TM 9-1980-AFM 136-7

This manual supersedes TM 9-1980, 15 November 1944; TB 9-1980-28, 10 July 1944; TB 9-1980-29, 15 July 1944; TB 9-1980-30, 22 July 1944; TB 9-1980-33, 22 September 1944; TB 9-1980-35, 4 January 1945; TB 9-1980-36, 7 February 1945; TB 9-1980-38, 19 February 1945; TB 9-1980-39, 21 February 1945; TB 9-1980-41, 22 February 1945; TB 9-1980-45, 20 March 1945; TB 9-1980-47, 5 April 1945; TB 9-1980-48, 11 April 1945; TB 9-1980-49, 24 April 1945; TB 9-1980-50, 7 May 1945; TB 9-1980-52, 19 May 1945; TB 9-1980-53, 29 May 1945; and TB 9-1980-54, 6 June 1945.

BOMBS FOR AIRCRAFT

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CONTENTS.

This manual supersedes TM 9–1980, 15 November 1944; TB 9–1980–28, 10 July 1944; TB 9–1980–29, 15 July 1944; TB 9–1980–30, 22 July 1944; TB 9–1980–33, 22 September 1944; TB 9–1980–35, 4 January 1945; TB 9–1980–36, 7 February 1945; TB 9–1980–38, 19 February 1945; TB 9–1980–39, 21 February 1945; TB 9–1980–41, 22 February 1945; TB 9–1980–45, 26 March 1945; TB 9–1980–47, 5 April 1945; TB 9–1980–48, 11 April 1945; TB 9–1980–49, 24 April 1945; TB 9–1980–50, 7 May 1945; TB 9–1980–52, 19 May 1945; TB 9–1980–53, 29 May 1945; and TB 9–1980–54, 6 June 1945

CHAPTER 1
INTRODUCTION

1. Purpose

The purpose of this manual is to supply such information of a technical nature concerning aircraft bombs as may be necessary for their proper care, handling, identification, and use, and to supply a convenient source of reference data.

2. Scope

a. The bombs and components described herein comprise those procured and issued by the Ordnance Corps (this includes bombs and components of Navy design which are assigned an "AN" model designation). Data on chemical and Navy designed bombs and components may be found in pertinent Department of the Army and Department of the Navy publications, respectively (see app. I).

b. Basic definitions, description, and procedures are given in the first three chapters. General information, such as is common to all bombs is given in chapter 4. The subsequent chapters give detailed description of particular components and models.

c. Appendix I lists references to pertinent publications.

d. Appendix II includes tables of data pertaining to arming wires, fuzes, bombs and clusters, fin and fin lock nuts, and fuze seat dimensions. Complete round data, that is, authorized combinations of bombs and components are presented in tabular form in chapter 6.

3. Extent of Revision

This revision differs from TM 9–1980, 15 November 1944 in the following respects:

[redacted]

a. DELETIONS. Data pertaining to chemical bombs and components (except for components serving identically for ordnance procured bombs) have been deleted since the procurement and issue of these items have been made the responsibility of the Chemical Corps. Tables of data pertaining to typical bomb targets and packing and shipping have been deleted since such information is available in other publications; for typical bomb targets and the selection of bombs and fuzes, see FM 1–110; for packing and shipping data, see Department of the Army Supply Catalogs in the ORD 11 series. In addition, the following have been discontinued or classified as obsolete and have been deleted:

BOMBS AND CLUSTERS

BOMB, armor-piercing, M52, M52A1, M61, M62, M62A1, M62A2, and M63.
BOMB, depth, AN–Mk 17, AN–Mk 29, AN–Mk 37, AN–Mk 38, AN–Mk 41, AN–Mk 44, and AN–Mk 47.
CLUSTER, fragmentation bomb, M1.
CLUSTER, practice bomb, M2 and M2A1.

COMPONENTS

ADAPTER, cluster, M1, M4, M5, M6, M7 (the M4, M5, M6, and M7 are used for clusters of chemical bombs).
EXTENSION, fuze, M1, all lengths.
FUZE, bomb, nose, mechanical time, M127, M128, M135, M135A1, M136, M136A1, and M138.
FUZE, bomb, nose, AN–M104.
FUZE, bomb, nose, M126 and AN–M126A1 (for use with chemical bombs).
FUZE, bomb, tail, M106, M106A1, M121, M122, and Mk 229.
FUZE, bomb, hydrostatic (transverse), AN–Mk 224 and AN–Mk 234.

b. REVISIONS. Where necessary, information on fuzes, bombs, cluster adapters, and clusters has been revised and brought up to date.

c. ADDITIONS. Information on destruction of bombs and bomb components to prevent enemy use has been included and also tables of data on fin assemblies and fin lock nuts and fuze seat dimensions. In addition, data pertaining to the following have also been added:

BOMBS AND CLUSTERS

ADAPTER-BOOSTER, M117.
BOMB, depth, 350-lb, AN-Mk 54 Mod 0 and Mod 1.
BOMB, fragmentation, 120-lb, M86.

BOMB, GP, 12,000-lb, M109 (T10), and components.
BOMB, GP, 12,000-lb, M112.
BOMB, GP, 22,000-lb, M110 (T14), and components.
BOMB, GP, 44,000-lb, T12.
BOMB, SAP, 2,000-lb, M103 (T7).
BOMB, SAP, 25,000-lb, T28E4.
BOMB, TI, 100-lb, M84A1.
BOMB, TI, 250-lb, M89, M90, M91, M98, and M100.
CLUSTER, fragmentation bomb, 100-lb, M28 series and 500-lb, M29 series.
CLUSTER, fragmentation bomb, M26.
Clusters employing hook and cable adapters.
DEVICES, antiricochet, M16 and M17.
KIT, conversion, for 20-lb fragmentation bombs.

COMPONENTS

FIN ASSEMBLY, M120, M121, M123, and M124.
FUZE, bomb, mechanical time, M144, AN–M145, AN–M146, M147, M152, M153, and M155.
FUZE, bomb, nose, AN–M103A1, M139, M139A1, M140, M140A1, M163, M164, M165, M170, and M171.
FUZE, bomb nose, VT, AN–M166 and AN-M168.
FUZE, bomb, tail, M160, M161, and M162.
NUT, fin lock, M1, M2, and M3.
PRIMER-DETONATOR, M14, 0.24-SEC DELAY.

MISCELLANEOUS

Data pertaining to standard bomb fillers and current modifications of bombs and components.
Model designations for fin assemblies and arming wire assemblies.

4. The Bomb

a. DEFINITION. A bomb is a particular kind of ammunition which is designed to be dropped from an airplane in flight to inflict damage on the enemy. It usually consists of a metal container filled with explosives or chemicals, a device for stabilizing its flight so that it can be aimed accurately, a mechanism for exploding the bomb at the target, and such safety devices as may be necessary to make it reasonably safe to carry. The metal container, called the bomb body (figs. 7 to 9), is usually streamlined with a rounded (ogival) nose and a tapered tail. The stabilizing device (fig. 3) is attached to the tail end of the body and generally consists of a sheet metal fin assembly, although a parachute or cloth streamers may be used. The mechanism for exploding the charge is called a

fuze (figs. 10 to 17) and is generally placed in the nose or in the tail end of the body. Two or more fuzes are occasionally used in the same bomb for different effects, for flexibility in use, or to insure reliability of functioning—that is, should one fuze malfunction, the other will cause the bomb to explode. The safety devices are usually built into the fuze and are held in place during storage and shipment by seal wires or cotter pins. When the bomb is prepared for use, the seal wire and cotter pins are replaced by an arming wire which is not removed till the bomb is dropped.

b. REPRESENTATIVE TYPES AND SIZES. Figures 1 and 2 illustrate various types of bombs and their comparative sizes. The following legend is keyed alphabetically to figures 1 and 2 to aid in identifying the different bombs shown therein:

A—BOMB, depth, TNT, 350-lb, AN–Mk 54 Mod 1.
B—BOMB, gas, HD, 115-lb, M70A1.
C—BOMB, photoflash, 100-lb, AN–M46 (M46).
D—BOMB, smoke, PWP, 100-lb. AN–M47A4.
E—BOMB, practice, 100-lb, M38A2.
F—BOMB, GP, tritonal, 250-lb, AN–M57A1.
G—BOMB, GP, TNT, 100-lb, AN–M30A1.
H—BOMB, fragmentation, TNT, 23-lb, M72A1.
I—BOMB, fragmentation, TNT, 20-lb, AN–M41A1.
J—BOMB, incendiary, 4-lb, AN–M50A2.
K—BOMB, fragmentation, TNT, 4-lb, M83.
L—BOMB, practice, miniature, 3-lb, Mk 23.
M—CLUSTER, fragmentation bomb, M28A2 (100-lb size).
N—BOMB, SAP, picratol, 500-lb, AN–M58A2.
O—BOMB, incendiary, 500-lb, AN–M76.
P—BOMB, gas, 1,000-lb, AN–M79.
Q—BOMB, SAP, picratol, 1,000-lb, AN–M59A1.
R—BOMB, AP, Exp D, 1,000-lb, AN–Mk 33.
S—BOMB, AP, Exp D, 1,600-lb, AN–Mk 1.
T—BOMB, GP, tritonal, 2,000-lb, AN–M66A2.
U—BOMB, LC, TNT, 4,000-lb, M56A2 (AN-M56A2).
V—BOMB, GP, tritonal, 12,000-lb, M109 (T10).
W—BOMB, GP, tritonal, 22,000-lb, M110 (T14).
X—BOMB, GP, tritonal, 44,000-lb, T12.

5. Release

The bomb is carried in a rack in the airplane's bomb bay by means of a shackle (fig. 4). Hooks on the shackle engage suspension lugs attached to the bomb body. The loop of an arming wire is attached to a separate hook (pawl) at the center of the shackle. The free ends of the arming wire are passed through safety devices in the fuze thus maintaining the fuzes in a safe (unarmed) condi-

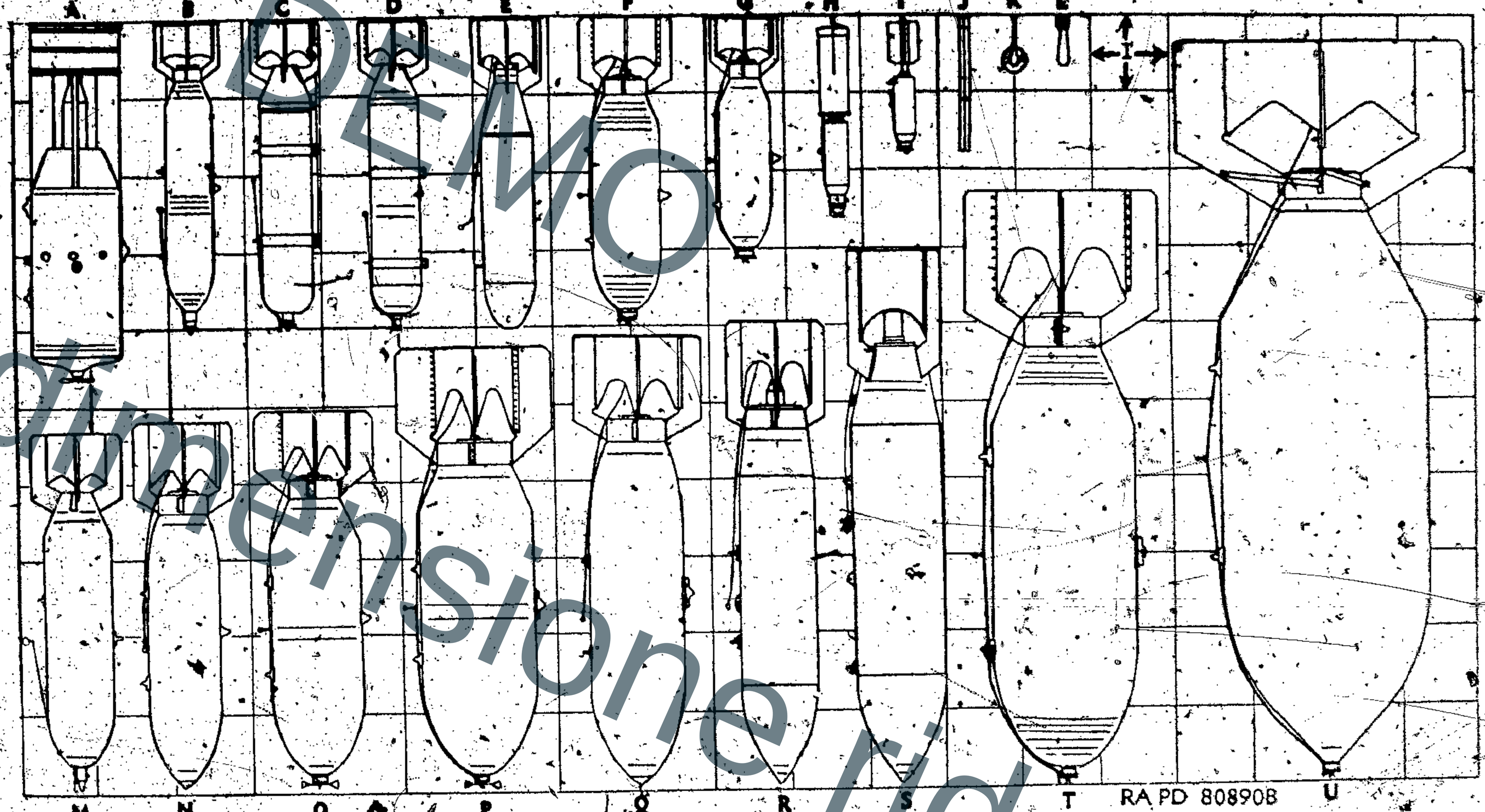


Figure 1. Bombs, representative types.

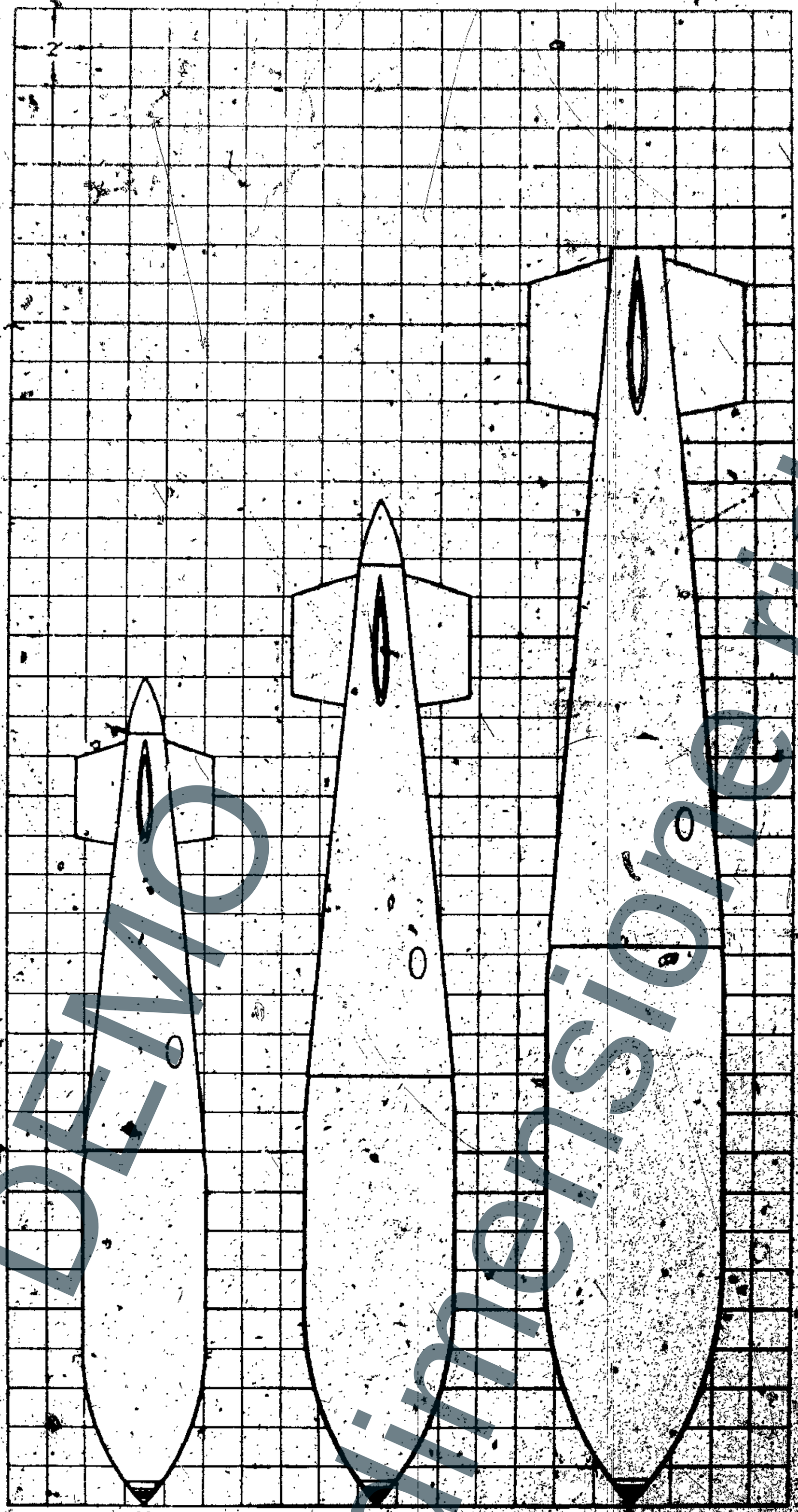


Figure 2. Bombs, representative types—Continued

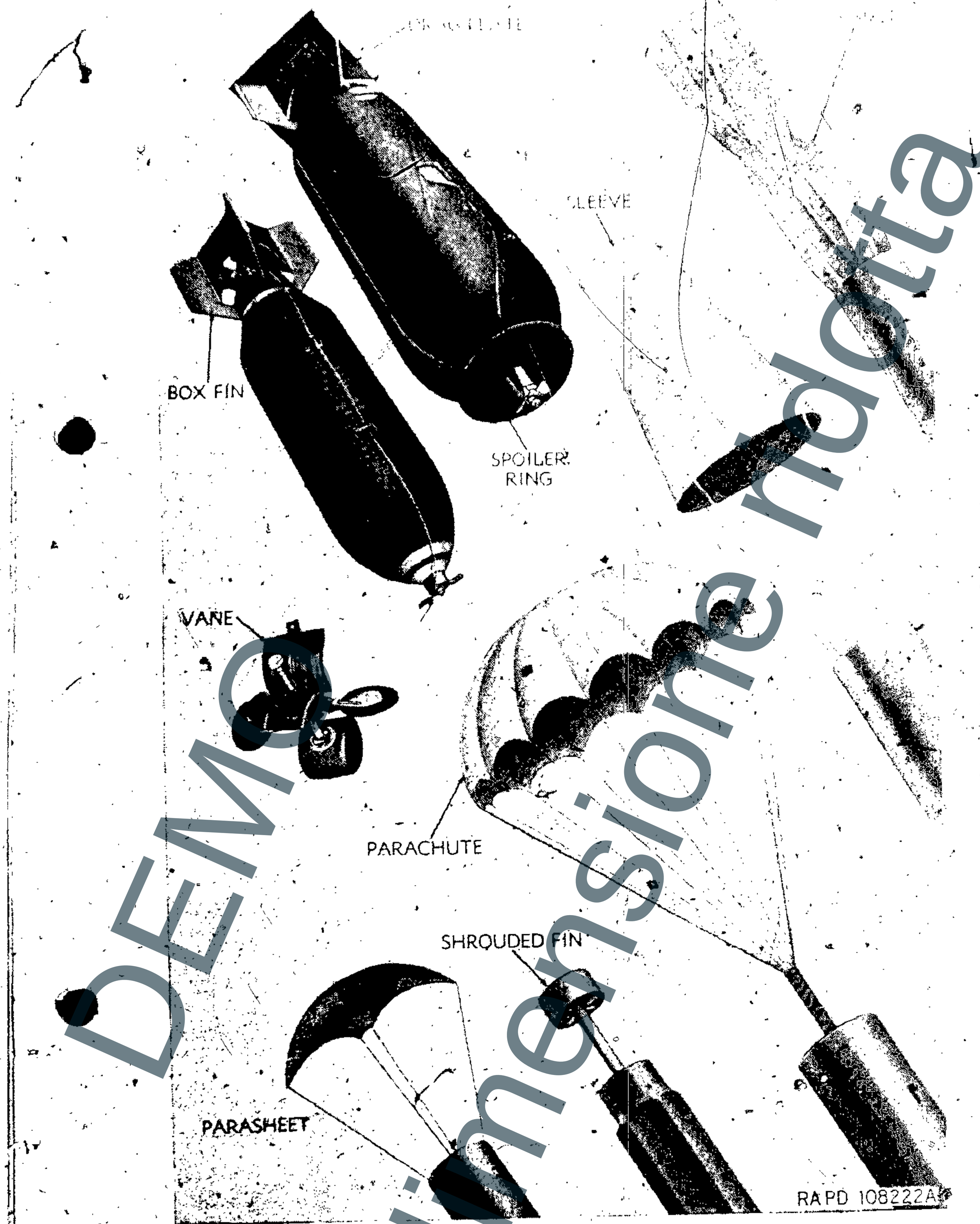


Figure 3. Methods of stabilizing flight.

