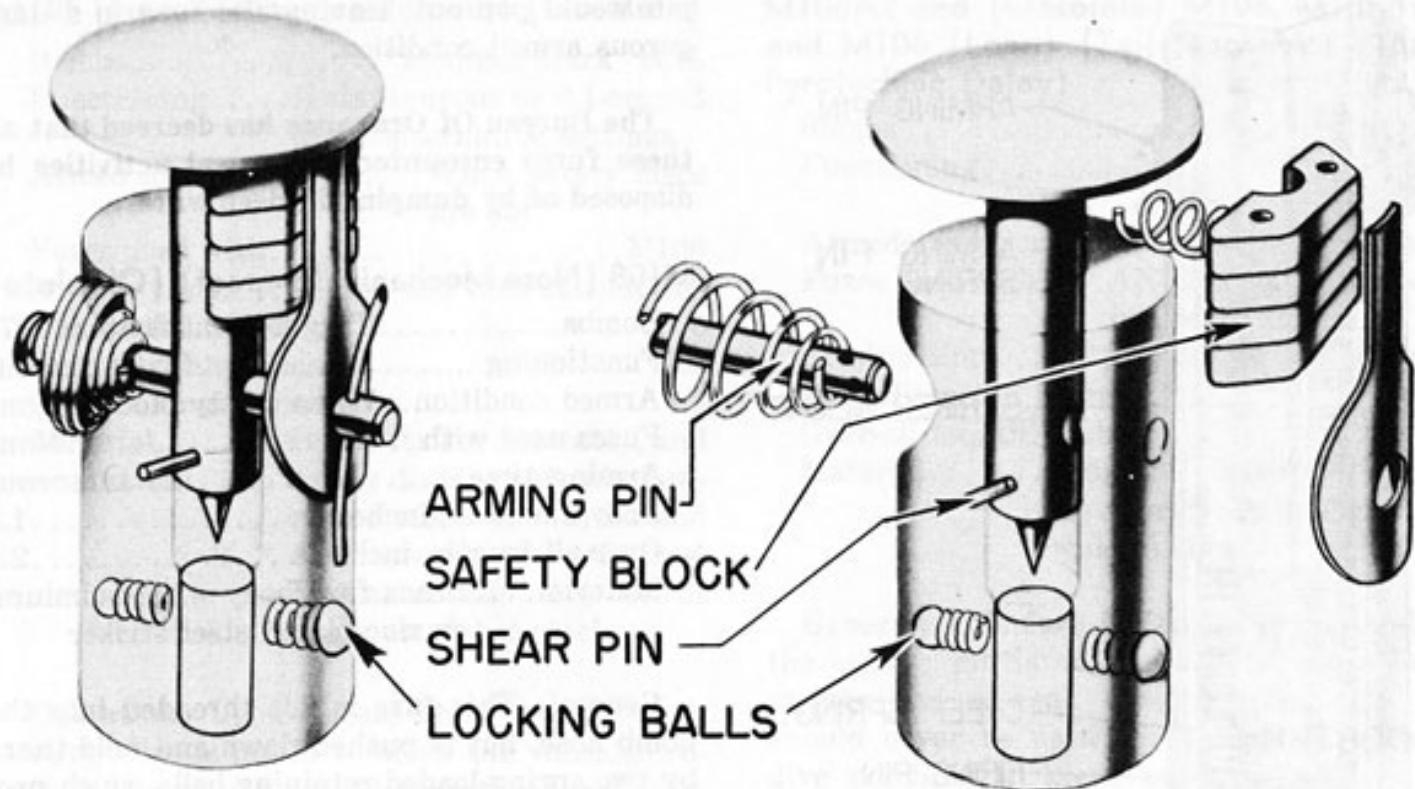


Figure 333. Nose Fuze M-108

**AN-M110A1, AN-M126A1, M110 (Obsolete), and M126 (Obsolescent) (Nose Mechanical Impact)**

Bombs .....	20-lb. Frag. AN-M41A1
	115-lb. M70 Chemical
AN-M126A1.....	100-lb. Chemical AN-M47A2
Functioning .....	Instantaneous
Armed condition.....	When safety block is gone
Fuzes used with.....	None
Arming time.....	260 vane revolutions
Vane span, inches.....	3.0
Body diameter, inches.....	1.7
Over-all length, inches.	AN-M110A1—3-5/8 AN-M126A1—3-1/16
Material.....	Aluminum body with steel safety blocks and striker

**General:** These two fuzes are identical in both construction and operation. The only difference is that the booster is eliminated from the AN-M126A1. Instead of the booster, a steel cylinder, having the same dimensions as the booster,

is screwed into the base of the fuze body. This steel cylinder contains an enlarged firing train consisting of primer, upper detonator, and lower detonator, which is seated against the tetryl burster of the chemical bombs.

**Operation:** When the bomb is dropped and the arming wire pulled, the vanes rotate. The vanes are positively attached to the upper part of the stationary gear, which can rotate but cannot move in a vertical plane, because of a collar which rides in a groove in the fuze body. As the vanes and stationary gear rotate about the ball race, the movable gear, which is threaded up inside the stationary gear, also rotates. Both gears mesh with an idler gear, and (since the movable gear has one more tooth than the stationary gear) for each rotation the movable gear lags one tooth, thus unscrewing downward from the stationary gear. As the sleeve of the movable gear moves down, it releases the safety block, allowing the block to be expelled by centrifugal force. The sleeve is moved down far enough in 260 rotations of the

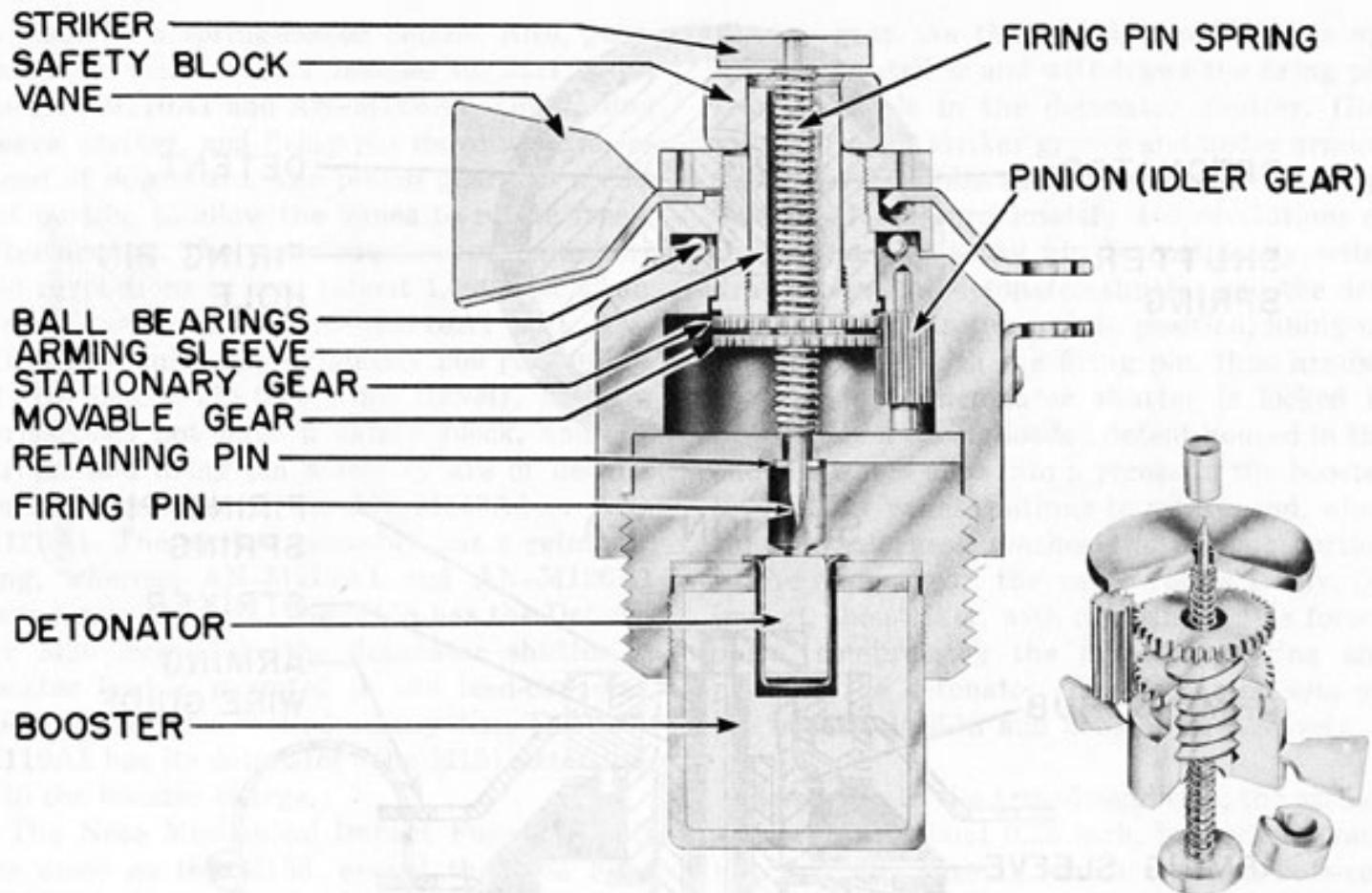


Figure 334. Nose Fuze AN-M110A1

vanes to arm the fuze. On impact, the striker is driven down, overcoming the resistance of the firing-pin spring; and the firing pin initiates the explosive action instantaneously.

**Remarks:** The original designs, M110 and M126, had more teeth on the gears, and consequently required 570 vane revolutions to arm. They also had three safety blocks, each 120° segments, and the arming sleeve fitted in a groove in the blocks in the unarmed position, preventing them from falling out. The original designs also had larger vanes.

If the striker head is flush with the fuze body, the fuze is in a fired condition. In such condition, the striker should not be pulled away from the fuze, as the firing pin is sensitive and withdrawal might create sufficient friction to ignite the primer.

#### M158 and M159 (Nose Mechanical Impact) Bombs

M158 . . . . .	Frag. AN-M41 and AN-M41A1
	115-lb. Chemical M70
M159 . . . . .	100-lb. M47A2 (H)
	100-lb. M47A2 (WP)
	100-lb. Incend. AN-M47A2
	100-lb. Incend. AN-M47A3
Functioning . . . . .	Instantaneous
Armed condition . . . . .	When striker protrudes 0.25 inches beyond vane nut
Fuzes used with . . . . .	None
Arming data . . . . .	440 vane revolutions; 1,000 feet of air travel
Vane span, inches . . . . .	3.0
Body diameter, inches . . . . .	1.752
Over-all length, inches . . . . .	
M158 . . . . .	3.69
M159 . . . . .	3.22
Material . . . . .	Aluminum body with steel safety blocks and striker

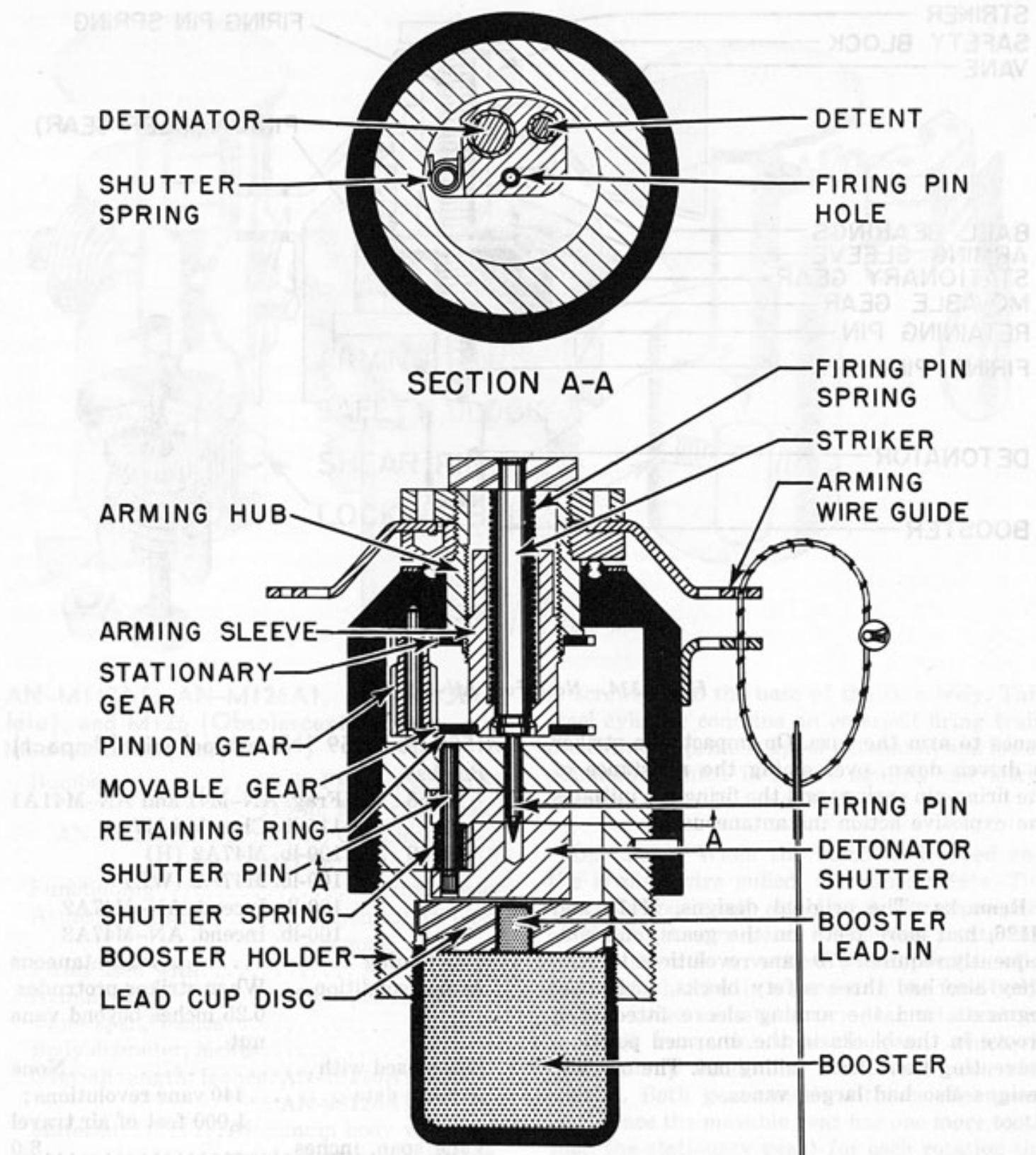


Figure 335. Nose Fuze M158

**General:** These fuzes are essentially the same as the Nose Mechanical Impact Fuzes AN-M110A1 and AN-M126A1, except that

they incorporate a spring-actuated detonator shutter which rotates into position after withdrawal of the firing pin, and is locked

in place by a spring-loaded detent. Also, gear-reduction ratio is 40:1 instead of 34:1 as in the AN-M110A1 and AN-M126A1. The arming sleeve, striker, and firing pin move upward instead of downward. The pinion gear has a cut-out portion to allow the vanes to rotate freely after arming. The vanes require approximately 440 revolutions to arm (about 1,000 feet of air travel), whereas the AN-M110A1 and AN-M126A1 require approximately 260 revolutions to arm (about 725 feet of air travel). The new series does not have a safety block, and the striker and firing pin assembly are of heavier construction than in the AN-M110A1 or AN-M126A1. The striker assembly has a retaining ring, whereas AN-M110A1 and AN-M126A1 have a retaining pin. The M158 has the Detonator M20 located in the detonator shutter, a booster lead-in mounted in the lead-cup disc, and a booster below the lead-cup disc. The AN-M110A1 has its detonator (the M13) extending into the booster charge.

The Nose Mechanical Impact Fuze M-159 is the same as the M158, except that the Fuze M159 eliminates the lead disc (which carries lead cup) and the booster, but incorporates a detonator holder (top of holder fits flush against shoulder of booster holder) which is essentially the same as the AN-M126A1 detonator holder assembly except that it has an all-tetryl detonator which acts as relay detonator. The Nose Mechanical Impact Fuze M159 has two arming-wire guides to facilitate positioning of the arming wire, where the M158 has one. The over-all length of the M159 is approximately the same as the AN-M126A1, but shorter than the over-all length of the M158.

**Operation:** When the bomb is dropped and the arming wire pulled, the vanes rotate. The arming vane, nut, outer ball race, arming hub, and stationary gear rotate as a unit, but cannot move in a vertical plane because of a collar on the arming hub. The movable and stationary gears mesh with the pinion gear (idler gear), and (since the movable gear has one more tooth than the stationary gear) for each rotation the movable gear lags one tooth, thus screwing upward (right-hand threads) and toward the sta-

tionary gear. As the movable gear moves up, it lifts the striker and withdraws the firing pin from the hole in the detonator shutter. (Retaining ring in striker groove and under arming sleeve bevel enables simultaneous movement upward.) After approximately 440 revolutions of the vanes, the firing pin is completely withdrawn from the detonator shutter and the detonator shutter is swung into position, lining up the detonator with the firing pin, thus arming the fuze. The detonator shutter is locked in position by a spring-loaded detent housed in the shutter which slips into a recess in the booster holder. The vanes continue to rotate, and, when the movable gear reaches the cut-out portion in the pinion gear, the vanes rotate freely. On impact, the striker, with its firing pin, is forced down, compressing the firing-pin spring and piercing the detonator. The detonator sets off the booster lead-in and booster successively.

**Remarks:** In the armed condition, the striker will protrude about 0.25 inch, beyond the vane nut, but any fuze in which the gap between the underside of the striker and the face of the vane nut exceeds 0.125-inch should be treated as armed.

### M111, M111A1, M111A2, M127, and M138 (Nose Clockwork Aerial Burst)

#### Bombs

M111A2.....	Parachute Flare AN-M26
	Photoflash AN-M46
	Fragmentation Cluster
	Adapters M15 and M16
M127.....	Incendiary Cluster
	Adapter M10A1
M138.....	Incendiary Cluster
	Adapter E6R2
Functioning.....	5-92 seconds, or impact instantaneous
Armed condition.....	When safety block and arming pin are both out
Fuzes used with.....	None
Arming time.....	Approximately 260 revolutions
Vane span, inches.....	3

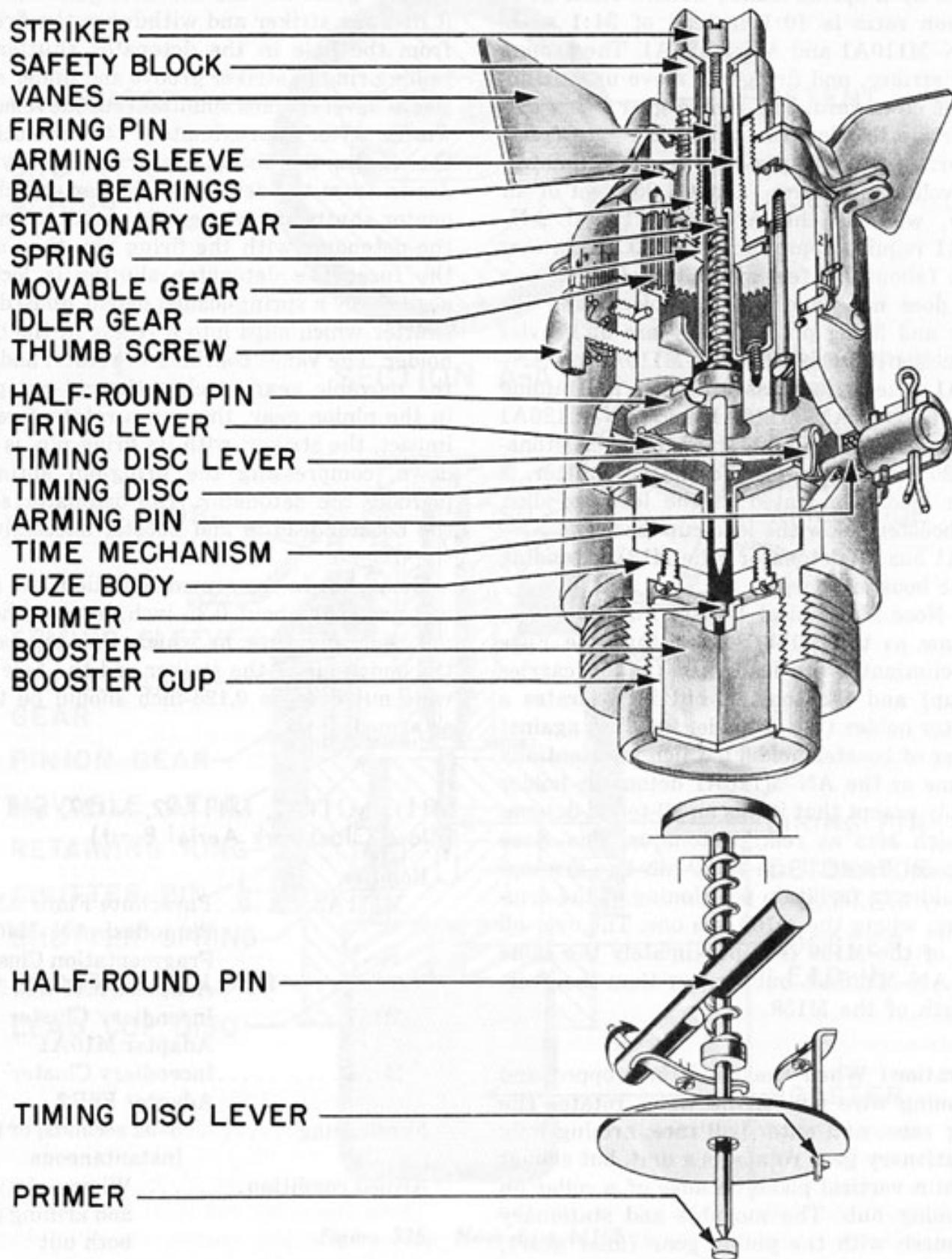


Figure 336. Aerial Burst Fuze M111A2

Body diameter, inches.....	1.63
Over-all length, inches..	M111A2—4.5; M127 and M138—4.95
Material .....	Aluminum alloy body with zinc- or cadmium- plated steel striker

**General:** The Nose Clockwork Aerial Burst Fuze M127 is formed by assembling the booster and detonator assembly from a Nose Mechanical Impact Fuze AN-M110A1 to a M111A2 fuze body. The result is a mechanical time fuze with an 18-gram tetryl booster instead of a black powder booster such as in the M111A2. The Nose Clockwork Aerial Burst Fuze M138 is the same as the M127, except that the M138 has only 7 grams of tetryl, the balance of the space being taken up by an inert clay pellet. (M127 booster was too powerful for Cluster Adapter E6R2 and damaged the bombs in the cluster; hence, reduction of tetryl.)

**Operation:** The desired time interval is set on the graduated scale, and the locking screw tightened. Upon release of the cluster or flare from the plane, the arming wire is withdrawn from the fuze. The vanes are then free to rotate, and the arming pin jumps out. The arming vane, nut, outer ball race, arming hub, and stationary gear rotate as a unit. As the vanes and stationary gear rotate on the ball race, the idler gear is rotated, thus rotating the movable gear and the arming sleeve to which it is attached. The arming sleeve is threaded into the arming hub and extends inside the safety block. Since the movable gear has one more tooth than the stationary gear, it lags one tooth on every rotation and gradually unscrews downward. After approximately 260 vane revolutions, the arming sleeve has unthreaded far enough to be withdrawn from the safety block, which is then thrown clear by centrifugal force. The timing disc, meanwhile, has been rotated by the spring-driven clockwork. After the predetermined time has elapsed, the slot in the timing disc will be positioned opposite the timing disc lever. Through a series of levers, pressure forces this timing-disc lever into the slot, thus

freeing the firing lever. Since the half-round pin is no longer retained by the firing lever, it is free to rotate under the pressure of the spring-loaded firing pin, a collar on the firing pin bearing on one side of the notch in the half-round pin. As the half-round pin rotates, the firing pin is released and impinges on the primer, firing the booster. If the timing mechanism should fail, the fuze would still detonate on impact, because the striker would be forced down and would shear any obstruction between it and the primer.

**Early designs:** The original Nose Clockwork Aerial Burst Fuze M111 had a setting range of from 15 to 93 seconds, and, because of the greater number of teeth on its gears, required 570 vane revolutions to arm.

M111A1 reduced minimum setting time on the scale from 15 to 5 seconds. The fuze, however, could not be set for less than 8 seconds, since, if set for less, the clockwork functioned before the fuze was armed, and the firing-pin spring pulled the striker down tightly against the safety blocks, stopping the rotation of the vanes, thus preventing aerial burst. Both of these early designs had three 120° section safety blocks with a groove which received the arming sleeve of the movable gear. They also had weaker gears with more teeth; and larger, weaker vanes.

**Remarks:** The M111A2 booster contains 70 grains of black powder.

Neither the M127 nor the M138 should be assembled to their respective clusters, until the cluster has been locked in place in the bomb rack.

The Nose Clockwork Aerial Burst Fuze M127 is being replaced by the M128; the M138 is being replaced by the M145; the M111A2 is being replaced by the M146.

These fuzes are equipped with a spinner device to force the safety block to rotate with the arming vane and insure positive ejection of the safety block after the arming sleeve has withdrawn. Only later lots of M111A2 are equipped with the spinner device.

**AN-M128, AN-M145, AN-M146, and AN-M147 (Nose Clockwork Aerial Burst)****Bombs**

- AN-M128 ..... Cluster, Incendiary, AN-M17A1
- AN-M145 ..... Cluster Adapter, Incendiary, E6R2
- AN-M146 ..... Flares and photo-flash; Butterfly Clusters M28 and M29
- AN-M147 ..... Target Identification Bombs M89, M90, M98 Target Identification
- Bomb M84; Incendiary AN-M47A2, A3

**Functioning** ..... Aerial burst, 5-92 seconds; or instantaneous

**Armed condition** ..... When safety collar and arming pin are both out, and detonator is aligned under firing pin

**Fuzes used with** ..... None for M128, M146 and M147; M152 or M153 used with M145

Arming time	Approximately 260 vane revolutions
Vane span, inches	3
Body diameter, inches	1.93
Over-all length, inches	AN-M128, AN-M145 —6.2; AN-M146— 5.67; AN-M147— 5.72.
Material	Aluminum alloy body with zinc- or cadmium-plated steel striker

**General:** These fuzes modify the Nose Clockwork Aerial Burst Fuze M111A2 by the addition of a detonator slider held out of line until the fuze is partially armed by a crank-shaped arming stem. The four fuzes in the series are identical, except for the boosters employed; the AN-M128 has the booster of the M127 (tetryl); the AN-M145, that of the M138 (tetryl-clay pellet); the AN-M146, that of the M111A2 (black powder); and the AN-M147, the AN-M126A1 primer detonator, instead of a booster.

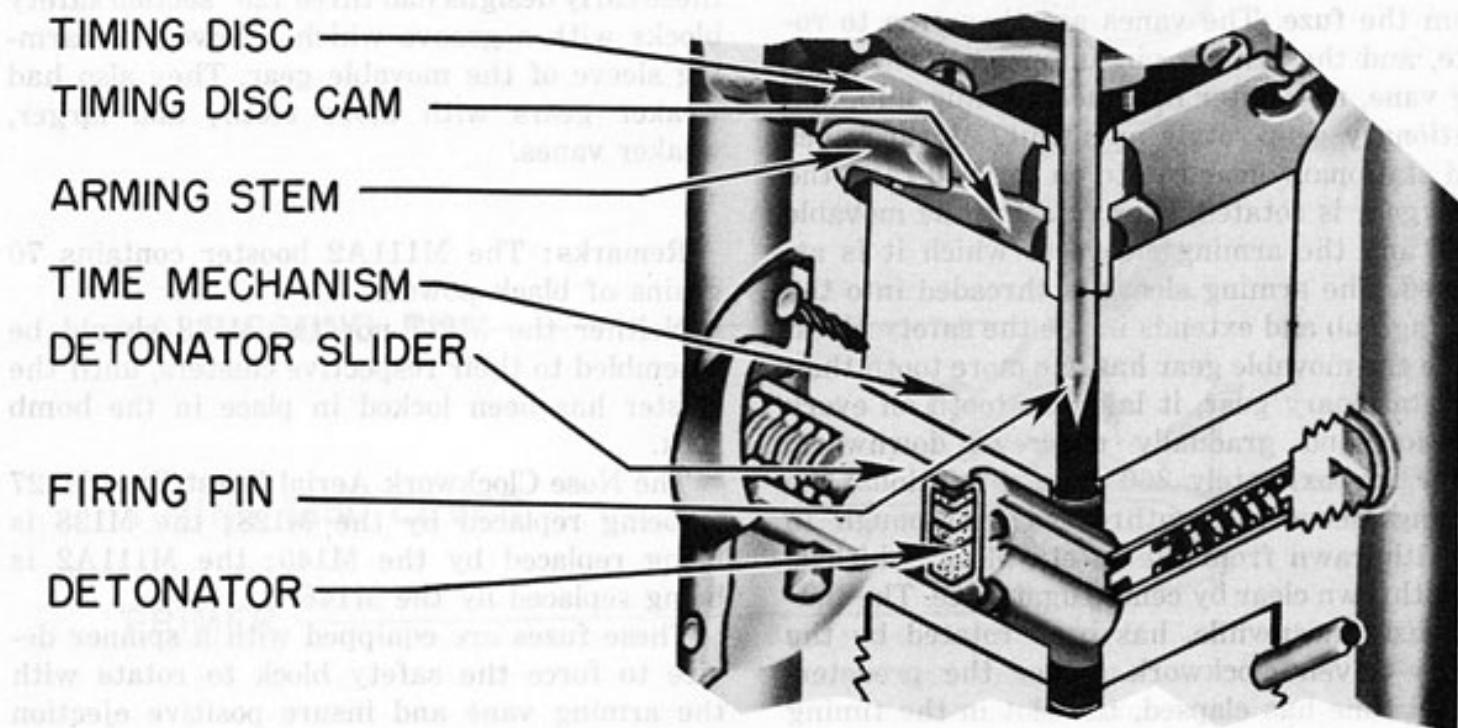


Figure 337. Aerial Burst Fuze AN-M128

**Operation:** Same as M111A2, except that, after approximately four seconds of rotation of the timing disc, the release arm located below the timing disc, and turning with it, frees the crank-shaped end of the arming stem. The lower end of the arming stem then presents its cut-away section to the detonator slider, which will then align itself below the firing pin and become locked in place there by a spring-loaded detent.

When the detonator is aligned, the timing disc continues to turn. After the predetermined time has elapsed, the slot in the timing disc will be positioned opposite the timing-disc lever. Through a series of levers, pressure forces this timing-disc lever into the slot, thus freeing the firing lever. This, in turn, frees the half-round cocking pin, which is forced to rotate under pressure of the spring-loaded firing pin. As the half-round cocking pin rotates, the firing pin is released and impinges on the primer, firing the booster.

**Remarks:** The AN-M128 replaces the M127; AN-M145 replaces the M138; and AN-M146 replaces the M111A2.

These fuzes are equipped with a spinner device to force the safety block to rotate with the arming vane; this assures positive ejection of the safety block after the arming sleeve has withdrawn.

#### MI35, MI36, MI35AI, and MI36AI (Nose Clockwork Aerial Burst)

Bombs .....	All G.P.; and 4,000-lb. L.C. AN-M56. May be found in 90-lb. and 260-lb. Frag.; 500-lb. and 1,000-lb. Chemical
Functioning .....	M135 — 5 to 92 sec. M136 — 5 to 30.6 sec. (Both will function on impact.)
Armed condition .....	When safety block, arming pin, and lower arming pin are out
Fuzes used with.....	None normally, unless AN-M100A2 series is used for insurance

Arming time .....	Approximately 260 revolutions
Vane span, inches.....	3.6
Body diameter, inches.....	2.7
Over-all length, inches.....	9.1
Material .....	Upper part of body is aluminum alloy; lower part, cadmium-plated steel

**General:** These fuzes are a combination of the Nose Clockwork Aerial Burst Fuze M111A2 and the Nose Mechanical Impact Fuze AN-M103, in which the former fuze has been assembled to a modified body and booster portion of the Fuze AN-M103. The setting pin of the AN-M103 has been removed, and in its place the spring-loaded lower arming pin has been inserted. The lower arming pin holds the detonator carrier out of line with the firing train until the arming wire is pulled.

The Nose Clockwork Aerial Burst Fuze M135 incorporates a time setting which can be adjusted to the nearest 0.1 second, and the fuze will fire accurately within plus or minus one second; time calibrations are made for every half second, with a 10-division vernier scale located on the non-rotating part of the fuze for setting to the nearest 0.1 second.

The M136 incorporates a time setting which can be adjusted to 0.2 of a second, and the fuze will fire accurately within plus or minus 0.3 second. The greater accuracy of the M136 is achieved by an improved clockwork mechanism. This fuze was developed to provide greater accuracy, presupposing that a method can be devised for accurately measuring the altitude of release.

**Operation:** Prior to loading the fuzed bomb into the plane, the time setting is made and the time set screw tightened. The arming wire is withdrawn as the bomb is dropped, and the vanes start to rotate. The arming pin is ejected, and the time mechanism starts to operate, the lower arming pin being simultaneously ejected, allowing the spring-loaded detonator carrier to move over into the armed position. After ap-

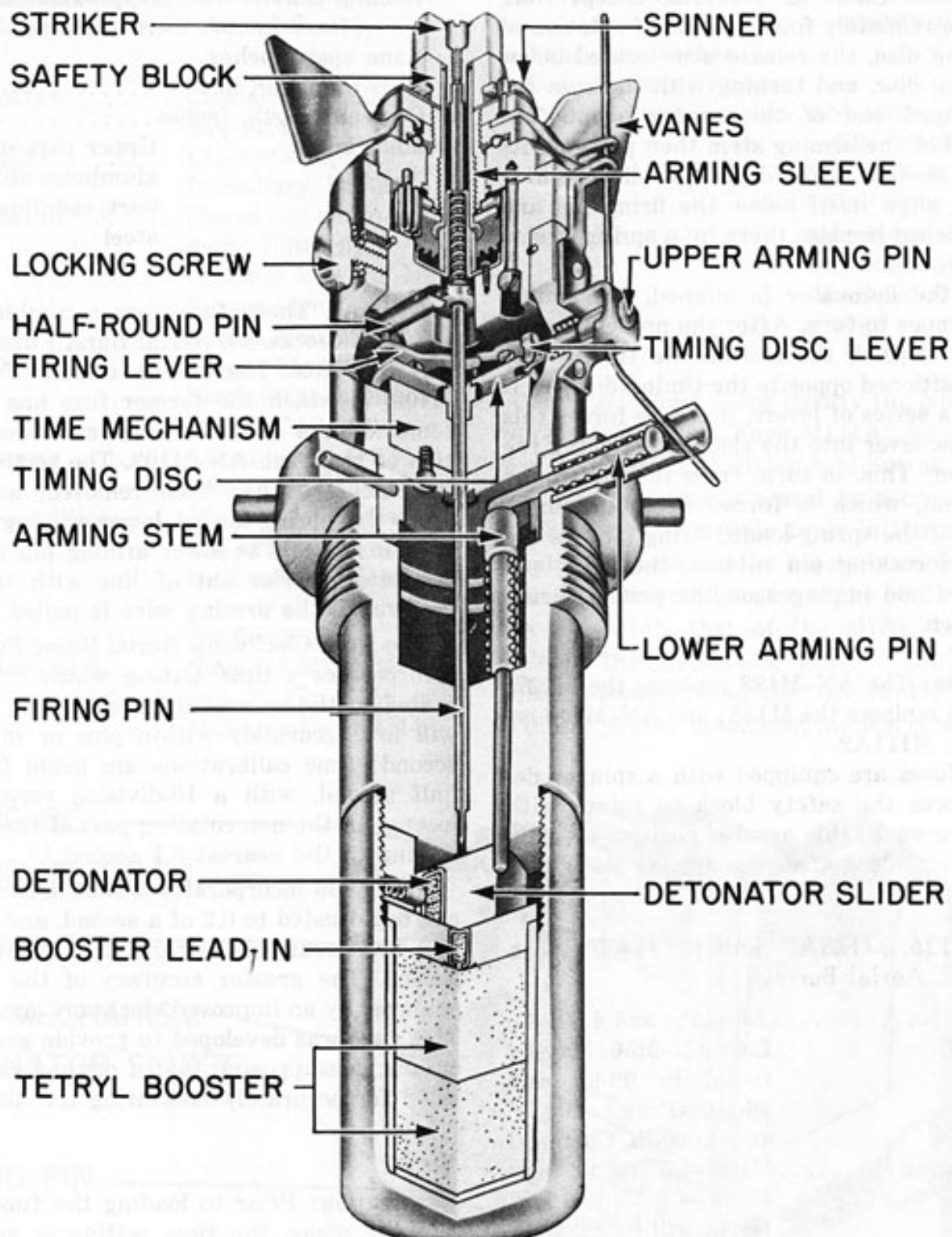


Figure 338. Aerial Burst Fuze M135A1

proximately 750 feet of air travel, the safety block is released from the fuze. After the set time has expired, the firing pin will be freed

and its spring will force it into the primer and detonate the bomb.

The bomb may detonate if it strikes a target

prior to complete functioning of the time mechanism, provided the arming wire has been withdrawn, in which case the firing pin would shear the rather delicate levers obstructing it.

**Remarks:** Effective use of these fuzes in G.P. bombs presupposes that a method can be devised for accurately measuring the altitude of release.

The round knurled locking screw has been replaced in current production with a wing-nut type, and replacement wing nuts are being sent to the field. This change was made so that ordnance personnel can get a good grip on the nut and eliminate the possibility that the setting might slip and cause either premature or late functioning.

The Nose Clockwork Aerial Burst Fuzes M135A1 and M136A1 are the same as the M135 and the M136, except that they incorporate a lower time limit of 10 seconds instead of 5 seconds. The minimum setting time was increased to prevent any possibility of damage to the plane by the bomb fragments. The M135A1 and

the M136A1 will replace the M135 and the M136 respectively, when available. It is recommended that a minimum setting of 10 seconds be used for all M135 and M136 fuzes now in the field.

#### M144 (Nose Clockwork Aerial Burst)

Bombs .....	250-lb. Target Identification M89, M90, M98
Functioning .....	1.6 — 30.6 sec., or instantaneous if slider aligned
Armed condition .....	When safety collar and arming pin are both out, and detonator is aligned under firing pin
Fuzes used with .....	None
Arming time .....	6 to 9 vane revolutions
Vane span, inches .....	3
Body diameter, inches .....	1.93
Over-all length, inches .....	5.67
Material .....	Aluminum alloy body with zinc- or cadmium-plated steel striker

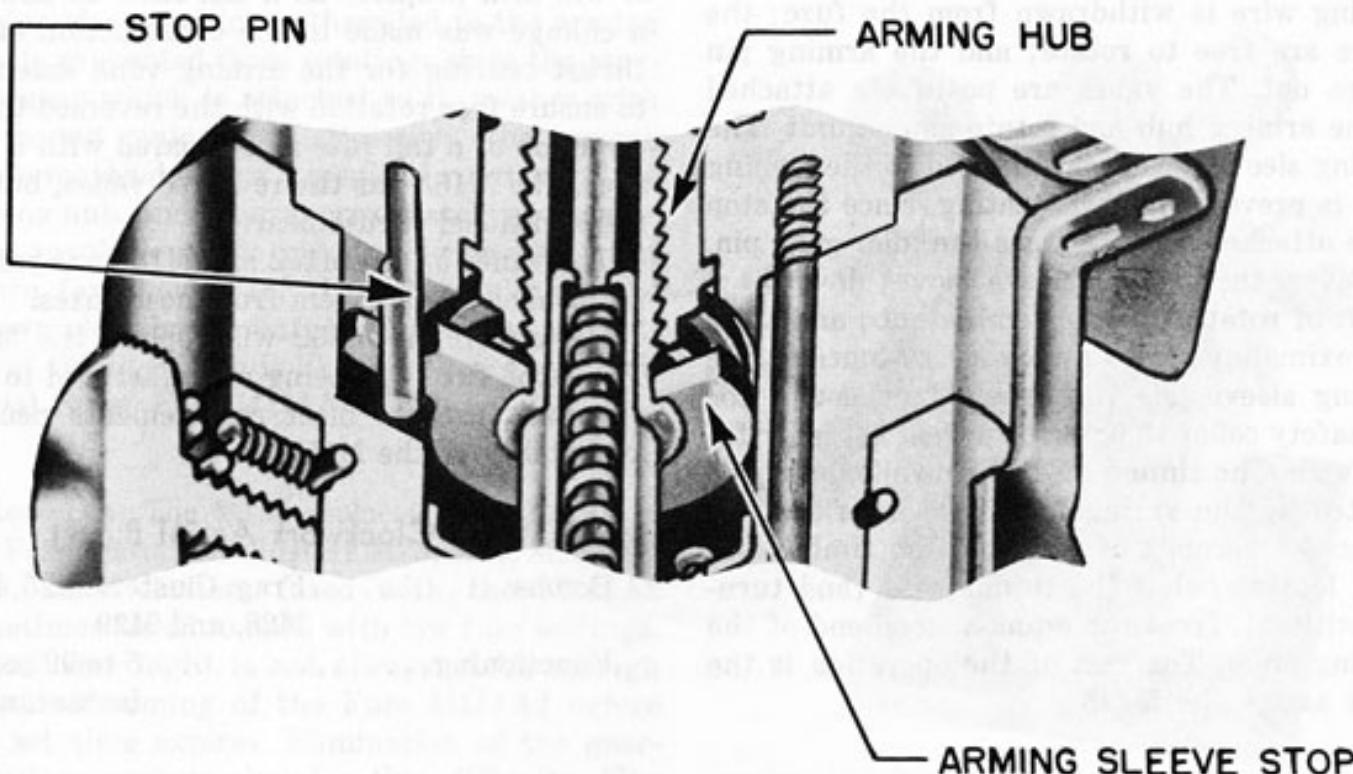


Figure 339. Aerial Burst Fuze M144

**General:** The Nose Clockwork Aerial Burst Fuze M144 is similar to the AN-M146, except that it has direct-drive instead of gear-reduction arming, resulting in ejection of the safety block after approximately six to nine turns of the arming vane. The direct drive involves the removal of the stationary gear from the arming hub, the movable gear from the arming sleeve, and the idler gear from the pin. The arming-sleeve stop plate fixed to the bottom of the arming sleeve has a fork which engages the pinion-gear pin and prevents the arming sleeve from rotating. This change was made to ensure that the safety block is ejected in less than the mechanical functioning time of the fuze. In addition, the M144 incorporates a clock mechanism which runs three times as fast as the AN-M146 clock mechanism. This results in a minimum setting of 1.6 seconds instead of 5, a maximum setting of 30.6 seconds instead of 92, and a slider arming time of  $1.5 \pm 0.5$  seconds instead of  $4.5 \pm 1.5$ . Because of the shorter running time, the clockwork is more accurate in the M144.

**Operation:** Upon release of the bomb, the arming wire is withdrawn from the fuze; the vanes are free to rotate; and the arming pin jumps out. The vanes are positively attached to the arming hub and rotate as one unit. The arming sleeve, which is threaded to the arming hub, is prevented from rotating, since the stop plate attached to it engages the idler-gear pin. However, the arming sleeve moves down as a result of rotation of the arming hub; and after approximately six to nine vane revolutions the arming sleeve has withdrawn far enough for the safety collar to be thrown clear by centrifugal force. The timing disc, meanwhile, has been rotated by the spring-driven clockwork. After  $1.5 \pm 0.5$  seconds of rotation, the timing-disc cam, located below the timing disc (and turning with it), frees the crank-shaped end of the arming stem. The rest of the operation is the same as for the M146.

### M152, and M153 (Tail Mechanical Aerial Burst)

Bombs.....	Incendiary Cluster Adapter M23
Functioning.....	5 to 92 seconds; or instantaneous if slider aligned
Armed condition .....	When safety collar and arming pin are both out, and detonator is aligned under firing pin
Fuzes used with.....	Nose Fuze AN-M145
Arming time.....	Approximately 260 vane revolutions
Vane span, inches.....	3
Body diameter, inches.....	1.93
Over-all length, inches.....	6.2
Material.....	Aluminum alloy body with zinc- or cadmium-plated steel striker

**General:** The Tail Mechanical Aerial Burst Fuze M152 is the same as the AN-M145, except that the M152 has reversed vanes so that it will arm properly as a tail fuze. In addition a change was made in the construction of the thrust bearing for the arming vane assembly, to ensure free rotation with the reversed thrust direction of a tail fuze as compared with a nose fuze. The M153 has the reversed vanes, but not the additional thrust bearing.

The vanes of the M152 and M153 are painted red to distinguish them from nose fuzes.

**Remarks:** The M152 will replace the M153. The M153 fuze was being manufactured to provide tail fuzes to meet requirements pending availability of the M152.

### M155 (Nose Clockwork Aerial Burst)

Bombs.....	Frag. Clusters M26, M27, M28, and M29
Functioning.....	5 to 92 sec., or instantaneous

Armed condition.....	When safety block and arming pin are both out
Fuzes used with.....	None
Arming time.....	Approximately 6 to 9 vane revolutions
Vane span, inches.....	3
Body diameter, inches.....	1.63
Over-all length, inches.....	4.5
Material.....	Aluminum alloy body with zinc- or cadmium-plated steel striker

**General:** The Nose Clockwork Aerial Burst Fuze M155 is the same as the M111A2, except that the gear-reduction system has been eliminated. A spinner device is incorporated to force the safety block to rotate with the arming vane. Elimination of the gear-reduction system has been accomplished by removing the stationary gear from the arming hub, and pinning the pinion gear in place so that it cannot rotate.

**Operation:** The vanes are positively attached to the arming hub and rotate as one unit. The arming sleeve, which is threaded to the arming hub, is prevented from rotating, since the movable gear which is attached to it, meshes with the bound pinion gear. However, the arming sleeve moves down as a result of rotation of the arming hub, and after approximately six to nine vane revolutions the arming sleeve has withdrawn far enough for the safety block to be thrown clear by centrifugal force. The remainder of the operation is like the Nose Clockwork Aerial Burst Fuze M111A2.

**Remarks:** The M155 replaces the M111A2 in the Fragmentation Clusters M26, M27, M28, and M29, since clusters fuzed with the M111A2 sometimes failed to open with low fuze settings. The cluster flight is not always stable enough to permit arming of the Fuze M111A2 before the set time expires. Elimination of the gear-reduction system obviates this difficulty. The spinner insures ejection of the safety block at completion of arming.

### T77 (Nose Clockwork Aerial Burst)

**General:** The T77 is an M111A2 fuze body with anemometer vanes, instead of the propeller vanes. This development was produced to ensure proper functioning of this type of fuze when used in the Fragmentation Bomb Cluster M26, or earlier model of the cluster.

The cluster may tumble in flight, preventing ordinary vanes from rotating sufficiently in the proper direction to arm the M111A2; hence the anemometer vanes were substituted.

**Description:** Modification kits are issued to provide parts for converting the M111A2 into the T77 when the fuze is to be used in the fragmentation cluster. The kit contains the anemometer vane, vane nut, safety block, and fuze fixture. This fuze fixture serves as a support for the fuze during the process of modification.

**Remarks:** No such modification is necessary on the M155, because it arms in six to nine turns of the vanes.



Figure 340. Aerial Burst Fuze T77

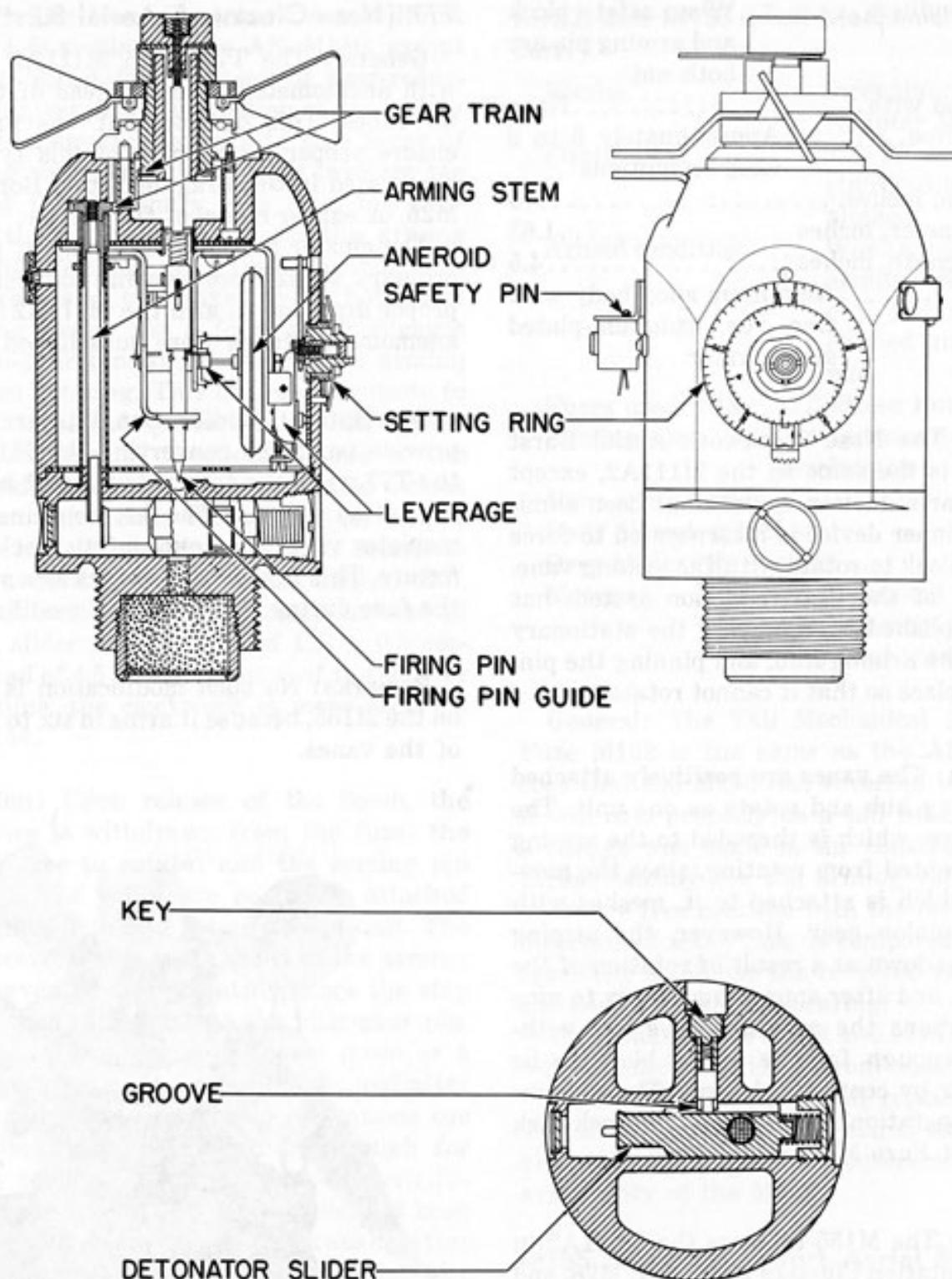


Figure 341. T27E4 Nose Barometric Fuze

**T27E4 (Nose Barometric)**

Bombs..... Not determined  
 Functioning..... Preset to fire at certain pressure (altitude)

Armed condition.....	Safety pin out; vane rotation
Diameter, inches.....	2.6 (approx.)
Vane span, inches.....	3.2
Over-all length, inches.....	6.0

**General:** This is an experimental design to obtain accurate firing at preset barometric pressure levels, and thus facilitate firing at exact altitudes (possibly within 200 feet of the setting). The fuze was originally designed for flares, but may be employed for other tactical purposes as testing continues.

**Description and operation:** Being air-travel armed, the T27E4 has vanes and gears similar to the M111 type of fuze. However, the gears act to thread an arming stem in the side of the fuze upward, allowing the spring-loaded detonator slider to be moved out and in line with the firing pin. A key screw in the fuze base rides in a slot in the side of the detonator slider and prevents rotation or misalignment of the detonator slider.

The safety pin on the outside of the fuze body locks the trip-firing mechanism. This pin is removed by the arming wire as the bomb is released. When this safety pin is removed, the aneroid bellows is free to move (through its leverage system) the trip-firing mechanism when the fuze reaches an area of pressure corresponding to that set on the dial.

#### M112, M113, and M114 (Obsolescent), and AI Modifications (Tail Mechanical Impact)

##### Bombs

M112A1.....	100-lb. G.P. AN-M30
	250-lb. G.P. AN-M57
M113A1.....	500-lb. G.P. AN-M43, 64
	500-lb. S.A.P. AN-M58
	600-lb. G.P. M32
M114A1.....	1,000-lb. G.P. AN-M44, 65
	1,000-lb. S.A.P. AN-M58
	1,100-lb. G.P. M33
	2,000-lb. G.P. AN-M34, 66
	2,000-lb. S.A.P. M103

Functioning....Primer Detonators M16 and M16A1 with 4 to 5, 8 to 11, or 8 to 15 seconds delay are interchangeable

Armed condition....When vane assembly has risen 0.75 inch

Fuzes used with.....None

Arming data.....18-21 vane revolutions; 100 feet of air travel

Vane span, inches.....	5
Body diameter, inches.....	1.5
Over-all length, inches.....	M112A1— 9.6
	M113A1—12.6
	M114A1—16.6
Material.....	Cadmium-plated steel

**General:** These fuzes are designed for ship and masthead bombing by land-based planes. The only difference in these three fuzes is in the length of the arming stem. Larger bombs require a longer arming stem, so that the vanes can catch the air slip from the bomb.

