Edward T. James
Capt. Ord.

(53)

RESTRICTED

ORDNANCE PAMPHLET NO. 988

Change 1 thru 7 Added
Addendum 1 Added

BOMB FUZES

A BUREAU OF ORDNANCE PUBLICATION **MAY 1943**

(RESTRICTED)

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

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OP 988, CHANGE 2

12 January 1944

BOMB FUZES

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BOMB FUZES

MAY 1943

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BUREAU OF ORDNANCE

RESTRICTED

May 1943

ORDNANCE PAMPHLET NO. 988

BOMB FUZES

1. This publication contains the description, operation, installation, care, maintenance and instructions for use of the following bomb fuzes:

Mark 219, Mark 221, Mark 223, AN-Mark 224, AN-Mark 234, Mark 227, Mark 228, Mark 229, AN-Mark 230

AN-M100A2, AN-M101A2, AN-M102A2, AN-M103, AN-M110A1, M112, M113, M114, M115, M116 and M117.

2. Suggestions and reports of error should be made to the Bureau of Ordnance, Washington, D. C.

3. It is important that a full and complete report of malfunctionings or difficulties encountered with any fuze be made to the Bureau of Ordnance, Washington, D. C. The report should contain a detailed identification including the lot and mod number of the fuze and should also contain ALL information concerning conditions, history and description of the trouble.

4. Aircraft carrying live bombs fuzed with these fuzes may take off or land on board carriers, or elsewhere subject to the following limitations:

(a) That it is determined by preflight inspection: that all arming wires are in place and in proper condition: and that the arming handle is set on "SAFE" position during take-off, landing, and while flying in the vicinity of friendly ships, ground forces or installations.

(b) Conditions for landing are normal.

(c) Weight limitations prescribed by the Bureau of Aeronautics for the type of airplane are not exceeded.

5. All Navy Aircraft Bomb Fuzes are designated by arabic mark numbers. The 200 series has been assigned to this class of fuzes. For example, the Mark XIX,Mod. 1 will be designated the Mark 219, Mod. 1.

6. This publication supersedes Ordnance Pamphlets Nos. 618 and 622 which should be destroyed by burning.

7. This is a RESTRICTED publication and should be handled in accordance with the provisions of Article 76, Naval Regulations, 1920.

W. H. P. BLANDY
Rear Admiral, U. S. Navy,
Chief of the Bureau of Ordnance

NAVY DEPARTMENT

BUREAU OF ORDNANCE

WASHINGTON, D. C.

RESTRICTED

10 August 1943

ORDNANCE PAMPHLET NO. 988

BOMB FUZES

1. This publication contains the description, operation, installation, care, maintenance and instructions for use of the various aircraft bomb fuzes used by the Navy in Navy and AN-Standard types of high explosive bombs.

2. Suggestions and reports of error should be made to the Bureau of Ordnance, Washington, D.C.

3. It is important that a full and complete report of malfunctionings or difficulties encountered with any fuze be made to the Bureau of Ordnance, Washington, D.C. The report should contain a detailed identification including the lot and mod number of the fuze and should also contain ALL information concerning conditions, history and description of the trouble.

4. In the individual chapters where statements appear that the fuzes are safe for take off or landing on board carriers or elsewhere when carrying live bombs fuzed with these fuzes, the following limitations apply:

(a) That it is determined by preflight inspection: that all arming wires are in place and in proper condition: and that the arming handle is set on "SAFE" position during take-off, landing, and while flying in the vicinity of friendly ships, ground forces or installations.

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W. H. P. BLANDY

W. H. P. BLANDY
Rear Admiral, U. S. Navy
Chief of the Bureau of Ordnance

RESTRICTED

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ORDNANCE PAMPHLET NO. 988
ADDENDUM 1 AUGUST 10, 1943

BOMB FUZES

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INDEX TO FUZES

PART I—NAVY FUZES:

PART II—ARMY FUZES:

PART I___Chapter 1 (RESTRICTED)

Bomb Nose Fuze—Mark 219, Mods 2, 3 And 4 Also Designated AN-Mark 219

CONTENTS

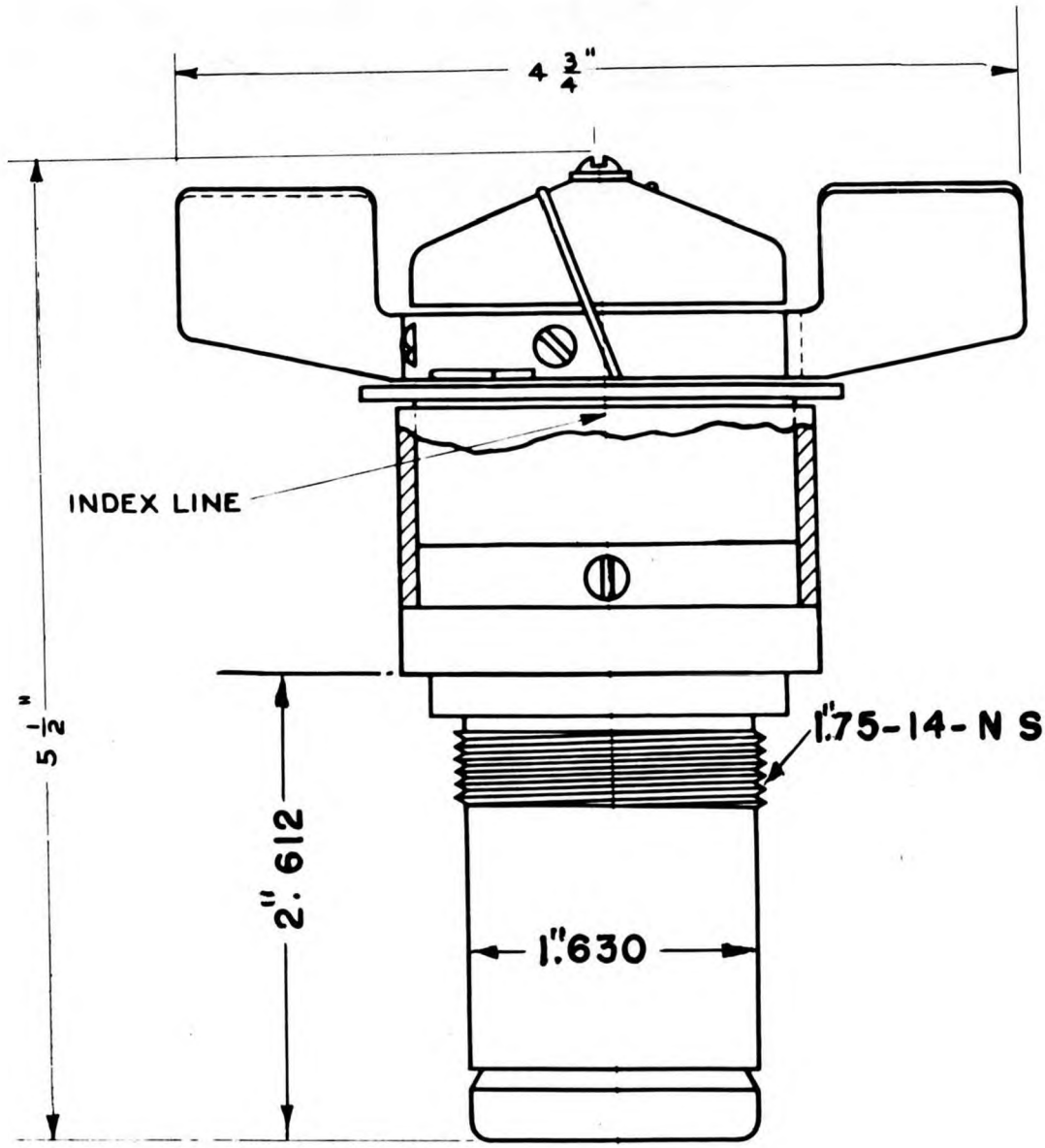
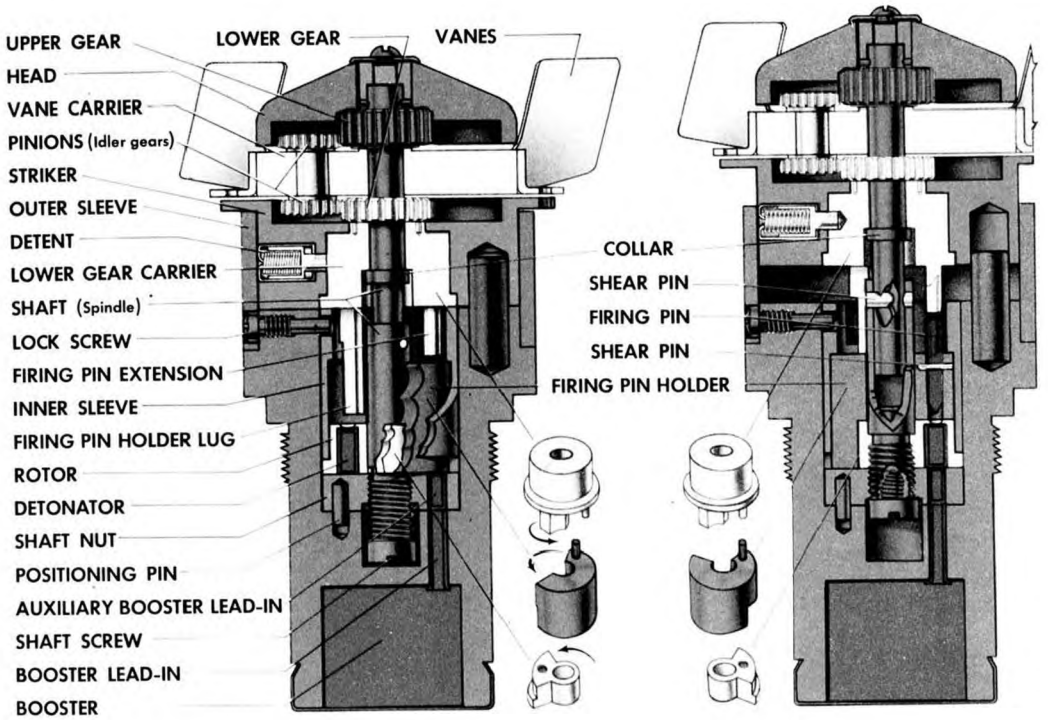


FIG. 1-1 — FUZE, BOMB, NOSE — MARK 219, MODS. 2, 3 AND 4. OUTLINE AND PRINCIPAL DIMENSIONS.



1 Pinions turn with vanes. Lower gear is locked, upper gear is forced in clockwise direction, one tooth for every complete rotation of vane.

2 Spindle is screwed upward until it jams, thus stopping upper gear.

3 Lower gear is free to rotate, as lower gear carrier has been lifted out of lock.

4 Pinion now forces lower gear counterclockwise.

5 The explosive train is aligned as follows:

(A) Firing pin extension moves from position **a** to position **d**.

(B) Firing pin moves from position **b** to position **d**.

(C) Detonator moves from position **c** to position **d**.

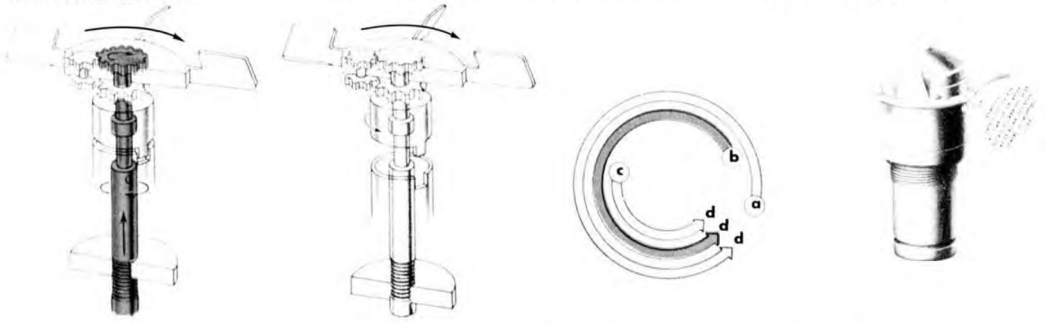
6 When bomb hits, shear pin is sheared.

7 Striker assembly is slammed back.

8 Firing pin extension hits firing pin.

9 Firing pin fires detonator.

10 Detonator fires booster.



BOMB FUZE (NOSE) · AN-219

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The Mark 219 Mod 2, 3, and 4 bomb nose fuzes are of the arming vane type, with mechanical delay arming. The modifications are identical and are used only to designate the manufacturer of the inert parts. Because of differences in manufacturing practices, the parts of a fuze made by one manufacturer are not necessarily interchangeable with parts of the same fuze made by another manufacturer.

Mark 219 Mod 2 is manufactured by the Naval Gun Factory.

Mark 219 Mod 3 is manufactured by the Nash Kelvinator Corporation.

Mark 219 Mod 4 is manufactured by the Reo Motors Incorporated.

This fuze has the features of long arming delay and instantaneous detonation on impact, including water impact, when armed.

It has a maximum practicable safety when unarmed. Delay arming furnishes maximum safety for dive bombing and protection against detonation when accidentally released from an airplane at low altitude. It is safe for landings and take-offs of aircraft with fuzed bombs anywhere, including decks of carriers.

(b) ***Bombs in which used***—The Mark 219, Mods 2, 3, and 4 may be used in the following bombs:

Mark 4 and Mods	—100-lb. Demolition Bomb
Mark 5	—30-lb. Fragmentation Bomb
Mark 12 and Mods	—500-lb. Demolition Bomb
Mark 13 and Mods	—1000-lb. Demolition Bomb
Mark 9	—500-lb. Light Case Demolition Bomb
Mark 9	—1000-lb. Light Case Demolition Bomb
Mark 42	—100-lb. Bomb
Mark 17 Mod 1	—325-lb. Aircraft Depth Bomb, Round Nose, TNT loaded
Mark 17 Mod 2	—325-lb. Aircraft Depth Bomb, Round Nose, TNT loaded
AN MARK 41	—325-lb. Aircraft Depth Bomb, Flat Nose, TNT loaded
AN Mark 44	—350-lb. Aircraft Depth Bomb, Round Nose, Torpex loaded
AN Mark 47	—350-lb. Aircraft Depth Bomb, Flat Nose, Torpex loaded
Mark 29	—650-lb. Aircraft Depth Bomb, Round Rose, TNT loaded
Mark 37	—650-lb. Aircraft Depth Bomb, Round Rose, TNT loaded
Mark 38	—650-lb. Aircraft Depth Bomb, Flat Nose, TNT loaded

An adapter and 2 Auxiliary boosters are required with all bombs with the exception of Mark 4 and Mods 100-lb. Demolition Bomb, Mark 5 Fragmentation Bomb, and Mark 42, 100-lb. Bomb.

Current Marks and Mods of Aircraft Depth Bombs are being issued with adapters and auxiliary boosters installed in the bombs. Mark 219 fuzes, together with the necessary adapters and auxiliary boosters, are supplied to carriers, seaplane tenders, and advance bases for fifty per cent (50%) of the Mark 12 and Mark 13 bombs carried.

The round nose bombs are issued from loading depots with flat nose attachments installed.

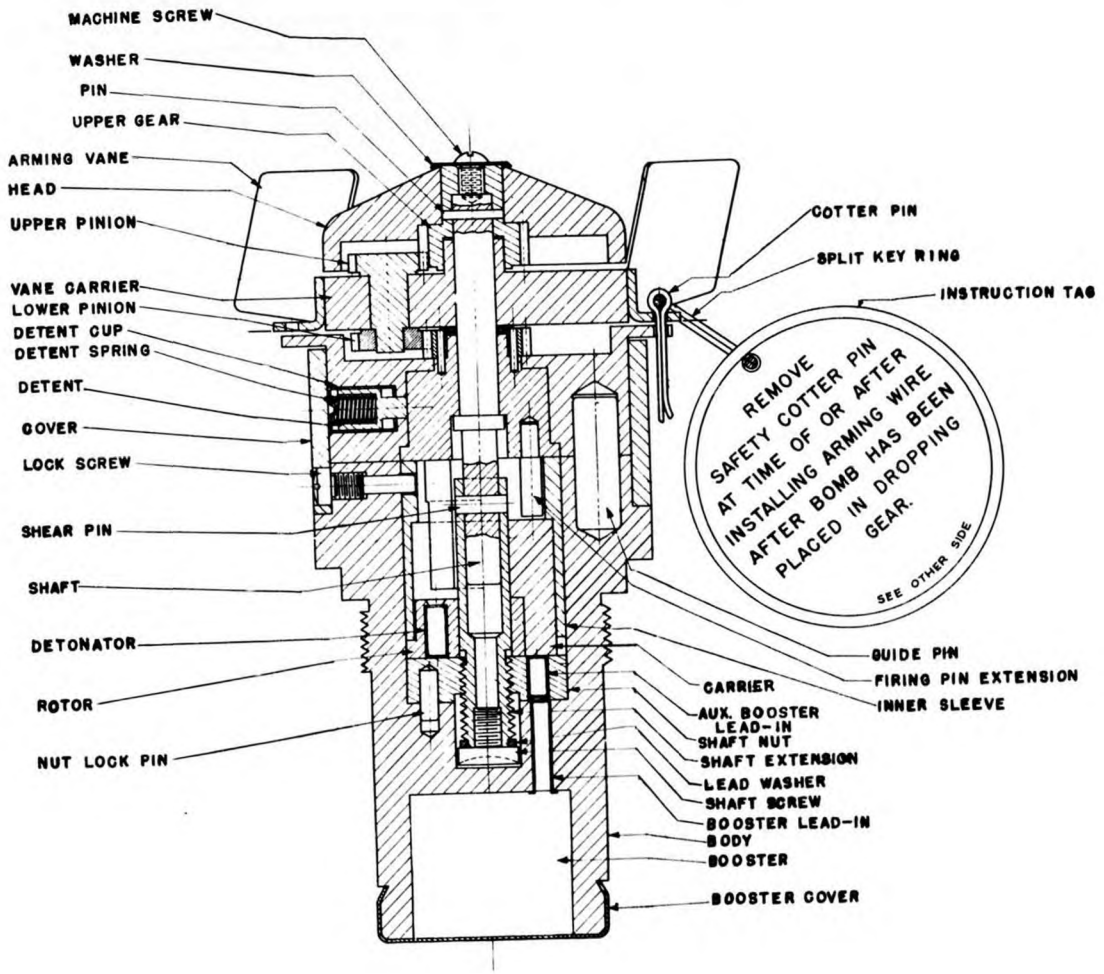
This fuze can be adapted for use in Army-Navy General Purpose Bombs by using a metal adapter and a Mark 4 auxiliary booster.

This fuze should not be used in the nose of depth bombs unless selective arming is available.

(c) ***Details***—The outline and principal dimensions of this fuze are shown in Fig. 1-1. General arrangement is shown in Bureau of Ordnance General Arrangement Drawing No. 202656, and Fig. 1-2 and 1-3. Fig. 1-5 is a photograph of a completely assembled fuze. Fig. 1-4 is a photograph of the disassembled parts.

It weighs approximately 4.06 pounds when loaded, is detonator safe and detonates the bomb instantaneously on impact.

(d) ***Arming***—When the bomb is released from the bomb rack (free to arm), the vane carrier is unlocked from the striker flange by withdrawal of the arming wire. The vane carrier then rotates by action of the airstream on the vane, driving the



UNARMED POSITION

FIG. 1-2 — FUZE, BOMB, NOSE — MARK 219, MODS. 2, 3 AND 4. GENERAL ARRANGEMENT DRAWING WITH PART NAMES. (UNARMED POSITION).

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

In this position the fuze is fully armed and rotation of the arming vanes under normal circumstances will cease. Should the fuze be subjected to wind speeds in excess of 300 miles per hour after arming is completed, the vanes will transmit enough force to shear the pins in the lower gear and carrier. Under this condition the vanes will continue to rotate without any effect on the armed fuze.

(e) ***Explosive components*** — The explosive train consists of a detonator, auxiliary booster lead-in, booster lead-in, and booster. The booster is about 25.5 (.898 Oz.) grams of tetryl, either pellet loaded or loaded in place. The booster is closed in by a booster cover placed over the body and crimped into the groove provided.

2. FUNCTIONING:

(a) ***Armed***—When the fuze is fully armed (See paragraph 1d), the firing pin extension, firing pin, and explosive train are in alignment. When impact occurs, the head, vane carrier, striker and lower gear carrier are forced toward the fuze body, thereby shearing the pin in the shaft. The firing pin extension in the lower gear carrier engages the firing pin and shears the firing pin shear pin. The firing pin penetrates and functions the detonator which in turn fires the auxiliary booster lead-in, the booster lead-in, and the booster which detonates the bomb as a unit. Fuze action is instantaneous on impact.

(b) ***Air travel required to arm*** — About 1000 feet of air travel along the trajectory is required to arm this fuze. The minimum altitude required for arming is approximately 500 feet when released from an airplane in horizontal flight at 100 miles per hour.

This is the distance required to arm. The minimum safe altitude for release will depend on the size of the bomb dropped.

(c) ***Sensitivity***—When dropped from an altitude sufficient to permit arming, this fuze will detonate the bomb instantaneously on impact with water or denser medium.

(d) ***Released safe***—When released safe (arming wire or safety cotter pin in place), the vanes are prevented from rotating and the fuze will not arm, therefore will not function on impact. Fuzes are proof tested to insure that they will not function when locked in the unarmed position and dropped on water. The fuze must not function in a drop on water from an airplane in horizontal flight at an altitude of 8,000 to 10,000 feet.

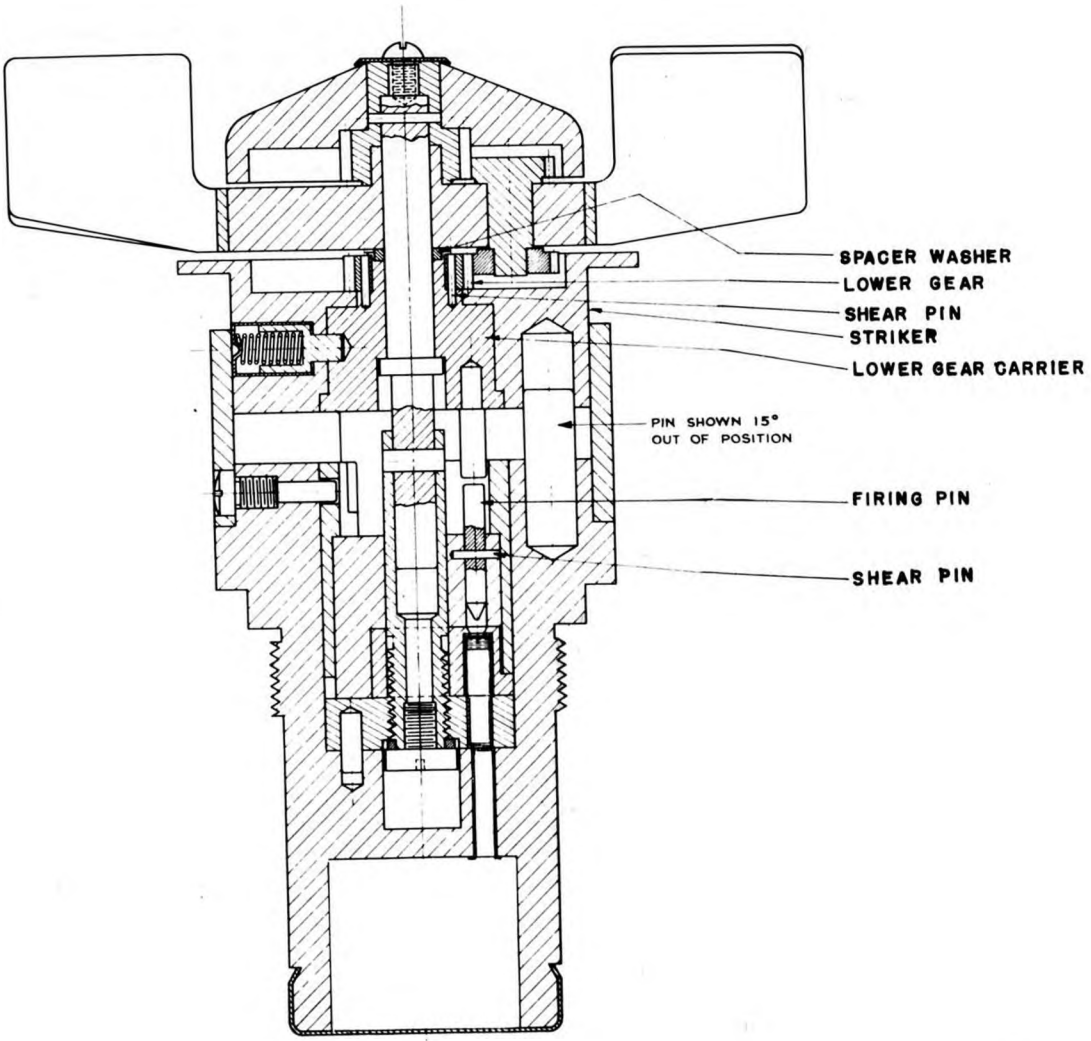
3. SAFETY FEATURES:

(a) ***When installed in a bomb***—When installed in a bomb with the arming wire in place, the arming vane is locked from rotating and arming the fuze. The explosive train is also broken; the detonator being out of alignment with the booster lead-in. The firing pin is out of alignment with the detonator, and the firing pin extension is not aligned with the firing pin. This fuze is detonator safe. If the detonator should explode when in the safe position, the gases would simply expand into the space above and no further action would take place. Fuzes are proof tested to insure that they will not function when dropped free to arm on a hard surface. The fuze must not function in a drop from an airplane in horizontal flight at an air speed of 60-70 miles per hour, at an altitude of 50-75 feet. Such a drop does not allow sufficient air travel to fully arm the fuze.

(b) ***During shipping***—During shipping, a safety cotter pin locks the vane and prevents rotation. The features of broken explosive train and detonator safety are also in effect. The fuze is also protected by a packing can and shipping box (See Packing—paragraph 7).

4. ARMED OR PARTIALLY ARMED FUZES:

(a) ***Appearance***—From exterior appearance, it is practically impossible to obtain a definite in-



ARMED POSITION

FIG. 1-3 — FUZE, BOMB, NOSE — MARK 219, MODS. 2, 3 AND 4. GENERAL ARRANGEMENT DRAWING WITH PART NAMES. (ARMED POSITION).

dication that the fuze is fully armed or very nearly armed. When completely armed, the striker flange should have moved away from the edge of the outer sleeve a distance of 5/16 inches and the lower gear and carrier rotated about 345° thereby bringing into alignment the firing pin extension, detonator and booster leads. Unless the carrier has rotated 345° after being elevated 5/16 inches, the fuze is not fully armed. If the striker flange has moved away from the outer sleeve more than 3/16 inches, the fuze should be regarded as armed. If it has not moved more than 3/16 inches, the fuze may be considered as partially armed.

(b) ***Removing from a bomb***—If the arming wire is not in place and the striker flange has moved more than 3/16 inches from the outer sleeve, consider the fuze as fully armed. Carefully remove the lock screw in the outer sleeve and gently withdraw the detonator and striker assembly, grasping the striker flange and pulling it forward along the axis of the fuze until completely withdrawn. Then remove the fuze body from the bomb and reassemble the fuze in an unarmed position as outlined in paragraph 6c and 6d below. If striker flange has not moved 3/16 inches from the outer sleeve, the fuze is only partially armed. Replace safety cotter pin and then remove fuze in the ordinary manner. Unarm by rotating the vanes counter-clockwise until the gears begin to tighten, then reversing rotation three or four turns. If the fuze tends to bind before being completely unarmed, do not force, but disassemble and inspect. Lock with safety cotter pin. The removal of armed or partially armed fuzes from bombs should always be performed by bomb disposal personnel when available. If not available, only personnel having a thorough knowledge of the fuze should do this work.

5. INSTALLATION IN A BOMB:

(a) ***Instructions***—The following procedure is recommended in fuzing and installing bombs:

(1) Remove the nose shipping plug from the bomb, inspect the fuze seat liner and threads and clean, if necessary. If auxiliary boosters are required, inspect to see that they are in place.

(2) Remove fuze from the hermetically sealed container and inspect outward appearance for any defective threads, bent vanes, etc. Reject unsatisfactory fuzes.

(3) If the fuze is satisfactory, screw it securely into place with a small spanner wrench. If the screw threads are clean and free running, the fuze may be screwed in handtight.

(4) Remove the safety cotter pin from the fuze and rotate the vane carrier slightly in each direction to ensure free rotation. Do not rotate the vanes more than one turn in either direction.

(5) Thread the end of the arming wire through the forward bomb lug (in case of two point suspension) and then through the uppermost hole in the striker flange and the hole in the nearest vane carrier lug.

(6) Place two Fahnestock connectors (safety clips) over the end of the arming wire to prevent the wire from slipping out of the holes, also to cause arming wire plate to be withdrawn from the bomb rack if the bomb is released safe.

(7) Place the bomb in the bomb rack and secure the arming wire plate to the bomb rack according to instructions for the particular rack being used. Pull the arming wire taut through the holes, *but maintain sufficient freedom for the arming wire plate in the bomb rack.*

(8) Push the safety clips snugly against the fuze and cut off excessive end of arming wire, allowing the end to extend about four inches past the vane carrier lug and safety clips. See that the end of the wire is free from burrs and kinks.

The arming wire may be assembled to the bomb and fuze either after the bomb is placed in the bomb rack or immediately before placing the bomb in the rack. The safety cotter pin must not be removed until just before the arming wire is threaded through the holes in the striker flange and vane carrier.

(b) ***Points to check***—When installing fuzes in bombs, make the following check-ups:

(1) Check the bomb fuze seat liner and threads.

(2) Check to see that auxiliary boosters, if required, are in place.

(3) Inspect vanes, threads and outward appearance of fuze.

(4) Check fuze vane for free rotation.

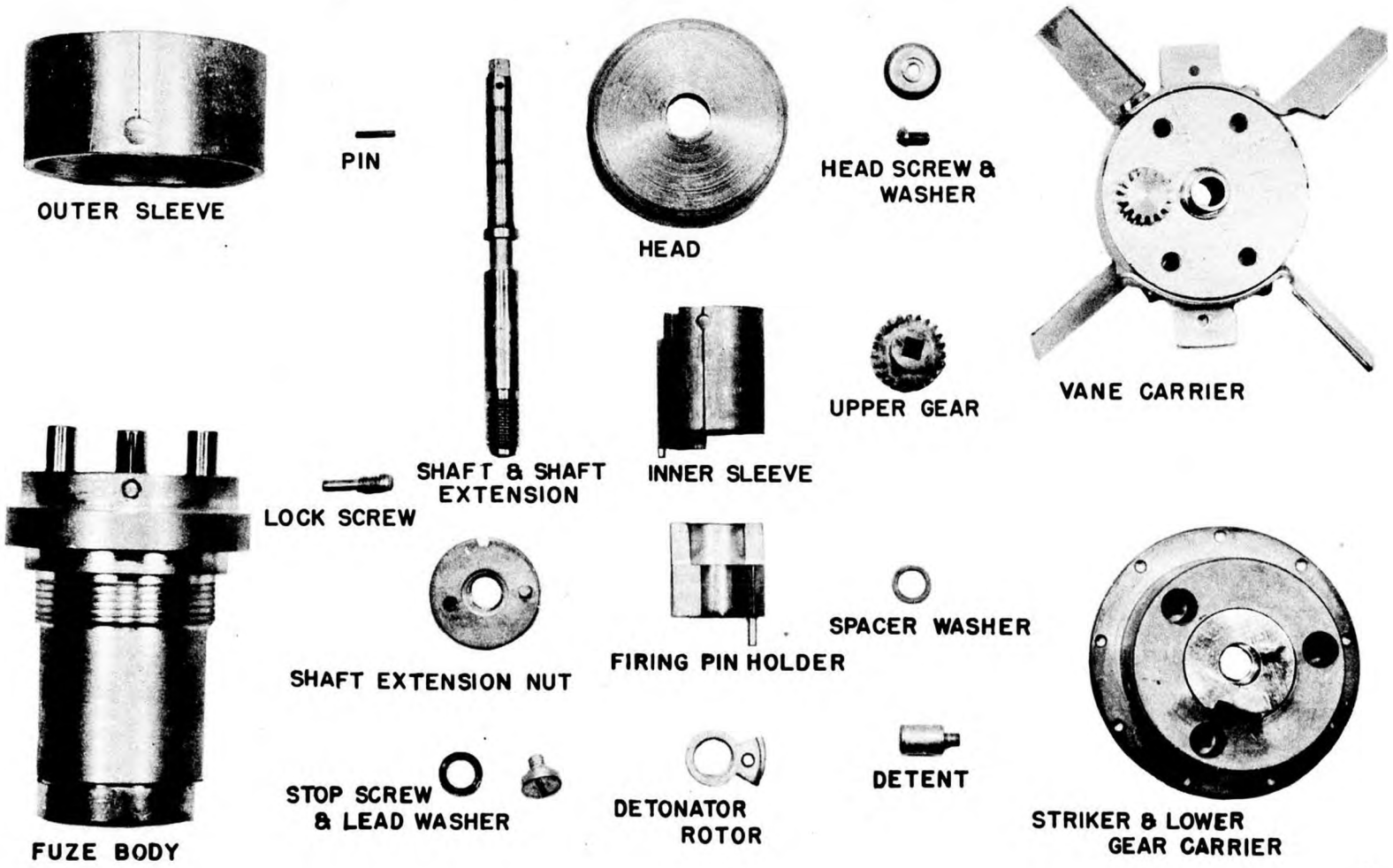


FIG. 1-4 — BOMB FUZE, MARK 219 MODS 2, 3 AND 4: DISASSEMBLED PARTS

(5) Check arming wire for smooth ends and properly inserted plate.

(6) Check to see that safety cotter pin has been removed.

6. SERVICING:

(a) ***Fuzes exposed to weather***—When exposed to salt spray, the Mark 219 fuze becomes inoperable after short periods of installation. In order to conserve available fuzes and insure their proper functioning after installation in bombs, the following procedure is authorized by the Bureau of Ordnance:

(1) The fuze must be disassembled and cleaned within 24 hours after it has been subjected to salt spray; otherwise, the fuze cannot be considered reliable for more than 2 days following its subjection to salt spray. If not disassembled and cleaned, the fuze should be turned into an ammunition or mine depot at the first opportunity. It is doubtful whether the fuze could be made serviceable after long delay in disassembly.

(2) Sealing the openings between the head, vane carrier and striker flange with petrolatum or grease may prevent the arming vanes from functioning, and is therefore NOT RECOMMENDED.

(3) Only personnel thoroughly familiar with the construction and operation of the fuze, under the supervision of the unit gunnery officer, shall be permitted to break down, clean and assemble a fuze. Observe all safety precautions in handling this type of ammunition. To disassemble and assemble, see 6d below.

(4) After disassembly, dry all parts with a clean rag, then lightly coat them with sperm oil or light mineral oil. Wipe the parts dry before assembly. *DO NOT ALLOW OIL TO COME IN CONTACT WITH THE EXPLOSIVE COMPONENTS.*

(5) Oil should not be allowed in contact with the detonator in the rotor. Excess oil should be avoided on the firing pin carrier (especially in firing pin hole) because of its proximity to the detonator. This also applies to the shaft nut which contains the auxiliary lead-in. In assembling the fuze, insure that the shaft extension nut is seated gently against the shoulder on the shaft extension. If the extension nut is brought up too tightly against the shoulder, the arming vanes may not function.

(b) ***Reports of malfunctionings***—Reports of malfunctionings should be accompanied with a complete history of the fuze and sent in to the Bureau of Ordnance. The report should contain the fuze lot number, weather exposed to, length of time in service, and other pertinent information.

(c) ***Disassembly of fuze***—Place the fuze in a vertical position, booster end downward, and remove the lock screw which is located on the index line of the outer sleeve. The striker and detonator assembly can then be removed, also the locking detent which is kept in place by the outer sleeve. Maintain this assembly in a vertical position and remove the small screw and washer from the top of the head. After removing the head, the following parts should be removed in the order named:

(1) Upper external gear by removing the pin locking it to the shaft.

(2) Vane carrier assembly

(3) Striker and lower external gear

(4) Inner sleeve

(5) Firing pin holder

(6) Detonator rotor

(7) The shaft extension nut which contains the auxiliary booster lead-in may be removed from the central shaft after removing the flanged slotted screw at the bottom of the shaft.

(d) ***Assembly***—The central shaft consists of two parts, the shaft and shaft extension, which are secured together with a copper shear pin. Care must be exercised to avoid shearing this pin during assembly of the fuze. Assembly should be in the following manner:

(1) Screw the shaft extension nut, with the fixed dowel down, onto the central shaft until seated gently against the shoulder on the shaft extension.

(2) Screw the flanged stop screw, with the lead washer in place, in the end of the shaft extension and tighten securely.

(3) Place the detonator rotor on the shaft and align index marks on the shaft extension nut and rotor.

(4) Place the firing pin carrier on the shaft with the extending part of the firing pin up. Position by turning it clockwise until it comes up against the shoulder of the rotor. (Note: Firing pin and detonator must be out of alignment.)

(5) Place the inner sleeve over the firing pin carrier with the lower projection in the groove of the shaft extension nut.

(6) Place the striker and lower gear carrier on the shaft so that the lug on the lower gear carrier

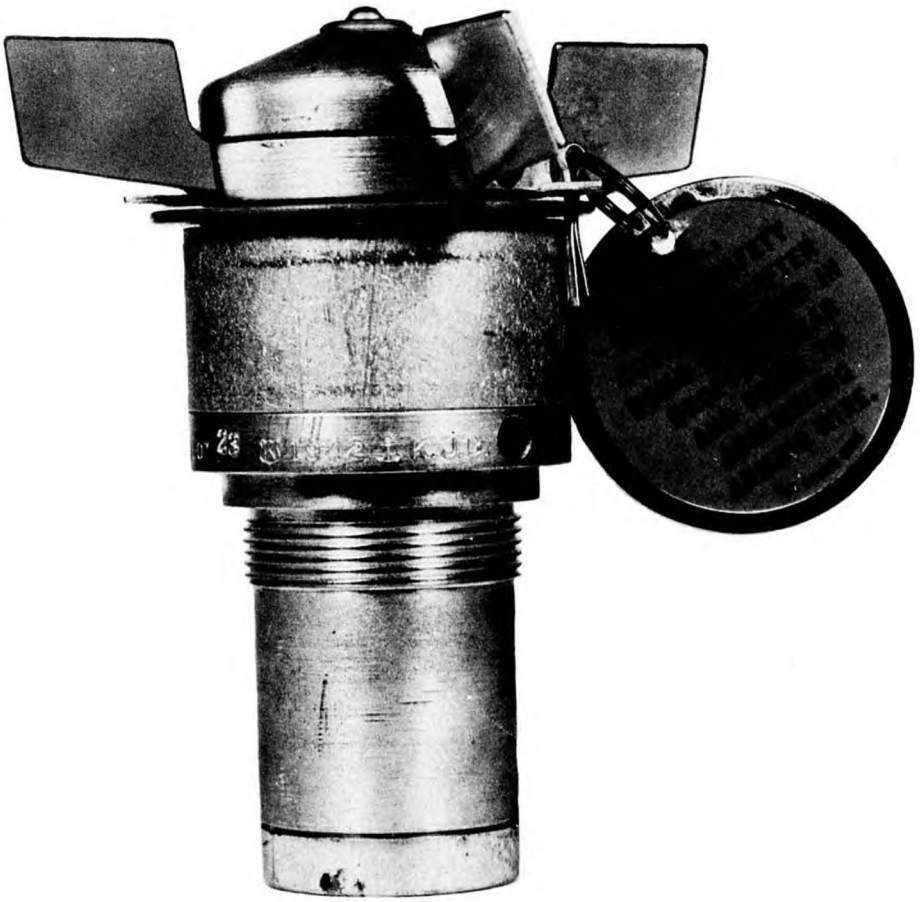


FIG. 1-5 — MARK 219 MOD 2, 3 AND 4 — PHOTOGRAPH OF FUZE

fits into the cut-out in the inner sleeve. When properly seated the lower edge of the striker should be flush with the top edge of the inner sleeve.

(7) Place the outer sleeve over the fuze body and start the lock crew into the threads of the tapped hole in the fuze body.

(8) Rotate the striker until the detent hole is lined up with the index line of the inner sleeve. Hold the assembly firmly by the shaft and striker flange and lower it into the fuze body with the index lines of the rotor assembly aligned with the index line of the outer sleeve. When seated properly the bottom of the striker flange will be flush with the top edge of the outer sleeve. If the assembly does not seat properly when first lowered into the body, rotate the striker and shaft back and forth through several degrees until proper seating is obtained.

(9) Grasp the shaft and striker flange and lift the assembly upward approximately one inch and insert the locking detent. Take care that the detent doe not drop into the hole in the lower gear carrier. The fuze will be a dud if this occurs. After assembly of the locking detent, lower the assembly back into position and tighten the lock screw. If the lock screw does not fit in freely rotate the central shaft clockwise one turn.

(10) Place the spacer washer and vane carrier on the shaft.

(11) Rotate the central shaft clockwise approximately one turn (unless performed in operation 9). This raises the shaft so that the locking pin can be inserted when the upper gear is assembled.

(12) Assemble the upper gear to the shaft and insert the pin through the hub and shaft.

(13) Place the head on the upper gear hub and secure with the washer and screw.

(14) Turn the arming vanes counterclockwise until the gearing just begins to tighten; then reverse the rotation about 5 to 10 turns and lock in place by inserting the safety cotter pin in the nearest registering hole.

7. PACKING AND MARKING:

Each fuze with two Fahnestock connectors (safety clips) is hermetically sealed in a metal container. Six completely loaded containers are packed in a metal packing box. For purpose of shipment from the manufacturer, a convenient number of metal packing boxes are packed into an outside wooden shipping box.

Each fuze body is stamped with the Mark and Mod number, lot number, manufacturer's initials, year of manufacture and inspector's initials.

The metal container is stenciled with the number of fuzes contained, Mark and Mod number, lot number, year inspector's initials, weight empty, weight loaded, contract number and place loaded.

Six fuses in metal container are packed in a metal packing box 15".53 x 10".36 x 6".31 and about 36 pounds weight loaded. It is marked thus: six (6) aircraft Bomb Fuzes Mark ..... Mod ....., lot number, year of manufacture, inspector's initials, weight of crate and contents. For shipmen from the manufacturer a convenient number o metal packing boxes are packed in an outside wooden shipping box.

Each box is marked: Detonating fuzes—handle carefully. The top is marked "This Side Up." It also is marked as follows:

(Number) Aircraft Bomb Fuzes Mark ..... Mod .....

Lot Number Year of Manufacture

Name of Manufacturer

Requisition, Contract or Order Number

Inspector's Initials

Shipping address

PART I—Chapter 2 (RESTRICTED)

SECTION 1

Bomb Fuze, Nose, Mark 221 Mods 1, 3 and 4; Except Lots 21, 22 and 23 of Mark 221 Mod 1

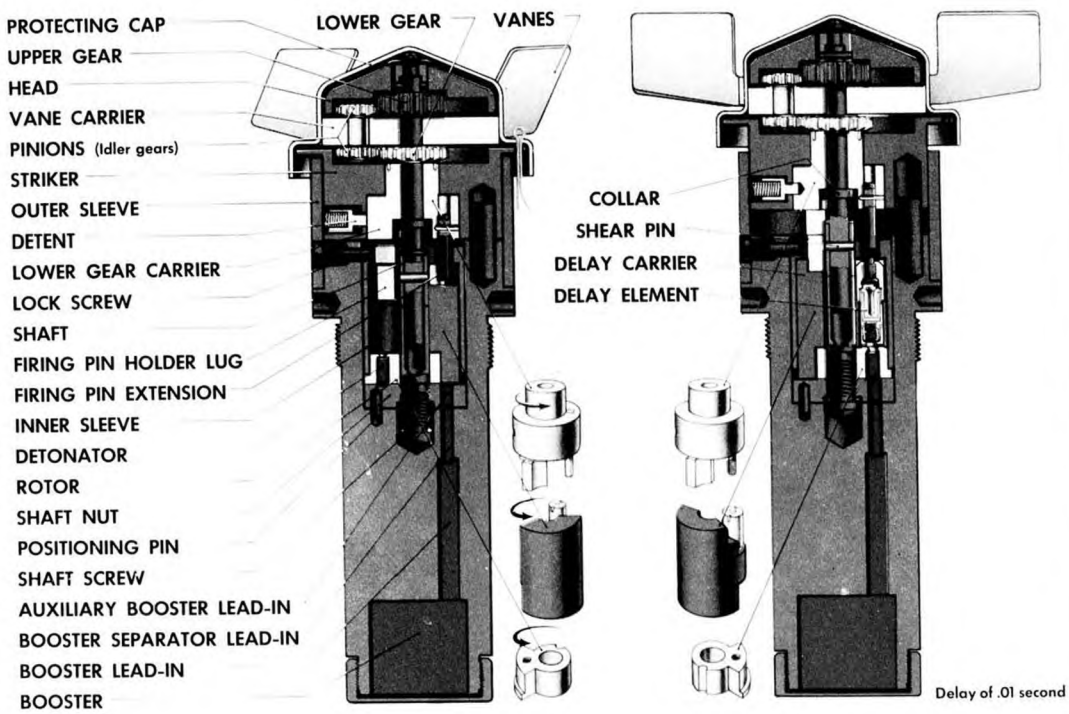
CONTENTS

PART I—Chapter 2 (RESTRICTED)

SECTION 2

Bomb Fuze, Tail, Mark 223 Mods 1, 3 and 4; Except Lots 21, 22 and 23 of Mark 223 Mod 1

CONTENTS



1 Pinions turn with vanes. Lower gear is locked, upper gear is forced in clockwise direction, one tooth for every complete rotation of vane.

2 Spindle is screwed upward until it jams, thus stopping upper gear.

3 Lower gear is free to rotate, as lower gear carrier has been lifted out of lock.

4 Pinion now forces lower gear counterclockwise.

5 The explosive train is aligned as follows:

(A) Firing pin extension moves from position **a** to position **d**.

(B) Firing pin moves from position **b** to position **d**.

(C) Detonator moves from position **c** to position **d**.

6 When bomb hits, shear pin is sheared.

7 Striker assembly is slammed back.

8 Firing pin extension hits firing pin.

9 Firing pin fires detonator.

10 Detonator fires booster.

BOMB FUZE (NOSE) • Mk 221

R E S T R I C T E D

SECTION 1

1. DESCRIPTION:

(a) ***General***—The Bomb Fuze Mark 221 Mods 1, 3 and 4; except lots 21, 22 and 23 of Mark 221 Mod 1 are similar in design. The variation in Mods indicates the manufacturer with resulting differences in tolerances and methods of manufacture. Mark 221 Mod 1 is produced by the Naval Gun Factory, Mark 221 Mod 3 by Nash Kelvinator, and Mark 221 Mod 4 by Reo Motors. It was previously designated Mark 21.

Note: (Lots 21, 22 and 23 of Mark 221 Mod 1 are modified for Anti-Submarine use, and are Marked "A.S.") The fuzes will be treated here as one. It is a nose fuze of the arming-vane type, with mechanical arming delay. The fuze is safe for use in dive bombing and for take-offs or landings anywhere, including the decks of carriers. It is designed to detonate the bomb with a 0.01 second delay after impact. It requires a striking velocity of 400 feet per second to assure functioning on water impact and approximately 850 to 1100 ft. of air travel to arm. The Bureau of Ordnance drawing number of the general arrangement is 202618. The weight is approximately 7.67 lbs.

(b) ***Bombs in which used***—This fuze is used in the following bombs:

500 lb. general purpose bomb Mark 12 and mods.

1000 lb. general purpose bomb Mark 13 and mods.

1000 lb. general purpose bomb Mark 36.

It may also be used in the following bombs, though such use is not recommended unless an instantaneous fuze is not available. The 0.01 second delay, for which the fuze is designed, may allow a light case to be so damaged before detonation, that a low order detonation may result.

500 lb. (light case) bomb Mark 9
1000 lb. (light case) bomb Mark 9
650 lb. Aircraft depth bomb Mark 29
650 lb. Aircraft depth bomb Mark 37
325 lb. Aircraft depth bomb Mark 17 and Mods
350 lb. Aircraft depth bomb Mark 44.

(c) ***Mechanical delay arming***—In the unarmed position the firing pin extension, the delay element, the detonator, and the booster lead-in are out of alignment. Arming occurs as the result of two successive motions, that of separation of the fuze body from the striker, and that of rotation aligning the firing pin extension, delay element, detonator and booster lead-in. The air stream rotating the vane carrier provides the power for these motions. Delay in arming is obtained by a reduction gear train interposed between the vane and central shaft, while the separation occurs between the fuze body and the striker. The delay in arming is continued during rotation, by the reduction gear train working between the vane and lower gear carrier. The reduction gear train reduces the rotation of the central shaft to one revolution for every twenty-three revolutions of the arming vane. Approximately one hundred and fifty revolutions of the arming vane are necessary to arm the fuze.

(d) ***Functioning mechanism*** — The central shaft is set in a shaft extension, resting on a narrow collar on the central shaft. The collar is secured to the shaft extension by a guide pin set through a groove in the shaft extension and the central shaft. The force of the impact shears the collar, and the central shaft telescopes into the shaft extension. On the lower end of the shaft extension is a left hand thread working in the shaft extension nut. This nut is grooved to retain the inner sleeve in alignment, and has a dowel which engages an opening inside the fuze body to prevent rotation of the nut. Thus, the screw thread on the shaft extension permits movement upward, through the shaft extension nut, until arrested by the flange of the stop screw. The shaft extension nut is counter-bored to receive a lead washer, which acts as a shock absorber for the stop screw flange. The vane carrier and striker assembly are rotatably mounted on the central shaft. External pinions, rigidly fixed to a common shaft, are mounted on the vane carrier. The lower pinion meshes with the lower external gear of the striker assembly. The upper pinion meshes with the upper external gear, set on the central shaft and secured to it by means of a shear pin. The pinion shaft rotates freely. The head is set on the square end of the central shaft and a protecting cap is placed over the head, secured to the vane carrier with four screws which also secure the arming vanes to the cap.

The striker assembly consists of the striker, the lower external gear and the lower gear carrier freely revolving in the striker. Projecting downward from the lower gear carrier, are the lug and firing pin extension. In the striker are three openings which engage corresponding pins in the fuze body. The openings and pins are irregularly spaced so that they will engage in only one posi-

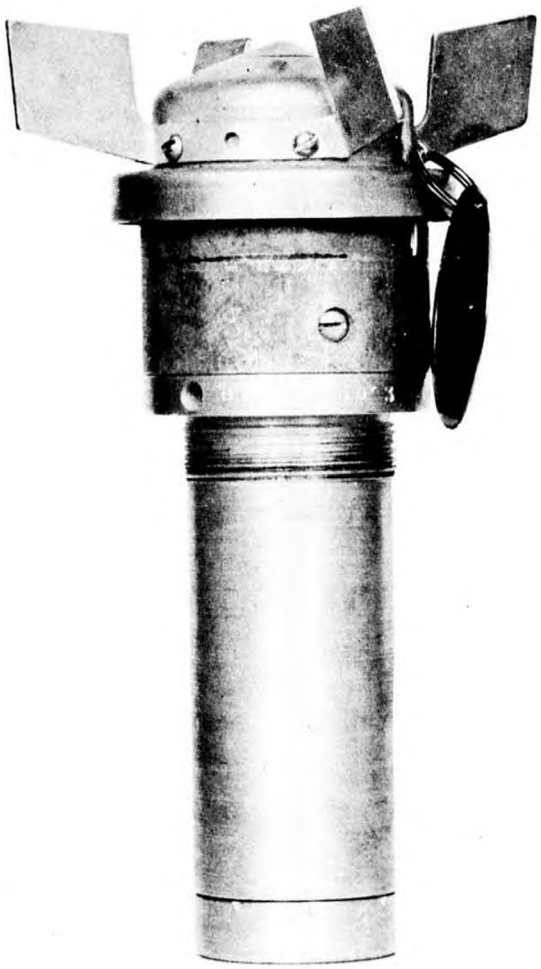


FIG. 1-6 — PHOTOGRAPH OF FUZE MARK 221

tion. As arming action takes place, the striker assembly withdraws from the fuze body until a separation of about five-sixteenths of an inch is reached between the lower flange of the protecting cap and an index line on the outer sleeve. The lug of the lower gear carrier actuates the delay carrier and detonator rotor by rotation. The firing pin extension is aligned over the firing pin in the armed position, and upon impact strikes the firing pin. The lower external gear is placed on the lower gear carrier, crimped and pinned into place. In the side of the striker is an opening which houses a detent lock pin compressed by the outer sleeve. When the fuze arrives at the armed position an opening in the gear carrier coincides with the detent pin opening, and the detent pin locks the striker to the gear carrier. The flange of the striker has nine equally spaced holes, one of which coincides with a hole in the protecting cap, upon assembly in the unarmed position. A safety cotter pin is inserted through the coincided holes to prevent rotation, and an instruction tag is secured to the pin by an intermediate key ring.

The outer sleeve is a guide for the striker and is secured to the fuze body by means of three lock screws.

The inner sleeve is fixed relative to the fuze body by the same lock screws that secure the outer sleeve and by a lug projecting downward that engages the groove in the shaft extension nut. The inner sleeve encloses the delay carrier and the detonator rotor, and engages the lug on the lower gear carrier.

The delay carrier is a segment of a cylinder housing the delay element. The firing pin of the delay element projects above the surface of the delay carrier. The delay carrier contains an opening in which is set a free locking pin, tapered end downward.

The detonator rotor is a cylindrical section with a flanged segmental section in which is housed the detonator (fulminate of mercury and Pom Pom mixture). Rotating motion of the rotor is limited by the recess in the inner sleeve confining it.

The fuze body houses the booster charge, booster lead-in and auxiliary booster lead-in. The booster cap is screwed on tightly and staked to the fuze body. It is not removed after the booster charges have been inserted. The fuze body is threaded for admission to the nose of the bomb. On the floor of the fuze body is a deep recess to receive the shaft extension. Irregularly spaced about this recess are three small openings for two lock pins and the dowel of the shaft extension nut.

(e) ***Explosive components*** — The explosive components consist of:

(1) Detonator—Small copper cup containing fulminate of mercury and Pom Pom mixture. Housed in the Detonator rotor.

(2) Auxiliary booster lead-in — Small copper cup containing tetryl. Housed in the shaft extension nut.

(3) Booster lead-in — Copper cup containing tetryl. Housed in the fuze body.

(4) Booster—38.2 grams of pressed tetryl in the booster cavity.

(5) Delay element—Contains black powder and a special detonator, housed in the delay carrier.

2. FUNCTIONING:

(a) ***Released for arming***—When the bomb is released, the arming wire is withdrawn from the fuze, allowing the air stream to rotate the arming vane. This rotation acting through the reduction gearing revolves the central shaft. The striker is prevented from turning by its engagement with the pins of the fuze body and the shaft extension nut is prevented from turning by the engagement of its dowel with the fuze body. The shaft, shaft extension and head rotate as a unit, at a lesser rate than the vane carrier. The action of the thread on the lower end of the shaft extension working in the shaft extension nut, moves the shaft assembly axially upward. The striker, vane carrier, protecting cap, and head accompany this movement, due to the shaft shoulder. The striker, withdrawing from the pins of the fuze body, withdraws the firing pin extension from engagement with the delay carrier. However, the lug on the lower gear carrier remains bearing against the side of the delay carrier.