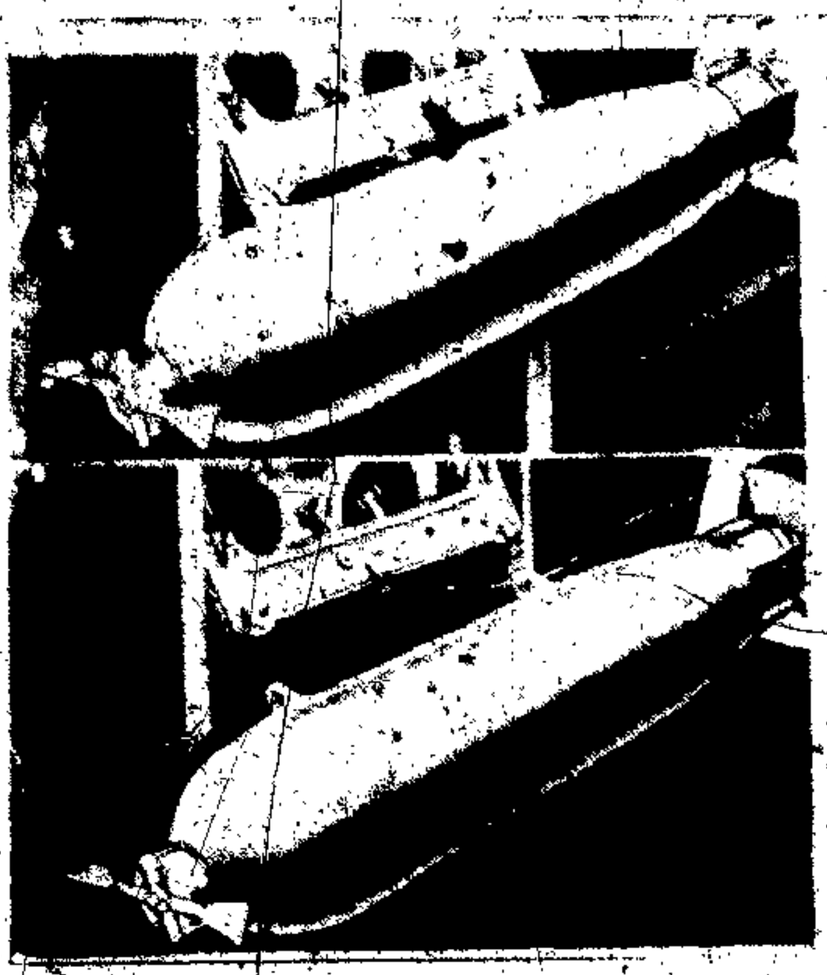


Figure 4. Arming wire.

tion. Fahnestock clips are placed over the protruding ends of the arming wire to prevent the wire from slipping out of the safety devices by accidental means (such as slip stream forces) prior to bomb release. If a bomb must be released over friendly territory, the arming wire is released with the bomb and stays in place as the bomb falls and prevents the fuze from arming so that the bomb does not explode when it strikes. When the bomb is released for effect, the arming wire is retained by the pawl and as the bomb drops, the wire is pulled from the fuze which is then free to become armed, that is, in condition to operate. Some fuzes arm by spring action, others by clockwork, powder train, or electrical means, but most fuzes now in use are armed by the action of an arming vane similar to a propeller which is driven by the air stream as the bomb falls. The arming vane may drive a gear train which, after a definite interval, removes safety blocks or alines the detonator with the next element in the explosive train (par. 6), usually the booster lead. When the bomb reaches the target, the firing pin is driven into the detonator which contains a pellet of sensitive explosive about the size of an aspirin tablet. The blast from the detonator explodes a booster of less sensitive explosive—about the size of a flashlight battery—which relays and amplifies the blast in order to explode the bursting charge of the bomb. Some fuzes have delay elements between the firing pin and detonator to delay the detonation of the bomb until it has had time to penetrate the target.

6. The Explosive Train
(fig. 5)

The type of explosive used in such large quantities as the loading of bombs must be relatively insensitive to shock and heat. This is

necessary for a number of reasons. It provides a reasonable degree of safety in storing, shipping, and handling; it allows the bomb to be dropped safe over friendly territory; and it permits the bomb to be used to penetrate a resistant target, such as armor plate, thick earth, or concrete, before exploding. If a bomb were to explode on impact outside such protection, the damage would be relatively slight. On the other hand, the type of explosive used in the fuze must be very sensitive, so that it will be sure to explode on impact of a firing pin. Such explosives are not safe to handle except in minute quantities which are strongly compressed in a metal capsule. These capsules—called detonators—are built into fuzes. However, the shock from the explosion of a detonator is not sufficiently strong to be reliable as a means of exploding the large amount of insensitive explosive which makes up the main charge of the bomb. So a quantity of an explosive which is more sensitive than the main charge is placed next to the detonator. This element is called the booster. The booster is small and sensitive enough to be exploded by the detonator yet large enough so that the shock of its explosion will explode the bursting charge of the bomb. Such an arrangement of elements is called the explosive train. This is the basic method of operation of all explosive ammunition.

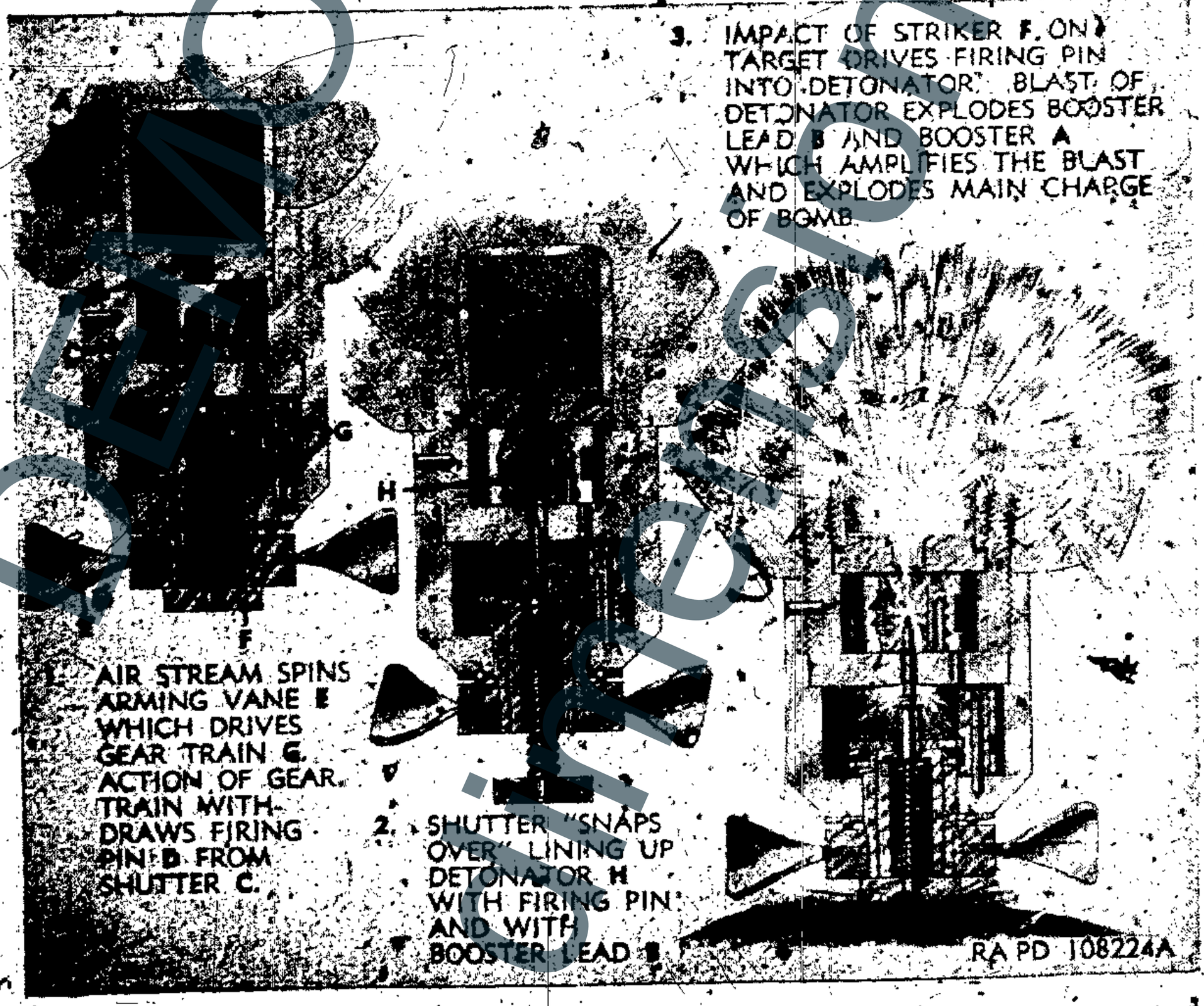
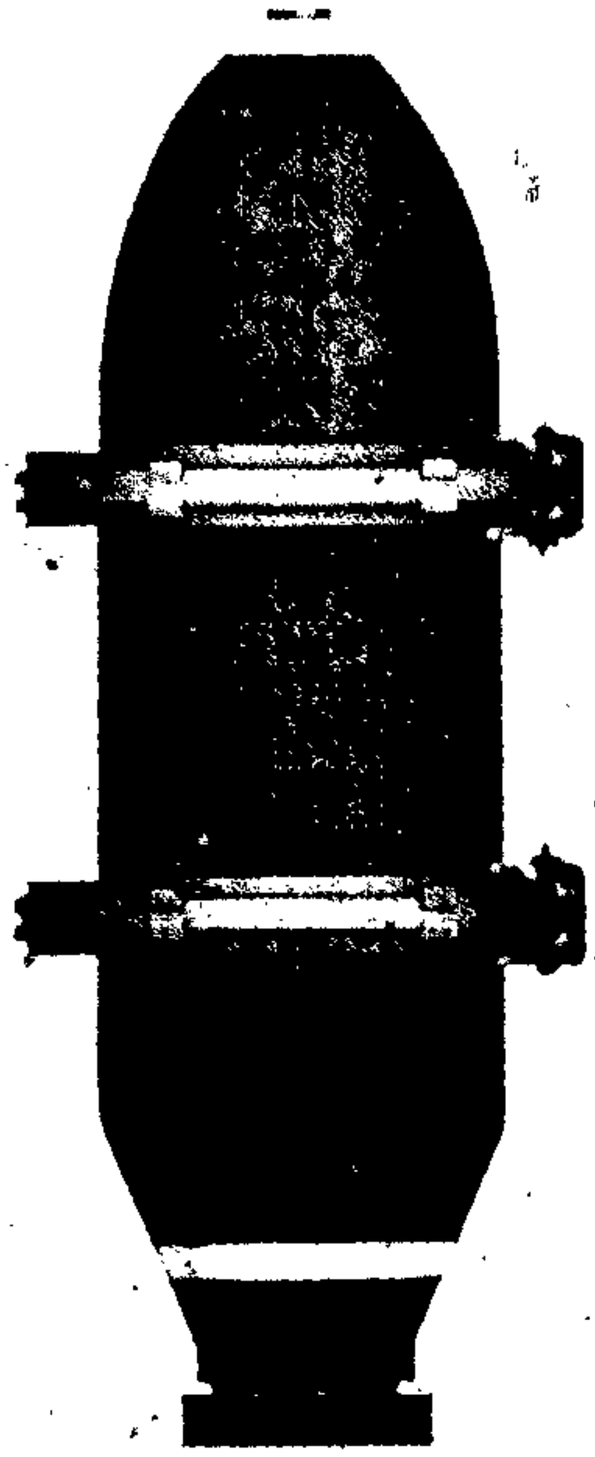


Figure 5. Explosive train.

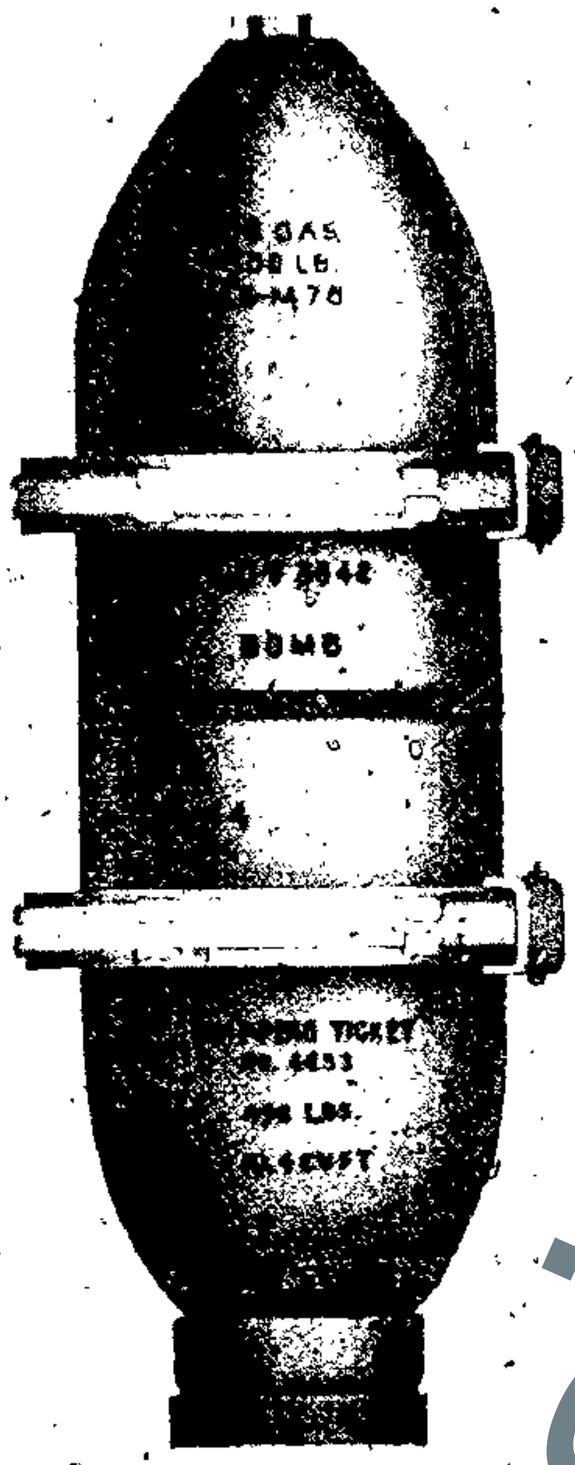
Figure 6. Effects of bomb burst.

7. Effects of Bomb Burst (fig. 6)

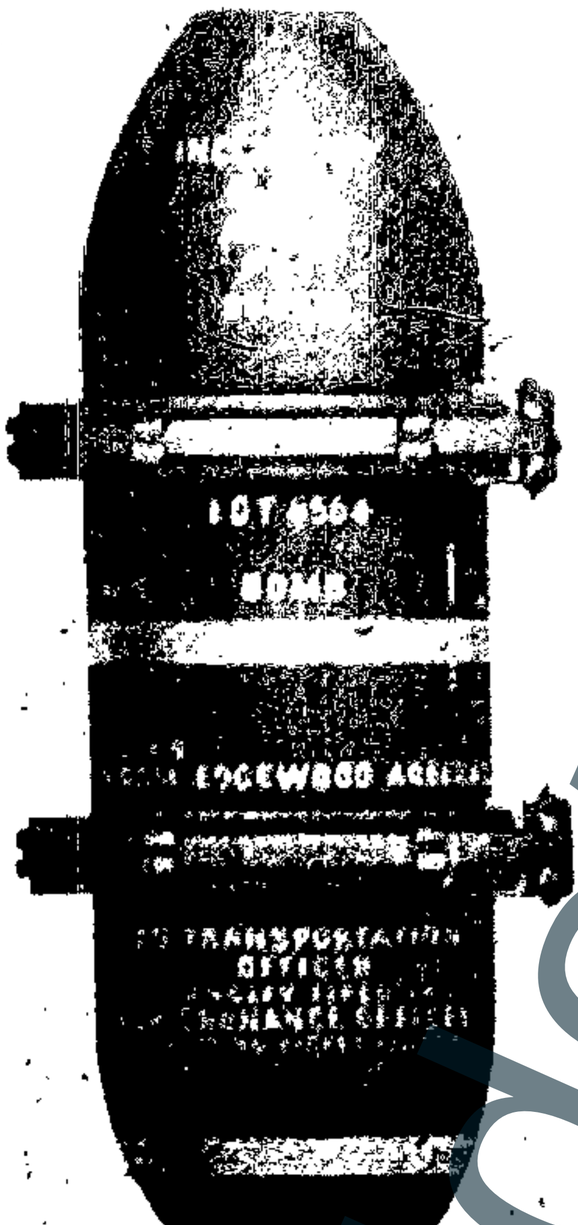
When a high explosive bomb is detonated, the charge is transformed in an instant (about 0.0002 sec.) into a very hot gas. This gas momentarily occupies only the volume of the solid explosive and consequently develops enormous pressure (about 100 tons per sq. in. for TNT). The gases expand violently in all directions, under influence of this pressure, shattering or displacing surrounding material, generating shock and pressure waves, and projecting fragments of the shattered case at high velocity. In the case of chemical bombs, the explosive charge is only large enough to open the bomb body and scatter the charge over the target.



GP–TNT



CHEMICAL–CG



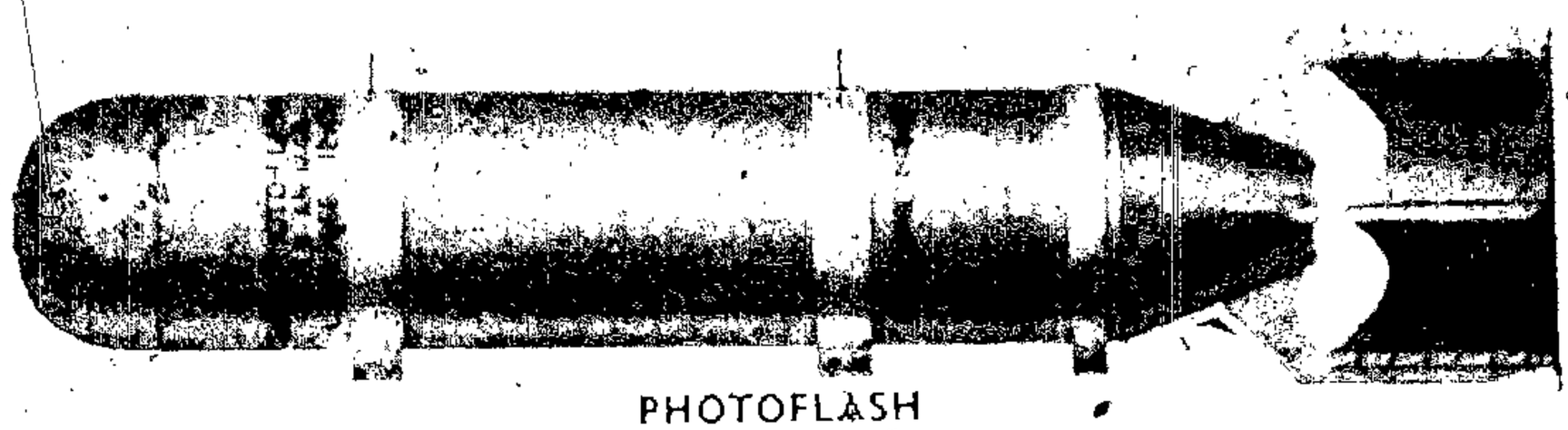
INCENDIARY

GP–COMP B

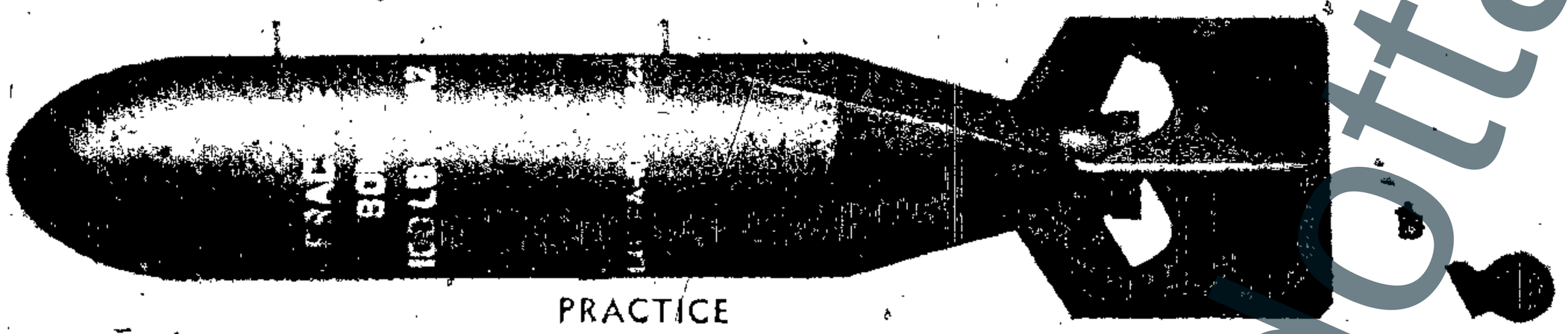
GP–TRITONAL

RAPD 108226A

Figure 7. Typical painting and marking of bombs (explosive and chemical).

