

# Intelligence

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U. S. NAVY BOMB DISPOSAL

JULY 1945, VOL. 2, No



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JAP

# OrocketORDNANCE

U.S. NAVY BOMB DISPOSAL

## Intelligence

BULLETIN•JUNE 1945•°1. 2, No. 2

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Japanese rocket ordnance can be best organized by grouping the various pieces according to intended use as follows:

1. Propulsion units.
  - A. Take off assist for aircraft (documentary).
  - B. Baka bomb (Models 10 and 20) Motors.
2. Bomb conversion for land bombardment.
  - A. Pusher Type separate from bomb (60 kg.).
  - B. Integral, with motor bolted minimum bomb (250 kg.).
3. Airborne series, Bomb and It (rocket)
  - A. Mk 4 (Type 3 No. 25, Mk .1 11, milp, Documentary).
  - B. Mk. 19 (7.5 kg., documentary I).
  - C. Mk. 27 (Expt. 18 No. 6. Mk. 27 Bomb, documentary).
  - D. Mk. 28 (Type 3 No. 1, Mk. 2M, documentary).
4. Bombardment types for ground use.
  - A. 20 cm. Navy spin stabilized.
  - B. 45 cm. Navy spin stabilized.
  - C. 20 cm. Army spin stabilized.
  - D. 12 cm. Navy spin stabilized.

The chart on the following page gives the known and recovered pieces of Japanese rocket ordnance. The Japanese designation of each item is given, along with data on propellant charge and the use for which the rocket was developed. Only the short code designation is given for the propellant. BDIB Vol. 2, No. 1, contains a discussion on code designation of propellants and should be referenced in connection with this article.

A discussion of each individual piece of rocket ordnance follows.

All known rocket propelled ordnance developed by the Japanese and recovered by Allied forces, either in the form of actual rounds or documentary evidence, is summarized here. Information gained from documents is included to give a more complete picture of rocket ordnance, and to fill in gaps of development. When data from this source is used it will be so indicated and evaluated where possible.

This document is issued to graduates of a course in Bomb Disposal, by the Officer in Charge, Navy Bomb Disposal School, under authority of Bureau of Ordnance letter F41-6 (L) of 22 April 1944. It is for information and guidance only and is not a Bureau of Ordnance Publication. It should be destroyed

# TYPES OF JAPANFst: ROCKET ORDNANCE

Japanese desi	Carrier Aircraft	Thrust 700 kg. 3 sec. Thrust 400 kg. 8 (sec.) Thrust 800 kg. 8 (sec.)-
Take-off Assist Rocket Mod Rocket Device Type 4 Mk. 1 Mod. 10. Rocket Device Type 4 Mk. 1 Mod. 20.	Carrier Aircraft 8 2.2 8 8	Range 1,000 m. (?) Range 5,000 m. Range 8,000 m. 40 m. sec. increase. 450 m. sec. increase. 300 m. sec. increase. (?) Range 1,600 m. Range 2,000 yds. Range 2,800 yds.
Bomb Launching Rocket Device Model 10. Bomb Launching Rocket Device Type 3. Special Mk. 1 Rocket Device Model 21. Special Mk. 1 Rocket Device Model 22.	250 kg. bomb. 250 kg. bomb.	
Type 3 No. 25 Mk. 4 bomb. Type 3 No. 1 Mk. 28 bomb. Expt. 18 No. 6 Mk. 27 Bomb Model 1. Mk. 19 7.5 kg. Aircraft Rocket	250 kg. Rocket bomb 10 kg. Rocket bomb 60 kg. Rocket bomb Aircraft	
20 cm. Rocket. 45 cm. Rocket.	20 cm. Navy 45 cm. Navy 20 cm. Army 12 cm. Navy	

## TAKE-OFF ASSIST

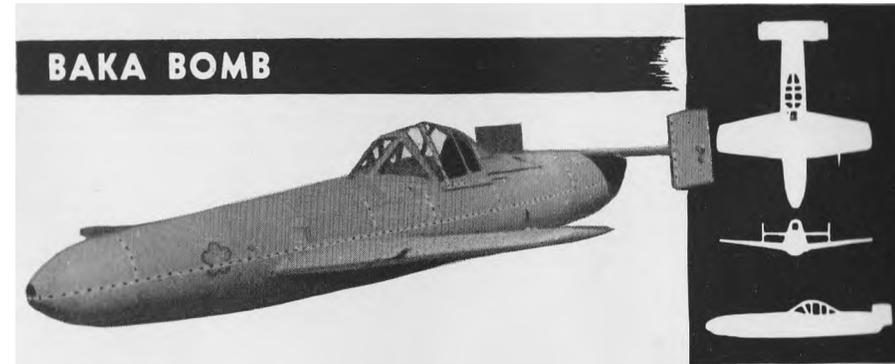
### FOR AIRCRAFT

Elementary evidence indicates that there is in existence a rocket unit for carrier aircraft designated "Take-off Assist Rocket Model 1." According to the document the unit gives a thrust of 700 kg. (1,540 lbs.) for a period of 3 seconds during take-off.

The propellant charge, according to the code designation, is comparable

to that used in the pusher unit developed to launch 60 kg. and 250 kg. bombs. Although it is not possible at present to positively predict the type of explosive used in an 444411-covered item, available information suggests a correlation between the short code name and actual chemical analysis.

Three grains of 343 Special DT, propellant are used. Each grain is 78.6 mm. (approximately 3 inches) in diameter and 512 mm. (approximately 20 inches) in length.



In appearance, the Baka bomb resembles a single-seat midwing monoplane having twin fins and rudders. The wings and tail surfaces are molded plywood, fabric covered. The fuselage is of metal construction. It is approximately 18 feet in length, the wingspan is about 15 feet, and the pilot's canopy is of panelled plexiglas. The recovered Baka bombs have no provision for landing gear or skid, indicating that the bombs may all be launched from a parent plane.

The rocket units for the Baka are designated Type 4 Mk. 1 Model 10 and Model 20. According to documents the Model 10, which has not been recovered, has three grains of propellant of the same dimensions as those used in the Model 20. The Model 20, which has been recovered, contains 6 grains of 500 special FDT (nitroglycerin 26.9, nitrocellulose 59.9, centralite 2.9, mononitronaphthalene

6.1, potassium sulfate 2.9, volatiles 1.3, ash 2.8). According to a captured document an alternate propellant may also be found containing N. C. 60-64 percent, N. G. 30 percent, potassium sulfate 2 percent, plasticizer 4-8 percent. Two forms of the Model 20 are used, one as the main motor located in the after portion of the fuselage, and one as a wing unit.

It is thought that the Baka may have been designed to be launched from a ship or land base. This would make the extra propulsion units attached to each wing necessary.

Both the Model 10 and Model 20 are the same diameter, the variation in size is in the length.

Documentary evidence indicates that the Model 10 is designed to be used as a wing unit. One motor being attached to each wing. It is shorter than the Model 20 and contains only



Motor Unit Model 20. Propulsion unit for Baka Bomb.

three grains as compared to the six grains used in the Model 20.

Three Model 20 motors are used as main propulsion units in the after end of the fuselage. They are arranged in the form of a triangle with two on bottom and one on top. The venturi tube of the upper motor extends aft beyond the ends of the venturi tubes of the two lower motors.

The overall length of a single rocket motor is 78 inches with a total weight of 266 pounds.

The motors are ignited by an electrically fired squib which threads into the forward end of each rocket motor. The igniter is connected to the electric firing circuit of the plane by a four-socket female plug, and a 26-inch two-strand insulated cable. A selector in the pilot's cockpit permits firing of any one of the three fuselage motors or the wing motors. The cable leads to two high resistance wire igniter bridges around each of which are wrapped a small quantity of guncotton. A flash from the guncotton ignites a small black powder charge, which in turn ignites the block powder contained in the perforated igniter body.

The warhead located in the foremost part of the bomb contains the explosive charge. By analysis the charge was found to be cast trinitroanisol. Total weight of the warhead is 2,215 pounds and weight of filling alone 69(1 pounds). The after end of the warhead is threaded to take the base plate, which is locked in place by a grub screw, 1, inches long. A second grub screw in the nose secures the nose fuze in place. The nose fuze is of the same basic construction and design as the A-3(d). Probable designation will be A-3 (g). Operation is identical to the A-3 (d).

The base plate is of one piece steel construction and has four tail fuze pockets grouped around a central threaded hole in a slightly raised portion of the base plate.

There are two each of two types of tail fuzes. One type utilizes the all-ways action principle and is designated the B-9 (a). The other type utilizes the inertia-striker principle and is designated B-10 (a). For a complete report on these fuzes see BDIB Vo. I No. 85.

## BOMB CONVERSION for

## LAND BOMBARDMENT

A. Pusher type separate from bomb.—This device has been recovered in two sizes. Both are designed to launch a Type 97, 60 kg. Land Use bomb from a crude V-shaped wooden trough.

The difference in size is a variation in length only. The longer model is designated Type 3 by the Japanese

and the short model is designated in documents as "Bomb Launching Rocket Device Model 10."

The motors may be used interchangeably and possibly are a means of varying the range. The short model is reported to have a range of 1,000 meters (1,093 yards). No figure is given for the longer model but it is

assumed that at least a 50 percent increase should be expected, as the length of the grain used is approximately twice the length of that used in the short model.

