ADVANCED FUZE & EXPLOSIVE ORDNANCE BULLETIN No. 3

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This Bulletin has been compiled by the staff of the U.S. Navy Bomb Disposal School primarily for the graduates of the Advanced Fuze & Explosive Ordnance School. While it is believed to be accurate, it is not to be considered an official publication.

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AIRCRAFT BOMBS

M83 FRAGMENTATION BOMB

INTRODUCTION

In view of the effective results obtained by the Germans with their "Butterfly" bombs (SD-2) in disorganizing communities and built-up areas, as well as on airfields, roads and troop movements, the army has made an adaptation of this bomb which, except for minor details, is an exact replica of the original German bomb. The U.S. adaptation of the German bomb has been designated M83.

DESCRIPTION

The bomb body is cylindrical in shape, cast in two halves and welded together. The bomb measures 3 inches in length and 3 inches in its largest diameter; wall thickness is 1/4 inch. Weight of the bomb is approximately 4 lbs. and the filler consists of 7 ounces cast T.N.T. The fuze cavity, 1-3/4 inches in diameter, is threaded with a left hand thread to prevent unscrewing of the fuze while the bomb is in flight and is situated athwartships in the body. The complete bomb is painted olive drab. (NOTE: At this writing, it has not been definitely established whether or not the bombs will be painted with a colored circumferential band. Should this be the case, notification will be made in the next issue of the Bulletin.)

VANES

The vane assembly consists of four pieces; two semi-cylindrical surfaces (wings) and two discs (propeller blades). Before the bomb is released, i.e., while it is still in the adapter cluster, the vane assembly is folded around the bomb to form a cylindrical casing which can be held closed against the pressure of the vane springs by means of a safety clip (Fig. 1). When the bombs are packed in the cluster adapter, the safety clips are removed, but the bombs remain in their closed status due to their proximity to one another. The arming spindle of the fuze in the closed position projects through the bomb casing.

OPERATION OF THE BOMB

When the cluster adapter bursts open, the individual M83's scatter and the vane assembly, under the influence of its coil springs, is free to open (Fig. 2). Air resistance causes the

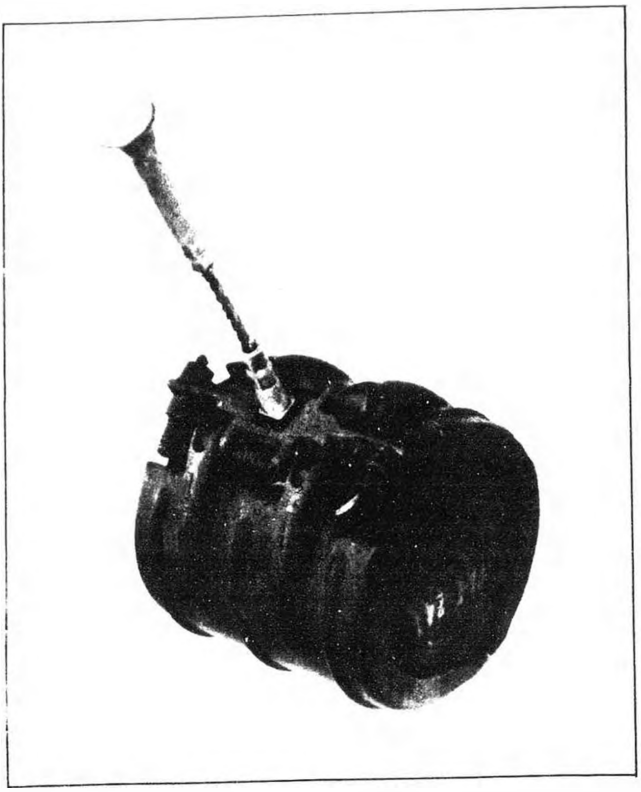

FIG 1 M83 FRAGMENTATION BOMB
(CLOSED POSITION)

FIG. 2 M83 FRAGMENTATION BOMB
(OPEN POSITION)

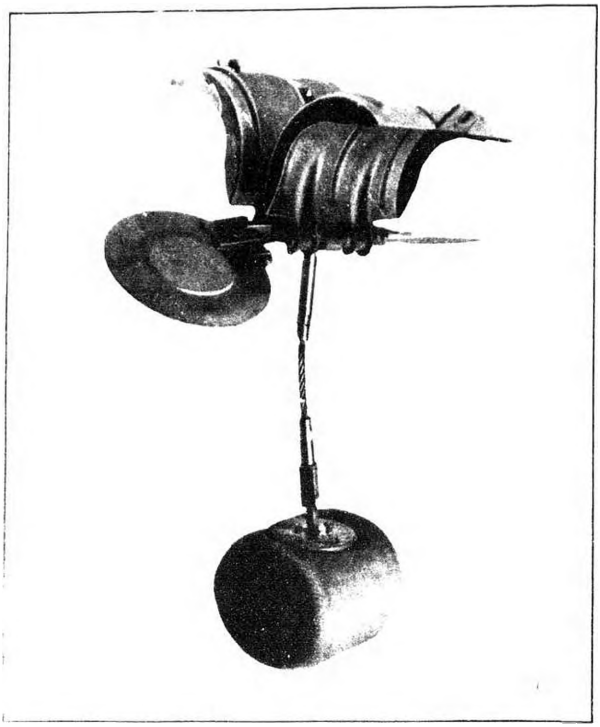

FIG 3 M83 FRAGMENTATION BOMB
(FULLY ARMED POSITION)

FIG. 4
M 129 FUZE GROUND OR AIR BURST

FIG. 5
M 130 FUZE - TIME

FIG. 6
M 131 FUZE ANTI-DISTURBANCE

opened vane assembly to rise to the upper end of the arming spindle. The vanes cannot come free of the spindle due to the square, tapered head on the spindle which engages a square hole in the hinge of the vane assembly. The two "wings" have the effect of a drogue and reduce the velocity of descent of the bomb. The "propeller blades", being set at an angle to each other cause the vane assembly to turn in a counter-clockwise direction, thereby screwing the arming spindle out of the fuze body, (Fig. 3), and permitting the fuze to arm. It is to be noted that the arming spindle is not withdrawn completely from the fuze. When the spindle has unscrewed sufficiently to permit arming of the fuze, it is retained in the fuze by a collar on the spindle. Thus the bomb is ready to act in accordance with the type fuze installed.

FUZES FOR M83

Three different fuzes will be available which have also been acapted from the German fuzes. The fuze designations are as follows:

U.S.	EXPERIMENTAL	GERMAN
M129	T47	Copy of (41)
M130	T48	" " (67)
M131	T49	" " (70)B

Initial shipments of the bombs will contain fuzes with "T" designations until production has progressed to the point where the official "M" designations will be used.

All three fuzes have identical external measurements:

Length of Fuze (Incl. Booster)	2 Inches
Length of Fuze (Less Booster)	1-1/8 "
Diameter of Fuze	1-3/4 "
Length of Arming Spindle	6-1/2 "

The fuzes screw into the bombs with a left hand thread and are tightened with a spanner wrench which fits into the two spanner holes in the top of each fuze. Luting on the threads insures a tight, moistureproof fit. Assembly of the fuzes in the bombs is done at the factory so that this work will not be required of service personnel.

M129 Fuze - Air or Ground Burst
Description:

This fuze is the only one which can be identified, after it has been inserted in the bomb, by its setting switch - "AIR - GROUND" located on top of the fuze (Fig. 4). The body is made up of three main sections, the top, middle and base. These

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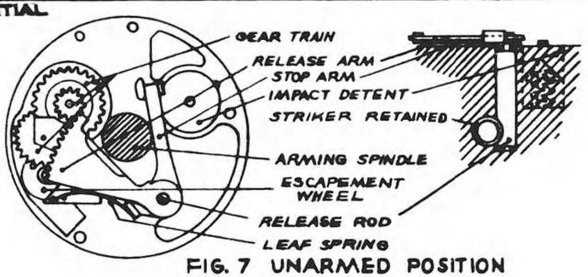