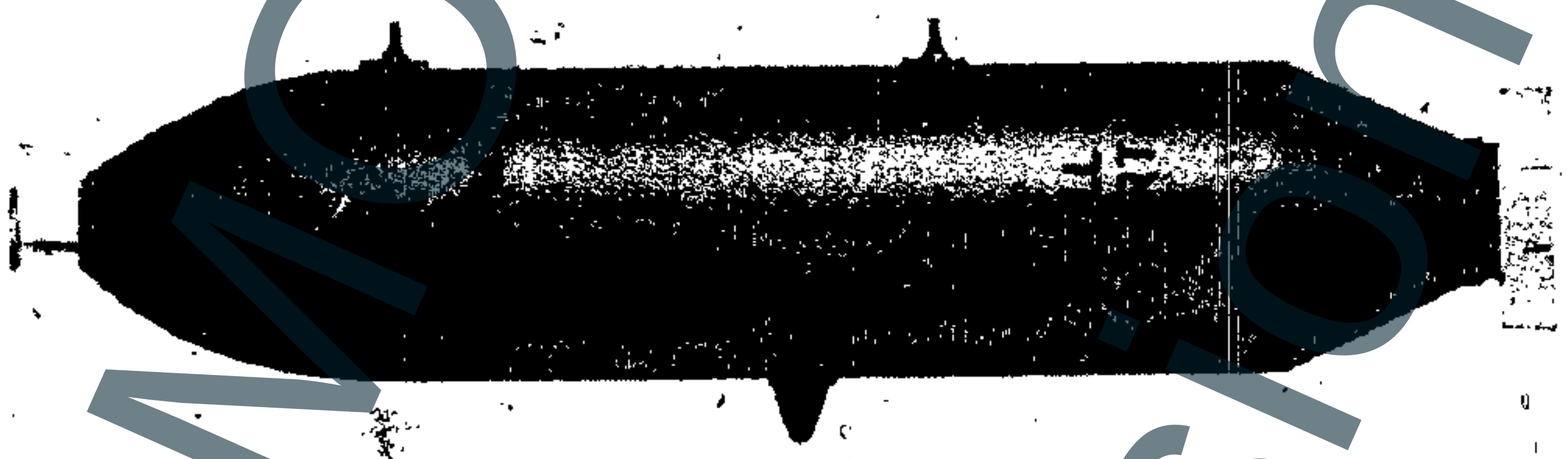


PHOTOFLASH



PRACTICE

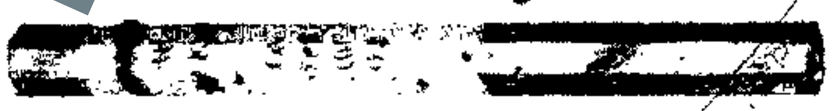
PWP SMOKE



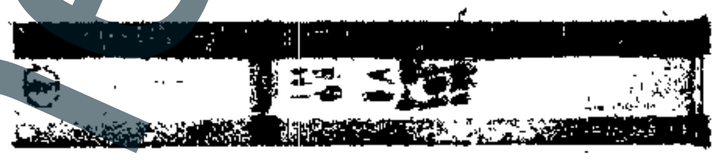
DRILL

FRAGMENTATION, 23-LB

FRAGMENTATION, 4-LB



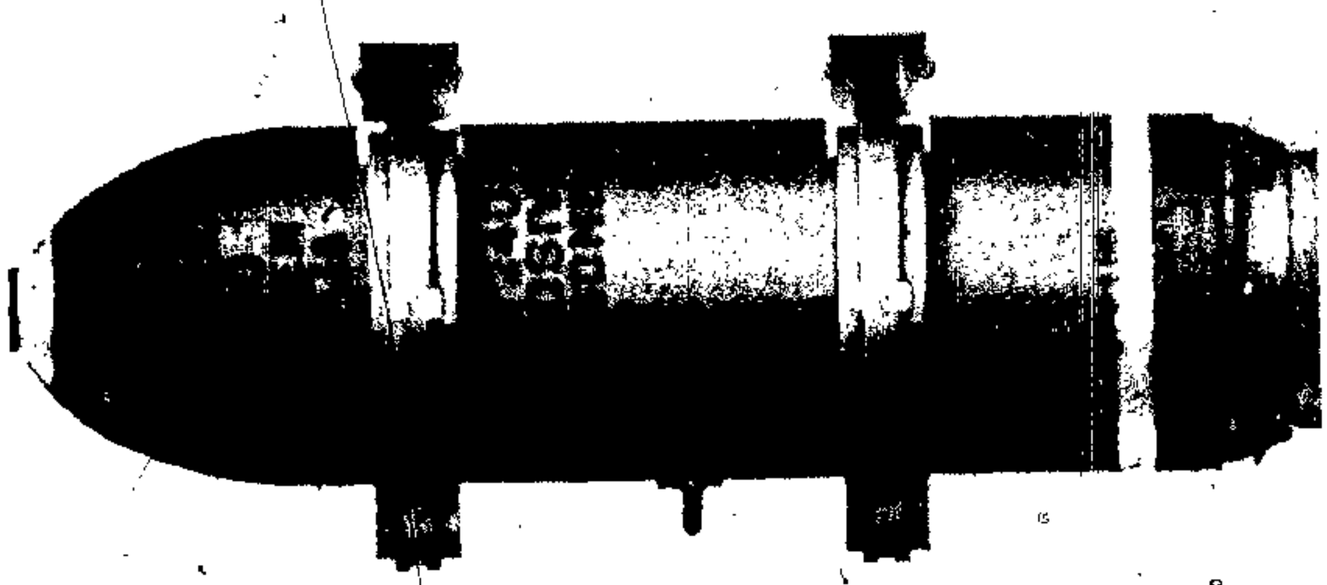
INCENDIARY, 4-LB



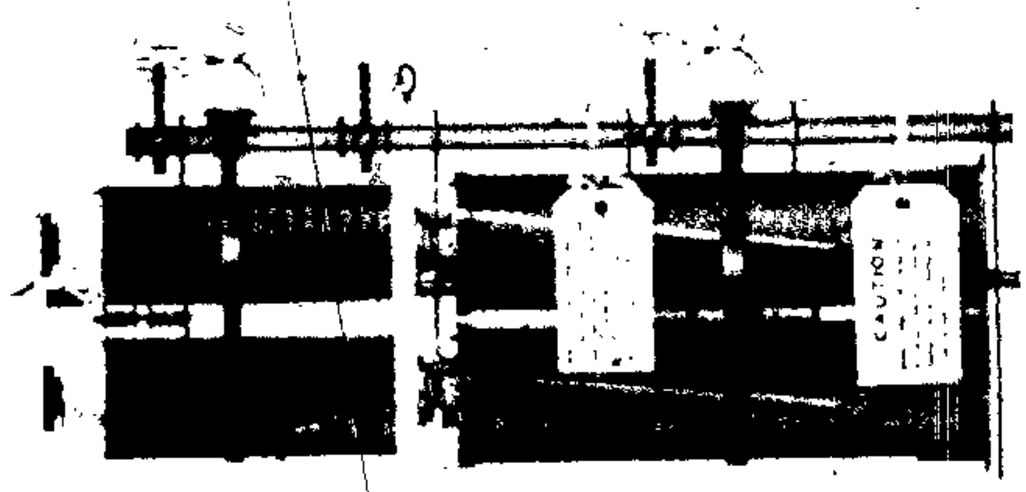
INCENDIARY, 6-LB

RA PD 108227A

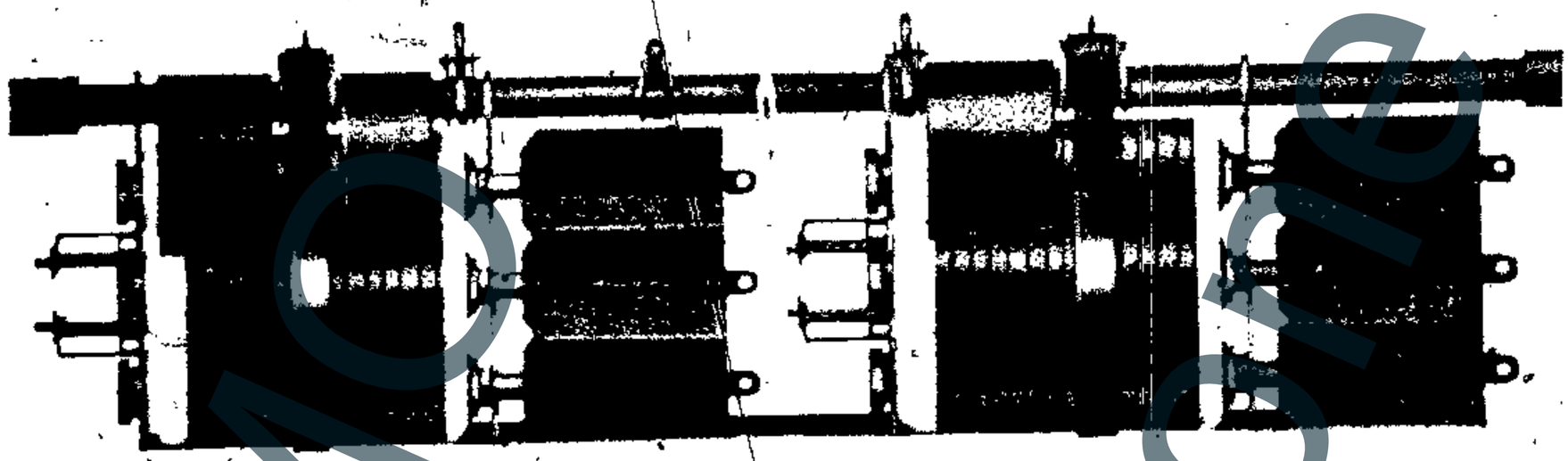
Figure 6. Typical painting and marking of bombs (pyrotechnic, chemical, inert, and explosive).



TI, M90



FRAG, AN-M4A1

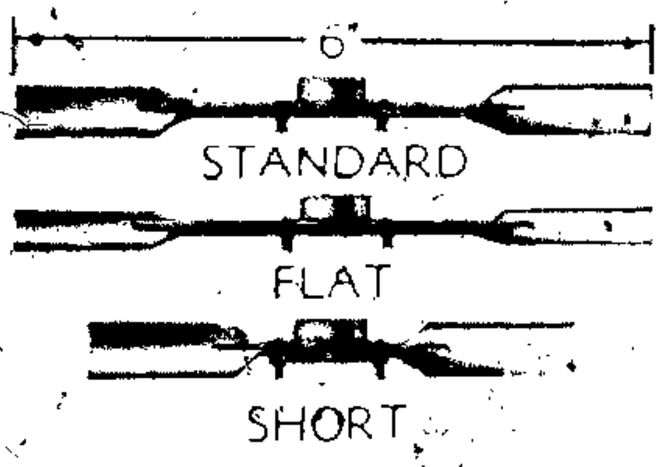


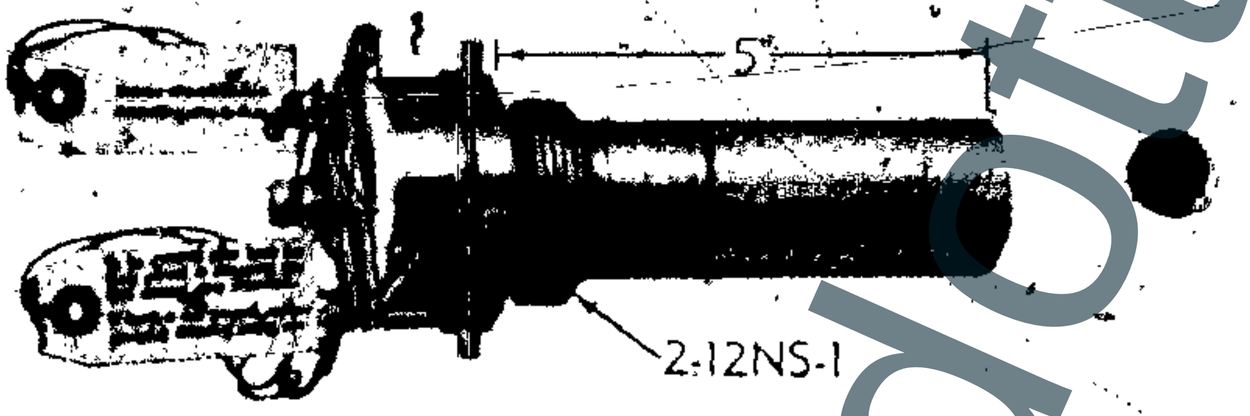
FRAG, M26A1

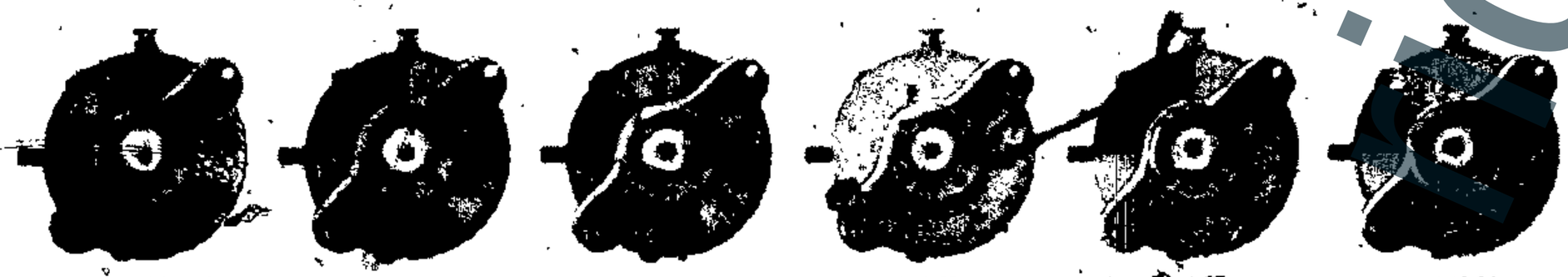
FRAG, M29

RA PD 108228A

Figure 9. Bomb clusters.







AN-M103A1 0.1 SEC. DEL. | AN-M140A1 0.025 SEC. DEL. | AN-M139A1 0.01 SEC. DEL | M163 0.1 SEC. DEL. | M165 0.025 SEC. DEL. | M164 0.01 SEC. DEL.

This is the standard impact nose fuze for the larger bombs. All fuzes of this type function instantaneously or with delay. They have the same fuze body but differ in marking and internal detail which provides for difference in length of air travel (indicated by yellow head) required to arm the fuze and difference in length of delay between impact and detonation (indicated by black wedges). The standard arming vane has a 60° pitch; the short vane (for clustered 90-lb. frag. bombs)—has a 60° pitch; the flat vane (for flat-nose depth bombs) has a 30° pitch. RA PD 108234

Figure 10. Selective instantaneous or delay nose fuzes.

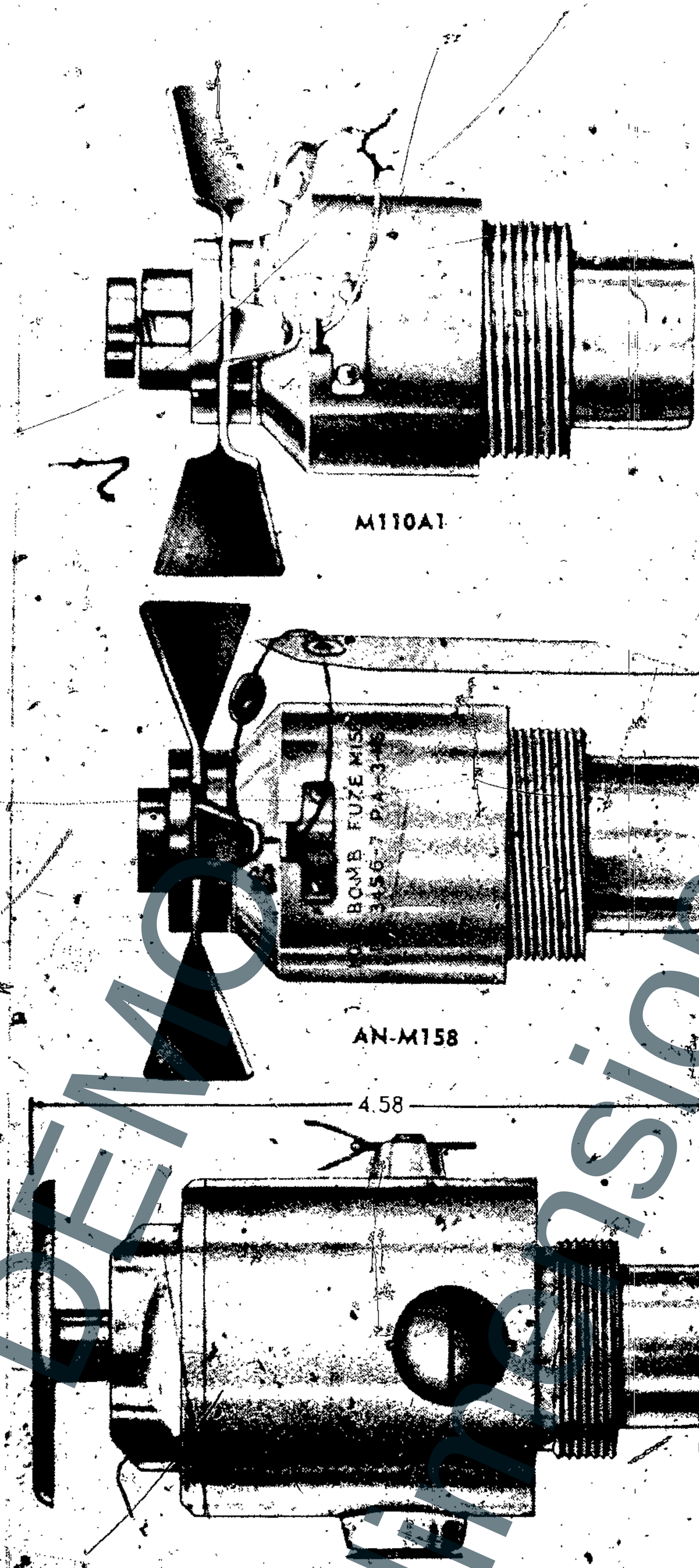


Figure 11. Impact nose fuzes—small.

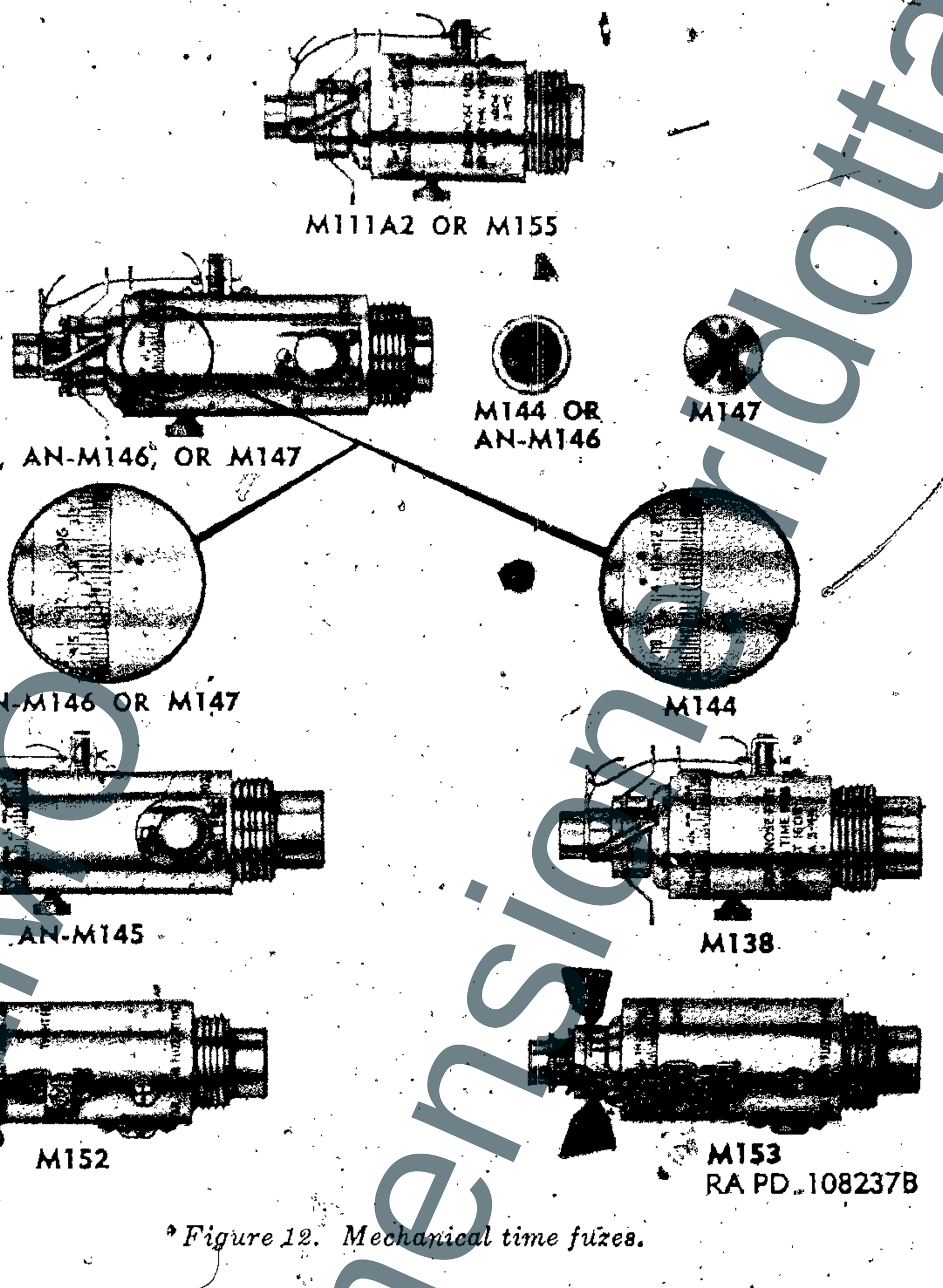
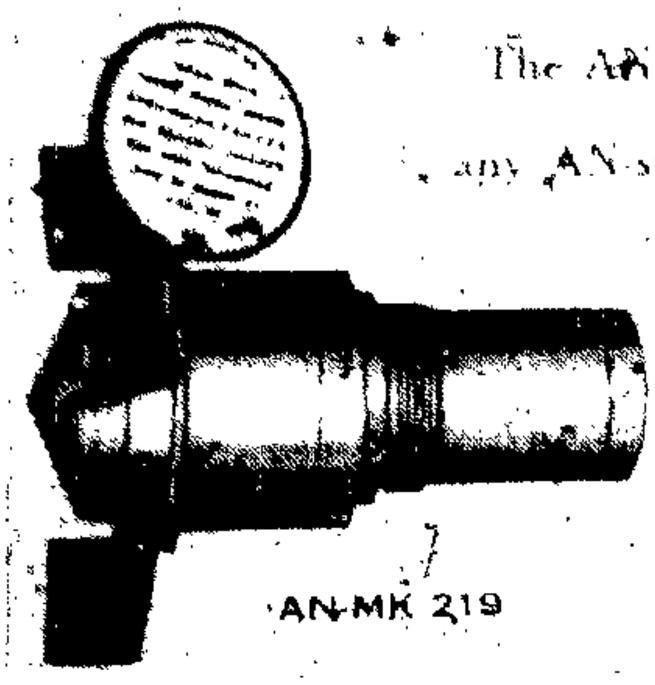


Figure 12. Mechanical time fuzes.



The AN-MK219 fuze is of navy design and may be used with any AN-standard general-purpose bomb by using an auxiliary booster, MK-4 and an adapter. It is an impact fuze of the arming-vane type with mechanical arming delay. It detonates immediately on impact.

The AN-M166 and AN-M168 fuzes are used with GP, fragmentation, and may be used with chemical bombs to produce air-burst functioning. They differ from mechanical time fuzes, which may be set for air-burst, in that they contain no time regulating devices.

The AN-M166 and AN-M168 are electrically operated fuzes which rely on the reception of a self-transmitted radio waye to function. The AN-M166 is known as the bar type and the AN-M168 as the ring type. As the bomb falls these fuzes continually transmit radio waves. As the bomb nears the target the transmitted wave "echoes" from the target and is received by the fuze where it is converted into the energy necessary to detonate the bomb. In either case, the fuze is so designed that it will explode in the close vicinity of the target wherein the greatest damage will result—thus the name "proximity fuze."