When the stop screw takes up against the shaft extension nut, the lug on the lower gear carrier simultaneously disengages from the inner sleeve. The shaft, shaft extension and head cease to rotate and become fixed. The vane carrier and protecting cap continue and lower gear carrier begins to rotate about the central shaft. Upon the rotation of the lower gear carrier through approximately 345° the following occurs:

(1) The lug on the gear carrier traverses the slot in the delay carrier until it takes up against the opposite face of the delay carrier. At this

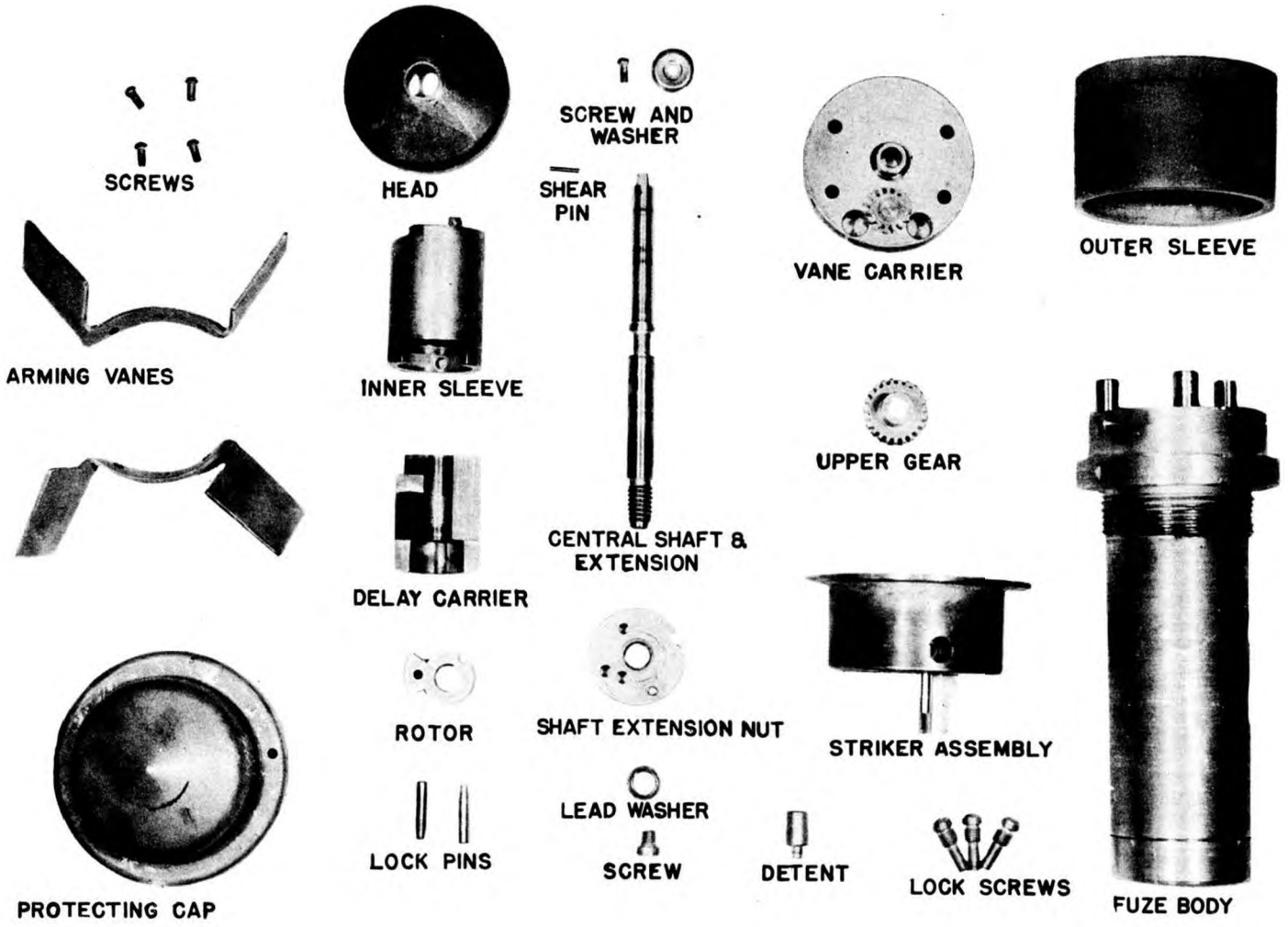


FIG. 1-7 — BOMB FUZE MARK 221: DISASSEMBLED PARTS

point the firing pin extension is aligned above the firing pin of the delay element.

(2) Forced by the lug, the delay carrier is rotated until the delay element is aligned above the detonator. At this point a surface of the delay carrier bears against the side of the detonator rotor.

(3) Forced by the lug of the lower gear carrier and the surface of the delay carrier, the detonator rotor is rotated until the detonator is aligned over the booster lead-in. At this point, the vane carrier ceases to rotate and all parts are fixed in the stationary position by the lock pin set in the delay carrier which has fallen through the shaft extension nut into its corresponding opening in the floor of the fuze body and by the detent pin which has locked the lower gear carrier to the striker body. The firing pin extension, delay element, detonator and booster lead-in are aligned and the fuze is in the armed position.

(b) ***Upon impact***—The force of the impact on the head of the fuze, shears the narrow collar of the central shaft, which is telescoped into the shaft extension. The firing pin extension strikes the firing pin and the primer is fired. The flash from the primer passes through and around the baffle and ignites the delay element which defers ignition of the special detonator 0.01 seconds. Functioning of this detonator fires the detonator in the rotor and hence the auxiliary booster lead-in, the booster lead-in and the main booster charge.

(c) ***Released safe***—If the bomb is released safe, the arming wire is released from the arming mechanism and drops with the bomb, thereby preventing arming of the fuze. Unarmed, the fuze will not function to detonate the bomb. Tests, wherein the fuze has been dropped from an altitude of 10,000 ft. on a hard surface, failed to detonate the booster charge.

3. SAFETY FEATURES:

(a) ***Detonator safety***—This fuze is detonator safe. In the unarmed position the detonator, and booster lead-in are out of alignment. Should the detonator function prematurely, neither the booster lead-in nor the booster charge would be actuated. The force of the detonation would be dissipated forward into the cavity between the rotor and the striker.

(b) ***Installed in bomb***—When the fuze is assembled in the bomb with arming wire in place, it is unarmed. Upon release of the bomb and withdrawal of the arming wire, the fuze does not become armed until it has traveled from 850 to 1100 ft. through the air. The fuze will not function until impact occurs with sufficient force to shear the collar on the central shaft.

(c) ***During shipping and stowage*** — Additional safety is assured during shipping and stowage, by a cotter pin locking the protecting cap and striker flange.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—If the fuze is accidentally dropped less than 5 feet, or the arming vane is allowed to rotate in any manner, the fuze should be inspected to determine whether or not it is armed. If the protecting cap flange has separated from the horizontal index line on the outer sleeve, five-sixteenths of an inch, the fuze is to be considered as fully armed. If the separation is less than five-sixteenths of an inch the fuze is not necessarily in the unarmed position. Any separation, greater than three-sixteenths of an inch, should be construed as questionable arming, and the fuze should be treated as fully armed. The fuze is partially armed if any separation exists, less than three-sixteenths of an inch.

(b) ***Handling***—If the fuze is not fully armed, in order to unarm it, the vane may be rotated in a counter-clockwise direction, looking at the fuze cap as it is assembled in the bomb, until it begins to bind. Then rotate in a clockwise direction, looking at the fuze cap as it is assembled in the bomb, until it begins to bind. Then rotate in a clockwise direction two or three turns and insert a cotter pin through the hole of the protecting cap and the nearest hole in the striker flange. If the fuze is fully armed, it should be carefully disassembled and reassembled in the unarmed position. See paragraphs 6 and 7.

5. INSTALLATION OF FUZE IN BOMB:

(a) ***Instructions:***

(1) Remove nose shipping plug from bomb. Inspect fuze seat liner and threads, and clean if necessary. The bombs require one auxiliary booster which is usually assembled. If the auxiliary booster has been stowed separately from the bomb, insert it in the nose cavity of the bomb. If an adapter and two auxiliary boosters for the

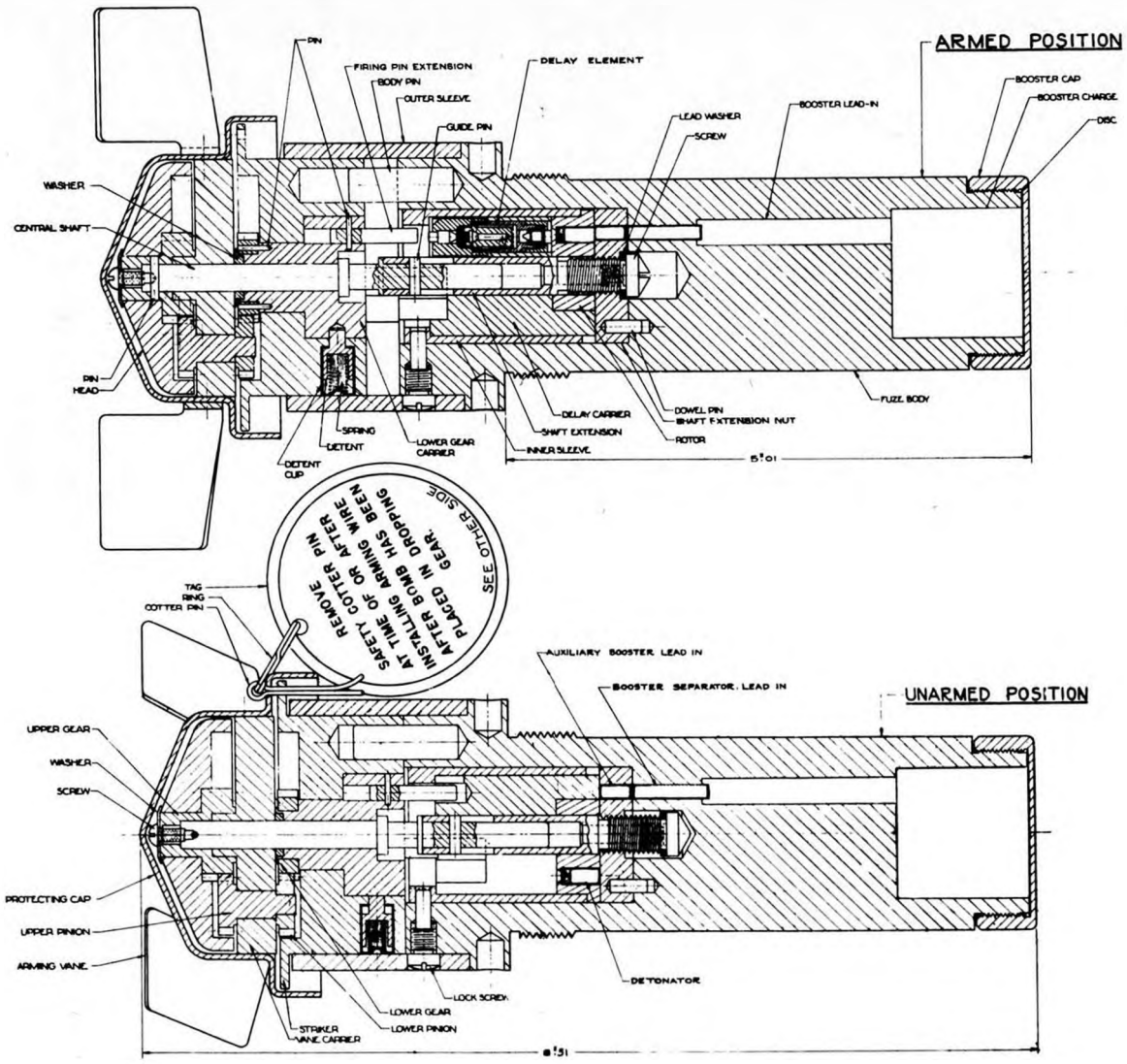


FIG. 1-8 — FUZE, BOMB, NOSE — MARK 221. GENERAL ARRANGEMENT DRAWING.

Mark 219 fuze are in the bomb, remove the adapter and one auxiliary booster.

(2) Remove the fuze from container and inspect for any defect in threads, or bent vanes. If the fuze appears unserviceable return to container, tag to indicate defect and return to a naval ammunition or mine depot as soon as possible.

(3) Thread the fuze in place by hand. Then tighten securely with a spanner wrench.

Note—The arming wire may be assembled either after the bomb has been placed on the bomb rack or immediately before. *THE SAFETY COTTER PIN MUST NOT BE REMOVED UNTIL THE ARMING WIRE IS READY TO BE ASSEMBLED.*

(4) Thread the end of one arming wire through the forward bomb suspension lug.

(5) Remove the safety cotter pin, with attached instruction tag, from the fuze and rotate the protecting cap and vanes slightly in each direction to ensure free rotation. *NEVER ROTATE MORE THAN ONE HALF TURN FROM ITS ORIGINAL POSITION.*

(6) Thread the end of the arming wire through the topmost hole in the striker flange and the hole in the protecting cap.

(7) Place two Fahnestock clips over the end of the arming wire, to prevent it from slipping out of its position.

(8) Secure the arming wire plate to the bomb rack, and be sure that the plate is secured to the rack in exact accordance with the instructions for the bomb rack in use. Neglect, herein, may result in dropping the bomb "safe" when an "armed" drop is desired or vice versa.

(9) Pull the arming wire taut in the fuze maintaining, however, freedom of the arming wire plate in the bomb rack. Push two Fahnestock clips snugly against the fuze. Cut off the excess end of the arming wire three to four inches beyond the protecting cap and clips.

(10) Inspect and ensure that the end of the arming wire is smooth and free of burrs and kinks.

(b) ***Points to check:***

(1) Before installing fuze—Inspect the fuze seat liner and threads for cleanliness. Inspect the fuze threads and the vanes for freedom of rotation.

(2) After installing—Ensure that the arming wire and arming wire plate are properly assembled, that the safety cotter pin has been removed and that the end of the arming wire is free of burrs.

6. DISASSEMBLY:

Place the fuze in a vertical position, booster end down. Remove the three lock screws from the outer sleeve and withdraw the detonator and striker assembly. Maintain the assembly in a vertical position and disossemble the parts in the following order:

(a) Screws securing the vanes, and the protecting cap.

(b) Screw and lock washer from the shaft and the head.

(c) Shear pin from the upper gear and shaft, and the upper external gear.

(d) Vane carrier assembly.

(e) Striker assembly.

(f) Inner sleeve.

(g) Delay carrier assembly, including the locking pin. Remove delay element, and store in accordance with instructions in the Bureau of Ordnance Manual.

(h) Detonator rotor: Segregate and stow in accordance with instructions in the Bureau of Ordnance Manual. *THIS IS A FULMINATE OF MERCURY DETONATOR.*

(i) Remove the stop screw, lead washer and the shaft extension nut from the shaft extension. This nut houses the auxiliary booster lead-in of tetryl.

(j) The free lick pin, in the floor of the fuze body, falls from its opening closest to the deep recess in the center of the fuze body floor.

NOTE: *DO NOT REMOVE THE BOOSTER CAP FROM THE FUZE BODY. IT IS STAKED TO THE BODY.*

7. ASSEMBLY:

The fuze parts should be assembled in the following order:

(a) Place the free lock pin, tapered end up, in the opening on the floor of the fuze body closest to the deep recess. (For convenience the shaft extension nut on the shaft extension can be used to accomplish this).

(b) Screw the shaft extension nut, fixed dowel down, on the shaft extension, until it is seated gently against the shoulder on the shaft extension. Place the lead washer and the stop screw on the shaft extension. Tighten securely.

(c) Place the detonator rotor, flanged surface down, on the shaft with the index marks on the nut and rotor in alignment.

FIG. 1-9 — PHOTOGRAPH OF FUZE MARK 223

(d) Position the delay carrier with locking pin, tapered end down, on the shaft, and turn it clockwise until it is in contact with the detonator rotor.

(e) Place the inner sleeve over the delay carrier, with the projecting lug set in the groove of the shaft extension nut.

(f) Place the striker assembly on the shaft, so that the lug on the lower gear carrier fits in the inner sleeve opening. Rotate the shaft approximately three-quarters of a turn, to prevent binding of the vane carrier after assembly. Care should be exercised in assembling the striker, so as to avoid striking the firing pin.

(g) Place the vane carrier on the shaft. Then set the upper external gear on the shaft, fitting it to the upper pinion, and at the same time fitting it so that the shear pin openings of the shaft and gear are aligned. Set shear pin in place.

(h) Place the outer sleeve on the fuze body. Set the detent pin in the side of the striker, and place the assembly in the fuze body with one hand, depressing the detent pin with the other so as to admit the assembly. Gently rotate the outer sleeve until the assembly falls into place so that the flange of the protecting cap is even with, or slightly above, the horizontal index line on the outer sleeve.

(i) Secure the outer sleeve and fuze body with the three lock screws. Place the head on the shaft, and assemble the protecting cap and vanes on the vane carrier with the screws provided.

(j) Rotate the protecting cap, counter-clockwise (facing the vane end of the fuze), until it begins to bind. Then rotate in a clockwise direction, two or three turns. Insert the cotter pin through the hole in the protecting cap and the nearest hole in the striker flange. Attach the Instruction Tag.

8. SERVICING:

(a) ***Use of lubricants***—Upon disassembly, the parts should be cleaned and well dried with a clean rag. *NO HEAVY OIL MAY BE USED.* Only a light coat of sperm oil or light mineral oil should be applied. All parts must be wiped dry of oil before assembly. *NO OIL SHOULD BE PERMITTED TO COME IN CONTACT WITH DETONATOR OR ANY EXPLOSIVE COMPONENT.*

(b) ***Fuzes exposed to weather***—Occasionally the fuze becomes inoperable by reason of corrosion. It should then be disassembled and cleaned as described above. Only personnel, thoroughly familiar with the construction and operation of the fuze, should be permitted to disassemble, clean and assemble the fuze.

(c) ***When bomb is not dropped***—If the bomb is not dropped, remove the arming wire and replace the safety cotter pin immediately. The vane carrier should not be rotated more than one-half turn in either direction. Remove the fuze from the bomb with a spanner wrench and wipe fuze dry. If the exposure has been such that direct contact with water, dirt or any foreign matter is likely to corrode or foul the parts, proceed as in subdivisions b, above.

(d) ***When the fuze is accidentally dropped***—If the fuze is accidentally dropped more than five feet, it will be considered unserviceable. If the safety cotter pin is still in place, the fuze should be turned in to a naval ammunition or mine depot. If the safety cotter pin is not in place, handle the fuze as though it were armed, and avoid striking the protecting cap or arming vane, as it may actuate the fuze. Carefully remove the lock screws in the outer sleeve and withdraw the detonator and striker assembly from the fuze body, by grasping the protecting cap flange and pulling it forward along the axis of the fuze. Examine the detonator and striker assembly and, if the collar of the central shaft is damaged, drop the detonator and striker assembly in deep water. Tag the fuze body and turn it in to a depot. If no damage exists at the collar of the central shaft, carefully reassemble the fuze in the unarmed position, lock with a cotter pin, tag and return to a depot.

9. PACKING AND MARKING:

(a) ***Packing*** — One completely loaded nose fuze and one completely loaded tail fuze are packed in a single tubular metal container of airtight construction. Two Fahnestock Clips are packed for each fuze. The fuzes are separated by a disc and are supported by rings and a tube. The empty container weighs about 7.25 lbs. The container with contents weighs approximately 26 lbs. It is 27″ in length and 5.″56 in diameter. The fuzes are placed alternately in each container.

Two containers are packed in a sheet metal crate, constructed with top and bottom supports to separate the containers from each other. The crate is 27.″ 125 x 12.″313 x 6.″25. It weighs 14 lbs. empty and approximately 65 lbs. packed.

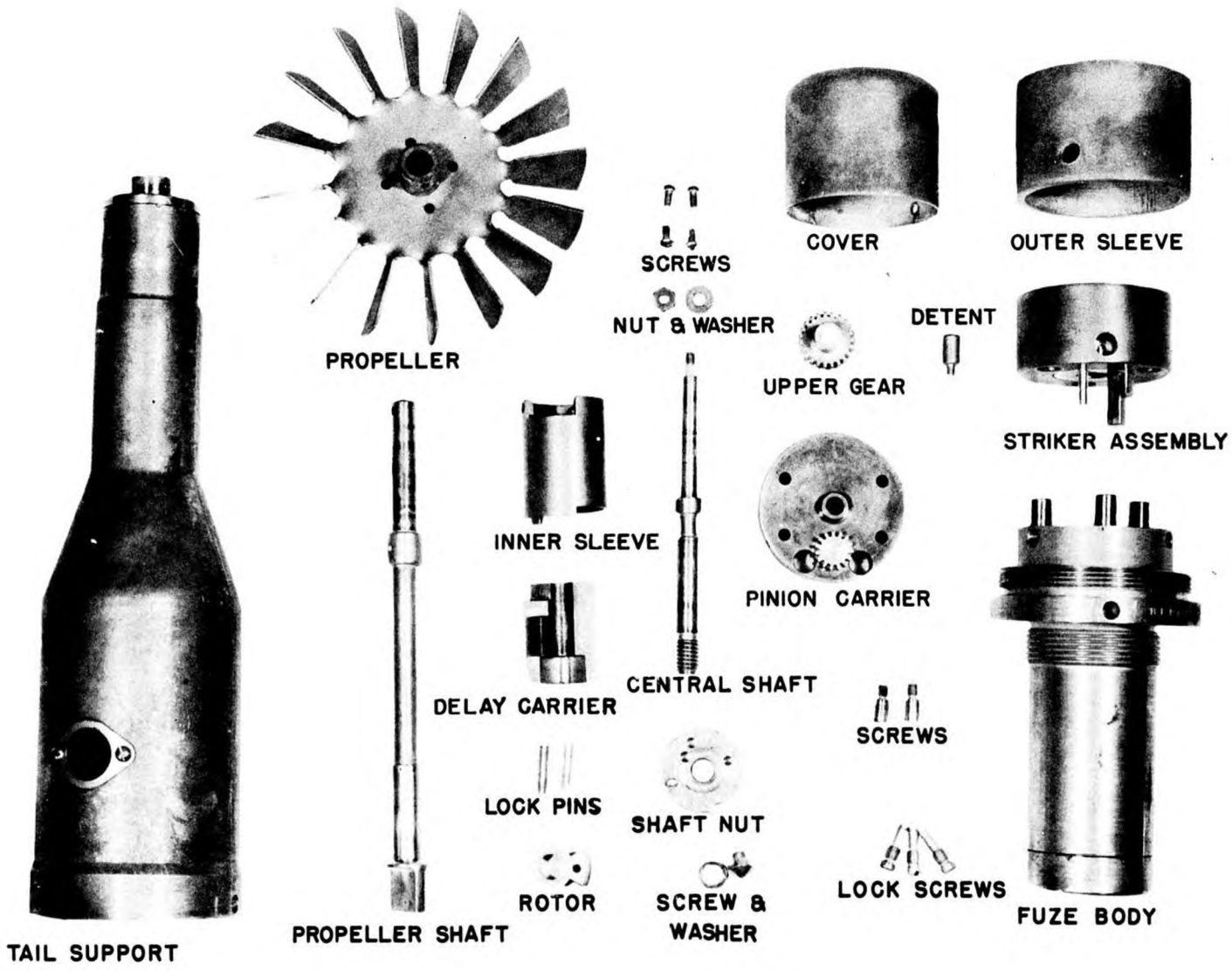


FIG. 1-10 — BOMB FUZE MARK 223: DISASSEMBLED PARTS

Marking—The container is marked:
One Bomb Fuze Mark 221 Mod—
Lot____ _____Year of manufacture
_____Name of manufacturer
_____Inspector's initials
and
One Bomb Fuze Mark 223 Mod—
Lot____ _____Year of manufacture
_____Name of manufacturer
_____Inspector's initials
_____Weight empty
_____Weight with contents

The crate is marked:
Aircraft Bomb Fuzes
Mark 221 Mod—and Mark 223 Mod—
Lot Number____ _____Year of manufacture
_____Name of manufacturer
_____Contract number
_____Inspector's initials
Weight of Crate
Weight of Crate and Contents

SECTION 2

1. DESCRIPTION:

(a) ***General***—The bomb fuzes Mark 223 Mods 1, 3 and 4; except Lots 21, 22 and 23 of Mark 223 Mod 1 are similar in design. The variation in mods indicate the manufacturer, with resulting differences in tolerances and methods of manufacture. Mark 223 Mod 1 is produced by the Naval Gun Factory, Mark 223 Mod 3 by Nash Kelvinator and Mark 223 Mod 4 by Reo Motors. It was previously designed Mark 23.
Note: (Lots 21, 22 and 23 of Mark 223 Mod 1 are modified for anti-submarine use and are marked "A.S.") They will be treated here as one.

It is a tail fuze of the arming vane type, with mechanical arming delay. Unarmed, it is safe for use in dive bombing, take-offs or landings anywhere, including the decks of carriers. It is designed to detonate the bomb with an 0.01 second delay after impact. It requires a striking velocity of 400 feet per second on water impact. Approximately 850-1100 feet of air travel is necessary to arm the fuze. The weight of the fuze is 10.5 lbs. The general arrangement is shown on the Bureau of Ordnance drawing number 202619.

(b) ***Bombs in which used***—This fuze is used in the following bombs:

500 lb. general purpose Mark 12 and Mods
1000 lb. general purpose Mark 13 and Mods
1000 lb. general purpose Mark 36

It may also be used in the following bombs, though such use is not recommended unless an instantaneous fuze is not available. The 0.01 second delay, for which the fuze is designed, may allow the light case to be so damaged before detonation, that a low order detonation may result.

500 lb. (light case) Mark 9
1000 lb. (light case) Mark 9

(c) ***Mechanical delay arming*** — Delay in arming Is obtained in the same manner as that in the Mark 221 Mods 1, 3 and 4 bomb nose fuze described in Section 1, paragraph 1c.

(d) ***Functioning mechanism*** — The functioning mechanism is similar in design to that of the Mark 221 Mods 1, 3 and 4 bomb nose fuze, described in Section 1, paragraph 1d, with the following differences noted:

(1) The shaft is one piece on which a collar is assembled, secured by a shear pin.

(2) The head is omitted.

(3) The protecting cap is replaced with an elongated cover which is secured to the vane carrier with four screws. The cover is slotted to receive the flattened end of the propeller shaft extension.

(4) A tail assembly consisting of the tail support, propeller and propeller shaft are provided. The support is a bottleshaped aluminum casting which screws on the fuze body and is secured by means of two lock screws: A celluloid window in the side

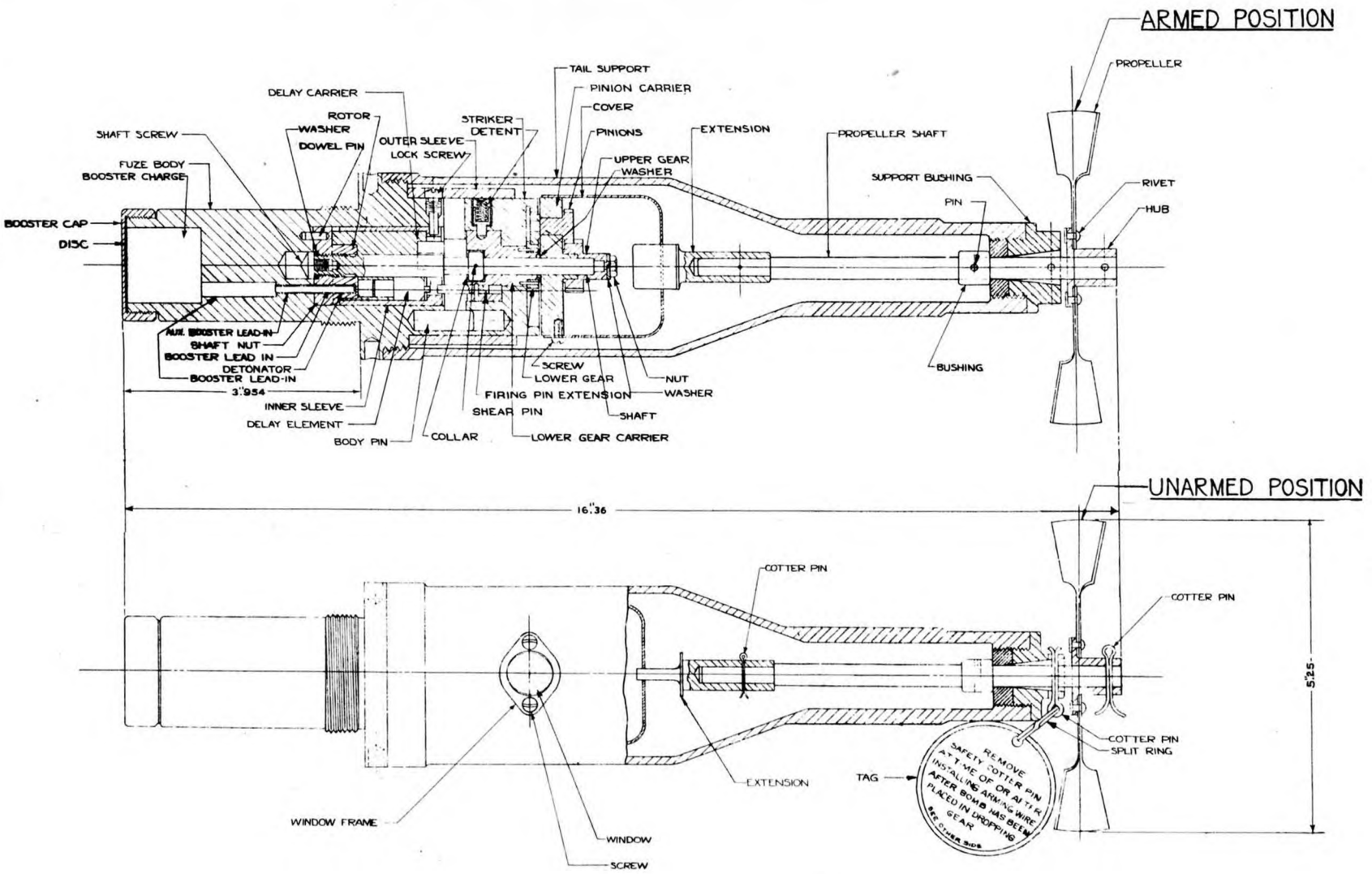


FIG. 1-11 — FUZE, BOMB, TAIL — MARK 223. GENERAL ARRANGEMENT DRAWING.

of the tail support provides means of visually determining whether the fuze is armed or unarmed.

The propeller shaft is flattened at one end, to fit the slot in the cover. The other end extends through a bearing in the tail support. A bushing, pinned to the shaft, limits its outward movement. The propeller is secured to the outer end of the propeller shaft, flanged side of hub down, by means of a cotter pin. Another cotter pin, inserted through the shaft and the bearing, prevents rotation of the propeller.

(e) ***Explosive components*** — The explosive components of this fuze are identical with those in the Mark 221 Mods 1, 3 and 4 bomb nose fuze. Refer to Section 1, paragraph 1e.

2. FUNCTIONING:

(a) ***Released for arming***—Refer to Section 1, paragraph 2a.

(b) ***Upon impact***—When impact occurs, the cover, vane carrier and striker, actuated by inertia move forward and shear the collar shear pin on the shaft. This frees the striker assembly and allows the firing pin extension to strike the firing pin in the delay element, setting of the detonation train described in Section 1, paragraph 2b.

(c) ***Released safe***—Refer to Section 1, paragraph 2c.

3. SAFETY FEATURES:

(a) ***Detonator safety*** — Refer to Section 1, paragraph 3a.

(b) ***Installed in bomb***—Refer to Section 1, paragraph 3b.

(c) ***During shipping and stowage*** — Additional safety is assured during shipping and stowage by a cotter pin locking the propeller shaft to the bearing of the tail support.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—If the fuze is accidentally dropped less than 5 feet, or the arming vane is allowed to rotate, the fuze should be examined to determine whether or not it is armed. The window is provided for this purpose. If the upper surface of the striker has separated from the outer sleeve, five-sixteenths of an inch, the fuze is armed. If the separation is less than five-sixteenths of an inch, however, the fuze is not necessarily unarmed. Any separation greater than three-sixteenths of an inch, should be construed as questionable arming and it should be treated as an armed fuze.

(b) ***Handling***—Refer to chapter 5, paragraph 4, section b.

5. INSTALLATION OF FUZE IN BOMB:

(a) ***Instructions***—The fuze is installed as described in Section 1, paragraph 5a, except as follows:

(1) The arming wire is threaded through the rear bomb suspension lug.

(2) The arming wire is threaded through the arming wire bracket which is attached to the bomb tail and through the arming wire tube.

(3) The Fahnestock clips are pushed snugly against the bracket.

For convenience in assembling this fuze, the propeller may be removed until the fuze is securely assembled to the bomb.

(b) ***Points to check***—Refer to Section 1, paragraph 5b.

6. DISASSEMBLY:

(a) Place the fuze in a vertical position, booster end down, withdraw the cotter pin from the propeller hub and remove the propeller.

(b) Remove the safety cotter pin.

(c) Remove the two lock screws in the tail support and unscrew the support from the fuze body. Remove the propeller shaft and the cover. The bearing on the tail support should not be removed. The other parts of the fuze are disassembled as described in detail for the Mark 221 mods 1, 3, and 4 in Section 1 paragraph 6. An exception is noted in that the delay carrier and detonator rotor are removed from the lower end of the shaft. The collar on the shaft prevents disassembly from above.

7. ASSEMBLY:

Assemble the detonator and striker assembly in the manner described in Section 1, paragraph 6, for the Mark 221 and Mod 1, 3 and 4 bomb nose fuze. Omit the protecting cap, and in its stead, secure the cover to the vane carrier. Insert the propeller shaft in the cover slot.

Place the tail support over the propeller shaft so that the shaft comes through the bearing. Screw the support on the fuze body to a point where the

two lock screws may be inserted to engage the fuze body and tail support. Rotate the propeller shaft counter-clockwise until the gearing begins to bind. Then reverse three or four turns and lock in place with a cotter pin through the hub of the bearing and the propeller shaft.

Place the propeller over the end of its shaft, flanged end of hub nearest the support, and secure it in place with a cotter pin through the hub and shaft.

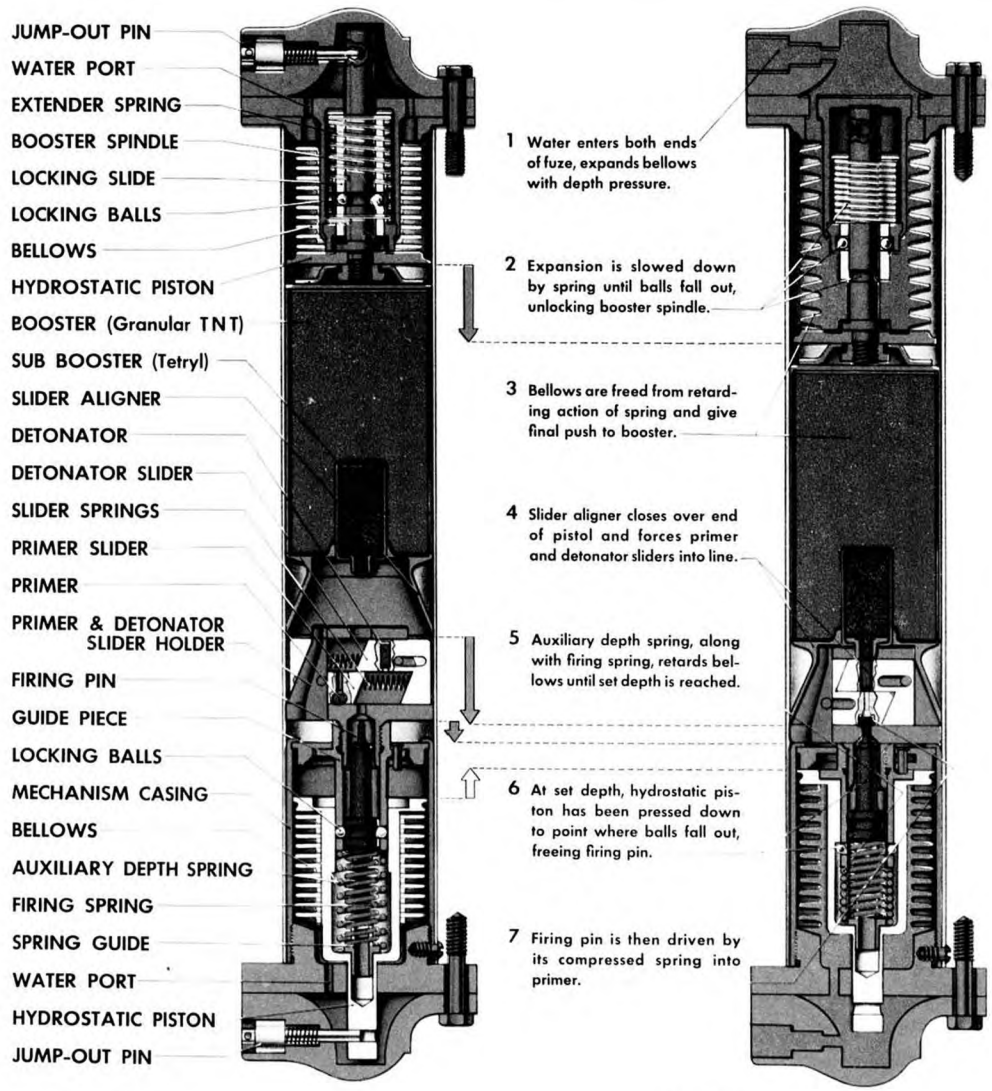
Note: In assembling the striker assembly, the edge of the striker falls even with the top of the outer sleeve when properly assembled.

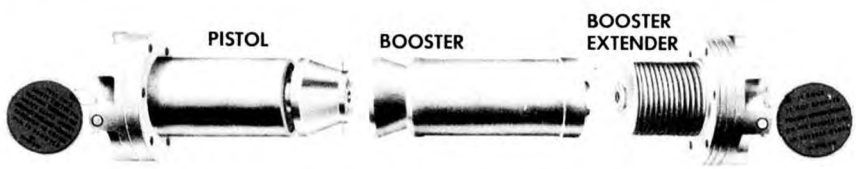
8. SERVICING:

Service the fuze in the same manner as described in Section 1, paragraph 7, for the Mark 221 Mods 1, 3 and 4 nose fuze.

9. PACKING AND MARKING:

The fuze is packed and marked in the manner described in Section 1, paragraph 8.





BOMB FUZE Mk 224

HYDROSTATIC (ATHWARTSHIP)

R E S T R I C T E D

RESTRICTED

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

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Acting Chief of Bureau

OP 988, CHANGE 4

26 August 1944

BOMB FUZES

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SECTION 3

1. The information within this CHANGE is for the guidance of all personnel concerned with the tactical employment and flight preparation of Bomb Nose Fuze Mark 239.

2. **General.**—Bomb Nose Fuze Mark 239 is an aircraft bomb fuze designed to be used in all AN-Standard General Purpose Bombs. It is essentially a Bomb Nose Fuze Mark 221 which has had the body diameter reduced in size to fit the nose fuze seat liner of AN-Standard Bombs. The internal design has not been changed and is identical with the Mark 221. It has been designed to utilize present stocks of the Fuzes Mark 221 for which no Bombs Mark 12 and Mark 13 are available. The Fuze Mark 239 arms only by air travel in approximately 850–1,100,′ which is equivalent to a vertical fall of about 200′ when the bomb is released in horizontal flight at 180 knots. The Fuze Mark 239 also employs the 0.01 second delay element used in the Mark 221.

3. Bomb Fuze Mark 239 is prepared for use as follows:

(a) Remove fuze from sealed shipping container and examine for any obvious physical defects such as damage to threads or dented fuze parts.

(b) Remove safety cotter pin and revolve arming vane carrier one complete revolution in each direction in order to determine that the vane carrier moves freely. Replace safety cotter pin.

(c) After examining fuze seat liner to insure that it is free and clear, screw fuze into the bomb hand tight. The use of wrenches or other tools is not dangerous, but is not considered desirable because of possible difficulty in removing the fuze if the bomb is not expended.

(d) Insert arming wire through the forward lug on the bomb and pass it through the hole in the vane carrier support and the striker flange. Cut arming wire so that approximately 3″ extend beyond the fuze. Place two (2) Fahnestock clips over the arming wire and push them up snugly against the vane cup. Remove safety cotter pin.

Disassembly: If the bomb is not dropped, the fuze may be removed and returned to stowage, following the above steps in reverse order. Any fuze so removed must be sealed tightly in its original container to prevent deterioration from moisture.

4. In all other features, Bomb Fuze Mark 239 is identical with Bomb Fuze Mark 221.

5. **Tactical Employment.**—The Bomb Fuze Mark 239 provides a 0.01 second delay nose fuze for use in AN–Standard General Purpose Bombs. It is suitable for use wherever a 0.01 second delay tail fuze is recommended in reference (b) to insure bomb detonation with that delay.

6. **Availability.**—Bomb Fuze Mark 239 is now being manufactured but none are available at the present time. A pilot lot is being produced, and dependent upon the results of service use, further production will be undertaken. Requests for this item should include the following information:

(a) Estimated quantity required for immediate important operational purposes.

(b) Estimated quantity anticipated for expenditure or installation per month.

(c) Stock level considered desirable to cover contingencies.

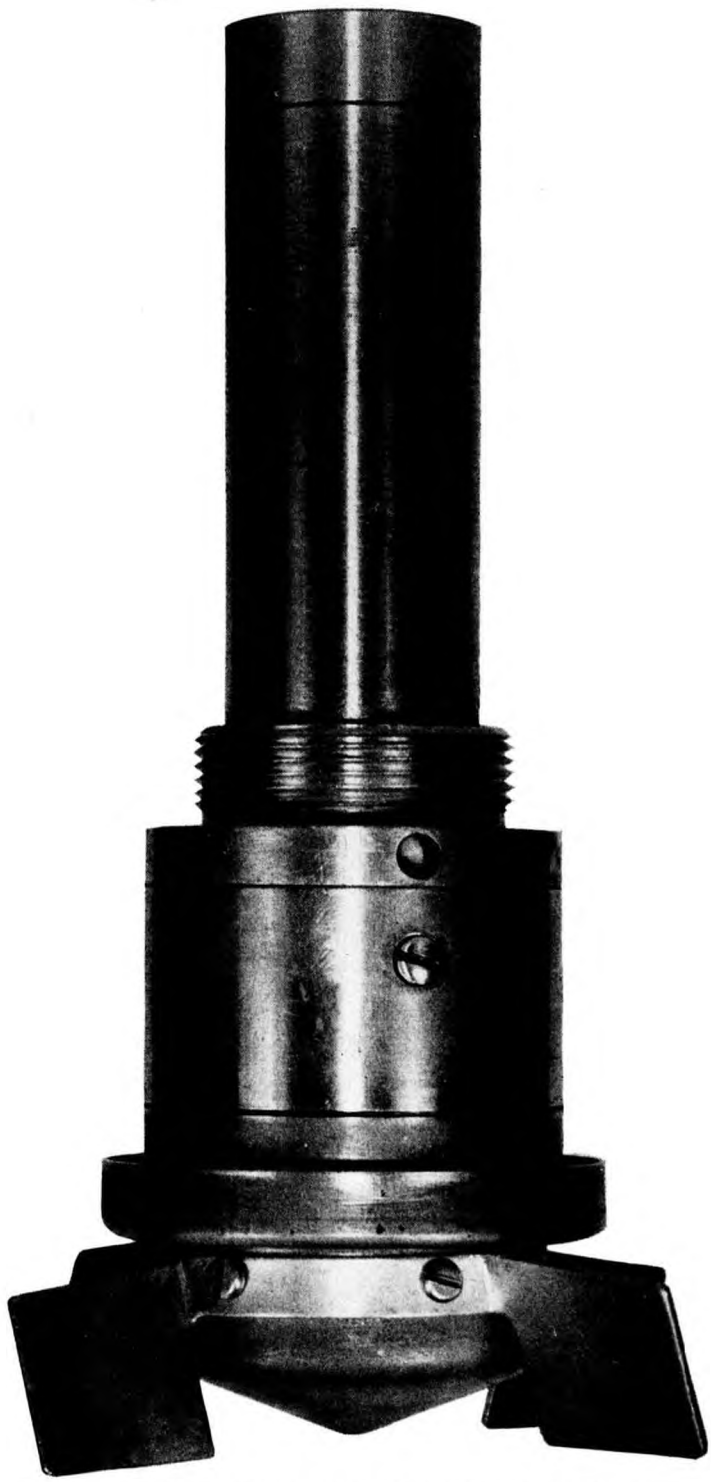


Figure 1-11a.—BOMB NOSE FUZE MARK 239

U. S. GOVERNMENT PRINTING OFFICE: 1944

PART I—Chapter 3 (RESTRICTED)

SECTION 1

Fuze, Bomb, Hydrostatic—Mark 224 Mods 1 And 2 Also Designated AN-Mark 224

CONTENTS

SECTION 2

Fuze, Bomb, Hydrostatic—Mark 234
Also Designated AN-Mark 234

CONTENTS

SECTION 1

Fuze, Bomb, Hydrostatic—Mark 224 Mods. 1 and 2

1. DESCRIPTION:

(a) ***General***—This fuze is designed for use in aircraft depth bombs and functions in response to hydrostatic pressure at a predetermined depth. No air travel is necessary for arming. The fuze is issued set for functioning at the depth which was, at the time of assembly, considered the best setting for general purpose. This fuze is issued in three sub-assemblies: pistol, booster and booster extender. The pistol contains the firing mechanism and depth setting mechanism. The pistol is marked with the depth for which it is set. This setting may be changed, as described in paragraph 5, for 25, 50, 75, 100, or 125 feet. The booster contains the sub-booster and booster charge. The booster extender acts to arm the fuze by aligning the explosive train.

This fuze is installed in an athwartship fuze cavity through the bomb. When assembled in the bomb, the fuze protrudes slightly on both sides of the bomb and an arming wire is required for each end. Modification 1 and 2 are alike in operation. Mod 1 is manufactured by York Safe and Lock Company and has bronze baffles. Plastic baffles will be used when the present supply of bronze baffles is exhausted. Mod 2 is manufactured by Stewart-Warner Company and all these fuzes have plastic baffles. There are other minor variations which are caused by differences in manufacturing practices.

General arrangement and part names of the pistol and booster extender are shown in figures 1-16 and 1-17. The Bureau of Ordnance General Arrangement Drawing number is 242658. Figure 3-1 is a photograph of a complete fuze, Mark 224 Mod 1.

(b) ***Bombs in which used***—The AN-Mark 224 fuzes are used in the following bombs:

Mark 17 Mod 1—325 lb. Aircraft Depth Bomb—Round Nose—TNT loaded

AN-Mk 17 Mod 2—325 lb. Aircraft Depth Bomb—Round Nose—TNT loaded

AN-Mk 41—325 lb. Aircraft Depth Bomb—Flat Nose—TNT loaded

AN-Mk 44—350 lb. Aircraft Depth Bomb—Round Nose—Torpex loaded

AN-Mk 47—350 lb. Aircraft Depth Bomb—Flat Nose—Torpex loaded

Mark 29—650 lb. Aircraft Depth Bomb—Round Nose—TNT loaded

Mark 37—650 lb. Aircraft Depth Bomb—Round Nose—TNT loaded

Mark 38—650 lb. Aircraft Depth Bomb—Flat Nose—TNT loaded

The round nose bombs are issued from loading depots with flat nose attachments installed.

When the fuze is used in the Mark 29, Mark 37 and Mark 38, 650-lb. bombs, a spacer which is furnished with the bomb (in the transverse tube attached to one of the cover plates) must be inserted between the booster extender and the booster can to compensate for the increased diameter of the bomb.

(c) ***Arming***—Both arming wires must be withdrawn to permit the fuze to arm and to function. When the arming wires are withdrawn, two jump-out pins are expelled by spring action. Water pressure is then free to act on the hydrostatic bellows (sylphon tubes), in the booster extender and pistol, which align the explosive train and operate the firing pin respectively at the predetermined depth setting.

(d) ***Explosive components*** — The explosive components consist of a primer, detonator, sub-booster and booster. The sub-booster consists of 15 grams (.528 ozs.) of tetryl in a small copper container imbedded in the booster. The booster consists of about 252 grams (8.881 ozs.) of granular TNT. The primer and detonator are located in the sliders in the detonator and primer holder attached to the pistol.

2. FUNCTIONING:

(a) ***Released armed*** — There are two jump-out pins; one in the pistol, and one in the booster extender. These pins are expelled by jump-out pin springs when the arming wires are withdrawn from the fuze. Removal of the jump-out pins allows water pressure to act on two hydrostatic bellows (sylphon tubes) in the pistol and booster extender, causing the following action:

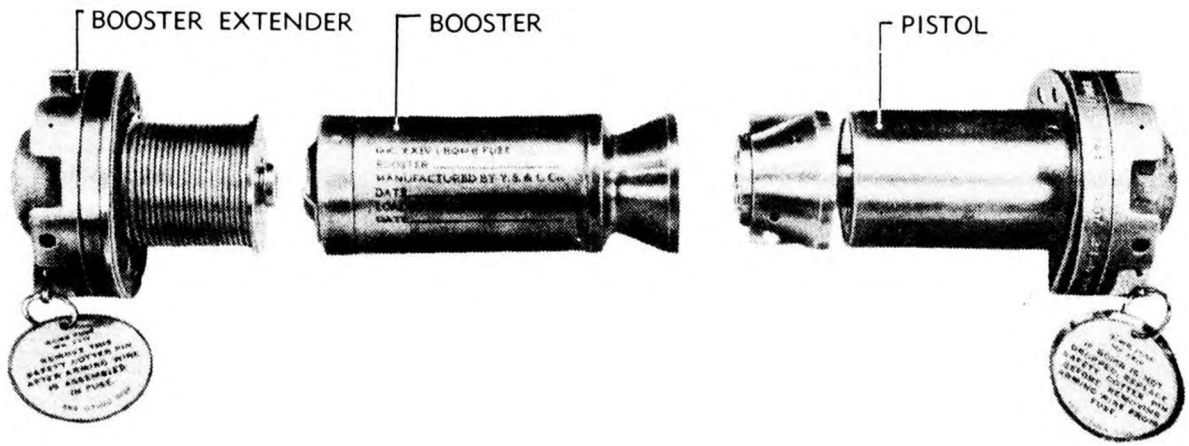


FIG. 1-12 — FUZE, BOMB, HYDROSTATIC, AN-MK. 224

(1) ***Action in booster extender*** — Water pressure in the hydrostatic bellows causes the bellows to extend. This moves the booster can forward and compresses the spring in the booster extender. After moving about eleven-sixteenths of an inch, the three balls which lock the booster spindle to the locking slide drop out of position. The spring then no longer retards the action, and the booster can moves forward with added impetus, completing a total travel of about one (1) inch. As the booster can moves forward, the slider aligner engages the primer and detonator sliders in the detonator and primer holder, moving them inward against their spring tension, thereby aligning the primer and detonator with the firing pin. The sub-booster has also moved forward along with the booster can and is now lined up with the balance of the explosive train.

(2) ***Action in pistol***—The hydrostatic bellows in the pistol is free to operate, having been unlocked when the jump-out pin was expelled. Pressure of the water in the hydrostatic bellows causes it to extend, compressing the firing pin spring behind the firing pin, which is held stationary by locking balls engaging the firing pin and guide-piece. After moving forward about thirteen-sixteenths of an inch, the balls move past a step in the hydrostatic piston and the balls drop out. This frees the firing pin, which is driven home by the compressed firing pin spring. The firing pin strikes the primer and sets off the explosive train, which has been aligned by action of the booster extender mechanism. The booster extender mechanism must operate to line up the explosive train, and must push the primer detonator holder about three-sixteenths of an inch toward the pistol before the pistol can fire. Hence, the spring in the booster extender is weaker than the firing pin spring. The extender thus operates before the time for the pistol to operate. The extender operates at a depth of 15-20 feet. It must operate at a lesser depth than the shallowest setting; otherwise it will delay functioning of the fuze when set for shallow operation. The depth at which explosion occurs is controlled by the strength of the firing pin spring (yellow or black), and auxiliary (red or green) spring, if used. Different combinations of springs will cause action at various depths (see paragraph 5).

(b) ***Air travel***—No air travel is required to arm this fuze. Once the arming wires and safety cotter pins are removed, the jump-out pins are expelled and the fuze is free to arm and operate hydrostatically.

(c) ***Sensitivity***—The fuze, when free to arm (jump-out pins ejected) is sensitive to fluid pressure and will arm at a depth of 15-20 feet of water, and detonate at the depth for which set. When dropped in Mark 17 depth bombs (round nose) from altitudes greater than 4,000 feet, some fuzes will not function until reaching excessively greater depths than that for which set, and some will be duds. The high striking velocities of high altitude drops cause high velocities through the water. High velocity through the water produces cavitation in the water (trapped air around the bomb) and prevents the water pressure from acting on the bellows. Below 3,000 feet, there should be no appreciable difference in performance caused by the altitude of release.

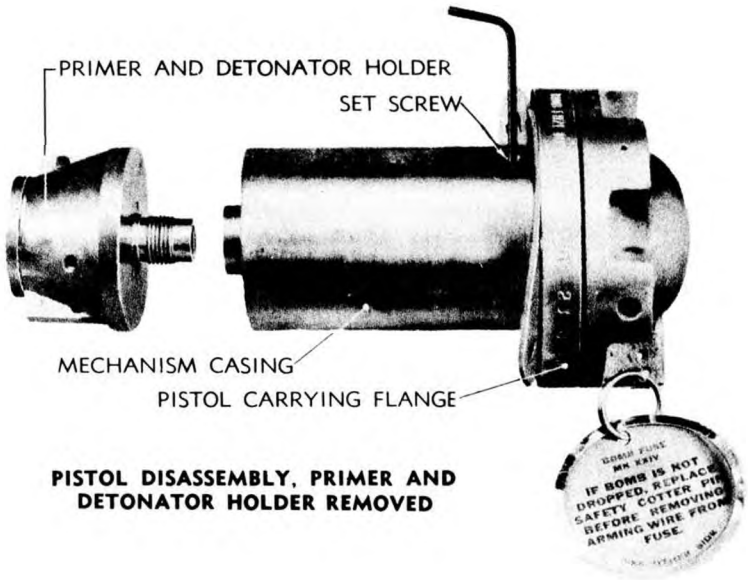
(d) ***Released safe***—If dropped with the arming wires or safety cotter pins in place, the fuze will remain unarmed and will not function, since the hydrostatic piston and the booster spindle are locked to the water baffles by the jump-out pins.

(e) ***Estimation of depth of functioning***—To estimate the depth of functioning of the bomb, observe the time lapse from first appearance of slick to upheavel; also the size and appearance of the upheaval. The time lapse and upheaval will vary with different sizes of bombs dropped, as well as with different depths of detonation. See Bureau of Ordnance Circular Letter V-89A for data.