FIG. 7 UNARMED POSITION

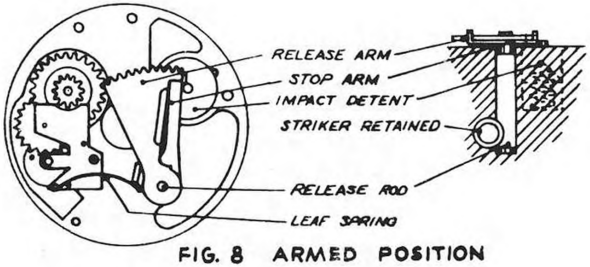

FIG. 8 ARMED POSITION

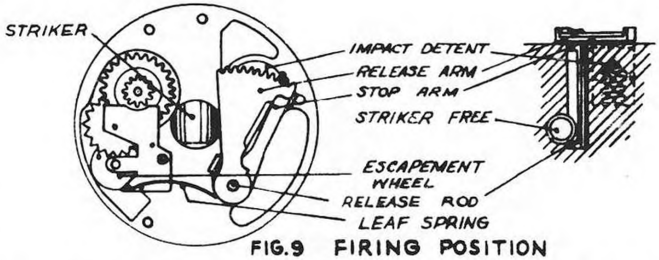

FIG.9 FIRING POSITION

M129 FUZE AIRBURST OR IMPACT

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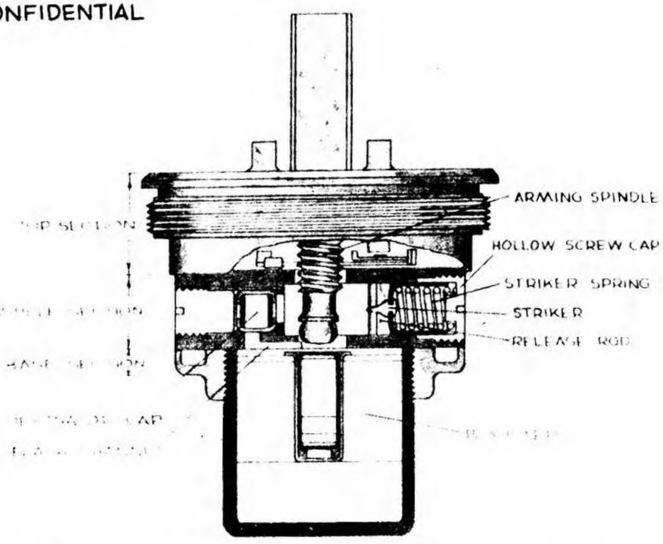


FIGURE 10 CROSS SECTIONAL VIEW

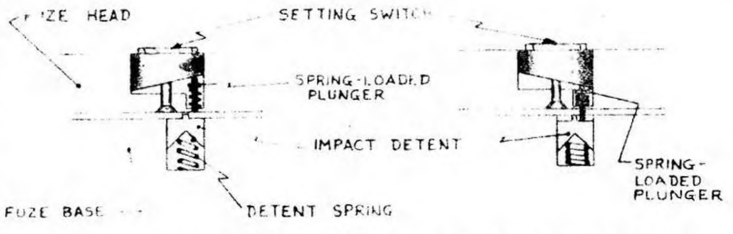


FIGURE 11. DETAIL OF SETTING SWITCH

are zinc alloy castings held together by three long screws.

1. The top section has a central hole threaded (R.H. Thread) to accommodate the arming spindle. The outside is threaded (L.H. Thread) to screw into the bomb body.

2. The middle section contains the clockwork mechanism and houses the striker, which fires the primer detonator in a horizontal rather than a vertical path (Fig. 10). On one side of the middle section is a large hollow screw cap, which retains the striker and striker spring. Diametrically opposite is another, smaller screw retaining the primer detonator.

3. The base section is a flat piece with a central hole threaded to mate with the plastic booster cup which contains tetryl. It is embossed "FUZE BOMB T47".

Operation:

The setting switch on top of the fuze body affords a choice of either "GROUND" or "AIR" burst.

"GROUND" Burst: The arming spindle requires approximately 3-1/2 turns before it has withdrawn sufficiently to permit the release arm to start its travel in a clockwise direction across the face of the mechanism. The release arm is fixed to the release rod, and the release rod holds back the striker as seen in detail sketch, Fig. 7. The motor of the fuze consists only of the firing pin spring which bears against the cut-away section of the release rod. This pressure drives the release arm. The speed of the release arm is controlled by the gear train. It takes the release arm about 2-1/2 seconds to reach the stop arm. Further rotation is prevented by the small projection in the center of the impact detent. In this position the fuze is fully armed as in Fig. 8. Upon impact, the impact detent overcomes its light coil spring due to inertia, and as it is forced down, permits both the stop arm and release arm to slip over the impact detent. The release rod is then fully rotated under the force of the striker spring and the striker is free to fire (Fig. 9).

"AIR" Burst: When the setting switch is set for "AIR" burst, the fuze operates exactly as above except that the impact detent has already been depressed by means of the spring loaded plunger under the setting switch (Fig. 11). In this condition, the projection on top of the impact detent does not offer any resistance to the release arm and stop arm during their travel across the face of the mechanism. Hence, the striker is free to move forward and fire the detona-

tor as soon as the release arm and stop arm have by-passed the impact detent and have reached their positions as seen in Fig. 9.

M130 Fuze - Time

Description:

The M130 fuze cannot be identified once it has been assembled in the bomb. There is no marking on the top of the fuze. Just as the M129, the M130 is made up of three zinc alloy castings, the top centrally threaded for the arming spindle, the middle section housing the clockwork and firing mechanism and the base section being a simple flat casting added only to afford a means of screwing the plastic booster cup to the fuze. The three sections are held together by three long screws.

The M130 incorporates a regular clock-spring as the main source of power for the clockwork mechanism, located top-side of the mechanism. In addition there is a powerful coil spring which drives the pivoted striker. There is only one screw on the side of the middle section, behind which is located the detonator cap.

Operation:

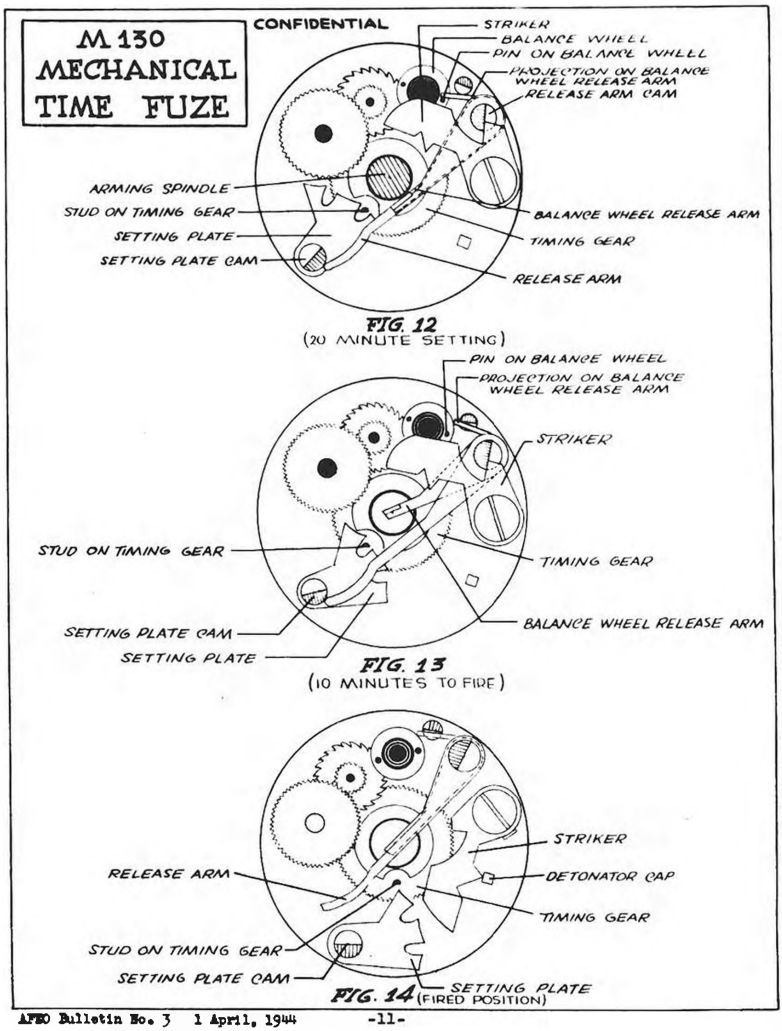
The clockwork mechanism in the unarmed position is seen in Fig. 12. When the arming spindle has been withdrawn approximately 1/4 inch, the balance wheel release arm, pivoted on the release arm cam, moves a limited distance until it is centered over the hole previously occupied by the arming spindle, (Fig. 13). This action (1) prevents reinsertion of the arming spindle and (2) starts the mechanism in operation as the projection on the balance wheel release arm frees the balance wheel.

With a maximum setting time of 30 minutes the functioning is as follows:

1. The timing gear, under the influence of its clock spring, rotates in a counter-clockwise direction. Near the end of its first revolution, the stud on the timing gear engages the first slot of the setting plate and pulls the latter around with it a limited distance in a clockwise direction.

2. Near the end of the timing gear's second revolution, the stud engages the second slot in the setting plate, once again moving it a limited distance.