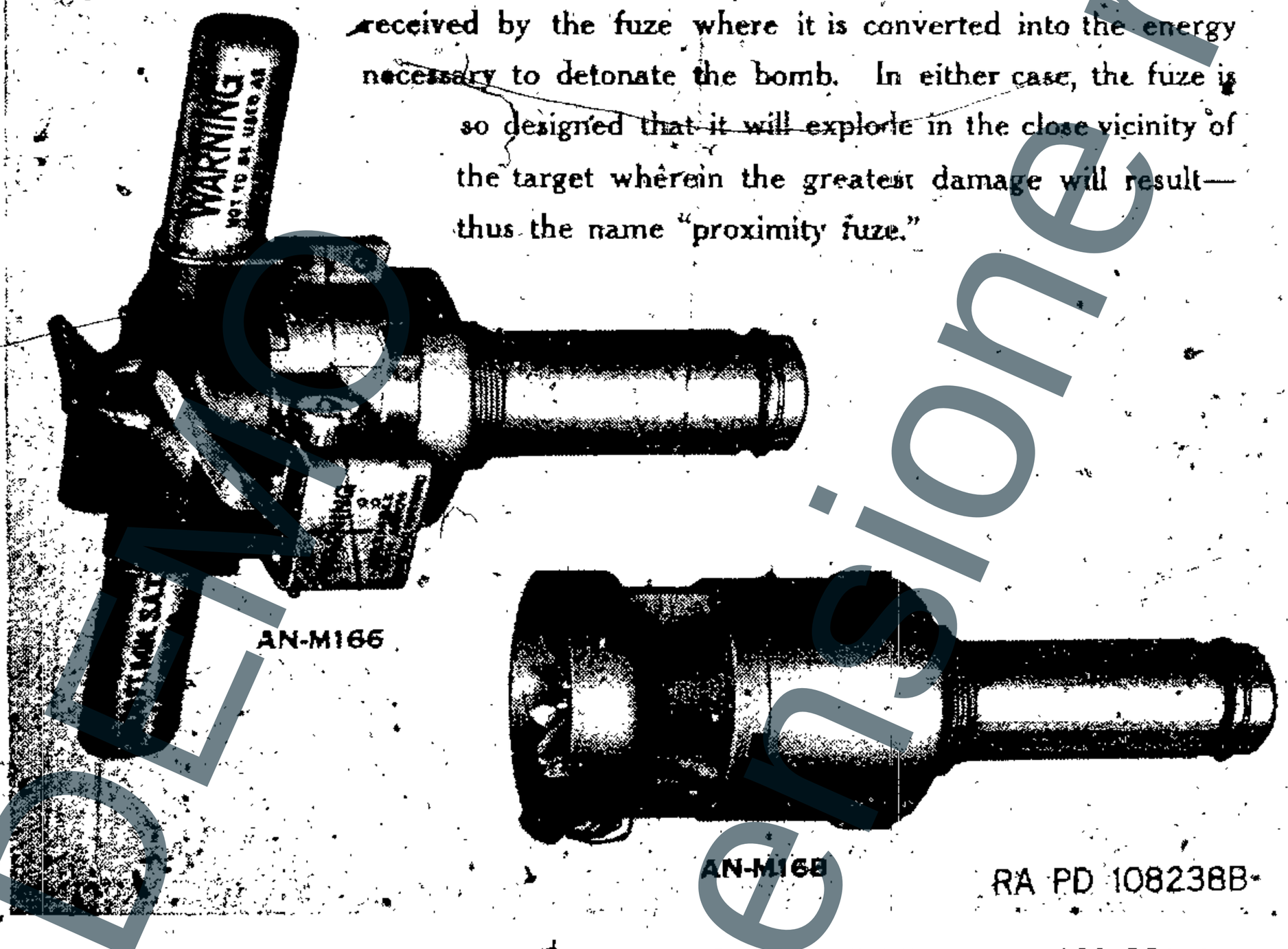
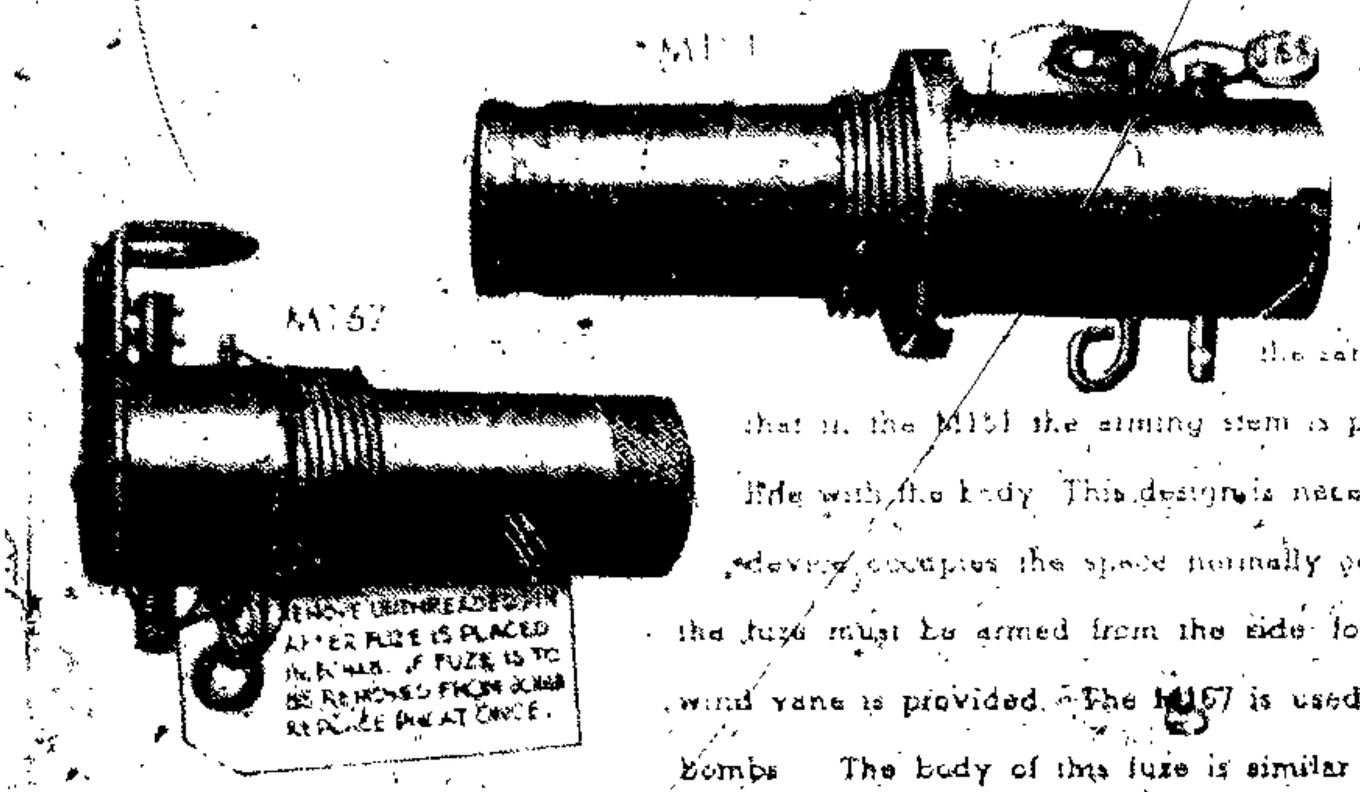


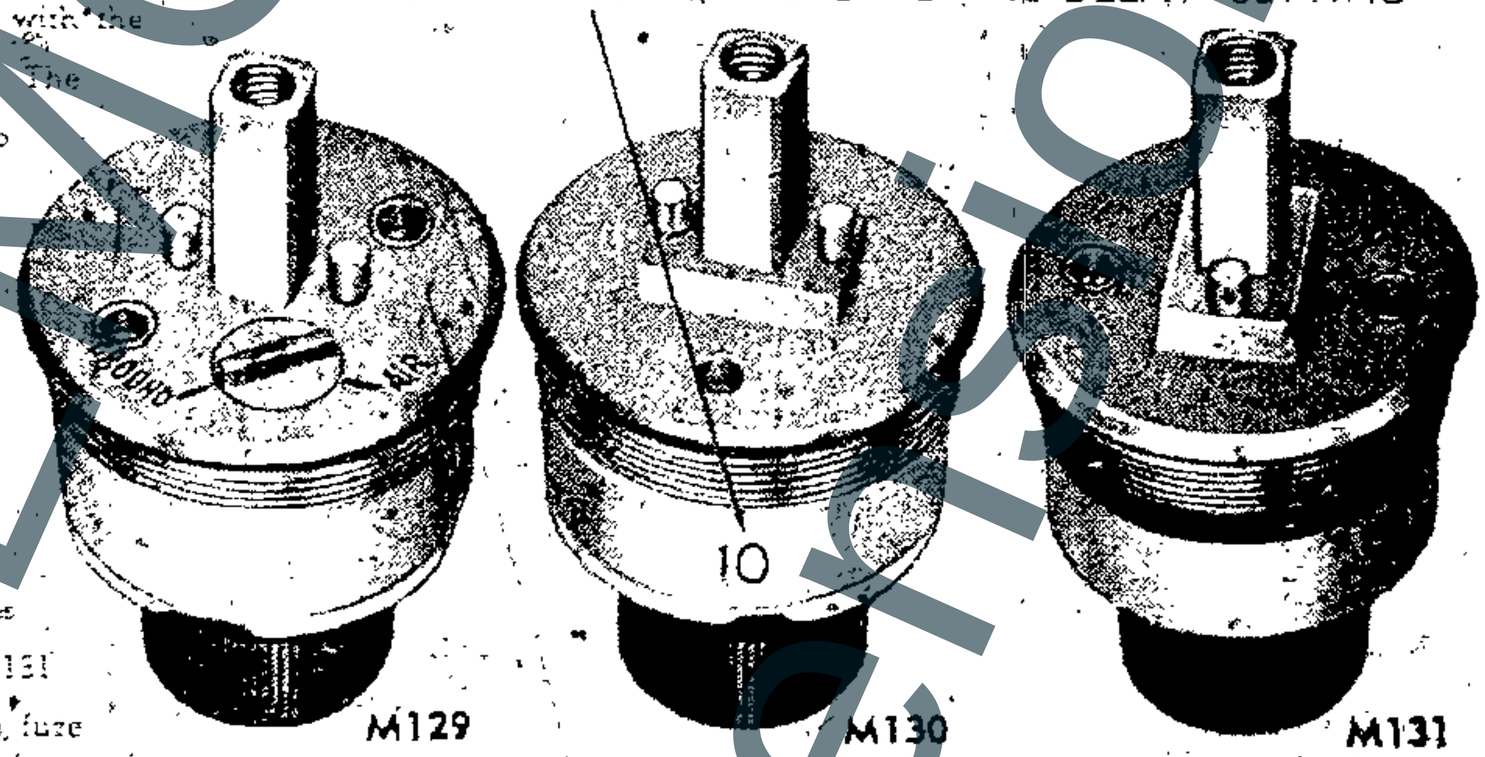
Figure 13. Nose fuzes AN–Mk 219 and VT, AN–M166 and AN–M168.



The M151 is a quick arming fuze used with antiricochet devices M16 and M17. The body of this fuze is essentially the same as the M112 tail fuze except that in the M151 the arming stem is perpendicular to rather than in line with the body. This design is necessary because the antiricochet device occupies the space normally occupied by the fin. Therefore the fuze must be armed from the side for which use an anemometer wind vane is provided. The M167 is used with the 1000-lb VB-1 [Azon] bomb. The body of this fuze is similar to the AN-M100A2 tail fuze except that the M167, like the M151, employs a transverse arming stem, for it too must be armed by a side mounted anemometer vane.

RA PD 108240A

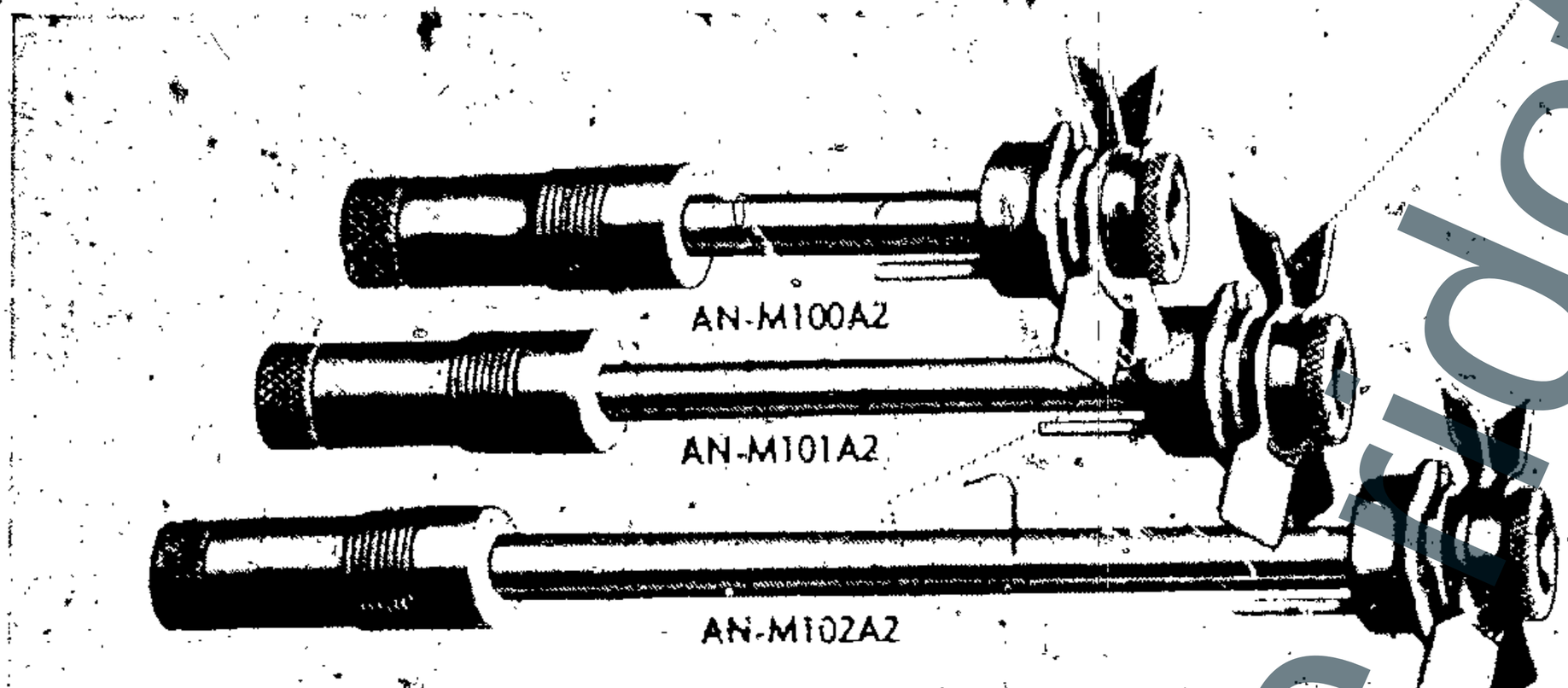
Figure 14. Miscellaneous fuzes.



These fuzes are used with the 4-lb. fleg bomb M83. The M129 fuze operates to detonate the bomb either in air or on impact depending on the setting. The M130 is a mechanical time fuze which detonates the bomb 2 to 60 minutes after arming. The M131 is an anti-disturbance fuze it becomes fully armed 2 seconds after impact. It will detonate the bomb any time thereafter when the bomb is jarred or slightly disturbed.

RA PD 108241A

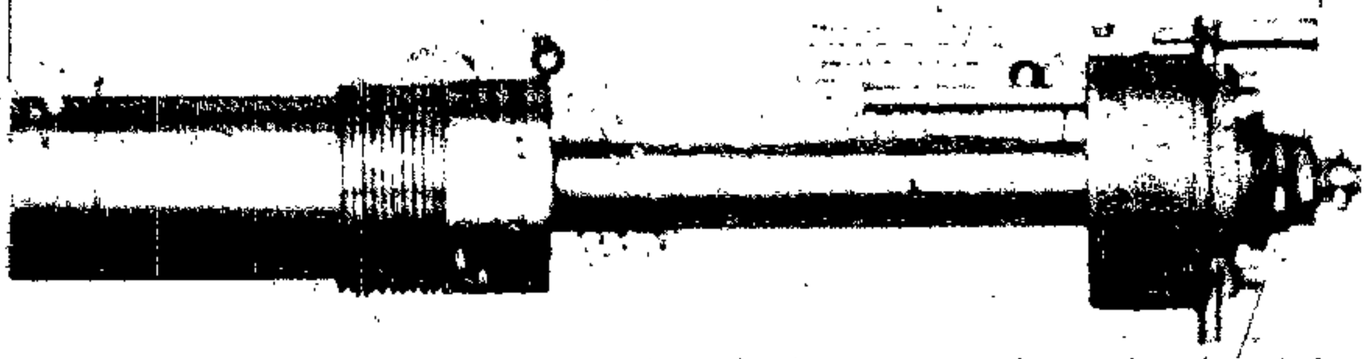
Figure 15. Fuzes M129, M130, and M131.



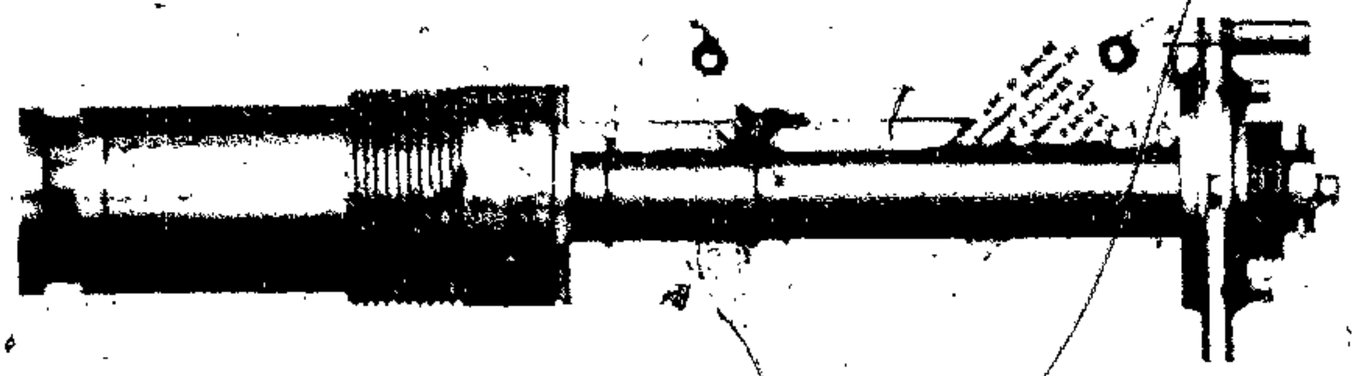
This group of fuzes is known as a series. Fuzes of one series—that is, fuzes with the same mechanism and action, but designed for bombs of different sizes—are distinguished among themselves by the length of arming stem

RA PD 108239

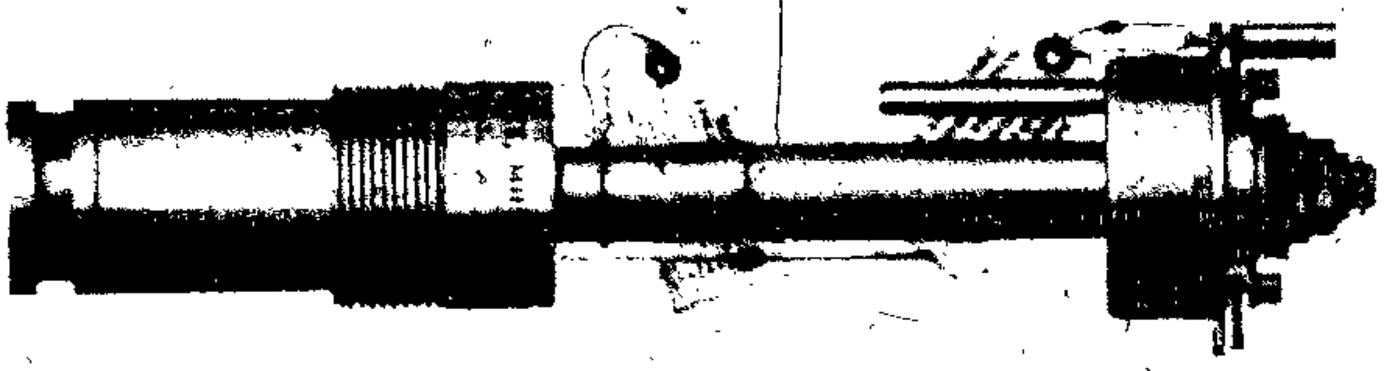
Figure 16. Tail fuze family.



The AN-M100A2 is an arming vane type impact fuze used with GP and frag bombs. Except for their greater length, the other fuzes of this series, the AN-M101A2 and AN M102A2, are identical to the AN-M100A2.



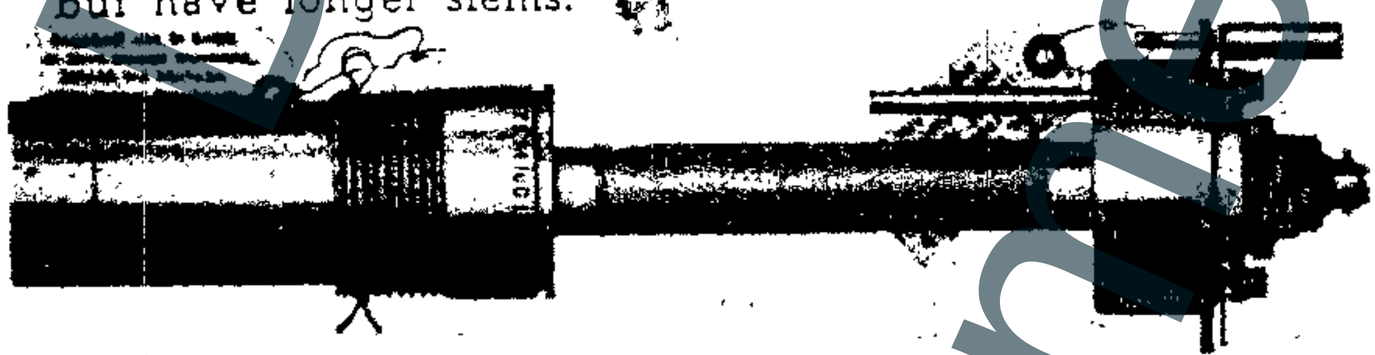
The M112A1 is a fast arming fuze for low level bombing. It is similar to the AN-M100A2 except that it has no gear train and it utilizes the primer detonator M16A1 instead of the M14. The M113A1 and M114A1 are identical in action but have longer stems.



The M115 consists of the AN-M100A2 type arming head and the M112 type body. The M116 and M117 are identical in action but have longer stems.

The M123A1 is a long delay fuze. A definite length of delay (from 1 hr to 6 days) is stamped on each fuze as part of its nomenclature. This fuze contains a booby trap. Once the fuze is inserted in the bomb it cannot be removed without detonating. The M124A1 and M125A1 are identical in action but have longer stems.

The M132 is similar to the M123A1 but has a nominal delay of 10 minutes. This fuze also is booby trapped. The M133 and M134 are identical in action but have longer stems.