Both models have the appearance of a short flat-nosed bomb with a venturi tube attached to the base to which is welded four tail fins.

The main body is a cylindrical steel tube which has a closing plate welded to its forward end. The plate is centrally bored to receive the igniter body. The base of the main body is externally threaded to take a dome shaped base cap to which is threaded the venturi tube and tail assembly.

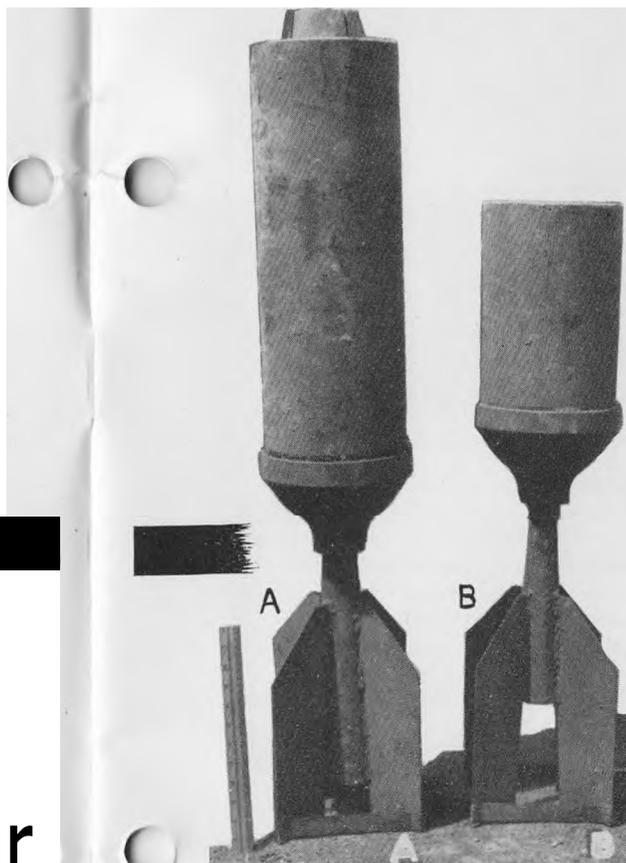
The three propellant grains are held in place by a metal grid which abuts a shoulder on the base cap. At the forward end of the propellant

charge is a black powder ignition pad held in position by a thin metal grid.

The igniter screws into the nose of the motor and consists of a metal cylinder 2.25 inches long and 1.12 inches in diameter. It contains an electrical bridge with match composition surrounded by approximately 1/2 ounce of black powder. Two 18-inch wire leads extend out from the firing bridge and are connected to two terminals on the launching trough.

## DATA

	Long	Short
Overall length .....	40"	33"
Maximum diameter .....	7 1/8"	7 1/8"
Length of main body .....	21"	11 1/2"
Diameter of main body ..	7 1/8"	7 1/8"
Wall thickness, main body ..	3/16"	3/16"
Length of base cap .....	7 1/8"	5 1/8"
Maximum diameter of base cap	7 1/8"	7 1/8"
Length of venturi tube-tail assembly .....	16"	18"
Length of venturi tube . . .	14"	12"
Diameter of venturi tube (aft) .....	2 1/8"	2 1/8"
Width of tail fins .....	10 1/8"	10 1/8"
Total weight filled .....	91.9 lb	
Diameter of igniting charge container	6 1/8"	
Weight of black powder ignition charge and squib	2 1/8" oz	
Length of propellant stick .	18 3/8"	10 3/4"
Diameter of propellant stick .....	3 3/4" oz	3 3/4"
Diameter of perforation ..	3/8"	3/8"
Total weight of propellant	24.9 lb	12.5 lb



B. Integral Type Bomb Pusher.—The following is taken from a field report, submitted by Major Keller, Ordnance Department, Ordnance Intelligence Officer, on the 250-kg. rocket recovered on Iwo Jima.

"The use of the large rocket on Iwo Jima by the enemy was typically Japanese. Employed as a harassing fire, it became well recognized by sound because of its flight along time length of the island from the northern part toward the Mount Suribachi

A. Type 3 Bomb Pusher.  
B. Bomb Launcher Rocket Device Model 10.

target area. While heavy barrages were not used, the rocket fire was endured almost nightly until shortly before the island was secured. These rockets were fired singly and with intervals of several minutes between rounds, with the target being the densely crowded neck of land between the eastern and western beaches immediately northeast of Suribachi. Since Japanese observation undoubtedly spotted both Corps Headquarters and the artillery concentration in their rocket target area, and attempted to center their rockets on that area, accuracy was very poor. The nearest hit to the center of the impact area was approximately 600 yards. Maximum dispersal covered an area of at least 4,500 yards long by 1,200 yards wide, with by far the greater number far over the target. From sightings, trajectory and rate-of-fire, it is believed that not more than two launchers were used during any period of delivery fire.

"The complete rocket and launcher have not been recovered to date. It appears all projectiles were fired, and the launchers either destroyed by the enemy or reduced to unrecognizable rubble by our own fire.

"Reconstruction of fragments was attempted, and a description of the rocket was written prior to the recovery of a Japanese manual on the rocket."

The following is a brief description of the rocket obtained from portions of Major Keller's report, captured documents and MEIU reports:

The tail assembly and tail cone-adaptor are removed from the Type 98 No. 25 bomb and a special internal plate is slipped into the after end of the bomb and is held in place against the explosive by the motor adaptor. A cylindrical spacing ring, whose sides are pierced by four 1-inch holes,

is welded to the after side of the base plate. This spacing ring serves to hold the base plate securely against the explosive in the bomb after the motor is assembled to the bomb. The Model 22 is secured to the No. 25 Ordinary bomb by screwing an adapter on the threads from which the tail assembly has been removed.

The propellant charge used consists of 2(1 sticks of 343 Special DT<sub>2</sub>). The chemical analysis is not known as the round has never been recovered in the unfired condition. The igniter consists of igniter body, electric cap and igniter charge and is ignited by current from a blasting machine.

The following data is given on the complete round as recovered and is printed here to aid in identification:

### DATA

Explosive head:	
Over-all length .....	39.6
Maximum diameter .....	11.9"
Wall thickness .....	0.5"
Total weight filled .....	435 lb.
Weight of explosive .....	212 lb.
Fuzing .....	A-3 (a)
Color .....	Blue-gray
Motor adaptor:	
Maximum diameter .....	11.9"
Length .....	2.6"
Rocket motor:	
Over-all length .....	78" (approx.)
Diameter .....	11.9"
Thickness of wall .....	1/8"
Total weight .....	251 lb.
Diameter of igniter well ....	3/4"
Length of tail assembly . ....	24.75"
Length of venturi tube .....	24.75"
Diameter of venturi tube 5.75"	
forward.	
Diameter of venturi tube 5.75"	
aft.	
Color .....	Blue-gray

According to documentary evidence both the Models 21 and 22 are launched from a crude wooden trough very much like that used to launch 60 kg. bombs.

*Integral type Bomb Pusher.  
Type 3 No. 25 Mk 4 Rocket Bomb.*



250 Kg. Mk. 4 Rocket Bomb (documentary)

Captured documents indicate that there is in existence at least four types of rocket propelled ordnance designed to be launched from aircraft. Reports from various air commands further substantiate their possible existence, but as none of the reported rounds have been recovered information regarding this type of ordnance is fragmentary and incomplete.

The Mk. 4 (Type 3 No. 25 Mk. 4) rocket bomb as described in documents contains 7 grains of 343 DT propellant. One grain in the center of the propellant body is longer than the other six and measures 445 mm. The short grains measure 397 mm. All grains are the same diameter, .786 mm.

It is reported that the rocket unit increases the speed of the released bomb 80 m./sec.

It is probable that the Type 3 No. 25 is the bomb finally adopted as the service round. Mention has been made of a No. 50 and a No. 5 Mk. 4 rocket bomb, but information now available indicates that these two bombs, if in existence, are comparable in design to the No. 25.

A Mk. 19, 7.5-kg. rocket is also reported and may be comparable in design to our aircraft rockets. No information, however, is available on this type.

The Type 3 No. 1 Mk. 28 bomb has a total of 16 grains, 19.2 mm. in diam-

eter and 350 mm. long. Type of propellant is listed as 76 DT<sub>1</sub>. Increased speed of bomb with propellant unit is listed as 450 m./sec.

An Experimental 18 No. 6 Mk. 27 Model 1 bomb is reported in documents and may be found with a production Type No. It uses the same type of propellant as the 10-kg. rocket (76 DT<sub>1</sub>). The diameter of the grain is the same (19.2 mm.), but is longer, 350 mm. Rated increase in speed is 300 m./sec.

Reports have been received from air commands operating in Asia and over Yap stating that rocket bombs have been used by the Japanese in those areas against our aircraft.

It was impossible to make identification but a document captured at Kwajalein revealed extensive trials and conclusions by the Japanese on rocket bombs.