3. Near the end of the third revolution, the stud on the timing gear engages the heel of the setting plate to move the latter clear of the timing gear. With the


M 130
MECHANICAL
TIME FUZE
CONFIDENTIAL
STRIKER
BALANCE WHEEL
PIN ON BALANCE WHEEL
PROJECTION ON BALANCE WHEEL RELEASE ARM
RELEASE ARM CAM
ARMING SPINDLE
STUD ON TIMING GEAR
SETTING PLATE
SETTING PLATE CAM
BALANCE WHEEL RELEASE ARM
TIMING GEAR
RELEASE ARM
FIG. 12
(20 MINUTE SETTING)
PIN ON BALANCE WHEEL
PROJECTION ON BALANCE WHEEL RELEASE ARM
STRIKER
STUD ON TIMING GEAR
TIMING GEAR
SETTING PLATE CAM
BALANCE WHEEL RELEASE ARM
SETTING PLATE
FIG. 13
(10 MINUTES TO FIRE)
STRIKER
RELEASE ARM
DETONATOR CAP
TIMING GEAR
STUD ON TIMING GEAR
SETTING PLATE CAM
SETTING PLATE
FIG. 14 (FIRED POSITION)

setting plate in this position, the setting plate cam presents its cut-away section to the release arm, thereby freeing the release arm. Under the influence of the coiled striker spring, the pivoted striker, bearing against the release arm cam, is free to strike in a counter-clockwise direction and fire the detonator (Fig. 14).

Each complete rotation of the timing gear takes approximately 9 to 10 minutes and with the maximum setting of the setting plate a delay of 27 to 30 minutes will result. By varying the initial position of the setting plate and/or timing gear at the factory, the fuze can be set to function for any desired time up to 30 minutes.

M131 Fuze - Anti-Disturbance

Description:

The body of the M131 fuze consists of two zinc castings, the top one having a center hole threaded for the arming spindle and the outer threads to screw the fuze into the bomb. The lower casting contains the timing, anti-disturbance and firing mechanisms; its base is internally threaded for the tetryl booster cup. The assembly is held together by three long screws. There are no markings on the fuze to identify it and when fitted into the bomb it cannot be distinguished from the M130. On one side of the lower casting is a large hollow screw which holds the firing pin and the firing pin spring under compression. Diametrically opposite is another smaller screw retaining the primer detonator. The timing mechanism prepares the anti-disturbance block to act when the bomb is subjected to handling or vibration. This fuze is so sensitive that the vibration caused by an aircraft propeller nearby may be sufficient to release the anti-disturbance block and fire the fuze.

Operation:

Fig. 15 shows the fuze in the unarmed position. When the arming spindle is withdrawn approximately 1/4 inch, the escape wheel spring and the timing gear are freed, and the fuze commences to arm. During the complete operational cycle, the fuze acts in three successive steps as follows:

1. After about 1/2 second, during which time the timing gear rotates in a clockwise direction under the influence of the coil drive spring, the entire mechanism is brought to a halt as the stud on the impact spring engages the stud under the timing gear and the fuze remains in this condition until impact.

2. On impact, the force of inertia on the flat impact

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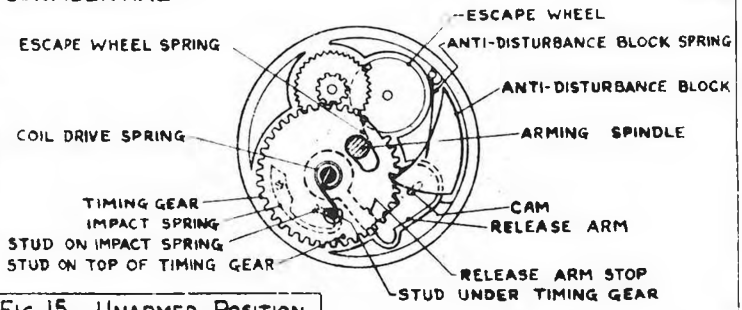


FIG. 15 UNARMED POSITION

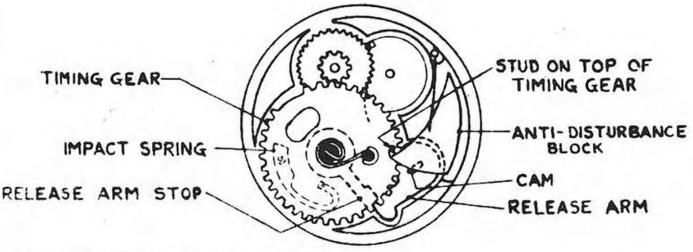


FIG. 16 ARMED POSITION

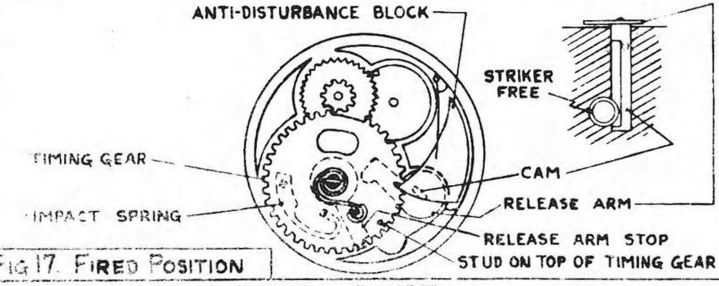


FIG. 17. FIRED POSITION

M-131 FUZE

spring, is sufficient to disengage the studs on the impact spring and the timing gear. The timing gear now continues its rotation for a period of approximately 5 seconds until the stud, sweated in place above the timing gear, engages a small projection on the end of the anti-disturbance block. Here the timing gear is once again brought to a halt with the fuze in a fully armed position as in Fig. 16. The fuze is now in an extremely sensitive condition since the anti-disturbance block is supported only by the delicate anti-disturbance block spring.

3. Should the fuze now be subjected to handling, shock or vibration, the projection on the anti-disturbance block and the stud above the timing gear would become disengaged. The timing gear can thus make its final run, this time until its blank segment permits it to slip by the small gear (with which it was previously engaged) with increased momentum. During this last swift movement, the stud under the timing gear strikes the release arm stop, moving it away from the release arm. Up until this instant the release arm and the cam, as seen in Figs. 15 and 16, were engaged in holding back the spring loaded striker. The release arm and cam now being free, (Fig. 17 insert) the striker forces the cam around in a clockwise direction, permitting the striker to slip by and fire the detonator cap. The resultant flash from the detonator passes through a vertical flash channel to initiate the booster. The firing position of the mechanism is seen in Fig. 17.

CLUSTER ADAPTERS (CONTAINERS)

There are two sizes of cluster adapters for the M83 bombs. When these cluster adapters are loaded they are known simply as "Clusters" and are assigned a different designation as indicated below.

WEIGHT	NO. OF BOMBS	CLUSTER ADAPTER	CLUSTER
100 lb.	24	M15 (T 10)	M28
500 lb.	90	M16 (T 11)	M29

The arrangement of the M83 bombs in the M28 cluster is shown in Fig. 18. This cluster is 43-1/2 inches in length (less fuze) and 8 inches in diameter. The suspension lugs are welded to one side of the interior casing and protrude diametrically through slots in the other half of the case. The cluster is fuzed with an AN-M111A2 aerial burst nose fuze. The tail is non-removable, being welded in place to the conical tail end of the case and the complete cluster is shipped one to a crate, less the

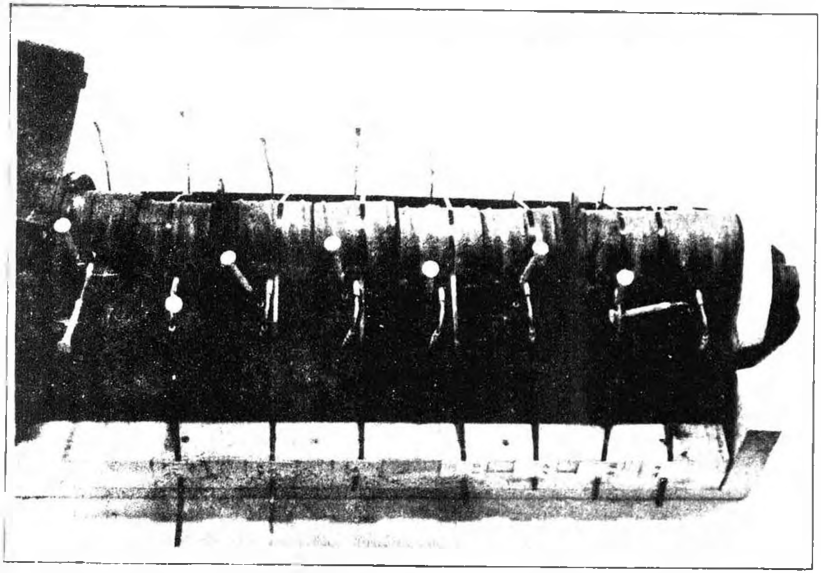


FIG.18 LOADING ARRANGEMENT OF M 83 FRAGMENTATION BOMBS IN M 28 CLUSTER

FIG 19 M15 100 LB

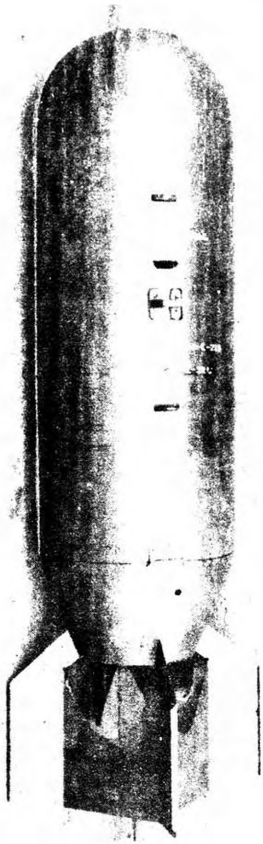


FIG.20 M16 500 LB.

