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**CONFIDENTIAL**

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## NOTICE

### REQUESTS FOR BOMB DISPOSAL SCHOOL PUBLICATIONS

Numerous requests for copies of U.S.N.B.D. publications have been received at the School from officers or activities not connected with Bomb Disposal. In some instances, E. P. officers have requested additional copies for other officers at their station. As a result of this, the School feels that it should clarify its position in regard to these requests.

A recent letter from the Chief of the Bureau of Ordnance directed the Officer-in-Charge of the Bomb Disposal School to submit all official requests for U. D. publications, from other than Bomb Disposal personnel, to the Bureau of Ordnance or to the Chief of Naval Operations for approval. In view of this fact, it is recommended that E.P.O.'s and AFPO graduates inform officers desiring our publications to submit OFFICIAL requests to the Officer-in-Charge of the School so that they may be forwarded to the cognizant authority for approval.

# ROCKETS

R E S T R I C T E D

## 2.25 ROCKET (SUB-CALIBER, AIRCRAFT)

### GENERAL

The 2.25 sub-caliber rocket, Fig. 1, for aircraft use was developed primarily for training purposes. Initially two types were designed, one approximating the trajectory of the 3.75 Rocket (3.75 Motor) and the other the trajectory of the 5.0 Rocket (3.75 Motor). However, it appeared from tests that a sub-caliber rocket to match the trajectory of each service round would not be necessary and that one model could be used for all training needs. The technique of accurate rocket fire can be learned by pilots by using any rocket round for training provided the appropriate sighting tables are available. Hence, the rocket which will probably become the standard design is the 2.25 Motor, Mark 11 and 2.25 Body, Mark 3 Mod 2.

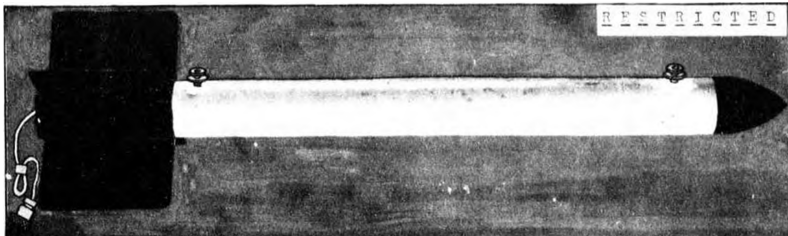
The sub-caliber rockets which have been designed are tabulated below:

<u>MOTOR</u>	<u>BODY</u>	<u>VELOCITY</u>	<u>APPROXIMATE TRAJECTORY OF:</u>
2.25 Mk 10 or 11	2.25 Mk 1 or 3 (1.6 lbs)	1150 ft/sec	3.75 Rocket (3.75 Motor)
2.25 Mk 12 or 13	2.25 Mk 1 or 3 (1.6 lbs)	810 ft/sec	5.0 Rocket (3.75 Motor)
2.25 Mk 10 or 11	2.25 Mk 2 (8.6 lbs)	810 ft/sec	5.0 Rocket (3.75 Motor)

The 2.25 Motor Mark 10 and 11 are similar to each other as are the 2.25 Motor Mark 12 and 13. The Motors Mark 10 and 11 differ from the Mark 12 and 13 by -

- (1) Diameter of the nozzle (Motors Mark 12 and 13 have a smaller nozzle.)
- (2) Weight of propellant (Grain in Motor Mark 10 and 11 - 1.75 lbs.)  
(Grain in Motor Mark 12 and 13 - 1.12 lbs.)

External dimensions of these rockets are the same. For recognition purposes, the 2.25 Motors Mark 10 and 11 are painted white with black fins, while the Motors Mark 12 and 13 are grey with black fins.



**FIG. 1. 2.25 ROCKET (SUB-CALIBER, AIRCRAFT)**

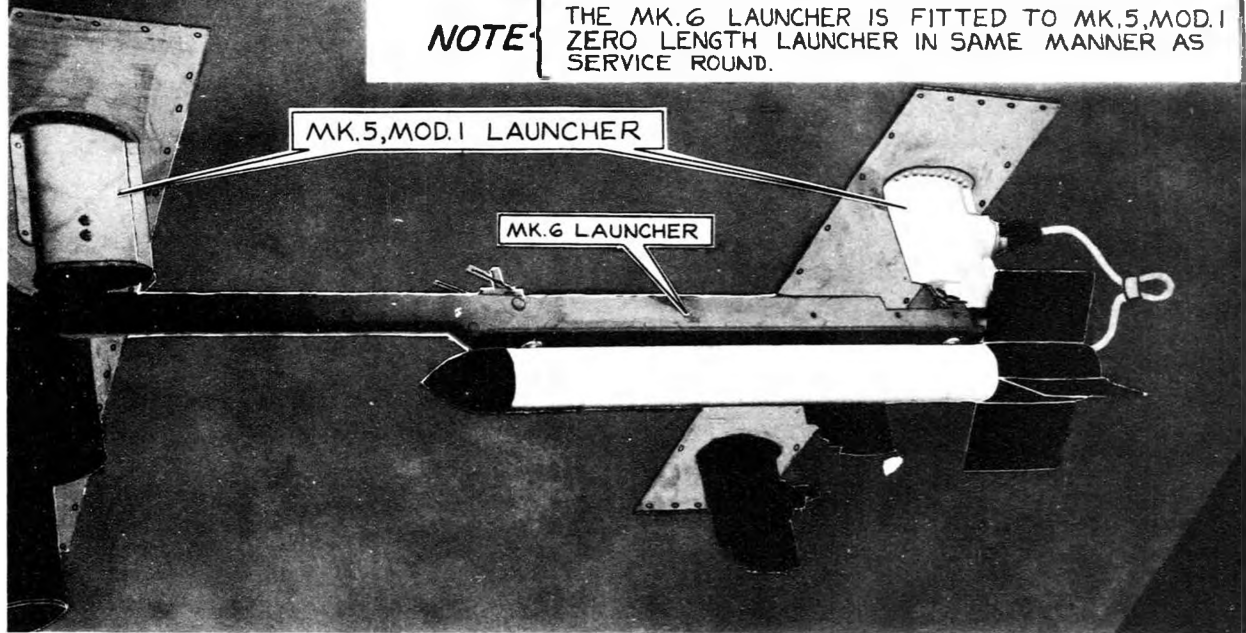
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## FIG. 2. 2.25 ROCKET (SUB-CALIBER, AIRCRAFT)

MOUNTED ON MK. 6 TYPE ROCKET LAUNCHER

**NOTE** { THE MK. 6 LAUNCHER IS FITTED TO MK. 5, MOD. 1  
ZERO LENGTH LAUNCHER IN SAME MANNER AS  
SERVICE ROUND.



MK. 5, MOD. 1 LAUNCHER

MK. 6 LAUNCHER

DESCRIPTION - 2.25 MOTOR MARK 11 AND BODY MARK 2 MOD 3:

Overall length of the rocket is 29 inches. Two button type lugs are provided on the motor tube spaced approximately 19 inches apart. Four fins are welded to the aft end of the motor tube and are not removable as is the case with most service rockets.

The 2 1/2 motor Mark 11 contains essentially the following parts:

- (1) Propellant. The propellant is an extruded cylindrical grain of ballistite weighing approximately 1-3/4 pounds. Inhibitor discs cemented to the ends of the grain control the burning area.
- (2) Igniter. A 14 gram black powder igniter in a plastic case is located at the forward end of the motor. This igniter is set off by an electrical squib.
- (3) Grid. The grid supports the propellant grain. During burning it prevents the grain from sliding rearward and clogging the nozzle opening.
- (4) Nozzle. The nozzle is a steel venturi through which the gases flow. It directs the gas jet in the desired direction and also provides for the expansion of the gases in the exit cone.
- (5) Nozzle Closure. The nozzle closure seals the rear end of the motor. It is crimped to the electrical pigtail, providing a moisture proof seal.
- (6) Pigtail. The electrical pigtail extends from the nozzle end and is the same design as that used in service rockets.

ASSEMBLY

Assembly of the sub-caliber 2 1/2 rocket is accomplished by screwing the body to the motor after removing the protector caps on the motor. This operation should be carried out with the assistance of a wrench and a vise. It is highly important that the body is fitted to the motor using a luting compound (white or red lead or similar substitute), and that a tight seal is effected between the two parts. If this is not done, there is a possibility of motor gases escaping between the two parts. The escaping gases will erode the zinc base die cast body and cause the flight to be erratic or the body to blow off of the motor.

ROCKET LAUNCHER MARK 6

Rocket launcher Mark 6, Fig. 2, is actually an adapter for accommodating the relatively short 2 1/2 sub-caliber rocket to the Mark 5 Mod 1 zero length launcher. The rocket launcher Mark 6 is placed on the Mark 5 Mod 1 zero length launcher in the same manner as a standard service round would be installed. A heavy shear wire (1/16" steel or heavy cotter pin) is inserted through the shear wire hole in the aft stud. This locks the Mark 6 launcher in place.

The 2 1/2 sub-caliber rocket is inserted in the rail slot of the Mark 6 launcher and is secured by a shear wire (#18 gauge soft copper) which is inserted through a latch arrangement as seen in Fig. 2.

Another type adapter known as the Mark 6 Mod 1 consists essentially of a rocket launcher Mark 6 with a special attachment for use on the Grumann type zero length launcher. (NOTE: It will be recalled that the aft "stud" of the Grumann type launcher differs from the Mark 5 Mod 1 in that suspension is accomplished by means of the fins rather than an aft suspension lug.)

