July 24, 1945

TB 9X-120

WAR DEPARTMENT TECHNICAL BULLETIN

Preliminary Instructions

VT FUZE T2004

War Department, Washington 25, D. C. • • 24 July 1945

1. SECURITY.

a. The classification of VT fuzes is set forth in letter, A.G. 471.82,(29 Nov 44), OB-S-B-M, dated 4 December 1944, extracts from which are listed in paragraph 11.

b. The utmost care will be taken to insure that the VT fuzes or information about the fuzes does not fall into enemy hands.

c. The dissemination of information concerning these fuzes will be held to a minimum. Information as to the contents or whereabouts of confidential matter will be disclosed only to those persons whose duties require such knowledge (Par. 11, 14, and 20, AR 380-5, March 1944).

2. GENERAL.

a. The VT fuze T2004 (Army), or Mk 172 Mod 0 (Navy), (Figs. 1, 2, and 9), is used for plane-to-ground firing of the 5" AR rocket (aircraft). This fuze is, in effect, an automatically-set time fuze. Without any field adjustment, it bursts on approach to earth, structures, materiel, and aircraft. Normally bursting occurs at distances between 10 and 40 feet from the target (see Fig. 3 and Par 3 d), causing greatest lethal fragmentation against personnel without top cover, such as men in foxholes and slit trenches, and gun crews on shipboard. (A more sensitive VT fuze, the T30, similar to the T2004 in other respects, is superior for plane-to-plane (anti-aircraft) use.)

b. The VT fuze T2004 is issued complete, packed separately and ready for assembly to the 5" AR rocket as an alternate type for the rocket nose impact fuze Mk 149. The VT fuze T2004 requires the 5" Mk 1 Mod 1 rocket head with a 2" thread and deep cavity (1.65" x 5.13"), which is special and differs from the 5" Mk 1 Mod 0 rocket head with 1.7" thread and conventional booster, used with the rocket nose impact fuze Mk 149.

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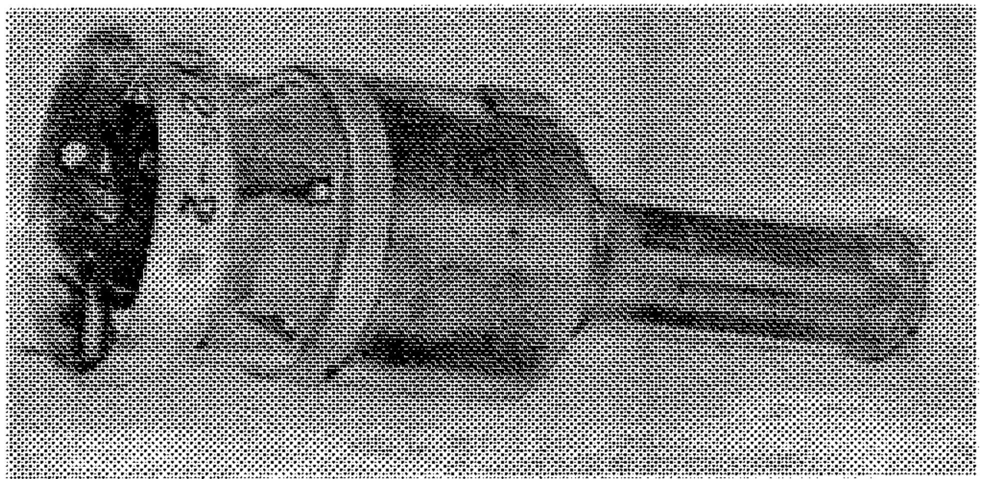

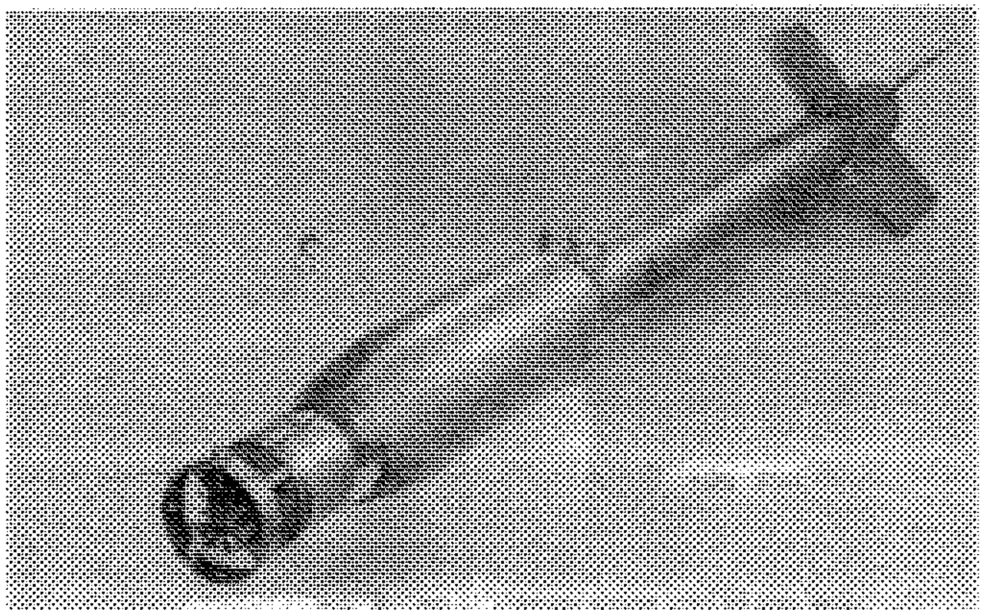

NOTE: The following two ammunition items are ballistically interchangeable.