ADAPTER CLUSTERS FOR M & S FRAGMENTATION BOMBS

AN-M111A2 fuze. Stenciling on the crate and the cluster will indicate the fuzing arrangement of the M83 bombs.

The M29 cluster holds 90 M83 bombs and is similar in construction to the M28. It too will be fuzed with an AN-M111A2 aerial burst nose fuze. This cluster has one additional carrying lug (Fig. 20) located centrally between the two standard lugs for use in connection with British aircraft. This adapter cluster is not sufficiently strong to permit shipment from the factory fully loaded. Therefore, the M83's and the adapter clusters M16 will be shipped separately and instructions for assembly will be enclosed with each shipment for service personnel. The M83's will be shipped in sticks of 10 for assemoly in the M16 adapter cluster.

GENERAL

TACTICAL USE

Clusters of M83's will serve their purpose best when dropped on enemy cities, airfields, troop movements, and any other area where fragmentation bombs are desirable. The outstanding feature of these bombs lies in their versatile fuzing arrangement.

ALTITUDE OF RELEASE

Tests have been conducted to determine proper altitude of release for the M83 clusters. The tests have shown that the clusters should be released from an altitude of 3000 to 5000 feet with the AN-M111A2 fuze set to function 5 to 8 seconds respectively after release. With such a setting the M83's will scatter to form a pattern approximately 200 x 300 feet.

AVAILABILITY

The M83 fragmentation bombs and their adapter clusters are now in production and are available for shipment to the field.

FUZES

M127 MECHANICAL TIME NOSE FUZE

The T39E1 nose fuze has been given the classifucation M127. This fuze is made by assembling the booster and detonator assembly from an AN-M110A1 fuze to a M111A2 fuze body (See page 137 "U.S. Bombs and Fuzes"). The result is a mechanical time fuze with a tetryl booster instead of a black powder booster.

The M127 is designed for use in aimable clusters of incendiary bombs. It may be set to function and open the cluster at any desired time from 5 to 92 seconds after release from the aircraft.

Experiments are still being conducted with the M127 in connection with the amount of tetryl required in the booster, the objective being to reduce to a minimum the amount of tetryl required to satisfactorily burst the cluster and render no damage to any of the incendiary bombs within the cluster.

PRECAUTION: - The M127 fuze, even though unarmed, may function due to crushing if accidentally dropped from a height of 2 feet when assembled to a 500 lb. cluster. The instruction tag on the fuze states that the fuze should never be assembled to a cluster until the cluster has been locked in place in the bomb rack.

In order to eliminate the sensitive and dangerous condition of the fuze, a modification of it is being developed with the detonator out of line but with the characteristics of the M127. This fuze is called the T55 and will eventually supersede the M127. The T55 is still undergoing changes but it is expected that it will be available for publication in the next issue of the Bulletin.

M135 MECHANICAL TIME NOSE FUZE

(U.S. Army, Chief of Ordnance Ltr. TB X-14)

GENERAL

This fuze, Fig. 21, is a combination of the M111A2 mechanical time fuze and the AN-M103 nose fuze in

which the former fuze has been assembled to a modified body and booster portion of the AN-M103 fuze. The time range of this fuze is 5 to 92 seconds and can be adjusted to the nearest 10th of a second. The fuze will fire accurately to within .4 second. (NOTE: Undergoing further tests is an adaptation of the M135, presently known as the T56E1 which is identical to the M135 except that it has a setting range of 5 to 30.6 seconds and will fire accurately to within .1 second.) The fuze will fit the bombs which the AN-M103 fuze will fit. Effective use of the fuze in G.P. bombs presupposes that a method can be devised for accurately measuring the altitude of release.

DESCRIPTION

The mechanical time portion of the fuze contains time graduations, the time set screw, the striker, safety block, vane and arming pin.

The time graduations range from 5 to 92 seconds, calibrated every 1/2 second and numbered every 3 seconds. A 10 division vernier scale (Fig. 22A) is located on the non-rotating part of the fuze so as to be used for setting the time graduations to the nearest 10th of a second.

The striker stop which is located between the striker and the safety block, prevents the safety block from falling out prematurely. The striker stop must not be removed from the fuze until the arming wire has been installed in the bomb rack.

The vane operates a gear mechanism which releases the safety block after approximately 750 feet of air travel.

The arming pin, which is held by a safety cotter pin during shipment and by the arming wire when installed in the bomb rack, starts the time mechanism at the moment that the bomb is released and the arming wire is withdrawn from the fuze.

The body and booster portion of the fuze are essentially a modified body of the AN-M103 fuze. The setting pin has been removed and a spring loaded lower arming pin is in its place. The lower arming pin, is held by a safety cotter pin during shipment and by the arming wire when its function is to hold down the modified arming stem of the AN-M103. Upon release of the lower arming pin, the detonator slider moves over lining up the firing train.

FUNCTIONING

Prior to loading the fuzed bomb into the plane, the time setting must be made on the fuze and the time

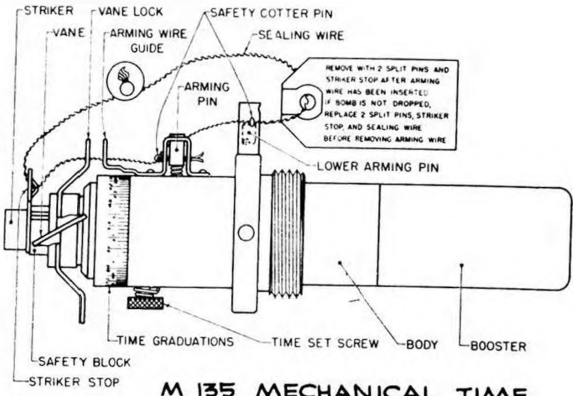


FIG. 21 M 135 MECHANICAL TIME NOSE FUZE

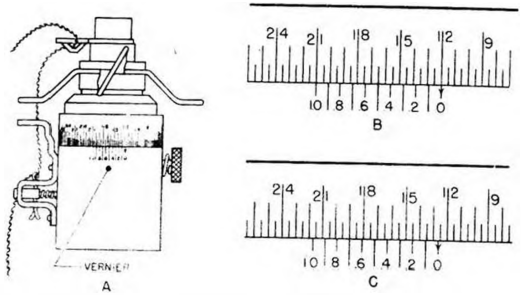


FIG. 22 M 135 TIME SETTINGS

set screw tightened. The arming wire is then threaded into the lower arming pin, through the arming pin, through the arming wire guide and the vane lock. The sealing wire, the striker stop and two safety cotter pins must then be removed.

The fuze operates as indicated below after the arming wire is withdrawn.

1. The vane lock is released and the vane starts to rotate.
2. The arming pin is ejected and the time mechanism starts to function.
3. The lower arming pin is ejected allowing the spring-loaded detonator slider to move over into the armed position.
4. After approximately 750 feet of air travel the safety block is released from the fuze. The time mechanism is then free to function according to the time set on the fuze. At the moment the time expires, the spring-loaded firing pin is forced rearward to strike the primer and detonate the bomb.

The bomb may detonate if it strikes a target prior to complete functioning of the time mechanism, provided the arming wire has been withdrawn. It can however be dropped "safe", in most cases, if the bomb has been released with the arming wire retained in the bomb.

INSTALLATION OF THE FUZE

Remove the nose closing plug from the bomb and inspect the fuze cavity to see that it is clean. Screw the fuze into the fuze cavity and tighten hand tight. Check to see that the arming pins line up with the suspension lugs. If they do not, loosen the fuze and insert paper shims between the flange of the fuze and the nose of the bomb so that when the fuze is hand tightened, the arming pins will line up with the suspension lugs.

SETTING THE FUZE

Loosen the time set screw. Turn the time graduation scale so that the full second mark to the right of the desired setting is opposite the 0 mark of the vernier scale. (EXAMPLE: If the time setting is to be 12.7 seconds, set 12 over the 0 mark as shown in Fig. 22B). Turn the time graduation scale so as to make the desired fractional part of a second, on the vernier scale, line up accurately with the closest full second graduation to its left on the time graduation scale. Disregard the half second graduation when making these settings. (In the above example, the .7 line on the vernier must then be made to coincide with the nearest full second graduation to its left, in this case 19 on the time graduation scale as shown in Fig. 22C.) This will now bring

the 0 mark on the vernier to its correct position for the desired setting.

Tighten the time set screw and check the reading. Full second or half-second settings may be made directly between the 0 mark and the time graduation scale.

