U.S. ARMY
DEFENSE AMMUNITION CENTER AND SCHOOL
SAVANNA, ILLINOIS

HAZARDOUS

ORDNANCE

RECOGNITION

AND SAFETY

AMMO-C-31-1
9203

THE FOLLOWING INFORMATION EXTRACTED FROM THE "HANDBOOK OF ORDNANCE DATA", COMPILED NOVEMBER 15, 1918, AND PUBLISHED BY THE U. S. ARMY ORDNANCE DEPARTMENT IN 1919 WAS NOT INCLUDED IN THE BASIC HANDOUT.

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ARTILLERY AMMUNITION

ARTILLERY PROJECTILES FOR FIELD GUNS, ANTIAIRCRAFT GUNS, HOWITZERS, ETC., USED DURING WORLD WAR I[1]

GUN	TYPE PROJECTILE	WEIGHT	LENGTH	BURSTING CHARGE
37 MM	COMMON STEEL SHELL	1.097 THROUGH 1.124	3.56	SHRAPNEL POWDER
1.457"	CAST IRON SHELL	1.0	3.623	SHRAPNEL POWDER
VICKERS-MAXIM	STEEL SHELL	1.0	3.596	SHRAPNEL POWDER
2.95"	CAST IRON SHELL	12.5	10.53	RIFLE POWDER
	CAST IRON SHELL	18.0	14.34	RIFLE POWDER
	SHRAPNEL	12.5	9.69	SHRAPNEL POWDER
75 MM	COMMON STEEL SHELL	12.18	10.19[2]	TNT
	COMMON STEEL SHELL (GAS)	12.18	10.19[2]	GAS
	COMMON SHRAPNEL	15.95	11.20	SHRAPNEL POWDER
	FRENCH SHRAPNEL	15.96	10.95[2]	SHRAPNEL POWDER
	COMMON STEEL SHELL ANTI-AIRCRAFT	14.3	11.2[2]	TNT OR AMATOL
	SHRAPNEL ANTI-AIRCRAFT	14.3	10.55	SHRAPNEL POWDER
3" MTN. HOW.	STEEL SHELL	15.0	11.6	HIGH EXPLOSIVE
	SHRAPNEL	15.0	10.84	RIFLE POWDER
	SHRAPNEL, HIGH EXPLOSIVE	15.0	11.0	HIGH EXPLOSIVE AND SHRAPNEL POWDER
3" FIELD GUN	STEEL SHELL	15.0	11.4	HIGH EXPLOSIVE
	SHRAPNEL	15.0	10.84	RIFLE POWDER
	SHRAPNEL, HIGH EXPLOSIVE	15.0	11.0	HIGH EXPLOSIVE AND SHRAPNEL POWDER
	COMMON STEEL SHELL, MODEL 1917	15.0	11.49[2]	TNT
3" AA GUN	COMMON STEEL SHELL, MK I, ANTI-AIRCRAFT	15.0	11.48[2]	TNT OR 50-50 AMATOL
	ANTI-AIRCRAFT TRACER SHELL, MK III	15.0	12.24	TRACER COMPOSITION
	ANTI-AIRCRAFT SHRAPNEL	15.0	11.86	SHRAPNEL POWDER
3.2" FIELD GUN	CAST IRON SHELL	13.5	9.4	RIFLE POWDER
	SHRAPNEL	13.5	7.5	RIFLE POWDER

3.6" MORTAR	CAST IRON SHELL	20.0	11.67	RIFLE POWDER
	SHRAPNEL	20.0	9.29	RIFLE POWDER
3.6" GUN	CAST IRON SHELL	20.0	11.67	RIFLE POWDER
	SHRAPNEL	20.0	9.29	RIFLE POWDER
	CAST IRON SHELL	30.0	14.7	[3]
3.8" GUN	STEEL SHELL	30.0	14.7	HIGH EXPLOSIVE, SHRAPNEL POWDER
3.8" HOW.	SHRAPNEL	30.0	13.2	[3]
	CAST IRON SHELL	60.0	18.52	[3]
	STEEL SHELL	60.0	18.52	HIGH EXPLOSIVE, SHRAPNEL POWDER
	SHRAPNEL	60.0	17.2	[3]
4.7" HOW.	COMMON STEEL SHELL, MK I	45.0	17.7[2]	TNT
4.7" GUN	COMMON STEEL SHELL, MK I	45.0	17.7[2]	50-50 AMATOL OR 80-20 AMATOL
	COMMON STEEL SHELL, MK II, GAS	45.0	16.76[2]	GAS
	COMMON SHRAPNEL	60.0	17.02	TNT
4.7" AA GUN	ANTI-AIRCRAFT, SHRAPNEL, MK I	45.0	14.23	SHRAPNEL POWDER
	ANTI-AIRCRAFT COMMON STEEL SHELL, MK III	45.0	15.8[2]	AMATOL
5" SIEGE GUN	CAST IRON SHELL	45.0	14.96	[3]
	STEEL SHELL	45.0	12.65	HIGH EXPLOSIVE, RIFLE POWDER
	SHRAPNEL	45.0	11.22[2]	[3]
5" SEA COAST GUN	COMMON STEEL SHELL, MK II	52.0	17.61[2]	TNT, 50-50 AMATOL OR 80-20 AMATOL
	COMMON STEEL SHELL, MK VI, GAS	52.0	17.2[2]	GAS
6" HOW.	CAST IRON SHELL	120.0	27.0	[3]
	STEEL SHELL	120.0	27.0	HIGH EXPLOSIVE RIFLE POWDER
	SHRAPNEL	120.0	21.53	[3]
6" SEA COAST GUN	COMMON STEEL SHELL, MK I, HOWITZER	90.0	22.33[2]	TNT, 50-50 AMATOL OR 80-20 AMATOL
	COMMON STEEL SHELL, MK II, GUN	90.5	22.33[2]	TNT, 50-50 AMATOL OR 80-20 AMATOL
	COMMON STEEL SHELL, MK III, GAS	90.5	21.26[2]	GAS

155 MM HOW.	SHRAPNEL, MK I	95.0	18.74	POWDER
.	SHELL, MK I	95.0	23.33[2]	TNT, 50-50 AMATOL OR 80-20 AMATOL
.	SHELL, MK II, GAS	95.0	23.39[2]	GAS
7" SIEGE HOWITZER	CAST IRON SHELL	105.0	17.05	[3]
	STEEL SHELL	105.0	17.05	HIGH EXPLOSIVE
.	SHRAPNEL	105.0	13.32	RIFLE POWDER [3]
7" SIEGE MORTAR	CAST IRON SHELL	125.0	20.97	[3]
	STEEL SHELL	125.0	20.97	HIGH EXPLOSIVE
.	SHRAPNEL	125.0	16.155	RIFLE POWDER [3]
8" HOW.	COMMON STEEL SHELL, MK I	200.0	27.16[2]	50-50 AMATOL OR 80-20 AMATOL
.	SEMISTEEL SHELL, MK II	200.0	25.78	50-50 AMATOL OR 80-20 AMATOL
.	COMMON STEEL SHELL, MK III, GAS	200.0	26.66[2]	GAS
9.2" HOW	COMMON STEEL SHELL, MK IX	290.0	26.80[2]	80-20 AMATOL
240 MM HOWITZER	COMMON STEEL SHELL, MK IX	290.0	26.80[2]	50-50 AMATOL
.	COMMON STEEL SHELL, MK I	356.0	33.84[2]	80-20 AMATOL

[1] THIS LISTING IS NOT ALL INCLUSIVE AND SPECIFICALLY DOES NOT INCLUDE MORTAR AMMUNITION.

[2] UNFUZED.

[3] NO EXPLOSIVE FILLER GIVEN IN REFERENCE MATERIAL.

MARKINGS ON THE ABOVE MENTIONED ROUNDS

COMMON STEEL SHELLS ARE PAINTED YELLOW TO DENOTE HIGH EXPLOSIVE FILLER AND GRAY TO DENOTE GAS FILLER. SEMISTEEL PROJECTILES HAVE THE TOP PAINTED BLACK TO THE BOURELLET, WHILE ABOVE THE BOURELLET THEY ARE PAINTED YELLOW IF FILLED WITH HIGH EXPLOSIVE, OR GRAY IF FILLED WITH GAS. COMMON SHRAPNEL IS PAINTED RED.

COLOR CODING FOR GAS FILLED PROJECTILES

COLOR CODING BANDS WERE LOCATED BETWEEN THE ROTATING BAND AND THE BOURRELET AS FOLLOWS:

FILLER	1ST BAND	2ND BAND	3RD BAND	STENCIL
VN[1]	WHITE	NONE	NONE	SPECIAL GAS
CG[2]	WHITE	WHITE	NONE	SPECIAL GAS
PS[3]	WHITE	RED	NONE	SPECIAL GAS
HJ[1]	RED	RED	RED	SPECIAL GAS
BA[1]	RED	NONE	NONE	SPECIAL GAS
PG[1]	WHITE	RED	WHITE	SPECIAL GAS
NC[1]	WHITE	RED	YELLOW	SPECIAL GAS
WP	YELLOW	NONE	NONE	SMOKE
SMOKE SHELL	NONE	NONE	NONE	SMOKE
THERMIT[4]	NONE	NONE	NONE	THERMIT
OTHER INCEND.	NONE	NONE	NONE	INCENDIARY
FM	YELLOW	YELLOW	NONE	SMOKE

ADDITIONALLY, FIXED AND SEMIFIXED AMMUNITION WILL HAVE A BLACK STRIPE .375" WIDE PAINTED ON THE BASE OF THE CARTRIDGE CASE (EXCLUDING THE PRIMER).

[1] AS OF THE DATE OF THIS WRITING, I COULD FIND NO DESCRIPTION OF SPECIFICALLY WHAT THESE GASES WERE. IF, IN FACT THEY WERE LOADED AT ALL, THEY WERE PROBABLY TOXIC OR INCAPACITATING.

[2] CG IS PHOSGENE, A TOXIC AGENT.

[3] PS IS CHLORPICRIN, AN INCAPACITATING AGENT.

[4] THERMIT IS THE OLD SPELLING OF THERMITE OR THERMATE.

CHEMICAL AGENTS

THE FOLLOWING CHEMICAL AGENTS WERE KNOWN TO HAVE BEEN PRODUCED BY THE U.S. FOR MILITARY USE. HOWEVER, SINCE THE U.S. WAS MAKING A SIGNIFICANT AMOUNT OF ORDNANCE FOR THEIR ALLIES PRIOR TO OUR ENTRY INTO THE WAR, SOME OF THESE AGENTS MAY NOT HAVE BEEN LOADED INTO U.S. AMMUNITION.

CHLORINE (CL)
PHOSGENE (CG) [5]
CHLORPICRIN (PS)
MUSTARD GAS (HS)
LEWISITE (M-1)
STANNIC TETRACHLORIDE

[5] "Some 1,600 tons of phosgene were manufactured in the United States during the (First) World War. Of this, 420 tons were shipped overseas in bulk; 18,600 LP (Levins Projector) drums containing 279 tons of this agent were also shipped to France. Some of these drums were fired in battle being the only American gas in American munitions used during the (First) World War".

SHRAPNEL PROJECTILES

(SEE PAGE 13) Unlike modern canister projectiles that spread their payload immediately upon exiting the cannon, WW I shrapnel projectiles worked like those of the Civil War ers;i.e., they were equiped with a time fuze and expelling charge. Yhat allowed the projectile to get much closer to its intended target before ejecting the shrapnel balls. The resin and ball matrix was provided to assure that the balls stayed in place inside the projectile assuring ballistic assuracy.

POINT DETONATING FUZES

(SEE PAGES 14-16) Most of the U.S. inventory of artillery fuzes at the beginning of the war were of the base detonating type. These were screwed into the base of the projectile and were thus hidden from view. However, it was learned from the experience of the Allies that it was desirable to have point detonating fuzes. (In many cases they offered quicker action; i.e., detonated upon contact with the target or ground rather than slightly penetrating. In the case of ground burst, this allowed more lethal fragment or gas dispersion.)

COLOR-CODING ON SOME FUZES

Some point detonating fuzes were color coded as follows:

NONDELAY . . . . . .WHITE HEAD
SHORT DELAY. . . . . .BLACK HEAD
LONG DELAY . . . . . .VIOLET HEAD
ADDITIONAL SAFETY FEATURES . .GREEN HEAD

ARTILLERY ADAPTER-BOOSTERS

(SEE PAGE 17) Due to the many combinations of sizes and designs of projectiles and fuzes, fuze adapter-boosters were in common use. These adapter-boosters allowed for a fuze of small diameter to be used in a fuze cavity of larger diameter. They were similar in overall appearance to modern bomb adapter-boosters.

PRIMERS

There were two basic types of artillery primers in use - percussion and friction. The percussion primers were very similar in function and appearance to modern percussion primers. The friction primers were very different. One type of primer had a pull wire that extended out the base of the primer body. When inserted into the cannon, the wire as pulled to the rear igniting the primer composition. The other type of friction primer had a pull wire extending out the side. when inserted into the cannon, the gunner could stand out to the side of the piece when firing. This same type of primer was used in the Civil War

CARTRIDGE CASES

The basic form and function of artillery cartridge cases have remained practically unchanged since the 1890s. However, for some smaller caliber (75mm, for example) ammunition "it was formerly the rule to solder a brass diaphragm down on top of the powder charge." This practice was discontinued with ammunition produced in the later stages of World War I.

EXPLOSIVES

Explosives either in use, under consideration or development during WW I.

TNT
50-50 AMATOL
80-20 AMATOL
EXPLOSIVE "D"
60-40 SODATOL
TROJAN GRENADE POWDER
GRENITE
TROJAN MORTAR POWDER
TETRYL
MERCURY FULMINATE
NITROSTARCH
BLACK POWDER
ANILITE
CRESYLITE
DINITROBENZOL + TNT
DINITROBENZOL + TNA (TETRANITROANILINE)
CHLORATE OR PERCHLORATE EXPLOSIVES
METHYL TETRYL
NITRATED IVORY NUT

HAND AND RIFLE GRENADES

For all practical purposes the U.S. had no hand or rifle grenades for military use at the beginning of WW I. We did, however, have the experience of the allies to guide them, when in 1917, we took up the design of hand grenades for use by our troops.

There were five classifications of hand grenades and one classification of rifle grenades adopted (practically all based on French or English designs):

1. DEFENSIVE GRENADES. (SEE PAGE 18) The defensive grenade was the Mk II (virtually identical in appearance and operation to the "Pineapple" grenade of WW II fame), so called because that it had to be thrown from defensive positions to prevent the thrower from being a target of its fragments.

DUMMY HAND GRENADE. The dummy grenade is made of cast iron, and resembles the defensive grenade, Mk II, in size, weight and contour. It is used for practice and painted bright red.

2. OFFENSIVE GRENADES. (SEE PAGE 19) The offensive grenade was the Mk III (very similar in appearance and function to the Offensive grenade of WW II), so called because it could be thrown while on the offense since there was little chance of the thrower being injured by fragments.

3. PHOSPHOROUS GRENADES. The phosphorous grenade has a barrel shaped steel container about 3 1/2" long by 2 1/4" in diameter containing approximately four ounces of white phosphorous.

4. GAS GRENADES. (SEE PAGE 20) This grenade is similar in size and shape to the phosphorous grenade except that this grenade has two annular corrugations on the body near the bottom to serve as a distinguishing mark. It contains 12 1/4 ounces of stannic tetrachloride[1].

5. INCENDIARY GRENADES. (SEE PAGE 20) There were two types of these. One was the thermite grenade, Mk I. To ignite it, the cover was removed and the primer holder struck manually. After a five second delay, the thermite was ignited. It was intended to be used to seal breechblocks of captured weapons and burn captured supplies.

The second type was the Incendiary Grenade, Mk I,which used the same body and fuze parts as the offensive grenade except that it had an igniter of thermite mixes with solidified oil instead of a detonator. The top half of the grenade was filled with thermite while the lower half of the body was filled with solidified oil. Some records indicate that these were not produced in large quantities.

6. V.B. RIFLE GRENADE, Mk I. (SEE PAGE 21) This was a copy of the French design consisting of a cylindrical body approximately 2 1/2 inches long by 2 inches in diameter and a discharger. The discharger with grenade was fitted over the muzzle of the rifle. When a standard ball round was fired, the bullet passed through a hole in the body of the grenade hitting a striker which fired the primer igniting an 8 second delay fuze. The propellant gases escaping from the muzzle of the rifle then propelled the grenade from the discharger out to a maximum range of about 200 yards.
(For trivia fans, the "V.B." stands for Vivens and Bessieres, two Frenchmen who invented this type of grenade.)

There was also a training version of this grenade and discharger that was inert.

[1] Stannic tetrachloride, also called tin tetrachloride, produces a noxious cloud of smoke.

GRENADE COLOR CODING

The bodies of live grenades are painted battleship gray while the bodies of practice grenades (no explosives) are painted red.

TRENCH MORTARS

Although there is a mortar listed in the table on page 2, there were no trench mortars in service with the U.S. Army at the beginning of WW I. However, there were five types adopted by the U.S. most of English design as shown in the table below. The literature of the day referred to the ammunition as "mortar bombs" or" shells".

TYPE	SHELL WEIGHT	SHELL CHARGE	CHARACTERISTICS
3" STOKES, Mk I	11 3/4 LBS.	HIGH EXPLOSIVE	AN INFANTRY WEAPON. MUZZLE LOADING SHELL AND PROPELLANT
4" STOKES, Mk I	15 LBS.	GAS, SMOKE, INCENDIARY, HIGH EXPLOSIVE	USED ONLY BY CHEMICAL WARFARE SERVICE. MUZZLE LOADING SHELL AND PROPELLANT.
6" TRENCH MORTAR, Mk I	52 LBS.	HIGH EXPLOSIVE	MUZZLE LOADING SHELL AND PROPELLANT
240-MM TRENCH MORTAR, Mk I	156 LBS.	HIGH EXPLOSIVE	MUZZLE LOADING SHELL, BREECH LOADING CARTRIDGE CASE.
11" SUTTON	205 LBS.		EXPERIMENTAL AS OF 1918. TO BE LOADED SAME AS 240-MM.

1. 3" STOKES MORTAR. (SEE PAGE 22) The ammunition is nominally 3" in diameter at the widest part and approximately 15" long (including fuze). The nose end is manufactured to accept a special fuze. The round may come with or without the fuze installed. At the forward and rear ends of the projectile there is a ring of slightly larger diameter than the rest of the body. These are bore-riding surfaces. At the rear is a cartridge container very similar to modern mortars. Up to three ballistite (a type of propellant) rings were installed depending upon the desired range.

2. The same fuze is used for both the 3" and 4" Stokes mortar. Somewhat hemispherical in shape, it is the Mk VI. It came with a "safety pin" installed that prevented the set back pellet from moving. Upon firing, the set back pellet was moved rearward freeing the safety fork to slide out to the side (this was a bore safety feature). Once the safety fork was removed the fuze was armed. The fuze was designed in such a way that it was to function irrespective of the position in which the shell strikes on impact. NOTE: Not only were live rounds produced, but a practice shell made of malleable iron was also produced.

3. 4" STOKES MORTAR. Very similar in physical appearance as the 3" except proportionately larger.

4. 6" TRENCH MORTAR, Mk I. (SEE PAGE 24) "The shell or bomb, nominally 6 inches in diameter and 15 inches long, is made of gray iron with its front end threaded for an adapter, and the rear end fitted with steel vanes which serve to keep the bombs steady in flight. Steel wire is wrapped around the vanes to hold the powder bags in position. The rear ends of the vanes are strengthened by connecting vane braces of forged steel. The propelling charge consists of 1 ounce bags of guncotton yarn and similar bags of ballistite tucked between the vanes in the wire wrapping according to the number used with the range desired. Four guncotton bags and two ballistite bags constitute the maximum charge."

5. 240-mm TRENCH MORTAR. The shell or bomb, nominally 9 1/2" in diameter and 36" long, is somewhat similar in appearance to the 6" shell in that it is fin stabilized. However, it is very different in that the propelling charge is separate from the shell. The shell is loaded tail down from the muzzle while the propelling charge in a cartridge case is loaded from the muzzle. This round did not depend upon the inertia of a falling round striking a primer to fire. The firing mechanism was apparently activated after the round was loaded.

6. FUZE, MK VII. (SEE PAGE 25) This was used with the 6", 240-mm and Sutton Trench Mortars. It came in both a delay and nondelay model. Its notable feature is the safety screw and ring which must be manually removed prior to firing.

LIVENS PROJECTOR

(SEE PAGE 26) "The Livens Projector is a mortar of the simplest type, which is used to discharge gas and incendiary shells. A cartridge case containing a number of bags of powder is dropped into the bottom of the projector with suitable wire connections leading from the electric primer in the powder to the point of operation. The shell is placed in the mortar over the cartridge case, the top of which is shaped to fit the base of the shell. The shell is provided with a length of Bickford (black powder time) fuse, which is ignited when the shell leaves the projector, and a standard type of detonator. A bursting charge of TNT is generally used with the gas shell. Black powder is usually employed to secure the ignition of the incendiary materials in the incendiary shells." The handle shown in the diagram apparently was used for carrying only and was removed prior to firing.

The Livens projector shells were about 24 inches long by 8 inches in diameter.

AERIAL DROP BOMBS

AERIAL DROP BOMBS OF THE UNITED STATES ARMY AS OF NOVEMBER 19, 1918.

DESIGNATION	WEIGHT	DIAMETER	LENGTH	FIRING MECHANISM NOSE	FIRING MECHANISM TAIL
DEMOLITION:					
MARK I	104	7 7/8	50	YES	YES
MARK II	22	4 3/4	28 1/4	NO	YES
MARK III	55 1/2	6	36 1/2	NO	YES
MARK IV	260	12 1/5	50	YES	YES
MARK V	550	16 1/2	63	YES	YES
MARK I-A[1]	105	7 7/8	39	YES	YES
MARK IV-A[1]	225	10 1/5	49	YES	YES
MARK V-A[1]	560	12 1/5	50	YES	YES
MARK VI-A[1]	1,000	20 7/8	63 1/2	YES	YES
FRAGMENTATION:					
MARK I	94	6	58	YES	NO
MARK II	19	3	30	YES	NO
MARK II-A	19	3	30	YES	NO
MARK II-B	24	5 1/8	24 1/2	YES	NO
MARK III[1]	49	4 3/4	50 1/2	YES	NO
BARLOW HEAVY DROP BOMB	93	6	80	YES	NO
INCENDIARY					
MARK I	40	6	38 1/5	YES	YES
MARK II	46	6	37 1/5		
MARK III[1]	100	7 7/8	48 3/4	YES	YES

[1] Even though these bombs had been developed, as of the date of the above table they had not been authorized for use.

(SEE PAGE 26)

1. Generally, demolition (also called high capacity) bombs were of an aerodynamic, tear-drop shape with rear fins. (For ammunition trivia fans who might look at the Mk VI-A demolition and notice that it weighs 1,000 lbs.: No, the U.S. had not developed any aircraft at that time that were capable of carrying a bomb that heavy. However, the Italians had developed a three man bomber capable of carrying up to 1,700 lbs of bombs at upwards of 80 miles per hour.)

2. The Barlow Heavy Bomb was a very unusual concept. As loaded onto the aircraft it was the dimensions given in the table above. After being dropped from the aircraft, a compressed gas cylinder in the bomb released and caused an extension rod to be driven out the bomb's nose. This caused the bomb's overall length to increase to 15 feet. At the end of the extension was a firing pin and one round of .30 cal. rifle ammunition which was aimed toward the rear of the bomb. Upon hitting the ground the firing pin

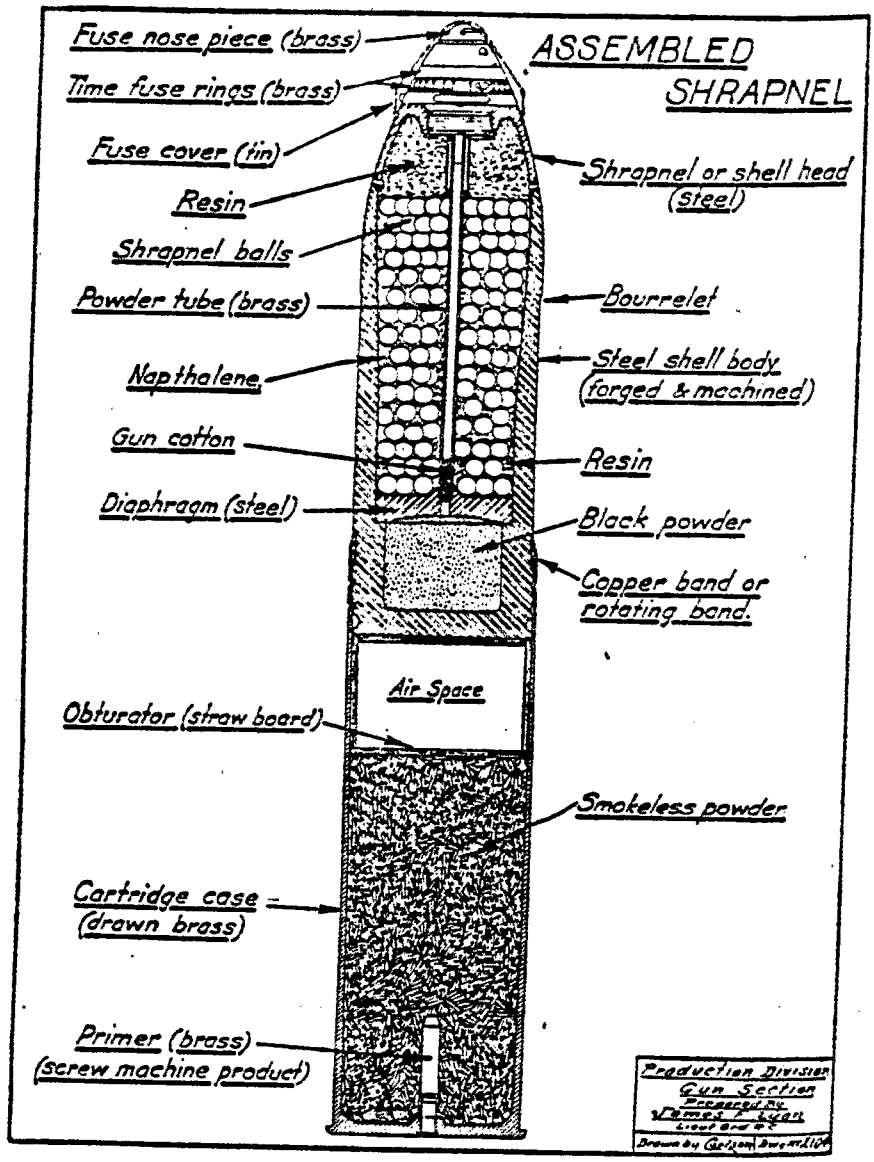
fired the rifle cartridge. The bullet passed upward through the hollow extension rod and hit a primer in the rear of the bomb causing it to detonate well above the ground. A total of only about 9,000 of these were produced.

3. Fragmentation bombs had a much higher body to filler weight ratio than did demolition bombs. These were, for the most part, adapted from rejected artillery projectile casings. The Mk I used a 6" projectile body, the Mk II a 75mm projectile body, the Mk II-A a 3" projectile body (this was the only one of the three to be put into large production), and the Mk III a 4.7" projectile body. Also they frequently had a short length of steel pipe inserted into the fuze well with a firing mechanism attached to the front of the pipe. This allowed detonation to occur above ground level.

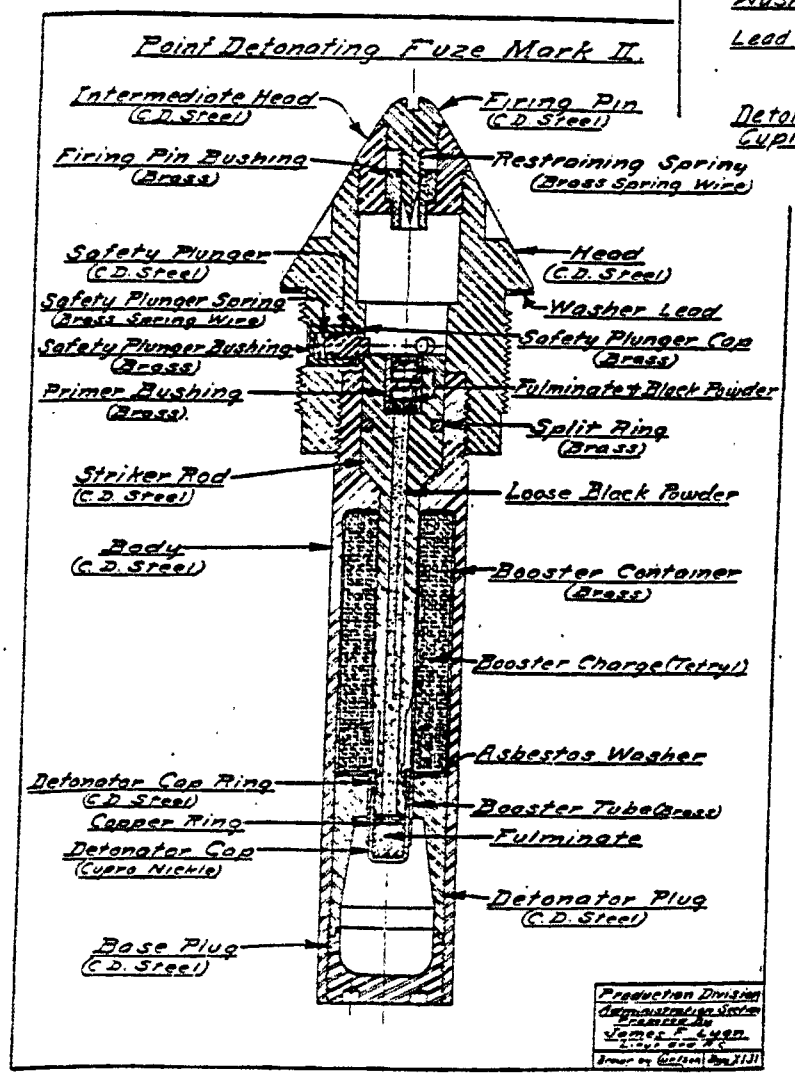
4. There were two designs of incendiary bombs. First, the Mk I, was a "scatter type" bomb filed with 19 lbs of cotton waste balls soaked in turpentine or solid oil balls wrapped in burlap with a 1 1/2 lb. black powder charge to ignite and scatter them around.

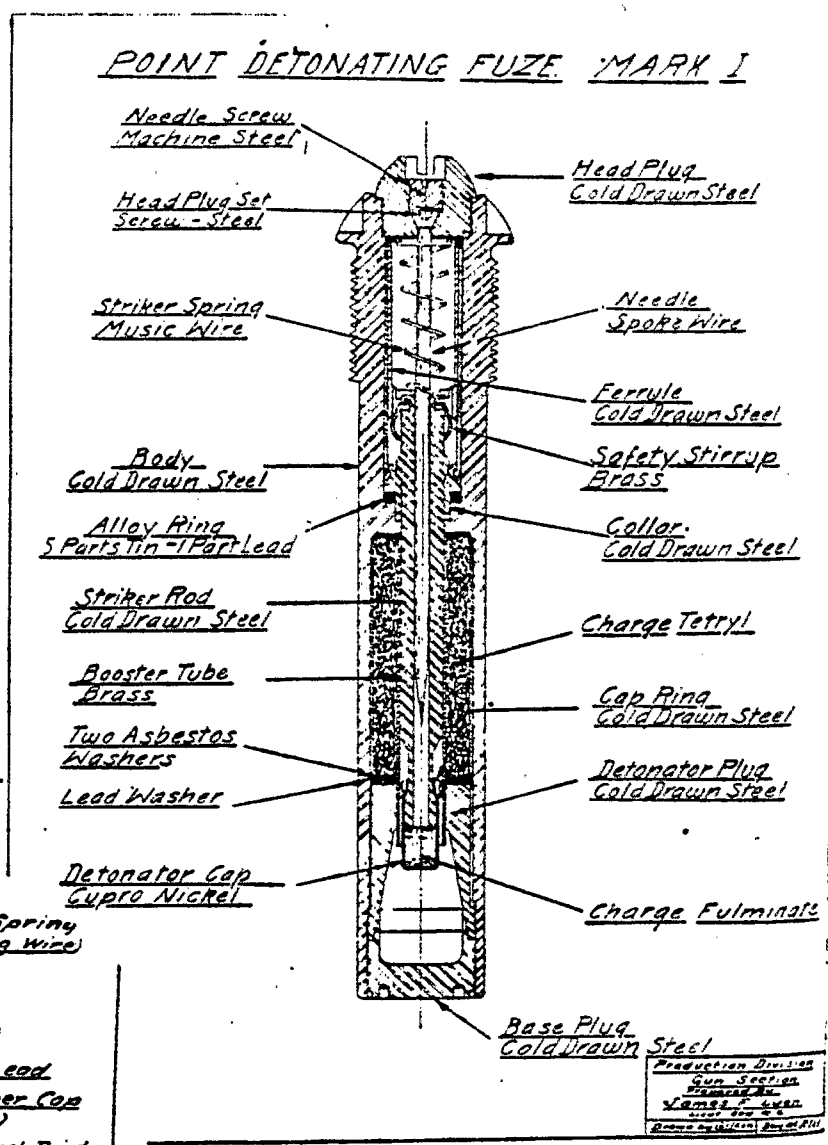
The other type of incendiary bomb, the Mk II, was called the "intensive type" because it was filled with solidified oil and thermite and tended to burn mush more intensely.