The sub-caliber 2 1/2 Rocket will fit the rail type, 70 inch Rocket Launcher Mark 4 directly without the use of an adapter.

GENERAL

Safety precautions in assembly, loading, handling, etc. are generally the same as those for service rockets.

The 2 1/2" sub-caliber rockets are shipped in wooden boxes, each box accommodating eight motors (with fins attached) and eight bodies, unassembled. The inert body demands no special stowage conditions; the rocket motor should, however, be stowed in accordance with rules and regulations set up for service rocket motors.

IMPORTANT

While the sub-caliber 2 1/2" aircraft rocket may not appear as formidable a weapon as the service rockets, caution must be observed at all times in handling them since neglect may result in accidents which can well be avoided by observing all safety precautions to be used for service rounds.

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# BOMBS

R E S T R I C T E D

## FRAGMENTATION BOMB, 110-LB., T13

### GENERAL

The 110-lb. fragmentation bomb, T13, Fig. 3, is a parachute suspension bomb which uses Nose Fuse AN-M120 or AN-M120A1. The bomb must be suspended from a bomb station having the length clearance of a 500-lb. bomb and may be suspended either singly or as a two-bomb cluster by use of cluster adapter M12 (see AFEC Bulletin No. 3, page 41).

### DESCRIPTION

The 110-lb. fragmentation bomb T13, Fig. 3, is made up of the 90-lb. fragmentation bomb M82 and a parachute unit T1 which is screwed to the rear of the bomb body in place of the normal tail fin assembly. These two parts are issued separately and must be assembled prior to use.

The bomb body is shipped unfuzed and unfinned, and without the parachute unit but the nose and tail closing plugs as well as a fin lock nut protector are in place. One suspension lug is welded to the bomb at the center of gravity. In order to use the AN-M120 or AN-M120A1 Nose Fuse, an M117 adapter booster (AFEC Bulletin No. 4, page 18) must be screwed into the nose. This is necessary because the diameter of the fuse threads is only 1-1/2 inches while the normal threads in the nose of the bomb have a diameter of 2 inches.

The parachute unit, T1, is issued ready to be assembled to the tail of the bomb. Each parachute unit consists of a cylindrical container 6-1/2 inches in diameter and 35-1/2 inches long, and a parachute which it houses. Two suspension bands are furnished, the smaller diameter band being used if necessary on the bomb body when preparing the complete round, and the larger diameter band remaining assembled to the parachute container. The rear band and either the front band or suspension lug may be used for suspension of the bomb. An arming cord extends forward from the front end of the parachute container and ends with a short length of arming wire. This arming wire must be assembled to the fuse when preparing the complete round. The lid of the parachute container is fastened by a latch and secured with a cotter pin. When assembling the complete round, the cotter pin is removed and replaced by the arming wire. An arming wire guide is located on the lid behind the latch.

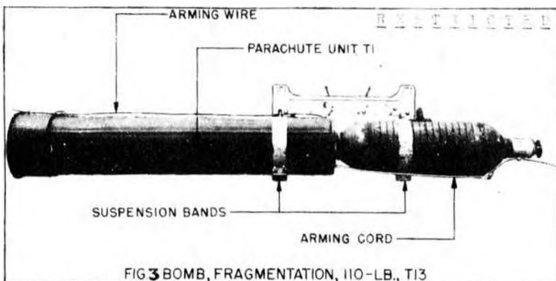


FIG 3 BOMB, FRAGMENTATION, 110-LB., T13

#### OPERATION:

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

When the bomb is dropped armed, the arming wire is withdrawn from the parachute container latch. As the bomb drops, the air stream removes the lid from the parachute container and allows the parachute to open to the rear of the container. The arming cord, which is attached to the shroud line, is pulled rearward when the parachute opens, thereby initiating the arming of the fuse. (NOTE: It will be recalled that the fuse, AN-M120 will become armed in approximately 2.5 seconds after ejection of the arming pin while the fuse AN-M120AL arms in a shorter time of approximately 1.9 seconds permitting even lower altitudes of release).

#### ASSEMBLY OF ROUND

The following are important points to be remembered in assembling a complete round.

1. When installing the suspension bands, it will be necessary that they be spaced exactly 14 inches apart. If a forward band is to be used instead of the suspension lug on the bomb, this band must be secured directly to the rear of the suspension lug.
2. After the nose fuse has been installed, draw the arming cord from the parachute container down to the fuse. Insert the arming wire, which is at the end of the arming cord, into the inner hole of the arming pin in the fuse. After the bomb has been installed in the plane, the cotter pin or safety pin in the fuse must be removed.
3. If the bomb is being prepared for single suspension, pass the free end of the arming wire through the rear suspension eye and through the latch and arming wire guide of the parachute unit. Remove the cotter pin before passing the wire through the latch. The swivel loop is then fastened to the bomb shackle in the normal manner and the wire drawn taut toward the rear and trimmed about 2 inches behind the arming wire guide.

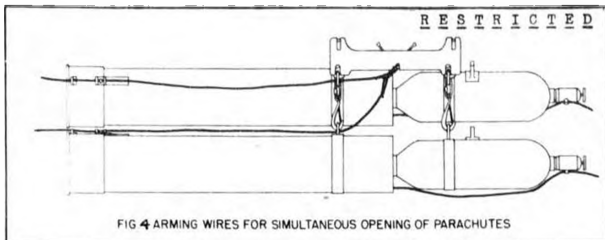
#### USE OF M12 CLUSTER ADAPTER WITH T13 FRAGMENTATION BOMBS:

There are two methods for assembling arming wires in clusters of two T13 bombs by means of cluster adapter M12. Both bombs must be clustered in the usual manner for using the M12 adapter but different results will be obtained, depending upon the manner of assembling the arming wires to the cluster.

#### Preparation of Arming Wires so that Parachutes Open Simultaneously (Fig. 4).

From this type of opening, it can be expected that both bombs will strike the ground close together and at approximately the same moment. After the rounds have been prepared, they are suspended from the bomb shackle using the M12 cluster adapter in the normal manner. The free end of the arming wire is then passed through the rear suspension eye and through the latch and arming wire guide of the upper bomb in the cluster. (See Fig. 4). Fasten the swivel loop to the bomb shackle and draw the wire taut towards the rear. Trim the wire about 2 inches behind the arming wire guide.

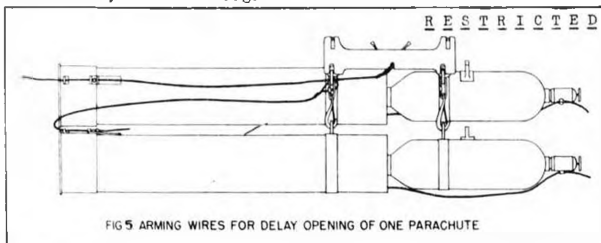
A second arming wire is then passed through the other bomb as above but the swivel loop of this arming wire is fastened to the swivel loop of the first arming wire.



To Assemble Arming Wires for Delay Opening of the Second Parachute Bomb. (Fig. 5)

The rounds are suspended from the bomb shackle using the M18 cluster adapter. The free end of an arming wire is passed through the rear suspension eye and through the latch and arming wire guide of the upper bomb in the cluster. The swivel loop is fastened to the bomb shackle, the wire drawn taut and trimmed.

The end of another length of arming wire (without swivel loop) is passed through and fastened to the rear suspension eye of the upper bomb in the cluster. Draw the other end of this wire to the rear of the cluster and pass it through the arming wire guide and then through the parachute container latch of the lower bomb of the cluster, as seen in Fig. 5.



TACTICAL DATA:

- (1) Two parachute units are packed in a metal lined wooden box weighing about 135 pounds.
- (2) Port fuzes AN-M120 or AN-M120A1 are packed 50 fuzes to a box, each fuze in an individual container. Total weight is approximately 102 pounds.
- (3) 25 adapter boosters, M117, are packed in a wooden box weighing about 53-1/2 pounds.

REFERENCE: TE9X-87 (Preliminary Instructions).

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# FUZES

R E S T R I C T E D

## NOSE FUZES MARK 156 MOD. O, & MARK 158 MOD. O

### GENERAL

Nose Fuzes Mark 156 Mod O and Mark 158 Mod O, Fig. 6, have an improved design and will replace Nose Fuzes Mark 131 and Mark 136 respectively. Both are sensitive impact fuzes. The Mark 156 Mod O is for use in 792 rockets while the Mark 158 Mod O is for projector charges. These fuzes are for anti-submarine warfare. Underwater travel of the fused charge rotates the arming vane and arms the fuse after a depth of 15 to 25 feet is obtained. These fuzes do not arm while traveling through the air. When armed, they function instantaneously upon impact with the steel surface or wood deck gratings of a submarine.

Changes made in the fuzes Mark 131 and Mark 136 to form fuzes Mark 156 Mod O and Mark 158 Mod O are as follows:

1. The firing pin sleeve has been lengthened to increase the guiding surface for the firing pin.
2. The seating surface for the firing pin spring on the shoulder of the firing pin has been reshaped to afford secure positioning of the spring.
3. The flange on the fuse body above the gasket has been made thicker for greater strength.
4. The vanes are made of heavier metal.
5. A locking detent has been added to the detonator shutter. It locks the shutter in place after the shutter has pivoted into the armed position.
6. The vertical shear wire between the upper portion of the plug and the arming vane hub has been eliminated and replaced by a radial vane shear wire. (NOTE: This shear wire prevents the vanes from turning while round is in the air; it shears on impact with the water at which time the fuse commences to arm.)
7. Other minor details of improved construction are incorporated.