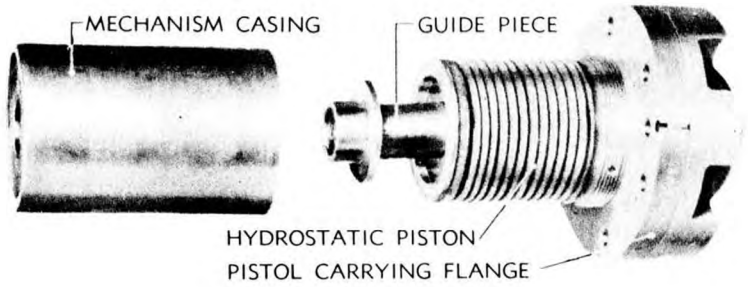
3. SAFETY FEATURES:

(a) ***When installed in a bomb***—When unarmed, the hydrostatic piston and booster spindle are locked by the jump-out pins, which are held in place by the arming wires. The primer, detonator and firing pin are out of alignment, breaking the explosive train, making the fuze detonator safe. Premature action of the detonator while the fuze is unarmed will not set off the explosive train. Even with jump-out pins expelled, the fuze will not operate when dropped on a hard surface from a plane in horizontal flight and 100 m.p.h. air speed from an altitude of 50-75 feet. It will function, however, at the depth for which set, if dropped in water. Bombs accidentally falling off planes taxiing on water will explode at the depth for which the fuze is set if the arming wires are withdrawn.

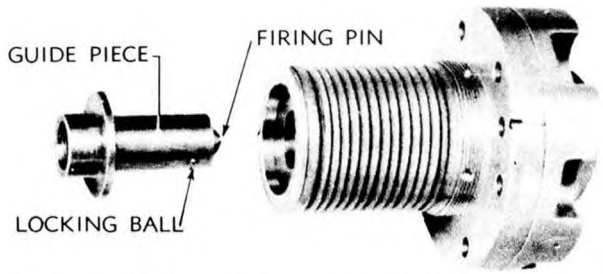
(b) ***During shipping***—During shipping, the jump-out pins are held in place by safety cotter pins and all the safety features of the fuze are in effect. The fuze is also packed in protective con-



PISTOL DISASSEMBLY, PRIMER AND DETONATOR HOLDER REMOVED



MECHANISM CASING REMOVED



GUIDE PIECE AND FIRING PIN ASSEMBLY REMOVED

FIG. 1-13 — FUZE, BOMB, HYDROSTATIC, AN-MK. 224 — DISASSEMBLY OF PISTOL FOR INSERTION OF AUXILIARY DEPTH SPRING

tainers in which the detonator and booster are separated so that accidental firing of the detonator will not set off the booster.

4. ARMED AND PARTIALLY ARMED FUZES:

When the arming wires and safety cotter pins are removed, the jump-out pins are expelled by the jump-out pin springs, and the fuze is then partially armed and will arm completely at pressure equal to that of water at the depth for which set. The fuze may be placed in an unarmed position by replacing the jump-out pins and springs so that the pins engage and lock the pistol hydrostatic piston and booster spindle, then replacing the safety cotter pin. To remove a free-to-arm or partially armed fuze from a bomb, lock the fuze in the unarmed position and proceed by reversing the procedure of installation outlined in paragraph 6.

5. TO CHANGE DEPTH SETTING:

Before installing this fuze in the bomb, the desired depth setting must be made by inserting in the pistol the proper firing pin spring (and auxiliary spring if necessary) which is supplied in the crate in which the fuze is packed. No change need be made if the setting is already that desired. Depth settings of 25, 50, 75, 100 and 125 feet are possible with this fuze. Early lots were assembled with 50 foot springs, but fuzes at present are assembled with 25 ft. springs. The yellow or 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 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

To change the depth setting of this fuze do not remove the water baffle. Proceed as follows: (See Figures 1-13 and 1-14).

(1) Unscrew primer and detonator holder after forcing counter-clockwise to break the staking.

(2) Remove set screw in mechanism casing and unscrew casing from pistol carrying flange.

(3) Remove guide piece, firing pin and the locking balls as a unit from hydrostatic piston bushing, thus affording access to the spring cavity.

(4) Remove springs from spring cavity.

(5) Insert appropriate spring as follows:

(a) For 25 foot setting, place yellow firing spring over the spring guide.

(b) For 50 foot setting, place the black firing spring over the spring guide.

(c) For 75 foot setting, install the black firing spring and place the green auxiliary spring over it.

(d) For 100 foot setting, install the yellow firing spring and place the red auxiliary spring over it.

(e) For 125 foot setting, install the black firing spring and place the red auxiliary spring over it.

(6) Reassemble the pistol equipped with the desired spring combination in accordance with the following procedure:

(a) Place firing pin and locking balls in proper position in guide piece and insert as a unit into the hydrostatic piston, resting the firing pin and guide piece on the firing spring and auxiliary spring (when used) respectively. Be sure that the locking balls engage the circular groove in the firing pin. If properly engaged, the firing pin point will be just below the top surface of the guide piece.

(b) Place the mechanism casing over the guide piece, taking care that the guide pin enters the hole in the guide piece. Screw mechanism casing home on the pistol carrying flange and replace the set screw. Always keep the firing pin pointed away from personnel.

(c) Reassemble primer and detonator holder to guide piece, taking care that end of firing pin is centered. Screw tightly home and stake with a suitable tool.

(d) Mark the pistol water baffle to indicate depth setting. If fuze is repacked, mark the packing can and data card as well.

6. INSTALLATION IN BOMB:

The following procedure is recommended for installing fuzes in bombs:

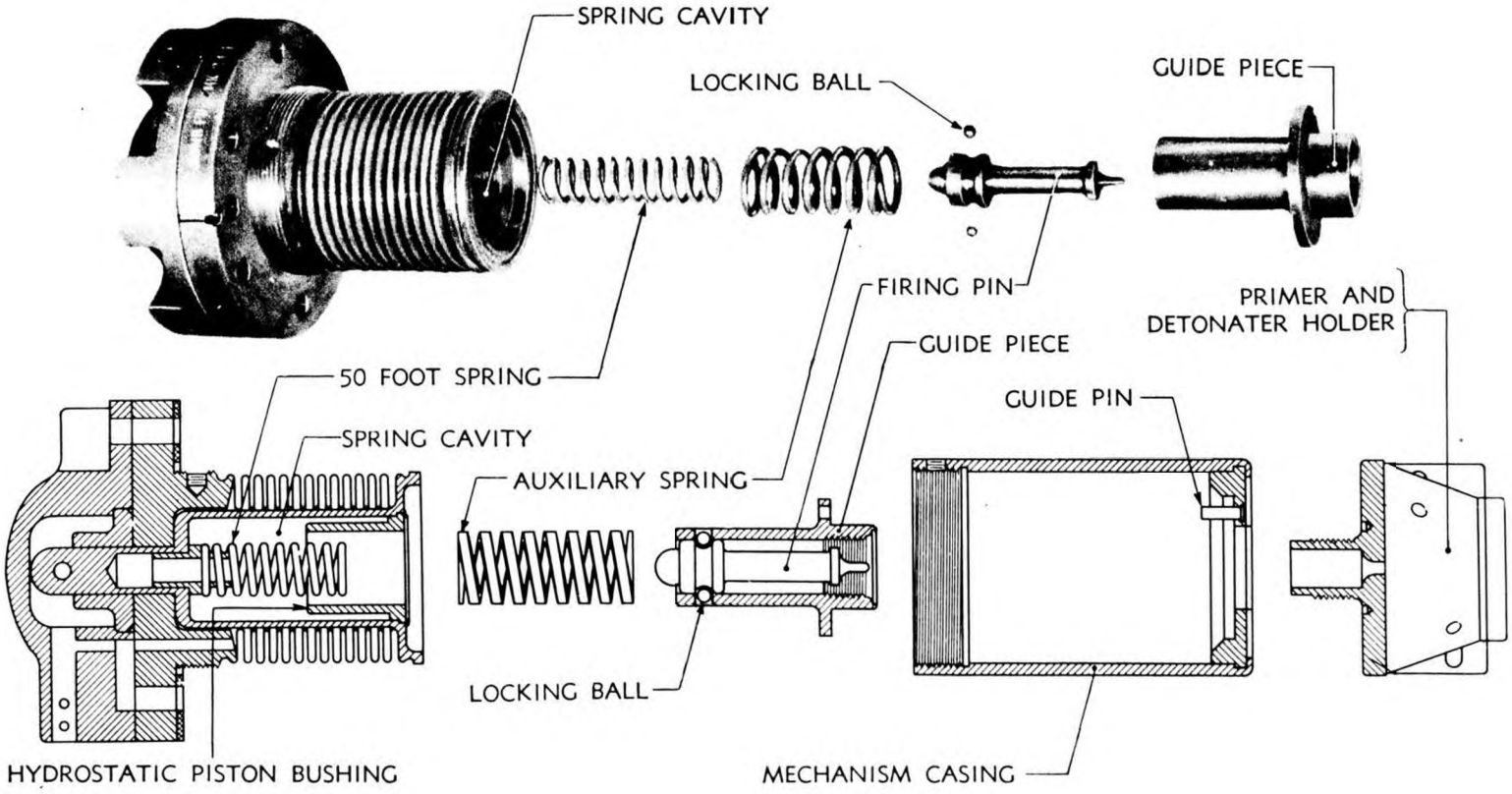


FIG. 1-14 — FUZE, BOMB, HYDROSTATIC, AN-MK. 224: DIAGRAM OF REASSEMBLY OF PISTOL WITH AUXILIARY DEPTH SPRING

(1) Remove the fuze cavity plates from the bombs and thoroughly cleanse the cavity and screw threads.

(2) Remove pistol from container and with it pointed in a safe direction away from personnel, depress the primer and detonator slides to make sure they operate freely.

(3) Apply a *thin* coat of fiber grease (Texaco Marfak No. 3 or equivalent) to both sides of the gasket to insure a watertight seal. Insert the pistol in either end of the fuze cavity with its gasket in place between the pistol flange and head of the tube. Make sure the pistol enters freely and locates itself properly upon the locating dowel pin. When properly installed, the jump-out pin will point toward the tail of the bomb. Insert the holding screws and draw them up evenly following a plan of tightening up on a bolt diagonally across from and not adjacent to the bolt last tightened. Be careful to tighten the screws uniformly, checking several times, in rotation, after the initial tightening. It is extremely important that a watertight seal be obtained between the fuze and head of the tube or a deeper functioning or dud will result.

(4) Remove the booster and booster extender from the container and remove the small wood block with the felt cap from the booster slider aligner. This block is put in to separate the booster and pistol in the packing can. Attach the booster extender to the booster by means of the slip-joint. Insert the assembly, with gasket in place, into the end of the tube opposite the pistol and tighten the holding screws with the same precautions used in securing the pistol. When used in the Mark 29, Mark 37, or Mark 38 bomb, the spacer is inserted between the booster and booster extender and are all joined together as a unit and then inserted into the tube. The spacer compensates for the larger diameter of these bombs.

(5) Attach arming wire plate to the bomb rack and spread the wires.

(6) Hoist bomb into place on the rack.

(7) With the bomb hooked to the rack, feed the arming wires through the fuze as the safety cotter-pins are removed. Do not remove cotter-pin completely until arming wire is started in the hole or the jump-out pin will be expelled by its spring. On the older type fuze, the arming wire can be inserted before the safety cotter-pin is withdrawn. Pull the arming wires taut, *but maintain sufficient freedom for the arming wire plate in the bomb rack.* It is unnecessary to use Fahnestock connectors with this fuze because the jump-out pins produce sufficient friction on the arming wires.

(8) Cut off the surplus length of arming wire so that about six (6) inches extend beyond the jump-out pins. Make sure the ends of the wires are free of burrs and kinks.

7. SERVICING:

(a) ***Exposed to weather*** — Whenever the Mark 224 hydrostatic fuze has been subjected to salt spray and at such other times as may be necessary to guard against corrosion, the fuze should be removed from the bomb and all exposed working parts thoroughly cleansed, dried and oiled. *This does not apply to parts not exposed to weather,* such as sliders, firing pin, etc. To apply oil to the internal parts might lead to contamination and deterioration of the explosive elements. The parts most vulnerable to corrosion are the jump-out pin springs. To accomplish the cleaning and oiling operation, the following procedure is recommended:

(1) After removal of the fuze from the bomb, the booster should be put in a secure place at a safe distance from the location where the cleaning and oiling is to be carried out.

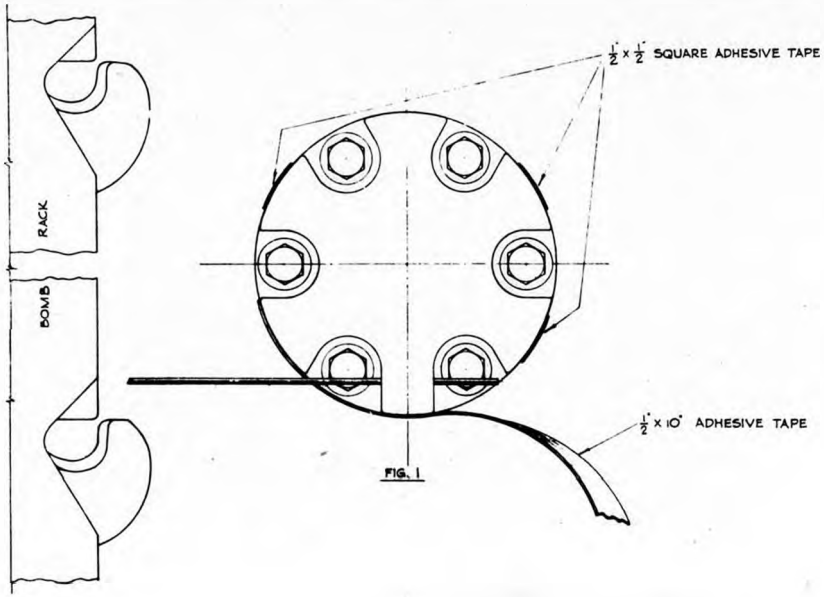
(2) Remove the safety cotter-pins from the jump-out pins.

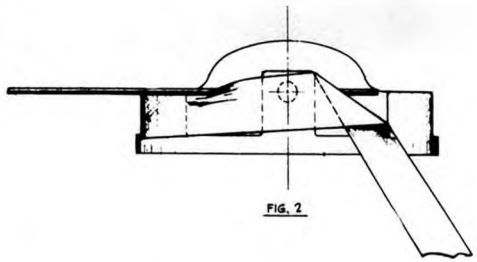
(3) Remove the water baffles and, with an air hose, blow out all water from the baffles and from the inside of the copper sylphons. Wipe all accessible surfaces with a clean cloth.

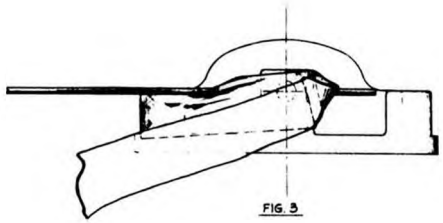
(4) To remove any salt deposits which may have collected on the jump-out pin springs, dip the water baffles in pure water and move the jump-out pin in and out. Dry with an air hose. If corrosion has taken place to such an extent that the jump-out pins do not move freely, this step should be repeated using kerosene or some other suitable solvent instead of water. If the jump-out pins cannot be made to move freely with adequate tension, the fuze should not be used.

(5) Apply a few drops of light oil to the jump-out pin springs.

(6) Apply a few drops of light oil to the central shafts which protrude from the center of the flange of the booster extender and pistol, and allow the oil to run down the post to the inside of the copper diaphragms.







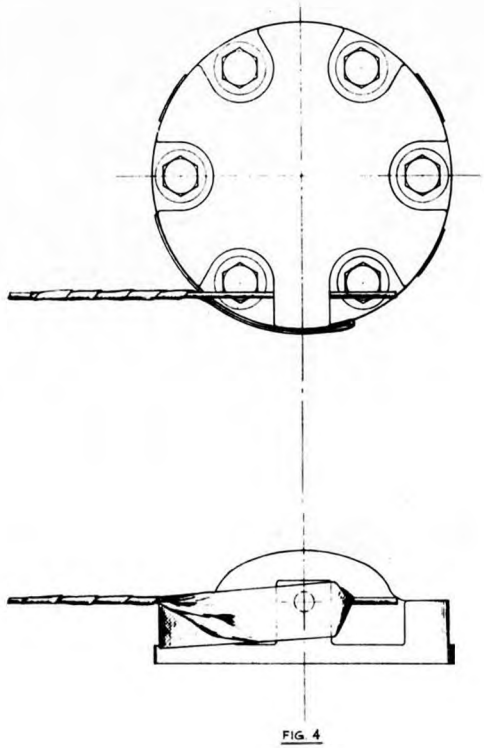


FIG. 1-15 — DIAGRAM OF WEATHERPROOFING OLDER FUZES

(7) Reassemble the fuze. Before each take-off, the tension of the jump-out pin springs should be checked. This can be done without removing the cotter pins or arming wires by pushing on the jump-out pins. If the spring is in a satisfactory working condition, the pin can be moved in a small distance, and when released will spring back to its original position.

(b) ***Weather-proofing for older fuzes***—Recommended only for externally suspended bombs in freezing weather. After the bomb containing the fuze is attached to the plane, the arming wires inserted and the cotter pins removed, carefully wipe off all exposed surfaces of the fuze, especially those surrounding the holes in the water baffle. Cut three squares of fresh adhesive tape (one-half inch by one-half inch) and carefully apply two of these to the small holes (0".086) on the leading edge of the baffle (baffles of recent manufacture may not have these holes), apply the third square to the seventeen-sixty-fourths inch hole in the lower edge of the baffle. Cut a piece of fresh adhesive tape (ten inches by one-half inch). Cover the remaining seventeen-sixty-fourths inch water-entrance hole (in upper edge of baffle) with one end of the tape and holding it in place, continue the tape to cover the jump-out pin hole. Smooth out tape with thumb and be sure it is sticking to the baffle. With the tape held over the jump-out pin hole with thumb, twist the remaining length of tape just once and fold directly back on top of the first layer as far as the arming wire, then securely wrap the remaining tape around the arming wire above the fuze. Apply a small piece of tape over each of the safety cotter pin holes, and a little grease around the arming wire, taking care not to get grease on the adhesive tape. Figure 3-4 is a diagram showing this method of weather-proofing. The later fuzes have weather-proofing features built into them and should not have to be weather proofed in this manner.

(c) ***Reports of malfunctioning***—Failure of this fuze to function may be from any of the following causes:

(1) Bomb dropped with arming wire in place.

(2) Bomb dropped in shallow water.

(3) Icing.

(4) Transverse tube in bomb not clean.

(5) Fuze not securely bolted to bomb, permitting leakage.

(6) Failure to remove safety cotter pin.

(7) Excessive corrosion, especially of jump-out pins and springs and primer detonator holders.

Reports of malfunctionings should contain the Mark and Mod, fuze lot number, weather exposed to, length of time in service and all other pertinent information and history of the fuze.

8. PACKING AND MARKING:

The fuze including pistol, booster extender, booster, gaskets, and securing screws are hermetically sealed in a metal packing can. The pistol, containing the detonator, is separated from the booster by a felt capped block of wood placed in the booster slider aligner.

Stamped on the flange of the pistol and booster extender and stenciled on the side of the booster is the following information:

Mark and Mod number of fuze.

Lot number.

Manufacturer's initials.

Year of loading.

Inspector's initials.

The pistol is also marked with the depth for which set. The metal container is marked as follows:

Number contained—Name and Mark and Mod numbers.

Lot number—Year.

Name of Manufacturer.

Requisition, contract or order number.

Inspector's initials.

Four metal containers, each containing one complete fuze with bolts and gaskets, are secured in a metal packing crate so as to prevent any movement in the crate during transit. Additional springs for the four fuzes are packed in the crate center. The packing crates are marked thus:

(number) Aircraft Bomb Fuze Mark 224 Mod

Hydrostatic Type—(Stenciled in red)

Lot No. , Year of manufacture

(Name of manufacturer)

Requisition, contract or order No.

Inspector's initials

Weight of packing crate and contents

The weight of the crate, empty, is approximately 6.5 pounds.

The weight of the crate with fuzes is approximately 56.5 pounds.

Approximate size of the packing crate is 17.2" x 7.8" x 7.8".

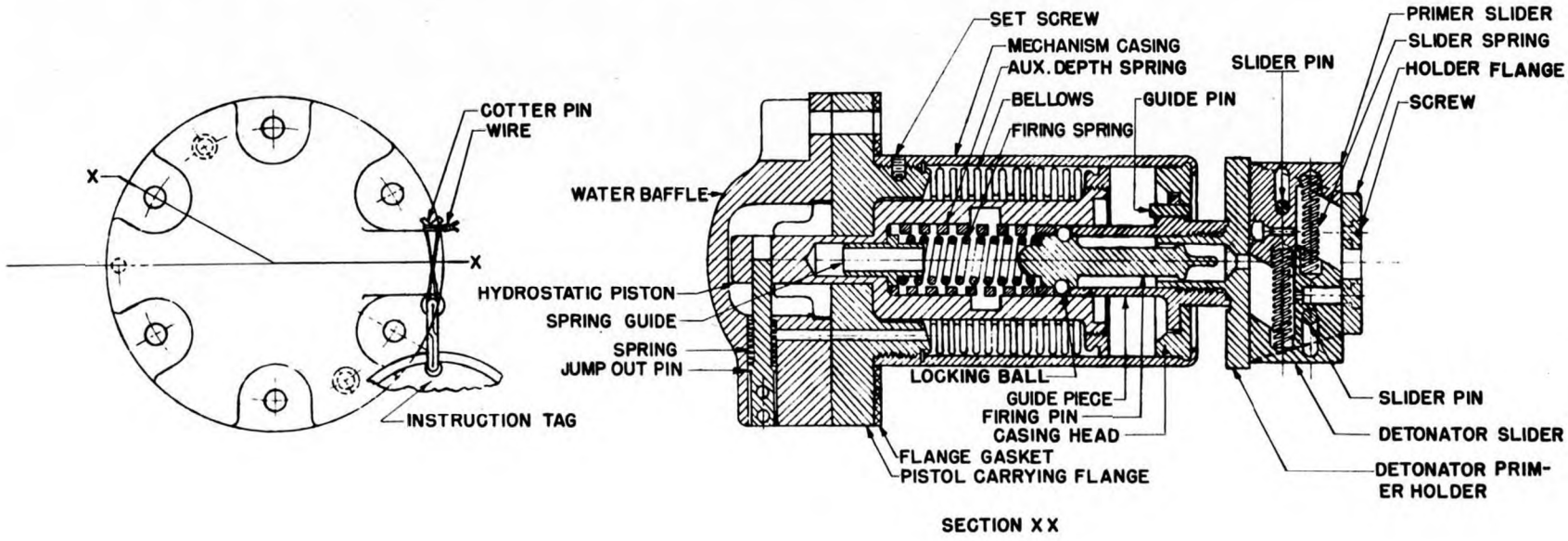
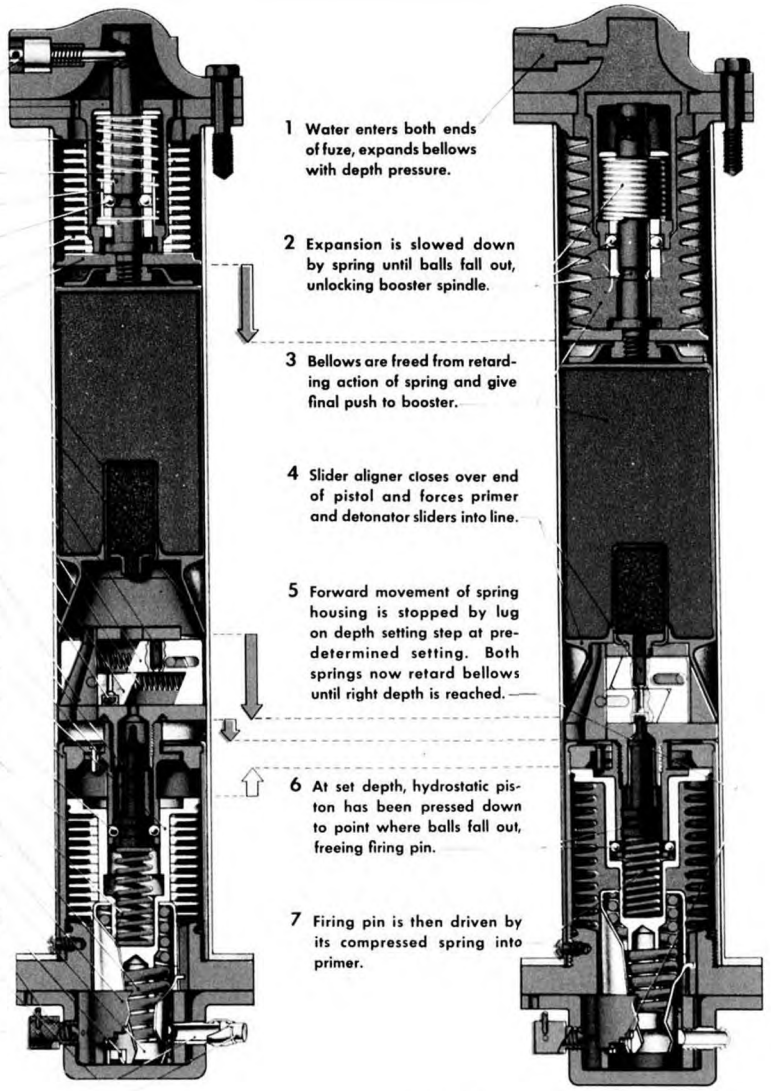
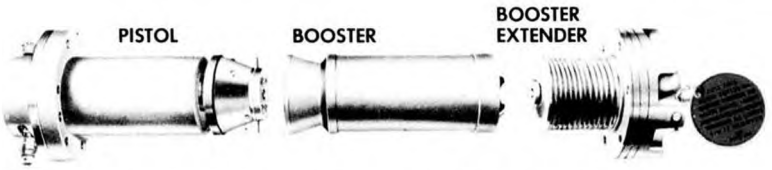


FIG. 1-16 — FUZE, BOMB, HYDROSTATIC — AN-MARK 224 PISTOL. GENERAL ARRANGEMENT WITH PART NAMES.





BOMB FUZE Mk 234

HYDROSTATIC (ATHWARTSHIP)

R E S T R I C T E D

SECTION 2
Fuze, Bomb, Hydrostatic—Mark 234

1. DESCRIPTION:

The Mark 234 fuze in operation is essentially the same as the Mark 224, Mods 1 and 2 fuze. The principal difference is that the Mark 234 fuze may be adjusted to fire at 25-50-75-100 or 125 foot depths by means of an external setting knob, without disassembly. The Mark 234, like the Mark 224, Mods 1 and 2, is issued in three sub-assemblies; the pistol, booster and booster extender, which are installed in a transverse fuze cavity in the bomb. The booster of the Mark 224 Mods 1 and 2 and Mark 234 are alike. The booster extender of the Mark 234 is the same as the Mark 224 Mods 1 and 2 of recent manufacture, in that the baffle plate is plastic and only one hole is provided for the arming wire and safety cotter pin. The jump-out pin hole also acts as the water entrance hole, and remains sealed against the entrance of water until the jump-out pin is expelled.

General Arrangement of the pistol is shown in Figure 1-19. Bureau of Ordnance General Arrangement Drawing number is 344482. Figure 1-18 is a photograph of the Mark 234 pistol.

2. BOMBS IN WHICH USED:

The Mark 234 fuze may be used in all the bombs in which the Mark 224 Mods 1 and 2 are used.

A spacer is required (as for the Mark 224 Mods 1 and 2) when used in the Mark 29, Mark 37 and Mark 38 - 650 pound bombs, to compensate for the greater diameter of the bomb.

3. ARMING:

When dropped (in order to permit the fuze to function), the arming wire to the booster extender is withdrawn and the wire to the pistol retains the synthetic rubber (neoprene) tube and the plug to which the wire is positively attached. When the arming wire is withdrawn from the booster extender, the jump-out pin is expelled by spring action, unlocking the central shaft and unsealing the hole. The wire to the pistol, by retaining the synthetic rubber tube and the plug, unseals the water entrance hole. Water pressure is then free to act on the hydrostatic bellows in the booster extender and pistol which align the explosive train and operate the firing pin respectively at the predetermined depth setting, as in the Mark 224 Mods 1 and 2.

4. DEPTH SETTING MECHANISM:

The pistol contains two springs; the firing pin spring and the adjustable spring. For the 25-foot setting, only the firing pin spring is compressed as the hydrostatic bellows extends due to water pressure. For deeper setting, the adjustable spring must also be compressed. By increasing the amount the adjustable spring must be compressed, more pressure (and consequently more depth) is necessary to extend the hydrostatic bellows enough to function the fuze.

The depth setting step has four stepped surfaces, one for each (except 25-foot) depth setting. As the hydrostatic piston moves forward, lugs on the spring housing come up against a stepped surface, stopping the forward movement of the spring housing and causing compression of the adjustable spring. For the 25-foot setting, the lugs on the spring housing do not come up against a step and the adjusting spring is not compressed. By rotating the depth setting step, the various stepped surfaces are placed below the lugs on the spring housing, so that for each increased depth setting beyond 25 feet, the adjusting spring will have to be compressed to a greater degree. To change the setting of the fuze, the following operations are performed on the pistol end:

Remove the safety clip from the knurled step lock screw and unscrew about two turns. This releases the depth setting step, so that the depth setting knob (which is opposite the step lock screw) can be moved. Move the depth setting knob to the desired depth, as indicated on the head of the pistol; then retighten the step lock screw and put the safety clip through it in such a manner that the screw cannot loosen.

5. INSTALLATION IN BOMB:

Installation in a bomb is essentially the same as the Mark 224 Mods 1 and 2, the only difference being that the arming wire to the pistol is attached

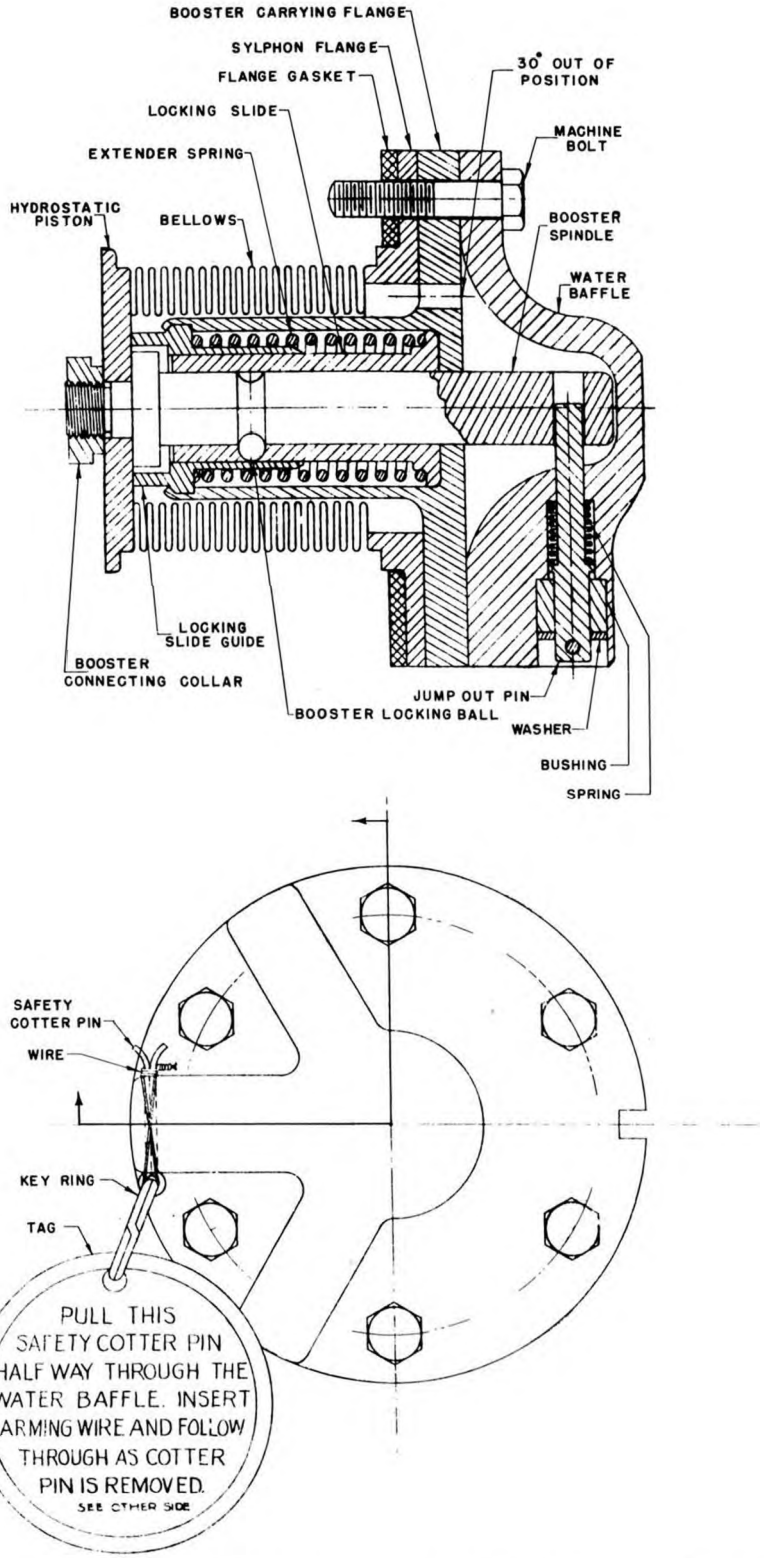


FIG. 1-17 — FUZE, BOMB, HYDROSTATIC, AN-MARK 224 BOOSTER EXTENDER. GENERAL ARRANGEMENT WITH PART NAMES.

so as to retain the depth setting knob plug and the synthetic rubber tube. Pass the end of the arming wire through the hole provided in the plug and cut off excess wire, allowing about 6" to extend beyond the plug. Bend one-half inch to three-quarters inch of the end of the wire and fold it back on itself. Alternate method is to make a small loop in the wire near the end. The wire will then be unable to slip back through the hole in the plug, and so will retain the plug as the bomb drops away from the rack.

When installing the Mark 234 pistol in a bomb, it is necessary to have the depth setting knob near the center of the depth setting hole, so that it will not interfere with inserting the holding screws. The step lock screw should be unscrewed several turns and the depth setting knob moved to the central position. The pistol may then be placed in the bomb and the holding screws inserted and tightened. The desired depth setting may then be made and the step lock screw tightened and locked.

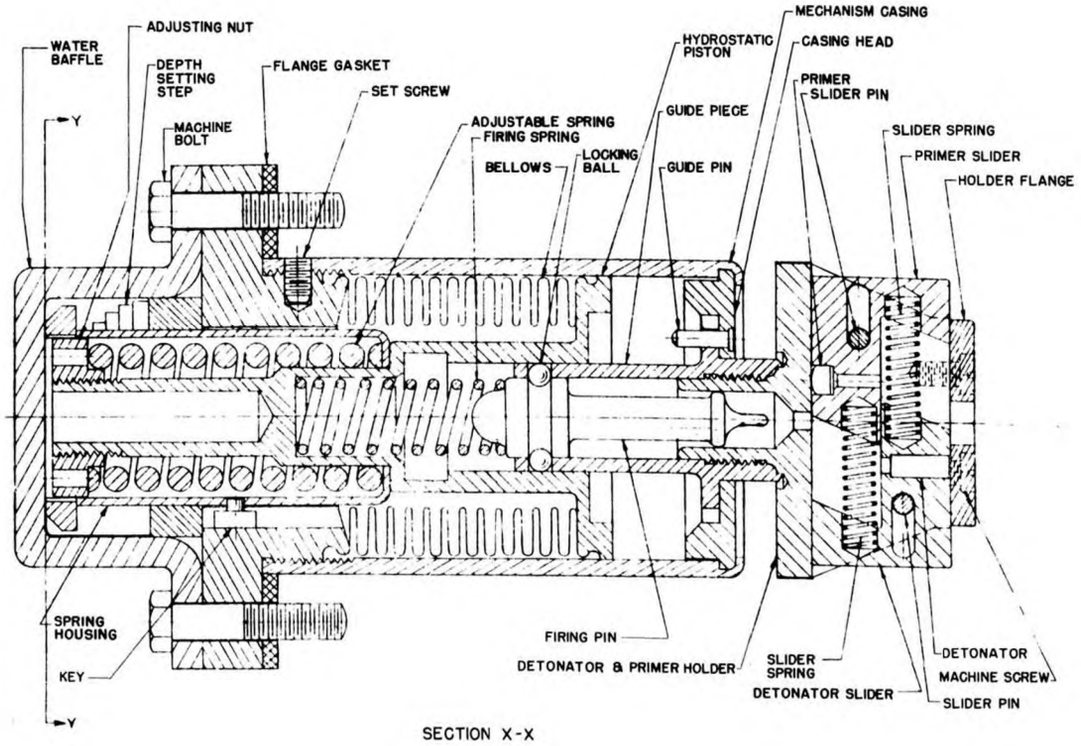
Care should be exercised in handling the fuzed bomb, to insure that the rubber connector and plug are not broken or pulled from the setting knob.

6. SERVICING:

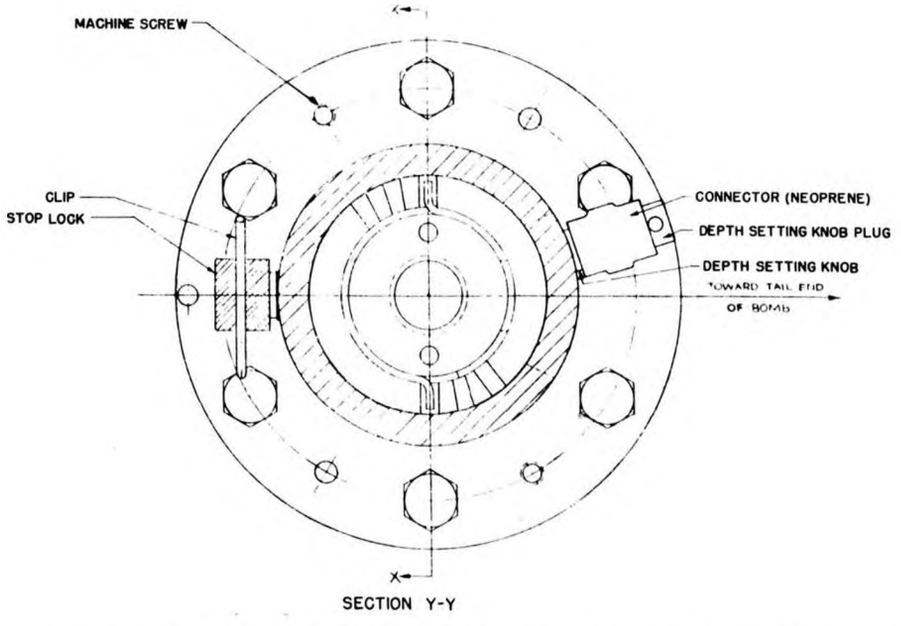
The same general procedure may be followed in servicing the Mark 234 fuze as outlined for the Mark 224, Mods 1 and 2. To oil the setting mechanism and inside of the hydrostatic bellows in the pistol, remove the rubber tube from the setting knob and apply a few drops of light oil through the hole in the setting knob. Unscrew the step lock screw about two turns and move the setting knob back and forth several times to work the oil in. Re-set for the proper depth and tighten and lock the step lock screw. Wipe the setting knob dry of all oil and replace the rubber tube and plug.

Weatherproofing features have been incorporated in the design of this fuze. Synthetic rubber bushings are inserted around the jump-out pins to prevent entrance of water. Gasket material is cemented to the depth setting step just inside the depth setting hole in the water baffle. When the step lock screw is tightened, the depth setting step is pressed against the inside surface of the water baffle and the gasket material seals the depth setting hole against entrance of water. Weatherproofing as used on the older Mark 224 fuzes should therefore be unnecessary.

FIG. 1-18 — FUZE, BOMB, HYDROSTATIC, AN-MARK 234 PISTOL



SECTION X-X



SECTION Y-Y

FIG. 1-19 — FUZE, BOMB, HYDROSTATIC, AN-MARK 234 PISTOL. GENERAL ARRANGEMENT DRAWING.

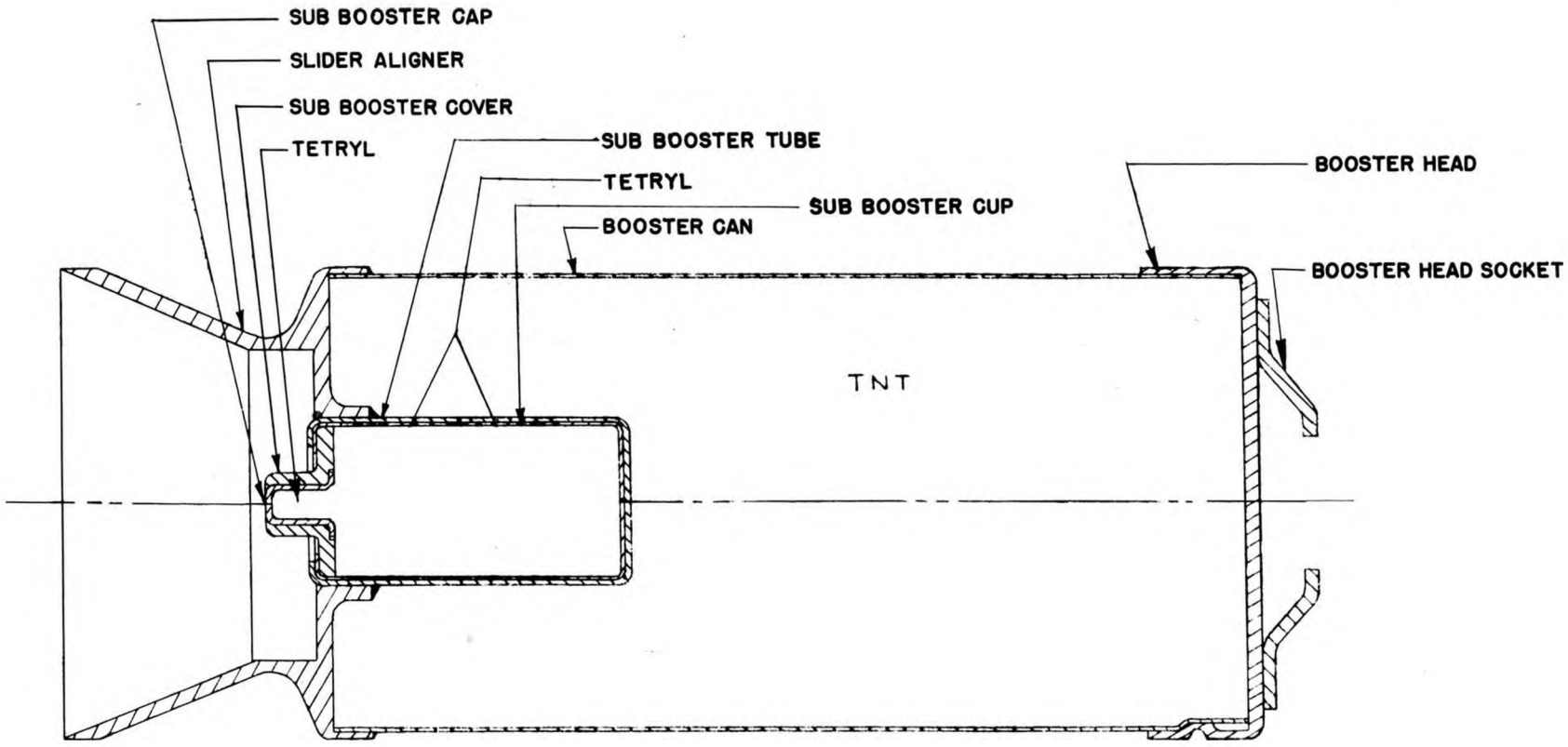


FIG. 1-20 — FUZE, BOMB, HYDROSTATIC, AN-MARK 224 AND 234 BOOSTER EXTENDER: GENERAL ARRANGEMENT DRAWING

PART I—Chapter 4 (RESTRICTED)

Aircraft Bomb Fuze—Mark 227 (Spinning Fuze)

CONTENTS

FIG. 1-21 — PHOTOGRAPH OF MARK 227 (SPINNING FUZE)

1. DESCRIPTION:

(a) ***General***—The Mark 227 (spinning fuze) is a nose fuze and is armed by centrifugal force caused by spin of the bomb after release. It is designed to detonate the Mark 34 Anti-Aircraft bomb on impact with materials, such as airplane wings, fuselage or light metal construction. About 1000 feet of altitude, corresponding to 1500 feet along the trajectory, is required for arming near sea level. Greater distance is required at high altitude because of the rarer atmosphere. It is safe for takeoffs or landings anywhere, including the decks of aircraft carriers. The weight of this fuze is 0.7 pounds. The principal parts of the fuze are the nose and the base, secured together by crimping the lower end of the nose over the base. A disc is interposed between the nose and the base. The nose contains the assembly of the firing pin dedents and firing pin. The base contains the assembly of the slider, slider detents, dowel pins, detonator and booster. The names of the various parts and the general arrangement drawings with the fuze in the unarmed and armed positions are shown in Figure 1-22. The Bureau of Ordnance General Arrangement Drawing is No. 236875. Figure 1-21 is a photograph of a completely assembled fuze.

(b) ***Bombs in which used***—The Mark 227 fuze is used only in the Mark 34 Anti-Aircraft bomb which has a specially designed tail vane to cause the bomb to spin about its longitudinal axis when dropped.

(c) ***Arming***—The fuze is in the unarmed position until the bomb in which it is carried is dropped from an airplane. Upon dropping, the bomb begins to rotate due to the angular setting of the bomb tail vanes. The fuze is armed by the centrifugal force set up by this rotation which moves a slider outward until stopped by the inner surface of the nose. At about 1500 r.p.m. the firing pin detents and slider detents are thrown outward thereby unlocking the firing pin and slider. The movement of the slider brings the detonator, located in the slider, into alignment with the firing pin and the booster lead-in. The fuze is then fully armed and will detonate on impact. Reliable arming of the fuze is dependent upon the free and easy movement of the sliding parts, and upon the nose being concentric with the axis of the fuze. To insure that all movable parts will function properly, they are assembled and tested by spinning, before acceptance.

(d) ***Explosive components***—The explosive components consist of a detonator, booster lead-in and booster. The main booster charge consists of about 3.05 grams (0.107 oz.) of tetryl.

2. FUNCTIONING:

(a) ***When armed***—As soon as the bomb is released it is free to arm. When rotation of the bomb has reached about 1500 r.p.m., centrifugal force arms the fuze and it will function on impact. When the projecting head of the firing pin comes in contact with any object having an appreciable resistance to impact, such as the surface of an airplane wing, the firing pin is momentarily retarded while the fuze and bomb continue in their flight, causing the firing pin to puncture the disc and stab the detonator, thus exploding the detonator which in turn sets off the booster and the burster charge of the bomb.

(b) ***Air travel required to arm***—Near sea level the bombs require about 1500 feet of air travel along the trajectory to reach a spin rate sufficient to arm the fuze. At 20,000 feet altitude about 3,000 feet of air travel is required for arming.

(c) ***Sensitivity***—When dropped from sufficient altitude to permit arming, the fuze will function with about .001 second delay on impact with materials, such as the wings or fuselage of an airplane. Sample fuzes are given routine acceptance tests to insure functioning. They must function on impact with water when dropped in Anti-Aircraft Bombs (spinning type) loaded with granulated TNT. The drops are made from aircraft at an altitude of 1000 feet and sufficient speed (about 100 knots) to insure arming.

3. SAFETY FEATURES:

This fuze is assembled in the unarmed position and remains in this condition during transportation, stowage, and until the bomb in which it is assembled is dropped from an airplane. In the unarmed position two detents, held in position by two springs, lock the striker and prevent it from moving toward the explosive components. The slider contains the detonator, which is out of alignment with the firing pin and the booster lead-in. The slider is locked in this position by two other detents held in position by springs. Arming wires are not used. The bombs may be dropped unarmed by jettisoning the container in which the bombs are carried. Sample fuzes (unarmed) are tested by assembling in inert loaded AA bombs

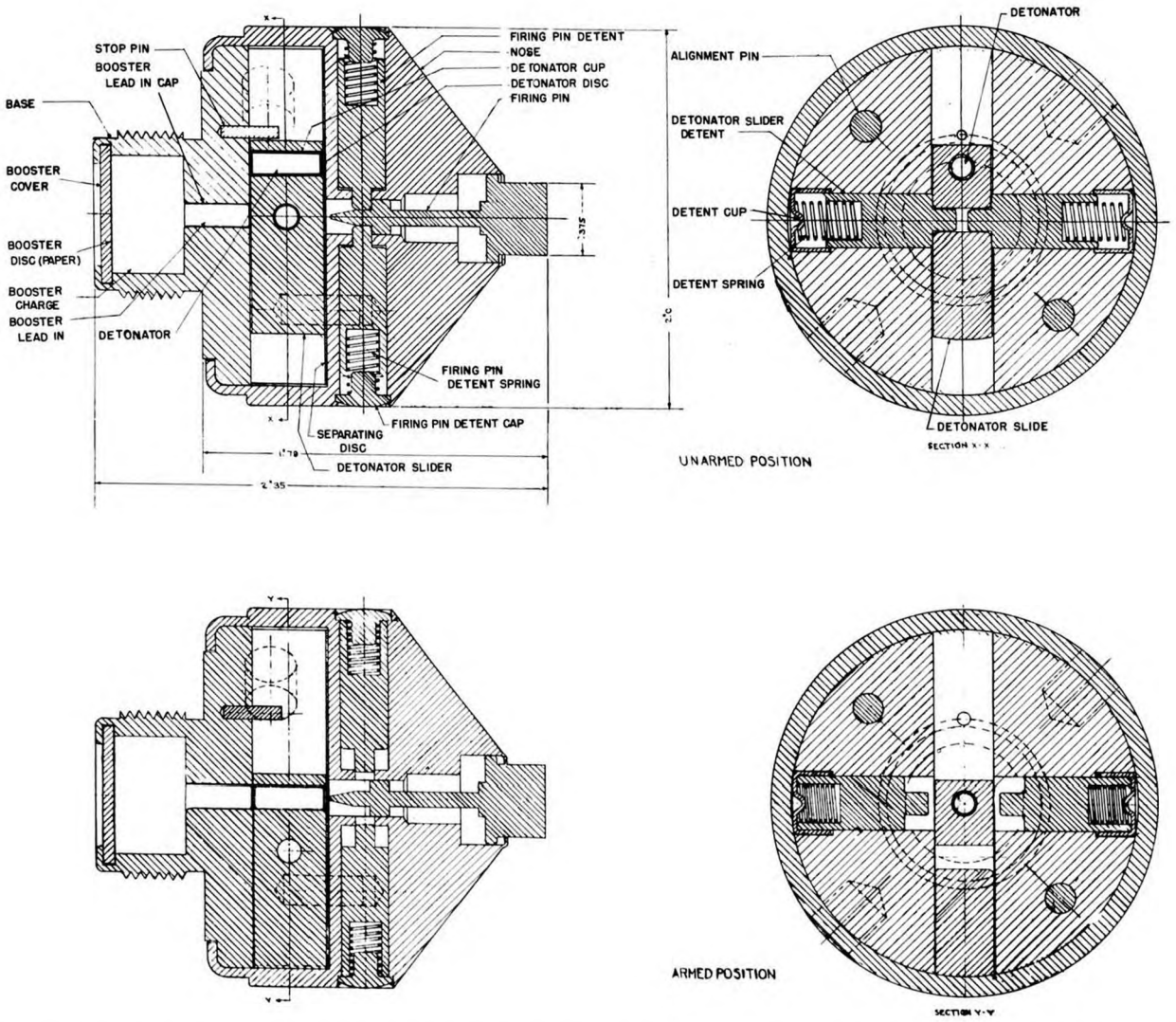


FIG. 1-22 — AIRCRAFT BOMB FUZE MARK 227 (SPINNING FUZE): GENERAL ARRANGEMENT WITH PART NAMES AND PRINCIPAL DIMENSIONS.

(spinning type) and given a 30 foot drop test (nose down) upon armor plate. The fuze must not explode.

Other fuzes are given a low altitude hard surface acceptance test. In this test, fuzes with boosters removed are assembled in inert loaded AA bombs (spinning type) and dropped free to arm on a hard surface from an airplane in horizontal flight at an air speed of 100 m.p.h, at an altitude of 50-75 feet. Neither the detonator nor any part of the explosive train must function in this test.

4. ARMED FUZES:

To arm this fuze, the bomb must be released to produce the necessary spin for arming; therefore, there never is a problem of handling or removing armed or partially armed fuzes from a bomb, unless the bomb has been dropped and failed to function. Bomb disposal personnel should dispose of such bombs and fuzes.

5. INSTALLATION IN THE BOMB:

Remove the nose shipping plug from the bomb, inspect the fuze seat liner and threads and clean if necessary. Remove the fuze from the sealed container and inspect the outward appearance for faulty threads or other defects. Screw the selected fuze into place hand-tight. If necessary, because of binding threads, a small spanner wrench may be used. Since no arming wires are used with this fuze, the bomb is then ready to be placed in the bomb carrying container.

6. SERVICING:

Because the nose section is crimped over the base, it is impractical to disassemble this fuze in the field. The bomb and fuze are protected by the carrying container while on an airplane and should not suffer unduly from service. The fuze should be given the usual care and protection in handling and stowing.

If appearances (corrosion, exterior damage, etc.) indicate the fuze to be unserviceable; seal in a fuze container, tag and turn in to an ammunition depot if possible.

7. PACKING AND MARKING:

Twenty-four fuzes are packed in a single metal container size 8".03 x 5 11/16" diameter. The container is hermetically sealed and protects individual fuzes from damage in handling and transportation.

Four metal containers each containing 24 fuzes are packed in a metal packing crate, size 17".35 x 13".00 x 12".88 and 102.0 pounds weight, loaded.

Each fuze is stamped with the Mark and Mod number, lot number, manufacturers initials, year of manufacture and inspectors initials.

Each metal container and packing crate is marked with the name and Mark of the fuze, the number contained therein, the name of the contractor, the lot number and the number and date of the contract or Bureau of Ordnance requisition. The crate is plainly marked: "Detonating Fuzes—Handle Carefully."