When the greatest accuracy is desired, a correction in time setting must be made to allow for the brief interval that elapses between the time that the bomb is released and the time the bomb is free of its arming wire. Thus a delay of approximately 0.2 seconds is incurred. In order to correct for this 0.2 seconds, the time setting to be made on the fuze should be 0.2 seconds less than would be made if no correction were applied. Therefore, if it were desired to have the bomb detonate 12.7 seconds after release, the corrected setting would be 12.7 - 0.2 or 12.5 seconds. For best results, the setting should be made to get a burst some where between 0 and 100 feet.

INSTALLING ARMING WIRE

Use the arming wire packed with the fuzes. This wire is .034 inch in diameter. The .062 inch diameter wire normally used with large bombs must not be used with this fuze.

Thread the wire through the front suspension lug and the two holes in the lower arming pin tube. Extend the wire through the holes in the arming pin and through the arming wire guide and the vane lock. Pull the wire tight enough so there is no excess slack and cut off the free end to leave about 3 inches in front of the vane lock. Remove the sealing wire together with the striker stop and the two cotter pins attached to it.

REPLACING FUZE IN STORAGE

If the bomb is not dropped the following procedure must be followed:

1. Insert a safety cotter pin through the lower arming pin tube. The lower arming pin may have to be pushed in with a small screw driver in order to clear the cotter pin holes.
2. Insert a safety cotter pin through the arming pin and insert the striker stop between the striker and safety block.
3. Thread a sealing wire through the two cotter pins, the arming wire guide, the vane lock and the striker stop. Twist the free ends of the sealing wire together.
4. Remove the arming wire.

5. Remove the fuze from the bomb.
6. Replace the fuze in its original container. Reseal the container by wrapping the joint with adhesive tape.
7. Place a nose closing plug in the fuze cavity of the bomb.

PACKING AND DATA

Each fuze is packed in a sealed metal can. The cans must be opened with a can opener. Twenty cans, 24 arming wire assemblies and 2 can openers are packed in a wood box weighing approximately 100 lbs.

T54 NOSE FUZE

The T54 is a nose fuze which will not have a widespread distribution and therefore will not be extensively

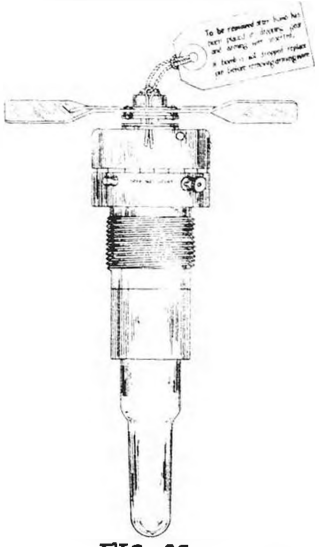


FIG. 23
T 54 NOSE FUZE

used but it is mentioned here for interest value and for those who may encounter it in the field.

In the Pacific theatre, a number of Japanese bombs have been recovered intact from captured bomb dumps. In order to utilize these bombs, the T54 fuze has been developed. It is an adaptation of the AN-M103 to which a gaine(booster) is screwed having the external appearance of the Japanese standard type gaine. The shape of the Japanese gaine had to be retained in order that it would fit into the gaine cavity in the nose of the bombs. The threads on the fuze body have been turned to fit all Japanese navy bombs.

Like the AN-M103 fuze, the T54 has two settings, - instantaneous and short delay.

MISCELLANEOUS

THE 4.5 BARRAGE ROCKET

INTRODUCTION

The 4.5 Barrage Rocket (BR) is a light demolition rocket with a point detonating fuze. It is intended for launching from landing boats, amphibious trucks, or other vehicles where the recoil of guns or mortars would be objectionable, and from portable launchers of one or more rails. The rocket is propelled by a motor from a guide rail which in standard models varies from 3-1/2 to 8 feet in length. The fragmentation of the rocket is comparable to that of a 105 mm. howitzer shell.

The 4.5 BR is limited, because of its inherent inaccuracy, to use in saturating a target area. The average deviation in deflection is in the order of 26 mils. The maximum range at 45° quadrant angle is between 1000 and 1100 yards. When a specific point target is to be hit with a minimum expenditure of ammunition, the BR should not be used. The rocket is especially valuable in amphibious landing operations to give the attacking forces fire power during the time between cessation of naval shelling and the time when small arms fire becomes effective (at about 600 yards).

The rocket, shown in Fig's 24 and 25 consists of three parts - motor, body, and fuze. The body and motor are coupled by means of a threaded adapter, and the fuze screws into the nose of the body. The assembled rocket is 30 inches long, has a maximum diameter of 4.5 and weighs 28.7 pounds.

BODY

The body is cylindrical, 4.5 in diameter, about 13.0 long and weighs 19.9 lbs. when filled with T.N.T. The forward end is hemispherical, and the rear end is reduced to screw onto the motor unit. It is hot-pressed from standard 4.0 pipe with 1/4 inch wall thickness. About 6.5 lbs. of high explosive can be loaded through a 2-3/4 inch hole in the rear which is later sealed with the motor adapter. The fuze liner, in the nose of the body, contains a booster charge of granular T.N.T. Although the usual filling is T.N.T., bodies filled with FS (Sulphur trioxide in chlorosulfonic acid) and WP (White Phosphorous) are in production.

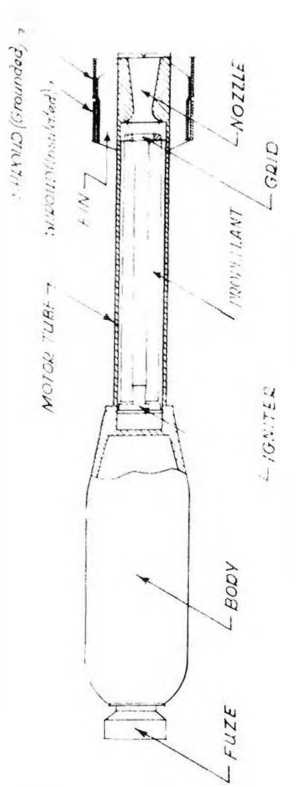


FIG. 24

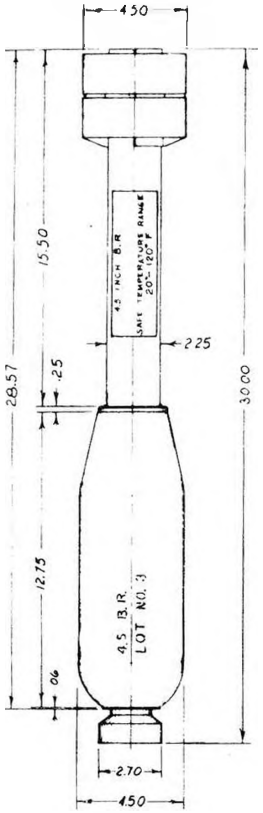


FIG. 25

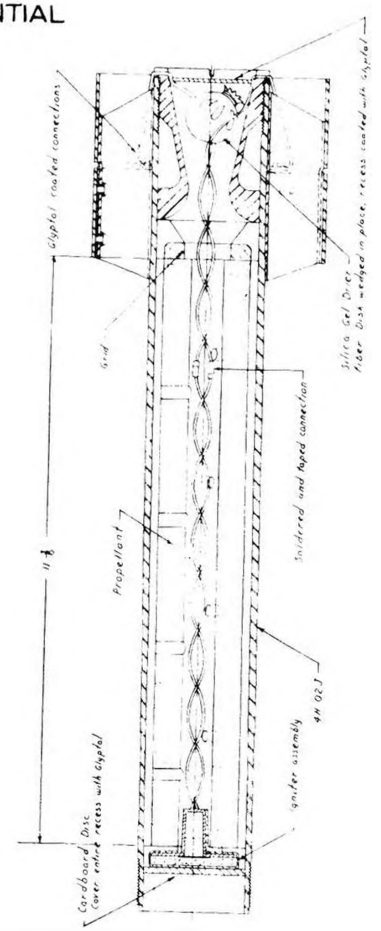


FIG. 26 MOTOR AND TAIL ASSEMBLY FOR 4.5 BARRAGE ROCKET

MOTOR

A typical propelling unit, Fig. 26, is the 2"25 rocket motor, consisting of a seamless steel tube 15"5 long, fitted with a nozzle at the aft end and sealed by the adapter to the body at the front. It contains a single cylindrical grain of solventless extruded ballistite (double-base smokeless powder) 11"0 long, with a 1"7 outside and a 0"6 inside diameter. When ignited, the powder grain burns uniformly on all surfaces at a constant rate. The gases evolved are forced out through the nozzle at a high velocity and, by their reaction on the motor, propel the unit forward. The propulsion does not depend on any interaction with the air or with the launcher, so there is no recoil. The burning continues for about 0.3 seconds, during which time the rocket travels about 60 feet. After this the projectile is in free flight. At the rear of the motor tube are two cylindrical shrouds of the same diameter as the head, which serve to align the round while on the launcher and to stabilize the flight.

