39017

ADVANCED FUZE & EXPLOSIVE ORDNANCE BULLETIN No. 7

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CONFIDENTIAL

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BOMBS

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

AIRCRAFT DEPTH BOMBS

INTRODUCTION:

The purpose of this article is to help clarify the present status of Navy depth bombs. There have been numerous reports sent to the Bureau of Ordnance involving accidents using depth bombs and it is hoped that the following information may lead toward a more complete understanding of depth bombs, their fuzes, current use, and safety precautions.

Depth bombs will be taken up first, followed by fuzes used in them and finally a resume of accidents involving their use. The depth bombs will be classified as either "ACCEPTABLE" or "PREFERRED" for usage.

Mark 17, 325 lb. (Acceptable)

The Mark 17, 325 lb. depth bomb has a TNT filler. There are very few of these left in the field since the bomb has not been manufactured for quite some time. The tail is of light spot welded construction and is easily susceptible to distortion on impact with water, the result being that the underwater travel may be irregular.

Mark 17 Mod 1, 325 lb. (Acceptable)

The Mark 17 Mod 1 is the same as the Mark 17 except that a sturdier tail assembly is used.

Mark 17 Mod 2, 325 lb. (Acceptable)

The Mark 17 Mod 2 is the same as the Mark 17 Mod 1 except that it has a larger filling hole to facilitate filling operations. The bomb has an overall length, including the AN-Mk 219 nose fuze, of 55"5 and a diameter of 15"2.

AN-Mark 17 Mod 2, 325 lb. (Acceptable)

This bomb is the same as the Mark 17 Mod 2 except for painting. While most of the Mark 17 depth bombs were painted grey overall, the AN-Mark 17 Mod 2 is painted an overall olive drab in accordance with the standard AN-M specifications, having a 1" yellow band at the nose and tail and a 1/4" broken band at the center of gravity. It is shipped to the field with the same accessories as the Mark 17 Mod 2 and has two shipping bands.

AN-Mark 44, 350 lb. (Acceptable)

The AN-Mark 44 is the same as the AN-Mark 17 Mod 2 except that it is Torpex loaded.

REMARKS:

All the Mark 17 and Mods are shipped to the field in individual crates except the last production of the Mark 17 Mod 2 which were equipped with two shipping bands. In each case an adapter ring for the AN-Mark 219, two Auxiliary Boosters, Mark 1, and shipping plug are installed in the nose fuze cavity.

These depth bombs can be fitted with a trunnion band (BuOrd Drawing #387706) for dive bombing. When using the trunnion band, however, a nose fuze only can be used since the band partially covers the transverse fuze cavity.

Some of the earlier depth bombs had a comparatively weak tail. This feature was not very desirable since the structural stength of the tail (together with a flat nose) is an important factor in eliminating erratic underwater trajectory and similar unfavorable performances of depth bombs. A ricochet will usually cause the bomb tail to strike the water so violently that the vanes and shrouds will be deformed unless the tail structure is adequate to resist such action. Upon re-entrance into the water, the rudder action of the deformed tail may be sufficient to cause an unpredictable underwater trajectory. Even when no ricochet occurs, a tail which can be deformed when the bomb enters the water may cause erratic underwater travel.

In view of the above circumstances, later mods of depth bombs were made with rugged tail construction.

FLAT NOSE ATTACHMENTS

All of the above depth bombs, (All Mark 17 and Mods, AN-Mark 17 Mod 2 and AN-Mark 44) have round noses to which flat nose attachments can be fitted. When the flat nose attachments were first available they were filled with either cement or plaster of paris and attached to available bombs at ammunition depots for shipment to the field. This procedure did not prove satisfactory, however, since there was a tendency to rust and pit underneath the filler which required removal of the flat nose for scraping, brushing and repainting. Therefore, this practice was abandoned and bombs and their flat nose attachments were shipped separately.

The main purpose of providing a flat nose shape for an aircraft depth bomb is to reduce the possibilities of ricochet when the bomb is dropped on water under conditions which result in low entrance angles (high speed and low altitude of release). In general, it may be stated that the flat nose shape will reduce the entrance angle at which a depth bomb is likely to ricochet to a value of approximately 13 degrees. The corresponding value for a round nose depth bomb is about 20 degrees. Flat nose depth bombs of the 325 - 350 pound class may generally not be expected to ricochet when dropped from altitudes greater than 80 feet and ground speeds less than 200 knots. The corresponding values for 650 - 700 lb. depth bombs are 80 feet and 210 knots.

The flat nose shape also contributes to a definite reduction of underwater dispersion. Tests have indicated that, in comparison to round nose shapes, flat nose depth bombs have approximately one-seventh as much lateral dispersion.

Cases have been known where a flat nose attachment was fitted to the bombs but it had not been filled with either plaster of paris or cement. This practice is highly undesirable and has a tendency to increase the possibility of tumbling of the bomb due to deformation of the flat nose upon striking the water, more so than if the flat nose had been eliminated altogether.

Flat nose attachments increase the total weight of 325 - 350 lb. depth bombs by approximately 44 pounds and the total weight of 650 lb. depth bombs by about 72 pounds.

AN-Mark 41, 325 lb. and AN-Mark 47, 350 lb. (Acceptable)

These bombs are identical except that the AN-Mark 41 is TNT filled while the AN-Mark 47 is Torpex filled. With these bombs the first attempt was made to have an integral flat nose. They are essentially an AN-Mark 17 Mod 2 with a "built-in" flat nose. Both have a rugged fin construction which in most cases will remain intact on water impact.

These bombs are shipped with one Auxiliary Booster, Mk 1. No adapter ring for the AN-Mark 219 nose fuze is shipped since the bombs were intended for use with the AN-M103 nose fuze which does not require an adapter as does the AN-Mark 219. Two shipping bands are fitted.

Trunnion band (BuOrd Drawing #387708) may be used for dive bombing. This band does not interfere with the athwartship's fuze pocket since the fuze pocket has been moved aft with respect to the AN-Mark 17 Mod 2. Hence, a dive bombing attack with either nose or hydrostatic transverse fuze may be made. For submerged targets the nose fuze must be dropped safe if it is desired to have the hydrostatic fuze cause detonation. This combination is not advisable unless selective arming is available. Minimum release altitudes, as prescribed by Cominch (See Page 16) must be followed when dropping depth bombs with either the hydrostatic or nose fuze controlling.

Mark 53, 325 lb. and Mark 54, 350 lb. (Preferred)

These are the newest of the depth bombs, the Mark 53 being TNT loaded while the Mark 54 is Torpex loaded. Otherwise, the bombs are identical.

The features of these newly designed bombs are:

1. Elimination of cross-tube for athwartships hydrostatic fuzes.

2. A redesign of the after-end of the bomb to provide for a hydrostatic tail fuze, AN-Mark 230, and to provide for four-point attachment of the tail.

   NOTE: The tail is much stronger in construction and is secured to the bomb by four bolts which must be tightened firmly and in rotation. Reports from tests indicate no "wiping-off" of the tails.

3. Elimination of all permanent external fittings and lugs, with provisions for the assembly of the fittings and lugs as required.

   NOTE: These fittings will be found in the tail crate wrapped in glass batting.

4. A reduction in diameter from 15?0 to 13?50 and no increase in length for this class of bombs.

5. It has an integral flat nose.

6. One Auxiliary Booster, Mark 1, is shipped in the nose fuze cavity of the Mark 54 for intended use with the AN-M103 nose fuze; however, pending the development of the "crash-proof" AN-M103, present design of the AN-M103 is not recommended. With an additional Auxiliary Booster, Mark 1 and an adapter ring, the AN-Mark 219 may be used.

The primary reason for the development of this bomb is to make available in this class of depth bombs, a hydrostatic fuze of the air-arming vane type with a safe air travel to arm. This added safety feature is important to all anti-submarine operations where landings and take-offs are on water, and to carrier-based aircraft where water crashes are possible.

The Bureau of Ordnance has recommended that present stocks of depth bombs aboard carriers be replaced by the Mark 53 and Mark 54 types as soon as practicable.