PART I—Chapter 5 (RESTRICTED)

Fuze, Bomb, Tail—Mark 228, Mark 228 Mod 1 Also Designated AN-Mark 228

CONTENTS

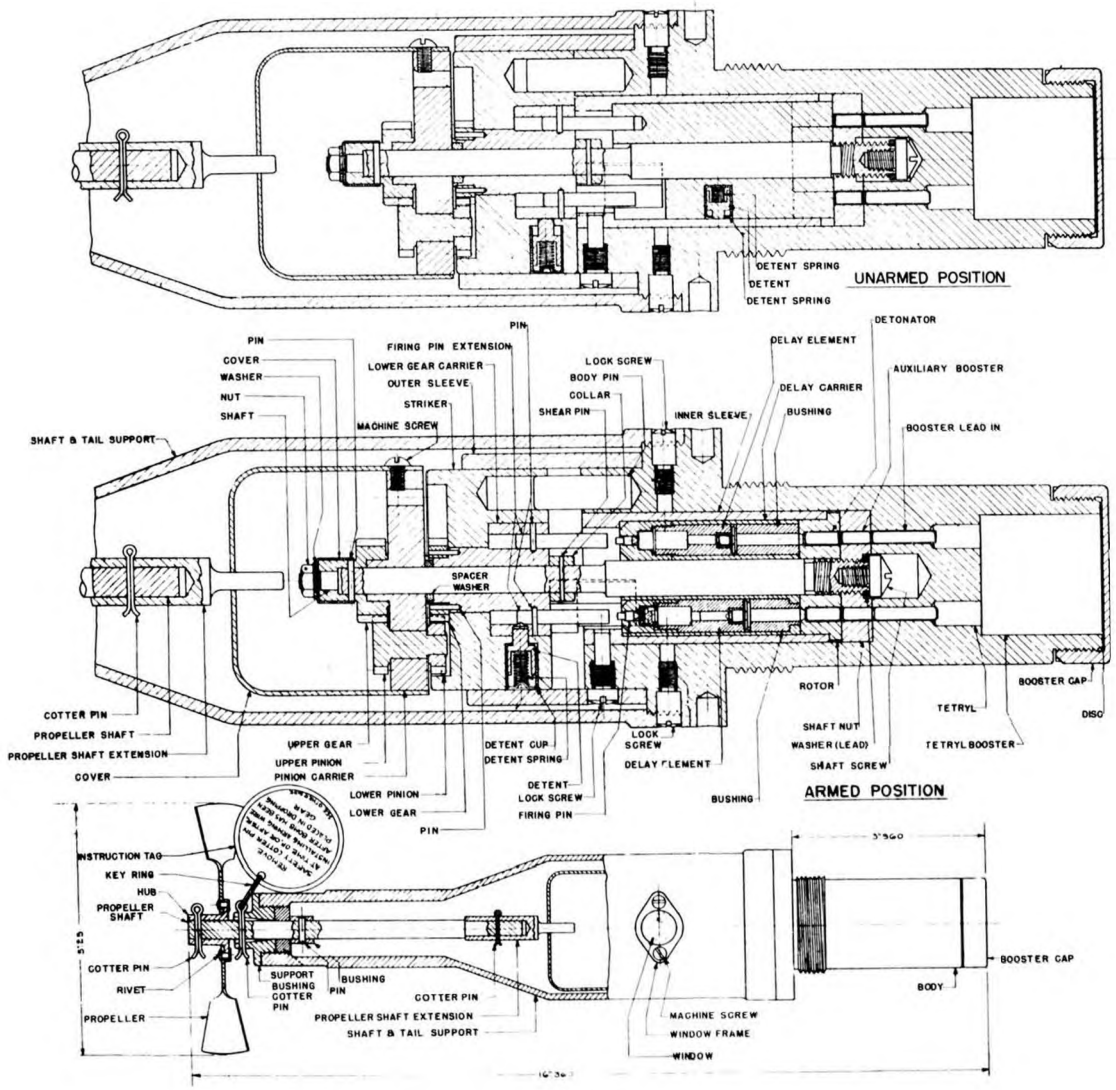
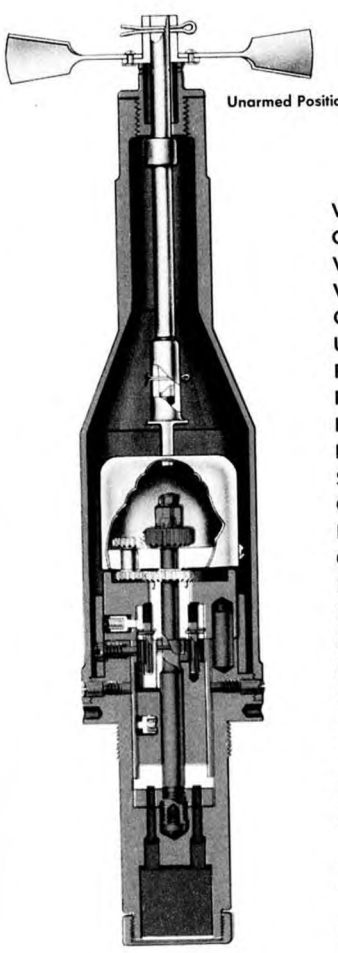
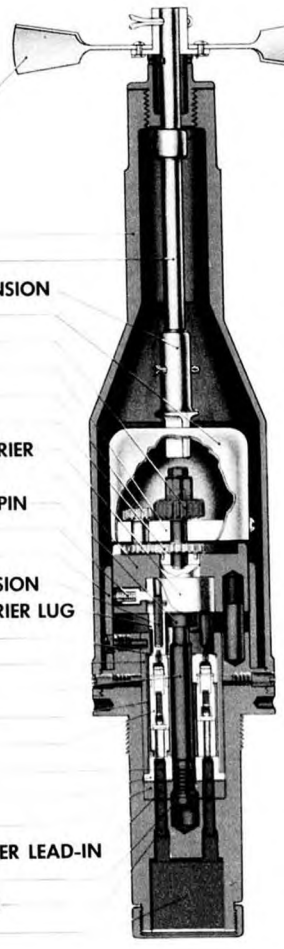


FIG. 1-23 — FUZE, BOMB, TAIL — MARK 228, MARK 228 MOD. 1: GENERAL ARRANGEMENT WITH PART NAMES.



VANES
COVER
VANE SHAFT
VANE SHAFT EXTENSION
CAP
UPPER GEAR
PINION CARRIER
PINIONS
LOWER GEAR
LOWER GEAR CARRIER
STRIKER
COLLAR & SHEAR PIN
DETENT
OUTER SLEEVE
FIRING PIN EXTENSION
LOWER GEAR CARRIER LUG
FIRING PIN
INNER SLEEVE
CENTRAL SHAFT
DELAY CARRIER
DELAY ELEMENT
DETONATOR
ROTOR
SHAFT NUT
AUXILIARY BOOSTER LEAD-IN
SHAFT SCREW
BOOSTER LEAD-IN
BOOSTER



1 When arming wire is pulled out, vanes are free to turn.

2 Pinions turn with vanes. Lower gear is locked by lug on lower gear carrier, upper gear is forced in clockwise direction.

3 Central shaft is screwed upward until it is stopped by shoulder on shaft screw, thus stopping upper gear.

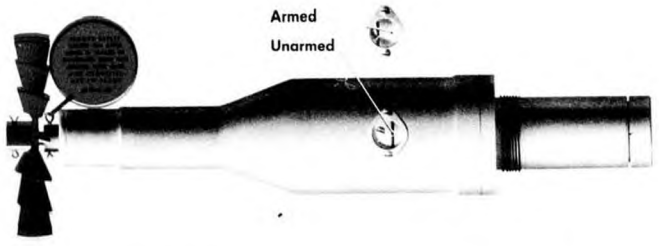
4 Lower gear is now free to rotate, as lower gear carrier has been lifted out of lock in inner sleeve.

5 Pinion forces lower gear counter-clockwise, aligning firing pin extensions, delay elements, detonator, and lead-ins. Detents in striker and delay carrier insure proper alignment.

6 When bomb hits, shear pin in collar is sheared, striker assembly is slammed back.

7 Firing pin extension hits firing pin, which initiates explosive train.

*Mk223 similar to AN-Mk228, except for single firing train. Delay of .01 seconds for Mk223. Delay of .08 seconds for AN-Mk228.
Vanes of AN-Mk228 are painted red.
Vanes of Mk223 are unpainted.



BOMB FUZE (TAIL)
AN-Mk 228 • Mk 223*

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The AN Mark 228 fuze is a bomb tail fuze of the arming vane type. It has mechanical arming delay and is designed to detonate the bomb with a delay of approximately 0.08 ($\pm$ 0.01) seconds after impact. The delay arming permits the bomb to fall clear of the airplane before the fuze is armed. Delayed action on impact allows penetration of the target before detonation occurs. The arming delay and safety features incorporated in this fuze make it safe for dive bombing and for landings and takeoffs of aircraft with fuzed bombs anywhere including decks of carriers. Mark 228 and Mark 228 Mod 1 are identical; the different designations are to indicate the manufacturer. Mark 228 is manufactured by the Naval Gun Factory. Mark 228 Mod 1 is manufactured by Reo Motors Corporation. Because of differences in manufacturing practices, the parts of a fuze made by one manufacturer are not necessarily interchangeable with parts of the same fuze made by another manufacturer.

(b) ***Bombs in which used***—The Mark 228 and Mark 228 Mod 1 fuzes are used in the following bombs:

AN-Mark 33 —1000 lb. Armor Piercing Bomb
Mark 1 (Navy)—1600 lb. Armor Piercing Bomb
AN-Mark 1 —1600 lb. Armor Piercing Bomb

(c) ***Details***—Assembly of the parts is shown in Bureau of Ordnance General Arrangements Drawing No. 236220 and Figures 1-23. Figure 1-24 is a photograph of a complete fuze. Figure 1-25 is a photograph of the disassembled parts. Its weight is about 10.5 lbs. loaded. Complete arming is accomplished in about 150-160 turns of the arming vane. Approximately 1100 feet travel along the trajectory is required for arming.

(d) ***Arming***—When the bomb is released from the carrying gear (in armed position), the propeller is unlocked by withdrawal of the arming wire. The propeller then rotates by action of the air stream and this rotation is transmitted through the propeller shaft and cover to the reduction gearing. The reduction gearing reduces the motion so that 23 turns of the propeller shaft are necessary to produce one revolution of the central shaft.

The gearing is so arranged that the lower gear cannot turn as long as the lug on the lower gear carrier engages the slot of the inner sleeve. The upper gear, therefore, takes up the rotation and advances the central shaft on its threads until stopped by the shoulder on the shaft screw. At about this instant, the lug on the lower gear carrier is disengaged from the slot in the sleeve, allowing the lower gear and carrier to rotate. As the rotation of the shaft and upper gear is stopped, the motion is transferred to the lower gear and carrier which rotate through approximately 175°, thereby bringing into alignment the firing pin extensions, delay elements, detonators and leads of each explosive train. As this rotation is completed, a detent in the delay carrier engages the sleeve, insuring the proper alignment of the explosive train. Another detent in the striker engages the lower gear carrier, insuring proper alignment of the firing pin extension with the explosive train.

In this position the fuze is fully armed and rotation of the propeller under normal circumstances will cease. Should the fuze be subjected to windspeeds in excess of 300 miles per hour after arming is completed, the propeller will transmit enough force to shear the pins in the lower gear and carrier. Under this condition, the propeller will continue to rotate without any effect on the armed fuze.

(e) ***Explosive components***—This fuze contains two explosive trains for greater reliability. They consist of primer, delay element, detonator, auxiliary booster lead-in, booster separator lead-in, booster lead-in and booster. Both trains lead to the booster charge, consisting of approximately 38.2 grams (1.346 oz.) of tetryl, located in the base of the fuze body.

2. FUNCTIONING:

(a) ***Armed***—When the fuze is fully armed, the firing pin extensions, firing pins, and explosive trains are in alignment (See 1-d). When impact occurs, the striker and lower gear carrier are driven forward shearing the shear pin through the supporting collar and shaft. The firing pin extensions in the lower gear carrier strike the firing pins which extend slightly above the top surface of the delay element assemblies, setting off the primer. The flash from the primer passes around a baffle and ignites the delay element, which after burning through sets off the subdetonator in the delay element, which in turn successively sets off the detonators in the rotor, lead-ins and booster in the fuze body. Strictly speaking, the explosive trains do not operate simultaneously, as one firing pin extension is slightly longer than the other. This affords greater

FIG. 1-24 — FUZE, BOMB, TAIL MARK 228, MARK 228 MOD 1 — PHOTOGRAPH OF FUZE

reliability of fire as all the force of the striker and lower gear carrier is transferred first to the firing pin under the longest firing pin extension and then to the firing pin under the shorter extension.

(b) ***Air travel required to arm***—In a 1600 lb. AP bomb, about 1100 feet of air travel along the trajectory is required to arm this fuze. The altitude required for arming is approximately 500 feet when released from an airplane in horizontal flight at 100 knots. Five hundred feet is the altitude required to arm; the safe altitude for release will depend on the size of the bomb dropped. Air travel required to arm will be somewhat less when used in bombs of smaller diameter and somewhat more in bombs of larger diameter.

(c) ***Sensitivity***—The Mark 228 fuze installed in a 1600 lb. AP bomb traveling at 400 feet per second will function on impact with five-eighths inch thick armor. It will function on impact on water when dropped from an airplane in horizontal flight at 4500 feet altitude or higher.

(d) ***Released safe***—If the bomb is dropped safe, the arming wire is released from the carrying gear and drops with the bomb, preventing the vanes from rotating, and the fuze will not arm. Tests are made to insure that fuzes will not function when locked in the unarmed position and dropped on water. The bombs in this test must not detonate when released from an airplane in horizontal flight and 8,000 to 10,000 feet altitude.

3. SAFETY FEATURES:

(a) ***When installed in a bomb***—This fuze is detonator safe; the firing pin extensions, delay elements, detonators and booster lead-ins being out of alignment until the fuze is armed. When installed in a bomb, the fuze is unarmed and is held in this condition by the arming wire. Proof tests are made to insure that fuzes free to arm will not function in horizontal bombing on a hard surface at an air speed of 60 to 70 miles per hour and 50 to 75 feet altitude.

(b) ***During shipping***—During shipment, each fuze individually packed in a sealed container, is locked in an unarmed condition by a safety cotter pin.

4. ARMED OR PARTIALLY ARMED FUZES:

(a) ***Appearance***—A small glass window is placed in the side of the fuze to permit visual examination. If unarmed, the upper surface of the striker and the lower edge of the cover are about flush with the top edge of the outer sleeve. From appearances, it is practically impossible to determine whether a fuze is completely armed or just very nearly armed. When completely armed, the striker should have moved out from the outer sleeve about eleven-thirty-seconds inch, and the striker rotated 175°. Unless the striker has rotated 175° after being elevated eleven-thirty-seconds inch, the fuze is not fully armed. If the striker has not moved away from the outer sleeve more than three-sixteenths inch, the fuze may be considered as partially armed and returned to the unarmed position by rotating the vanes counterclockwise (looking at the vane end). Rotate until the gears begin to tighten, then reverse rotation three or four turns and lock by inserting the safety cotter pin. If binding occurs, do not use force, but disassemble the fuze and inspect. If the striker has moved away from the outer sleeve more than three-sixteenths inch, the fuze should be disassembled to unarm.

(b) ***Removing from a bomb***—In removing an armed or partially armed fuze from a bomb, use the utmost caution not to jar the fuze or the bomb. Replace the safety cotter pin, gently unscrew the fuze and withdraw it carefully from the bomb. Unarm it, following instructions in paragraph 4a above. When removing a fuze from a bomb, the safety cotter pin should always be inserted. It will not make the fuze safe if fully armed, but will prevent the fuze from becoming fully armed if only partial arming has been accomplished. If the fuze is so distorted that it cannot be unscrewed from the bomb, replace the safety cotter pin and dispose of in the safest way practicable, such as gently lowering the fuzed bomb under the surface and releasing in deep water.

5. INSTALLATION IN A BOMB:

(a) ***Instructions***—The following is the procedure recommended for fuzing bombs:

(1) Remove the fuze hole cover from the bomb, inspect the fuze seat liner and threads and clean if necessary. Inspect to see that the auxiliary booster is in place in the bomb.

(2) Remove fuze from the hermetically sealed container and inspect outward appearance for any defects in threads or bent vanes. (If defects are found, do not use the fuze but replace it in the container, seal the container with adhesive

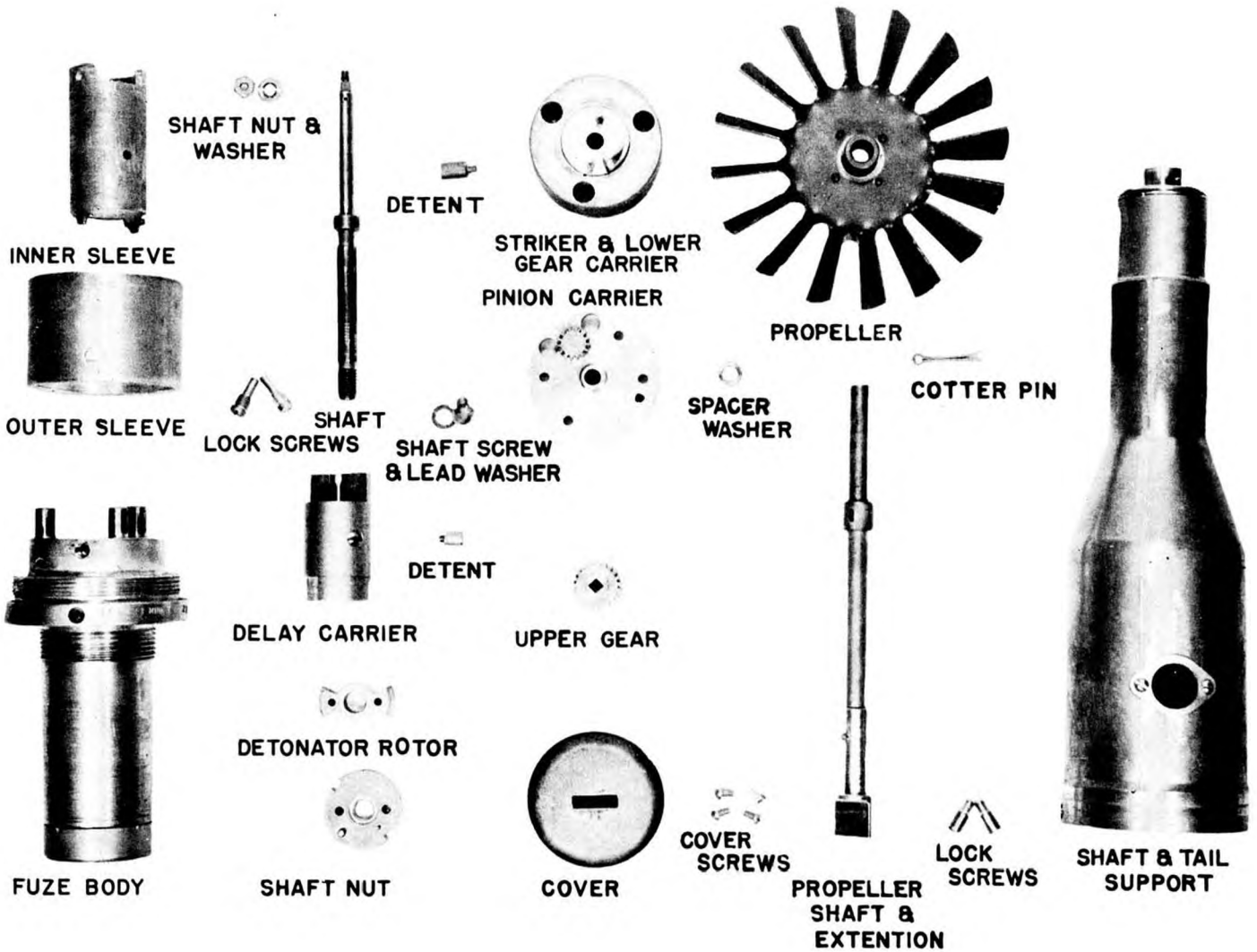


FIG. 1-25 — BOMB FUZE, MARK 228 & MARK 228 MOD 1: DISASSEMBLED PARTS

tape, attach tag listing defects and turn in to the nearest depot).

(3) Screw the selected fuze securely into place, handtight. If necessary, because of binding threads, a small spanner wrench may be used.

(4) Attach the arming wire bracket, furnished with the bomb, to the tail support of the fuze, so as to be in a vertical position when the bomb is placed in the rack. It will be necessary to remove the arming vanes before the arming wire bracket can be attached. The arming wire bracket will be a part of the tail vane assembly of the earlier lots of Mark 1—1600 lb. AP bombs.

(5) Place the arming vane on the shaft and fasten with the cotter pin provided. (The tail vane of the Mark 228 fuze is painted red to distinguish it from the Mark 223 tail vane which has a slightly different pitch.)

(6) Remove the safety cotter pin from the fuze and turn the vane in each direction to ensure free rotation. Do not rotate the vane more than about one turn in either direction.

(7) Thread the arming wire through the rear bomb suspension lug and then through the arming wire bracket. Be sure the arming wire tube (brass tube furnished with the bracket) covers the arming wire where it passes through the arming vanes. With wing suspension on seaplanes, the action of water spray on the arming vanes during take-off causes them to beat on the wire; and, if the tube is not in place, the wire may be pulled out, allowing the fuse to arm while on the plane. If more convenient, the arming wire plate may be put in the bomb rack first and the bomb then hoisted into place.

(8) Place the bomb in the carrying gear and properly insert the arming wire plate. Pull the arming wire taut, *but maintain sufficient freedom for the arming wire plate in the bomb rack*. When shackles are used, they are placed on the bomb and then the bomb is hoisted to the bomb rack. the arming wire may be put on either before or after hoisting the bomb to the rack.

(9) Attach 2 Fahnestock connectors on the end of the wire and slide them up to the arming wire bracket.

(10) Cut off surplus length of arming wire so that about six inches extends beyond the Fahnestock connectors. Make sure the end of the wire is smooth and free of burrs.

(b) ***Points to check***—When fuzing and installing bombs in planes, make the following check-ups:

(1) Inspect the bomb fuze seat liner and threads and clean if necessary.

(2) See that the auxiliary booster is in place in the bomb.

(3) Inspect outward appearance of fuze for defective threads, bent vanes, etc.

(4) See that the arming wire bracket is secure and properly located so as not to foul the arming vanes.

(5) Be sure safety cotter pin has been removed.

(6) Rotate arming vane slightly in both directions to ensure free rotation.

(7) See that the arming wire plate is properly placed in the bomb rack.

(8) See that the brass tube covers the arming wire where it passes between the propeller blades.

(9) See that Fahnestock clips are attached and that the end of the arming wire is smooth and has about six inches extending.

6. SERVICING:

(a) ***Use of lubricants***—Under ordinary circumstances, this fuze requires no lubricants. If lubrication becomes necessary to insure proper operation because of exposure, a slight amount of light oil may be used on the propeller shaft and if necessary on the gear train. No lubricant should be used below the gears as it might come in contact with the explosives and lead to contamination and deteterioration of the explosive elements.

(b) ***Fuzes exposed to weather***—Fuzes exposed to weather and salt spray should be inspected regularly and serviced if necessary to insure proper operation. As a precautionary measure against corrosion, a small quantity of light-grade lubricating oil should be applied to the bearing surfaces periodically. The shaft should be inspected regularly to insure free rotation. When shafts show a tendency to become corroded or "frozen," they should be removed and cleaned by personnel who thoroughly understand the fuze. The following procedure is recommended:

(1) After removal of the fuze from the bomb, remove the arming vanes and safety cotter pin.

(2) Remove set screws locking the tail support and unscrew from the fuze body.

(3) Withdraw the propeller shaft from support bushing. After cleaning, the bearing surfaces should be lightly oiled before reassembly.

The gears may be tested for free rotation by rotating the cover slightly in both directions. If they do not rotate freely, the cover may be removed by withdrawing the screws securing it to the pinion gear carrier. The upper gears are then exposed and may be cleaned and oiled. Test operation by rotating the carrier slightly in both directions. Reassemble by reversing the above disassembly procedure. Be sure to replace the safety cotter pin. If the fuze is replaced in the container, seal with adhesive tape.

When working with a fuze, always handle it with the greatest of care. Never hammer or force any of the parts. If the fuze cannot be made to operate properly, seal it in the container, tag properly and turn in to the nearest depot at the first opportunity.

(c) ***Reports of malfunctionings***—In reporting malfunctions, give the fuze lot number, length of time in service, type of weather exposed to and all other pertinent information and history of the fuze.

(d) ***Disassembly***—Complete disassembly should only be performed if the procedure outlined in paragraph 6b above fails and when the fuze cannot be turned in and must be used. To disassemble, place the fuze in an upright position with arming vanes up. Remove the cotter pin from the arming vane and lift the vane off the shaft. Remove the safety cotter pin. Remove the set screws locking the shaft and tail support and unscrew it from the fuze body. Lift out the propeller shaft and remove the cover after removing the screws securing it to the pinion gear carrier. Remove the outside sleeve after removing the three lock screws holding it in position. This will free the locking detent held in place by the outer sleeve. Grasp the central shaft and remove the entire striker and detonator assembly from the fuze body. The following parts should then be removed in the order named:

(1) Upper external gear by removing the nut and washer on top of the central shaft and the retaining cup and shear pin of the upper gear.

(2) Pinion gear carrier.

(3) Lower spacer washer.

(4) Striker and lower gear carrier.

(5) Inner sleeve and detent in the delay carrier, held in place by the inner sleeve.

(6) Flanged slotted screw and lead washer at bottom of shaft.

(7) Shaft nut which contains the auxiliary booster lead-in (left hand thread).

(8) Detonator rotor.

(9) Delay carrier.

(e) ***Assembly*** — Assembly in the following order is recommended:

(1) Place the delay carrier on the lower end of the central shaft against the shaft collar with the single lug end first.

(2) Place the rotor in position between the lugs of the delay carrier.

(3) Screw the shaft nut containing the auxiliary booster lead-in, with the fixed dowel down, on the central shaft until seated gently against the shoulder on the shaft.

(4) Insert the locking detent in the hole provided in the delay carrier and place the inner sleeve in position with the projection on the lower edge in the groove in the shaft nut.

(5) Place striker assembly on the central shaft and position the lug in the cutout in the top edge of the sleeve. Care must be exercised when inserting the striker in order to prevent the firing pin extensions coming in contact with the delay element firing pins, as the primer may be accidentally fired.

(6) Place spacer washer over shaft and into the recess provided in the lower gear carrier.

(7) Rotate the central shaft clockwise approximately one turn; this raises the shaft so that the shear pin can be inserted when the upper gear is assembled.

(8) Place the pinion gear carrier into position on the shaft.

(9) Place the upper gear on the shaft and insert pin. Place cup over hub of upper gear and fasten in place with washer and nut on shaft end.

(10) Screw the flanged slotted screw with the lead washer in place tightly in the lower end of the central shaft.

(11) Assemble the cover to the pinion gear carrier with the screws provided.

(12) Place the outer sleeve over the fuze body and start the locking screws into the tapped holes in the body. Rotate cover backward until the gearing begins to tighten.

(13) Insert the striker head assembly into the fuze body and bring into alignment by rotating the cover backward until the assembly is seated.

(14) Grasp the cover and lift up about one inch to permit insertion of the locking detent in the hole in the striker. Then let the assembly slide back into position.

(15) Turn the cover forward approximately six turns. If seated properly the upper surface of the striker shall be about flush with the top edge of the outer sleeve.

(16) Insert the flattened end of the propeller shaft extension into the elongated hole in the cover. Place the tail support over the propeller shaft and screw onto the fuze body. Fasten to the fuze body with the two lock screws.

(17) Rotate the propeller shaft counterclockwise until the gearing begins to tighten; then reverse rotation three or four turns and lock in place by inserting the safety cotter pin in the hole provided and spreading the ends. Attach instruction tag.

(18) Place the propeller over the end of the shaft with flanged end of hub nearest the tail support and lock in place by inserting the cotter pin through the hub and shaft.

If the fuze is not to be used immediately, it should be repacked and resealed in the fuze container.

7. PACKING AND MARKING:

(a) ***Fuze container***—One completely loaded bomb fuze and two Fahnestock connectors (safety clips) are packed in a single metal container, hermetically sealed. The container is stenciled with the number of fuzes contained, mark and mod number, lot number, year, inspector's initials, weight empty, weight loaded, contract number, and place loaded. The fuze itself is stamped with the Mark and Mod number, lot number, year, manufacturer's initials and inspector's initials.

(b) ***Packing box***—Four fuzes in metal containers are packed in a metal packing box 17.06" x 11.56" and 60 lbs. weight loaded. It is marked thus:

(Quantity) Aircraft Bomb Fuze—Mark and Mod number.

Type (stenciled in red)—Requisition, contract or order number.

Manufacturer's name, inspector's initials, weight of crate and contents.

PART I—Chapter 6 (RESTRICTED)

Hydrostatic Tail Bomb Fuze—Mark 229

CONTENTS

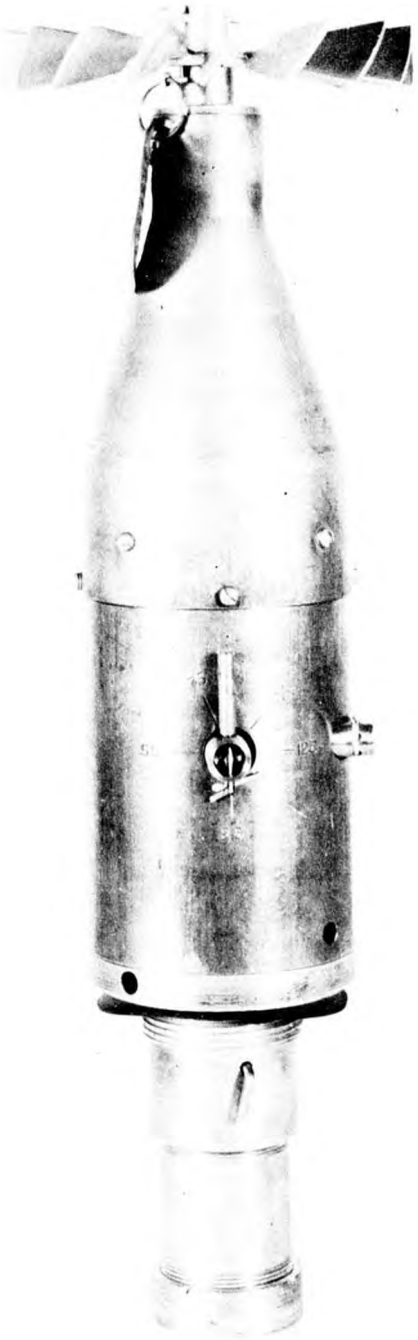
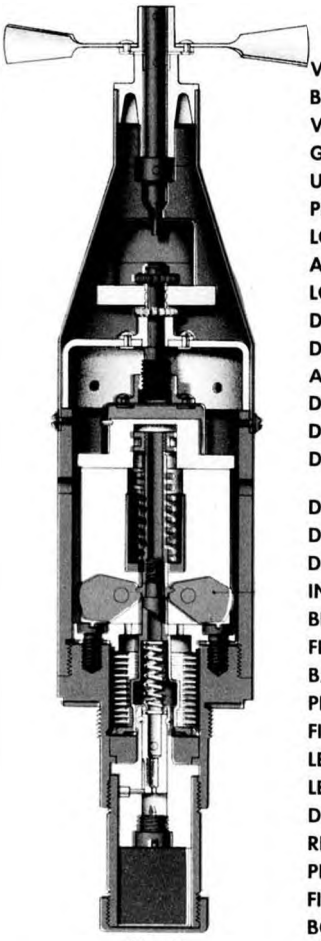
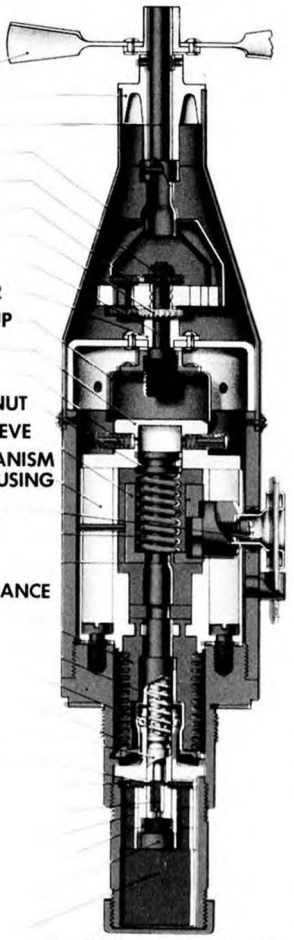


FIG. 1-26 — BOMB FUZE MARK 229 — PHOTOGRAPH (EARLY MODEL)



View A
Unarmed Position of MK229

VANES
BUSHING
VANE SHAFT
GEAR COVER
UPPER GEAR
PINIONS
LOWER GEAR
ARMING SHAFT
LOWER GEAR CARRIER
DETENT RETAINING CUP
DETENT CARRIER
ARMING DETENT
DEPTH SPRING STEM NUT
DEPTH ADJUSTING SLEEVE
DEPTH SETTING MECHANISM HOUSING
DEPTH SETTING KNOB
DEPTH SPRING
DEPTH SPRING STEM
INERTIA COUNTER BALANCE
BELLOWS
FIRING SPRING
BALLS
PISTON
FIRING PLUNGER
LEAD-OUT CHARGE
LEAD-IN CHARGE
DETONATOR
RELAY
PLUNGER HOUSING
FIRING POINT
BOOSTER



View B–(¼ turned from view A)
Firing Position of MK229

1 When arming wire is pulled out, vanes are free to turn.

2 Rotation of vanes, acting through reduction gearing, turn arming shaft, which screws detent retaining cup upward.

3 Withdrawal of cup releases arming detents, thus unlocking depth setting stem nut and leaving fuze armed.

4 Inertia counter balances prevent fuze from functioning on impact of bomb on water surface.

5 When bomb submerges, water enters through two ports into depth setting mechanism housing.

6 Water pressure expands bellows and forces piston downward.

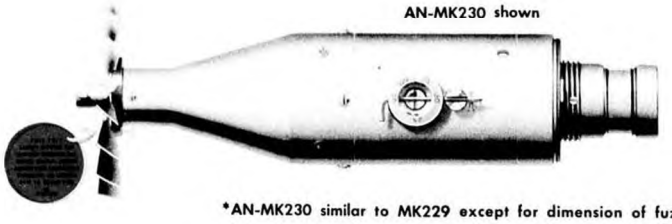
7 Depth spring, along with firing spring, retard bellows until predetermined depth is reached.

8 At set depth, hydrostatic piston has been pressed down to point where balls fall out, freeing firing plunger which houses detonator.

9 Firing plunger is then driven by its compressed spring downward.

10 Firing point pierces detonator, (at this position explosive trains are aligned) initiates detonator, lead-out charges, lead-in charges, relay and booster charge.

AN-MK230 shown



*AN-MK230 similar to MK229 except for dimension of fuze body.

BOMB FUZE • Mk 229, AN–Mk 230*

HYDROSTATIC (TAIL)

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The Mark 229 Tail Bomb Fuze is a hydrostatic fuze for anti-submarine use. It functions by means of hydrostatic pressure at a pre-determined depth setting of 25, 50, 75, 100, or 125 feet. A change in the depth setting is made by an external setting dial without disassembly of the fuze. This fuze is of the arming vane type and is designed for mechanical delay arming. It is safe for use in dive-bombing and for take-offs or landings anywhere, including carrier decks. It was previously designated Mark 29. The Bureau of Ordnance general arrangement drawing number is 300256. This fuze is similar to the AN-Mark 230 fuze; except that, in the AN-Mark 230, the portion of the fuze that fits into the bomb is 1.3″ shorter than in this fuze.

(b) ***Bombs in which used***—This fuse is used principally in the following bombs:

650 lb. aircraft depth bomb—Mark 29

650 lb. aircraft depth bomb—Mark 37

650 lb. aircraft depth bomb—Mark 38

If the above bombs are not available the fuze can also be used in these bombs:

500 lb. (light case) bomb—Mark 9.

1000 lb. (light case) bomb—Mark 9

500 lb. general purpose bomb—Mark 12.

1000 lb. general purpose bomb—Mark 13.

(c) ***Mechanical delay arming***—Delay arming is obtained by means of a reduction gear train interposed between the arming vane and the arming shaft. It reduces the rotation of the arming shaft to one turn for 23 revolutions of the arming vane. Rotation of the arming shaft, raises the detent retaining cap thereby allowing the arming detents to jump out and unlock the functioning mechanism. Approximately 110 turns of the arming vane are required to arm the fuze.

(d) ***Functioning mechanism*** — The hydrostatic piston, piston ring, counterweight rack, depth spring stem, and depth spring stem nut move as one unit. The open ends of the hydrostatic bellows are secured to the hydrostatic piston ring and the depth setting mechanism housing. The assembly is water tight. The fuze becomes armed when the arming detents are disengaged from the groove in the depth spring stem nut. In this condition hydrostatic pressure is free to act on the hydrostatic piston assembly. The water enters two ports in the body sleeve and through holes in the depth setting mechanism housing. Hydrostatic pressure extends the bellows, and forces the piston downward, compressing the firing spring and depth spring as it moves. The firing plunger contains the detonator and lead-out charges and is locked to the plunger housing by six balls. After the hydrostatic piston has moved downward about three-eighths inch (this distance is the same for all depth settings), the balls locking the firing plunger, are forced into the annular recess in the hydrostatic piston, and the compressed firing spring forces the plunger downward. The plunger houses the detonator. As the plunger moves downward the firing point enters an opening in the plunger, and pierces the detonator. In this position, the explosive trains are aligned. The action of the firing point as it pierces the detonator, initiates the detonator, lead out charges, lead in charges, relay pellets and booster charge. The piston assembly is counter-balanced by two inertia counter-balances to prevent the fuze from firing on impact with the surface of the water.

(e) ***Depth setting mechanism***—The firing spring and the depth spring are compressed as the hydrostatic piston assembly moves downward. By increasing the amount the depth spring must be compressed, more pressure (and consequently greater depths) is necessary to cause the hydrostatic piston to move that distance required to operate the fuze. The depth setting sleeve slides in the depth setting mechanism housing. The depth setting cam has five surfaces, each for one depth setting. Each surface locates the setting sleeve in a different relative position with respect to the mechanism housing so that for each increased depth setting, the depth spring will have to be compressed to a greater degree. The depth setting cam is set by an external setting ring. The figure on the setting dial closest to the lock, constitutes the depth for which the fuse is set.

(f) ***Explosive components*** — The explosive components consist of the detonator, lead-out charges, lead-in charges, relay pellets, and booster charge. The booster charge, relay pellets and lead-in charges consist of approximately 25.5 grams of tetryl. The detonator and lead-out charges are in the firing plunger.

2. FUNCTIONING:

(a) ***Released free to arm***—When the bomb is released free to arm, the arming wire withdraws from the fuze, allowing the air stream to turn the arming vane. The rotation of the vane acting

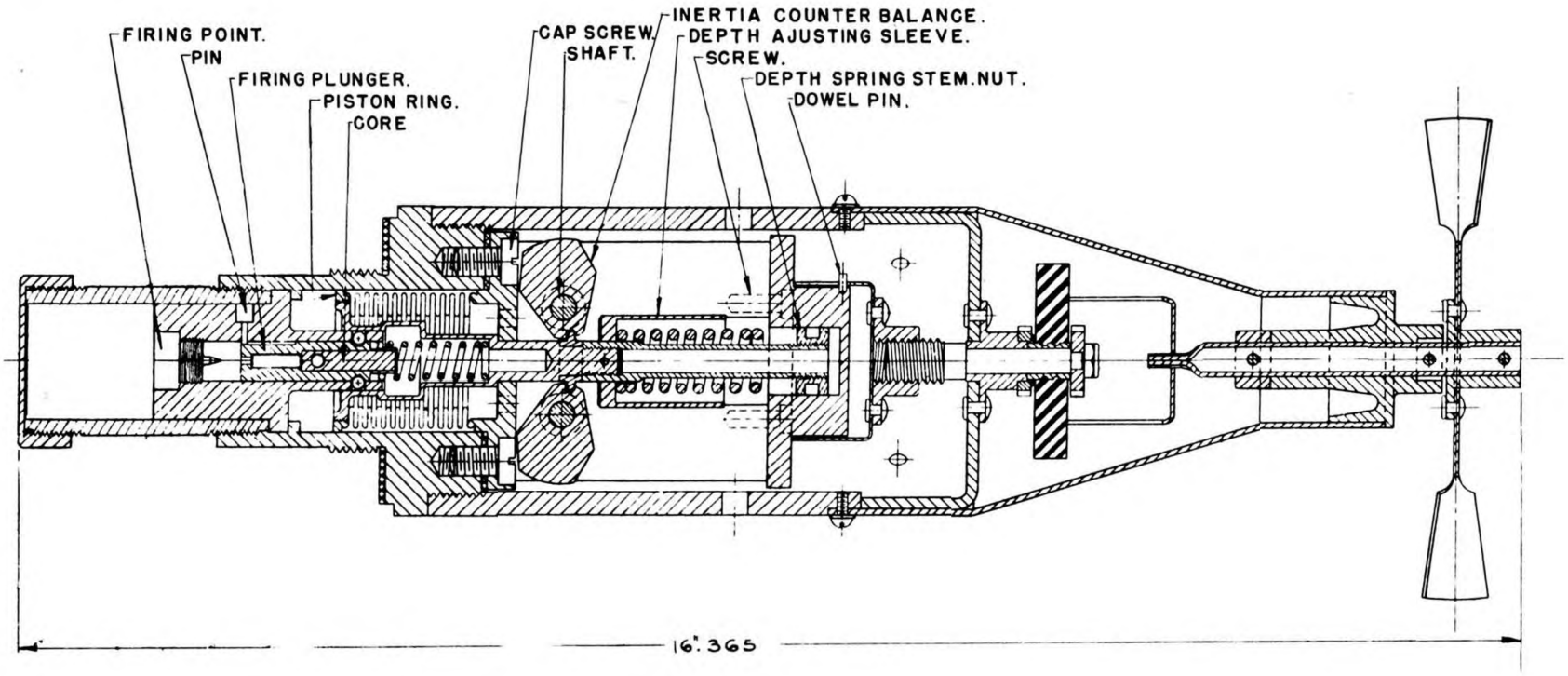


FIG. 1-27 — FUZE, BOMB, TAIL, HYDROSTATIC — MARK 229: GENERAL ARRANGEMENT DRAWING. (UNARMED POSITION).

through the reduction gearing, turns the arming shaft, which withdraws the detent retaining cup from the detent carrier. The withdrawal of the cup releases the two arming detents from their engagement with the depth setting stem nut, leaving the fuze armed. The inertia counterbalances prevent the fuze from functioning on impact of the bomb with the surface of the water. When the bomb submerges, water enters the fuze through two ports in the body sleeve and through holes in the depth setting mechanism housing. Hydrostatic pressure acting on the bellows, forces the piston downward, compressing the firing spring until the balls which lock the firing plunger to its housing, fall out. The firing plunger, now free to move, is forced by the pressure of the firing spring downward, firing the fuze.

(b) ***Air travel required to arm*** — The air travel along the trajectory necessary to arm this fuze is 400-500 feet. The minimum altitudes of release, to insure arming this fuze, for various air speeds in horizontal flight bombing are:

Air Speed—Knots	100	150	200	250
Altitude of Release—feet	130	60	35	20

The minimum *SAFE* altitudes of release depend upon other factors and not upon air travel required to arm.

Partial prearming of the fuze, to insure arming at low altitudes of release, is *NOT* recommended. No visual means exist to determine whether the fuze is partially armed. If the fuze were partially prearmed on successive occasions, the air arming feature becomes entirely unreliable.

(c) The depth of functioning can be estimated from observation of the surface phenomena, and noting the time between slick and upheaval. This data varies according to the size of the bomb.

(d) If the bomb is released safe, the arming wire is released from the arming mechanism of the rack and drops with the bomb, preventing the arming of the fuze. Unarmed, the fuze will not function after it enters the water or on impact with hard surfaces.

3. SAFETY FEATURES:

(a) ***Detonator safety***—This fuze is detonator safe. The detonator and lead-out charges are not aligned with the lead-in charges in either the armed or safe position. If the detonator should function prematurely, the force of the detonation is dissipated in the cavity between the plunger housing and hydrostatic piston.

(b) ***Installed in a bomb***—When the fuze is installed in a bomb, with the bomb in the bomb rack and the arming wire assembled, it is in the unarmed or safe position. It does not become armed until the bomb has been released free to arm and has traveled the distance through the air necessary to arm. The explosive train between the lead-out charges in the firing plunger and the lead-in charges in the plunger housing are out of alignment. The firing point is aligned with the detonator in the firing plunger, but the plunger is locked to the plunger housing by six balls, and is not released until hydrostatic pressure causes the fuze to function. Inertia counter-balances prevent the fuze from functioning upon impact.

(c) ***During shipping and stowage***—During shipping and stowage, additional safety is obtained by (1) a safety rod inserted through the fuze body, plunger housing, and firing plunger, positively locking these parts together (2) A cotter pin which locks the arming vane to the bushing.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—No visual means are provided, to determine from the external appearance of the fuze whether it is armed or not. Partially armed fuzes can be completely unarmed by turning the arming vane backward. Completely armed fuzes cannot be unarmed by this method but must be disassembled.

(b) ***Handling***—The functioning mechanism is so counter-balanced that even though the fuze be fully armed, it will not fire from handling or shock on dropping. It will fire only on pressure (air or water) being introduced into the hydrostatic bellows. Armed fuzes may safely be removed from a loaded bomb. However the safety rod locking the firing plunger to the plunger housing should be inserted as soon as possible after the fuze has been removed from the bomb.

(c) ***Salvaging*** — Armed or partially armed fuzes should be disassembled and reassembled according to instructions in paragraphs 6d and 6e.

5. INSTALLATION:

(a) ***Instructions*** — To install the fuze in a bomb:

(1) Remove the tail shipping plug from the bomb, inspect the fuze seat liner and threads, and clean if necessary. The bombs require an auxiliary booster which is usually assembled. If

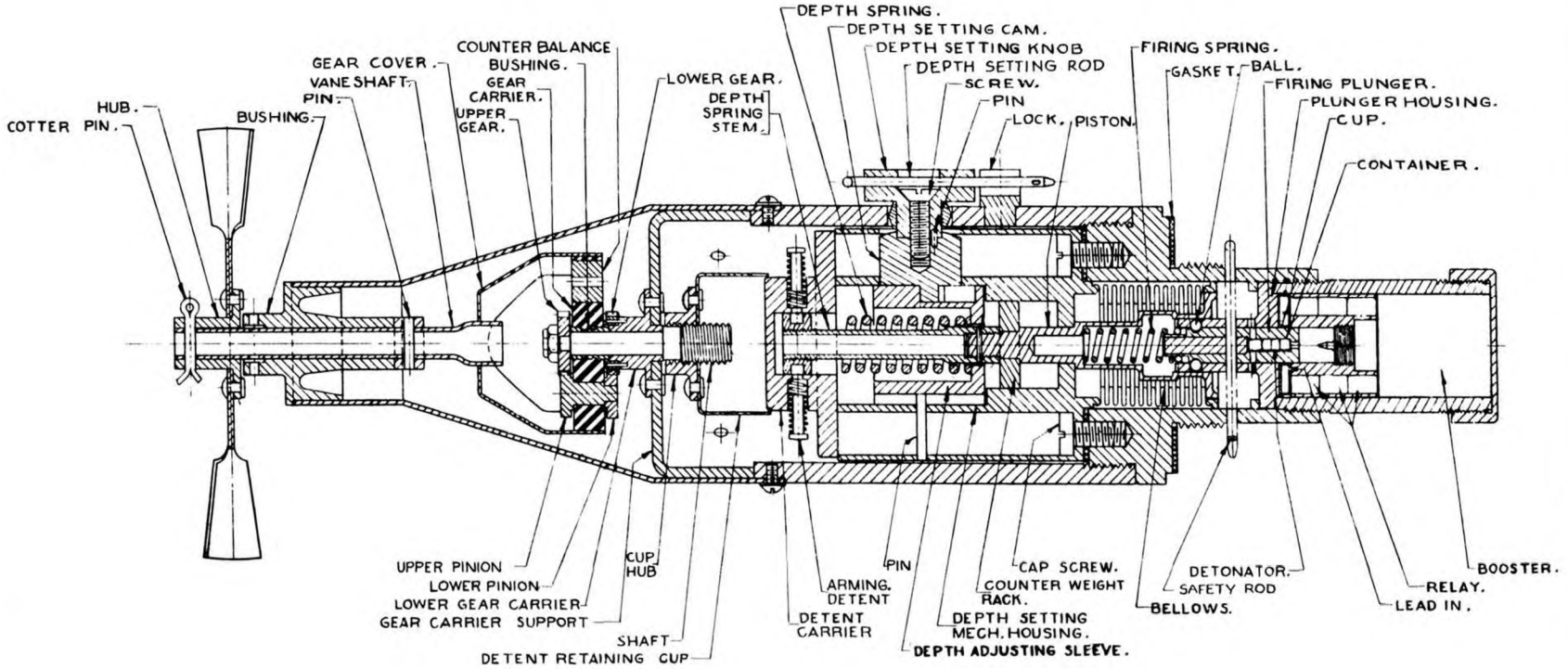


FIG. 1-28 — FUZE, BOMB, TAIL, HYDROSTATIC MARK 229: GENERAL ARRANGEMENT DRAWING (ARMED POSITION).

the auxiliary booster has been stowed separately from the bomb, insert it in the tail cavity of the bomb.

(2) Remove the fuze from the container and inspect for any defects in thread or vanes. If the fuze appears unserviceable, return it to the container, tag to indicate the defect and return it to a naval ammunition or mine depot.

(3) If the fuze is serviceable, make the desired depth setting. (See par. 5b.)

(4) Remove the safety rod from the fuze body.

(5) Screw the fuze in the bomb by hand, first making sure that the gasket, between the fuze body and adapter booster is properly in place. Tighten securely with a spanner wrench. A watertight seat is necessary to prevent seepage of water past the gasket with consequent malfunctioning of the fuze. Do not use grease or sealing compounds on the gasket or seat, since contact with the explosive components causes the components to deteriorate.

(6) Attach the arming wire bracket, furnished with the bomb, so that it will be in a vertical position when the bomb is placed in the rack.

(7) Thread the long end of the arming wire through the suspension lug of the bomb and through the bracket and the arming wire tube. Adjust the arming wire so that it extends 3 to 4 inches beyond the bracket, ensuring that the end of the wire is free of burrs.

(8) Slip two safety clips (Fahnestock connectors) over the end of the arming wire until the first one just touches the bracket.

(9) Remove the safety cotter pin.

Should it become necessary to remove fuze from the bomb, carry out the above steps in the reverse order, making sure that the cotter pin is replaced. Repack and reseal in the fuze container.

(b) ***Changing the depth setting*** — Set for the desired depth before installation in the bomb, though the setting can be changed after installation. To make a depth setting change:

(1) Remove the cotter pin from the depth setting rod and withdraw the rod from the setting knob and lock.

(2) Turn the setting knob so that the desired depth setting is adjacent to the lock.

(3) Insert the depth setting rod through the appropriate hole in the setting knob and through the slot in the lock. Replace the cotter pin in the depth setting rod. A different depth setting device was provided in the earlier models of the fuze. In those models to change the depth settings:

(4) Unscrew the lock handle.

(5) Rotate the setting handle until the long end of the handle lines up with the desired depth.

(6) Retighten the lock handle.

(c) ***Points to check*** — The following points should be checked during installation of the fuze in the bomb:

(1) That the seat liner of the bomb is free of foreign matter.

(2) That no grease or sealing compound is used on the seat or gasket.

(3) That the gasket between fuze and fuze seat is in place.

(4) That the fuze is securely tightened so that the installation is watertight.

(5) That the fuze is set for the desired depth functioning.

(6) That the arming wire is properly installed.

(7) That the safety cotter pin locking the vane shaft has been removed.

The use of three safety clips is recommended when this fuze is used with the mark 35 bomb rack.

6. SERVICING:

(a) ***Use of lubricants***—The use of lubricants and preservatives of any kind is not permitted, unless, after the fuze has been exposed to the weather, the arming vane does not turn freely, or there is evidence of corrosion. In these cases remove the arming vane, place a few drops of light machine oil between the vane shaft and bushing, rotate the vane shaft back and forth about a half turn a few times and replace the arming vane and cotter pin. When rotating the vane shaft back and forth, be careful not to prearm the fuze. The use of oil on the shaft may increase the air travel required to arm, at low temperatures. For this reason only a few drops of a very light oil (clock or watch oil) should be used. The gears, vane shaft, and threads on the arming shaft and cap hub are brushed lightly with dry powdered graphite by the manufacturer at assembly. This acts as a lubricant. No other lubricant should be used unless corrosion has taken place.

(b) ***Fuzes exposed to weather***—Fuzes which have been exposed to the weather should be examined and oiled, if necessary, as described in par. 6a.

(c) ***Reports of Malfunctionings***—Reports of malfunctionings and difficulties encountered with the fuze should be reported to the Bureau of Ordnance. The report should contain the lot number of the fuze, the lot number, if any, of the other ammunition components, a detailed description of the conditions, the previous history and any other pertinent information.

(d) ***Disassembly***—The only authorized disassembly operation is the removal of the delay arming mechanism sub-assembly. To remove this mechanism, perform these operations in the following order:

(1) Insert the safety rod if it has been removed.

(2) Remove the screws which secure the arming mechanism housing to the body sleeve and remove the delay arming sub-assembly.

(3) Unscrew the detent retaining cup from the arming shaft.

(4) Remove the screws which secure the arming mechanism housing to the gear carrier support. Then remove the gear carrier support by pulling on the arming shaft.

(5) Inspect the gears for binding or corrosion. If necessary use a few drops of a very light machine oil (watch or clock oil).

(e) ***Assembly***—To assemble perform the following operation in the following order:

(1) Assemble the arming detent springs and arming detents.

(2) Depress the arming detents, and assemble the detent retaining cup over the arming detents and detent carrier.

(3) Assemble the gear assembly to the arming mechanism housing, and secure the four screws and lock washers. Insert the cotter pin through the bushing and arming vane.

(4) Assemble the delay arming sub-assembly by rotating the entire assembly (to thread the arming shaft into the cup hub) until the arming mechanism housing seats on the body sleeve. Then secure with four screws and lock washers.

(5) Remove the safety cotter pin and turn the arming vane counter-clockwise (facing the arming vane) as war as it will go without forcing. Turn clockwise about 6 turns, and replace the cotter pin.

7. PACKING AND MARKING:

(a) ***Fuze container***—One fuze is packed in a cylindrical metal container of five and eleven-sixteenths inches maximum diameter and 17."00 maximum length. The weight of the fuze and container is 13.35 lbs. The container is sealed, and is opened by a scored tear strip. The container is marked.

ONE HYDROSTATIC BOMB FUZE MK 229 U.S.N.
LOT NO. YEAR OF MANUFACTURE
NAME OF MANUFACTURER
INSPECTOR

(b) ***Fuze container crate***—Four fuzes in containers are packed in one metal fuze container crate approximately 11."56 x 17."50 high. The weight of the crate including the fuzes is 60 lbs. The top of the crate is marked:

HYDROSTATIC BOMB FUZES MK 229
LOT NO. NAME OF MANUFACTURER
YEAR OF MANUFACTURE
CONTRACT NO. INSPECTOR'S INITIALS
NET WEIGHT LBS. GROSS WEIGHT LBS.