The ballistite grain is ignited when current is passed through the electric squib in the black powder primer located in the forward end of the motor. Two wires brought out through the powder grain and the nozzle connect to the two shrouds which constitute the cylindrical tail. The forward shroud is insulated from the rest of the rocket to prevent a short circuit to the after (grounded) shroud. A removable shorting wire between the squib leads or a shorting clip is provided to prevent accidental premature ignition during shipment and stowage.

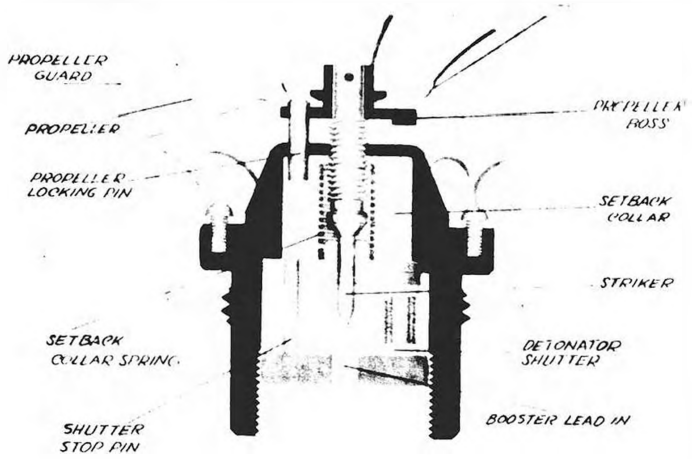
THE FUZE - MARK 137

The fuze used in the 4"5 RP is the Mark 137 shown in Fig. 27. This is an air arming, [illegible] firing rocket fuze.

Description:

The propeller is secured to the striker by means of a cotter pin. Protection is afforded the propeller with a propeller guard which is affixed to the top of the fuze body by four screws. The striker is screwed into the body and extends down alongside the detonator shutter. The detonator shutter is rotated by the shutter spring so that the detonator will be directly under the striker after it has risen out of the way during the arming of the fuze.

Fitted around the striker is a set-back collar and spring. A propeller locking pin extends from the set-back collar through the head of the fuze and into a ratchet hole in the propeller boss.



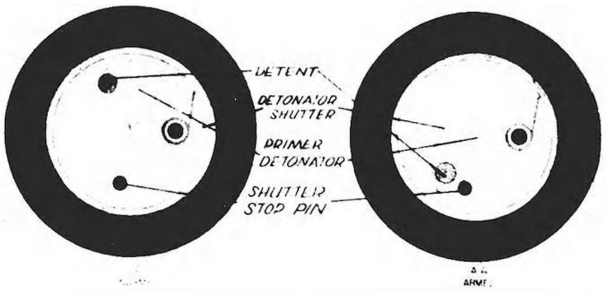


FIG. 27 MK. 137 A.I.R. FUZE

Operation:

When the fuze is inserted in the rocket, the safety wire is withdrawn and the rocket placed in the projector. At the instant the rocket is projected, set-back causes the set-back collar to move against its spring. This movement of the set-back collar withdraws the propeller locking pin from the propeller boss, freeing the propeller which immediately starts to rotate. The set-back collar spring will return the set-back collar to its original position at the end of acceleration but the striker will have unscrewed sufficiently to prevent re-engagement of the propeller locking pin with the propeller boss after 3 or 4 revolutions.

Rotation of the propeller will cause the striker to thread against the top of the fuze body. As the striker rises it withdraws itself from alongside the detonator shutter allowing it to pivot and align the detonator directly under the striker and over the booster lead-in. Approximately 8 to 10 rotations of the propeller are required to arm the fuze.

On impact with the beach or water, the striker shears the threads in the top of the fuze body, pierces the detonator, initiating the explosive train.

Field tests on the BR under actual operating conditions show the arming distance to be approximately 100 feet. Frequently, if a round has abnormally low velocity due to a motor failure and therefore falls short, it will not fire because the acceleration was insufficient to arm the fuze. The fuze will fire on ground or water impact provided the angle of impact is greater than about 30°. Under favorable circumstances, tree bursts may occur. Duds with fuzes properly assembled should not exceed 5 percent.

ASSEMBLY OF BR ROUND

1. Inspection of Fuze. A fuze should always be checked visually for damage. If the propeller guard is bent, it may prevent the fuze from arming. It should be verified that no portion of the propeller projects beyond the guard and that the propeller locking pin engages the propeller boss. While there should be a small amount of play in the unarmed position, the propeller should not be free to turn. However, if the propeller extends beyond the guard, handle with care as the fuze may be armed. Do not move or attempt to screw the propeller down because in so doing the striker may be screwed down onto the primer detonator causing the fuze to fire.

A thorough inspection of the propeller and set-back pin is important particularly if the fuze has been exposed to moisture.

2. Readying the Round. The motor is screwed onto the body preferably with a strap wrench. Remove the shipping plug. Inspect the threads in the fuze seat liner of the rocket body to make sure that they are free of burrs and dirt. See that one Mark 3 auxiliary booster is installed. Screw the fuze in and tighten with a wrench. Stow the round in ready box, fuze end down. Just prior to use the shorting wire or clip is removed. When the round is placed on the launcher, the fuze safety wire is removed. Fire only between 10° and 120° Farenheit.

3. Disassembling Unused Rounds. First, the fuze must be inspected to see that it is not armed. The safety wire is then replaced. Remember that doing this will not render an armed fuze safe; the wire only prevents accidental arming. When a fuze is armed, it should be carefully removed from a round without the wire being replaced and destroyed. Second, if the fuze is unarmed, it may be removed and returned to its box. The shipping plug is replaced in the fuze liner. Last, the motor and body are unscrewed and returned to their respective containers.

SHIPPING AND STOWAGE

For the present, the 4.5 BR ammunition will be shipped in wooden shipping boxes as follows:

QUANTITY	ITEM	BOX SIZE	WEIGHT
6	Mark 2 Bodies	19 X 17 X 12"*	150 Lbs.
4	Mark 3 Bodies	11.2 X 11.1 X 7.2"	95 Lbs.
6	Mark 8 Motors	18.5 X 13.5 X 9.5"	60 Lbs.
8	Mark 9 Motors	21 X17.4 X 10.2"	83 Lbs.
60	Mark 137 Fuzes	21 X 17 X 9"	60 Lbs.

*Can be used for Ready Box.

The fuzes, motors and bodies should be stowed in separate magazines in the boxes in which supplied. Unnecessary exposure to weather should be avoided, particularly in the case of the Mark 137 fuze.

In general, the BR should be handled in the conventional manner for high explosives. The motor charge will not detonate, but it should not be subjected to rough treatment.

For further precautions in stowage, refer to AF & EO Bulletin No. 2. The information given under "Shipping and Stowage" applies to the 4.5 BR as well as the forward firing aircraft rockets.

LAUNCHERS FOR THE 4.5 BR

There are numerous launchers which are designed for use with the 4.5 BR. A short description of some of the more prevalent types follows:

1. THE SINGLE RAIL LAUNCHER weighs about 30 Lbs. and is designed for use on land. A firing cable, 15 feet long (attached) and a hand operated generator are provided with each unit. Quadrant adjustment can easily be made. The Mark 3 is a BuOrd single rail, 6 feet in length; the Mark 3 Mod 1 is the wooden single rail, 5 feet long; the Mark 4 is a single rail with cleats to stabilize the assembly.

2. THE JEEP 10-RAIL is built of corrugated sheet steel for mounting on the 1/4 ton 4 X 4 scout car. In addition to the 10 rounds on the launcher, 10 more can be carried in the vehicle. The quadrant angle is adjustable between 5° and 45° and firing can be done from within the jeep even while in motion. The total weight of the launcher is about 225 Lbs. The Jeep launcher is designated by BuOrd as the Mark 5.

3. THE 3-RAIL WOODEN LAUNCHER is an expendable unit, light and easily portable. It is used with the hand operated generator and has an adjustable quadrant angle. Multiple firings of two to ten units set up to establish a line of fire of as much as 1000 feet in length can be accomplished. The BuOrd Mark 2 and Mark 2 Mod 1 are packing box models while the Mark 6 was the regular type. The packing box type contains 3 rounds of ammunition.

4. THE SUPPORT-BOAT 12-RAIL LAUNCHER consists of a "crate" of 12 rails supported by a trunnion frame which is welded to the deck of the boat adjacent to the cockpit armor. One LCSS carries 2 crates making possible a salvo of 24 rounds which can be loaded from the rear and can be elevated from 0° to 50° quadrant angle. The BuOrd designation is Mark 1.

5. THE DUKW 120-RAIL LAUNCHER is for the 2-1/2 ton amphibian truck. The rails, essentially tubes, are 5 feet long with a fixed elevation of 45°. With the equipment it is possible to launch 3000 pounds of rockets in about 30 seconds. The launcher can be removed and mounted on a 2-1/2 ton 6 X 6 truck.

6. THE MARK 7 AUTOMATIC is a single rail and includes an automatic feed magazine so that 12 rounds may be loaded. Firing of a complete salvo can be completed in less than 4 seconds. The launcher is 61 inches long, has an overall width of 12 inches, and weighs about 115 Lbs. It may be mounted on jeeps, trucks and many types of landing craft.