Mark 29, 650 lb. (Obsolete) and Mark 37, 650 lb. (Acceptable)

The Mark 29 is the only depth bomb which may be classified as obsolete. It is the round nose type, TNT filled. The out-

standing objection to this bomb was its long, weak tail. The Bureau of Ordnance ordered all of these tails scrapped because when using the Mark 229 hydrostatic tail fuze, the fuze could not arm due to eddy currents set up by the tail.

While the tail of the Mark 29 was objectionable, the body itself was satisfactory. By making a 6" shorter, stronger tail and fitting it to a Mark 29 body, the result was a Mark 37 650-lb. depth bomb. It is recommended that any present stocks of Mark 29 bodies be fitted with Mark 37 tails, and the bodies restenciled "MARK 37". (See Cir. Ltr. AV41-43).

Flat nose attachments for the Mark 37 are required for the same reasons that the Mark 17 depth bombs were fitted with flat noses, i.e., help prevent ricochets and erratic underwater travel. The first lots of both Mark 29 and Mark 37 were shipped with plaster filled flat noses attached but because of rust and pitting, this practice was abandoned and in subsequent lots the flat nose attachment was shipped separately for filling and assembly in the field.

Trunnion bands are not used. Instead a trunnion lug, which can be screwed into the bomb is supplied in the tail crate. These bombs are shipped with three Auxiliary Boosters,Mark 1 (two in the nose fuze cavity and one in the tail fuze cavity) and one adapter ring for the AN-Mark 219 nose fuze.

Mark 38, 650 lb. (Acceptable) and Mark 49, 700 lb. (Acceptable)

The Mark 38 is TNT loaded with an overall length (including the nose fuze and tail) of 61.1 and 17.7 in diameter. It has an integral type flat nose and an extra strong reinforced tail. The bomb is painted olive drab overall. The TNT filler weighs 424 lbs.

The Mark 49 is identical to the Mark 38 except that it is filled with 462 pounds of Torpex increasing the overall weight to approximately 700 lbs.

These bombs are shipped with two Auxiliary Boosters, Mark 1 (one each in the nose and tail fuze cavities). No fuze adapter ring is included.

FUZES FOR USE IN DEPTH BOMBS:

The following fuzes are available for depth bombs:

NOSE	ATHWARTSHIPS	TAIL
AN-M103	AN-Mark 224 & Mods	Mark 229 & Mods
AN-Mark 219 & Mods	AN-Mark 234 & Mods	AN-Mark 230 & Mods
Mark 221 & Mods		

AN-M103

The AN-M103 fuze will fit into the nose of all depth bombs. At present, however, its use from CV's is restricted by BuOrd because the fuze is not considered crash-proof. In one instance a TBF airplane carrying depth bombs took off from a carrier, pulled up in a steep climb, lost flying speed, rolled over, and plunged into the water in a near vertical attitude. Incident to this severe crash, one or more bombs exploded immediately after the plane hit the water. The bombs were fuzed with both the hydrostatic fuze AN-Mark 234 and nose fuze AN-M103. There was no opportunity for the hydrostatic fuzes to operate due to hydrostatic pressure and it is known that the nose fuze AN-M103 can be damaged by a side-swiping motion which shears off the arming vanes and cup and gear assembly, thereby releasing the safety discs and automatically arming the fuze. Any subsequent impact on the striker which is thus exposed will cause the fuze to function. The fuze AN-M103 is being modified by the Army to make it fully crash-proof. Nose fuzes should not be installed in depth bombs unless tactics planned require it, and meanwhile only the AN-Mark 219 Mod 3 and 4, which is crash-proof, should be used.

In using the AN-M103 fuze with flat nose depth bombs or those having the flat nose attachment, it must be remembered that the enlarged new type arming vane should be used to insure that the fuze will arm. This special vane is included in the tail assembly crate for all depth bombs now being issued.

AN-Mark 219 and Mods 2, 3 and 4

As indicated above, the AN-Mark 219, because it is crash-proof, should be used in the nose of depth bombs if tactical requirements demand it, to give instantaneous action. With this fuze two Auxiliary Boosters, Mark 1 and an adapter ring must be used.

Mark 221 and Mods 1, 3 and 4

This fuze in Mods 1, 3 and 4, except lots 21, 22 and 23 of Mark 221 Mod 1, are similar in design. The variation in mods indicates the different manufacturers with resulting differences in tolerances and methods of manufacture. (Lots 21, 22 and 23 of Mark 221 Mod 1 and all of Mark 221 Mod 2 are modified for anti-submarine use in G. P. bombs and are marked "A.S.") The Mark 221 is not recommended for use in depth bombs because it has a .01 second delay which is sufficiently long to permit the comparatively light case of a depth bomb to break up before detonation, particularly on land targets, and consequently a low order detonation may result.

AN-Mark 224 Hydrostatic Fuze

The AN-Mark 224 and Mods 1 and 2 will fit into all depth bombs except the Mark 53 and Mark 54 which make no provision for a transverse fuze. This fuze functions in response to hydrostatic pressure at predetermined depths of 25, 50, 75, 100 or 125 feet and no air travel is necessary for arming.

The Mark 224, Mark 224 Mod 1, Series A, B and C have been restricted for target and practice use primarily for reason of their age (See Circular Letter AV58-43). With these exceptions all other Mark 224's may still be used.

AN-Mark 234 Hydrostatic Fuze

This fuze operates on a similar principle to that of the AN-Mark 224, and will fit all depth bombs capable of accommodating the AN-Mark 224. The principle difference between the two fuzes is that the AN-Mark 234 may be adjusted for 25, 50, 100 and 125 foot settings externally while the AN-Mark 224 must be disassembled for the setting adjustment.

Certain lots of the AN-Mark 234 Mod 2 appeared with a plastic head and were not considered entirely satisfactory. All present available stocks of this plastic head model are being returned to ammunition depots for reworking.

AN-Mark 234 Mod 1 and certain lots of AN-Mark 234 Mod 2 with bronze heads are still serviceable.

SAFETY PRECAUTIONS FOR AN-MARK 224 and AN-Mark 234

1. Whenever possible, JETTISON BOMBS "SAFE" BEFORE MAKING A FORCED LANDING IN WATER.

2. The AN-Mark 224 requires two arming wires: One to the booster extender end and the other to the pistol end, and both wires have to be withdrawn in order for the fuze to function. With this type fuze it has been the practice to leave both arming wires attached to a common arming plate or swivel loop, which has the effect of forming a bridle across the top of the bomb. From evidence available, it appears that the most likely reason

for the high incidence of accidents of this nature involving TBF's is that even in relatively gentle water landings, the bomb shackles tend to separate or swing out from the rail structure, thereby releasing the bombs, and the bridle formed by the arming wires catches on some obstruction, or is retained in the shackle, withdrawing the wires from the fuze. The fuze is then armed and ready to function as soon as it sinks to the set depth.

To increase the safety of athwartship hydrostatic fuzes it is recommended that two complete and independent arming wires be used for each transverse fuze. Further it is recommended that, if available, several loop type arming wires be used with all bomb racks and shackles. For complete details on installation of arming wires on various types of bomb racks and shackles, attention is called to OTI V14-44 dated 20 June 1944.

3. When loading the bomb shackles Mark 3 and Mark 4 type, check by visual inspection that the shackles are properly latched. The shackles should then be locked and left in that condition during take-off and until just prior to release if practicable. (See OTI V8-44)

4. The wood shipping plug in the booster cone should always be removed before installing the fuze in the bomb, since it will prevent the primer detonator sliders from lining up when the bomb reaches the set depth. This shipping plug should not be confused with the booster spacer which must be used in the 650 pound and 700 pound depth bombs because they have a 2"5 greater diameter than the 325-350 pound sizes. The booster spacer will be found in the 650 pound depth bomb in the transverse tube.

5. In some cases failures of both the AN-Mark 224 and AN-Mark 234 have resulted from anodized detonator sliders. The detonator sliders undergo an anodizing process in manufacture which has a tendency to leave the surface of the sliders with minute eruptions. Since oiling is not recommended for reasons that it might penetrate to the explosive element and cause a failure, powdered graphite should be used on all surfaces. Where graphite is not available, a soft lead pencil will suffice. Sufficient graphite should be used to reduce the pressure necessary to move the sliders to about one pound. After application, wipe off the excess graphite.