The document was issued under the Japanese security classification of Most Secret. Bomb Experiment 37 had as its purpose the obtaining of reliable information on parts and material necessary to the fabrication of a successful rocket bomb to be known as the Mk. IV bomb. The committee from the Naval Air Technical Arsenal and the Yokosuka Naval Air Group was to obtain this data thru test and experiments with two experimental bombs—the Expt. 14, No. 3 Mk. IV practice bomb and the

Expt. 14, No. 25 Mk. IV dummy bomb. These experiments lasted more than 1 year beginning 8 August 1941 and were concluded 11 November 1942. The final report, made 19 October 1943, was accompanied by 26 Charts and tables showing data of the experiments (defects in the experimental bombs and recommended changes to be incorporated in the final design of the Mk. IV bomb). In addition, a number of photographs, charts and drawings accompany the translation and are available for references.

Numerous tests were conducted and finally the committee approved the original basic design of the Mk. IV bomb, recommending the incorporation of suggested changes with the statement "See no reason why Mk. IV bomb may not be designed after the model of experimental 14, No. 25 Mk. IV dummy bomb."

These early experiments show Japanese concern over the development of rocket bombs. In view of the lapse of time since these early experiments, the Japanese have the capability of producing an effective airborne rocket bomb.

## OMBARDMENT TYPES

### for GROUND USE

*A. Navy 20 cm. spin stabilized rocket.*—The Navy 20 cm. rocket explosive head is a slightly modified 20-cm. projectile. The rotating band is removed and the round may be found with or without the rotating band groove depending upon the method of conversion.

The motor, which is screwed onto the adapter in the base of the projectile contains 7 grains of 240 Special DT<sub>6</sub> propellant. Chemical composition: Nitroglycerine 30 percent Nitrocellulose 65 percent, NaCl 2 percent, Centralite 3 percent. The propellant grains fit into the chamber against a perforated cup which in turn hold the black powder ignition bag.

A steel base plate with a grid attachment closes the motor. It has six offset nozzles and a central threaded tube for the primer. The flash from the percussion primer passes through the perforation of the center propellant grain and ignites the black powder charge, which in turn sets off the propellant.

The rocket is painted maroon over-all with a green tipped nose and a yellow band at the junction of motor and project He.

The round is fired from a crude steel launcher 8 feet long. It has a hipod support at the forward end and two short legs aft which hold the launcher base approximately 1 foot off the ground. The round is fuzeed with a centrifugally armed point detonating instantaneous fuze.

## DATA

- A. Projectile:  
 Over-all length ..... 588 mm.  
 Weight ..... 49.9 kg.  
 Weight of filling ..... 17.5 kg.  
 Body diameter ..... 210.5 mm.
- B. Motor:  
 Over-all length ..... 46 cm.  
 Weight with propellant .... 40 kg.  
 Weight of propellant ..... 8.3 kg.  
 Weight of black powder  
 ignition charge ..... 50.6 gm.  
 Length of propellant grain . 29 cm.  
 Diameter of propellant  
 grain ..... 5.8 cm.  
 Diameter of perforation .. 1.1 cm.

*B. Navy 45 cm. spin-stabilized rocket.*—The 45 cm. rocket is similar in basic design to the Navy 20-cm rocket except for the differences in size. The rocket weighs 1,514 pounds and is 672 inches long.

The explosive head or projectile has a conical rather than an ogival nose and consists of a nose and a barrel welded together. Both nose and barrel are sheet steel that has been rolled and welded. The junction with the motor is effected by a coupling. The coupling extends inside the barrel and is secured by weld. The flange of the coupling abuts the end of the barrel and is secured by an external weld. The motor threads onto the after end of the coupling. The base plate threads

into the coupling and is sealed %6111 a gas check.

A noteworthy feature is that either Navy or Army nose fuzes may be used. The Navy rocket fuze used with the 20 cm. rocket can thread directly into the pocket or an adapter can be inserted. The adapter takes the Army Type 100 selective instantaneous or delay mortar fuze. When the adapter is used, the Navy gaMe well in the charge is filled with a picric pellet recessed for an Army gaine.

The motor or after part of the rocket consists of a steel cylinder which screws onto the base of the projectile, a forward grid, an ignition charge, an after grid and 6 tapered nozzles welded to a base plate which screws into the base of the motor. The steel cylinder contains 39 grains of 240 Special DT<sub>6</sub> propellant. Reported specimens contained 39 grains. Chemical analysis of the red grains was as follows: Nitroglycerine 37 percent, nitrocellulose 60 percent, stabi-



*Navy 20 cm Spin stabilized Rocket.  
 Navy 45 cm Spin stabilized Rocket.*

lizer 5.8 percent. The green grains are composed of nitroglycerine 29.1 percent, nitrocellulose 65.1 percent, stabilizer 5.8 percent.

The following data on the rocket is given. For more complete and detailed coverage refer to MEIU #1, Report #148.

## DATA

- A. Projectile data:  
 Length ..... 40•S"  
 Diameter ..... 17.7 S"  
 Weight of explosive ..... 401 lb.  
 Type of explosive ..... type '18
- B. Motor data:  
 Length ..... 27"  
 Diameter ..... 17.75"  
 Weight empty ..... 26) lb.  
 Weight of propellant ..... 131.5 lb.  
 Weight of ignition charge .... 83 oz.

The round is maroon over-all with a green nose. An Arabic numeral is stenciled on the nose in white. The only label found on the round reported contained the following data on the propellant.

Common Propellant.

Kind: 240 Special DT<sub>6</sub>,  
 Lot No.: 9P.

Manufactured: September 1944.

*C. Army 20-cm. spin stabilized rocket.*—The Army 20-cm. rocket is similar to the Navy 20-cm. rocket but is

designed and manufactured to be used as a rocket and not converted from an 8-inch projectile as in the case of the Navy round.

Two slightly different designs exist: in one the motor has two pronounced bourrelets; in the other the sides of the motor are almost straight. The

motor weight of the straight round is greater. The complete round is 37 inches long and the weight ranges around 180 pounds.

The projectile is a thin-walled tube with an ogival nose. It is closed at the base by a male plate which is concave to permit a maximum explosive charge.

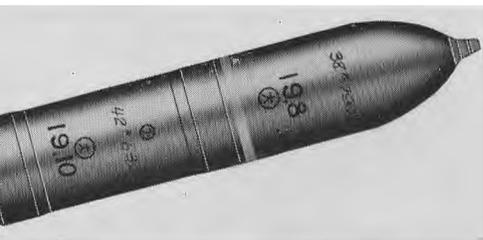
The filling is high-grade cast TNT. The fuze pocket will take the Type 100 selective instantaneous-short delay mortar fuze.

The motor is a tube threaded at both ends. The forward end threads onto the projectile base plate; the after end receives the motor base plate.

The propellant used consists of 8 single perforated cylindrical grains of "Smokeless Powder B" (Japanese designation). The complete chemical analysis is pending.

### DATA

- A. Projectile (same for both rounds):  
 Over-all length ..... 17.6"  
 Maximum diameter ..... 7.9"  
 Weight empty ..... 50.3 lb.  
 Weight of filling (cast TNT) 35.7 lb.
- B. Motor: *Bourellet Straight*  
 Over-all length ..... 19.06" 19.06"  
 Diameter of bearing surface ..... 7.94" 7.94"  
 Weight empty ..... 47.2 lb. 52 lb.  
 Propellant weight . . 21.2 lb. 22 lb.  
 Length of propellant grain ..... 13.37" 13.37"  
 Diameter ..... 2.28" 2.28"



Army c0 cm Spin stabilized Rocket.

The launcher for the Army rocket is markedly superior to the trough used for the Navy rocket. It consists of a tube, two legs, and a base plate. The launcher can be elevated and trained by an elevating post and worm gear which gives fine adjust-

ment and consequently much more accurate fire. The launcher is designated Type 4, 20-cm. rocket launcher.

The entire round is black. A single yellow hand is painted on the projectile at the junction with the motor.

D. /2-rm. Navy spin stabilized rocket.—  
 The Japanese have equipped their small suicide boats with two rocket launchers on the stern from which 12-cm. incendiary rockets are fired.

Although the rounds recovered are painted black over-all and carry a yellow hand on the projectile body, the round is definitely Navy. A yellow hand on the base of the motor is also contrary to known Army color markings. It is possible that this may be a new Navy color scheme.

The following is stenciled on the projectile at the junction with the motor (19-12 Sa-9) December 1944, Sag, probably a Navy assembly shop. The nose of the projectile on the round observed was rusty making it impossible to tell if any color band was present.

The propellant charge consists of six long and one short grain of 150 Special DT<sub>6</sub>. Each grain is 33.4 mm in diameter. The long grains are 355.6 mm. in length and the short grains 269.5 mm.

The body of the war head is a one-piece steel cylinder on the forward end of which is welded a hollow ogival steel nose. The after end of the war-head body is threaded internally to receive the forward end of the war head motor adapter. A wooden plug fills the space in the hollow nose. The war-head body contains a metal canister filled with 62 metal encased, incendiary (W. P.) pellets. Running the length of the cylinder and centrally located is a small burster tube containing five picric acid cylinders.