GENERAL INFORMATION

Ballistics

The pressure in the motor tube during burning of the propellant is almost constant. It varies, depending on initial powder temperature from about 900 p.s.i. at 10°F. to 2200 p.s.i. at 120°F. The motor tube is designed to withstand about 5000 p.s.i. which gives ample safety factor. The burning time varies between 0.6 and 0.? seconds at the above temperatures. The average final velocity is about 365 feet per second. Between 60°F and 120°F., the range is about constant but falls off slightly at lower temperatures. The range is also maximum when quadrant angle is set at 45°.

The inaccuracy of the rocket is due mainly to construction - the thrust given by the motor is "malaligned" with respect to the center of gravity of the round and causes the rocket to deviate off course during acceleration.

Reference: California Institute of Technology JEC 11.2

NEW LOCKING ARRANGEMENT FOR BOMB BASE PLUG AND ADAPTER BOOSTER

All long delay (time) tail fuzes have a ball locking device which causes the fuze to fire if an attempt is made to withdraw the fuze after it is installed. In the case of service bombs now in the field this locking device can be circumvented by unscrewing the adapter booster or by unscrewing the entire base plug. To prevent the enemy from nullifying the anti-withdrawal feature of these fuzes, the following modifications have been made.

An annular groove is milled in the internal threaded portion of the base plug (Fig. 2B). The purpose of the groove is to act as a keyway for the adapter booster lock pin. Each adapter booster has a hole drilled through from the outer threads to the inner mating fuze threads. The M115 adapter booster is drilled after the fuze adapter has been assembled to the adapter booster, in order to be sure that the holes will line up to take the lock pin. Adapter boosters so staked will be known as the M102A1 and M115A1 and will be assembled to the

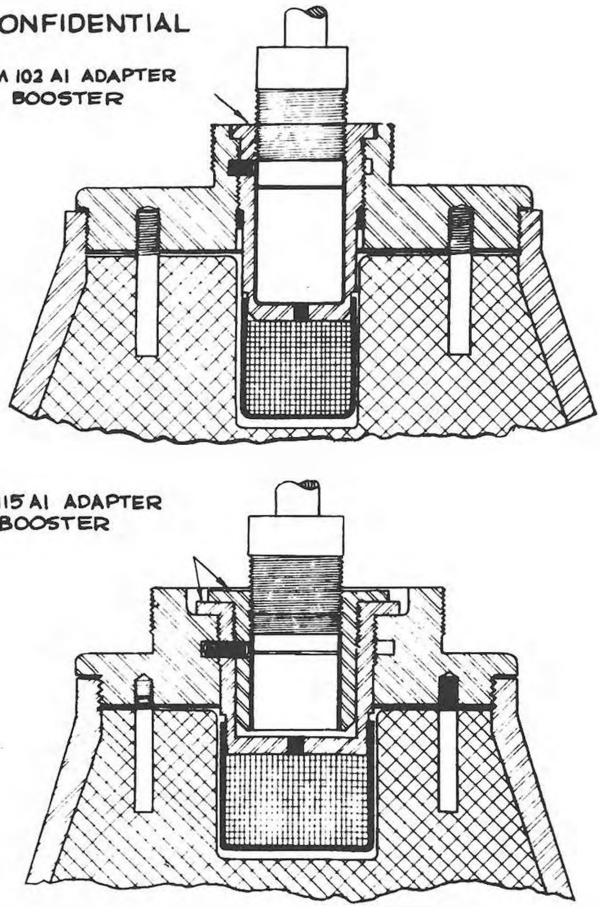


FIG.28 ARRANGEMENT OF BASE PLUGS AND ADAPTER BOOSTERS M 102 A1 AND M 115 A1

adapter booster, in order to be sure that the holes will line up to take the lock pin. Adapter boosters so staked will be known as the M102A1 and M115A1 and will be assembled to the bombs at the loading plants without inserting the lock pins. In this way service personnel may remove the fuze adapter of the M115 adapter booster for use of the AN-Mk 230 fuze. A lock pin will be provided with each M123, M124 and M125 long delay (time) tail fuze. When using these fuzes the lock pin is inserted into the hole provided in each adapter booster prior to assembling the fuze in the bomb. It is recommended that a heavy grease or other viscous substance be used to retain the pin in the hole prior to inserting the fuze. The fuze will then retain the pin in place.

Locking pins will be furnished with the M123 series fuzes with instruction tags as to their use fastened to them. Sufficient extra pins will be issued separately to take care of the fuzes already produced prior to the change. Two different size pins are required, but only one pin per bomb is necessary.

The base plug in the bomb has been fitted with two studs located on the inner surface of the plug and screwed in place. These studs will project into the T.N.T. explosive filler and will be locked in position when the T.N.T. hardens. This is accomplished by screwing in the base plug with the two studs installed before the last T.N.T. pour has been made. When the plug has been screwed in and tightened with a wrench, the last T.N.T. pour is made through the hole in the center of the base plug. Then the adapter booster is screwed in as outlined above. The adapter boosters and bombs will be marked as follows in order to distinguish them from bombs which are not staked:

BOMB SIZE	LDT FUZE	BOMB USING SHORT PIN WITH M102A1	BOMB USING LONG PIN WITH M115A1
100 lb.	M123	AN-M30A1	----
250 lb.	M123	AN-M57A1	----
500 lb.	M124	----	AN-M64A1
1000 lb.	M125	----	AN-M65A1
2000 lb.	M125	----	AN-M66A1

Aircraft loaded with these staked bombs and with fuzes with the anti-withdrawal device must jettison their bombs in deep water or enemy territory before landing. Staked bombs assembled with any type of fuze that has jammed and cannot be defuzed, must be lowered into deep water or otherwise disposed of.

It is of great importance to check the bomb racks and shackles on aircraft when carrying bombs with M123 series fuzes to insure their ability to jettison when necessary.

Ref: BuOrd Dr. No. 419255; U.S. Army B.D. Tech. Info. Bul. #22

AIRCRAFT RADAR/RADIO CIRCUIT DESTRUCTORS

INTRODUCTION

Destructors are devices for rendering radar and radio equipment aboard aircraft inoperative. Although it would be desireable to totally destroy such units, the amount of explosive necessary for complete destruction presents too great a hazard for safety. Hence, the destructors contain only sufficient explosive to destroy one specific electrical circuit within the receivers or transmitters. It is particularly important that the frequency control mechanism be destroyed so that the enemy cannot determine the frequency under which the aircraft has been operating. Sets such as the IFF (Identification, Friend or Foe equipment) are therefore fitted with receptacles to accomodate the destructors. There are two types in current use - the AN-M1 and the AN-M3, which will be dealt with separately.

AN-M1 DESTRUCTOR

The AN-M1 destructor, Fig. 29, is a relatively small unit, measuring 1"25 in length and 0"3 in diameter. The elements of the explosive train consist of a hot wire bridge, which acts as an igniter, the relay and detonator assemblies.

The ignition assembly is composed of a small phenolic resin tube which is filled with 13 mg. of guncotton through which runs the hot wire bridge. The ends of the small phenolic tube are closed with guilding metal caps which serve as contacts as well as to secure the hot wire bridge.

The relay assembly consists of a flanged relay cup which keeps the sleeve from shifting. The cup contains the relay charge consisting of 410 mg. of lead azide. The relay cup fits into the detonator cup which houses a charge of 1.3 gm. of lead azide.

The detonator holder and detonator cup are made of commercial brass. The large sleeve is phenolic tubing and acts as insulation between the detonator holder and detonator cup.

Operation:

The operation of the AN-M1 destructor is identical with that of an electric blasting cap. When the destructor is screwed into an IFF set, a clip fits over the

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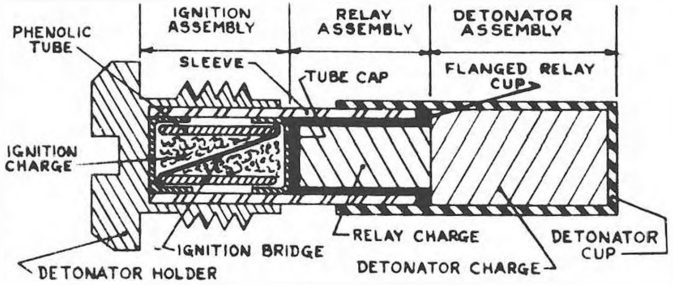


FIG. 29 AN-M1 DESTRUCTOR

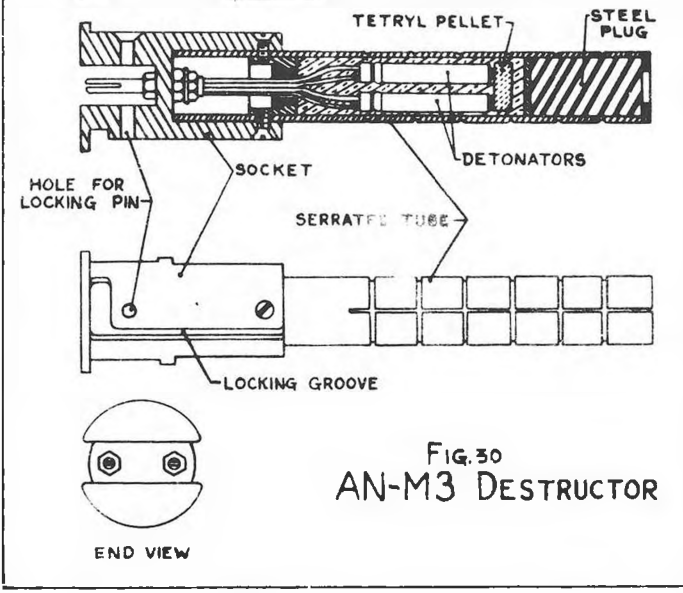


FIG. 30
AN-M3 DESTRUCTOR

end of the detonator cup. When the circuit is activated, the detonator holder and detonator cup form the two leads. The ignition bridge becomes white hot, ignites the gun cotton which in turn sets off the relay and detonator charges.