Mark 229 and AN-Mark 230 Hydrostatic Tail Fuzes

For a discussion of the latest modifications in these fuzes see AFEO Bulletin No. 6, page 5.

Wherever possible it is recommended that preference be given to the Mark 229 Mod 3 over previous mods in operational missions because this fuze incorporates additional safety features.

GENERAL SAFETY PRECAUTIONS:

1. Properly install and check arming wires. Use a separate arming wire for each fuze (or each end of the athwartships fuzes).

2. Test to insure that the detonator sliders in athwartships fuzes are not jamming or sticking and that they slide freely.

3. Never install an impact nose fuze in depth bombs unless it is intended to use the bomb for instantaneous action and for this purpose only.

4. For low altitude drops use only flat nosed depth bombs or round nosed depth bombs with properly filled flat nose attachments installed. The flat nose is the best anti-ricochet shape so far discovered. After a flat nose attachment is secured to the bomb, the intervening space must be filled with a mixture of plaster or cement and allowed to dry. An empty flat nose attach-

ment is worse than none, since it will probably be unsymmetrically deformed and cause the bomb to broach or tumble.

5. Insure that bomb tails are undamaged and properly secured to the bomb body. Accurate and uniform underwater trajectories depend essentially on the condition of the tail.

6. Avoid extremely low altitude drops at high speeds. Generally, a flat nose depth bomb will not ricochet if the entrance angle is 13 degrees or greater. The corresponding angle for a round nose depth bomb is about 20 degrees.

MISCELLANEOUS ACCIDENTS:

Danger from "Dry Hits". Unfuzed 350 lb. depth bombs Mark 47 (Torpex) detonated when dropped on concrete from a plane in horizontal flight at 160 mph true air speed, altitude 2000 to 2500 feet. The striking velocities were between 350 and 425 ft/sec. Bombs which missed the concrete surface and hit on hard frozen ground did not detonate.

Although a concrete surface is not a very close representation of a surfaced submarine, it must be concluded that the possibility exists that a Torpex-loaded depth bomb may detonate without fuze action on making a dry hit. BuOrd knows of two instances in which loss of a plane may be attributed to detonation of a depth bomb hitting a surfaced submarine and even in these instances there is at least equal likelihood that the detonation may have been caused by AA fire of the enemy. Tests are in progress to desensitize Torpex-loaded depth bombs, thereby making them completely safe for "dry hits".

A number of cases have been reported where unarmed depth bombs detonated at great depth seven to ten minutes after entering the water. There was little or no surface indication of the explosion and no damage was done. These explosions are explained by the extreme pressures shearing the jump-out pins in the hydrostatic fuzes Mark 224 and AN-Mark 234. (In the case of the hydrostatic fuzes Mark 229 and Mark 230, the detents on the depth spring stem nut may fail under extreme pressures before the sylphon bellows fails. Active steps are being taken to correct this in both the Mark 229 and AN-Mark 230.)

A PBY Plane on anti-submarine patrol carried depth bombs fuzed with both instantaneous impact nose fuzes and hydrostatic fuzes. A submarine was sighted and attack made a short interval after the submarine submerged. A train of depth bombs was dropped with the arming controls set with the nose fuzes on "SAFE" and the hydrostatic fuzes on "ARMED". One of the bombs detonated on impact with the surface of the water. The plane was so heavily damaged that it had to land immediately and sank shortly after. It is not known whether the arming wire to the nose fuze of the bomb that detonated was retained or not, but this is considered the most probable cause of this casualty. The practice of using selective arming involving instantaneous or very short delay impact fuzes at low altitudes, requires more confidence in the reliability of the arming system than is justified by past experience. (See OCL AV16-44)

ATTENTION!

✓ At present the only depth bomb being manufactured and loaded is the Depth Bomb Mark 54, 350 lb. (Torpex) and has become available in production quantities to be issued to carriers as rapidly as possible. Experience indicates that carrier based planes usually have less opportunity to jettison bombs at times when forced landings most frequently occur. When available, the Depth Bombs Mark 54 fuzed with the hydrostatic tail fuze, AN-Mark 230 should be used, since this fuze is an air-arming type and requires approximately 300-400 feet of air travel to become armed.

✓ The Mark 53, same as the Mark 54, but TNT filled, is not yet being loaded. Hence, none of these are available as yet.

✓ Depth bombs authorized for training and practice drops:

1. Mark 17 - all mods
2. AN-Mark 44
3. Mark 37 (For use in high altitude or dive bombing only)

✓ Depth Bombs authorized for service use of land based planes:

1. AN-Mark 41
2. Mark 37
3. AN-Mark 47
4. Mark 38
5. Mark 54 (Priority of issue is for carrier based planes)

✓ Depth bombs authorized for training and service use of ship based planes:

1. Mark 54 - (CV use)
2. AN-Mark 41 - (CV use)
3. AN-Mark 47 - (CV use)
4. Mark 17 Mod 2 - (BB, CA and CL use)

✓ According to BuOrd Confidential Dispatch #231801 of 23 January 1944, 650 and 700 lb. depth bombs Mark 29, Mark 37 and Mark 38 are restricted to high level or dive bombing drops only. They should not be used in low level anti-sub attacks or low level training drops.

✓ Mark 49 (Torpex) completely restricted from use for anti-submarine warfare due to reported functioning of this bomb unfuzed.

✓ Pending availability of AN-M103A1 nose fuze (crash-proof) the AN-Mark 219 with additional auxiliary booster Mark 1 and adapter ring are recommended as nose fuze where instantaneous action is desired.

✓ AN-Mark 221 nose fuze is not recommended for use in depth bombs.

✓ AN-M103 nose fuze should not be used aboard CV's because it is not considered "crash-proof". However, is there is reasonable assurance that planes on mission will definitely unload depth bombs, AN-M103 may still be used at the discretion of the Commanding Officer.

✓ The AN-Mark 229 Mod 3 and the AN-Mark 230 Mod 4 are the latest developments in hydrostatic tail fuzes incorporating additional safety features. (See AFEO Bulletin No. 6).

✓ All transverse hydrostatic fuzes are serviceable except the following:

Mark 224) For target and
Mark 224 Mod 1 Series A B and C) practice only.
Mark 234 Mod 2 - those with plastic heads only.
Mark 234 Mod 3

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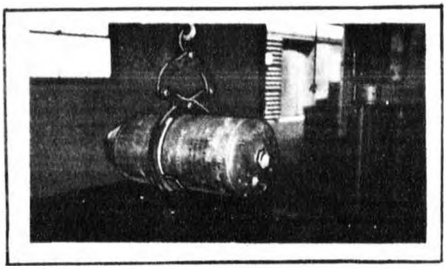


In view of the fact that the Mark 53 and Mark 54 Depth Bombs have no external fittings to facilitate handling, N.A.D. Hawthorne, Nevada, has devised a modified "Ice Tongs" for moving these depth bombs. Its operation is reported to be very satisfactory. Construction is spark proof.

REFERENCES:

1. O.P. 988
2. Cir. Ltr. AV16-44
3. Cir. Ltr. AV84-43
4. OTI V14-44
5. BuOrd Ltr (Mn2d) F41-6(1) dated 27 May 1944

RESTRICTED

BASE FUZE MARK 157

Description:

The Mark 157, Fig 1 , is a pressure arming impact firing rocket base fuze currently being manufactured and available for use in 5"0 forward firing aircraft rockets. The fuze is much the same as the Mark 146 base fuze with the following differences:

1. A .02 second delay detonator replaces the non-delay detonator of the Mark 146. The sensitivity of the Mark 157 base fuze is somewhat less than that of the Mark 146 fuze since the percussion type primer caps used in delay explosive trains are inherently less sensitive than the stab type primer caps in instantaneous detonators.