**Operation:** As the vanes rotate, the arming stem is unthreaded from the plunger. There are no reduction gears in the vane assembly, the arming stem being secured to the vane nut by a cotter pin; and 18 to 21 revolutions of the vanes will free the plunger. A key pin riding in a groove in the plunger prevents it from rotating as the arming stem is withdrawn. On impact, the plunger compresses its creep spring and the spring-loaded firing pin forces the locking balls out into the enlarged part of the fuze cavity, freeing the firing pin. The cocked firing-pin spring forces the firing pin against the primer, initiating the delay in the primer detonator.

**Early designs:** The original M112, M113, and M114 used the Primer Detonator M16, which is the same as the M16A1 except that the shoulder is lower. Hence, when the Primer Detonator M16A1 was designed, it was necessary to alter the base of the fuze slightly to permit use of this primer detonator with the higher shoulder on its external surface. The alternative Primer Detonators M16 had delays of 4 to 5 or 8 to 11 seconds, whereas the longer-delay M16A1 has a range of from 8 to 15 seconds. This delay consists of a barium chromate silicon powder in place of the lead chromate silicon mixture used in the Primer Detonator M16. The M16, though no longer being manufactured, can still be used in the Tail Mechanical Impact Fuzes M112A1, M113A1, and M114A1.

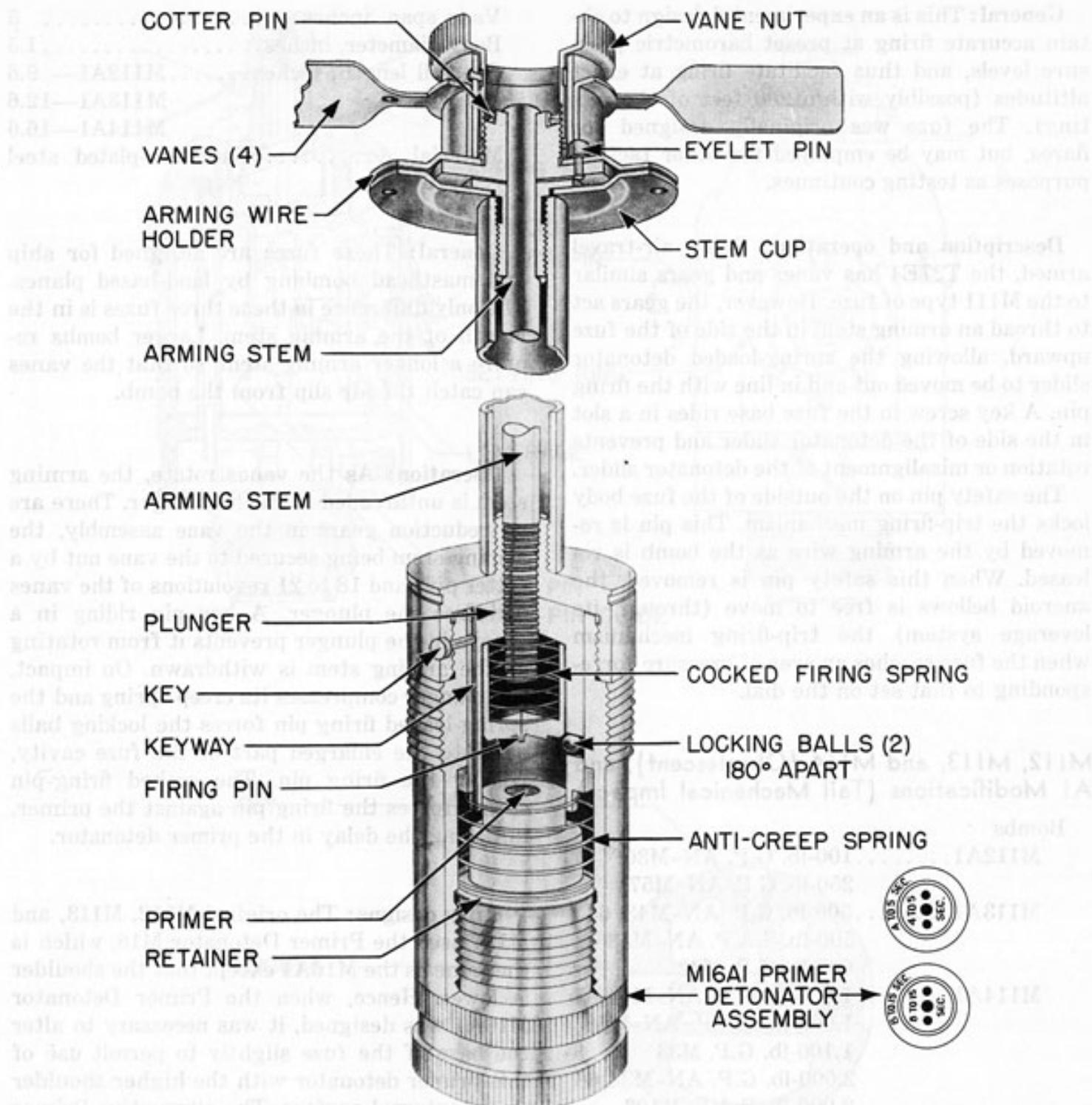


Figure 342. Tail Fuze M112A1

**Remarks:** This fuze will function on an impact angle of 3°, and gives positive action because of its cocked firing pin. This fuze is unsafe for carrier landings. Delay of 4 to 5 seconds should be used against sea targets, and delay of 8 to 15 seconds against land targets.

Never turn the vanes counterclockwise to render the fuze safe, as the arming stem may depress the plunger instead of engaging it.

These fuses may have a groove around the top of the fuze body, or the top may be straight

like the AN-M100 series fuzes. This groove is a distinguishing mark used by those manufacturers making both the M112 and AN-M100 series fuzes, and is not to be considered a positive mark for fuze identification.

### M115, M116, and M117 (Tail Mechanical Impact)

Bombs

M115.....	100-lb. G.P. AN-M30 250-lb. G.P. AN-M57
M116.....	500-lb. G.P. AN-M43, 64 ..... 500-lb. S.A.P. AN-M58 600-lb. G.P. M32
M117.....	1,000-lb. G.P. AN-M44, 65 1,000-lb. S.A.P. AN-M58 1,100-lb. G.P. M33 2,000-lb G.P. AN-M34, 66 2,000-lb. S.A.P. M103

Functioning..... Primer Detonators M16A1:

4-5, 8-15 seconds delay

Primer Detonators M16:

4-5, 8-11 seconds delay

Armed condition..... When gear carrier stop protrudes less than 1 inch below vane cup

Fuzes used with..... None

Arming data..... Same as AN-M100A2, AN-M101A2, AN-M102A2 respectively

Vane span, inches..... 5

Body diameter, inches..... 1.5

Over-all length, inches..... M115— 9.6

M116—12.6

M117—16.6

Material..... Cadmium-plated steel

**General:** This series is for ship and masthead bombing by land- or carrier-based planes. The only difference between these fuzes is in the length of the arming stem. Larger bombs require a longer arming stem, so that the vanes can catch the air slip from the bomb. The only difference between these three fuzes and the M112A1 series is that this series employs the reduction gears as used in the AN-M100A2 series, consequently having a longer arming time. Actually, the M115 series is a composite of the M112 series body with the AN-M100A2 series vane and reduction-gear assembly.

**Remarks:** These fuzes will take either the Primer Detonators M16 with delays of 4 to 5 or 8 to 11 seconds, or the Primer Detonators M16A1 with delays of 4 to 5 or 8 to 15 seconds. Actually the M16's are no longer being manufactured, though they are still to be found in the field. These fuzes can be used for skip or masthead bombing from land or carrier bases. These fuzes may have a groove around the top of the fuze, or the top may be straight as in the AN-M100 series. The groove is a distinguishing mark used by manufacturers making both fuzes, and is not to be considered a positive sign for fuze identification.

Never turn the vanes counterclockwise to render a fuze safe, as the arming stem may depress the plunger instead of engaging it.

### M151 (Tail Mechanical Impact)

Bombs..... 100-lb. AN-M30A1 and 250-lb. G.P. AN-M57A1 equipped with Anti-Ricochet Parachute M7 and Fuze Adapter M202; 500-lb. G.P. AN-M64A1, equipped with Anti-Ricochet Parachute M6 and Fuze Adapter M200

Functioning.... 4 to 5 or 8 to 15 seconds delay

Armed condition.... Consider armed if arming stem extends  $1\frac{5}{8}$  inches from fuze body (vane shaft side); or after approximately 12 vane revolutions.

Fuzes used with..... None

Arming time..... Approximately 12 vane revolutions

Vane span, inches..... 5

Body diameter, inches..... 1.5

Over-all length, inches..... 5.55

Material..... Cadmium-plated steel

**General:** The Tail Mechanical Impact Fuze M151 consists of a modified M112A1 series fuze body. The body has been lengthened to accommodate a plunger stem which is attached to the plunger proper. A transverse arming stem replaces the regular in-line arming stem. A retainer pin and spring-type lock nut have been

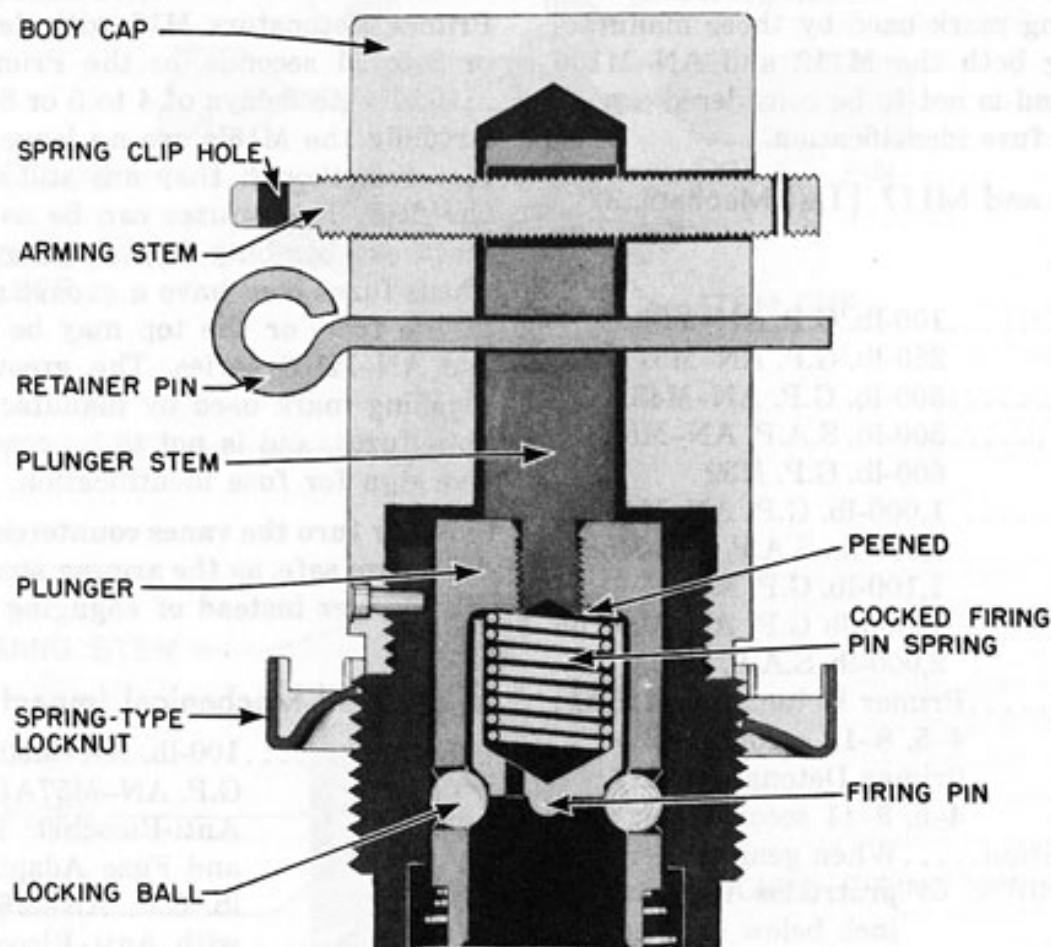


Figure 343. Tail Fuze M151

incorporated. In addition, the M151 uses an anemometer-type vane. The anemometer-vane arming shaft is attached to the arming stem by a spring clip.

**Operation:** Upon withdrawal of the arming wire from the arming shaft, the anemometer vane is free to rotate, and causes the arming stem to unscrew from the fuze. After approximately 12 vane revolutions, the arming stem has withdrawn completely from the plunger stem, and the fuze is armed. On impact, the plunger compresses the anti-creep spring and the spring-loaded firing pin forces the locking balls out into the enlarged part of the fuze cavity, freeing the firing pin. The cocked firing-pin spring forces the firing pin against the primer, initiating the delay in the primer detonator.

**Remarks:** The length of the anemometer-vane

arming shaft varies in length, depending on the fuze adapter used, and is considered a part of the fuze adapter. The Adapter M202 uses a 4-inch arming shaft, and the M200 uses a 7 1/8-inch arming shaft.

Depending on which M16A1 primer detonator is used, the fuze will have a 4 to 5 or 8 to 15 second delay.

#### MI23, MI24, and MI25 (Obsolescent) (Tail Chemical Time, Anti-Withdrawal)

##### Bombs

M123.....	100-lb. G.P. AN-M30A1
	250-lb. G.P. AN-M57A1
M124.....	500-lb. G.P. AN-M64A1
	500-lb. S.A.P. AN-M58A2
M125.....	1,000-lb. G.P. AN-M65A1
	2,000-lb. G.P. AN-M66A1, 66A2
	1,000-lb. S.A.P. AN-M59A1
	2,000-lb. S.A.P. M103

Functioning.....	Chemical long-delay fuze: delays of 1, 2, 6, 12, 24, 36, 72, and 144 hours
Armed condition.	Consider armed if dropped, because of glass ampoule; or after 75.6 to 190 revolu- tions of vanes.
Fuzes used with.....	None
Arming time.....	75.6 to 190 revolutions
Vane span, inches.....	5
Body diameter, inches.....	1.5
Over-all length, inches.....	M123— 9.6 M124—12.6 M125—16.6
Material.....	Zinc-plated and dichromate- coated steel

**General:** The only difference in these three fuzes is in the length of the arming stem. Functioning time is determined—for the 1-, 2-, 6-, and 12-hour delays—by varying the concentration of the alcohol-acetone solution, and for the 24-, 36-, 72-, and 144-hour delays, by varying the thickness of the celluloid disc (thickness increases as delays increase). The Detonator M19A2 contains the primer mixture of lead azide and tetryl.

**Operation:** The stem case and gear system of these fuzes are identical to the fuzes in the AN-M100A2 series, except that the threads on the arming stem are right-hand threads and thread downward instead of out. The pinion gear revolves around the stationary gear, and, in so doing, rotates the movable gear (which has one more tooth than the stationary gear) one tooth per revolution. Since the arming stem is secured to the movable-gear sleeve, it also rotates counter-clockwise, threading down toward the glass ampoule. The arming stem exerts pressure on the ampoule cap, causing the glass ampoule to break where it rests on seat disc and knife edge. Attached to the arming stem is a stem collar, which compresses a rubber washer to seal the upper part of the fuze from leakage (344-387 revolutions of vanes to seal). In the 1-, 2-, 6-, and 12-hour delays, the acetone or alcohol-acetone solution is freed to act on the celluloid ring re-

taining the locking balls. In the 24-, 36-, 72-, and 144-hour delays, the acetone is freed to act on the celluloid disc and subsequently the celluloid ring retaining the locking balls. As the acetone or alcohol-acetone solution acts on the celluloid ring, the locking balls are forced out by the head of the screw which is threaded into the spring-loaded firing pin. After the predetermined delay, as effected by varying the concentration of the alcohol-acetone solution or by varying the thickness of the celluloid disc, the balls will be forced clear of the screw head and the firing pin will strike the detonator.

If an attempt is made to withdraw the fuze, once it has been installed, the anti-withdrawal locking ball will ride into the shallow part of its groove, and lock the lower fuze body to the adapter booster. Further turning of the fuze will merely unthread the upper fuze body from the lower part, allowing the spring-loaded firing-pin sleeve to force the sleeve balls into the separation, driving both the sleeve and the firing pin toward the detonator. A separation of 3/64-inch activates the fuze, regardless of the length of time the acetone or alcohol-acetone solution has been acting, or if the fuze is in an unarmed condition. Later lots require 1 1/2 turns or 3/32-inch to activate.

**Remarks:** Never attempt to withdraw the fuze during or after installation in the bomb. If the bombs with this fuze are not dropped, they must be jettisoned over enemy territory or in the sea. They cannot be considered safe, even if dropped unarmed.

The fuzes should not be subjected to temperatures exceeding 120° F. (High temperature may damage the celluloid ring.) In the packing box are two vials of powder—one a green-stoppered vial, the other a red-stoppered vial. If the temperature exceeds 150° F., the powder in the green-stoppered vial will melt or solidify, and the fuzes are not to be used for low-altitude bombing. If temperature exceeds 170° F., the powder in the red-stoppered vial will melt or solidify, and the fuzes must be destroyed.

Before inserting the fuze in the bomb, gage the adapter-booster cavity with the plug gage provided in each box of fuses. Any bomb with

which difficulty is experienced in inserting this gage, must not be fuzed with these fuzes.

Later lots of these fuzes are equipped with new-type lock nut as on the M123A1 series.

### **MI23A1, MI24A1, and MI25A1 (Tail Chemical Time, Anti-Withdrawal)**

Bombs.....	Same as M123 series
Armed condition.....	Consider armed if dropped, because of glass ampoule; or after 4 to 6 turns of the vanes.
Fuzes used with.....	None
Arming time.....	4 to 6 vane turns
Vane span, inches.....	5
Over-all length, inches.....	M123A1— 9.39 M124A1—12.39 M125A1—16.39
Material.....	Zinc- or cadmium-plated steel

**General:** The only difference in these three fuzes is in the length of the arming stem. The M123A1 series fuzes were developed to eliminate any possibility of premature firing resulting in aerial bursts, which sometimes occurred in the unstaked M123 series. Essentially, the M123A1 series differs from the M123 series in that the gear-reduction system has been eliminated, and a direct-drive arming system has been installed. Functioning time in these fuzes is determined in the same manner as the M123 series. The Detonator M19A2 contains the primer mixture of lead azide and tetryl.

**Operation:** When the arming wire is withdrawn, the vane assembly starts to rotate, causing rotation of the clip hub, clip, and arming stem. After about four to six turns of the vanes, the arming stem moves inward far enough to break the ampoule. Approximately five to six additional turns are sufficient to seal the fuze; i.e., the stem collar is flush against the rubber retainer washer. The balance of the operation is the same as the M123 series.

**Remarks:** Prior to the development of the M123A1 series, the M123 series with gear reduction was modified by pinning the body extension

of the fuze to the body by use of two steel shear pins to prevent premature firing (aerial burst being caused by the torque developed by the gear-reduction system after sealing). Kits were also provided for installing these shear pins in the field.

Before the M123A1 series was in production, existing stocks of M123 series fuzes on hand in this country were modified; the stem cup was utilized without the gear-reduction assembly, and a vane hub, clip hub, clip, safety catch, and eight-bladed vane installed. This was designated the M123A1 series.

The fuzes of the M123A1 series, as well as the later M123 series lots, do not have the solvent dyed in various colors. Dye particles entered pores of the ampoule glass at the sealing point, increasing the possibility of breakage and leakage.

In the M123A1 series, if the body extension is backed off approximately 3/32 of an inch from the body, fuzes are activated, regardless of the length of time the acetone or alcohol-acetone solution has been acting, and regardless if the fuzes are in an unarmed condition.

**Modification:** The M123A1 series was modified, adding an ampoule-retainer sealing cup made of gilding metal, a sealing washer, set screw, and lock nut. This modification assures more effective sealing, since the arming screw crushes (but does not break through) the ampoule-retainer sealing cup. The set screw and lock nut hold the ampoule retainer in place and assure a tight fit against the retainer cup.

### **MI32, MI33, and MI34 (Tail Chemical Time, Anti-Withdrawal)**

Bombs.....	Same as M123 series
Functioning.....	10 minutes average chemical delay with range of 6-80 minutes delay possible, due to temperature variations
Armed condition.....	No external indication, assumed to be armed if dropped.
Fuzes used with.....	None

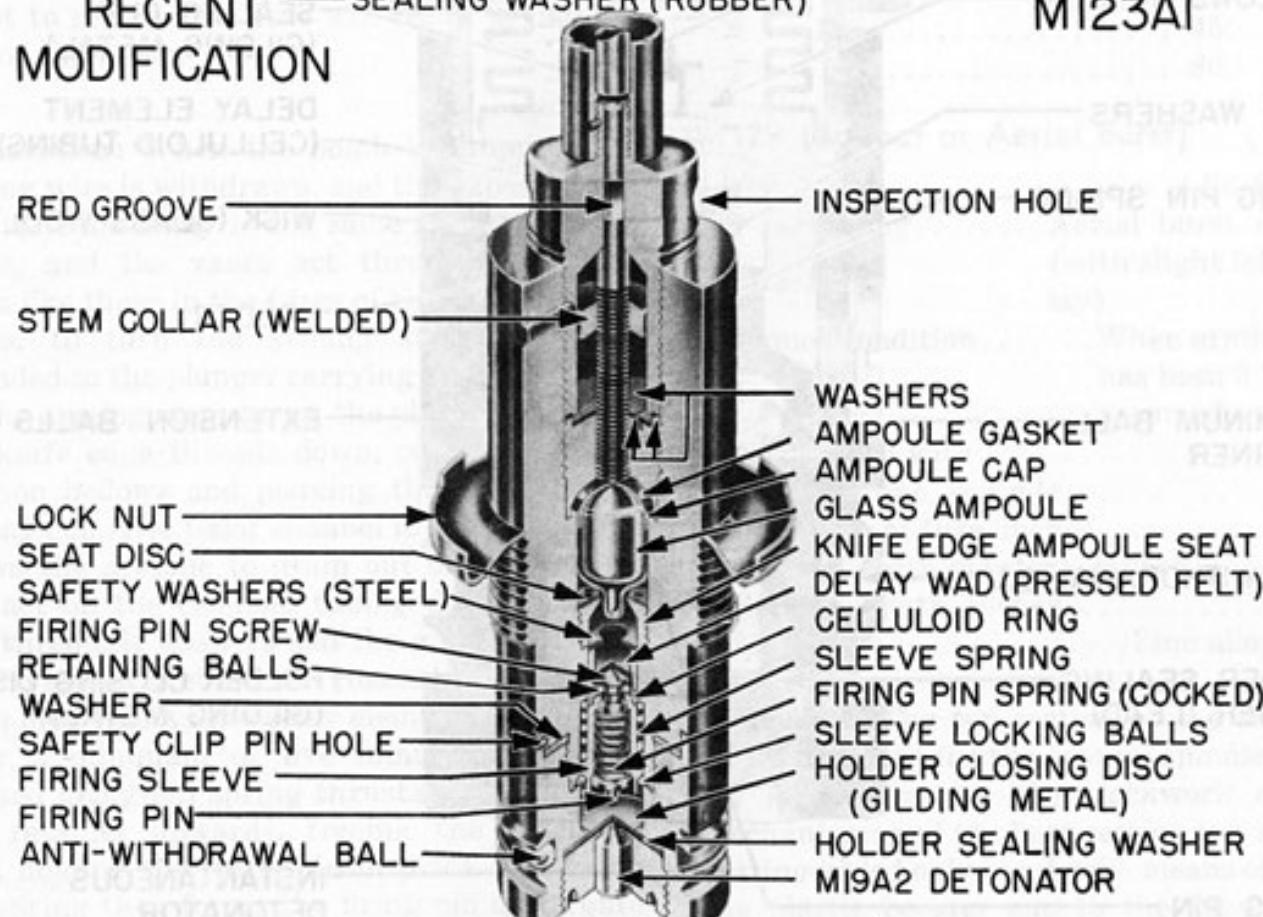
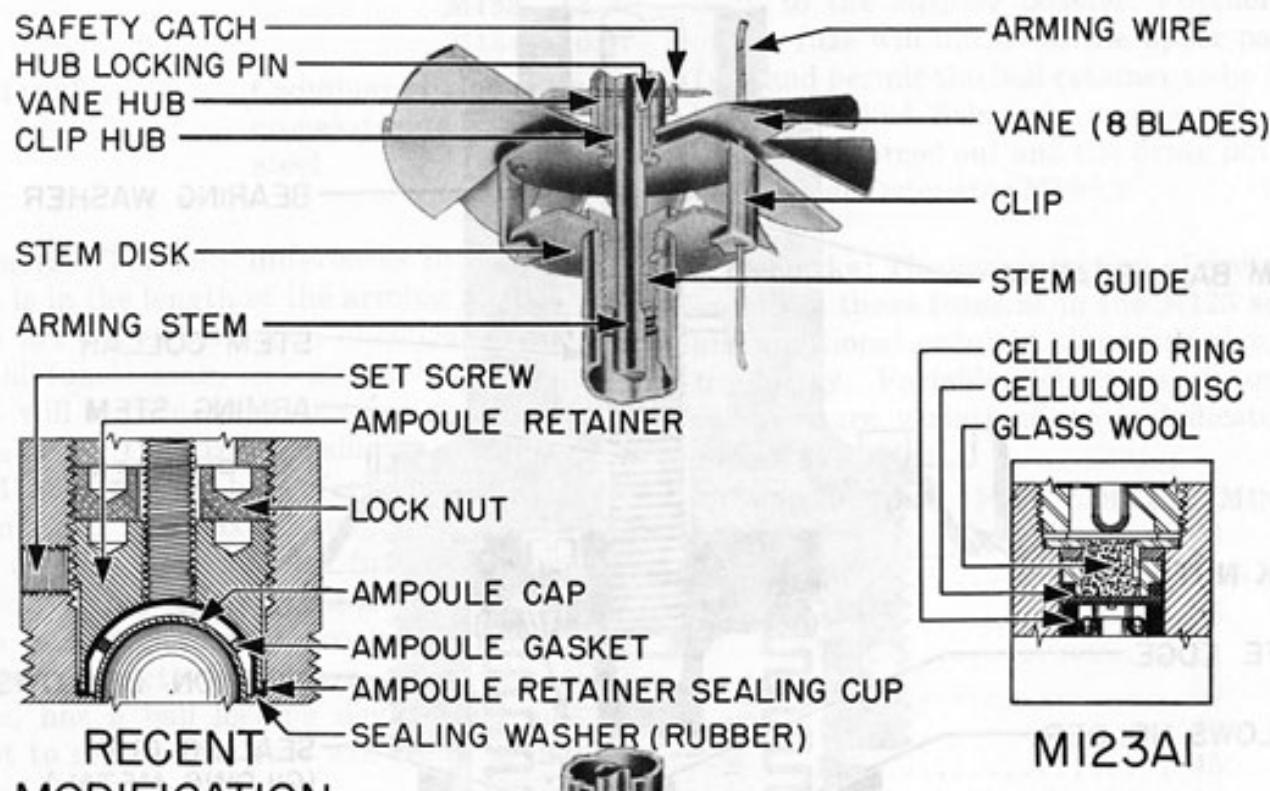


Figure 344. Tail Time Fuze M123A1

Arming time.....63 vane revolutions (min.)  
84 vane revolutions (max.)

Vane span, inches.....5  
Body diameter, inches.....1.5

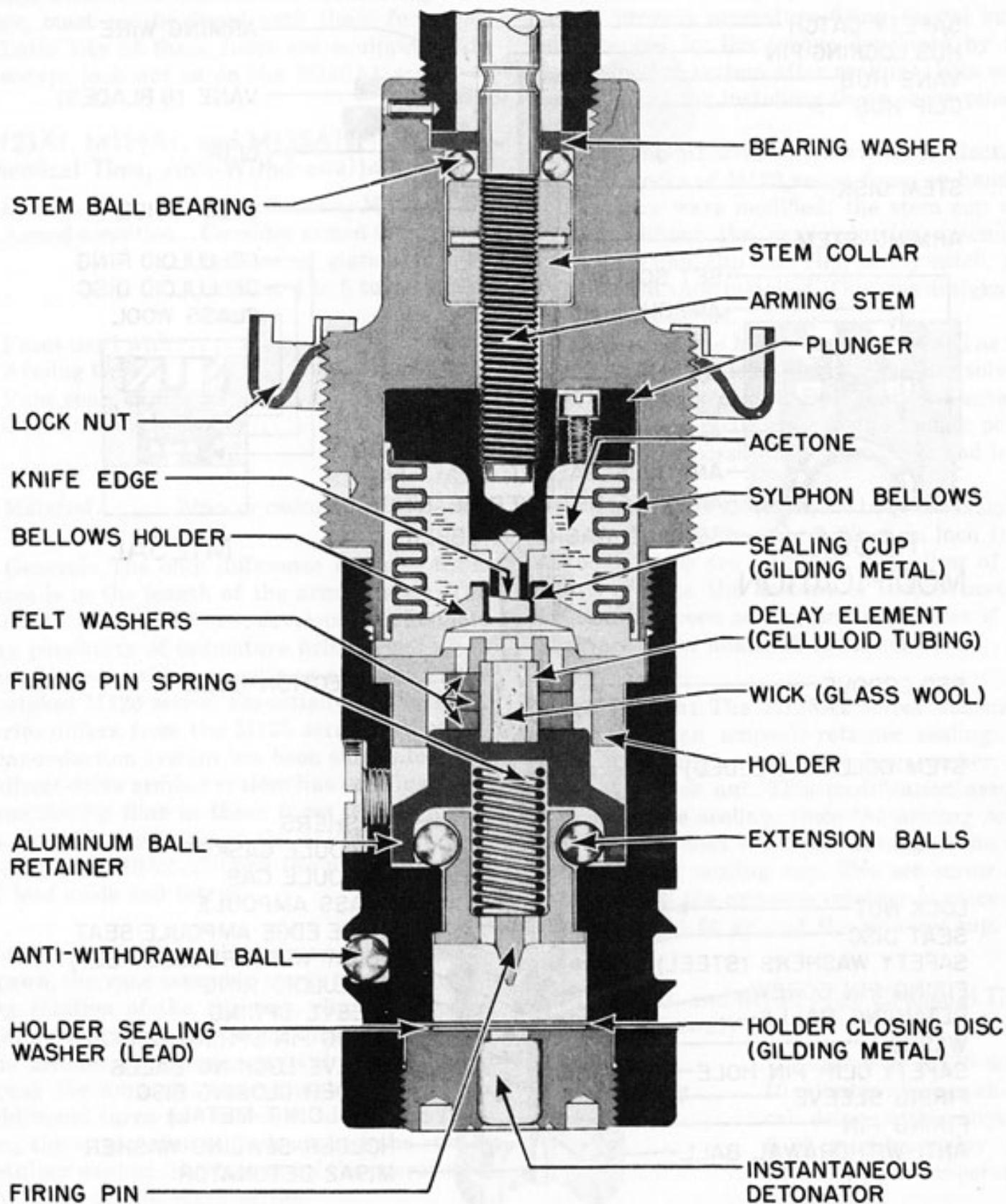


Figure 345. Tail Time Fuze M132

Over-all length, inches.....	M132— 9.57
	M133—12.57
	M134—16.57
Material.....	Cadmium or zinc plate, or cronak-treated zinc-plated steel

**General:** The only differences in these three fuzes is in the length of the arming stem. These fuzes are dependent upon chemical action for normal functioning, and atmospheric temperatures will have a direct bearing on the length of the delay. The fuzes are similar in principle to the M123 series, but are safer in that the solvent is contained in a flexible copper bellows rather than a glass ampoule. The fuze body does not project far beyond the adapter booster; hence, there is less chance of breakage upon severe multiple impacts. This fuze, as in the M123 series, has a ball locking device, and any attempt to remove the fuze will result in detonation of the bomb.

**Operation:** When the bomb is dropped, the arming wire is withdrawn, and the vanes rotate. The vane assembly is the same as in the M123 series, and the vanes act through reduction gears like those in the fuzes of the AN-M100A2 series, to turn the arming stem, which is threaded to the plunger carrying the knife edge. As the arming stem turns, the plunger carrying the knife edge threads down, compressing the sylphon bellows and piercing the gilded metal sealing cup. The T-slot channel in the knife edge allows the acetone to drain out of the bellows and act on the celluloid tubing delay element. The three felt washers and the glass wool wick absorb excess acetone and concentrate it on the delay element. As the delay element is dissolved after a minimum of five minutes, the compressed firing-pin spring thrusts the aluminum ball retainer upwards, freeing the extension balls holding the firing pin in place. The firing pin spring then forces the firing pin down onto the Detonator M19A2.

If an attempt is made to withdraw the fuze once it has been installed, the anti-withdrawal locking ball will ride into the shallow part of

its groove and lock the lower part of the fuze body to the adapter booster. Further turning of the fuze will unthread the upper part of the fuze and permit the ball retainer to be forced up by the cocked firing-pin spring, allowing the balls to be forced out and the firing pin to strike the Primer Detonator M19A2.

**Remarks:** The concentration of acetone is not varied in these fuzes as in the M123 series, nor are additional celluloid plugs added to prolong the delay. Variable delays result only from temperature variations, as is indicated in the following table:

TEMPERATURE (F)	DELAY (MINUTES)
122°.....	6
110°.....	7.5
85°.....	15
70°.....	21
55°.....	30
40°.....	40
32°.....	45
10°.....	80

### M129 (Impact or Aerial Burst)

Bomb.....	4-lb. Frag. M83
Functioning.....	Aerial burst or Impact (with slight inherent delay)
Armed condition.....	When arming spindle has been 3 1/2 turns, assumed armed
Fuzes used with.....	None
Arming time, seconds.....	2.5
Diameter of fuze, inches.....	1.75
Length (with booster), inches.....	2
Spindle length, inches.....	6.5
Material.....	Zinc alloy castings

**General:** The top section of the fuze is centrally threaded for the arming spindle; the middle section houses the clockwork and firing mechanism; and the base section is a simple flat casting added only to afford a means of screwing the plastic booster cup to the fuze. The fuze screws into the bomb with a left-hand thread, and is tightened with a spanner wrench which fits into the two spanner holes in the top of each fuze. Luting on the threads insures a tight,

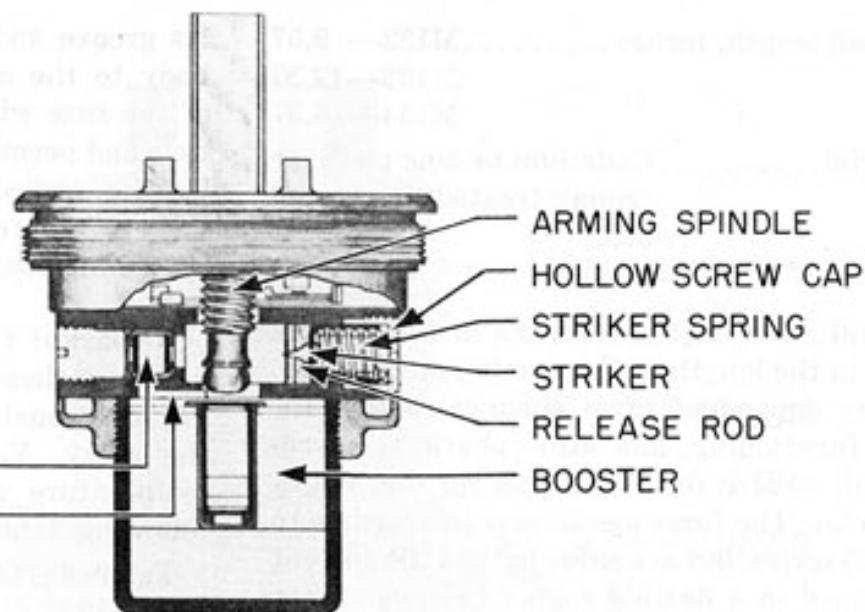
TOP SECTION

MIDDLE SECTION

BASE SECTION

DETONATOR CAP

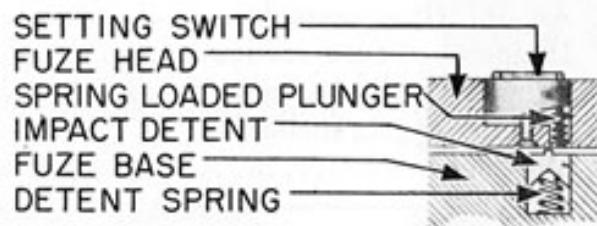
FLASH CHANNEL



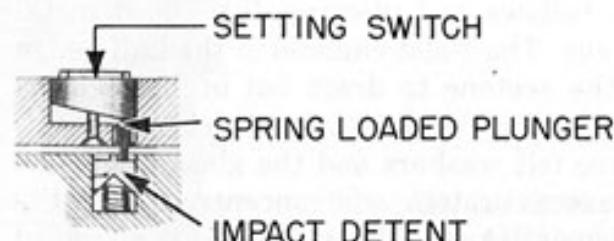
CROSS SECTION



EXTERIOR



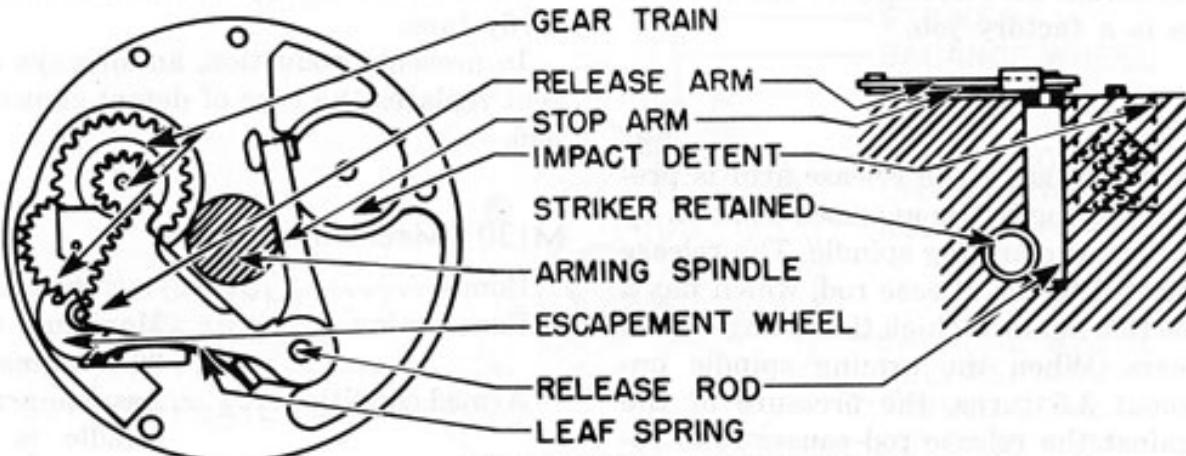
GROUND SETTING



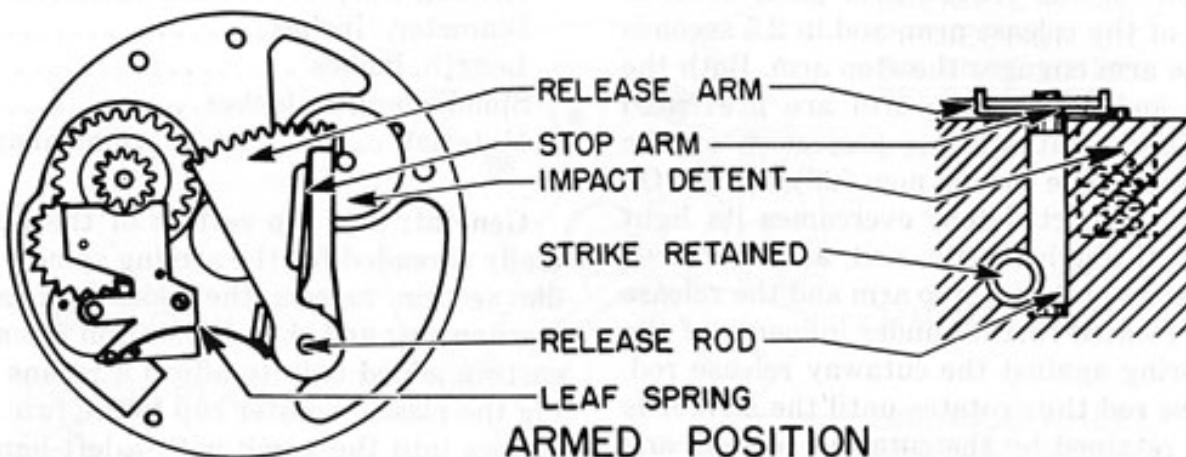
AERIAL BURST SETTING

SETTING SWITCH

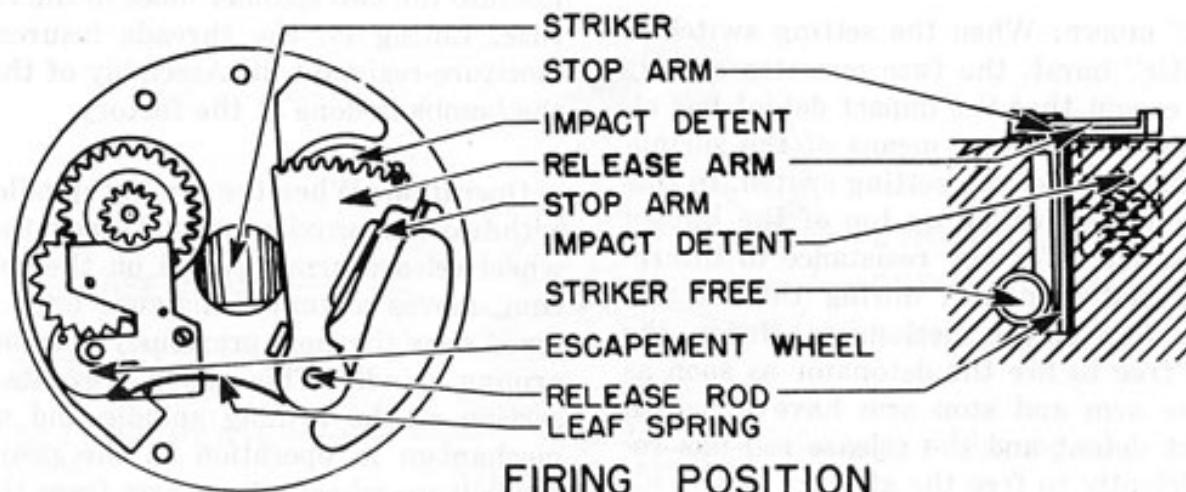
Figure 346. Impact or Aerial Burst Fuze M129



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ARMED POSITION



FIRING POSITION

Figure 347. Details of Fuze M129

moisture-resistant fit. Assembly of the fuzes in the bombs is a factory job.

### Operation

**"GROUND" BURST:** The release arm is prevented from moving in the unarmed position by the presence of the arming spindle. The release arm is attached to the release rod, which has a cutaway section against which the spring-loaded striker bears. When the arming spindle unthreads about 3.5 turns, the pressure of the striker against the release rod causes it to rotate and move the release arm in a clockwise direction. A gear train through which the external teeth of the release arm pass, controls the speed of the release arm, and in 2.5 seconds the release arm engages the stop arm. Both the stop arm and the release arm are prevented from further rotation by a projection on the impact detent. The fuze is now fully armed. On impact, the impact detent overcomes its light coil spring through inertia, and, as it is forced down, permits both the stop arm and the release arm to be rotated further under influence of the striker spring against the cutaway release rod. The release rod thus rotates until the striker is no longer retained by the cutaway section, and the striker fires the detonator cap.

**"AIR" BURST:** When the setting switch is set for "Air" burst, the fuze operates exactly as above, except that the impact detent has already been depressed by means of the spring-loaded plunger under the setting switch. In this condition, the projection on top of the impact detent does not offer any resistance to the release arm and stop arm during their travel across the face of the mechanism. Hence, the striker is free to fire the detonator as soon as the release arm and stop arm have bypassed the impact detent and the release rod has rotated sufficiently to free the striker.

**Remarks:** This fuze is the only one of the three fuzes for the Bomb M83 which can be identified after it has been inserted in the bomb. Its setting switch, marked "Air-Ground" on top of the fuze, identifies it.

This fuze is a copy of the German (41) butterfly fuze.

In present production, an all-ways action detent replaces the type of detent shown in figure 346.

### M130 (Mechanical Time)

Bomb.....	4-lb. Frag. M83
Functioning.....	Maximum setting of 30 minutes
Armed condition.....	Assume armed when spindle is out 0.25 inch.
Fuzes used with.....	None
Arming time.....	3.5 rotations of spindle
Diameter, inches.....	1.75
Length, inches.....	2
Spindle length, inches.....	6.5
Material.....	Zinc alloy castings

**General:** The top section of the fuze is centrally threaded for the arming spindle; the middle section houses the clockwork and firing mechanism; and the base section is a simple flat casting added only to afford a means of screwing the plastic booster cup to the fuze. The fuze screws into the bomb with a left-hand thread, and is tightened with a spanner wrench which fits into the two spanner holes in the top of each fuze. Luting on the threads insures a tight, moisture-resistant fit. Assembly of the fuzes in the bombs is done at the factory.

**Operation:** When the arming spindle has been withdrawn approximately 0.25-inch, the balance-wheel release arm, pivoted on the release-arm cam, moves a limited distance until it is centered over the hole previously occupied by the arming spindle. This action prevents the reinsertion of the arming spindle and starts the mechanism in operation as the projection on the balance-wheel release arm frees the balance wheel. With a maximum setting time of 30 minutes, the functioning is as follows:

1. The timing gear, under the influence of its clock spring, rotates in a counterclockwise direction. Near the end of its first revolution, the stud on the timing gear engages the first slot of

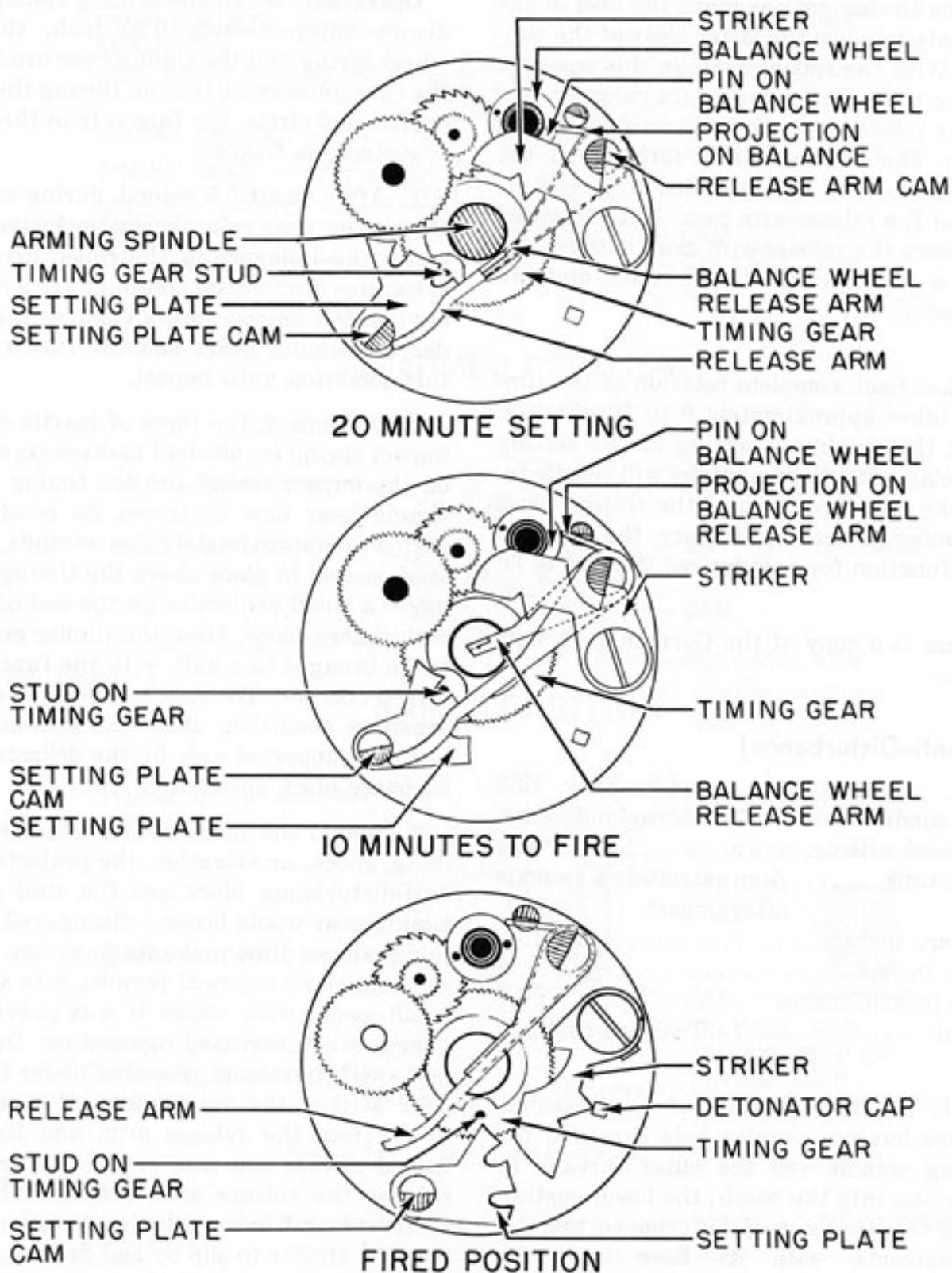


Figure 348. Mechanical Time Fuze M130

the setting plate and pulls the latter around with it a limited distance in a clockwise direction.

## 2. Near the end of the timing gear's second

revolution, the stud engages the second slot in the setting plate, once again moving it a limited distance.

3. Near the end of the third revolution, the

stud on the timing gear engages the heel of the setting plate to move the latter clear of the timing gear. With the setting plate in this position, the setting-plate cam presents its cutaway section to the release arm, thereby freeing the release arm. The release arm is forced past the setting plate by the spring-loaded striker bearing against the release-arm cam. As the pivoted striker clears the release-arm cam, it is free to strike in a counterclockwise direction and fire the detonator.

**Remarks:** Each complete rotation of the timing gear takes approximately 9 to 10 minutes, and, with the maximum setting of the setting plate, a delay of 27 to 30 minutes will result. By varying the initial position of the setting plate and/or timing gear at the factory, the fuze can be set to function for any desired time up to 30 minutes.

This fuze is a copy of the German (67) butterfly fuze.

### M131 (Anti-Disturbance)

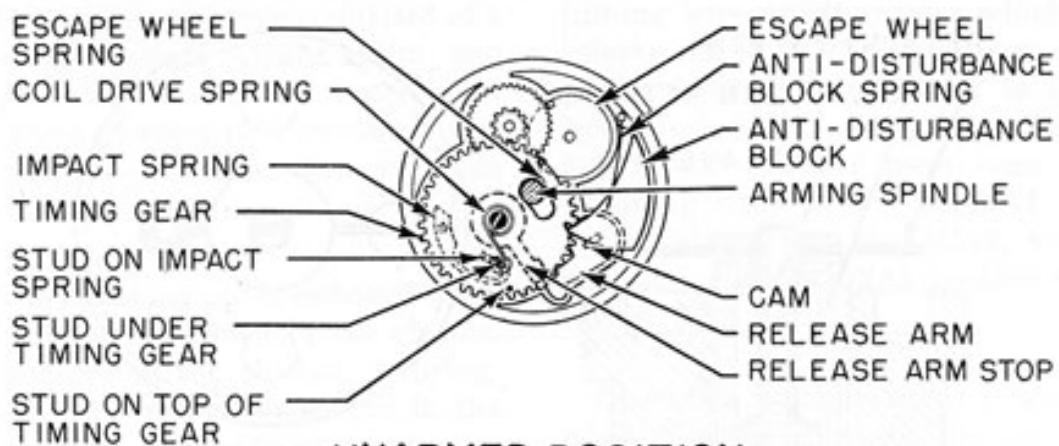
Bomb.....	4-lb. Frag. M83
Armed condition.....	No external indication
Fuzes used with.....	None
Arming time.....	Approximately 5 seconds after impact
Diameter, inches.....	1.75
Length, inches.....	2
Spindle length, inches.....	6.5
Material.....	Two zinc castings

**General:** The fuze consists of two castings, the top one having a center hole threaded for the arming spindle and the outer threads to screw the fuze into the bomb; the lower casting containing the timing, anti-disturbance, and firing mechanisms, with its base internally threaded for the tetryl booster cup. The assembly is held together by three long screws. On one side of the lower casting is a large hollow screw which holds the firing pin and the firing-pin spring under compression. Diametrically opposite is another smaller screw retaining the primer detonator.