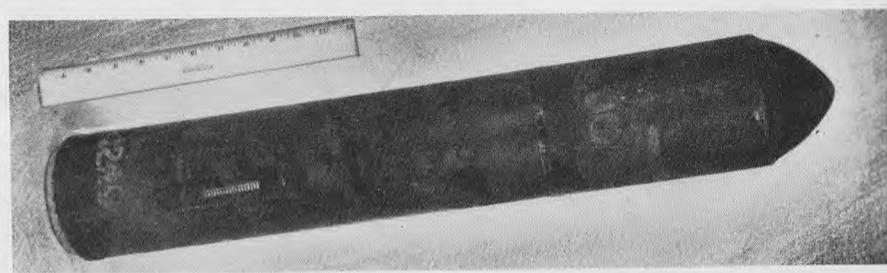
The motor body is a steel cylinder similar to the war head cylinder. The forward end is threaded internally to take the after end of the war head motor adapter. The after end is threaded internally to take the base plate, which houses the offset orifices

and the primer. In the forward end of the motor body is a square grid with each corner bent 90° to form four legs, thus giving the grid an octagonal shape. There is one large hole 1 1/8 inches in diameter in the center of the forward grid. Around the central hole are six smaller holes 1/6 inch diameter. Attached to the grid by a silk line is a circular, silk powder bag, containing 1 ounce of black powder, which is ignited from the flash of the primer in the base of the motor body. The after grid, located in the base of the motor body, contains six circumferential holes, 1/6 inch diameter, and one centrally located hole threaded to receive the primer sleeve. The after grid is supported by three lugs on the inner surface of the base plate and a short central collar, which extends aft and is a part of the after grid. The primer sleeve appears to be a short length of hollow pipe threaded on either end.

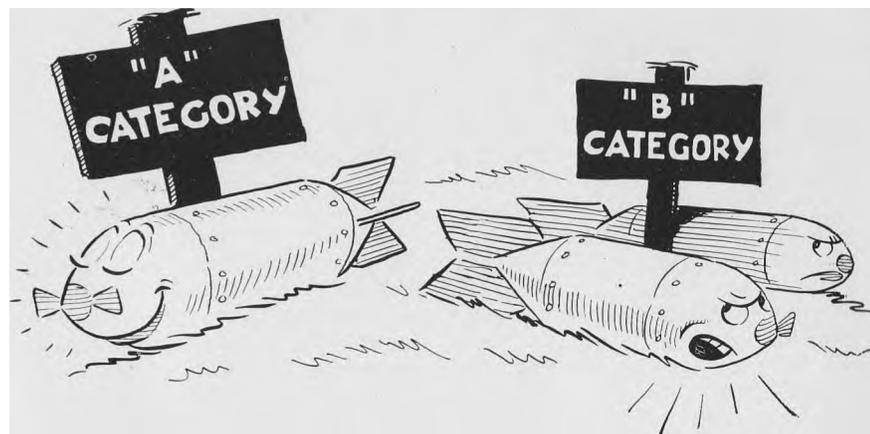
The fuze threads into the after end of the war head motor adapter and is, in effect, a powder delay train. Into the forward end of the fuze is threaded a small gaine containing a high explosive, which is actuated by the delay train housed in the body of the fuze. There are no moving parts in the fuze. The powder delay element is initiated by a small black powder bag which is crimped to the after end of the fuze, and is in turn initiated by the primer. The delay train allows the rocket to travel 2,000 to 3,000 yards before the main charge is detonated.

### DATA

- A. War head:  
 Weight empty ..... 6 lb. 5% oz.  
 Length ..... 10"  
 Diameter ..... 4"
- B. Motor body:  
 Weight ..... 13 lb. 11 oz.  
 Length ..... 17 5/8"  
 Diameter ..... 4 11/16"



Navy 12 cm Incendiary Shrapnel.



# Trends

## IN JAPANESE ORDNANCE

The Japanese show a marked trend toward the use of substitute metals in present manufacture of fuzes, projectiles, propellant cases and other ordnance pieces.

Several ordnance items have been captured in which the first recovered pieces have been of brass and later recoveries have been of steel, partial steel or aluminum construction. It is impossible to check all items for date of adoption by the armed forces, but in general it can be stated that the trend in construction has been from brass to a substitute metal.

It cannot be definitely stated that such substitutions are necessitated by a shortage of a particular metal, but it is reasonably safe to assume that such is the case. Due to inherent difficulties encountered in the service use of such substitutes, it is reasonable to assume that they would not be used if it were not necessary.

Especially is the above true in the use of steel in the construction of propellant cases.

A steel propellant case is relatively inelastic and therefore fails to form a good gas seal in the breech of the gun. The case also may be difficult to remove from the gun due to the failure of the case to return to its near normal diameter after firing. The fact that steel is subject to rust makes stowage a problem especially in forward areas.

A captured document lists the following steel cases for Navy guns:

1. Steel cartridge case for short 20-cm. gun.
2. Steel cartridge case for 14-cm., 40-cal. gun.
3. Steel cartridge case for short 12-cm. gun.
4. Mark I steel cartridge case for 8-cm., 40-cal. gun.

5. Mark II steel cartridge case for 8-cm., 40-cal. gun.
  6. Mark I steel cartridge case for short 8-cm. gun.
  7. Steel cartridge case for 5-cm. gun.
  8. Short 5 cm. steel cartridge case.
  9. 25 mm. with steel case recovered.
- None of the above reported rounds with steel case have been recovered to date except the 25 mm.

In addition to the Navy rounds listed above the following Army projectiles have been recovered with steel propellant cases or brass coated steel.

1. 7.7 mm. rimless.
  2. 70 mm. Type 92 howitzer.
  3. 75 mm. Type 88 gun, ammunition.
- (a) Ammunition for the Type 38 Field gun and similar weapons (brass plated steel).
- (b) Type 41 mountain gun ammunition (brass plated steel).
4. 105 mm. steel case.

Further reports have been made of fuzes for Type 89, 50 mm. grenade discharger that were manufactured in October 1944 were of black steel. Most Type 88 artillery fuzes and Type 100 mortar fuzes of recent manufacture that have been found on Luzon are of steel. A new Type 88 artillery fuze, made on and after September 1944 has an upper body of steel and a lower body of what appears to be a light metal-like aluminum.

In several instances bomb fuzes have been recovered in which the metal used was brass, brass and steel, or steel alone. These variations in construction have been noted within a particular fuze. Some may also be constructed of aluminum.

The following are some of the bomb fuzes recovered that show the above variations.

1. Army A-2 (c). May be found with a brass body or steel body.
2. Navy A-3 (b). Brass body with steel vanes.
3. Navy A-3 (c). Brass body steel nose cap.
4. Navy A-3 (d). Brass body steel vanes.
5. Navy A-3 (e). Steel body brass nose cap.
6. Army A-7 (a). Aluminum body.
7. Army A-8 (a). Brass body steel vanes.
8. Army A-8 (b). Brass body steel vanes.
9. Army B-2 (a). Steel body brass locking ring (may also be steel).
10. Army B-5 (a). Aluminum.
11. Navy B-5 (b). Steel.
12. Navy B-5 (c). Aluminum alloy body.
13. Army B-7 (a). Brass body steel arming vanes.
14. Army B-8 (a). Brass body steel vanes.
15. Navy C-1 (a). Steel.
16. Navy C-2 (a). Steel.
17. Army C-3 (a). Steel body brass inside.
18. Army D-1 (a). Aluminum body brass vanes.
19. Navy D-2 (a). Brass.
20. Navy D-2 (b). Cadmium plated.
21. Navy D-2 (c). Cadmium plated.

In addition to the above variations in external construction several internal parts have been modified as to

material of construction. These include strikers, firing pins, shear wires which may be either copper or brass, and various fittings. The strikers and firing pins have been found mil dr 01 steel or of brass.

The construction of bombs have undergone relatively little change as far as material of construction. The kg. has been recovered with tinned steel tail fins substituted for the conventional aluminum. Aside from this instance very little variation has been noted.

A few modifications have been found in material of construction in bomb fuze gains, projectile case primers, and detonator holders. The trend in all cases appears to be from brass to some substitute usually steel.

Improvised rounds of various grenade type ordnance items, land mines, and booby traps also indicates a possible shortage of materials, and also a definite lack of facilities and time for standard manufacture. This is especially true in such items as grenades made from steel pipe, frangible grenades, converted shell cases used as grenades, improvised pull devices laying of bombs, nose up as land mines.

Very few booby traps manufactured as such are known to have been used by the Japanese. Several types of land mines have been manufactured by the enemy, but cases have been reported in which these were never planted though present. At the same site improvised mines were installed though not always rigged for firing.

# EARTHQUAKE BOMBS

It has become readily apparent in recent months that military targets of vital importance have existed and do exist in appreciable numbers which cannot be rendered ineffective by direct attack with standard American bombs. Mention need only be made of the submarine pens, the rocket launching sites, and the underground factories recently erected by the enemy to illustrate this fact. The massive construction of these enemy installations provides evidence of the requirement for a bomb strong enough to withstand penetration of such heavily reinforced structures, large enough to produce an explosion of earthquake proportions, and accurate enough to assure certainty of hitting the vital areas of these defenses. General Doolittle, when questioned about the need for a large bomb, replied: "We have a requirement for a 22,000-pound bomb today, and have had a requirement for a 12,000-pound bomb for about a year."

The fact that installations as gigantic as these were undertaken during wartime and in areas subject to attack indicates very clearly that it is not yet possible to predict the eventual bomb capabilities required to meet all targets of the future. The protective

measures adopted by the enemy in future construction will determine these capabilities, and conversely the ability to employ very large bombs will dictate the protective measures that the enemy must adopt.