2. The firing pin and firing pin body are pinned together by a thin lock wire.

While the primary difference in the Mark 157 is the addition of the .02 delay element and an improved firing pin arrangement, both the Mark 146 and Mark 157 have undergone the following modifications (See Fig. 1).

1. The inlet shield has been modified. The two outside "legs" of the shield are slightly longer than the flat base of the shield so that the inlet screen will not be crushed when the inlet screw is tightened. This feature gives assurance that motor gases can penetrate the inlet screen and enter the channel below leading to the pressure chamber.

2. The ball retaining plug has replaced the screw plug. This plug is staked in place.

3. A safety pin has been fitted below the spacer sleeve. The addition of this pin is primarily the means for facilitating assembly operations by preventing the spacer sleeve enclosing the shutter assembly from slipping out of place as the booster magazine is screwed in.

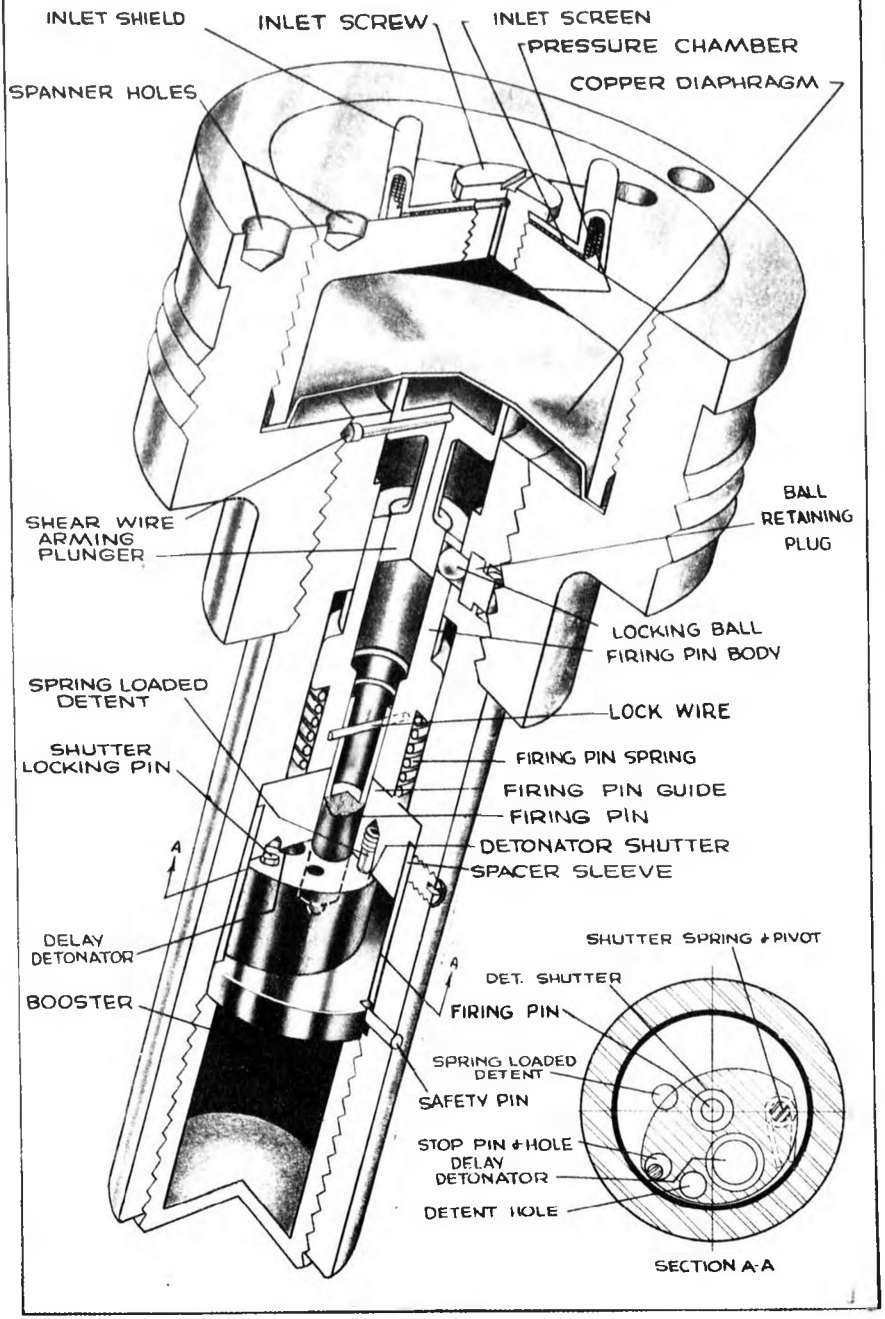
4. The detonator shutter has taken on an oval shape, eliminating the former squared corners.

NOTE: The latest lots of the Mark 146 have been further modified to use (1) a weaker creep spring, (2) a more sensitive primer, and (3) a more tapered firing point. These changes were made to increase the overall sensitivity of the fuze. At present the Mark 146 is no longer being manufactured, all production facilities being utilized to turn out Mark 157's).

Operation:

When the rocket is fired, gas under considerable pressure from the rocket motor passes through the inlet screen underneath the inlet screw and enters the pressure chamber. As the gas pressure

FIG. 1 MK. 157 — BASE FUZE



builds up, the diaphragm bears against the arming plunger breaking the shear wire and forcing the arming plunger down. The locking ball, which is preventing the upward movement of the firing pin body, moves over into the narrow portion of the arming plunger. Then the firing pin body moves up carrying the firing pin out of the shutter cavity. At this point the shutter would normally move over as it does in other fuzes employing a similar type shutter. However, at the moment the rocket is fired, the force of setback will thrust the shutter up (not down since this is a base fuze) and the shutter locking pin will mate with the hole in the bottom of the firing pin guide. This will mate with the hole in the bottom of the firing pin guide. This will prevent the shutter from moving over despite the fact that the firing pin will have moved up by that time. As long as the rocket is accelerating, (i.e. as long as the rocket motor is burning), setback will keep the shutter locked in this position. When the motor burns out, the shutter will be forced down again by its spring. This will disengage the shutter locking pin from the hole in the bottom of the firing pin guide and the shutter can then move over in the normal manner. The .02 second delay detonator is then in line with the firing pin where it is locked by the detent. On impact, the force of inertia drives the firing pin body and the firing pin down against the delay detonator, at the same time shearing the thin copper lock wire which holds the firing pin and the firing pin body together. The purpose of having this lock wire is to prevent crushing of the delay detonator if it were subjected to a blow by the combined weight of the firing pin and the firing pin body. After a delay of .02 of a second, the fuze fires.

Installation:

The Mark 157 comes already installed in the base of 5"0 rocket bodies.

Safety Precautions:

Since the Mark 157 operates on an entirely different principle than the conventional arming vane or propeller type fuzes, it becomes difficult to determine whether or not the fuze has armed. This fact cannot be recognized from external appearance.

While the fuze is designed to withstand accidental drops of 40 feet without becoming armed when installed in the 5"0 Mark 1 H. E. body using a steel nose plug, it is recommended that if the fuze has been subjected to any severe blow or drop the rocket body with the fuze be lowered base down into deep water.

General:

The Mark 157 fuze has been developed to afford greater penetration of the target than was possible with the non-delay detonator of the Mark 146.

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

IGNITION UNIT FOR AIRCRAFT JETTISONABLE GAS TANKS (EXPERIMENTAL)

Purpose:

These units are designed to cause ignition of the napalm thickened gasoline gel in jettisonable gas tanks upon impact with water or ground.