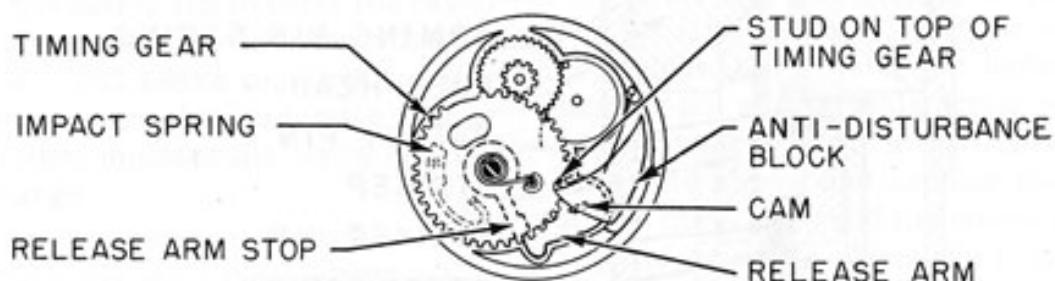
**Operation:** When the arming spindle is withdrawn approximately 0.25 inch, the escape-wheel spring and the timing gear are freed, and the fuze commences to arm. During the complete operational circle, the fuze acts in three successive steps, as follows:

1. After about 0.5 second, during which time the timing gear rotates in a clockwise direction under the influence of the coiled drive spring, the entire mechanism is brought to a halt as the stud on the impact spring engages the stud under the timing gear; and the fuze remains in this condition until impact.
2. On impact, the force of inertia on the flat impact spring is sufficient to disengage the studs on the impact spring and the timing gear. The timing gear now continues its rotation for a period of approximately five seconds, until the stud, seated in place above the timing gear, engages a small projection on the end of the anti-disturbance block. Here the timing gear is once again brought to a halt, with the fuze in a fully armed position. The fuze is now in an extremely sensitive condition, since the anti-disturbance block is supported only by the delicate anti-disturbance-block spring.
3. Should the fuze now be subjected to handling, shock, or vibration, the projection on the anti-disturbance block and the stud above the timing gear would become disengaged. The timing gear can thus make its final run, this time until its blank segment permits it to slip by the small gear (with which it was previously engaged) with increased momentum. During this last swift movement, the stud under the timing gear strikes the release-arm stop, moving it away from the release arm, and the spring-loaded striker can now rotate the release-arm cam as the release arm is freed. The cam is forced around in a clockwise direction, permitting the striker to slip by and fire the detonator cap, initiating the booster.

**Remarks:** There are no markings on the fuze to identify it; and, when fitted into the bomb, it cannot be distinguished from the Fuze M130. This fuze is so sensitive that the vibration caused by an aircraft propeller near by may be



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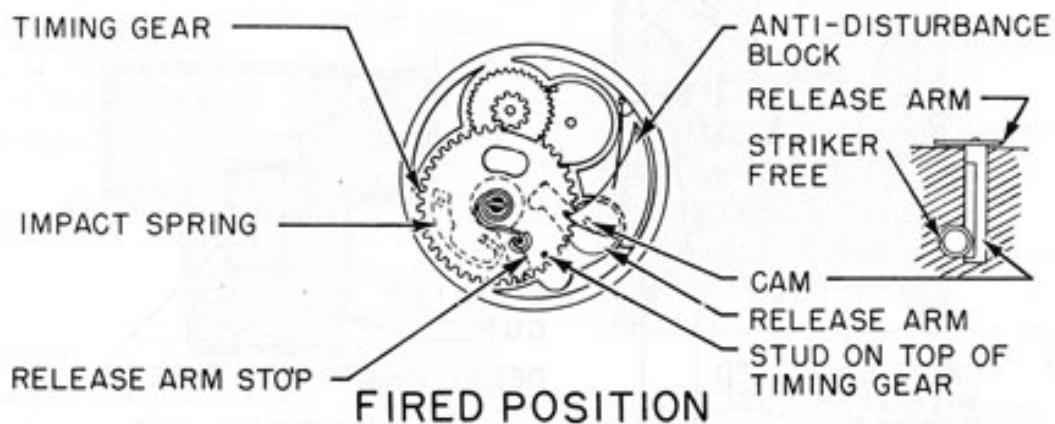


Figure 349. Anti-Disturbance Fuze M131

sufficient to release the anti-disturbance block and fire the fuze.

This fuze is copied from the German (70) B, butterfly fuze.

#### M142 (M3) (Nose, All-Ways Action Type)

Bomb.....10-lb. Incendiary M74  
(NP or PT 1)

Functioning.....Instantaneous

Armed condition.....When release pin is out  
Fuzes used with.....None  
Arming time.....Instantaneous  
Body diameter, inches.....1.125  
Over-all length, inches.....3.250  
Material....Steel head, zinc alloy die casting

**General:** The Nose Fuze M142 supersedes the Nose Fuze M3. The Nose Fuze M3 was used in

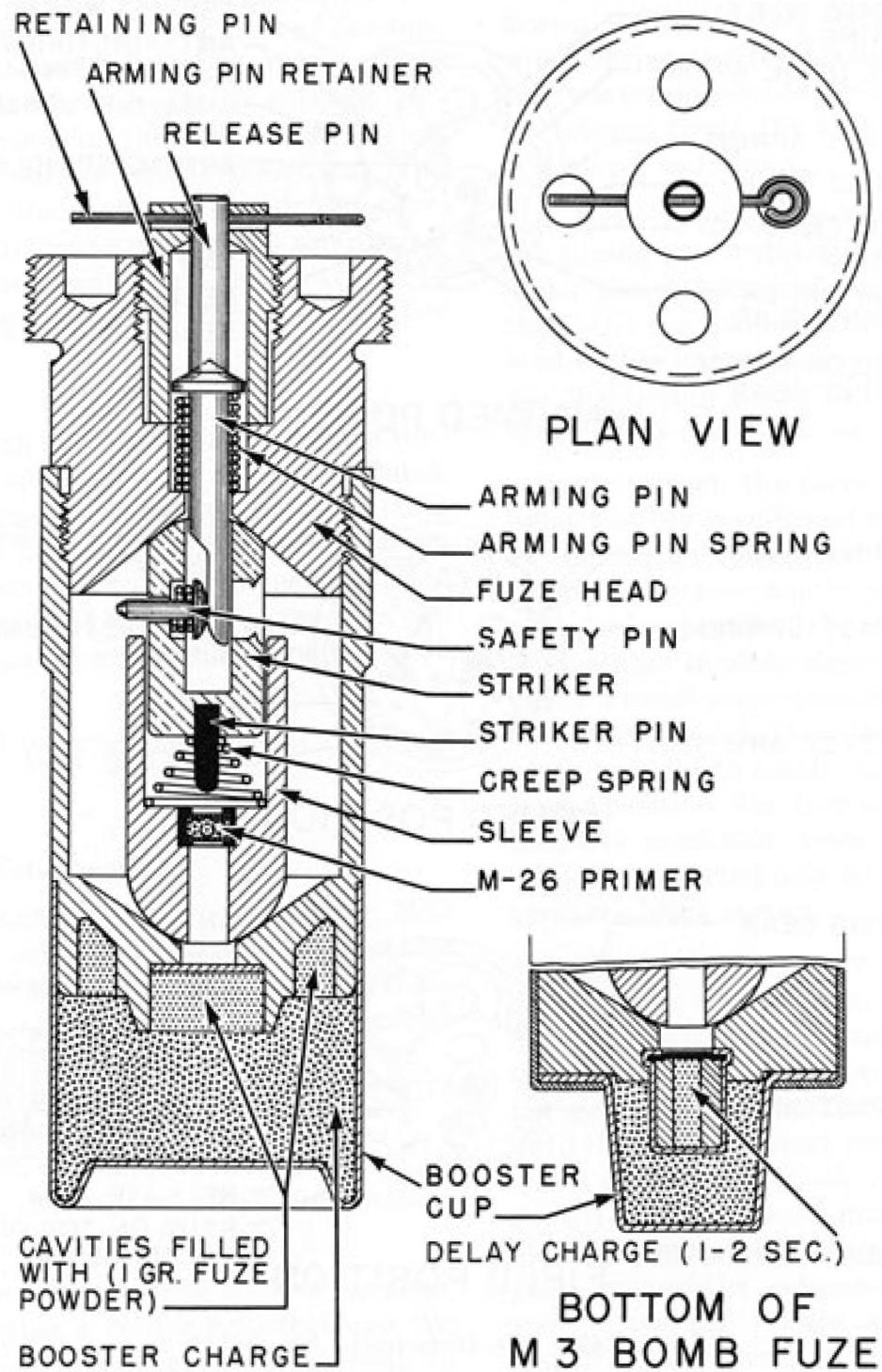


Figure 350. All-Ways Action Nose Fuze M142

experimental production of the M74; however, it was found that the 1 to 2 second delay incorporated in this fuze was unnecessary, as the inherent delay was sufficient. Therefore, it was redesigned and designated the Nose Fuze M142.

The Nose Fuze M142 is an all-ways action fuze which screws into the nose of the bomb.

This fuze consists essentially of a steel head and arming-pin retainer; steel striker pin and safety pin; zinc alloy die casting striker, sleeve, fuze casing and arming pin; Percussion Primer M26, cavities in the end of the case filled with one gram of fuze powder, and a zinc booster cup filled with three grams of propellant powder.

The M3 differed in that it had a Percussion Primer M29, built-in delay charge composed of a lead spitter fuze (potassium nitrate, sulfur, and charcoal) capped at both ends by match composition (60% black powder, 40% collodion) and a cellulose nitrate booster cup filled with one gram of fuze powder.

**Operation:** The retaining pin is removed when the fuzed bombs are assembled in the cluster. While the bombs are in the cluster, a spring-loaded release clip holds the release pin in the body of the fuze. Upon release from the cluster, the release clip springs off, allowing the release pin to jump out under action of its spring. This action permits the safety pin to enter the cavity in the striker, and the fuze is armed. Impact forces the striker and sleeve together, causing the striker pin to pierce the Percussion Primer M26, which, in turn, initiates the cavity charges and booster charge.

**Remarks:** The Percussion Primer M26 is better than the M29, since it will function even on soft surface impact.

The Nose Fuze M142A1 will replace the M142, because the latter cannot be "re-safed" after the release pin is released. The release pin can be reinserted in the Nose Fuze M142A1. Nose Fuze M142 is reclassified as substitute standard.

#### M142A1 (Nose, All-Ways Action)

Bomb.....	10-lb. Incendiary M74
Functioning .....	Instantaneous
Armed condition.....	When release pin is out
Fuzes used with.....	None
Arming time.....	Instantaneous
Maximum body diameter, inches.....	1.125
Over-all length, inches.....	3.25
Material.....	Steel head, zinc alloy die casting

**General:** The Nose Fuze M142A1 replaces the M142 for use in the 10-pound Incendiary Bomb M74, since the latter cannot be "re-safed" after the release pin is expelled. The M142A1 can be readily re-safed by pushing the release pin back

into the unarmed position and inserting the retaining wire or other wire which will hold the release pin in the safe position.

The Nose Fuze M142A1 is similar to the Nose Fuze M142, except that the head and the arming-pin retainer have been changed; two retaining balls in the M142A1 have replaced the safety pin in the M142, and the bottom contour of the M142A1 booster cup is concave rather than flat.

**Operation:** The retaining wire is removed when the fuzed bombs are assembled in the cluster. While the bombs are in the cluster, a spring-loaded release clip holds the release pin in the body of the fuze. Upon release from the cluster, the release clip springs off, allowing the release pin to jump out under action of the arming-pin spring. This action permits the retaining balls to move inward, freeing the striker from the sleeve and arming the fuze. Impact forces the striker and the sleeve together, causing the striker to pierce the Percussion Primer M26, which, in turn, initiates the cavity charges and booster charge.

#### M150 (Tail, All-Ways Action)

Bomb.....	10-lb. Smoke M77 (HC)
Functioning .....	Instantaneous
Armed condition.....	When arming pin is out
Fuzes used with.....	None
Arming time.....	Instantaneous
Body diameter, inch.....	1
Over-all length, inches.....	3.5
Material.....	Zinc alloy die castings

**General:** The Tail Fuze M150 is an all-ways action fuze which screws into the tail of the Smoke Bomb M77. This fuze consists essentially of a zinc alloy fuze head, arming pin, striker, striker sleeve, and case, a steel striker pin and safety pin, a Percussion Primer, M26, and a starting mixture enclosed in a zinc cup.

**Operation:** The retaining wire is removed when the fuzed bombs are assembled in the cluster. While the bombs are in the cluster, their proximity holds an arming band with a

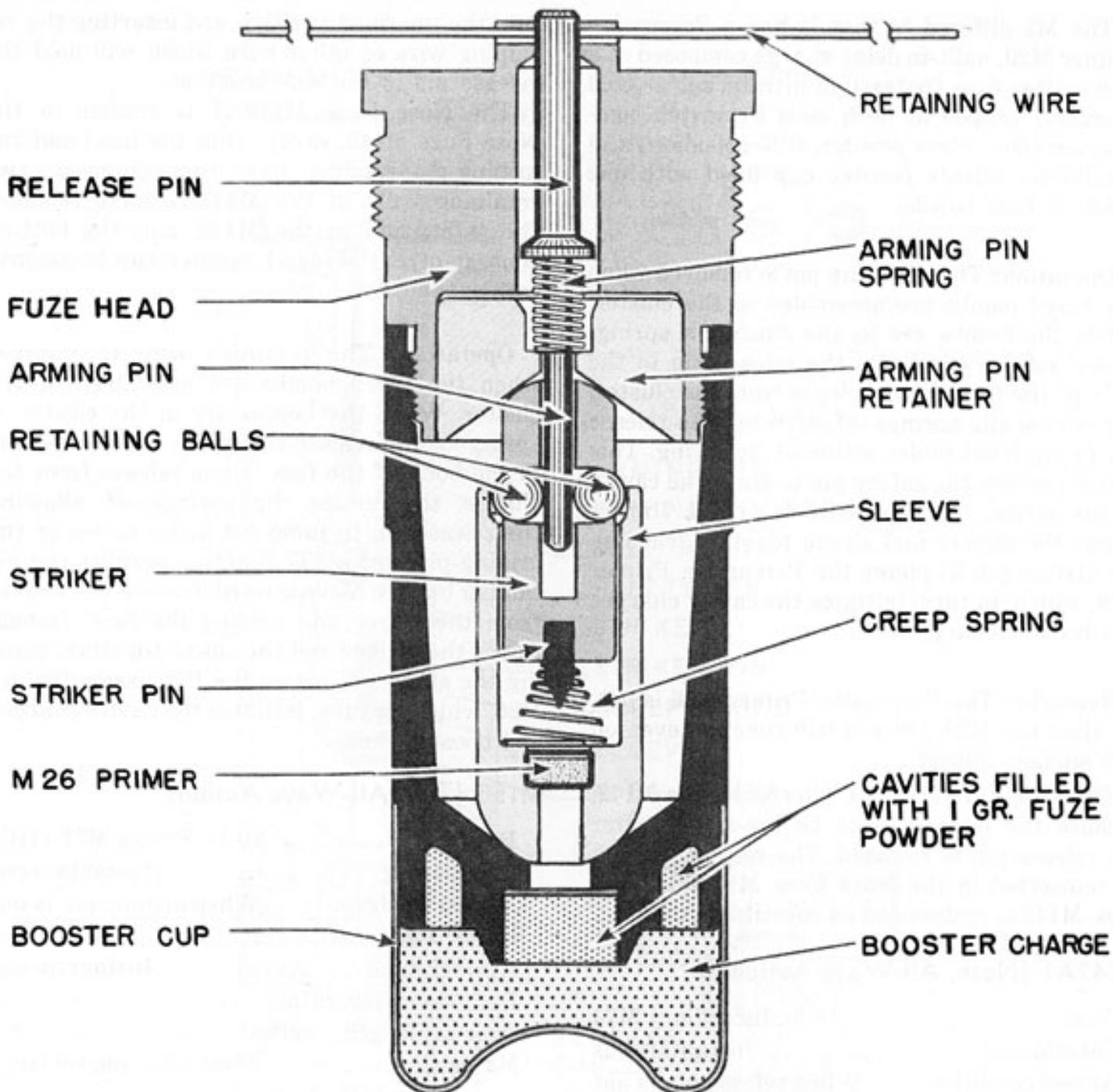


Figure 351. All-Ways Action Nose Fuze M142A1

spring against the head of the fuze, depressing the arming pin. When the bombs are released, the arming pin, together with the arming band, is forced out by the arming-pin spring, permitting the safety pin to enter the cavity in the

striker. Impact forces the striker and sleeve together, causing the striker pin to pierce the Percussion Primer M26, which, in turn, ignites the starter mixture, and subsequently the HC smoke mixture.

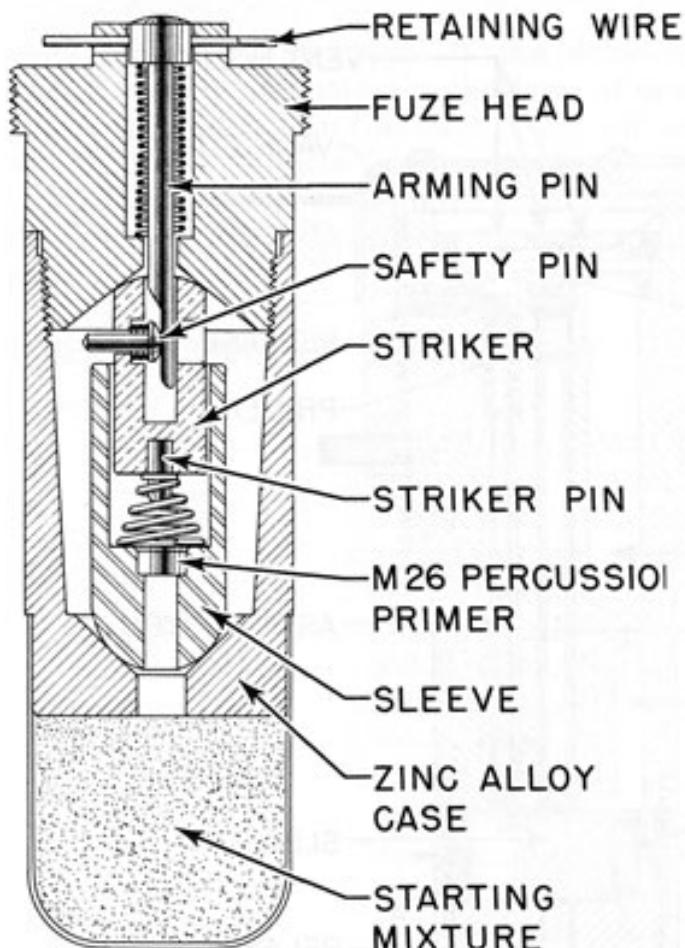


Figure 352. All-Ways Action Tail Fuze M150

### MI49 (Nose Impact or Blast Pressure)

Bombs.....All bombs receiving AN-M103A1  
 Armed condition...12 to 13 vane revolutions;  
 release pin out

Fuzes used with.....None  
 Arming time.....8 to 9 vane revolutions for  
 ejection of release pin; 12  
 to 13 vane revolutions to  
 arm fully

Vane span, inches.....5.25  
 Body diameter, inches.....2.5  
 Over-all length, inches.....7.56  
 Material.....Cadmium- or zinc-plated steel

**General:** The Nose Fuze M149 is a detonator-safe nose fuze. The fuze is designed both for instantaneous action on impact and for air-burst a short distance above the target as a result of the blast wave from the first bomb of a stick of bombs. The first bomb will detonate

on impact, while its blast, if of sufficient intensity, will detonate the second bomb, etc., in the air over the target. For example, if 500-pound bombs are dropped in train at 0.05 second intervals at air speed of 200 m.p.h. (14.7-foot spacing) from 10,000 feet, the burst of the second bomb in air will be at a point approximately seven feet ahead of (horizontal separation) the first bomb and 23 feet above (vertical separation) the first bomb. Other bombs in the stick will function the same distances from the bomb which precedes them.

**Operation:** As the arming wire is withdrawn, the vane cup rotates. After approximately eight or nine turns of the vane cup, the release pin is ejected by its spring. The arming stem rises under pressure of its spring, permitting the detonator slider to align itself below the flash tube. After 12 or 13 turns of the vanes, the vane cup falls off, and the fuze is now fully armed. Bombs fuzed with the Nose Fuze M149 should be released in close train, to take advantage of the air burst feature of the fuze. The first bomb of a stick will detonate on impact with the ground; impact simply snaps the diaphragm to its reversed position, causing the firing pin to strike the primer.

The second bomb of the stick will be detonated by the pressure blast of the first bomb. The blast of the first bomb will cause the diaphragm in the fuze of the second bomb to snap over while the bomb is still in the air a relatively short distance above the target, and thus cause detonation.

Should the diaphragm fail to function for air burst, the fuze can still fire from impact action.

**Remarks:** When installing the M149, check the vane cup to see that it is free to turn. However, do not unscrew the vane cup, as only a few turns are required to arm the fuze. In the armed condition, the fuze must of necessity be very sensitive.

The fuze is equipped with three expansion chambers, so that, as the diaphragm snaps in, it will not be resisted by an air cushion, which

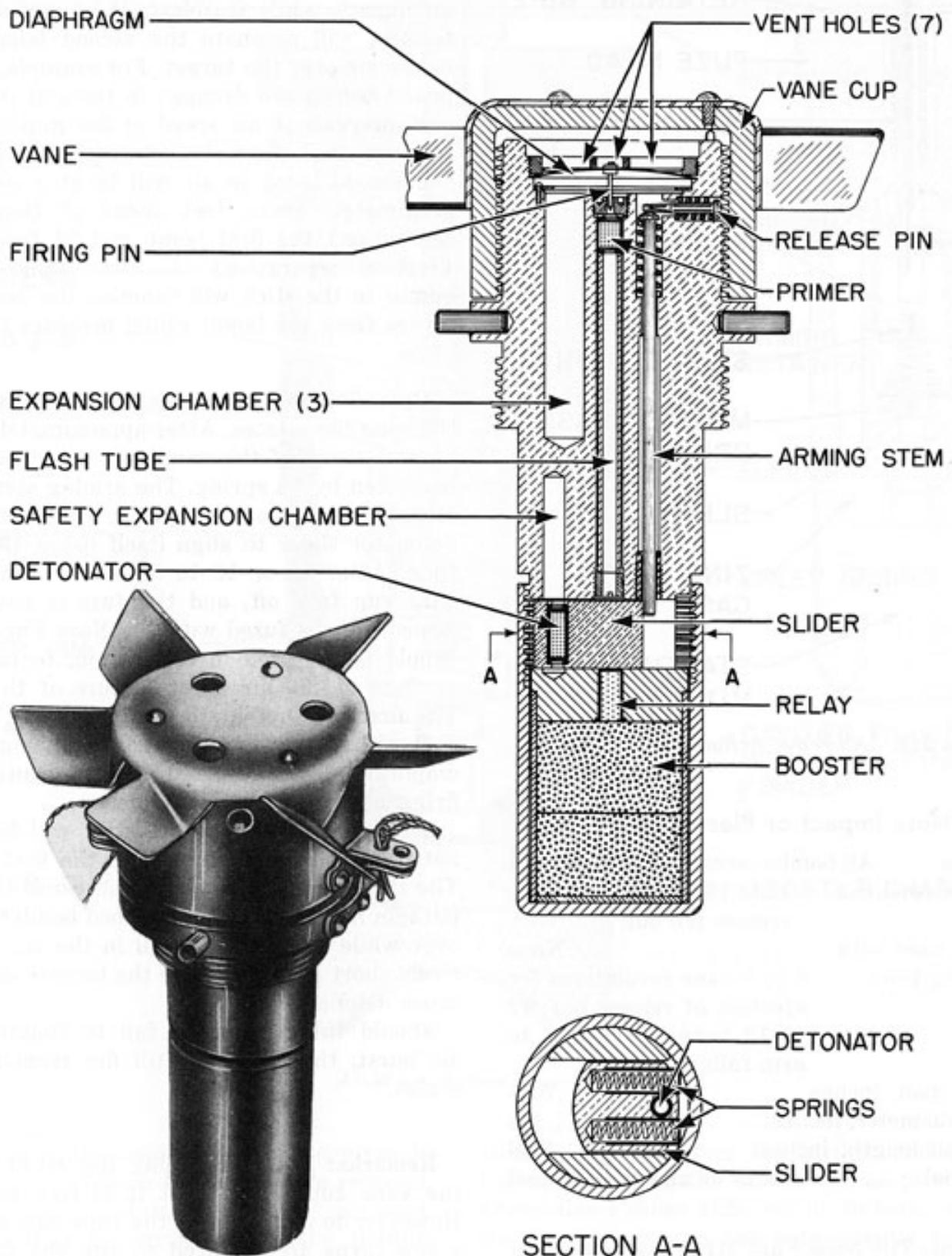


Figure 353. Impact or Blast Pressure Fuze M149

might prevent complete inward movement of the diaphragm.

This fuze is detonator safe. In the unarmed position, the detonator is lined up with the

safety expansion chamber. If the detonator should function prematurely, the force of detonation is dissipated in this cavity, and will not set off the lead-in and booster charges.

Production of the Nose Fuze M149 has been discontinued, since V.T. fuzes offer more assurance of air burst.

### T50E1 and T50E4 (V.T.) (Cancelled)

#### Bombs

T50E1 .....	100-lb. G.P. AN-M30
	250-lb. G.P. AN-M57
	2,000-lb. G.P. AN-M66
	220-lb. Frag. AN-M88
	260-lb. Frag. M81
T50E4 .....	500-lb. G.P. AN-M64
	1,000-lb. G.P. AN-M65
	500-lb. Chem. AN-M78
	1,000-lb. Chem. AN-M79
Functioning.....	10-40 feet above ground
Armed condition .....	If vanes are free to rotate, assumed to be armed
Arming time .....	3,600-ft. min. S.A.T. (some lots of T50E4, 3,100-ft.)
Fuzes used with.....	AN-M1002 series normally; M160 series
Over-all length, inches.....	10.4
Body diameter, inches.....	3.4
Material.....	Steel body, plastic top, metal ring, steel or plastic vanes

**General:** These are V.T. fuzes of the ring type. They are designed to detonate the bomb at a point above the earth which will give effective fragmentation. These ring-type fuzes are especially sensitive to "passing objects", and therefore are useful in defoliating by blast and in getting roof-top bursts in city areas.

At the present stage of development, approximately 80 per cent of the fuzes will operate properly upon approach to the target; up to 15 per cent may function spontaneously after arming but before approaching the target; and 5 per cent will be inoperative.

**Operation:** When the bomb is dropped, the

arming wire is pulled, releasing the spring-loaded vane locking pin, which jumps out, freeing the vanes for rotation. The vanes rotate and drive the electric generator and the worm and spur gear reduction train. After the required number of vane revolutions, the detonator lines up with the booster lead-in and at the same time becomes electrically connected to the firing circuit. The rotor detent in the detonator rotor snaps into a hole in the rotor housing, locking the detonator in the armed position and at the same time withdrawing from the keyway in the arming stem. The vanes continue to rotate at high speed, driving the generator, which, in the meantime, has activated the V.T. element and charged the firing condenser. The fuze is now armed. Upon approach to the target under the proper conditions, the V.T. element activates the firing circuit, which discharges the firing condenser through the electric detonator, initiating the explosive train.

**Remarks:** These fuzes are mechanically interchangeable with the Nose Fuze AN-M103; but are not tactically interchangeable with impact fuzes or with each other. If the V.T. Fuze T50E1 are used in bomb sizes for which the V.T. Fuze T50E4 are specified, very low air bursts will result. The same is true for the reverse transposition.

Some lots of the T50E4 cannot accommodate the Air-Travel Arming Delay M1 because of a much heavier steel ring around the vanes. No delayed arming can be accomplished on these lots of fuzes. If a fuze is found with the vane locking pin gone and the vanes free to rotate, it must be considered armed and should not be used.

Vanes may be either ten-bladed steel vanes or three-bladed plastic vanes, interchangeably.

### M166 (V.T.)

Bombs.....	All bombs receiving Fuze AN-M103A1, except Depth AN-Mks 41, 47, 53, 54
Functioning.....	40-60 feet above ground
Arming time.....	3,600-ft. min. S.A.T.

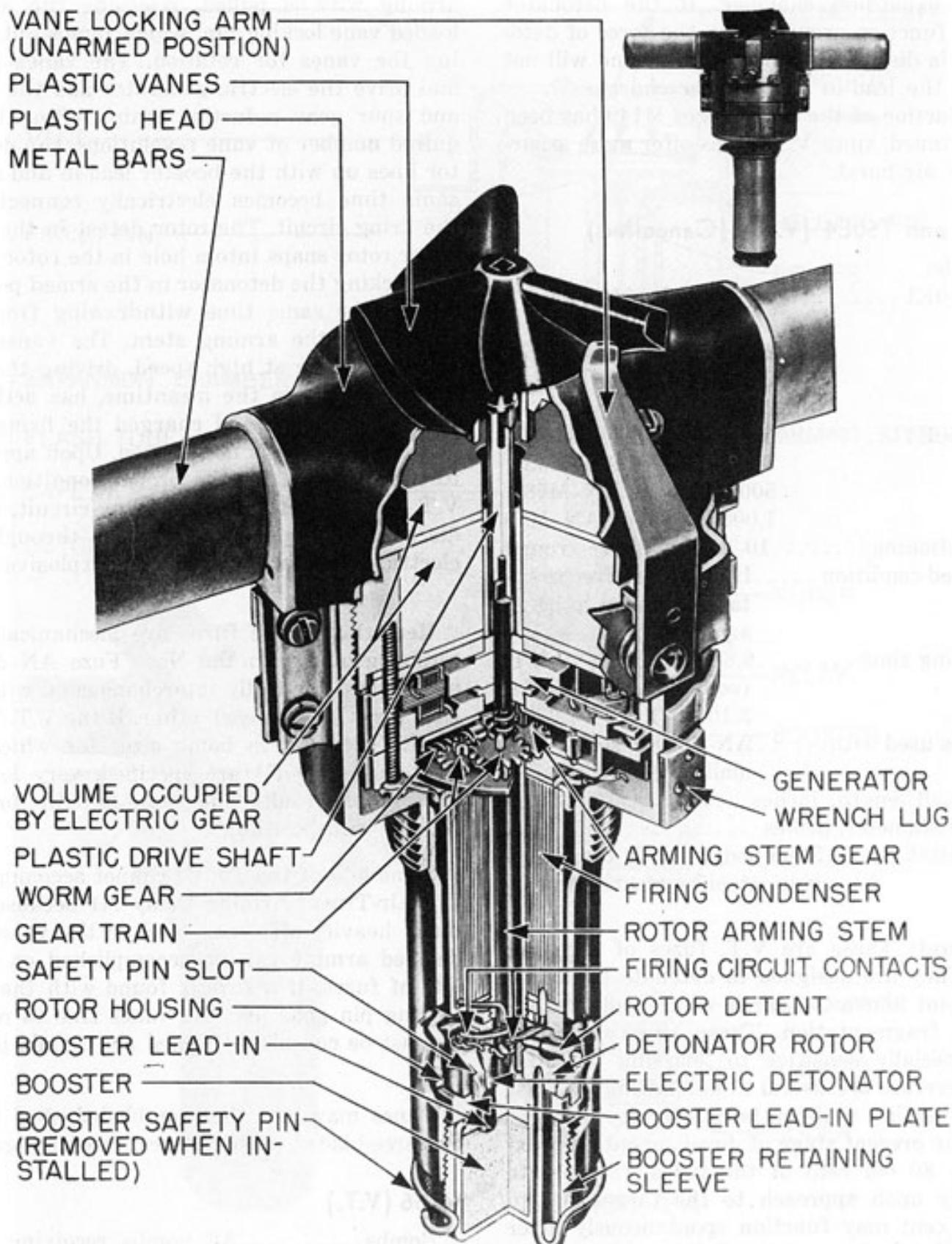


Figure 354. V.T. Fuze M166

Fuzes used with.....	AN-M100A2 series normally; M160 series
Over-all length, inches.....	10.4
Body diameter, inches.....	10.0 (across bars)
Material .....	Steel body, plastic top, two aluminum bars athwartships, plastic vanes

**General:** This is a V.T. fuze of the bar type. This fuze is more sensitive to head-on approach to a target than the ring type and less sensitive to "passing" objects. It can be used interchangeably in any bomb which will take the Nose Mechanical Impact Fuze AN-M103A1 when air burst is desired, except in the depth bombs noted above, where the air stream does not give sufficient velocity to the vanes because of the flat nose. At the present stage of development, approximately 85 per cent of the fuzes will function properly on approach to the target; a small percentage will be inoperative; and the remainder will function spontaneously after arming but before approaching the target.

**Operation:** Similar to the T50 type.

**Remarks:** Arming may be further delayed by use of Air-Travel Arming Delay M1. The device clamps onto a bracket, preventing the vane locking arm from releasing the vanes until the pre-set air travel on the M1 device has been completed.

This fuze has a safety pin running alongside the booster to secure the detonator rotor in the unarmed position. Before installation in a bomb, the safety pin should be removed and reinserted. If it cannot be reinserted, the fuze is armed or partially armed and should be destroyed.

The bars of this fuze should not be used to tighten the fuze into the bomb and should be carefully protected from strain or shock. This fuze is not generally recommended for use in bombs less than 10 inches in diameter, because of the possibility of damaging the bars in "bombing up" the plane and in releasing the bombs. Damage to the bars will cause a malfunctioning of the fuze. A few fuzes of this

type were issued as the T51 with a 4,500-foot minimum S.A.T. but with other characteristics identical to the M166 (T51E1).

Modifications now in development on this fuze provide for a sensitivity control switch which will allow for two settings, and a strengthening of the metal bars so that they will stand 400 pounds of torque and allow their being used as a wrench in inserting the fuze.

### T91 and M168 (V.T.)

#### Bombs

M168 .....	100-lb. G.P. AN-M30 250-lb. G.P. AN-M57 220-lb. Frag. AN-M88 260-lb. Frag. M81 2,000-lb. G.P. AN-M66
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Functioning.....30-60 feet above ground when released below 8,000 feet.

Armed condition.....If vanes are free to rotate, assumed to be armed unless safety pin can be inserted

#### Arming time

T91.....2,000 ft. min. S.A.T.

Fuzes used with.....AN-M100A2 series normally; M160 series

Over-all length, inches.....10.4

Body diameter, inches.....3.4

Material.....Steel body, plastic top, metal ring, steel or plastic vanes

**General:** This is a V.T. fuze of the ring type, similar to the T50E1 series. The V.T. Fuzes T91 differ from the T50E1 group in that they have greater sensitivity and are specially designed to be used for low-level, medium-level, dive, and toss bombing. These ring-type fuzes are especially sensitive to "passing" objects and therefore are useful in defoliating by blast and in getting roof-top bursts in city areas.

At present, about 85 per cent will operate properly upon approach to the target; 5 to 10 per cent may function spontaneously after arming, and 5 per cent will be inoperative. These fuzes have minimum S.A.T. reduced to 2,000 feet for use in low, medium, dive, and toss

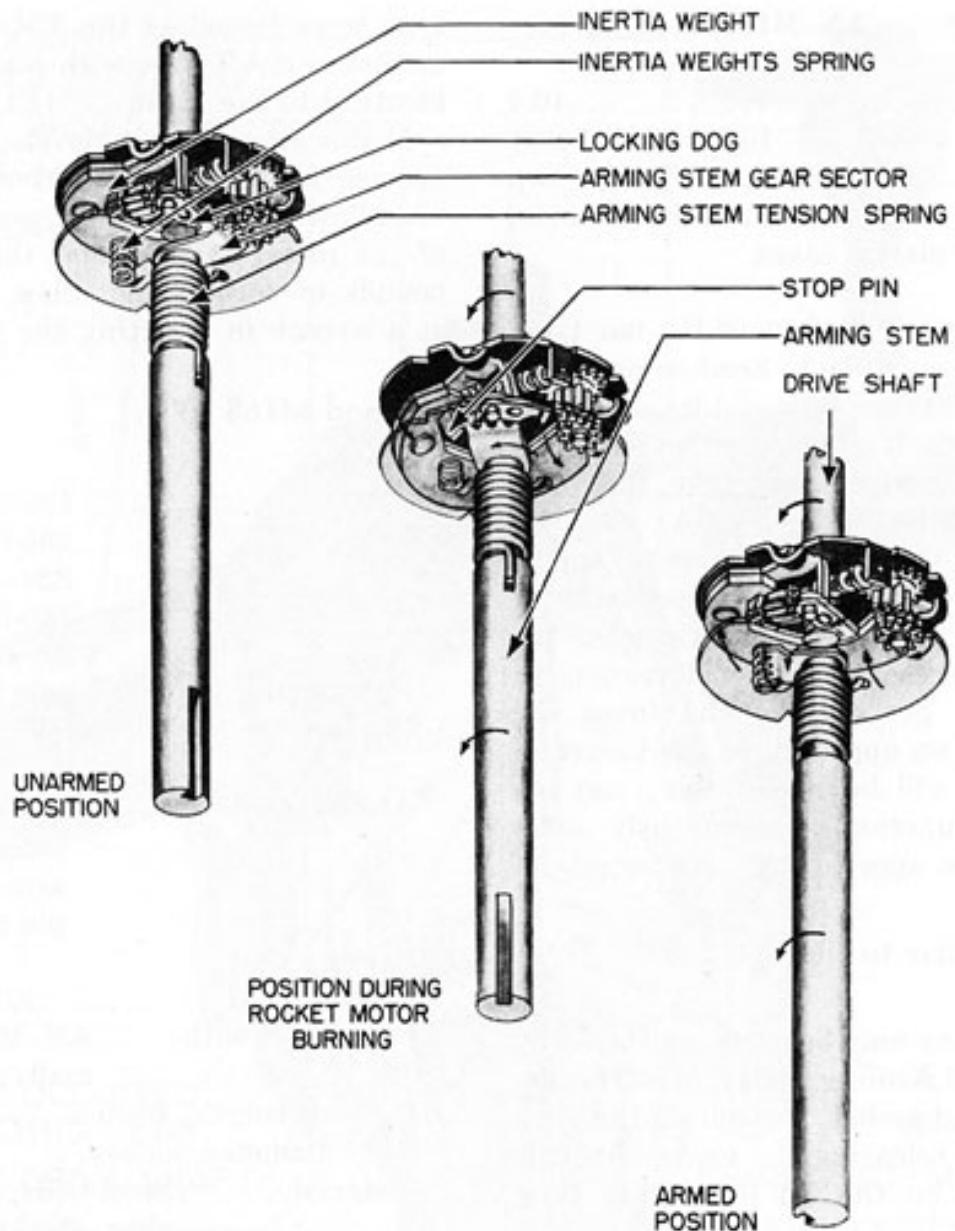


Figure 355. V.T. Fuze M168—Arming Device

bombing. S.A.T. can be extended by use of the Air-Travel Arming Delay M1.

**Operation:** Like the T50 series.

**Remarks:** These fuzes are not to be used for horizontal bomb runs, because the minimum S.A.T. is such that the fuzes may be completely armed when only 250 feet below the carrying aircraft, and early bursts in this position would cause damage to the plane.

#### T82 (V.T.) (Cancelled)

Bombs.....	All bombs receiving Fuze AN-M103A1
Functioning.....	40-60 feet above ground
Arming time.....	3,600 ft. min. S.A.T.
Fuze used with.....	AN-M100A2 series normally; M160 series
Over-all length, inches.....	8.4
Body diameter, inches.....	10.0 (across bars)
Material.....	Steel body, plastic top, two aluminum bars athwartships

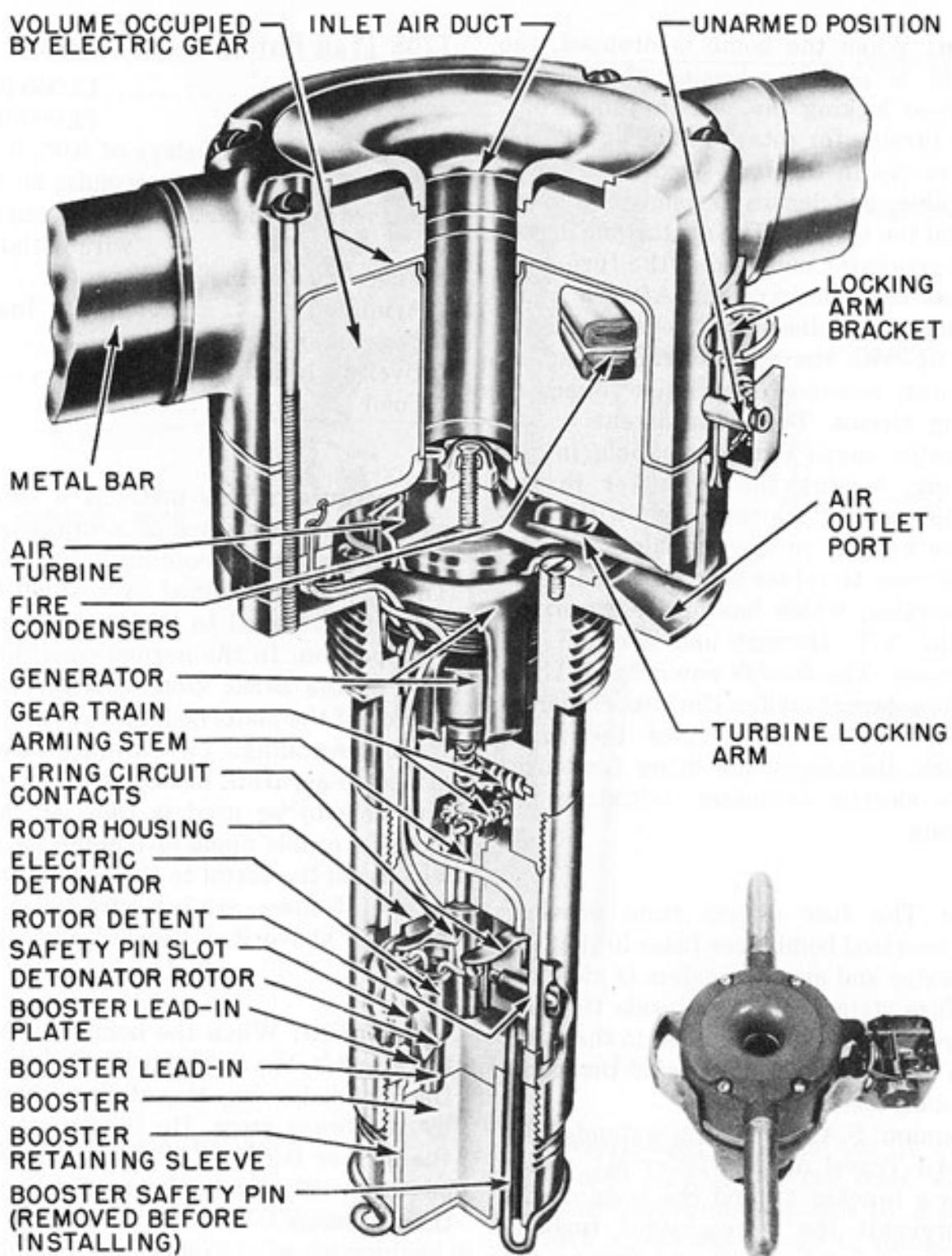


Figure 356. V.T. Fuze T82

**General:** This is a V.T. fuze of the bar type. This fuze, like the V.T. Fuze M166, is more sensitive to head-on approach to a target than the ring type and less sensitive to "passing" objects. It can be used interchangeably in any bomb which takes the Nose Mechanical Impact

Fuze AN-M103A1 when air burst is desired. At the present stage of development, approximately 90 per cent of the fuses will function properly upon approach to the target, and the remainder either will function spontaneously after arming but before approaching a target, or will be inoperative.

**Operation:** When the bomb is dropped, the arming wire is pulled, releasing the spring-loaded turbine locking pin, which jumps out, freeing the turbine for rotation. The air stream enters the cavity in the fuze head, blows over the air turbine, and leaves through the lower ports, around the turbine. The air turbine drives the electric generator mounted in the fuze stem and the gear reduction system. After a minimum number of turbine revolutions, the detonator lines up with the booster lead-in and, at the same time, becomes electrically connected to the firing circuit. The rotor detent in the detonator rotor snaps out into a hole in the rotor housing, locking the detonator in the armed position and at the same time withdrawing from the keyway in the arming stem. The turbine continues to rotate at high speed, driving the generator, which has in the meantime activated the V.T. element and charged the firing condenser. The fuze is now armed. Upon approach to a target under the proper conditions, the V.T. element activates the firing circuit, which discharges the firing condenser through the electric detonator, initiating the explosive train.

**Remarks:** The fuze differs from previous generator-energized bomb nose fuzes in that the entire generator and arming system is mounted inside the fuze stem, which fits inside the fuze well. The firing condenser is carried in that part of the body section which is outside the bomb and will usually be demolished.

The minimum S.A.T. may be extended by use of the Air-Travel Arming Delay M1, which clamps onto a bracket around the body of the fuze and prevents the spring-loaded turbine-locking pin from jumping out and freeing the turbine until the pre-set air travel of the M1 device has been completed.

The booster safety pin in this fuze locks the detonator rotor in the unarmed position. Before installation of the fuze in a bomb, the pin should be pulled and reinserted. If it cannot be reinserted, the fuze is armed or partially armed and should be destroyed.

### T708 (Tail Pistol)

Bombs.....	12,000-lb. G.P. T10
	22,000-lb. G.P. T14
Functioning.....	Delays of 0.05, 0.25, 0.5, 3.0, 11.0 seconds; 30, 60 minutes
Armed condition.....	Safety pin and arming wire withdrawn
Fuzes used with.....	None
Arming time.....	Instantaneous
Body diameter, inches.....	2
Over-all length, inches.....	3-7/8
Color .....	Brass

**Description:** This pistol is a simple impact mechanism consisting of a brass body with a central channel to accommodate a heavy striker. The striker is retained by a small brass cross which is fastened to the top of the striker by a copper pin. In the normal condition, the four tabs of the brass cross extend outward over the top of the pistol body, preventing the striker from descending. Two arming-wire holes are drilled in separate planes at 90° to each other. The hole to be used is that which gives the more favorable angle of pull-off for the arming wire from the pistol to the fusing unit. Parallel to one of these arming wire holes, and about 1/4 inch above it, is located a safety-pin hole.

**Operation:** When the bomb is released from the aircraft, the arming wire is withdrawn from the pistol, leaving the striker supported only by the brass cross. On impact, the inertia of the striker bends the tabs of the brass cross, allowing the striker to move forward and pierce the detonator.

**Remarks:** The use of this pistol is restricted to high-level bombing operations, as there is danger of non-functioning from low altitudes.

Three of these pistols, located 120° apart in the base plate, are used with the 12,000-pound G.P. bomb.

The striker used with this pistol is of the needle type; thus only sensitive-type detonators can be used.

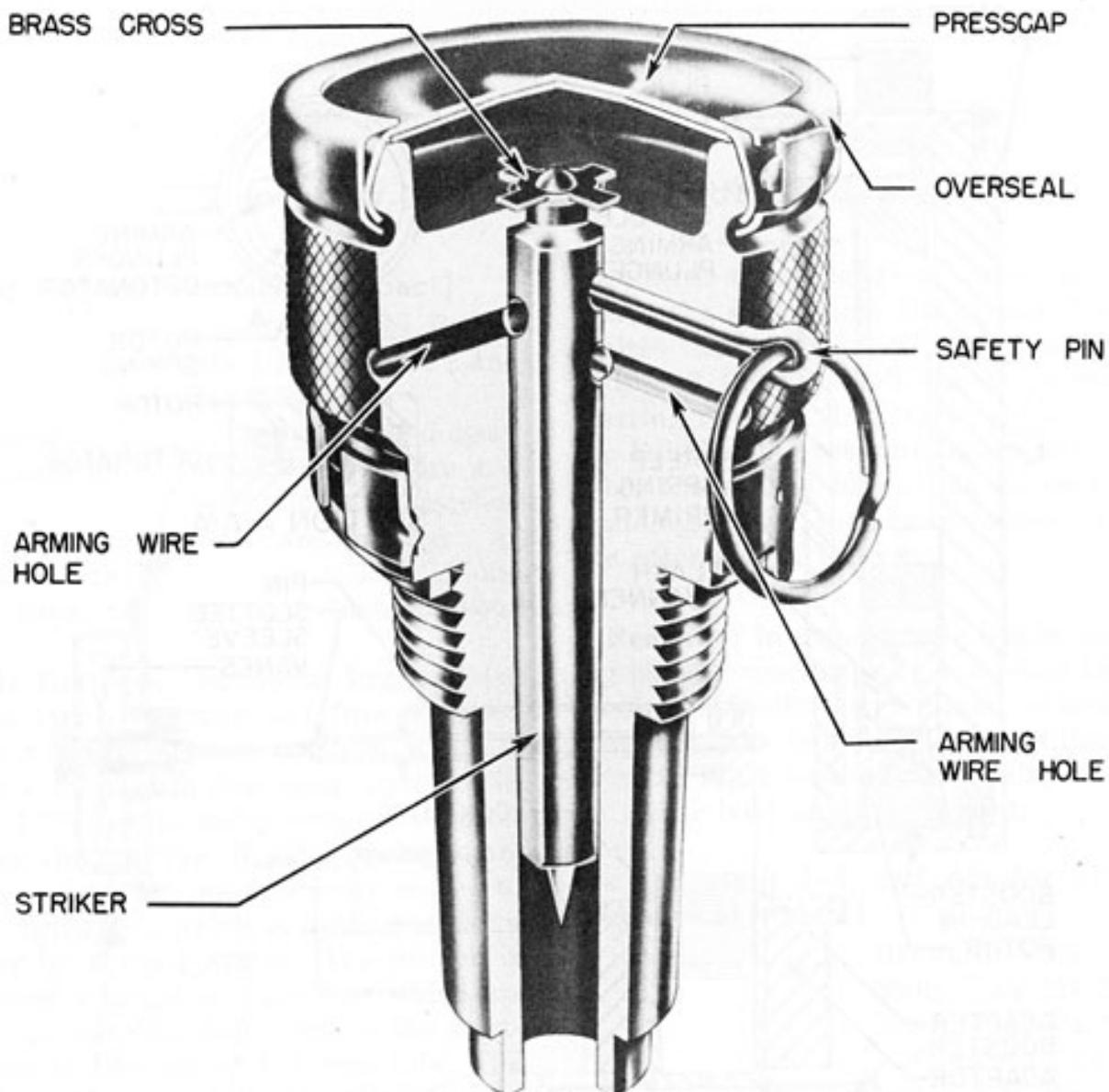


Figure 357. Tail Pistol T708

### T723 (Tail Mechanical Impact)

Bombs.....12,000-lb. T10; 22,000-lb.  
T14 (3 T723's in tail)  
Functioning.....Delays to be determined in  
tests; will depend on  
mission  
Armed condition.....When arming spindle  
is out of fuze; no  
external evidence

**General:** The Tail Mechanical Impact Fuze T723 is designed as a replacement for the Pistol T708 (British No. 58) in the G.P. Bombs T10 and T14, to provide air-travel arming.

**Description:** This fuze has its windmill vanes mounted outside the tail cone, and connected to the fuze arming spindle by a slotted sleeve, which allows the spindle to thread out into the slot. The fuze is detonator safe, the detonator being housed in a rotor which lines up after the arming spindle is out of the fuze. A larger auxiliary booster is used with this fuze, because of the size of the bomb.

**Operation:** The shipping plug is removed when the fuze is inserted in the bomb. Release from the plane pulls the arming wire and allows the vanes to start rotating. They thread

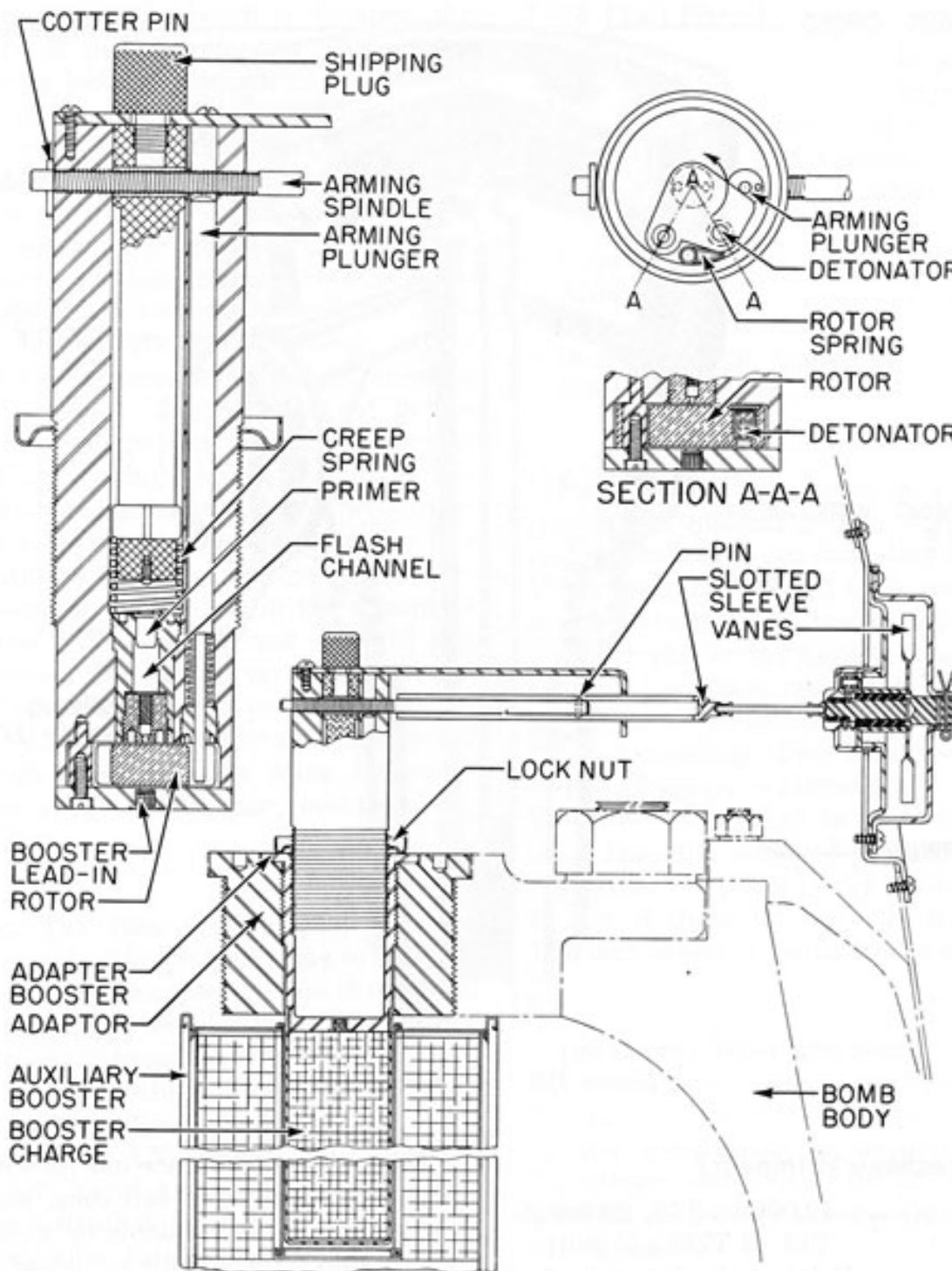


Figure 358. Tail Fuze T723

the arming spindle out, the spindle's connecting pin riding up the groove in the slotted sleeve. When the spindle is out, the spring-loaded plunger moves up, freeing the rotor, which is turned by its spring until the detonator is in position under the delay pellet. The

rotor spring then acts as a lock to hold it in position. The fuze is now armed, and on impact the heavy inertia weight will overcome the creep spring and strike the primer, which will set off the delay pellet and then the detonator.