5" AR rocket consisting of: and	5" AR rocket consisting of:
3.25" rocket motor Mk 7 Mod 0 Navy 5" Mk 1 Mod 1 rocket head VT fuze T2004	3.25" rocket motor Mk 7 Mod 0 Navy 5" Mk 1 Mod 0 rocket head Rocket nose impact fuze Mk 149

c. Complete nomenclature is as follows:

Army . . . . FUZE, VT, T2004
Navy . . . . FUZE (VT rocket), Mk 172 Mod 0

3. CHARACTERISTICS. - The VT fuze T2004 functions automatically due to the proximity of the target, rather than by impact or time action, thereby causing an air burst to occur at a height determined by the fuze mechanism. No fuze setting is required. The fuze may be used either day or night and is not affected by clouds, fog, snow, or light rain. Normal fuze operation may be expected at temperatures between -65° F. and +165° F., provided rocket limitations are not exceeded.

a. Safety and arming - Both mechanical and electrical safety measures are embodied in the VT fuze T2004 (Fig. 9). Safety is provided by:

(1) An interrupted detonator-explosive train, which is safe against dropping and rough handling after the arming wire has been withdrawn, and until the train is alined at completion of acceleration through the combined effect of acceleration and air travel.

(2) An electrical delay system, initiated upon completion of acceleration and closure of firing circuit, which provides detonator safety for an additional period of time (normally 0.6 to 1.2 seconds).

(3) A setback weight in the gear mechanism, operation of which requires approximately 300 feet of air travel under a minimum acceleration of 10g. The setback weight, actuated under proper acceleration, allows the arming shaft to rotate. If this air travel is experienced without the required acceleration, the fuze will become a dud upon subsequent normal firing. Safety is not impaired.

b. Visible indications attesting mechanical safety - Various visible indications which will attest the mechanical safety of the VT fuze T2004 are:

(1) The presence of a car seal installed at the loading plant to insure that the arming vane has not been rotated or tampered with subsequent to loading and prior to use.

(2) A vane locking pin held in place by the arming wire until the moment of firing.

(3) A safety pin inserted alongside the booster cup indicates safe position of the detonator rotor. The pin extends through the tetryl lead plate and into the rotor. Since a failure of the arming shaft restraining devices would allow the spring loaded shaft to turn into the armed position, the safety pin should be removed and reinserted and removed again, as instructions on the safety pin tag indicate. (If safety pin will not insert easily, reject and destroy the fuze.)

[redacted]

c. Burst heights - The burst height of the VT fuze T2004 in the 5" AR rocket varies with dive angle and terrain characteristics; as a result of manufacturing tolerances, there will be some variation in burst height between different fuzes for fixed dive angle and terrain conditions.

(1) The variation of average burst height with dive angle is shown graphically in figure 3. This curve is for approach to average terrain.

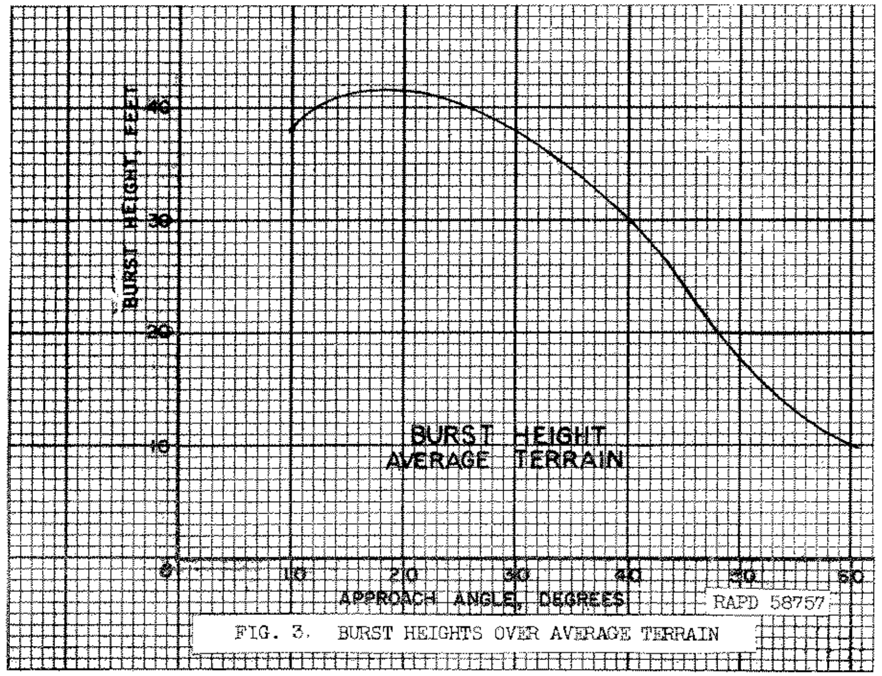

FIG. 3. BURST HEIGHTS OVER AVERAGE TERRAIN

(2) Soil conditions will cause deviations from values of average height plotted in figure 3. Burst heights will be increased for a given angle over wet soil, metal fragments or water and will be decreased on approach to dry soil. As an example, at 30 degrees, burst height may average 20 feet over dry soil and 60 feet over wet soil or ground littered with metal fragments.