Description:

The unit, Fig.2 , consists of a modified tank cap carrying an M3 fuze (all-ways action - See page AFEO Bulletin No. 5) on the outside connected by an adapter through the center of the cap to a

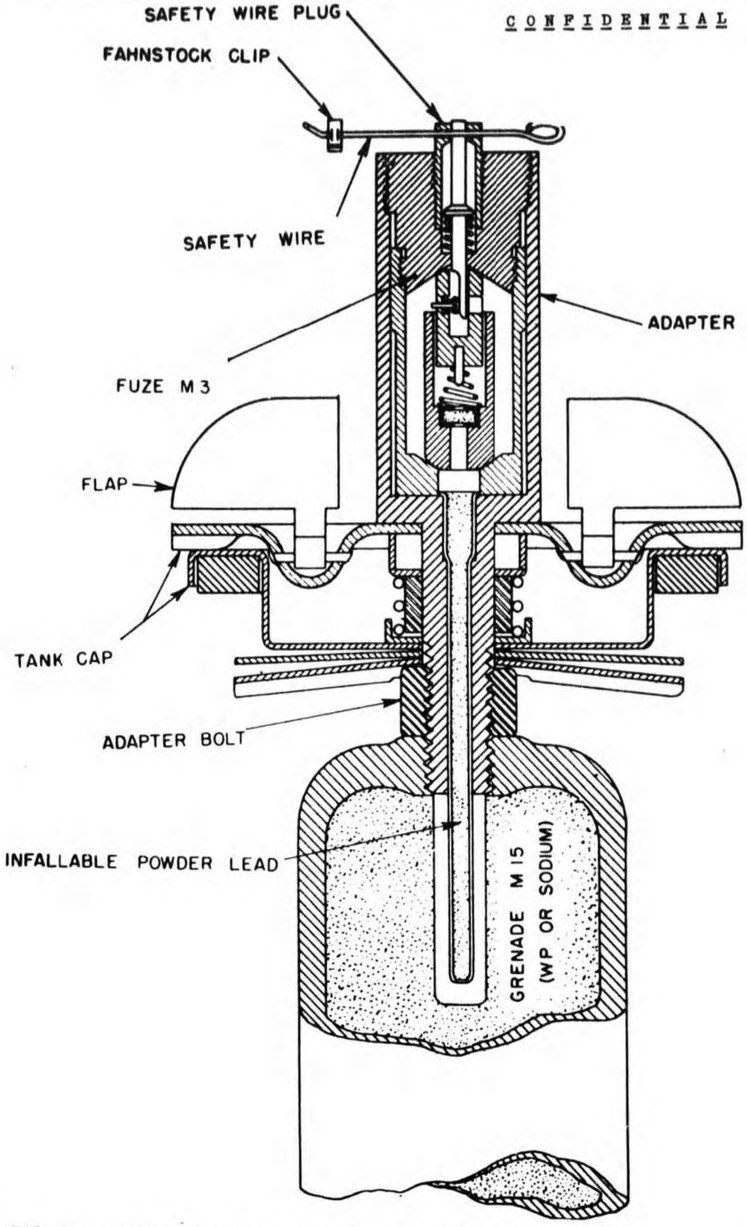

FIG. 2 IGNITION UNIT FOR AIRCRAFT JETTISONABLE GAS TANK (EXPERIMENTAL).

grenade M15 on the inside. The M3 fuze is retained in the safe (unarmed) position by an arming wire which is pulled when the tank is dropped, thus arming the fuze instantly. The adapter which carries the M3 fuze and the M15 grenade has a hollow central channel filled with Infallible Powder, a commercial mixture, which transmits the flash of the M3 fuze primer to the burster of the grenade. Two types of filler are used in the grenades, depending on the target. If the target is surrounded by water, a sodium filled grenade is used because sodium will float and burst into flame when it comes in contact with water thus igniting the surrounding scattered gasoline gel. Similarly, for land targets, white phosphorus (WP) filled grenades were found to be more efficient.

These ignition units will fit any Navy jettisonable gas tank. Upon receipt the units will be arranged as follows:

(a) The grenade will already have been screwed into position on the modified tank cap.

(b) The M3 fuze will be in the same package but separate from the tank cap.

Installation:

(a) Screw the M3 fuze firmly into the adapter of the modified tank cap.

(b) Substitute this entire assembly for the standard tank cap in the gasoline gel filled jettisonable tank.

(c) Rig an arming wire securely from the tank rack or other plane structure to the short safety wire already in the fuze. One Fahnestock clip should be secured to the free end of the safety wire. The M3 fuze should be screwed into the adapter, and the safety wire plug in the end of the fuze should be turned to such a position that the arming wire will pull out more or less parallel to the small hole in the end of the fuze. Otherwise the safety wire might break off and remain in the fuze when the tank is dropped preventing fuze action on impact.

Operation:

When the tank is dropped, the arming wire is automatically pulled, arming the fuze. Upon impact with ground or water the flimsy tank bursts, scattering the gasoline gel over a wide area. At the same time the M3 fuze acts to burst the grenade scattering white phosphorus or sodium around in the gel, resulting in ignition of the gel.

Maintenance:

None required.

Special Precautions:

1. Do not remove the safety wire from the M3 fuze at any time since this would result in automatic arming. If this should happen inadvertently, such an armed fuze should be disposed of in the most practical manner.

2. Do not assemble the M3 fuze into the tank cap until just before use.

3. Gas tanks carrying this igniter shall be jettisoned in the open sea or other safe area before returning to base or carrier. They should be dropped with the arming wire remaining in place if the plane is so equipped and it is not desired that the gel ignite. If the tactical situation is such that tanks which are not dropped on an enemy target must be jettisoned so that no conflagration results, then

the tank racks must be equipped beforehand with Bomb Arming Control AN-A2 (Fed. Stock No. 3-C-1806) or, if this is not available, the A1 type (Fed. Stock No. 3-C-1805) will be satisfactory.

Remarks:

These ignition units have been supplied under high priority but do not meet the safety requirements of the Bureau of Ordnance principally because the M3 fuze arms immediately upon pulling out the arming wire with no air travel. If they are used by carrier based aircraft, this hazard should be borne in mind. A simple air arming device is being developed at high priority for use in later units should they be required.

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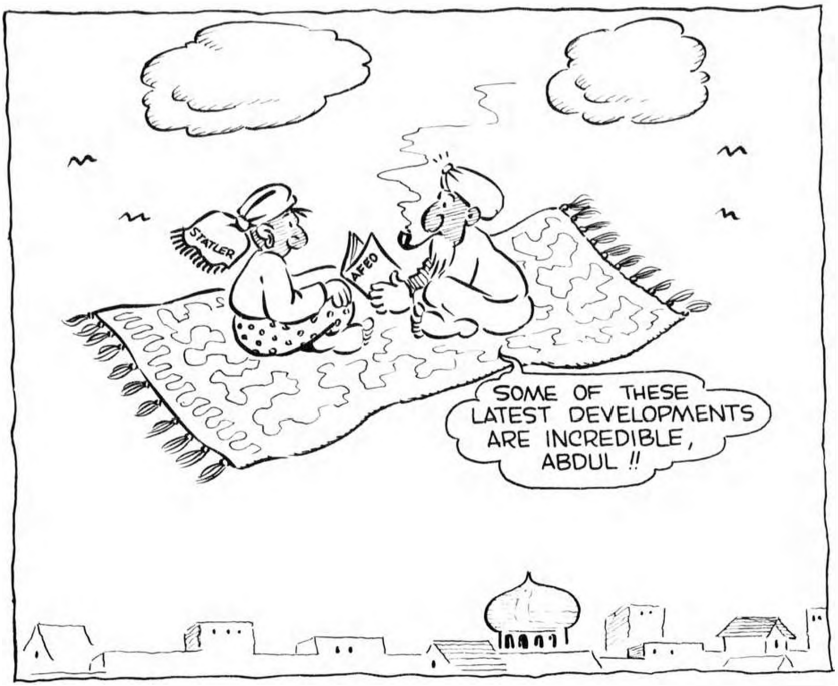

MISCELLANEOUS

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

MINIMUM ALTITUDE OF PLANES FOLLOWING
RELEASE OF LIVE BOMBS, INCLUDING DEPTH BOMBS

The following is a recent Cominch letter which is self-explanatory:

UNITED STATES FLEET
Headquarters of the Commander in Chief
NAVY DEPARTMENT
Washington 25, D. C.

FF1/A5-5/F41
Serial: 02392

14 July 1944

CONFIDENTIAL

From: Commander In Chief, United States Fleet.
To: Commander In Chief, U. S. Pacific Fleet.
Commander In Chief, U. S. Atlantic Fleet.