The M160 is similar to the AN-M100A2 but requires a longer air travel to arm. The M161 and M162 are identical in action but have longer stems.

RA PD 108242A

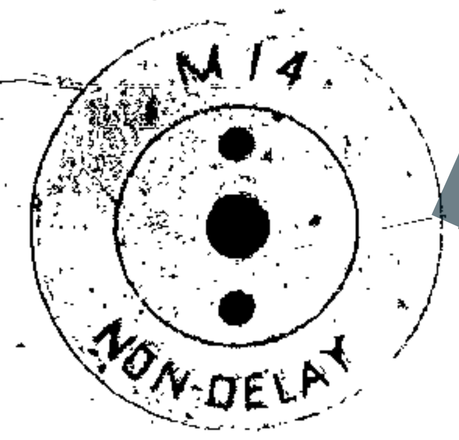
Figure 17. Tail fuzes.

AN-MK 228

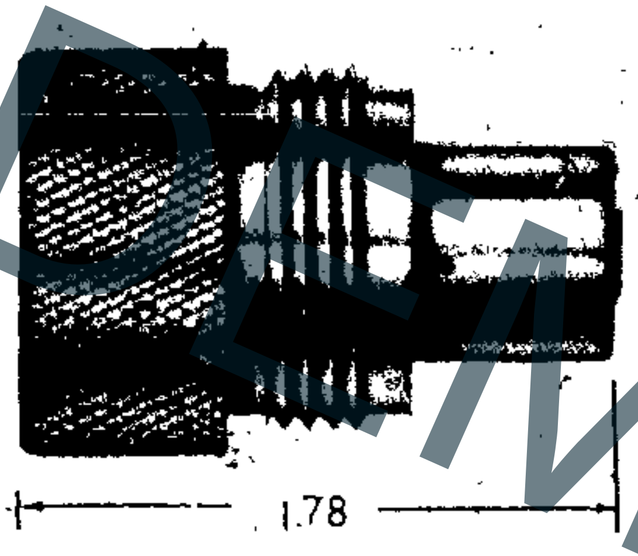
AN-MK 230 MODS 4, 5, AND 6

These tail fuzes are of the arming vane type with mechanical arming delay. The AN-Mk 228 is an impact fuze used with armor-piercing bombs. It contains two explosive trains for greater reliability of functioning. The AN-Mk 230 Mods 4, 5, and 6 is a hydrostatic fuze for anti-submarine use. It functions at predetermined depth settings of 25–50–75–100 or 200 feet and is used with 500-lb, 1,000-lb, and 2,000-lb GP bombs of the "M60" series fitted with adapter booster M115 and is also used with the Mk 54 Mod 1 depth bomb. Before assembling this fuze to GP bombs, it is necessary to first remove the fuze sleeve from the adapter booster.

Figure 18. Tail fuzes, Navy type.

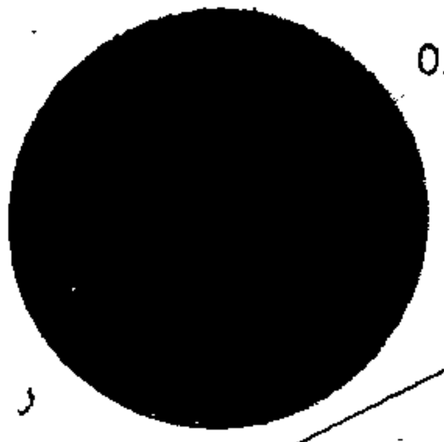


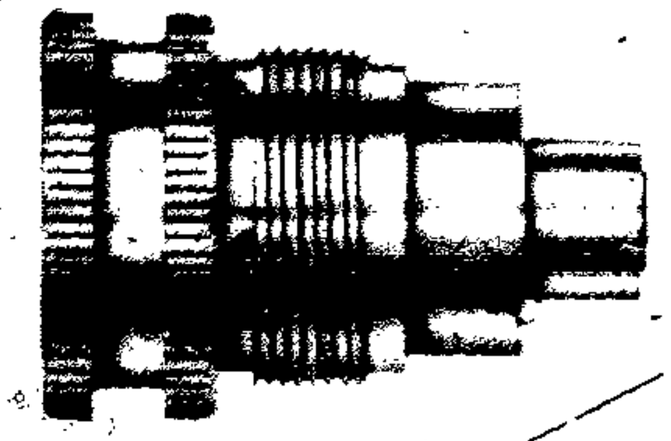
NON-DELAY



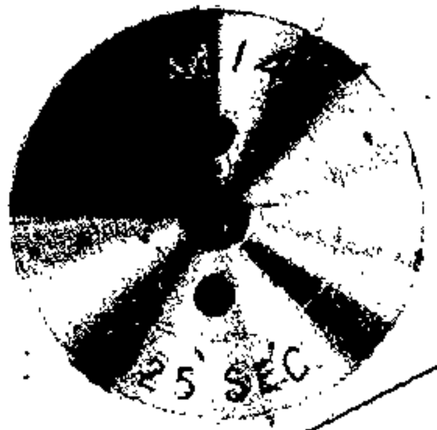
0.10 SEC DELAY

0.24 SEC DELAY





0.025 SEC DELAY



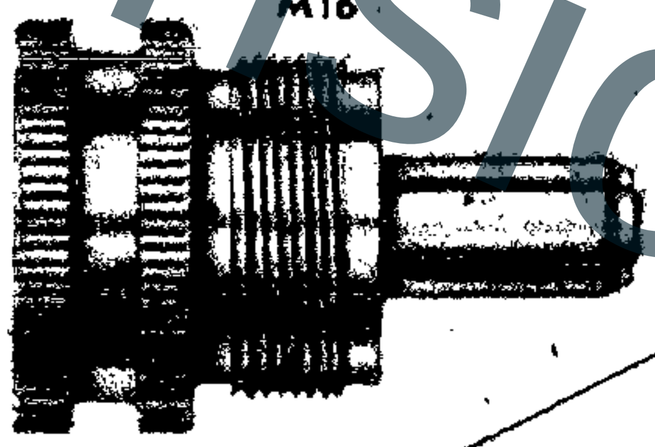
8-15 SEC DELAY

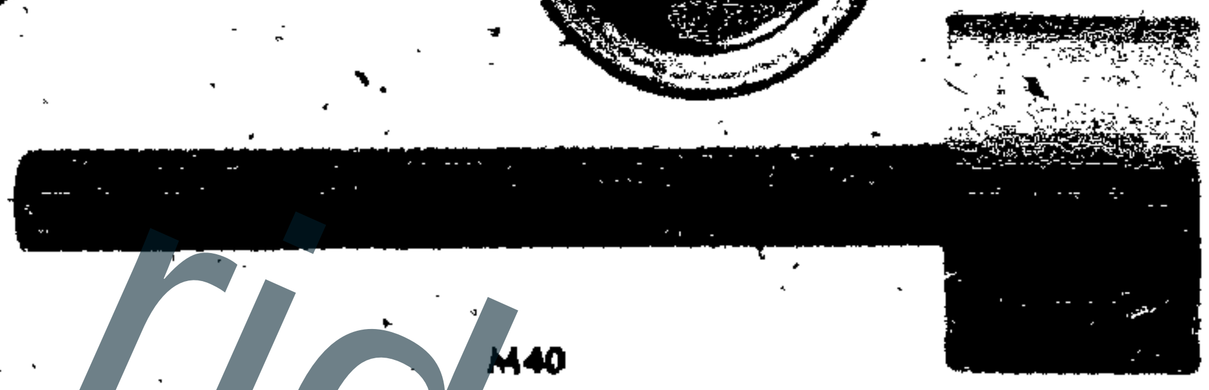
0.01 SEC DELAY

4-5 SEC DELAY

DELAYS	
NON-DELAY	
0.025	SEC
0.04	SEC
0.05	SEC
0.14	SEC
0.5	SEC
1.0	SEC
3.0	SEC
11.0	SEC
25 TO 30	SEC

NON-DELAY





RAPD 108244A

Figure 19. Primer-detonators.

CHAPTER 3

ASSEMBLY

10. Inspection Prior to Assembly

a. GENERAL. Most bombs and their components are shipped separately and are assembled in the field to form the complete rounds which are dropped from the airplane. Figure 20 shows these components and their packings as received; the bomb body fitted with nose and tail plugs, shipping bands, fin lock nut, and fin lock nut protector; the fin in metal crate; and the fuzes in hermetically sealed containers. When components are unpacked for assembly into complete rounds, they will be inspected (as outlined in *b* through *g* below) to insure that they are in serviceable condition.

b. BOMB BODY. Bombs will be inspected to insure that exposed surfaces are free of foreign material, particularly particles of explosive. The fuze cavities and threads will be inspected and cleaned if necessary. Suspension lugs should be examined for damage which might weaken the lugs or their attachment to the bomb body.

c. FUZES. If, upon the opening of packing boxes, any of the hermetically sealed containers are found to have been punctured or split, or the seal broken in any way, the fuzes contained therein are considered unserviceable and will not be used; this does not apply to fuzes repacked in the field in containers resealed with adhesive tape for temporary protection. Otherwise, inspect the fuze for defective threads, bent vanes, and corrosion, and, when required, examine the fuze to see that the proper primer-detonator is assembled. For those fuzes which require the substitution of a primer-detonator, check the primer-detonator cavity in the fuze body to insure that no foreign matter is present, as anything which prevents an easy assembly of primer-detonator into its cavity may cause a premature explosion or cause the bomb to be a dud. Inspect all fuzes for presence of safety devices—cotter pins, shear wires, and arming pins. If any of these are missing, handle the fuze with extreme care and return it to its container, marking the item for disposal as unsafe ammunition. *Only safe and serviceable fuzes will be used in the assembly of complete rounds—reject all others.*

d. PRIMER-DETONATOR. Dispose of primer-detonators which have either loose primers or show signs of corrosion or other visible defect.

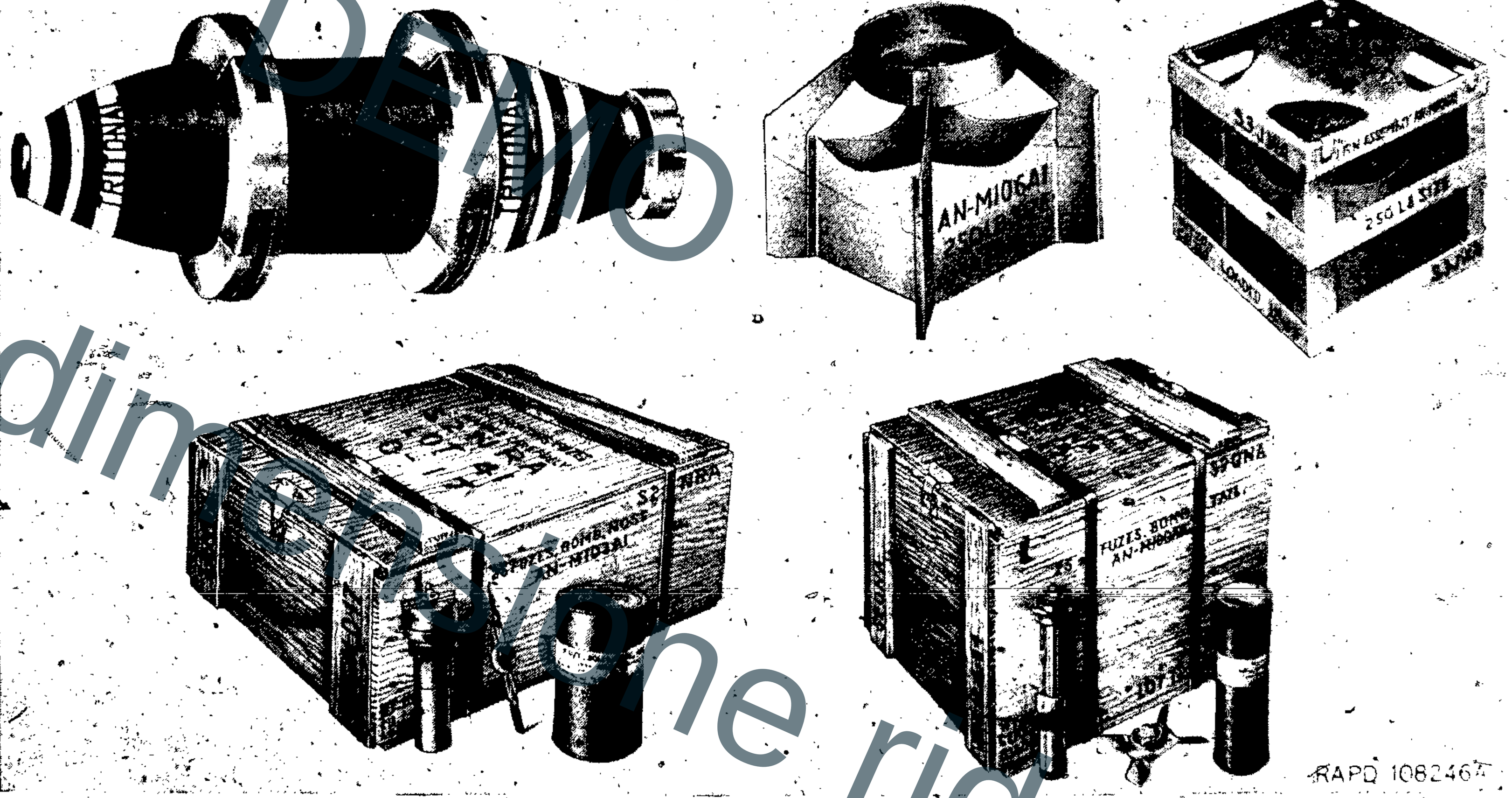


Figure 20. Components of complete round as received.

[illegible] can be used effectively in any bomb with a fuze well that will accept the M163 type nose fuse, while the ring type, although it has the same size well, can be used only in the bomb sizes for which it is specified. In both types, the external part of the fuze body is a cylinder 3 to 4 inches in diameter and 5 inches long, with a vane at the nose. The ring type has a metal ring surrounding the vane with a vane stop pin sealed in the ring. The bar type has two 4-inch metal bars extending radially from the head, and a vane stop arm mounted on a bracket on the side. In both types, the part of the body which is assembled within the bomb conforms in size and shape to the M163 type nose fuse except that there is a safety-pin clipped around the base and extending into the end of the fuze. This safety pin is never removed until just before assembling the fuze to the bomb.

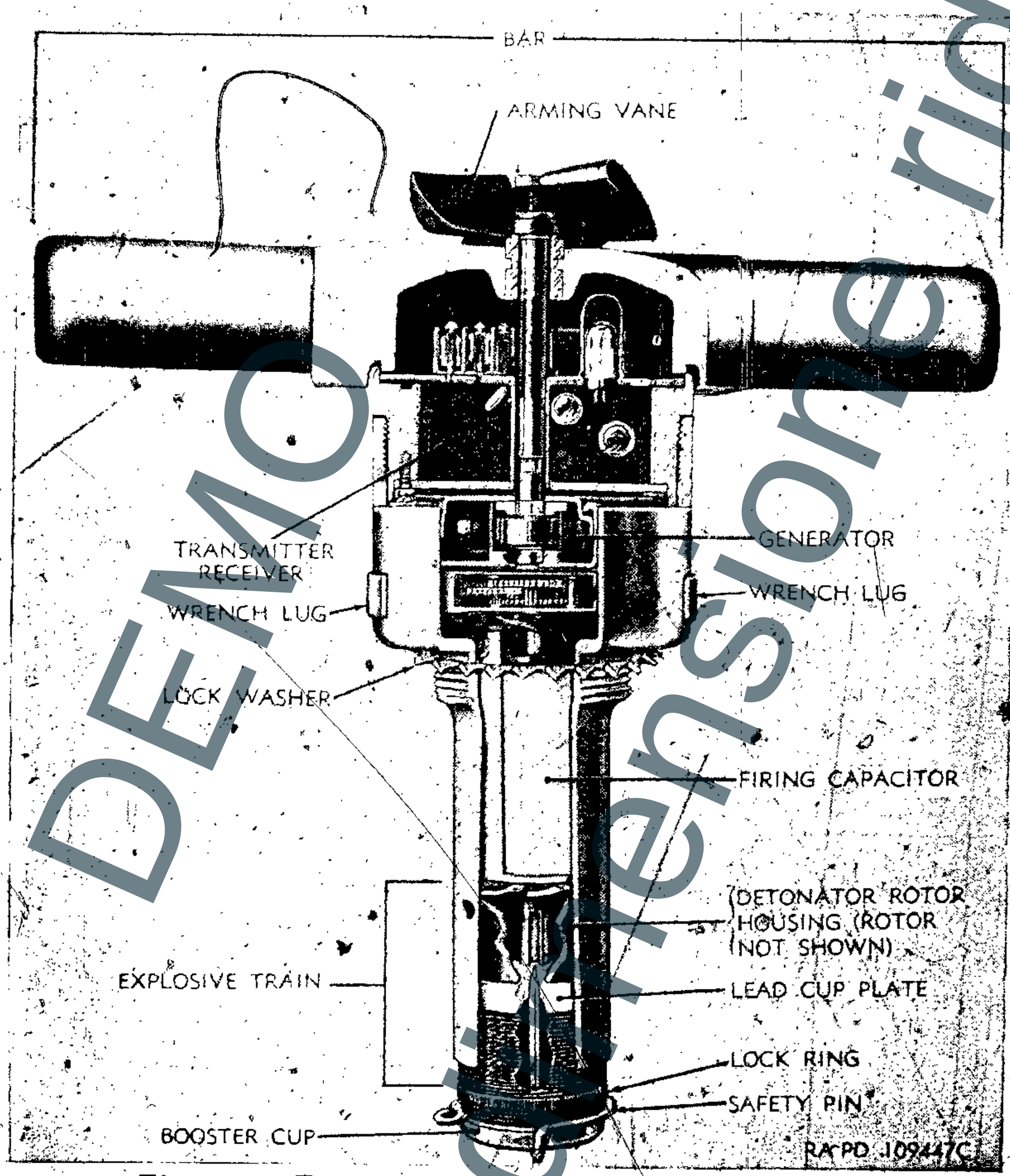


Figure 55. Fuze, bomb, nose, VT, AN–M166—sectioned.

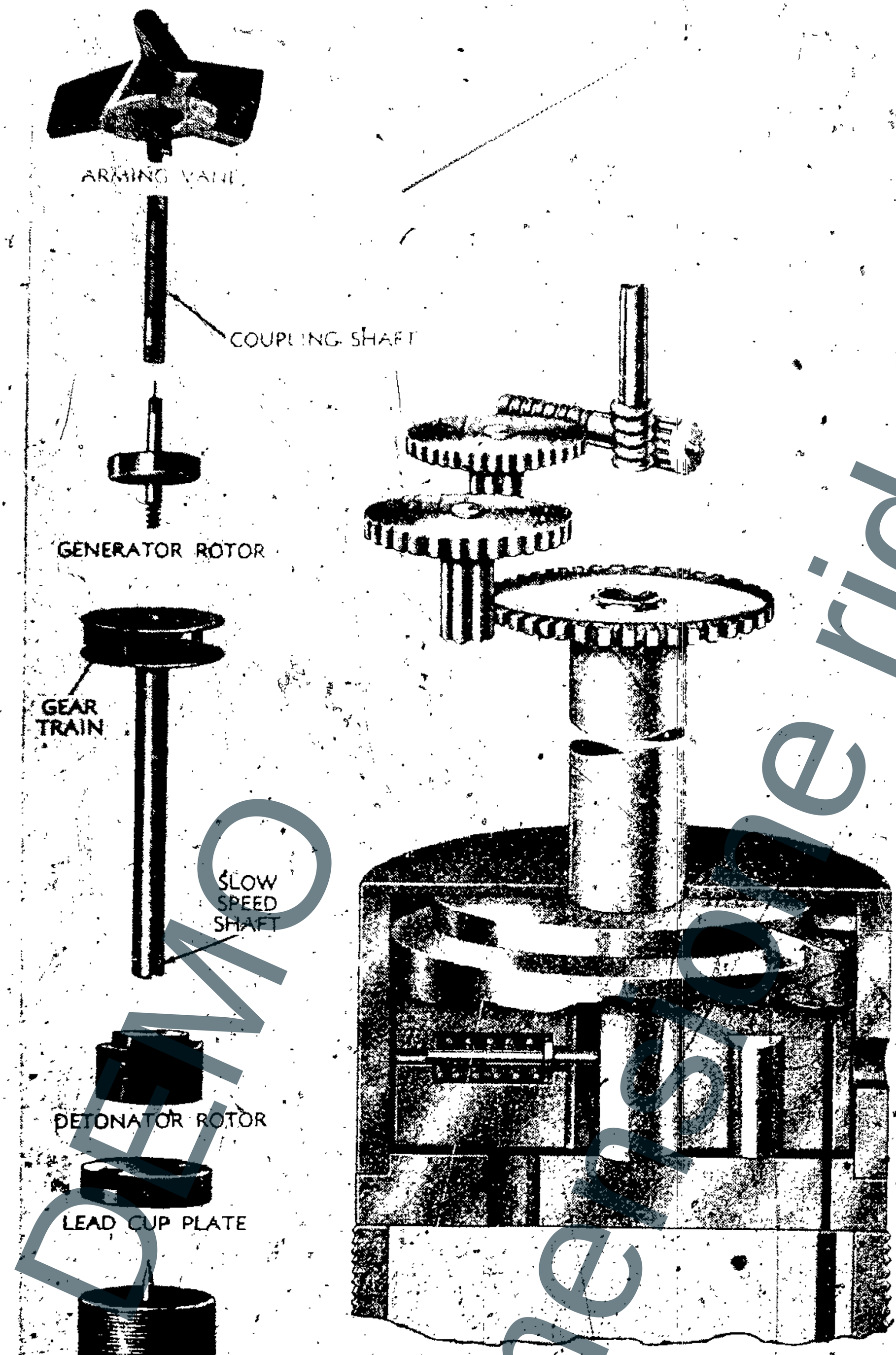


Figure 56. VT bomb fuze—details of mechanical arming system.