(3) Terrain irregularities, such as trees, crests, streams, and material objects will normally cause a fuze function at slightly greater heights than would occur over uniform terrain. Irregularities in terrain will cause unpredictable burst heights at low angles of approach.

d. Range dispersion - Figures 4 and 5 illustrate the manner in which burst height and approach angle affect range dispersion. Dispersion is small at approach angles greater than 30 degrees but increases greatly at angles below 30 degrees.

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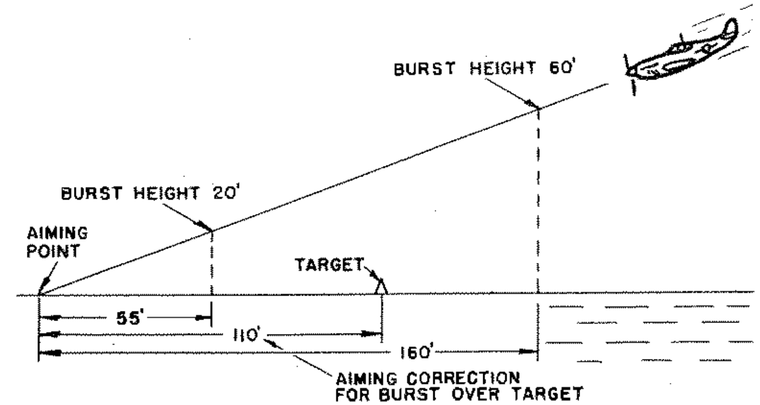

FIGURE 4. EFFECT OF VARIATION IN BURST HEIGHT ON RANGE DISPERSION, WITH 20° DIVE ANGLE.

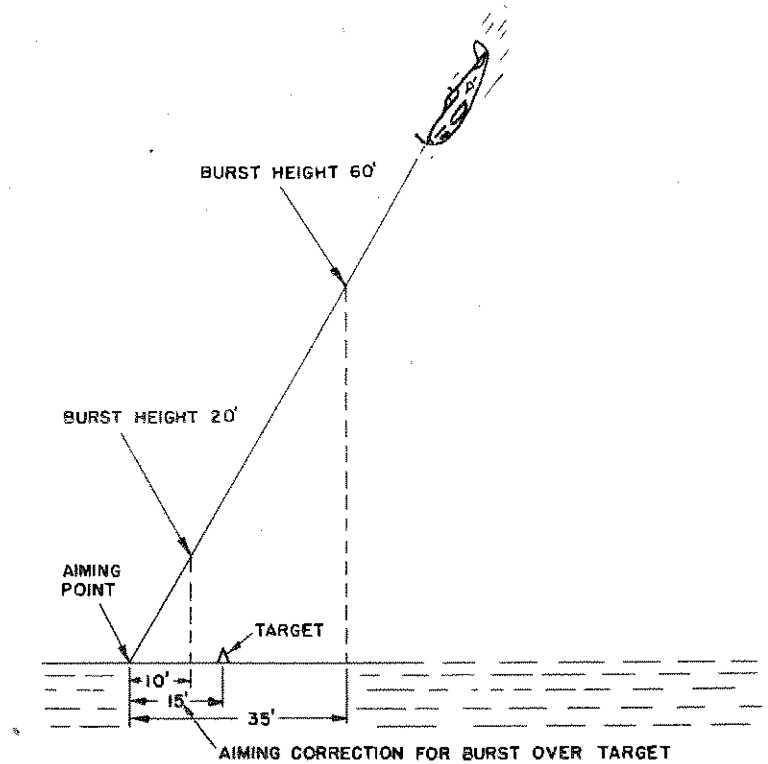

FIGURE 5. EFFECT OF VARIATION IN BURST HEIGHT ON RANGE DISPERSION, WITH 60° DIVE ANGLE.

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e. Leading the target - Leading the target is a method of aiming a rocket ahead of the target so that it is directly over the target when it functions (see Figs. 4, 5, and 6). The correct distance to lead a target (aiming correction), in order to place the most fragments on it is shown graphically in figure 6.