Subject: Minimum Altitude of Planes Following Release of Live Bombs, Including Depth Bombs.

Reference: (a) Cominch conf Serial 03063 dated 9 Dec 1942 and encl (A) thereto.

Enclosure: (A) Air Travel Table.

1. Reference (a) is hereby canceled. Effective upon receipt, the instructions in the following tables supersede all previous correspondence on the subject of minimum altitude of planes following release of live bombs, including depth bombs.

2. The altitudes quoted herein are considered to be the minimum at which an airplane should be restored to approximately level flight following the release of live bombs or depth bombs in order to assure reasonable safety to the bombing airplane. Responsible commanders are authorized to depart from these instructions when deemed necessary in order to assure effective action against the enemy.

3. Class I - Instantaneous or Short Delay (.1 second or less) Impact Fuze Controlling.

Bomb	Fuze	Minimum Altitude	See Notes a, b, c
100, 325, 350 lb.	Any impact fuze with delay of .1 second or less	500'	For impeller type fuzes provided enough altitude and speed is used to insure sufficient air travel to arm the fuze in accordance with information given under notes.
500 lb.		600'	
650,700,1000 & 1600 lb.		700'	
2000 lb.		900'	

Class II - Hydrostatic or Long Delay Impact (4 seconds or greater) Fuze Controlling.

Bomb	Minimum Altitude	See Notes a, b, c
Flat Nose Depth Bombs or Round Nose Depth Bombs with Flat Nose attachment. 100 and 500 lb.	80'	For impeller type fuzes provided enough altitude and speed is used to insure sufficient air travel to arm the fuze in accordance with information given under notes.
1000, 1600, & 2000 lb.	100'	

Class III - Clustered Fragmentation Bombs

The 23 lb. fragmentation bomb (parachute) AN-M40 is a low level fragmentation bomb. The minimum release altitude is 75 feet and the maximum release altitude is approximately 400 feet. This bomb with present fuzing is not safe for carrier use.

The 20 lb. fragmentation bomb AN-M41 is a high level fragmentation bomb and when assembled in clusters of six or more bombs, the minimum release altitude is 800 feet. This bomb is safe for carrier use.

Class IV - Clustered Incendiaries and Smoke Bombs

These clusters must be dropped from sufficient altitude to open adequately in order that the bombs attain the proper inclination on impact to function the fuze. 3500 feet is the minimum altitude of release required for clusters of incendiary bombs to penetrate the tile roof structure of the dwellings found in the major enemy cities.

Notes:

(a) The term minimum altitude is that altitude at which an airplane shall be brought to approximately level flight as soon as practicable, after release of bombs. Attention is called to the fact that, in dive or glide bombing, releases must be made at sufficiently greater altitude to permit safe pull-out in accordance with current instructions issued by the Bureau of Aeronautics.

(b) The minimum altitude specified is true altitude. All pilots before using these figures should carefully review Bureau of Aeronautics Note #20-37 which sets forth the altimeter errors to be expected in dive bombing.

(c) These altitudes are to minimize to a practical degree the danger of serious damage to own plane from blast and fragments of own bomb. They do not guarantee entire freedom from occasional damage.

(d) These altitudes are to minimize to a practical degree the danger of ricochet from water. 325-350 lb. flat nose depth bombs may generally not be expected to ricochet when dropped from altitudes greater than 80 feet and ground speeds less than 200 knots.

(e) On land targets and at minimum altitudes (Class II) 11 second delay fuzes should be used when available in preference to 4 second delay fuzes in order to decrease the danger to the bombing airplane from long ricochets.

The term "air travel" used in this letter means the distance along the trajectory and should not be confused with altitude. In horizontal bombing it can be approximated by

$$\text{Air travel in feet} = \sqrt{h^2 + \frac{h\,v^2}{5.6}}$$

where h = vertical fall of the bomb in feet
v = true air speed in knots

In steep dive bombing air travel approximately equals altitude. The air travel required for various fuzes is given in the table in enclosure (A).(ED. NOTE: SEE OPPOSITE PAGE)

R. S. EDWARDS,
Chief of Staff.

Copy to:
BuOrd
BuAer
DCNO(Air)(Complete)

HOWARD E. OREM,
Flag Secretary.

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AIR TRAVEL TABLE

CONFIDENTIAL

Fuzes	Tail or Nose	Maximum Air Arming Travel (Ft)	Vertical Fall in Feet When Released From Horizontal Flight at				Remarks
			100 Kts.	150 Kts.	200 Kts.	250 Kts.	
Mk 219 and AN-Mk 219	N	1100	520	300	165	105	2000-2500' Max. Air Travel to Arm in Flat Nose Depth Bomb
Mk 221	N	1100	520	300	165	105	400 ft/sec Striking velocity needed to function on water impact
Mk 223	T	1100	520	300	165	105	400 ft/sec striking velocity needed to function on water impact.
AN Mk 224 and Mk 224		None					Athwartship - Hydrostatic. Arms by Hydrostatic pressure
Mk 227	N	1500'-Near Sea Level 3000'-At 20,000' Altitude					Arms by Centrifugal Force Resulting From Spinning of Bomb in Flight.
Mk 228 and AN-Mk 228	T	1100	520	300	165	105	
Mk 229	T	500	130	60	35	20	
Mk 230 and AN-Mk 230	T	400	95	52	31	20	
Mk 234 and AN-Mk 234		None					Athwartship - Hydrostatic - Arms by Hydrostatic Pressure
Mk 243	N	500	130	60	35	20	
M-103	N	3000	2145	1600	1120	800	
AN-M103 (delay)	N	1080	580	335	200	135	2500' Max. Air travel to Arm in 325-350 lb. Flat Nose Depth Bomb, may not arm if used in 650-700 lb. flat nose depth bomb. If special depth bomb vane is used, 1500' max. air travel will arm fuze when installed in largest depth bomb.
AN-M103 (inst)	N	1820	1060	690	440	290	
AN-M100A2	T	485	145	65	40	25	
AN-M101A2	T	555	190	90	55	20	
AN-M102A2	T	665	265	130	80	45	
M-110 and AN-M110A1	N	725	260	125	75	40	465' Air Travel to Arm when installed in 1000 lb. GP
M112, M113, M114	T	100	8	4	6	2	4-5 and 8-15 second delay, not safe for carrier use
M115	T	485	145	65	40	25	M115, M116, M117. Fuzes have 4-5 and 8-15 second delay
M116	T	555	190	90	55	30	
M117	T	665	265	130	80	45	465' Air Travel to arm when installed 1000 lb.GP
M123	T	370	80	40	28	20	Long delay fuzes 1 to 144 hours, require an additional 500' to 1000' to seal fuze body to prevent leakage of fluid after fuze is armed.
M124	T	370	80	40	28	20	
M125	T	370	80	40	28	20	
AN-M126 & AN-M126A1	N	725	260	125	75	40	

NOTE:

The arming distances shown are the maximum arming distances for the fuzes when installed in the largest bombs in which they are normally used. The arming distances will be somewhat less when fuzes are installed in smaller bombs.

ENCLOSURE (A)

BOMB FUZES FAIL TO ARM BECAUSE OF LOW ALTITUDE OF RELEASE

"Pilots should be briefed on the minimum speed and altitude necessary to arm the bombs they carry on each mission." This is the conclusion of the bomb disposal unit which, after our occupation of Eniwetok, disposed of many fuzes in an unarmed condition due to lack of sufficient air travel to arm them.

Depth bombs found on the island were all of the flat nosed variety and varied only in the main filling used. Failure to detonate in practically all cases was caused by dropping from an altitude too low to permit the fuze to arm. Observers of the bombing stated that planes were dropping from as low as 500 feet which, at usual speeds, is insufficient height to permit arming either the AN-Mark 219 or the AN-M103 nose fuzes.

Six 325 pound depth bombs were found within an area 200 yards square. Four of them were definitely from the same stick as they were found in a straight line approximately the same distance apart. Not one was armed - presumably because the bombs were dropped from too low an altitude. Several depth bombs which had split open on hitting the ground did not explode.