PRACTICE BOMBS. "One of the interesting phases of the bomb manufacturing program grew out of the necessity for target practice for our aviators. for this work we built dummy bombs of terra cotta, costing about a dollar apiece. Instead of loading these bombs with explosive, we placed in each a small charge of phosphorous and a loaded paper shotgun shell, so that the bomb would eject a puff of smoke when it hits its object. The aviators could see the smoke puffs and thereby determine the accuracy of their aim."

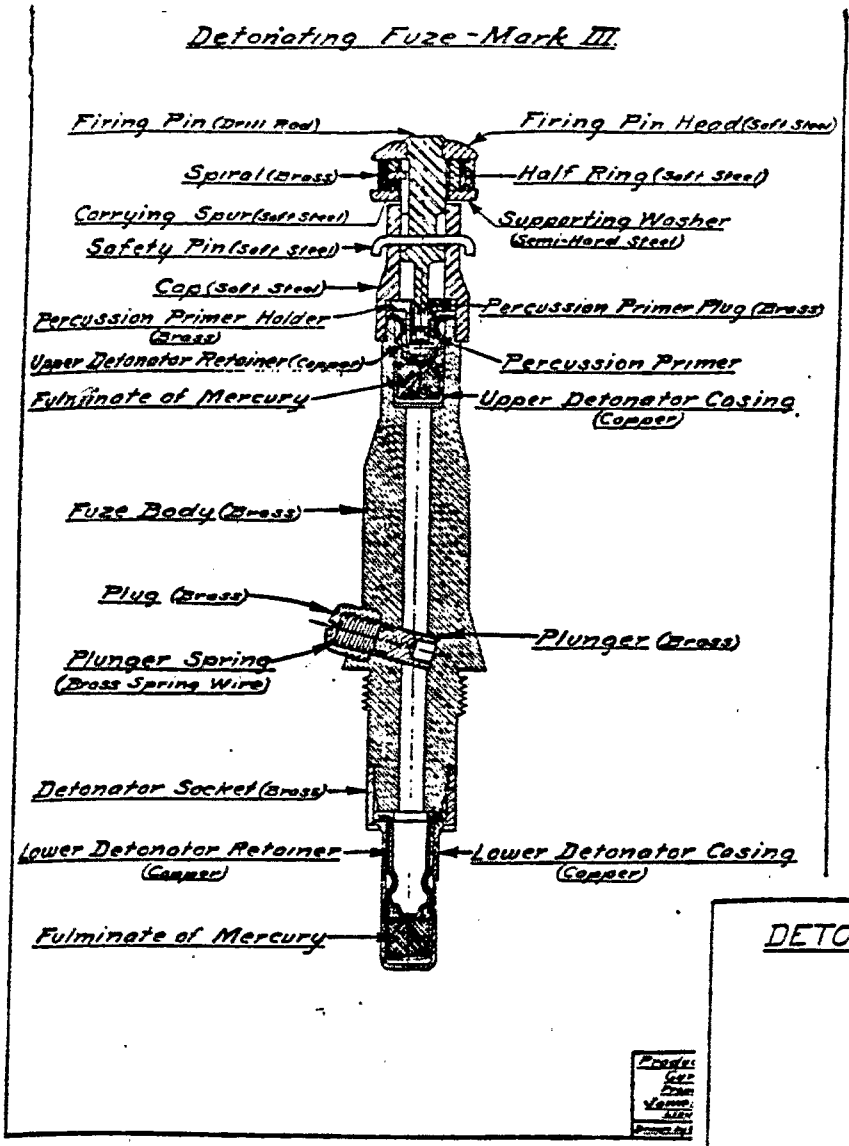


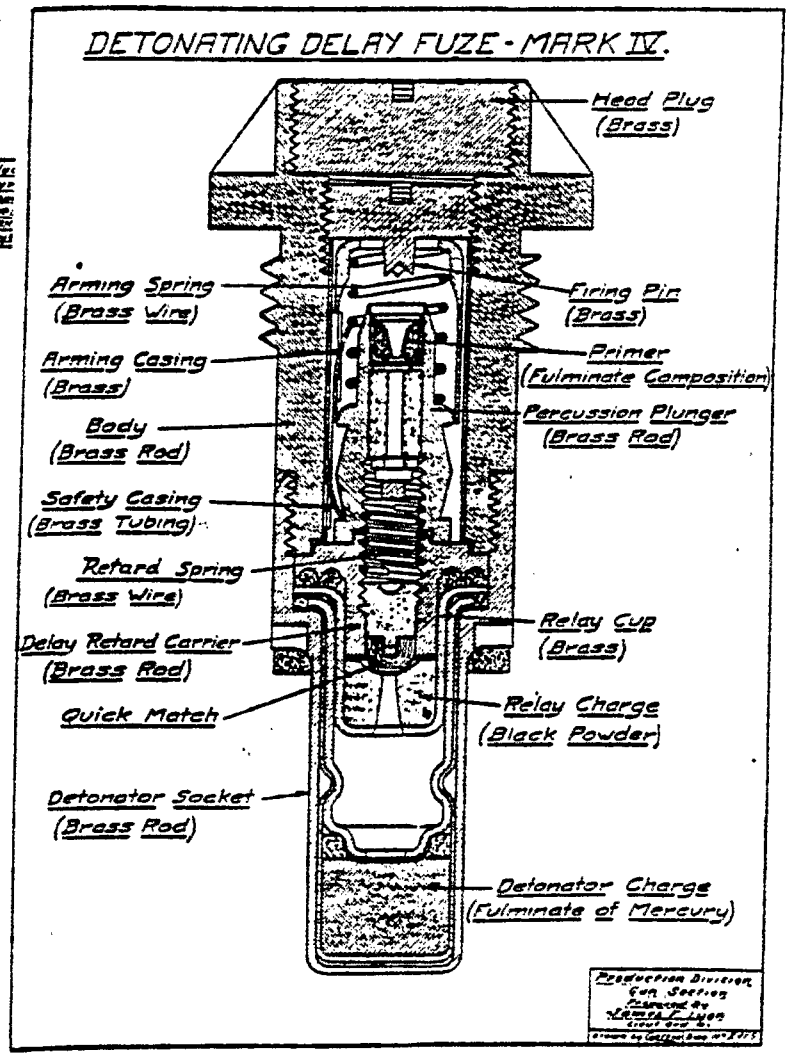
TYPICAL SHRAPNEL CARTRIDGE SHOWING TIME FUZE, RESIN AND BALL MATRIX, BLACK POWDER EXPELLING CHARGE AND OTHER COMPONENTS



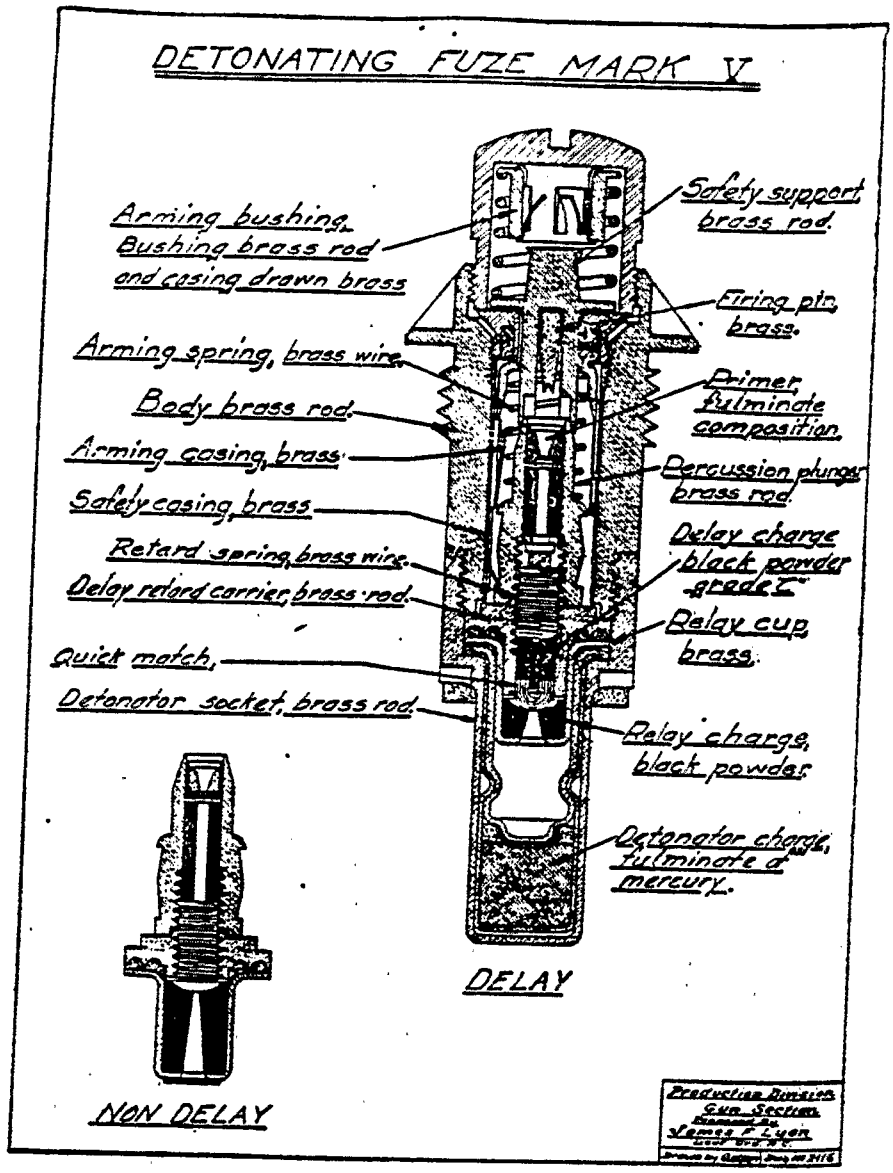


TYPICAL POINT DETONATING FUZES
ADAPTED FROM PROVEN EUROPEAN
DESIGNS

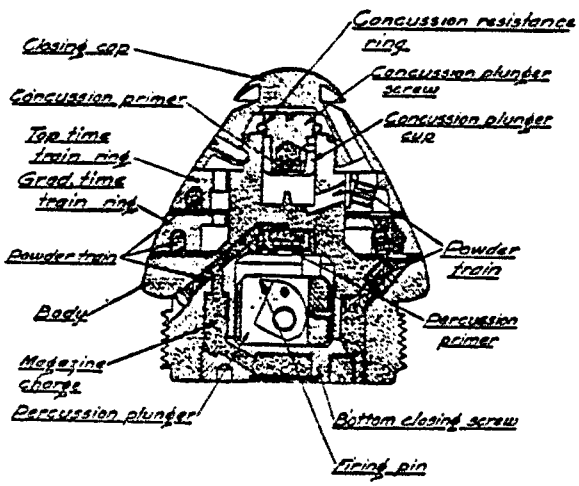




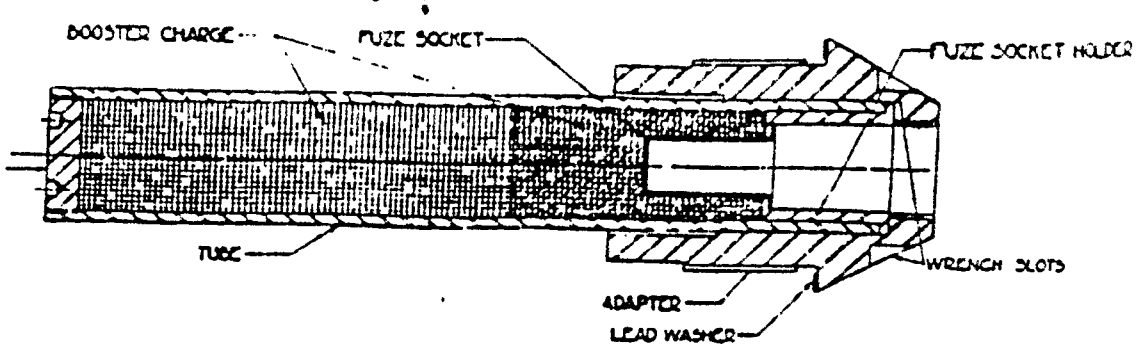
TYPICAL POINT DETONATING FUZES
ADAPTED FROM PROVEN EUROPEAN
DESIGNS

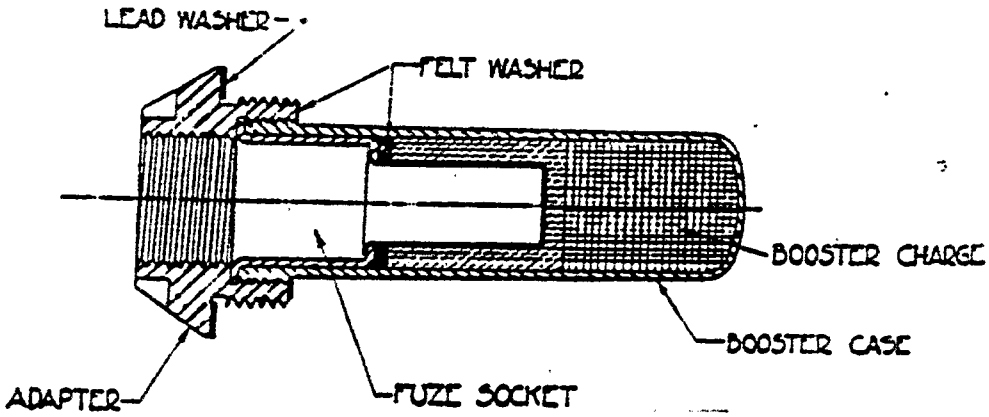


POINT DETONATING FUZE

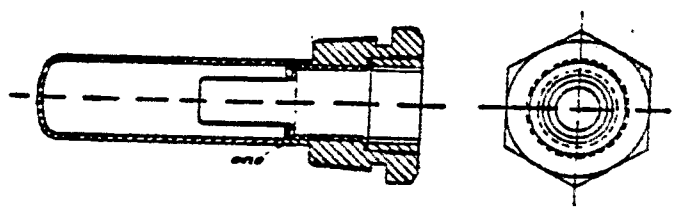


COMBINATION TIME AND PERCUSSION FUZE

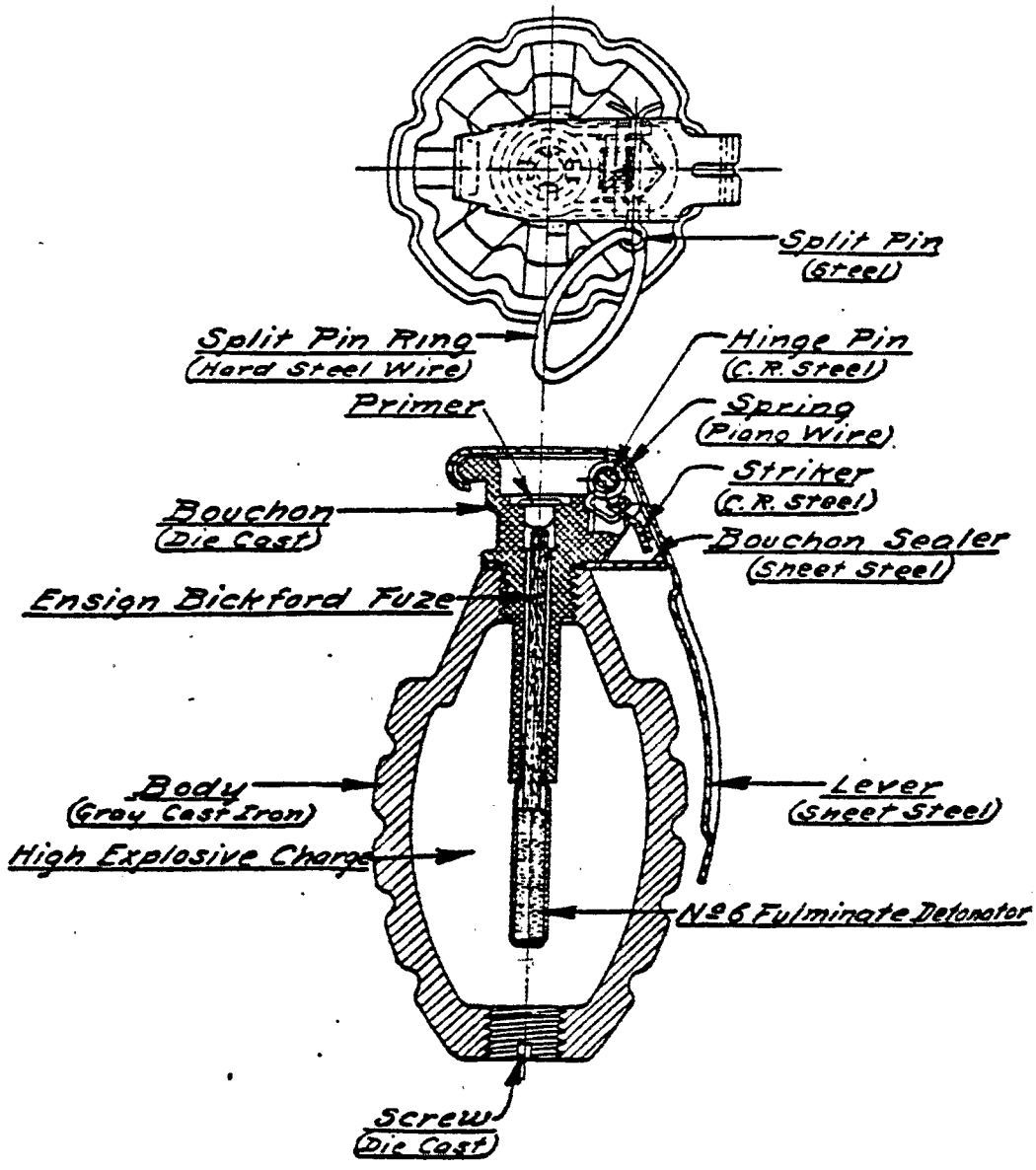




TYPICAL ADAPTER AND BOOSTERS

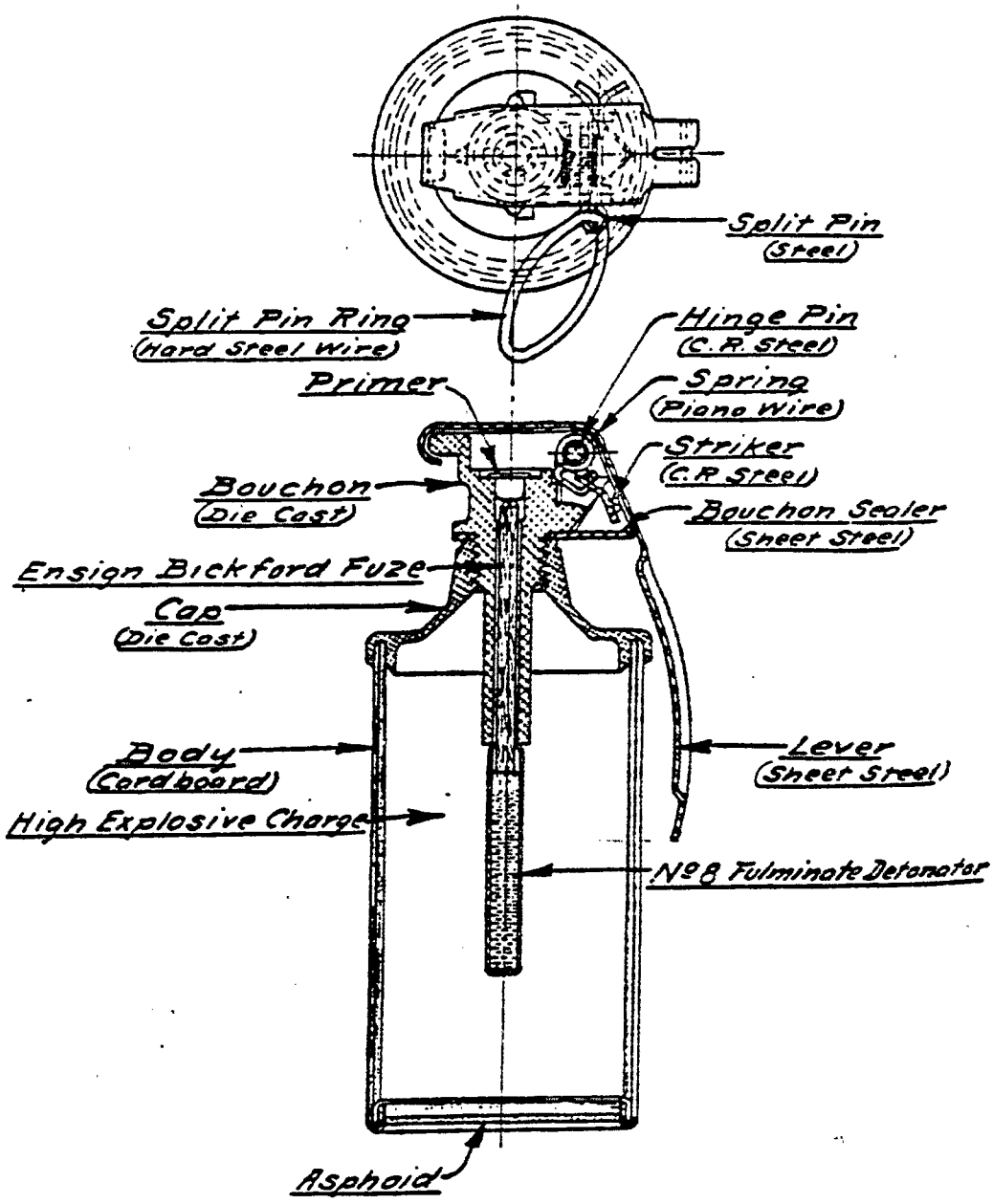


Defensive Hand Grenade Mark II.



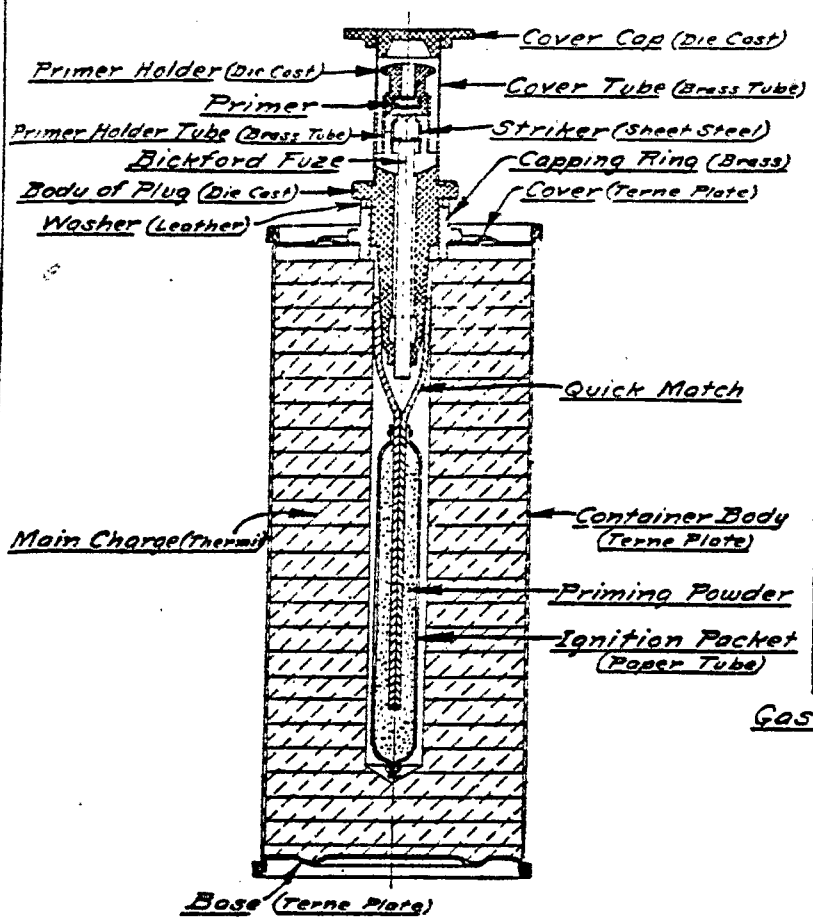
DEFENSIVE HAND GRENADE, MK II

Offensive Hand Grenade Mark III.



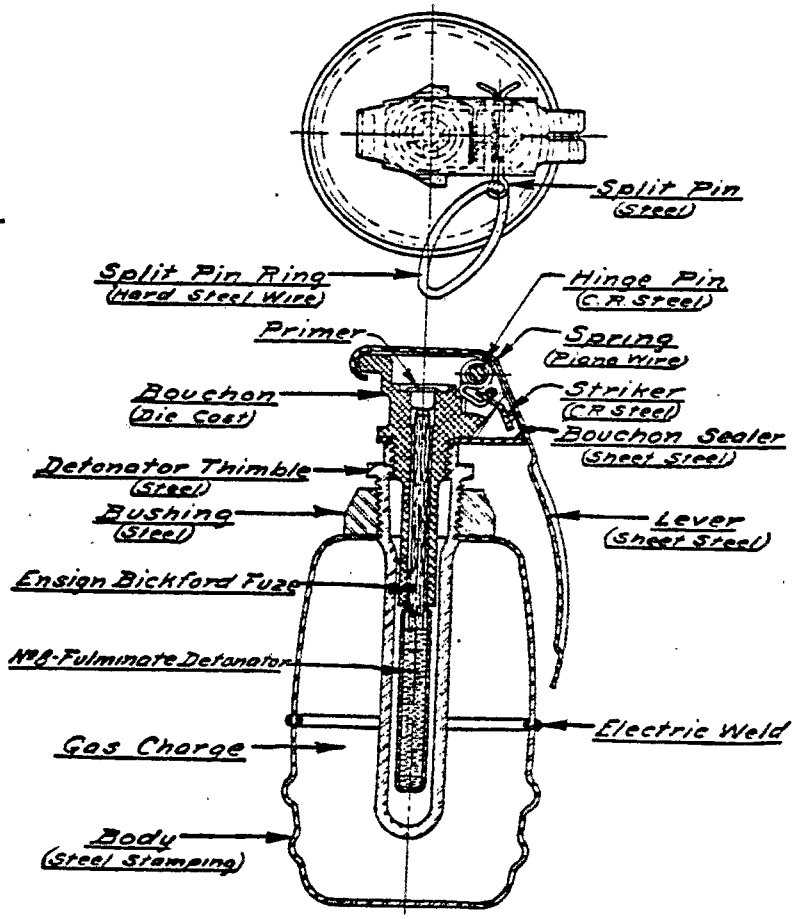
OFFENSIVE HAND GRENADE, MK III

Thermit Hand Grenade Mark I.



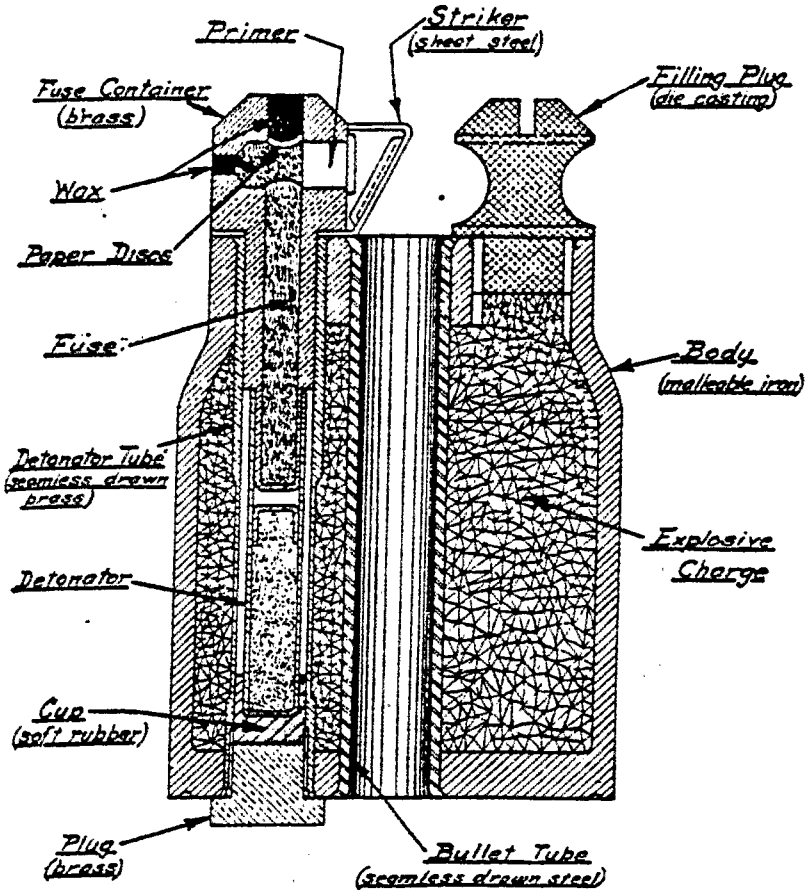
INCENDIARY HAND GRENADE, MK I

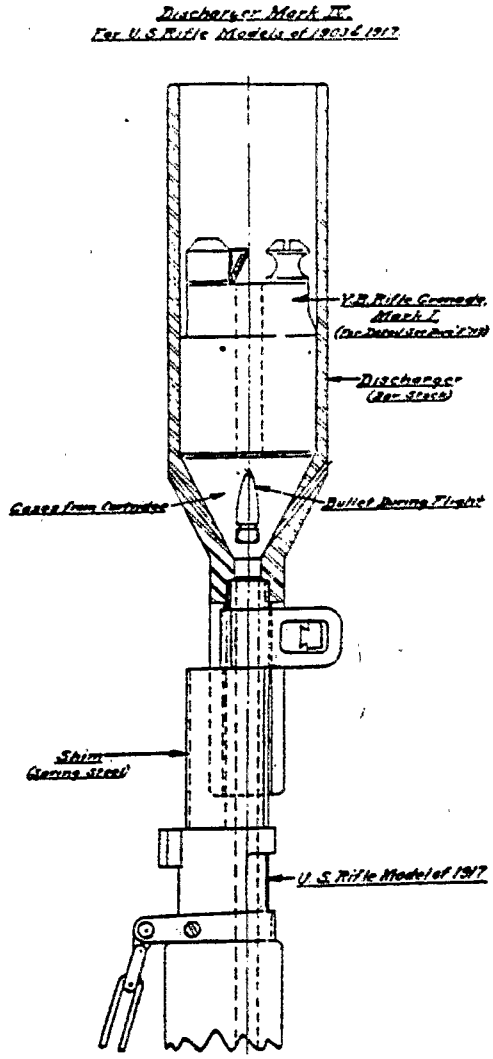
Gas Hand Grenade Mark II.