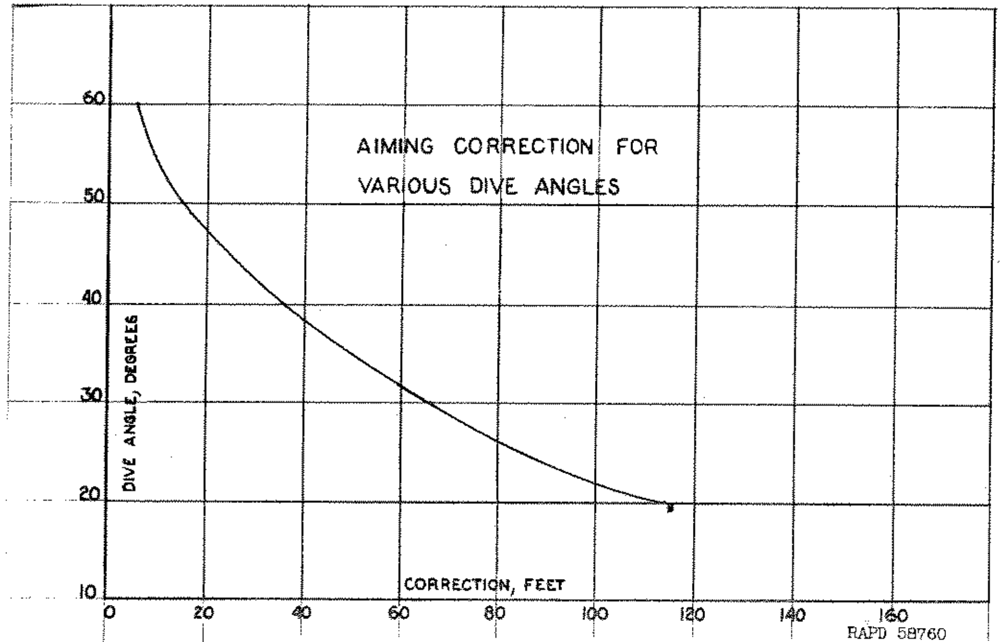

FIG. 6. AIMING CORRECTION FOR VARIOUS DIVE ANGLES

f. Angle of approach - It is recommended that the dive angle be as steep as practicable, preferably above 30 degrees, when using the VT fuze T2004.

g. Reliability - Approximately 85 percent of the VT fuzes T2004 may be expected to function effectively at the target.

h. Malfunctions - The 15 percent malfunctions occurring in the use of the fuze may be due to:

(1) "Early" function - Detonation after arming has been completed but prior to the approach to the target, or other object.

(2) Dud - A failure to function. VT fuze duds will be partially compensated for by operation of the base fuze in the rocket head.

i. Minimum release range - An electrical delay is incorporated in this fuze, of such value that the earliest possible "early" function (as defined above), will occur with enough separation between the rocket and plane to present no hazard to the plane or pilot. Minimum release range is defined as the minimum distance, between plane and ground target at the instant of rocket release, required to

insure that overall (mechanical and electrical) arming is completed before arrival of the rocket at the target (Fig. 7). The minimum release range will vary with plane speed and rocket temperature, and is shown graphically in figure 8.

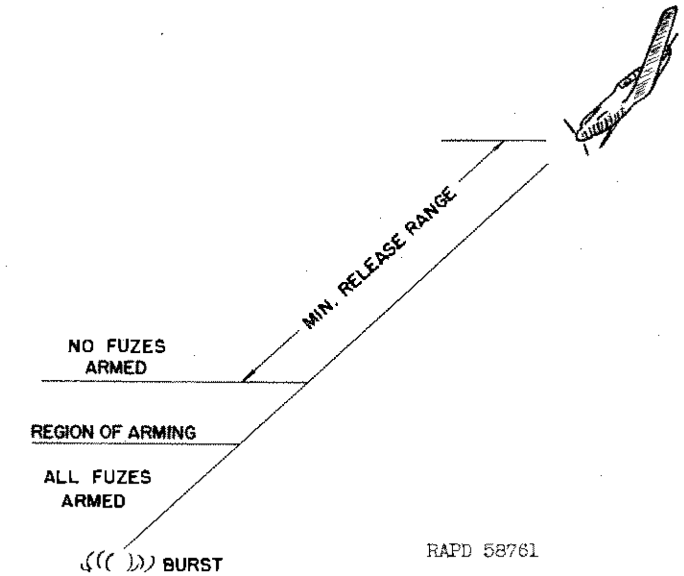

FIGURE 7-MIN. RELEASE RANGE-ARMING ZONE

4. OPERATION

a. Normal operation - The VT fuze T2004 is an electromagnetic fuze supplied with energy from a high-speed generator (see Fig. 9). The generator is driven by a metal vane which also drives an arming shaft (and detonator rotor carrying the electric detonator), by means of a system of reduction gears during the first few degrees of approach toward the alined position. After approximately 300 feet of air travel under a minimum acceleration of 10g, a gear sector on the arming shaft is freed from the reduction gear system. A pawl on the setback weight interferes with the sector as long as this minimum acceleration exists. Upon cessation of acceleration, the interference by the pawl is removed and the shaft and rotor spring into the armed position. At this instant, the firing circuit is closed. The electrical delay is initiated and energy is stored in a condenser, which under conditions existing when approaching a target, is released through the electric detonator, starting the explosive train sequence.

b. Released safe - When a VT fuze T2004 is released safe, the arming wire is disengaged from the plane and travels with the rocket. Since the arming wire does not release the vane locking pin, the metal vane is prevented from turning and the fuze travels in an unarmed position, allowing operation of the base fuze on impact.