9128420—50—8

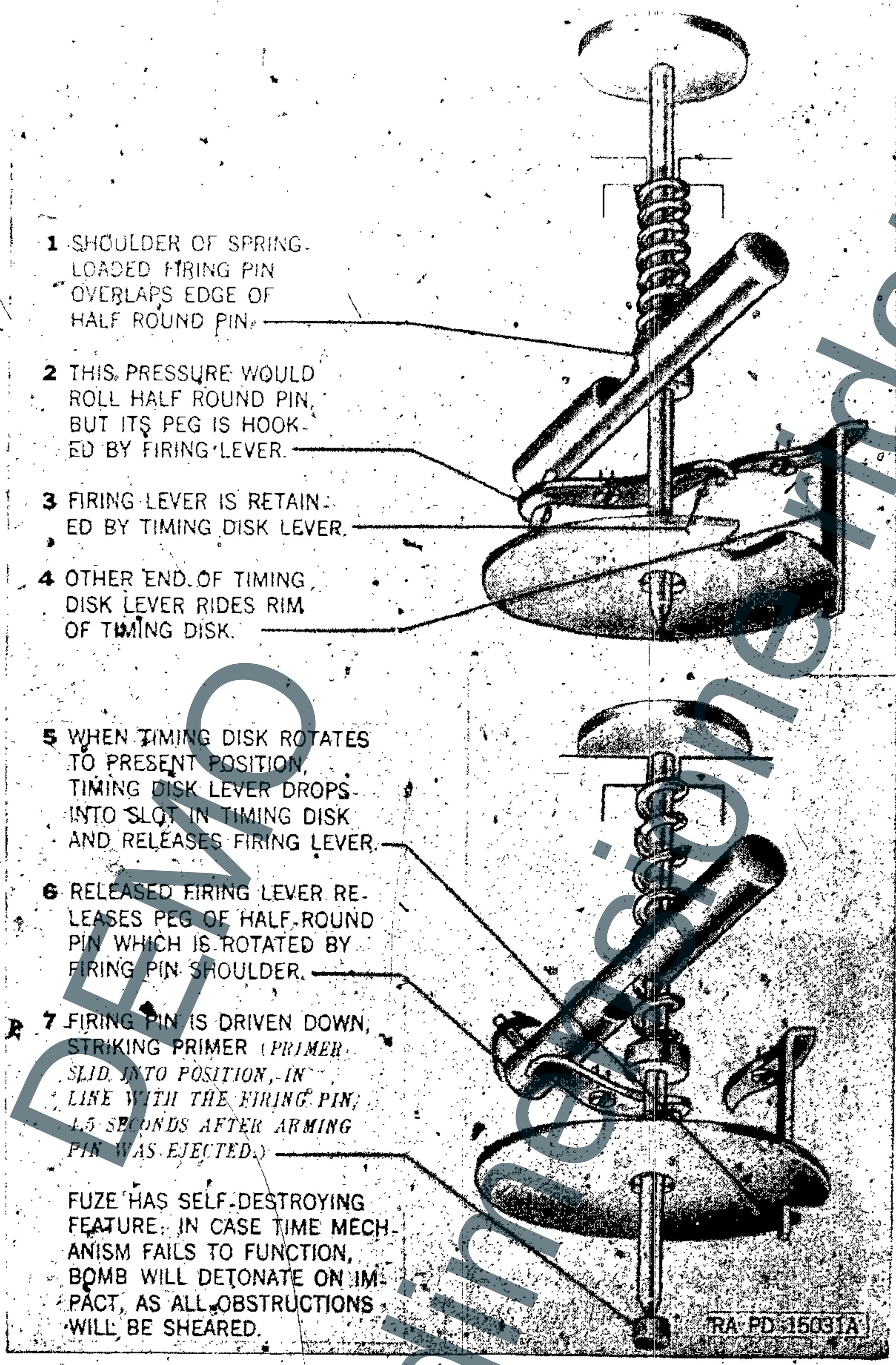
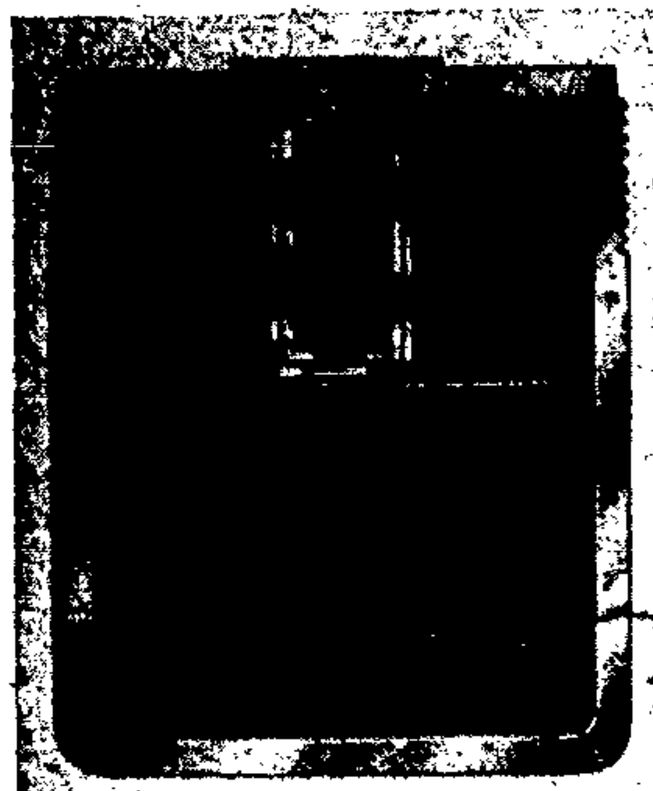


Figure 61. Mechanical time fuze—principles of functioning.



M110A1

M138

M111A1, A2
M155

M144
AN-M146

M147

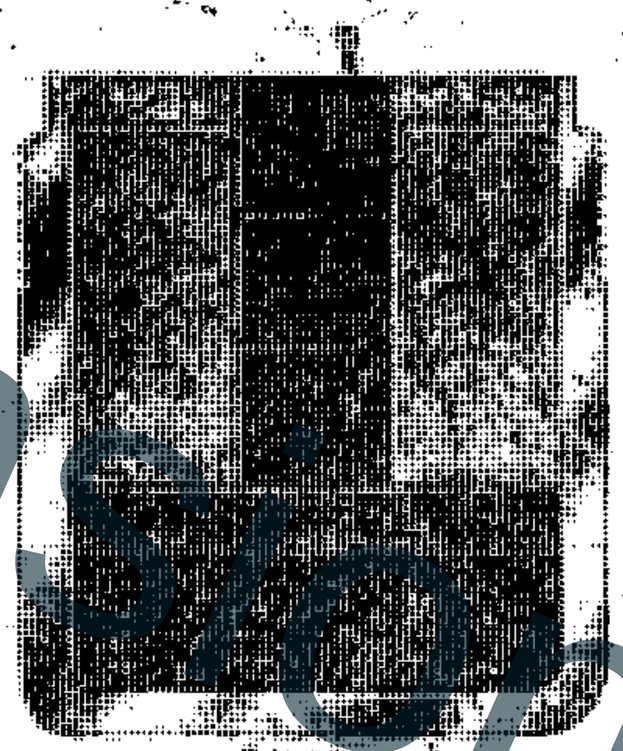
LEGEND

CLAY PELLET

BLACK POWDER

TETRYL PELLET

AN-M158



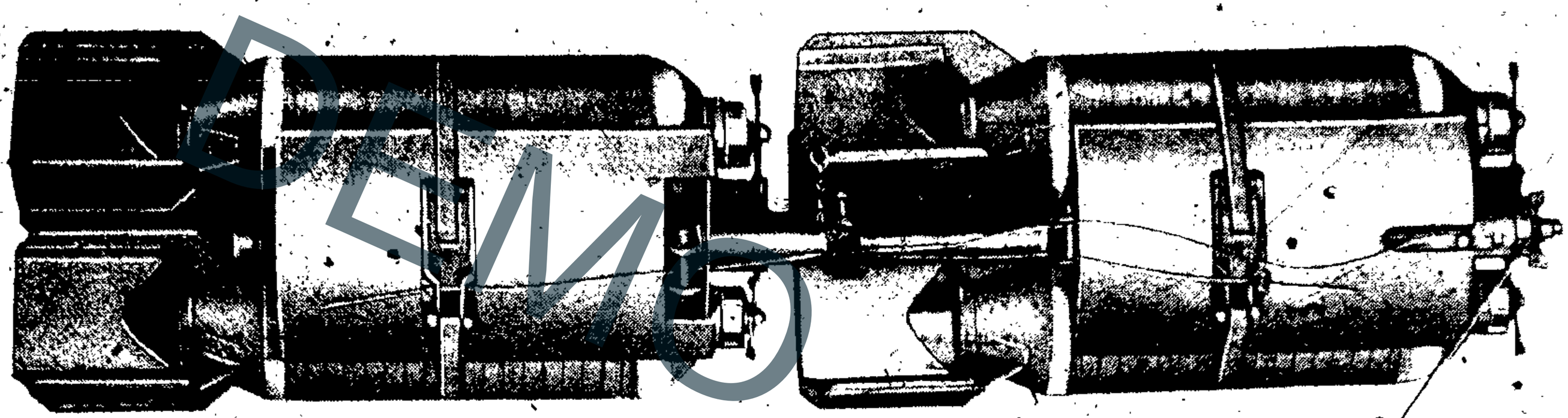
AN-M145
M152
M153

NOTE.—BOOSTER, IGNITER, AND DETONATOR UNITS USED WITH MECHANICAL TIME AND OTHER FUZES. ALL FUZES IN EACH LINE BELOW USE SAME BODY.

M110A1
M111A2, M138
AN-M145, AN-M146, M147 (AND WITH REVERSED VANES) M152
AN-M158

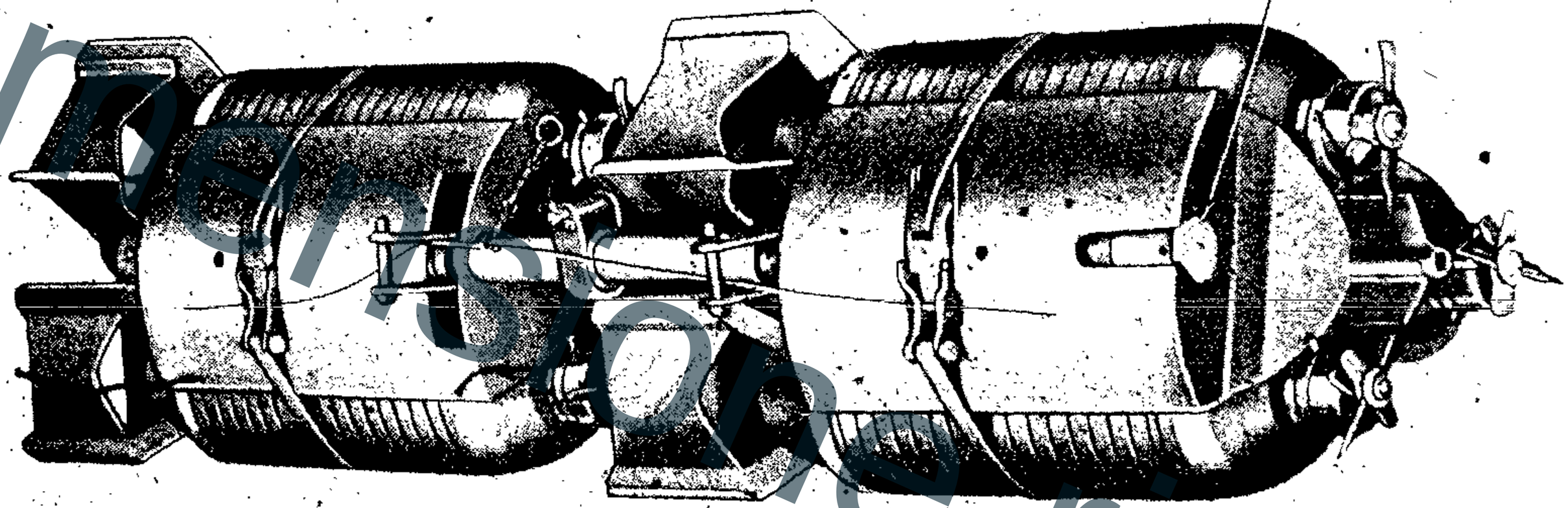
RA PD 10944A

Figure 62. Booster, igniter, and detonator units used with mechanical time and other fuzes.



DELAY OPENING

WITH FUZE
WITHOUT FUZE



IMMEDIATE OPENING

RAFD 12460

Figure 127. Cluster, fragmentation bomb, M27 type—showing cluster set for delay opening and immediate opening.

(6) Remove lower fuze vane lock.
(7) Remove fuzes from middle and lower layers of bombs.
(8) Repack and reseal fuzes in containers.
(9) Replace fuze hole plugs and replace cluster in original packing.

Note. If the cluster was prepared for immediate opening, new shear wires must be installed before cluster can be used for delay opening. WIRE, arming, low brass, 0.064-inch diameter, cut to proper length, may be used as a replacement shear wire; loops formed at both ends (similar to those on the original shear wire) will hold it in place.

186. Cluster, Fragmentation Bomb, M27 Series

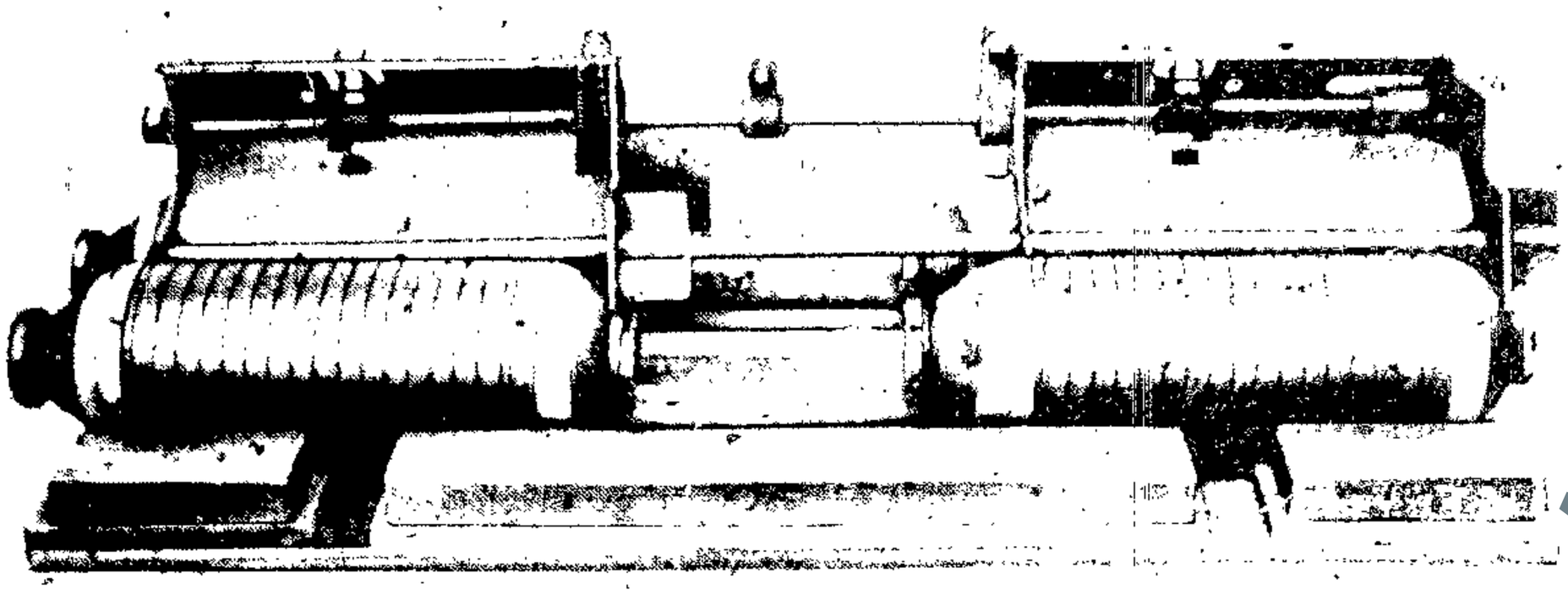
a. GENERAL. The only difference between these clusters is that the M27 employs the ADAPTER, cluster, M14 and the M27A1 uses the ADAPTER, cluster, M14A1 (par. 169). In all other respects the information in this paragraph pertains to both the M27 and M27A1. This cluster (figs. 127 and 132) is of the 500-pound size and contains six 90-pound fragmentation bombs M82. The cluster may be adjusted to discharge the individual bombs immediately or, by the action of one or two mechanical time fuzes, to discharge the bombs 5 to 92 seconds after release from the plane. This cluster is assembled in the field and its components may be supplied unassembled or partially assembled. The assembled cluster is 59 inches long and weighs 585 pounds.

b. ASSEMBLY OF CLUSTER FOR STORAGE AND SHIPMENT.

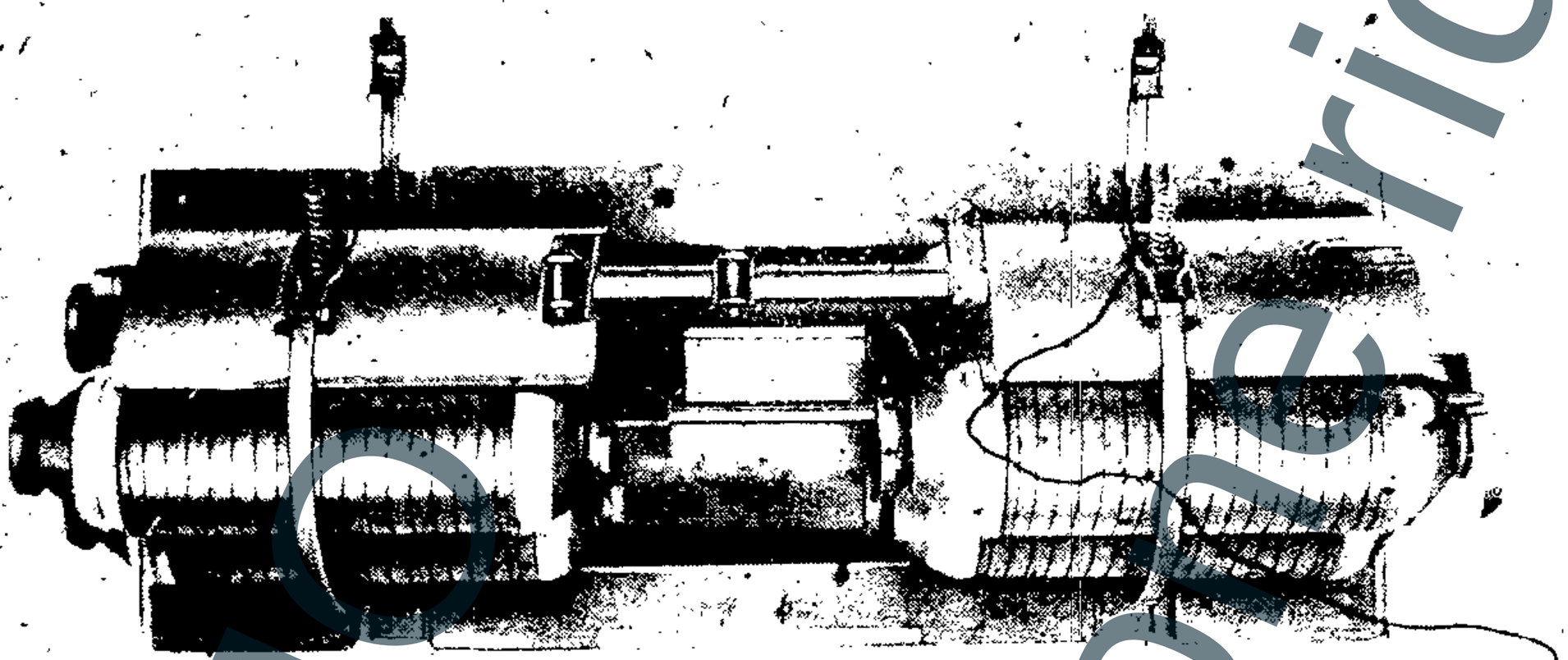
(1) *Cluster.* The preliminary assembly of the cluster is carried out as follows (fig. 129):

(*a*) Place four bombs, pointing in the same direction, on

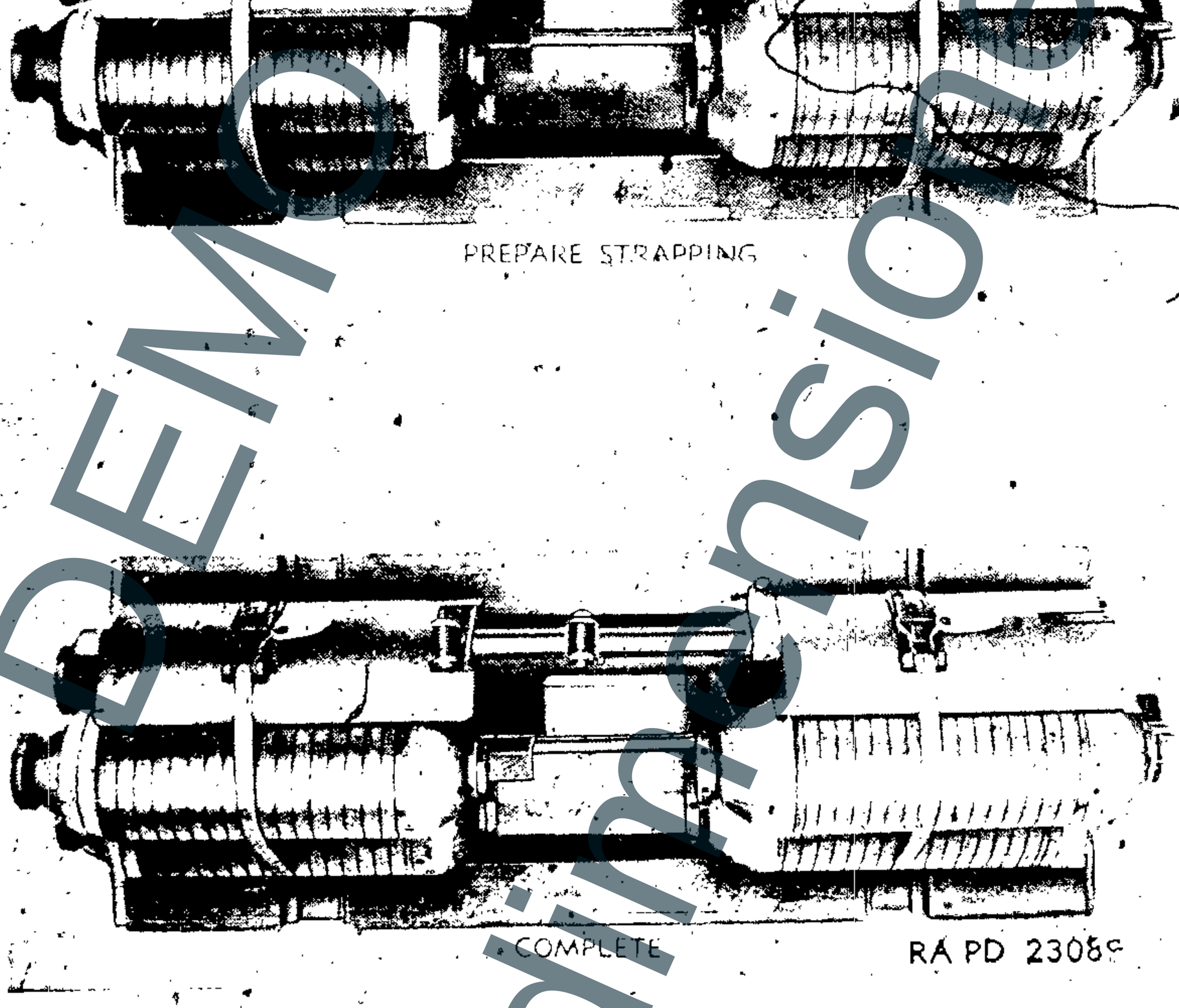
Figure 128. Assembly cradle for M27 clusters.