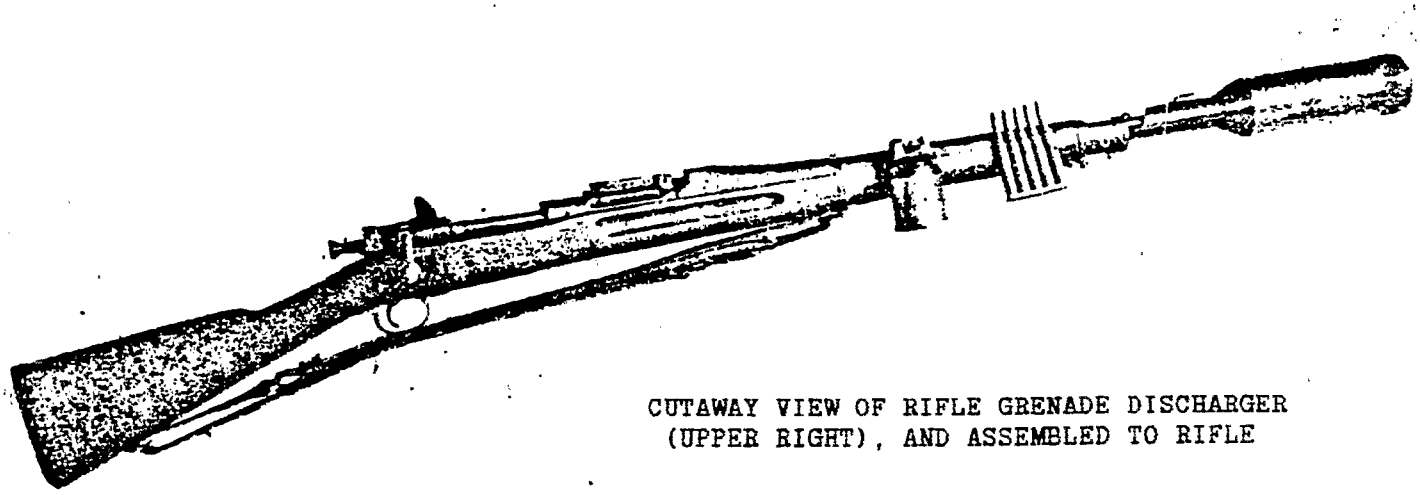


GAS HAND GRENADE MK II

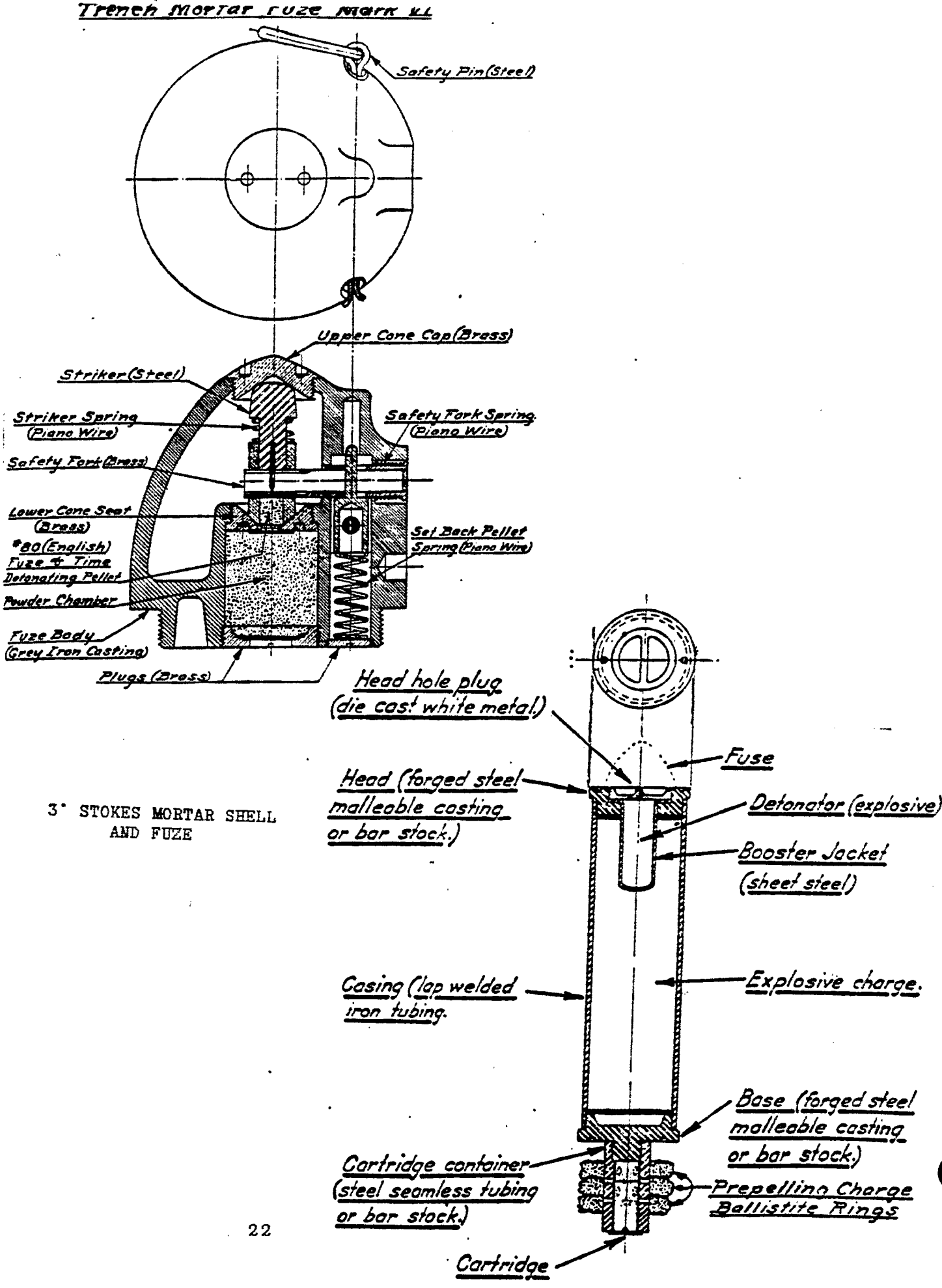
V.B. RIFLE GRENADE MARK I



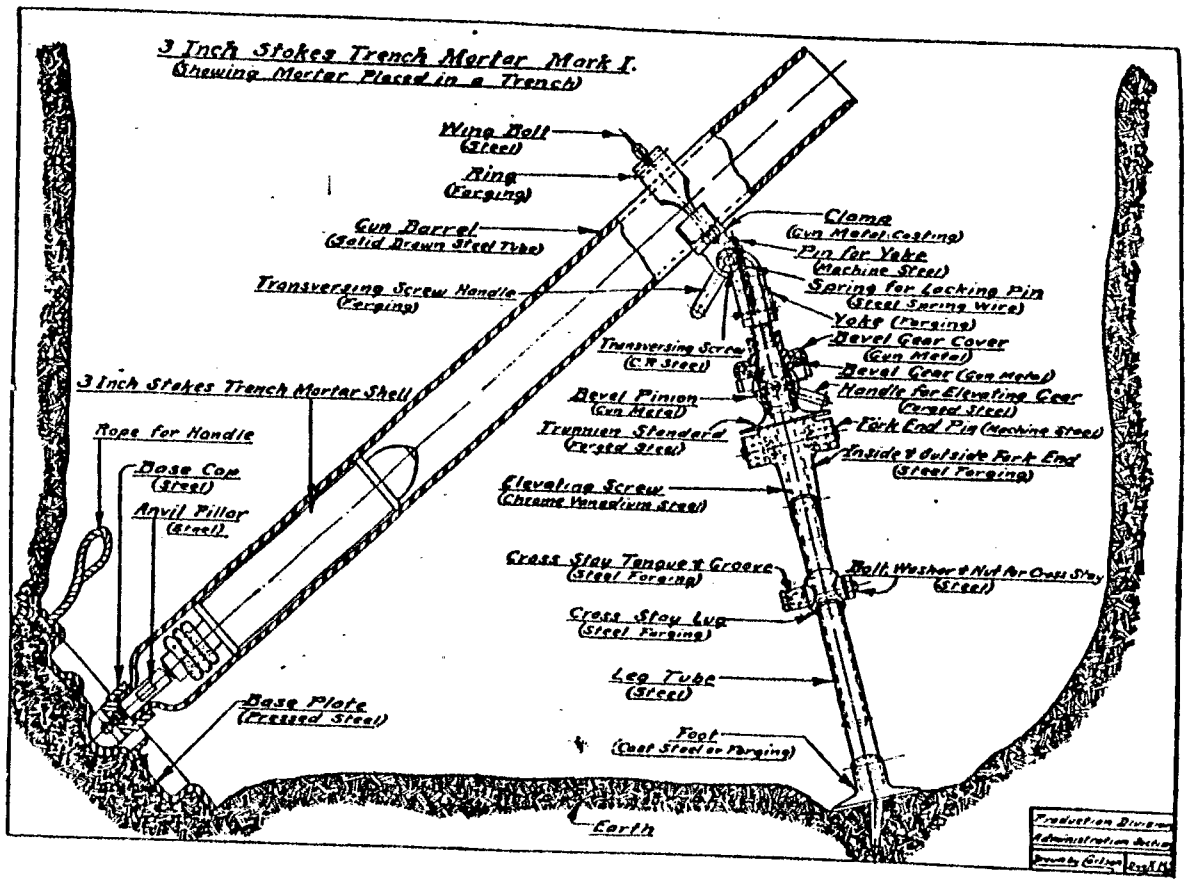




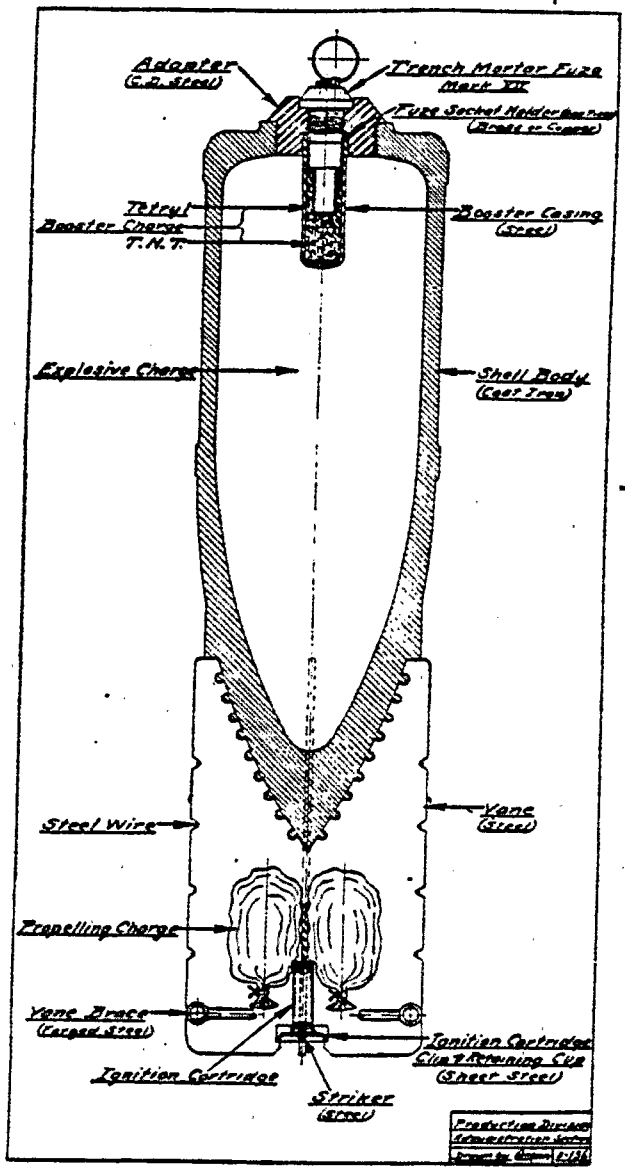
CUTAWAY VIEW OF RIFLE GRENADE DISCHARGER (UPPER RIGHT), AND ASSEMBLED TO RIFLE

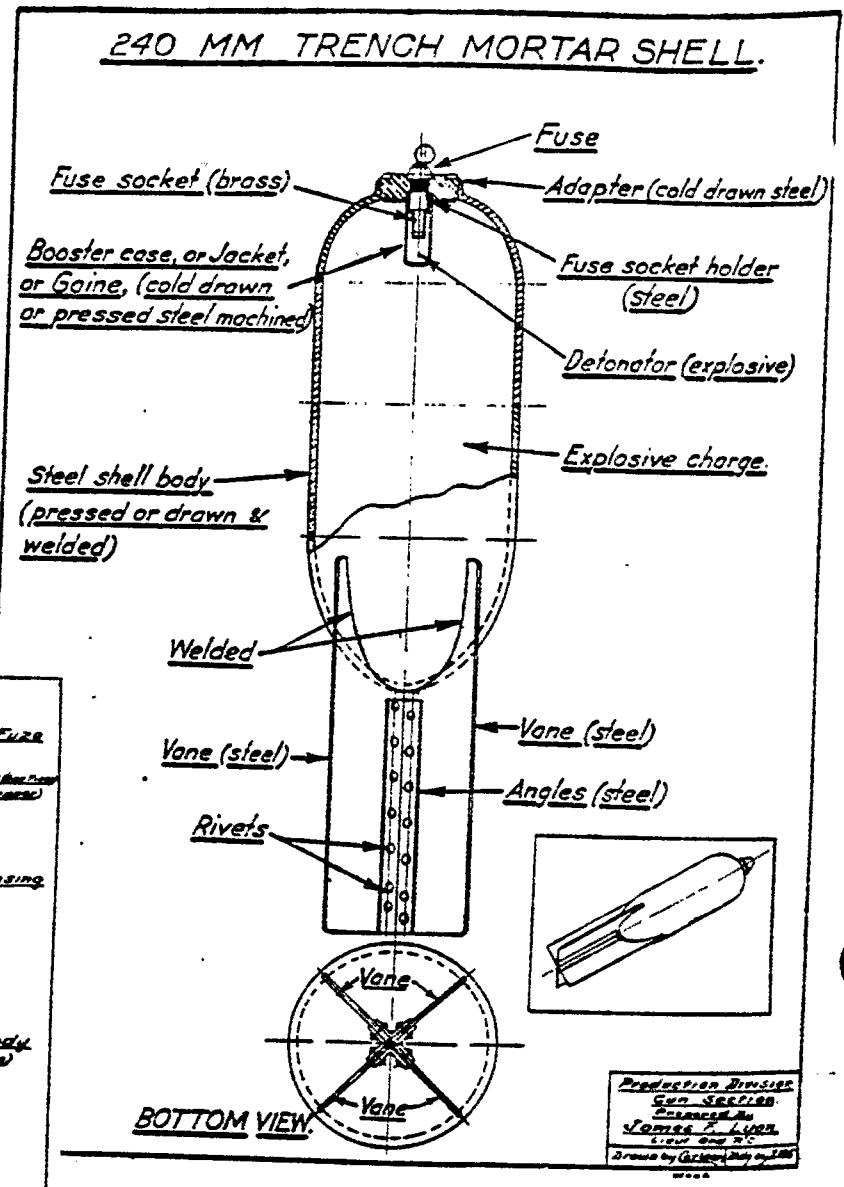


3" STOKES MORTAR SHELL AND FUZE

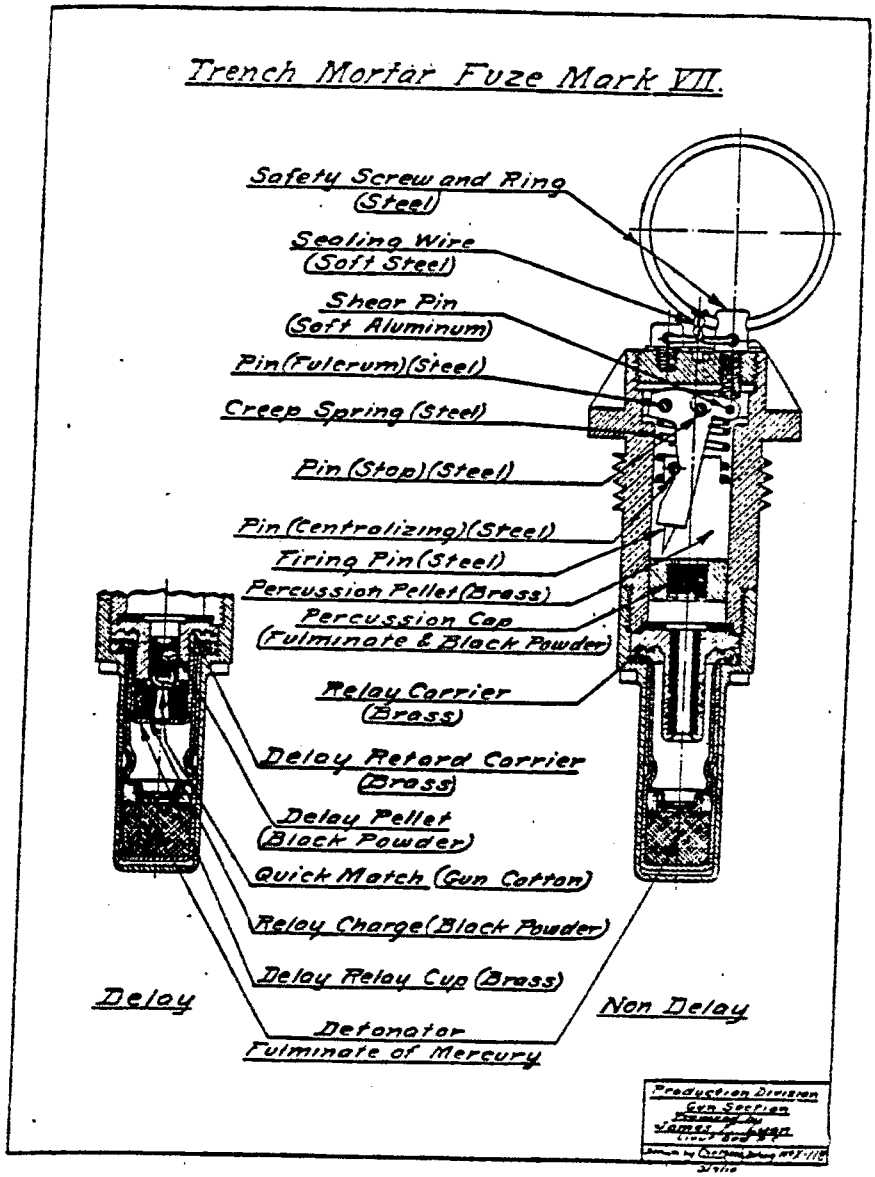


STOKES MORTAR EMPLACED IN A DEFENSIVE TRENCH

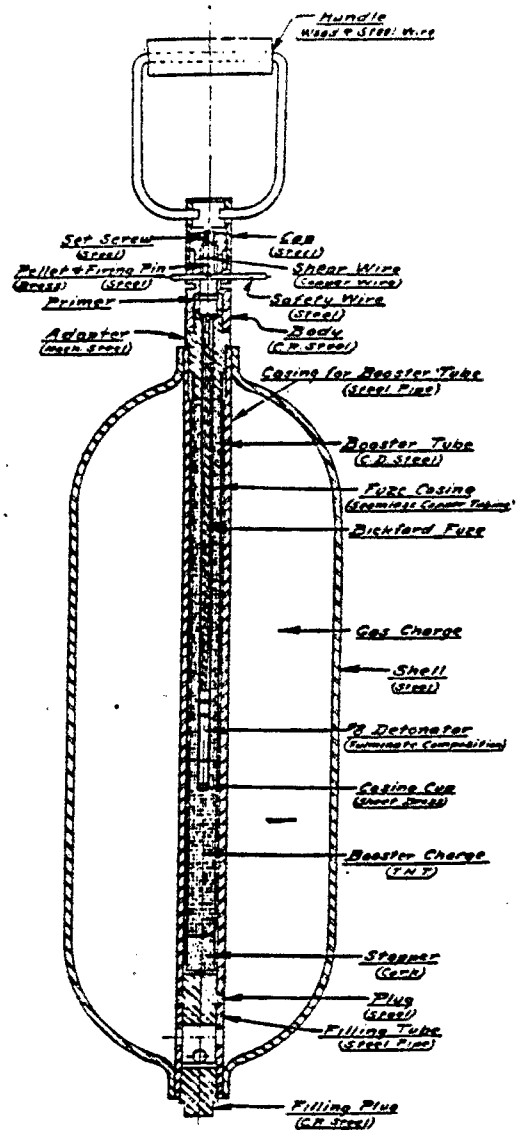




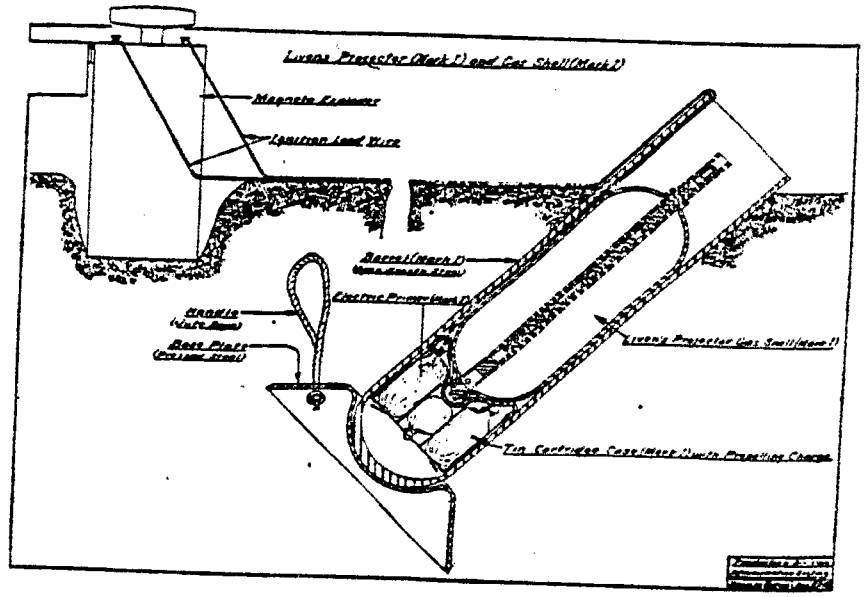
6" TRENCH MORTAR SHELL (LEFT)
AND 240-MM TRENCH MORTAR
SHELL (TOP)

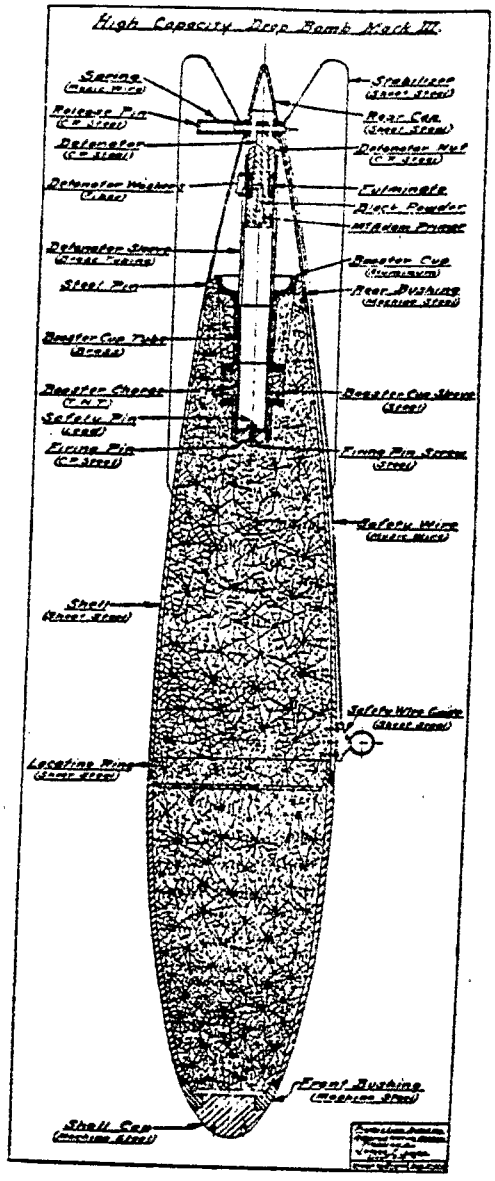


TRENCH MORTAR FUZE FOR 6" AND 240-MM TRENCH MORTARS

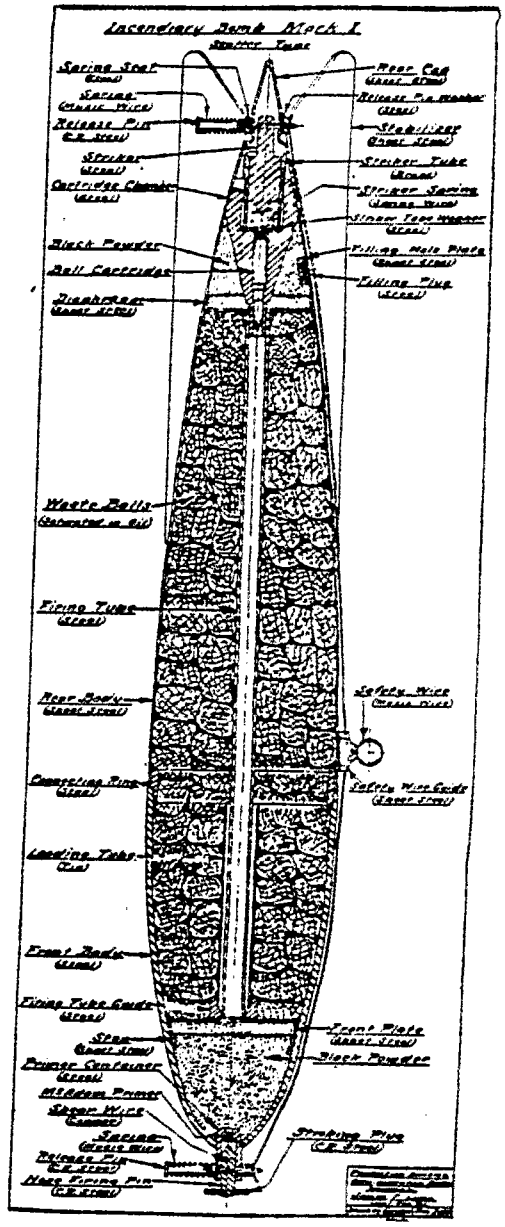


LIVENS PROJECTOR SHELL (LEFT)
AND LIVENS PROJECTOR (BOTTOM)

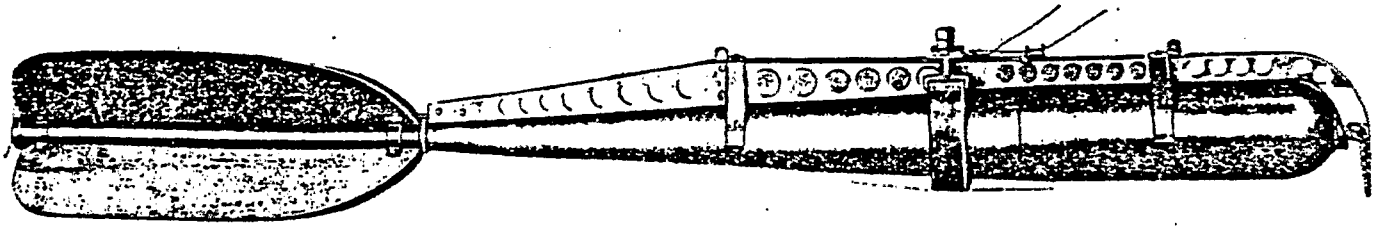




TYPICAL HIGH EXPLOSIVE BOMB



TYPICAL INCENDIARY BOMB



BARLOW HEAVY DROP BOMB WITH RELEASE MECHANISM (TOP)
BARLOW HEAVY DROP BOMB WITH ROD EXTENDED (BELOW)

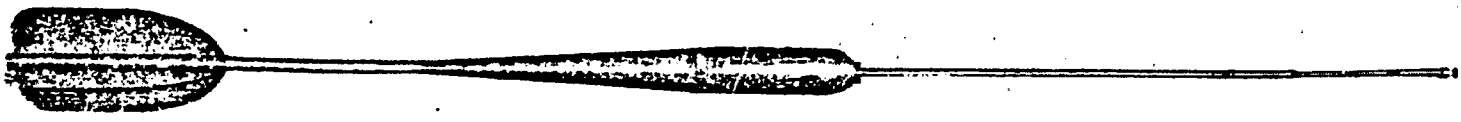


TABLE OF CONTENTS

COURSE OBJECTIVES

This course is designed to provide training to non-ordnance personnel in the general functioning of various types of ammunition, their safety features, and physical characteristics with the result being the ability to recognize and identify potentially hazardous ammunition and explosive items.

By the end of the course, the student will be able to:

1. Identify characteristics of both high and low explosives.
2. Identify various sources of ammunition information.
3. Interpret ammunition color coding.
4. Identify types of conventional ammunition by physical characteristics, markings and color coding.
5. Identify the different explosive hazard associated with each type of ammunition.
6. Implement safety procedures upon the discovery of hazardous ordnance.

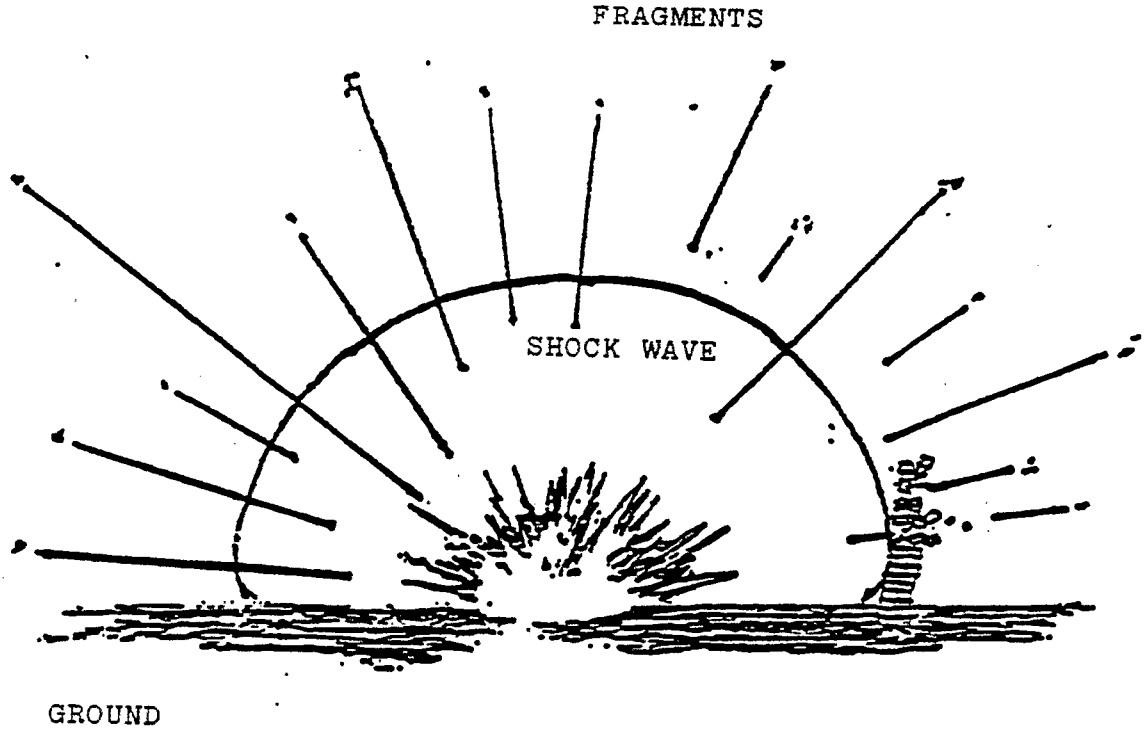
These results will be accomplished by use of this handout, lecture, viewgraphs and hands-on training aids.

EXPLOSIVES
PROPELLANTS
AND
CHEMICAL AGENTS

EXPLOSIVE - A MATERIAL THAT HAS THE POTENTIAL TO CHEMICALLY CHANGE FROM A SOLID TO A LARGE VOLUME OF HOT GASES VERY QUICKLY.

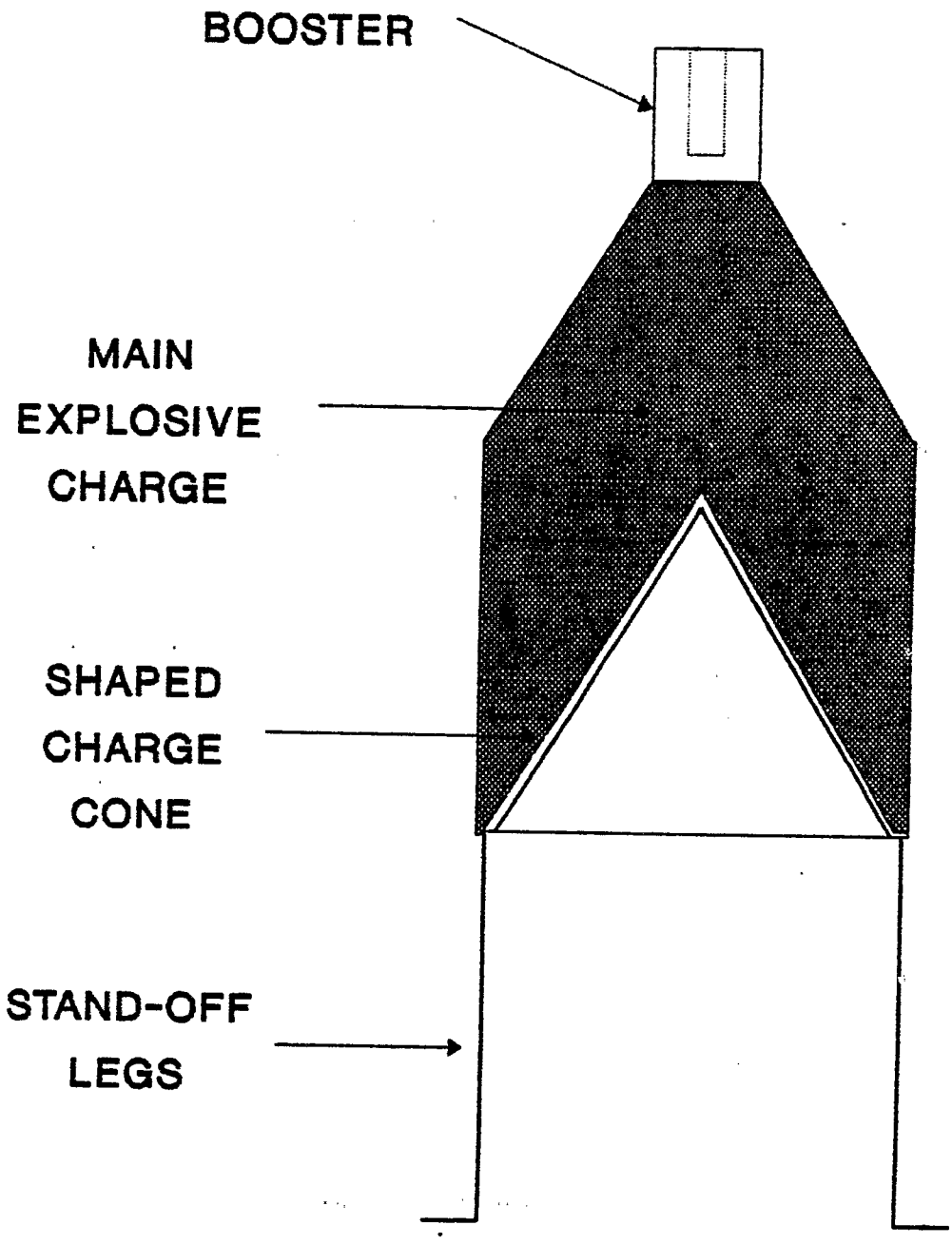
HIGH EXPLOSIVE - A MATERIAL THAT UNDERGOES THE CHEMICAL CHANGE AT A RATE FASTER THAN THE SPEED OF SOUND. EXAMPLES: TNT, EXPLOSIVE D, AMATOL, COMPOSITION B, MERCURY FULMINATE, ETC.

LOW EXPLOSIVE - A MATERIAL THAT UNDERGOES THE CHEMICAL CHANGE AT A RATE SLOWER THAN THE SPEED OF SOUND. EXAMPLES: BLACK POWDER, SMOKELESS POWDER, ROCKET PROPELLANT, ETC.