PART I—Chapter 7 (RESTRICTED)

Fuze, Bomb, Tail AN-Mk 230 (Formerly AN-Mk. 30)

CONTENTS

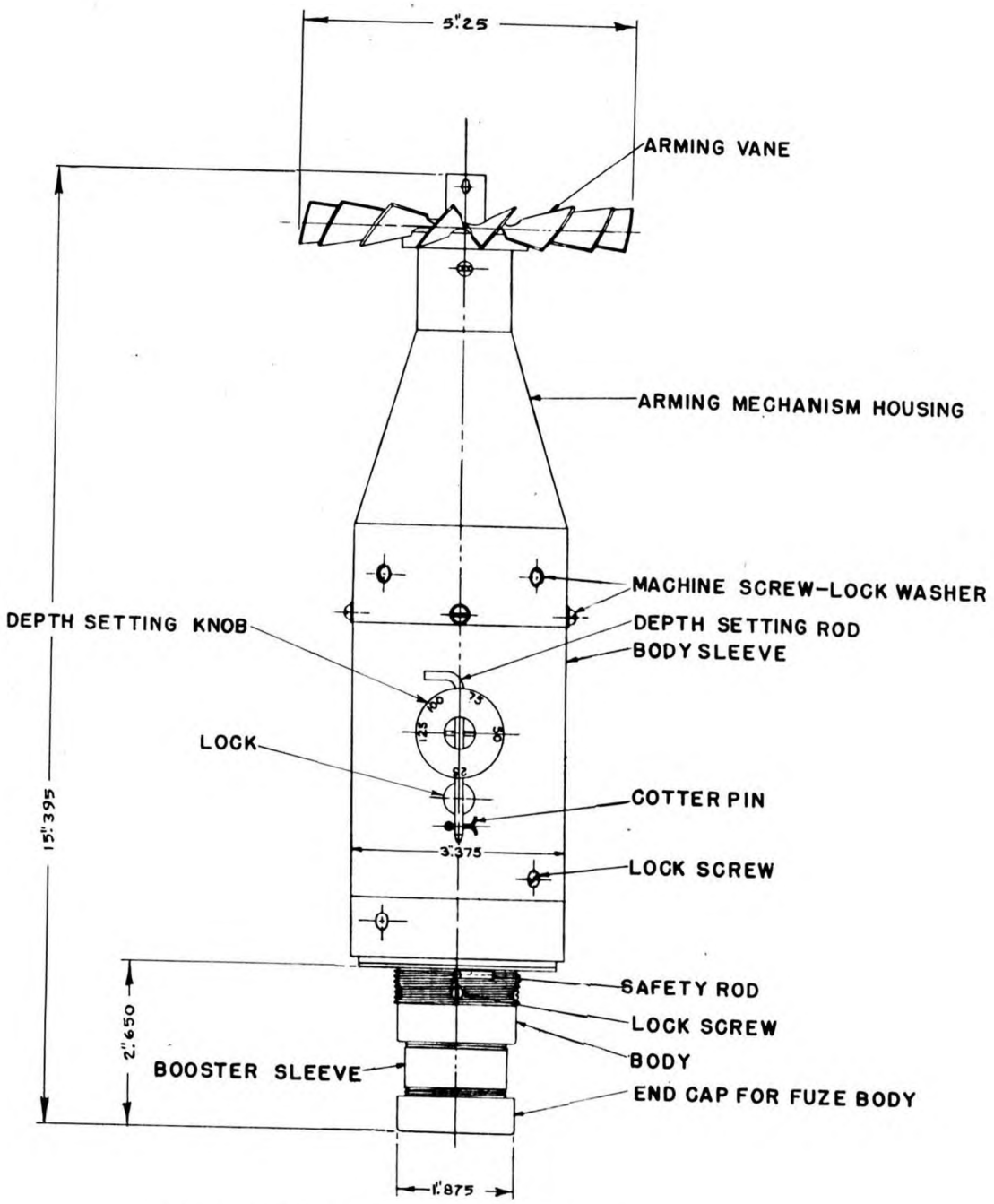


FIG.1-29-OUTLINE OF AN-MK.230 BOMB FUZE

1. DESCRIPTION:

(a) ***General***—The AN-Mk 230 tail bomb fuze is a hydrostatic fuze for use primarily in attacks upon submarines. It is identical to the AN-MK 30 fuze and was formerly so designated. It functions in response to hydrostatic pressure at predetermined depth settings of 25, 50, 75, 100 or 125 feet. Changes in depth setting are made by an external depth setting knob without disassembly of the fuze. This fuze is of the arming vane type and has mechanical delay arming. It is safe for dive bombing and for takeoffs and landings anywhere including the decks of carriers; however, particular attention should be taken that the arming system of the bomb rack is kept on "safe" during takeoffs and landings over water. The general arrangement is shown on Bureau of Ordnance Drawing No. 344435. Figure 1-29 shows the outline and principal dimensions of the fuze. Figures 1-30 and 1-31 show the general arrangement in the unarmed and armed positions respectively and the names of the various parts.

The AN-Mk 230 fuze is similar to the Mk 229 except for the dimensions of the fuze body. The length of that part of the fuze body which fits into the bomb is approximately 1.″3 shorter for the AN-Mk 230 than for the Mk 229; however the diameter and thread are the same. The AN-Mk 230 fits into the Army M115 adaptor-booster.

(b) ***Bombs in which used***—This fuze is used in the following Army-Navy Standard bombs:

AN-M64 500 lb. General Purpose Bomb
AN-M65 1000 lb. General Purpose Bomb
AN-M66 2000 lb. General Purpose Bomb

Although the AN-Mk 230 fuze fits into the bombs in which the Mk 229 is used, it cannot be used with these bombs because the fuze body does not extend far enough into the fuze seat liner. The auxiliary booster used in these bombs is approximately 1.3 inches too short to take up all of the space between the bottom of the fuze and the fuze seat liner.

(c) ***Mechanical delay arming***—Delay arming is obtained by interposing a reduction gear train between the arming vane and the arming shaft, to reduce the rotation of the arming shaft to one turn for 23 revolutions of the arming vane. Rotation of the arming shaft, raises the detent retaining cap thereby allowing the arming detents to jump out and unlock the functioning mechanism. Approximately 110 turns of the arming vane are required to arm the fuze.

(d) ***Functioning mechanism***—The hydrostatic piston, piston ring, counter-weight rack, depth spring stem, and depth spring stem nut move as a single unit. The open ends of the hydrostatic bellows are secured to the hydrostatic piston ring and the depth setting mechanism housing respectively, and the assembly is tested for water tightness. When the fuze becomes armed, the arming detents are disengaged from the groove in the depth spring stem nut and the hydrostatic piston assembly is free to be acted upon by hydrostatic pressure. When the fuze is submerged, water enters through two ports in the body sleeve and holes in the depth setting mechanism housing. Hydrostatic pressure extends the bellows and forces the hydrostatic piston downward, compressing the firing spring and the depth spring as it moves. The firing plunger contains the detonator and lead-out charges and is locked to the plunger housing by six balls. After the hydrostatic piston has moved downwards about three-eighths inch (this distance is the same for all depth settings), the balls locking the firing plunger jump out into the annular recess in the hydrostatic piston and the compressed firing spring forces the plunger into the firing point thereby simultaneously aligning the explosive trains and initiating successively the detonator, lead-out charges, lead-in charges, relay pellets and booster charge. The hydrostatic piston assembly is counterbalanced by two inertia counterbalances to prevent firing of the fuze upon impact with the surface of the water.

(e) ***Depth setting mechanism*** — The firing spring and the depth spring are compressed as the hydrostatic piston assembly moves downward. By increasing the amount the depth spring must be compressed, more pressure (and consequently greater depths) are necessary to cause the hydrostatic piston to move the distance required to operate the fuze. The distance the hydrostatic piston moves is the same for all depth settings.

The depth setting sleeve slides in the depth setting mechanism housing. The depth setting cam has five surfaces (one for each depth setting) each of which locates the setting sleeve in a different definite position with respect to the mechanism housing, thereby causing the depth spring to be compressed slightly for the 25 foot setting and increasing amounts for the greater depth settings. The depth setting cam is set by an external depth setting knob. The figure on the depth setting knob closest to the lock is the depth for which the fuze is set.

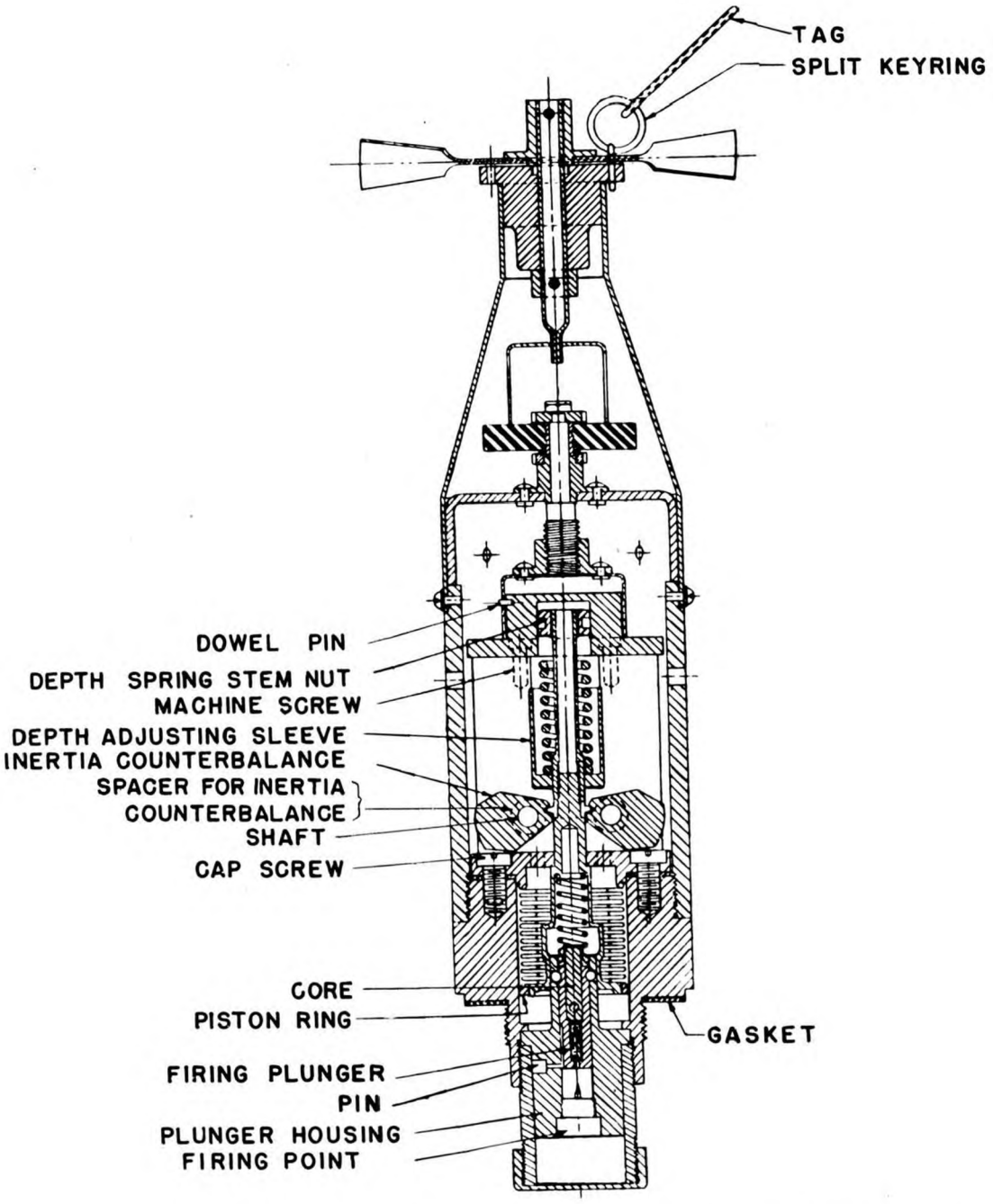


FIG. 1-30 — ASSEMBLY OF AN-MK. 230 BOMB FUZE, UNARMED POSITION.

(f) ***Explosive components*** — The explosive components consist of the detonator, lead-out charges, lead-in charges, relay pellets and booster charge. The detonator and lead-out charges are in the firing plunger. The booster charge, relay pellets and lead-in charges consist of approximately 25.5 grams (0.9 oz.) of tetryl.

2. FUNCTIONING:

(a) ***Released armed***—When the bomb is released armed, the arming wire is withdrawn from the fuze thereby allowing the air stream to turn the arming vane. The rotating arming vane, acting through the reduction gearing, turns the arming shaft thereby withdrawing the detent retaining cup from the detent carrier and releasing the two arming detents. The fuze is now armed. The inertia counterbalances prevent the fuze from functioning on impact of the bomb with the surface of the water. After the bomb has submerged, water enters the fuze through two ports in the body sleeve. Hydrostatic pressure fires the fuze at the predetermined depth setting.

(b) ***Air travel required to arm*** — The air travel along the trajectory necessary to arm this fuze is 400 to 500 feet. The minimum altitudes of release to insure arming this fuze for various air speeds in horizontal bombing are:

Air speed—knots	100	150	200	250
Alt. of release—feet	130	60	35	20

The above values for the minimum altitudes of release should not be confused with the minimum *safe* altitudes of release which depend upon other factors and not upon the air travel required to arm. The minimum *safe* altitudes of release are determined by Cominch.

Partial prearming of the fuze to insure arming at low altitudes of release is not recommended. No visual means exist to show at a glance whether or not the fuze is partially armed. If partial prearming is allowed, instances will undoubtedly arise of successive individuals turning the arming vane until the air arming feature becomes entirely unreliable. Experience has shown that this cannot be prevented by tagging or painting such fuzes.

(c) ***Estimating depth of functioning*** — The depth of functioning can be estimated from observation of the surface phenomena and noting the time between slick and upheaval. This data is independent upon the size of the bomb.

(d) ***Released safe***—If the bomb is released safe the arming wire is released from the arming mechanism of the bomb rack and drops with the bomb thereby preventing the fuze from arming. Being unarmed, the fuze will not function after it enters the water, nor will it function on impact with a hard surface.

3. SAFETY FEATURES:

(a) ***Detonator safety***—This fuze is detonator safe. In the unarmed or safe position, the detonator and lead-out charges are not aligned with the lead-in charges. If the detonator should function prematurely, the force of the detonation is dissipated in the cavity between the plunger housing and hydrostatic piston.

(b) ***Installed in a bomb***—When the fuze is installed in a bomb which is placed in the bomb rack of an airplane with the arming wire in place, the fuze is in the unarmed or safe position and does not become armed until the bomb has been released "armed" from the bomb rack and has traveled the distance in the air necessary to arm the fuze. The explosive train is broken between the lead-out charges in the firing plunger and the lead-in charges in the plunger housing. The firing point is aligned with the detonator in the firing plunger which is locked to the plunger housing by six balls and is not released until hydrostatic pressure causes the fuze to function. The inertia counterbalances prevent the fuze from functioning on impact with the surface of the water.

(c) ***During shipping and stowage***—During shipping and stowage additional safety is obtained (1) by a safety rod inserted through the fuze body, plunger housing, and firing plunger, positively locking these elements together, and (2) by a cotter pin locking the arming vane to the bushing.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—There is no visual means of determining from the external appearance of the fuze whether or not it is armed. Partially armed fuzes can be completely unarmed by turning the arming vane backwards. Completely armed fuzes cannot be unarmed by turning the vane backwards but must be disassembled.

(b) ***Handling***—The functioning mechanism is so counterbalanced that even if the fuze is fully armed, it will not fire from handling or the shock on dropping, but it will fire when fluid pressure (air or water) is applied to the fuze through the two ports in the body sleeve. Armed fuzes may

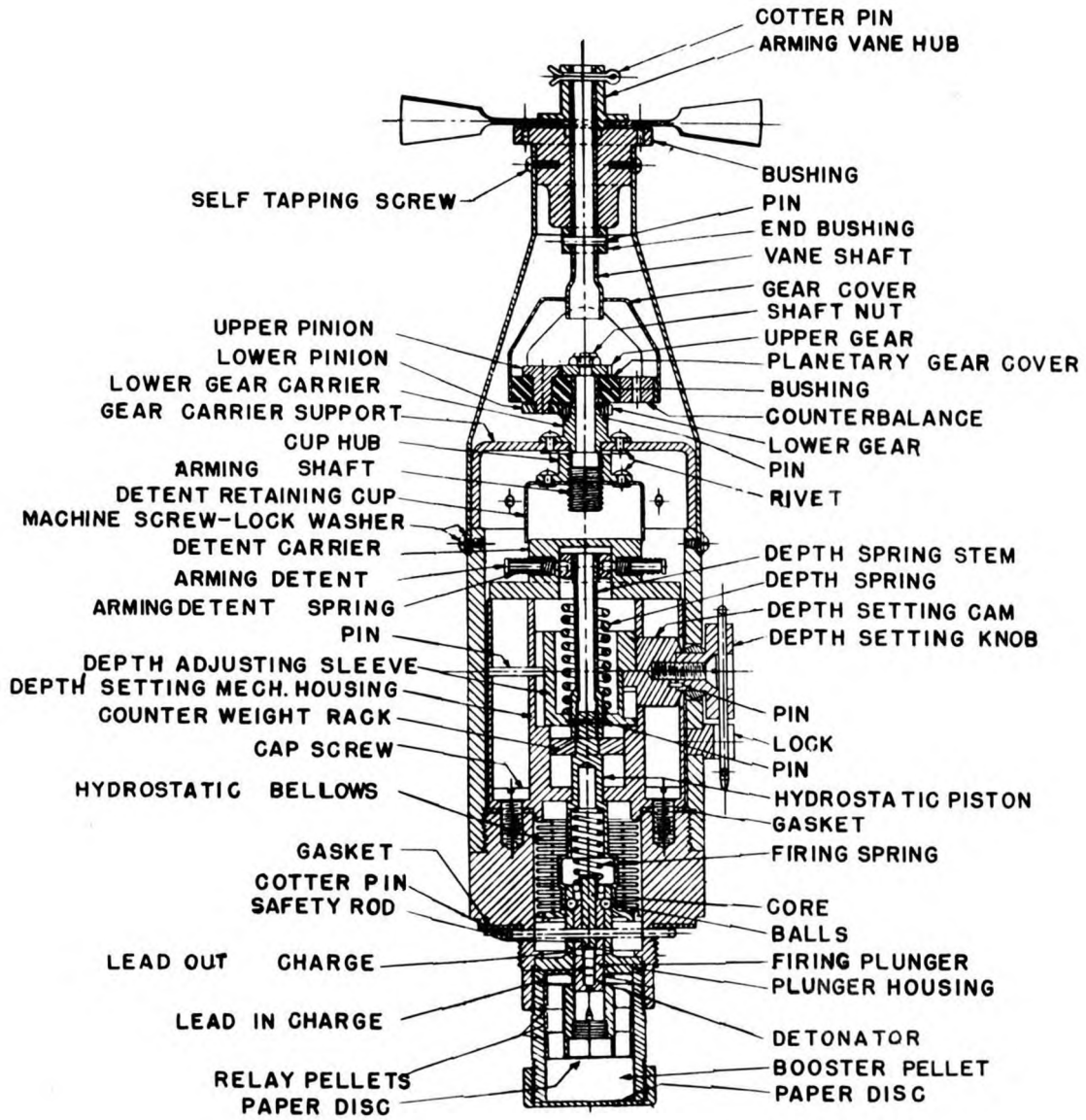


FIG.I-31- ASSEMBLY OF AN-MK. 230 BOMB FUZE, ARMED POSITION.

safely be removed from a loaded bomb; however the safety rod locking the firing plunger to the plunger housing should be inserted as soon as possible.

(c) ***Salvaging***—Fuzes which are armed or partially armed should be disassembled and reassembled according to the instructions in paragraphs 6d and 6e.

5. INSTALLATION:

(a) ***Instructions***—To install the fuze in a bomb perform the following operations in the order indicated:

(1) Unscrew the shipping plug and fuze adapter from the M115 adapter-booster in the tail of the bomb. Inspect adapter-booster and threads. Clean, if necessary using a wood stick.

(2) Remove the fuze from the sealed metal container.

(3) Set fuze for the desired depth. See paragraph 5b.

(4) Remove safety rod from fuze body.

(5) Screw the fuze into the adapter-booster after making sure that the gasket between the fuze body and adapter booster is properly in place. Tighten the fuze with a spanner wrench. A watertight seat is necessary to prevent seepage of water past the gasket and consequent malfunctioning of the fuze. Do not use grease or sealing compounds on the gasket and seat because of their proximity to the explosive components. Excess grease reaching the detonator will cause it to deteriorate.

(6) Thread the longer end of the arming wire assembly through the rear suspension lug of the bomb and the nearest pair of holes in the bushing and arming vane. Should the safety cotter pin occupy these holes, place a second cotter pin through another pair of holes before removing the original cotter pin. The shorter end of the arming wire assembly is for the nose fuze and should be cut off when no nose fuze is used.

(7) Adjust arming wire to protrude beyond arming vane from 4 to 6 inches.

(8) Slip two safety clips (Fahnestock connectors) over the end of the arming wire until the first clip just touches the face of the vane. The fuze is now completely assembled in the bomb.

(9) Remove safety cotter pin after bomb has been placed in dropping gear of airplane.

Should it be necessary to remove the fuze from the bomb, carry out the above steps in the reverse order. Inspect the fuze and repack and reseal in fuze container.

(b) ***Changing depth setting***—The fuze should be set for the desired depth setting before installation in the bomb but the setting can be changed after the fuze has been installed in the bomb. To change the depth setting of the fuze:

(1) Remove the cotter pin from the depth setting rod and withdraw the rod from the depth setting knob.

(2) Turn the depth setting knob so that the desired depth setting is opposite the lock. The fuze shown on Figure 7-1 is set to function at 25 feet.

(3) Insert the depth setting rod through the appropriate hole in the depth setting knob and through the slot in the lock. Replace the cotter pin in the depth setting rod.

(c) ***Points to check*** — The following points should be checked during installation of the fuze in the bomb:

(1) That the gasket between the fuze body and adapter-booster is in place.

(2) That no grease has been used on the gasket.

(3) That the fuze is securely tightened, and

(4) That the fuze is set to function at the desired depth.

After the bomb has been placed in the dropping gear of the airplane, the following points should be checked before takeoff:

(1) That the arming wire is properly installed.

(2) That the safety cotter pin locking the arming vane has been removed.

6. SERVICING:

(a) ***Use of lubricants***—The use of lubricants and preservatives of any kind is not allowed unless, after the fuze has been exposed to the weather, the arming vane does not turn freely or there are evidences of corrosion. In this case remove the arming vane, place a few drops of light machine oil between the vane shaft and bushing, rotate the vane shaft back and forth about a half turn a few times and replace the arming vane and cotter pin. When rotating the vane shaft back and forth be careful not to prearm the fuze. The use of oil on the vane shaft may increase the air travel required to arm, especially at low temperatures. For this reason only a few drops of a very light oil (clock or watch oil), should be used.

The gears, vane shaft, and threads on the arming shaft and cup hub are brushed lightly with dry powdered graphite by the manufacturer at assembly. The graphite acts as a lubricant.

(b) ***Fuzes exposed to weather***—Fuzes which have been exposed to the weather should be examined and oiled, if necessary, as described in paragraph 6a.

(c) ***Reports of malfunctionings***—Reports of malfunctionings and troubles encountered with the fuze should be reported to the Bureau of Ordnance. The report should contain the lot number of the fuze and other ammunition components, in addition to the detailed description of the conditions, previous history, and other pertinent information relating to the ordnance material and the malfunctioning or trouble encountered.

(d) ***Disassembly***—The only authorized disassembly operation is the removal of the delay arming mechanism sub-assembly. To remove this mechanism perform the following operation in the order indicated:

(1) Insert the safety rod to lock the firing plunger to the plunger housing, if this rod has been removed.

(2) Remove machine screws holding arming mechanism housing to body sleeve and remove delay arming mechanism sub-assembly.

(3) Unscrew detent retaining cup, from arming shaft.

(4) Remove machine screws holding arming mechanism housing to gear carrier support. Remove gear carrier support by pulling on arming shaft.

(5) Inspect gears for binding and corrosion. Oil, if necessary, using a few drops of a very light machine oil (watch or clock oil).

(e) ***Reassembly***—To reassemble perform the following operations in the order indicated:

(1) Assemble arming detent springs and arming detents.

(2) Depress arming detents with fingers and assemble detent retaining cup over arming detents and detent carrier.

(3) Assemble gear carrier support and reduction gearing assembly to arming mechanism housing and secure with the four machine screws and lock washers. Insert cotter pin through bushing and arming vane.

(4) Assembler delay arming sub-assembly by rotating entire assembly (to screw arming shaft into cup hub) until arming mechanism housing seats on body sleeve. Assemble the four machine screws and lock washers.

(5) Remove safety cotter pin and screw the arming vane counterclockwise (facing arming vane) as far as it will go without forcing. Turn forward about 6 turns and reinsert safety cotter pin.

(6) Repack fuze in fuze container and seal with adhesive tape until it is again required.

7. PACKING AND MARKING:

(a) ***Fuze container***—One fuze is packed in a cylindrical metal container five and eleven-sixteenths inches maximum diameter and 16.05″ maximum length. The weight of the fuze and container is 17.0 lb. The container is sealed, and is opened by a scored tear strip. The container is marked:

ONE HYDROSTATIC BOMB FUZE ANMK 230 U.S.N.
LOT NO. YEAR OF MANUFACTURE
NAME OF MANUFACTURER
INSPECTOR

(b) ***Fuze container crate***—Four fuzes in fuze containers are packed in a metal fuze container crate approximately 11.56″ x 11.56″ x 16.54″ high. The weight of the crate including the fuzes is approximately 74.5 lb. The top of the crate is marked:

4 HYDROSTATIC BOMB FUZES AN-MARK 230
LOT NO. NAME OF MANUFACTURER
YEAR OF MANUFACTURE
CONTRACT NO. INSPECTOR'S INITIALS
NET WEIGHT LBS. GROSS WEIGHT LBS.

RESTRICTED

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

To all holders of Ordnance Pamphlet 988
Insert change; write on cover "Change 3 entered"
Approved by The Chief of The Bureau of Ordnance

Acting Chief of Bureau

OP 988 CHANGE 3

8 August 1944

BOMB FUZES

ORDNANCE PAMPHLET 988 is changed as follows:
1. Add the following pages: 78a, 78b, 78c, and 78d.

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*Applicable Addressees.

605030—44

1. The information within this CHANGE is for the guidance of all personnel concerned with tactical use and flight preparation of bombs fuzed with Tail Hydrostatic Fuze AN–Mark 230 Mod 4.

2. DESCRIPTION.

(a) ***General***—The Tail Hydrostatic Fuze AN–Mark 230 Mod 4 is similar to the AN–Mark 230 of previous Mods, with the exception that the fuze is sealed to prevent water entrance at any point other than the regular water ports, and the arming mechanism which frees the detent jump-out pins operates by rotation rather than by vertical raising of the detent retaining cup. This modification prevents arming of the fuze in case the tail cone or arming mechanism housing becomes knocked off the fuze accidentally or upon water entry, and also prevents the fuze from firing from hydrodynamic pressures which are encountered in erratic movement of the bomb through the water or on reentry after ricochet. Figures 1–32, 1–33, and 1–34 show the changes which have been made to the various parts. The AN–Mark 230 Mod 4 will also have a slight oval undercut above the fuze pocket threads to accommodate the new oval neoprene washer which has replaced the flat gasket formerly used.

(b) ***Bombs in Which Used***—This fuze is used in the following bombs:

500-lb.—General-purpose Bombs AN–M64
1,000-lb.—General-purpose Bombs AN–M65
2,000-lb.—General-purpose Bombs AN–M66
325-lb.—Depth Bomb (TNT-loaded) Mk 53
350-lb.—Depth Bomb (Torpex-loaded) Mk 54

Although the Fuze AN–Mark 230 Mod 4 fits in the bombs in which the Fuze Mark 229 is used, it cannot be used with these bombs unless a special auxiliary booster approximately 1″.3 long is used to take up the space between the bottom of the fuze and the fuze seat liner. Such a booster is not standard as a Navy production item.

(c) ***Mechanical Delay Arming***—Delay arming is obtained by interposing a reduction gear train between the arming vane and the arming shaft to reduce the rotation of the arming shaft to 1 to 23 revolutions of the arming vane. Rotation of the arming shaft causes the arming nut assembly to rise, raising the pins clear of the detent carrier body. When the pins are fully clear of the body, further rotation of the arming shaft causes the detent retaining cup to rotate until the apertures align themselves opposite the detents, allowing the detents to jump out, freeing the depth spring stem nut. The detents are prevented from jumping completely out of their holes by detent retaining pins which are fitted into the detect carrier body. A metal strap passes over the detent retaining cup, preventing the removal of the cup from the detent carrier; thus if the arming mechanism housing is broken free without rotation of the arming vanes, the fuze will not become armed.

(d) ***Mechanism***—The functioning mechanism of this fuze is exactly the same as for the AN–Mark 230 of previous Mods.

(e) ***Depth Setting Mechanism***—The depth setting mechanism of the AN–Mark 230 Mod 4 is the same as the AN–Mark 230 of previous Mods.

(f) ***Explosive Components***—The explosive components of the AN–Mark 230 Mod 4 are the same as the AN–Mark 230 of previous Mods.

3. FUNCTIONING.

(a) ***Release to Arm***—When the bomb is released to arm, the arming wire is withdrawn from the fuze, allowing the air stream to turn the arming vane. The rotating arming vane acting through the reduction gear turns the arming shaft, thereby rotating and causing the arming nut assembly to rise, and raising the rotating pins clear of the detent carrier body. When the pins are fully clear of the body, further rotation of the arming shaft causes the detent retaining cup to rotate until the apertures align themselves opposite the detents, allowing the detents to jump out, freeing the depth spring stem nut. At this point the fuze is completely armed. The inertia counterbalances prevent the fuze from functioning on impact of the bomb with the surface of the water. After the bomb has submerged water enters the fuze through two water ports in the body sleeve. Hydrostatic pressure fires the fuze at 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.

(b) ***Air Travel Required to Arm***—Air travel along the trajectory necessary to arm this fuze is 300′–400′. The vertical fall of the bomb to insure

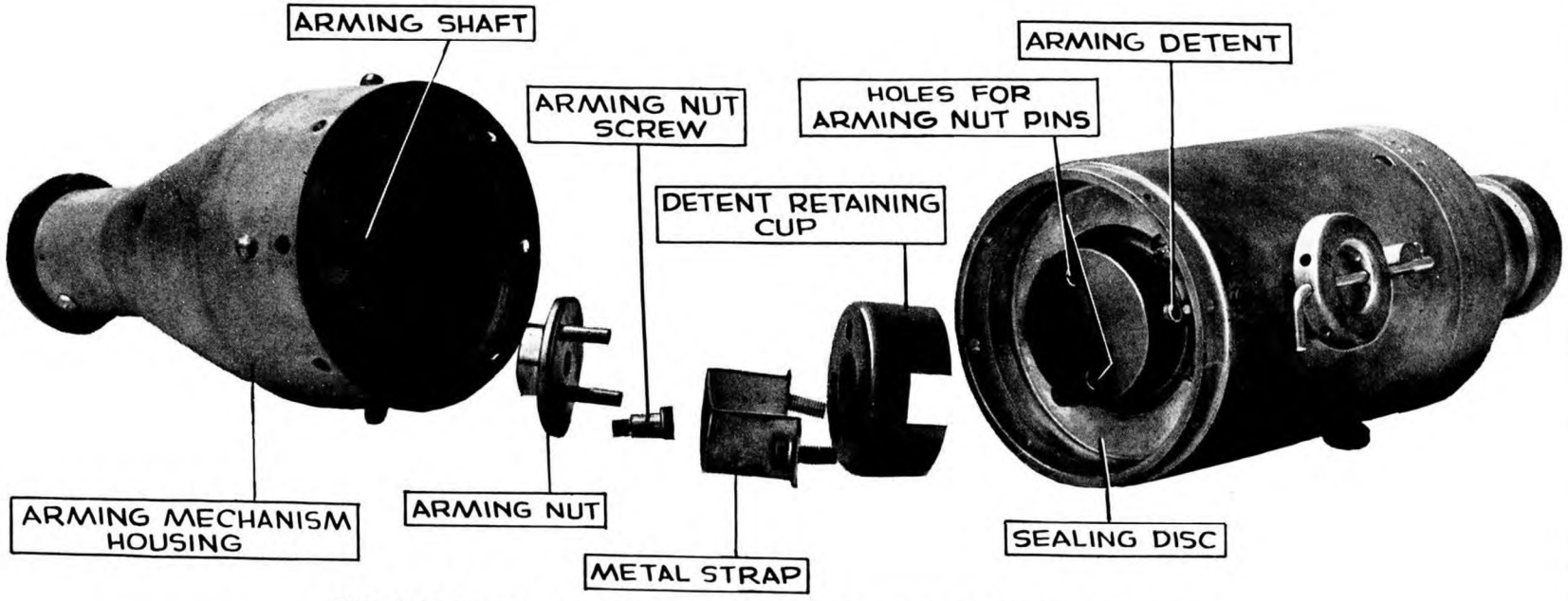

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FIG. 1-32 AN-MK 230 MOD 4. SHOWING MODIFIED ARMING MECHANISM.

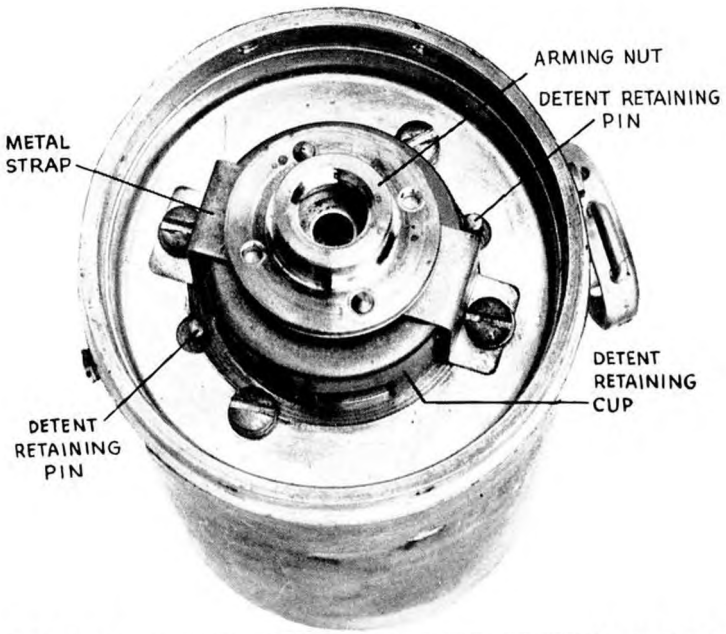

FIG. 1–33 AN–MK 230 MOD 4. UNARMED POSITION, ARMING NUT FLUSH WITH METAL STRAP. NOTE POSITION OF CUT-AWAY FOR ARMING DETENTS.

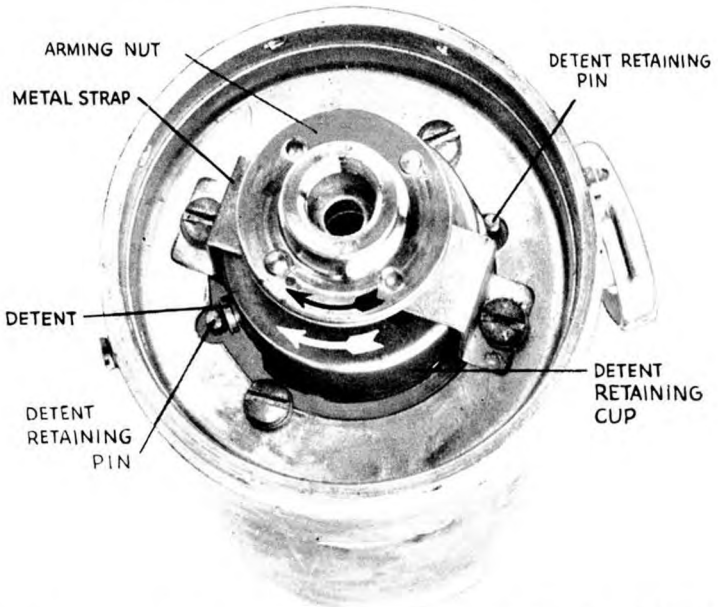

FIG. 1–34 AN–MK 230 MOD 4. ARMED POSITION, ARMING NUT HAS RAISED AND PINS IN ARMING NUT HAVE TURNED DETENT RETAINING CUP 85° TO ALLOW ARMING DETENTS TO JUMP OUT

arming this fuze at various air speeds in horizontal bombing is as follows:

Air speed—knots....	100	150	200	250
Vertical fall—feet....	130	60	35	20

The above values for the vertical fall of the bomb to arm the fuze should not be confused with the minimum safe altitudes of release, which depend upon other factors and not upon the air travel required to arm. The minimum safe altitudes of release are established by CominCh.

4. SAFETY FEATURES—The AN-Mark 230 Mod 4 possesses all of the safety features of the AN-Mark 230 of previous Mods, in addition to the antiaccidental arming device and the water sealing cup.

5. ARMED AND PARTIALLY ARMED FUZES—Handling Precautions which apply to the AN-Mark 230 of previous Mods also apply to AN-Mark 230 Mod. 4.

6. INSTALLATION AND SERVICING INSTRUCTIONS—Installation and servicing instructions for the AN-Mark 230 Mod 4 are the same as for the AN-Mark 230 of previous Mods.

7. PACKING AND MARKING.

(a) ***Fuze Container***—One fuze is packed in a cylindrical metal container $5\frac{1}{16}$" maximum diameter and 16.05" maximum length. The weight of the fuze and container is 17.0 lbs. The container is sealed, and is opened by a scored tear strip. The container is marked:

ONE HYDROSTATIC BOMB FUZE AN-MARK 230 MOD 4 U. S. N.

LOT NO. YEAR OF MANUFACTURE

NAME OF MANUFACTURER

INSPECTOR

(b) ***Fuze Container Crate***—Four fuzes in fuze containers are packed in a metal fuze container crate approximately 11.56" x 11.56" x 16.54" high. The weight of the crate, including the fuzes, is approximately 74.5 lbs. The top of the crate is marked:

4 HYDROSTATIC BOMB FUZES AN-MARK 230 MOD 4

LOT NO. NAME OF MANUFACTURER

YEAR OF MANUFACTURE

INSPECTOR'S INITIALS

NET WEIGHT LBS.

CONTRACT NO. GROSS WEIGHT LBS.

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OP 988 CHANGE 6

14 September 1944

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BOMB NOSE FUZE MARK 243

ILLUSTRATIONS:

1. This CHANGE describes the tactical use and flight preparation of bombs fuzed with Bomb Nose Fuze Mark 243.

2. General. - Bomb Nose Fuze Mark 243 is for use in all AN standard and Navy type general purpose bombs. It has been designed to give water discriminating action when used against marine targets. In the case of direct hits upon 1/4" or thicker steel plate, nose fuze action is initiated and the bomb is detonated with a delay of .025 second. In the case of water impact, no nose fuze action is obtained and detonation of the bomb is controlled by a tail fuze of longer delay or hydrostatic type. This affords maximum effect in allowing near misses to detonate with mining action well below the surface of the water. Arming is accomplished by rotation of the arming vanes, which removes the arming screw and allows the arming stem to become clear of the detonator slider which then is aligned beneath the delay element by spring action. Approximately 450 feet of air travel is required to arm the fuze. The principle of operation of the fuze is that impacts upon the striker must be sufficiently severe to shear three brass threads and allow the striker to impact the firing pin of the delay element. Drops from 15,000' onto water have not resulted in fuze action.

3. Bomb Fuze Mark 243 is prepared for use as follows:

(a) Remove fuze from sealed shipping container and examine for any obvious physical defects such as damage to threads or dented fuze parts.

(b) Remove safety cotter pin and revolve arming vane carrier one complete revolution in each direction, in order to determine that the vane carrier moves freely. Replace safety cotter pin.

(c) After examining fuze seat liner to insure that it is free and clear, screw fuze into the bomb hand tight. The use of wrenches or other tools is not dangerous, but is not considered desirable because of possible difficulty in removing the fuze if the bomb is not expended.

(d) Insert arming wire through the forward lug on the bomb and pass it through the hole in the vane carrier and the striker flange. Cut arming wire so that approximately 3" extends beyond the fuze. Place two (2) Fahnestock clips over the arming wire and push them up snugly against the vane cup. Remove safety cotter pin.

Disassembly. - If the bomb is not dropped, the fuze may be removed and returned to stowage, following the above steps in reverse order. Any fuze so removed must be sealed tightly in its original container to prevent deterioration from moisture.

4. Functioning:

(a) Upon withdrawal of the arming wire, the vanes and the vane cup rotate. The pinion gear runs around both the upper and lower gears. As the gear assembly turns, the arming screw moves up and the arming stem rises accordingly under pressure of the arming stem spring. After 130 turns of the vanes, requiring approximately 400-500' of air travel, the fuze is fully armed. That is, the arming vanes fall free of the fuze, the arming stem has moved out of its cavity in the detonator slider, permitting the detonator to become aligned below the delay element. The detonator slider is then locked in place by a spring-loaded detent, and the slider locking pin.

(b) Upon impact with water from altitudes of 15,000' or below, no fuze action occurs. Upon impact with 1/4" or thicker steel plate above or below the surface of the water, the striker body is forced inward, shearing the three (3) brass shear threads and the locating pin, which permits the striker to impact the firing pin of the delay element. The delay element fires the detonator after a delay of .025 second, which in turn initiates the booster lead-in and the booster.

5. Tactical Use. - The purpose of developing the water discriminating Nose Fuze Mark 243 is to provide a means for obtaining, in the same bomb, the maximum destructive effect on a ship target for either a direct hit or a near miss. In case of a direct hit, the Nose Fuze Mark 243 will function after a delay of .025 second. In case of a near-miss, a longer delay is needed for best mining effect. Since on water impact the Nose Fuze Mark 243 will be a dud, the depth of functioning of the bomb can be controlled by the tail fuze. For high angle drops, the Bomb

Tail Fuze AN-M100A2, or AN-M101A2, or AN-M102A2 fitted with 0.1 second delay primer detonator M14 is recommended for best mining action. For shallower entrance angles such as might be obtained in high speed glide bombing, the Hydrostatic Tail Fuze AN-Mark 230 with a depth setting of 25 feet is recommended for use in conjunction with the Nose Fuze Mark 243.

6. Safety Features:

(a) When the fuze is in the unarmed condition, the detonator is not aligned above the booster lead-in nor is it aligned beneath the delay element. If the delay element fires for any reason, the detonator slider will effectively prevent initiation of the booster lead-in. If the detonator, which is contained in the detonator slider, is fired inadvertently while in the unarmed condition, the forces of the explosion are vented into the hole above the detonator and no initiation of the booster lead-in occurs.

(b) If the fuze is damaged so that the vane cup and arming mechanism are broken free from the fuze, the arming screw will remain in the striker and will prevent the arming stem from rising.

(c) If the vane cup is separated from the vane cup support by a distance of 1/4" or more, the fuze must be considered armed and must be disposed of in the safest way possible.

7. Maintenance Instructions:

(a) This fuze, when assembled and loaded, is staked and pinned together so that it cannot be readily disassembled. No servicing of the fuze is required. If a fuze of this nature were disassembled, its water discriminating properties would be affected. For these reasons, no disassembly, either partial or complete, of the Bomb Nose Fuze Mark 243 is authorized. Since the reduction gears of the arming mechanism are specially treated at the time of manufacture, it is recommended that no lubricants of any kind be used on this fuze.

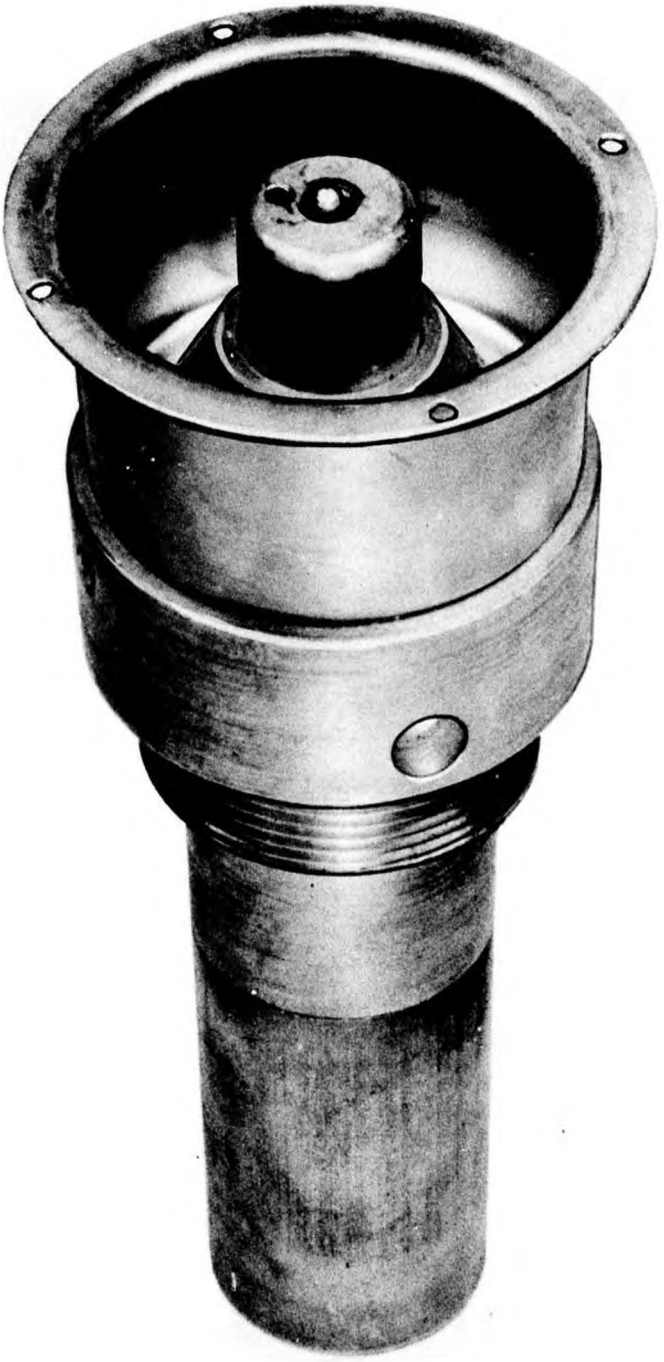
8. Packaging and Shipping. - Fuzes and arming vanes are hermetically sealed in tear-strip metal containers, fifteen containers in a wooden box 26-1/2" x 15-1/2" x 11" (app.), weighing 98 lbs. (app.).

9. On new and replacement items, initial distribution will be critical and will be made under guidance of the Chief of Naval Operations. Requests through established logistic channels should accordingly indicate the following information:

(a) Estimated quantity required for immediate important operational purposes.

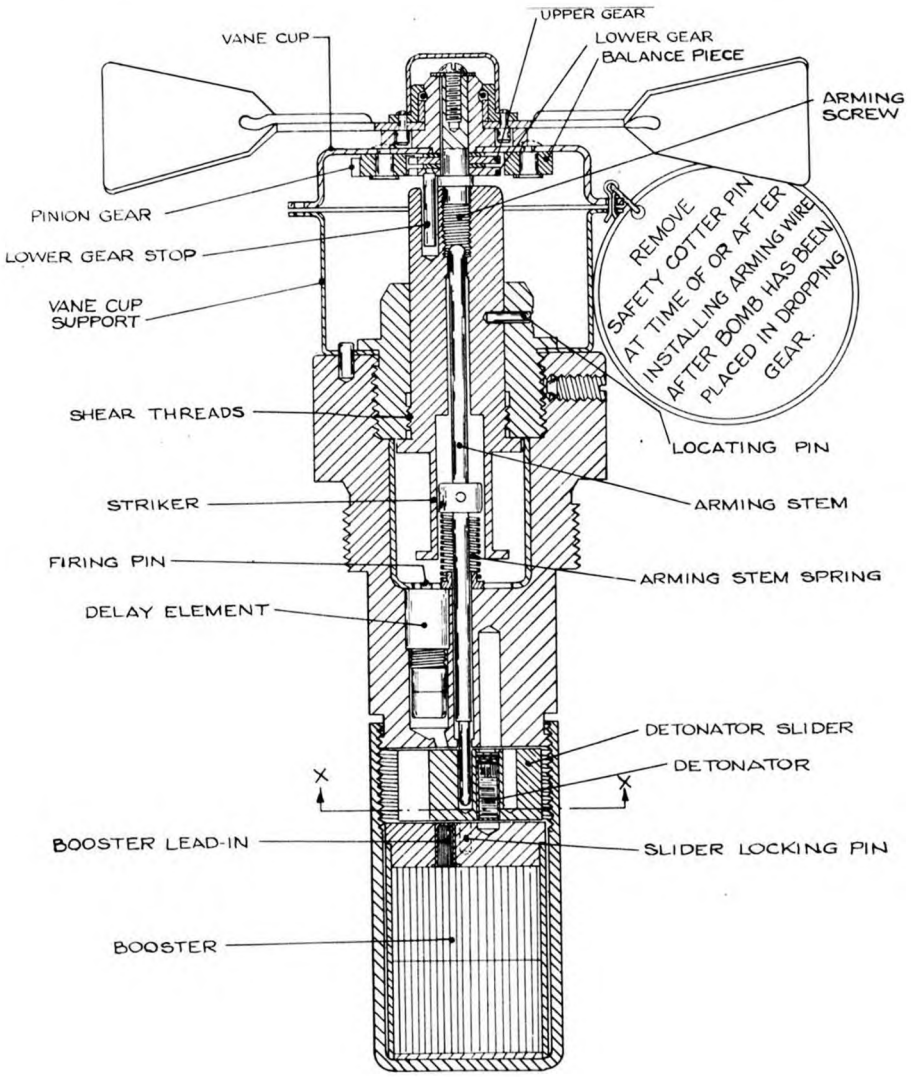
(b) Estimated quantity anticipated for expenditure or installation per month.

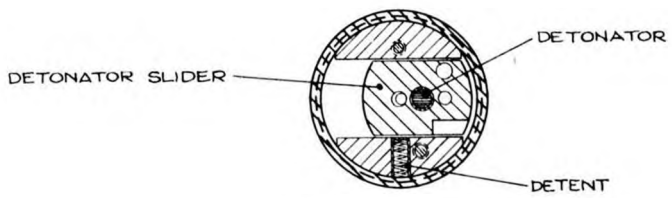
(c) Stock level considered desirable to cover contingencies.



BOMB NOSE FUZE MARK 243 (ARMED CONDITION)

BOMB NOSE FUZE MARK 243 (UNARMED CONDITION)





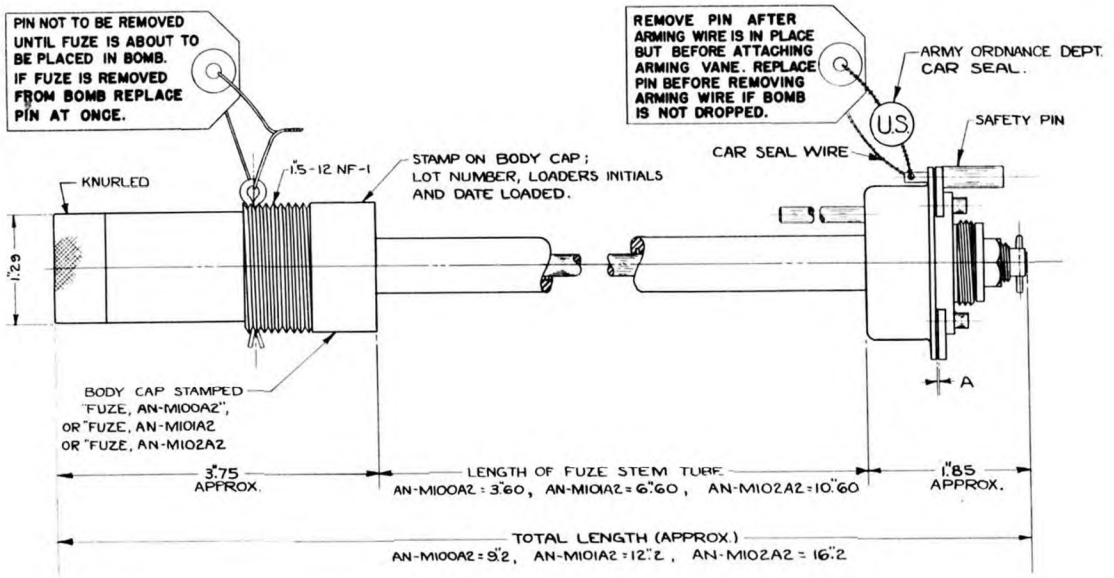
SECTION X-X

'BOMB NOSE FUZE MARK 243

PART II—Chapter 1 (RESTRICTED)

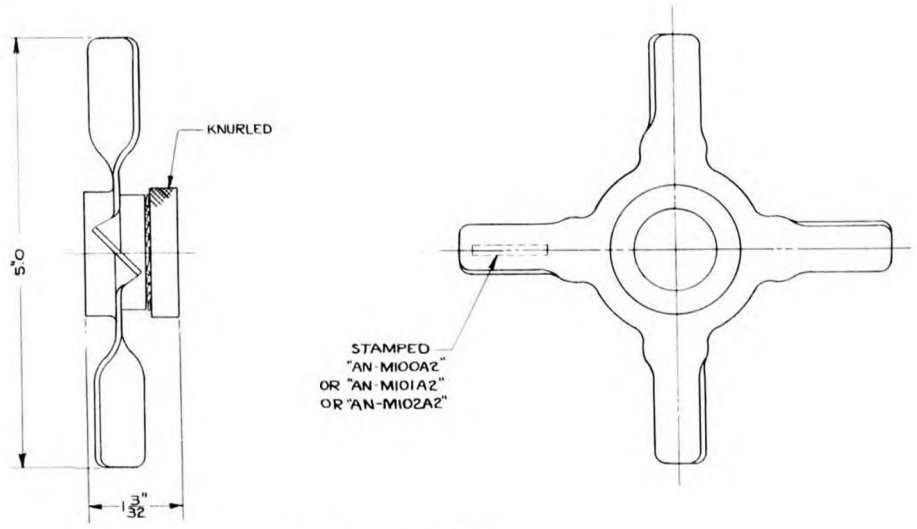
Fuzes, Bomb, Tail, AN-M100A2 AN-M101A2 And AN-M102A2

CONTENTS



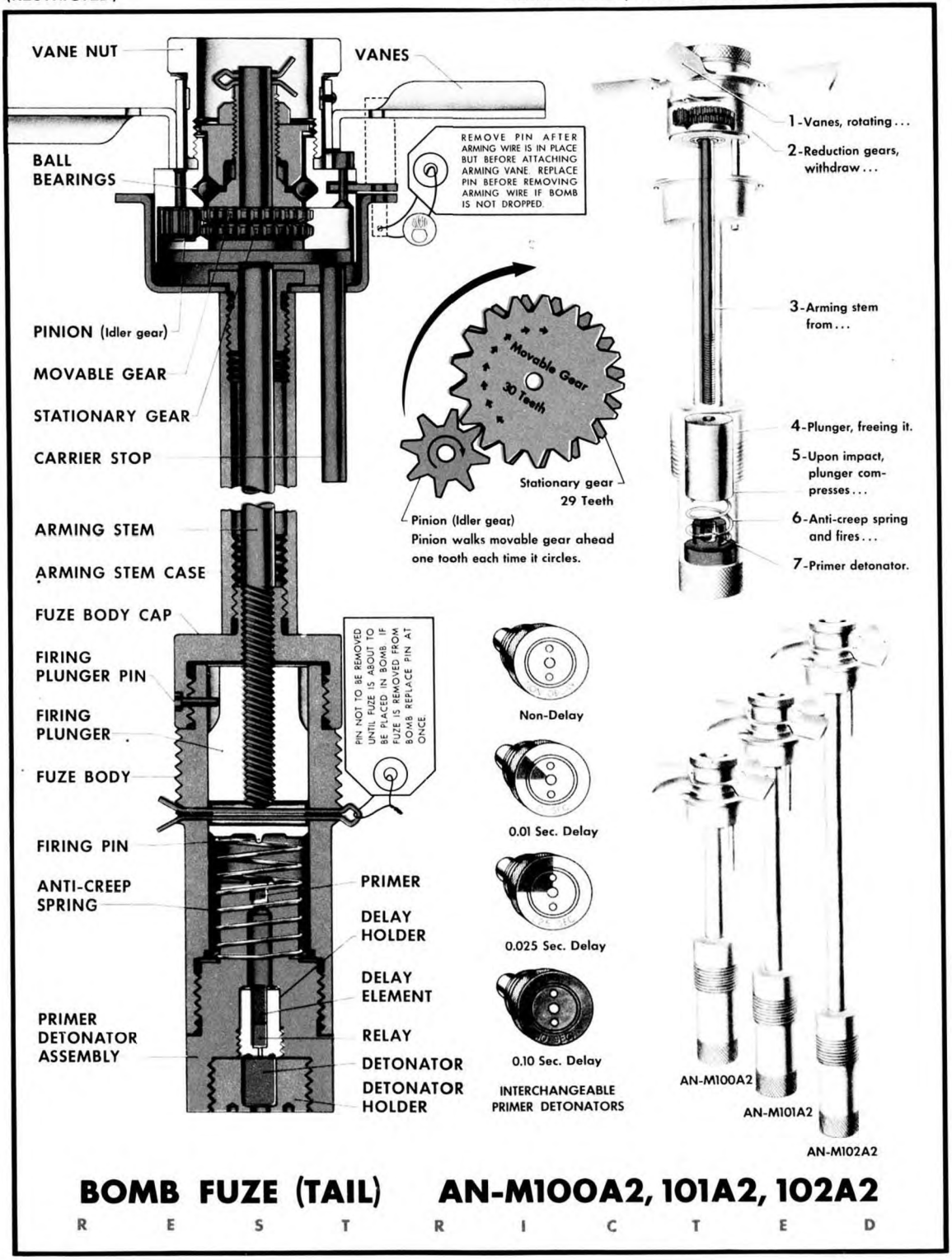
APPROX. WEIGHT FULLY LOADED

AN-M100A2	2.7 LB
AN-M101A2	2.9 LB.
AN-M102A2	3.2 LB.