The only difference between fuzes Mark 156 Mod O and Mark 158 Mod O is that the set-back collar shear wire has been omitted on the Mark 156 Mod O. The reason for this is that the rocket propelled charge does not impart sufficient set-back force to sever the set-back collar shear wire. The Mark 158 Mod O on the other hand, is subjected to sufficient set-back when projected, or fired from the projector to require a set-back collar shear wire.

### ARMING MECHANISM

Locking pins in the arming vane hub and the plug, respectively, fit in a slot in the set-back collar, positively locking the arming vane until the set-back force causes the set-back collar to move backward on the plug. In the Fuse Mark 156 Mod O, the set-back collar is maintained in the forward position by the tension of the spring plate on the locking pins. (See detail sketch, Fig. 6). In the Fuse Mark 158 Mod O, this collar is maintained in the forward position by the spring plate and also by the collar shear wire through the collar and plug. This collar shear wire is sheared

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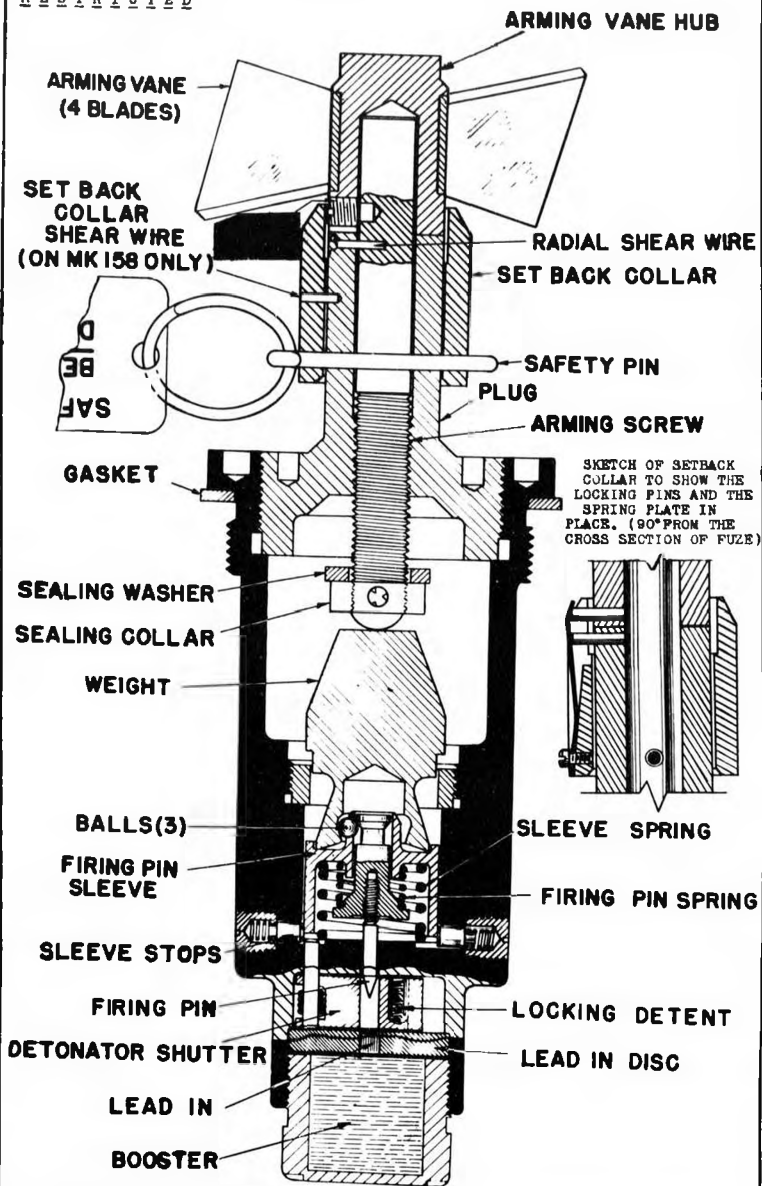


FIG. 6 FUZE MK. 156 MOD. 0 & MK. 158 MOD. 0

by the set-back force at the time the charge is projected. The internal radial shear wire prevents the air stream from turning the arming vane and arming the fuse while the charge is traveling through the air. Upon impact with the surface of the water, the impact force causes the arming vane to rotate, shearing the vane shear wire. Continued rotation of the arming vane unscrews the arming screw from the plug and arms the fuse. The firing mechanism moves with the arming screw as described below. At the end of travel of the arming screw, the sealing washer is jammed between the plug and the sealing collar, which is fastened to the arming screw by a cotter pin, thereby making the fuse watertight.

#### FIRING MECHANISM

The firing mechanism consists of the firing pin, the cocked firing pin spring, the firing pin sleeve, the weight, and three balls. As the arming screw moves forward, the sleeve spring pushes the firing mechanism forward until the firing pin sleeve strikes the retaining ring. As the firing mechanism moves forward, the firing pin is withdrawn, releasing the shutter. The shutter spring rotates the shutter against the stop-pin, thus aligning the detonator in the shutter with the booster lead-in and with the firing pin. Two pairs of sleeve stops are pushed inward by the stop springs, one pair just before the firing pin releases the shutter, and the other pair just after the release. These sleeve stops prevent the firing pin from piercing the detonator when the arming vane is turned backward by hand or any other means (counterclockwise looking at nose of fuse) on an armed or partially armed fuse, and thus provide a means for making safe for handling those fuzes which have accidentally armed. They prevent the firing pin sleeve, and consequently the firing pin, from being pushed back to the position it occupies when the fuse is unarmed.

After the fuse is completely armed, inertia causes the weight to move forward on normal impact or laterally on oblique impact, thereby allowing the three balls to jump out and release the cocked firing pin. The firing pin spring is assembled and remains compressed until the firing pin is released by movement of the weight. Prior to impact and the action of inertia, the weight is held in place by the compressed firing pin spring acting through the firing pin, firing pin sleeve and three balls.

#### FUNCTIONING

When the fuse is installed in a rocket which is fired from a launcher, set-back forces at the instant of firing cause the set-back collar to move backward and unlock the arming vane. The collar shear wire, which is on the Fuse Mark 158 Mod O only, is sheared at this time. The set-back collar is prevented from moving forward again by the spring plate dropping down behind the locking pin in the plug. The arming vane is prevented from being turned by the passing air (during air travel) by the radial shear wire, which is perpendicular to the axis of the fuse. Upon impact with the surface of the water, the arming vane begins to turn and severs this vane shear wire. Continued rotation of the arming vane arms the fuse. At a depth of 15 to 25 feet, the fuse is completely armed. Armed fuzes function with instantaneous action upon impact with the steel surface or the wooden deck gratings of a submarine.

#### SAFETY PRECAUTIONS

1. When this fuse has armed, that is, when the set-back collar has moved back and the vane hub has moved away from the forward end of the plug, it is very dangerous to handle because of its extreme sensitivity. To make armed fuzes safe for handling, carefully screw the arming vane backwards (counterclockwise looking at the nose of fuse) as far as it will go. The fuse should then be lowered gently into deep water. If the fuse is installed in a rocket or projector charge, the fused charge should be disposed of in a like manner after it has been made safe for handling. **DO NOT ATTEMPT TO REMOVE THE ARMED FUZE FROM THE CHARGE.**
2. When installing the fuse in a charge, it should be tightened with a spanner in the outer pair of holes, not the spanner holes in the plug. Use proper tools.

3. If a round is not fired, the safety pin through the set-back collar must be reinserted before the round is returned to stowage.
4. Check that correct fuze is installed in proper rocket or charge and used with the proper launcher or projector.
5. See that fuze safety pin is removed just prior to firing of charges.

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REFERENCE: Ordnance Pamphlet 1017 (First Revision)  
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C O N F I D E N T I A L

## THE M123A1 SERIES LONG DELAY TAIL FUZES

### INTRODUCTION

Reference is invited to AFEO Bulletin No. 6, page 12, covering the staking of the body extension to the body of the M123 series fuzes. As was stated, this modification was made to eliminate the possibility of premature firing resulting in aerial bursts, known to have occurred in rare cases.

Further development work by the Army has resulted in modified fuzes known as the M123A1 series, (Fig. 7), embodying a direct drive arming system. The new series should do away with any possibility of the premature firing phenomena. Production of this new series is under way, and the fuzes are ready for service use.

### DESCRIPTION

The M123A1 series differs from the M123 series as follows:

1. Gear reduction system has been eliminated, and a direct drive arming system installed. The direct drive arming system embodies an eight-bladed arming vane assembly which is attached to the top of the fuze by means of a safety catch.
2. The stem collar on the M123A1 series is welded to the arming stem, instead of being pinned, as on the M123 series.
3. M123A1 series has a spring steel lock nut which gives more positive locking than the locking ring found on the M123 series.
4. No shear pins are incorporated in the M123A1 series for staking the body extension to the body, as direct arming eliminated necessity for this feature.
5. A safety clip on the M123A1 series covering the lower part of body and body extension and retaining the anti-withdrawal ball, during shipment, replaces the thumb screw and ball clip retainer.