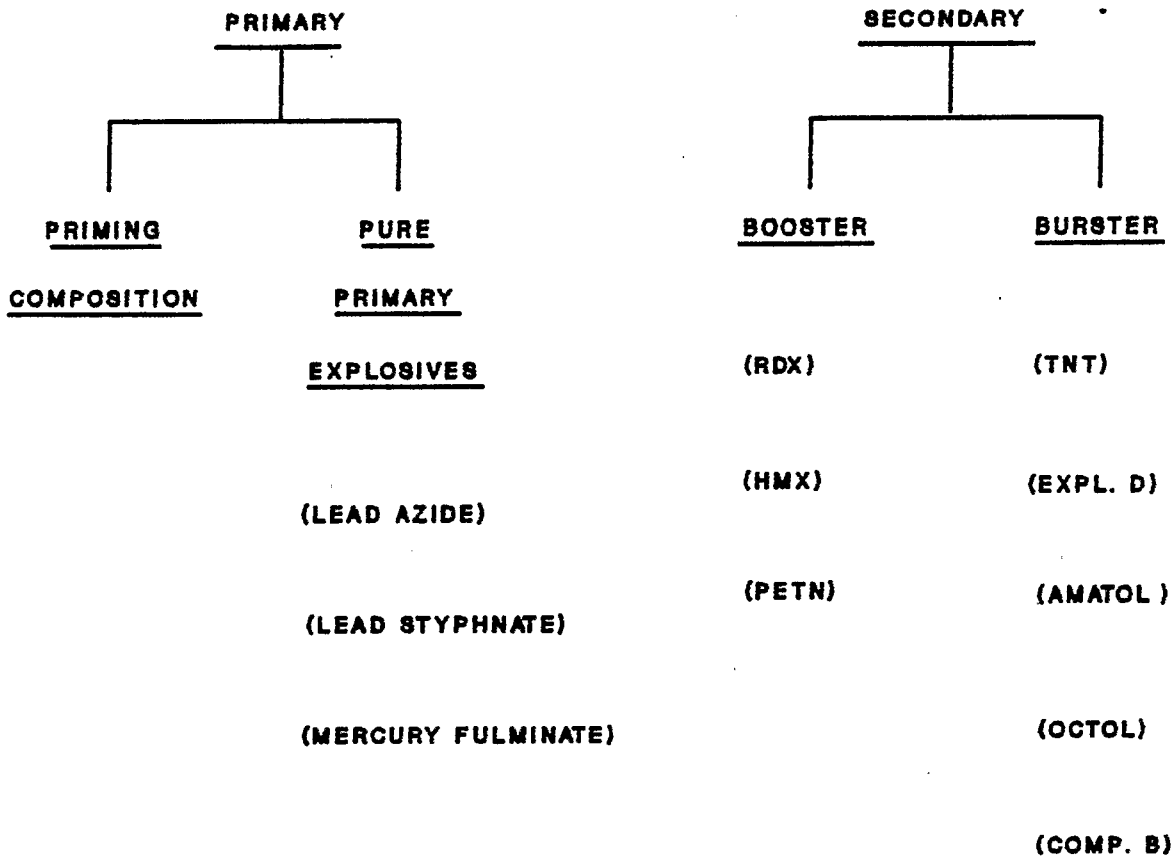


EFFECTS OF AN EXPLOSION

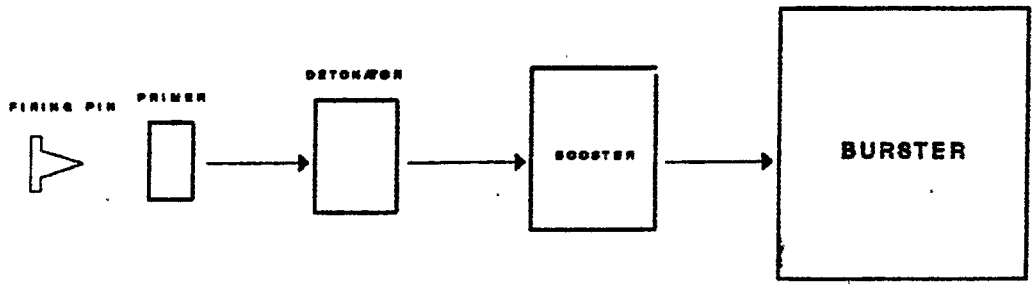
SHAPED CHARGE

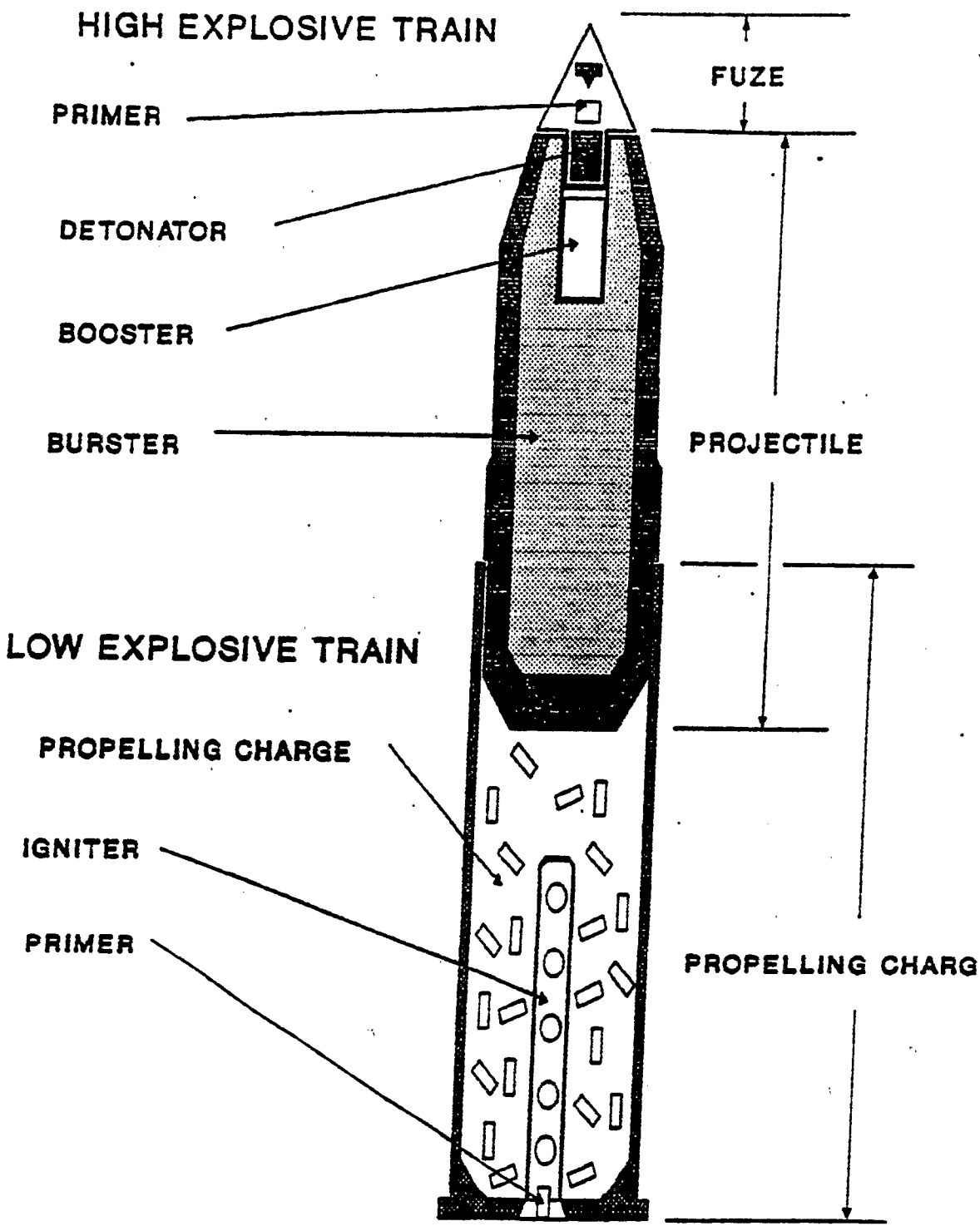


CLASSIFICATIONS OF HIGH EXPLOSIVES



HIGH EXPLOSIVE TRAIN





EXPLOSIVE TRAINS

COMMONLY USED EXPLOSIVES[1]

NAME	DESCRIPTION	REMARKS
BLACK POWDER	BROWN TO BLACK	MANUFACTURED IN GRAINS THAT RANGE IN SIZE FROM SMALLER THAN SALT GRAINS TO GRAINS AS LARGE AS SMALL PEBBLES. HIGHLY SENSITIVE TO IGNITION BY HEAT, FRICTION, FLAME, SPARK. WHEN WET, IT IS CORROSIVE TO MOST METALS.
TNT	LIGHT YELLOW TO BROWN OR GRAY	SLIGHTLY CORROSIVE WITH LEAD. USED IN BOMBS, GRENADES, DEMOLITION CHARGES, PROJECTILES. EXUDES AT ELEVATED TEMPERATURES. MODERATELY TOXIC BY SKIN ABSORPTION OR INHALATION.
EXPLOSIVE D	BRIGHT YELLOW TO ORANGE. ALSO CALLED AMMONIUM PICRATE.	RELATIVELY INSENSITIVE. HIGHLY TOXIC BY INHALATION, INGESTION, OR SKIN ABSORPTION.
AMATOL	LIGHT BROWN TO YELLOW. MIXTURE OF	SLIGHTLY HYGROSCOPIC. HAS CORROSIVE EFFECTS ON COPPER, BRONZE, LEAD, BRASS. HIGHLY TOXIC BY INHALATION, SKIN CONTACT, INGESTION.
COMPOSITION B	WHITE TO BROWNISH YELLOW TNT AND EXPLOSIVE D.	SLIGHTLY CORRODES COPPER, BRASS, CADMIUM, ZINC. USED IN BOMBS, PROJECTILES, GRENADES, SHAPED CHARGES.
OCTOL	LIGHT BROWN	USED IN BOMBS, PROJECTILES, SHAPED CHARGES.
RDX	WHITE. ALSO CALLED CYCLONITE.	SENSITIVE TO IMPACT AND FRICTION. SLIGHTLY CORROSIVE WITH COPPER, BRASS, MILD STEEL, CADMIUM. MODERATELY TOXIC BY INHALATION OR INGESTION.
HMX	WHITE. ALSO CALLED OCTOGEN.	SENSITIVE TO IMPACT AND FRICTION. SLIGHTLY TOXIC.
PETN	WHITE	SENSITIVE TO IMPACT. SLIGHTLY CORROSIVE TO BRASS, CADMIUM, ZINC. VERY SLIGHTLY TOXIC.

NAME	DESCRIPTION	REMARKS
LEAD AZIDE	WHITE TO LIGHT BROWN	VERY SENSITIVE TO IMPACT, FRICTION, SPARKS. CORROSIVE TO COPPER, ZINC. VERY SLIGHTLY TOXIC.
LEAD STYPHNATE	LIGHT ORANGE TO REDDISH BROWN	SAME AS LEAD AZIDE.
MERCURY FULMINATE	GRAYISH	VERY SENSITIVE TO IMPACT, FRICTION, SPARKS. CORROSIVE TO ALUMINUM, MAGNESIUM, COPPER, BRONZE, COPPER, ZINC, BRASS. HIGHLY TOXIC THROUGH SKIN ABSORPTION, INHALATION, INGESTION. SYMPTOMS RESEMBLE MERCURY POISONING.

[1] MANY DOZENS OF MATERIALS HAVE BEEN USED AS MILITARY EXPLOSIVES OVER THE YEARS. THIS IS ONLY A LISTING OF SOME OF THE MORE COMMONLY USED EXPLOSIVES THAT HAVE BEEN IN SERVICE. IT IS FAR FROM BEING A COMPREHENSIVE LISTING.

CHEMICAL AGENTS USED IN MUNITIONS

SYMBOL	COMMON NAME	VISUAL IDENTIFICATION	ACTION[1]
GB	SARIN	COLORLESS LIQUID	NERVE AGENT - NON-PERSISTENT
VX	NONE	COLORLESS LIQUID	NERVE AGENT - PERSISTENT
H	LEVINSTEIN MUSTARD	COLORLESS TO PALE YELLOW LIQUID	BLISTER AGENT
HD	DISTILLED MUSTARD	COLORLESS TO PALE YELLOW LIQUID	BLISTER AGENT
HT	MUSTARD-T MIXTURE	CLEAR YELLOW LIQUID	BLISTER AGENT
L	LEWISITE		BLISTER AGENT
CL	CHLORINE	YELLOW GAS	INCAPACITATING AGENT
CG	PHOSGENE	COLORLESS GAS	CHOKING AGENT
CK	CYANOGEN CHLORIDE	COLORLESS GAS	BLOOD AGENT
AC	HYDROGEN CYANIDE		BLOOD AGENT
BZ	NONE	WHITE CRYSTALLINE SOLID	INCAPACITATING AGENT
CN	NONE	WHITE CRYSTALLINE SOLID	TEAR AGENT
CNS	NONE	LIQUID	TEAR AGENT
CS	NONE	WHITE CRYSTALLINE SOLID	TEAR AGENT
CR	NONE	LIQUID WITH BROWNISH TINGE	RIOT CONTROL
BBC	NONE	LIQUID	TEAR AGENT
DA	NONE	WHITE TO BROWN SOLID	VOMITING AGENT
DC	NONE	CLEAR LIQUID	VOMITING AGENT
DM	NONE	YELLOW TO GREEN SOLID	VOMITING AGENT

FS	NONE	CLEAR LIQUID	SCREENING SMOKE
FM	NONE	HEAVY COLORLESS LIQUID	SCREENING SMOKE
HC	HEXACHORO-ETHANE	WHITE SOLID	SCREENING SMOKE
WP	WHITE PHOSPHOROUS	PALE YELLOW SOLID	SCREENING SMOKE AND INCENDIARY
PWP	PLASTICIZED WHITE PHOSPHOROUS	PALE YELLOW LIKE PUTTY	SCREENING SMOKE AND INCENDIARY
TM	THERMATE THERMITE	LIGHT TO DARK GRAY	INCENDIARY AGENT
IM	NONE		INCENDIARY AGENT
NP	NAPALM	LIGHT TAN TO BROWN JELLY	INCENDIARY AGENT
PT	PYROTECHNIC MATERIAL	LIGHT GRAY	INCENDIARY AGENT
TEA	TRIETHYL ALUMINUM	CLEAR LIQUID	INCENDIARY AGENT
TPA	THICKENED PYROPHORIC AGENT	CLEAR LIQUID	INCENDIARY
RP	RED PHOSPHOROUS	REDDISH BROWN POWDER	SCREENING SMOKE

[1] AGENTS GB THROUGH BZ ARE TO BE CONSIDERED AS LETHAL. ALTHOUGH SOME WERE NOT SPECIFICALLY INTENDED TO BE DEADLY, ANY OF THESE AGENTS IN MODERATE EXPOSURES MAY CAUSE DEATH IF ADEQUATE MEDICAL TREATMENT IS NOT ADMINISTERED PROMPTLY.

SOURCES OF INFORMATION

SOURCES OF INFORMATION

ARMY:

NUMBER	TITLE	REMARKS
TM 9-1300-200	AMMUNITION GENERAL	GENERIC INFORMATION ON TYPES OF AMMUNITION WITH ILLUSTRATIONS. TYPICAL COLOR CODING INFORMATION. SOME HISTORICAL INFORMATION.
TM 9-1300-214	MILITARY EXPLOSIVES	DETAILED INFORMATION ON EXPLOSIVE MATERIALS USED BY THE MILITARY. INCLUDES CHEMICAL MAKEUP AND PROPERTIES, TOXICOLOGICAL DATA AND TESTS USED ON UNKNOWN MATERIAL TO DETERMINE IF IT IS AN EXPLOSIVE.
TM 43-0001-26-2	ARMY AMMUNITION DATA SHEETS FOR CHEMICAL WEAPONS AND MUNITIONS	SPECIFIC DESCRIPTIONS OF ITEMS STILL IN THE AMMUNITION STOCKPILE. INCLUDES PICTURES, FILLERS PHYSICAL DATA, ETC.
TM 43-0001-27	ARMY AMMUNITION DATA SHEETS FOR SMALL CALIBER AMMUNITION	SPECIFIC DESCRIPTIONS OF SMALL ARMS AMMUNITION FROM .22 CAL. THROUGH 30MM INCLUDING FUZES AND ACCESSORIES.
TM 43-0001-28	ARMY AMMUNITION DATA SHEETS FOR ARTILLERY AMMUNITION GUNS, HOWITZERS, MORTARS, RECOILLESS RIFLES, GRENADE LAUNCHERS AND ARTILLERY FUZES	SPECIFIC DESCRIPTIONS OF ARTILLERY AMMUNITION FROM 40MM GRENADES THROUGH 8" HOWITZERS INCLUDING FUZES, PROPELLING CHARGES AND CERTAIN ACCESSORIES.
TM 43-0001-29	ARMY AMMUNITION DATA SHEETS FOR GRENADES	SPECIFIC DESCRIPTIONS OF HAND AND RIFLE GRENADES.
TM 43-0001-30	ARMY AMMUNITION DATA SHEETS FOR ROCKET SYSTEMS, ROCKET FUZES AND ROCKET MOTORS	SPECIFIC DESCRIPTIONS OF ROCKET AMMUNITION INCLUDING ROCKET MOTORS, WARHEADS AND FUZES.

NUMBER	TITLE	REMARKS
TM 43-0001-36	ARMY AMMUNITION DATA SHEETS FOR LAND MINES	SPECIFIC DESCRIPTIONS OF ANTIPERSONNEL AND ANTI-TANK MINES. INCLUDES THOSE EMPLACED BY HAND AS WELL THE NEWER ARTILLERY DELIVERED MINES.
TM 43-0001-37	ARMY AMMUNITION DATA SHEETS FOR MILITARY PYRO-TECHNICS	SPECIFIC DESCRIPTIONS OF VARIOUS PYROTECHNIC ITEMS INCLUDING SIGNALS, FLARES, SIMULATORS, AND MISCELLANEOUS ITEMS.
TM 43-0001-38	ARMY AMMUNITION DATA SHEETS FOR DEMOLITION MATERIALS	SPECIFIC DESCRIPTIONS OF DEMOLITION BLOCKS, SHAPED CHARGES, BLASTING CAPS, CRATERING CHARGES, MINE FIELD CLEARING DEVICES, AND ASSOCIATED ACCESSORIES.
TM 43-0001-39	ARMY AMMUNITION DATA SHEETS FOR CARTRIDGES, CARTRIDGE ACTUATED DEVICES AND PROPELLANT ACTUATED DEVICES	SPECIFIC DESCRIPTIONS OF SMALL, SPECIAL PURPOSE HIGH AND LOW EXPLOSIVE LOADED ITEMS.
FM 3-9	MILITARY CHEMISTRY AND CHEMICAL COMPOUNDS	DETAILED DESCRIPTIONS OF CHEMICAL AGENTS AND THEIR EFFECTS.
	NAVY:	
SW010-AB-GTP-010	UNITED STATES NAVY AMMUNITION HISTORICAL AND FUNCTIONAL DATA	GENERIC DESCRIPTION OF NAVAL AMMUNITION INCLUDING NAVAL GUN AMMUNITION, PYROTECHNICS, TORPEDOES, UNDERWATER MINES, GUIDED MISSILES, ETC.
	AIR FORCE	
TECHNICAL ORDERS	11A-SERIES	SPECIFIC DESCRIPTIONS OF AIR FORCE AMMUNITION.

DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 9-1300-214**

MILITARY EXPLOSIVES

This copy is a reprint which includes current pages from Changes 1

HEADQUARTERS, DEPARTMENT OF THE ARMY

SEPTEMBER 1984

Technical Manual
No. 9-1300-214

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC 20 September 1984

MILITARY EXPLOSIVES

REPORTING OF ERRORS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Armament, Munitions and Chemical Command, ATTN: AMSMC-MAY-T(D), Picatinny Arsenal, NJ 07806-5000. A reply will be furnished to you.

*This manual supersedes TM 9-1300-214, 28 November 1967, including all changes.

CHAPTER 12

TOXICITY OF ENERGETIC MATERIALS

12-1. General. This section contains general information about toxicity of military explosives. All tables indicating quantity distance separations, minimum distances, etc., have been removed from this manual. Applicable information may be found in DoD 6055.9-STD, Ammunition and Explosives Safety Standards.

12-2. Toxicity of United States Military Explosives.

a. Many explosives, because of their chemical structures, are somewhat toxic. To be acceptable, a military explosive must be of minimum toxicity. Careful attention must be paid to this feature because the effects of toxicity may vary from mild dermatitis or a headache to serious damage to internal organs.

b. Table 12-1 is a concise presentation of the toxicological properties of selected United States military explosives.

Table 12-1 Toxicity of United States Military Explosives

Explosive	Health hazard	Protective measures
Initiating explosives		
Lead azide	Lead azide is not considered to be particularly toxic but inhalation of the dust should be avoided since this causes a headache and distention of the blood vessels.	Avoid inhalation. Tolerance level below 0.2 milligrams per cubic meter in air.
Mercury fulminate	Poisoning has symptoms of mercury poisoning. At low levels causes dermatitis and irritation of the mucous membranes.	Avoid all routes of exposure. Tolerance level below 0.01 milligrams per cubic meter in air.
Boostering explosives		
PETN	PETN is not unduly toxic since it is nearly insoluble in water and usually is handled while wet. It, therefore, cannot be absorbed through the skin and inhalation of the dust is improbable. Tests have shown that small doses of PETN cause decrease in blood pressure; larger doses cause dyspnea and convulsions.	
Tetryl	Moderately toxic by inhalation or ingestion.	Avoid inhalation or ingestion.
	Tetryl has a strong coloring action on the human skin and can cause a dermatitis.	To minimize these effects, use cold cream containing 10 percent sodium perborate.
	Inhalation of tetryl dust has recognized toxic effects.	Avoid inhalation. Tolerance level below 1.5 milligrams per cubic meter in air.

CHAPTER 13
DETECTION AND IDENTIFICATION OF ENERGETIC MATERIALS

13-1. Introduction. This chapter discusses the methods used to detect and identify energetic materials. Almost all of the analytical chemistry techniques are used. Normally, identification involves a series of tests, each providing a clue to the identity of the compound. In addition to the techniques discussed in this chapter, identifying information can be obtained from physical properties such as melting point, crystalline structure, density, physical state, color, and indicies of refraction.

13-2. Wet Chemical Methods. When a test sample is treated with an appropriate reagent, a coloration is produced which is characteristic of the compound being tested. These reactions are known as color reactions and may help identify the sample. The compound which produces the color change is called the color reagent. Color reactions are used to some degree for preliminary identification and confirmation but have largely been replaced by the more modern instrumental techniques. Table 13-1 lists some of the common color reactions used to identify explosives.

Table 13-1. Color Tests

	Water Solution or Extract of Energetic Material			Solid of Energetic Material		
				Color effect of test with solution of-		
	Color of solution	Color of universal pH test	Color of precipitate with Nessler's reagent	Ethylenediamine	Diphenylamine	Thymol
TNT	(Insoluble)	-	-	Maroon	Colorless	-
Tetryl	(Insoluble)	-	-	Red	Blue	Green
Picric acid	Yellow	Red	(No ppt)	Orange	-	-
Explosive "D"	Yellow	-	Brown	Orange	-	-
Haleite	None	-	(No ppt)	None	Blue[1]	Orange
Nitroguanidine	None	-	White	-	Blue	Green
Ammonium nitrate	None	-	Brown	None	Dirty green	Green[1]
PETN	(Insoluble)	-	-	None	Dirty green	Green
Nitroglycerin	None	-	(No ppt)	-	Deep blue	Green
DEGN	None	-	(No ppt)	-	Deep blue	Brown[2]
Nitrocellulose	None	-	-	-	Blue	Green
Tritonal	(Insoluble)	-	-	Maroon	Colorless	-
Tetrytol	(Insoluble)	-	(No ppt)	Maroon	Intense blue	Green
Picratol	Yellow	-	Brown	Maroon	-	-
Ednatol	None	Orange	(No ppt)	Maroon	Intense blue	Orange
Amatol	None	-	Brown	Maroon	Dirty green	Green
Ammonal	None	-	Brown	Maroon	Dirty green	Green
Pentolite	None	-	(No ppt)	Maroon	Dirty green	Green
Black powder[3]	None	No change	-	-	Blue	Green

[1]Color appears immediately.

[2]Sometimes explodes mildly (puffs) upon addition of sulfuric acid.

[3]Tests of dried water extract.

The tests are performed in the following manner.

a. *Test 1.* Place 0.05 gram of the explosive in a 5 milliliter beaker, add 2 to 3 milliliters of distilled water, and stir for 5 minutes.

(1) Observe color of liquid.

(2) Wet one end of a strip of universal pH indicator paper and note any change in color.

(3) Add a drop of Nessler's reagent and note the color of any precipitate formed. Prepare the reagent by dissolving five grams of potassium iodide in a minimum quantity of cold distilled water and adding a saturated aqueous solution of mercuric iodide until a faint precipitate is formed. Add 40 milliliters of 50-percent potassium hydroxide solution. After the solution has clarified by settling, dilute to 100 milliliters with distilled water, allow to settle, and decant.

b. *Test 2.* Place 0.05 gram of the unknown material in an indenture of a white porcelain spot-test plate. Add two or three drops of a 65 to 68 percent aqueous solution of ethylenediamine and stir. Note the color of the solution (not the solid).

c. *Test 3.* Place 0.05 gram of the unknown material in an indenture of a white porcelain spot-test plate and add three or four drops of a diphenylamine solution. Stir the mixture and, after one minute, note the color of the solution. Prepare the diphenylamine solution by dissolving one gram of diphenylamine in 100 milliliters of concentrated CP sulfuric acid.

d. *Test 4.* Place 0.05 gram of the unknown material in an indenture of a white porcelain spot-test plate. Add an equal amount of crystalline thymol and three drops of concentrated sulfuric acid. Stir the mixture and note its color after five minutes or more.

e. *Additional Tests.* If the unknown material is not identified completely by the tests in subparagraphs 13-2 a. through d. and data listed in table 13-1, tests should be performed to determine whether the material is one of those indicated in (1) through (14) below.

(1) RDX. Place several milligrams of the white, unknown material in a test tube and add about 200 milligrams of thymol and six drops (0.3 ml) of concentrated sulfuric acid. Warm the tube for five minutes at 100°C, and add 5 to 10 milliliters of ethanol. RDX produces a rich blue color. Under these conditions sugars and aldehydes give a brown color, and HMX gives a pale blue-green color. RDX can be further distinguished from HMX by repeating the test at 150°C. Under these conditions RDX still gives a blue color, but HMX produces an olive color.

(2) Composition A-3. Place 0.1 gram of the material in a 10 milliliter beaker and add two or three drops of acetone. Warm the mixture and allow to stand for five minutes. Evaporate the acetone by gently warming on a steambath, cool, and add 2 milliliters of carbon tetrachloride. Cover the beaker and warm the contents, occasionally swirling the mixture. Cool the mixture and allow the undissolved material to settle. Decant the supernatant liquid into a 5 milliliter beaker, evaporate to dryness, and note if a waxy (not tarry) residue is obtained. Dry the undissolved material in the 10 milliliter beaker and test for RDX as described in (1) above.

(3) Composition B. Place 0.2 gram of the pale yellow to medium brown material in a 10 milliliter beaker and add 2 to 3 milliliters of chloroform. Cover the beaker. Warm and digest the mixture for 10 minutes with occasional swirling. Decant the supernatant liquid through a filter paper and evaporate the filtrate to dryness. Repeat digestion of the insoluble residue in the beaker with three more portions of chloroform discarding the decanted liquid in each case. Dry the insoluble residue by evaporating any adherent chloroform. If the original material was composition B, the residue from the chloroform solution consists of TNT and wax. Test the TNT and wax mixture with ethylenediamine and diphenylamine as described above. The insoluble residue obtained by extraction with chloroform consists of RDX. Test as described in (1) above.

(4) Composition C-3. Place 0.2 gram of the putty-like explosive in a 10 milliliter beaker and add 5 milliliters of benzene. Mix and digest for 10 minutes crushing any lumps present. Decant the supernatant liquid through a filter paper and evaporate the benzene with gentle heating. Note whether a dark, tarry residue remains. Wash the insoluble residue left by benzene extraction with two or three, 3 milliliter portions of a 2:1 ether-ethanol mixture and dry the washed residue. Test this as described under RDX in (1) above. To the decanted ether-ethanol washings, add 15 milliliters of distilled water and heat the mixture until all ether and alcohol are removed. If a white precipitate (nitrocellulose) is noted, catch the precipitate on a filter, wash with ethanol, dry by evaporation of the ethanol, and test for nitrocellulose as indicated in table 13-1.

TECHNICAL MANUAL

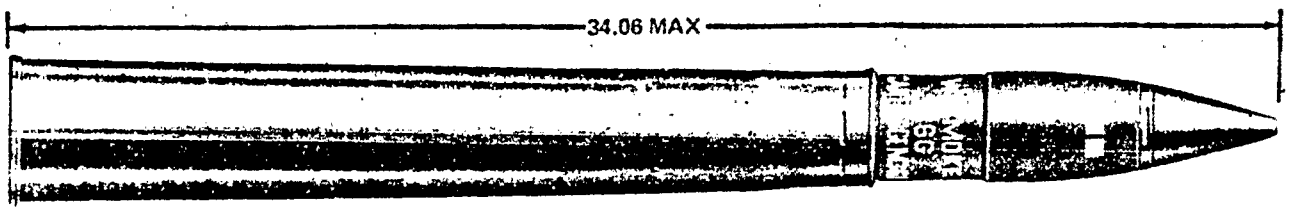
ARMY AMMUNITION DATA SHEETS

ARTILLERY AMMUNITION GUNS, HOWITZERS, MORTARS, RECOILLESS RIFLES, GRENADE LAUNCHERS, AND ARTILLERY FUZES (Federal Supply Class 1310, 1315, 1320, 1390)

This copy is a reprint which includes current pages from Changes 1 through 13.

HEADQUARTERS, DEPARTMENT OF THE ARMY

CARTRIDGE, 76-MILLIMETER: SMOKE, WP, M361A1 OR M361



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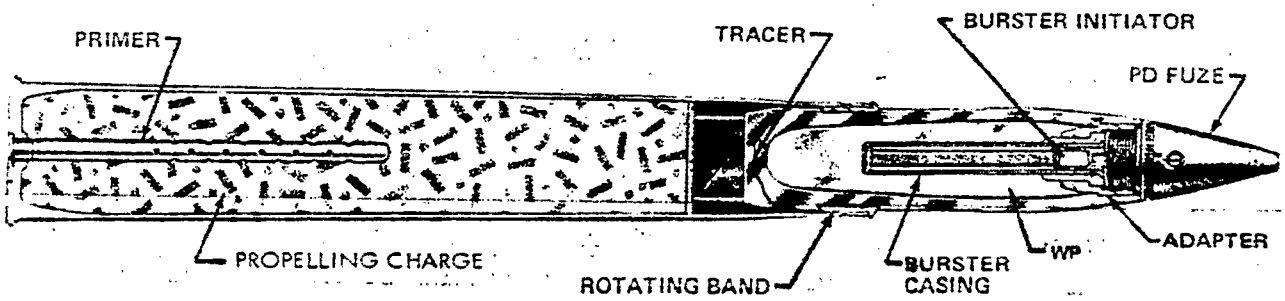


AR199850

Type Classification:

OBS MSR 11756003

Use:

This fixed ammunition is used in 76-mm guns for screening and spotting fire. The cartridge also has a slight incendiary effect.

Description:

The projectile body is a thin walled, forged steel casing. The point-detonating (PD) fuzed projectile contains a white phosphorous (WP) filler and a combination one-piece aluminum burster casing and adapter. The burster casing houses a projectile-burster and burster initator loaded with tetrytol. The brass or steel cartridge case assembled to the projectile contains a single-base propellant and a percussion primer. A distinguishing characteristic of these rounds is the cartridge case-over-band construction. The specially designed rotating band has a crimping groove which permits the cartridge case to be assembled over the rotating band and rigidly crimped to it.

Functioning:

When the weapon is fired, the primer flashes igniting the propellant. Gases created by the burning propellant force the projectile from the gun barrel. On impact the burster initiator, activated by the PD fuze, detonates the burster charge. This ruptures the projectile casing and expells the white phosphorous filler. On contact with the air the white phosphorus ignites, creating a dense white smoke.

Difference Between Models:

Cartridge M361 is similar to Cartridge M361A1 except that the burster is contained in a two-piece steel casing and the adapter is a separate component. Also Model M361A1 includes a tracer assembly in the base of the projectile. See Tabulated Data for cartridge case and fuze differences.

Tabulated Data:

Complete round:
- Type ---------- Smoke WP
- Weight ---------- 25.82 lbs.
- Length ---------- 34.06 in.
- Cannon used with ---- M32, M48

Projectile:
- Body material ------- Forged steel
- Color
  - Old ---------- Gray w/yellow band and yellow marking
  - New ---------- Light green w/ yellow band and red marking
- Filler and weight ---- WP - 1.38 lbs.
- Burster ---------- M28 - 1.2 oz. tetrytol
- Burster initiator ---- M2

Component:
- Cartridge case ------- M361A1: M88B1 M361: M88
- Propelling charge---- M6, 3.64 lbs.
- Primer---------- M68, M58 percussion
- Fuze ---------- PD: M521 (M361A1) M48A3 (M361)

Performance:
- Maximum range ----- 14,594 meters (16,296 yds)
- Muzzle velocity------ 713 mps (2,400 fps)

Temperature Limits:

Firing:
- Lower limit --------- - 40°F
- Upper limit --------- + 125°F

Storage:
- Lower limit --------- - 80°F (for period not more than 3 days)
- Upper limit --------- + 125°F

*Packing ---------- 1 round per fiber container; 2 containers per wooden box

*Packing Box:
- Weight ---------- 86 lbs.
- Dimensions---------- 39-15/16 x 10-15/16 x 7-3/32 in.
- Cube---------- 1.8 cu. ft.