Many 100 and 500 pound AN-M64 G P bombs were found. The AN-M100A1 was present in three 100 pound G P bombs and the AN-M100A2 in five others. None of the fuzes had armed. Several AN-M103 fuzes were found with the arming wires or safety wires still in place. In most cases, it is believed that low level or release caused the failure of the fuzes to arm where the arming wire had been pulled out.

One 100 pound bomb with armed fuzes had failed to detonate because of improper angle of impact. Evidence indicated that the bomb had skidded along the surface on its side before coming to rest, and the angle of impact was probably not great enough to actuate the fuzes. Releases from higher altitudes would result in a more nearly vertical angle of descent.

A 500 pound bomb was unearthed by a bull dozer operator when he caught it under the nose of his blade and set it up on its tail. The bomb had lain undetected beneath the surface until picked up by the blade. The bomb was fuzed with the Mark 221 nose fuze and the Mark 223 tail fuze; neither had armed completely. Once again, lack of sufficient air travel seemed the most logical explanation for the failure to arm.

Pilots must realize that while a low altitude of release promotes bombing accuracy, too low a release may prevent their bombs from arming.

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REFERENCE: Air Operations Memorandum No. 29

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CONFIDENTIAL

TACTICAL USE OF FORWARD FIRING AIRCRAFT ROCKETS

(It will be noted that this report differs in some recommendations from the report previously presented in AFEO Bulletin No. 5. The principal difference is the suggestion that both rockets and bombs may be employed on the same run. In actual battle and in training, other squadrons have recommended expending bombs on the first run and making a second run for use of the rockets. It is pointed out that the employment of rockets is still in the experimental stage and that the development of standard doctrine will have to await battle experience.)

First, consider the rocket as a primary weapon. There are two possible uses; as auxiliary artillery for support of landing operations, and as a heavy strafing weapon on landing barges, destroyers and against ground installations. In all cases of this use, it is recommended that a fairly steep glide from 4000 to 6000 feet and that a slant range of not more than 1,000 yards be used. Strafing with fixed guns also may be carried out during the dive, but aim must be maintained for accuracy in rocket fire rather than gun fire. Various rocket bodies are being developed for various objectives which should increase the effectiveness of this weapon against ground or small surface objectives.

In attacking a destroyer with rockets, it probably would be practical to make some type of split attack similar to a torpedo attack but at an angle that would provide better protection from anti-aircraft fire. From the accuracy displayed by several divisions with little practice, it is believed that four planes could badly damage an enemy destroyer in one pass with four rockets each or a total of 16 rockets.

The secondary use is as a strafing weapon while making an attack with a bomb load. Since the TBF can carry a variety of bomb bay loads, each one should be examined for possibilities.

For glide bombing with any combination of bombs, rockets could be used to advantage on the target while in the bombing run with very little or no shift of the point of aim necessary. Rockets could be used on retirement against vessels of the screen.

For minimum altitude bombing, the rocket should be effective against both the screen and the primary target. This would apply to some degree in night attacks also, but the use of the rocket would give away position during the run which would be a disadvantage. This type of run, however, made at night with rockets only might be practical if bomb loads are not practical at that particular time.

If it would be practical to carry rockets and a torpedo and if the squadron torpedo attack doctrine covers a high altitude-high speed approach, the rockets could be used to great advantage to discourage the anti-aircraft gunners of the screen on both the approach and retirement. It might not be unusual, even, to destroy part of the screen while making a torpedo run on the primary target. The position of the planes would, of course, be revealed.

Under any load conditions, it may be practical to load one-half or one-third of the attack group with rockets as auxiliary strafers. In this case, standard strafing tactics employed by fightrons could be used.

Employment and Tactics Against Land Targets

A large field for rockets is against land targets. The TBF can carry a combination of bomb load and rockets that makes it an ideal support aircraft - the load of eight rockets to be used as auxiliary artillery.

If an airdrome is the objective, the rockets with delayed action fuzes might be effective in putting runways out of commission. Or, if a bomb load is carried for the runways themselves, the rockets would be effective against hangars or fuel storage tanks. To some degree, rockets, used as a strafing weapon, would be effective against riveted aircraft. Since the rockets could be fired with great accuracy, almost any target against which a 5" H.E. shell would be effective, could be destroyed.

Operating against ground installations, one loading combination which could be used to advantage would be rockets with incendiary clusters in the bomb bay. The clusters have proved satisfactory against store dumps, ammunition dumps and fuel storage. With the additional "scatter" effect of H.E. shells, a great deal of additional damage could be done by scattering fires started by the incendiaries.

The major problem involved tactically is the break-away after firing. With the present rocket and rocket motor, a range of 1,000 yards is a practical maximum. In a high-speed attack, 1,000 yards is about the minimum range as well, in order to enable the aircraft to clear the blast or the explosion from the target if hit squarely. Torpedo-Eight feels that the positive slant range is 1,000 yards. If a salvo of rockets is to be fired, the interval between pairs at 250 knots and using a Mark 2 Mod 4 distributor in "automatic" would be approximately 425 yards. Using the "single" fire, the interval still would be approximately three seconds. Even a two second interval would result in about a 275 yard interval. With the range almost set at 1,000 yards, it would be extremely difficult to fire more than two pairs during one run.

The only type of run in which this range of 1,000 yards is not necessary is a very high angle dive where the trail is fairly small. The mil correction in this type of run would be small and rockets could be fired from 2,500 yards down to 1,500 yards and a pullout effected. This, however, probably would build up speeds and positive accelerations in excess of the TBF limits. In any case, longer range can be obtained by increasing the angle of the glide or dive.

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REFERENCE: Air Operations Memorandum No. 26

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R E S T R I C T E D

3"5 and 5"0 FORWARD FIRING AIRCRAFT ROCKETS

In OHI V6-44, the Bureau of Ordnance has issued official instructions for assembly and loading of 3"5 and 5"0 rocket ammunition. For drawings of the various component parts AFEO Bulletin No. 2 or "U. S. Bombs and Fuzes" may be consulted. OHI V6-44 is quoted as follows:

Assembly and Loading:

The 3"5 and 5"0 rocket ammunition is shipped in three parts, each in a separate container as follows:

(a) 3"25 Rocket Motor Mark 7

(b) 3"5 Rocket Body or 5"0 Rocket Boby

(c) Point Detonating Fuze Mark 148 or Mark 149

To Assemble the Rocket, proceed as follows:

A. Remove the rear shipping cap from the after end of the rocket motor by unscrewing the tail ring which holds this cap in place.

B. Feed the electrical connector cable (pigtail) through the cylindrical portion of the fin assembly.

C. Push the fin assembly onto the motor, taking care that the rear lug band suspension loop, or button, is midway between two of the fins.

D. When the fin assembly rests securely against the rear lug band, screw the tail ring up against the fin assembly and tighten into place with the wrench provided in the shipping box.

NOTE: CARE MUST BE TAKEN WHEN PLACING THE FINS ON THE MOTOR THAT THE FINS ARE NOT BENT OR DAMAGED; OR THAT THE ELECTRICAL CONNECTOR CABLE IS NOT DAMAGED, BENT OR

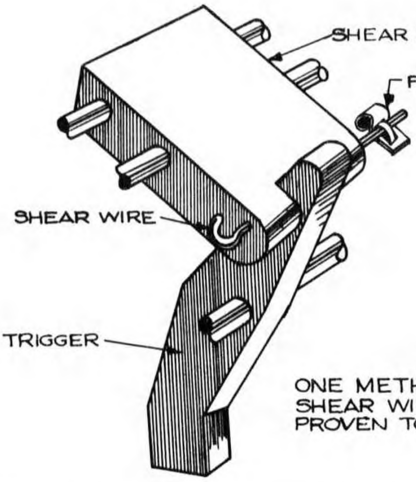

FIG. 3
ONE METHOD OF SECURING SHEAR WIRE WHICH HAS PROVEN TO BE SATISFACTORY.

DAMAGED FINS WILL PROBABLY RESULT IN ERRATIC FLIGHT; AND A DAMAGED ELECTRICAL CONNECTOR CABLE MAY RESULT IN FAILURE OF THE ROCKET TO FIRE. DO NOT STAND THE MOTOR ON THE NOZZLE END, AS THE ELECTRICAL CONNECTOR CABLE MAY THEREBY BE DAMAGED.