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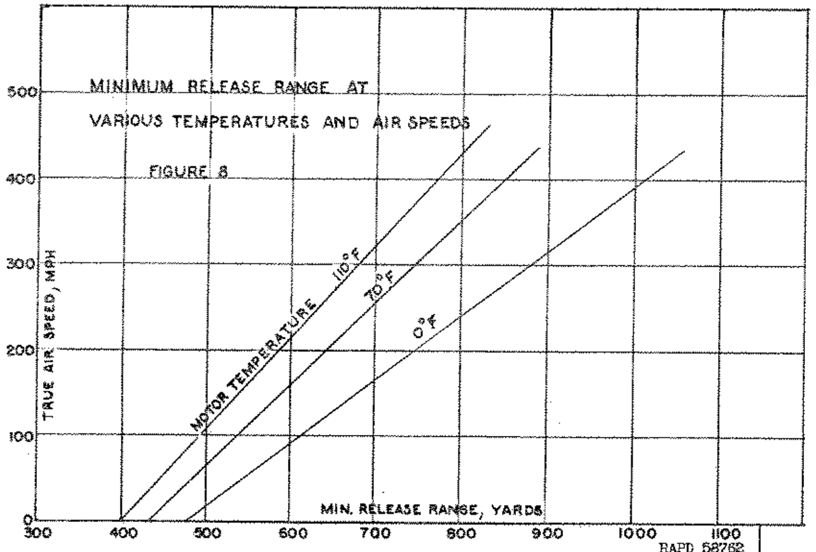

FIG. 8. MINIMUM RELEASE RANGE AT VARIOUS TEMPERATURES AND AIR SPEEDS

5. ASSEMBLY OF VT FUZE T2004 TO ROCKET.

a. Remove the fuze from its container and inspect for broken seal or defects such as bent arming vane, loose parts, dents, etc.

b. Inspect the rocket assembly. See that the fuze well is free of dirt, rust, or other foreign material. See that the head, motor, and fins are tight. Do not use rockets with bent or damaged fins.

c. Remove the rear safety pin from the booster cup (refer to instruction tag), and check to see that the pin is not bent or sheared. Reinsert the safety pin to check the unarmed position of the interrupter rotor. If the safety pin does not insert easily, reject the fuze and destroy it. Remove the safety pin again and retain it, since in case the round is to be disassembled, the pin will be required.

d. Install the fuze, wrench-tight in the nose cavity of the rocket head, using the T4 special wrench (fig. 10) packed in each box of fuzes.

e. Remove the seal wire from the vane locking pin. If it is necessary to realine the vane locking pin to insert the arming wire properly, with respect to the launcher, remove the cotter pin from the vane locking pin and install the locking pin in any one of four holes on the nose ring of the fuze.

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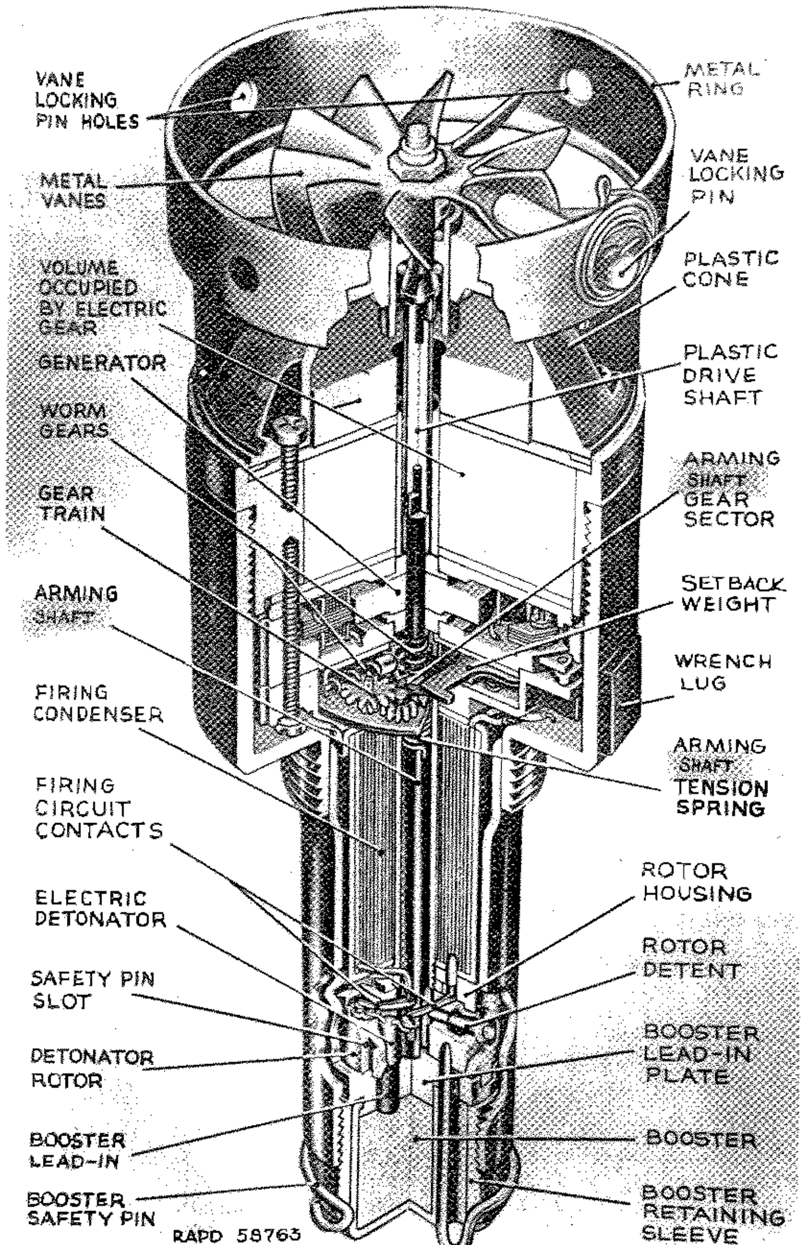