*NOTE: See SC for complete packing data including NSN's.

Shipping and Storage Data:

- Quantity - distance class ---------- 5
- Storage compatibility ---------- A
- DOT shipping class ---------- A
- DOT designation ------- AMMUNITION FOR CANNON WITH SMOKE PROJECTILES
- DODAC---------- 1315-C128
- Drawing number ------- P85133

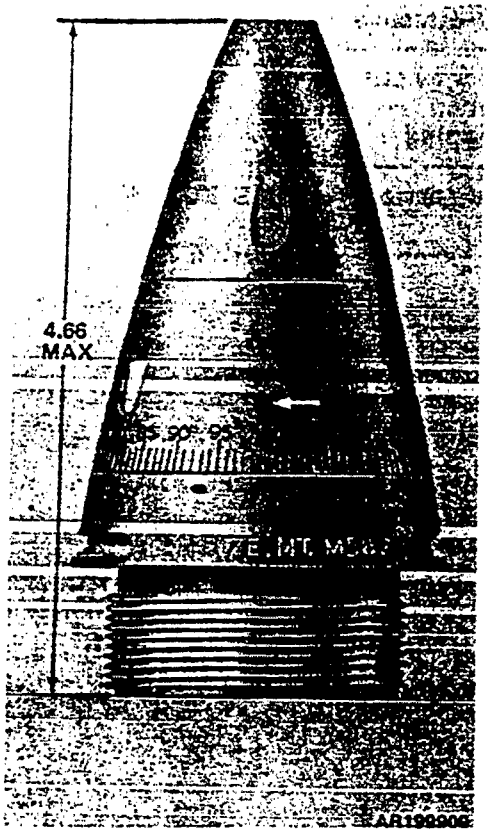
Limitations:

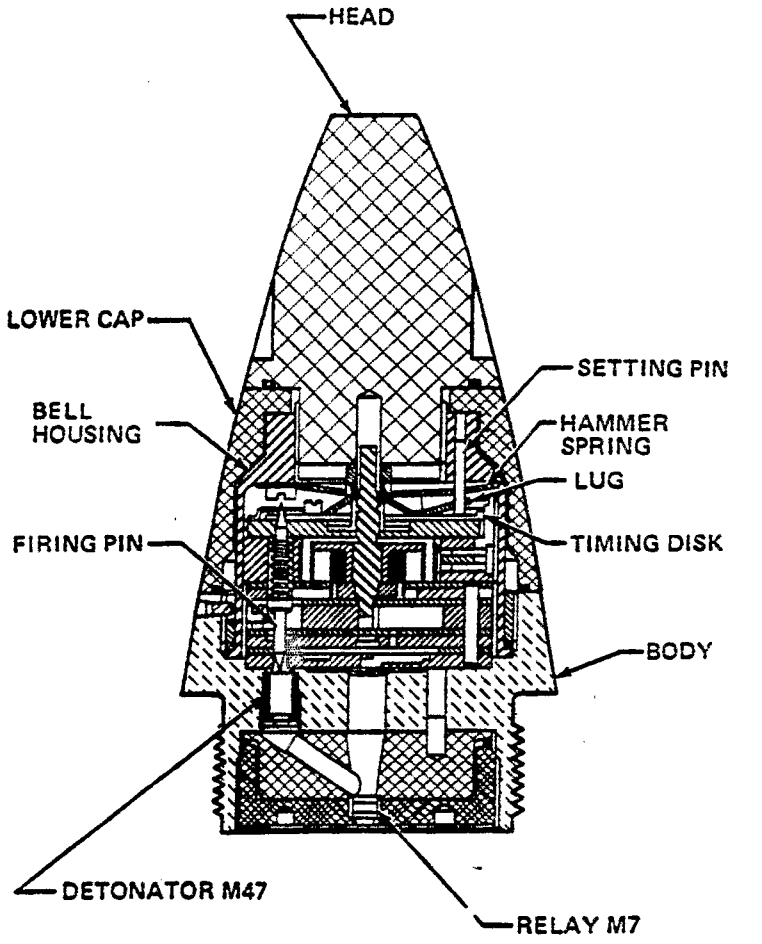
a. Since the burster in this ammunition is loaded with tetrytol, it is not to be stored or fired at temperatures exceeding + 125°F.

b. Store and transport rounds at temperatures below 111.4°F (melting point of WP). If impractical store rounds on bases, so that if WP melts it will resolidify with void space in the nose of the projectile. Erratic performance may occur if voids exist inside of WP filler.

References:

SC 1305/30-IL
SB 700-20
DARCOM P 700-3-3
TM 9-1300-251-20
TM 9-7017-5
TM 9-7017-6





Type Classification:

Std AMCTC 267 dtd 1962

Use:

Fuze M562 is a mechanical time type used with 4.2-inch mortar illuminating cartridges.

Description:

The aluminum head is threaded into the bell housing under the lower cap. The rotatable lower cap has an exterior scale graduated in seconds from 0 to 100, plus a safety line stamped S. The movement is a spring-driven clockwork and escapement mechanism to provide the fuze functioning time desired. The steel body of the fuze contains a detonator near the top and a relay in a retainer at the base. A fuze setting line and vernier scale are inscribed on the exterior.

Functioning:

When the lower cap is rotated to set the time, the timing disk of the movement is rotated also by means of a setting pin lodged in an upraised lug on the disk. When the cartridge is fired, setback causes a hammer spring to strike the upraised lug, releasing the disk from the setting pin. Centrifugal force releases the detents (not shown) holding the timing movement. When the timing disk has rotated to the preset time, a notch in the disk engages the firing arm. The firing arm slides

into the notch and turns, permitting the spring-loaded firing pin to strike the detonator and initiate the explosive train.

Tabulated Data:

Type	MT
Weight	1.56 lbs.
Length:	
Visible	3.76 in.
Overall	4.66 in.
Thread size	2-12 UNS-1
Assembly Dwg. No.	10520791

Temperature Limits:

Firing:	
Lower limit	-40 °F
Upper limit	+125 °F
Storage:	
Lower limit	-80 °F (for not more than 3 days)
Upper limit	+160 °F (for not more than 4hrs/day)
*Packing	8 fuzes in metal container; 2 containers in wirebound box
*Packing Box:	
Weight	45.2 lbs.
Dimensions	14-7/8 x 12-13/16 x 9-1/4 in.
Cube	1.0 cu. ft.

*NOTE: See SC for complete packing data including NSN's.

Shipping and Storage Data:

Quantity-distance class	1
Storage compatibility group	B, N & E
DOT shipping class	C
DOT designation	TIME FUZES
DODAC	1390-N283

Explosive Components:

Detonator M47 and Relay M7.

References:

TM 9-1015-215-12
TM 9-1300-251-20
SC 1340/98-IL

ARMY FM 3–9
AIR FORCE AFR 355–7

FIELD MANUAL

MILITARY CHEMISTRY AND CHEMICAL COMPOUNDS

HEADQUARTERS, DEPARTMENT OF THE ARMY

FIELD MANUAL
No. 3-9
AIR FORCE REGULATION
No. 355-7

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE

WASHINGTON, D.C., *30 October 1975*

MILITARY CHEMISTRY AND CHEMICAL COMPOUNDS

than DA. For moderate concentrations, the effects last about 30 minutes after an individual leaves the contaminated atmosphere. At a higher concentration, the effects may last up to several hours.

(24) *Protection required.* Protective mask.

(25) *Decontaminants.* None required in the field. Alkali solution or DS2 may be used for decontamination in enclosed places.

(26) *Persistency.* Short, because the compound is disseminated as an aerosol.

(27) *Use.* Although vomiting compounds are *not* authorized for military use, they are discussed in this manual to present a complete coverage of all potential chemicals for use in military operations.

3–10. Tear Producing Compounds

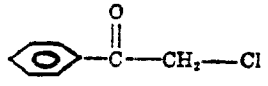
a. General. The tear compounds cause flow of tears and irritation of the skin. Since tear compounds produce only transient casualties, they are widely used for training, riot control, and for situations where long-term incapacitation is unacceptable. When used against poorly equipped guerrilla or revolutionary armies, they have proved extremely effective. When released indoors, they can cause serious illness or death. The principal tear compounds are discussed in *b* through *g* below.

b. Chloroacetophenone (CN).

(1) *Chemical name.* Chloroacetophenone.

(2) *Formula.*

(*a*) *Structural.*



(*b*) *Molecular.* $C_6H_5COCH_2Cl$.

(3) *Molecular weight.* 154.59.

(4) *Vapor density (compared to air).* 5.3.

(5) *Liquid density.* 1.187 at 58° C.

(6) *Solid density.* 1.318 at 20° C.

(7) *Melting point.* 54° C. pure, 46 to 48° C. plant purity.

(8) *Boiling point.* 248° C.

(9) *Vapor pressure.* 0.0026 mm Hg at 0° C.; 0.0041 mm Hg at 20° C.; 0.152 mm Hg at 51.7° C.

(10) *Volatility.* 2.36 mg/m³ at 0° C.; 34.3 mg/m³ at 20° C.; 1060 mg/m³ at 51.7° C.

(11) *Flash point.* High enough not to interfere with the military use of the compound.

(12) *Decomposition temperature.* Stable to boiling point.

(13) *Latent heat of vaporization.* 98 calories per gram. Like vomiting compounds, CN must be vaporized or dispersed by some means other than its own volatility.

(14) *Rate of hydrolysis.* Not readily hydrolyzed.

(15) *Hydrolysis products.* Hydrogen chloride and a hydroxyacetophenone.

(16) *Stability in storage.* Stable.

(17) *Action on metals or other materials.* Tarnishes steel slightly.

(18) *Odor.* Fragrant; similar to that of apple blossoms.

(19) *Median lethal dosage (LCt_{50}).* 7,000 mg-min/m³, dispersed from solvent; 14,000 mg-min/m³, dispersed from No. 112 thermal grenade.

(20) *Median incapacitating dosage (ICt_{50}).* 80 mg-min/m³.

(21) *Rate of detoxification.* Rapid; effects disappear in minutes. High concentrations may cause skin irritation which usually disappears within a few hours.

(22) *Skin and eye toxicity.* Irritating; not toxic in concentrations likely to be encountered in the field.

(23) *Rate of action.* Practically instantaneous.

(24) *Physiological action.* In addition to powerful lacrimatory effects, CN is an irritant to the upper respiratory passages. In higher concentrations, it is irritating to the skin and causes a burning and itching sensation, especially on moist parts of the body. High concentrations can cause blisters. The effects are similar to those of sunburn, are entirely harmless, and disappear in a few hours. Certain individuals experience nausea following exposure to CN.

(25) *Protection required.* Protective mask.

(26) *Decontaminants.* Aeration is sufficient in the field. In enclosed areas, soda ash solution or alcoholic caustic soda will decontaminate CN.

(27) *Persistency.* Short, because the compounds are disseminated as an aerosol.

(28) *Use.* Training and riot control.

c. CNC.

(1) *Chemical name.* None; solution of chloroacetophenone in chloroform.

(2) *Formula.*

(*a*) *Chloroform.* $CHCl_3$ (70 parts by weight).

(*b*) *CN.* $C_6H_5COCH_2Cl$ (30 parts by weight).

TECHNICAL MANUAL

UNITED STATES NAVY AMMUNITION

HISTORICAL AND FUNCTIONAL DATA

THIS PUBLICATION SUPERSEDES NAVORD OP 4 (VOLUME ONE ONLY)

FIFTH REVISION DATED 15 OCTOBER 1972

PUBLISHED BY DIRECTION OF

COMMANDER, NAVAL SEA SYSTEMS COMMAND

TABLE of CONTENTS

AMMUNITION IDENTIFICATION AND COLOR CODING

THERE ARE SEVERAL AIDS IN DETERMINING WHETHER AN UNKNOWN ITEM IS A PIECE OF AMMUNITION. IF THE ITEM IN QUESTION IS NOT TOO DETERIORATED, RUSTED, DIRT COVERED, ETC., THESE ARE:

PHYSICAL CHARACTERISTICS SUCH AS SIZE AND SHAPE
CERTAIN AMMUNITION PECULIAR MARKINGS
COLOR CODING

THE PHYSICAL CHARACTERISTICS OF REPRESENTATIVE EXAMPLES OF AMMUNITION WILL BE COVERED IN LATER BLOCKS OF INSTRUCTION.

THIS BLOCK WILL FAMILIARIZE YOU WITH CERTAIN TYPES OF AMMUNITION MARKINGS AND COLOR CODES.

R6MMA

EXAMPLE OF AMMUNITION IDENTIFICATION CODE

1305-246-2967 A131

EXAMPLE OF FEDERAL STOCK NUMBER AND DODIC

1305-00-246-2967 A131

EXAMPLE OF NATIONAL STOCK NUMBER AND DODIC

1305-A131

EXAMPLE OF DODAC

PBA-3757-23

EXAMPLE OF OLD ARMY OR AIR FORCE LOT NUMBER

BE-246-HAW-53

EXAMPLE OF OLD NAVY LOT NUMBER

SOD78B023-017

EXAMPLE OF NEW LOT NUMBER

OLD COLOR CODING SYSTEM[1]

TYPE OF AMMUNITION	BODY COLOR AND MARKING COLOR
ARMOR PIERCING (W/O HE)	BLACK W/WHITE MARKINGS
ARMOR PIERCING (W/HE)	OLIVE DRAB W/YELLOW MARKINGS
HIGH EXPLOSIVE	OLIVE DRAB W/YELLOW MARKINGS
ILLUMINATING	GRAY W/WHITE MARKING AND WHITE BAND
CHEMICAL:	
PERSISTENT GAS	GRAY W/GREEN MARKING, TWO GREEN BANDS
NONPERSISTENT GAS	GRAY W/GREEN MARKING, ONE GREEN BAND
TRAINING AND RIOT CONTROL	GRAY W/RED MARKING. ONE RED BAND
SMOKE	GRAY W/YELLOW MARKING, ONE YELLOW BAND[2]
INCENDIARY	GRAY W/PURPLE MARKING, ONE PURPLE BAND
PRACTICE	BLUE W/WHITE MARKING
DUMMY (INERT)	BLACK W/WHITE MARKING

[1] EXCEPT FOR BOMBS, PYROTECHNICS, AND SMALL ARMS.

[2] RIFLE SMOKE GRENADES WILL HAVE A BAND OF THE COLOR OF SMOKE PRODUCED.

OLD COLOR CODING FOR BOMBS

TYPE OF BOMB	BODY COLOR	MARKING	IDENTIFICATION BANDS COLOR	NOSE	CENTER	TAIL
HIGH EXPLOSIVE:						
TNT	OLIVE DRAB	BLACK	YELLOW	ONE		ONE
AMATOL	OLIVE DRAB	BLACK	YELLOW	ONE		ONE
COMP B	OLIVE DRAB	BLACK	YELLOW	TWO		TWO
TRITONAL	OLIVE DRAB	BLACK	YELLOW	THREE[1]		THREE[1]
CHEMICAL:						
SMOKE	GRAY	YELLOW	YELLOW	ONE	ONE	ONE
INCENDIARY	GRAY	PURPLE	PURPLE	ONE	ONE	ONE
PERSISTENT	GRAY	GREEN	GREEN	TWO	TWO	TWO
NONPERSISTENT	GRAY	GREEN	GREEN	ONE	ONE	ONE
TARGET IDENTIFICATION	GRAY	BLACK	NONE			
PHOTOFLASH	GRAY	BLACK	NONE			
LEAFLET	OLIVE DRAB	BLACK	NONE			
PRACTICE	BLUE	WHITE	NONE			
DRILL	OLIVE DRAB	BLACK	BLACK	ONE		ONE

[1] ONE 1/2" BAND BETWEEN TWO 1" BANDS

OLD COLOR CODING - CHEMICAL AGENTS

BODY	MARKINGS	REMARKS
GRAY	GREEN	NON-PERSISTENT AGENT
GRAY	GREEN	PERSISTENT AGENT
GRAY	RED	TEAR GAS
GRAY	YELLOW	SMOKE AGENT
GRAY	PURPLE	INCENDIARY AGENT

NEW COLOR CODING SYSTEM FOR AMMUNITION, INCLUDING BOMBS [1]

AMMUNITION	BODY	MARKING	BAND
HIGH EXPLOSIVE (EXCEPT 20MM)	OLIVE DRAB	YELLOW	
HIGH EXPLOSIVE (20MM)	YELLOW	BLACK	NONE
HIGH EXPLOSIVE PLASTICIZED (HEP)	OLIVE DRAB	YELLOW	BLACK
HIGH EXPLOSIVE ANTITANK	BLACK	YELLOW	NONE
ANTIPERSONNEL ANTITANK MINES	OLIVE DRAB	YELLOW	
INCENDIARY	LIGHT RED	BLACK	NONE
HIGH EXPLOSIVE INCENDIARY (HEI)	YELLOW	BLACK	LIGHT RED
ARMOR PIERCING INCENDIARY (API)	BLACK	WHITE	LIGHT RED
ARMOR PIERCING: W/BURSTING CHARGE	BLACK	YELLOW	NONE
W/O BURSTING CHARGE	BLACK	WHITE	NONE
CANISTER	OLIVE DRAB	WHITE	NONE
FLESHETTE LOADED	OLIVE DRAB	WHITE	
SIMULATOR	WHITE	BLACK	
ILLUMINATING: SEPARATE LOADING	OLIVE DRAB	WHITE	WHITE
FIXED OR SEMI-FIXED	WHITE	BLACK	NONE

(LISTING CONTINUED ON NEXT PAGE)

AMMUNITION	BODY	MARKING	BAND
PRACTICE: ◦			
W/LOW EXPLOSIVE			BROWN
W/HIGH EXPLOSIVE			YELLOW
W/O EXPLOSIVE			NONE

[1] SEE SEPARATE CHART FOR CHEMICAL AMMUNITION COLOR CODING

NEW COLOR CODING - CHEMICAL AGENTS

BASE COLOR	IDENTIFICATION MARKINGS	AGENT SYMBOL	REMARKS
		TOXIC	
GRAY	DARK GREEN	GB	TOXIC NERVE AGENT[1]
GRAY	DARK GREEN	VX	TOXIC NERVE AGENT[2]
GRAY	DARK GREEN	H	TOXIC BLISTER AGENT[2]
GRAY	DARK GREEN	HD	TOXIC BLISTER AGENT[2]
GRAY	DARK GREEN	HT	TOXIC BLISTER AGENT[2]
GRAY	VIOLET	CG	PHOSGENE[1]
GRAY	VIOLET	CK	CYANOGEN CHLORIDE[1]
		INCAPACITATING	
GRAY	DARK GREEN	L	TOXIC BLISTER AGENT
GRAY	VIOLET	AC	HYDROGEN CYANIDE
GRAY	VIOLET	BZ	NO COMMON NAME
GRAY	VIOLET	CL	CHLORINE
		RIOT CONTROL	
GRAY	RED	CN	TEAR GAS
GRAY	RED	CNS	TEAR GAS
GRAY	RED	CS	TEAR GAS
GRAY	RED	CR	TEAR GAS
GRAY	RED	BBC	TEAR GAS
GRAY	RED	DA	VOMITING AGENT
GRAY	RED	DC	VOMITING AGENT

SMOKES

LIGHT GREEN	BLACK	RP	SMOKE AGENT
LIGHT GREEN	BLACK	FM	SMOKE AGENT
LIGHT GREEN	BLACK	FS	SMOKE AGENT
LIGHT GREEN	BLACK	HC	SMOKE AGENT
LIGHT GREEN	LIGHT RED	WP	WHITE PHOSPHOROUS
LIGHT GREEN	LIGHT RED	PWP	WHITE PHOSPHOROUS

INCENDIARIES

LIGHT RED	BLACK	PT	INCENDIARY AGENT
LIGHT RED	BLACK	TEA	INCENDIARY AGENT
LIGHT RED	BLACK	TPA	INCENDIARY AGENT
LIGHT RED	BLACK	TH	INCENDIARY AGENT
LIGHT RED	BLACK	NP	INCENDIARY AGENT

[1]NON-PERSISTENT AGENT

[2]PERSISTENT AGENT

SMALL ARMS AMMUNITION

SMALL ARMS AMMUNITION (SAA) IS THAT AMMUNITION USED IN PISTOLS, RIFLES, SHOTGUNS AND SOME MACHINE GUNS.

FOR PURPOSES THIS INTRODUCTION, SAA IS THAT AMMUNITION USED WITH WEAPONS HAVING A MUZZLE DIAMETER OF UP TO .60 CALIBER.

GENERAL STATEMENTS:

WITH FEW EXCEPTIONS, THE ONLY EXPLOSIVE MATERIAL THAT MAY BE EXPECTED TO BE FOUND IN SAA IS THE PRIMER AND GUN POWDER.

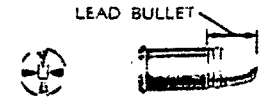
THE MOST SENSITIVE COMPONENT OF SAA IS THE PRIMER.

THERE ARE FEW, IF ANY, IDENTIFICATION MARKINGS ON SAA.

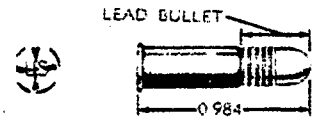
THE REASON FOR COLOR CODING SOME ROUNDS IS TO IDENTIFY THEIR USE RATHER THAN TO IDENTIFY THEIR CONTENTS

SAA COLOR CODING

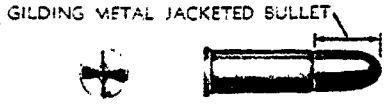
COLOR OF BULLET TIP	MEANING
NATURAL	BALL, HIGH PRESSURE TEST, DUMMY, ETC.
BLACK	ARMOR PIERCING
SILVER	ARMOR PIERCING INCENDIARY
BLUE	INCENDIARY
BLUE W/BLACK RING	ARMOR PIERCING INCENDIARY
RED	TRACER
MAROON	TRACER
ORANGE	TRACER
BROWN	TRACER
GREEN W/SILVER RING	FRANGIBLE
RED W/SILVER BAND	ARMOR PIERCING INCENDIARY W/TRACER
BLUE W/SILVER RING	ARMOR PIERCING INCENDIARY
ORANGE W/SILVER RING	ARMOR PIERCING INCENDIARY W/TRACER



CARTRIDGE, BALL, CAL. .22, SHORT (HIGH VELOCITY)



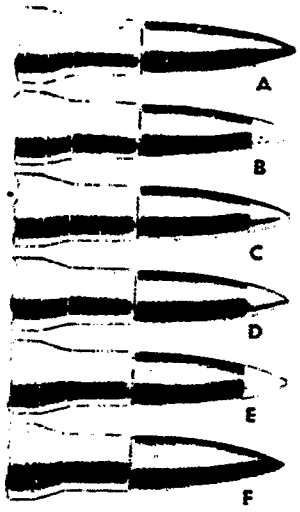
CARTRIDGE, BALL, CAL. .22, LONG RIFLE



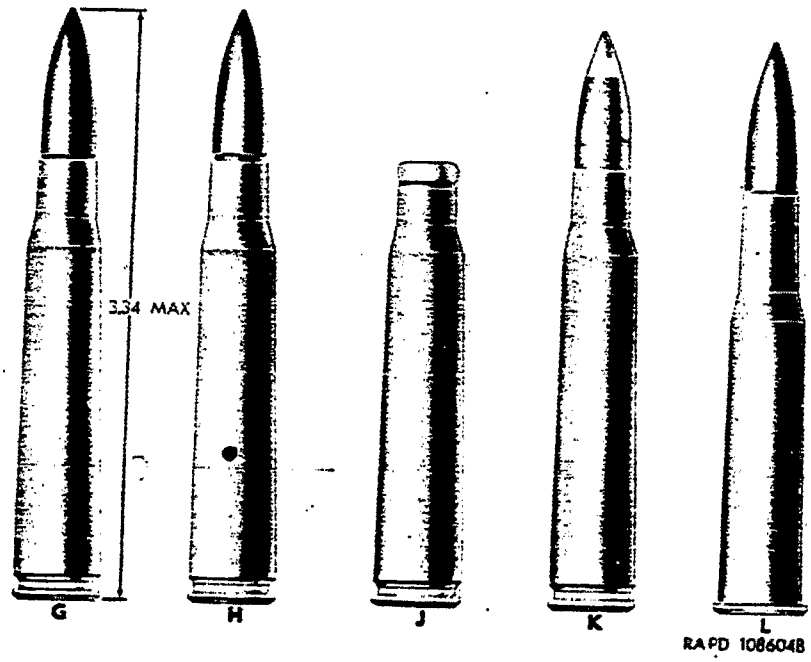
CARTRIDGE, BALL, CAL. .22, LONG RIFLE, M24

RA PD 108642A

.22 CAL. AMMUNITION

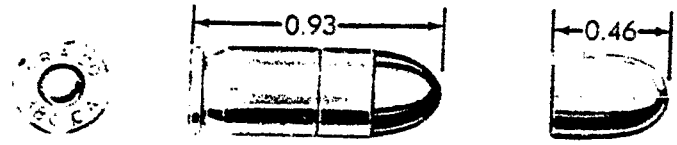


A (CARTRIDGE, ARMOR-PIERCING, CAL .30, M2
B (CARTRIDGE, ARMOR PIERCING INCENDIARY, CAL .30 M14 (T5)
C CARTRIDGE, INCENDIARY CAL .30, M1
D CARTRIDGE TRACER, CAL .30 M1
E (CARTRIDGE TRACER, CAL .30 M25 T10, FOR M25 T72E1
F (CARTRIDGE TEST, HIGH PRESSURE CAL .30, M1
G CARTRIDGE BALL CAL .30, M2
H CARTRIDGE DUMMY, CAL .30, M2
J CARTRIDGE BLANK, CAL .30, M 909
K (CARTRIDGE BALL FRANGIBLE CAL .30, M22 T44
L (CARTRIDGE SUBCALIBER CAL .30, M1925

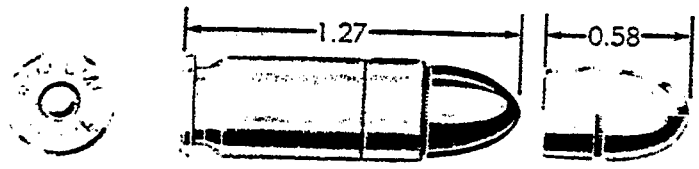


RAPD 1086048

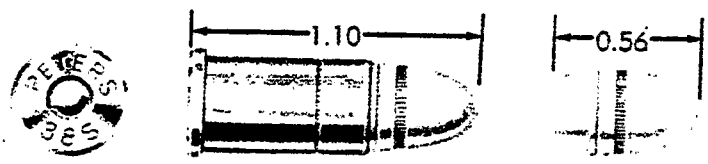
.30 CAL. RIFLE AMMUNITION



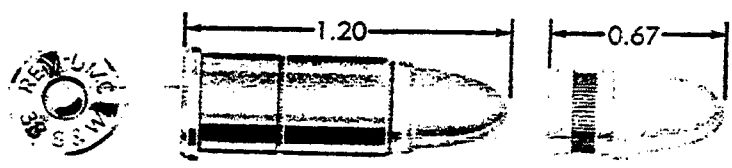
CARTRIDGE, BALL, AUTOMATIC PISTOL, CAL. .380,
95-GRAIN BULLET (9-MM SHORT)