ARMING VANE ASSEMBLY

FIG. 2-1 — OUTLINE OF TAIL BOMB FUZES AN-M100A2, AN-M101A2 AND AN-M102A2.



BOMB FUZE (TAIL) AN-M100A2, 101A2, 102A2

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The AN-M100A2, AN-M101A2, and AN-M102A2 tail bomb fuzes function on impact. These fuzes can be equipped with any one of the following delays: 0.01 sec., 0.025 sec., 0.1 sec. or non-delay* by substituting the proper M14 primer detonator (Fig. 2-3). When issued they are equipped with the 0.025 sec. primer detonator. These fuzes are of the arming vane type and have mechanical delay arming. The arming vane, delay arming mechanism, firing mechanism, and explosive components of the three models are identical. The lengths of the fuze stem tubes and the arming stems, and consequently the overall lengths, differ for each model. This is shown on the outline drawing of these fuzes (Fig. 2-1). The variations in length are necessary to properly locate the arming vane in the air stream so that the same type of fuze can be used in various sized bombs. The arming vane is strong enough to withstand air speeds of 600 knots. These fuzes are safe for dive bombing and for takeoffs and landings anywhere including the decks of carriers. Fig. 2-2 shows the general arrangement and gives the names of the various parts.

The AN-M100A2, AN-M101A2, and AN-M102A2 fuzes (or A2 series) replace the AN-M100A1, AN-M101A1 and AN-M102A1 fuzes (or A1 series). In the A2 series, the air travel required to arm has been decreased, the arming vane has been strengthened, and the number of blades on the arming vane has been decreased from 8 to 4. Other details of the A and A2 series are identical.

The drawing numbers of the assemblies or general arrangements for the A2 series are:

Fuze	Bureau of Ordnance Drawing No.	U. S. Army Ordnance Dept. Drawing No.
AN-M100A2	309538	73-8-3
AN-M101A2	309535	73-8-7
AN-M102A2	309533	73-8-8

Revision date of drawings: August 8, 1942.

*The distinction between non-delay and instantaneous fuze action is as follows: Instantaneous action is obtained in nose fuzes in which the force of the impact directly drives the striker and firing pin into the primer or detonator. Bombs so fused will be detonated before any penetration occurs. Non-delay action is obtained in tail fuzes in which the retardation imparted to the bomb on impact causes an inertia plunger to move forward and strike the primer or detonator. Bombs so fuzed will not be detonated quite as rapidly as for instantaneous action and consequently may have a very small penetration. The lag obtained in non-delay action is due to the inertia of the firing plunger.

(b) ***Bombs in which used***—These fuzes are used in the following Army-Navy Standard bombs:

Fuze	Bomb	
AN-M100A2	100 lb. AN-M30	General Purpose Bomb
	250 lb. AN-M57	General Purpose Bomb
AN-M101A2	500 lb. AN-M64	General Purpose Bomb
	500 lb. AN-M58A1	Semi-Armor Piercing Bomb
AN-M102A2	1000 lb. AN-M65	General Purpose Bomb
	2000 lb. AN-M66	General Purpose Bomb
	4000 lb. AN-M56	Light Case Bomb
	1000 lb. AN-M59	Semi-Armor Piercing Bomb

They can also be used in the following bombs which have been superseded by the AN-M64, AN-M58A1, AN-M65, and AN-M66 respectively.

Fuze	Bomb	
AN-M101A2	500 lb. AN-M43	General Purpose Bomb
	500 lb. AN-M58	Semi-Armor Piercing Bomb
AN-M102A2	1000 lb. AN-M44	General Purpose Bomb
	2000 lb. AN-M34	General Purpose Bomb

(c) ***Mechanical delay arming***—Delay arming is obtained by interposing a reduction gear train between the arming vane and the arming stem, thereby reducing the rotation of the arming stem to one turn for 30 revolutions of the arming vane. The arming vane, which is not assembled to the fuze during shipping and stowage, is fastened to the bearing cup by the vane nut when the fuze

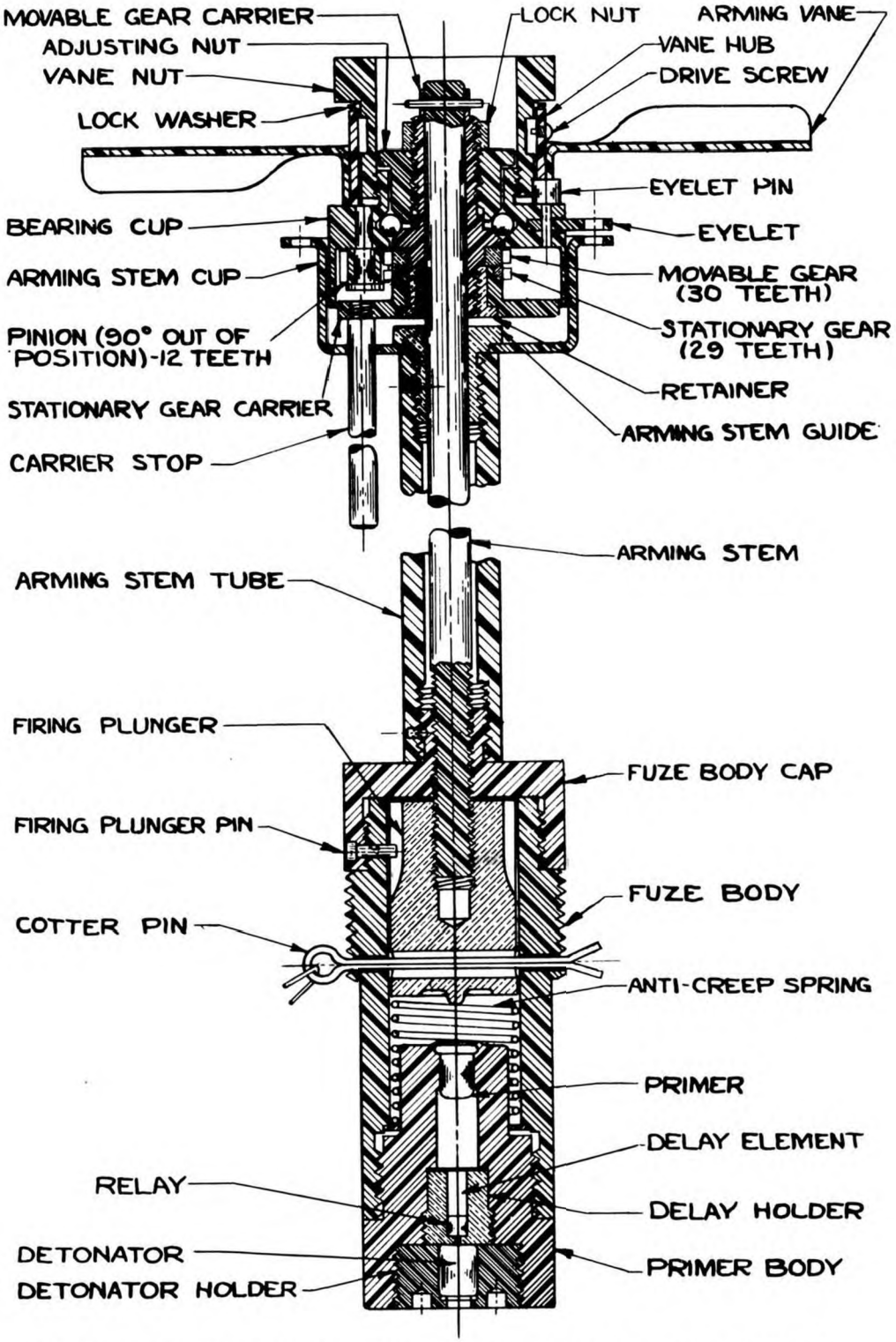


FIG.2-2. ASSEMBLY OF TAIL BOMB FUZES AN-M100A2, AN-M101A2 AND AN-M102A2.

is installed in the bomb. The heads of the eyelet pins on the bearing cup fit into grooves in the arming vane and vane hub, positively locking the vane to the bearing cup. The reduction gear train is housed in the arming stem cup, and is withdrawn from the cup as the arming vane rotates to arm the fuze. The carrier stop prevents the stationary gear carrier from revolving but allows it to move laterally. The balls between the bearing cup and the movable gear carrier take up the end thrust and reduce the friction.

(d) ***Firing mechanism***—The retardation imparted to the bomb on impact causes the brass firing plunger to move forward due to its inertia, strike the primer and initiate the explosive train. In the safe or unarmed position, the plunger is prevented from moving forward by the arming stem which is threaded to both the fuze body cap and the firing plunger. When the arming stem is unscrewed from the firing plunger by rotation of the arming vane, an anti-creep spring keeps the plunger from moving forward and striking the primer, until impact of the bomb. By screwing the arming stem through the fuze body cap before screwing it into the firing plunger, any accidental blows on the arming vane or gear mechanism are not transmitted to the firing plunger. The end of the firing plunger pin slides in a groove in the firing plunger, to prevent it from rotating.

(e) ***Primer detonator (explosive components)***—The explosive components consist of a primer, black powder delay element (except for non-delay action), relay, and detonator, all of which are contained in the M14 primer detonator which screws into the bases of these fuzes. The explosive components in the primer detonator are sealed against the entrance of air or moisture. The booster charge is contained in the adapter-booster which is shipped assembled in the bomb.

The primer detonators are supplied with the following delays: 0.01 sec., 0.025 sec., 0.1 sec. and non-delay, and they can readily be interchanged on the ground. (See paragraph 5a(3)). The fuzes are issued with a 0.025 sec. delay primer detonator. Additional primer detonators are issued as follows:

	% *(Based on number of bombs issued)*	
Delay	General Purpose Bombs	Semi-Armor Piercing Bomb
0.01	100%	50%
0.10	25%	50%
Non-Delay	25%	0%

Fig. 8-3 shows the method of marking for various delays.

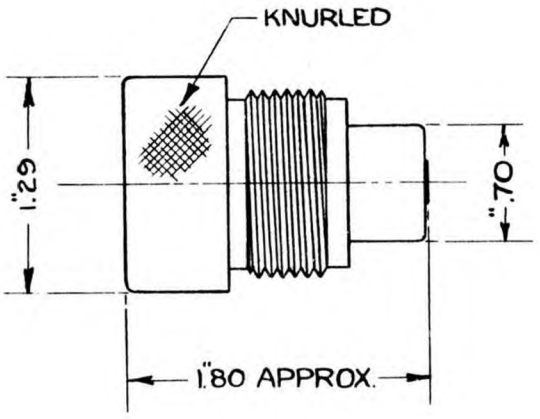
2. FUNCTIONING:

(a) ***Released armed***—When the bomb is released "armed" the arming wire is withdrawn from the fuze thereby allowing the air stream to turn the arming vane. The rotating arming vane, acting through the reduction gear train, unscrews the arming stem from the firing plunger, thereby releasing the plunger and arming the fuze. From 150 to 170 revolutions of the arming vane are required to arm the fuze. After the fuze becomes armed the plunger is restrained from striking the primer cap by an anti-creep spring, until impact of the bomb. After approximately 200 more revolutions of the arming vane, the arming stem has unscrewed from the body cap and the entire arming assembly (arming vane, gear mechanism, and arming stem) is carried away from the bomb by the air stream. The retardation imparted to the bomb on impact, causes the inertia firing plunger to move forward, strike the primer and initiate the explosive train.

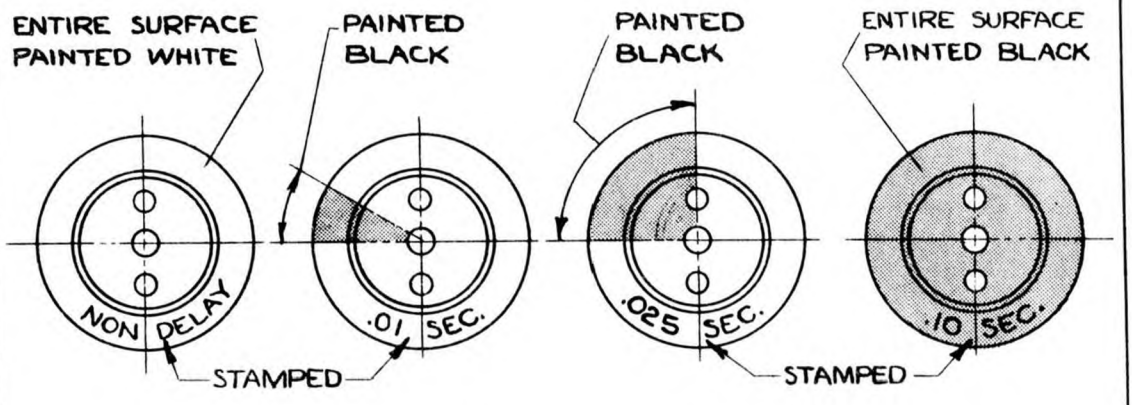
(b) ***Air travel required to arm*** — The air travel along the trajectory required to arm these fuzes and the corresponding minimum altitudes of release for various air speeds when these fuzes are installed in various sized bombs are given in Table 2-1. For bombs not listed in Table 2-1 the air travel should be estimated from the data given and from the diameters of the bombs. The variations in air travel are due to differences in the diameter and construction of the various bombs.

(c) ***Sensitivity***—When used in the 1000 and 2000 lb. bombs, impact on the light weather deck of a ship may not offer sufficient resistance to initiate the fuze unless a deck beam is also hit. However, tests indicate the fuze will function almost certainly on the deck below the weather deck. These fuzes will function on impact with the surface of the water when dropped in a bomb from the minimum safe altitude of release.

(d) ***Released safe***—If the bomb is released safe, the arming wire is released from the arming mechanism of the bomb rack and is dropped with



OUTLINE OF PRIMER DETONATOR M14



NON DELAY | 0.01 SEC. DELAY | 0.025 SEC. DELAY | 0.10 SEC. DELAY

METHOD OF MARKING FOR VARIOUS DELAYS

FIG. 2-3. OUTLINE AND METHOD OF MARKING M14 PRIMER DETONATORS.

the bomb, thereby preventing the arming vane from rotating and the fuze from arming. The fuze, being unarmed, will not function on impact.

3. SAFETY FEATURES:

(a) ***Installed in a bomb***—When the fuze is installed in a bomb which is placed in the bomb rack of an airplane with the arming wire in place, the fuze is in the unarmed or safe position and does not become armed until the bomb has been released "armed" from the bomb rack and has traveled the distance in the air necessary to arm the fuze. The firing plunger, although lined up with the explosive train, is restrained from moving until the arming stem unscrews by rotation of the arming vane. Striking the arming vane or arming stem cup will not cause the fuze to function.

The booster charge is contained in the adapter-booster which is shipped assembled in the bomb. When the fuze is installed in the bomb, the detonator is aligned with the booster lead-in, and premature detonator action will result in detonation of the explosive charge in the bomb. However no reports have been received of detonation of any bombs due to premature detonator action.

(b) ***During shipping and stowage***—During shipping and stowage additional safety is provided (1) by a cotter pin which extends through the fuze body and the firing plunger to positively prevent movement of the plunger, and (2) by a safety pin (Fig. 2-1) which locks the reduction gearing mechanism. The ends of a wire inserted through a hole in the end of the safety pin are sealed with the Army Ordnance car seal. The fuze cannot be installed in the bomb without removing the cotter pin and the safety pin. The booster charge is contained in the adapter-booster which is shipped assembled in the bomb.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—If the arming vane and reduction gear mechanism are missing the fuze is armed. However, if the arming vane and reduction gear mechanism are not missing, the fuze is not necessarily in the unarmed or safe position. If the distance between the eyelet on the gear mechanism and the flange on the vane cup (dimension A Fig. 8-1) is less than one-half inch the fuze is only partially armed. If the distance is one-half inch to three-quarters inch, arming is questionable and the fuze should be considered as armed. If the distance is greater than three-quarters inch the fuze is armed.

(b) ***Handling***—Striking the arming vane or gear mechanism will not drive the firing plunger into the primer because the arming stem is also threaded to the stationary fuze body cap.

If the fuze is not installed in a bomb it may be made safe for handling by inserting a pin through the hole in the fuze body and the firing plunger, or by unscrewing the primer detonator in the base of the fuze.

If the fuze is installed in a bomb, it is impossible to insert a pin through the fuze body and the firing plunger. No attempt should be made to unarm the fuze by turning the arming vane backwards because failure of the threads on the arming stem and firing plunger to engage would result in pushing the firing plunger into the primer with probable initiation of the explosive train. To remove from the bomb, the vane should be locked in its present position and the fuze should be carefully unscrewed from the bomb and immediately upon removal, a pin should be inserted through the fuze body and plunger and the primer detonator should be unscrewed.

(c) ***Salvaging*** — Fuzes which have become armed armed or partially armed may be salvaged by inserting the safety cotter pin through the fuze body and the firing plunger, turning the arming vane backwards as far as it will go and then turning the vane forward about twenty revolutions. Fuzes so salvaged will require approximately the same air travel to arm as the fuzes when issued. Remove the arming vane, replace the safety pin which locks the delay arming mechanism, and repack fuze in a fuze container until again required.

5. INSTALLATION OF FUZE IN BOMB:

(a) ***Instructions***—To install the fuze in a bomb perform the following operations in the order indicated:

(1) Remove tail shipping plug from bomb, and inspect adapter-booster and threads. Clean, if necessary.

(2) Remove the fuze from the sealed metal container.

(3) Change primer detonator if necessary. The fuzes, as issued, are equipped with a 0.025 sec. delay primer detonator. To change, unscrew the present primer detonator by hand, and screw in

by hand the primer detonator having the desired delay.

(4) Remove cotter pin from fuze body complying with instructions on tag.

(5) Screw fuze, less arming vane assembly, into the adapter-booster in the tail of the bomb until it seats hand-tight. Use no tools. No auxiliary boosters are required.

(6) Thread the longer end of the arming wire assembly through the rear suspension lug of the bomb and the nearer pair of eyelets on the fuze. Should the nearer pair of eyelets be occupied by the safety pin and car seal tag, place a second pin through the eyelets diametrically opposite, before removing the original safety pin. The shorter end of the arming wire assembly is for use on the nose fuze. If no nose fuze is used cut the shorter end off.

(7) Cut car seal wire and remove safety pin, complying with instructions on tag.

(8) Thread end of arming wire through appropriate eyelet in arming vane assembly. At the same time slip vane over end of fuze so that the slots in the hub fit over the heads of the two eyelet pins.

(9) Screw the vane nut on the threaded end of the bearing cup, handtight.

(10) Adjust arming wire to protrude beyond arming vane from 2 to 3 inches.

(11) Slip two safety clips (Fahnestock connectors) over end of arming wire until the first one just touches the face of the vane. The fuze is now completely assembled in the bomb.

Should it be necessary to remove the fuze from the bomb, carry out the above steps in the reverse order. Inspect the fuze and repack in a fuze container; seal container with adhesive tape.

(b) ***Points to check***—Before installing the fuze in a bomb, check the primer detonator for the desired delay.

After installing the fuze in the bomb check that the arming wire is properly installed.

6. SERVICING:

(a) ***Use of lubricants***—Lubricants or preservatives of any kind should not be used with these fuzes. The reduction gear train is coated with colloidal graphite by the manufacturer at assembly which acts as a lubricant, and the parts are plated for protection against corrosion. The use of oil increases the air travel required to arm, especially at low temperatures. In laboratory tests, five cycles of twenty-four hour salt spray exposures were required to cause any slowing down in the arming of the fuze.

(b) ***Fuzes exposed to weather***—Laboratory tests indicate that these fuzes are not adversely affected when subjected to a salt spray estimated to be equivalent to about twenty takeoffs and landings with a sea plane, and to five cycles of alternate freezing and thawing. However, it is impossible to simulate actual conditions in laboratory tests. It is recommended that fuzes which have been installed in bombs and exposed to the weather for three weeks be replaced with new fuzes. However, depending upon the weather conditions under which the planes are operating, it may be necessary to replace the fuzes after a shorter period of exposure.

If sufficient bombs are available, it is recommended that fuzes which have been exposed to the weather be dropped to check their functioning. Complete data on the length of the exposure, approximate temperatures and weather conditions during the exposure, and other pertinent data should be obtained by the Ordnance Officer and forwarded to the Bureau of Ordnance for information and distribution to forces operating in similar climatic conditions.

(c) ***Reports of Malfunctionings***—Reports of malfunctionings and troubles encountered with these fuzes should be reported to the Bureau of Ordnance. The report should contain the lot number of the fuze and other ammunition components, in addition to the detailed description of the conditions, previous history, and other pertinent information relating to the ordnance material and the malfunctioning or trouble encountered.

The loader's initials, date (month and year) loaded, and the lot number are stamped or marked on the fuze, fuze container, packing box, and the accompanying ammunition data card. The lot number is required for all purposes of record.

(d) ***Disassembly***—The only authorized disassembly operation is the removal of the primer detonator, and the installation and removal of the arming vane.

(e) ***Primer Detonator*** — Primer detonators having loose primers, evidence of corrosion, or other visible defects should be disposed of.

7. PACKING AND MARKING:

(a) ***Fuze container***—One fuze, less the arming vane, is packed in a black cylindrical metal container. The dimensions and weights of the containers are as follows:

Fuse	Maximum Dimensions of Fuze Container		Weight of Fuze and Container—Lb.
	Dia.—in.	Length—in.	
AN-M100A2	2.6	9.7	3.38
AN-M101A2	2.6	12.7	3.78
AN-M102A2	2.6	16.7	4.38

A metal tear strip soldered to the container and cover seals the container during shipping and stowage. A ring attached to one end of the tear strip facilitates opening the container. The sample marking on a container is as follows:

FUZE, BOMB, TAIL AN-M100A2
LESS ARMING VANE
0.025 SEC. DELAY
LOADER'S INITIALS, LOT NO. PACKED (MONTH AND YEAR)
(DRAWING NO. 73-8-3) REV. DATE OF FUZE DRAWING

The data is altered as applies.

(b) ***Packing box for fuzes***—Twenty-five fuzes in containers and twenty-five arming vanes are packed in a wood packing box. The maximum dimensions and weights of the packing boxes are:

FUZE	Maximum Dimensions of Packing Box			Weight of box and Fuzes—lb.
	Length—in.	Width—in.	Height—in.	
AN-M100A2	24-5/16	14-3/4	15-1/16	116.3
AN-M101A2	27-5/16	14-3/4	15-1/16	128.9
AN-M102A2	31-5/16	14-3/4	15-1/16	145.3

The cover is secured by flat head wood screws and by two steel bands wrapped around the box. Sample marking on the side of the box is:

25 FUZES
BOMB, TAIL, AN-M100A2
0.025 SEC. DELAY
PACKED (MONTH AND YEAR) LOT NO.

The data is altered as applies.

(c) ***Packing can for primer detonator***—One primer detonator is packed in a black, cylindrical metal container 1".5 in diameter and 1".9 long. The cover is sealed with an adhesive tape sealing strip which is provided with a tab to facilitate opening. The strip is marked:

PRIMER DETONATOR M14
.01 DELAY (or as applies)

(d) ***Packing box for primer detonators***—Twenty-five primer detonators in packing cans are packed in a metal container packing box 8-5/32" by 8-5/32" by 2-1/32" high. The cover is sealed with an adhesive tape sealing strip which is provided with a tab to facilitate opening. The weight of the box and contents is 13.5 lb. The top and one side of the box is marked:

25 PRIMER DETONATORS, M14
0.1 DELAY LOT 1234

The data is altered as applies.

TABLE 2-I

Fuze and Bomb	Ave. Air Travel Req'd Feet	Minimum Altitude of Release in Feet for Following Air Speeds in Knots			
		100	150	200	250
AN-M100A2					
AN-M30 100 lb. G.P.	445	130	60	35	20
AN-M57 250 lb. G.P.	485	145	65	40	25
AN-M101A2					
AN-M64 500 lb. G.P.	555	190	90	55	30
AN-M102A2					
AN-M65 1000 lb. G.P.	465	135	60	35	20
AN-M66 2000 lb. G.P.	665	265	130	80	45

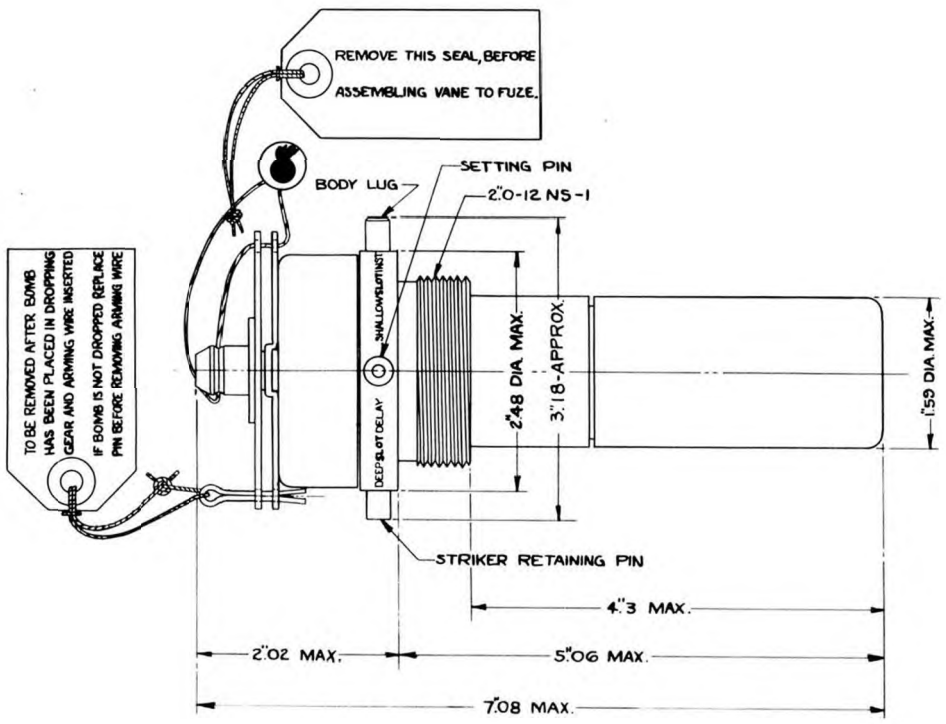
NOTE: The values for the air travel required are average values. Variations will not exceed ± 10% of the value given. The values for the minimum altitude of release are computed from the maximum air travel (average value for air travel increased by 10%) and are the minimum altitudes of release which will positively insure arming of the fuze in horizontal bombing.

The above values should not be confused with the minimum *SAFE* altitudes of release which depend upon other factors and not upon the air travel required to arm. The minimum safe altitudes of release are determined by the Commander in Chief, United States Fleet.

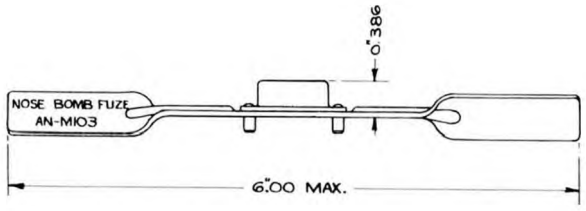
PART II___Chapter 2_____ (RESTRICTED)

Fuze, Bomb, Nose AN-M103

CONTENTS



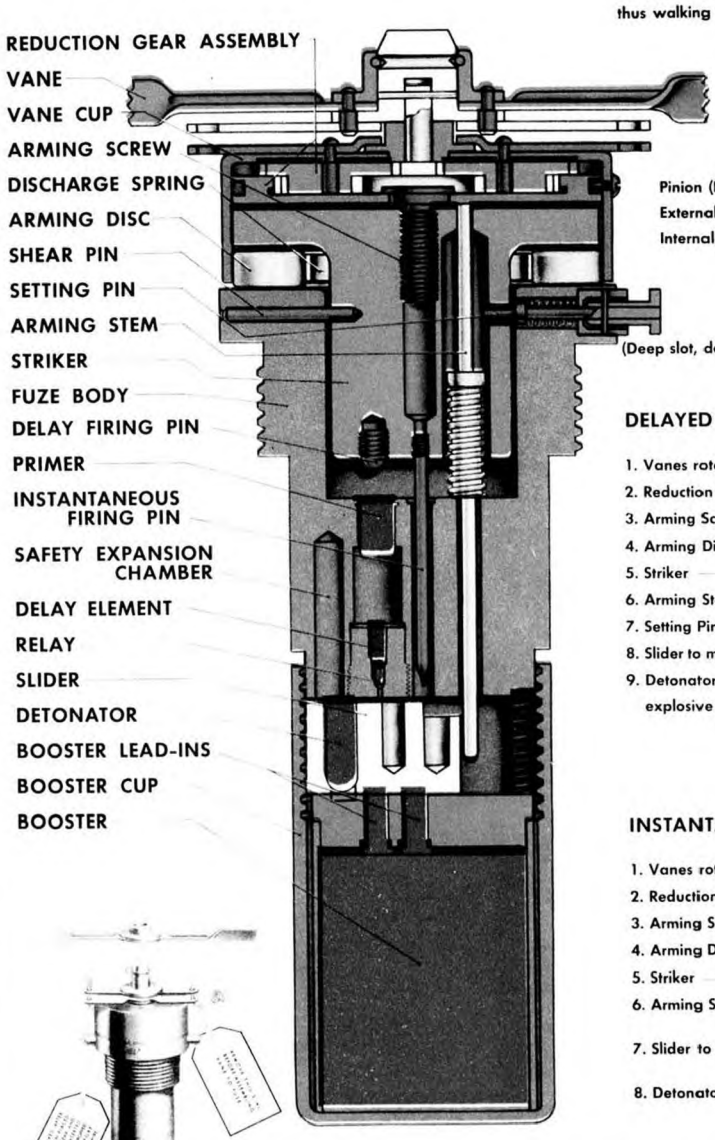
FUZE AS SHIPPED



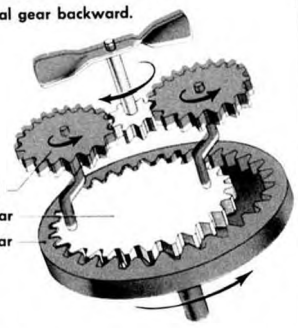
ARMING VANE ASSEMBLY

NOTE:
WEIGHT OF FUZE FULLY LOADED = 3.7 LBS. APPROX.
FOLLOWING INFORMATION IS STAMPED ON FUZE BODY:
NOSE BOMB FUZE AN-M103, LOADER'S INITIALS, DATE LOADED AND LOT NUMBER.

FIG. 2-4 — OUTLINE OF NOSE BOMB FUZE AN-M103.



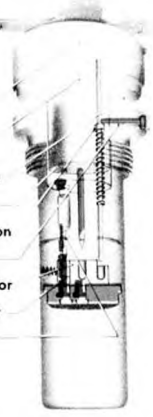
External gear, attached to off-center hubs on the pinions is cranked around without rotating, thus walking the internal gear backward.



(Deep slot, delay; Shallow slot, instantaneous)

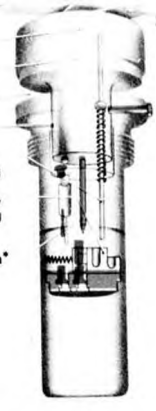
DELAYED ACTION

1. Vanes rotate
2. Reduction Gears, turning
3. Arming Screw which allows
4. Arming Discs to fly out and free
5. Striker
6. Arming Stem Shoulder catches on
7. Setting Pin, allowing
8. Slider to move only far enough for
9. Detonator to line up with delay explosive train*



INSTANTANEOUS ACTION

1. Vanes rotate
2. Reduction Gears, turning
3. Arming Screw which allows
4. Arming Discs to fly out and free
5. Striker
6. Arming Stem withdraws fully, allowing
7. Slider to move completely over, aligning
8. Detonator with instantaneous firing pin*



*On impact, striker crushes downward, shearing shear and setting pins, and initiating explosion

BOMB FUZE (NOSE) • AN-M103

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The AN-M103 is a nose bomb fuze which functions on impact. It can be set readily while on the ground for either instantaneous or 0.1 sec. delay action by means of an external setting pin. When issued to the service the fuze is set for delay action. This fuze is of the arming vane type and has mechanical delay arming. The arming vane is shipped and stowed unassembled to the fuze and is not assembled until the fuze is installed in the bomb. This fuze is safe for dive bombing and for takeoffs and landings anywhere including the decks of carriers. The weight, completely loaded is approximately 3.7 pounds. The general arrangement or assembly is shown on Bureau of Ordnance Drawing No. 276324 or Army Ordnance Department Drawing No. 73-8-14 of revision date July 15, 1942. Figure 2-4 shows the outline and principal dimensions. Figure 2-5 shows the general arrangement and the names of the various parts.

(b) ***Bombs in which used***—The nose fuze AN-M103 is primarily for use in the following Army Navy Standard bombs:

AN-M30	100 lb. General Purpose Bomb.
AN-M57	250 lb. General Purpose Bomb.
AN-M64	500 lb. General Purpose Bomb.
AN-M65	1000 lb. General Purpose Bomb.
AN-M66	2000 lb. General Purpose Bomb.
AN-M56	4000 lb. Light Case Bomb.
AN-Mark 13 Mod 1	1000 lb. Aircraft Mine.

This fuze can also be used in the following AN standard bombs which have been superseded by the AN-M64, AN-M65 and AN-M66:

AN-M43	500 lb. General Purpose Bomb.
AN-M44	1000 lb. General Purpose Bomb.
AN-M34	2000 lb. General Purpose Bomb.

This fuze can also be used in the following Navy and Army Navy Standard bombs:

Mark 9 and Mods	500 lb. Light Case Bomb.
Mark 9 and Mods	1000 lb. Light Case Bomb.
Mark 12 and Mods	500 lb. Demolition Bomb.
Mark 13 and Mods	1000 lb. Demolition Bomb.
Mark 17 and Mark 17 Mod 1	325 lb. Aircraft Depth Bomb.
AN-Mark 17 Mod 2	325 lb. Aircraft Depth Bomb.
Mark 29	650 lb. Aircraft Depth Bomb.
Mark 37	650 lb. Aircraft Depth Bomb.
Mark 38	650 lb. Aircraft Depth Bomb.
An-Mark 41	325 lb. Aircraft Depth Bomb. (Flat Nose)
AN-Mark 44	350 lb. Aircraft Depth Bomb.
AN-Mark 47	350 lb. Aircraft Depth Bomb. (Flat Nose)

NOTES:(1) One auxiliary booster is required when this fuze is used in the Navy bombs.

(2) When this fuze is used in the light case bombs and the aircraft depth bombs, the fuze should be set for instantaneous action to prevent breaking up of the bomb case before detonation occurs.

This fuze can be installed in the AN-M58 and AN-M59 500 pound and 1000 pound semi-armor piercing bombs by removing the nose plug with which these bombs are ordinarily equipped. Its use in these bombs is a secondary feature and is recommended only when no suitable demolition or general purpose bombs are available.

(c) ***Mechanical delay arming***—Delay arming is obtained by interposing a reduction gear train between the arming vane and the arming screw, thereby reducing the rotation of the arming screw to one turn for sixty-five and one-third revolutions of the arming vane. The reduction gear train is contained in the vane cup, and is connected to the arming screw which screws into the striker in the nose of the bomb. As the arming vane rotates the arming screw unscrews from the striker and the entire arming mechanism and vane cup move forward with it. Two keys located diametrically opposite on the vane cup and sliding in grooves in the striker, prevent the vane cup from rotating but allow it to move forward.

(d) ***Selective instantaneous or delay action***—Instantaneous or 0.1 sec. delay action is obtained by selective positioning of the detonator slider. The arming stem holds the detonator slider in the unarmed or safe position. A spring pushes the arming stem forward against the internal gear of the arming mechanism as the latter moves forward during the arming operation. After approximately 180 turns of the arming vane (equivalent to about three-sixteenths inch forward movement), the end of the arming stem has moved forward past the first step in the detonator slider, thereby allowing the slider springs to push the slider over far enough to align the detonator with the delay element. If the fuze is set for delay action, movement of the arming stem past the first step in the detonator slider is prevented by a collar on the arming stem hitting the end of the setting pin. If the fuze is set for instantaneous action, the end of the setting pin does not protrude through the arm-

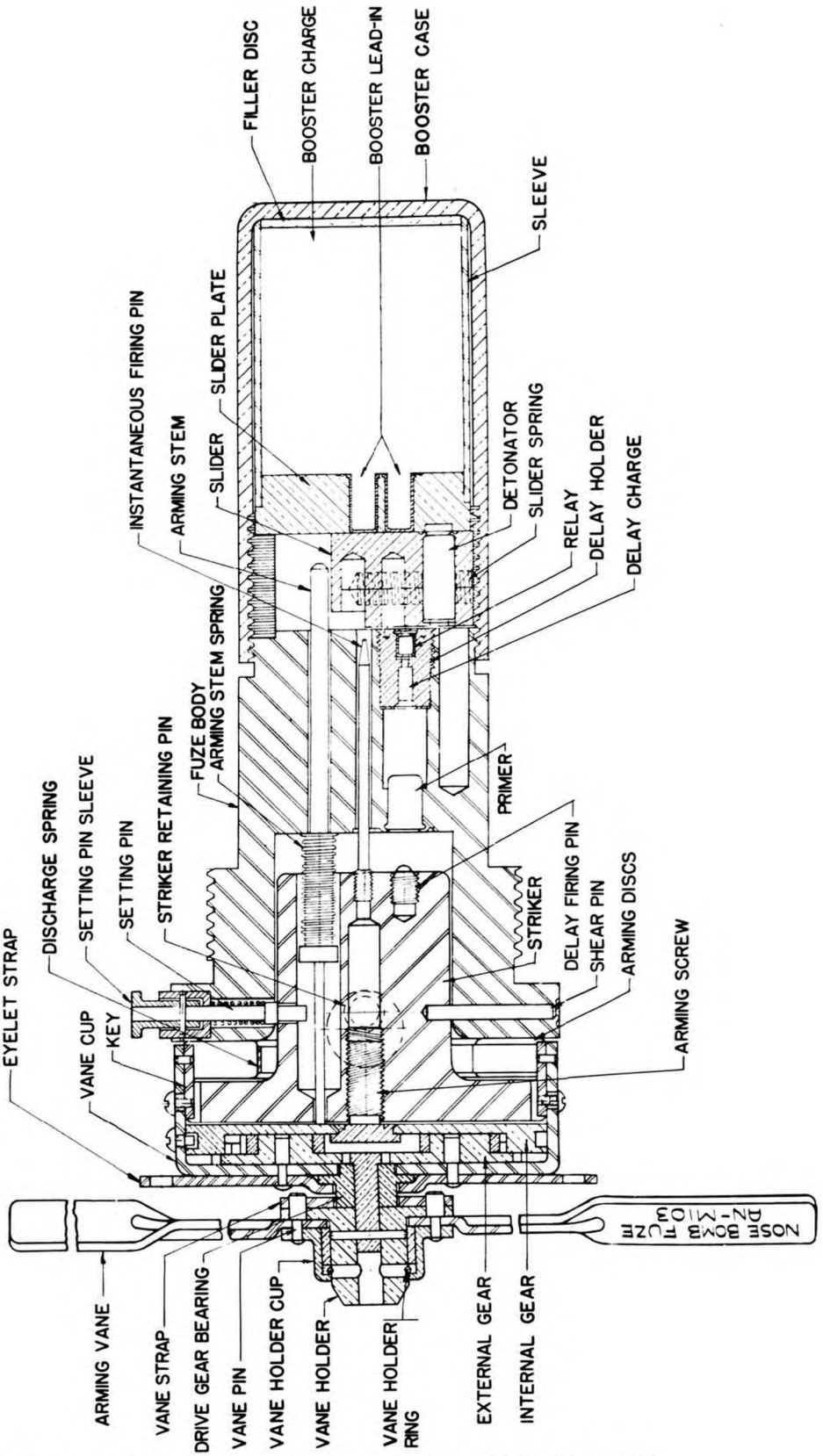


FIG. 2-5 - GENERAL ARRANGEMENT OF NOSE BOMB FUZE AN-M 103

ing stem hole in the striker, and the arming stem continues to move forward, along with the internal gear, past the first step in the detonator slider thereby allowing the slider springs to push the slider over an additional amount and align the detonator with the instantaneous firing pin. In both the delay and instantaneous positions the detonator slider is prevented from moving back by a detent resting on a stepped surface of the slider.

Selection of instantaneous or delay action is done by an external setting pin which projects from the side of the body. During shipping and stowage the pin is in the deep slot or delay position. To set for instantaneous action, lift the pin, rotate one quarter turn and drop into the shallow slot. The fuze body adjacent to the setting pin is stamped "DEEP SLOT DELAY SHALLOW SLOT INST."

(e) ***Striker assembly***—To initiate the explosive train, the striker must be driven into the fuze body. In the unarmed position, 13 arming discs are placed between the striker flange and fuze body to prevent driving the striker into the body. The discs are held in place by the vane cup, and are ejected when the cup is withdrawn by a flat discharge spring which circles the striker and is secured to adjacent discs. The striker is now restrained from moving by a 0.102" dia. brass shear pin and the 0.105" dia. brass setting pin which acts as a second shear pin. Two firing pins are assembled to the striker, one for delay action and one for instantaneous action. The delay firing pin is located off center and is lined up with the primer which ignites the delay element. The arming stem guides the striker when it is driven into the fuze body to insure the delay firing pin striking the primer. To prevent the striker from falling out after impact, a 0.20" dia. striker retaining pin is fixed to the fuze body and projects into a 0.58" dia. hole in the striker. The retaining pin rests against the side of the hole in the striker so that only the shear pins restrain the striker from being driven into the body but the retaining pin prevents the striker from falling out. This feature eliminates fuze failures which would result if the fuze were set for delay action and the striker and arming stem should happen to fall out (as may occur on water impact) and consequent moving of the detonator slider to the instantaneous position before the delay element burns through.

(f) ***Explosive components***—This fuze contains two explosive trains, one for delay action and one for instantaneous action; however, as previously described, the same detonator forms part of both trains.

The delay action explosive train consists of the primer, delay charge, relay, detonator, booster lead-in and booster. The primer and the delay element assembly containing the delay charge and relay are assembled in the fuze body and are sealed against the entrance of moisture. The flash from the primer when struck by the delay firing pin, ignites the black powder delay element which after burning for 0.10 to 0.15 seconds sets off the relay. If the fuze is set for delay action, the detonator, booster lead-in, booster, and explosive charge in the bomb are successively detonated. The instantaneous explosive train consists of the detonator, lead-in, and booster. If the fuze is set for instantaneous action, the detonator, lead-in, booster and explosive charge in the bomb are successively detonated when the instantaneous firing pin pierces the detonator. The booster charge consists of about 50 grams (1¾ oz.) of tetryl.

(g) ***Successive steps in arming***—The successive steps in arming of this fuze are:

(1) After approximately 180 revolutions of the arming vane the detonator slider moves over to the delay position.

(2) After approximately 200 revolutions of the arming vane, the arming discs between the striker flange and fuze body are ejected and the fuze is fully armed for delay action. The fuze, even when set for instantaneous action, becomes armed for delay action at this time. Consequently the fuze is in a condition to function whenever the vane has turned about 200 revolutions.

(3) After about 300 revolutions of the arming vane, the detonator slider moves over to the instantaneous position if the fuze is set for instantaneous action.

(4) Continued rotation of the arming vane merely unscrews the delay arming mechanism.

2. FUNCTIONING:

(a) ***Released armed***—When the bomb is released "armed" the arming wire is withdrawn from the fuze permitting the arming vane to be rotated by the air stream. Rotation of the arming vane unscrews the delay arming mechanism from the striker in the nose of the fuze thereby successively allowing the detonator slider to move over first to the delay position; the arming discs between the striker flange and fuze body to be ejected and finally the detonator slider to move over to the instantaneous position if the fuze has

been so set. At air speeds less than approximately 220 feet per second (150 miles per hour) the delay arming mechanism falls away from the fuze. At greater air speeds, air pressure may hold the mechanism on the nose; this, however, does not affect the functioning of the fuze.

When the fuze is set for delay action, the detonator is aligned with the delay element. On impact, the striker is driven into the fuze body. The delay firing pin on the striker impinges on the primer, the flash from which ignites the black powder delay element which, after burning through, sets off the remainder of the explosive train. The instantaneous firing pin is driven into a recess in the detonator slider.

When the fuze is set for instantaneous action, the detonator is aligned with the instantaneous firing pin on the striker. On impact the striker is driven into the fuze body and the instantaneous firing pin is driven into the detonator, thereby instantaneously setting off the booster and the bomb.

(b) ***Air travel required to arm***—The air travel along the trajectory required to arm this fuze when set for delay and instantaneous action and when fuzed in various size bombs, and the corresponding minimum altitudes of release for various air speeds in horizontal flight bombing are given in Table 2-II. Data for bombs not listed can be approximated from the data given and the size and shape of the bomb.

(c) ***Sensitivity***—This fuze will function on impact with water when dropped from altitudes sufficient to arm the fuze.

(d) ***Released safe***—If the bomb is released "safe" the arming wire is released from the arming mechanism of the bomb rack and drops with the bomb thereby preventing the fuze from arming [illegible] impact.

3. SAFETY FEATURES:

(a) ***Detonator safety***—This fuze is detonator safe. In the unarmed or safe position, the detonator is lined up with a cavity in the fuze body. If the detonator should function prematurely, the force of the detonation is dissipated in this cavity. The tetryl lead-in which is closer to the detonator will not be set off. Premature functioning of the delay element or relay will not set off the detonator.

(b) ***Installed in bomb***—This fuze, when installed in a bomb which is placed in the bomb rack of an airplane with the arming wire in place, is in the unarmed position and does not become armed until the bomb has traversed the required air travel after release from the bomb rack. The instantaneous action explosive train is broken between the instantaneous firing pin and detonator and between the detonator and booster lead-in. The delay action explosive train is broken between the relay in the delay holder assembly and the detonator, and between the detonator and booster lead-in, but the delay firing pin and primer in the delay assembly are lined up. The arming discs between the striker flange and fuze body prevent driving the striker into the fuze body.

(c) ***During shipping and stowage***—During shipping and stowage the arming vane is not assembled to the fuze. A wire is threaded through holes in the vane holder, vane strap, and eyelet strap. The ends of the wire are sealed with a car seal. A cotter pin is inserted in the second set of holes in the eyelet and vane straps. The wire and cotter pin prevent operation of the delay arming mechanism.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—When the delay arming mechanism is missing or has unscrewed from the striker far enough to allow the arming discs between the striker flange and fuze body to be ejected, the fuze is armed. If the clearance between the vane cup and fuze body is greater than one-eighth inch, the fuze is partially armed.

(b) ***Handling***—For both armed and partially armed fuzes, the arming vane may safely be turned backwards (counterclockwise looking at nose of [illegible] has not moved over. Fuzes in which the clearance between the vane cup and the fuze body is greater than one-eighth inch but in which the arming discs are still in place are safe for handling although they may no longer be detonator safe. Fuzes which have had the arming discs ejected may be made safe for handling by placing metal (or wood) blocks between the striker flange and fuse body and securing the blocks in place by any suitable means such as with adhesive tape. The blocks prevent accidentally driving the striker into the fuze body.

If an armed or partially armed fuze is installed in a live loaded bomb, make the fuze safe for handling as outlined above, before attempting to unfuze the bomb.

(c) ***Salvaging***—No attempt should be made to disassemble this fuze. Fuzes which have become armed or partially armed should be disposed of in the most suitable manner available.

5. INSTALLATION:

(a) ***Instructions***—To install this fuze in a bomb follow the instructions below in the order indicated:

(1) Remove nose shipping plug from bomb and inspect the fuze seat liner and threads. Clean fuze seat liner, if necessary, using a wooden stick.

NOTE. When this fuze is used in Navy bombs an auxiliary booster is required. The auxiliary booster is shipped assembled in the bomb. Check to see that it is properly placed.

(2) Remove fuze from sealed metal container.

(3) Cut and remove seal wire complying with instructions on tag.

(4) Screw fuze, less arming vane, into the nose of the bomb until it is seated handtight. Use no tools.

(5) Thread the shorter end of the arming wire through the front suspension lug of the bomb and through the nearer pair of eyelets. Should the nearer pair of eyelets be occupied by the cotter pin and tag, place a second cotter pin through the pair of eyelets diametrically opposite, before removing the original cotter pin. This cotter pin and tag is not to be removed until the bomb is installed in the dropping gear of the airplane, and the arming wire is inserted. Instructions on tag read, "To be removed after bomb has been placed in dropping gear and arming wire inserted. If bomb is not dropped replace pin before removing arming wire."

(6) Adjust arming wire to protrude from two to three inches from bomb.

(7) Slip two safety clips (Fahnestock connectors) over end of arming wire until they just touch the face of the vane strap.

NOTE. For the Mark 35 and Mark 41 bomb racks, the use of three safety clips is recommended. To insure positively that the arming wire is released from the arming mechanism and is dropped with the fuze when the bomb is dropped "safe" from the dropping gear.

(8) Slip arming vane assembly over vane holder so that the heads of the two vane pins enter mating holes in the flange of the vane holder and the vane holder spring snaps into the groove on the vane holder. The fuze is now completely assembled in the bomb, except that the cotter pin (see 5 above) must be removed after the bomb has been installed in the airplane.

Should it be necessary to remove the fuze from the bomb, carry out the above steps in the reverse order. An ordnance officer or person authorized by him should inspect the fuze. Repack and reseal in original container.

(b) ***Points to check***—After the bomb has been placed in the dropping gear of the airplane, the following points should be checked before the take-off:

(1) That the arming wire is properly installed.

(2) That the safety cotter pin is removed.

(3) That the fuze is set for the desired action, i.e., instantaneous or delay.

6. SERVICING:

(a) ***Use of lubricants***—Lubricants or preservatives of any kind should not be used unless, after exposure to the weather, the arming vane does not turn freely or there is evidence of corrosion. In this case; place a few drops of light machine oil on the drive gear bearing (between the eyelet and vane straps); turn the arming vane back and forth about a half revolution a few times, and replace the cotter pin. When rotating the vanes back and forth, care should be taken not to prearm the fuze. The use of oil on the fuze may increase the air travel required to arm, especially at low temperatures. For this reason only a few drops of very light machine oil (clock or watch oil) should be used.

The reduction gear train is coated with colloidal graphite by the manufacturer at assembly. The graphite acts as a lubricant.

(b) ***Fuzes exposed to weather***—Fuzes which have been exposed to the weather should be examined and oiled, if necessary as described in paragraph 6a.

Laboratory tests indicate that the fuze is not adversely affected when subjected to a salt spray estimated to be equivalent to about twenty take-offs and landings with a seaplane, and to five cycles of alternate freezing and thawing. However it is impossible to simulate actual conditions in laboratory tests. It is recommended that fuzes which have been installed in bombs and exposed to the weather for three weeks be replaced with new fuzes. However depending upon the weather

conditions under which the planes are operating, it may be necessary to replace the fuzes after a shorter period of exposure.

If sufficient bombs are available, it is recommended that fuzes which have been exposed to the weather be dropped to check their functioning. Complete data on the length of exposure, approximate temperatures and weather conditions during the exposure, and other pertinent information should be forwarded to the Bureau of Ordnance for information and distribution to forces operating in similar climatic conditions.

(c) ***Reports of malfunctionings***—Reports on malfunctionings and troubles encountered with the fuze should be reported to the Bureau of Ordnance. The report should contain the lot number of the fuze and other ammunition components, in addition to the detailed description of the conditions, previous history and other pertinent information relating to the ordnance material and the malfunctioning of trouble encountered.

The loader's initials, date (month and year) loaded, and the lot number are stamped or marked on the fuze, fuze container, packing box, and the accompanying ammunition data card. It is required for all purposes of record.

(d) ***Disassembly***—No attempt should be made to disassemble this fuze. Fuzes which have become damaged, corroded or otherwise fouled up, should be disposed of in the most suitable manner available.