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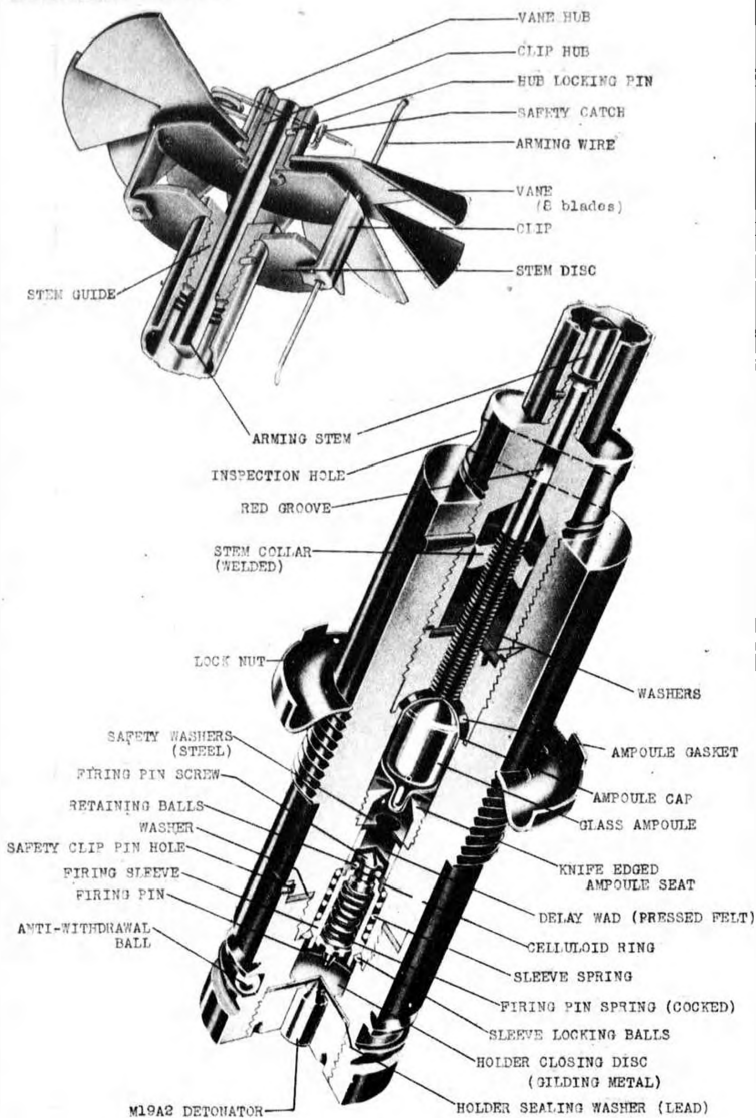


FIG. 7 M123A1 SERIES FUZE (L.D.T.)  
(1, 2, 6, & 12 HOURS DELAY)

6. The M19A2 detonator used in the M123A1 series differs from the M19 detonator, in that it is slightly longer and carries a larger explosive charge. (Detonator holder not changed.)

#### OPERATION

1. Arming wire is pulled, vane assembly starts to rotate, causing rotation of clip hub, clip, and arming stem.
2. After about 4 to 8 turns of the vane, the arming stem moves inward far enough to break ampoule.
3. Approximately 5 to 6 additional turns are sufficient to seal fuze, i.e., stem collar is flush against the rubber retainer washer.
4. Balance of operation is the same as the M123 series.

#### REMARKS

1. Existing stocks of M123 fuzes on hand in this country were modified, by eliminating the gear reduction system, and substituting a direct drive arming mechanism using an eight-bladed vane.
2. More rigid specifications and factory inspection tests were instituted on later lots of the M123 series ampoules, and are being carried out on the M123A1 series also.
3. The M123A1 series as well as the later M123 series lots do not have the solvent dyed in various colors. (Dye particles entered pores of ampoule glass at the sealing point, increasing the possibility of breakage and leakage.)

#### PREPARATION AND INSTALLATION OF M123A1 SERIES

1. Inspect temperature vials in packing box. If powder in green stoppered vial has melted or solidified, temperature has exceeded 150° F. and fuzes must not be used for low altitude bombing. If powder in red stoppered vial has melted or solidified, temperature has exceeded 170° F. and fuzes must be destroyed. (Celluloid ring may be damaged by exposure to high temperature.)
2. Before attempting to insert the fuze in the bomb, the cavity in the adapter-booster shall be gaged by the use of the plug gage provided in each box of fuzes. This procedure is necessary to make sure no trouble will be experienced in inserting the long delay fuze. The gage should be inserted by threading it into the threads of the adapter-booster until the gage seats on the bottom of the adapter-booster. Insertion of the gage to the point where the top flange of the threaded portion is flush or below flush with the adapter-booster must be accomplished without forcing the gage. Any bomb with which difficulty in this gaging operation is experienced must not be fuzed with any fuze having an anti-withdrawal device, since if this fuze jams in insertion and removal is attempted, premature firing will result due to jamming of anti-withdrawal ball against side of adapter booster.
3. Remove safety clip. Ball should move freely in groove. After safety clip has been removed, every effort should be made to handle fuze carefully since the fuze will fire if the body extension is backed off approximately 3/32 inch from the body.
4. Remove adhesive tape and shipping plug from detonator end of fuze. In removing tape and plug, fuze must be held by body extension and not by body.

5. Insert (1) holder closing disc (gilding metal), (2) holder sealing washer (lead), and (3) detonator holder assembly in lower end of fuse. These parts are packed in the wooden block inclosed with each fuse. Tighten detonator holder assembly with wrench. Since the purpose of the holder closing disc and sealing washer is to seal the detonator against the liquid contents of the fuse, considerable torque should be used to assure proper seating of the detonator holder assembly. When properly assembled, the holder sealing washer will be flattened and deformed to a considerable extent. In making this assembly, special care should be taken that the crimp holding the anti-withdrawal ball in place is not damaged.
6. After making sure ball will move freely in groove, back off the spring type lock nut (Palnut) to allow fuse to be screwed into the bomb as far as possible. After fuse has been screwed into adapter booster, turn the spring type lock nut down and tighten by application of the special Palnut type of wrench until the lock nut is tight against the flange of the adapter-booster. FUZE MUST NOT BE UNSCREWED DURING OR AFTER ASSEMBLY TO BOMB, SINCE UNSCREWING WILL CAUSE BALL TO SETZE IN ADAPTER AND CAUSE FUZE TO FIRE.
7. Arming wire should be inserted through clip, stem disc, and vane before safety pin is removed. (Secure with 2 Fahnestock clips). Fuse is to be inserted in bomb immediately before aircraft takeoff. FUZZED BOMBS MUST NEVER BE STORED.

LONGER DELAYS OF M123A1 SERIES FUZES

Fig. 7 shows the M123A1 series fuse incorporating the 1, 2, 6 and 12 hour delay assembly. The delay assembly of the M123A1 series having 24, 36, 72 or 144 hours differs from this in that it has a celluloid disc on top of the celluloid ring. (The celluloid disc increases in thickness as delays increase.) In addition a glass wool absorber is placed above the celluloid disc. The alcohol-acetone ratio for all delays and identification is shown below:

<u>Identification*</u>	<u>Delay, hours</u>	<u>Acetone</u>	<u>Alcohol</u>
1 Dot	1, 24, 36, 72, 144	100%	--
2 Dots	2	70% ± 1%	Remainder
3 Dots	6	25% ± 1%	Remainder
4 Dots	12	10% ± 0.5%	Remainder

\* Dots are sand blasted on ampoule. External identification is the stamping of delay on body extension.

EFFECT OF TEMPERATURE VARIANCE ON AVERAGE DELAY TIME

Changes in fuse temperature of the M123A1 series will cause the average delay time to vary approximately as follows:

<u>1-hr. Delay</u>		<u>2-hr. Delay</u>	
<u>Temperature</u>	<u>Average Time</u>	<u>Temperature</u>	<u>Average Time</u>
115° F.	15 min.	115° F.	20 min.
90° F.	20 min.	90° F.	50 min.
75° F.	30 min.	75° F.	1 hr.
55° F.	45 min.	55° F.	1 hr. 30 min.
25° F.	2 hrs. 10 min.	25° F.	3 hrs. 15 min.

6-hr. Delay	
Temperature	Average Time
115° F.	1 hr.
90° F.	1 hr. 30 min.
75° F.	2 hrs.
55° F.	3 hrs.
25° F.	11 hrs. 20 min.

12-hr. Delay	
Temperature	Average Time
115° F.	1 hr. 15 min.
90° F.	2 hrs 30 min.
75° F.	3 hrs 50 min.
55° F.	9 hrs
25° F.	30 hrs

24-hr. Delay	
Temperature	Average Time
115° F.	1 hr. 30 min.
90° F.	6 hrs.
75° F.	12 hrs.
55° F.	24 hrs.
25° F.	*

36-hr. Delay	
Temperature	Average Time
115° F.	2 hrs. 30 min.
90° F.	11 hrs.
75° F.	20 hrs.
55° F.	37 hrs. 30 min.
25° F.	62 hrs. 30 min.

72-hr. Delay	
Temperature	Average Time
115° F.	*
90° F.	37 hrs.
75° F.	53 hrs.
55° F.	96 hrs.
25° F.	*

144-hr. Delay	
Temperature	Average Time
115° F.	*
90° F.	52 hrs.
75° F.	90 hrs.
55° F.	135 hrs.
25° F.	*

\* Information to be furnished when available.

REFERENCE: Instruction Sheet packed with Fuzes.

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R E S T R I C T E D

## SUPPLEMENTARY INFORMATION ON NOSE FUZE T29E2 (M149)

The following information will supplement that found in AFEO Bulletin No. 9, page 21, regarding the expected functioning of this type fuze:

(a) Tests have been made to-date dropping in train 500-lb bombs fuzed with T29E2 Fuzes at 0.05 second intervals. According to these tests, reliable fuze functioning of all bombs in the train may be expected, the first by impact action and the rest in air due to pressure waves.