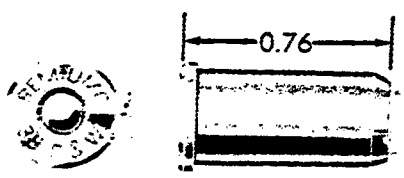
CARTRIDGE, BALL, CAL. .38, SUPER AUTOMATIC COLT,
130-GRAIN BULLET, METAL JACKET



CARTRIDGE, BALL, REVOLVER, CAL. .38, SHORT COLT,
125- OR 130-GRAIN BULLET

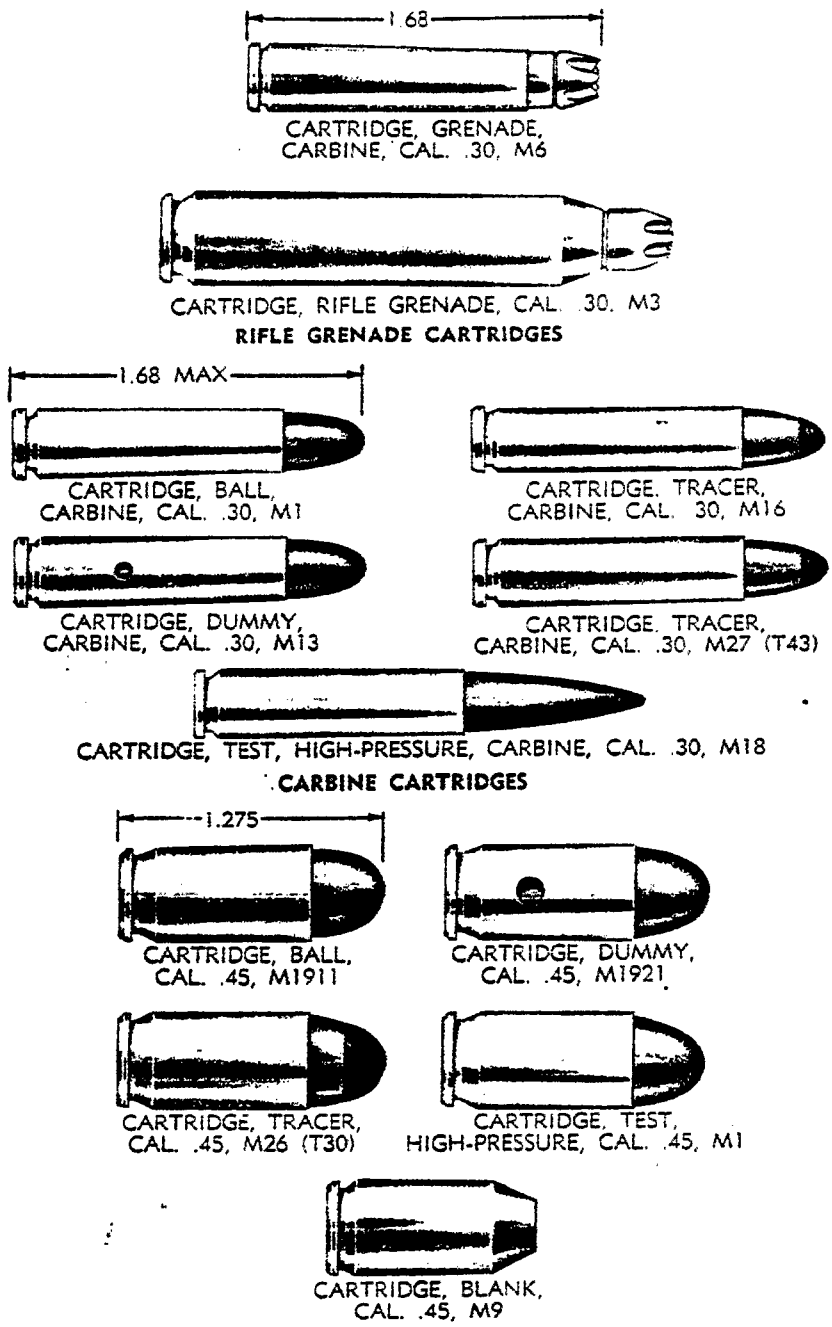


CARTRIDGE, BALL, REVOLVER, CAL. .38, S&W,
146-GRAIN BULLET

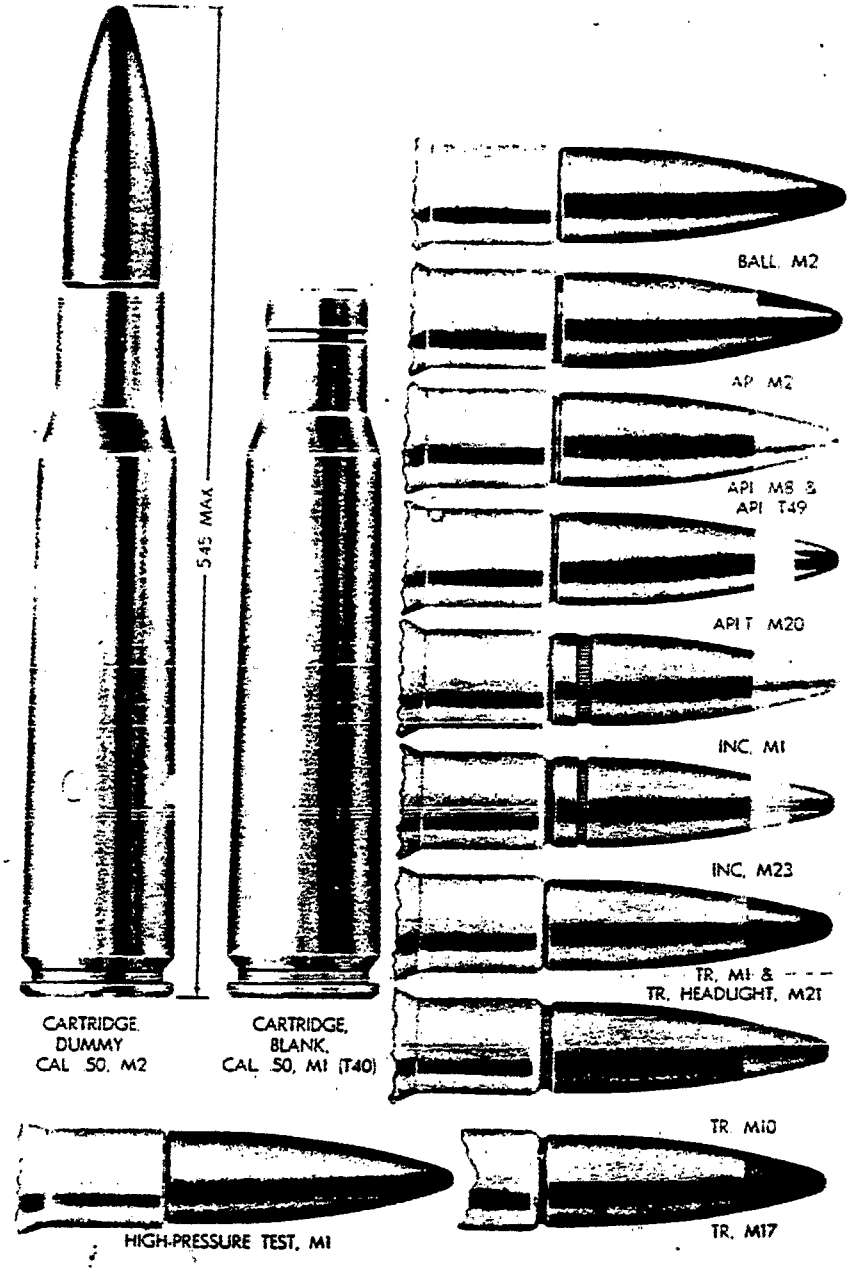


CARTRIDGE, BLANK, REVOLVER, CAL. .38, S&W

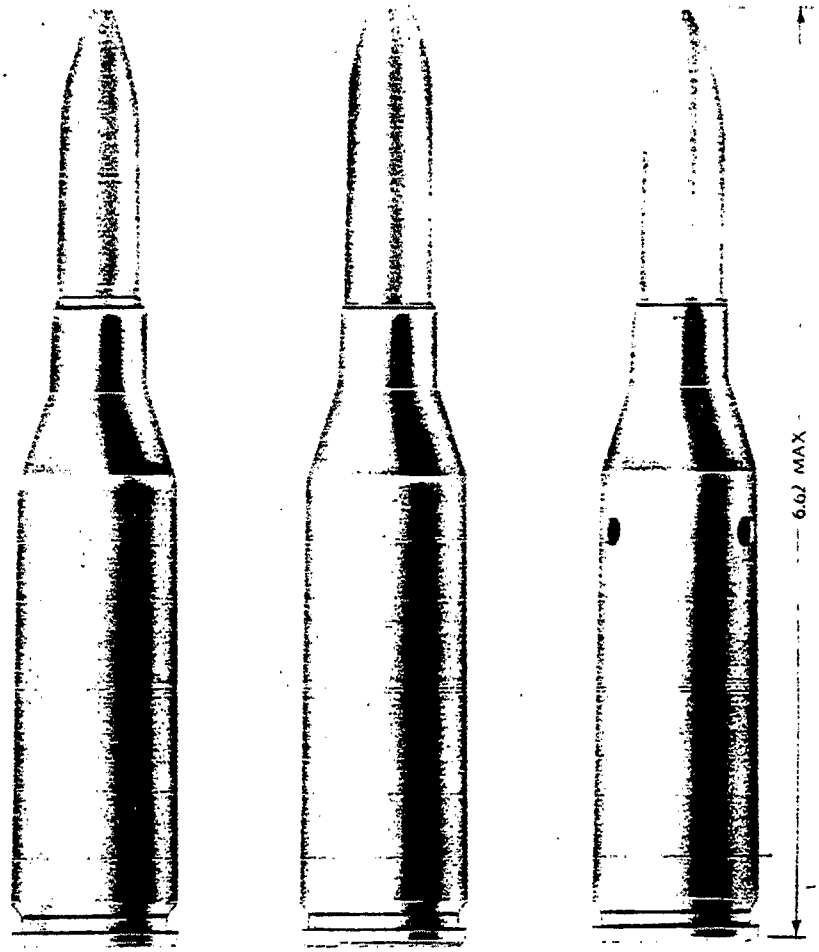
.38 CAL. PISTOL AMMUNITION



RIFLE, CARBINE AND .45 CAL. PISTOL AMMUNITION



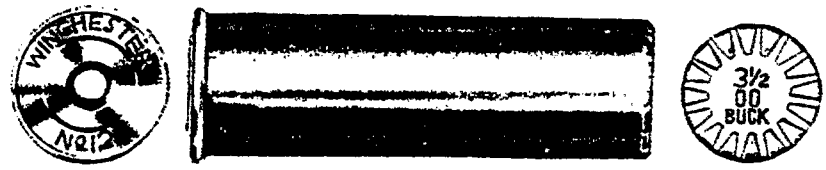
.50 CAL. AMMUNITION



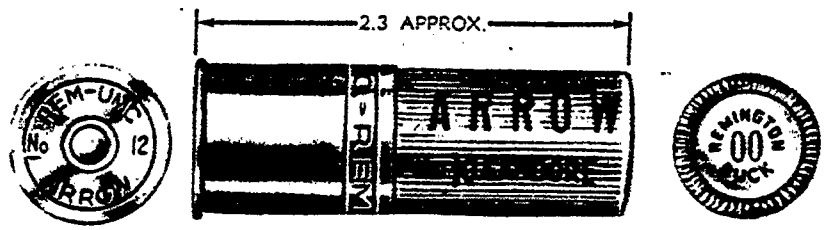
CARTRIDGE, BALL, CAL. .60, T77E1* OR T80**

CARTRIDGE, HIGH PRESSURE TEST, CAL. .60, T33E1* (FOR USE ONLY IN TESTING WEAPONS)

CARTRIDGE, DUMMY CAL. .60, T35

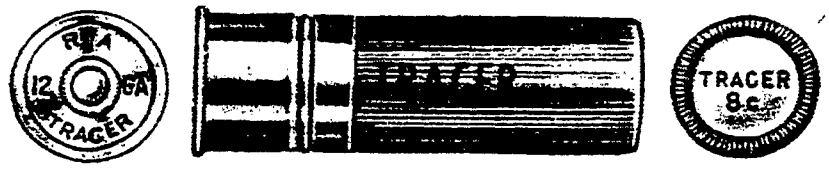


SHELL, SHOTGUN, ALL BRASS, 12-GAGE, NO. 00 BUCK, M19

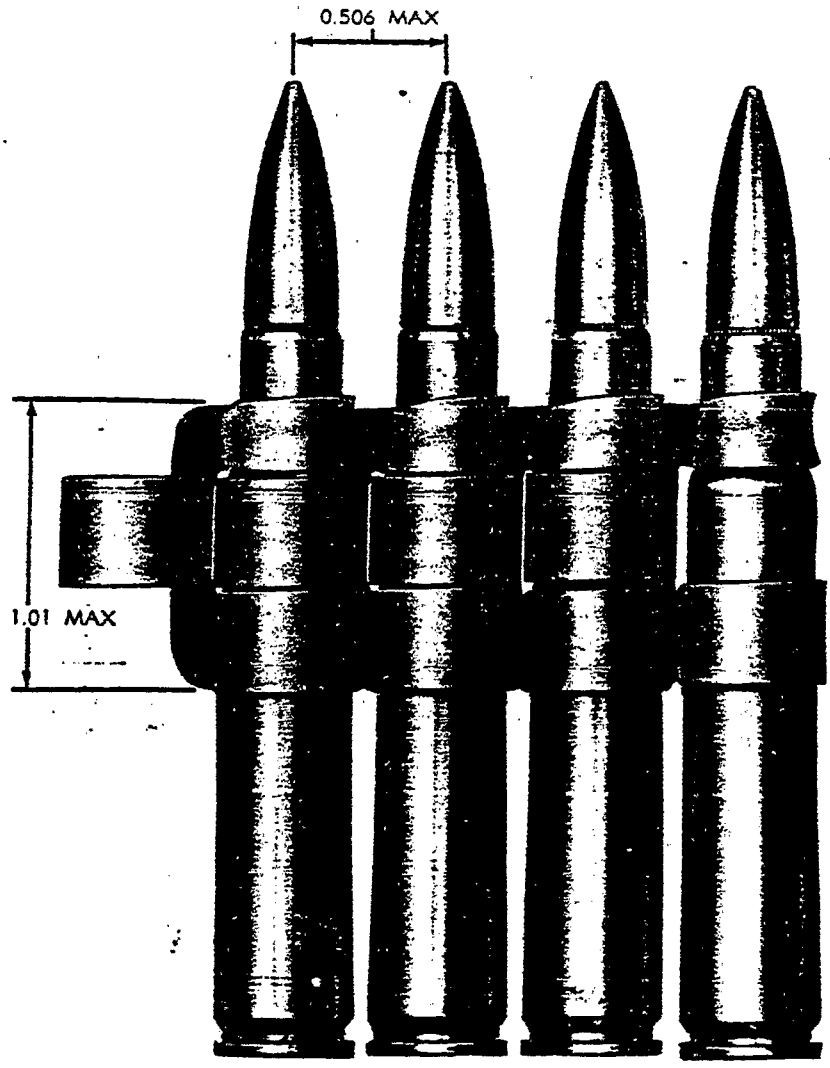


SHELL, SHOTGUN, 12-GAGE, PAPER,
LOADED WITH SMOKELESS POWDER AND #00 BUCKSHOT

SHELL, SHOTGUN, 12-GAGE, PAPER,
LOADED WITH SMOKELESS POWDER AND #7-1/2 CHILLED SHOT



SHELL, SHOTGUN, 12-GAGE, PAPER,
LOADED WITH SMOKELESS POWDER, #8 CHILLED SHOT, AND TRACER



EXAMPLE OF SAA ACCESSORIES - LINKS FOR MACHINE GUN

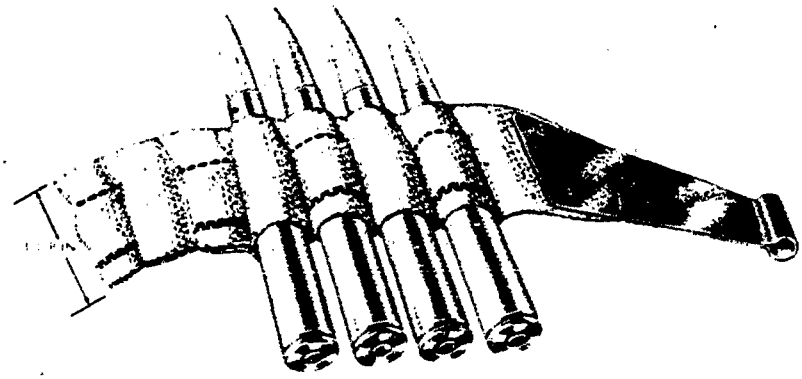
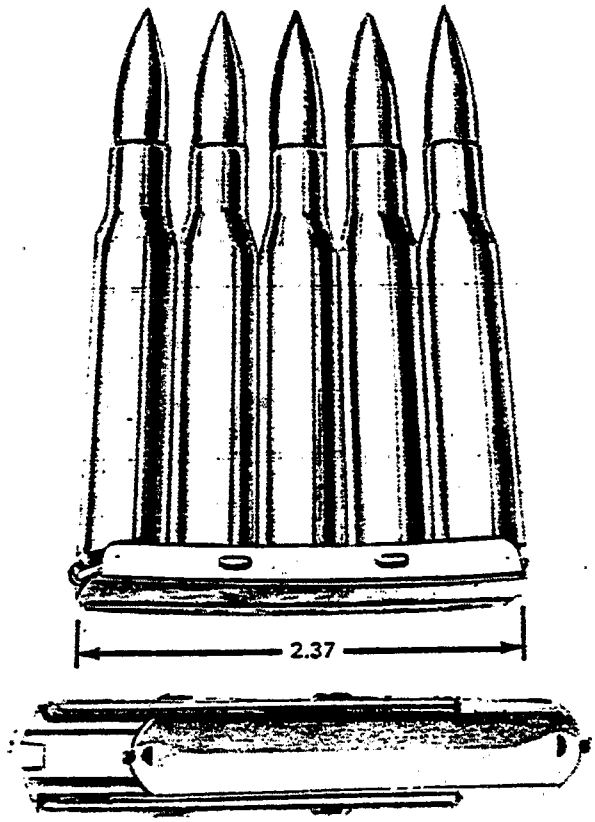
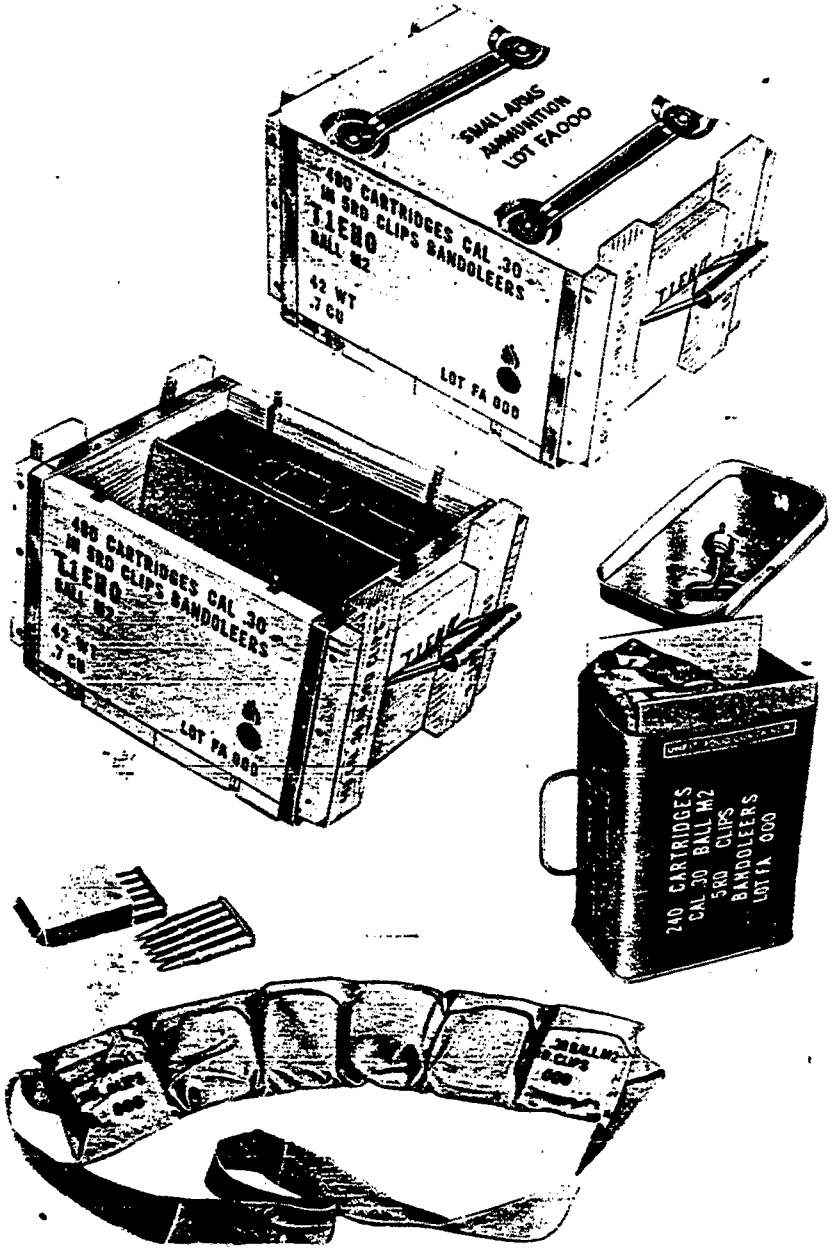


Figure 50. Section of 250-round web belt, caliber .30 M1917.



EXAMPLES OF SAA ACCESSORIES - WEB BELT FOR MACHINE GUN AND CLIP FOR RIFLE



SAA PACKAGING

8-RD. CLIPPED

5-RD. CLIPPED

CAL .30 BELTED

CAL .30 LINKED

CAL .50 LINKED

RA PD 151938

BAA PACKAGING

ARTILLERY AMMUNITION

ARTILLERY TYPE AMMUNITION USUALLY CONSISTS OF FOUR COMPONENTS: PRIMER, PROPELLING CHARGE, FUZE AND PROJECTILE. THESE HAVE BEEN MANUFACTURED, ISSUED AND STORED EITHER SEPARATELY, AS COMPONENTS, OR ASSEMBLED AS COMPLETE ROUNDS. GENERALLY, THE PRIMERS, FUZES AND PROPELLING CHARGES CONTAIN EXPLOSIVES. MOST PROJECTILES ALSO CONTAIN EXPLOSIVES; HOWEVER,THERE ARE SOME TYPES OF PROJECTILES THAT DO NOT CONTAIN ANY EXPLOSIVES. EXAMPLES OF THESE ARE PRACTICE PROJECTILES AND SOME TYPES OF ARMOR PIERCING PROJECTILES.

THE COLOR CODING INFORMATION GIVEN EARLIER APPLIES TO ARTILLERY TYPE AMMUNITION.

THE BEGINNING OF MODERN ARTILLERY DID NOT COME ABOUT UNTIL AFTER THE CIVIL WAR. MANY OF THE PRINCIPLES LAID DOWN IN THE LATE 19TH CENTURY REGARDING THEIR DESIGN, FUNCTION AND SAFETY ARE STILL IN USE.

GENERAL STATEMENTS:

FUZES HAVE ONE OR MORE SAFETY FEATURES BUILT INTO THEM.

PROPELLING CHARGES GENERALLY DETERIORATE IN CONTACT WITH MOISTURE.

HIGH EXPLOSIVES DO NOT ALWAYS DETERIORATE IN THE PRESENCE OF MOISTURE.

SIZES OF U. S. ARTILLERY WEAPONS KNOWN TO HAVE BEEN IN USE SINCE THE CIVIL WAR

UP TO 3 INCHES

1.457" GUN
20MM GUN
37MM GUN
40MM GUN
57MM RIFLE
60MM MORTAR
2.95" GUN
75MM GUN

3 INCHES UP TO 5 INCHES

76MM GUN
3" MORTAR
3" GUN
81MM MORTAR
90MM RIFLE
90MM GUN
105MM RIFLE
105MM HOWITZER
105MM GUN
106MM RIFLE
4.7" GUN
120MM GUN

5 INCHES UP TO 10 INCHES

152MM GUN
6" MORTAR
6" GUN
155MM HOWITZER
155MM GUN
7" NAVY GUN
8" HOWITZER
9.2" HOWITZER
240MM HOWITZER
10" GUN

LARGER THAN 10 INCHES

280MM GUN
12" MORTAR
12" GUN
14" GUN
16" HOWITZER
16" GUN

GENERAL TYPES OF ARTILLERY TYPE AMMUNITION

FIXED - THE PROJECTILE IS PERMANENTLY ATTACHED TO THE CARTRIDGE CASE AT THE TIME OF MANUFACTURE. THERE IS NO PROVISION TO ADJUST THE PROPELLING CHARGE.

SEMI-FIXED - THE PROJECTILE FITS SNUGLY INTO THE CARTRIDGE CASE, BUT IS NOT PERMANENTLY ATTACHED. THIS PERMITS ADJUSTMENT OF THE PROPELLING CHARGE.

SEPARATE LOADING - PROJECTILE, PROPELLING CHARGE AND PRIMER ARE SEPARATE COMPONENTS THAT MUST BE LOADED INTO THE CANNON INDIVIDUALLY.

SEPARATED - PROPELLING CHARGE AND PRIMER ARE PERMANENTLY FIXED INSIDE THE CARTRIDGE CASE. PROJECTILE AND CARTRIDGE CASE ARE LOADED IN TO THE CANNON INDIVIDUALLY.

COMMON TERMS ASSOCIATED WITH ARTILLERY TYPE AMMUNITION

AP - ARMOR PIERCING. THIS TYPE OF PROJECTILE MAY OR MAY NOT CONTAIN ANY EXPLOSIVES.

APC - ARMOR PIERCING CAPPED. THE HARD STEEL OF THE PROJECTILE HAS SOFT STEEL CAP. THIS TYPE OF PROJECTILE MAY OR MAY NOT CONTAIN ANY EXPLOSIVE.

APERS - ANTI-PERSONNEL. WHEN USED IN CONJUNCTION WITH ARTILLERY, THIS INDICATES THAT THE PROJECTILE CONTAINS FLESHETTES (NAILS) AND AN EXPLOSIVE CHARGE TO DISPERSE THEM.

APDS - ARMOR PIERCING DISCARDING SABOT. THIS TYPE OF PROJECTILE USUALLY CONTAINS LITTLE OR NO EXPLOSIVE.

BE - BASE EJECTING. THIS TYPE OF PROJECTILE CARRIES CARGO THAT IS EJECTED IN FLIGHT OUT THROUGH THE BASE.

CANISTER - THIS TYPE OF PROJECTILE CONTAINS FLESHETTES OR STEEL CUBES BUT DOES NOT CONTAIN ANY EXPLOSIVE.

DP - DUAL PURPOSE. THIS TYPE OF PROJECTILE CONTAINS A SHAPED CHARGE FOR USE AGAINST ARMOR. ALSO, THE PROJECTILE BODY IS DESIGNED TO FRAGMENT TO CAUSE INJURY TO PERSONNEL IN THE VICINITY.

DUMMY - THIS TYPE OF PROJECTILE IS USED FOR PRACTICE IN LOADING THE CANNON AND ODES NOT CONTAIN ANY EXPLOSIVE.

FUZE - A COMPONENT ADDED TO THE PROJECTILE THAT CAUSES THE PROJECTILE TO FUNCTION AT THE PROPER INSTANT.

HE - HIGH EXPLOSIVE. THIS INDICATES THAT THE PROJECTILE CONTAINS HIGH EXPLOSIVE. OTHER TYPES OF PROJECTILES MAY CONTAIN HIGH EXPLOSIVES ALSO.

HEAT - HIGH EXPLOSIVE ANTI-TANK. THIS TYPE OF PROJECTILE CONTAINS A SHAPED CHARGE.

HERA - HIGH EXPLOSIVE ROCKET ASSIST. THIS TYPE OF PROJECTILE CONTAINS A HIGH EXPLOSIVE BURSTING CHARGE AND A SMALL ROCKET MOTOR TO EXTEND ITS RANGE.

HVAP - HYPER-VELOCITY ARMOR PIERCING - THIS TYPE OF PROJECTILE CONTAINS LITTLE OR NO EXPLOSIVE.

HVTP - HYPER-VELOCITY TARGET PRACTICE. THIS TYPE OF PROJECTILE CONTAINS LITTLE OR NO EXPLOSIVE.

ILLUM - ILLUMINATING. THIS TYPE OF PROJECTILE CONTAINS SOME TYPE OF ILLUMINATING DEVICE, USUALLY A PARACHUTE SUSPENDED FLARE.

MP - MULTI-PURPOSE. SAME MEANING AS DUAL PURPOSE.

PRACTICE - THIS TYPE OF PROJECTILE IS USED FOR TARGET PRACTICE. IT MAY OR MAY NOT CONTAIN EXPLOSIVES.

RAP - ROCKET ASSISTED PROJECTILE. SEE HERA.

SABOT - A DEVICE ATTACHED TO A PROJECTILE TO ASSURE THAT IT RIDES DOWN THE BARREL OF THE CANNON PROPERLY. THE SABOT DOES NOT CONTAIN ANY EXPLOSIVE.

SHELL - PROJECTILE.

TP - TARGET PRACTICE. THIS TYPE OF PROJECTILE MAY OR MAY NOT CONTAIN ANY EXPLOSIVE.

TRACER - A SMALL PYROTECHNIC COMPOSITION INSTALLED IN THE BASE OF THE PROJECTILE THAT IGNITES UPON FIRING AND IS VISIBLE TO THE GUNNER. WHEN A TRACER IS INSTALLED IN A PROJECTILE, THE MARKINGS WILL HAVE "-T".

WP - WHITE PHOSPHOROUS. THIS TYPE OF PROJECTILE CONTAINS WHITE PHOSPHOROUS AS ITS MAIN FILLER. IT ALSO MAY CONTAIN EXPLOSIVES.

TERMS ASSOCIATED WITH CIVIL WAR ERA AMMUNITION

1. A SOLID ROUND BALL, COMMONLY KNOWN AS A "CANNONBALL", IS CALLED A "SOLID SHOT" OR JUST "SHOT". ALTHOUGH THEY CONTAINED NO EXPLOSIVE, THEY WERE EFFECTIVE AGAINST PERSONNEL AND MATERIAL. SINCE THE SHOT WAS PRONE TO RICOCHET, SOMEWHAT LIKE A FLAT ROCK DOES WHEN SKIMMED OVER WATER, THIS EFFECT WAS PERFECTED BY GUNNERS AGAINST BOTH GROUND TROOPS AND WARSHIPS.

2. HOLLOW SHOT. THIS WAS IDENTICAL TO SOLID SHOT EXCEPT THAT THE BALL WAS HOLLOW. THIS GAVE IT LIGHTER WEIGHT AND CONSEQUENTLY HIGHER VELOCITIES AND LONGER RANGES.

3. CASE SHOT. ALSO CALLED "SPHERICAL CASE", "BULLET SHELL", "SHRAPNEL SHELL", AND "SHRAPNEL". THIS TYPE OF PROJECTILE WAS A TIME FUZED, THIN WALLED PROJECTILE FILLED WITH RELATIVELY SMALL ROUND BULLETS, GENERALLY SET IN A MATRIX OF SULFUR, ASPHALT, ROSIN, OR SIMILAR COMPOSITION WITH A SMALL BURSTING CHARGE, SUFFICIENT ONLY TO BREAK OPEN THE CASING. BEING PRIMARILY A CARRIER OF THE BALLS, THIS TYPE OF PROJECTILE DID NOT DEPEND ON THE FRAGMENTATION OF THE OUTER CASING FOR EFFECT. WHEN THE PROJECTILE BROKE APART JUST IN FRONT OF OR OVER THE ENEMY, THE BALLS CONTINUED TO TRAVEL AT THE VELOCITY OF THE BALL. HOWEVER, BEING UNCONFINED, THEY WOULD SPREAD OUT.

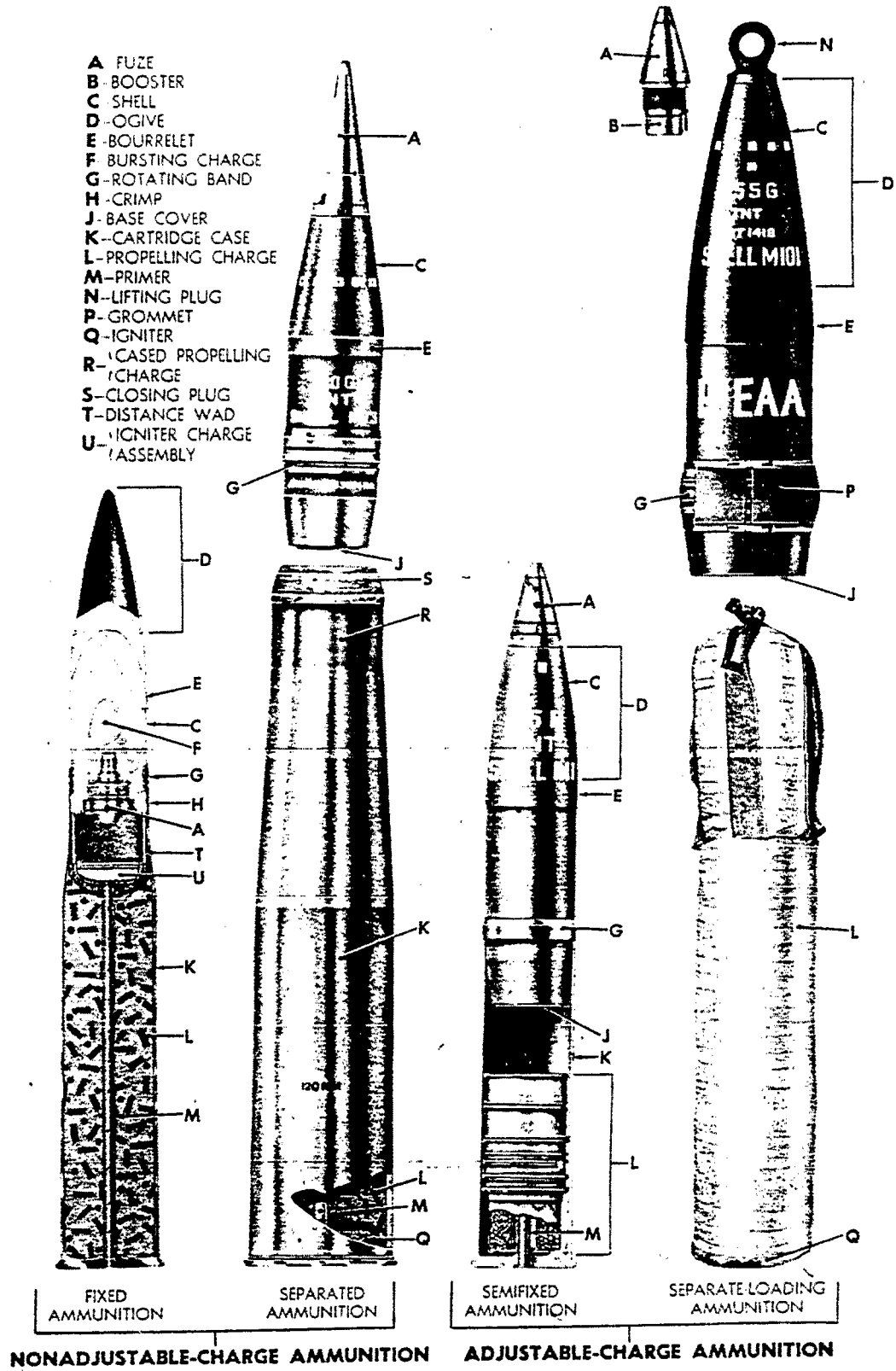
4. COMMON SHELL. THIS WAS A HOLLOW CASING DESIGNED TO BREAK INTO MANY FRAGMENTS FROM A BURSTING CHARGE. THIS TYPE OF PROJECTILE EMPLOYED BLACK POWDER AS A BURSTING FUZE AND HAD AN IMPACT TYPE FUZE.

5. BLIND SHELL. THIS WAS SIMILAR TO THE COMMON SHELL EXCEPT THAT IT HAD THICKER WALLS AND NO EXTERIOR FUZE. THIS WAS USED AGAINST FORTIFICATIONS AND SHIPS. IT WAS INTENDED THAT THE PROJECTILE WOULD HIT ITS TARGET AND THE HEAT GENERATED BY FRICTION AS IT PASSED THROUGH IT WOULD BE SUFFICIENT TO SET OFF THE BLACK POWDER BURSTING CHARGE.

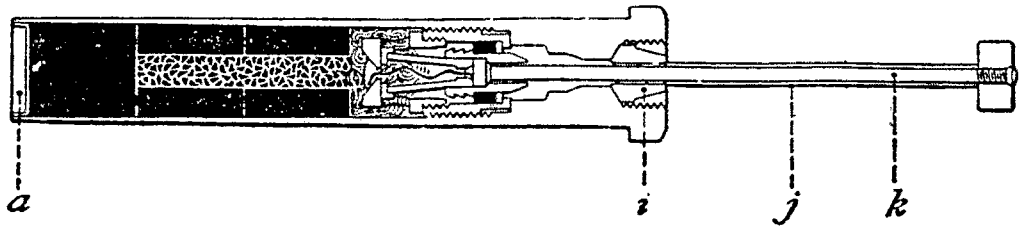
6. CANISTER. THIS USUALLY CONSISTED OF SPHERICAL BALLS CONTAINED IN A THIN CONTAINER. THE BALLS WERE PACKED IN THE CONTAINER, USUALLY A TINNED SHEET IRON CYLINDER OF LIGHT WEIGHT, IN SAWDUST. THE FRONT OF THE CANISTER WAS CLOSED BY A WOODEN OR LIGHT WEIGHT DISC WITH THE CYLINDRICAL END OF THE CANISTER CRIMPED OVER IT. THE REAR OF THE CANISTER CONTAINED A HEAVY IRON DISC SLIGHTLY LESS IN DIAMETER THAN THE BORE. WHEN FIRED, THE CANISTER WOULD BREAK OPEN BY THE ACTION OF AIR AND DISPERSE THE BALLS IN FRONT OF THE CANNON. THIS HAD THE EFFECT OF BEING A CANNON SIZED SHOTGUN.

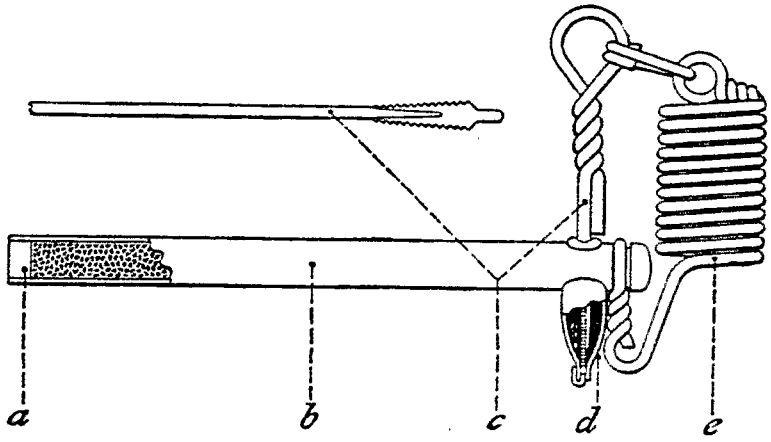
7. GRAPE SHOT. THIS WAS SIMILAR TO CANISTER, EXCEPT THAT IT WAS USED IN LARGER CANNONS AND HAD NO METAL CYLINDER.

8. BOLT. THIS WAS A SOLID PROJECTILE, BUT FIRED FROM A RIFLED CANNON RATHER THAN A SMOOTHBORE. THEREFORE IT HAD A LONG, CYLINDRICAL BODY.