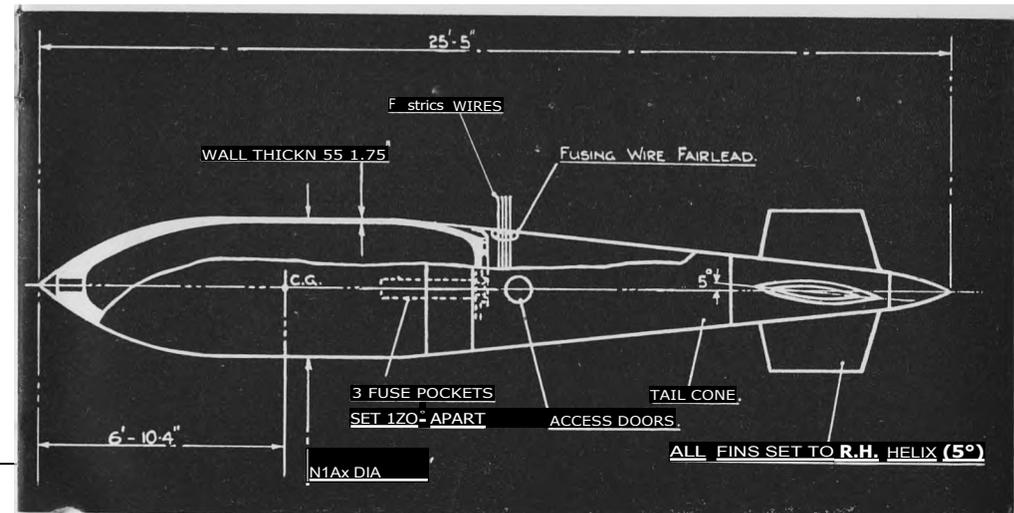
As a matter of fact, since the beginning of World War II, periodic experiments have been conducted by various of the United Nations in an attempt to develop a satisfactory large type bomb; i. e., a bomb weighing 4,000 pounds or over. Noteworthy among these efforts were the British H. C. "Blockbusters" and the American L. C. "Light Case" bombs.

These bombs ranged from 2,000 pounds to 12,000 pounds, in weight

Cross section of "Grand Slam" Bomb.  
(From British Original)



"Tall Boy" being dropped by B-29.



and consisted of light, metal bodies filled with explosive. The loading factor of the bombs ran as high as 80 percent. The designed purpose of this type of bomb was to cause extensive damage over wide areas as the result of the instantaneous detonation on impact of the very heavy explosive charge contained. Blast damage was to be the principal effect; closely built-up areas, such as unarmored factories and large cities, were to be the principal targets.

Operationally, these bombs did not produce the results expected of them. Difficulties were experienced in obtaining complete high order detonation of the main explosive charge, and it was found that the bomb bodies tended to break up on impact before complete detonation was achieved. The problem of obtaining instantaneous fuze reaction also was never completely solved. Despite these difficulties, however, the British made wide and fairly successful use of the "Blockbusters," but the U. S. Army Air Forces dropped the L. C. bombs in favor of a bomb load consisting of a larger number of smaller bombs.

The more recent requirement for a large type bomb became apparent when the enemy began to move into fortifications and assembly plants underground and to protect them with reinforced concrete installations. Moreover, air reconnaissance missions were reporting the building of an evidently designed for launching enemy "V" type weapons. A satisfactory countermeasure was not available, and the development of one became a project of the highest priority.

From this need emerged a new type of large bomb, the British "D. P." (Deep Penetration) 12,000-pound and 22,000-pound bombs, nick-named "Tall Boy," and "Grand Slam," respectively. These bombs differ from the earlier types of large bombs not only in their general characteristics but in their designed function.

They are neither a blast type demolition bomb nor an armor-piercing bomb. Rather, their devastating effect is gained by the production of heavy shock waves deep within the earth. As will be seen in later discussion of their operational employment, greater damage has been achieved from near misses with these bombs than from direct hits on the target.

The two bombs are nearly identical in their design characteristics, "Grand Slam" being merely an inflated version of "Tall Boy." Every effort has been made to give the bombs a per-

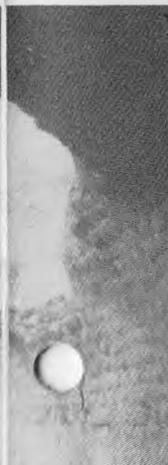
**CONFIDENTIAL**



**VIEW OF "EXCAVATED"  
12,000 LB. "TALL BOY" BOMB  
CRATER ON SAUMUR  
TUNNEL.**

**SAUMUR. (RAILWAY TUNNEL)**  
*Note the direct hit on the roof of the  
entrance to the tunnel. This crater  
is 100 feet wide.*

**CONFIDENTIAL**



fectly streamlined contour to obtain greater precision and maximum striking velocity. Their precision and terminal velocity are also enhanced by a special type tail assembly, which consists of a cone, longer than the bomb body, fitted with four fins of aerofoil cross-section. These fins are set at an angle of 5° to the axis of the tail and impart a rotary motion to the bombs as they fall.

Dimensional details of the bombs follow:

	<i>Tall Boy</i>	<i>Grand Slam</i>
Over-all length .....	21'	25'5"
Maximum diameter	38"	46"
Body length .....	10'4"	12'1"
Width across fins . . .	44.3"	53.6"
Over-all weight .....	11,800 lb.	22,400 lb.
Explosive filling . . . .	Torpex	Torpex
Explosive weight .....	5,200 lb.	9,200 lb.
Charge/weight ratio .....	45%	42%

The detonation of the bombs is accomplished by three tail pistols placed 120° apart in the base plate of the bomb body. The pistol used is the No. 58 Mk. I, containing a simple inertia type striker retained in the

unarmed position by a light brass cross. Two fuzing holes are drilled in separate planes in the pistol body at 90° to each other. The one employed is that which gives the more favorable angle of pull-off for the arming wire from the pistol to the fuzing unit. Parallel to one of the fuzing wire holes is a third hole for the safety pin which supports the striker during transit and fuzing operations.

Used in conjunction with these pistols is a set of interchangeable detonators, offering a wide choice of delay times. Delays which have been used operationally have included: 0.07 second, 0.25 second, 0.5 second, 3 seconds, 11 seconds, 25-30 seconds, 30 minutes, and 1 hour.

Suspension of the bombs in the plane is accomplished by means of a single, chain-type supporting band located at the center of gravity of the

**BREST—U-BOAT PENS.** A 12,000 lb. bomb crater through 19'6" reinforced concrete U-boat shelter roof.



bomb and joined at the bottom by a special Vickers release clip. The bombs are held in position in the plane by a series of adjustable sway braces, fore and aft, and a pin and slot arrangement prevents the bomb from rolling.

The bombs are currently carried in specially modified Lancaster aircraft, although a new and improved version of the Lancaster, the "Lincoln" bomber, is presently being prepared to carry these bombs for operational use in the Pacific theater.

The method of manufacturing these bombs is itself of interest. British

specifications call for a single piece casting of the entire bomb body, with a forged steel nose plug and a forged steel base plate fixed into place. American manufacturers, however, prefer to build up the bomb in five sections welded together. The three center sections are made from steel plate rolled into a cylinder and seam welded longitudinally. They are then taper-bored to give the internal contour and machined to the proper external dimensions. Forged steel nose and base sections are then added.

British employment of "Grand Slam" and "Tall Boy" is noteworthy,



*"Tall Boy" being loaded in, a Lancaster.*

and the operating procedure and targets attacked may point the way to the most efficient utilization of these bombs by the A. A. F. It was not deemed necessary or desirable by the British to adapt all available Lancaster aircraft for large bomb stowage. And to train all aviation personnel in the handling, loading, and tactical employment of the bombs would be a

task far out of proportion to the relatively small use the bombs would receive. The bombs remained in a special purpose category and were employed only against very specific types of targets. It was felt that the use of these big bombs should be restricted to targets requiring their specialized effectiveness and that great loss of bombing efficiency would result from overtaxing the talents of the large bomb squadrons.

Accordingly, the R. A. F. set aside bomber squadrons composed of selected men with considerable combat experience, all specially trained for high level precision attack with large bomb weapons. As an example of the position of these squadrons in the R. A. F. organization, the commander of one of the squadrons was a group captain who relinquished that rank to accept that of wing commander so that he might take command of the squadron.

All combat bombing was by individually aimed releases, generally from altitudes of between 18,000 and 20,000 feet, and always under conditions of good visibility. Each plane made its own individual target run, but a single file formation was developed which allowed 18 bombs to be in the air simultaneously. This was necessary so that the explosion of the first bomb would not obscure the target from later planes in the formation. The bombing accuracy obtained by these squadrons was phenomenal and un-



B 29 carrying "Tall Boy"

doubtedly was a major factor contributing to the success of the missions attempted.

In the period from June 1944 to April 1945, 34 different targets were attacked by these squadrons in a total of about 40 missions. Nearly 655 "Tall Boy" and 17 "Grand Slam" bombs were operationally expended. Five general types of targets were attacked, with one exception, all with considerable success. These 5 types of targets were:

1. Capital ships.
2. Surface installations protected by at least 16 feet of reinforced concrete.
3. Underground installations.
4. Viaducts and heavy bridges.
5. Dams and canal dykes.