(b) If 500-lb bombs are dropped in train at 0.05 second intervals at air speed of 200 mph (14.7 foot spacing) from 10,000 feet, the burst of the second bomb in air will be at a point approximately 7 feet ahead of (horizontal separation) the first bomb and 23 feet above (vertical separation) the first bomb. The third bomb in the train will burst the same distance ahead of and above the second bomb and the fourth bomb will burst the same distance ahead of and above the third bomb, etc.

(c) If 500-lb bombs are dropped in train at 0.05 second intervals at an air speed of 175 mph (12.8 foot spacing) from 20,000 feet, the burst of the second bomb in air will be at a point approximately 7 feet horizontal separation and 27 feet vertical separation from the first bomb. Other bombs in this train will burst at the same distance from their preceding bombs in the train.

REFERENCE: TB 9X-89

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# MISCELLANEOUS

C O N F I D E N T I A L

## FLASHLESS POWDER, INDEX DESIGNATION SPCG

Smokeless powder, when burning in the chamber of a gun, produces a mixture of gases which is both hot and combustible when brought into contact with the oxygen of the outer air. The combustion of this gaseous mixture gives rise to a large and dazzling bright muzzle flash called the main secondary flash. Main secondary flashes from large cannon may be visible at night for a distance of as much as 30 miles. Such flashes also temporarily destroy night vision of exposed personnel. A smaller, less intense, flash arising from the residual chemical interaction in the gaseous system results from the primary decomposition of the powder before final equilibrium has been established. This flash, called the primary flash, occurs nearer the muzzle than the main secondary flash. Primary flashes are usually masked by main secondary flashes. A third flash, called muzzle glow, occurs right at the gun muzzle and is caused by the luminescence of the hot gases leaving the muzzle. It is always small in size, of low intensity, dull red in color and non-blinding. As in the case of primary flashes, muzzle glows are not evidenced when main secondary flashes occur.

In addition to the three types of muzzle flash mentioned above, some light in the vicinity of the muzzle often arises from sparks. These are hot particles of varied origin, such as particles of metal from the projectile rotating band, particles from the cork plugs used in semi-fixed ammunition, etc.

There are four ways, different in principle, which may be used to obtain flashlessness:

- (a) An inorganic salt, particularly salts of potassium, may be added to the smokeless powder charge, or these salts may be incorporated in the powder during manufacture.
- (b) A carbonaceous material may be added to the smokeless powder charge or the carbonaceous material may be incorporated in the powder during manufacture.
- (c) A cool explosive such as nitroguanidine may be incorporated in the powder during manufacture.
- (d) The ignition, powder burning rate, gun design, projectile design, may be altered, individually or all together, in such a fashion that the gun becomes more efficient.

Flashless pellets, essentially a mixture of inorganic potassium salts, are now commonly used in 3", 4", 5" and 6" guns. The performance of rounds made flashless through the addition of flashless pellets on top of the smokeless powder charge is inferior to that of rounds made up with powder having the potassium salt incorporated in it (SPDF). Since current production of SPDF powder does not meet immediate requirements, a form of flashless pellets will continue to be issued for service use. A modified pellet, which is in the form of a powder grain and which has good flash suppressing properties, is also being developed. This pellet also has the decided advantage of not leaving an undue amount of residue and of not forming a fused clinker mass such as has sometimes caused gun jams.

It is to be noted that the principles set forth in (a) and (b) above have been combined to produce a new flashless 8"/65 powder. Production of this powder has been started, and it will be issued to the ships concerned as soon as it becomes available.

The principle outlined in (d) above is being utilized to good advantage. Development has been initiated, utilizing this method as well as those described in (a) and (b) above, for making reduced velocity rounds, flashless in all major caliber guns.

The principle stated in (c) above was used by the British in developing a propellant called Cordite N. A new powder of the Cordite N type has been adopted as a temporary measure for U. S. Naval use. This is a propellant which is new to the U. S. Naval service and is a double based powder which is flashless with the flash reducing ingredients being incorporated in the grain. This gives approximately 50% more smoke than present smokeless powder, while the present single based flashless powders give approximately 100% more smoke than standard smokeless powders. The index designation for this new propellant is SPCG instead of the designations now in use for service powders. (See footnote for definition of index number and for list of present designations). The letter "C" indicates a change in stabilizer from diphenylamine to carbamate, and the letter "G" indicates a double based powder containing nitroglycerine.

SPCG powder has a nominal composition as follows:

Nitroguanidine	55%
Nitrocellulose (13.1% of Nitrogen)	19
Nitroglycerine	18.7
Carbamite (stabilizer)	7.3

Amounts of potassium sulfate varying from 1.5 to 5 percent are added to the above composition to aid in flash suppression. Acetone is used as a solvent to facilitate colloidizing.

The physical shape of the new flashless powder grain is the same as present smokeless powder; i.e., cylindrical, seven-perforated grains. It is chalk-white in color and opaque, and becomes slightly yellow with age.

SPCG powder contains only one tenth of volatile solvent contained in pyro powder and is, therefore, less susceptible to ballistic change on stowage. Deterioration of SPCG powder, like all smokeless powders, is caused by the liberation of oxides of nitrogen from the powder at a greater rate than they can be absorbed by the stabilizer. SPCG powder deterioration may be accelerated by specific types of impurities. Contamination by salt water, dirt, and iron rust are to be especially avoided. When such contamination is detected, the procedure given in paragraph 1-18, Part I, Chapter I, of BuOrd Pamphlet No. 4 must be followed without delay. An excess of Carbamate stabilizer; i.e., ethyl centralite, is present in SPCG powder to insure long life. The carbamate stabilizer may give rise to a substance which softens paint. It is very important therefore that SPCG powder containers should be unpainted internally.

Because of the nitroglycerine content in SPCG powder, the surface of powder grains sometimes becomes moist; this condition is called sweating and is due to the exudation of nitroglycerine, which is liable to occur after exposure to cold and subsequent warming. This sweating is caused by the freezing of the nitroglycerine, which crystallizes on the powder grain surfaces and subsequently melts when the temperature rises.

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Powder Index - A number assigned to a lot or blend of lots of smokeless powder after its proof and acceptance.

Other Designations:

- SPD - Smokeless powder stabilized by the addition of diphenylamine.
- SPDM - Non-hygroscopic powder.
- SPDF - Flashless powder.
- SPDX - Water-dried powder.
- SPDE - A blend of stabilized powders.
- SPDW - Reworked powders.

Crystallisation of nitroglycerine may take place after storage at 45° F. or below. Sweating may also occur due to the distillation of nitroglycerine at temperatures of 110° F. or over for 24 hours or more.

Sweating as a result of freezing of the nitroglycerine does not necessarily have an adverse effect upon the ballistic properties of SPCG powders. If it does occur, however, the powder becomes much more sensitive than it normally is, and therefore, must not be removed from its containers for any purpose, nor should the powder or containers be unnecessarily moved or handled until the powder recovers its normal state. This will result by the reabsorption of the nitroglycerine if the temperature is kept above 45° F. If the powder has been subjected to temperatures of 110° F. and over for more than 24 hours, it likewise becomes sensitive. Inasmuch as reabsorption is not complete as in the case of freezing, disposition should be requested from the Bureau. If any charges have been subjected to temperatures of 45° F. and below, or 110° F. and above, it is to be assumed that exudation has occurred, and the charges are to be handled as outlined herein. Complete data on any sweating observed along with the action taken shall be submitted to the Bureau of Ordnance in as expeditious a manner as possible.

All the regulations covering the stowage, handling and general care of smokeless powder apply to normal SPCG powder; i.e. powder which has not been exposed to temperatures outside the limits of 45° F. - 110° F. However, because of the effect of elevated temperatures on the nitroglycerine content, the 65.5° C. (150° F.) surveillance test shall not be conducted aboard ship, but daily visual examination of samples and tests for local heating in magazines prescribed by BuOrd Pamphlet 8-6, shall be rigorously adhered to. The 65.5° C. surveillance shall be conducted on landed samples of Naval Ammunition Depots, Oahu, Mare Island, and St. Julien's Creek. Such samples should be landed at such times as to conform as nearly as practicable with the requirement of BuOrd Pamphlet No. 4.

New SPCG powder which has not been exposed to abnormal temperatures is as safe as new single-base smokeless powder and therefore, as indicated above, may be stowed in the same magazine with single-base powders. SPCG powder has been in use by British land and sea forces for many years and is considered by them as the safest of their cordite powders. SPCG powder is not unique in that it should not be abnormally exposed. All smokeless powder has a tendency to become abnormal when exposed to extreme temperatures and all smokeless powder is therefore given special treatment when so exposed. SPCG powder which has been exposed to temperatures which place it in an abnormal category, (See paragraph above) shall be stowed in a separate magazine and isolated from all normal powder.

Because of the behavior of SPCG powder, overseas transportation of SPCG powder shall be limited to ammunition ships and to only those that are equipped with holds in which the air is changed at least once every twenty (20) to thirty (30) minutes and are insulated so that under all conditions the temperature requirements (45° F. to 110° F.) will be met. Charges of SPCG powder shall in no circumstance be landed in advance areas for stowage-ashore purposes; and if landed for the purpose of transfer only, all possible effort shall be made to prevent exposure to a higher or lower temperature than herein prescribed. Any charges abnormally exposed shall in no instance be transferred to any vessel, but shall be isolated and the Bureau of Ordnance notified of complete details and action taken in as expeditious a manner as possible.

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- REFERENCES: 1. Navord OCL A61-44.  
2. Bulletin of Ordnance Information No. 2-44.