7. PACKING AND MARKING:

(a) ***Fuze container***—One fuze, less the arming vane, is packed in a cylindrical metal container 3.46″ maximum diameter and 7.51″ maximum length. The weight of the fuze and container is 4.5 lb. The container is sealed and opened by a metal tear strip soldered to the container. A ring in the end of the tear strip facilitates opening. The container is painted black and is marked as follows:

FUZE, BOMB, NOSE AN-M103
LESS ARMING VANE
Loader's Initials, Lot No.
Drawing No. 73-8-14
Loaded (Month and Year)
Revision Date of Drawing

(b) ***Packing box***—Twenty-five (25) fuzes in containers, and twenty-five (25) arming vanes wrapped in kraft paper in five (5) packages of five (5) each are packed in a wood packing box twenty-two and one-fourth inches long, seventeen and one-eighth inches wide and nine and three-sixteenths inches high. The weight of the box and container is 132.5 lb. The lid to the box is secured by wood screws. One side and the ends of the box are marked:

25 FUZES, BOMB, NOSE
AN-M103
LOT NO.

Table 2-II
Fuze Set for Delay Action

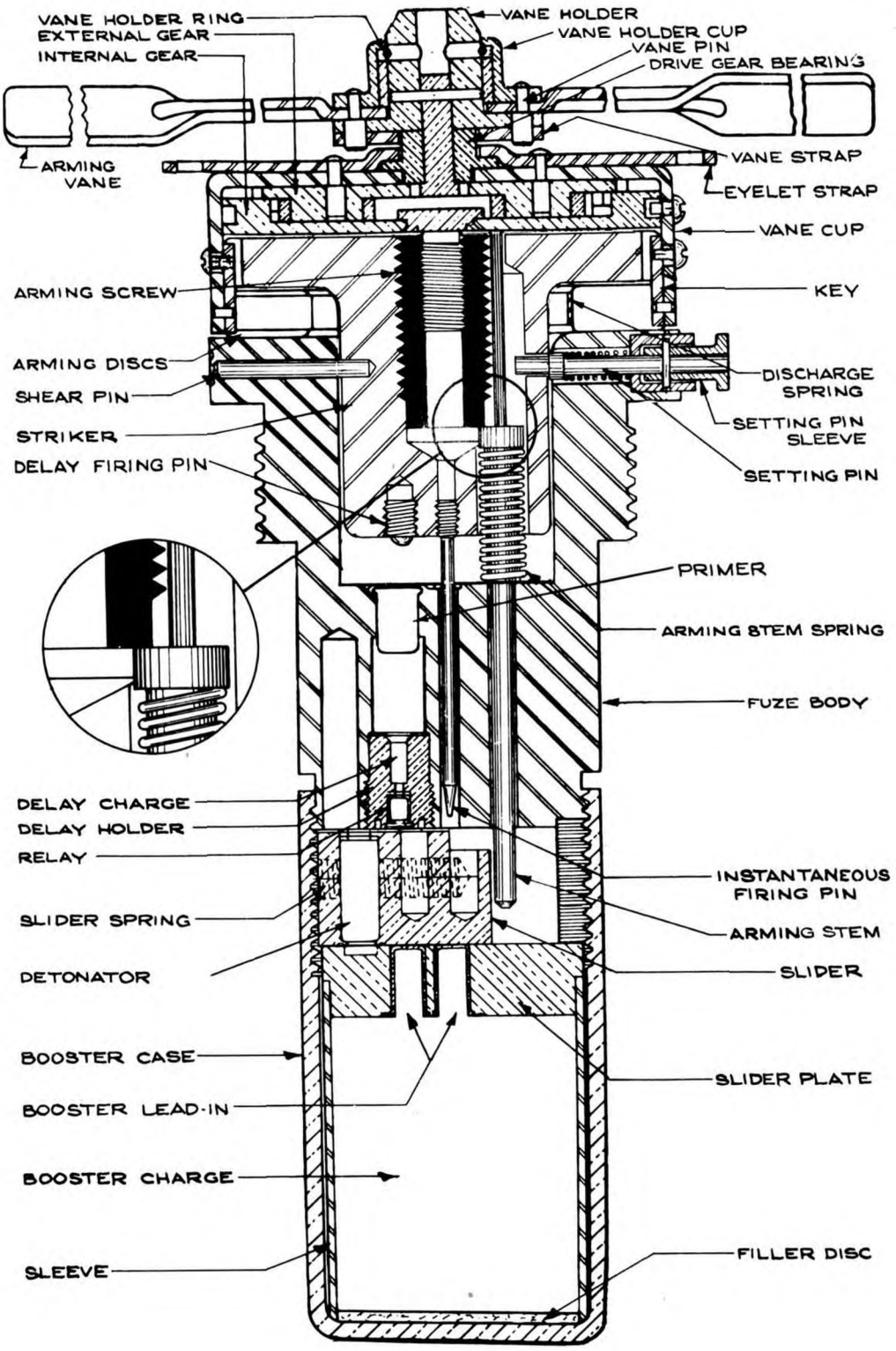
Bomb	Average Air Travel Required Feet	Minimum Altitude of Release in Feet For Following Air Speeds in Knots			
		100	150	200	250
AN-M30 100 lb. G.P.	510	160	75	45	25
AN-M57 250 lb. G.P.	630	240	115	70	40
AN-M64 500 lb. G.P.	670	270	135	80	45
AN-M65 1000 lb. G.P.	685	275	140	85	45
AN-M66 2000 lb. G.P.	1080	580	335	200	135

Fuze Set for Instantaneous Action

Bomb	Average Air Travel Required Feet	Minimum Altitude of Release in Feet For Following Air Speeds in Knots			
		100	150	200	250
AN-M30 100 lb. G.P.	765	335	170	100	60
AN-M57 250 lb. G.P.	940	460	255	150	95
AN-M64 500 lb. G.P.	1000	510	295	175	110
AN-M65 1000 lb. G.P.	1030	535	310	185	120
AN-M66 2000 lb. G.P.	1620	1060	690	440	290

NOTE: The values for the air travel required are average values. Variations will not exceed ± 10% of the value given. The values for the minimum altitude of release are computed from the maximum air travel (average value for air travel increased by 10%) and are the minimum altitudes of release which will positively insure arming of the fuze in horizontal flight bombing.

The above values should not be confused with the minimum *safe* altitudes of release which depend upon other factors and not upon the air travel required to arm. The minimum safe altitudes of release are determined by the Commander in Chief, United States Fleet.



BOMB NOSE FUZE, AN-M103 A1

Fuze, Bomb, Nose AN-M103A1

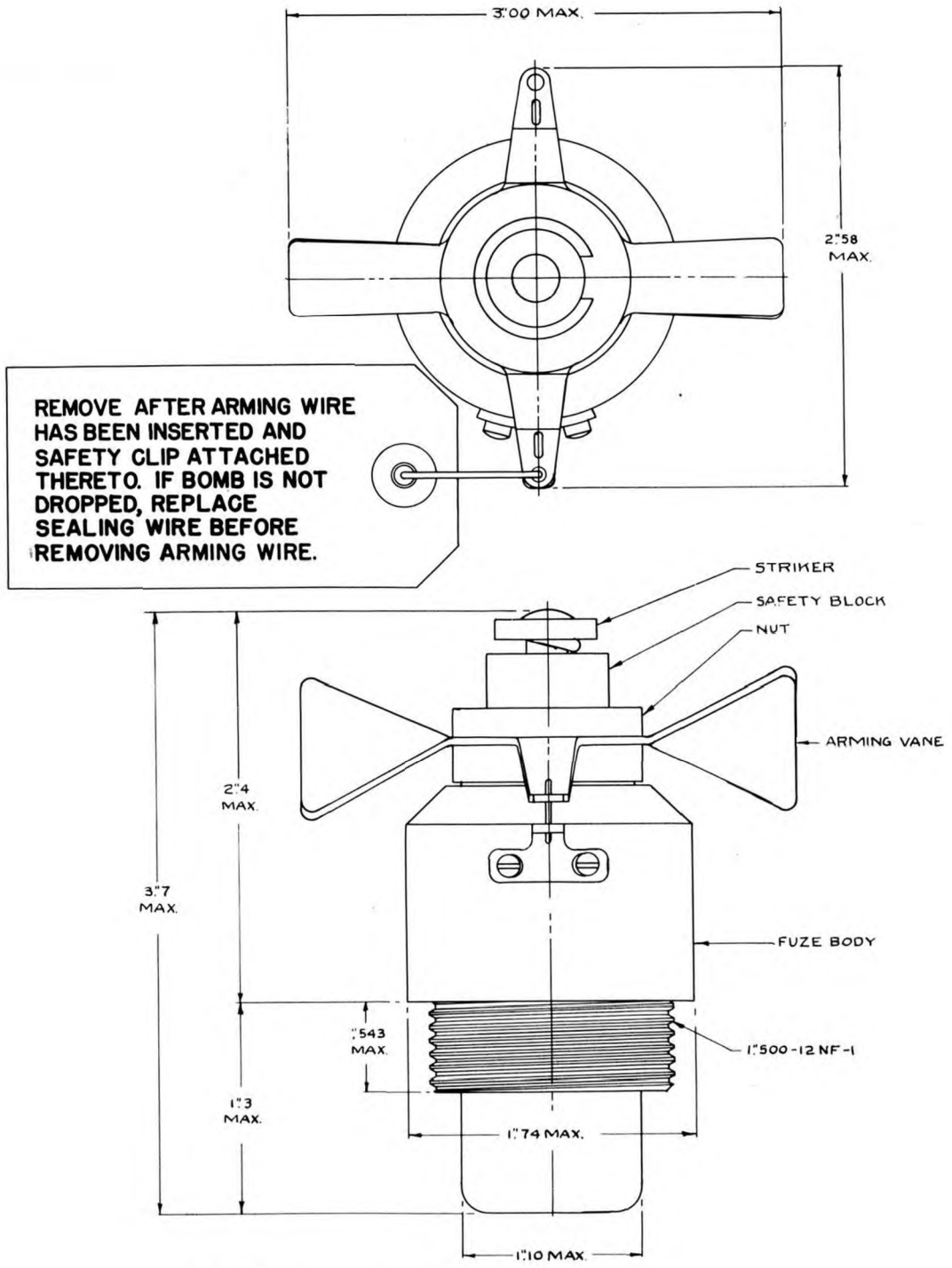
1. Description:

(a) The Bomb Fuze AN-M103 has been modified as shown on page 98a and is now designated AN-M103A1. The modification consists of enlarging and lengthening the arming screw so that the bottom of the arming screw serves to restrain the arming stem shoulder. This modification prevents the rising of the arming stem if the arming mechanism is accidentally broken free of the fuze. Formerly, such an accident would completely arm the fuze. This modification is designed to increase safety. In all other features, the Bomb Nose Fuze AN-M103A1 is identical with the Bomb Nose Fuze AN-M103.

PART II___Chapter 3_____ (RESTRICTED)

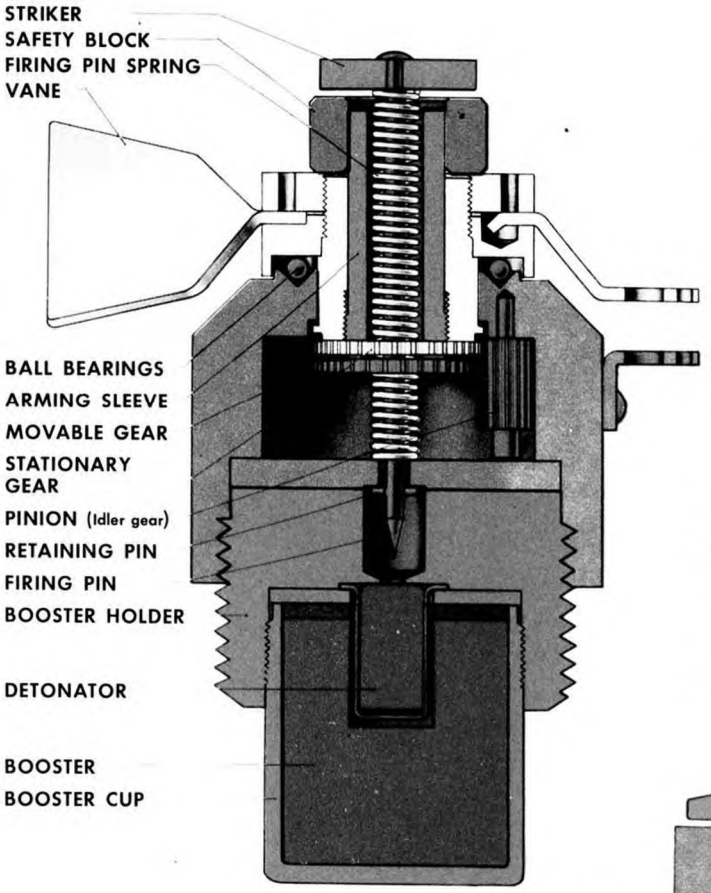
Fuze, Bomb, Nose AN-M110A1

CONTENTS

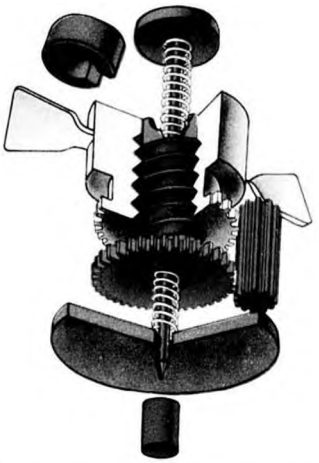


NOTE:
WEIGHT OF FUZE FULLY LOADED - 1"02 LBS. APPROX.
THE FOLLOWING INFORMATION IS STAMPED ON FUZE BODY:
NOSE BOMB FUZE AN-M110A1, LOT NUMBER,
LOADER'S INITIALS AND DATE LOADED (MO. AND YR.).

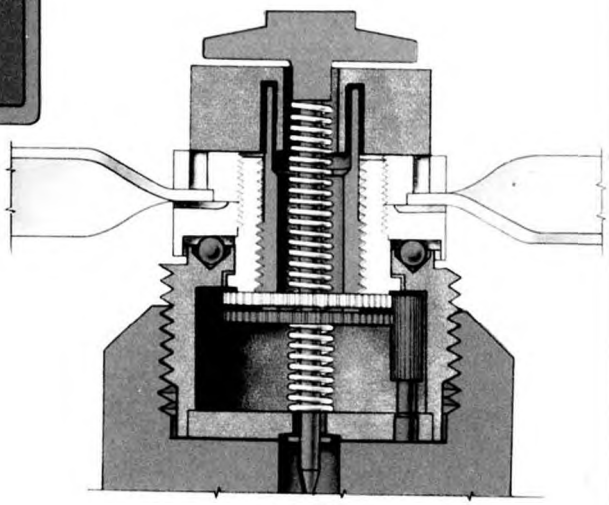
FIG.2-6- OUTLINE OF NOSE BOMB FUZE AN-M110A1



AN-M110A1



1 Vanes rotate stationary gear which meshes with pinion.
2 Pinion rotates movable gear which has one more tooth than stationary gear.
3 Movable gear lags one tooth every rotation and this unscrews it downward.
4 As movable gear descends it pulls arming sleeve downward freeing safety blocks.
5 Upon impact, striker drives firing pin into detonator.



AN-M110

AN-M110A1

AN-M110

BOMB FUZE (NOSE) · AN-M110, 110A1

RESTRICTED

1. DESCRIPTION:

(a) ***General***—The AN-M110A1 is a nose bomb fuze which functions on impact with instantaneous action. It is of the arming vane type, has mechanical delay arming, and is safe for landings and takeoffs anywhere including the decks of carriers. The weight of the fully loaded fuze is approximately 1.02 lb. The initial lots of these fuzes are cadmium plated; succeeding lots may be given a "Cronak" or dichromate finish and have a blue bronze appearance. The general arrangement or assembly is shown on Bureau of Ordnance Drawing No. 339670 or Army Ordnance Department Drawing No. 73-8-77, Fig. 2-6 shows the outline and principal dimensions of this fuze. Fig. 2-7 shows the general arrangement or assembly and the names of the various parts.

(b) ***Bombs in which used***—This fuze is used in the AN-M41 20-lb. fragmentation bomb. These bombs are issued to the service in the AN-M1A1 fragmentation bomb cluster (100-lb size). The cluster contains 6 bombs which are fuzed when issued. The actual weight of the cluster is 137 lb.

This fuze is used also in the M70, 115-lb. chemical bomb, which may be adopted later as an Army-Navy Standard.

(c) ***Mechanical delay arming***—Delay arming is obtained by interposing a reduction gear train between the arming vane and the arming sleeve thereby reducing the relative rotation between the arming sleeve and arming hub to one turn for 34 turns of the arming vane. The arming vane, nut, outer ball race, arming hub and stationary gear rotate as a unit. The arming sleeve and movable gear rotate as a unit and the arming sleeve unscrews from the arming hub as the arming vane turns. The ball bearings between the fuze body and outer ball race reduce the friction and take up the end thrust while the fuze is arming in flight. Approximately 260 revolutions of the arming vane are required to arm this fuze.

(d) ***Striker details***—The striker, which is a five-eighths inch dia. disc, and the firing pin are fastened together to form the striker-firing pin assembly. This assembly is held to the fuze by a retaining pin which passes through the firing pin behind the end plate. In the unarmed or safe position, a safety block is interposed between the striker and the nut on the delay arming mechanism, to positively prevent the firing pin from being driven into the detonator. The safety block is held in place by the arming sleeve until the latter is withdrawn by rotation of the arming vane. Approximately 260 revolutions of the arming vane are required to arm the fuze. In the armed position, the firing pin spring holds the firing pin away from the detonator until impact.

(e) ***Explosive components*** — The explosive components consist of the detonator and booster charge. The detonator fits into the detonator holder cup which projects into the booster charge. The booster charge consists of 17.4 grams (0.6 oz.) of tetryl.

2. FUNCTIONING:

(a) ***Released armed***—When the cluster (or the bomb) is released armed, the vane stops (or the arming wire) are withdrawn from the fuze, thereby allowing the air stream to turn the arming vane. The rotating arming vane, acting through the reduction gearing, unscrews the arming sleeve from the arming hub. The diameter of the striker disc and the diameter and weight of the safety block are such that air pressure during flight on the nose of the fuze, forces the safety block against the nut of the rotating gear mechanism. The spin thus imparted to the safety block causes it to be thrown out by centrifugal action when the arming sleeve is withdrawn. The fuze is now completely armed, but the arming vane continues to spin. The firing pin spring holds the firing pin away from the detonator until impact. On impact, the firing pin is driven into the detonator, initiating the explosive train and detonating the bomb with instantaneous action.

(b) ***Air travel required to arm*** — The air travel along the trajectory necessary to insure arming of this fuze is 725 feet. The corresponding minimum altitudes of release for various air speeds in horizontal flight bombing are:

Air Speed—Knots	100	150	200	250
Alt. of Release—Ft.	260	125	75	40

The above values for the minimum altitudes of release should not be confused with the minimum *safe* altitudes of release which depend upon other factors and not upon the air travel required to arm. The minimum safe altitudes of release are determined by Cominch.

(c) ***Sensitivity***—This fuze is very sensitive. It will function on impact with the surface of the water and on impact with extremely lightly constructed targets.

(d) ***Released safe*** — If the cluster (or the bomb) is dropped safe, the arming wire is released

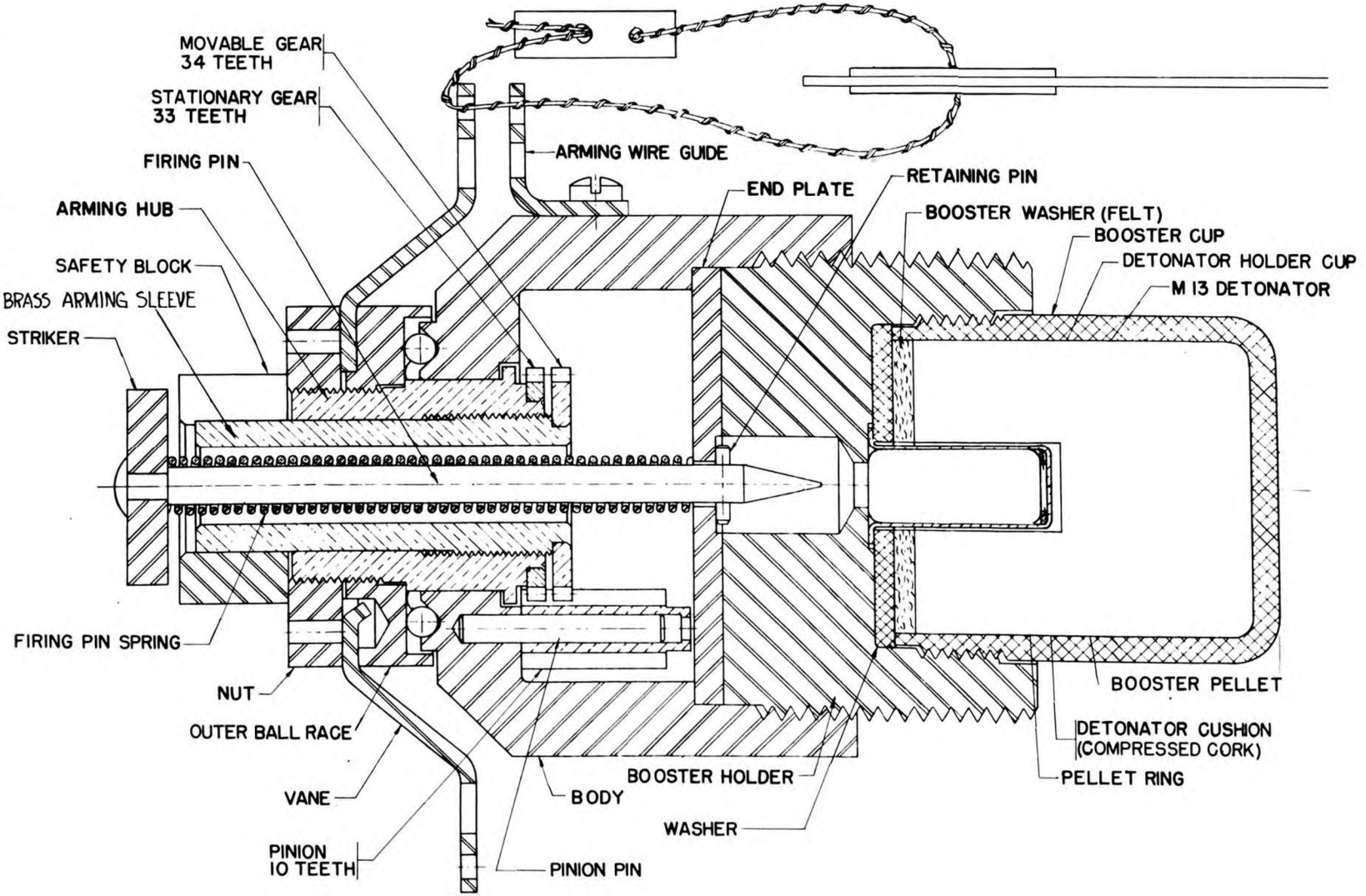


FIG2-7-GENERAL ARRANGEMENT OF NOSE BOMB FUZE AN-M 110A1

from the arming mechanism and drops with the cluster (or the bomb), thereby preventing the fuze from arming. Being unarmed the fuze will not function on impact. In actual tests, unarmed fuzes did not function when dropped 15 feet on a heavy steel deck; this is equivalent to a drop of 12,000 feet on normal soil.

3. SAFETY FEATURES:

(a) ***Installed in a bomb***—When the fuze is installed in a bomb which is placed either in a cluster or in the bomb rack of an airplane with the arming wire in place, the fuze is in the unarmed position and does not become armed until the bomb has been released from the bomb rack and has traveled the distance along the trajectory necessary to arm the fuze. The safety block prevents the firing pin striking the detonator until after arming.

The detonator projects into the booster charge; consequently premature detonator action will result in detonation of the explosive charge in the bomb. However, no reports have been received of detonation of bombs due to premature detonator action.

(b) ***During shipping and stowage***—During shipping and stowage, the arming vane is prevented from turning by a wire inserted through the arming vane and the arming wire guide screwed to the fuze body. The ends of the wire are fastened together by a car seal. This also applies to the fuzes shipped installed in the bomb in the AN-M1A1 cluster.

As an additional precaution during shipping and stowage the safety block will be secured in place either by adhesive tape or by a metal clip. This adhesive tape or metal clip should be removed immediately before the cluster is installed on the airplane. If any safety block falls out when the adhesive tape or metal clip is removed, the block should be put back in place and secured by wrapping at least two turns of adhesive tape around it. If this condition occurs it should be reported to a responsible authority who will decide upon the proper disposition of the cluster involved.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—If the safety block is not in place between the striker and the reduction gearing mechanism, the fuze is armed. If the amount the arming sleeve extends above the nut (dimension A Fig. 2-7) is less than about one-fourth inch but the safety block is still in place, the fuze is partially armed. However, except for requiring fewer turns of the arming vane to arm completely, a partially armed fuze with the safety block still in place is no more unsafe than a completely unarmed fuze.

(b) ***Handling***—Armed fuzes may be made safe for handling by inserting a block of metal or wood between the striker and the reduction gearing mechanism, and securing the block by any suitable means such as with adhesive tape.

(c) ***Salvaging***—Partially armed fuzes (safety block still in place but dimension A Fig. 2-7 less than about one-fourth inch) may be salvaged by turning the arming vane counterclockwise (looking at arming vane toward the booster) as far as it will go and then turning it forward about 15 turns. Dimension A Fig. 2-7 should then be not less than one-fourth inch; if it is appreciably different from this value the fuze should be disposed of.

Fuzes which have become completely armed (safety block missing) should be disposed of in any suitable manner after having been made safe for handling. See paragraph 4b.

5. INSTALLATION:

(a) ***Instructions***—The bombs in the AN-M1A1 cluster are already fuzed when received. Note precaution in paragraph 3(b).

To install the fuze in the M-70 chemical bomb follow the instructions below in the order indicated:

(1) Remove fuze from paper carton.

(2) Remove safety clip (or adhesive tape) from the safety block.

(3) Screw fuze into nose of bomb until it seats, handtight. Use no tools.

(4) Thread the arming wire through the front suspension lug of the bomb and through the inner eyelets on the arming wire guide and vane tab of the fuze, until the swivel loop is midway between the two suspension lugs on the bomb. Slip two Fahnestock connectors over the arming wire and push them up to the vane tab. Cut off arming wire so that it protrudes two to three inches beyond the vane tab.

(5) Remove safety wire which is threaded through the outer eyelets in vane tab and arming wire guide. Should it be necessary to remove the fuze from the bomb, carry out the above steps in the reverse order. Inspect the fuze and repack in fuze carton.

(b) ***Points to check*** — After the bomb is installed in the airplane, the following points should be checked before the take-off: (1) That the arming wire is properly assembled, and (2) that the safety seal wire has been removed. In the AN-M1A1 cluster check the following points before takeoff: (1) that the arming wire is properly assembled to the cluster release mechanism, (2) that the cotter pins are removed from the cluster release mechanisms, and (3) that the safety seal wire on each fuze has been removed. The vane stop in the cluster bracket prevents the arming vanes from rotating until the bombs are discharged from the cluster.

6. SERVICING:

(a) ***Use of lubricants***—Lubricants or preservatives of any kind should not be used on this fuze. The reduction gear mechanism is coated with colloidal graphite by the manufacturer at assembly which acts as a lubricant.

(b) ***Fuzes exposed to weather***—It is recommended that fuzes which have been installed in bombs and exposed to the weather for three weeks be replaced with new fuzes. However, depending upon the weather conditions under which the planes are operating it may be necessary to replace the fuzes after a shorter period of exposure.

If sufficient bombs are available, it is recommended that fuzes which have been exposed to the weather be dropped to check their functioning. Complete data on the length of exposure, approximate temperatures and weather conditions during the exposure, and other pertinent information should be obtained by the Ordnance Officer and forwarded to the Bureau of Ordnance for information and distribution to forces operating in similar climatic conditions.

(c) ***Reports of Malfunctionings***—Reports of malfunctionings and troubles encountered with the fuze should be reported to the Bureau of Ordnance. The report should contain the lot number of the fuze and other ammunition components, in addition to the detailed description of the conditions, previous history, and other pertinent information relating to the ordnance material and the malfunctioning or trouble encountered.

The loader's initials, date (month and year) loaded, and the lot number are stamped or marked on the fuze, fuze carton, packing box and the accompanying ammunition data card. The lot number is required for all purposes of record.

(d) ***Disassembly***—No attempt should be made to disassemble these fuzes. Fuzes which have become damaged, corroded, or otherwise fouled up should be disposed of in the most suitable manner available.

7. Packing and Marking:

(a) ***Fuze carton***—When not issued with the bomb clusters, twelve fuzes are packed in a paper carton having the following dimensions, nine and twenty-nine-thirty-seconds inches long by nine and seventeen-thirty-seconds inches wide by four and three-eighths inches high. The weight of the carton and fuzes is 13.85 lb. The carton is coated with wax and marked as follows:

12 FUZES
BOMB, NOSE, AN-M110A1

(b) ***Packing box***—Four cartons (48 fuzes) are packed in a wood packing box twenty-three and one-sixteenth inches long by eleven and three-sixteenths inches wide by eleven and seven thirty-seconds inches high. The weight of the packing box and fuzes is 77.1 lb. The cover on the packing box is hinged and locked by a hasp. The side of the box is marked:

48 FUZES
BOMB, NOSE, AN-M110A1

PART II—Chapter 4 (RESTRICTED)

Fuze, Bomb, Tail—M112, M113 And M114

CONTENTS

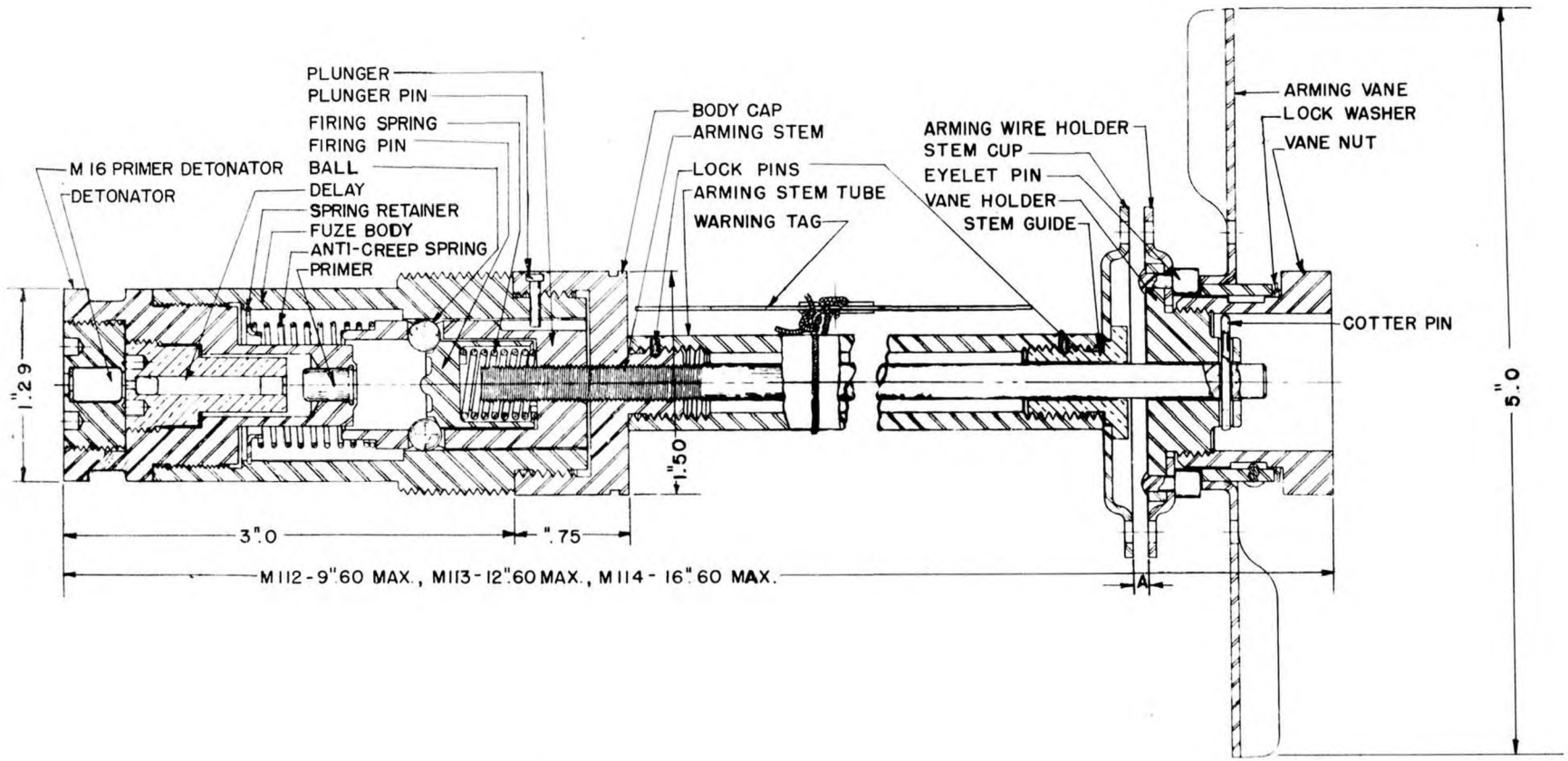
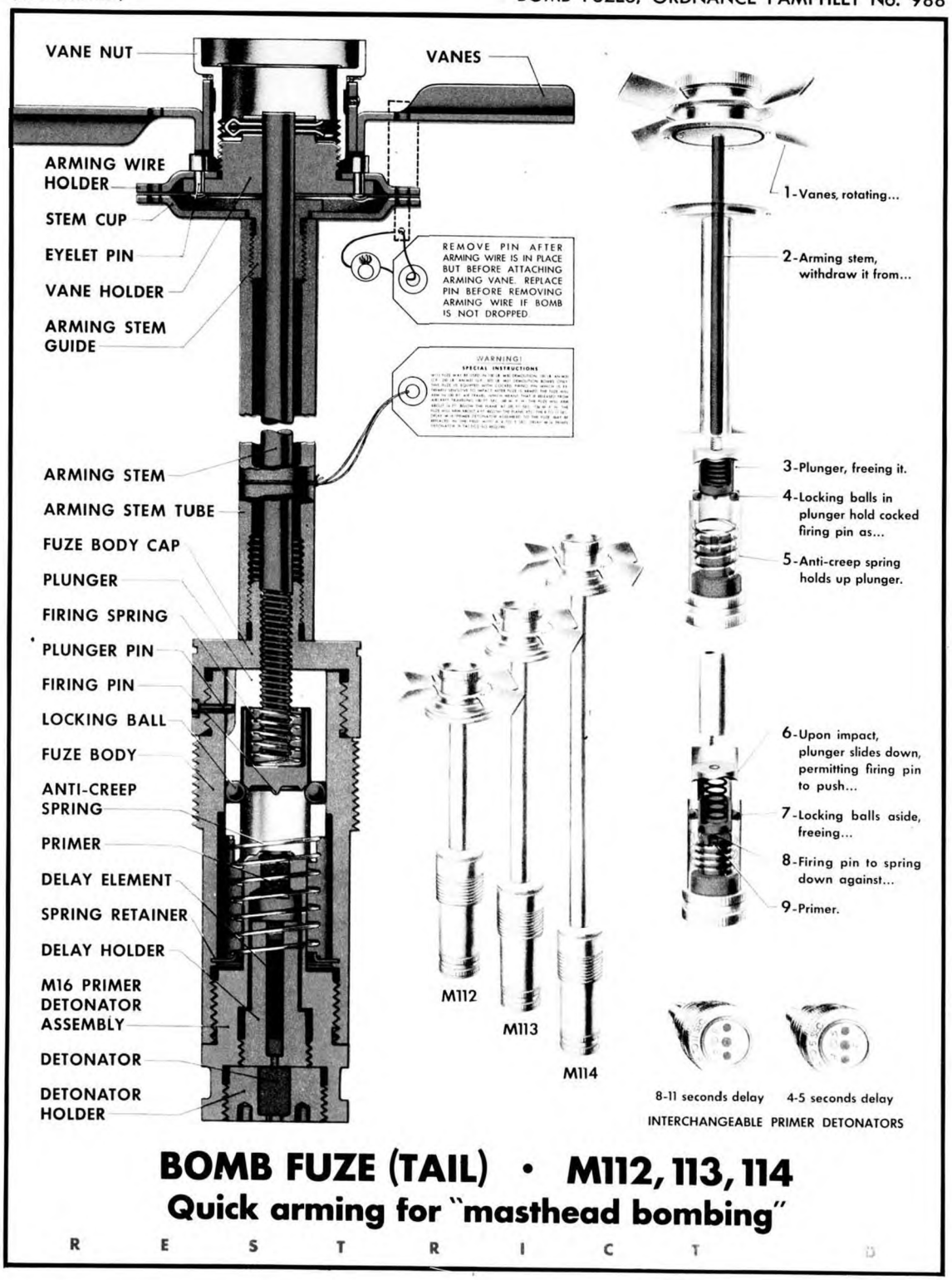


FIG. 2-8 — FUZE, BOMB, TAIL — M112, M113, M114: GENERAL ARRANGEMENT WITH M16 PRIMER DETONATOR INSTALLED.



BOMB FUZE (TAIL) • M112, 113, 114

Quick arming for "masthead bombing"

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The M112, M113 and M114 bomb tail fuzes are of the arming vane type, with mechanical delay arming. They function with delay action on impact and may be equipped with either a 4 to 5 second delay or an 8 to 11 second delay by installing the proper primer detonator. When issued they are equipped with the 8 to 11 second primer detonator. About 100 feet of air travel along the trajectory is required to arm these fuzes. They are safe for dive bombing, but are NOT SAFE FOR USE ON CARRIERS, EITHER FOR TAKE-OFFS OR LANDINGS, AND SHOULD NOT BE USED ON CARRIERS. LANDINGS AND TAKE-OFFS NEAR SHIPS OR IMPORTANT BUILDINGS SHOULD BE AVOIDED AND IF THE BOMB FALLS OFF, THE AIRPLANE SHOULD TAXI RAPIDLY AWAY.

Because this fuze is SUPERSENSITIVE, and because of the SHORT AIR TRAVEL ARMING DISTANCE, every PRECAUTION should be taken to GUARD AGAINST ACCIDENTAL RELEASE.

The arming vane, firing mechanism and explosive components of the three models are identical. The length of the arming stem tubes and arming stems, and consequently the overall lengths differ for each model. This is shown in the drawing of the fuze (Fig. 2-8). The different lengths are necessary to properly locate the arming vane in the air stream when assembled in various sized bombs. The arming vane is strong enough to withstand air speeds of 600 knots.

The M112, M113 and M114 fuzes do not have any reduction gearing, which accounts for the short air travel required to arm. A long delay primer detonator and cocked firing pin have been incorporated in these fuzes.

Figure 2-8 shows the general arrangement and gives the names of the various parts. Principal dimensions also are shown in figure 2-8.

The general arrangement drawings for the M112, M113 and M114 are:

Fuze	Bureau of Ordnance Drawing No.	U. S. Army Ordnance Dept. Drawing No.
M112	372739	73-8-112
M113	372742	73-8-114
M114	372745	73-8-116

(b) ***Bombs in which used*** — The following tabulation shows the Army-Navy Standard Bombs with which these fuzes may be used:

Fuze	Bomb	
M112	100 lb. AN-M30	General Purpose Bomb
	250 lb. AN-M57	General Purpose Bomb
M113	500 lb. AN-M43	General Purpose Bomb
	500 lb. AN-M64	General Purpose Bomb
	500 lb. AN-M58A1	Semi-Armor Piercing Bomb
	500 lb. AN-M58	Semi-Armor Piercing Bomb
M114	1000 lb. AN-M44	General Purpose Bomb
	1000 lb. AN-M65	General Purpose Bomb
	2000 lb. AN-M34	General Purpose Bomb
	2000 lb. AN-M66	General Purpose Bomb
	1000 lb. AN-M59	Semi-Armor Piercing Bomb

(c) ***Arming***—In these fuzes the arming vane is directly connected to the arming stem. The arming vane, which is not assembled to the fuze during shipping and stowage, is fastened to the vane carrier by the vane nut when the fuze is installed in the bomb. The heads of the eyelet pins in the vane holder fit into grooves in the arming vane and vane hub, positively locking the vane to the vane holder. The vane holder is securely fastened to the arming stem by a cotter pin passing through the stem and vane holder. One turn of the vane will therefore produce one turn of the arming stem. In the safe or unarmed position, the plunger is prevented from moving forward by the arming stem which is threaded to both the body cap and the plunger. A pin extends through the fuze body into a groove in the plunger, preventing the plunger from rotating while the stem is being unscrewed but allowing axial motion for firing. The arming wire prevents the vanes from rotating. When the bomb is dropped free to arm, the arming wire is withdrawn and the arming vane rotates in the air stream. The arming stem is unscrewed from the plunger by rotation of the arming vane. As soon as the arming stem is unscrewed from the plunger the fuze is fully armed and will function on impact. An anti-creep spring keeps the plunger and firing pin from moving forward and

firing the primer until impact of the bomb. After unscrewing from the plunger, the arming stem will unscrew from the body cap, and the vane and arming stem will be carried away from the bomb by the air stream.

(d) ***Explosive components*** — The explosive components consist of a primer, delay element, relay and detonator. They are all contained in the M16 primer detonator which screws into the base of the fuze body. The booster charge is contained in the adapter booster which is shipped assembled in the bomb. The primer detonator is stamped on the end; "4 to 5 Sec." to denote 4 to 5 seconds delay, or "8 to 11 Sec." to denote 8 to 11 seconds delay. The M16 primer detonator also has a groove in the knurling for differentiating from the M14 Primer Detonator which has much shorter delays. In order to prevent the installation of the M14 primer detonator in this fuze the threads on the M14 primer detonator do not fit the threads in this fuze. Use only M16 Primer Detonators in these fuzes.

2. FUNCTIONING:

(a) ***Released armed***—When the bomb is released armed the arming wire is withdrawn from the fuze. The fuze will then arm as explained in paragraph 1c above and function on impact.

The firing mechanism consists of a firing pin and cocked firing pin spring, plunger, locking balls, anti-creep spring and retainer. The firing pin and spring are assembled inside the plunger with the firing spring in the compressed position behind the firing pin. They are held in this position by two locking balls in the plunger which are kept in place by the inside surface of the fuze body. The plunger and firing pin are kept from moving forward after arming, but before impact, by the anti-creep spring. When impact occurs inertia carries the plunger and firing pin forward, compressing the anti-creep spring. After moving forward a short distance the locking balls pass a step on the inner surface of the fuze body and the balls drop out, thereby unlocking the firing pin. The compressed firing spring then drives the firing pin forward against the primer. The primer explodes and sets off the delay. After burning through, the delay sets off the relay which fires the detonator, the auxiliary booster and the bomb.

(b) ***Air travel required to arm***—The arming stem is unscrewed from the plunger after 18 to 21 revolutions and the fuze is fully armed. About 100 feet of air travel along the trajectory is normally required for arming. The arming stem is unscrewed from the fuze cap after about 18 more revolutions (about 100 feet additional air travel) and is carried away from the bomb by the air stream. The distance below the airplane at which these fuzes arm depends upon the speed of the airplane at the time of release. At a speed of 68 miles per hour, the fuze arms approximately 16 feet below the plane. At a speed of 136 miles per hour, the fuze arms about 4 feet below the plane. Because of the delay in the fuze, there is some additional safety if the fuze should fire when it arms.

(c) ***Sensitivity***—This fuze is SUPERSENSITIVE. The anti-creep spring is just strong enough to balance the weight of the plunger assembly. Only slight retardation is necessary to initiate action. With the fuze in the armed position, action will be initiated on impact with water or any light structure.

(d) ***Released safe***—If the bomb is released safe, the arming wire is released from the arming mechanism of the bomb rack and drops with the bomb. With the arming wire in place the vanes cannot rotate and arm the fuze. Being unarmed, the fuze will not function on impact.

3. SAFETY FEATURES:

(a) ***When installed in a bomb***—When installed in a bomb with the arming wire in place, the arming vane is locked from rotating and arming the fuze. The fuze is in the safe position and does not become armed until the bomb has been released and has traveled the necessary distance through the air required to arm the fuze. The firing pin and plunger are lined up with the explosive train. However, the plunger is restrained from moving until the arming stem is unscrewed from the plunger by rotation of the arming vane. The arming stem is also threaded through the fuze body cap. This prevents any accidental blows on the arming vane or stem from being transmitted to the plunger.

The booster charge is contained in the adapter booster which is issued assembled in the bomb. When the fuze is installed in the bomb, the detonator is aligned with the booster lead-in. Premature detonator action will result in detonation of the explosive charge in the bomb. However, no reports have been received of detonation of any bombs as a result of premature detonator action.

(b) ***During shipping and stowage***—During shipping and stowage the fuze is in the unarmed

position. A safety pin is inserted through holes in the arming wire holders and prevents the arming stem from rotating. A wire through a hole in the end of the safety pin locks it in position. The ends of this wire are sealed together with a car seal.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance*** — If the arming vane and stem are missing the fuze is armed. However, if the arming vane and stem are not missing, the fuze is not necessarily in the unarmed or safe position. If the distance between the arming wire holder and stem cup (dimension A—Fig. 2-8) is less than one-half inch the fuze is only partially armed. If the distance is one-half to three-fourths inch, arming is questionable and the fuze should be considered as armed. If the distance is greater than three-fourths inch the fuze is armed.

(b) ***Removing from a bomb***—The removal of armed or partially armed fuzes from bombs should be performed by bomb disposal personnel if available. If not available only personnel who thoroughly understand the fuze should perform the work. First lock the arming stem from rotating by inserting a cotter pin or wire through the holes in the arming wire holder and stem cup. This will not make the fuze any safer if it is fully armed, but will prevent partially armed fuzes from becoming completely armed. The fuze should then be carefully unscrewed from the bomb, taking care not to jar or drop the fuze or bomb. The bomb should be maintained in a horizontal position or with the nose end up. Immediately after removal, maintain the fuze in an upright position (vane end down) and unscrew the primer detonator from the fuze body. If the fuze is fully armed it should be disposed of in the safest way practicable. If partially armed, the fuze may then be put in the unarmed position by rotating the arming vane and stem in a counterclockwise direction. Screw the arming stem into the plunger until the arming wire brackets are in contact, then unscrew the stem three-fourths to 1 turn. Fuzes thus placed in the unarmed position will require approximately the same air travel to arm as when issued. Remove the arming vane and replace the safety pin to prevent rotation of the arming stem. Reassemble the primer detonator in the fuze and repack in a fuze container until again required.

If the fuze is so distorted that it cannot be removed from the bomb, the fuzed bomb should be disposed of in the safest way practicable, such as lowering under the surface and releasing in deep water.

5. INSTALLATION IN A BOMB:

(a) ***Instructions***—To install the fuze in a bomb perform the following operations in the order indicated:

(1) Remove the tail shipping plug from the bomb and inspect the adapter booster and threads. Clean if necessary.

(2) Remove the fuze from the sealed metal container. Inspect for damaged threads or vanes.

(3) Change the primer detonator if necessary. To change, unscrew the primer detonator by hand and screw in by hand the primer detonator having the desired delay. Primer detonators having loose primers, evidences of corrosion or other visible defects should be disposed of.

(4) Screw the fuze, less arming vane, into the adapter booster in the tail of the bomb until it seats, hand-tight. Use no tools. No auxiliary boosters are necessary.

(5) Thread the longer end of the arming wire assembly through the rear suspension lug of the bomb and the nearer pair of holes in the arming wire holder and stem cup. Should the nearer pair of holes be occupied by the safety pin, place a second pin through the holes diametrically opposite before removing the original safety pin. The shorter end of the arming wire assembly is for the nose fuze and should be cut off when the nose fuze is not installed.

(6) Cut the retaining wire and remove the safety pin, following the instructions on the tag. Instructions on the tag are "Remove pin after arming wire is in place but before attaching arming vane. Replace pin before removing arming wire if bomb is not dropped."

(7) Place the arming vane into position so that the slots in the hub fit over the heads of the two eyelet pins and so that the arming wire passes through the hole in the vane that is in alignment. Attach two safety clips (Fahnestock connectors) to end of arming wire.

(8) Screw the vane nut on the threaded end of the vane holder, hand-tight.

(9) Place the bomb in the bomb rack and pull the arming wire taut but *allow sufficient freedom for the arming wire plate in the bomb rack.*

(10) Slip the two safety clips (Fahnestock connectors) snugly against the vane and cut off excessive end of arming wire, allowing the end to extend

5 to 6 inches past the vane and clip. The end of the wire should be free from burrs and kinks.

Should it be necessary to remove the fuze from the bomb, carry out the above steps in reverse order. Inspect the fuze, repack in fuze container and seal with adhesive tape.

(b) ***Points to check***—When installing fuzes in bombs make the following check-ups:

(1) Inspect adapter booster and threads in the bomb and clean if necessary.

(2) Inspect vanes, threads and outward appearance of fuze.

(3) Check primer detonator for proper delay.

(4) Check arming wire for proper installation.

(5) See that the safety pin is removed and that the arming vane is properly assembled.

6. SERVICING:

(a) ***Use of lubricants***—Lubricants or preservatives of any kind should not be used on this fuze. The arming stem threads are coated with colloidal graphite by the manufacturer at assembly. The graphite acts as a lubricant.

(b) ***Fuzes exposed to weather***—Laboratory tests indicate that the AN-M100A2 series of fuzes are not adversely affected when subjected to a salt spray estimated to be equivalent to that received in about twenty take-offs and landings with a seaplane and to five cycles of alternate freezing and thawing. Such tests have not been made on the M112, M113 and M114 fuzes, but since they are similar to the AN-M100A2 fuzes they should be able to withstand as severe treatment. The fuze and installation should be thoroughly checked before each take-off. Rock the vanes back and forth (the amount the arming wire will permit) to determine if the shaft is "frozen" in the guide.

(c) ***Reports of malfunctionings***—Reports of malfunctionings and troubles encountered with these fuzes should be reported to the Bureau of Ordnance. The report should contain the designation and lot number of the fuze and other ammunition components, also a detailed description of the history, conditions and other pertinent information concerning the ordnance material and malfunctioning or trouble encountered.

(d) ***Disassembly***—The only authorized disassembly or assembly is the removal or installation of the primer detonator and arming vane and the placing of the fuze in the safe condition as explained in paragraph 4b. Although the fuze is inert when the primer detonator is removed, assembly and disassembly are not authorized because special tools are required.

7. PACKING AND MARKING:

(a) ***Fuze and fuze container***—The fuze body cap is stamped with designation of fuze, loader's lot number, loader's initials and date (month and year) loaded. Sample stamping: "Fuze, M112, Lot 1234, P.A., 9-42."

One fuze, less the arming vane, is packed in a black cylindrical metal container. The dimensions and weights of the containers are as follows:

Fuze	Maximum Dimensions of Fuze Container		Weight of Fuze and Container—Lb.
	Dia.—in.	Lgth.—in.	
M112	2.6	9.7	3.25
M113	2.6	12.7	3.50
M114	2.6	16.7	4.00

A metal tear strip with ring or key attached facilitates opening the container. The following is a sample of the marking on a container.

Fuze, Bomb, Tail, M112
Less Arming Vane
8 to 11 Sec. Delay

Loader's Initials, Lot No. Packed (Month & Year)
Drawing No. Rev. Date of Fuze Drawing
The data is altered as applies.

(b) ***Packing box for fuzes***—Twenty-five fuzes in containers and twenty-five arming vanes are packed in a wood packing box. The maximum dimensions and weights of the packing boxes are as follows:

Fuze	Maximum Dimensions of Packing Box			Weight of Box and Fuzes—lb.(Approx.)
	Length—in.	Width—in.	Height—in.	
M112	18-9/16	14-3/4	15-27/32	112
M113	21-9/16	14-3/4	15-27/32	124
M114	25-9/16	14-3/4	15-27/32	141

The packing box cover is fastened with flathead wood screws and the box bound with two steel straps.

Sample marking on the side of the box is:

25 Fuzes
Bomb, Tail, M112
8 to 11 Sec. Delay

Packed (month and year) Lot No.

The data is altered as applies.

(c) ***Packing can for primer detonator***— One primer detonator is packed in a black, cylindrical metal container 1.355″ diameter and 2.17″ long. The weight of the primer detonator and container is about .5 lb. The cover is sealed with an adhesive tape strip with a tab to facilitate opening. The strip is marked:

Primer Detonator M16
4 to 5 Sec. Delay (or as applies)

(d) ***Packing crate for primer detonator***— Twenty-five primer detonators in packing cans are packed in a metal packing crate, approximately 8″ by 8″ by 2.25″ high. The cover is sealed with an adhesive tape sealing strip which is provided with a tab to facilitate opening. The weight of the box and contents is about 13.75 lb. The top and one side of the crate are marked:

25 Primer Detonators, M16
4 to 5 Sec. Delay Lot 1234

The data is altered as applies.

PART II—Chapter 5 (RESTRICTED)

Fuze, Bomb, Tail—M115, M116, M117

CONTENTS

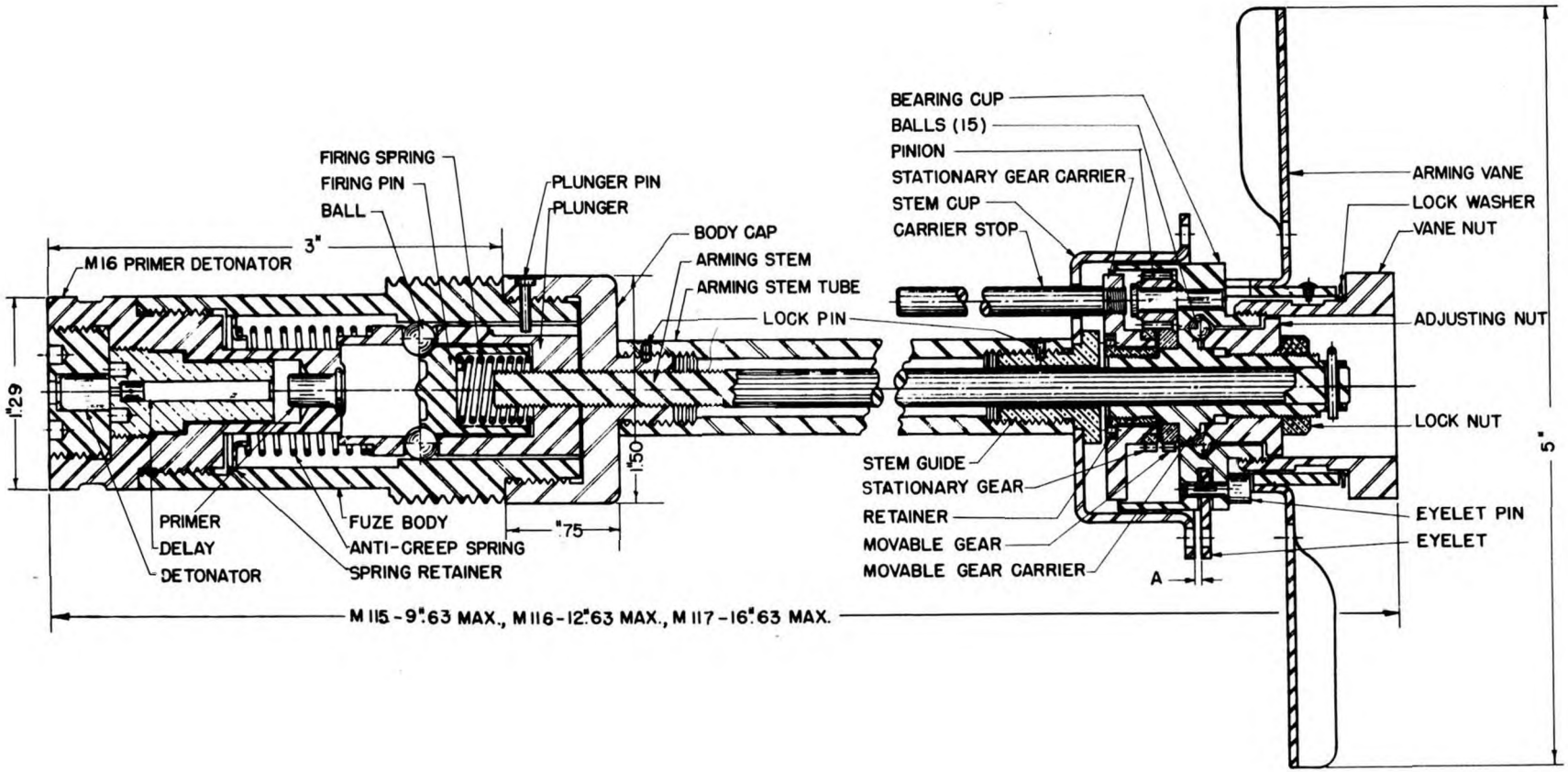
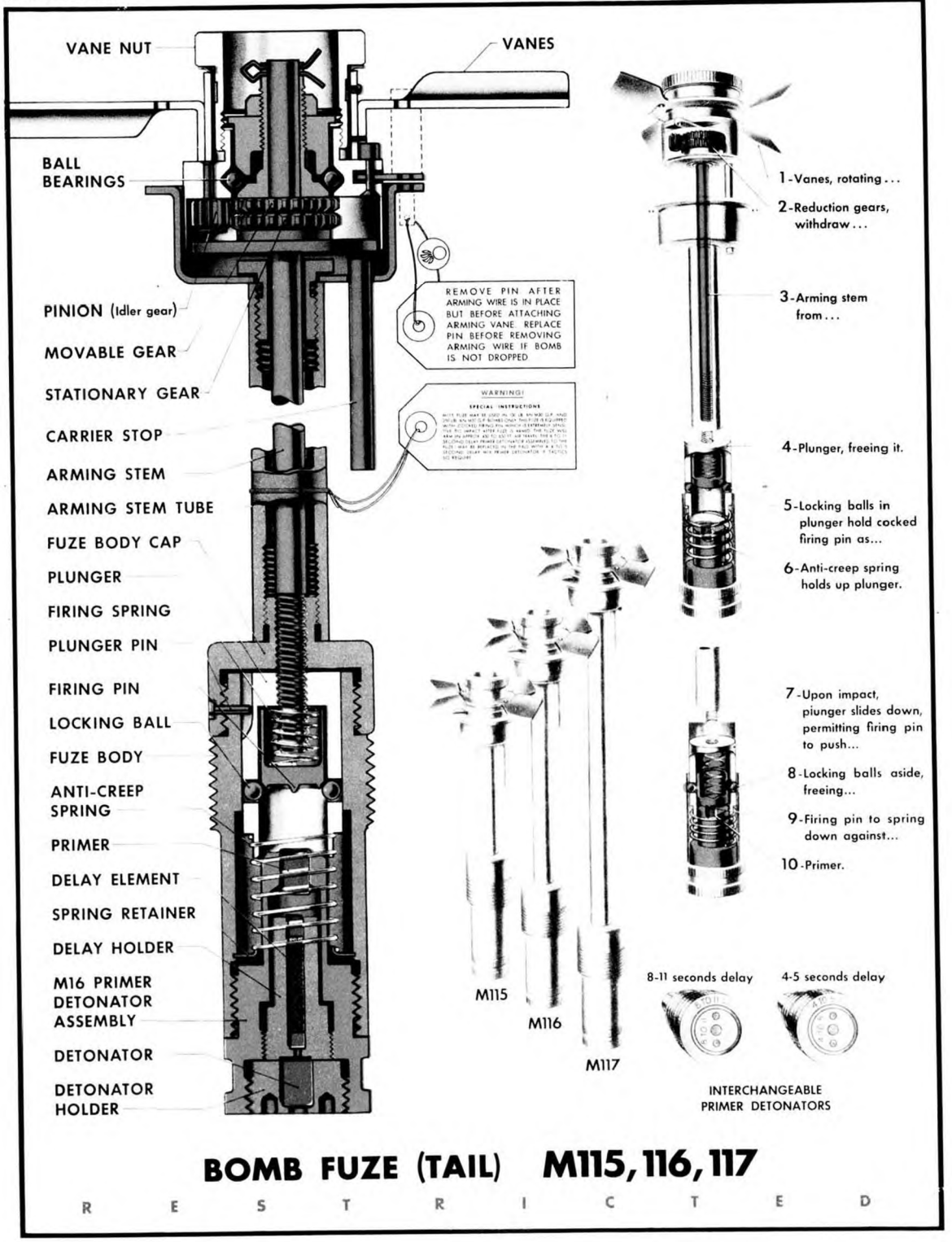


FIG. 2-9 — FUZE, BOMB, TAIL — M115, M116, M117: GENERAL ARRANGEMENT WITH M16 PRIMER DETONATOR INSTALLED



BOMB FUZE (TAIL) M115, 116, 117

R E S T R I C T E D

1. DESCRIPTION:

(a) ***General***—The M115, M116 and M117 are bomb, tail fuzes of the arming vane type, with mechanical delay arming. They function with delay action on impact and may be equipped with either a 4 to 5 second delay or an 8 to 11 second delay by installing the proper primer detonator. When issued they are equipped with the 8 to 11 second primer detonator. About 650 feet of air travel along the trajectory is required to arm these fuzes. The arming vane, delay arming mechanism, firing mechanism, and explosive components of the three models are identical. The lengths of the fuze stem tubes and arming stems and consequently the overall lengths differ for each model. This is shown in the drawing of the fuze (Fig. 2-9). The different lengths are necessary to properly locate the arming vane in the air stream when assembled in various sized bombs. The arming vane is strong enough to withstand air speeds of 600 knots.