*Capital ships.*—The effectiveness of large bombs of the D. P. type against large naval targets cannot be over-emphasized. It has been proved that the employment of this weapon under good operational conditions will bring certain disaster to the most formidable vessels of any navy.

On 15 September 1944, the battleship *Tirpitz* was attacked off Tromso, Norway, with 14 "Tall Boy" bombs fuzed with 11-second detonators. No direct hits were accomplished, but an undetermined amount of damage from near misses caused the ship to be towed from anchorage. The second attack, on 29 October, failed because of the successful use of smoke obscure-

ment by the enemy. On 12 November, 33 "Tall Boys" were dropped near misses completely capsizing the ship and sinking her in a period of 8 minutes.

*Reinforced surface installations.*—Qualified success was encountered in the use of "Tall Boy" against this type of target. Three missions, carrying a total of 27 bombs, were sent against the U-boat pens at Brest in August 1944. The protective bulwarks were 1,200 feet long by 630 feet wide and carried a roof of 16-20 feet of reinforced concrete. Nine direct hits were scored; 5 penetrated partially and blew through the remainder of the roof; 4 made craters of various sizes, but did not result in complete perforation. Great material damage was achieved, but the target was not rendered completely inoperative.

Again, at Wizernes, France, a heavy concrete dome covering a "V" weapon underground installation and launching site was attacked with 32 "Tall Boys" in 2 missions. At least 2 near misses were scored, causing major subsidence of the quarry face and breaking loose large masses of the

**BIELEFELD VIADUCT.** This oblique photograph shows the destruction caused in the recent attack by Bomber Command in which "Tallboy" Deep Penetration bombs were used.





**VIEW OF CONCRETE DOME AT WIZERNES. REPORTEDLY LARGEST STRUCTURE OF ITS KIND IN EXISTENCE.**



*Note damage caused to dome supporting rib by near miss of 12,000 lb. "Tall boy" bomb.*

concrete burster slab. Tunnels were caved in at two locations, and other near misses destroyed large construction machinery and railroad installations.

Of the 14 targets attacked in this class, the effectiveness of "Tall Boy" against 8 could be classified as positive; against 5 doubtful; against at least 1 negative. It was substantially proved that "Tall Boy" would not penetrate 16 feet of reinforced concrete, but in several cases at least 20 feet was perforated by partial penetration and subsequent blow-through. Major damage resulted against structures of this type whenever the installation was within the crater radius of a near miss. This damage was invariably more effective than that caused by a direct hit.

*Underground installations.*—The use of "Tall Boy" against this type of installation was attended with unqualified success. At Marquise Mimoyecques, three tunnels 135 feet below ground

level were collapsed due to subsidence resulting from bomb hits on the surface. A direct hit on the concrete burster slab broke loose about 1,000 tons of concrete, which fell into an inclined shaft.

An attack was carried out against an underground railroad tunnel at Saumur France, with 19 "Tall Boy" bombs. One direct hit above the tunnel excavated about 16,000 cubic meters of soil and blocked the tunnel completely.

*Viaducts and heavy bridges.*—Against every target of this type, successful results were obtained. Typical of these missions was the strike against the railroad viaducts at Bielefeld. Thirty-two "Tall Boys" and one "Grand Slam" were dropped in two missions. No direct hits were scored but one near miss totally destroyed six spans, or about one-third of the viaduct.

*Dams and canal dykes.*—In the case of substantial size dams, such as were

located at Sorpe and the Urft, multiple hits with "Tall Boy" bombs were not sufficient to cause effective damage. The Kembs Dam and canal dykes, which are somewhat smaller than Sorpe and the Urft, were effectively destroyed or put out of action.

The conclusions drawn are that these bombs are excellent weapons for attack on capital ships, viaducts and bridges, underground installations, and small dams and canal dykes. Although less effective against heavily protected surface installations, nevertheless the damage caused is sufficient to warrant use of the bombs for that purpose even though complete destruction is not achieved. Against massive concrete dams of the largest

type, the bombs are not sufficiently effective; major damage, either from near misses or direct hits, is not accomplished.

Experiments have been conducted with American B-29 aircraft carrying one "Tall Boy" to determine its feasibility as an attack weapon against concrete-covered or underground Japanese installations. Although difficulties are encountered in loading these large bombs into the bay of the relatively low-slung B-29, the A. A. F. has nevertheless deemed the weapon of sufficient importance to initiate a heavy bomb program of its own. This program envisages the use of "Tall Boy" and "Grand Slam" in their present form and the development of other bombs of even greater size.

# ACKNOWLEDGMENTS

Barclay .....	5-28	6-2	Holsinger (rpt.) .....	6-1	6-18
Barclay .....	5-31	6-6	Horton .....	5-29	6-11
Barclay .....	6-11	6-14	Jennings .....	6-11	6-14
Barry .....	5-23	5-28	Jeter (rpt.) .....	6-5	6-6
Bartlett (rpt.) .....	6-4	6-11	Keating .....	5-22	5-28
Benoit (rpt.) .....	5-25	6-4	Keating .....	5-29	6-4
Benoit .....	5-29	6-7	Keating .....	6-2	6-8
Benoit .....	6-14	6-18	Keating .....	6-13	6-19
Berg (rpt.) .....	6-1	6-18	Lawler .....	5-22	5-28
Brady .....	5-14	5-25	Lewis (rpt.) .....	5-18	5-28
Brown, C. K (rpt.) .....	5-23	5-28	McKenna .....	5-10	6-4
Brown, H. E. (rpt.) .....	5-20	5-29	McAuliffe .....	6-6	6-9
Brown, C. K (rpt.) .....	5-25	5-31	Martin (rpt.) .....	6-5	6-12
Brubaker (rpt.) .....	5-22	5-28	Martin (rpt.) .....	6-8	6-19
Brubaker .....	6-1	6-4	Martz .....	6-14	6-20
Brubaker .....	6-8	6-11	Merriman .....	6-3	6-15
Brubaker .....	6-9	6-11	MilkT, J. (rpt) .....	5-21	6-1
Brubaker (rpt.) .....	6-6	6-12	Murphy, J .....	5-24	5-31
Bruggink .....	6-4	6-11	Murphy WO .....	6-1	6-20
Bruggink .....	5-31	6-12	Naffziger .....	5-6	6-4
Burt .....	5-24	5-29	Norris (rpt.) .....	5-11	5-28
Carlin (rpt.) .....	6-5	6-14	Norris (rpt.) .....	5-21	6-1
Carnahan .....	5-28	6-4	Norris (rpt.) .....	5-24	6-4
Carnahan .....	6-4	6-8	Norris (rpt.) .....		6-13
Carnahan .....	6-7	6-12	Patton, W. (rpt.) .....	5-11	5-28
Carnahan (rpt.) .....		6-19	Patton, W. (rpt.) .....	5-16	5-29
Carrigan (rpt.) .....	5-17	5-28	Patton (rpt.) .....	5-22	6-4
Carrigan (rpt.) .....	6-7	6-18	Patton (rpt.) .....	5-25	6-8
Conway .....	6-9	6-11	Porter .....	6-14	6-20
Conway (rpt.) .....	5-31	6-11	Rea .....	6-10	6-14
Conway .....	6-13	6-15	Roland .....	5-14	5-31
Conway .....	6-15	6-18	Rook .....	5-19	5-29
Davis .....	5-6	5-28	Rutherford .....	5-30	6-7
Davis (rpt.) .....	5-24	6-18	Sarkisian .....	5-23	5-25
Dawson (rpt.) .....		6-11	Sawyer (rpt.) .....	6-11	6-20
Dehnel (rpt.) .....	6-3	6-15	Seip .....	5-27	6-6
Faass .....	5-19	5-29	Spartz (rpt.) .....	6-1	6-14
Faass .....	5-22	5-31	Stitt .....	6-11	6-13
Faass .....	6-2	6-11	Sturken .....	5-17	5-25
Franklin .....	5-28	5-29	Sturken (rpt.) .....	5-31	6-11
Graham (rpt.) .....	5-31	6-8	Quint .....	6-4	6-19
Gray .....	4-23	6-9	Thorne (rpt.) .....	6-8	6-13
Hamilton (rpt.) .....	6-1	6-12	Tuttle .....	6-1	6-12
Hanson (rpt.) .....	5-11	5-28	Weinberg (rpt.) .....	5-3	5-24
Hanson (rpt.) .....	5-16	5-29	Whittemore .....	5-22	5-31
Hanson (rpt.) .....	5-22	6-4	Witte .....		6-13
Hanson (rpt.) .....	5-25	6-8	Witte .....	6-5	6-15
Hayes .....	6-1	6-8	Wright .....	5-21	6-4
Hemphill (rpt.) .....	5-29	6-4			

# 11103111 DUMP ( ACCIDENTS



Numerous accidents have occurred in the past due to improper handling of captured and U. S. ordnance in bomb dumps or central collecting areas.

This article is written with the intention of offering some explanation of these occurrences and suggesting preventative measures.

It has been found in various instances that for no apparent reason ammunition dumps, prepared for disposal at sea or shipment to rear areas, have suddenly exploded.

Excerpts from a letter written by Lt. Tom Carlin, USMC BDO, in which he gives some of the problems of bomb disposal encountered in the field, state that: "Pyrotechnics are another serious problem to men in the forward area. According to Lieutenant Lewis, BDO MAG 11, 90 percent of fires in bomb dumps are caused by improper handling of pyrotechnics. After a heavy rain, pyrotechnics will burst into flame for no apparent reason."