FIT ADAPTER OVER-ALIGNED BOMB



PREPARE STRAPPING



COMPLETE

RA PD 230859

Figure 129. Steps in assembling M27 clusters.

an assembly cradle (par. 169) such as that illustrated in figure 128.

(*b*) Fit adapter over bombs and aline bombs to fit the nose and tail supports.

(*c*) Thread a shear wire through each of the two holes in the upper member between the side plates of the release mechanisms.

(*d*) Assemble remaining two bombs to adapter.

(*e*) Attach formed end of straps to release mechanisms with "D" bolts, assembling lock washer and nut loosely.

(*f*) Pass straight ends of straps around bombs and attach clamp to strap.

Note. To attach clamp to strap, pass straight end of strap through the wide slot in the clamp from the top. Place the clamp in approximate position in release mechanism and mark place for bending. Let the clamp slide down the strap and form a hairpin bend at the point marked. Bring the clamp back up the strap and pass the free end of the strap through the narrow slot. Pull up the clamp and, if necessary, seat it by tapping with a wooden block.

(*g*) Place kick-out spring over each shear wire.

(*h*) Place strap clamp on release mechanism, threading shear wire through clamps. Fasten clamp in position with cotter pin and tag, and spread ends of cotter pin.

(*i*) Tighten strapping around bombs by rolling strapping on "D" bolts with open-end wrench. When proper tension is obtained, tighten nut.

Note. The strap should be tight enough so that all slack is taken up, and tapping the strap with a wrench will cause it to rebound. However, it should not be so tight that the strap clamp cannot be depressed by thumb pressure.

(*j*) Form a loop in each shear wire, similar to the preformed loop at the other end (fig. 130).

Note. If available, Nicopress sleeve may be used to fasten shear wire, by crimping two sleeves to the shear wire first with crimping pliers, then with special crimping tool. Another piece of wire is placed in the empty channel of the sleeve to insure tight crimp.

(2) *Connectors.* Connectors are assembled as follows (fig. 129):

(*a*) Remove nose plugs of bombs in rear bank and replace with tubular connector assembly.

(*b*) Screw extension out until the cup is against the cone of the bomb in the forward band, wrenchtight.

(*c*) Holding the extension, tighten lock nut.

(3) *Nose protector cap.* Nose protector cap is assembled as follows:

(*a*) Remove nose plug from the forward bank of bombs.

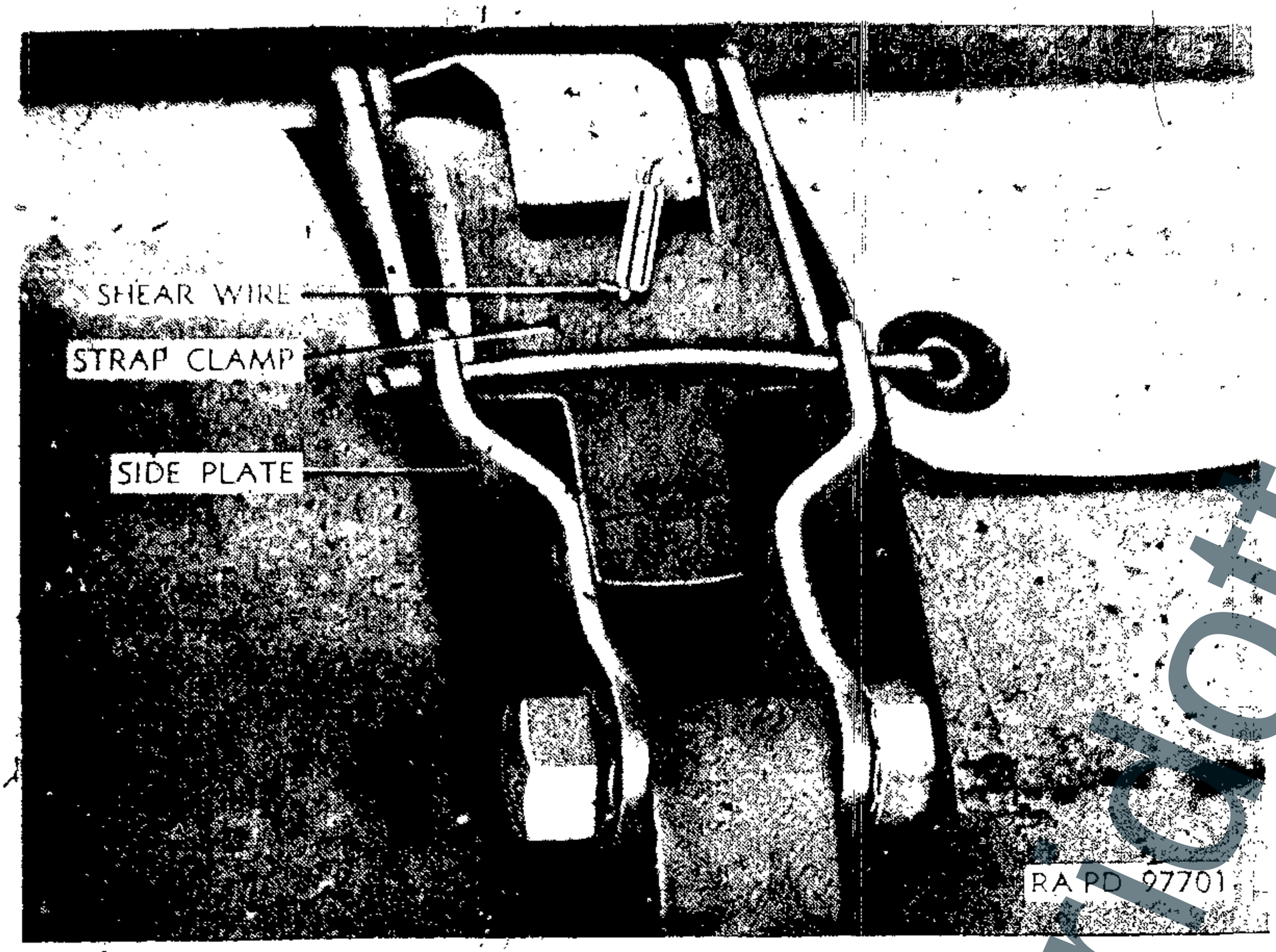


Figure 130. Shear wire assembly.

(*b*) Place nose protector cap in position and fasten in place by replacing nose plugs.

(4) *Shipping bands.* Shipping bands are assembled as follows:

(*a*) Brace the lower half of the shipping band assembly to prevent it from moving.

(*b*) Place the cluster into shipping band so that strapping is alined properly within the bands.

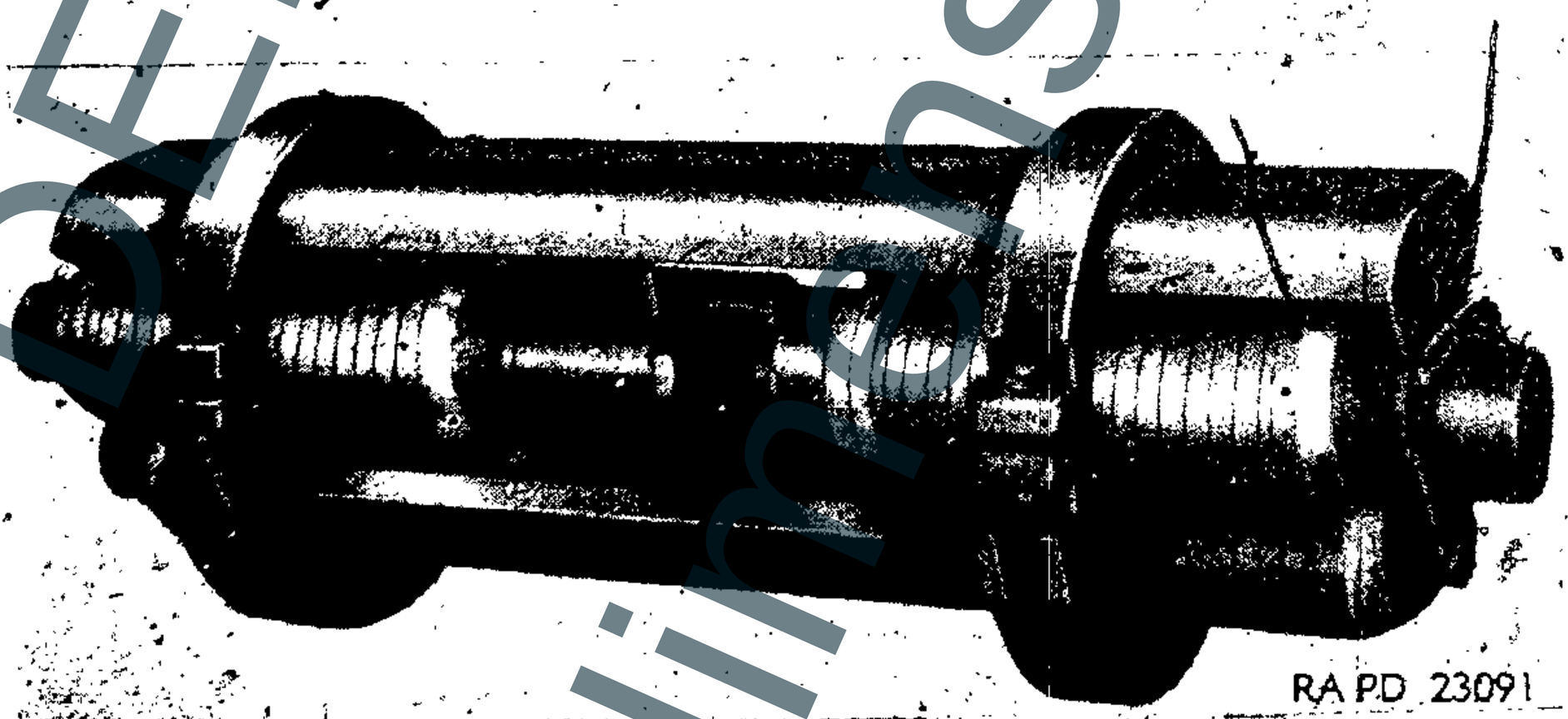


Figure 131. M27 cluster in shipping bands.

(c) Place upper half of shipping band assembly over cluster and assemble bolts, washers, and lock washers.
(d) Examine assembly to see that bands bear properly against the bomb bodies.

c. PREPARATION FOR USE.

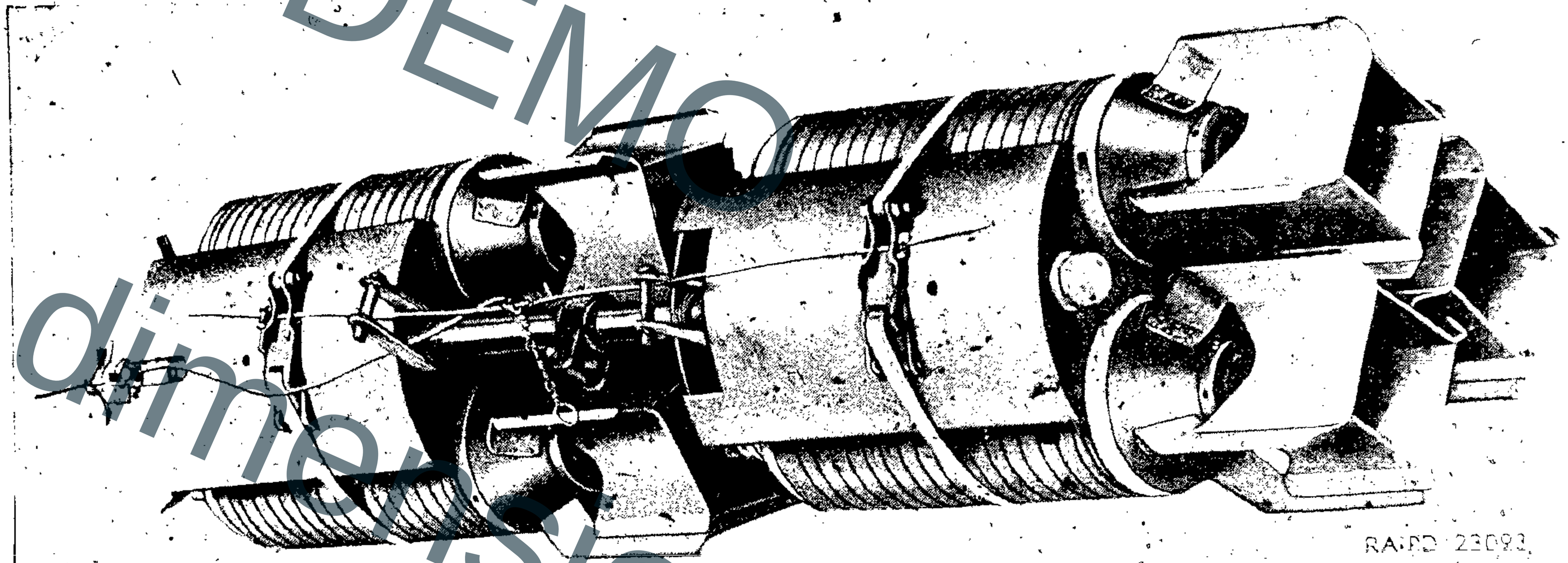
(1) *General.* The cluster, partially assembled as described above, is prepared for use by assembling the fins and fuzes to the individual bombs and adjusting the adapter for immediate or delayed opening on release.

(2) *Assembly of bombs.*

(a) Remove cluster from shipping bands.
(b) Remove nose plugs and nose protector cap.
(c) Release lock nuts and remove connectors.
(d) Remove fin lock nuts from all bombs.
(e) Inspect fuze cavities and threads.
(f) Assemble fins to bombs. Be careful that fins are located so that they will not interfere with each other and will not be damaged when the cluster is installed in the plane (fig. 132).
(g) Unpack six FUZE, bomb, AN–M103A1. Inspect for serviceability. Discard the vane assembly supplied with the fuze.
(h) Set each fuze for superquick action by pulling out the setting pin and turning it so that the locating pin seats in the shallow slot.
(i) Screw a fuze into the nose of each bomb, handtight. If necessary, transfer the safety cotter pin so that it will be accessible from the outside of the cluster.
(j) Cut and remove the fuze seal wire. Assemble the short (4.6 in) vane supplied with the fin assembly.
(k) Remove the safety cotter pin and turn the vane each way to be sure that the adapter vane stop will prevent the fuze vane from rotating.

(3) *Preparation for delayed opening.* To prepare the cluster for delayed opening after release, prepare bombs as described in (2) above, then,

(a) Remove plug from nose end of upper member (fuze adapter) and remove envelope containing set screw. Inspect to see that the cavity is clear.
(b) Unpack FUZE, bomb, nose, mechanical time, M155, and inspect for serviceability. Remove and replace the striker stop to be sure that the safety block will not fall out.
(c) Set the time desired on the fuze. Loosen the thumbscrew in the side of the fuze body, turn the head of the



RAIPD 23093

Figure 132. M27 cluster—rear view.

fuze until the index line is opposite the number of seconds desired, and tighten thumbscrew.

(*d*) Screw the fuze handtight into the fuze adapter. Assemble set screw and lock nut loosely. Back off the fuze until the arming pin points up, that is, away from the lower member. Tighten the set screw and lock nut.

(*e*) Thread a heavy and a fine branch of the arming wire through the forward suspension lug. Thread the heavy branch through the vacant holes in the release mechanism. Thread the fine branch through the inner holes of the fuze arming pin, arming wire guide, and vane tab so that about 2.5 inches protrudes beyond the vane tab. Place a safety clip (Fahnestock) on the branch of the heavy wire.

(*f*) Thread the remaining branch of heavy wire through the rear suspension lug and through the holes in the rear release mechanism. Place a safety clip (Fahnestock) on the wire. Cut off the unused branch of fine wire close to the swivel loop attachment.

(*g*) Cut and remove fuze sealing wire, safety cotter pin, and striker stop.

(*h*) Install cluster in plane.

(*i*) Remove safety cotter pins from both cluster release mechanisms and from all six bomb fuzes.

(*j*) If cluster is not dropped, disassemble and return components to storage by reversing the above steps.

(4) *Preparation for immediate opening.* To prepare cluster for opening immediately on release, prepare bombs as described in (2) above, then,

(*a*) Thread a heavy branch of the arming wire through each suspension lug and through the holes in the corresponding release mechanism. Place a safety clip (Fahnestock) on each branch.

(*b*) Cut off both branches of fine wire close to the swivel loop attachment.

(*c*) Cut the shear wire in each release mechanism close to the clamp.

(*d*) Install the cluster in the plane.

(*e*) Remove safety cotter pins from both release mechanisms and from all six bomb fuzes.

(*f*) If the cluster is not dropped, replace all cotter pins and shear wire (185 *d* above) or tie a conspicuous tag to the release mechanism to indicate that the shear wire has been cut and that the cluster is for immediate opening only.

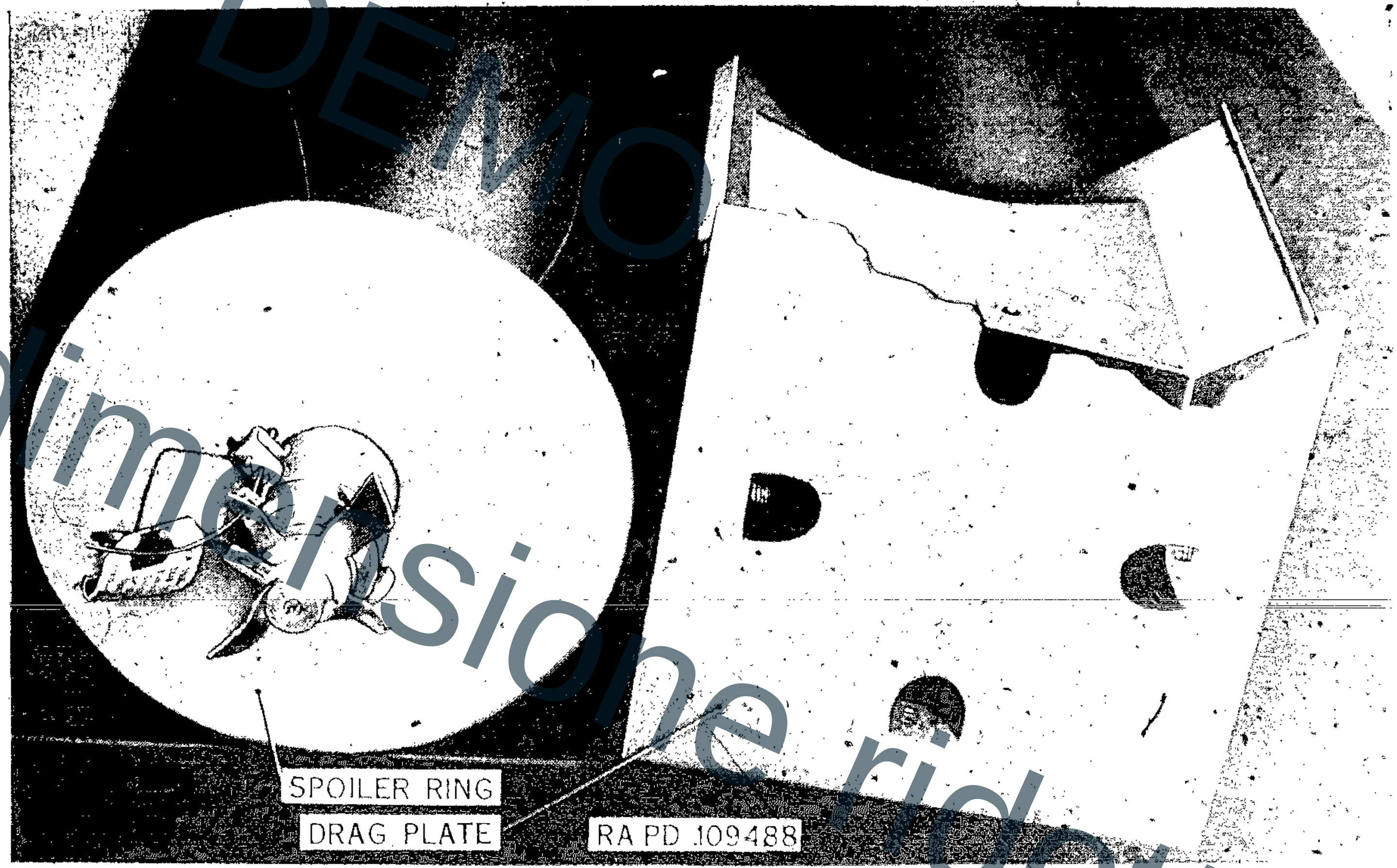


Figure 133. Cluster, fragmentation bomb, M28A2 assembled

d. PRECAUTIONS.

(1) The general precautions for handling bombs, clusters, and fuzes will be observed.

(2) The time fuze will crush and function if cluster is dropped on it.

(3) If immediate opening is desired, shear wire must be cut or cluster will not open.

(4) If delay opening is desired, shear wire must be left intact and fuze installed and set.

(5) Cluster must open at altitude of 1,000 feet minimum to provide enough time for the bomb fuze to arm.

(6) Immediate opening of the cluster produces the most favorable impact pattern. At openings greater than 10 to 12 seconds, (aprx 2,000 ft of fall), range errors increase appreciably.

187. Cluster, Practice Bomb, M5

CLUSTER, practice bomb, M5 (100-lb size) (3 BOMB, practice, 23-lb, M71 or M71A1) is assembled in the field from the following components:

ADAPTER, cluster, M3 or M3A1, complete.
BODY, bomb, for 23-pound, practice bomb, M71, or M71A1.
PARACHUTE, unit, assembly, M3, or M4 (modified).