## NAVY-DESIGNED BOMB FUZES

**Mk 3 Mod 1 (Nose Mechanical Impact)**

Bombs.....	Floating Smoke Bombs Mk 1 Mods 1 and 2 and Mk 3 Mod 0
Functioning .....	18-second delay
Armed condition....	When arming wire and spring-loaded horseshoe collar are removed
Fuzes used with.....	None
Arming time.....	Instantaneous

**General:** The Nose Mechanical Impact Fuze Mk 3 Mod 1 is a water impact fuze designed as an integral part of each bomb in which it is used. It consists of a fuze body, mounted in the nose of the bomb, and a vent-tube assembly running through the HC filler of the bomb. A washer in front of the fuze body serves to retain the firing pin, which is held away from the primer by a creep spring. The primer is mounted over a length of time fuse which extends to a quick match increment in the starting mixture at the rear of the vent tube. The after end of the vent tube is sealed with a blow-out disc.

The Adapter Mk 1 is attached to the protruding fuze body to ensure fuze functioning on either water or land impact. The adapter, which is attached to the protruding body by three set screws, consists of a cup-shaped head mounted on a freely moving plunger. The plunger, which is held in its guide by two stop screws, will transmit any blow on the cup to the firing pin. A spring-loaded horseshoe collar is mounted beneath the cup to hold the plunger away from the firing pin.

**Operation:** Upon release of the bomb, the arming wire is pulled, releasing the spring-loaded horseshoe collar, which falls away from the adapter. The fuze is then armed. On im-

pact with either land or water, the plunger drives the striker into the primer. The primer ignites the time fuse, which burns for 18 seconds and then sets off the quick match and starting mixture. The starting mixture ignites the HC filler. As pressure builds up in the vent tube, the seal is blown out. Since the bomb floats nose-down, the smoke passes out through the after end of the vent.

**Remarks:** In using smoke bombs for screening landing operations, it was found that a fair number of bombs were dropped on land and the fuze did not function. The addition of the Adapter Mk 1 ensured functioning of the fuze on either land or water impact.

**Mk 219 Mods 2-4, and AN-Mk 219 (Nose Mechanical Impact)**

Bombs.....	100-lb. G.P. Mk 4 Mods 30-lb. Frag. Mk 5 500-lb. G.P. Mk 12 Mods 1,000-lb. G.P. Mk 13 Mods 500-lb. L.C. Mk 9 1,000-lb. L.C. Mk 9 100-lb. Chemical Mk 42 All types of depth bombs
Functioning .....	Instantaneous
Armed condition....	When striker flange has risen more than 0.31 in. from outer sleeve, and arming wire is gone
Fuzes used with.....	Mk 223 in G.P. bombs, or Mks 224, 234, 229, or AN- Mk 230 in depth bombs
Arming time.....	170 vane revolutions
Vane span, inches.....	4.75 (4 vanes)
Body diameter, inches.....	2.75
Over-all length, inches.....	5.5
Material.....	Steel, aluminum alloy, and brass parts

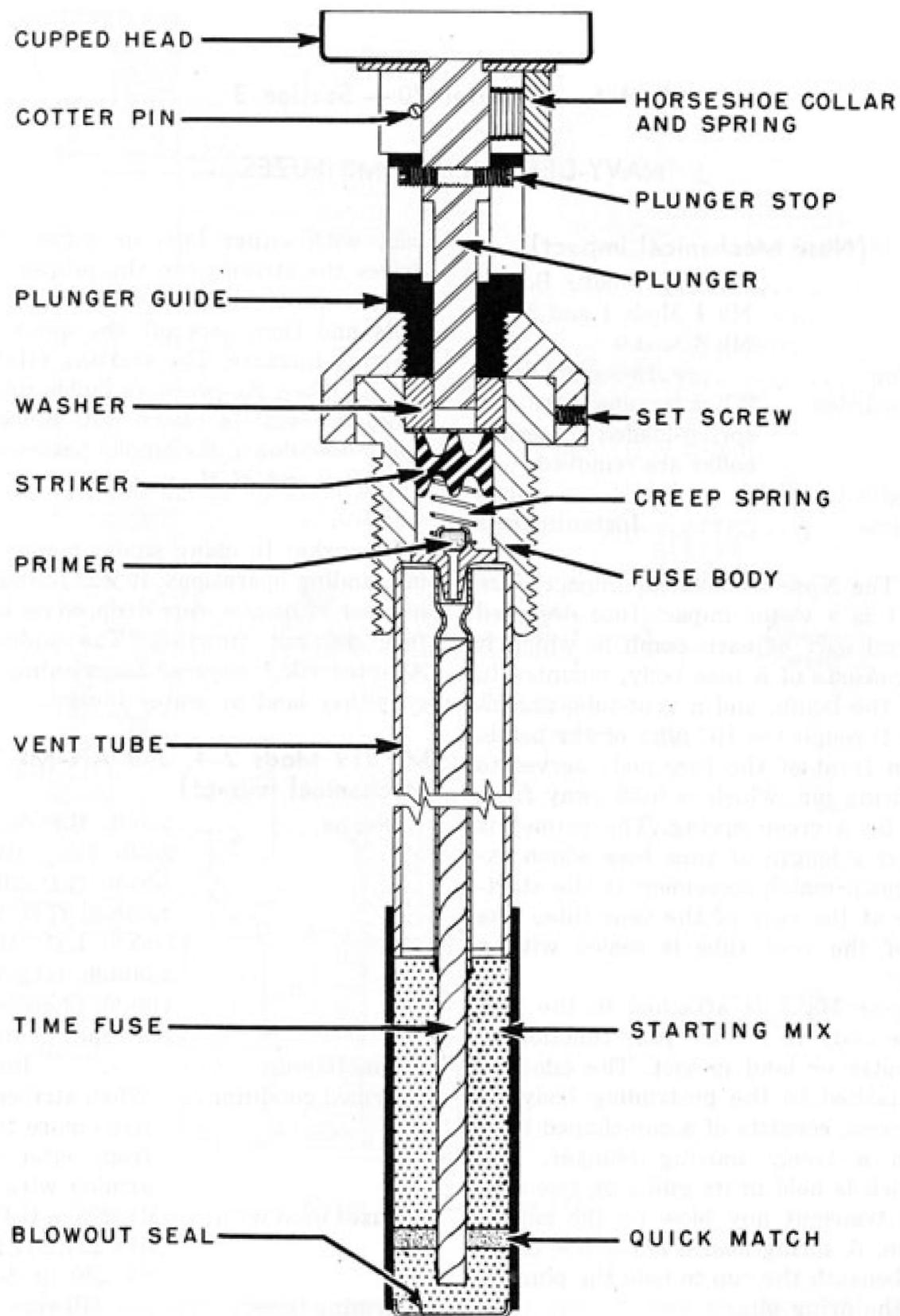


Figure 359. Nose Fuze Mk 3 Mod 1

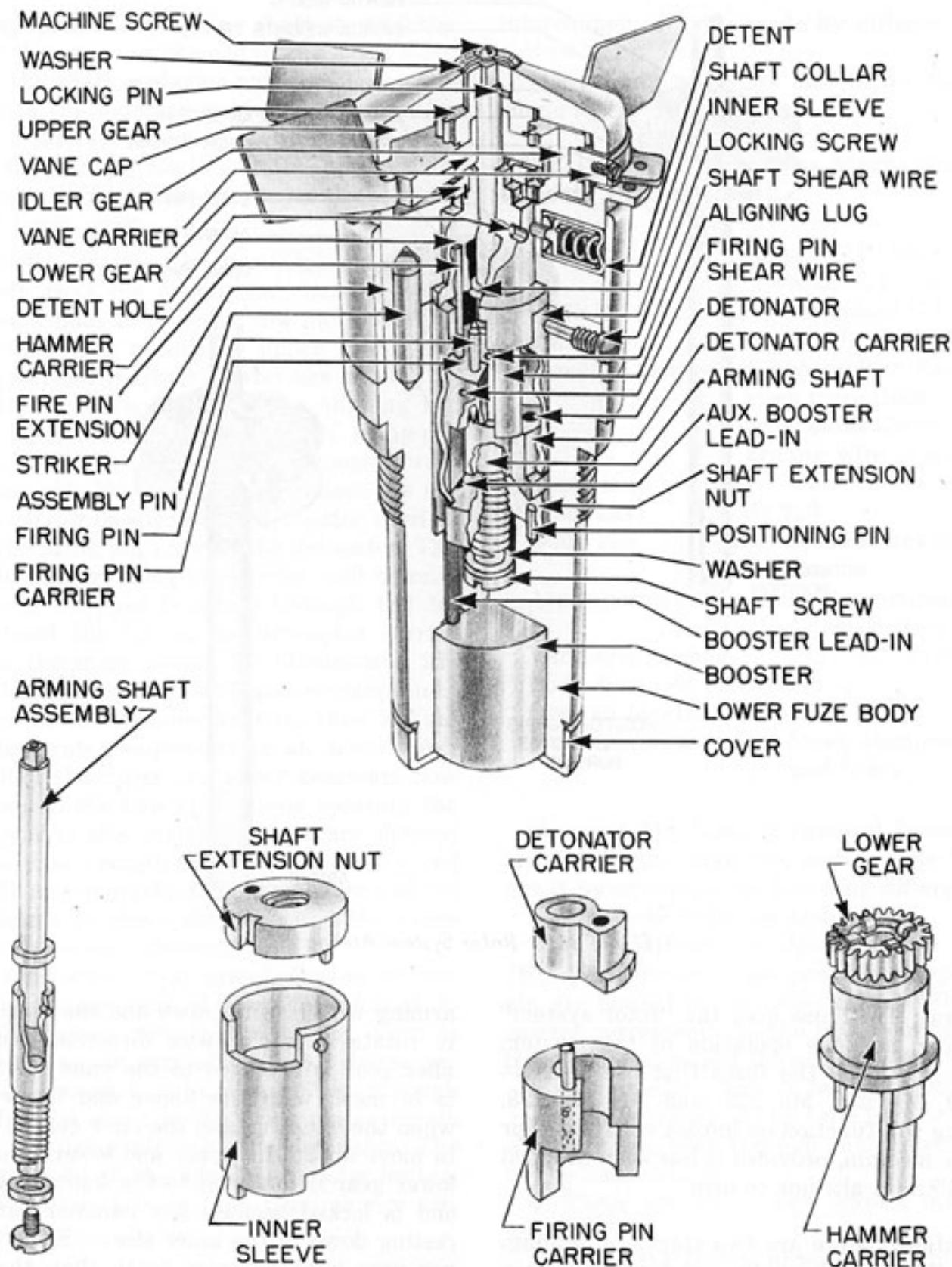


Figure 360. Nose Fuze AN-Mk 219

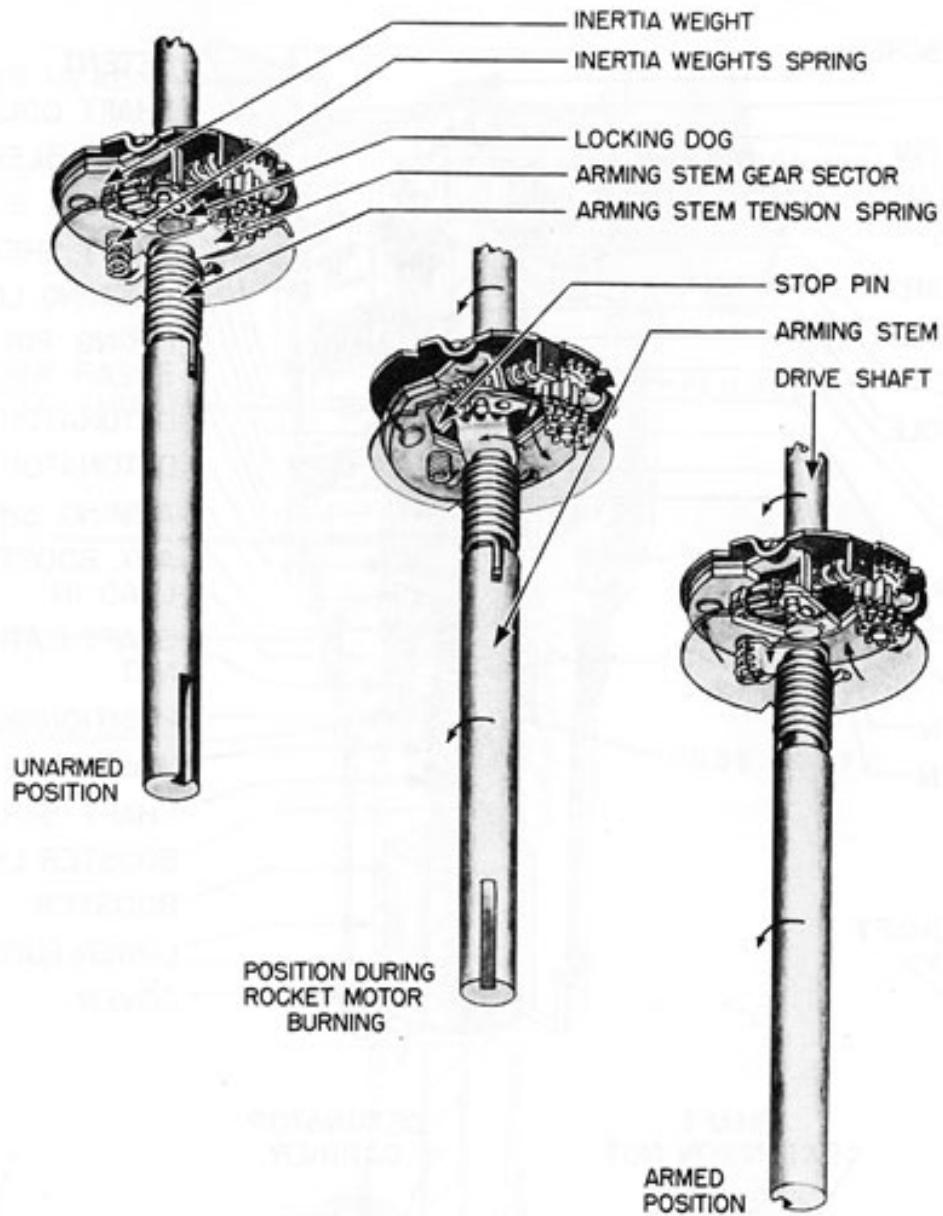


Figure 361. Rotor System Arming

**General:** This fuze uses the "rotor system" of arming, and the operation of this system is the same in all the fuzes that use it: AN-Mk 219, Mk 221, Mk 223, and AN-Mk 228. This fuze will function on impact with water or a denser medium, provided it has been dropped from sufficient altitude to arm.

**Operation:** There are two stages of arming. During the first stage, the upper gear is free to rotate and the lower gear is held stationary. During the second stage, the lower gear is free to rotate and the upper gear is held stationary.

**FIRST STAGE:** As the bomb is dropped, the

arming wire is withdrawn and the vanes begin to rotate in a clockwise direction. Since the idler gear is attached to the vane carrier and is in mesh with the upper and lower gears, when the vanes rotate, the idler gear is caused to move about the upper and lower gears. The lower gear is attached to the hammer carrier, and is locked because the hammer carrier is resting down in the inner sleeve. Since the upper gear has one more tooth than the lower gear, the upper gear will rotate in a clockwise direction, one tooth for every complete revolution of the idler gear. The upper gear is positively attached to the arming shaft, and, in

rotating, threads the arming shaft up until the head of the screw on the end of 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, freeing the lower gear.

**SECOND STAGE:** The lower gear has one less tooth than the upper gear; hence, as the pinion continues to revolve (now meshing with the teeth of the stationary upper gear), 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.

**Remarks:** The early Mk 219, Mods 2, 3, and 4 are identical to the AN-Mk 219. The different Mods merely indicated the manufacturer of the fuze. This was important only in that slight differences in the manufacture prevented the

interchange of parts made by different manufacturers.

The internal parts are held in the fuze by a single master locking screw.

### Mk 221 and Mk 239 (Nose Mechanical Impact) (Obsolescent)

#### Bombs

Mk 221.....	500-lb. G.P. Mk 12
	1,000-lb. G.P. Mk 13
Mk 239.....	AN-standard G.P. bombs
Functioning.....	0.01 second delay
Armed condition..	When striker flange has risen more than 5/16 inch from outer sleeve, and arming wire is gone

#### Fuzes used with

Mk 221.....	Mk 223
Mk 239.....	AN-M100 series in AN-M G.P. bombs

Arming time.....	Approximately 150 revolutions
------------------	-------------------------------

Vane span, inches.....	5.3 (four vanes)
Body diameter, inches.....	2.75
Over-all length, inches.....	8.5
Material.....	Steel, aluminum alloy, and brass

**General:** The Nose Mechanical Impact Fuze Mk 221 is essentially the same as the Mk 219, but it incorporates the following differences:

1. The body is longer and larger.
2. It incorporates a delay of 0.01 second. The delay element and percussion-type firing pin are housed in the delay carrier. The delay carrier corresponds to the firing-pin carrier in the Nose Mechanical Impact Fuze Mk 219.
3. A protecting cap is over the head. The vanes are screwed to the vane carrier by four screws which pass through the protecting cap to the vane carrier.
4. There are three lock screws instead of one.
5. When the fuze is armed, a lock pin in the floor of the fuze body falls through an opening in the shaft extension nut, locking the rotor and the delay carrier to the shaft extension nut, and thus preventing the parts from getting out of line before impact.

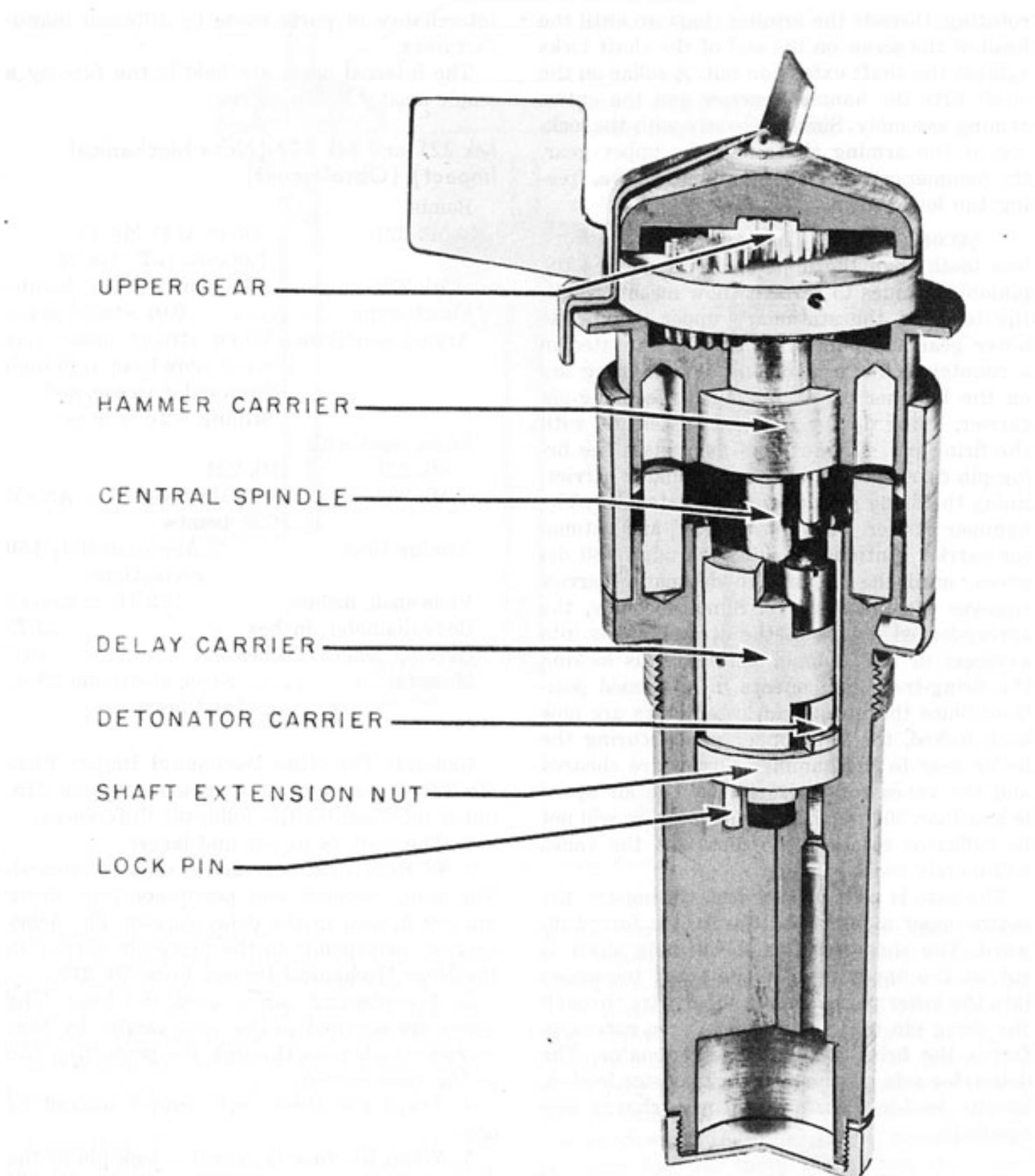


Figure 362. Nose Fuze Mk 221

6. The central spindle has a shear collar and a guide pin which permit the central spindle to

telescope. The Nose Mechanical Impact Fuze Mk 239 is a Fuze Mk 221 modified by reducing

the diameter of the fuze (extending from the booster cup to the fuze threads) from 1.875 inches (Mk 221) to 1.59 inches. The Mk 239 was designed to utilize present stocks of Fuze Mk 221 in AN-standard G.P. bombs.

**Operation:** The operation of the Mk 221 and Mk 239 is the same as the operation of the AN-Mk 219.

**Remarks:** The delay element consists of a primer, a delay pellet of black powder, and a special detonator of fulminate of mercury; the detonator consists of fulminate of mercury mixture; and the auxiliary booster lead-in, booster lead-in, and booster consist of tetryl.

The Mk 221 will fit into the nose of the depth bomb, but the 0.01 second delay may allow the case of the bomb to be so damaged that a low-order detonation may result. Therefore, it is not recommended that the Mk 221 be used with the depth bomb.

### Mk 223 (Tail Mechanical Impact) (Obsolescent)

Bombs.....	500-lb. G.P. Mk 12 and Mods;
	1,000-lb. G.P. Mk 13
Functioning.....	0.01 second delay
Armed condition.....	When striker has risen over 5/16 inch above outer sleeve, as seen through window in aluminum casing
Fuzes used with.....	AN-Mk 219 or Mk 221
Arming time.....	150 vane revolutions
Vane span, inches.....	5.25 (16 vanes, unpainted)
Body diameter, inches.....	3.25
Over-all length, inches.....	16.36
Material.....	Cast-aluminum case; fuze parts are steel, aluminum alloy, and brass

**General:** The fuze is essentially a Mechanical Impact Fuze Mk 221 with an external protective bottle-shaped casing of aluminum, a vane extension shaft, and 16 vanes instead of four. This casing screws onto the fuze body and is secured by two lock screws. The lower end of

the vane shaft has a flattened surface and fits into a slot in the top of the fuze cap, which is attached by screws to the pinion carrier. The fuze has a delay element in the delay carrier similar to the Mk 221; and a celluloid window in the protective casing permits inspection of the fuze to determine whether or not it is in the armed condition.

**Operation:** When the arming wire is withdrawn, the arming vanes and the vane shaft rotate. The lower end of the vane shaft engages the cap, which rotates and revolves the pinion around the inner gears, operating the reduction gearing. The alignment of the firing-pin extension, delay carrier (firing-pin carrier in AN-Mk 219), and detonator is similar to that of the Nose Mechanical Impact Fuze AN-Mk 219.

**Remarks:** The central spindle in this fuze does not telescope, but the collar on the central spindle which supports the hammer carrier is held by a shear wire which breaks on impact as the cap, vane carrier, and striker move forward under the influence of inertia.

The delay element consists of a primer, a delay pellet of meal "D" black powder, and a special detonator of fulminate of mercury mixture; and the auxiliary booster lead-in, booster lead-in, and booster consist of tetryl.

The moving parts housing the firing train are held in the fuze by three locking screws.

### AN-Mk 228 (Tail Mechanical Impact)

Bombs.....	1,000-, 1,600-lb. A.P. bombs
Functioning.....	0.08 second delay
Armed condition.....	When striker flange has risen more than 5/16 inch above outer collar, as seen through celluloid window
Fuzes used with.....	None
Arming time.....	150-160 vane revolutions
Vane span, inches.....	5.25 (16 vanes, painted red)
Body diameter, inches.....	3.15
Over-all length, inches.....	16.36

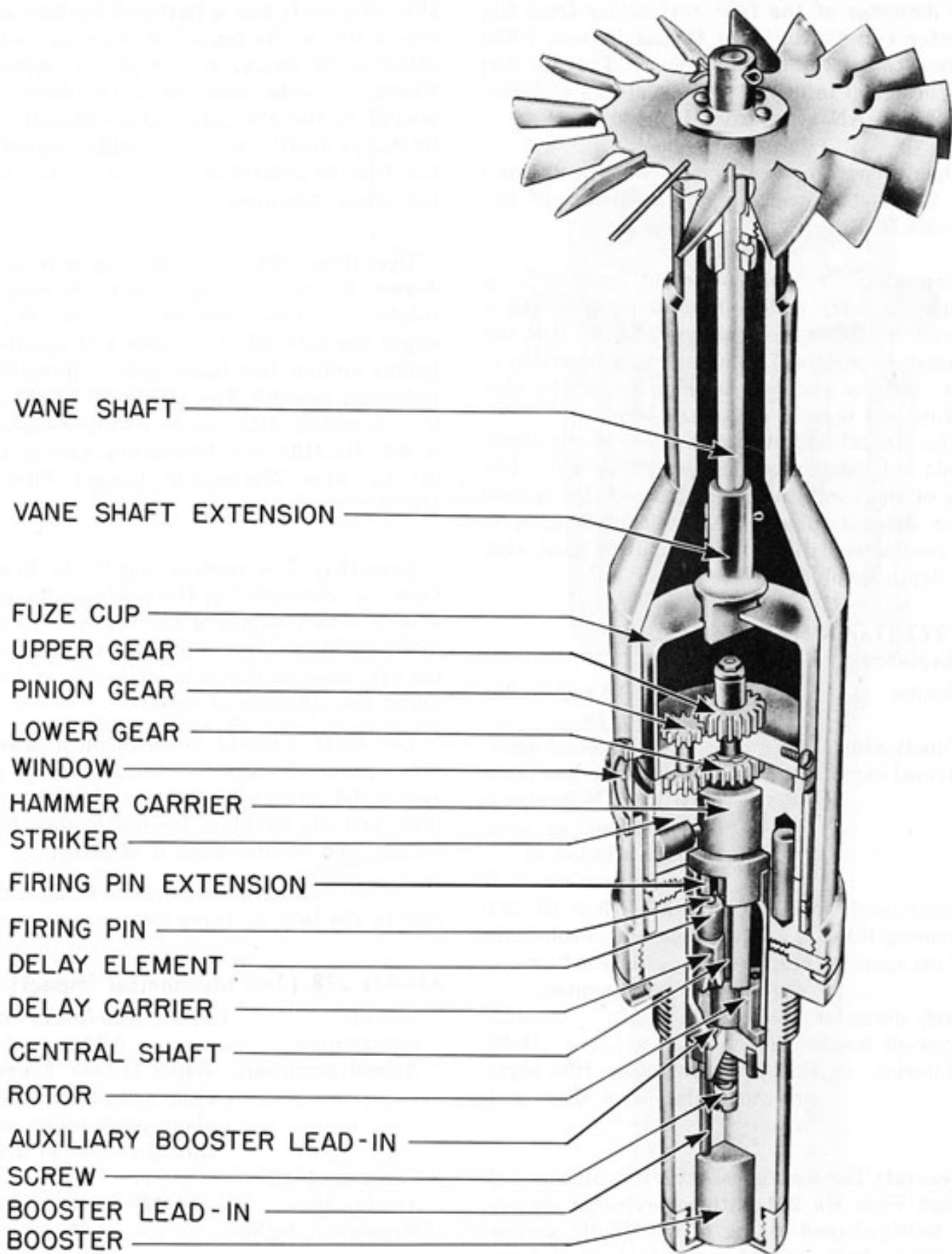


Figure 363. Tail Fuze Mk 223

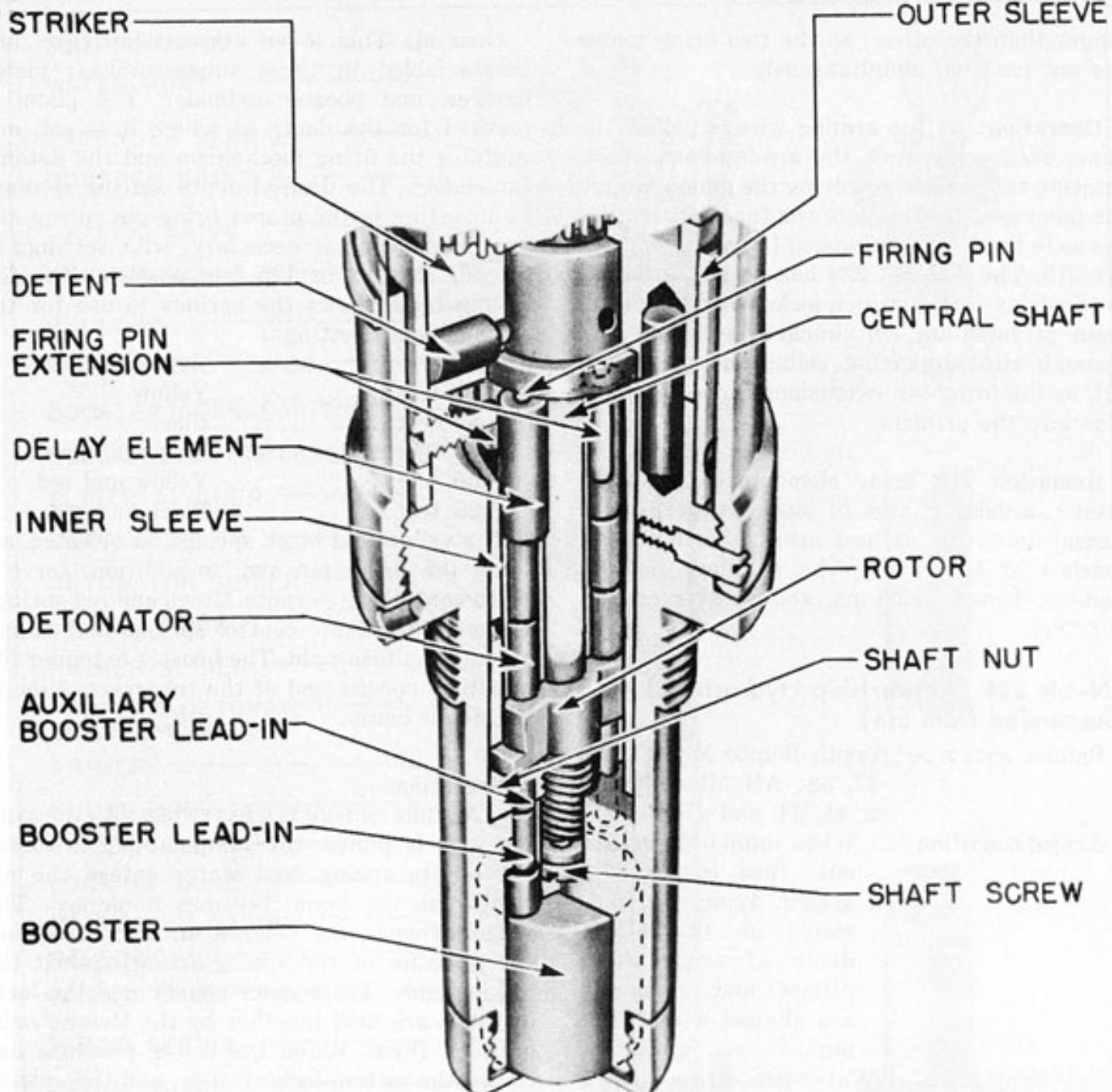


Figure 364. Tail Fuze AN-Mk 228

Material.....Steel, aluminum alloy, and brass; the brass parts are tin plated and some steel parts are cadmium plated.

**General:** This fuze is similar in design and operation to the Tail Mechanical Impact Fuze Mk 223, and is almost identical in external appearance. It is distinguished from the Mk 223 in that it has red vanes. The AN-Mk 228 has

the following distinctive internal features: It has two separate explosive trains and a delay of 0.08 second; two firing-pin extensions are fitted on the lower end of the hammer carrier. Two delay elements and two delay firing pins are housed in the delay carrier. The detonator carrier has two detonators, and the shaft extension nuts contain two auxiliary booster lead-ins which are aligned with two booster lead-ins in the fuze body. One firing pin is slightly

longer than the other; so the two firing trains are not initiated simultaneously.

**Operation:** As the arming wire is pulled, the vanes rotate and turn the arming-vane shaft, rotating the cap and revolving the pinion around the inner gears. Arming of the fuze then continues as in the Nose Mechanical Impact Fuze AN-Mk 219. The AN-Mk 228 has an added detent in the delay carrier which locks when the firing train is lined up. On impact, a shear wire through the supporting collar and spindle is cut, as the firing-pin extensions force the firing pins into the primers.

**Remarks:** The delay elements consist of a primer, a delay charge of black powder, and a special detonator of lead azide; the detonator consists of lead azide; the auxiliary booster lead-ins, booster lead-ins, and booster consist of tetryl.

#### AN-Mk 224 (Athwartship Hydrostatic) (Suspended from use)

Bombs.....: Depth Bombs Mks 17, 29, 37, 38; AN-Mks 17 Mod 2, 41, 44, and 47

Armed condition ....: When jump-out pins are out, fuze is partially armed. Arming is completed at 12-15-foot depth of water when primer and detonator are aligned with firing pin.

Functioning.....: Water pressure at depth set for 25, 50, 75, 100, or 125 feet of water

Fuzes used with....: AN-M103, AN-Mk 219, or Mk 221 in nose, and Mk 229 in tail in 650-lb. depth bombs

Over-all length, inches....: Pistol assembly—6.9; booster extender assemblies—9.9

Body diameter, inches.....: 3.6  
Material.....: Bronze, brass, steel, and aluminum

**General:** This is an athwartship fuze, and is assembled in three subassemblies: pistol, booster, and booster extender. The pistol is marked for the depth at which it is set, and contains the firing mechanism and the detonator sliders. The desired depth setting is made by inserting in the proper firing-pin spring and auxiliary spring if necessary, with settings of 25, 50, 75, 100, or 125 feet possible. The following table shows the springs to use for the various depth settings:

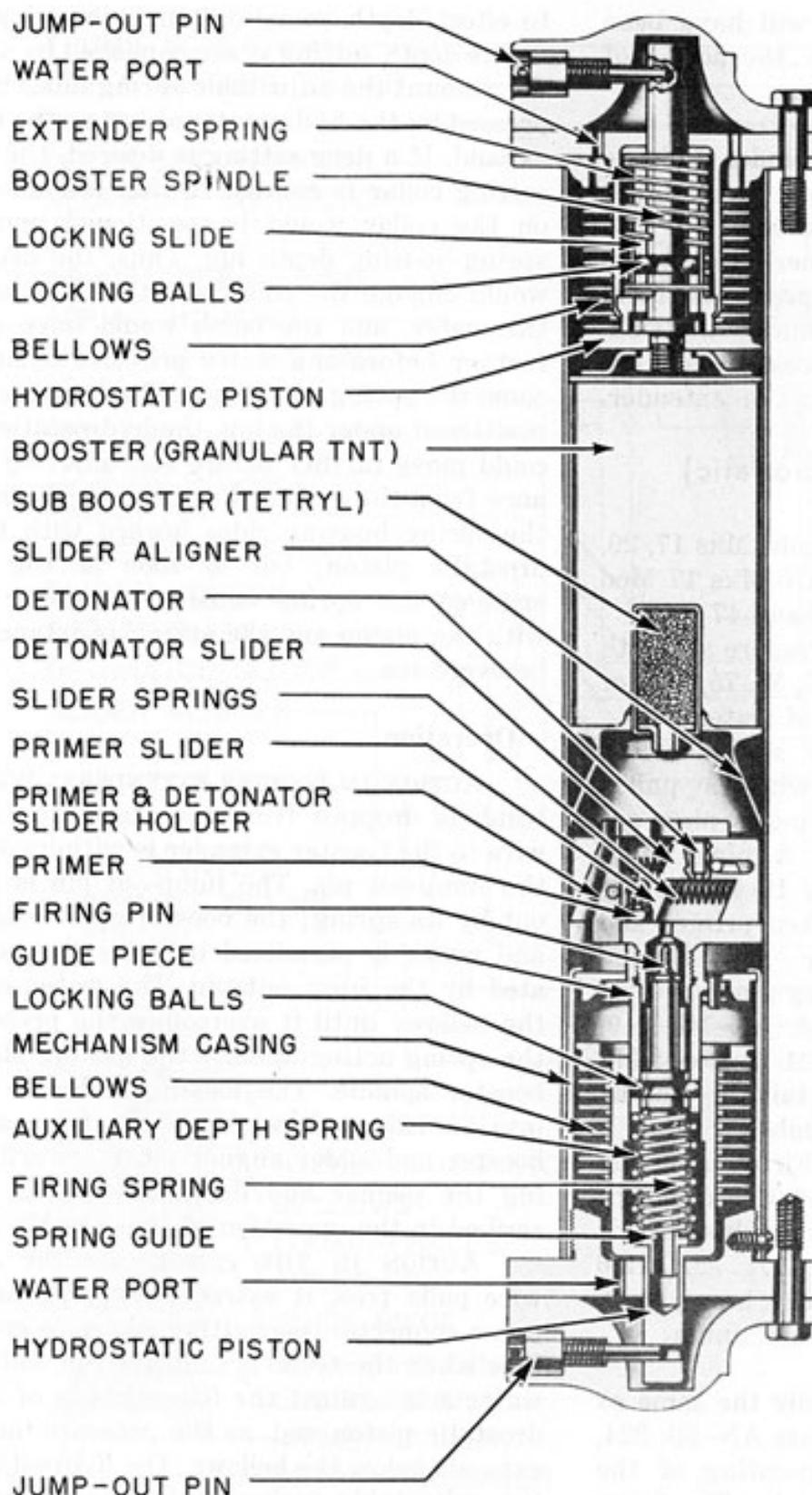
DEPTH	SPRING COLOR
25 feet.....	Yellow
50 feet.....	Black
75 feet.....	Black and green
100 feet.....	Yellow and red
125 feet.....	Black and red

The yellow and black springs, as selected, actuate the firing pin and, in addition, serve a depth-controlling purpose. Green and red springs are auxiliary depth-control springs and do not actuate the firing pin. The booster extender fits into the opposite end of the transverse tube in the depth bomb.

#### Operation

**ACTION IN BOOSTER EXTENDER:** As the arming wire is pulled, the jump-out pin is forced out by its spring, and water enters the assembly as the bomb becomes immersed. The water expands the bellows until it overcomes the pressure of the spring acting against the locking slide. The booster spindle and the locking slide are held together by the locking balls between them. When the water pressure has forced the piston, locking slide, and the spindle inward sufficiently for the locking balls to slip into the enlarged groove in the fuze body, the entire booster extension is free to move the remaining inch toward the pistol. The hollow-cone shaped slider aligner, bearing inward against the L-shaped primer and detonator sliders, forces them inboard against their springs, thus lining up the explosive train.

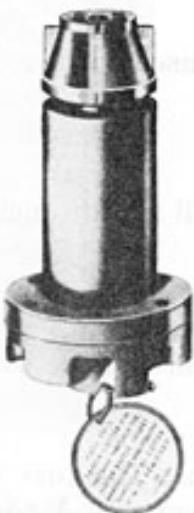
**ACTION IN PISTOL:** As the water pressure increases and overcomes the tension of the firing and auxiliary depth springs in the piston, the bellows extend and the base of the hydrostatic piston moves down over the firing pin



BOOSTER EXTENDER



BOOSTER



PISTOL

Figure 365. Athwartship Hydrostatic Fuze AN-Mk 224

guide piece. This action compresses the firing and auxiliary depth springs; and, when the enlarged part of the hydrostatic piston comes op-

posite the locking balls, they are forced out by the spring pressure, freeing the firing pin to be forced against the primer. The L-shaped

primer and detonator sliders will have been lined up with the firing pin by the action of the slider aligner.

**Remarks:** If the booster extender fails to function properly and force the slider aligner over the primer and detonator sliders, the fuze cannot function. The slider aligner which holds them in the armed position is prevented from returning to the unarmed position by the locking slide, which locks after the locking balls are forced out from the spindle in the extender.

**AN-Mk 234 (Athwartship Hydrostatic)  
(Suspended from use)**

Bombs.....	Depth bombs Mks 17, 29, 37, 38; AN-Mks 17 Mod 2, 41, 44, and 47
Functioning.....	Water pressure at depth set for 25, 50, 75, 100, or 125 feet of water
Armed condition...	Partially armed when arming wire is pulled and jump-out pins are ejected. Arming completed at 12-15 feet of water when primer and detonator are aligned with firing pin.
Fuzes used with.....	AN-M103, AN-Mk 219, or Mk 221 in nose; Mk 229 in tail in 650-lb. depth bombs.
Over-all length, inches.....	Firing assembly—6.9; Extender assembly—9.9
Body diameter, inches.....	3.6
Material.....	Bronze, brass, steel, and aluminum

**General:** The fuze is essentially the same as the Athwartship Hydrostatic Fuze AN-Mk 224, being an athwartship fuze consisting of the pistol, booster, and booster extender. The firing assembly and booster extender are inserted in the athwartship tube of the depth bombs from opposite sides. The AN-Mk 234 differs from the AN-Mk 224 in that it has an external setting device and does not require disassembly

to effect depth variations in functioning.

The depth setting is accomplished by varying the amount the adjustable spring must be compressed by the hydrostatic piston as the bellows expand. If a deep setting is desired, the depth-setting collar is rotated so that a shallow step on the collar would be positioned under the spring-housing depth lug. Thus, the depth lug would engage the collar shortly after entering the water, and the bomb would have to sink farther before the water pressure could overcome the spring resistance. If a deep step were positioned under the lug, the hydrostatic piston could move farther before encountering resistance from the spring. Until the lug is engaged, the spring housing rides inward with the hydrostatic piston; but as soon as the lug is engaged the spring housing no longer moves with the piston and the spring resistance must be overcome.

**Operation**

**ACTION IN BOOSTER EXTENDERS:** When the bomb is dropped from the plane, the arming wire to the booster extender is withdrawn from the jump-out pin. The jump-out pin is thrown out by its spring; the booster spindle is freed, and water is permitted to enter the hole created by the jump-out pin. The water expands the bellows until it overcomes the pressure of the spring acting against the locking slide and booster spindle. The locking balls are forced into an enlarged groove in the fuze, and the booster and slider aligner move inward, aligning the primer and detonator sliders, as described in the operation of the AN-Mk 224.

**ACTION IN THE PISTOL:** As the arming wire pulls free, it extracts the plug and neoprene connector, permitting water to enter the fuze when the bomb is immersed in water. The water acts against the flanged base of the hydrostatic piston and, as the pressure increases, expands below the bellows. The hydrostatic piston, adjustable spring, and spring housing all move inward until the depth lug engages the step on the depth-setting collar which has been positioned opposite it. At this point, the spring housing no longer moves inward. The hydrostatic piston continues to move inward under

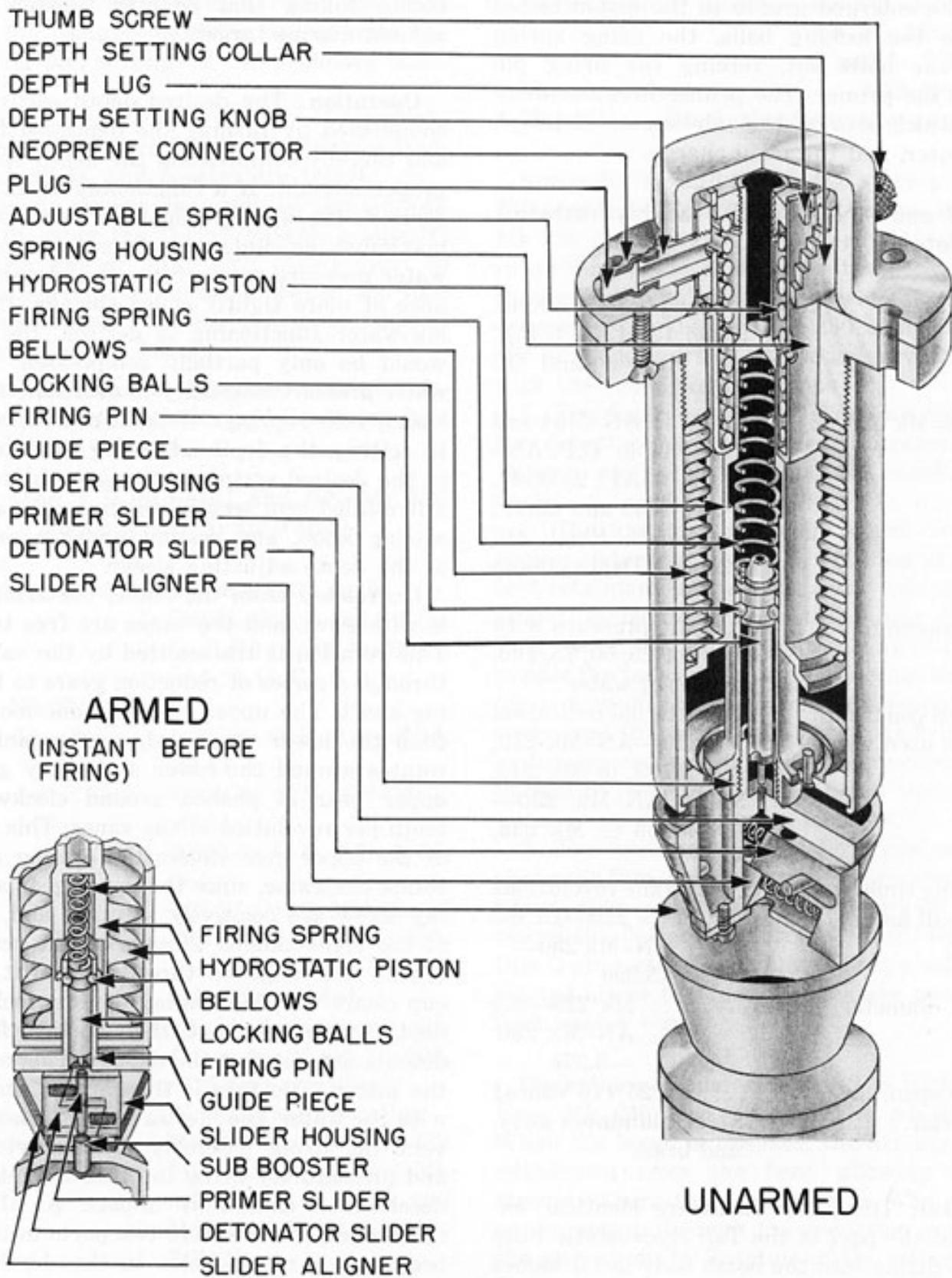


Figure 366. Athwartship Hydrostatic Fuze AN-Mk 234

pressure of the water, but its movement is restricted by the resistance of the adjustable

spring. Meanwhile, the movement of the hydrostatic piston compresses the firing spring; and,

when the enlarged groove in the piston comes opposite the locking balls, the firing spring forces the balls out, forcing the firing pin against the primer. The primer fires the detonator, which sets off the sub-booster of tetryl, the booster, and the main charge.

### Mk 229 and AN-Mk 230 (Tail Hydrostatic) (Obsolete)

#### Bombs

Mk 229.....	650-lb. depth bombs, 500-lb. Mks 9 and 12 (L.C., G.P.); 1,000-lb. Mks 9 and 13 (L.C., G.P.)
AN-Mk 230.....	500-lb. G.P. AN-M64 and 64A1; 1,000-lb. G.P. AN- M65 and 65A1; 2,000-lb. G.P. AN-M66 and 66A1; 325-lb. Depth Bomb Mk 53, 350-lb. Depth Bomb Mk 54
Functioning.....	Hydrostatic pressure with settings for 25, 50, 75, 100, or 125 feet of water
Armed condition.....	No external indication
Fuzes used with.....	Mk 229—AN-Mk 219, AN-M103, or Mk 243, Nose; AN-Mk 230— AN-M103 or Mk 243, Nose
Arming time.....	110 vane revolutions
Over-all length, inches.....	Mk 229—16.365 AN-Mk 230— 15.395
Body diameter, inches.....	Mk 229—3.4 AN-Mk 230 —3.375
Vane span, inches.....	5.25 (16 vanes)
Material.....	Steel, aluminum alloy, and brass

**General:** These two fuzes are identical, except that the part of the Tail Hydrostatic Fuze Mk 229 fitting into the bomb body is 1.3 inches longer than the corresponding part of the AN-Mk 230; hence, the AN-Mk 230 cannot be used in bombs that take the Fuze Mk 229. The AN-Mk 230 fits into the Adapter Booster M115 or M115A1, and can be used in the general-purpose

bombs taking that adapter booster for use against marine targets.

**Operation:** The desired depth setting is accomplished by turning the depth-setting knob and thereby compressing the depth spring the proper amount. If a functioning at 125 feet is desired, the spring would be compressed the maximum amount, consequently causing the water pressure to overcome the greater resistance of more tightly coiled springs. If a shallow-water functioning is desired, the springs would be only partially compressed, and the water pressure necessary to overcome the more loosely coiled springs would be considerably less. In setting, the depth-adjusting sleeve is raised to the desired spring compression by means of a five-sided cam secured to the external depth-setting knob, and resting under a projection of the depth-adjusting sleeve.

On release from the plane, the arming wire is withdrawn and the vanes are free to rotate. This rotation is transmitted by the vane shaft through a series of reduction gears to the arming shaft. The upper gear has one more tooth than the lower gear, and, as the pinion gear rotates around the lower stationary gear, the upper gear is pushed around clockwise one tooth per revolution of the vanes. This rotation of the upper gear causes the arming screw to rotate clockwise, since the upper gear and arming screw are positively secured; and, because of the right-handed threads on the screw, the detent retaining cup threads up on it. As the cup clears the two arming detents locking the depth-spring stem nut, their springs force the detents out, freeing the depth spring stem and the piston. The fuze is then armed. On impact with the water, the inertia counterbalances prevent the firing assembly from moving down and prematurely firing the fuze because of the deceleration caused by impact. As the bomb submerges, water enters two ports in the outer body and through holes in the depth-setting mechanism housing. Hydrostatic pressure, acting on the sylphon bellows, forces the hydrostatic piston downward, compressing the firing spring, until the retaining balls fall out into the widened portion of the piston. The firing

plunger is then forced downward by the pressure of the compressed firing spring onto the fixed firing pin, setting off the explosive train.

**Remarks:** The detonator consists of fulminate of mercury and tetryl pellets. The booster lead-in, relay pellets, and booster are tetryl.

The O-ring gasket has replaced the Garlock gasket. In using the O-ring gasket, a support ring (steel washer 0.120 inch thick) must be used to assure metal contact between the fuze and fuze-seat liner, thereby preventing distortion of the fuze on impact.

**Do not disassemble this fuze without reinserting the safety pin through the lower fuze body and firing plunger.**

#### Mk 229 Mod 3 (Obsolete) and AN-Mk 230 Mods 4, 5 and 6 (Tail Hydrostatic)

##### Bombs

Mk 229 Mod 3 . . . . . 650-lb. depth bombs  
500-lb. Mks 9 and 12 (L.C., G.P.) ; 1,000-lb. Mks 9 and 13 (L.C., G.P.)