Another instance in which bomb disposal personnel were confronted with a like problem occurred during the invasion of Saipan. Various new pieces of Japanese ordnance had been collected for shipment to rear areas. Among these were three 250 kg. in-

incendiary bombs (Type 2 No. 25 Mk. 3 Model 1). For no apparent reason one of the bombs exploded and threw incendiary pellets, contained in the bomb, over an area 500 yards in diameter.

At first it was thought that the bomb had been set off by the enemy, as it occurred at night. But this theory was discarded for what seems to be a much more plausible answer. The Type 2 No. 25 Mk. 3 Model 1 bomb is filled with incendiary pellets contained in steel tubes. Surrounding these pellets and filling all voids is an ignition mixture of barium nitrate, aluminum powder, and a small percentage of oil. When barium nitrate becomes moist an exothermic reaction takes place in which barium oxide and free oxygen are formed with the liberation of heat. Any exothermic reaction is a progressive process with an increasing speed of reaction. Thus it is believed that due to this production of heat and a ready source of free oxygen, the aluminum powder is ignited spontaneously and in turn splits the bomb case and ignites the incendiary pellets.

It is almost impossible to keep ordnance completely free from moisture in areas which have such torrential rains as are experienced in the Pacific areas. However, if all shipping plugs

are screwed in securely and the ordnance placed in an area where drainage is good the danger of the filling becoming wet is markedly decreased.

Ordnance known to contain pyrotechnics or incendiary mixtures should always be stowed in an area separate from other explosives. It is also advisable to shade it from the direct rays of the sun as any increase in temperature tends to increase the speed of any chemical reaction which may be going on in the bomb. All Mk. 3 bombs should be handled and stored with care.

A captured document yields the following information on handling and stowage of the Type 99 Mk. 3 No. 3 Bomb Modif. 1. Since this bomb contains yellow phosphorus, observe the following precautions:

1. When loading and unloading the bomb be careful to avoid shock.



2. Do not expose the bomb to rain, dew or high temperature.



3. Store the bomb in a packing box in a special compartment free from other explosives and fire arms. Do not store it in any place where there is a high temperature.



4. When leakage of the yellow phosphorus is suspected, place the bomb in a container filled with water or well moistened sawdust, or dispose of in water.



5. Wear gloves in handling suspected leaky bombs.

Several accidents have also resulted from handling pyrotechnic ordnance

having parachutes attached. Uninformed personnel and souvenir hunters are the greatest offenders and should be warned to stay away from collection areas even though it may necessitate posting a guard. Declaring an area out of bounds is not enough.

In one recently reported case a large dump of Japanese "Frangible HCN Grenades," one of the most insidious of all chemical warfare gases, was looted for the boxes and metal containers in which the glass grenade is packed. In the process many grenades were broken, the gas was liberated and casualties resulted.

Photoflash bombs, parachute flares, self-projecting smoke grenades and incendiary grenades are all a common cause of fires and subsequent explosions in ammunition dumps. United States smoke and phosphorus grenades left behind by our advancing troops become damp and soon rust through the thin case. As soon as air strikes the filling the contents start to burn and in turn sets off any explosives near.

A little care during collection can avoid dangerous fires. In instances where smoke or phosphorus grenades are found unpacked and partly damaged, instant disposal is necessary, even though it may mean extra effort. If no other means of disposal is available, pulling the pins and throwing into a large body of water is a possible method.

The source of the following information is not known and the number of instances in which the described method of disposal has been used was not stated but the information is included for what value it may have.

In disposing of the U. S. 4-pound incendiary bomb AN—M50A1 (US B&F, p. 78)- the following procedure is reported to have been used. Single bombs removed from a cluster were dropped a short distance onto a hard surface and the incendiary mixture burned out harmlessly. However, possibly due to a chemical change in the initiating black powder, charge, a high order detonation sometimes

resulted. This explosion it is thought drove the incendiary charges downward onto the steel nose piece of the "bomb throwing the solid steel nose piece as much as 150 yards. Those rounds marked AN—M50XA, etc., should of course never be disposed of in this manner, as they contain an explosive charge in the nose, and the advisability of such a procedure is questionable in all cases. Several accidents have resulted from allowing uninformed personnel access to bomb and ammunition dumps in which scattered pieces of dangerous ordnance may be handled. Hand grenades with the safety pins pulled, fired projectiles, armed fuzes and igniters are all a potential danger in the hands of sight seeing, *souvenir-hunting persons.*



It is often impossible to obtain small boats at the times needed for rapid disposal at sea, and this of course necessitates stock piling of recovered ordnance until facilities are available. When possible, however, those pieces considered most dangerous should be disposed of as rapidly as recovered.

W. P. projectiles recovered with split cases should be handled with care to prevent contact with the bare skin and should be disposed of by dumping in water. It is often dangerous to blow W. P. projectiles in situ as portions of the filling may remain in the ground or on nearby objects and cause future damage and injury to personnel.

Captured document indicates that the Japanese 1-kg. practice bomb is also a dangerous piece of ordnance. Due to the fact that the case is made

of very thin steel the document warns against handling of damaged rounds. The bomb has a red phosphorous filling and damage to the case could easily allow enough air to enter to cause combustion. As is the case with all incendiary mixtures the bomb should be kept out of the direct rays of the sun.

Japanese Army projectiles with incendiary or smoke fillings should be handled with care. Under no circumstances should an Army projectile with a gray body be disassembled in the field by persons who are not completely familiar with the construction of the liquid phosphorus and gas filled rounds.

The so-called Japanese "Sound Shell" as well as all float lights and flares are initiated by removing a tear strip which allows moisture to enter. Once the tear strip is removed the item should be disposed of. A float light may appear small and harmless in itself but in the middle of a stock pile of high explosives it can and has caused a great deal of damage.

In summary it might be said that the following general rules will help to prevent some of the unexplained explosions in and around ammunition dumps.

1. Try to pick an area fairly remote from other activities.
2. If possible make use of natural shade.
3. Pick an area with good drainage especially for pyrotechnic and incendiary ordnance.
4. If possible post a guard on the area.
5. Keep all ordnance to be disposed of moving out for final disposal as rapidly as possible. This will call for planning and high pressure salesmanship as all vehicles, boats and equipment are at a premium in the early stages of an operation.
6. All ordnance to be shipped for intelligence purposes can be better protected by having it crated and covered in some manner.

# T82VT BOMB FUZE

This is an automatic aerial burst nose fuze of the general class designated as VT. It is designed to initiate detonation of the bomb on approach to the earth at heights to give effective fragmentation and blast damage to the target. Burst heights vary with the size of the bomb and the type of target but are more or less independent of altitude and air speed at time of release when above 5,000 feet. Following are average burst heights in feet obtained in common bombs when dropped from 10,000 feet at 200 miles per hour true air speed over average land with the T51E1 fuze. Accurate data on burst heights with the T82 are not available but will be slightly higher than these figures.

T51E1: AN-M30-60; AN-57-60; AN-M81-60; AN-M64-40; AN-M65-40; AN-M66-25.

This fuze is more sensitive to head-on approach to a target than the ring type and less sensitive to "passing objects." It can be used interchangeably in any bomb which takes the AN-M103 fuze when air burst is desired.

At the present stage of development, approximately 90 percent of the fuzes will function properly upon approach to the target and the remainder will either function spontaneously after arming but before approaching a target or will be inoperative.

This fuze has a minimum safe air travel of 3,600 feet which may be extended by use of the T2E1 delay arming device which clamps onto a bracket around the body of the fuze and