NOTE: THE BOOSTER SAFETY PIN CANNOT BE IN POSITION WHEN THE ROTOR IS IN THE POSITION SHOWN. THE SAFETY PIN IS SHOWN FOR COMPLETENESS ONLY.

FIG. 9. CUTAWAY DRAWING OF FUZE, VT, T2004, WITH DETONATOR ROTOR IN ARMED POSITION.

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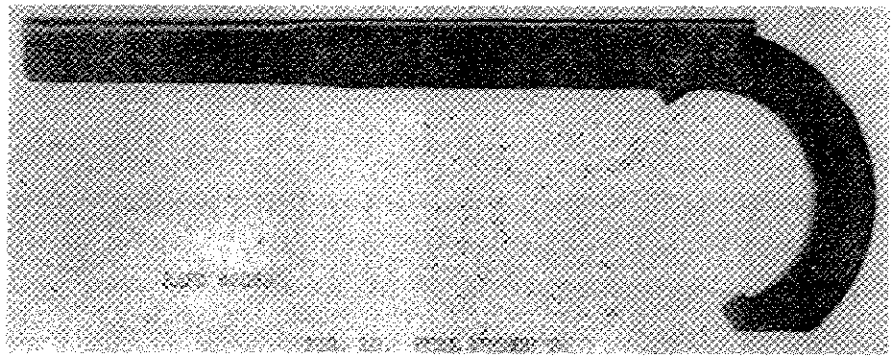
f. Install the arming wire through the hole from which the seal wire was removed (The hole inside, nearest the arming vane, (Fig. 11). Pull the arming wire through the hole until it extends three to four inches beyond the fuze; then remove the cotter pin from the vane locking pin, allowing the arming wire to hold the vane locking pin in place. Do not use Fahnestock clips with these fuzes.



6. DISASSEMBLY PROCEDURE. - If use of the fuzed rocket is not likely for 48 hours, the fuze should be removed as follows:

a. Replace the cotter pin in the hole nearest the head of the vane locking pin. If necessary, press in on the head of the vane locking pin to expose the hole. Remove the arming wire.

b. Remove the fuze from the rocket head, using the special wrench, T4. An unarmed fuze cannot fire and is entirely safe to handle and remove from rockets.

c. Replace the safety pin in the booster cup. If the pin will not easily insert, destroy the fuze.

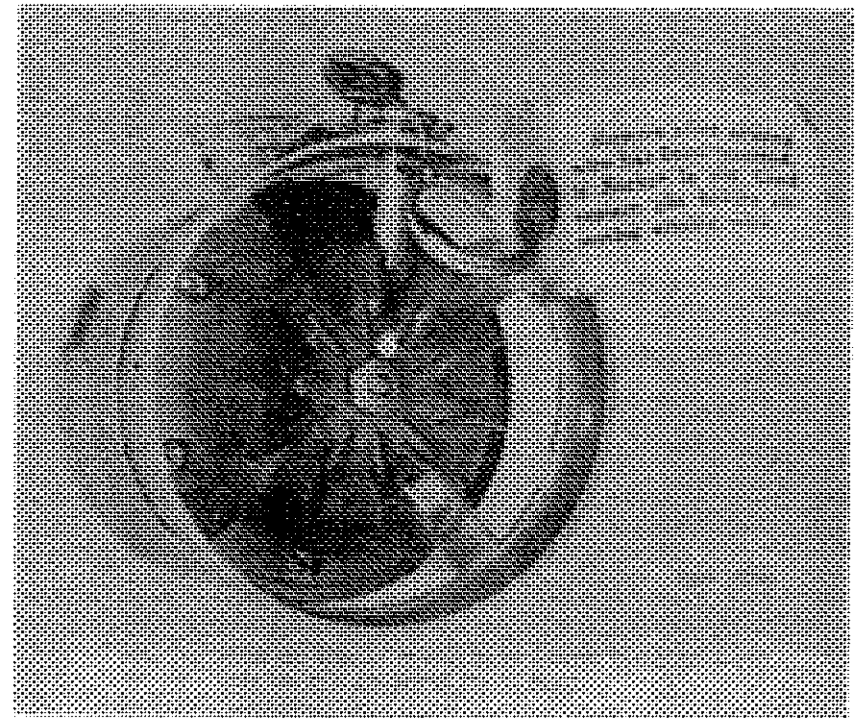
d. Replace the fuze in its shipping can and seal the lid of the can with friction tape.