AN-Mk 230 Mods 4, 5, and 6 . . . . . 500-lb. G.P. AN-M64, 64A1  
1,000-lb. G.P. AN-M65, 65A1  
2,000-lb. G.P. AN-M66, 66A1  
325-lb. Depth MK 53 and AN-Mk 53 Mod 1; 350-lb. Depth Mk 54 and AN-Mk 54 Mod 1

Functioning . . . . . Hydrostatic pressure with settings for 25, 50, 75, 100, or 125 feet of water

Armed condition . . . . . No external indication

Fuzes used with . . . . . Mk 229 Mod 3—AN-Mk 219, AN-M103 or Mk 243, Nose; AN-Mk 230 Mod 4—AN-M103 or Mk 243, Nose

Arming time . . . . . 110 vane revolutions

Over-all length, inches . . . . . Mk 229 Mod 3—16.365; AN-Mk 230 Mods 4, 5, and 6—15.395

Body diameter, inches . . . . . Mk 229 Mod 3—3.4; AN-Mk 230 Mods 4, 5, and 6—3.375  
Vane span, inches . . . . . 5.25 (16 vanes)  
Material . . . . . Steel, aluminum alloy, and brass

**General:** The Tail Hydrostatic Fuze AN-Mk 230 Mod 4 and Mk 229 Mod 3 replace the AN-Mk 230 and Mk 229. The latest Mods incorporate changes which eliminate the possibility of the fuzes arming accidentally when the bomb is dropped safe. The AN-Mk 230 Mod 4 and the Mk 229 Mod 3 are the same as previous Mods, with the following exceptions:

1. The fuze is sealed by a sealing cup above the detent carrier to prevent entrance of the water at any point other than the regular water ports.

2. The arming mechanism which frees the arming detents operates by rotation of the detent retaining cup rather than by raising it vertically. A metal strap is fitted over the cup. These additions (a) prevent arming of the fuze in case the tail cone or arming-mechanism housing is torn off the fuze accidentally upon water entry, and (b) prevent the fuze from firing from hydro-dynamic pressures which are encountered in erratic movement of the bomb through the water or on re-entry after ricochet.

3. The fuzes now have a slight oval undercut above the fuze-pocket threads to accommodate the new O-ring gasket (live rubber) which has replaced the flat gasket formerly used. By use of this O-ring gasket, the holes for the safety rod located above the fuze threads are now sealed from water entry.

**Operation:** In operation, the Tail Hydrostatic Fuze Mk 230 Mod 4 is like the AN-Mk 230. When the bomb is released, the arming wire is withdrawn from the fuze, allowing the air stream to turn the arming vanes. The rotating vanes, acting through the reduction gear, turn the arming shaft. Rotation of the arming shaft first causes the arming nut assembly to rise (since it cannot turn because of the two pins which project into the detent carrier). When the two pins of the arming nut are fully clear of the detent carrier, the arming nut "washer"

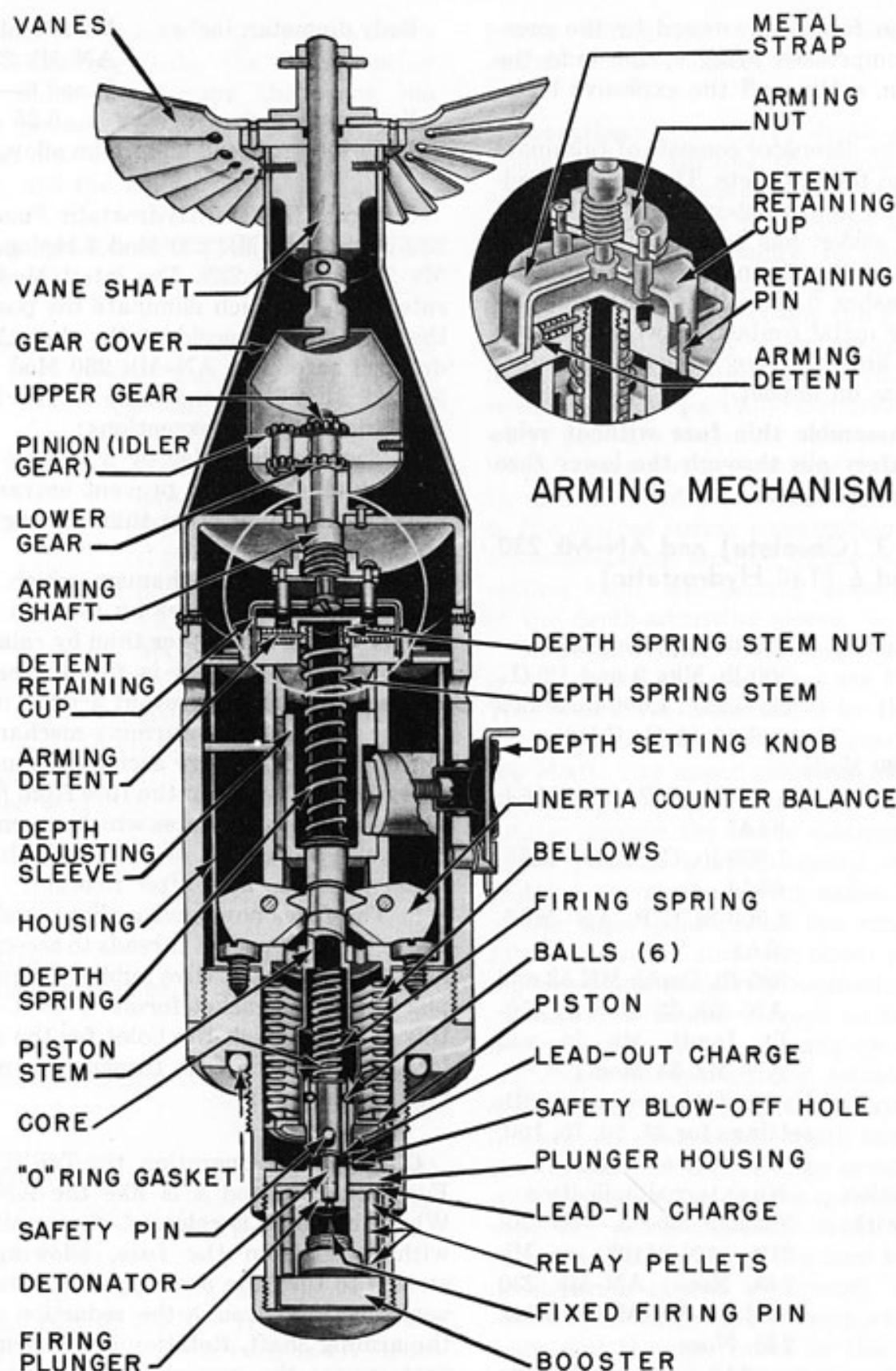


Figure 367. Tail Hydrostatic Fuze AN-Mk 230 Mod 4

jams under the arming shaft, preventing further rising. The arming shaft then turns the

arming nut assembly and, by means of the two pins, rotates the detent retaining cup approximately 85°, until the two cutaway portions align themselves opposite the detents. The detents are then ejected, freeing the depth-spring stem nut and thereby arming the fuze. To limit the amount of water entering the sylphon bellows, the detents are prevented from jumping completely out of the detent carrier by the detent retaining pins which are fitted into the flange of the detent carrier. The inertia counterbalances prevent the fuze from functioning on impact with the surface of the water. After the bomb has submerged, water enters the fuze through two water ports in the body sleeve, and the fuze fires at the predetermined depth setting. The use of the sealing cup above the detent carrier prevents water entry through the open end of the fuze in case the tail cone is broken off on impact.

**Remarks:** Do not disassemble this fuze without reinserting the safety pin through the lower fuze body and firing plunger.

Earlier productions of these fuzes did not incorporate an undercut. In using the O-ring gasket with these fuzes, a support ring (steel washer, 0.120 inch thick) must be used to assure metal contact between the fuze and the fuze-seat liner, thereby preventing distortion of the fuze on impact.

The Tail Hydrostatic Fuze AN-Mk 230 Mod 5 is the same as the AN-Mk 230 Mod 4, except that the firing pin is welded to the booster cap as in the Mk 231, and the depth setting is emphasized for 25 feet and relaxed for 50 feet.

The AN-Mk 230 Mod 6 is the same as the AN-Mk 230 Mod 4, except that the depth setting is emphasized for 25 feet and relaxed for 50 feet.

### Mk 231 Mod 0 and Mk 240 Mod 0 (Tail Hydrostatic)

#### Bombs

Mk 231 Mod 0 . . . 350-lb. Depth AN-Mk 54  
 Mod 1  
 500-lb. G.P. AN-M64  
 500-lb. G.P. AN-M64A1

Mk 240 Mod 0 . . .	1,000-lb. G.P. AN-M65
	1,000-lb. G.P. AN-M65A1
	2,000-lb. G.P. AN-M66
	2,000-lb. G.P. AN-M66A1
	2,000-lb. G.P. AN-M66A2
Functioning . . .	Hydrostatic pressure at 25 feet
Armed condition . . .	No external indications
Arming time . . .	40-45 vane revolutions; 300-400 feet air travel; 35-100 feet vertical fall
Over-all length, inches . . .	Mk 231 Mod 0—12.5 Mk 240 Mod 0—16.5
Body diameter, inches . . .	3.375
Material . . .	Steel, aluminum alloy, and brass

**General:** The Tail Hydrostatic Fuze Mk 231 Mod 0 and Mk 240 Mod 0 are tail hydrostatic fuzes in the general design scheme of the Mk 229 and Mk 230. They are considerably simpler in construction, however, and easier to manufacture. The Mk 240 Mod 0 is four inches longer than the Mk 231 Mod 0, to assure proper arming in larger bombs, but is otherwise identical to the Mk 231 Mod 0. A single depth setting is provided, and the fuzes are expected to function in a depth range of 25 to 30 feet.

To provide positive action against fuze function on reverse impacts (particularly ricochets), these fuzes have an inertia ring which adds its weight to that of the piston assembly to counteract the force of the two counterbalances exerting a contrary pressure in such impacts. On normal impacts, the inertia ring merely rests on the firing-pin housing.

**Operation:** Upon release of the bomb from the plane, the arming wire is withdrawn, permitting rotation of the vane and the vane shaft. Rotating with the vane and threading out of the arming-stem guide is the arming stem; after 40 to 50 vane revolutions the stem has risen sufficiently to allow the two arming balls to fall inward, freeing the hydrostatic piston and arming the fuze.

At normal impact with water, the inertia counterbalances prevent the fuze from firing; and, on reverse impact, the inertia ring operates as previously mentioned. After submersion, water flows around the baffle ring and into the

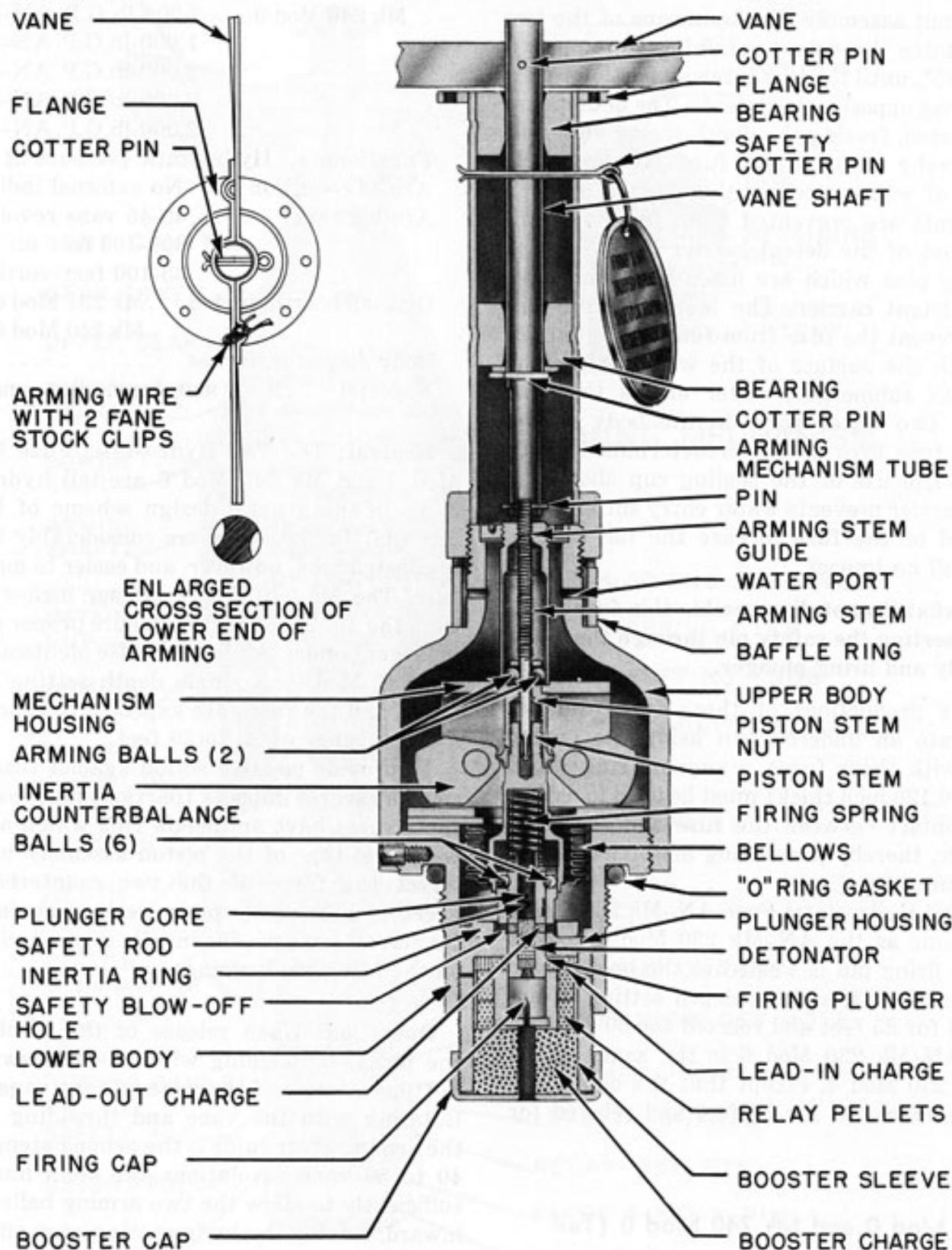


Figure 368. Tail Hydrostatic Fuze Mk 231 Mod 0

fuze through the two ports. The baffle ring prevents the fuze from firing when subjected to sudden surges of water such as might occur on

reverse impact. Hydrostatic pressure now extends the bellows, thus forcing the hydrostatic piston downward and compressing the firing

spring. After the piston has moved 9/32 inch, the six retaining balls locking the firing plunger to the plunger housing jump into the annular recess in the piston. The compressed firing spring thrusts the plunger against the firing point, initiating the explosive train.

**Remarks:** The lower end of the arming stem is grooved for about 0.2 inch of its length. The purpose of this feature is to arrest arming of the fuze, should the bomb be accidentally released in water without the arming wire, as in crash landings. In this event, water might rotate the vane, initiating arming action. Arming would be stopped, however, once the grooved section faced the balls, since hydrostatic pressure on the piston assembly would force the balls into the grooves, jamming the arming stem in place and preventing further rotation of the vane.

The vane shaft is connected to the arming stem by a slip joint, to remove the danger of arming the fuze by a blow damaging or carrying away part of the arming mechanism. In this connection, it will be noted that the arming-mechanism tube has a circumferential groove near its base which is provided to cause shearing at that point, should the force of impact break off part of the arming mechanism.

When the Tail Hydrostatic Fuze Mk 240 Mod 0 is used in the 2,000-pound G.P. Bomb AN-M66, it is to be equipped with a special 26.5° pitch vane, to assure proper arming; the standard 20° pitch vane of the Mk 231 Mod 0 will be used when the Fuze Mk 240 Mod 0 is installed in the 1,000-pound G.P. bomb AN-M65. The special-pitch vane will be painted. (No color has been specified at the time of writing.)

Production of the Tail Hydrostatic Fuze Mk 231 Mod 0 has been stopped because of adequate supplies of the Tail Hydrostatic Fuzes AN-Mk 230 Mods 4, 5, and 6. The Mk 240 Mod 0 will not be produced at all.

#### Mk 232 Mod 1 (Nose Impact or Electrical Firing)

Bombs.....All G.P. and depth bombs, and old-type demolition and L.C. bombs

Functioning.....	Impact instantaneous or electrical impulse
Armed condition.....	When vanes are 3/8 inch away from striker housing
Fuzes used with.....	Usually none
Arming time.....	8 vane revolutions
Over-all length, inches.....	7
Body diameter, inches.....	2.5
Vane span, inches.....	5.125 (16 vanes)
Material.....	Steel and brass

**General:** The Nose Impact or Electrical Firing Fuze Mk 232 Mod 1 is a bomb nose fuze of the arming-vane type, requiring little air travel to arm. It may be initiated by an electrical impulse or impact on a hard surface, detonating instantaneously. The fuze has an electric semi-cap which, when fired by an impulse, blows through a hole leading to the detonator and sets it off. For electrical firing as well as impact, the fuze must first be armed, allowing the detonator slider to move over into a position where the detonator can be initiated by either the firing pin or the explosion of the semi-cap.

#### Operation

**AS AN IMPACT FUZE:** A cotter pin, which is wired in place with a small fuze wire, prevents the arming vanes from rotating. The arming wire is attached to this cotter pin, and withdrawal of the arming wire breaks the light fuze wire. The vanes are then rotated by action of the wind stream, and this rotation is transmitted to the striker, which advances on the threads in the striker housing. It advances until stopped by the striker stop coming up against the bottom of the striker housing. As the striker advances on its threads, it withdraws the firing pin from the slider, which is then forced over by its springs, lining the detonator up with the firing pin and booster lead-in. A detent locks the detonator slider in the armed position. Upon impact, the brass collar threads are sheared by the firing-pin block, and the firing pin is forced into the detonator.

**ELECTRICAL FIRING:** Detonation is initiated by means of the squib being directly fired by an electric current through the igniter bridge.

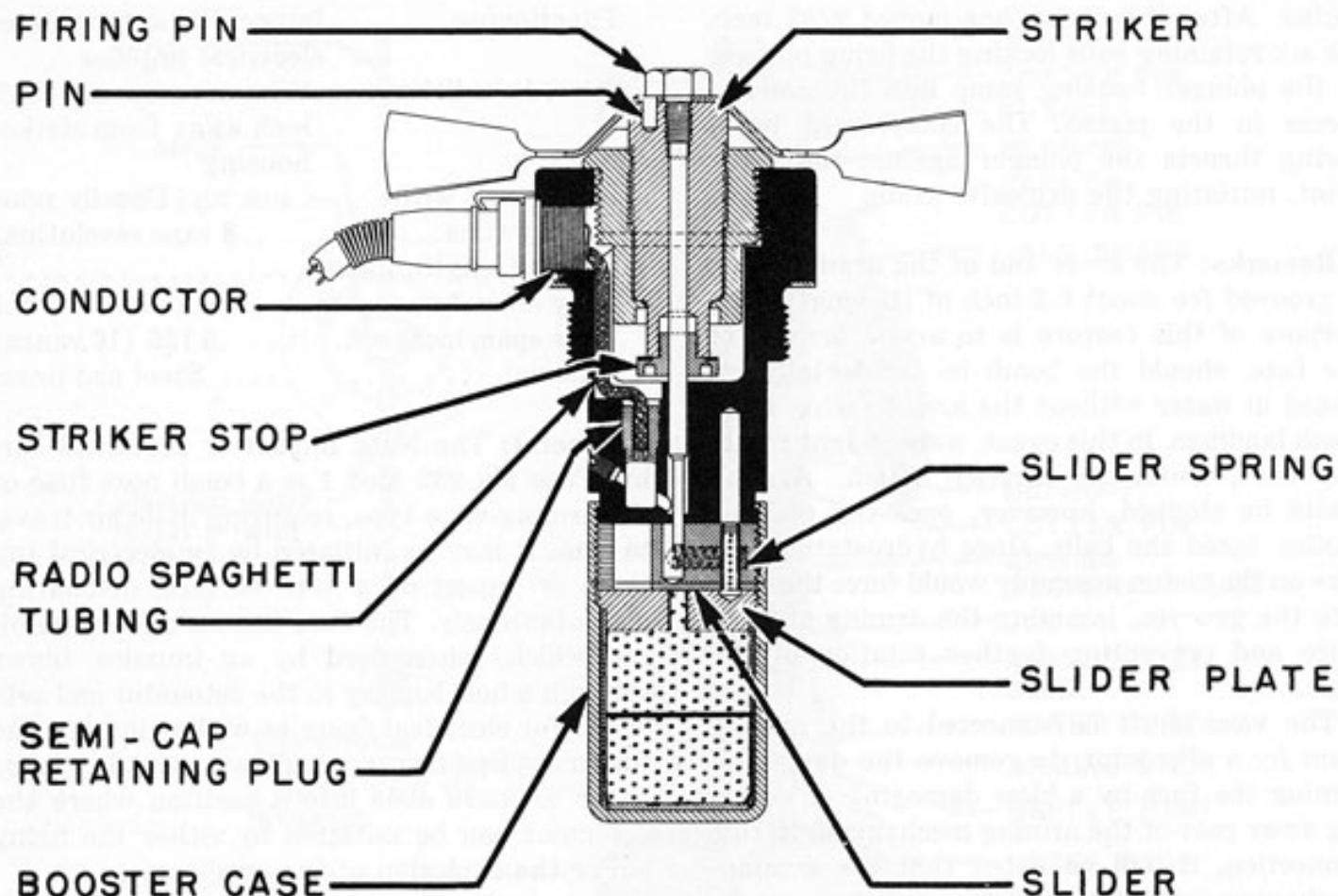


Figure 369. Nose Impact or Electrical Firing Fuze Mk 232 Mod 1

**Remarks:** The fuze will not function on impact with water, but must strike a hard surface in order to strip the striker-housing threads.

No attempt should be made to unarm this fuze by rotating the vanes backward.

#### Mk 233 (Nose Electrical)

Bombs.....100-lb. G.P. Mk 4 Mod 4

Functioning.....Electrical impulse

Armed condition.....When cable is pulled free from rotor cap, and cap is in a locked condition

Fuzes used with.....Mk 232 Mod 1

Arming time.....Rotation of the rotor cap 180 degrees, when pulled by the cable attached to it

Over-all length, inches.....4.51

Body diameter, inches.....2.375

Material.....Steel

**General:** The fuze will function instantly upon explosion of the electric semi-cap. It is mechanically armed by means of a motor in the plane. The body is that of a Nose Mechanical Impact Fuze AN-Mk 219, in which the vanes, cap, and rotors have been removed, and a hole has been drilled in the shoulder for the accommodation of electric wiring. A rotor block has been inserted in the rotor cavity in the fuze body. The rotor block contains an electric semi-cap with lead-in wires and a detonator. These units are assembled, unarmed, 180 degrees from the booster lead-in in the fuze body.

**Operation:** In the unarmed position the detonator in the rotor is offset 180 degrees from the booster lead-in. To arm the fuze, the rotor is rotated 180 degrees, at which point the detonator and booster lead-in are aligned. This is accomplished by means of a motor in the airplane,

exerting a pull on one end of the arming cable. This pull rotates the pulley to which the other end of the cable is secured, and thereby rotates the rotor to the armed position. There it is locked by the lock detent. Continuing force of the motor's pull on the arming cable shears the 0.035-inch copper shear wire which secures the cable to the pulley.

The protective shipping cap covering the connector plug is removed when the fuze is assem-

bled to the bomb, and connection is made with the source of electrical current in the airplane. Closing the electrical circuit after the fuze is armed successively initiates the semi-cap, detonator, booster charges, and explosive charge in the bomb.

**Remarks:** The detonator consists of lead azide, and the booster lead-in and booster consist of tetryl.

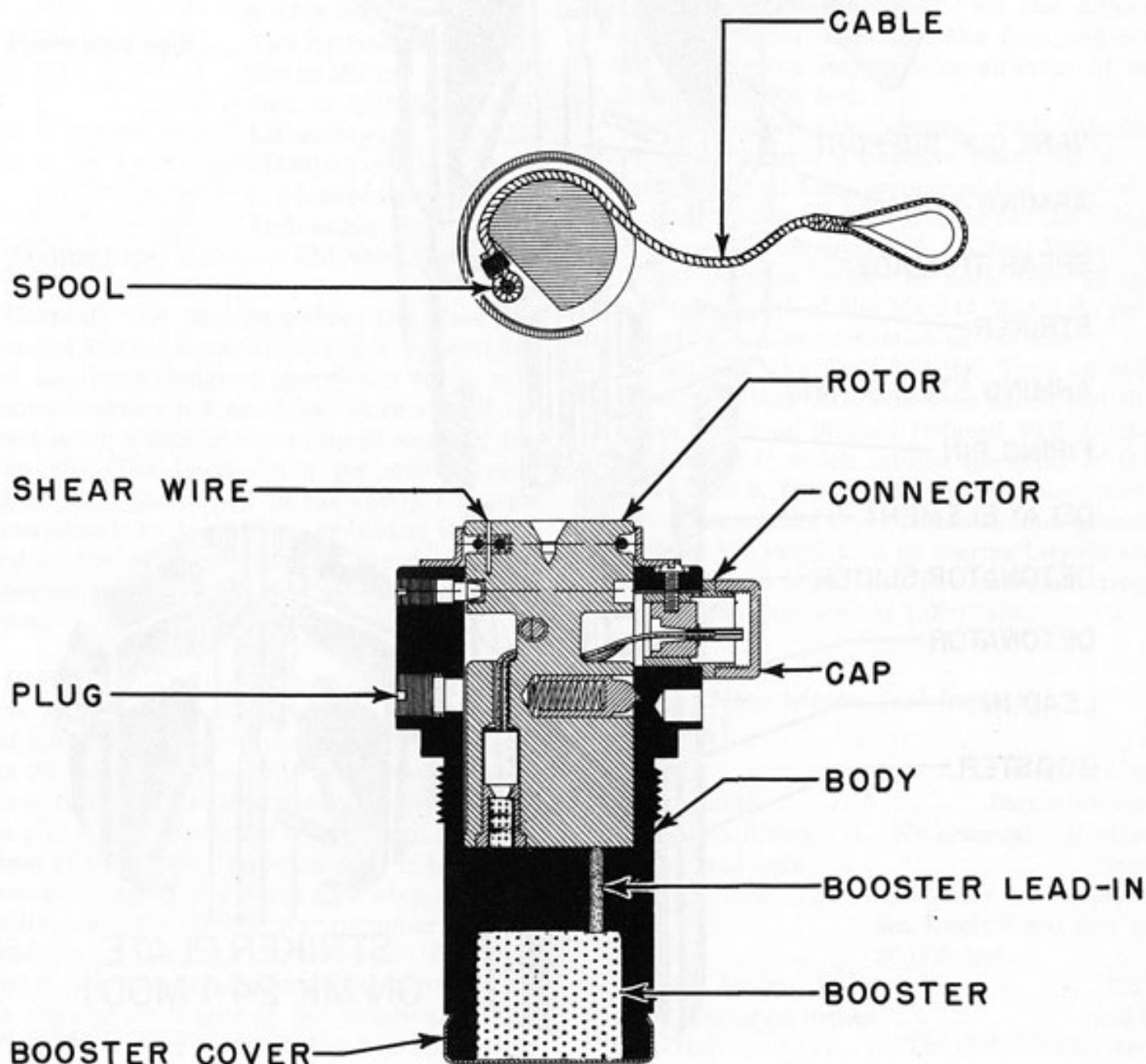


Figure 370. Nose Electrical Firing Fuze Mk 233

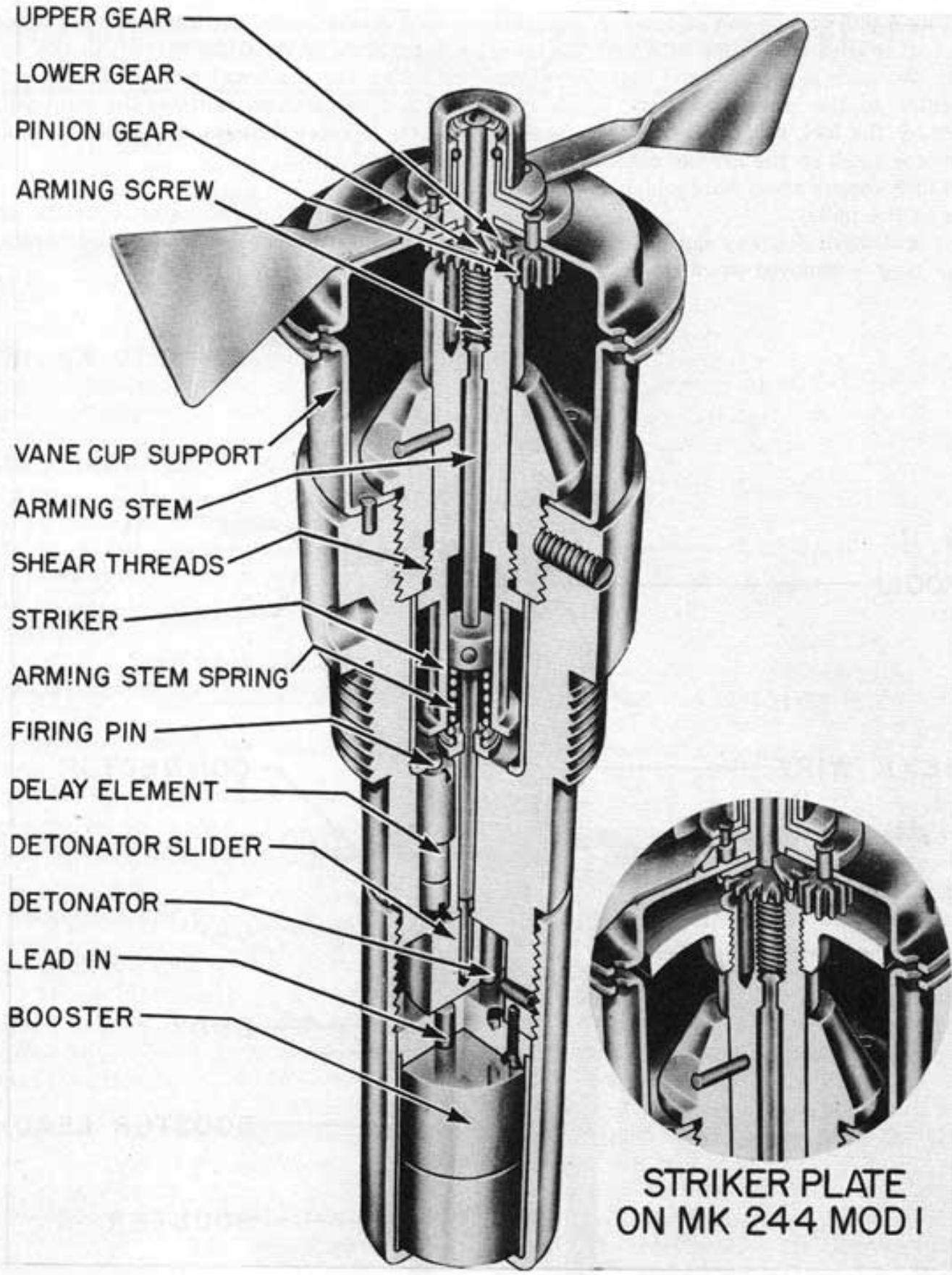


Figure 371. Nose Impact Fuzes Mk 243 Mod 0 and Mk 244 Mod 1

**Mk 243 Mod 0 and Mk 244 Mods 0 and 1  
(Nose Mechanical Impact)**

Bombs.....	500-lb. G.P. AN-M64 and 64A1
	500-lb. G.P. Mk 12 Mod 2
	1,000-lb. G.P. AN-M65 and 65A1
	1,000-lb. G.P. Mk 13 Mod 2
	2,000-lb. G.P. AN-M66 and 66A1
Functioning, Mk 243 Mod 0.....	Delay of 0.025 second
Armed condition...	When space between vane cup and vane-cup support is 5/16 inch
Fuzes used with....	Tail Hydrostatic AN-Mk 230 or Mk 229 (set for 25 feet in high-speed glide bombing); or AN-M100A2 series (with 0.24-second delay for high-angle drops)
Arming time.....	130 vane revolutions

**General:** The fuze resembles the Nose Mechanical Impact Fuze AN-M103 in appearance, and has been designed specifically to be used against submarines or ships, since it will not function on water or at an impact angle of less than 45°. The blunt firing pin merely rests loosely over the primer in the cavity cup, and, when struck by the striker shoulder, is driven against the primer, initiating the delay. It is intended as a replacement for the hydrostatic fuzes.

**Operation:** As the vanes rotate, the pinion gear revolves around the upper movable gear and lower stationary gear. Since the upper gear has 23 teeth and the lower gear has 22 teeth, the upper gear is pushed around clockwise with the pinion by the amount of one tooth per revolution of the vanes. The lower gear is prevented from rotating by the lower-gear stop arm protruding into the striker. As the upper gear rotates, the arming screw unthreads from the striker, allowing the arming stem spring to lift the arming stem free of the detonator slider. After 130 vane revolutions, the vanes fall away and the arming stem clears the detonator slider, which is moved across the fuze body by its spring and locked under the delay element by a

detent and the slider locking pin. On impact with a hard surface, the striker body is forced inward, shearing both the locating pin and the shear threads and forcing the shoulder of the striker against the blunt firing pin. The firing pin sets off the primer delay of 0.025 second, the detonator, the booster lead-in, and the booster in succession.

**Remarks:** When using this fuze, check the vanes by simply turning back and forth a few times in order to determine that the arming mechanism operates easily. The fuze will not function on water impact from altitudes of release up to 20,000 feet.

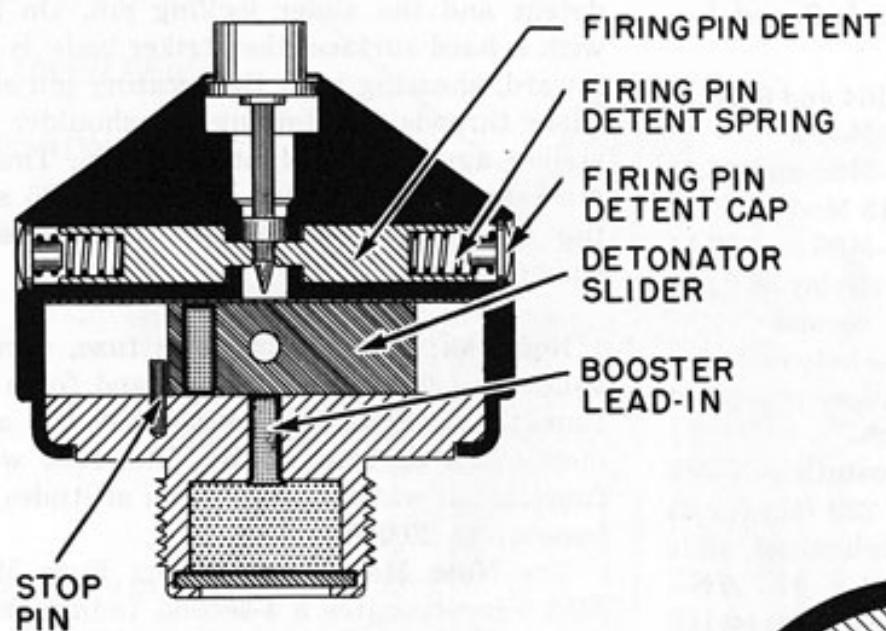
The Nose Mechanical Impact Fuze Mk 244 Mod 0 incorporates a 4-second (minimum of 4, maximum of 5) delay instead of the 0.025-second delay of the Mk 243. Except for the delay, the two fuzes are identical. "4-Sec. Delay" is stamped in black letters on both sides of the vane cup support of the Mk 244 Mod 0, to provide easy visual identification of the fuze.

To activate the Fuze Mk 243 Type on soft ground, a striker plate has been added and the number of shear threads reduced 50% in the Mk 244 Mod 1, which retains the delay of the Mk 244 Mod 0. The modification has been made to allow use of this type of fuze against ground targets in the event that no marine targets are encountered on a mission. The minimum dropping altitude over land is 1,000 feet.

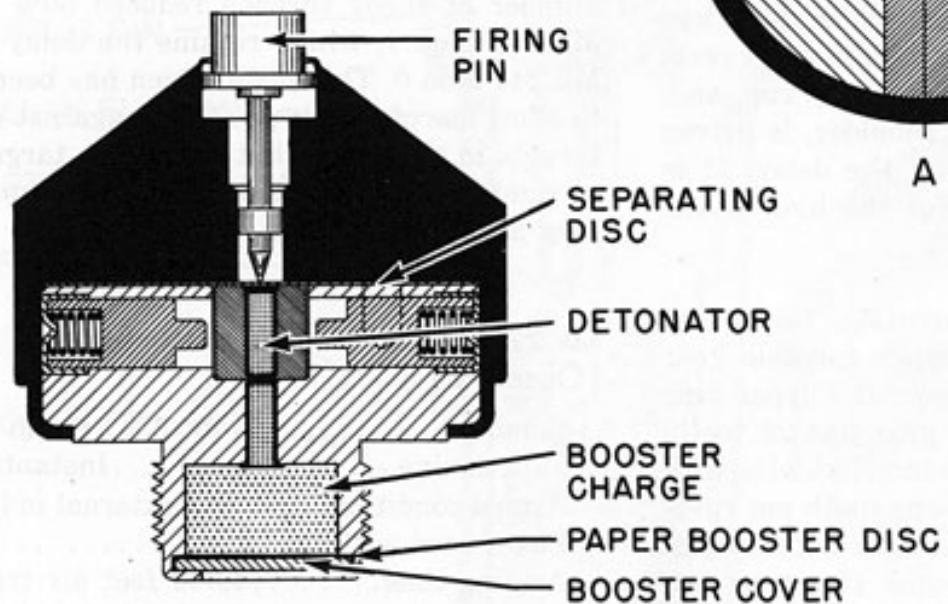
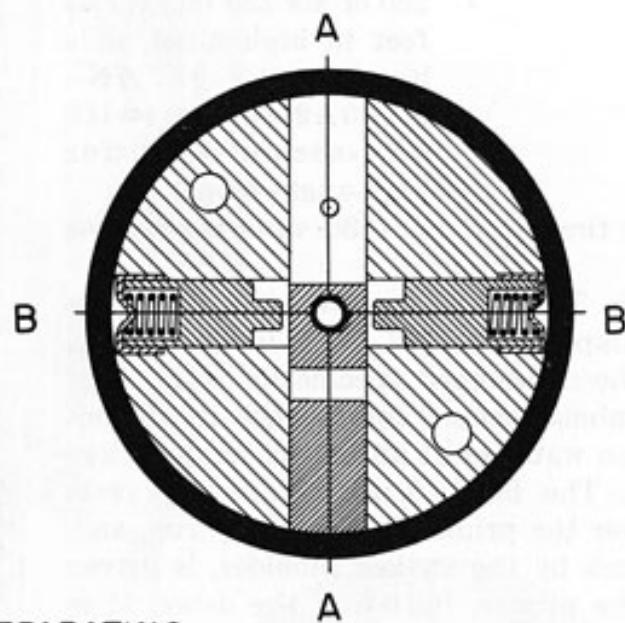
**Mk 227 (Nose Mechanical Impact)  
(Obsolete)**

Bomb.....	5-lb. A.A. Bomb Mk 34
Functioning.....	Instantaneous
Armed condition.....	No external indication
Fuzes used with.....	None
Arming time.....	1,500 feet air travel at sea level; 3,000 feet at 20,000 feet
Over-all length, inches.....	2.35
Body diameter, inches.....	2.0
Material.....	Tin-plated brass and alloy castings

**General:** This fuze is unique in American



SECTION A-A  
UNARMED POSITION



SECTION B-B  
ARMED POSITION

Figure 372. Nose Fuze Mk 227

aviation ordnance in using centrifugal force as its arming device. The rotational velocity re-

quired to arm the fuze is acquired by the offset tail fins on the small bomb.

**Operation:** Two pairs of centrifugal detents are employed—one pair supporting the striker, and the second pair positioning the slider with the primer detonator out of line with the firing pin. At a rotational velocity of 1,500 r.p.m., the detents move out of the way, compressing their springs and allowing the slider freedom of movement. The slider is mounted with its center of gravity away from the axis of rotation; so, when the detents move out of the slider, centrifugal force carries the slider into line with the firing pin. Upon impact, the firing pin is driven into the primer detonator, initiating the explosive action.

**Remarks:** The Bomb Mk 34 and Fuze Mk 227 were designed for air-to-air bombing, but have not proved successful in this use. It has, however, had limited use against parked aircraft and was dropped for its nuisance value on night raids during the early stages of the war in the Pacific.

#### Mk 237 Mod 0 and Mk 238 Mod 0 (Tail, Lead-Shear-Wire, Long-Delay, Time)

##### Bombs

Mk 237 Mod 0 . . . 500-lb. G.P. AN-M64A1  
 Mk 238 Mod 0 . . . 1,000-lb. G.P. AN-M65A1  
                           2,000-lb. G.P. AN-M66A1,  
                           A2

Functioning . . . Lead-shear-wire, long-delay fuze; delays of 2, 10, 20, and 30 hours

Armed condition . . . Partially armed after approximately 150 vane revolutions; fully armed after impact

Fuzes used with . . . . . None  
 Arming time . . . . . Approximately 150 vane revolutions and impact requirement

Vane span, inches . . . . . 5  
 Body diameter, inches . . . . . 2  
 Over-all length, inches . . . . . Mk 237 Mod 0, 13.6  
                                   Mk 238, Mod 0, 17.6

Material . . . . . Zinc or cadmium-plated steel

**General:** These fuzes differ only in the length of their arming stem. Delay arming is obtained

by means of the 30-to-1 gear-reduction system, which is like that of the Tail Fuze M115 Series. Upon completion of arming, the gear-reduction assembly and the arming stem do not separate from the fuze, but cease rotation. Functioning time of these fuzes is determined by a lead shear wire (50% lead, 50% tin). The various delays are obtained by varying the diameter of the wire, i.e., increasing the diameter for longer delays. The slider carries a Detonator Mk 23, which is made up of three explosive components; namely, azide priming mixture, lead azide, and tetryl. The fuze incorporates a tetryl booster lead-in, but does not have an integral booster.

**Operation:** The complete arming of the fuze is effected in two stages: air travel and impact. Upon withdrawal of the arming wire, the vane assembly rotates, causing the arming stem to rotate *via* the gear-reduction system. The lower end of the arming stem is encased by the firing-pin housing nut, which, in turn, is pinned to the firing-pin housing. To the bottom of the firing-pin housing is attached the slider stop. In addition, the firing pin is locked to the firing-pin housing by two balls, and the firing-pin housing, in turn, is locked to the ball-retainer sleeve by two balls. As the arming stem screws upward, the entire firing assembly moves upward under the action of the ball-retainer spring. After approximately 150 revolutions of the vanes, the firing assembly has risen sufficiently to withdraw the slider top and firing pin from the slider slot, allowing the slider to align its detonator below the firing pin. (A detent locks the slider in position.) Continued rotation of the vanes causes the O-ring gasket on the firing-pin housing nut to seat and stop rotation of the vane assembly.

On impact, the ball-retainer sleeve is forced down by the inertia freeing the retaining balls. At the instant deceleration ceases, the ball-retainer sleeve is forced upward by its spring, allowing the firing balls to jump out of their recess, and the spring-loaded striker is restrained only by the lead shear wire. The fuze is now fully armed. The firing pin, under action of its spring, exerts pressure on the lead shear wire

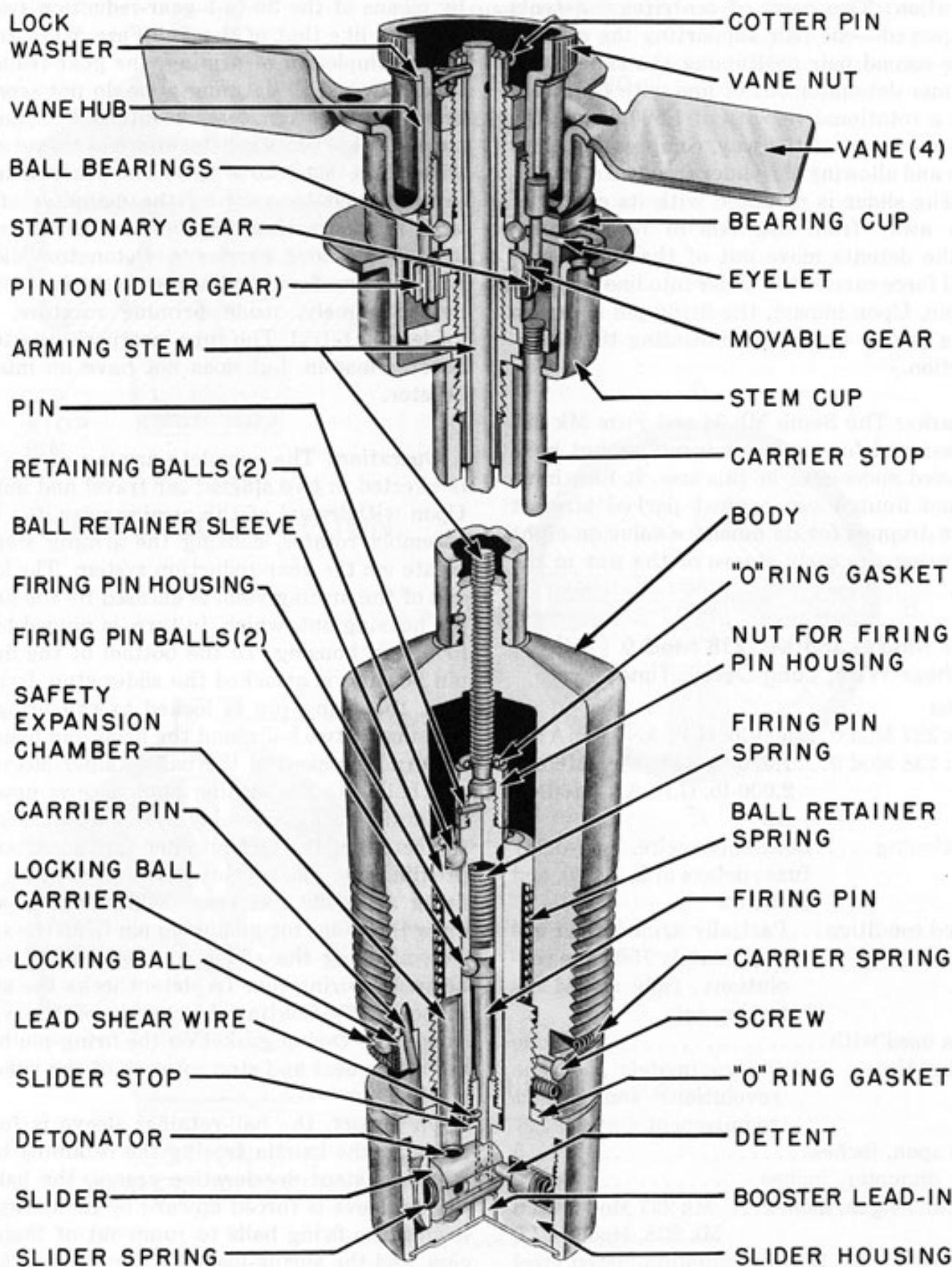


Figure 373. Long-Delay Tail Fuzes Mk 237 Mod 0 and Mk 238 Mod 0

and causes the wire to shear when the proper length of time has elapsed, depending on temperature conditions. The firing pin strikes the detonator, which, in turn, sets off the booster lead-in.

**Remarks:** These fuzes incorporate an anti-withdrawal feature, but no booby trap device like the M123 series. Under normal handling and installation, the anti-withdrawal feature does not function, since the locking ball and its carrier are held in place in the deep part of the eccentric groove, by a carrier pin and spring. Upon impact, however, the force of inertia is sufficient to withdraw the carrier pin from the fuze body, and allow the carrier spring to pull the ball carrier into the shallow part of the eccentric, locking the fuze in place. The fuze body is case-hardened to prevent removal with a wrench after impact. Since these fuzes require impact to lock in place, bombs with these fuzes can be safely returned to the base or carrier, and the fuzes removed for stowage.

Since these fuzes have a two-inch thread diameter, it is necessary to remove the inner sleeve of the Adapter Booster M115A1 before installation. Fuzes should be screwed securely into the adapter booster; otherwise a dud may result. A special short-length locking pin is shipped with these fuzes for securing the Adapter Booster M115A1 to the base plate.

Bombs fuzed with these fuzes should not be released at an altitude lower than that specified by the Chief of Naval Operations as the minimum safe altitude of release for instantaneous action fuzes; for, if the bomb is subjected to multiple impact, the first impact would completely arm the fuze, and the second might shear the lead shear wire, allowing the fuze to fire without delay.

These fuzes are detonator safe. In the unarmed position, the detonator is lined up with the safety expansion chamber. If the detonator should function prematurely, the force of detonation is dissipated in this cavity, and will not set off the booster lead-in charge, or adapter booster charge.

## Part 6 — Chapter 20 — Section 4

### IGNITER FUZES AND IGNITERS

#### Fuze M154, Igniters M13 and M14, and Experimental Types E3R1, E3R2, E3R4, E4R1, E4R2, E4R3, E4R4, E4R6, and E4R7

Bombs.....	Jettisonable fuel tanks, incendiary-filled
	M13      M14
Type.....	External... Internal
Fuze.....	M154..... M154
Burster.....	C8R1..... C8R1
Cap.....	None..... Supported
Functioning.....	Inst. .... Inst.
Igniters used with...	M16..... M15
Armed condition..	If arming wire and retain- ing wire are missing
Arming time.....	Armed when dropped

**General:** Thirteen igniters were developed

simultaneously for use with the "fire bombs", of which four have been standardized—namely, the Igniters M13, M14, M15, and M16. The igniters of the M13 and M14 type use the Fuze M154, a modification of the Nose Fuze M142, the greatest emphasis being placed on the M13 and M14, which will eventually supplant all other igniters using the Fuze M154.

The Igniters M13 and M14 differ in that the M13 is designed to be attached to the outside of the bomb by means of a clamp, while the M14 has an adapter which allows the igniter to be installed in the filler-cap opening in the tank. Because of this difference, the M13 is known as an external igniter, while the M14 is called an internal igniter. The Igniters M13 and M14 consist of either a sodium (Na) or a white

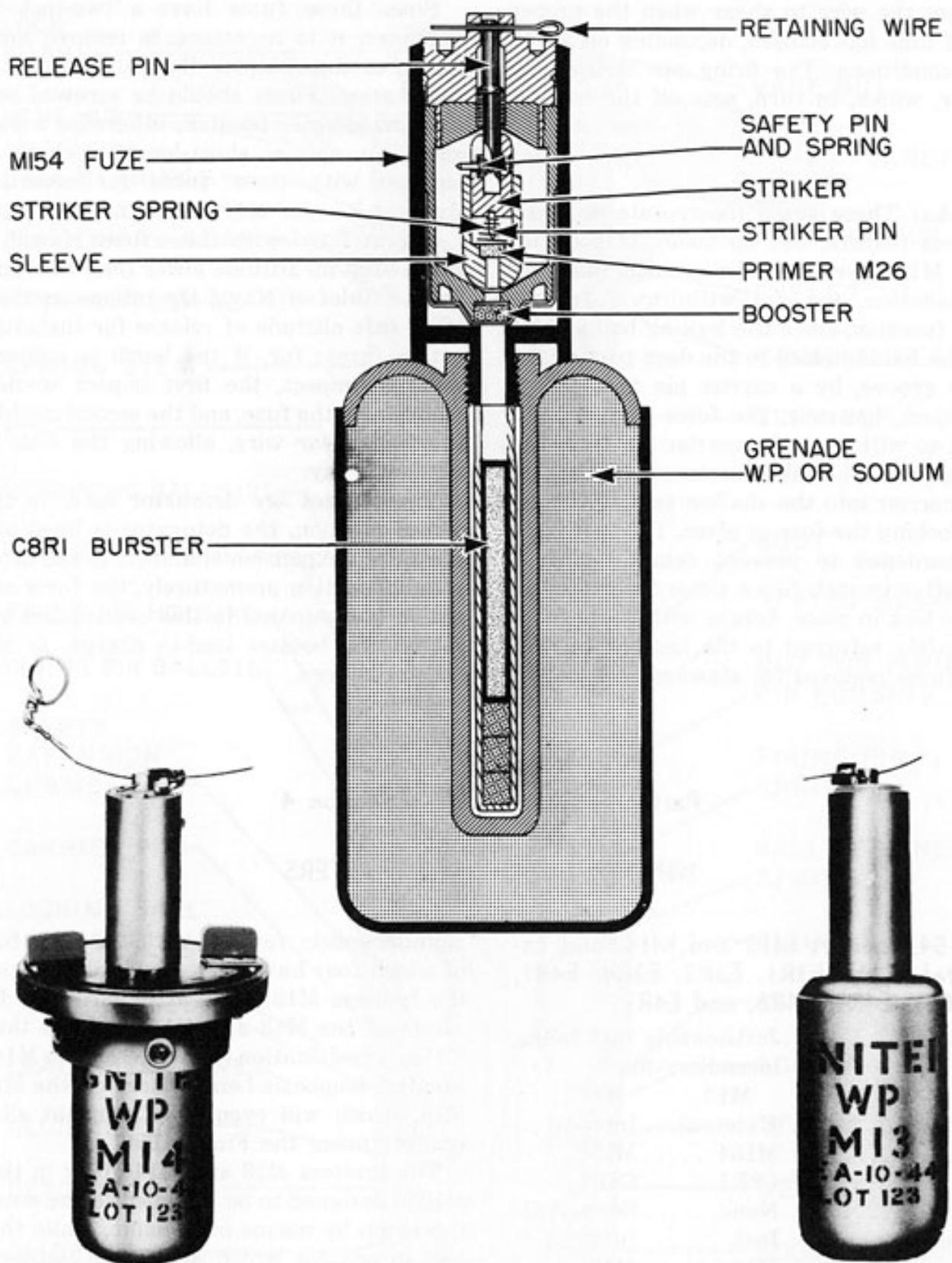


Figure 374. Igniters M13 and M14, and Cutaway Showing Fuze M154

phosphorus (W.P.) Hand Grenade M15 and a Burster C8R1 (DuPont C56 blasting cap and 2.5

grams of tetryl) fitted to an All-Ways Action Fuze M154.