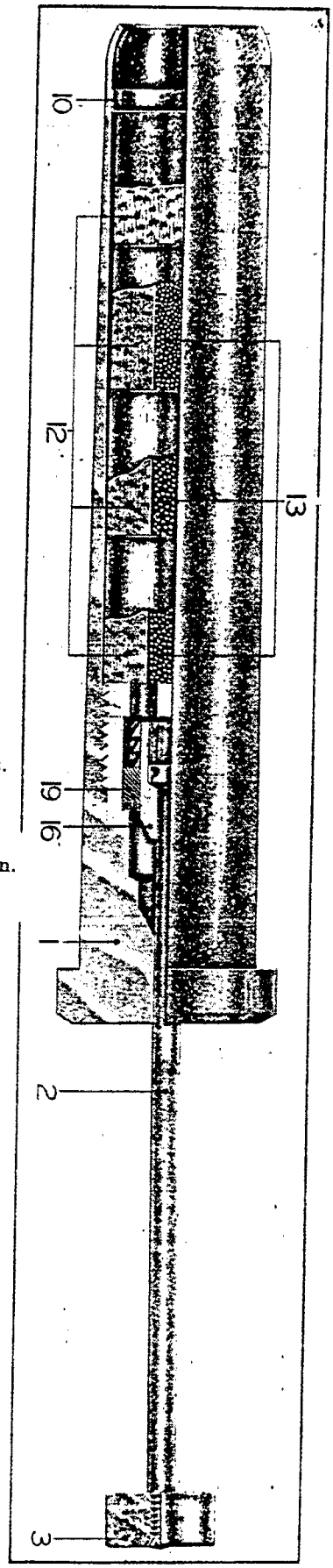
GENERAL TYPES OF ARTILLERY



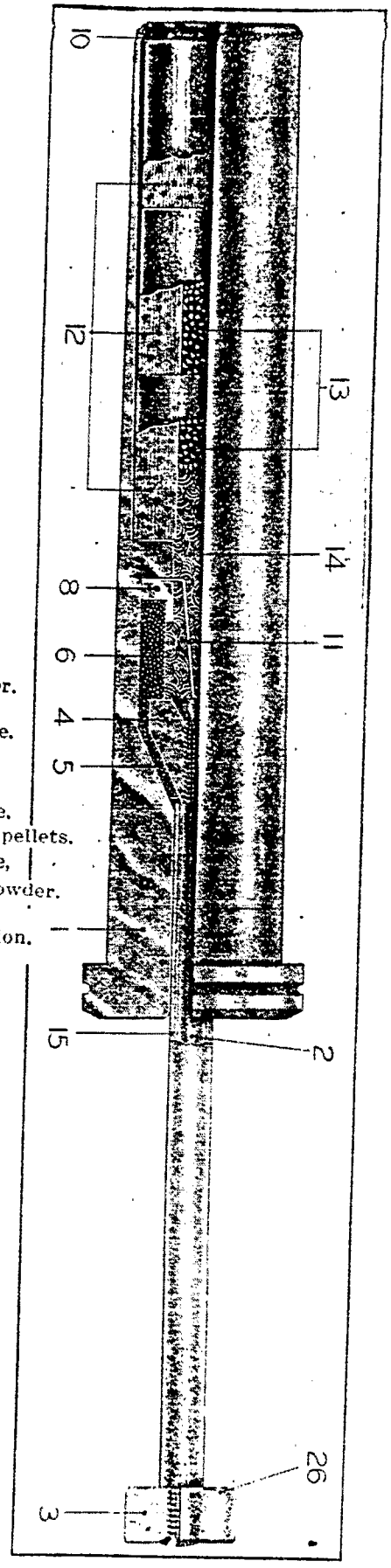


FRICTION TYPE PRIMER

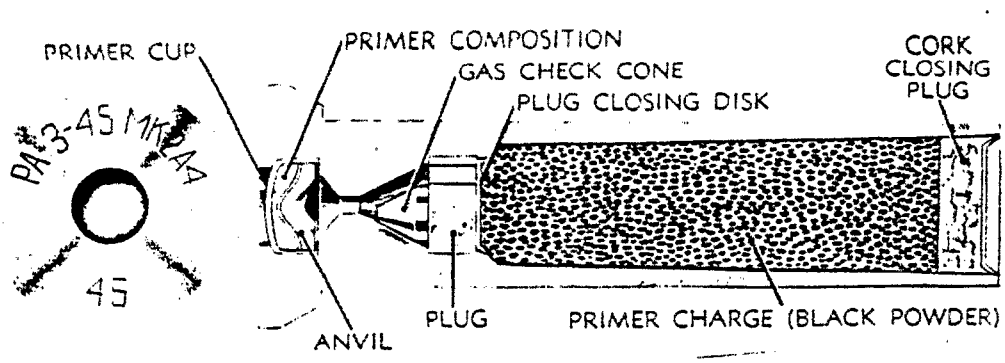
1. Body.
2. Wire.
3. Button.
10. Closing cup.
12. Primer charge, black-powder pellets.
13. Primer charge, loose black powder.
16. Gas check.
19. Friction composition.

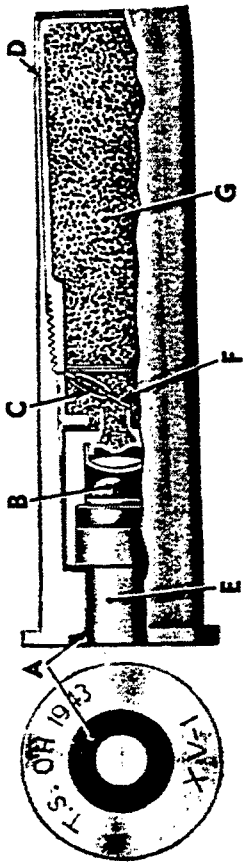


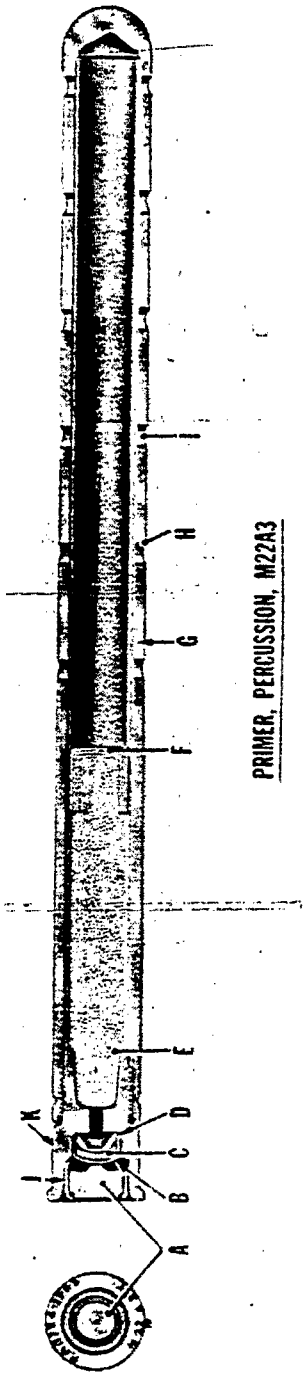
1. Body.
2. Wire.
3. Button.
4. Contact plug.
5. Plug insulator.
6. Insulator.
8. Contact sleeve.
10. Closing cup.
11. Contact wire.
12. Primer charge, black-powder pellets.
13. Primer charge, loose black powder.
14. Gun cotton.
15. Paper insulation.
26. Paper washer.