If the motor is not to be used immediately, replace the rear shipping cap to prevent damage to the electrical connector cable.

E. Check that the rear lug band on the rocket is the one that will fit the launcher being used. The two launchers used for aircraft rockets require different rear lug bands on the motors. The Launcher Mark 4 (AFEO Bulletin No. 2, page 8) requires a rear lug band with a suspension button, while the Launcher Mark 5 Mod 1 (AFEO Bulletin No. 5, page 38) requires a band with a loop (marked "For Use with Zero Length Launcher Only"). Both types of rear lug bands are shipped in the box with the motors, one on the motor and one as a spare.

F. Remove the front shipping cap from the motor and screw the motor tightly into the body. Strap wrenches may be used if available; but it is imperative that body and motor be threaded together to the full extent of the threads. Do not remove the cardboard washer and spacer from the forward end of the motor as they are required to hold the propellant assembly firmly in position.

G. The Base Fuze Mark 146 or Mark 157 (See page 10) comes installed in the base of the 5"0 body and no attempt is to be made to remove the installed fuze.

H. To install the Nose Fuze Mark 148 or Mark 149, remove the conical nose plug and screw the fuze into its place. The Fuze Mark 148 requires an extra adapter which is shipped with the rocket body. Care must be taken in installing either nose fuze not to allow the fuze auxiliary booster to fall out of the fuze seat liner. The fuze may be installed either before or after the round is loaded on the launcher, according to the circumstances. When loading a plane with folded wings, it is necessary to install the fuzes before placing the round in the launcher in order to avoid having the auxiliary booster fall out.

To load the rocket on the launcher, proceed as follows:

A. AFTER THE SAFETY PLUG HAS BEEN REMOVED FROM THE FIRING CIRCUIT, load the launcher from the rear by sliding the lugs into the "T" slot of the Launcher Mark 4 or into the catches on the Launcher Mark 5 Mod 1.

B. Insert the shear wire through the trigger arm at the rear of the launcher and secure the shear wire in place. The shear wire is shipped in the motor box. (See Fig. 3)

C. A new shear wire must be used after each arrested landing. If the shear wires are lost or additional wires are needed, either hard-drawn 12-gauge copper wire or bomb-arming wire of .064 diameter may be used.

D. Install the fuze arming wire and hold it in place by attaching Fahnestock clips ahead of the fuze; two clips are required for the Fuze Mark 148 and one for the Fuze Mark 149. About three inches of wire should protrude in front of the Fahnestock clip. For the Fuze Mark 148, an arming wire sleeve is required. This sleeve leads the arming wire through the vanes of the propeller and thereby prevents fouling of the arming vane. The arming wire, arming wire sleeves and the Fahnestock clips are shipped in the box with the bodies. No sleeve is required for the Fuze Mark 149.

E. Just before the pilots man their planes, remove the shorting clips from the electrical connector plugs and plug in the cables. The ordnancemen, one to each wing, doing the plugging in must stand to one side of the round being plugged in.

Use and Care in Handling:

A. Rocket motors should be stowed in a cool dry place. Generally, stowage conditions should be the same as those for smokeless powder.

B. Rocket motors should be kept away from sources of electricity and from strong radio transmitters. The rocket motor is non-propulsive until a body is screwed on; but, if ignited, it constitutes a dangerous fire hazard.

C. When the rocket is loaded, the area directly behind the rocket should be free of personnel and equipment because of the blast from the nozzle if the round were accidentally ignited.

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

MARINE BREADBASKET - A LA MOLOTOV

Something new in bombs startled some Solomons Japanese recently. Manufactured by the Marines, the infernal machine contained 400 rounds of .45 caliber ammunition, 50 rounds of .30 caliber, 40 pounds of TNT, six to eight signal flares of various colors, smoke bombs and possibly sundry other items of assorted ordnance. Peering through the pouring rain, the pilot who dropped the missile observed with considerable satisfaction a brilliant flash, flares shooting in all directions, and a billowing cloud of smoke. Although no doubt materiel damage was slight, the spiritual effect was considered worth the effort.

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REFERENCE: Air Operations Memorandum No. 31

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R E S T R I C T E D

WING NUT FOR M135 AND M136 MECHANICAL TIME NOSE FUZES

Both the M135 and M136 (See page 18, Bulletin No. 3, and page 14 Bulletin No. 6 respectively) have been shipped to the field with a round knurled type setting or locking screw. According to Army sources there have been cases where ordnance personnel working with these fuzes did not tighten the locking screw sufficiently, the supposition being that they could not get a good grip on this type of nut when making the desired time setting adjustment. Hence, there was a possibility that the setting might slip, and cause either premature or late functioning.

In order to improve this situation, the Army is using a wing nut in current fuze production to replace the round knurled type. Use of this wing nut will permit ordnance personnel to get a firm grip on the nut and produce a more secure time setting. For fuzes already in the field, the Army plans to ship out replacement wing nuts. Upon receipt of these wing nuts in the field, personnel are cautioned not to open the sealed fuze containers to fit the wing nuts until the fuze is actually ready for use in operational work.

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IMPROPERLY ASSEMBLED AFEO BULLETIN NO. 6

Shortly after AFEO Bulletin No. 6 was mailed out, it was discovered that a few were improperly assembled in that pages 9 to 16 inclusive were inadvertently omitted, while other pages were duplicated.

Since it cannot be determined which addressee received an improperly assembled Bulletin, all addressees are requested to check their copy. Upon writing to the Officer-in-Charge, U. S. N. Bomb Disposal School, a complete Bulletin will be forwarded. It is regretted that this inconvenience should have occurred.

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SUGGESTED READING

(Restricted)

1. BuOrd Circular Letter AV14-44, "100 lb. Cluster M28 and 500 lb. Cluster M29 of 4 lb. Fragmentation Bombs M83 - Tactical Use and Flight Preparation of."

   This circular letter has official BuOrd information on the U. S. adaptation of the Butterfly bomb.

(Restricted)

2. Ordnance Pamphlet 747 (First Revision), "Depth Charges Mark 6, Mk 6 Mod 1, Mark 7 and Mk 7 Mod 1 - Operating and Maintenance Instructions."

   This O.P. includes excellent pictures, drawings, and well written material on subject depth charges. For personnel responsible for handling depth charges it is indispensible.

(Restricted)

3. Ordnance Pamphlet 1176, "Range Table for 3"5 and 5"0 Aircraft Rockets (3"26 Motors) Used with Mark 4 and Mk 5 Launchers"

   This data contained in this publication are primarily for use in determining the sight settings for firing rockets under various sorts of conditions.

(Restricted)

4. Ordnance Pamphlet 1003 (First Revision), "4"5 Rocket Launchers Mark 1 and Mark 8".

   This O.P. contains a description of the 4"5 (B.R.) Rocket Launchers Mk 1, Mk 1 Mod 1 and Mk 8 together with instructions for using these launchers. It will prove highly beneficial to personnel doing rocket or directly related work.

(Restricted)

5. Ordnance Pamphlet 1019, "Armor-Piercing Bombs - Description and Instructions for Use", dated 3 January 1944.

   This O.P. contains a complete description and detailed instructions for the use of the following A. P. bombs:

AN-Mk 33	1000 lb.
Mk 1	1600 lb.
AN-Mk 1	1600 lb.
AN-M59 (S.A.P.)	1000 lb.

(Restricted)

6. NAVORD OTI M5-44, "Cable and Chain Cutter Mark 1".

   The cable and chain cutter Mark 1 is a container for explosive designed to cut, by explosive means, chain and cable of diameters up to two inches. The explosive used to fill the cutter is U. S. Army Composition C-2, a plastic, putty-like substance. Approximately 1-1/2 pounds are

required to fill the container. Two U. S. Army Engineer Corps special detonators, hooked up in parallel, are used for detonation. This device operates either in air or in water. For complete details refer to subject OTI (Ordnance Technical Instructions).

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