If the bombs are to be dropped at sea, the Na grenade is used, while if the bombs are employed against land targets the W.P. grenade is attached. At the present time, the Na-filled Igniter M13 is restricted and the W.P.-filled M13 is to be dumped by Navy activities. Both the W.P.- and the Na-filled M14 are available. Neither the M13 nor the M14 is considered safe for carrier landings.

**Operation:** When the bomb is released, the arming wire is pulled, permitting the spring-loaded arming pin to move upward, thus allowing the safety pin to fly inward, arming the fuze. On impact, the striker pin and sleeve are forced together, igniting the Primer M26. Flash from the primer initiates the black powder booster and, latterly, the Burster C8R1, which, in turn, breaks the grenade case, allowing the W.P. or Na to ignite the incendiary mixture scattered by the bursting tank.

**Modifications:** The following are experimental igniters developed concurrently with the M13 and the M14.

The E3R1, E4R1, and E4R2 differ from the M13 and M14 respectively in that they use an Infallible Powder burster (similar to Ballistite) instead of the Burster C8R1 of the standardized models. In addition, the E4R1 has an unsupported cap instead of a supported one as in the M14 and the E4R2. The unsupported cap is a standard filling cap modified for use as an igniter. The supported cap is one specifically designed for the igniter. All three use the Fuze M154; they are restricted by the Navy to land-base training use only.

The E3R2, E4R3, and E4R4 differ from the M13 and M14 respectively in that they use a Burster C8, known commercially as the DuPont C56 blasting cap, instead of the C8R1, which is similar, except for a supplementary 2.5 grams of tetryl. In addition, the E4R4 has an unsupported rather than a supported cap as in the E4R2 and the M14. All three use the Fuze M154; for the Navy, the W.P.-filled igniters using the Burster C8 are unserviceable and should be dumped; and the Na-filled ones are restricted.

The E3R4 and the E4R7 differ from the M13

and M14 respectively in that they use the Fuze E9R20 rather than the M154. The E9R20 is an anemometer-arming all-ways action fuze converted from the Nose Fuze M154. The Burster C8R1 is present in both igniters, as in the M13 and M14, and the E4R7 has a supported cap. Both Na- and W.P.-filled igniters are unserviceable under Navy order and should be dumped.

The E4R6 is identical to the M14, except that it has an unsupported cap. It uses the Fuze M154 and has a Burster C8R1. The W.P.-filled E4R6 is to be dumped.

**Remarks:** The Igniter M15 is designed to be clamped externally to the tank or fin assembly at any convenient point at which a suitable clamp has been provided or improvised. In cases where no clamp has been provided, the local ordnance officer must ensure that the igniter is rigged in accordance with the best ordnance practice. The clamp must be installed so that the axis of the igniter is at 90° to the axis of the tank.

#### Fuze M157; Igniters M15 and M16

Bombs.....	Jettisonable fuel tanks, incendiary-filled	
	<b>M15</b>	<b>M16</b>
Type.....	External...	Internal
Fuze.....	M157.....	M157
Burster.....	C8R1.....	C8R1
Cap.....	None.....	Supported
Functioning.....	Inst.....	Inst.
Igniters used with...	M14.....	M13
Armed condition...	Any unthreading of M157	
Arming time.....	18-30 vane revolutions; 150-220 feet of air travel	

**General:** The igniters considered here use the Anemometer-Arming All-Ways Action Fuze M157. The Igniters M15 and M16 differ in that the M15 is designed to be attached to the outside of the bomb by means of a clamp, while the M16 has an adapter which allows the igniter to be installed in the filler-cap opening in the tank. Because of this difference, the M15 is known as an external; the M16, as an internal igniter.

The Igniters M15 and M16 consist of either a sodium (Na) or a white phosphorus (W.P.)

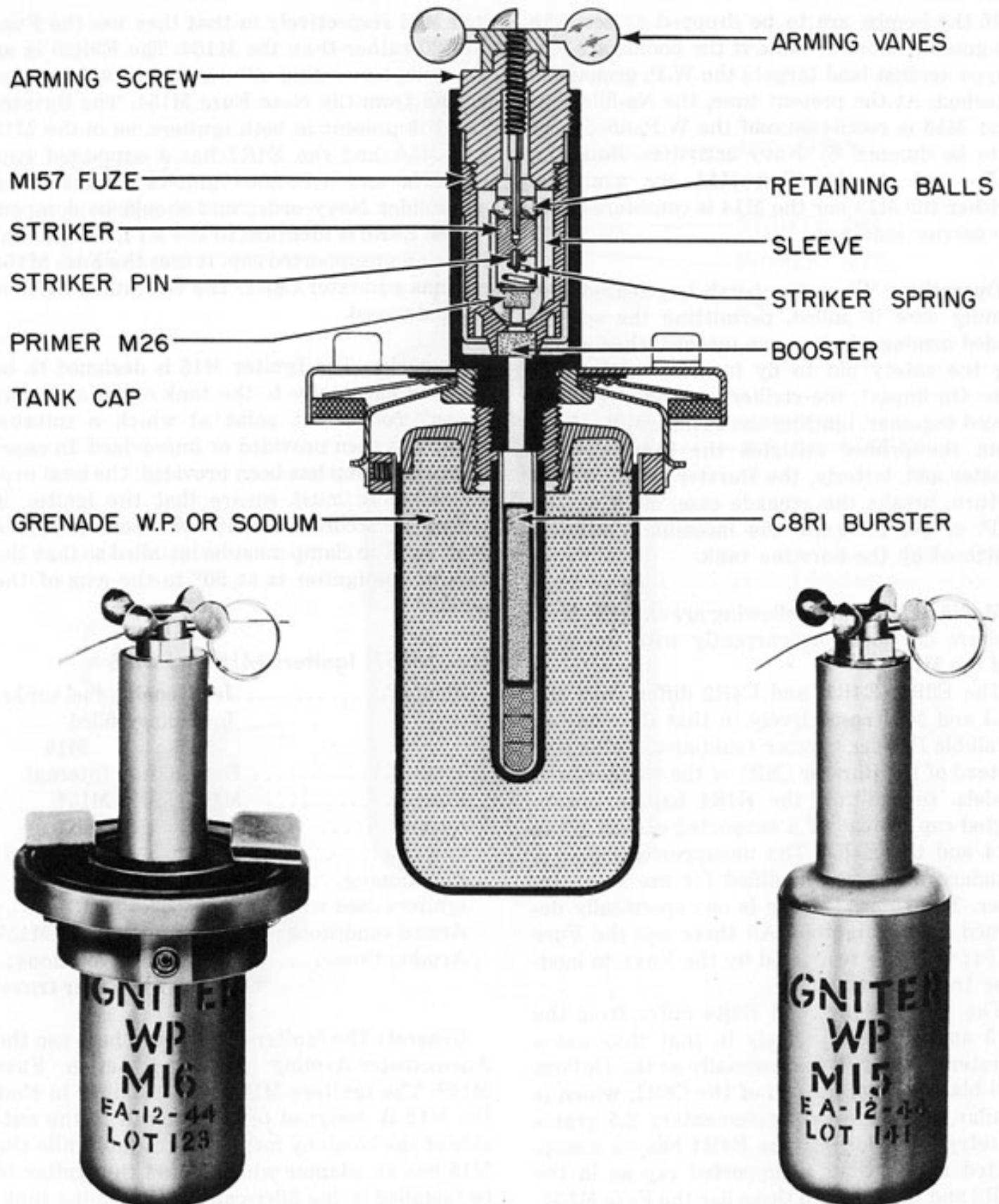


Figure 375. Igniters M15 and M16, and Cutaway Showing Fuze M157

Hand Grenade M15 and a Burster C8R1 (DuPont C56 blasting cap and 2.5 grams of tetryl) fitted to the Fuze M157. If the bombs are to be dropped at sea, the Na grenade is used, while if the bombs are employed against land targets, the W.P. grenade is attached. W.P.- and Na-filled Igniters M15 and M16 are available and are suitable for carrier use.

**Operation:** When the bomb is released, the arming wire is pulled, permitting the anemometer vanes to rotate. The rotation of the vanes threads the arming stem out of the fuze body; the fuze is armed when the stem clears the arming balls, allowing them to fall inward, freeing the striker for movement on impact. The arming assembly threads completely out of the fuze and falls away. On impact, the striker pin and sleeve are forced together, igniting the Primer M26. Flash from the primer initiates the black powder booster and, latterly, the Burster C8R1, which, in turn, breaks the grenade case, allow-

ing the W.P. or Na to ignite the incendiary mixture scattered by the bursting tank.

**Remarks:** Even though the igniter is released safe and the fuze does not function, impact may break open the Grenade M15, scattering its white phosphorus or sodium filler. This will ignite the gasoline gel, just as though the burster had scattered the filler. For this reason, the igniter cannot be considered capable of "safe" dropping with absolute assurance of non-functioning.

The Igniter M15 is designed to be clamped externally to the tank or fin assembly at any convenient point at which a suitable clamp has been provided or improvised. In cases where no clamp has been provided, the local ordnance officer must ensure that the igniter is rigged in accordance with the best ordnance practice. The clamp must be installed so that the axis of the igniter is at 90° to the axis of the tank.

The supported cap is a cap specifically designed for use with an igniter.

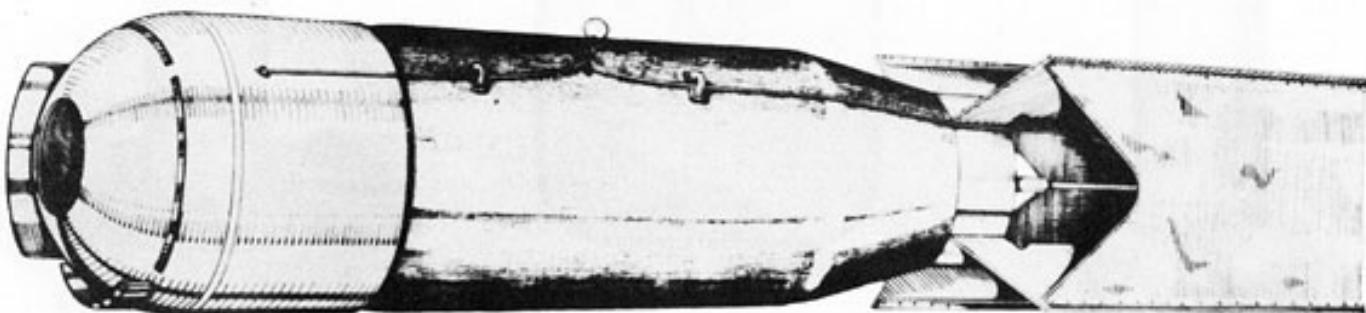
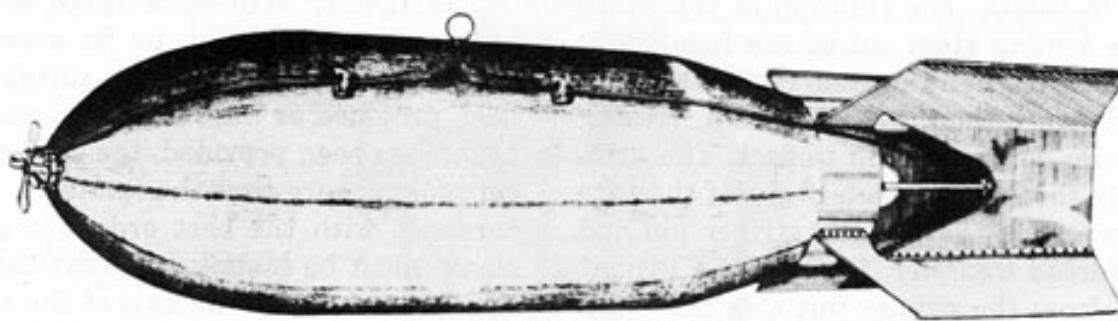


Figure 376. 1,000-pound G.P. Bomb AN-M65 (above) and Same Bomb Fitted with "Dove" Nose Attachment and Special Tail (below)

## GUIDED MISSILES AND FUZES

### Chapter 21 — MISSILES

#### Section I — INTRODUCTION

##### General

One of the newest trends in American ordnance development, guided missiles became service items in the last months of World War II. Guidance was applied to modified bombs, winged glide bombs, and standard aircraft, and in jet- and rocket-propelled airframes.

Guided missiles have great range, high payload capacity and extreme accuracy; and their progress in design has proceeded so rapidly that on only a few items has the design become standardized or "frozen". All the missiles included in this book were at least in the testing stage and were being pursued as active projects at the time of writing. Furthermore, only those missiles designed for combat or military purposes—none of the basic research items—are included; and, of these, only their ordnance components can be described in detail.

##### Guidance

American missiles are usually guided by remote radio control, the receiver in the missile acting through servo units to position the air foils.

##### Intelligence

The person controlling the flight of the mis-

sile will guide its path on the basis of information obtained visually, through a television receiver, or by ordinary radar tracking. Some missiles have automatic guidance features, of such a nature that, once the target has been "shown" to the missile's intelligence unit, it will automatically "home on" to its destination unassisted.

##### Propulsion

Depending on the particular item, a missile may be powered by gravity, aircraft engines, JATO units, rocket motors, or jet motors.

##### Warheads

Thus far, guided missiles have adapted standard bombs as their explosive payloads. Fuzing of these bombs differs from the standard fuzes in that the fuzes must be made in an elbow shape, in order to fit in the fuze pockets and, at the same time, permit vane arming.

##### Cognizance

For the Navy, the Bureau of Ordnance and the Bureau of Aeronautics are developing guided missiles; for the Army, the Air Forces are in charge of the program.

## BUREAU OF ORDNANCE MISSILES

## 1,200-pound "Dove" Bomb Mk 64 (Air-to-Surface Missile)

Over-all length, inches.....	84.5
Over-all diameter, inches.....	18.75
Weight of intelligence units and special tail, pounds.....	183
Warhead (1,000-pound G.P. Bomb AN-M65) weight, pounds.....	975
Total weight, pounds.....	1,160
Fuzing.....	Tail Fuze AN-M102A2

**General:** The Bomb Mk 64 is an experimental heat-homing bomb, consisting of a detecting, computing, and guiding mechanism housed in a nose attachment fitted on the 1,000-pound G.P. Bomb AN-M65. It is designed for attack on maneuvering targets and is effectively employed in both high-angle and dive-bombing runs against objects which have sufficient thermal contrast to their background.

"Dove" is designed to fit the normal plane stowage, but carrying capacity is sometimes reduced because of the missile's increased length. The special Bomb Fin Mk 1 is a box-kite shape and eight inches longer than the standard tail for this bomb.

**Control:** Aerodynamic control is effected in range and azimuth by means of four movable nose deflectors independently controlled, which thus form quadrants of a cylindrical surface whose axis is parallel to that of the bomb. The deflectors may be extended a maximum distance of 4½ inches. The movement of the deflectors is determined by the intelligence unit, which consists of the heat-detecting eye, gyro system, auxiliary electronic relays, servo motors, and battery.

**Suspension:** Standard.

## 1,600-pound "Bat" S.W.O.D. Mk 9 (Air-to-Surface Missile)

Over-all length, feet.....	11.9
Wing span, feet.....	10
Total weight, pounds.....	1,600
Warhead.....	1,000-pound G.P. Bomb AN-M65
Fuzing.....	Nose—Mk 235 Mod 0 Tail—Mk 236 Mod 0

**General:** S.W.O.D. (Special Weapons Ordnance Device) Mk 9, or "Bat", is a glide bomb equipped with a radar homing set mounted in the nose. It is designed primarily for attacking marine targets, and is effective for night or day attacks upon shipping in any weather in which the parent plane can fly. The launching planes need not stay in the vicinity of the target, and may release as many as four of these missiles in salvo.

The airframe consists of plywood sections which are fitted around the Bomb AN-M65. Control surfaces consist of an elevon on each wing which can be moved to control pitch or bank. There are no control surfaces on the tail.

To ensure destruction of the intelligence system, the Demolition System Mk 122 is used.

Installation of the Fuzes Mk 235 and Mk 236, with their outside windmills and flexible arming stems, is standard.

**Control:** This missile has its own radar transmitter and receiver. When the target is located on the scope of the monitor unit in the plane, it is put into the range step of the missile's scope and is automatically kept there. At the correct instant, determined by a glide ratio scale, the missile is released and is guided to its target by the radar signal in its own scope. The guiding radar supplies corrections to the servo system, which is also controlled by a gyro pilot, the device which maintains flight attitude.

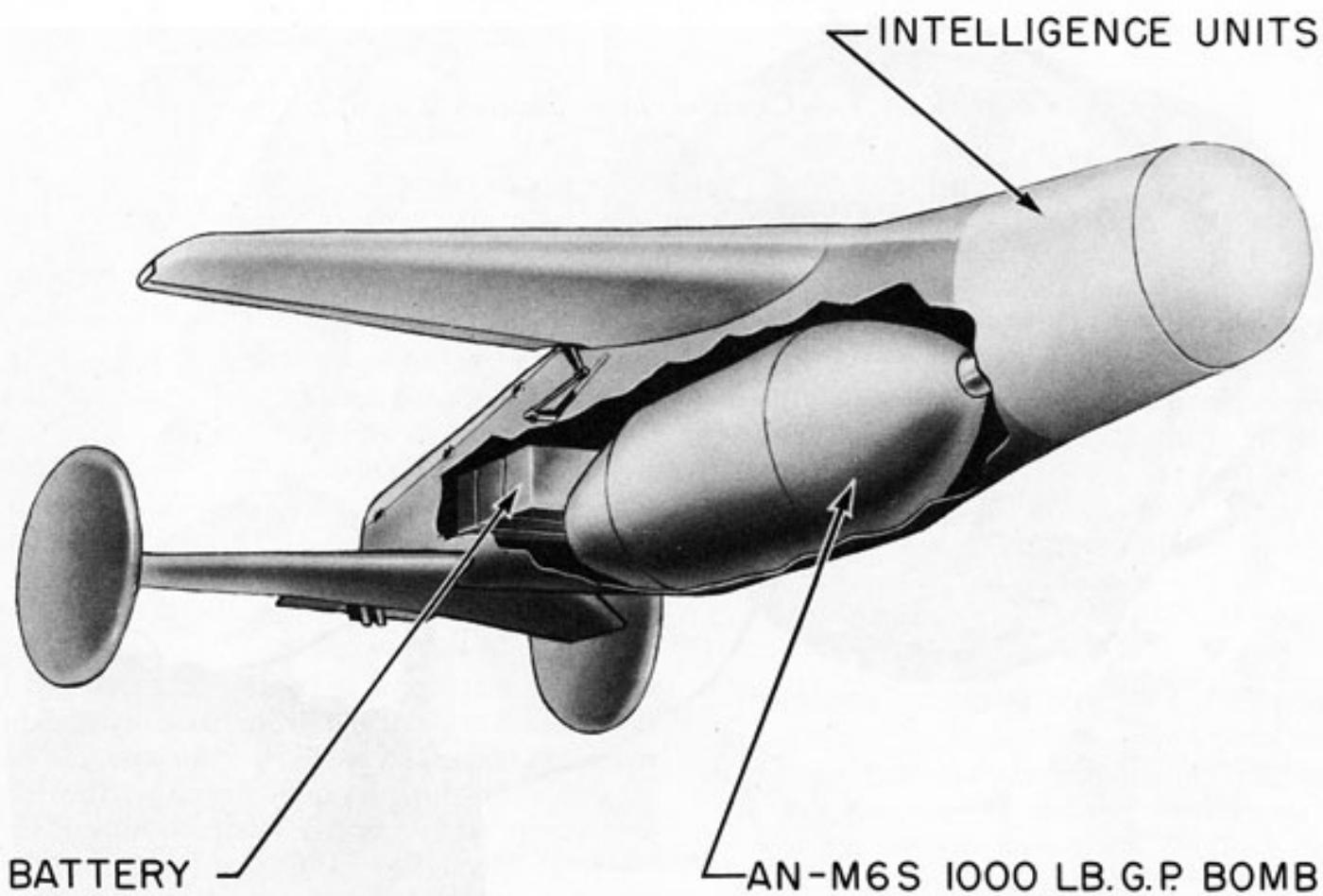


Figure 377. "Bat" Missile, Showing Location of Warhead

**Suspension:** Standard bomb lugs are employed on the airframe. Also, there is the multi-conductor cable connecting the missile's radar with the monitor set in the plane, known as the umbilical cord.

**Demolition system:** This destructor assembly consists of the S-122-11G switch, Junction Box Mk 1 Mod 0, primacord connectors, and ten Demolition Charges Mk 4. The S-122-11G switch incorporates an inertia weight, held by a spring tension of  $11g$ , which will topple if that force is exceeded in an impact. When this inertia weight topples (it is mounted on a universal pivot) the contact bar, which has been transmitting the spring tension to the inertia weight, rotates because of the spring load and completes the electrical circuit across the contacts. This switch has an arming stem, connected to windmill vanes mounted on the outside of the mis-

sile fuselage, which unscrews to arm the switch. These vanes have an arming wire to prevent rotation before release from the parent aircraft. On one side of the switch is a clear plastic inspection port. Tension on the spring is pre-set at  $11g$  when the switch is assembled at the factory.

When the switch completes the circuit, current from the battery sets off the electric blasting cap in the junction box, which fires the primacord connectors and then the TNT blocks, placed around the intelligence unit.

**Remarks:** The S.W.O.D. Mk 9 is commonly known as "the 1,000-pound Bat". The S.W.O.D. Mk 10, built around a 2,000-pound bomb is not being actively developed, because it is felt that the 1,000-pound size is large enough for currently projected uses.

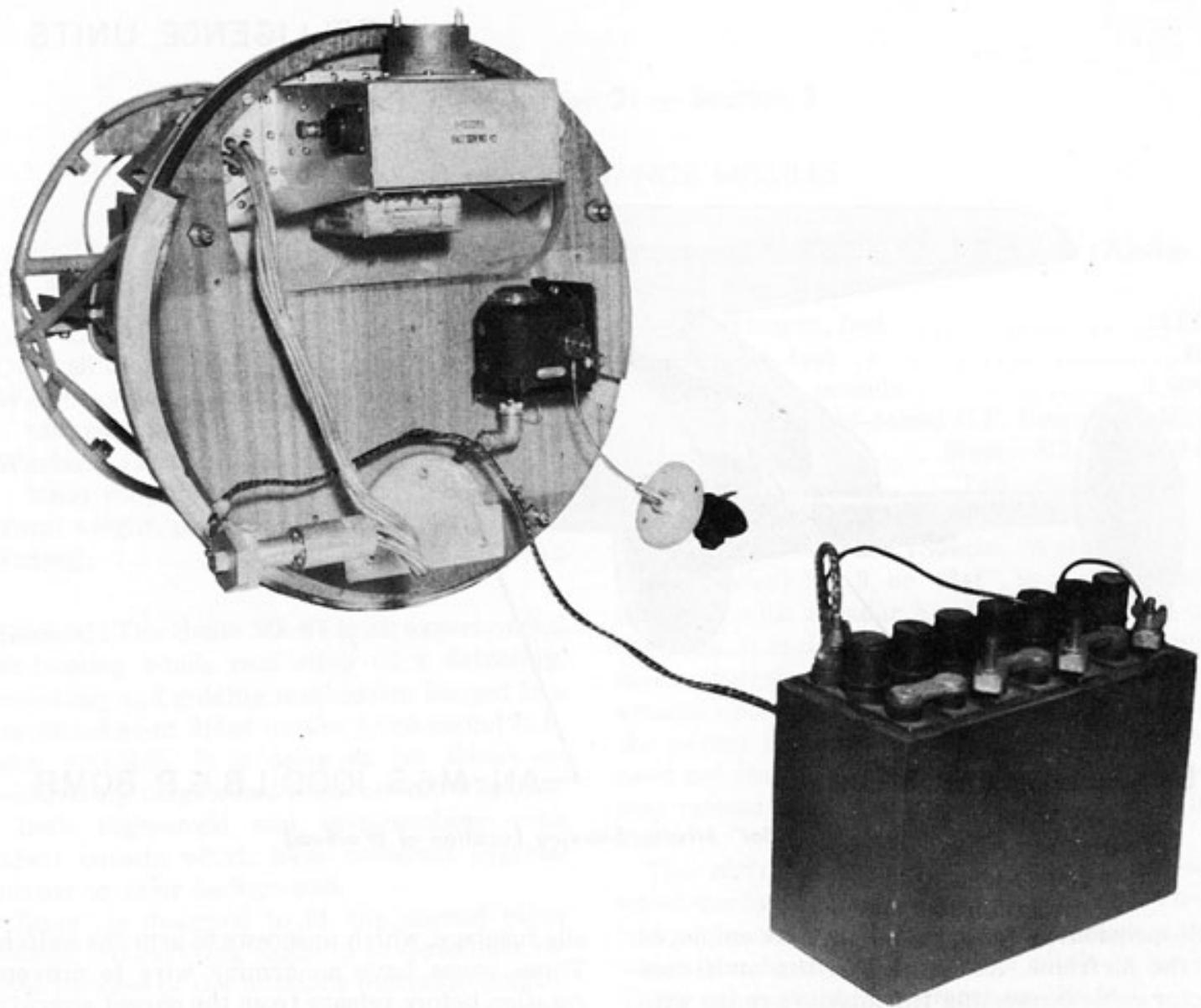


Figure 378. *Battery, Inertia Switch, Junction Box and Connectors of Demolition System Mk 122*

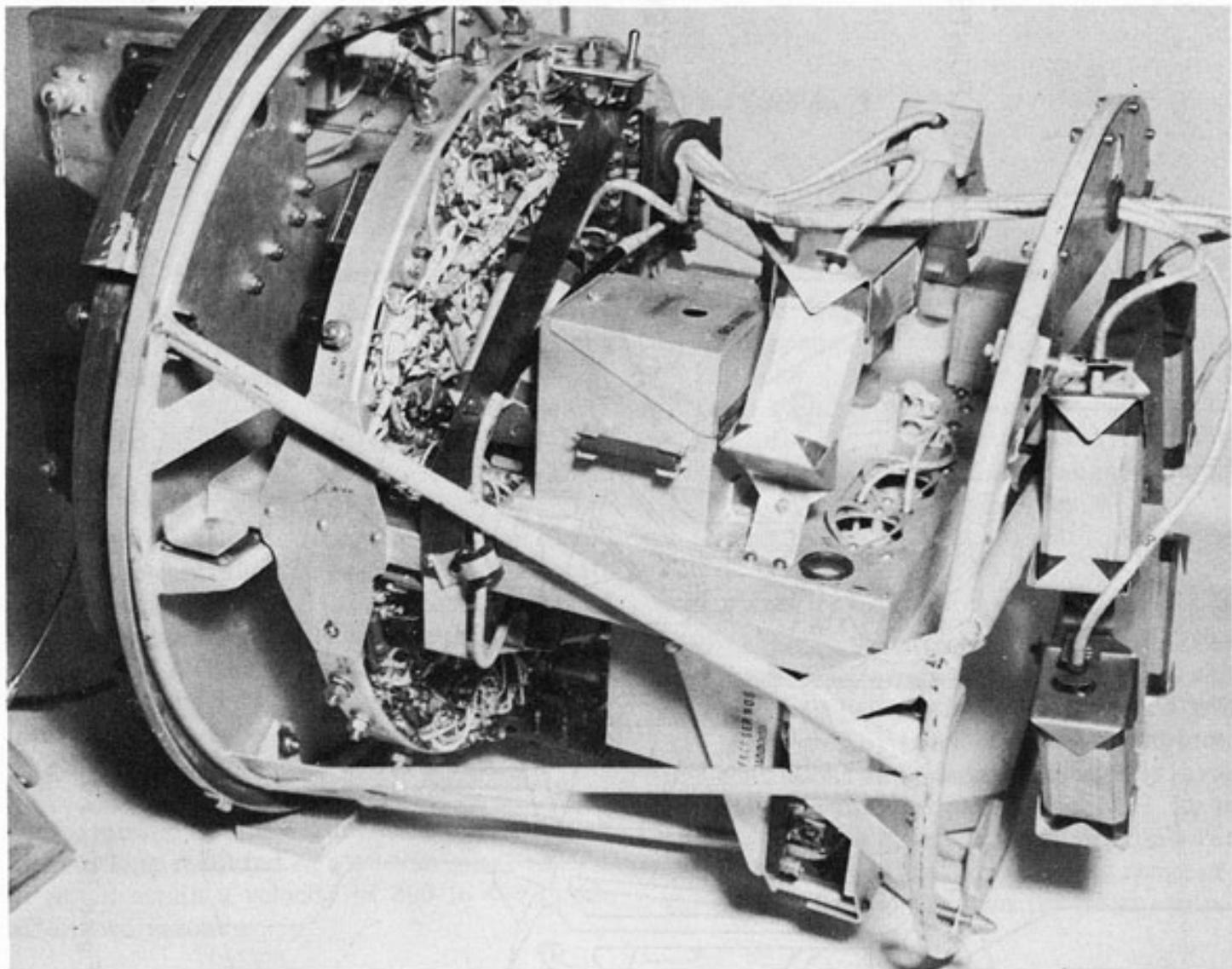


Figure 379. Location of TNT Blocks in Demolition System Mk 122

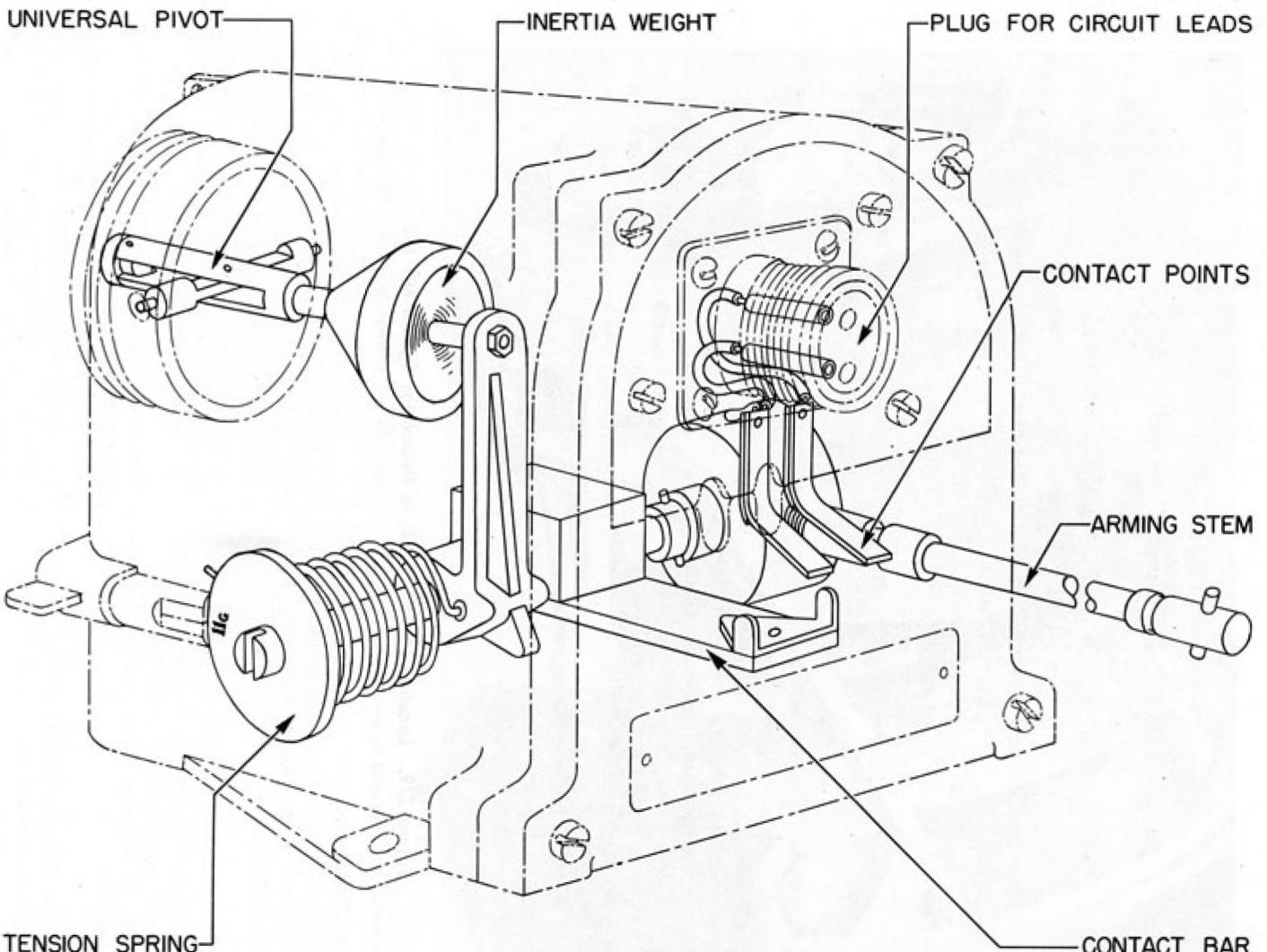


Figure 380. S-122-11G Inertia Switch

## BUREAU OF AERONAUTICS MISSILES

**"Little Joe" 650-pound Surface-to-Air Missile**

Over-all length.....	8 feet 6 inches
Span.....	4 feet 9 inches
Total weight, pounds.....	4 rockets—591 6 rockets—651
Warhead.....	100-pound G.P. Bomb AN-M30
Fuzing.....	V.T. M166

**General:** "Little Joe" is a short-range (10,000 foot) radio-controlled, flare-sighted antiaircraft missile with a 100-pound G.P. warhead, launched from a shipboard catapult with the aid of standard rockets. A Canard-type airframe with cruciform wing and bow plane, it was designed to intercept Baka-type bombs and suicide planes. The missile is powered by a JATO unit.

The missile would be launched from a catapult 20 feet long mounted in a 40-mm gun position. It would attain a velocity of 300 to 400 m.p.h. after two seconds.

**Control:** By observing the flare track, the launcher guides the missile to its target with radio signals sent to the receiver in "Little Joe". The AN/ARW-17 receiver actuates signals which, in turn, operate the servo mechanisms to position the control surfaces. A gyro system provides the stability.

**Propulsion:** An 8AS1000 E JATO unit serves as the main propulsive motor. This unit weighs 139 pounds and contains about 75 pounds of Gal-cit propellant. It delivers 1,000 pounds thrust for eight seconds.

Four or six 3.25-inch Aircraft Rocket Motors Mk 7 are used to assist in launching.

**Warhead:** The 100-pound bomb has only the V.T. fuze.

**1,400-pound "Lark" Ship-to-Air Missile**

Over-all length.....	12 feet 6 inches
Wing span.....	6 feet 2 inches
Tail span.....	4 feet
Total weight, pounds.....	1,361
Warhead.....	Undetermined; probably a specially designed fragmentation head
Fuzing.....	Still experimental

**General:** The "Lark" is launched from a ship board catapult for attacking high-altitude bombers. It has cruciform wings and tail surfaces, the tail surfaces being offset 45° from the wings, and is powered by two liquid-fuel rocket motors, one continuous and one intermittent. It is radio-controlled in the first part of its flight, its position determined by the launching ship's radar. When it comes within radar homing range of the target, the homing mechanism takes control.

It is launched at 150 m.p.h. from a multiple-charge shipboard catapult by means of two 12AS1000 F JATO units which are jettisoned after exhaustion. With a range of 80,000 yards, an optimum ceiling of 30,000 feet, and a rate of climb of 8,200 feet per minute, it may develop a maximum speed of 650 m.p.h. Designed strength permits a maximum lateral acceleration of 4g. Slant range is estimated to be 45 miles, with time of flight of about five minutes.

**Control:** By use of the ship radar intelligence, radio control will maintain the missile in the center of the tracking radar beam during the initial phase of flight. When the range of the automatic homing radar is reached, it will take over and navigate a collision course with the target. Both remote radio control and radar homing devices are connected to control surfaces

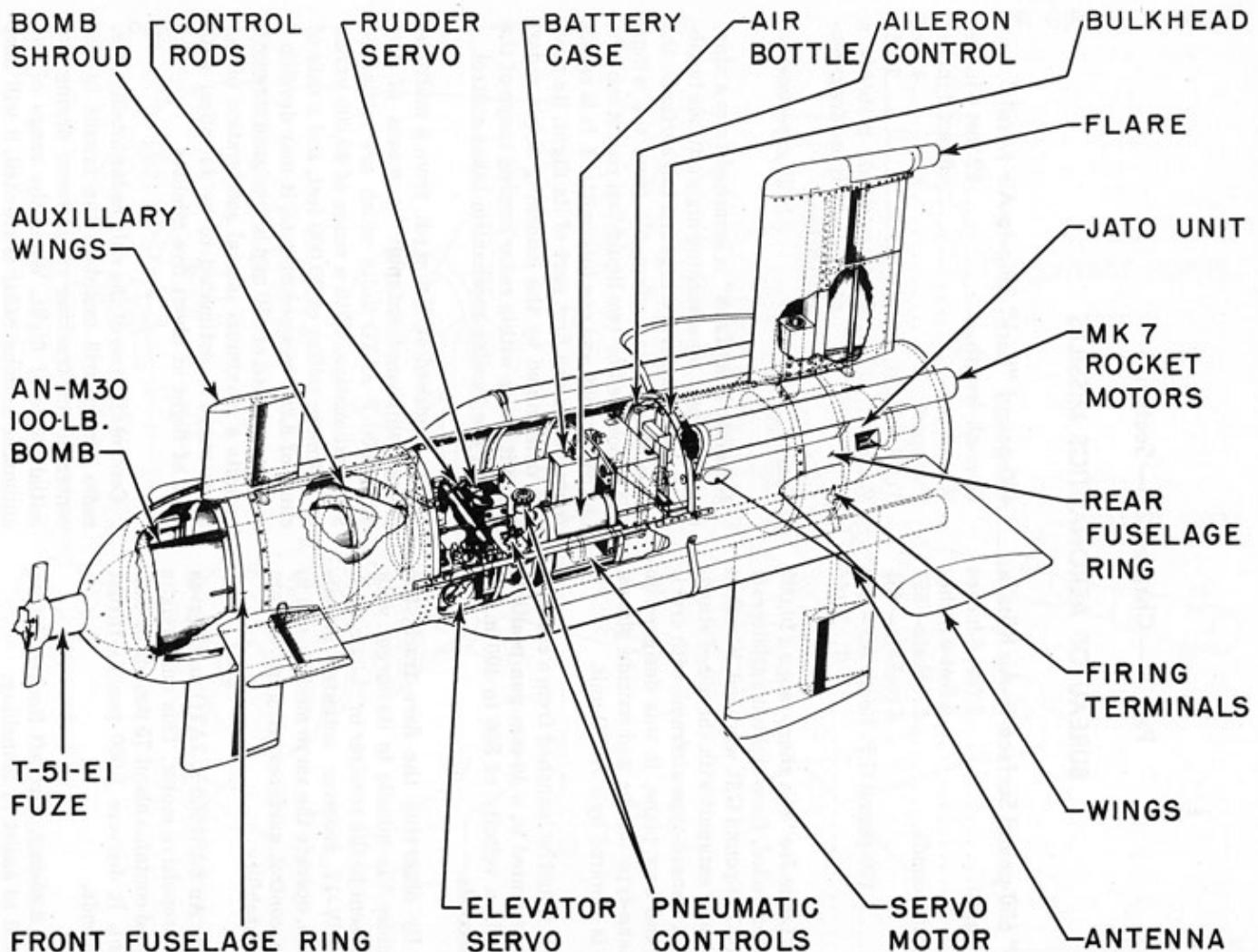


Figure 381. "Little Joe" Missile

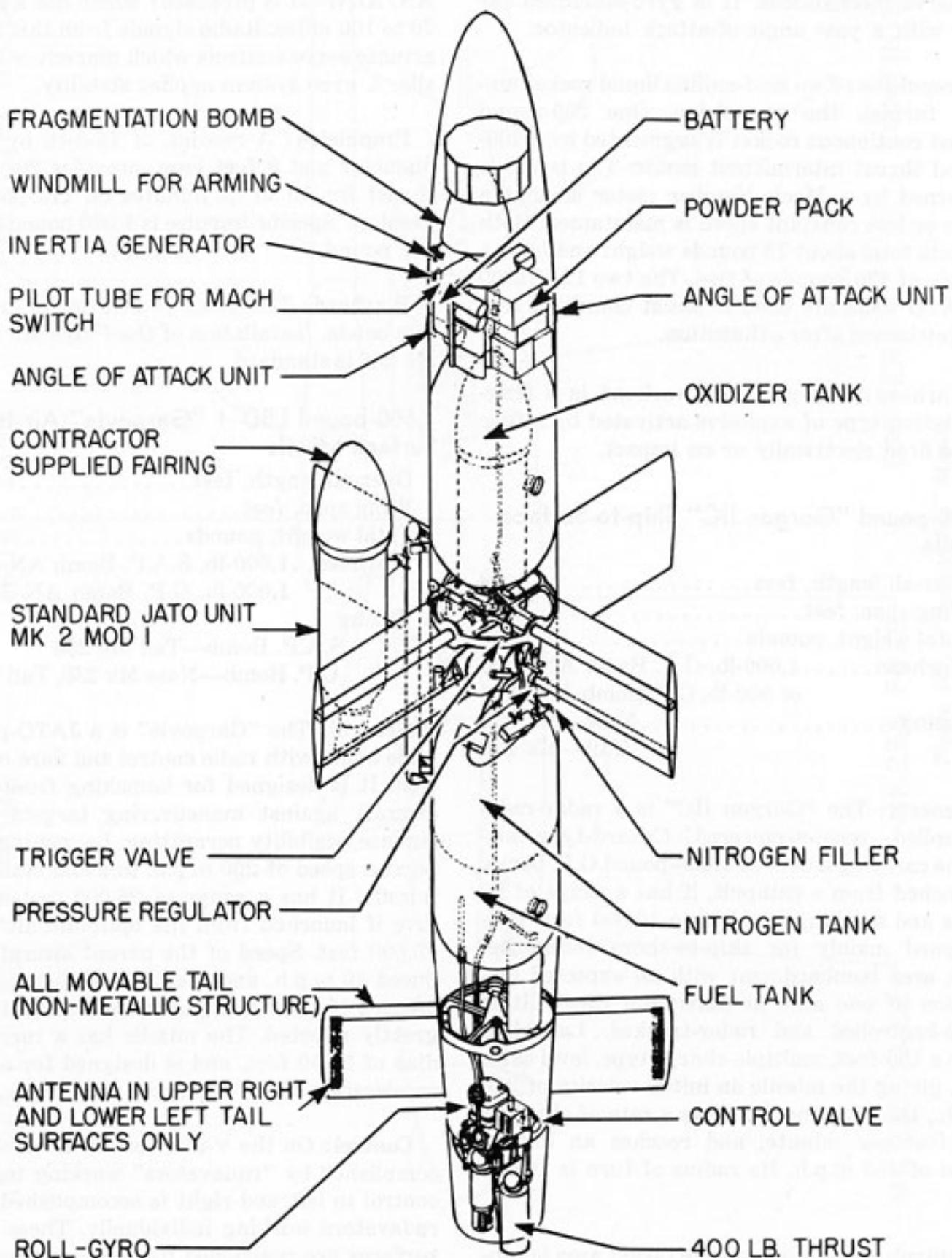


Figure 382. "Lark" Missile

by servo mechanisms. It is gyro-stabilized for roll, with a yaw angle-of-attack indicator.

**Propulsion:** Two acid-aniline liquid rocket motors furnish the propulsion. One 200-pound thrust continuous rocket is augmented by a 400-pound thrust intermittent motor. The latter is governed by a Mach Number meter so that a more or less constant speed is maintained. Both rockets total about 75 pounds weight and have a supply of 490 pounds of fuel. The two 12AS1000 F JATO units are used to assist launching and are jettisoned after exhaustion.

**Warhead:** The proposed warhead is a fragmentation type of explosive activated by a fuse to be fired electrically or on impact.

#### 1,700-pound "Gorgon IIC" Ship-to-Surface Missile

Over-all length, feet.....	18
Wing span, feet.....	11
Total weight, pounds.....	1,688
Warhead.....	1,000-lb. G.P. Bomb AN-M65 or 500-lb. G.P. Bomb AN-M64
Fuzing.....	Nose—Mk 235 Tail—Mk 236

**General:** The "Gorgon IIC" is a radar-radio controlled, resojet-powered, Canard-type airframe carrying a 500- or 1,000-pound G.P. bomb. Launched from a catapult, it has a range of 90 miles and a ceiling of 8,000 to 10,000 feet. It is designed mainly for ship-to-shore round-the-clock area bombardment with an expected dispersion of one mile at maximum range. It is radio-controlled and radar-tracked. Launched from a 150-foot, multiple-charge type, level catapult, giving the missile an initial velocity of 240 m.p.h., the "Gorgon IIC" has a rate of climb of 600 feet per minute, and reaches an impact speed of 450 m.p.h. Its radius of turn is 10,000 feet.

**Control:** Intelligence on the target area is provided by AN/APN-33 A1 radar, range 70 miles. Radio control of the missile is accomplished by the receiver AN/ARW-17 (for combat the

AN/ARW-37 is proposed) which has a range of 70 to 100 miles. Radio signals from this receiver actuate servo controls which maneuver the missile. A gyro system applies stability.

**Propulsion:** A resojet, of 14-inch by 10-inch diameter and 9 feet long, provides 200 pounds thrust for 10 to 20 minutes on 174 pounds of gasoline. Specific impulse is 1,030 pound-seconds per pound.

**Warhead:** The bomb is held in its cradle by two bands. Installation of the Fuzes Mk 235 and Mk 236 is standard.

#### 1,600-pound LBD-1 "Gargoyle" Air-to-Surface Missile

Over-all length, feet.....	10
Wing span, feet.....	8½
Total weight, pounds.....	1,646
Warhead.....	1,000-lb. S.A.P. Bomb AN-M59 or 1,000-lb. G.P. Bomb AN-M65
Fuzing	
	S.A.P. Bomb—Tail Mk 236
	G.P. Bomb—Nose Mk 235, Tail Mk 236

**General:** The "Gargoyle" is a JATO-powered glide bomb with radio control and flare observation. It is designed for launching from carrier aircraft against maneuvering targets on the surface, visibility permitting. Launching should be at a speed of 200 m.p.h. to avoid stalling the missile. It has a range of 26,000 feet in a 30° dive if launched from the optimum altitude of 15,000 feet. Speed of the parent aircraft is reduced 10 m.p.h. and the take-off distance is increased 15 to 80 feet, but maneuverability is not greatly affected. The missile has a turning radius of 2,550 feet, and is designed for a lateral acceleration of 4g. Top speed: 600 m.p.h.

**Control:** On the V-tail, control in pitch is accomplished by "rudavators" working together; control to left and right is accomplished by the rudavators working individually. These control surfaces are positioned by servo motors which take their signal from the radio receiver. The receiver, AN/ARW-17 (the AN/ARW-37 is proposed for combat) weighs 20 pounds and has

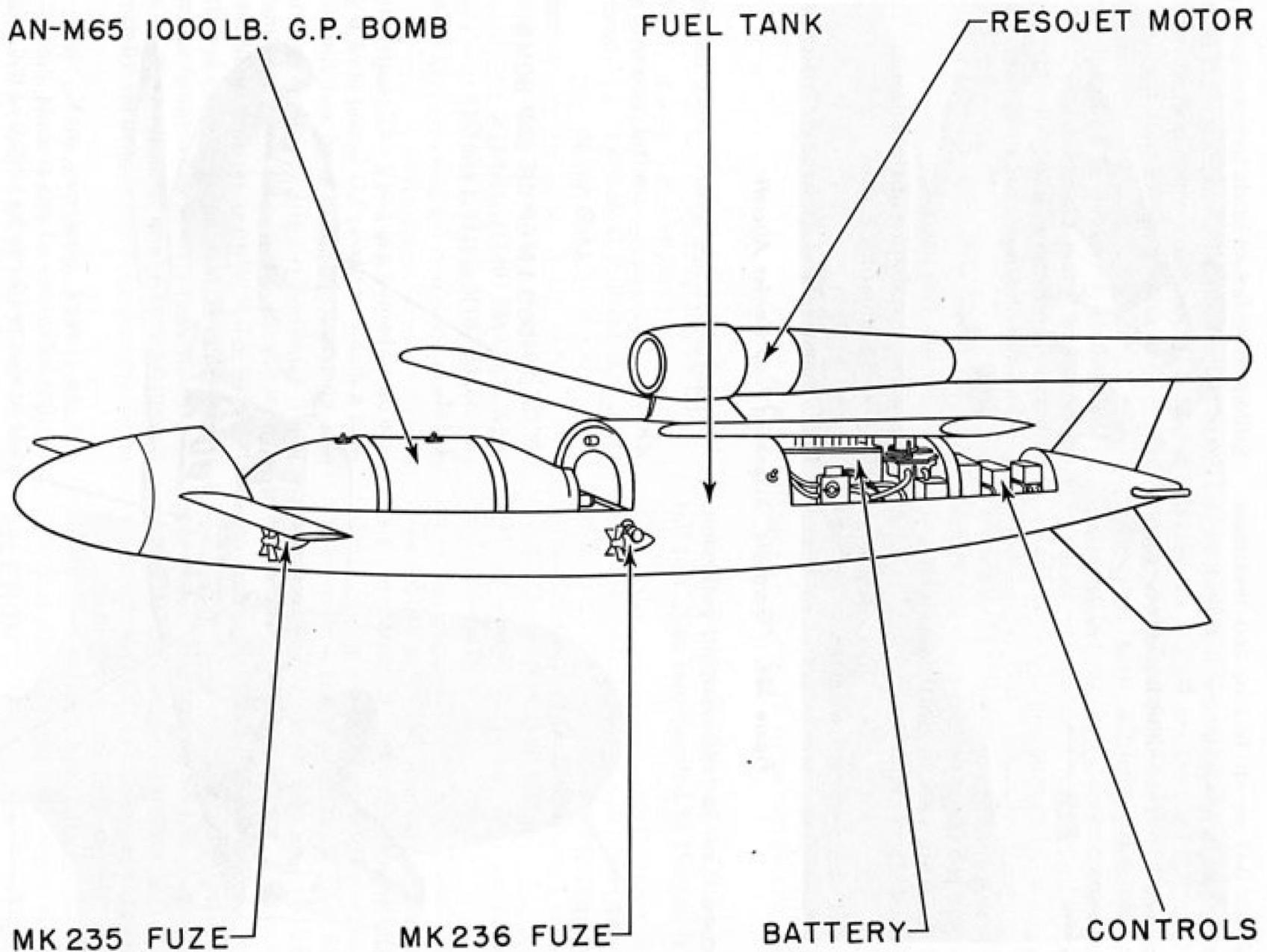


Figure 383. "Gorgon IIC" Missile

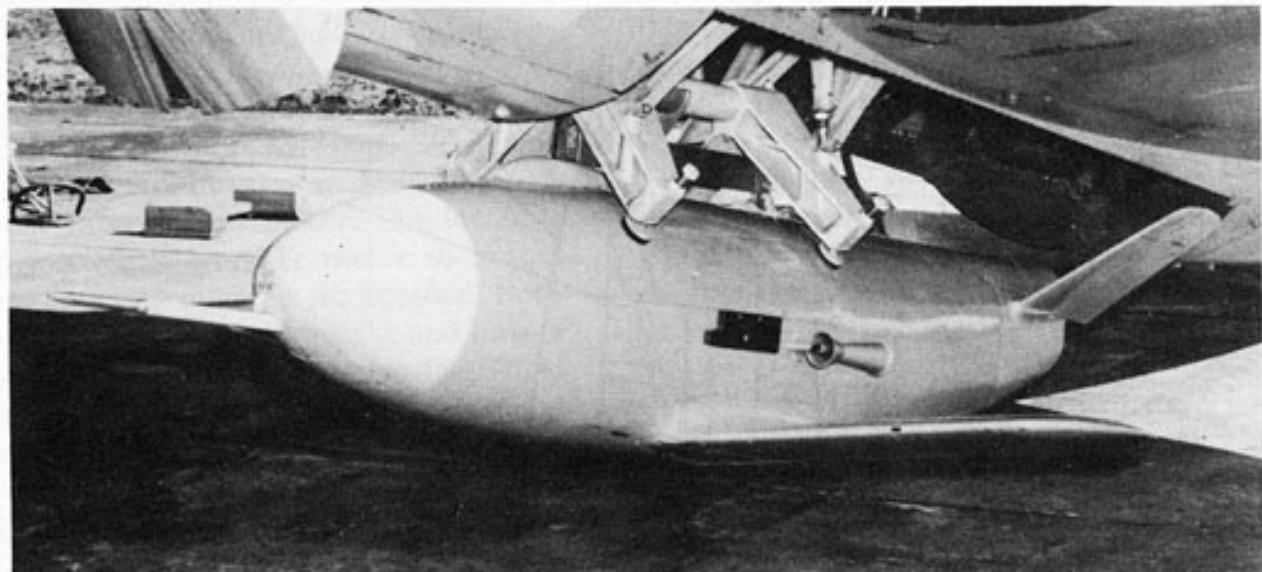


Figure 384. "Gargoyle" Suspended from Carrier Aircraft

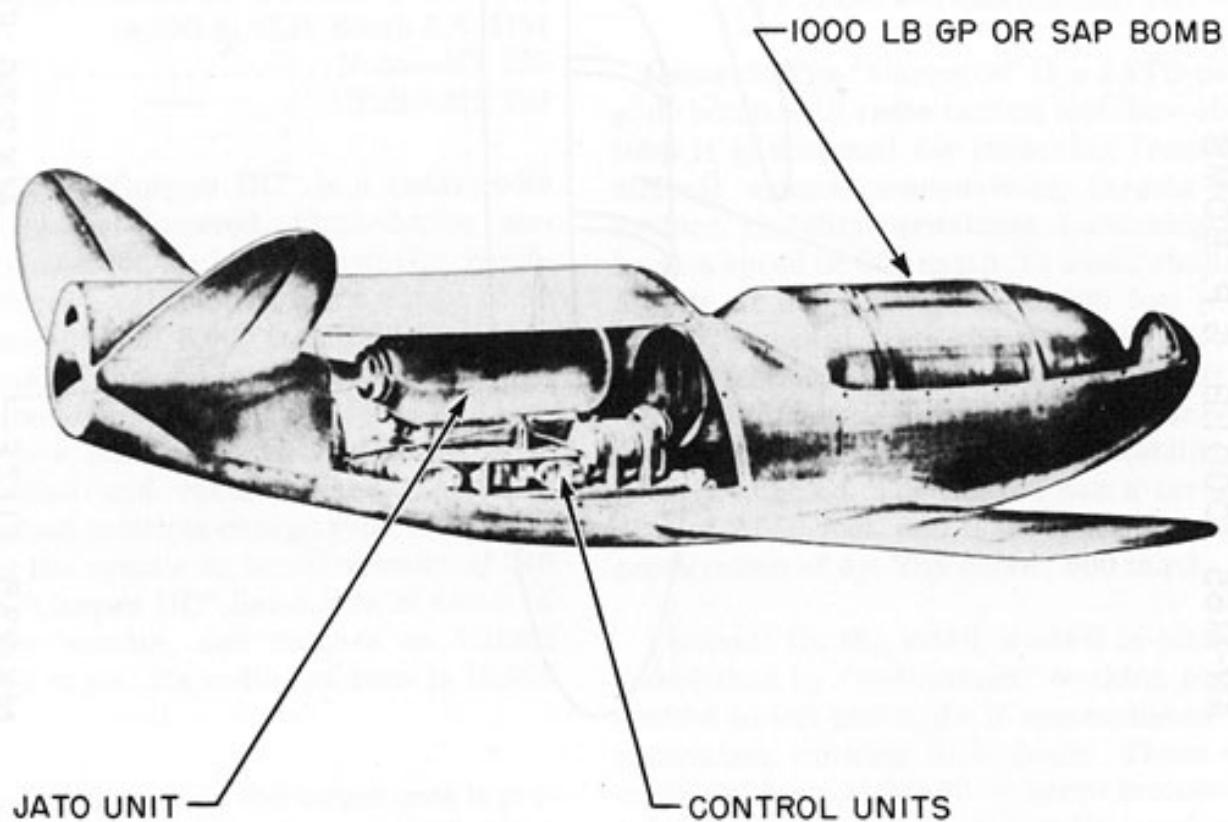


Figure 385. "Gargoyle" with Panels Removed

an estimated range of about 28 miles, depending on the antenna employed. Weight of servo system: 125.6 pounds.