Installation:

Installation of the AN-M1 destructor is made by simply inserting the destructor in its receptacle and screwing in tightly. Since the AN-M1 is capable of very limited destruction, the radio/radar sets must use from 6 to 13 destructors for complete demolition of the vital electrical circuits, depending upon the set concerned.

AN-M3 DESTRUCTOR

Description: The AN-M3, Fig. 30, is larger than the AN-M1.

Length (w/o plug)	6 13/16
O.D. of Steel Tube	0 11/16
Diameter at Base of Flange	1 1/16

This destructor contains two electric detonators resembling ordinary electric blasting caps. These are connected to pins, forming a socket in the base of the destructor similar to that found on an electric iron. Just forward of the two blasting caps is a small pellet of tetryl which furnishes the main disruptive effect. The whole explosive assembly is encased within a serrated steel tube.

Operation:

When current is sent to the destructor from the aircraft's power supply, the blasting caps within are exploded. The explosion from these sets off the tetryl pellet and the serrated steel tube bursts violently, blowing fragments at a high velocity through the frequency control and surrounding parts on the transmitter chassis. Because of the more powerful nature of the AN-M3 destructor, only one of this type is required to wreck the circuits in ABK sets satisfactorily.

Installation:

To install, the destructor unit is slipped into a socket on the power chassis. This socket is nothing more than a guide tube which forms the principal support for one end of the destructor. The other end is supported by the flange of the destructor socket in which there are two bayonet pins that engage slots cut into the surface of the destructor case. At the base of the destructor, a two-terminal female jack connects and makes contact with the pins leading to the electric caps. By means of a plug, this jack connects to the aircraft's power supply.

CIRCUITS

The circuits required for the operation of both types of destructors are essentially the same and consist, basically, of a manually operated switch, an inertia switch, an indicator panel and the plug itself that provides current for the destructors. The manual switch is closed when it is desired to voluntarily destroy the equipment; the inertia switch provides for a positive destruction upon crashing of the plane in case there has not been time to close the manual switch. The indicator panel is simply a means whereby the operator can tell whether or not there is voltage in the control circuit.

PRECAUTIONS

These destructors are a potential source of accidents to both personnel and equipment and are subject to the same precautions as those for handling blasting caps and other detonators.

1. They should never be dropped or handled roughly, not only to avoid danger of explosion by impact, but also to avoid rupture of the electrical firing bridge wire.
2. They should be kept free from grease and moisture.
3. They will not be effected by any ordinary temperature changes to which they may be exposed.
4. Afloat, they will not be stored with any explosive except other detonators.
5. BuOrd recommends that the destructors be kept clear of power lines and other sources of electricity.
6. Do not take more destructors from the magazine than are needed for immediate use.

CORRECTION ON ORDNANCE HANDLING INSTRUCTION (OHI) ISSUED WITH LONG DELAY TAIL FUZES M123, M124 AND M125

At the present time shipments of the M123 series fuzes contain OHI AV24-43 tickets dated 22 September 1943. This instruction card states that the fuze requires only 80 to 100 feet of air travel to arm. A recent check-up has proven this relatively short arming distance to be incorrect. The Army has recently conducted further tests in this regard and the following arming and sealing distances are the results.

It is of utmost importance that the pilot be informed about the correction in the amount of air travel required to arm the M123 series fuze and if a supply of these fuzes is available, it is suggested that the OHI's be corrected accordingly.

ARMING DISTANCE IN FEET

FUZE	BOMB SIZE					
	100 lb.	250 lb.	500 lb.	1000 lb.	2000 lb.	
M123 M124 M125	500	540	610	520	740	Maximum Revolutions of vanes to arm - 190.
		SEALING DISTANCE IN FEET*				
M123 M124 M125	900	970	1100	930	1300	Maximum Revolutions of vanes to seal - 387

*Sealing Distance is interpreted as the flight of the bomb required to permit the arming spindle stop to screw down onto the rubber washer, thus effecting a sealed closure for the acetone.

REWORKING OF NOSE FUZES
MARK 131 AND MODS, AND MARK 136 AND MODS
(BuOrd Circular Letter A119-43)

Recent tests have shown that occasional failures to arm were experienced when firing Mark 131 Mod 1 and Mark 136 Mod 1 fuzes in projectors Mark 10, 11, 20 and 22. These failures have been caused by the broken ends of the vane shear wire striking each other after one or more revolutions of the arming vane. This interference prevented further revolution of the arming vane and resulted in the projector charge or rocket being a dud. Shear wire interference takes place after the projector charge or rocket has entered the water and would not be detected by the ship firing the charge.

All Mark 131 Mod 1 and Mark 136 Mod 1 fuzes including the Mark 131 Mod 1 and Mark 136 Mod 1 fuzes recently reworked for other defects, whereby the letters "R" and "S" were suffixed to the lot numbers, are to be withdrawn from ships and stations as unserviceable and are not to be reissued.

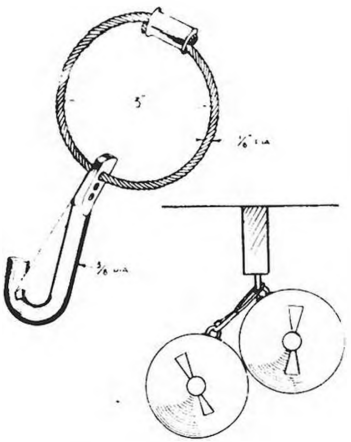
All ships issued the above nose fuzes are directed to exchange them at the first opportunity for fuzes

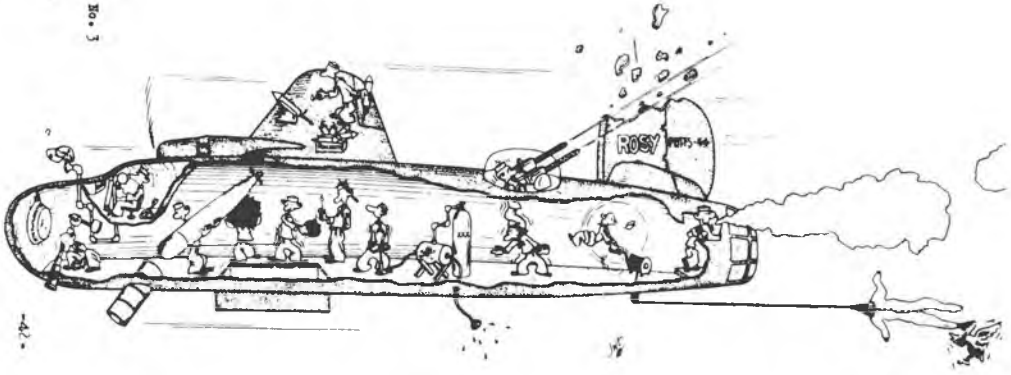
Mark 131 Mod 3 or 4 and Mark 136 Mods 3, 4, 5 or 6. The Mark 131 Mod 3 and Mark 136 Mod 3, 4 and 5 fuzes have the vane shear wire secured in place. Mark 131 Mod 4 and Mark 136 Mod 6 have a radial type vane shear wire. Failures of the type outlined in the first paragraph above will not occur with any of the later modifications.

The Mark 131 Mod 1 and Mark 136 Mod 1 fuzes exchanged by the fleet at ex-continental depots or advance bases are to be returned by these activities to continental ammunition depots for disposition.

M12 ADAPTER

The adapter, M12, (Fig. 31) is designed to suspend two 100 lb. bombs from a 100 lb. bomb station. After placing the circular cables over the suspension lugs, the first bomb is suspended in the usual manner. The second bomb is then attached to the clip hooks of the adapters. Fuzing and installation of the arming wires is standard. However, as both arming wires will have to use the same arming hook, it is suggested that arming wires with flat arming wire plates be used.





NAVAL AVIATION ORDNANCE - 1944

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