7. STORAGE AND HANDLING.

a. Packaged fuzes - Fuzes may be stored for extended periods of time and are not adversely affected by temperatures between -40° F. and 140° F., when in the original containers and if unopened.

b. Unpackaged fuzes - Exposure to high humidity atmosphere tends to deteriorate unpackaged fuzes. Fuzes should be unpacked only in quantity sufficient to meet the immediate need. Fuzes which are not to be used within 48 hours should be returned to storage, repacked in their original containers with the lids taped securely. Such fuzes should be used first before opening sealed containers.

c. Handling - VT fuzes T2004, as originally packed, may be subjected to the same handling as other fuzes, but with proper regard to security (see Par. 11). Dropping will not normally



damage a packaged fuze, but dropping may damage an unpackaged fuze. Rough or abusive handling of the fuzes may tend to increase malfunctions but will not decrease the safety of the fuze. Damaged fuzes should be destroyed.

8. PACKING AND MARKING - VT fuzes T2004 are packed in hermetically sealed cans. Nine such cans are packed per wooden box. A special fuze wrench is packed in each box to be used in assembly and disassembly of the fuze to the rocket head.

a. Packing data -

Fuze weight	4.5	lbs.
Overall diameter of fuze.	3.4	ins.
Overall length of fuze.	10.4	ins.
Length of fuze extending beyond fuze well . .	5.0	ins.
Number of fuzes in box	9	
Weight of box	77	lbs.
Dimensions of box . . . . . . 14 x 15 27/32 x 15 1/2		ins.
Volume of box	2	cu. ft.
A. I. C. symbol	S9IJA	

b. Packaging - Fuzes are supported within their respective metal containers (Fig. 12), by rubber, plastic, and metal mountings. These mountings should be removed from the fuze before assembling it to a rocket projectile.

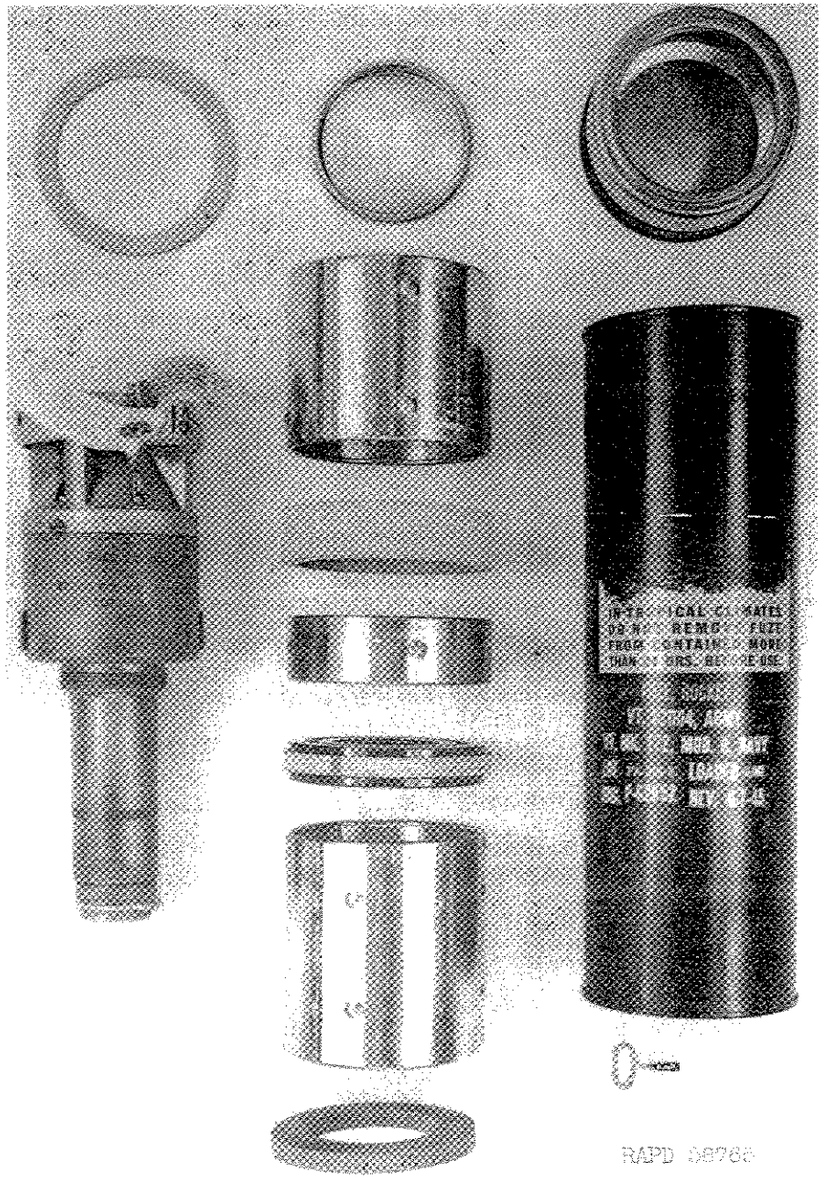


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FIG. 12. CONTAINER FOR VT FUZE T200M SHOWING MEANS BY WHICH FUZE IS RESILIENTLY SUPPORTED

c. Marking -

(1) Each packing box (Fig. 13), is stamped with complete nomenclature, number of fuzes, lot number, date loaded, weight, cubage, and shipping data.