**Power:** A standard 8AS1000 JATO unit, weighing 150 pounds, provides a propulsive thrust of 1,000 pounds for eight seconds. The fuel is 80 pounds of solid Galcit 63C propellant contained in a 9½ by 28¾-inch casing.

**Suspension:** Exact specifications are not now

available; but in test drops D-6 shackle and sway braces were employed (see figure 384). When the G.P. bomb is used, two steel straps 1/16 inch by 1/2 inch through the suspension lugs on the bomb hold it to the cradle. If the S.A.P. bomb is loaded, a strap through the single British suspension lug is used; also, an adapter block is placed in the cradle to provide a snug fit for the smaller diameter of the S.A.P. bomb.

### Part 7 — Chapter 21 — Section 4

#### A.A.F. MISSILES

##### 1,000-pound VB-1 "Azon" Air-to-Surface Missile

Body diameter, inches.....	18.8
Warhead.....	1,000-lb. G.P. Bomb AN-M44, 65, or 65A1
<b>Fuzing</b>	
Nose.....	AN-M103A1, AN-M103, M139, M139A1, M140, M140A1, AN- M140A1, M163, M164, M165
Tail.....	M167

**Construction:** The VB-1 is a guided bomb employing a 1000-pound G.P. body to which a special tail unit has been attached, replacing the standard tail assembly. The VB stands for "Vertical Bomb" and indicates that the bomb is normally released from high altitude by use of a conventional bombsight and that the guided action for the bomb is relatively small, so that direction of the trajectory at the time of impact is essentially vertical.

**Tail unit:** More popularly known as the "Azon" bomb, since it can be controlled only in azimuth 2,000 to 3,000 feet on either side of the normal point of impact, the VB-1 has its controls in a radio receiver housed in the tail unit. A radio transmitter, operated by the bombardier in the parent aircraft, sends signals to the receiver, which, in turn, activates a servo motor

controlling the movement of the rudders in the tail fins. Also incorporated in the tail is a gyro

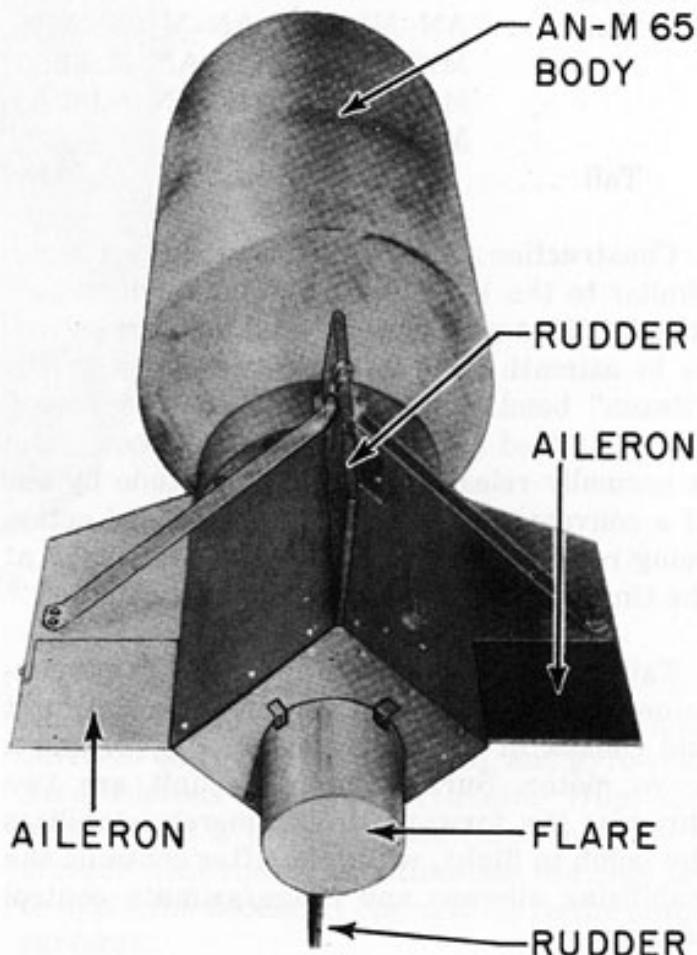


Figure 386. VB-1 "Azon"

and solenoid system which prevents the bomb from spinning by changing the pitch of the small ailerons in the fins.

Guide flares attached to the after end of the tail unit assist the bombardier in following the flight of the VB-1. Three flares, the T6E1 (white), T7E1 (red), and T8E1 (green) with an intensity of 1,000,000 candlepower each, are electrically armed and ignited three to four seconds after release, and burn from one to two minutes. Three mechanically armed and ignited flares, T21, T22, and T23 are under development.

**Suspension:** Suspension lugs are welded to the case in a manner similar to the G.P. bombs.

#### 1,000-pound VB-3 "Razon" Air-to-Surface Missile

Body diameter, inches.....	18.8
Warhead.....	1,000-lb. G.P. Bomb AN-M44, 65, or 65A1
<b>Fuzing</b>	
Nose.....	AN-M103A1, AN-M103, M103, M139, M139A1, AN-M139A1, M140, M140A1, AN-M140A1, M163, M164, M165
Tail.....	M167

**Construction:** The VB-3 is a guided bomb similar to the VB-1, with the major difference that its flight may be controlled in range as well as in azimuth, and is known generally as the "Razon" bomb. Like the VB-1, it has special tail unit fitted to a 1,000-pound G.P. body, and is normally released from high altitude by use of a conventional bombsight, the guided action being relatively small, so that the trajectory at the time of impact is essentially vertical.

**Tail unit:** The controls for the VB-3 are contained in the cylindrical section of the tail unit and consist of a radio receiver, a gyro, and a servo motor. Surrounding this unit are two shrouds; the forward shroud merely stabilizes the bomb in flight, while the after contains the stabilizing ailerons and range/azimuth control ailerons.

On each of the four struts supporting the after shroud is an aileron controlled by the gyro.

These four ailerons steady the bomb and prevent it from rotating while in flight. They are set 90° apart and operate in pairs; i.e., those ailerons placed opposite to each other move together in unison.

Four more ailerons are located on the outer surface of the after shroud. These are ailerons which control the trajectory of the bomb and adjust its flight in azimuth and range. They also work in pairs, and are operated by connecting rods which pass through the control unit and are activated by the servo motor. At present, two bombardiers are required with the VB-3 bomb; one controls range and the other azimuth. They work independently of each other and, by use of a special bombsight, they are always able to see the bomb in flight, superimposed on the target. As the bombardiers manipulate their control switches, radio waves are sent to the receiving unit in the tail. This unit activates the servo motor, which, in turn, moves the ailerons on the shroud, altering the flight of the bomb.

As in the VB-1, flares are employed to assist the bombardier in the visual control of the flight of the bomb. Currently used flares are the T6E1 (white), T7E1 (red), and T8E1 (green). They are of 1,000,000 candlepower, electrically ignited three to four seconds after release, and with one to two minutes of burning time. Mechanically-activated flares—T21, T22, and T23—are under development.

**Suspension:** Suspension lugs are welded to the case in a manner similar to the G.P. bombs.

#### 1,200-pound VB-6 "Felix" Air-to-Surface Missile

Over-all length, inches.....	91.2
Over-all diameter, inches.....	18.6
Total weight, pounds.....	1,202
Warhead.....	1,000-lb. G.P. Bomb AN-M65

Fuzing..... Nose—T85  
Tail—M167

**General:** The VB-6 is a heat-homing, high-angle bomb for attack against targets which give higher heat radiation than the surrounding areas. An added nose (84 pounds) and special tail assembly (143 pounds) carried on a stand-

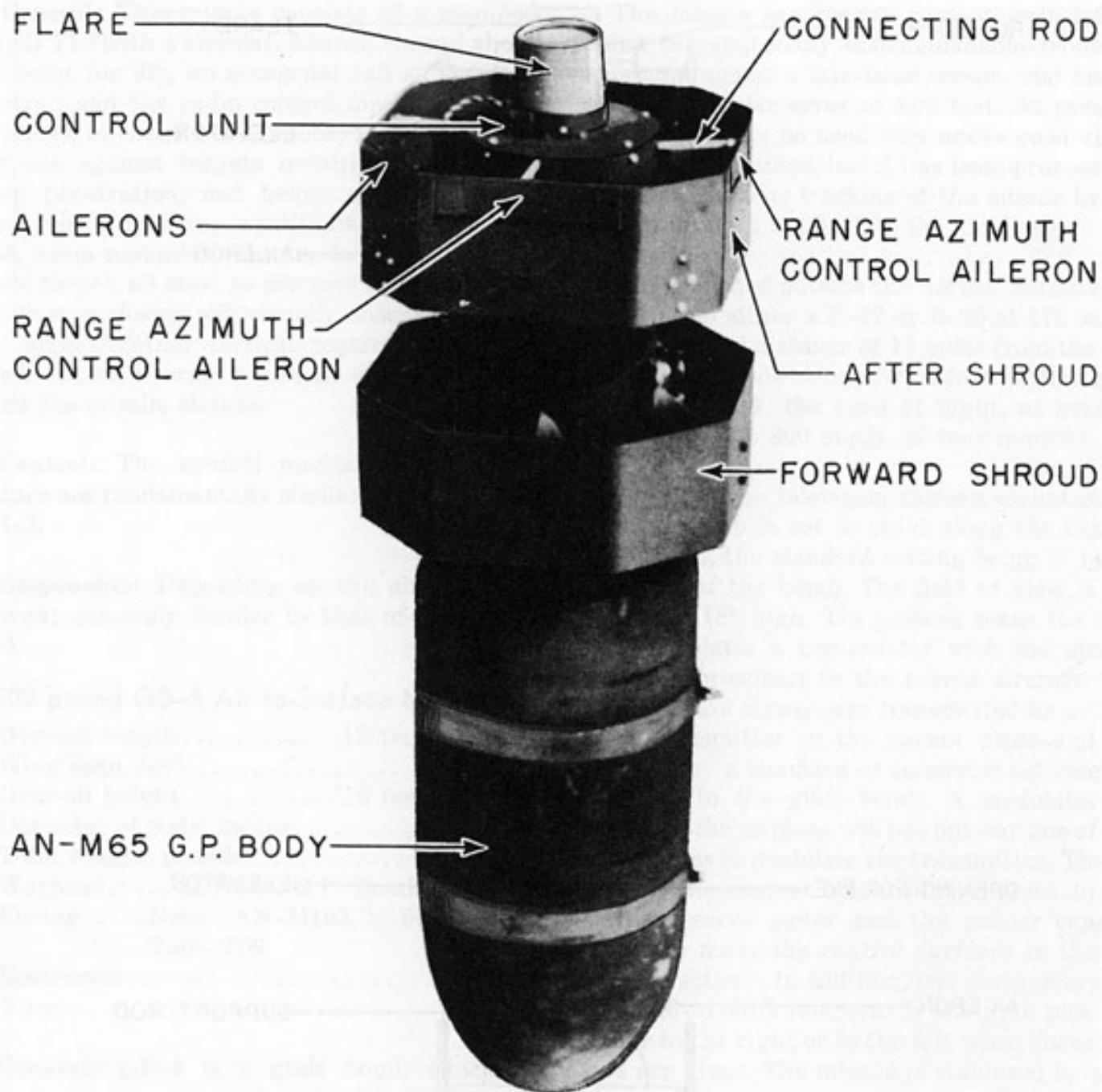


Figure 387. VB-3 "Razon"

ard 1,000-pound G.P. Bomb AN-M65 contain the heat-seeking equipment and the mechanism which operates the airfoil controls. Requisites for proper performance are clear weather and a target which has necessary heat-radiation quality. The bomb is sighted and released by standard Norden procedure.

**Control:** The tail assembly, which resembles that of VB-3, has range and azimuth control surfaces on an octagonal shroud, and gyro-stabilized ailerons to keep the missile from spinning. When a target passes into view, the increased heat radiations stimulate the nose unit to apply the necessary corrections to the shroud surfaces.

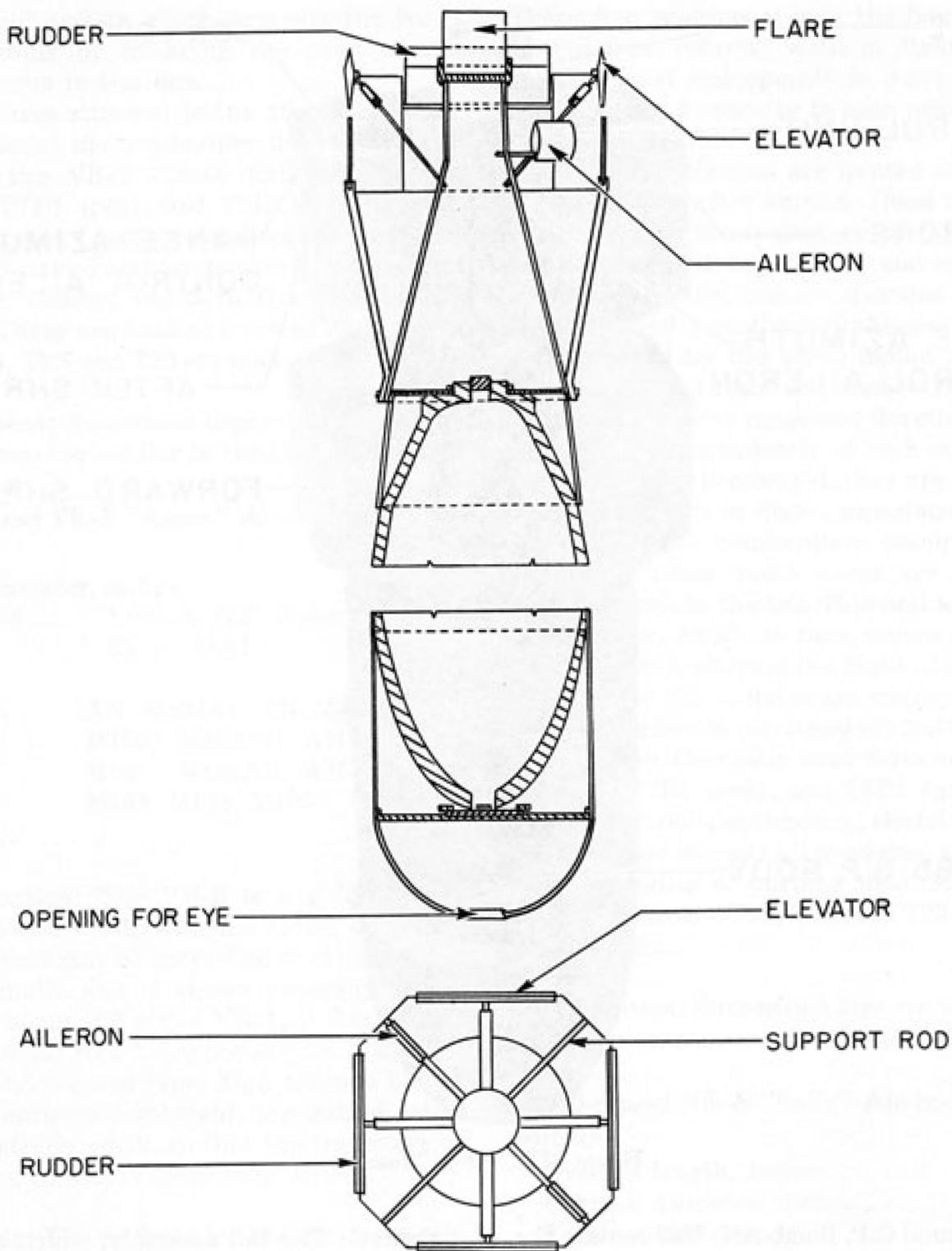


Figure 388. VB-6 "Felix"

**Suspension:** Standard lugs.

**Remarks:** The Nose Fuze T85 has a special plate attached to it, on which the nose assembly is bolted.

**12,000-pound VB-13 "Tarzon" Air-to-Surface Missile**

Over-all length, feet.....	21
Warhead.....	12,000-lb. G.P. Bomb T10
Fuzing.....	Three Fuzes T723 in tail

**General:** This missile consists of a modified Bomb T10 with a circular, 54-inch shroud about its body for lift, an octagonal tail surface for control, and the radio control mechanisms for guidance in range and azimuth. It is well suited for use against targets requiring direct hits, deep penetration, and heavy explosive loads. Good visual bombing conditions are necessary, and, when several bombs are to be used on the same target, all must be dropped together, since the first explosion will visually obscure the target area. Another tactical requirement is for the dropping aircraft to remain on its bomb run until the missile strikes.

**Control:** The control mechanism and procedure are fundamentally similar to those of the VB-3.

**Suspension:** Depending on the aircraft employed; generally similar to that of the Bomb T10.

#### 2,500-pound GB-4 Air-to-Surface Missile

Over-all length.....	12 feet 2 inches
Wing span, feet.....	12
Over-all height.....	6 feet 2 inches
Diameter of body, inches.....	24
Total weight, pounds.....	2,536
Warhead.....	2,000-lb. G.P. Bomb AN-M66
Fuzing.....	Nose—AN-M103, M139, or M140
	Tail—T59
Destructor.....	T9
Fuze.....	T62

**General:** GB-4 is a glide bomb which is launched from an aircraft and guided by remote radio control to its surface target by employing television intelligence picked up by a television camera on the missile and radioed to a receiver in the launching plane. It has a special plywood airframe built around a 2,000-pound bomb, with rudders and elevators but no ailerons. The airframe is fastened to a magnesium casting threaded to the tail of the bomb.

The missile is effective against well defined point targets, easily distinguishable from the surroundings on a television screen, and has an average circular error of 200 feet. At present, the weapon can be used only under good visual bombing conditions, but it has been proposed to incorporate radar tracking of the missile by the parent aircraft to alleviate the handicap.

It is launched outside the normal antiaircraft range from either a B-17 or B-25 at 175 m.p.h. at a preferred distance of 17 miles from the target at an altitude below 15,000 feet. With a glide ratio of 6 to 1, the time of flight, at average rates of 250 to 300 m.p.h., is four minutes.

**Control:** The television camera mounted under the bomb is set to point along the bomb's flight path, the standard setting being 3° below the axis of the bomb. The field of view is 14° wide and 18° high. The camera scans the area and modulates a transmitter with the picture which is broadcast to the parent aircraft. The radio control signals are transmitted by a "liaison" transmitter in the parent plane and are received by a standard or command set receiver installed in the glide bomb. A modulator installed in the airplane will put out any one of five audio tones to modulate the transmitter. The relays in the control unit switch current to the elevator servo motor and the rudder capstan motor to move the control surfaces in the desired directions. In addition, two more relays are actuated to shift temporarily the gyro pick-offs either to the right or to the left when those signals are given. The missile is stabilized by a directional gyro to give roll and azimuth control.

**Suspension:** The missile is carried outside the plane on a Shackle D7. Electrical cables, connected to it, pull out on release.

**Destructor:** The Destructor T9 is placed in the control box and is actuated, on impact, by the Fuze T62.

handed their Japanese allies the secret of the most advanced aerial bomb guidance system in the world. The Japanese had been using a system of television cameras to control the bombs they were dropping on the United States. This was the first time that the Japanese had been able to get a clear picture of the target area and then drop bombs on it. The Japanese had also been using a system of television cameras to control the bombs they were dropping on the United States. This was the first time that the Japanese had been able to get a clear picture of the target area and then drop bombs on it.

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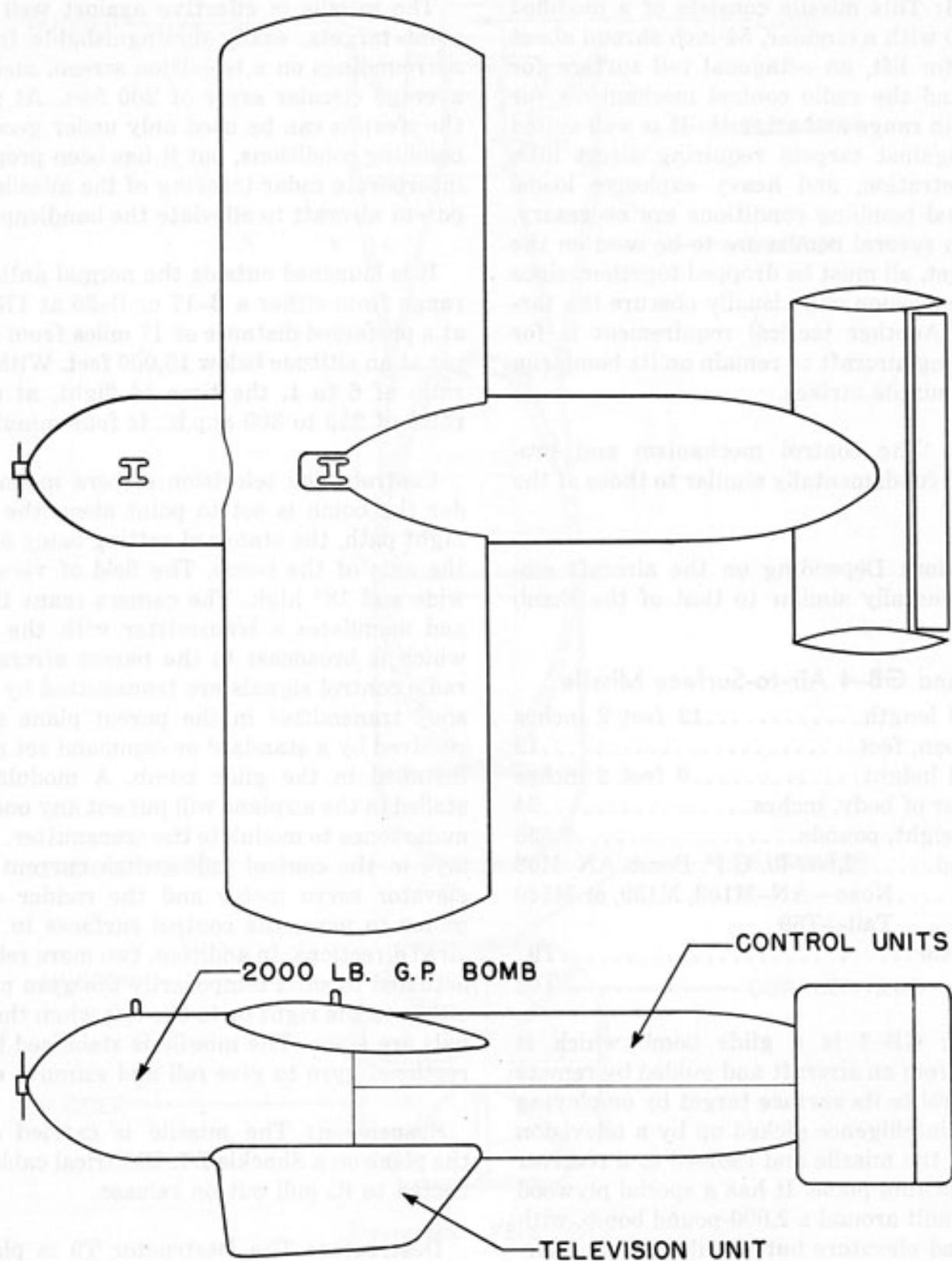


Figure 389. GB-4 Missile

#### 2,500-pound GB-8 Air-to-Surface Missile

Over-all length..... 11 feet 7 inches  
Span..... 12 feet 0 inches

Tail ..... 4 feet 8 inches  
Total weight, pounds..... 2,555  
Warhead..... 2,000-lb. G.P. Bomb AN-M66

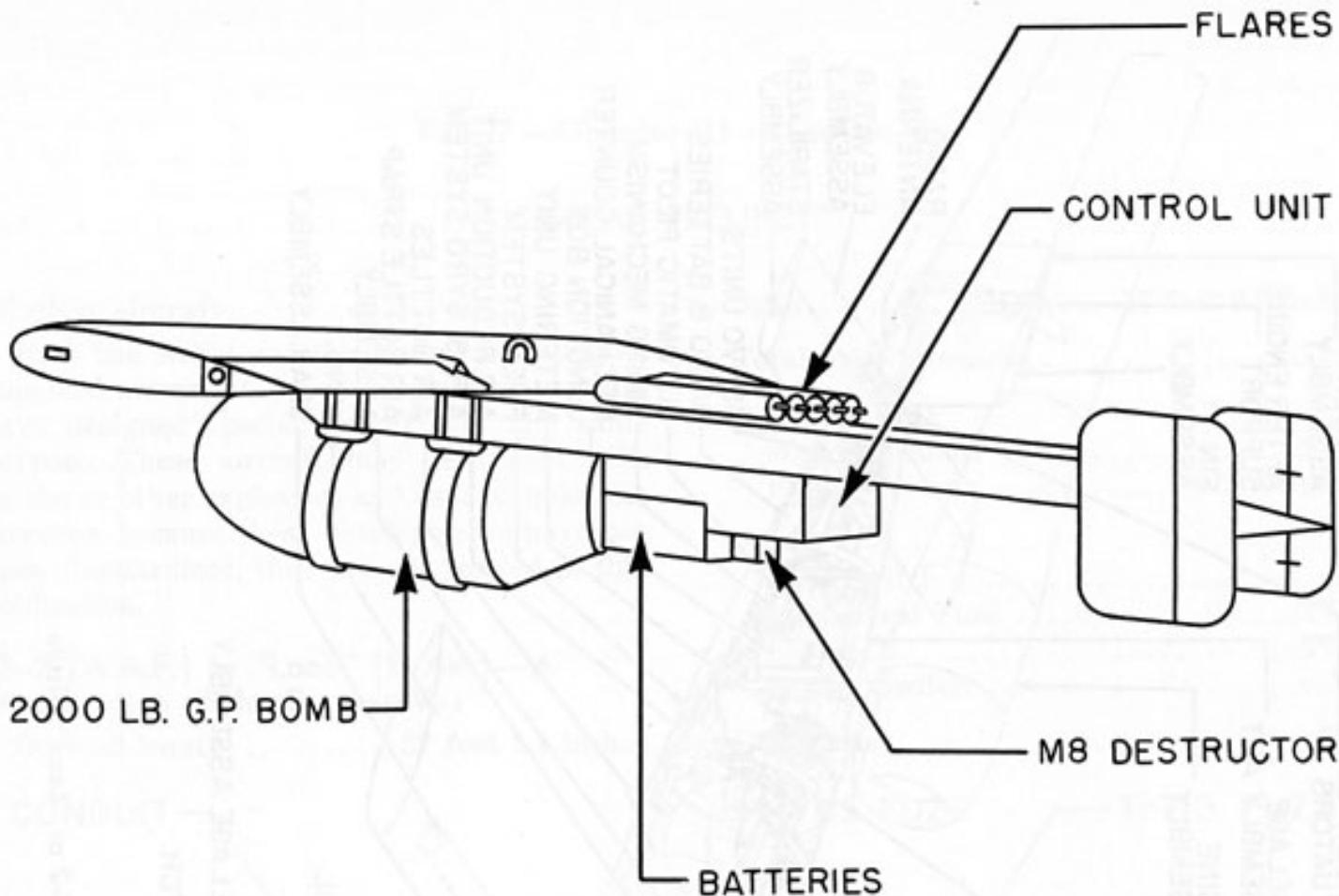


Figure 390. GB-8 Missile

Fuzing.....	Nose—AN-M103, M139, M140
Tail—M156	
Destructor .....	M8
Fuze .....	M121
Flare .....	T3, T4

**General:** This is a radio-controlled glide bomb, with flare observation, designed for use on large installations. The wing is covered with plywood and is bolted to the boom assembly. The two spar booms are of solid poplar and have hinged bands attached to their front ends which secure the bomb to the frame. The elevator is covered with metal to prevent damage by the flares.

The GB-8 should be launched with the parent plane on a bomb run when the target is at bombardier's angle of 75°—which is still outside normal A.A. range at altitudes from 10,000 to 15,000 feet. It will glide at speeds

varying about 6 to 1 depending on the elevator setting.

**Control:** The guiding system consists of a radio control link from the plane to the missile, servo connections to the control surfaces, gyro stabilization, and a flare panel of five Flares T3 and T4 (white and red) for observation.

Control surfaces are the ailerons on the wings, the elevator surface, and a single rudder on the left vertical stabilizer.

**Destructor:** The Destructor M8 mounted under and to the starboard of the control compartment is actuated, on impact, by the Fuze M121.

**Suspension:** The bomb is carried on the outside of the plane on a Shackle D7. A warm-up electrical cable pulls out on release.

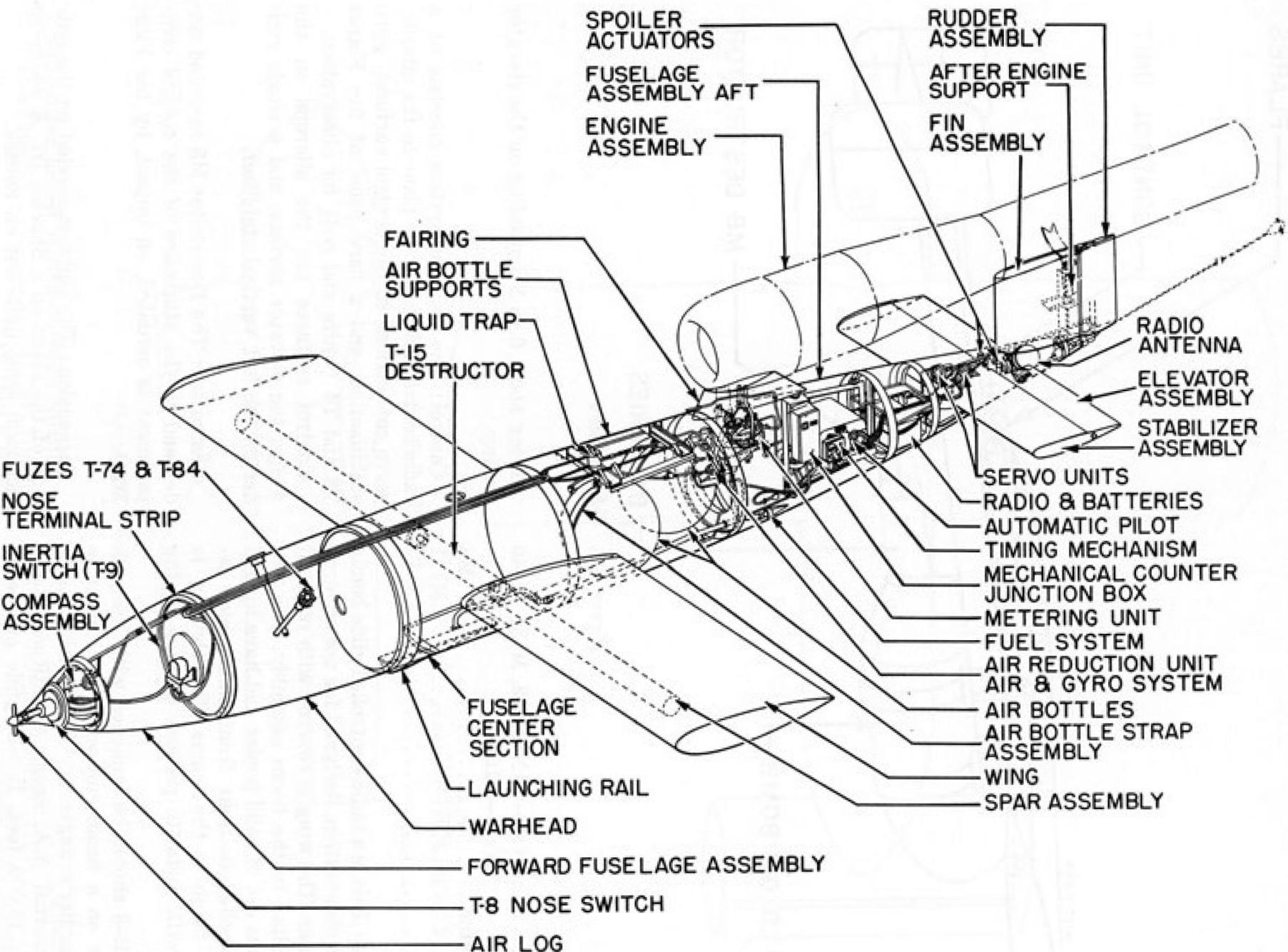


Figure 391. JB-2 or "Loon" Missile

## SIMILAR PROJECTS

## Pilotless aircraft

Both the Army and the Navy have adapted standard aircraft for remote radio control and have designed special aircraft for the same purpose. These aircraft may be loaded with bombs or other explosives and used as missiles; however, because these developments have not been standardized, they are not treated in this publication.

## JB-2 (A.A.F.) or "Loon" (BuAer)—A Modification of the German V-1

Over-all length.....27 feet 1.1 inches

Span.....	17 feet 8.1 inches
Total weight, pounds.....	5,025
Warhead (T9)	
Weight, pounds .....	2,100
Filling, pounds.....	1,875 Tritonal
Fuzing	
Nose Switch .....	T8
Mechanical Fuze .....	T715
Electrical .....	T705
Impact Switch .....	T9
Destructor .....	T15

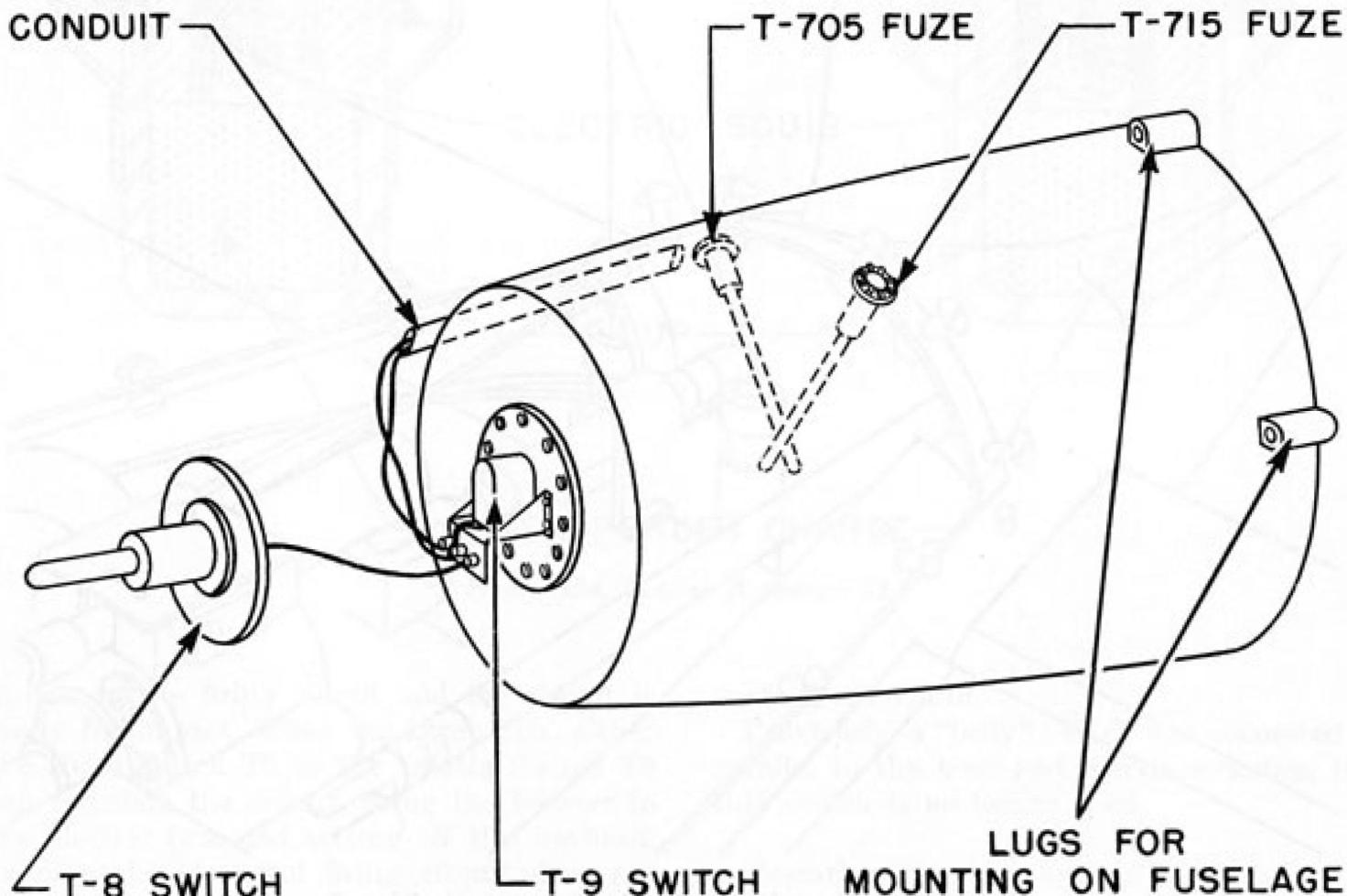


Figure 392. Warhead of "Loon", with Fuzes and Switches in Place

**General:** The JB-2 and "Loon" are copies of the German V-1, with modifications. As far as the ordnance components are concerned, the Army and Navy modifications are the same.

**Warhead:** The warhead is an aluminum-enclosed charge of Tritonal. The case is  $\frac{3}{8}$ -inch thick and is bolted to the fuselage abaft the nose piece by four lugs.

**Destructor T15:** At the appropriate distance from the target, as determined by the Veeder Root Counter, an electrical contact is closed, which sets off the electric blasting caps in the Destructor T15, igniting the small charge and blasting apart the two junctions in the wing spar. The spar breaks; the wings come off; and the missile is forced into the dive toward its target.

Previously, the missile was put into its dive

by the action of the Spoiler Actuators T1. These were small steel bullet-like cups filled with black powder and an electric squib. When activated by the Veeder Root Counter, they were fired down two vertical tubes in the tail section, releasing a spring-loaded knife arm which cut the rubber hoses from the servo motors to the controls; and, at the same time, the spring pulled the elevators down, putting the bomb into its dive.

**Fuzing:** The missile has an electrical fuze, an inertia switch, and a contact switch interlocked in an electric circuit with the Veeder Root Counter and battery. The electrical fuze closes its break in the circuit when the missile has traveled the distance set in the fuze gear train for arming (in the T705, 3 to 50 miles). When the bomb is at a prescribed distance set on the Veeder Root Counter, the counter closes its

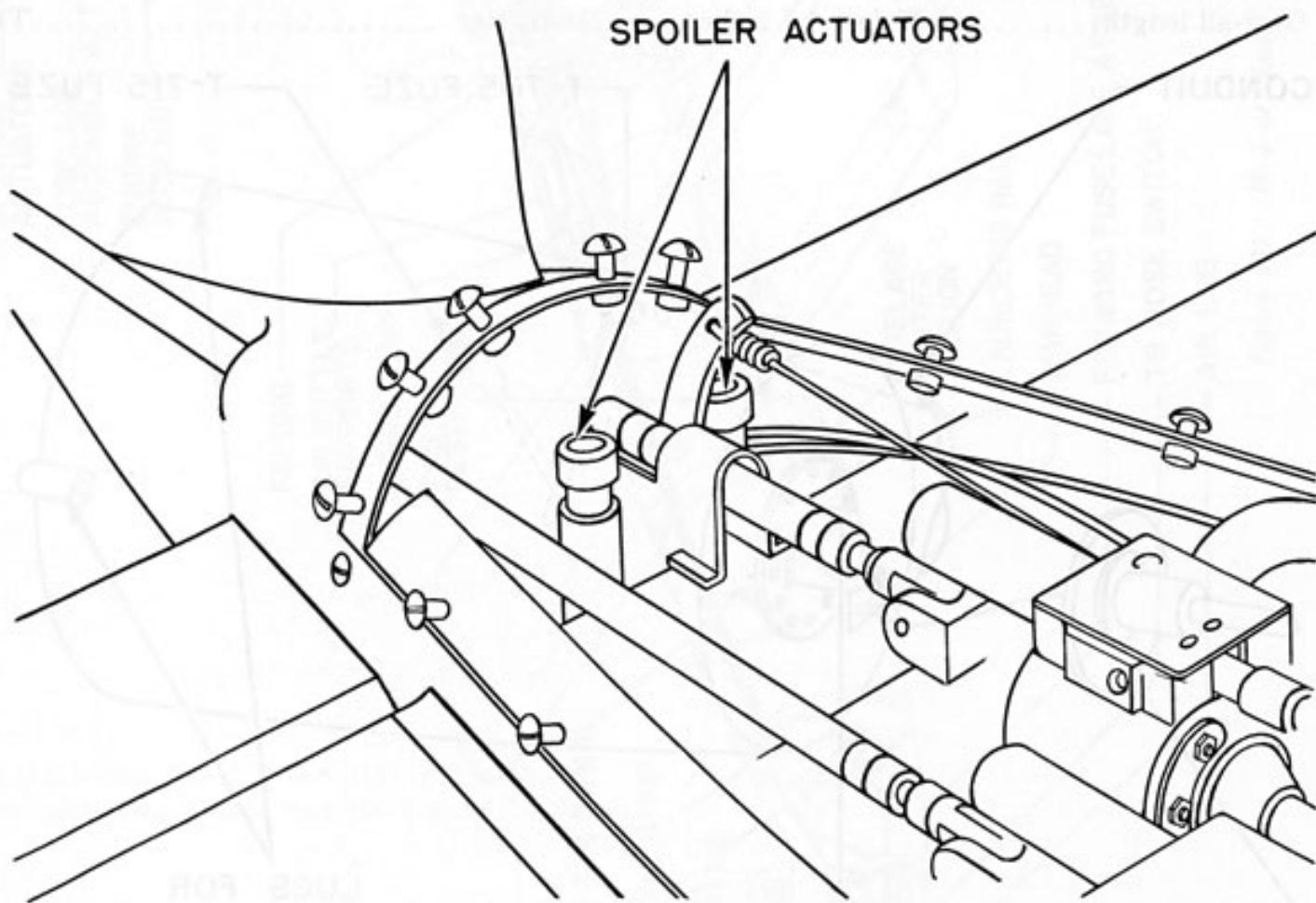


Figure 393. Location of Spoiler Actuators in "Loon"

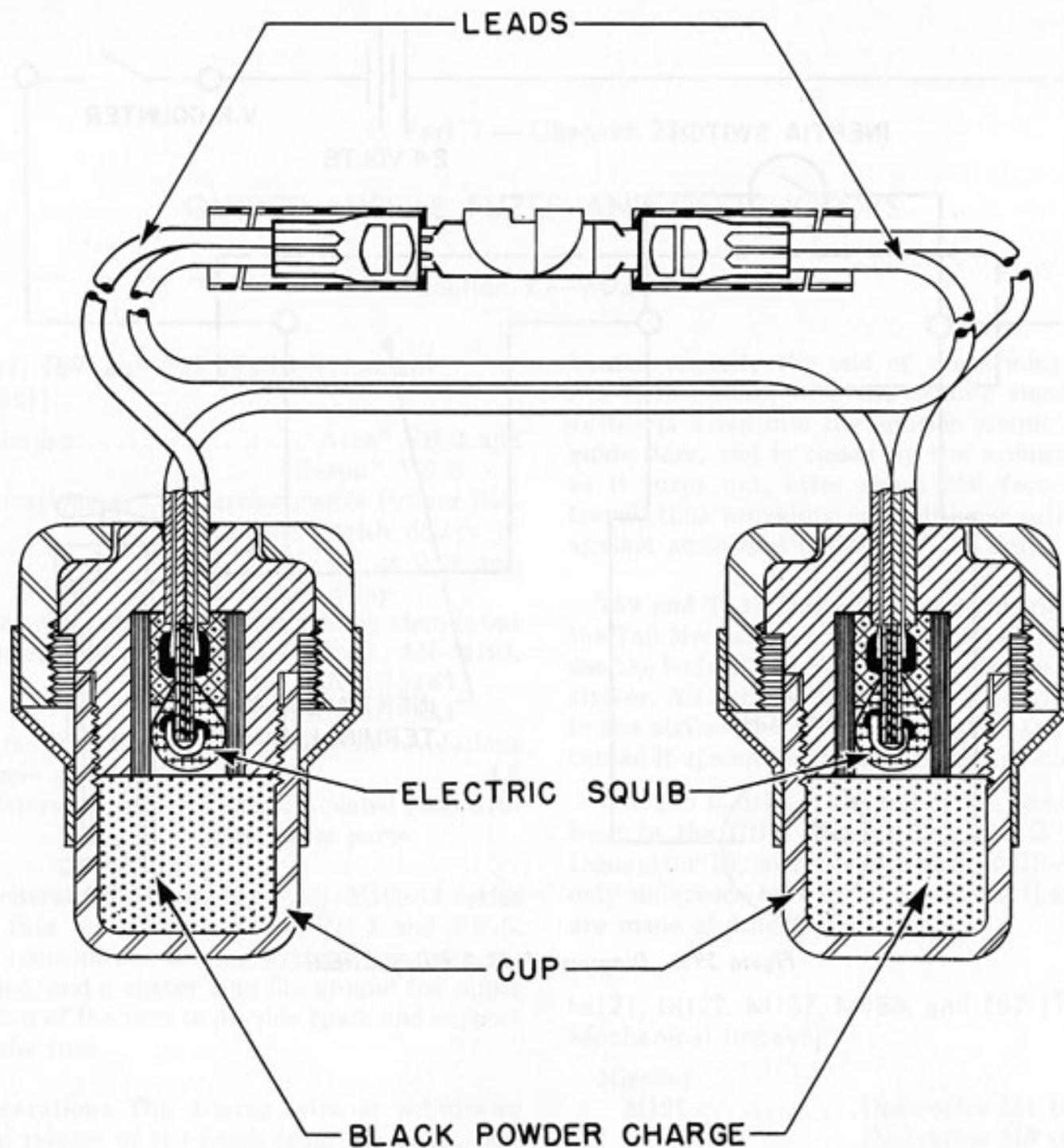


Figure 394. Spoiler Actuators T1

switch in the firing circuit and the circuit is ready for impact. When the bomb hits, either the Nose Switch T8 or the Inertia Switch T9 can complete the circuit, firing the booster in the electric fuze and setting off the warhead. In case the electrical firing circuit does not function properly, the mechanical fuze can de-

onate the warhead.

Previously, a "belly" switch was connected in parallel to the nose and inertia switches, but this switch is no longer used.

**Remarks:** This missile uses liquid oxygen as fuel, this oxygen being highly explosive.

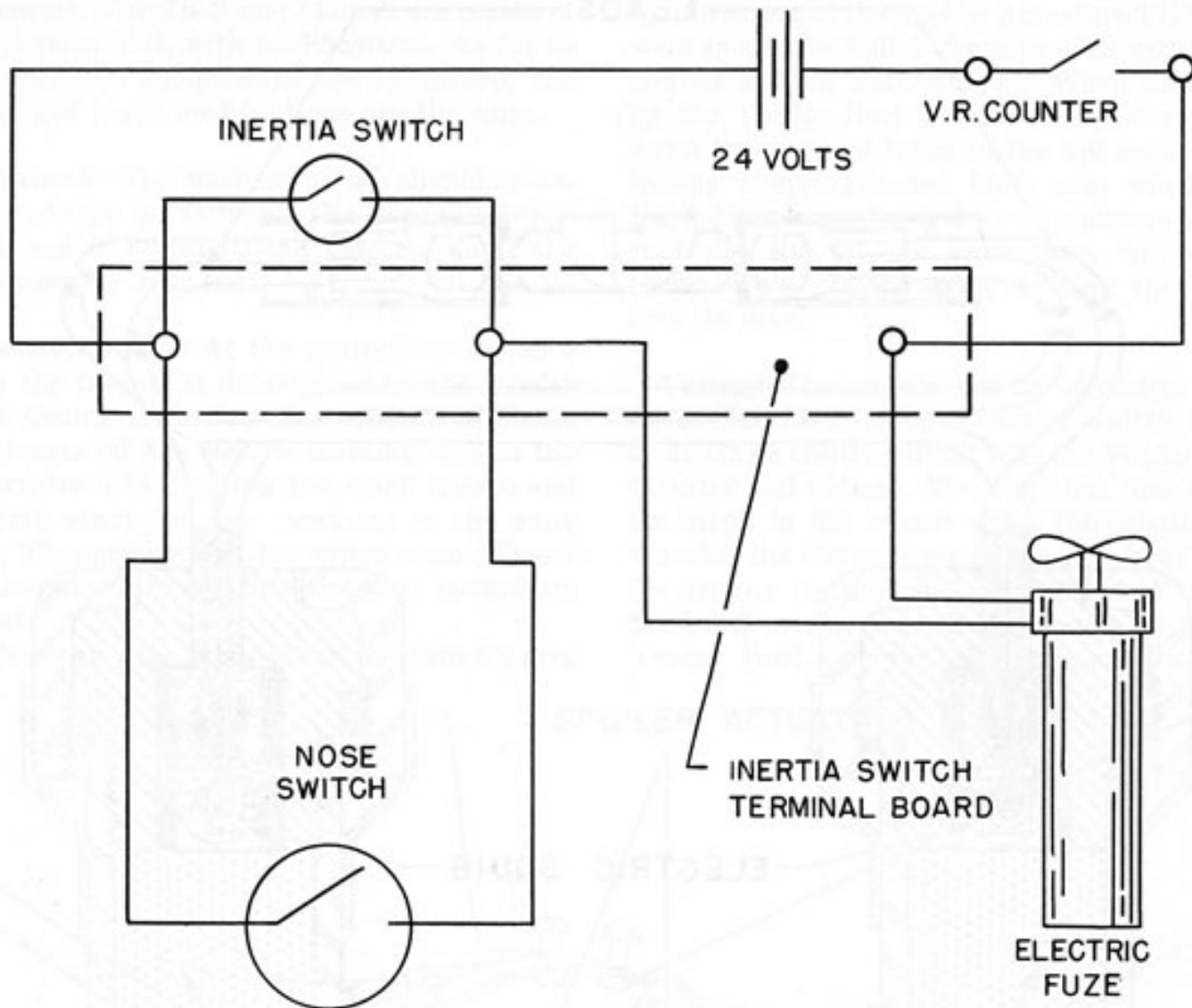


Figure 395. Diagram of JB-2 Firing Circuit

## GUIDED MISSILE FUZES AND DESTRUCTORS

## Section I — FUZES

**M167, T59, and T62 (Tail Mechanical Impact)**

Missiles..... "Azon" VB-1 and  
"Razon" VB-3

Functioning.... Interchangeable Primer Detonator M14 with delays of 0.01, 0.025, 0.1 or 0.24 second, or non-delay

Armed condition... When arming stem is out  
Fuzes used with.... AN-M103A1, AN-M103,  
M139, AN-M139A1,  
M140, AN-M140A1

Arming data..... 1,200 vane revolutions  
Vane span, inches..... 1.5  
Material..... Cadmium-plated steel with  
some brass parts

**General:** The M167 is an AN-M100A1 series tail fuze modified to fit the VB-1 and VB-3. An anemometer arming system has been installed, and a spacer ring fits around the upper section of the fuze to provide space and support for the fuze.