The bomb body and parachute unit are assembled and the parachute unit assembly is modified, if the M4 is used, by removing the suspension cable and removing the shipping cover and pull wire container and replacing them by the loose fitting cover supplied as part of the adapter assembly. Three bombs are bound in the cluster by the two steel straps which are fastened in place by cotter pins in the outer eyelets in the buckles. The arming wire is then inserted with one branch through the inner eyelets of each buckle and a safety clip placed on each end. The assembled cluster is 31 inches long and weighs 84 pounds.

Section VI. AIMABLE CLUSTERS

188. Cluster, Fragmentation Bomb, M28 Series

a. DESCRIPTION. This series of clusters consists of the models M28, M28A1, and M28A2. The M28 uses the ADAPTER cluster, M15; the M28A1 uses the adapter M15A1 (with spoiler ring and drag plate); and the M28A2 uses the adapter M15A2 (which contains a new nose locking cup in addition to spoiler ring and drag plate) (par. 170). In all other respects the clusters in this series are identical, and the information in this paragraph pertains to

the three models unless otherwise noted. The 100-pound M28 type bomb cluster consists of an M15 type cluster adapter containing twenty-four 4-pound fragmentation bombs M83 arranged in eight banks of three bombs each (similar to method shown in fig. 134, for M29 type clusters). The fragmentation bombs are equipped with an M129, M130, or M131 fuze (pars. 105 to 107). The FUZE, bomb, nose, mechanical time, M155 is authorized for use with these clusters. However, in the absence of the M155, the AN–M146 may be used.

b. FUNCTIONING. When the cluster is released armed, the arming wire is withdrawn from the time fuze, allowing the fuze to arm. When the time set on the fuze has elapsed, the fuze functions and blows the nose cup into the adapter, permitting the cluster to open and disperse the bombs. The individual bombs function as described in par. 140.

c. PREPARATION FOR USE.

(1) Assemble drag plate (*d* below).

(2) Unscrew the bolts and remove the L shaped protectors from the suspension lugs. If single hook suspension is desired, push the double lugs down into the cases and attach the single lug with the screws provided.

(3) Cut wire on nose cup retainer and remove wire and retainer. When carrying out this operation on the M28 or M28A1 cluster, be careful not to push the cup off its seat. When carrying out this operation on the M28A2, make certain that the locking cup screws are tight.

(4) Assemble spoiler ring and fuze (*e* below).

(5) If the cluster is not used, restore components to original condition and packings.

d. TO ASSEMBLE THE DRAG PLATE. Using figures 113 and 133 as a reference, proceed as follows:

(1) Rest the cluster in a horizontal position on a support so that the tail fin is several inches above the ground.

(2) Fit the drag plate over the tail fin so that one ear rests against the outside of each side of the tail fin.

(3) If holes are not drilled in the tail fin to accommodate the drag plate, drill holes with a No. 30 drill (0.128-in diam), using the holes in the drag plate ears as guides.

(4) Screw the drag plate to the fin, using the special self-tapping screws issued with the drag plate. Make sure the drag plate is secure.

e. TO ASSEMBLE SPOILER RING. Using figures 113 and 133 as a reference, proceed as follows:

(1) Place the spoiler ring over the fuze cavity of the cluster

[illegible] the flange of the spoiler ring hole in inside the cavity.

(2) With holding the spoiler ring in this position, screw the fuze into the fuze cavity. Tighten it by hand; adjust, at the same time, the final position of the spoiler ring so that the small hole in the ring is in line with the arming pin of the fuze.

(3) When installing the arming wire, pass the wire through the hole in the spoiler ring.

f. PRECAUTIONS. In addition to the general precautions for handling bombs, clusters, and fuzes, the following will also be observed:

(1) Protect unpacked clusters, not intended for immediate use, from atmospheric moisture.

(2) Under no circumstances will the using arm attempt to disassemble the cluster or any of its bomb components.

(3) Because of great dispersion and drift, best results are obtained when the cluster is released at altitudes of 2,000 to 5,000 feet with fuze setting of 5 to 8 seconds.

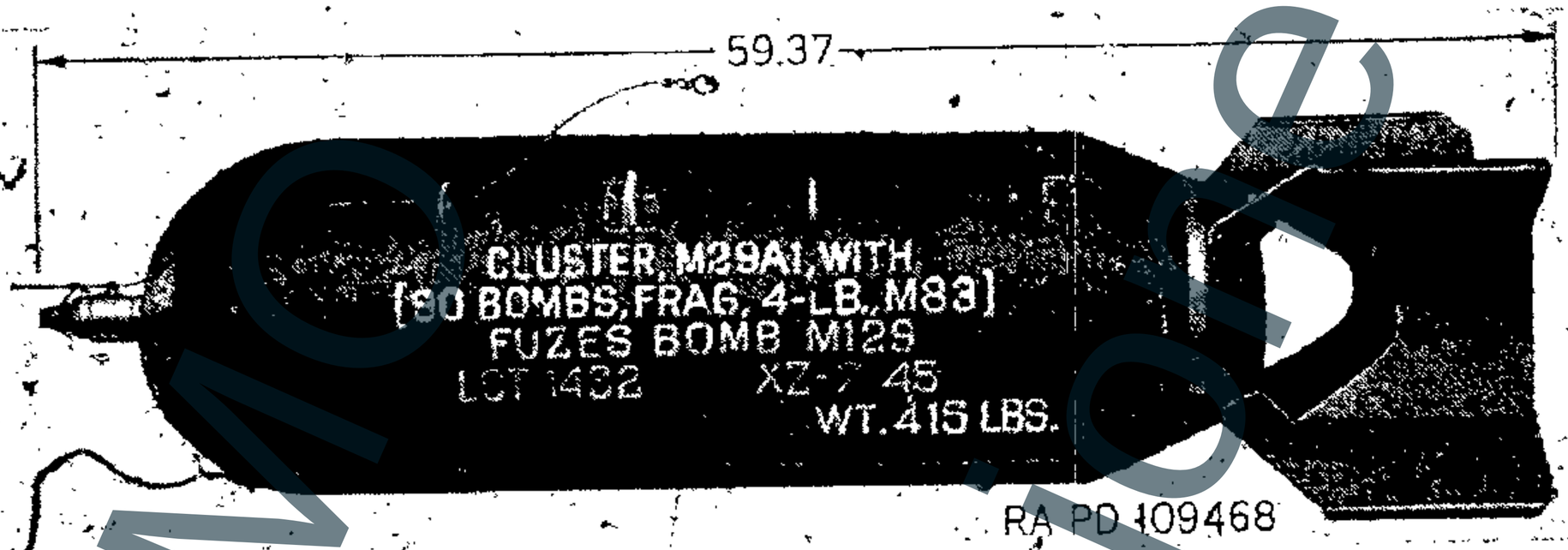


Figure 134. Cluster, fragmentation bomb, M29A1—complete.

189. Cluster, Fragmentation Bomb, M29 Series

a. GENERAL. These clusters are identical except that the M29 employs the ADAPTER, cluster, M16 (par. 171) and the M29A1 uses the M16A1 which differs from the M16 by the addition of a new nose locking cup (par. 170 *d*). Except for that difference, the information in this paragraph pertains equally to the M29 and M29A1. The M29 type cluster (fig. 134) is of the 500-pound size and is assembled in the field. It consists of ninety 4-pound fragmentation bombs M83 assembled in the M16 type cluster adapter. The FUZE, bomb, nose, mechanical time, M155, is authorized for use with these clusters. However, in the absence of the M155, the AN–M146 may be used. The cluster fits any 500-pound bomb station.

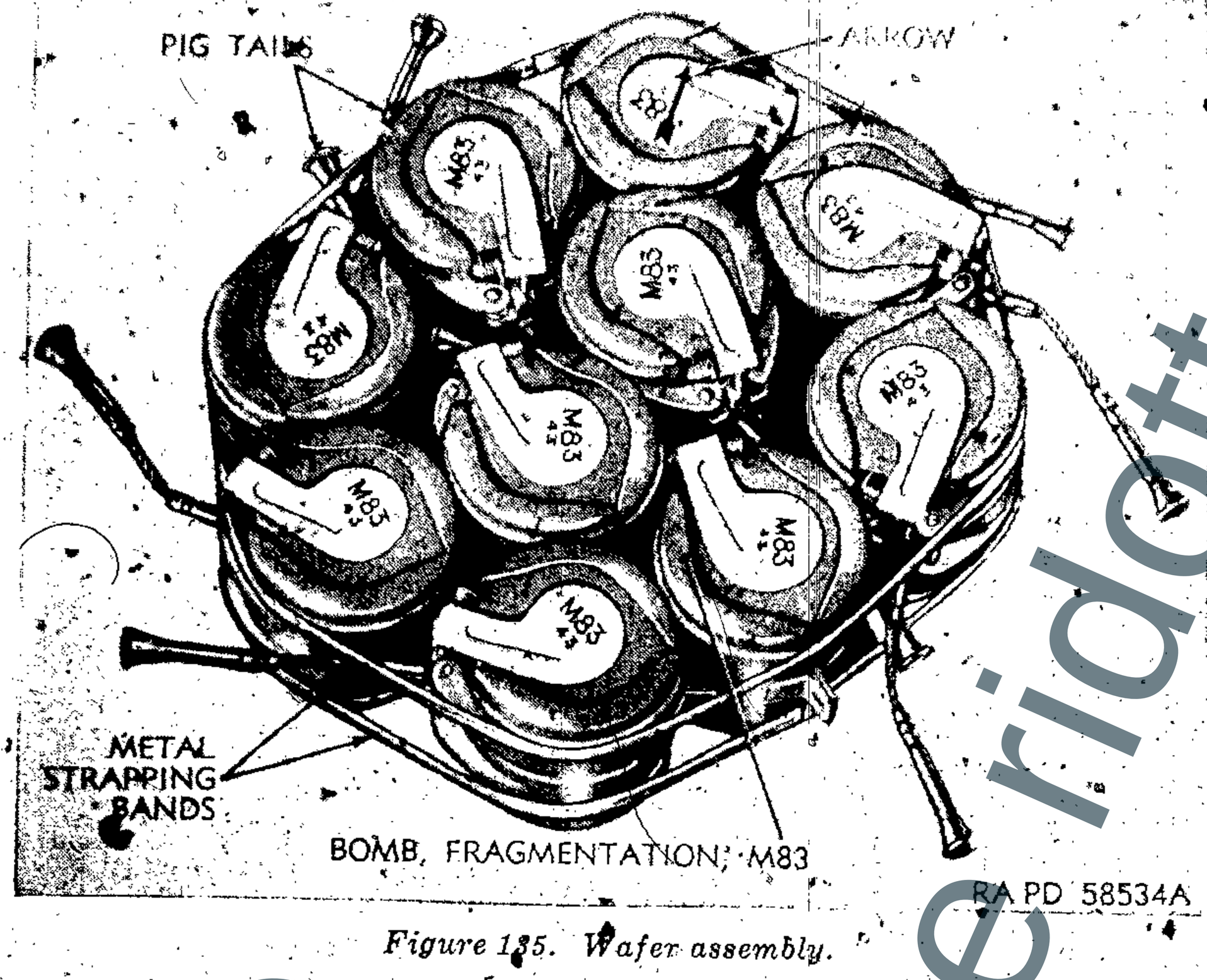


Figure 135. Wafer assembly.

b. COMPONENTS. The M29 type cluster consists of the following components:

(1) An ADAPTER, cluster, of the M16 type. This is a bomb-shaped metal adapter with hinged top cover and with partitions inside the body for inserting wafers of M83 bombs (figs. 135 and 136).

(2) Ninety BOMB, fragmentation, 4-pound, M83 in wafer form (135). Ten bombs are assembled in each wafer and nine wafers are placed inside the adapter.

(3) FUZE, bomb, nose, mechanical time, M155, for insertion in the nose of the adapter.

(4) Arming wire assembly for bomb cluster M29 or M29A1.

c. PREPARATION FOR USE. The cluster components are shipped separately and must be assembled in the field. The steps listed below should be followed carefully:

(1). *Preparing the adapter.*

(*a*) Unpack cluster adapter M16 or M16A1 from wooden shipping box, and place it on suitable horizontal supports so that no weight will be on the tail fins.

(*b*) Unscrew and remove the suspension lug guards.

(*c*) Cut wire on cup container located in the nose of adapter. Remove cup retainer and wire.

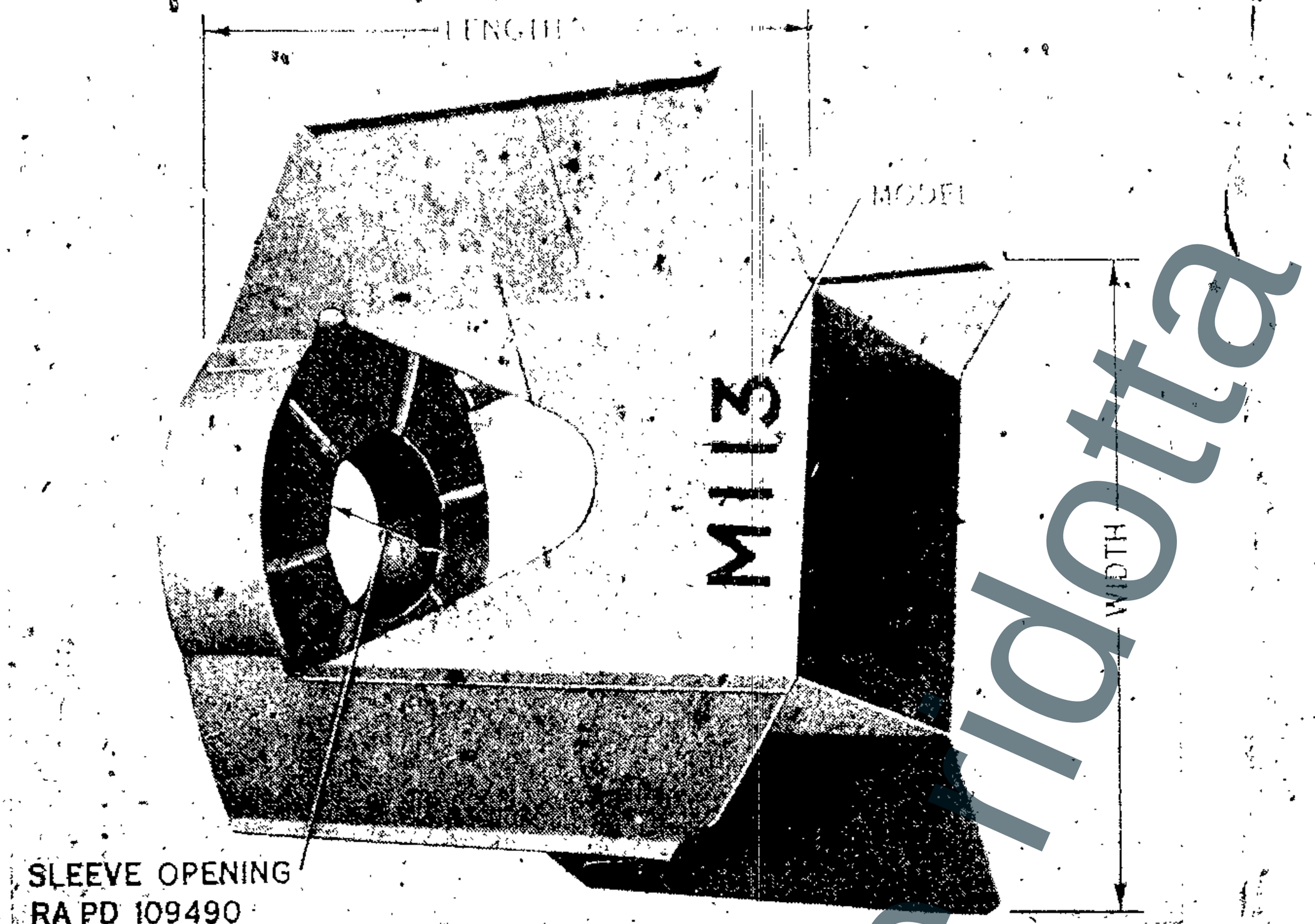


Figure 137. Fin assembly.

Table XXV. Arming Wire Data

Model of arming wire and/or bombs used with—	Pc mk	Assembled length of branches (in)	Length and diameter of unassembled wire (in)
M1—for 100-lb GP and demolition.	82-3-234XA	22, 30	54.0 x 0.064
	82-3-234WA	24, 33	59.0 x 0.064
	82-3-234BA [1]	24, 36	62.0 x 0.064
	82-3-234U [1]	22, 30	54.0 x 0.064
M1A1—for 100-, 250-, and 300-lb GP and demolition or 220- or 260-lb frag.	82-3-234FB	27, 33	62.0 x 0.064
	82-3-234YA [2]	30, 36	68.0 x 0.064
	82-3-234GA [1]	34, 39	75.0 x 0.064
	82-3-234EB [1]	28, 34	64.0 x 0.064
M3—for 100-lb TI, M84 and M84A1 or 100-lb practice target, M75 or M75A1.	82-3-234S	26	26.25 x 0.064
	82-3-277C	26	26.25 x 0.064
	82-3-312B	26	26.25 x 0.064
	82-3-405D	26	26.25 x 0.064
	82-3-409C	26	26.25 x 0.064
M4—for 250-lb TI	82-3-234RA	40	40.25 x 0.036
M5—for 500-lb GP, demolition, chemical, incendiary and SAP or 600-lb demolition.	82-3-234HB	33, 42	77.0 x 0.064
	82-3-234YA [3]	33, 42	77.0 x 0.064
	82-3-234NB		
	82-3-234FA	33, 42	77.0 x 0.064

See footnotes at end of table.

Table XXV. Arming Wire Data—Continued

Model of arming wire and/or bomb used with—	Pc mk	Assembled length of branches (in)	Length and diameter of unassembled wire (in)
M6—for 500-lb SAP	82-3-234BB	41	41.25 x 0.064
M6A1—for 500-lb and 1,000-lb SAP.	82-3-234VA [1]	46	46.25 x 0.064
	82-3-234VA	48	48.25 x 0.064
M7—for 1,000-lb GP, demolition, and chemical.	82-3-234ZA [2]	34, 45	81.5 x 0.064
	82-3-234ZA	36.5, 45	83.5 x 0.064
	82-3-234KA [1]	36, 50	88.0 x 0.064
M8—for 2,000-lb GP and demolition, or 1,100-lb demolition.	82-3-234AB	49, 60	111.0 x 0.064
	82-3-234SA	49, 60	111.0 x 0.064
	82-3-234NA [1]	49, 60	111.0 x 0.064
M9—for 2,000-lb SAP	82-3-234ZC	54	54.25 x 0.064
M10—for 4,000-lb LC	82-3-234UA	62, 68	132.0 x 0.064
For 20-lb parachute frag	82-3-207G	6	6.75 x 0.064
For cluster, M28, M28A1, or M28A2.	82-3-234CB	28	28.25 x 0.064
	82-3-439K	26	26.25 x 0.036
For 90-lb frag or 100-lb practice M38A2.	82-3-234W [1]	34	34.25 x 0.064
	82-3-213D	34	34.25 x 0.064
For cluster M29 or M29A1	82-3-446H	34	34.25 x 0.036
AP bombs	82-3-234ZB	54	52.25 x 0.064
100-lb parachute frag clusters	82-3-378F	7, 11	20.0 x 0.064
100-lb frag clusters	82-3-234DB [1]	14, 18	34.0 x 0.064
	82-3-350H	14, 18	34.0 x 0.064
AN-Mk—bombs	150931 Navy	55, 55	108.0 x 0.064
Parachute, M5	82-3-520F [4]	6	6.25 x 0.064
	82-3-520C	42	42.25 x 0.064
Parachute, M6, M7	82-3-592	1-56, 2-68	138.0 x 0.064
			57.25 x 0.064
500-lb frag cluster	82-3-477A	35, 16, 20	38.0 x 0.064
			36.25 x 0.036
Cable adapter M17 (T15)	82-3-626	2-27, 22	2- 52.125 x 0.064
		1-31, 26	1- 60.125 x 0.064
Cable adapter M18 (T16)	82-3-627	4-28	59.125 x 0.064
Cable adapter M24A1 (T19)	82-3-629 [5]	27.75	29.125 x 0.064
		36.75	38.125 x 0.064
		33.75	35.125 x 0.064
		27.75	29.125 x 0.064
		37.75	39.125 x 0.064
		31.75	33.125 x 0.064

[1] One additional clip must be added to assemblies of this pc mk to equal 82-3-350H.
[2] Revision date of 5-26-42.
[3] Revision date of 12-14-42.
[4] Assembled to arming cord as issued.
[5] Hanger and link assembly 82-3-599A, required to complete assembly.

Table XXVI. Fuze Data

Model	Type			Arming			Dimensions		
M No. (T No.)	Position	Action	Delay or time range	Type	Delay (rev and/or sec)	Air Travel (ft)	Length (in.)	Weight (lb)	Thread
BODY FUZES									
M129	Body	Airburst or impact.	Inst or non-delay	Vane	6 rev and 3 sec		3.01	0.39	1.75–24NS–1LH
M130	do	Mech time	10, 20, 30, 40, 50, or 60 minute delay.	do	6 rev		3.16		1.75–24NS–1LH
M131	do	Antidisturbance.	Inst	Vane and impact.	6 rev and 2 sec after impact.		3.16		1.75–24NS–1LH
NOSE FUZES, LARGE									
M103	Nose	Impact	0.1 sec or Inst	Vane	409 rev D	1,140	7.0	3.7	2.–12NS–1
					692 rev SQ	1,710			
M103 (AN–M103)	do	do	0.1 sec or Inst	do	180 rev D	510	7.0	3.7	2.–12NS–1
					302 rev Inst	765			
AN–M103A1	do	do	0.1 sec or Inst	do	180 rev D	510	7.0	3.7	2.–12NS–1
					302 rev Inst	765			
M139 (T66)	do	do	0.01 sec or Inst	do	180 rev D	510	7.0	3.7	2.–12NS–1
					302 rev Inst	765			
AN–M139A1 (M139A1)	do	do	0.01 sec or Inst	do	180 rev D	510	7.0	3.7	2.–12NS–1
					302 rev Inst	765			
M140 (T67)	do	do	0.025 sec or Inst	do	180 rev D	510	7.0	3.7	2.–12NS–1
					302 rev Inst	765			

See footnotes at end of table.