These fuzes are safe for dive bombing and for take-offs and landings anywhere including the decks of carriers.

These fuzes are similar to the M112, M113 and M114, but have a reduction gear mechanism to increase the air travel required to arm. The reduction gear mechanism is the same as that used in the AN-M100A2 series of fuzes. The firing mechanism with cocked firing pin is the same as the M112, M113 and M114. Figure 2-9 shows the general arrangement and gives the names of the various parts. Principal dimensions also are shown in Figure 2.9.

The general arrangement drawings for the M115, M116 and M117 are:

Fuze	Bureau of Ordnance Drawing No.	U. S. Army Ordnance Dept. Drawing No.
M115	374922	73-8-158
M116	374925	73-8-160
M117	374928	73-8-162

(b) ***Bomb in which used***—These fuzes may be used in the following Army-Navy Standard Bombs:

Fuze	Bomb	
M115	100 lb. AN-M30	General Purpose Bomb
	250 lb. AN-M57	General Purpose Bomb
M116	500 lb. AN-M43	General Purpose Bomb
	500 lb. AN-M64	General Purpose Bomb
	500 lb. AN-M58	Semi-Armor Piercing Bomb
	500 lb. AN-M58A1	Semi-Armor Piercing Bomb
M117	1000 lb. AN-M44	General Purpose Bomb
	1000 lb. AN-M65	General Purpose Bomb
	2000 lb. AN-M34	General Purpose Bomb
	2000 lb. AN-M66	General Purpose Bomb
	1000 lb. AN-M59	Semi-Armor Piercing Bomb

(c) ***Mechanical delay arming***—Delay arming is obtained by interposing a reduction gear train between the arming vane and the arming stem, to reduce the rotation of the arming stem to one turn for 30 revolutions of the arming vane. The arming vane, which is not assembled to the fuze during shipping and stowage, is fastened to the bearing cup by the vane nut when the fuze is installed in the bomb. The heads of the eyelet pins in the bearing cup fit into grooves in the arming vane and vane hub, positively locking the vane to the bearing cup. The delay arming mechanism is housed in the stem cup, and is withdrawn from the cup as the arming vane rotates and unscrews the arming stem from the plunger. The carrier stop prevents the stationary gear carrier from revolving but allows it to move axially. The balls between the bearing cup, movable gear carrier and adjusting nut take up the thrust and reduce the friction.

(d) ***Firing mechanism***—The firing mechanism consists of a firing pin and cocked firing pin spring, plunger, locking balls, anti-creep spring and retainer. The firing pin and spring are assembled inside the plunger with the firing spring in the compressed position behind the firing pin. They are held in this position by two locking balls in the plunger which are kept in place by the inside surface of the fuze body. When the fuze is armed, the plunger and firing pin are prevented from moving forward before impact by the anti-creep spring.

(e) ***Primer detonator (explosive components)***—The explosive components are all contained in the M16 primer detonator which screws into the base of the fuze body. This is the same primer detonator that is used in the M112, M113 and M114 fuzes. The explosive components consist of a primer, delay element, relay and detonator. The booster charge is contained in the adapter booster which is shipped assembled in the bomb. The primer detonator is stamped on the end: "4 to 5 Sec." to denote 4 to 5 second delay, or "8 to 11 Sec." to denote 8 to 11 second delay. The M16 primer detonator has a groove around the knurled head which distinguishes it from the straight knurled head of the M14 primer detonator used in the AN-M100A2 series of fuzes. The M14 primer detonators have much shorter delays than the M16. In order to prevent the installation of the M14 primer detonator in this fuze, the threads on the M14 primer detonator do not fit the threads in this fuze. Use only M16 primer detonators in these fuzes.

2. FUNCTIONING:

(a) ***Released armed*** — When the bomb is dropped free to arm, the arming wire is withdrawn and the arming vane rotates in the air stream. The rotating arming vane, acting through the reduction gear mechanism, unscrews the arming stem from the plunger. The plunger is then free and the fuze is fully armed. The anti-creep spring holds the plunger assembly from moving forward until impact occurs. On impact, inertia carries the plunger assembly forward, compressing the anti-creep spring. After moving forward a short distance, the locking balls pass a step on the inner surface of the fuze body and the balls jump out, thereby unlocking the firing pin. The compressed firing pin spring then drives the firing pin forward against the primer. The primer explodes and sets off the delay. After burning through, the delay sets off the relay which fires the detonator, the auxiliary booster and the bomb.

(b) ***Air travel required to arm***—The arming stem is unscrewed from the plunger after 150 to 170 revolutions of the arming vane and the fuze is fully armed. The arming stem is unscrewed from the fuze cap after about 200 more revolutions of the arming vane, and the entire assembly (vane, gear mechanism and arming stem) is carried away from the bomb by the air stream. The air travel along the trajectory and the corresponding minimum altitudes of release required to accomplish arming for various air speeds when the fuzes are installed in various bombs is given in Table 2-III. The variations in air travel are due to differences in the diameters and construction of the bombs.

(c) ***Sensitivity***—This fuse is SUPERSENSITIVE. The anti-creep spring is just strong enough to balance the weight of the plunger assembly. Only slight retardation is necessary to initiate action. With the fuze in the armed position, action will be initiated on impact with water or any light structure.

(d) ***Released safe***—If the bomb is released safe, the arming wire is released from the arming mechanism of the bomb rack and drops with the bomb. With the arming wire in place, the vanes cannot rotate and arm the fuze. Being unarmed, the fuze will not function on impact.

3. SAFETY FEATURES:

(a) ***When installed in a bomb***—When installed in a bomb with the arming wire in place, the arming vane is prevented from rotating and arming the fuze. The fuze is in the safe position and does not become armed until the bomb has been released and has traveled the necessary distance through the air required to arm the fuze. The firing pin and plunger are lined up with the explosive train. The plunger, however, is restrained from moving until the arming stem is unscrewed from the plunger by rotation of the arming vane. The arming stem is also threaded through the fuze body cap. This prevents any accidental blows on the arming vane from being transmitted to the plunger.

The booster charge is contained in the adapter booster which is issued assembled in the bomb. When the fuze is installed in the bomb, the detonator is aligned with the booster lead-in. Premature detonator action will result in detonation of the explosive charge in the bomb. However, no reports have been received of detonation of any bombs as a result of premature detonator action.

(b) ***During shipping and stowage***—During shipping and stowage the fuze is in the unarmed position. A safety pin inserted through a hole in the stem cup and eyelet prevents the arming stem from rotating. A wire through a hole in the end of the safety pin locks it in position. The ends of this wire are sealed together with a car seal.

4. ARMED AND PARTIALLY ARMED FUZES:

(a) ***Appearance***—If the arming vane and reduction gear mechanism are missing, the fuze is armed. However, if the arming vane and gear mechanism are not missing, the fuze is not necessarily in the unarmed or safe position. If the distance between the eyelet and the vane cup flange (dimension A, Fig. 2-9) is less than one-half inch, the fuze is only partially armed. If the distance is one-half to three-fourths inch, arming is questionable and the fuze should be considered as armed. If the distance is greater than three-fourths inch, the fuze is armed.

(b) ***Removing from a bomb***—The removal of armed or partially armed fuzes from bombs should be performed by bomb disposal personnel if available. If not available, only personnel who thoroughly understand the fuze should perform the work. First, lock the arming vanes from rotating by inserting a cotter pin or wire through the holes in the stem cup and eyelet. This will not make the fuze any safer if it is fully armed, but will prevent partially armed fuzes from becoming completely armed. The fuze should then be carefully unscrewed from the bomb, taking care not to jar or drop the fuze or bomb. The bomb should be maintained in a horizontal position or with the nose end up. Immediately after removal, maintain the fuze in an upright position (vane end down) and unscrew the primer detonator from the fuze body. If the fuze is fully armed, it should be disposed of in the safest way practicable. If partially armed the fuze may be put in the unarmed position by rotating the arming vane and stem in a counterclockwise direction. Screw the arming stem into the plunger as far as it will go, then reverse rotation and turn the vane clockwise about 20 revolutions. Fuzes thus placed in the unarmed position will require approximately the same air travel to arm as when issued. Remove the arming vane and replace the safety pin to prevent rotation of the arming stem. Reassemble the primer detonator in the fuze and repack in a fuze container until again required.

If the fuze is so distorted that it cannot be removed from the bomb, the fuzed bomb should be disposed of in the safest way practicable, such as lowering under the surface and releasing in deep water.

5. INSTALLATION IN A BOMB:

(a) ***Instructions***—To install the fuze in a bomb, perform the following operations in the order indicated:

(1) Remove the tail shipping plug from the bomb and inspect the adapter booster and threads. Clean if necessary.

(2) Remove the fuze from the sealed metal container. Inspect for damaged threads, vanes, etc.

(3) Change the primer detonator if necessary. To change, unscrew the primer detonator by hand and screw in by hand the primer detonator having the desired delay. Primer detonators having loose primers, evidences of corrosions or other visible defects should be disposed of.

(4) Screw the fuze, less arming vane, into the adapter booster in the tail of the bomb until it seats, hand tight. Use no tools. No auxiliary boosters are necessary.

(5) Thread the longer end of the arming wire assembly through the rear suspension lug of the bomb and the nearer pair of holes in the stem cup and eyelet. Should the nearer pair of holes be occupied by the safety pin, place a second pin through the holes diametrically opposite before removing the original safety pin. The shorter end of the arming wire assembly is for the nose fuze and should be cut off when the nose fuze is not installed.

(6) Cut the retaining wire and remove the safety pin, following the instructions on the tag. The instructions on the tag are: "Remove pin after arming wire is in place, but before attaching arming vane. Replace pin before removing arming wire if bomb is not dropped."

(7) Place the arming vane into position so that the slots in the hub fit over the heads of the two eyelet pins and so that the arming wire passes through the hole in the vane that is in alignment. Attach two safety clips (Fahnestock connectors) to end of arming wire.

(8) Screw the vane nut on the threaded end of the bearing cup, hand tight.

(9) Place the bomb in the bomb rack and pull the arming wire taut, but *allow sufficient freedom for the arming wire plate in the bomb rack.*

(10) Slip the two safety clips (Fahnestock connectors) snugly against the vane and cut off excessive end of arming wire, allowing the end to extend 5 to 6 inches past the vane and clip. The end of the wire should be free from burrs and kinks.

Should it be necessary to remove the fuze from the bomb, carry out the above steps in reverse order. Inspect the fuze, repack the fuze container and seal with adhesive tape.

(b) ***Points to check***—When installing fuzes in bombs, make the following check-ups:

(1) Inspect adapter booster and threads in the bomb and clean if necessary.

(2) Inspect vanes, threads and outward appearance of fuze.

(3) Check primer detonator for proper delay.

(4) Check arming wire for proper installation.

(5) See that the safety pin is removed and that the arming vane is properly assembled.

(6) Rock vanes backward and forward slightly to make sure that the vanes can rotate.

6. SERVICING:

(a) ***Use of lubricants***—Lubricants or preservatives of any kind should not be used on this fuze. The arming stem threads and reduction gear train is coated with colloidal graphite by the manufacturer at assembly. The graphite acts as a lubricant.

(b) ***Fuzes exposed to weather***—Laboratory tests indicate that the AN-M100A2 series of fuzes are not adversely affected when subjected to a salt spray estimated to be equivalent to that received in about twenty take-offs and landings with a seaplane and to five cycles of alternate freezing and thawing. Since the M115, M116 and M117 fuzes contain the same reduction gear and vane assembly as the AN-M100A2 series, it may be assumed that they will withstand the same treatment. However it is impossible to simulate actual conditions in laboratory tests. It is recommended that fuzes which have been installed in bombs and exposed to the weather for three weeks be replaced with new fuzes. However, depending upon the weather conditions under which the planes are operating, it may be necessary to replace the fuzes after a shorter period of exposure. The fuze and installation should be thoroughly checked before each take-off. Turn the vanes back and forth (the amount the arming wire will permit) to determine if the arming mechanism is free to operate.

(c) ***Reports of malfunctionings***—Reports of malfunctionings and troubles encountered with these fuzes should be reported to the Bureau of Ordnance. The report should contain the designation and lot number of the fuze and other ammunition components, also a detailed description of the history, conditions and other pertinent information concerning the ordnance material and malfunctioning or trouble encountered.

(d) ***Disassembly***—The only authorized disassembly or assembly is the removal or installation of the primer detonator and arming vane and the placing of the fuze in the safe condition as explained in paragraph 4b. Although the fuze is inert when the primer detonator is removed, assembly and disassembly are not authorized because special tools are required.

7. PACKING AND MARKING:

(a) ***Fuze and fuze container***—The fuze body cap is stamped with designation of fuze, loaders' lot number, loaders' initials and date (month and year) loaded.

Sample stamping: "Fuze, M115, Lot 1234, P.A., 9-42"

One fuze, less the arming vane, is packed in a black cylindrical metal container. The dimensions and weights of the containers are as follows:

Fuze	Maximum Dimensions of Fuze Container		Weight of Fuze and Container-Lb.
	Dia.-In.	Length-In.	
M115	2.6	9.7	3.50
M116	2.6	12.7	3.75
M117	2.6	16.7	4.25

A metal tear strip with ring attached facilitates opening the container. The following is a sample of the marking on a container:

Fuze, Bomb, Tail, M115
Less Arming Vane
8 to 11 Sec. Delay
Loader's Initials, Lot No.
Drawing No.
Packed (Month and Year)
Rev. Date of Fuze Drawing
The data is altered as applies.

(b) ***Packing box for fuzes*** — Twenty-five fuzes in containers and twenty-five arming vanes are packed in a wood packing box. The maximum dimensions and weights of the packing boxes are as follows:

Fuze	Maximum Dimensions of Packing Box and Fuzes—Lb. (Approx.) Length—In.	Width—In.	Height—In.	Weight of Box
M115	18 9/16	14 3/4	15 27/32	119
M116	21 9/16	14 3/4	15 27/32	131
M117	25 9/16	14 3/4	15 27/32	148

The packing box cover is fastened with flat head wood screws and the box bound with two steel straps.

Sample marking on the side of the box is:

25 Fuzes
Bomb, Tail, M115
8 to 11 Sec. Delay
Packed (month and year) Lot No.

The data is altered as applies.

(c) ***Packing can for primer detonator***— One primer detonator is packed in a black, cylindrical metal container 1.335" diameter and 2.17" long. The weight of the primer detonator and container is about 0.5 lb. The cover is sealed with an adhesive tape strip with a tab to facilitate opening. The strip is marked:

Primer Detonator M16
4 to 5 Sec. Delay (or as applies)

(d) ***Packing crate for primer detonator***— Twenty-five primer detonators in packing cans are packed in a metal packing crate approximately 8" x 8" x 2.25" high.

The cover is sealed with an adhesive tape sealing strip which is provided with a tab to facilitate opening.

The weight of the box and contents is about 13.75 lb.

The top and one side of the crate are marked:

25 Primer Detonators, M16
4 to 5 Sec. Delay—Lot 1234

The data is altered as applies.

Table 2-III

Fuze and Bomb	Av. Air Travel Required Feet	Minimum Altitude of Release in Feet for Following Air Speeds in Knots			
		100	150	200	250
M115					
AN-M30 100 lb. G.P.	445	130	60	35	20
AN-M37 250 lb. G.P.	485	145	65	40	25
M116					
AN-M43 500 lb. G.P.	555	190	90	55	30
M117					
AN-M44 1000 lb. G.P.	465	135	60	35	20
AN-M34 2000 lb. G.P.	665	265	130	80	45

NOTE: The values for the air travel required are average values. Variations will not exceed ± 10% of the value given. The values for the minimum altitude of release are computed from the maximum air travel (average value for air travel increased by 10%) and are the minimum altitudes of release which will positively insure arming of the fuze in horizontal bombing.

For bombs not listed, the air travel can be estimated from the data given and from the weights and sizes of the bombs.

The values in this table should not be confused with the minimum safe altitudes of release, which depend upon other factors and not upon the air travel required to arm.

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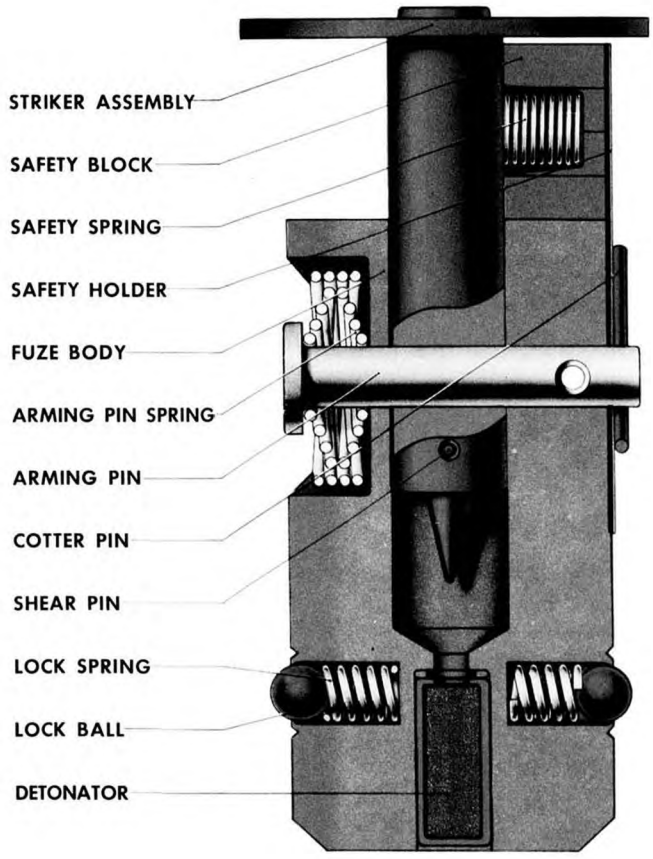
Schools	
General Ordnance School	2
Air Operations Schools	2
Naval Air Technical Trng. Schs.	2
Lighter Than Air Schools	2



Outside View

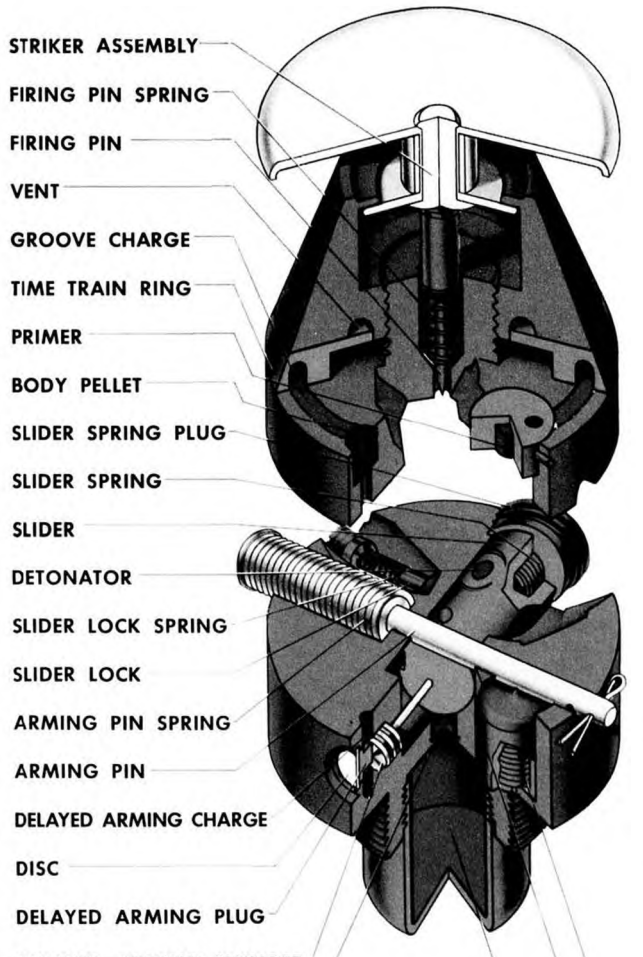
1 Arming pin bolts striker and safety holder. Safety holder retains safety blocks.

2 Pulling out arming wire lets arming pin fly out, safety holder frees safety blocks, leaving fuze armed.

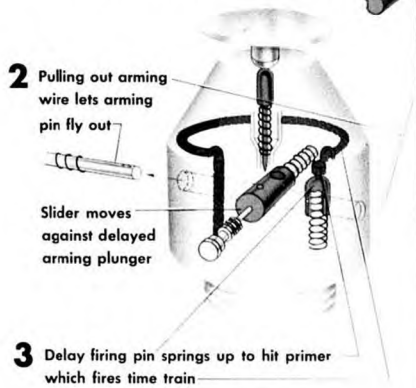
3 On impact, shear pin is sheared, firing pin is driven into detonator initiating explosive train.

BOMB FUZE (NOSE) · M108

R E S T R I C T E D



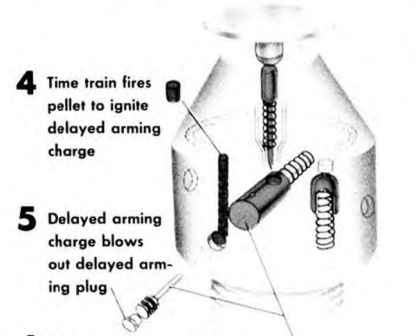
1 Arming pin holds back both delay firing pin and slider



2 Pulling out arming wire lets arming pin fly out

Slider moves against delayed arming plunger

3 Delay firing pin springs up to hit primer which fires time train



4 Time train fires pellet to ignite delayed arming charge

5 Delayed arming charge blows out delayed arming plug

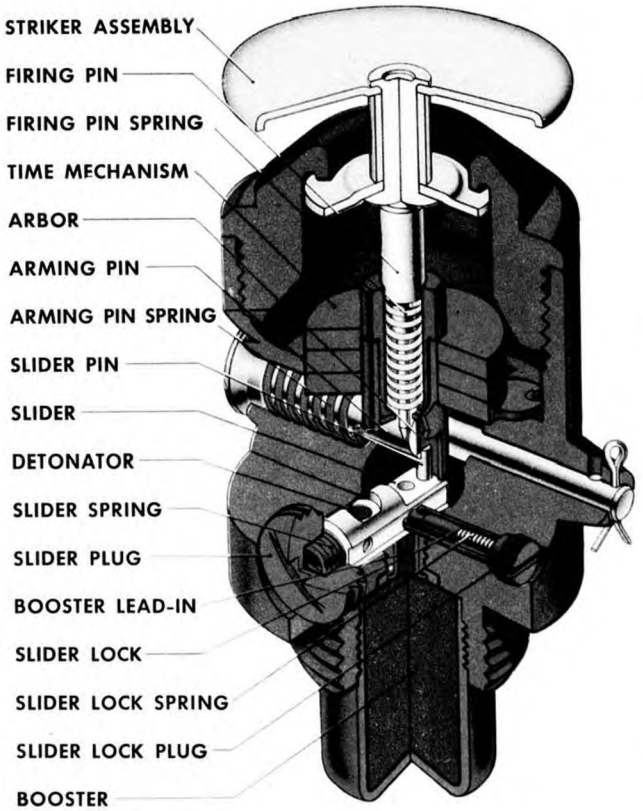
6 Slider springs over, pushing out delayed arming plunger

7 Detonator is now in direct line with firing pin

Total time delay—2.5 seconds

BOMB FUZE (NOSE) · AN-104

R E S T R I C T E D



1 Arming pin retains Arbor. Arbor retains Slider.

2 Pulling out arming wire lets arming pin fly out.

3 Arbor is then free to turn, starting time mechanism.

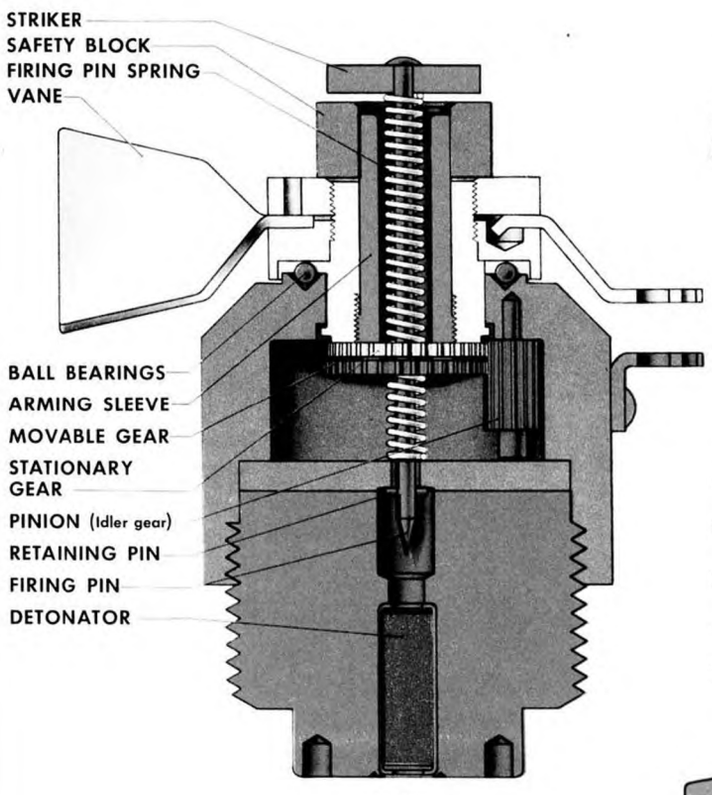
4 Time mechanism rotates arbor, freeing slider pin.

5 Spring moves slider to armed position, aligning detonator with firing pin.

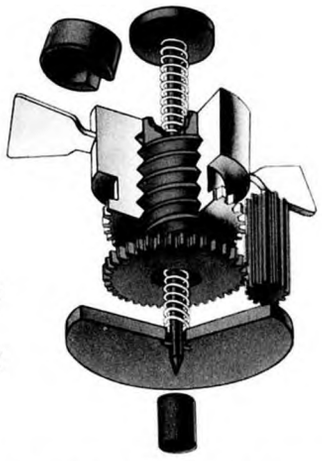
Arming time: 2.25 + 0.50 seconds.

BOMB FUZE (NOSE) • AN-M120

R E S T R I C T E D



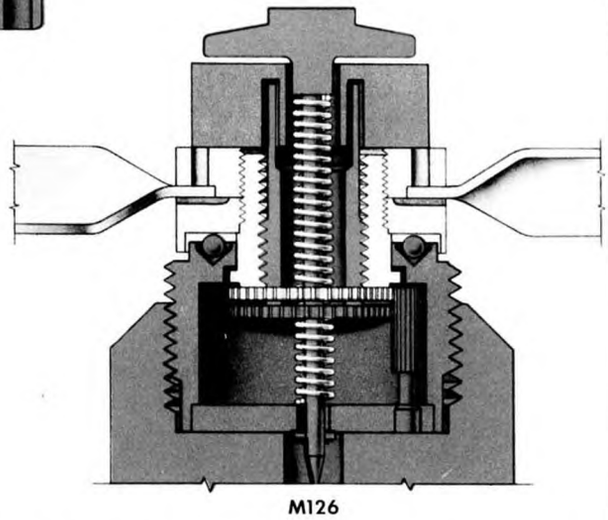
M126A1



1 Vanes rotate stationary gear which meshes with pinion.
2 Pinion rotates movable gear which has one more tooth than stationary gear.
3 Movable gear lags one tooth every rotation and this unscrews it downward.
4 As movable gear descends it pulls arming sleeve downward freeing safety blocks.
5 Upon impact, striker drives firing pin into detonator.

M126A1

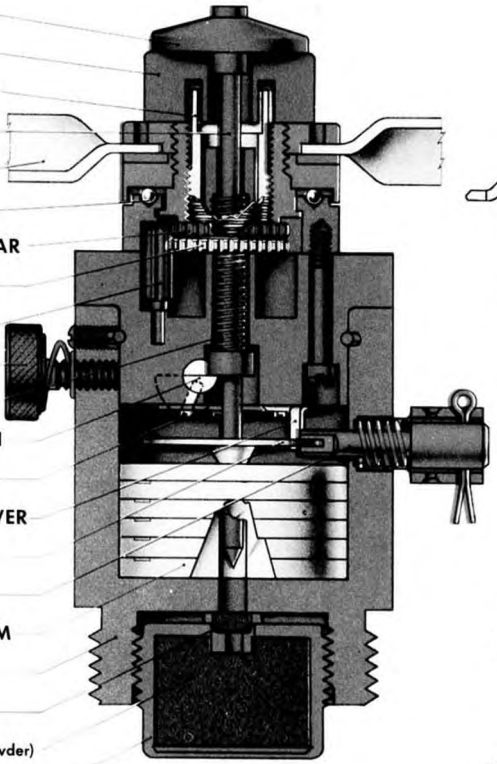
M126



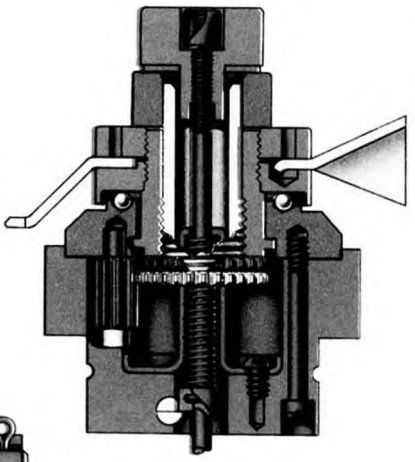
M126

BOMB FUZE (NOSE) · M126, 126A1

R E S T R I C T E D



AN-M111A1



AN-M111A2

5-93 Seconds Delay
AN-M111A1

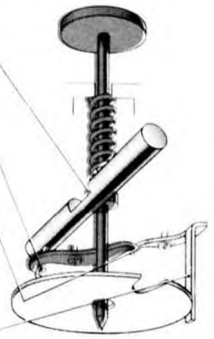
5-93 Seconds Delay
AN-M111A2

1 Shoulder of spring-loaded firing pin overlaps edge of half round pin.

2 This pressure would roll half round pin, but its peg is hooked by firing lever.

3 Firing lever is retained by timing disc lever.

4 Other end of timing disc lever rides rim of timing disc.



5 When timing disc rotates to present position, timing disc lever drops into slot in timing disc and releases firing lever.

6 Released firing lever releases peg of half round pin which is rotated by firing pin shoulder.

7 Firing pin is driven down, striking primer.

Fuze has self-destroying feature: in case time mechanism fails to function, bomb will detonate on impact, as all obstructions will be sheared.

FLARE FUZE AN-M111 A1 • AN-M111 A2

(MECHANICAL TIME)

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OP 988, CHANGE 5

7 September 1944

BOMB FUZES

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1. Insert this change sheet between C–4 instruction sheet and title page.
2. Add the following pages after page 119e: 119f, 119g, 119h.

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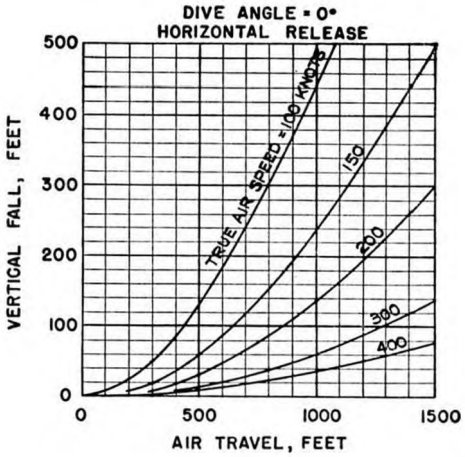
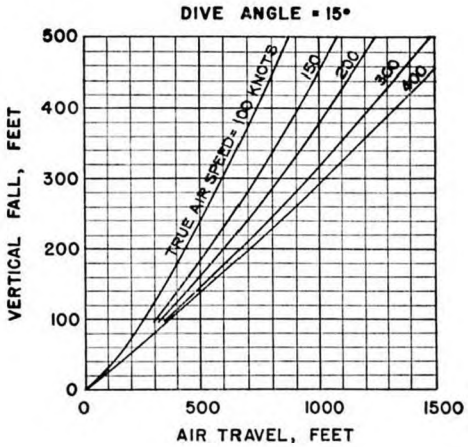
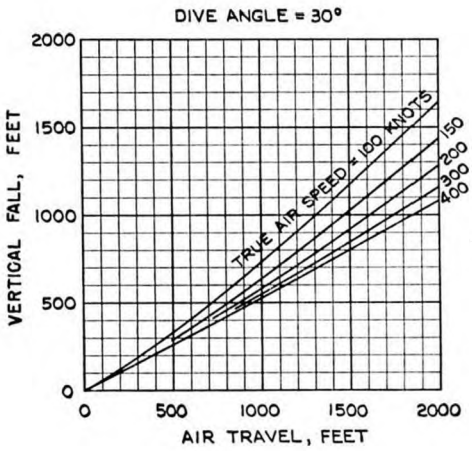
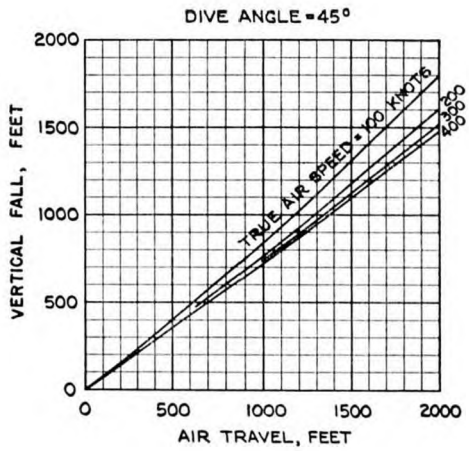
APPENDIX A

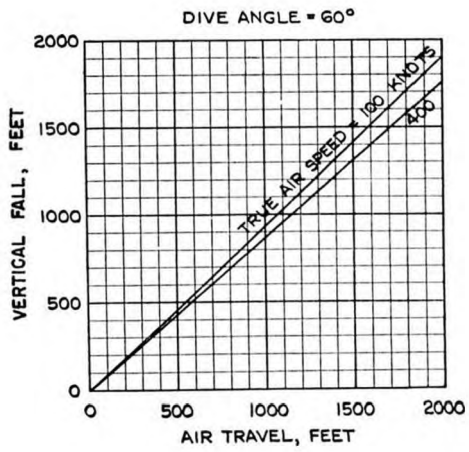
VERTICAL FALL REQUIRED TO ARM BOMB FUZES











Notes.—These charts provide a convenient means of determining the vertical fall in feet required to arm the various types of fuzes when the bomb is released in any combination of dive angle and speed. The "air travel" for entering the charts is the actual distance traveled by the bomb along the trajectory. Values of air travel are given in the table on page 119f under Air Arming Travel. Vertical fall required to arm is defined as the vertical distance between the point of release of the bomb and the point where the fuze becomes fully armed.

Procedure.—With air travel for a given fuze enter the chart for the appropriate dive angle. Project air travel vertically to the curve corresponding to speed of aircraft and from there horizontally to intersect the vertical fall scale. This intersection gives the vertical fall required to arm the fuze.

Example:

Given: Air travel..... 1,100 feet.
Dive angle..... 30 degrees.
True air speed..... 200 knots.
From 30° chart: Vertical fall..... 650 feet.

In dives over 60 degrees, vertical fall may be considered as equal to air arming travel listed in page 119f.

This chart supersedes BuOrd. sketch No. 120494

Air Travel (in feet) Required to Arm Bomb Fuzes [1]

Fuzes	Tail or nose	Air arming travel (ft.) [1]	Remarks
Mk 219 and AN-Mk 219....	N	1,100	2,000–2,500 feet Max. Air Travel to Arm in Flat Nose Depth Bomb.
Mk 221.....	N	1,100	400 ft./sec. striking velocity needed to function on water impact.
Mk 223.....	T	1,100	400 ft./sec. striking velocity needed to function on water impact.
AN Mk 224 and Mk 224....	.....	None	Athwartship-Hydrostatic, Arms by Hydrostatic Pressure.
Mk 227.....	N	[2] 1,500 [3] 3,000	Arms by Centrifugal Force Resulting from Spinning of Bomb in flight.
Mk 228 and AN-Mk 228....	T	1,100	
Mk 229.....	T	400	
Mk 230 and AN-Mk 230...	T	400	
Mk 234 and AN-Mk 234...	.....	None	Athwartship-Hydrostatic, Arms by Hydrostatic Pressure.
Mk 243.....	N	500	
AN-M103 (delay).....	N	1,080	2,500 feet Max. Air Travel to Arm in 325–350 lb. Flat Nose Depth Bomb may not arm if used in 650–700 lb. flat nose depth bomb. If special depth bomb vane is used, 1,500 feet max. air travel will arm fuze when installed in largest depth bomb.
AN-M103 (inst.).....	N	1,620	
AN-M103A1 (delay).....	N	1,080	
AN-M103A1 (inst.).....	N	1,620	
AN-M100A2	T	485	
AN-M101A2	T	555	
AN-M102A2	T	665	465 feet Air Travel to Arm when installed in 1,000-lb. G. P.
M-110 and AN-M110A1....	N	725	
M112,M113,M114,M112A1, M113A1, M114A1.	T	100	4–5 and 8–15 sec. delay, not safe for carrier use.
M115.....	T	485	M115, M116, M117 Fuzes have 4–5 and 8–15 sec. delay. 465 feet Air Travel to Arm when installed in 1,000-lb. G. P.
M116.....	T	555	
M117.....	T	665	
M123.....	T	370	Long Delay Fuzes 1 to 144 hours, requires an additional 500 feet to 1,000 feet to sea fuze body to prevent leakage of fluid after-fuze is armed.
M124.....	T	370	
M125.....	T	370	
M123A1	T	100	
M124A1	T	100	
M125A1	T	100	
AN-M126 and AN-M126A1.	N	725	
M132.....	T	100	Delay action fuzes with fixed nominal 10-min. delay. Delay may vary 6–80 mins. depending upon temperature.
M133.....	T	100	
M134.....	T	100	

[1] The air arming travel is the maximum arming distance for the fuze when installed in the largest bomb in which it is normally used. The arming distance will be somewhat less when the fuze is installed in smaller bombs.
[2] Near sea level.
[3] At 20,000 feet altitude.

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OP 988 CHANGE 7

19 September 1944

5 Pages ——— Page 1

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is changed as follows:

1. Insert this change sheet between C-6 instruction sheet and title page.

2. Add the following pages after page 119h: 119i, 119j, 119k and 119l.

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Fuze, Bomb, Tail M132, M133, M134

1. GENERAL.

a. Tail Bomb Fuzes M132, M133 and M134 (fig. 1) provide delay action to bombs in accordance with the following "fuze temperature - average time of delay" table:

Fuze Temperature (deg.F)	Average Time of Delay (min.)
120	6
100	10
80	16
60	26
40	40
20	59
10	80

2. COMPLETE ROUND DATA.

a. Bombs and Fuzes.

The following tabulation shows the bombs with which these fuzes may be used:

Tail Bomb Fuze M132

AN-M30 - 100-lb general purpose bomb
AN-M30A1 - 100-lb general purpose bomb
AN-M57 - 250-lb general purpose bomb
AN-M57A1 - 250-lb general purpose bomb

Tail Bomb Fuze M133

AN-M43 - 500-lb general purpose bomb
AN-M64 - 500-lb general purpose bomb
AN-M64A1 - 500-lb general purpose bomb
AN-M58 - 500-lb semi-armor-piercing bomb
AN-M58A1 - 500-lb semi-armor-piercing bomb
AN-M58A2 - 500-lb semi-armor-piercing bomb

Tail Bomb Fuze M134

AN-M44 - 1000-lb general purpose bomb
AN-M65 - 1000-lb general purpose bomb
AN-M65A1 - 1000-lb general purpose bomb
AN-M59 - 1000-lb semi-armor-piercing bomb
AN-M59A1 - 1000-lb semi-armor-piercing bomb
AN-M34 - 2000-lb general purpose bomb
AN-M66 - 2000-lb general purpose bomb
AN-M66A1 - 2000-lb general purpose bomb

b. Arming Wire. The arming wire is the same as that used for Tail Bomb Fuzes M123, M124 and M125.

c. Nose Fuze. At the present time, no nose fuze is to be used in combination with Tail Fuzes M132, M133 and M134.

3. DESCRIPTION.

a. The vane reduction gears and arming vane of these fuzes are the same as Tail Bomb Fuzes M123, M124 and M125, and the general overall appearance is somewhat similar to these fuzes. However the M132 series fuzes can be readily differentiated from the M123 series fuzes by the reduction of the diameter of the head beyond the locknut in the M132 series.

b. Overall lengths of the fuzes are as follows:

Tail Bomb Fuze M132 - 9.57 in.
Tail Bomb Fuze M133 - 12.57 in.
Tail Bomb Fuze M134 - 16.57 in.

c. The time delay mechanism of these fuzes is somewhat different from that used in Fuzes M123, M124 and M125. This mechanism has a metal bellows containing a red colored solvent which is released at the time of arming the fuze. The solvent acts upon a celluloid cylinder to produce the delay action.

d. An antiwithdrawal device, which is the same as used in Tail Bomb Fuzes M123, M124 and M125, is contained in these fuzes. CAUTION: Any attempt to unscrew fuze from the bomb will result in detonation of the bomb.

e. When issued, the fuze contains a safety clip containing two studs. One stud engages a hole in the fuze body and the other engages a hole in the fuze head. This clip prevents rotation between the fuze head and the fuze body. A safety screw is also located in the fuze body. This screw must be removed and replaced by the closing screw and closing screw washer prior to fuzing the bomb.

f. The detonator holder assembly and holder sealing washer are not assembled to the fuze when issued but are packed in the fuze container. The detonator holder cavity of the

fuze is plugged with absorbent cotton. This cotton will indicate leakage of the solvent prior to fuzing by being stained red. If the cotton indicates solvent leakage, the fuze should be destroyed.

g. A locknut which is located on the bomb mating threads is used to secure the fuze to the bomb firmly.

h. An adapter booster lock pin is assembled to one of the wires holding a card to the fuze. This pin should be inserted in the hole in the adapter booster of the bombs listed below prior to assembly of the fuze to the bomb. The adapter booster is the threaded part in the tail of the bomb into which the fuze is screwed. The adapter booster lock pin prevents removal of the adapter booster after the fuze is inserted in the bomb.

(1) A short adapter booster lock pin is issued with each Fuze M132 and should be used in the adapter booster of the following bombs:

AN-M30A1 - 100-lb general purpose bomb
AN-M57A1 - 250-lb general purpose bomb

(2) A long adapter booster lock pin is issued with each M133 and M134 Fuze and should be used in the adapter booster of the following bombs:

AN-M64A1 - 500-lb general purpose bomb
AN-M58A2 - 500-lb semi-armor-piercing bomb
AN-M65A1 - 1000-lb general purpose bomb
AN-M59A1 - 1000-lb semi-armor-piercing bomb
AN-M66A1 - 2000-lb general purpose bomb

(3) The adapter booster lock pins may be discarded if these fuzes are used on bombs other than those listed in steps (1) and (2) above.

i. Long or short fuze adapters may be found in Bombs AN-M64, AN-M65 and AN-M66. The fuze adapters are bushings which screw into the adapter booster of these bombs so as to enable assembly of the fuzes to the bombs. The antiwithdrawal device of Fuzes M132, M133 and M134 will detonate these bombs when assembled into a bomb containing a long fuze adapter if an attempt is made to withdraw the fuze. However, if the fuze is assembled to a bomb containing a short fuze adapter, withdrawal of the fuze may detonate the fuze and the bomb may or may not detonate. Long fuze adapters have been issued separately for the above bombs which now contain short fuze adapters. It is advisable to replace the short fuze adapters in the bombs listed above with long adapters prior to assembling these fuzes to the bombs.

4. FUNCTIONING.

a. When released armed, the arming wire is withdrawn and the vane is free to rotate. At approximately 100 feet of air travel the metal bellows is punctured and the solvent forced onto the celluloid cylinder. This initiates a softening action of the celluloid and sometime later (par. 1), the softened celluloid allows the spring-loaded firing pin to move forward and detonate the bomb.

b. When released safe, the arming wire does not allow the arming vane to rotate and the bellows is not punctured. There is no leakage of the solvent onto the celluloid cylinder and no resultant detonation of the bomb. However, the antiwithdrawal device will detonate the bomb if an attempt is made to remove a fuze even though the bomb is dropped safe.

5. INSPECTION BEFORE FUZING BOMBS.

a. Before assembling fuze, inspect the glass vials in the shipping box to determine whether the fuzes have been subjected to a temperature which might have damaged the fuze.

b. If the powder in the green-stoppered vial has melted and solidified, the fuze must not be used for low-altitude bombing (temperature has exceeded 150°F).

c. If the powder in the red-stoppered vial has melted and solidified, the fuze must be destroyed (temperature has exceeded 170°F).

6. ASSEMBLY OF FUZE TO BOMB.

a. Preliminary Operations (one-half hour prior to fuzing).

CAUTION: Remove the absorbent cotton from detonator holder cavity and be sure that no solvent has leaked onto the cotton. If the cotton indicates leakage by being stained red, destroy the fuze.

(1) Replace the cotton in the detonator holder cavity.

(2) Remove the safety screw. Shake the fuze several times, but do not strike it.

(3) Stand the fuze on the detonator holder end and let it remain in this position for one-half hour.

(4) After one-half hour, remove the cotton and inspect it for evidence of leakage. If the cotton has been stained red, destroy the fuze.

(5) Replace the safety screw in its opening in the fuze body. If the screw cannot be replaced, destroy the fuze.

b. Preparation of bomb.

(1) If the bomb to be fuzed is one of those listed in paragraph 3h, remove the adapter booster lock pin from the fuze and insert the pin into the hole provided inside the wall of fuze cavity of adapter booster. End of pin must be flush or below flush with inside surface of adapter booster before the fuze can be assembled to bomb.

(2) If the bomb to be fuzed is an AN-M64, AN-M65 or AN-M66 Bomb, inspect the fuze cavity to check whether the bomb has a long or short fuze adapter. If a short fuze adapter is present, remove it and insert a long fuze adapter. Stake the long fuze adapter into place. NOTE: The short fuze adapter can be used but may prevent detonation of the bomb if the antiwithdrawal device should be functioned.

(3) Screw thread gage, which is furnished with each box of fuzes, into the bomb fuze cavity until it seats. This assures that fuze will assemble without difficulty. Remove the thread gage. Do not use bomb if the bomb fuze cavity contains poor threads.

c. Fuzing operation.

(1) Remove safety screw from fuze body. Insert in its place, closing screw washer and closing screw. Tighten screw.

(2) Insert holder sealing washer (lead) into detonator end of fuze.

(3) Screw detonator holder assembly over washer. In doing this, support fuze by body so as to prevent rotation of parts. Tighten detonator holder securely with pin wrench.

(4) The extension ball should move freely through a small arc in its groove.

(5) Remove safety clip from fuze body. Do not allow fuze body to rotate about fuze head at any time after removal of safety clip.

(6) Hold fuze by the central tube and turn locknut so that it passes over all of the threads in order to make sure that the threads are in good condition. Place nut as far as possible toward vane end of fuze. Do not use fuzes with damaged threads.

(7) Screw the fuze into bomb by hand as far as possible, then tighten the locknut with L-wrench. Tap wrench lightly with small hammer to insure the nut is tight. CAUTION: Fuze must not be unscrewed during, or after assembly to bomb, since unscrewing will cause extension ball to seize and fire the bomb.

(8) Thread longer end of arming wire assembly through rear suspension lug of bomb and nearer pair of eyelets on the fuze. Should nearer pair of eyelets be occupied by safety pin and sealing wire, place a second pin through eyelets diametrically opposite, before removing original safety pin.

(9) Cut sealing wire and remove safety pin, complying with instructions on tag.

(10) Thread end of arming wire through appropriate eyelet in arming vane assembly. At same time, slip vane over end of fuze so that slots in hug fit over heads of the two eyelet pins.

(11) Screw vane nut on threaded end of bearing cup, handtight.

(12) Adjust arming wire to protrude beyond arming vane from 2 to 3 inches when the swivel loop is in position for the bomb rack. If arming wire is too long, cut off excess wire.

(13) Slip safety clip over end of arming wire until it just touches face of vane. The fuze is now completely assembled to the bomb.

7. PACKING.

a. Fuzes are packed 25 to a wooden packing box. Each fuze, less arming vane, is packed in a metal container. The holder sealing washer, detonator holder assembly, closing screw, and closing screw washer are secured in a wooden block by sealing tape. This block is packed in the fuze container. Twenty-five arming vanes are assembled in a rack which fits in one end of the packing box. Each packing box also contains:

(1) Pin wrench for tightening the detonator holder assembly.

(2) L-wrench for tightening the locknut.

(3) The glass vials which indicate whether fuzes have been exposed to dangerous storage temperatures.

(4) Thread gage for gaging and clearing the threads in the bomb fuze cavity prior to fuzing.

b. Fuzes may also be packed 12 to a wooden packing box in the same manner as above and with the same equipment.

8. SAFETY PRECAUTIONS.

All personnel concerned with these fuzes must be cautioned that any attempt to unscrew the fuze from the bomb will result in detonation of the bomb. Bombs fitted with these fuzes must not be returned to aircraft carriers. Bombs fitted with these fuzes may be returned to shore bases if the emergencies of war demand the conservation of bombs, in which case the bombs which have been fuzed with Fuzes M132, M133 and M134 must be stowed in a shaded area under special guard whose duty it is to prevent any attempt at removal of fuze from bombs. If storage temperature approaches 145°F bombs should be cooled by pouring water over roof of storage house or bombs. This procedure should be a last resort only and should not be attempted unless the tactical advantages outweigh the hazards involved.

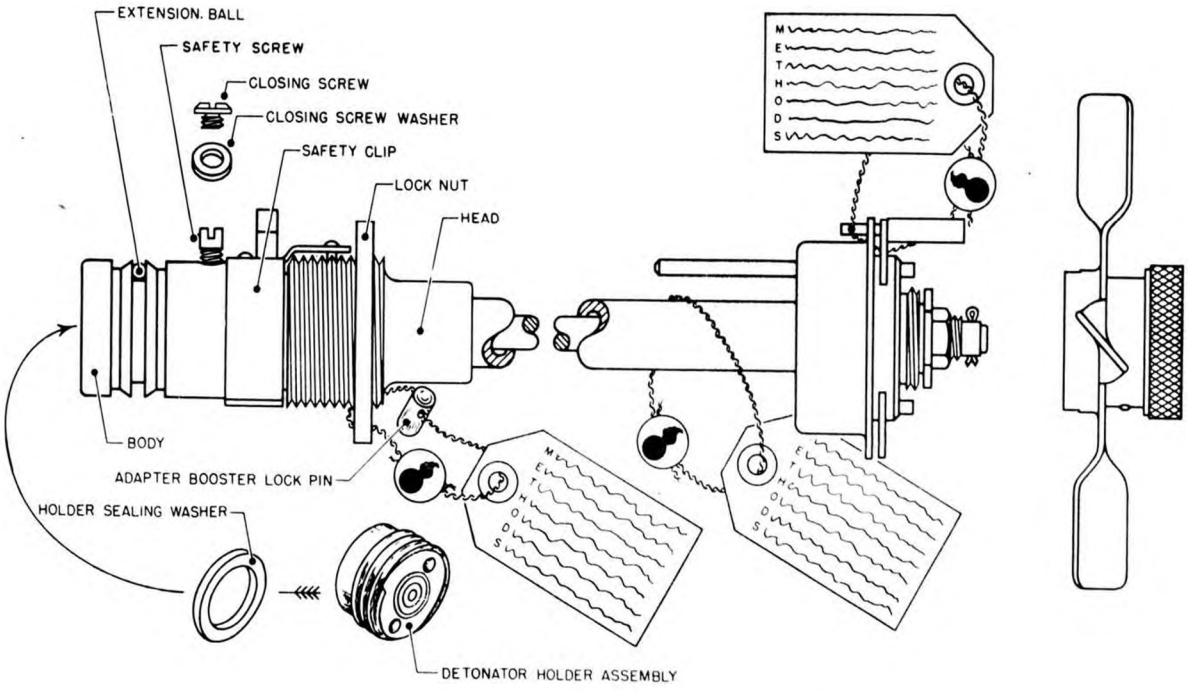

Figure 1 —FUZE, bomb, M132, M133, and M134 (tail)

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