**Operation:** The arming wire is withdrawn upon release of the bomb from the plane, permitting the spring-loaded arming pin to fly out and freeing the anemometer vanes for rotation. Rigidly attached to the vane assembly through a gear reduction system, the flexible shaft revolves with the vanes and turns a stem coupling which fits loosely to it. An arming stem riding in a slot in the coupling is threaded out of the firing plunger as the coupling revolves, arming the fuze. Upon impact, the plunger rides forward on its creep spring, hitting the Primer Detonator M14, initiating the explosive train.

A micro-switch mounted on the bracket is

located opposite the end of the arming stem and is in contact with the arming stem. This switch is wired into the ignition circuit of the guide flare, and is closed by the arming stem as it turns out, after about 350 feet of air travel, thus providing an additional safeguard against accidental ignition of the flare.

**T59 and T62:** These fuzes are generally like the Tail Mechanical Impact Fuze M167, but they use the body of the Fuze M112, with the cocked striker. Also, the arming spindle is not threaded in the striker sleeve; it slides out as the vanes thread it upward in the gear section of the fuze.

The T59 is used in the tail of the bomb warhead in the GB-4 Missile. The T62 is in the Destructor T9, which is also part of GB-4. The only difference between the fuzes is that they are made of different materials.

**M121, M122, M137, M156, and T57 (Tail Mechanical Impact)**

## Missiles

M121 ..... Destructor M4 (GB-4)  
Destructor M8 (GB-8)

M122 ..... GB-1 (Cancelled)

M137 ..... Destructor M5 (GT-1)  
(Cancelled)

M156 ..... GB-8

T57 ..... Undetermined

## Functioning

M121 ..... Non-delay—Primer Detonator M27

M122 ..... 4- to 5-sec. delay—Primer Detonator M16A1

M137 ..... 4- to 5-sec. delay—Primer Detonator M16A1

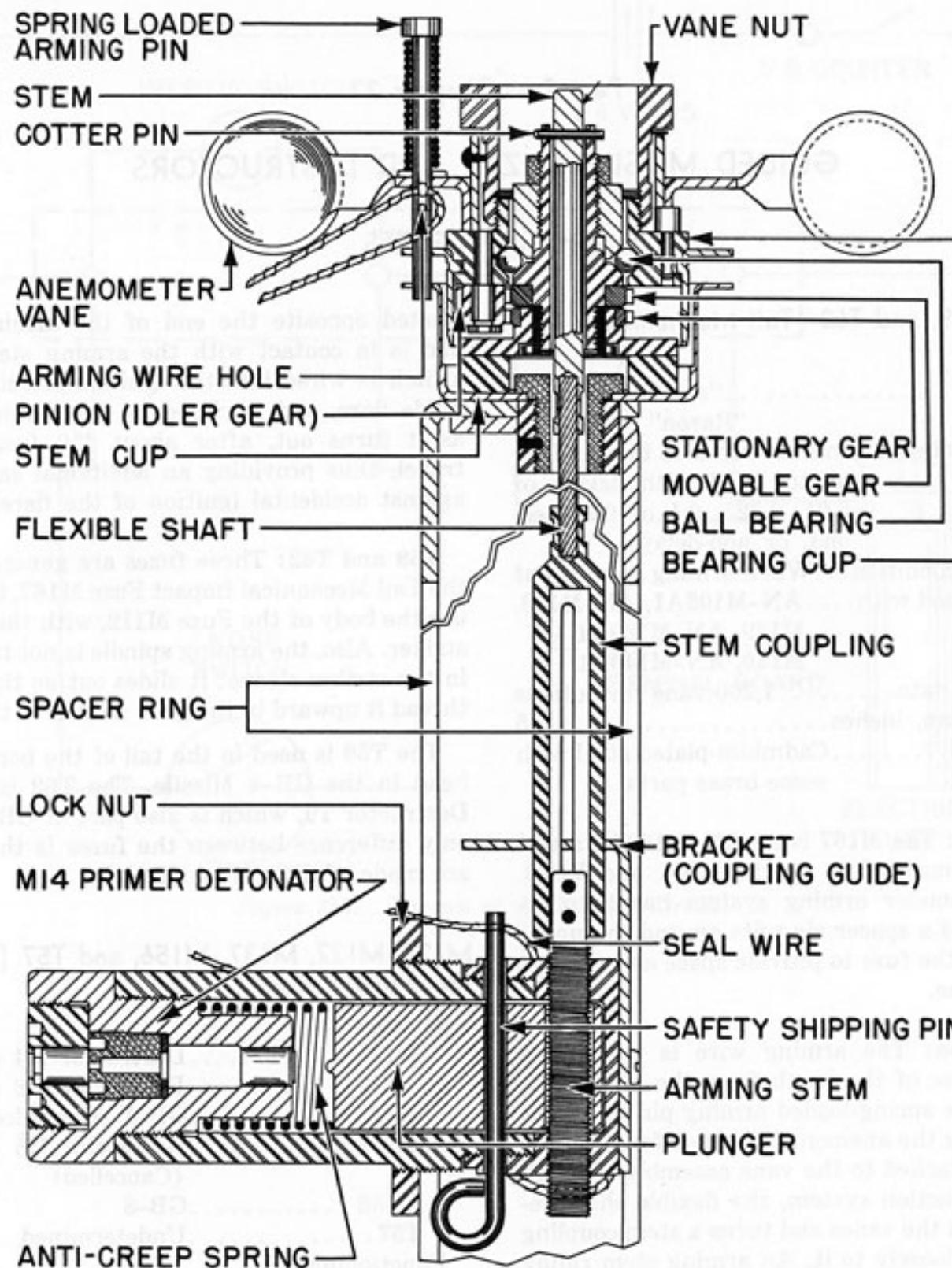


Figure 396. Tail Fuze M167

M156 ..... 4- to 5-sec. delay—Primer  
Detonator M16A1  
T57 ..... Non-delay

Length, inches	
M121	..... 9.6
M122	..... 16.6

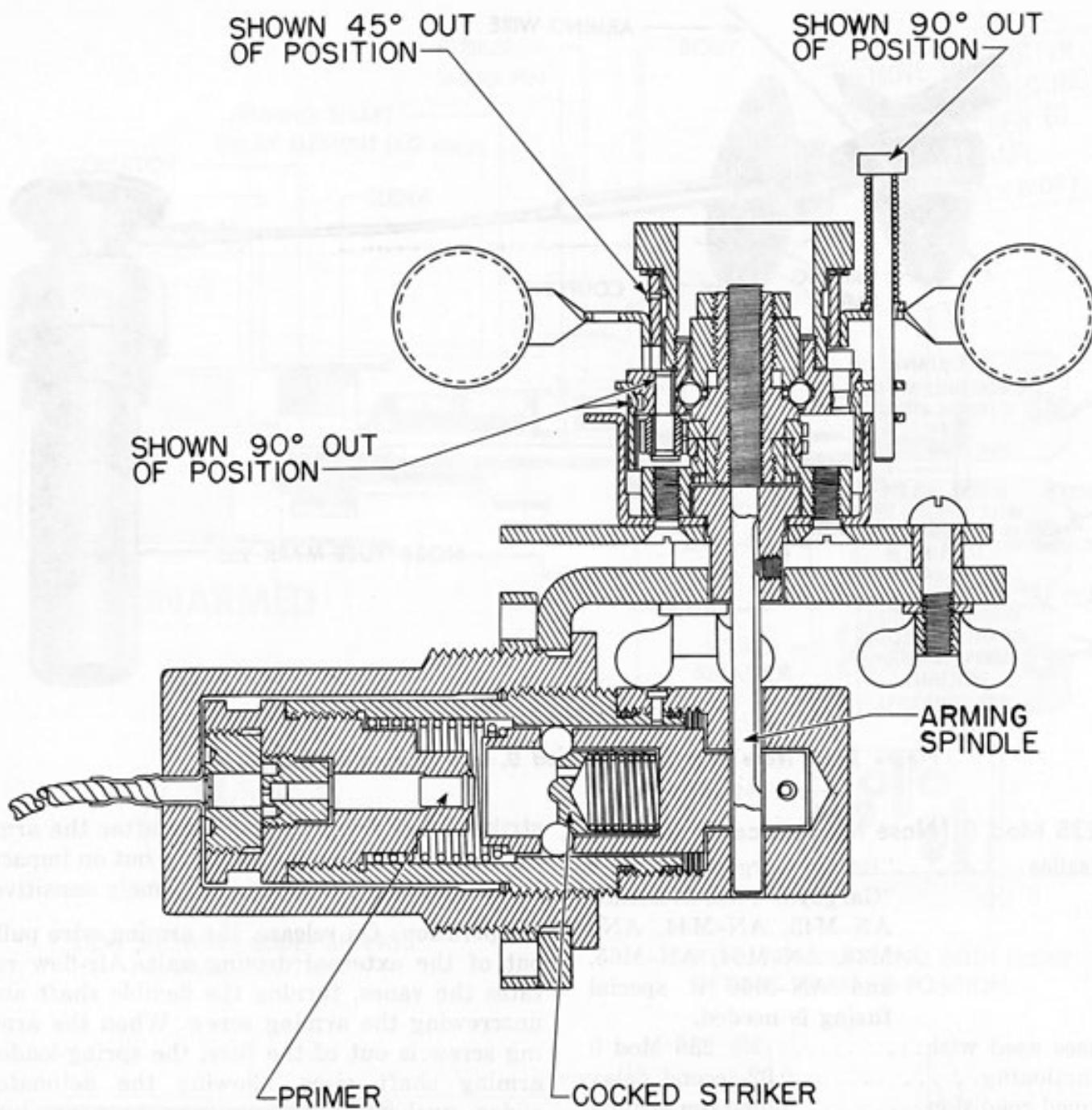


Figure 397. Tail Fuze T62

M137 .....	9.6
M156 .....	12.6
Arming data.....	150 to 170 vane revolutions

**General:** These fuzes are exactly like the M115 series, except for the primer detonator combinations and some differences in materials. The construction and operation are the same.

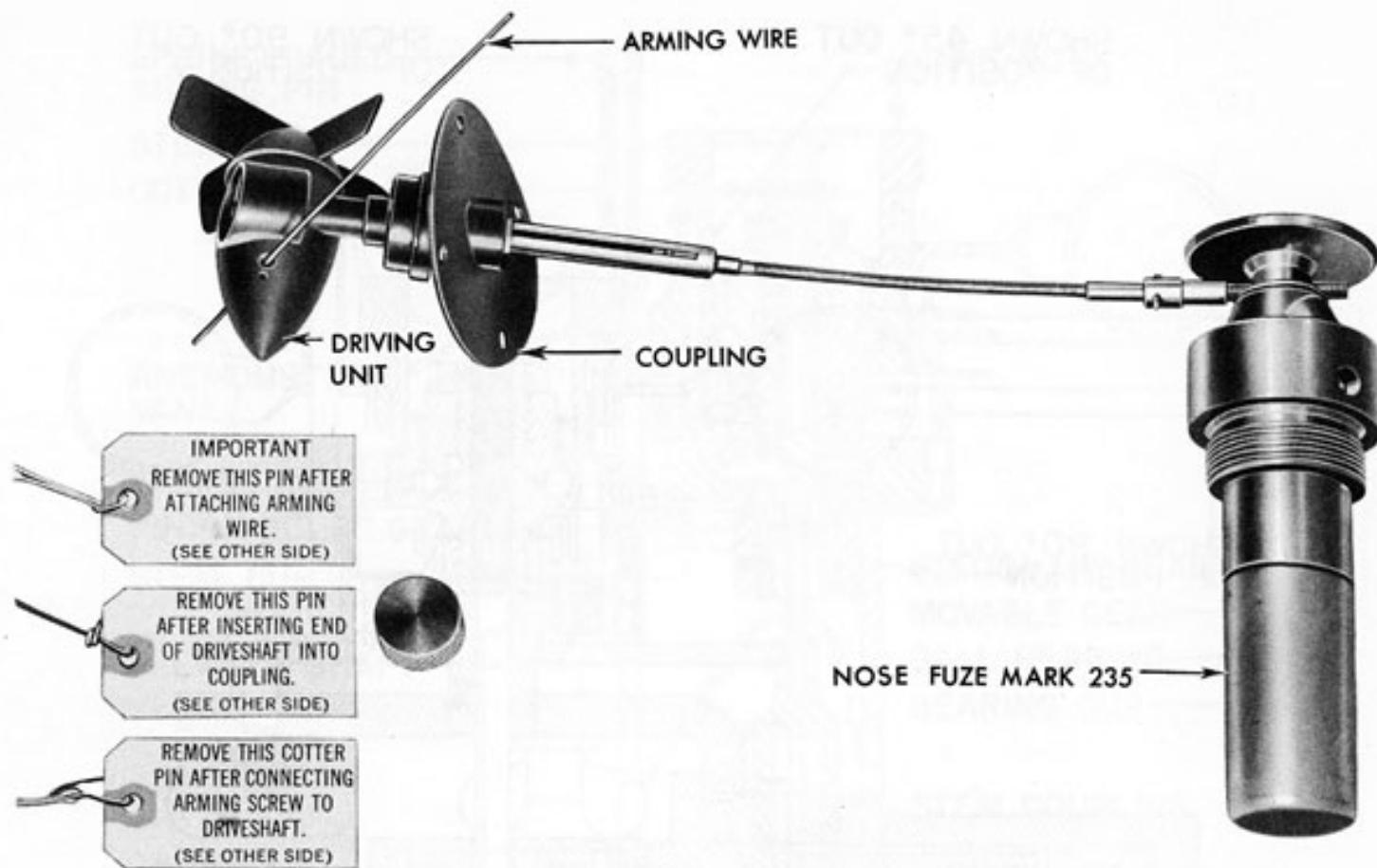


Figure 398. Nose Fuze Mk 235 Mod 0, with Driving Unit Attached

### Mk 235 Mod 0 (Nose Mechanical Impact)

Missiles.....	"Bat", "Gorgon IIC", and "Gargoyle"; will fit Bombs AN-M43, AN-M44, AN-M34, AN-M64, AN-M65, and AN-M66 if special fuzing is needed.
Fuzes used with.....	Mk 236 Mod 0
Functioning.....	0.02-second delay
Armed condition.....	When the arming screw is out
Arming data.....	2,500 to 3,000 feet air travel

**General:** Another of the elbow-type fuzes, the Mk 235's fuze body is connected by a flexible coupling to the external driving unit. The body part resembles somewhat the Nose Mechanical Impact Fuze AN-M103 with its sliding detonator shutter. However, in this fuze there is only the delay firing train. A snap ring in a groove on the neck of striker holds the

striker away from the hammer after the arming screw is out, until it is forced out on impact. When armed, this fuze is extremely sensitive.

**Operation:** On release, the arming wire pulls out of the external driving unit. Air-flow rotates the vanes, turning the flexible shaft and unscrewing the arming screw. When the arming screw is out of the fuze, the spring-loaded arming shaft rises, allowing the detonator slider, pushed by two springs, to move into position under the delay element and above the booster lead-in. A detent then locks the slider in place. On impact, the nose plate and striker are forced in, expanding the snap ring and forcing the firing hammer to drive the firing pin into the delay primer, setting off the delay and explosive train.

**Remarks:** The detonator has an expansion hole above it in the unarmed position, so that accidental detonation cannot set off the tetryl booster.

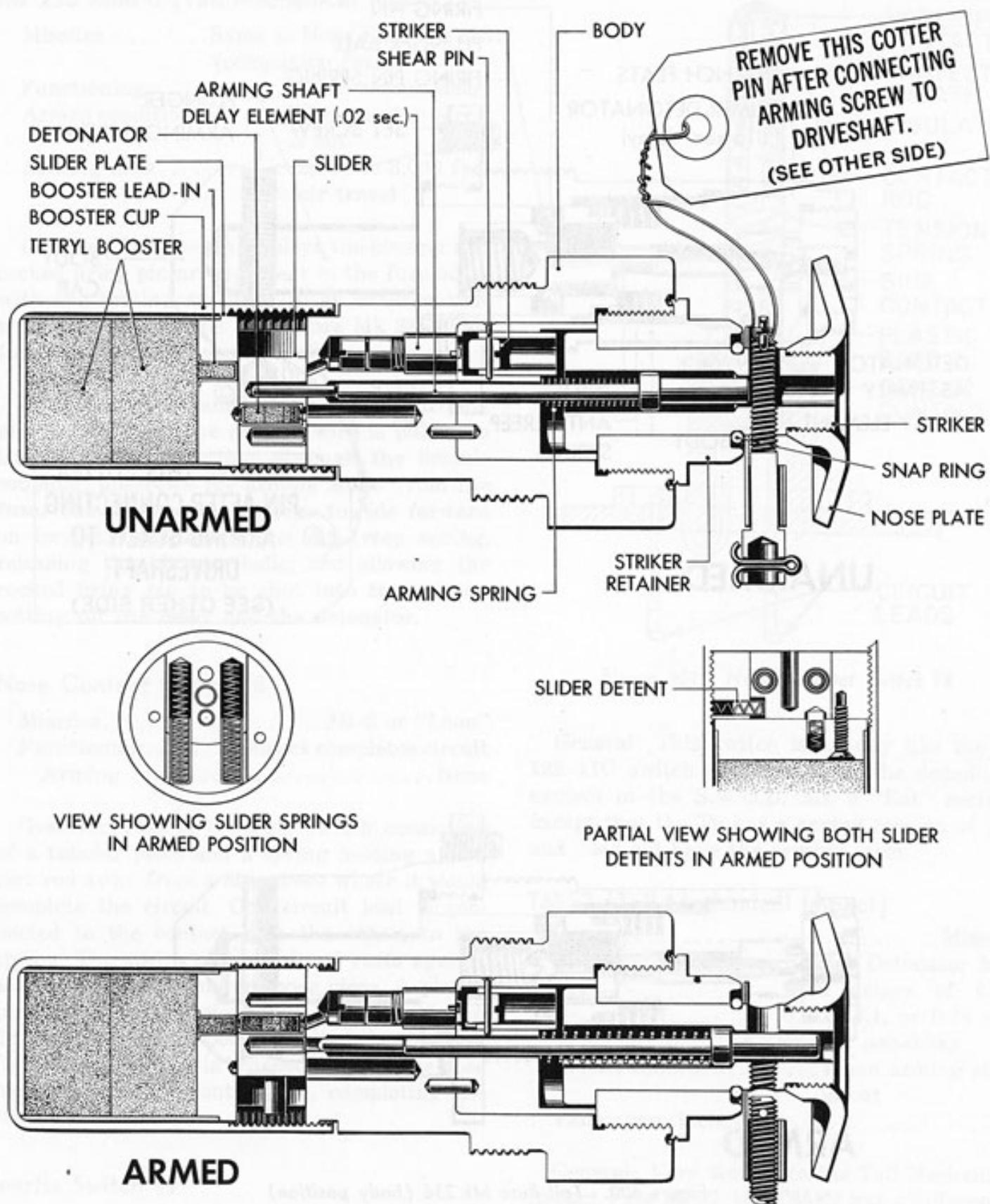


Figure 399. Nose Fuze Mk 235 (body position)

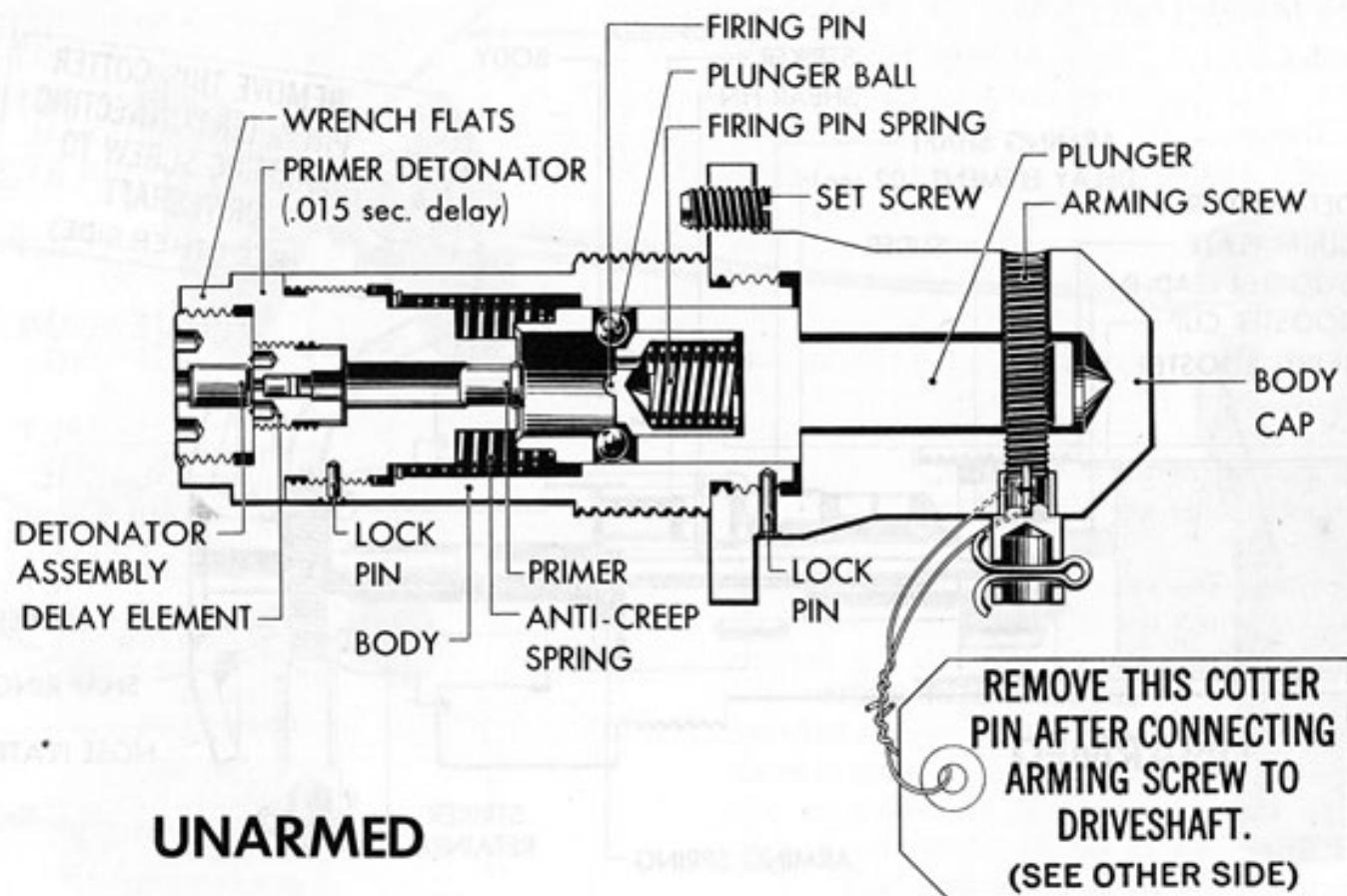
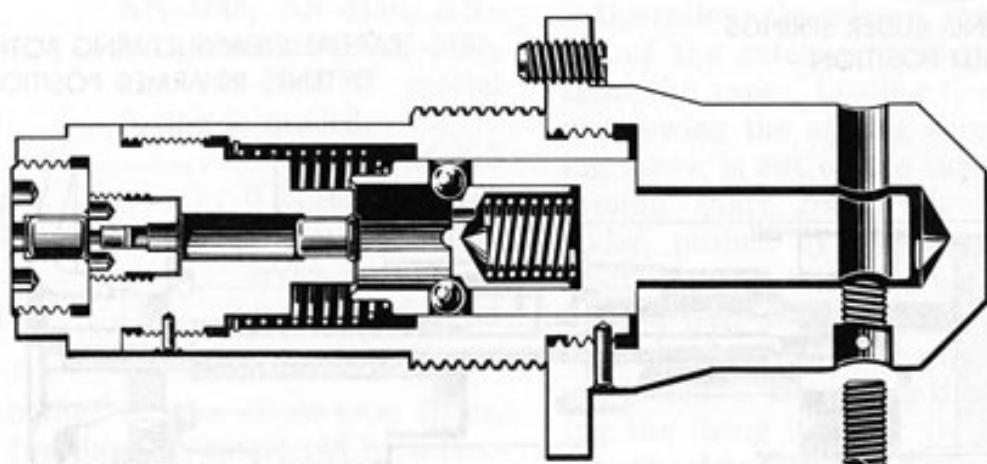
**UNARMED****ARMED**

Figure 400. Tail Fuze Mk 236 (body position)

**Mk 236 Mod 0 (Tail Mechanical Impact)**

Missiles..... Same as Nose Fuze Mk 235 (companion fuzes)  
 Functioning..... 0.015-second delay  
 Armed condition..... When arming screw is out  
 Arming data..... 2,500 to 3,000 feet air travel

**General:** This design employs the plunger and cocked firing pin arrangement in the fuze body, with the arming assembly in an exterior unit similar to that of the Nose Fuze Mk 235. This fuze is extremely sensitive when armed.

**Operation:** The vanes of the external arming unit rotate when the arming wire is pulled on launching. This rotation, through the flexible coupling, unscrews the arming screw from the fuze. The plunger is now free to ride forward on impact, overcoming the anti-creep spring, releasing the plunger balls, and allowing the cocked firing pin to be shot into the primer, setting off the delay and the detonator.

**Nose Contact Switch T8**

Missiles..... JB-2 or "Loon"  
 Functioning..... Impact completes circuit  
 Arming ..... None

**General:** This is a simple switch consisting of a tubular piece and a spring holding a contact rod away from a nose piece where it would complete the circuit. One circuit lead is connected to the contact rod; the other, to the spring. The spring's forward end rests against a copper-plated aluminum nose piece. A plastic tube insulates this piece from the contact rod. The contact rod is bolted to the plastic base. On impact, the tube is crushed, forcing the nose piece against the contact rod, completing the circuit.

**Inertia Switch T9**

Missiles..... JB-2 or "Loon"  
 Functioning.... "All-ways action" on impact (10g) completes circuit

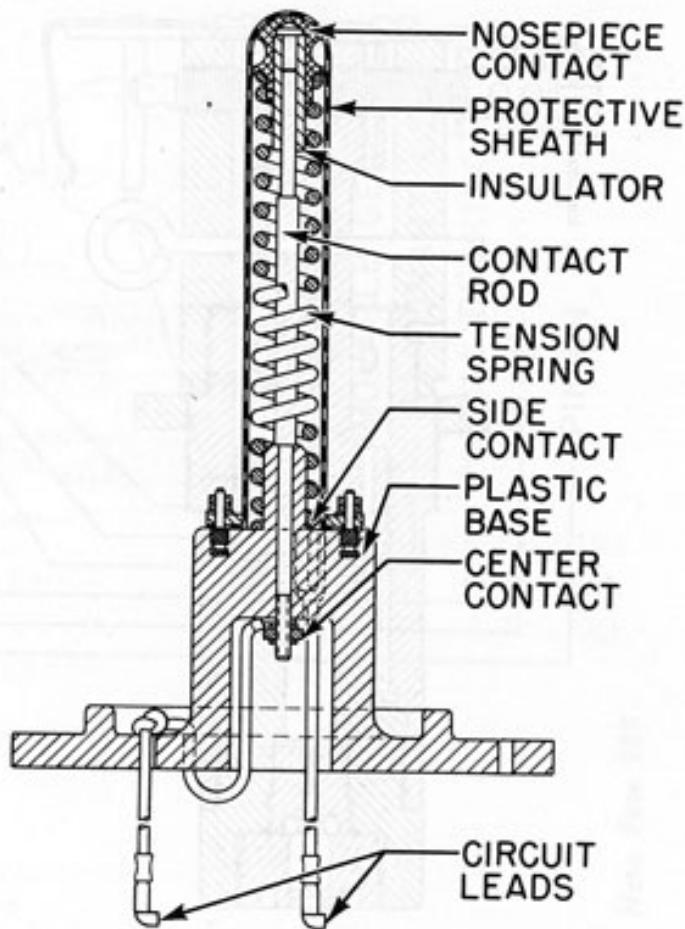


Figure 401. Nose Contact Switch T8

**General:** This switch is exactly like the S-122-11G switch described with the demolition system in the S.W.O.D. Mk 9 "Bat" section, except that the T9 has a spring tension of 10g and does not have the arming stem.

**T65E2 (Tail Mechanical Impact)**

Use ..... Missiles  
 Functioning..... Primer Detonator M14 with delays of 0.01, 0.025, 0.1, or 0.24 second, or non-delay  
 Armed condition..... When arming stem is out  
 Vane span, inches..... 5.2

**General:** Very similar to the Tail Mechanical Impact Fuze M167, the T65E2 has a differently shaped plunger and is mounted by a different bracket. It uses the M100 type vanes and reduction gear arming, is of the "elbow" design

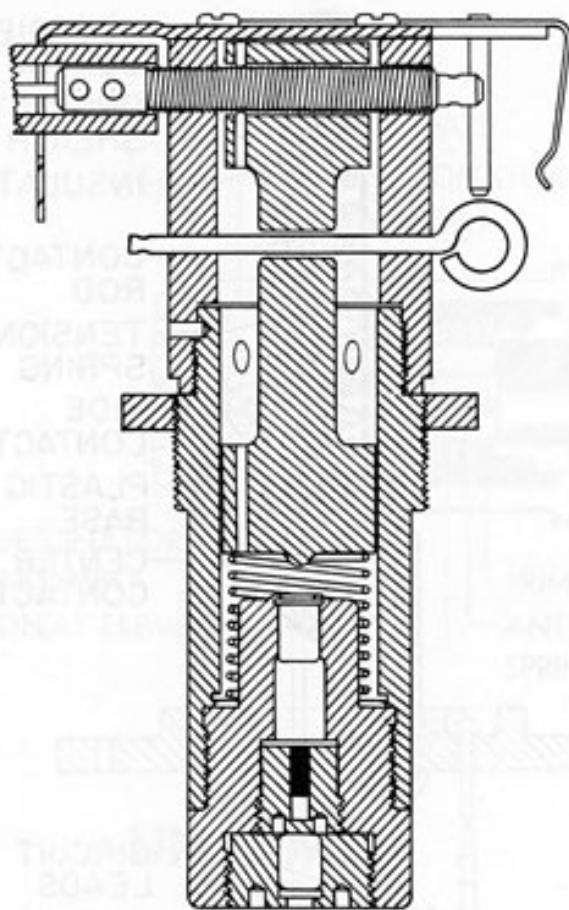


Figure 402. Tail Fuze T65E2

because of its projected use in guided missiles, and employs the Primer Detonator M14 with the interchangeable delays.

#### T85 (Nose Mechanical Impact)

Missiles ..... "Felix"  
 Functioning..... Instantaneous or 0.1-second delay  
 Armed condition..... When arming spindle is out  
 Arming data..... 1,200 vane revolutions

**General:** This is an "elbow"-shaped fuze for use in guided missiles. At present it is used only in the nose of "Felix" VB-6. It is essentially a Nose Mechanical Impact Fuze AN-M103 connected to the remote windmill arming vanes by a flexible cable. The vane and gear assembly is the same as that used on the Tail Mechanical Impact Fuze M167. The fuze proper is like the AN-M103, except that it does not have the vane cap, safety discs, or arming screw.

#### T715 and T84 Series (Athwartship Mechanical Impact)

Missiles.....JB-2 or "Loon"  
 Functioning.....All-ways-action, long-delay arming  
 Arming data....T715 can be set 4 to 45 miles  
 T84E1—4 to 5 miles  
 T84E2—12 to 15 miles  
 T84E3—25 to 30 miles  
 T84E4—40 to 50 miles

**General:** These are the mechanical fuzes of American design or the JB-2 or "Loon" missile. The T84 series was replaced by the T715, but neither fuze is now on order. The fuzes are similar in construction, except that the T715 allows for varying the arming time by an adjustable setting pin, whereas, in the T84 series, each modification has a fixed setting. Both fuzes have the heavy brass inertia weight and tapered firing-pin housings, so that slight sidewise impact, when armed, will release the cocked firing pin. The drive shaft from the vanes to the gear system is mounted in ball bearings. The locating clip is an assembly feature, to hold the inertia housing in place.

On the T715, arming time is set by varying the depth at which the setting pin is screwed into a drive dog. A special key is supplied with the fuze to insure accurate settings. The setting pin is slowly threaded out as the gears turn it, and, when it comes out of the dog, the fuze begins to arm itself. Following is a table of settings:

SPECIAL SCREW- DRIVER DEPTH (INCHES)	ARMING DISTANCE (MILES)
0.03	4
0.10	11
0.20	23
0.30	34
0.40	45

**Operation:** Vane rotation through the reduction gear train turns a drive disc, at the same time rotating a threaded gear and backing the threaded setting pin out of its drive dog. When the setting pin comes out, a spring shoves the dog toward the drive disc, latching the shaft

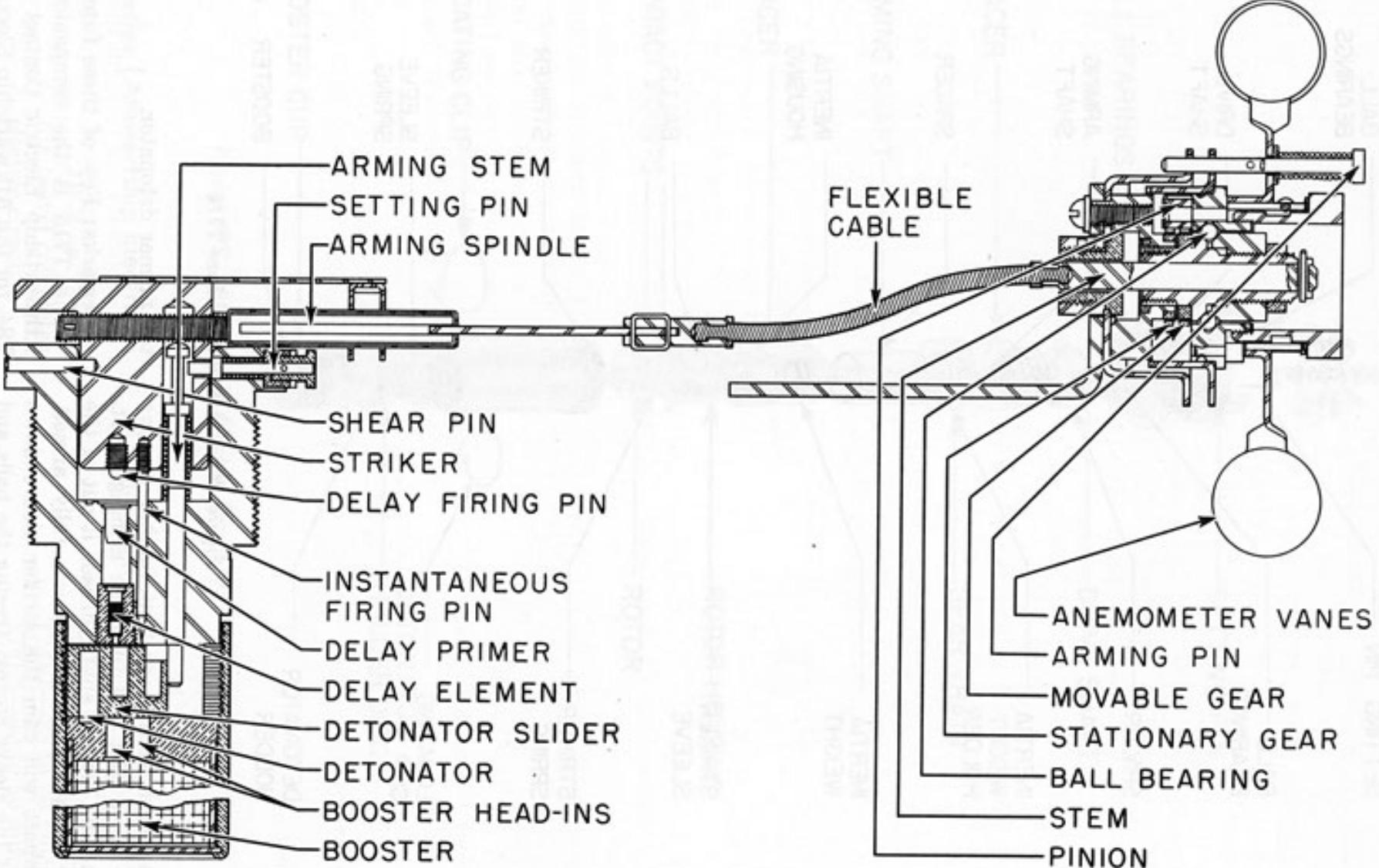


Figure 403. Nose Fuze T85

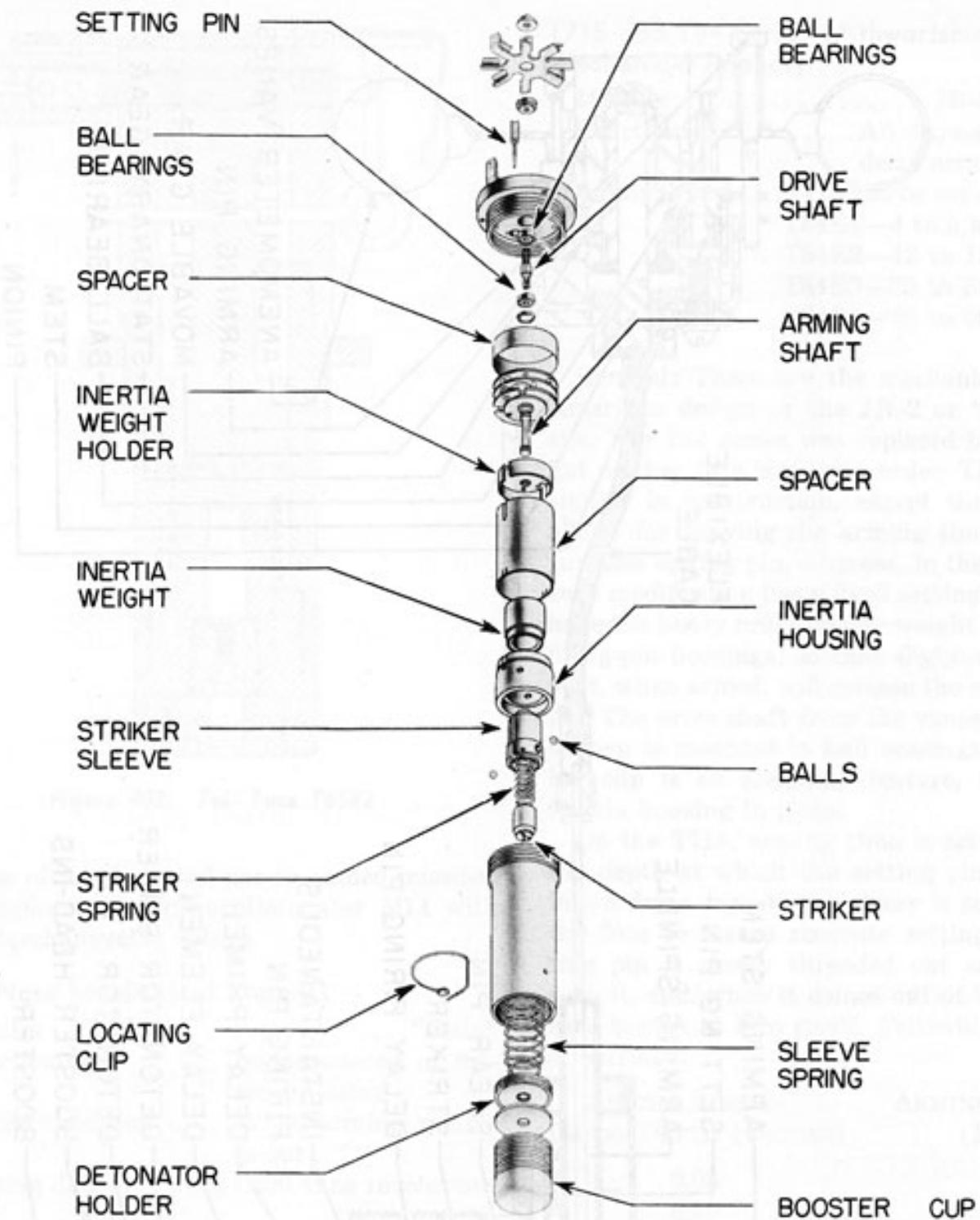


Figure 404. Athwartship Fuze T715

hub to the drive disc, so that further turning of the drive disc will turn the arming shaft. Turning the arming shaft threads it out of the striker sleeve. The fuze is now fully armed, and impact will cam the striker sleeve down against the sleeve spring, freeing the balls and allowing the cocked firing pin to be shot into

the primer detonator.

**Remarks:** Few of these fuzes were made.

The T715 is the companion fuze for the Athwartship Electric Contact Fuze T705; the T84, for the Athwartship Electric Contact Fuze T74 or corresponding modification.

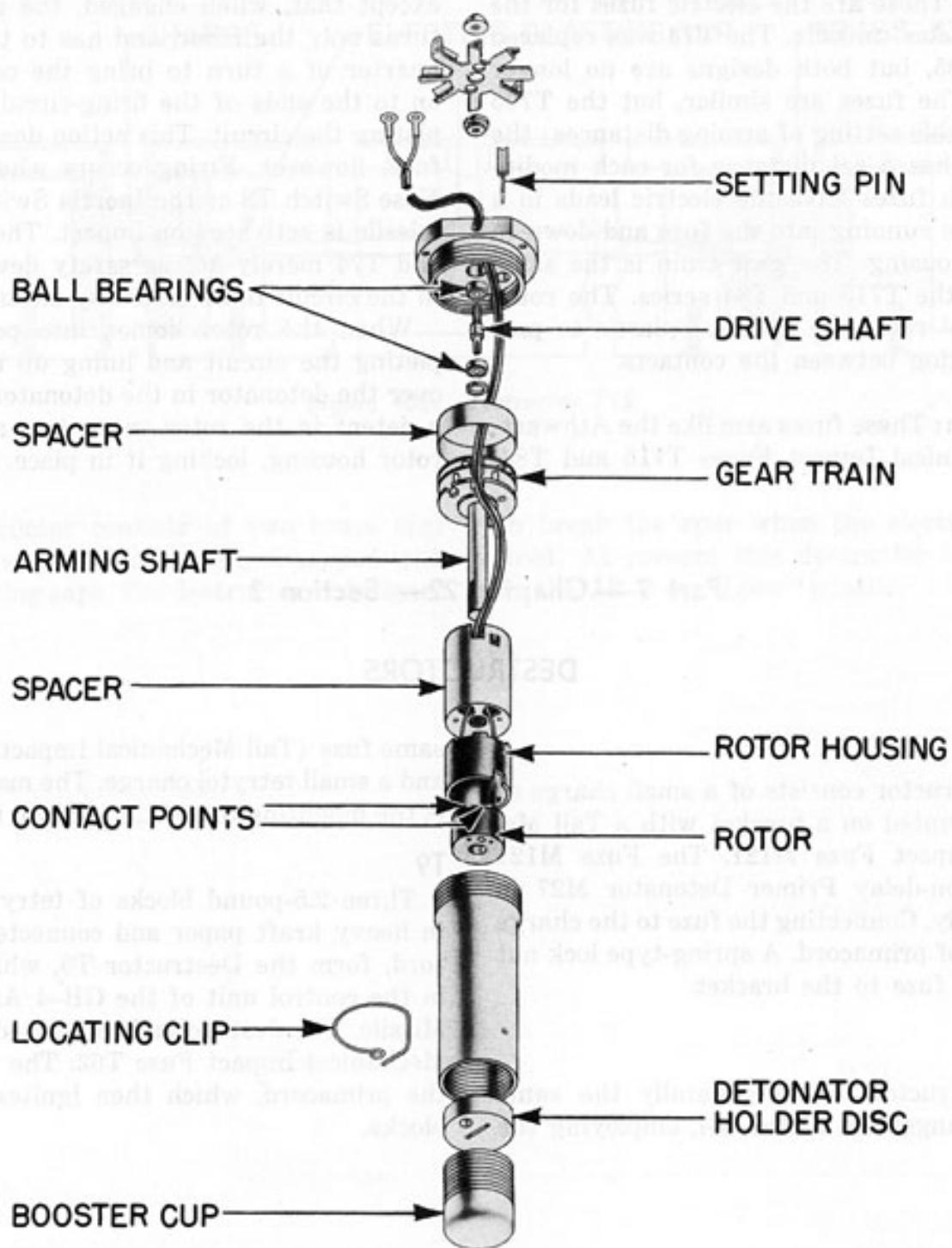


Figure 405. Athwartship Electric Fuze T705

#### T705 and T74 Series (Athwartship Electric Contact)

Missiles.....JB-2 or "Loon"  
 Functioning.....Air travel completes electric circuit

Arming data....T705 can be set 4 to 45 miles  
 T74E1—4 to 5 miles  
 T74E2—12 to 15 miles  
 T74E3—25 to 30 miles  
 T74E4—40 to 50 miles

**General:** These are the electric fuzes for the JB-2 or "Loon" missile. The T74 was replaced by the T705, but both designs are no longer on order. The fuzes are similar, but the T705 allows variable setting of arming distances; the T74 series has a set distance for each modification. Both fuzes have the electric leads in a rubber cable running into the fuze and down to the rotor housing. The gear train is the same as that in the T715 and T84 series. The rotor housing and rotor are made of plastic to provide insulation between the contacts.

**Operation:** These fuzes arm like the Athwartship Mechanical Impact Fuzes T715 and T84,

except that, when engaged, the arming shaft turns only the rotor, and has to turn it only a quarter of a turn to bring the contact points on to the ends of the firing-circuit leads, completing the circuit. This action does not fire the fuze, however. Firing occurs when either the Nose Switch T8 or the Inertia Switch T9 in the missile is activated on impact. The Fuzes T705 and T74 merely act as safety devices—breaks in the circuit to be closed by air-travel arming.

When the rotor comes into position, completing the circuit and lining up its flash hole over the detonator in the detonator-holder disc, a detent in the rotor snaps into a hole in the rotor housing, locking it in place.

## Part 7 — Chapter 22 — Section 2

### DESTRUCTORS

#### M4

This destructor consists of a small charge of tetrytol mounted on a bracket with a Tail Mechanical Impact Fuze M121. The Fuze M121 uses the non-delay Primer Detonator M27 in this assembly. Connecting the fuze to the charge is a length of primacord. A spring-type lock nut secures the fuze to the bracket.

#### M8

The Destructor M8 is generally the same kind of arrangement as the M4, employing the

same fuze (Tail Mechanical Impact Fuze M121) and a small tetrytol charge. The main difference is the mounting bracket, as shown in figure 407.

#### T9

Three 2.5-pound blocks of tetrytol, wrapped in heavy kraft paper and connected by primacord, form the Destructor T9, which is placed in the control unit of the GB-4 Air-to-Surface Missile. The destructor is activated by the Tail Mechanical Impact Fuze T62. The fuze sets off the primacord, which then ignites the charge blocks.

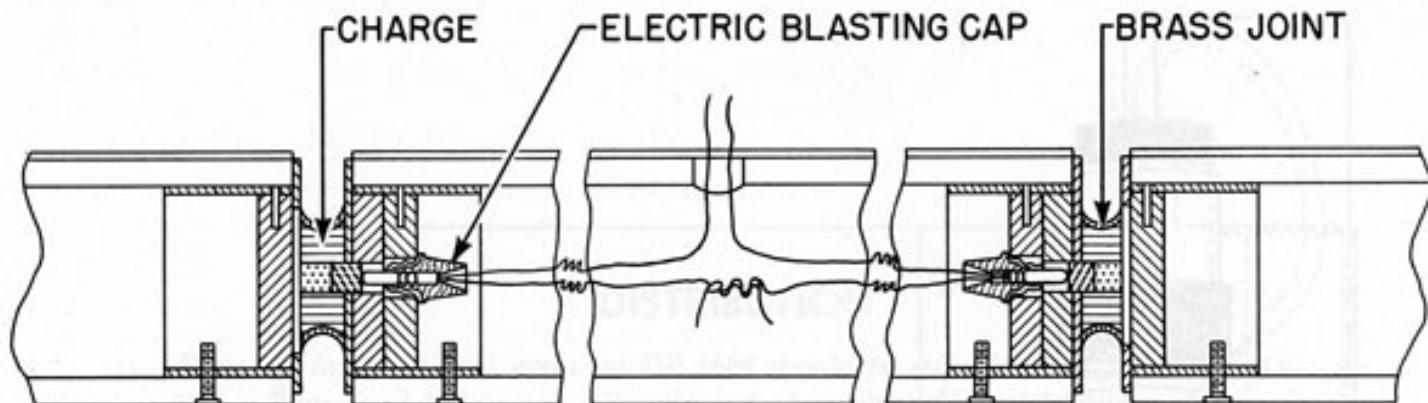


Figure 406. Destructor T15

### T15

This destructor consists of two brass spar joints filled with an explosive and capped with electric blasting caps. The destructor is designed

to break the spar when the electric caps are fired. At present this destructor is used only in the JB-2 or "Loon" missile.

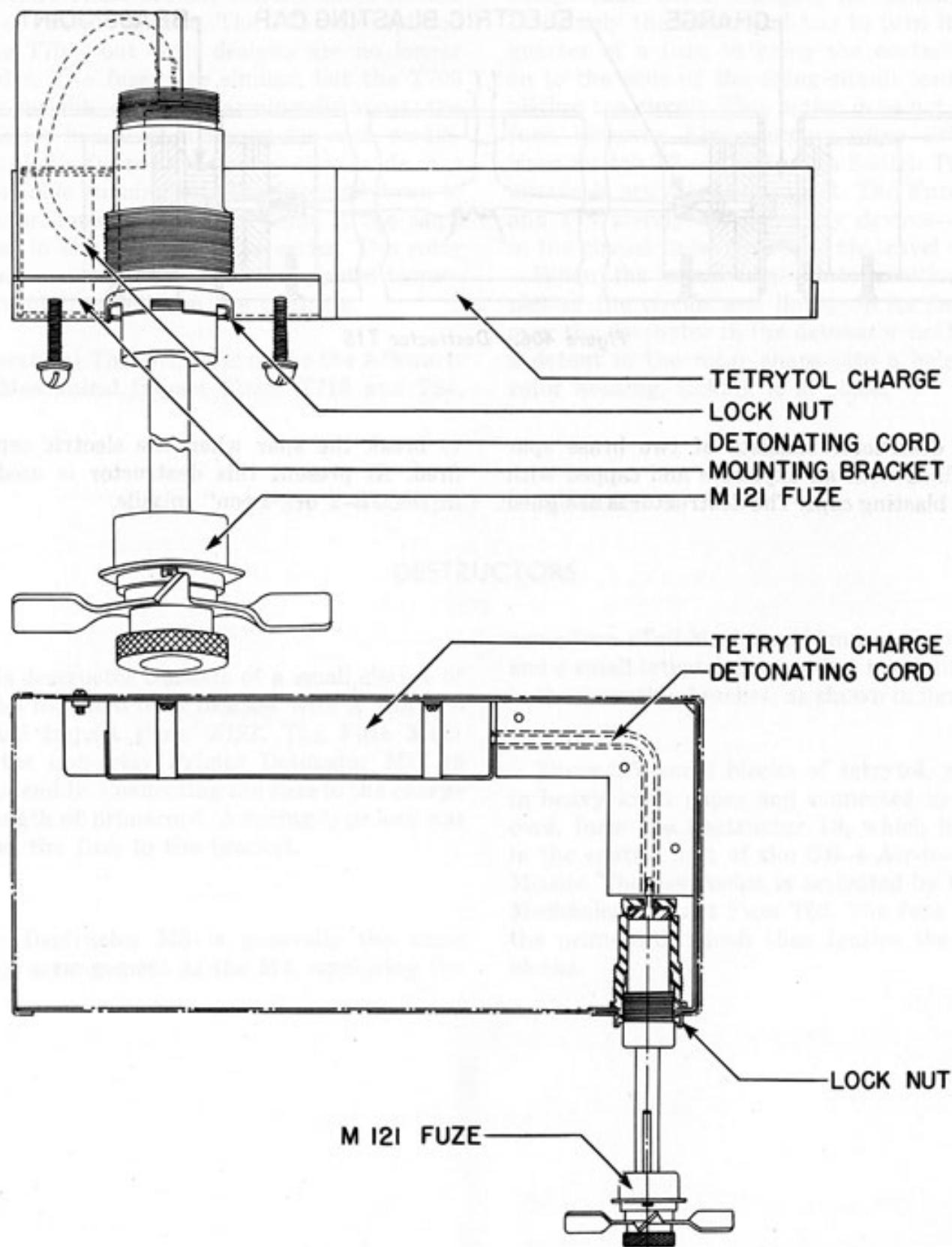


Figure 407. Destructors M4 and M8

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