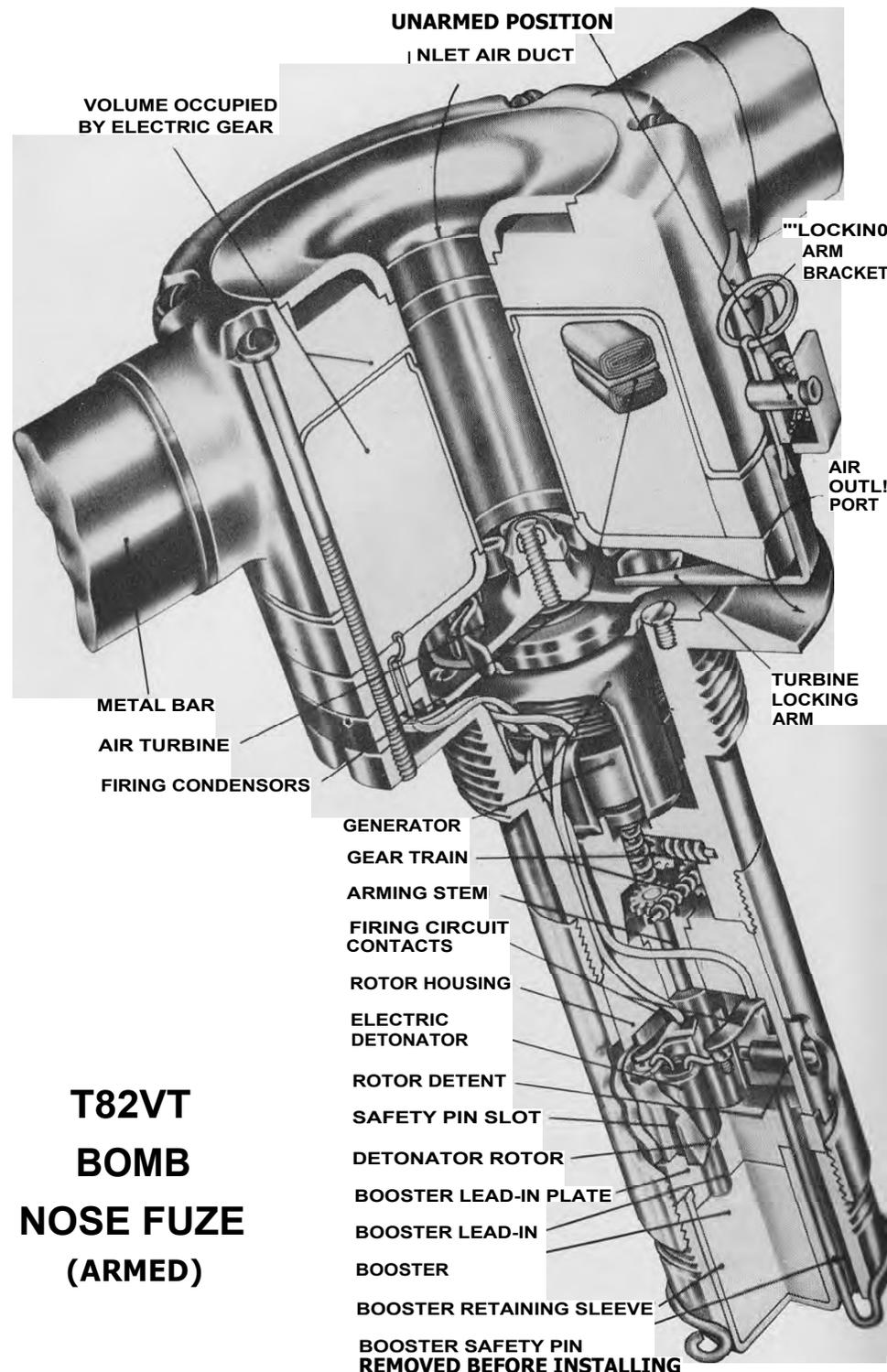
prevents the spring loaded turbine locking pin from jumping out and freeing the turbine until the present air travel of the T2E1 device has been completed.

The booster safety pin in this fuze locks the detonator rotor in the unarmed position. Before installation of the fuze in a bomb, the pin should be pulled and reinserted. If it cannot be reinserted, the fuze is armed or partially armed and should be destroyed.

When the bomb is dropped, the arming wire is pulled, releasing the spring loaded turbine locking pin which jumps out, freeing the turbine to rotate. The air stream enters the cavity in the fuze head, blows over the air turbine and leaves through the lower ports, around the turbine. The air turbine drives the electric generator mounted in the fuze stem and the gear reduction system. After a minimum number of turbine revolutions (3,600 feet minimum air travel), the detonator lines up with the booster lead-in and at the same time becomes electrically connected to the firing circuit.

If the fuze is complete or generally intact, it is safe to approach unless turbine is rotating at high speed. If wind velocity of more than 100 miles per hour is blowing directly into air entry ports, stop or deflect wind source before approaching. Fuze is safe to move or extract after turbine is secured against rotation by insertion of safety pin.

If the fuze is demolished except for portion in fuze well, it is completely safe to approach or move immediately.





# ORDNANCE

Although the following are not necessarily officially adopted terms, it is believed that they are correct as used by bomb disposal personnel.

## Definitions:

1. *Fuze*.—A fuze is a device used to function a bomb (projectile, mine, etc.) at the desired time and place.

2. *Conditions of a fuze*.—(a) *Unarmed or safe*.—A fuze is said to be unarmed when it is not in a condition to operate.

(b) *Armed*.—A fuze is armed when it is in a condition to operate.

(c) *Fired*.—A mechanical fuze is said to be in a fired condition when the firing pin is actually sticking in the primer or detonator.

NOTE.—This is a term usually used only by bomb disposal personnel to describe the condition of a dud.

(d) *Functioning*.—A long-delay (chemical action, clockwork, or shear wire) fuze is said to be functioning when the chemical action is taking place, the clock is running, or the wire is being sheared.

NOTE.—Short-delay or delay fuzes would be functioning while the delay train was burning.

3. *Arming time*.—The time from the instant the bomb is released until the fuze is in a condition to operate.

(a) *Expressed as follows:*

- (1) Feet of air travel.
- (2) Feet of water travel.
- (3) Seconds of fall.

(4) Number of revolutions of the vanes.

(5) Hydrostatic pressure.

4. *Free fall*.—The time of free fall is the time from the instant the fuze is in a condition to function until it starts to function.

5. *Delay time*.—The time from the instant the fuze starts to function until the bomb explodes.

(a) *Short delay*.—Under 1 second.

(b) *Delay*.—One second to 10 minutes. This an arbitrary figure sometimes given as 1 minute. Usually if the delay is incorporated in the fuze for the purpose of allowing the aircraft to clear the area safely, it is called a delay fuze to distinguish it from long-delay fuzes which have delays incorporated for various strategical and tactical purposes although actual functioning times may be nearly the same.

(c) *Long delay*.—Usual times—anything over 10 minutes (usually under 6 days).

(d) *Nondelay*.—A fuze which has no pyrotechnic delay but an inherent mechanical delay. These are found in inertia type tail fuzes.

6. *Firing pin*.—The point which actually impinges on the primer.

7. *Striker*.—The striker drives the firing pin into the primer. Firing pin and striker may be made of one piece.

8. *Anticreep spring*.—It is preferable to use the term anticreep spring in preference to the term creep spring for ordnance purposes.

# NOMENCLATURE

9. *Explosive train*.—The components of an explosive train can best be described by diagram. Note diagram below which shows a typical explosive train.

10. *Initiators*.—These are the explosives which initiate the explosive train. They are either primers or detonators.

11. *Primers*.—Primers ignite the explosive train and are designated sensitive, percussion, electric or friction primers.

(a) *Sensitive primers*.—If caused to explode by a sharp firing pin due to friction, it is a sensitive primer.

(b) *Percussion primer*.—If exploded by a blunt firing pin, it is designated a percussion primer.

(c) *Electric primer*.—Caused to explode by an electric current.

(d) *Friction primer*.—Caused to explode by ignition of a match composition.

12. *Detonators*.—Detonators initiate the explosive train by explosive shock. May be used without the primer in some instantaneous fuzes.

13. *Delay element*.—Usually a powder which burns evenly for a fixed time.

14. *Relay element*.—Term used to indicate a small amount of heat-sensitive explosive which is exploded by the burning of the delay and in turn sets off the detonator.

15. *Booster*.—These are powerful explosives which are sensitive to the explosive shock of the detonator. As the name indicates, its function is to increase the force of the detonator.

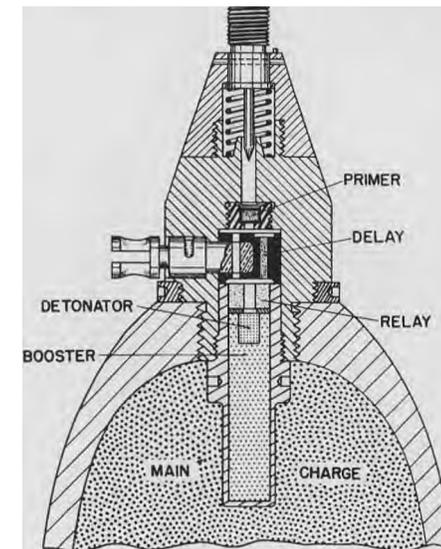
16. *Booster lead in*.—A pellet of explosive which is detonated by the detonator and which detonates the

booster. It is frequently of the same explosive mixture as the booster, but is a separate pellet from the booster.

17. *Lead out*.—Lead out is housed in the detonator carrier and serves the same function as the lead in. It is frequently called the detonator lead out and may detonate the lead in.

18. *Auxiliary booster*.—A booster which is enclosed in the bomb filling to assure a more powerful detonation.

19. *Gain*.—A gain is a container of explosives consisting of both a detonator and a booster (and sometimes containing the primer and delay elements as well) that is secured to the fuze.



Diagrammatic view showing components of explosive train.

# Attack on dap (a)

The extraction of this fuze, if in an armed condition, is believed inadvisable because of the inertia that might be applied to the movable striker and primer, thus causing the fuze to fire. The following attacks are therefore set forth in order of preference:

(1) Remove plug and extract striker and primer. This plug should be easily removed with a large screwdriver, even though it is slightly striced in the fuze. The stake usually encounters only the top thread of the plug and the threads are of a comparatively soft metal.

(2) Urea injection. In event the plug cannot be removed, urea is a positive means of immunizing the fuze. The urea fills the dome cavity, making it impossible for a flash from the primer to reach the delay element. It also completely fills the area between the striker and the primer, thus keeping them apart.

To inject urea, drill through the spanner hole directly above the plug until reaching the arming spindle hole. Thread in a self threading needle and proceed in the usual manner.



B-8(a) Tail Fuze.



— DANGEROUS

## JAPANESE WARNING SIGNS



TAKE CARE

LAND MINES  
HERE

DANGER

DON'T TOUCH