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C O N F I D E N T I A L

POINT DETONATING PROJECTILE FUZES,  
ARMING DISTANCE AND SENSITIVITY

(NOTE: For drawings and details of fuzes, consult "U. S. Navy Projectiles and Fuzes" dated August 1944, published by the Navy Bomb Disposal School.)

In view of several recent requests from the forces afloat for information concerning the arming distances and sensitivity of point detonating projectile fuzes, it appears desirable to give wide dissemination to the following data on the point detonating projectile fuzes Mark 29 and mods, (5" HC or larger); the Mark 30 and mods, (3" and 4" HC); the Mark 27 (40 mm AA); the Mark 12 or Mark 34 (141 AA); and the Mark 26 Mod 1 (20 mm AA).

The fuzes Mark 29 and 30 differ in contour and color of the ogive but are otherwise essentially alike. They detonate consistently on 1" wood at all probable service velocities. They will also function on ground or water impact at angles of fall of about 8° and 12° respectively. These fuzes are bore safe. The fuze Mark 29 fired at service velocity from a 5"/38 caliber dual-purpose gun is armed at 1' to 1-1/2' outside the muzzle of the gun. The fuze Mark 30 is armed from 1-1/2' to 2' outside the muzzle of the gun when fired at service velocity from a 4"/50 gun and from 3' to 4' from the muzzle of the gun when fired at service velocity from a 3"/50 gun. Firing tests at the Naval Proving Ground, Dahlgren, have shown that detonation may take place after striking cork or plastic fragments from cartridge case plugs while in flight.

The fuzes Mark 27 Mod 0 and the Mark 27 Mod 1 have different shaped firing pins and firing pin detents but are otherwise quite similar. Both mods are bore safe. The Mark 27 Mod 0 arms from 5' to 7' outside the muzzle, and the Mark 27 Mod 1 arms from 5' to 6' outside the muzzle. Both mods of the Mark 27 fuze are required to detonate on 3/16" chipboard at service velocity. Under the same conditions, they will usually detonate on a single sheet of newspaper or on cork or plastic fragments from cartridge case plugs. Paradoxically, however, these fuzes will not usually function on water impact at low angles. At a striking velocity of 1000 f.s., which corresponds to a slant range of about 3,800 yards, fuze action is obtained about 80 per cent of the time on O.032 duraluminum at 0° obliquity.

The characteristics of the fuze Mark 34 are quite similar to those of the fuze Mark 27 discussed above. They will fire on 3/16" chipboard at 1600 f.s., which corresponds to a slant range of about 1,000 yards. The fuze arms at about 4' outside the muzzle. The fuze Mark 12 is now obsolete. It was found that it tended to arm in the bore and therefore, to prevent bore prematures, the exposed portion of the firing pin was "eared" by crimping to keep the firing pin from resting on the detonator in flight. In this condition the fuze Mark 12 will detonate on O.032 duraluminum at a striking velocity of 1600 f.s., which corresponds to a range of 1,300 yards. It will not function on O.020 duraluminum at the same velocity.

The fuze Mark 26 Mod 1 differs from other Navy fuzes in that it is not bore safe in the technical sense, the detonator and booster being permanently in line; i.e., the fuze is always armed. The design is tolerated, however, since there is no firing pin or other moving part, which fact makes it possible to meet the tremendous production requirements for this ammunition. At 1250 f.s., striking velocity, which corresponds to a range of about 1,000 yards, the fuze is required to function 90 per cent or better against 1/8" mild steel at 0° obliquity. At the same velocity consistent performance cannot be expected against O.102 duraluminum. When this fuze was tested at sea it did not function on water impact. Yet strangely enough, detonations have occurred at the Naval Proving Ground, Dahlgren, when firing in a very heavy rain. The reasons for the inconsistencies in sensitivity are not known but are under further study.

The chief conclusion to be derived from the above is that no point detonating projectile fuze now in service should be fired through halyards, wires, or other similar obstruction since there is always the probability that the projectile will detonate. Gun crews should be trained not to fire through such material. The hazard created by impact of projectiles with cork fragments from neighboring mounts is considered negligibly small and is accepted in view of the fact that no reports of

prematures in flight, which are clearly attributable to impact of projectiles with cork fragments, have ever been received by BuOrd.

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REFERENCE: Bulletin of Ordnance Information No. 8-44

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R E S T R I C T E D

## MECHANICAL TIME FUZE, MARK 42 TYPE, FOR MAJOR CALIBER HIGH CAPACITY PROJECTILES

Erratic performance of mechanical time fuses of Mark 18 type, when used in 14" and 16" caliber projectiles necessitated the development of a new design of mechanical time fuze.

The mechanical time fuze, Mark 18 type, embodies a clockwork mechanism which utilizes centrifugal force acting on two weights for its primary driving force. These weights are assisted initially and for approximately half of the fuse running time by two coil springs known as "kick-off" springs. The difficulty encountered when using fuses of Mark 18 type in large caliber projectiles results from the relatively low spin rate of such projectiles which does not produce enough centrifugal force to operate accurately the regular Mark 18 type of clockwork mechanism. Although generally satisfactory in 12" projectiles, fuses of the Mark 18 type are not recommended for other than temporary use in projectiles above 8" caliber.

The new mechanical time fuze especially designed to function in 12" to 16" H.C. projectiles has been designated the Mark 42, Mod O. This fuze differs essentially from the Mark 18 type in that the primary driving force for its clockwork mechanism is provided by a coil spring which gives a positive driving force substantially independent of the rate of spin of the projectile, and applied during the entire running time of the fuze.

The Mechanical Time Fuze Mark 42, Mod O has the same outside form as the Mark 18 type and is set in the same manner. It is designed to function with approximately the same accuracy as the Mk 18 type, namely, within  $(.08 \pm .005 T)$  seconds of the actual setting where T is this setting.

Since the supply is critical, initial distribution of Mechanical Time Fuze Mark 42 Mod O will be made under the 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.

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REFERENCE: NavOrd OCL A60-44

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C O N F I D E N T I A L

## PERFORMANCE OF 14" H.C. PROJECTILE

A 14" HC projectile fitted with a base detonating fuze Mark 39 (non-delay), auxiliary detonating fuze Mark 35, and a steel nose plug was recently test-fired at a striking velocity of 1740 f.s., obliquity 20°, against a 12' x 12' x 8' reinforced concrete block. The accompanying series of photographs, Figs. 8 and 9, show that a hit by such a projectile, even when it is fitted with a non-delay base detonating fuze, will give more often

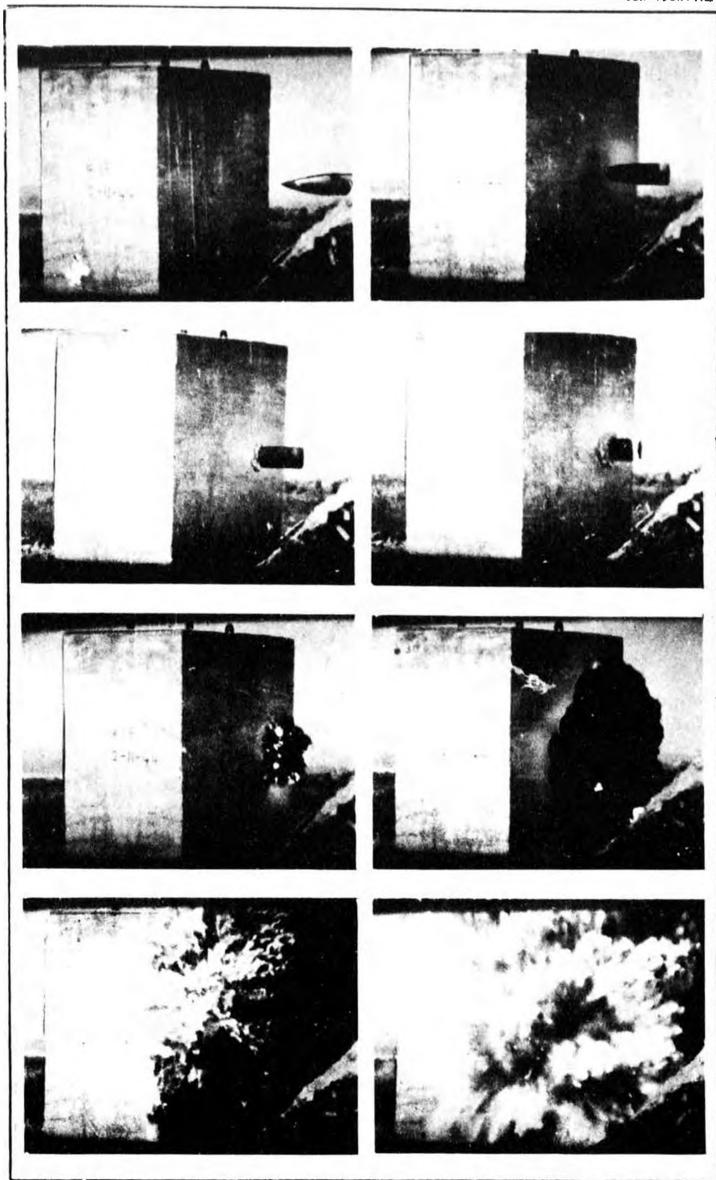


FIG. 6  
Series of photographs shows a 14" HC projectile fitted with base detonating fuse Mark 39 (Non-Delay and steel nose plug approach enter and detonate in reinforced concrete block (12' X 12' X 8').