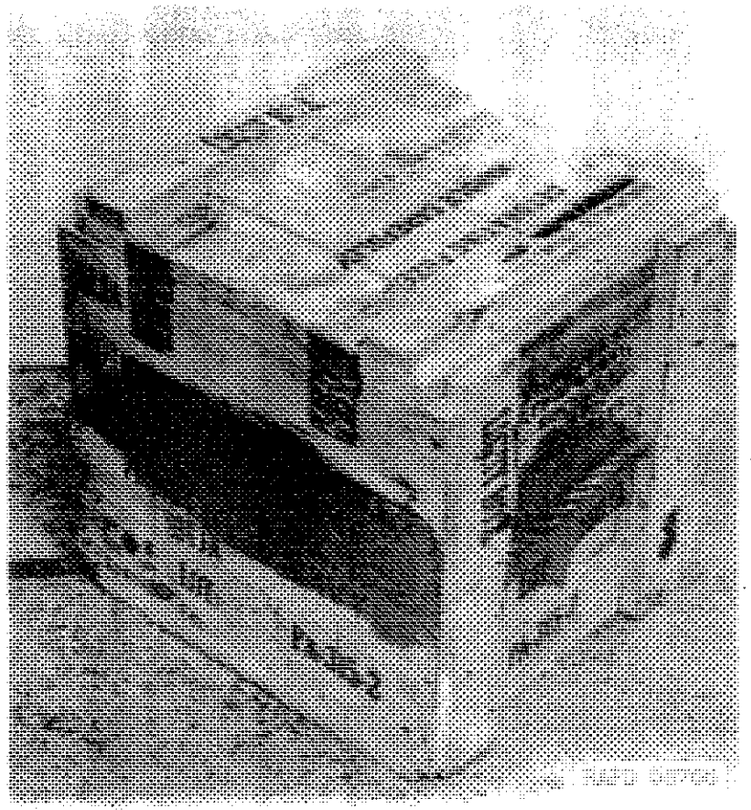

FIG. 13. PACKING BOX FOR VT FUZE T200

(2) Each fuze and container is stamped with complete nomenclature, lot number, and date of loading. Instruction tags are attached to the vane locking cotter pin, the sealing wire, and the safety pin through the booster cup.

9. DESTRUCTION. - In the event that destruction of ammunition and ordnance materiel becomes necessary, VT fuzes should be given as high a priority in order of destruction as possible, since it is believed that the enemy is not cognizant of this fuze. General procedures for destruction of ammunition are given in TM 9-1900. The following methods are recommended for destruction of VT rocket fuzes and literature pertaining to them.

a. Fuzes and fuze components -

(1) Individual cans or components may be disposed of by dropping them in permanent bodies of water at locations where water is at least 20 feet deep. Before disposal in this manner, all cans containing fuzes must be punctured.

(2) Fuzes and components may also be destroyed by use of explosives. Open a box of fuzes and remove one near the center. Insert a one-pound block of TNT with 5 feet of time fuze attached. Replace the fuze and then detonate after seeking cover behind a suitable barricade. Electric detonation may be used, in which case all boxes of fuzes should be prepared and detonated simultaneously.

b. Literature - Tear all instruction cards, pamphlets, bulletins, ammunition data cards, etc., to pieces. Soak in gasoline and burn.

10. DUD DISPOSAL.

a. A VT fuze T2004 will not fire unless the vane is turning rapidly (2,000 rpm. or more), even though the fuze is armed. An armed VT fuze T2004 which has been damaged while the vane was turning at high speed is dangerous and should not be handled until after 60 minutes with the vane at rest have elapsed. Before the expiration of 60 minutes, the fuze may be sensitive to shock, jar, or approach.

b. Dud disposal should never be attempted by unauthorized personnel.

11. SECURITY CLASSIFICATIONS.- It is particularly desirable that there be no publicity whatsoever regarding this equipment. AG letter 471.82 (29 Nov 44), OB-S-B-M, dated 4 December 1944, quoted in part below, gives the following security classifications regarding VT fuzes T2004:

a. Equipment for stockpiling and operational use . . . . RESTRICTED

b. Operational information and instructions, including technical documents and manuals . . . . . . CONFIDENTIAL

c. Transportation, handling and stowage within the United States . . . . CONFIDENTIAL

d. Technical information including diagrams, specifications, etc. . SECRET

* * * * * * *

e. Publication of information except as provided in paragraph b above, including reports on operational use and effectiveness . . . . SECRET

[A. G. 300.5 (24 Jul 1945)]

By order of the Secretary of War:

G. C. MARSHALL,
Chief of Staff

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EDWARD F. WITSELL
Major General
Acting The Adjutant General

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