AFWD Bulletin No. 10 1 November 1944

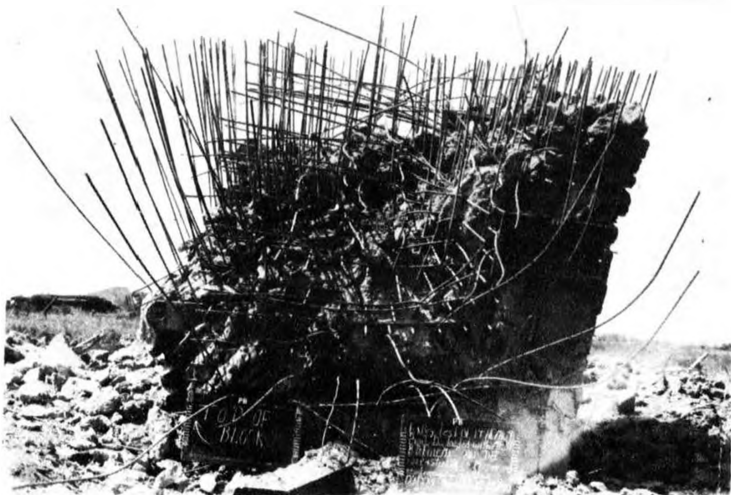


Fig. 9. Test-fire hit of 14" HC projectile fitted with base detonating fuze Mark 39 (Non Delay) on reinforced concrete block (12' x 12' x 8').

than not most gratifying results. It is to be especially noted that the slight inherent mechanical delay, which has been observed in the performance of all base fuzes, allowed this 14" projectile to penetrate more than half its length before fuze action occurred.

Special attention is invited to the fact that 8" to 16" HC projectiles are now being issued to the forces afloat with base detonating fuzes Mark 48 installed. These fuzes contain a delay element of 0.01 second which will allow complete penetration of a concrete block similar to the one noted above before the projectile detonates.

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REFERENCE: Bulletin of Ordnance Information No. 2-44.

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C O N F I D E N T I A L

## DEPTH BOMBS AN-MARK 53 MOD 1, AND AN-MARK 54 MOD 1

Depth bombs Mark 53 Mod 1, and Mark 54 Mod 1 have recently become "AN Standard". It will be recalled that these bombs are identical except for filling, the Mark 53 being loaded with 225.5 pounds of TNT, and the Mark 54 loaded with 250.2 pounds of Torpex. It is to be remembered that only the AN-Mark 53 Mod 1 and AN-Mark 54 Mod 1 have become AN Standard, while the original models remain Mark 53 Mod 0 and Mark 54 Mod 0. The only difference between the Mod 0 and the Mod 1 is that the latter will have the suspension lugs welded to the case spaced 14 inches apart. An additional central lug is provided for use on British aircraft, located 180° from the first two lugs. Hoisting provisions for the bombs are unique in that the screw-in hoisting lugs may be located at seven different points on the circumference of the bomb body in order to meet any hoisting condition.

A new asphaltic composition called Cavity Hot Melt has been developed by the Bureau of Ordnance which will be used to coat the inner surfaces of these depth bombs. This coating does not become hard after cooling but remains plastic even in zero temperatures. It provides smooth inner surfaces and corners. The thickness of the Cavity Hot Melt may be varied within any reasonably desired limits and may be satisfactorily applied in a coating up to 1/8 inch thick. The lining so obtained, in addition to providing a smooth inner surface for the bomb, also acts as a cushion for the explosive filler and thereby reduces the sensitivity of the bombs.

### IMPORTANT

1. Depth bombs AN-Mark 53 Mod 1 and AN-Mark 54 Mod 1 are satisfactory for releases up to 10,000 feet.
2. The new Cavity Hot Melt provides a smooth inner surface of the bomb and also serves as a cushion to aid in reducing its sensitivity.
3. Although these bombs will withstand the effects of low altitude high speed drops, they should not be dropped at such altitudes and speed combinations which are likely to cause ricochet. All types of flat nose depth bombs will generally not ricochet if the entrance angle is 13° or greater.
4. Whenever possible, JETTISON BOMBS "SAFE" IN A SAFE AREA BEFORE MAKING A FORCED LANDING.

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REFERENCE: 1. Naval Aviation Confidential Bulletin, September 1944.  
2. Bulletin of Ordnance Information No. 2-44.

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R E S T R I C T E D

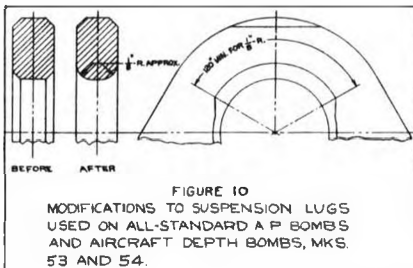
## DESIGNATION AND NOMENCLATURE OF ANTI-SUBMARINE WEAPONS

To minimize the possibility of compromising the security of anti-submarine weapons in general, BuOrd has issued Circular Letter G56-43 which states that the use of the symbols "A.S." or "A/S", or the word "anti-submarine" has been discontinued in connection with the designation and nomenclature of A. S. projectors Marks 10 and 11 (formerly known as hedgehogs), A. S. projector charges (A.S.P.C.), and A. S. projectors Marks 20 and 22 (formerly known as mousetraps). It is to be noted that the former A. S. projectors Marks 10 and 11 are to be referred to as projectors Marks 10 and 11. It is also noted that the former A. S. projectors Marks 20, 21 and 22 are to be referred to as 712 rocket launchers Marks 20, 21 and 22. Similarly, the former A. S. projector charges are to be referred to as "712 Projector Charges Mark \_\_\_\_\_".

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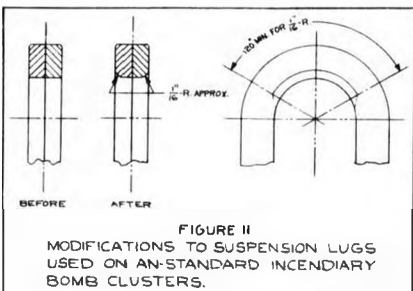
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## MODIFICATIONS TO AIRCRAFT BOMB SUSPENSION LUGS

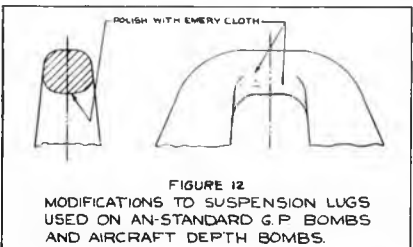


It has been ascertained that rough and sharp surfaces on bomb suspension lugs may adversely affect the release of bombs from current types of bomb racks and shackles. In extreme cases, such bomb lug surfaces may be a contributing cause in failure to release. Thus, it is particularly desirable that the engaging surfaces of the suspension lugs of every bomb be as smooth as possible.

The principal types of bomb suspension lugs are shown in Figs. 10, 11 and 12, together with the desired, smooth shapes of these lugs after modification. The modified shapes are being specified and incorporated in all new production, but for those bombs already manufactured, it will be necessary for Service personnel to modify the suspension lugs whenever practicable.



The sharp edges of the lugs may be broken and the engaging surfaces faired into a smooth, even contour by the use of strips of emery cloth. Rather coarse grained strips should be used at the start and then successively finer grained strips employed until the desired finish is attained. The strips of emery cloth should be about 1/2 inch wide and approximately 12 inches long.



When bomb suspension lugs have been modified as noted above, they should be coated with a suitable anti-rust compound. Thick, heavy grease coatings should be avoided.

### PRECAUTIONS

Under no circumstances should files or high speed grinders be used when modifying lugs on live, loaded bombs. If the lugs are removable, they may be taken to a shop and worked on there.

Bomb suspension lugs are highly stressed parts and no more material than necessary should be removed.

REFERENCE: Navord OTI V26-44

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C O N F I D E N T I A L

## HANDLE BOMBS CAREFULLY!

Regulations, orders, instructional films, and even a cartoon series, have stressed the necessity for careful handling of bomb type ammunition; but accidents from rough handling of this ammunition continue to occur. Individuals who know better continue to unload bombs from airplanes by simply dropping them on runways, lighten blimps by dropping their depth bombs on air fields, and deliver bombs by dropping the tail boards and then kicking the bombs out of the backs of trucks.

The absence of casualties in their own experience convinces some of these individuals that prohibitions against rough handling of bombs, set on "safe" or without fuzes, must be based upon fears too imaginary to deserve serious consideration in wartime. Some of them attempt to defend their position by their own interpretations of explosive sensitivity tests described in text books; but in that very complex subject they are on unsafe ground. Most of the conventional sensitivity tests necessarily are of laboratory types, such as allowing weights to fall on minute quantities of bare explosives or firing bullets at high velocities through small metal containers of explosives. Literature on experimental sensitivity tests would not clearly imply that cast TNT, covered by the 1/16" steel shell of a Mark 17 depth bomb, might be partially exploded by only a 2' drop. At a certain naval air station there was a PW-1 airplane with 3 bombs on it, side by side. The middle bomb was secured to the hoist which was to lower it. This bomb was released from the rack but at the same time the two out-board bombs were accidentally released, and both dropped to the concrete runway. The total free fall to the concrete runway was about 5-1/2'. After a fall of about 2', one bomb encountered a corner on the bomb trailer which was then under the airplane, and the result is best described as follows:

"...the bomb exploded with a report similar to that made by a caliber .50 when it fires.... Two enlisted men who were working on the bombs were each burned slightly on the hands from the flash which accompanied the explosion. The surface of the ground around the plane, in a circle measuring approximately 30' in diameter, was covered with powdered TNT. Approximately 15 lbs. of cast TNT was picked up from around the plane. One piece of cast TNT weighing about 1/2 lb. was blown 50 yards from the bomb."

The TNT explosive was found to be entirely normal, and all boosters and fuzes were recovered intact and in normal condition. The original dent was so located that no "pinching" action of the explosive in a crevice could have been involved.

Apparently there was involved an unusual (and perhaps previously rather poorly recognized) type of phenomenon, which might be termed the "container-dent sensitivity" of the explosive. The explosive itself was not struck directly, nor was the metal container perforated, but the dent apparently caused sufficient local heating to produce ignition. If the container had been either much thicker, or if it had been much thinner (like metal foil), the ignition hardly could have occurred. In this instance, there was only a partial explosion, but perhaps in other instances or with other explosives a complete action could occur. Thus, special attention is invited to the fact that bomb-type ammunition (even when unfuzed) should be handled with due care and due respect.

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REFERENCE: Bulletin of Ordnance Information No. 1-44.

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C O N F I D E N T I A L

## LOW ANGLES OF IMPACT WITH BR'S

Recent tests indicate that the minimum angle of elevation at which fuzes Mark 137 and Mark 145 will consistently function when fired in 4½ inch beach barrage rockets is about 15°. At angles of elevation lower than 15° the performance falls off considerably.

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REFERENCE: Bulletin of Ordnance Information No. 2-44.

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R E S T R I C T E D

## USE OF "MOD O" (MOD ZERO)

It has long been a BuOrd custom to designate the first piece of equipment or ordnance item by the assignment of a Mark number. Subsequent minor changes in type have been designated by the addition of a "Mod" with an appropriate number. At the same time there has grown up the custom of designating all equipment or ordnance items of a particular type by the use of the Mark number which applies, strictly speaking, only to the first of a group. In order to eliminate confusion between the type as a whole and the first item of the type, the first model will be termed Mod O. This action was stated in Navord OCL X6-44. To cite an example, refer to page 2 for details on the Fuze Mark 156 Mod O and Mark 158 Mod O.

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C O N F I D E N T I A L

## JAPS ENCOUNTER M123 SERIES FUZES

In a recent report from Aluslo Calcutta, the following account is revealed of a Jap's attempt to remove M123 series fuzes:

After our use of the M123 series fuzes, the Japanese attempted to dispose of our unexploded bombs. Burmans were conscripted to dig up the bombs, and final disposal was by dropping in the Irrawaddy river. In at least one instance, a Japanese officer was killed while sitting astride a U. S. bomb. Either he had attempted removal of a time fuze, or the setting time expired just as he began disposal operations. This incident was reported with some elation by a Burman who had been forced by the same Japanese officer to dig up the bomb.

Japanese prisoners of war and the Burmese indicated that our use of time bombs spread considerable terror among occupation forces. Our technique was to drop 500# bombs with 12-hour delay fuzes late in the afternoon, concentrating explosions during the early hours of morning. Since the airfield our planes were using was less than two miles from the targets, performance of the fuzes could be checked by ear. Detonations were about two hours ahead of settings, but were consistent.

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**ATTENTION !**

**RESTRICTED**

1. The following information is presented in an effort to help organize and clarify the relationships between new Army mechanical time bomb nose fuses:

FORMER DESIGNATION	NEW DESIGNATION	USE	REMARKS
T39	M127	Cluster, Aimable Incendiary M17A1	Similar in construction to the M11A2. Has full tetryl booster instead of black powder. Not detonator safe, i.e., detonator is in line with firing pin. Being replaced by T55 (M128). (For details, see AFEO Bulletin No. 3, page 18)
T39E1	M138	Cluster, Aimable Incendiary M18 (Formerly EGR2)	Same as M127 except for booster; has only a 1/2 tetryl booster, balance of booster space filled by inert clay pellet. Being replaced by T55E1 (M145). Fuze not detonator safe. (For details see AFEO Bulletin No. 6, page 16)
T55	M128*	Cluster, Aimable Incendiary M17A1	Similar to M127 but incorporates a detonator slider, and therefore is detonator safe, i.e., detonator out of line with firing pin until fuze has partially armed. Has full tetryl booster. Replaces M127. (For details see AFEO Bulletin No. 8, page 20)
T55E1	M145*	Cluster, aimable Incendiary M18 (Formerly EGR2)	Similar to M138 except that it has a detonator slider, i.e., detonator is out of line with firing pin until fuze has armed. Has 1/2 tetryl booster, balance of space in cup taken up by inert clay pellet. Replaces M138. (For details see AFEO Bulletin No. 8, page 20)
T55E2	M146*	Replacement for M11A2	Similar to M128 except that it uses the black powder booster of the M11A2. Fuze is detonator safe, i.e., detonator is out of line with firing pin until fuze has armed.
T56	M135	G. P. Bombs	Combination of M11A2 and body of AN-M103. Designed for use in nose fuze seat liner of G. P. bombs to give aerial burst. Setting range 5 to 92 sec. Fuze is detonator safe. (For details see AFEO Bulletin No. 3, page 18).
T56E1	M136	G. P. Bombs	Similar to M135 (Combination of M11A2 and AN-M103 body) except that setting range only from 5 to 30.6 sec. It is more accurate than M135. Fuze is detonator safe. (For details see AFEO Bulletin No. 6, page 14)

\* These "M" designations are not yet official but it is believed that standardization as such will be effected shortly. It is to be noted that the M128, M145 and M146 are identical except for the type of booster as indicated under "Remarks".

2. The Bureau of Ordnance plans to go into production in the near future on Army tail fuzes M115, M116 and M117. These fuzes manufactured by the Bureau will remain unchanged from regular Army production with one exception--Bureau production will be known as Tail Fuzes Mark 215, Mark 216 and Mark 217.
3. The M78, 500 lb. chemical bomb has been made "Bomb, Chemical 500 lb. AN-M78" together with "Burster, AN-M15".
4. While Depth Bombs Mark 53 and Mark 54 remain unchanged, the "Mod 1" of these depth bombs have been "AN" standardized as:
  - Depth Bomb, 325 lb. AN-Mark 53 Mod 1
  - Depth Bomb, 350 lb. AN-Mark 54 Mod 1

(NOTE: See page 23 for details)
5. In the past, it has been common practice to call the fuzes "M118" and "M119" as such. Actually these fuzes were never officially standardized with the assignment of an "M" number. The Army, at a recent meeting of the Ordnance Committee, pointed out that henceforth these two fuzes should be referred to only by their original "T" number, i.e., M118 is the T32, and the M119 is the T33.
6. The E6R2 500 lb. aimable incendiary cluster has become:
  - "Cluster, Aimable Incendiary, 500 lb., M18"
7. The T54 nose fuze, essentially a modified AN-M103 to which a Jap type gaine (booster) has been fitted for use in captured Jap Navy bombs is in the process of being standardized as the "Fuze, Nose, Bomb M148".
8. The T29E2 nose fuze, described in AFEO Bulletin No. 9, page 21, is expected to be standardized as the "Fuze, Nose, Bomb M149".
9. It has been recommended that the 20 lb. practice bomb AN-M48 be dropped from the list of standard bombs. This bomb is similar in appearance and size to the 20 lb. Fragmentation Bomb AN-M41. Since no more AN-M48 practice bombs will be made, the 20 lb. fragmentation bomb AN-M41 may be used for practice work thus enabling personnel to gain actual experience with a combat round.
10. The following items have been "AN" standardized:
  - (a) Flare, Aircraft Parachute, AN-Mark 8 Mod 1.
  - (b) Flare, Aircraft Parachute, AN-Mark 6 Mod 5.
  - (c) Bomb, Photoflash, 100 lb. AN-M46
  - (d) Signal, Miniature, Practice Bomb, Fluorescein, AN-Mark 5 Mod O.
11. The following items have been de-standardized:
  - (a) Bomb, Practice, 20 lb. AN-M48.
  - (b) Flare, Aircraft, Parachute, AN-Mark 5 Mod 3.

\* \* \* \* \*

### CORRECTION

The fuze described and pictured on page 24, AFEO Bulletin No. 9 is called the Fuze Mark 154 Mod 2 in error. A notation should be made changing the designation to Fuze Mark 154 Mod 3. In way of explanation, the Mod 2 differs from the Mod 3 in that the former does not have a rubber gasket between the burster tube collar and the burster retaining disc.

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## SUGGESTED READING

(Restricted)

1. Ordnance Pamphlet #1175, "2#25 Rockets, Target".

This O.P. contains a description of the 3.25 Rockets, Target, with instructions for use in the training of anti-aircraft gun crews on shore or aboard ship.

(Restricted)

2. Ordnance Pamphlet #1234 (Preliminary), "One Hundred Pound Incendiary Bomb AN-M47A2 - All Purpose", dated 29 July 1944.

Complete information on handling, stowage, assembly and use of the AN-M47A2 is covered in this O.P. Incendiary bombs are currently seeing increased use and this O.P. should be of interest to all personnel handling bombs.

(Restricted)

3. Navord OTI A5-44 - "Demolition Firing Device Mark 1 Mod 1".

This device is a mechanical trigger mechanism designed to fire a percussion cap in a standard threaded chamber. It is a versatile mechanism and may be adapted to a variety of tasks. With the current trend of increased interest in booby traps, etc., it is recommended that subject OTI be secured and digested.

(Restricted)

4. Ordnance Pamphlet #1255 (Preliminary), "Range Table for 2#25 Rocket (Sub-Caliber) used with Aircraft Launchers Mark 5 and Mods", dated 14 September 1944.

This O.P. contains information on the flight of the 2#25 Rocket (sub-caliber) fired from aircraft. The data are primarily for use in determining the proper sight settings for firing the rockets under various sets of conditions.

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