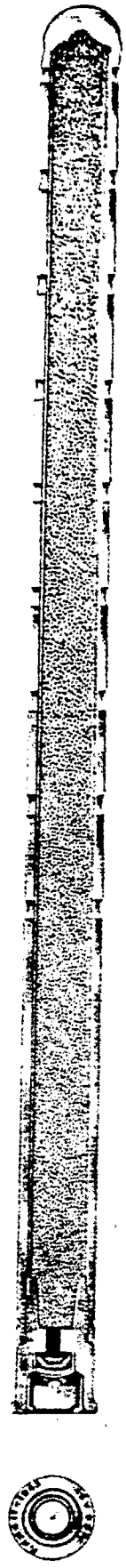


FRICTION AND ELECTRIC PRIMERS

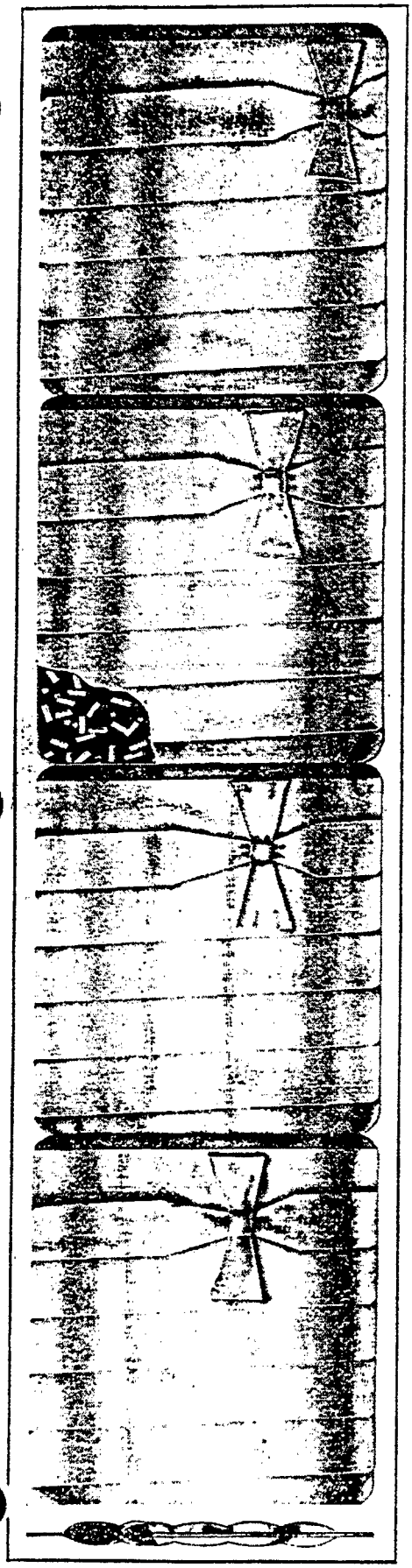


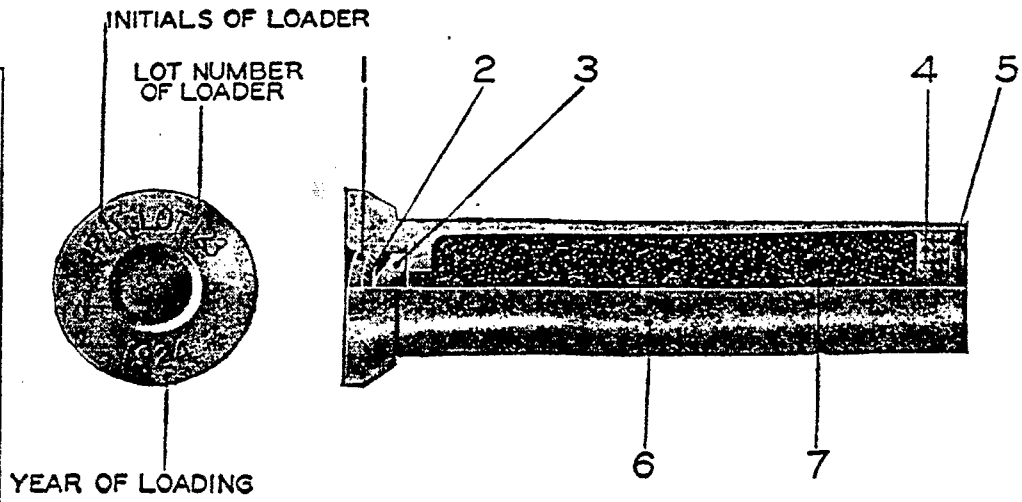






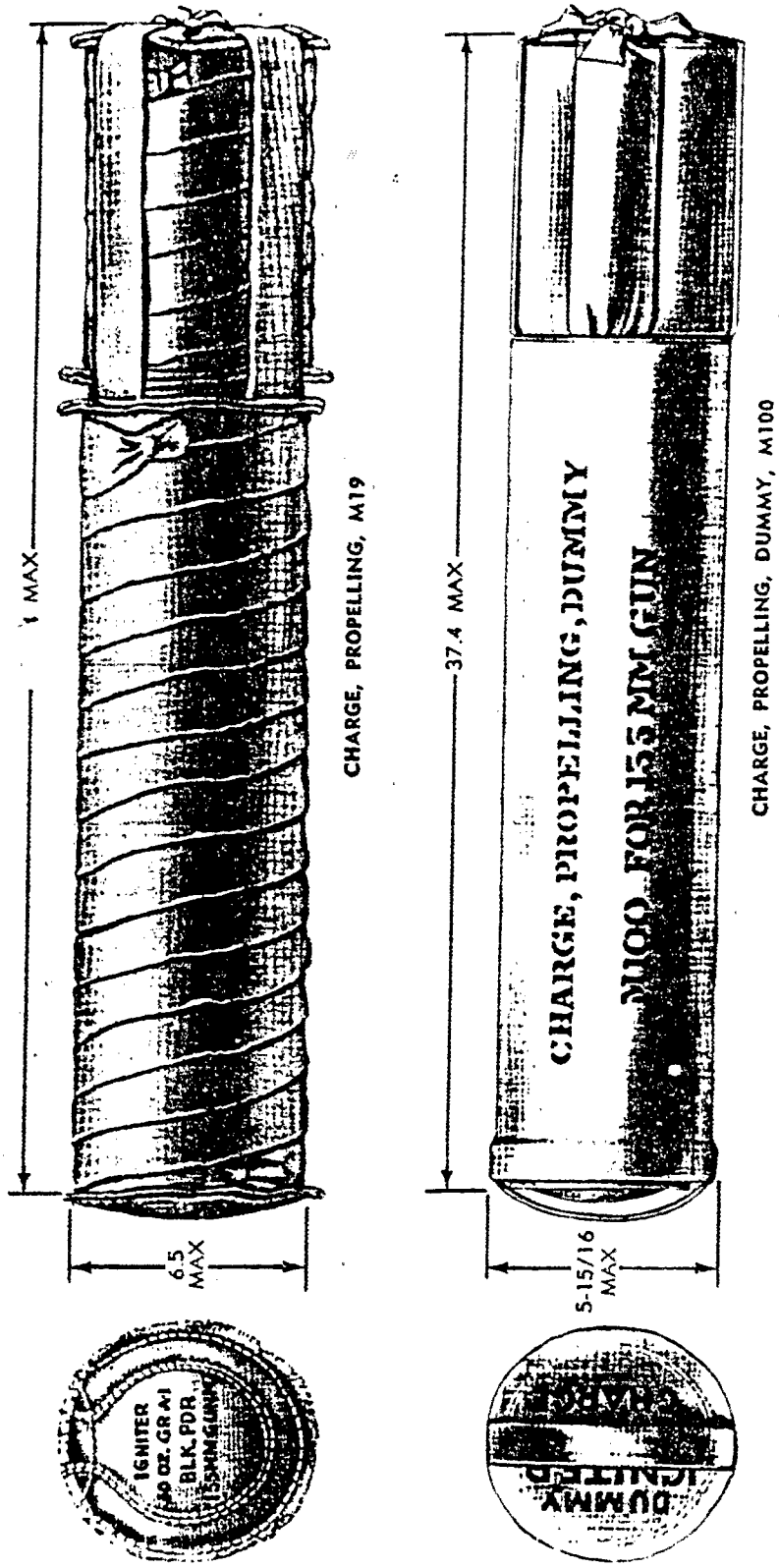
PERCUSSION PRIMERS



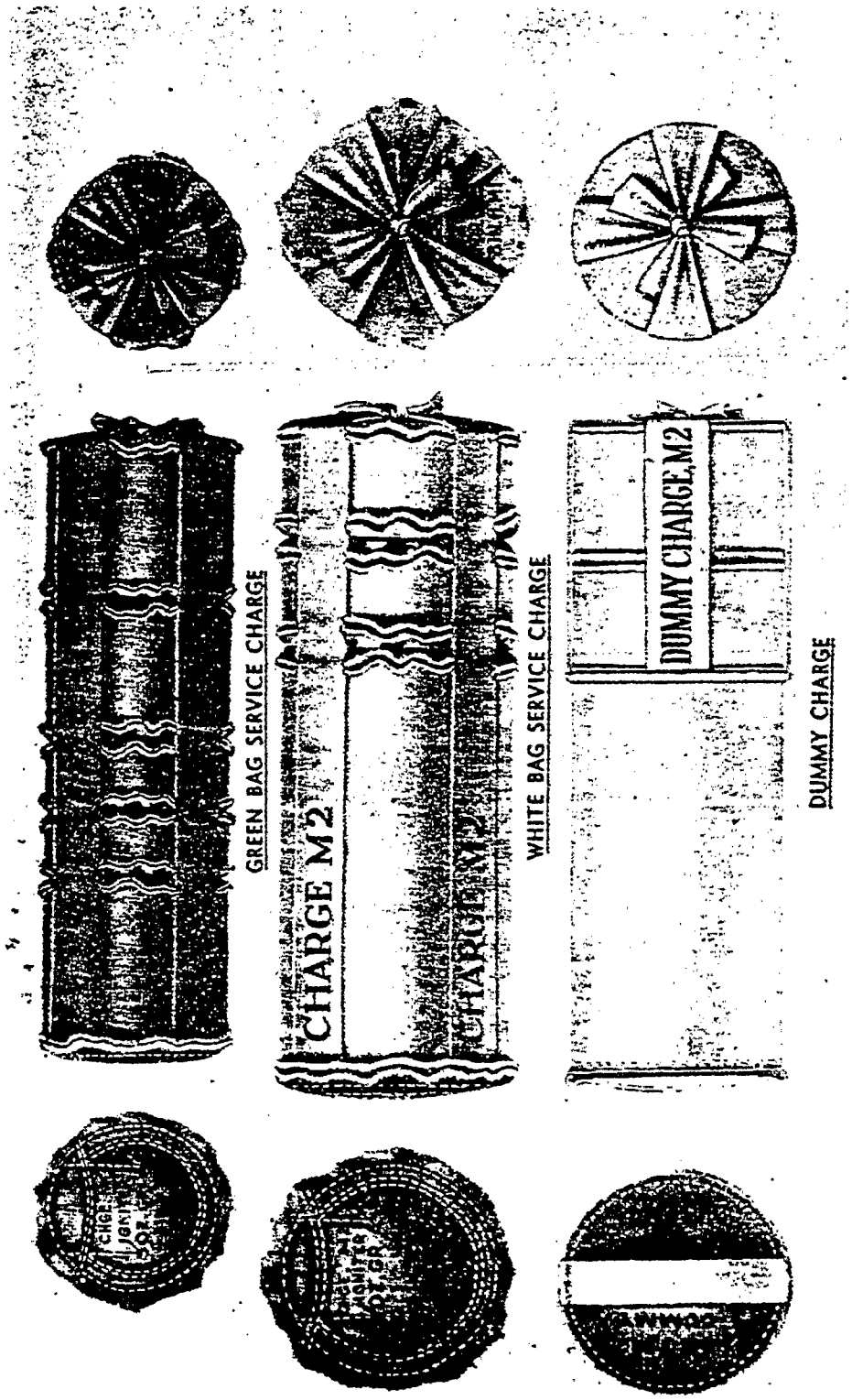


1. Percussion cup.
2. Percussion composition.
3. Anvil.
4. Wax.
5. Shellac.
6. Case.
7. Primer charge, black-powder.

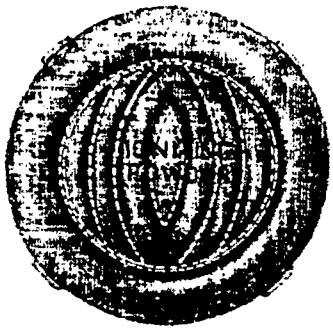
SEPARATE LOADING PROPELLING CHARGE AND PRIMER

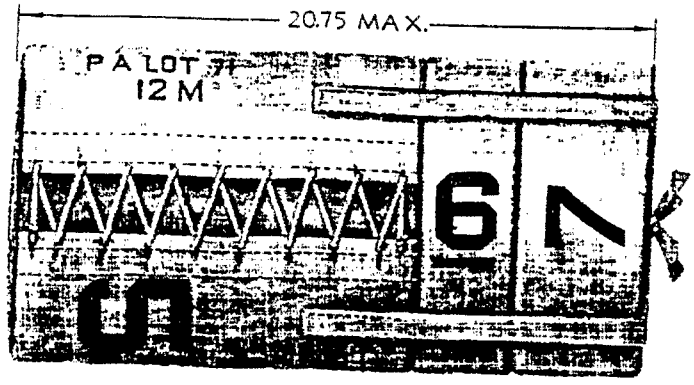


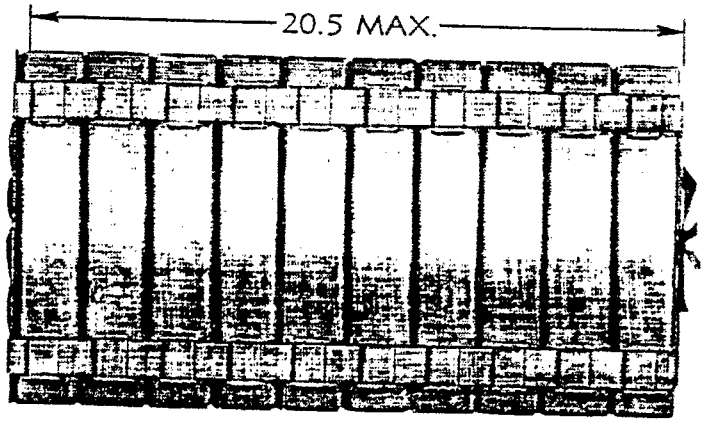
SEPARATE LOADING PROPELLING CHARGES



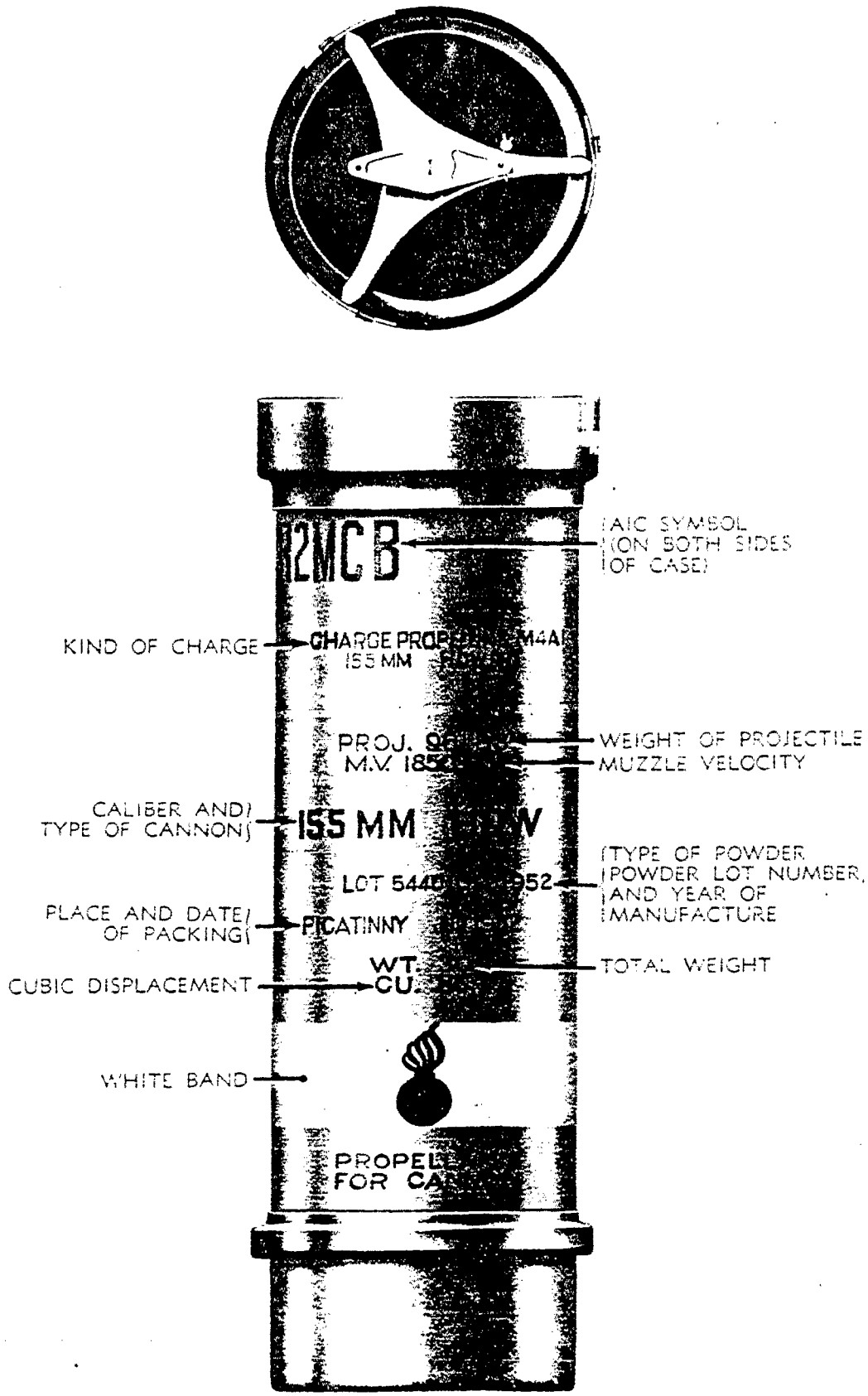
SEPARATE LOADING PROPELLING CHARGES



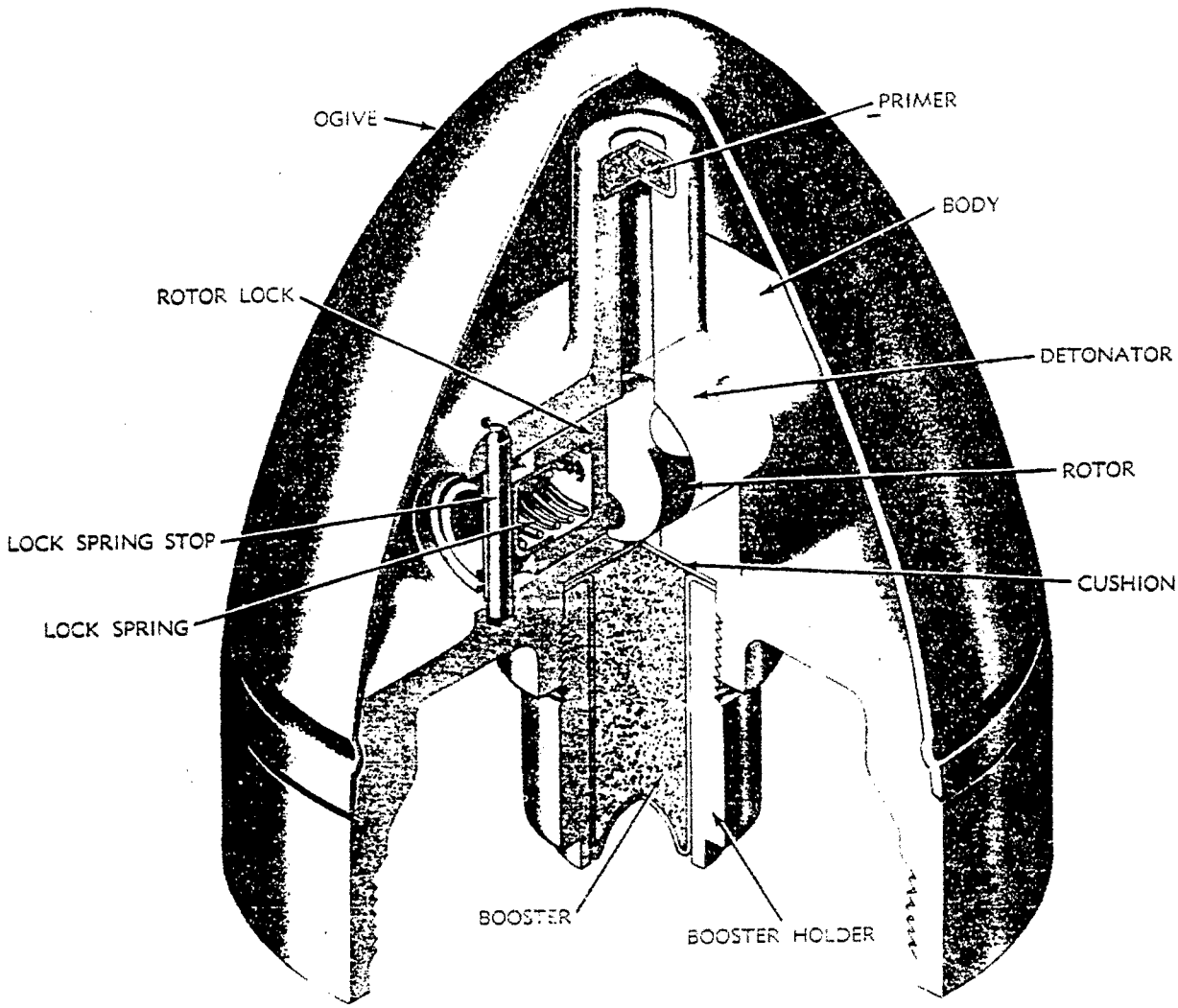




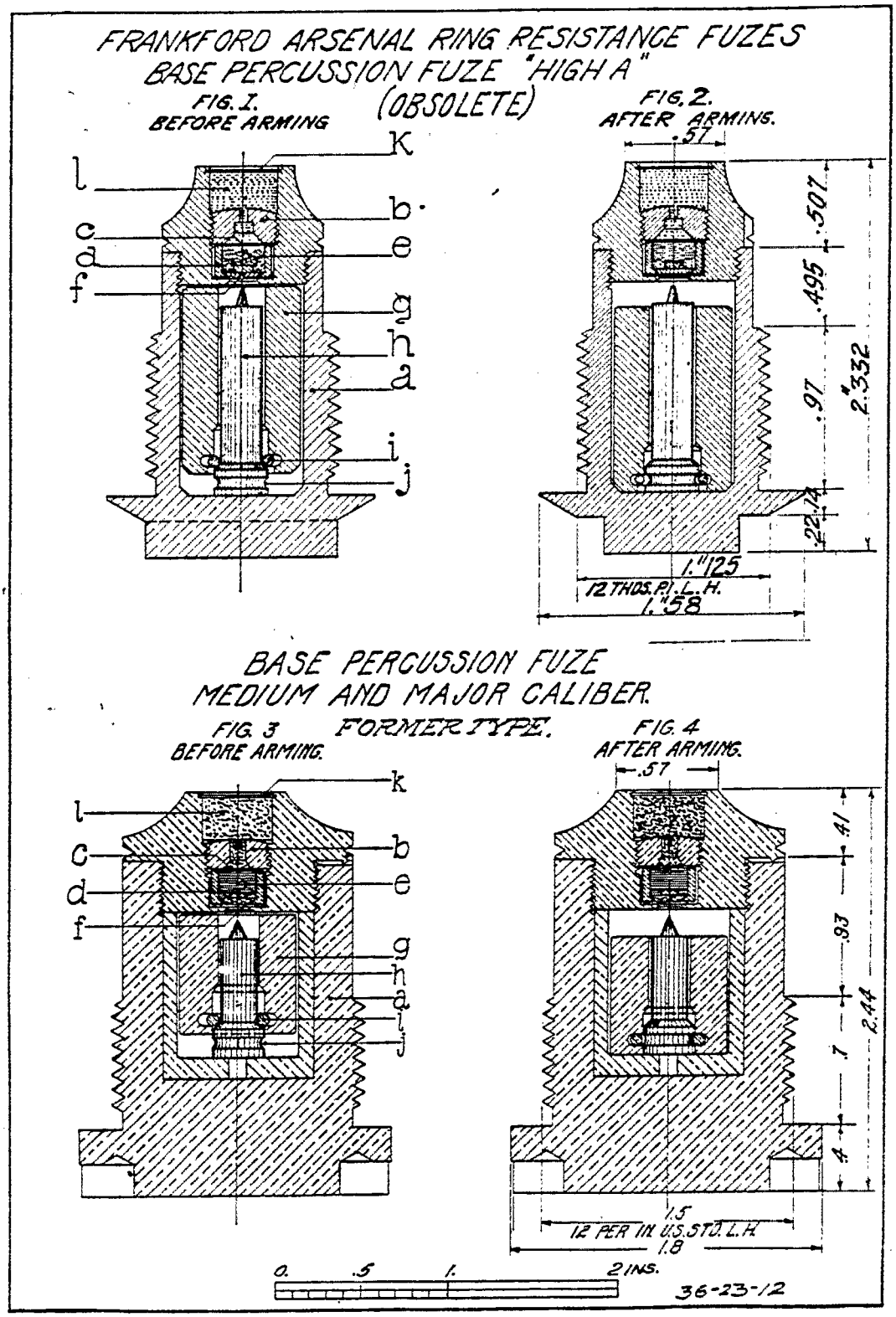
PROPELLING CHARGE FOR 12" MORTAR



TYPICAL PROPELLING CHARGE CONTAINER

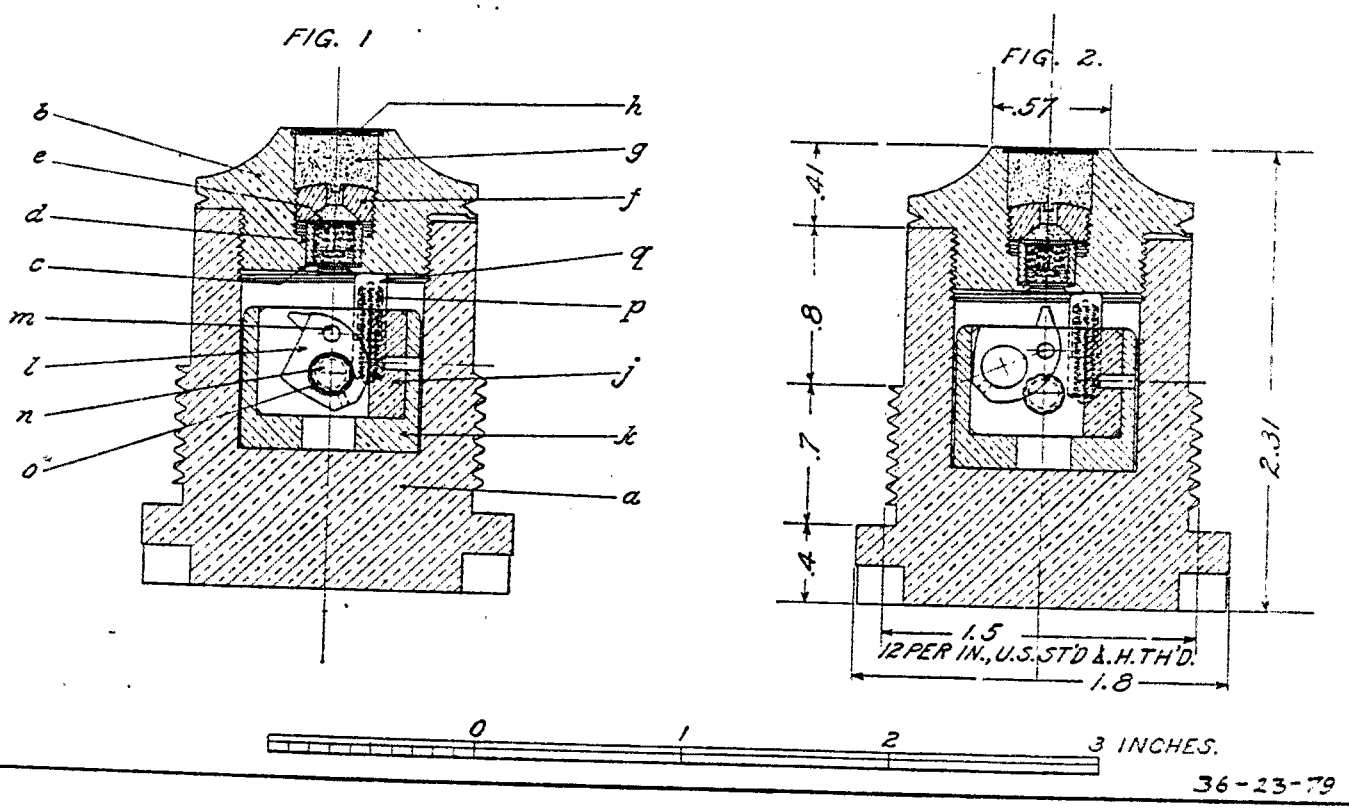


TYPICAL POINT DETONATING FUZE

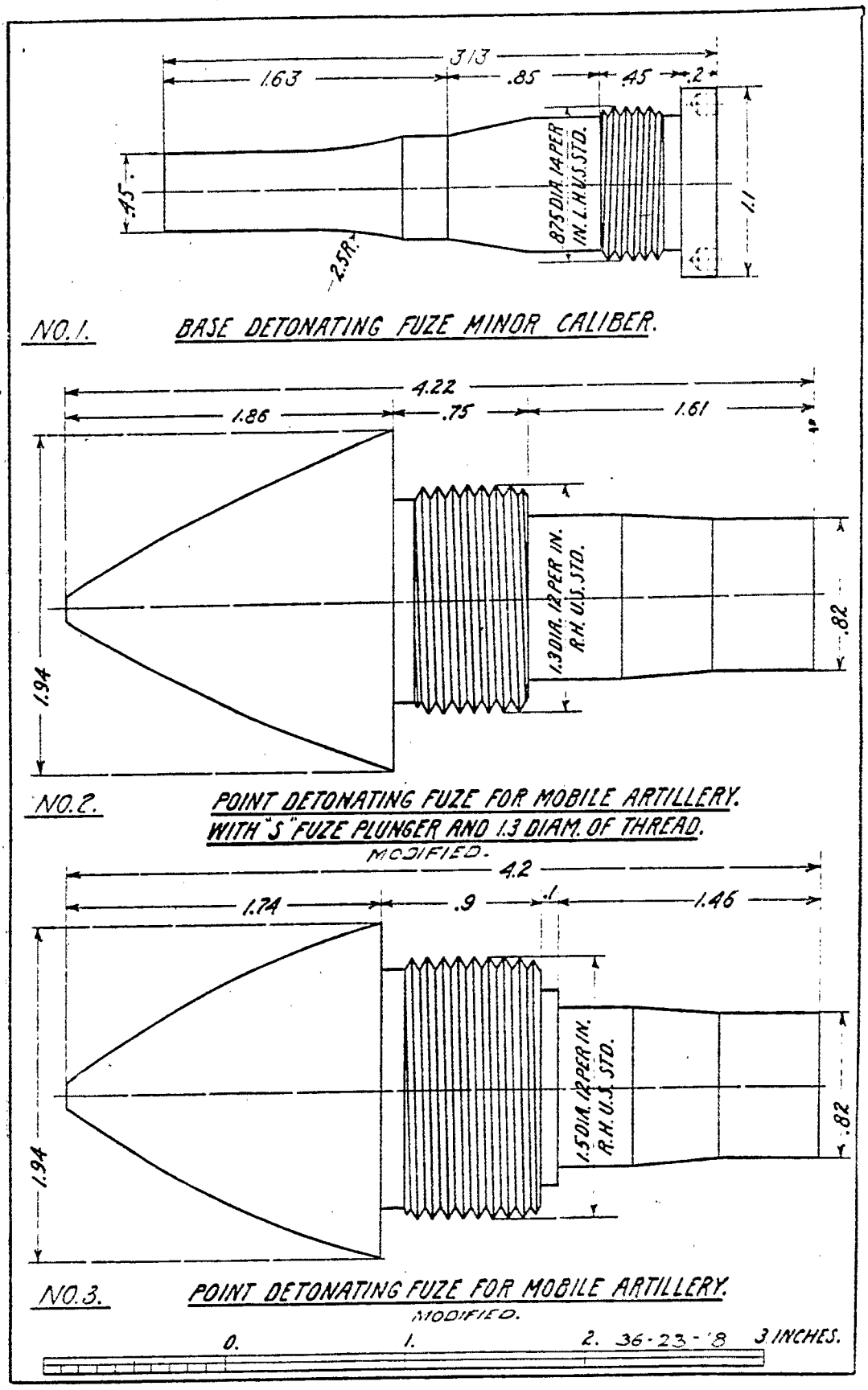


BASE PERCUSSION FUZES - RING RESISTANCE SAFETY FEATURE

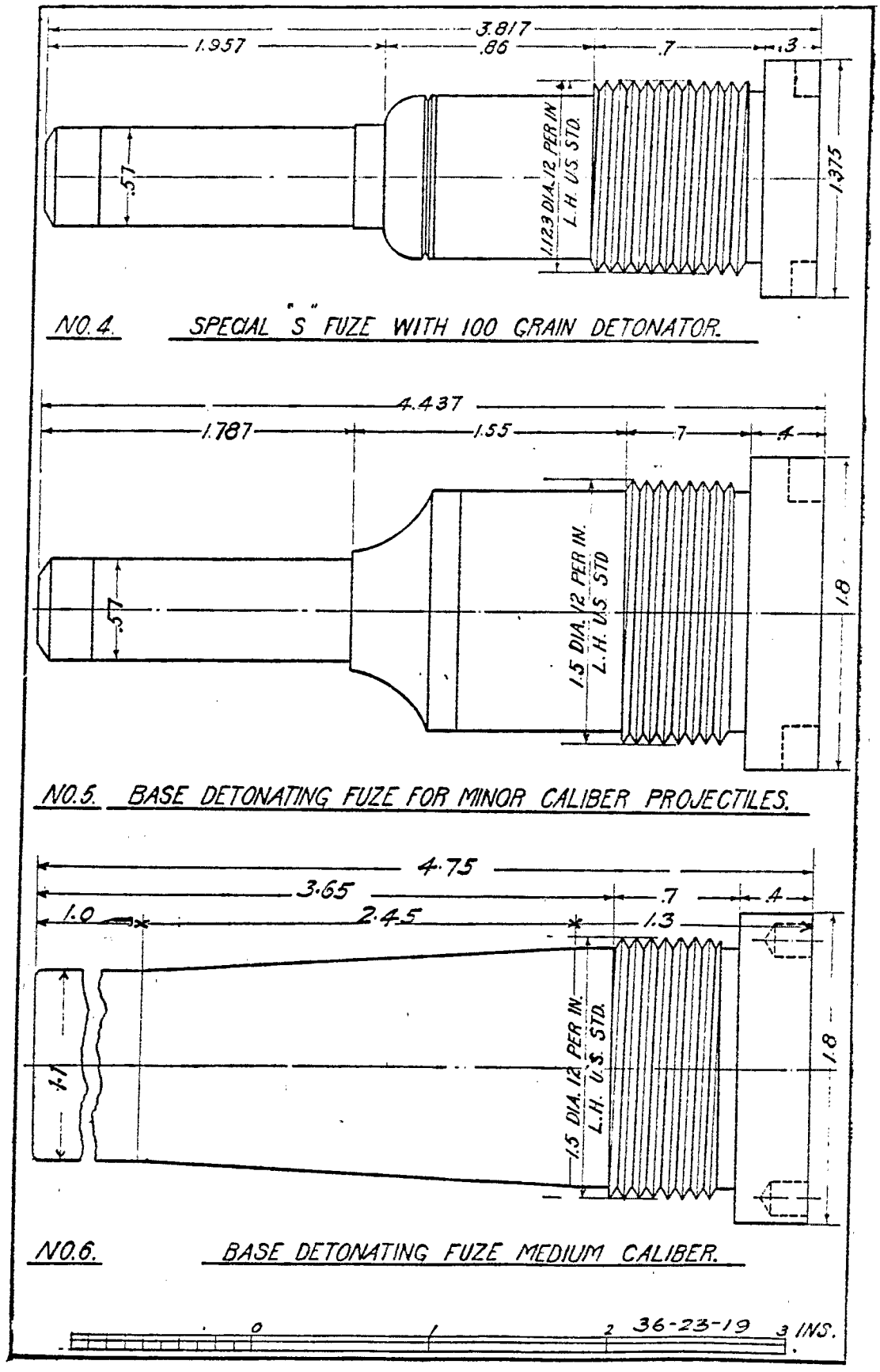
BASE PERCUSSION FUZE, MEDIUM AND MAJOR CALIBER.



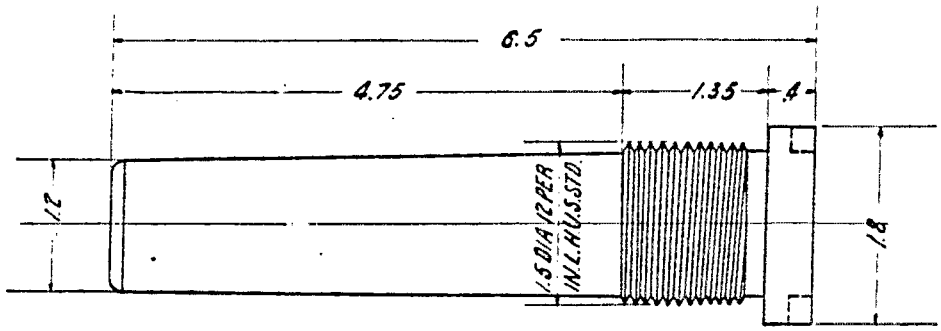
BASE PERCUSSION FUZE - CENTRIFUGAL ACTING SAFETY FEATURE



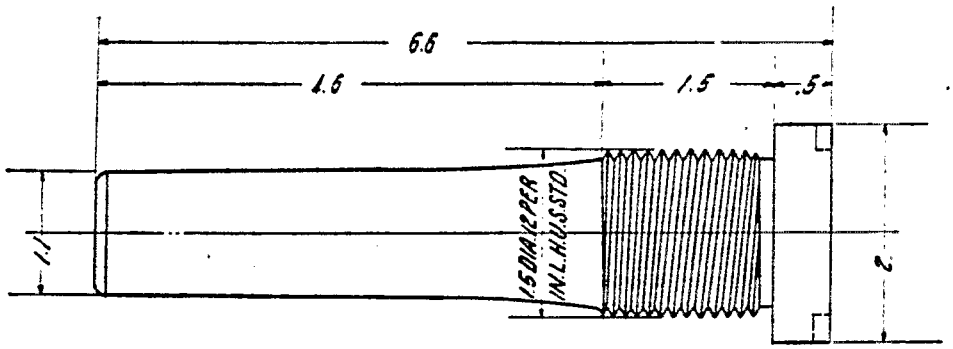
SIZES OF EARLY POINT DETONATING FUZES



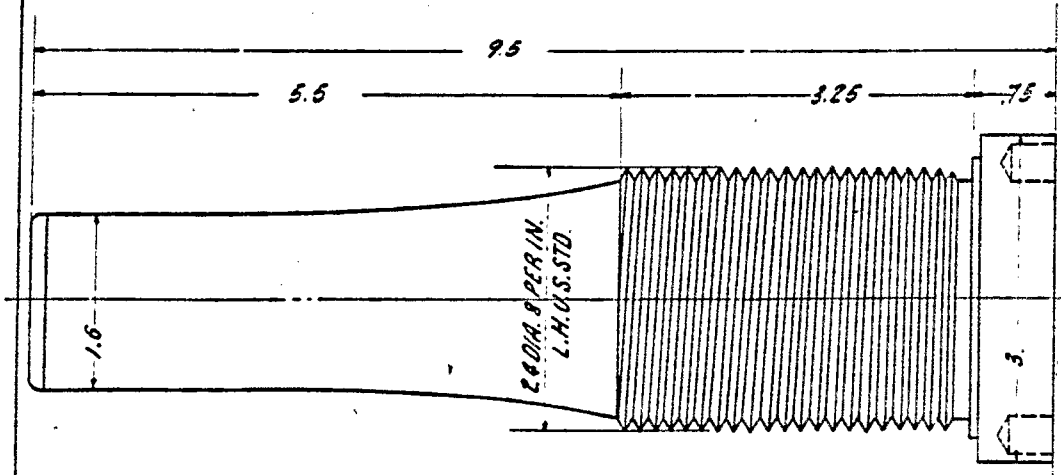
SIZES OF EARLY BASE DETONATING FUZES



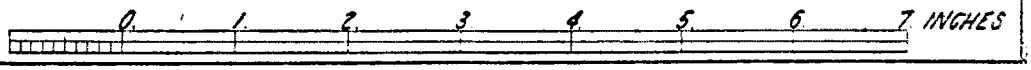
NO.7. BASE DETONATING FUZE FOR MEDIUM CALIBER PROJECTILES.



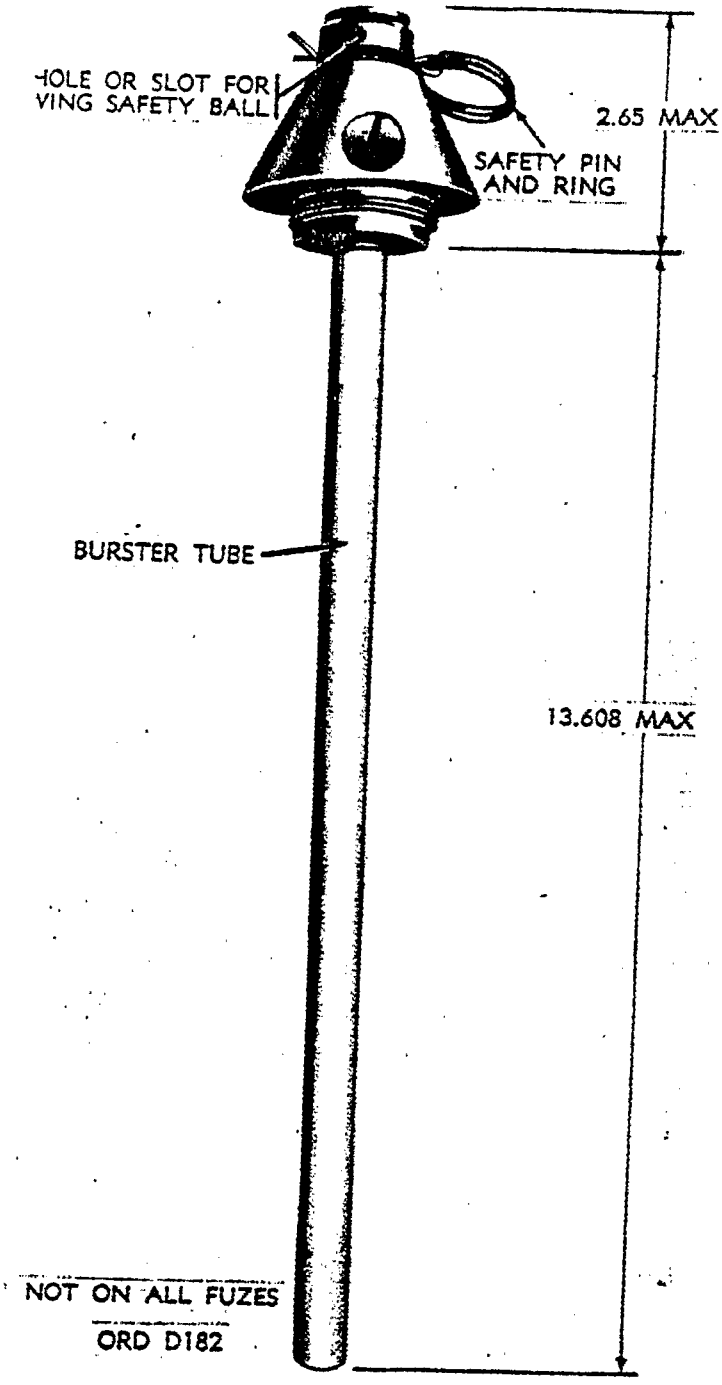
NO.8. SIEGE DETONATING FUZE MODIFIED PIERCE STOCKS.



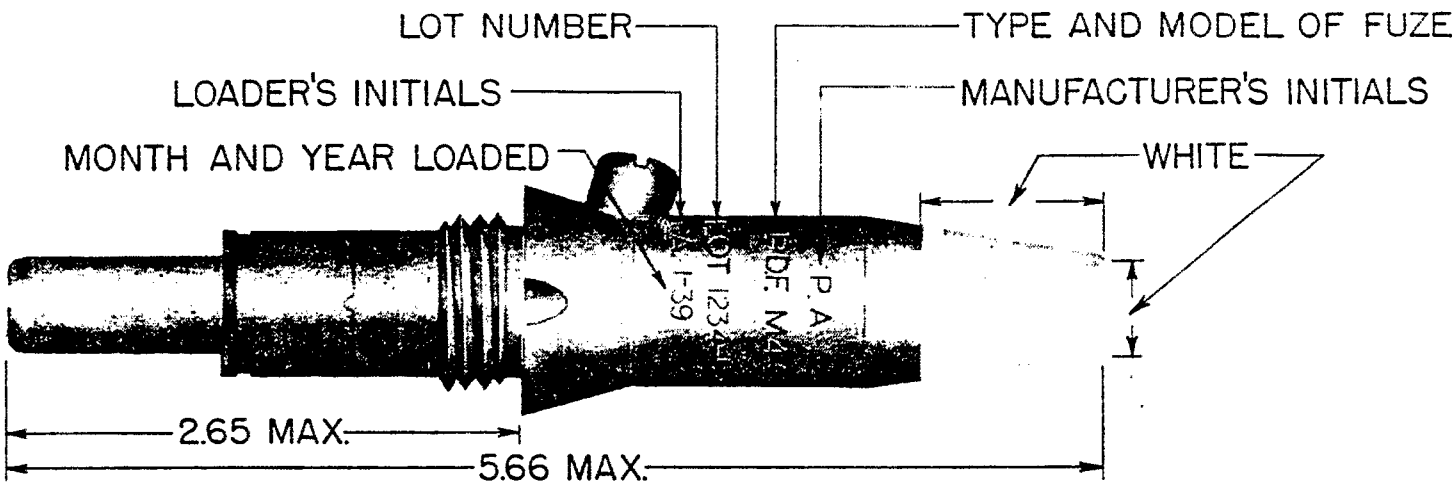
NO.9. A.P. DETONATING FUZE MODIFIED PIERCE STOCKS.



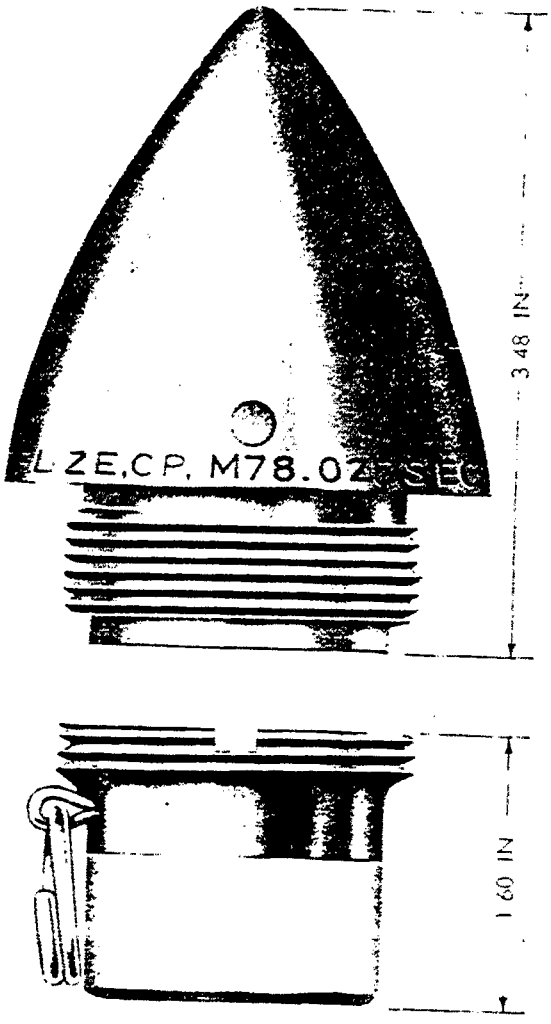
SIZES OF EARLY BASE DETONATING FUZES



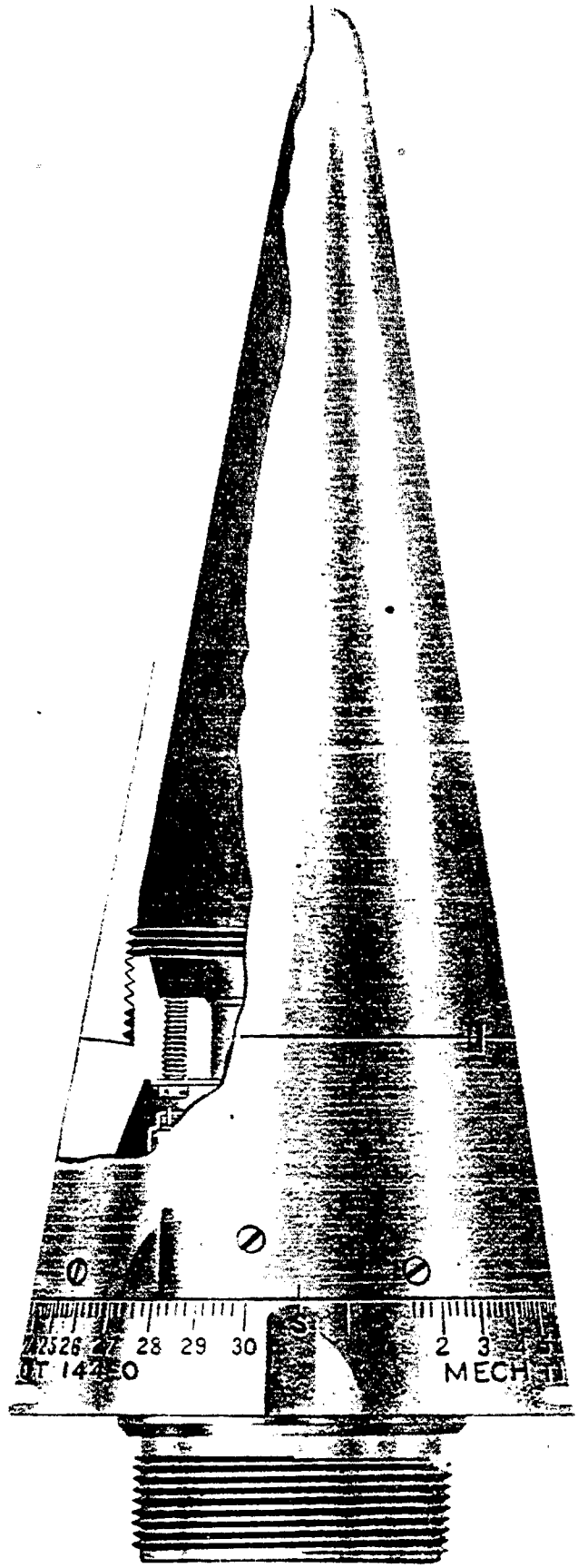
POINT DETONATING FUZE, M8



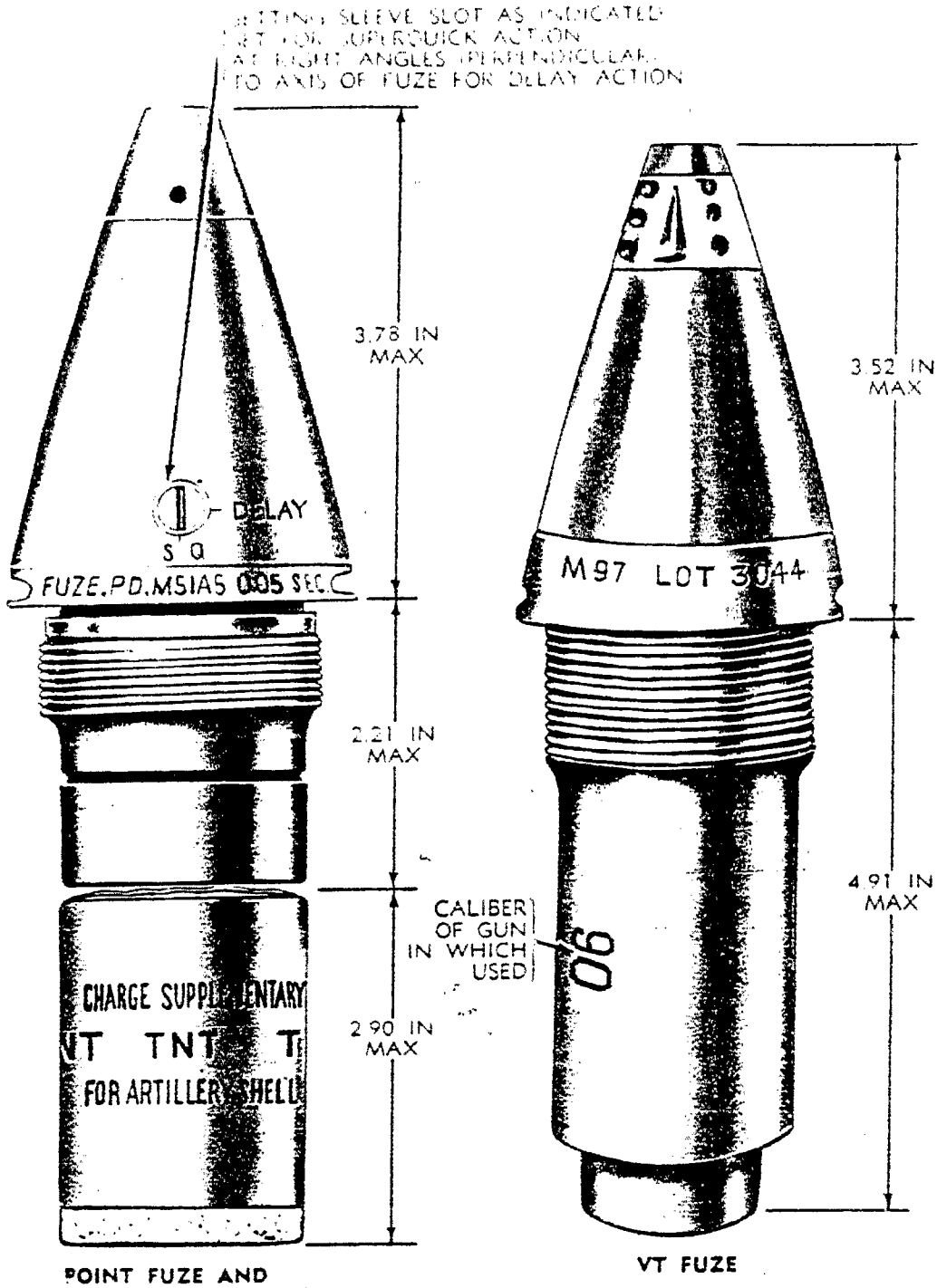
POINT DETONATING FUZE, M46



CONCRETE PIERCING FUZE WITH BOOSTER



MECHANICAL TIME FUZE

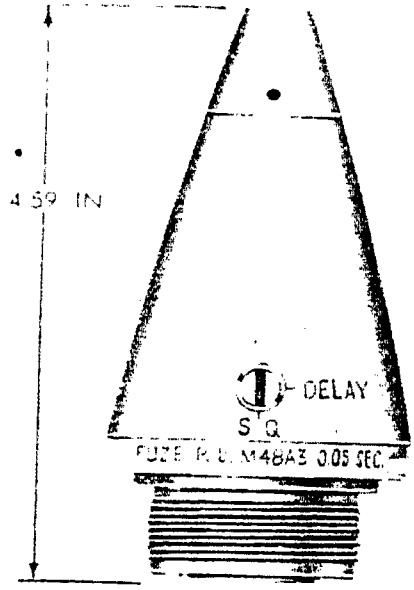


POINT FUZE AND SUPPLEMENTARY CHARGE

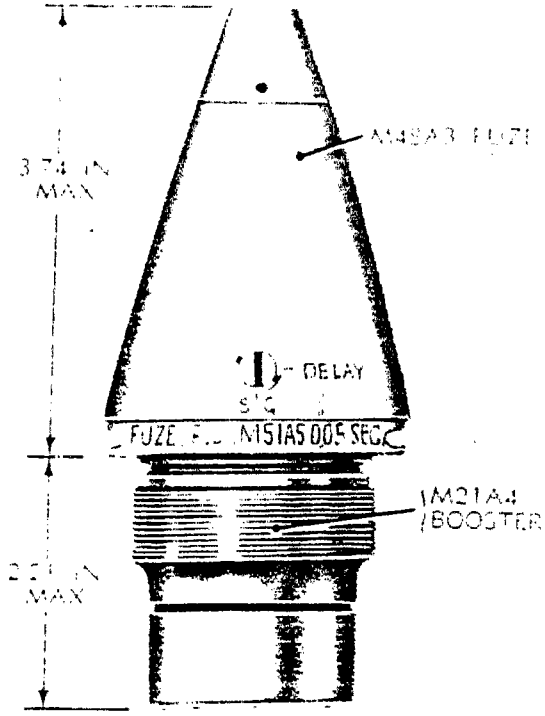
VT FUZE

POINT DETONATING SUPER-QUICK AND DELAY

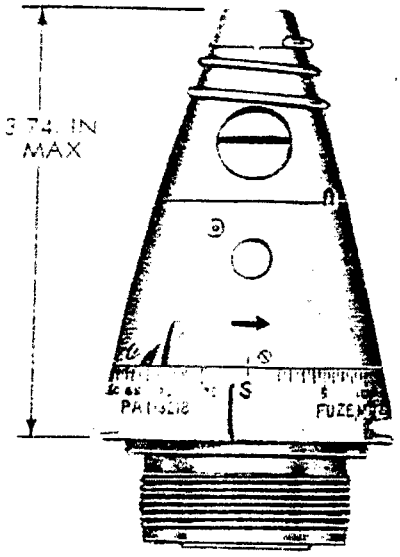
VARIABLE TIME FUZE



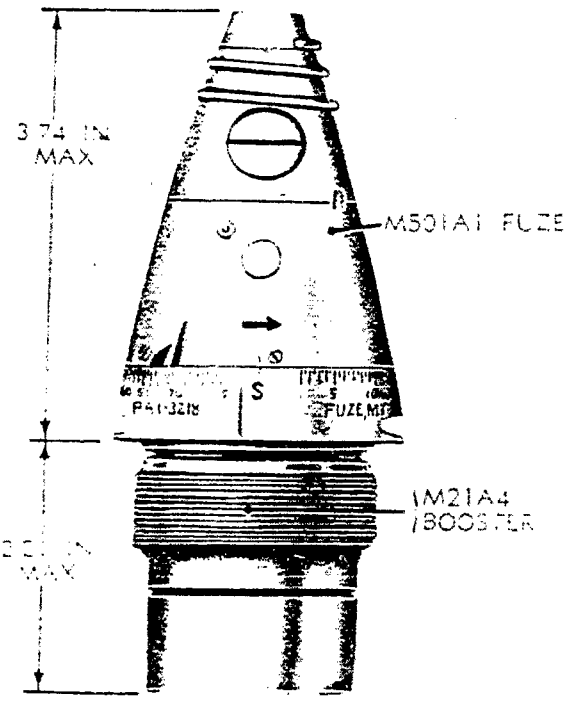
M48A3 SQ AND 0.05-SEC DELAY IMPACT



M51A5 PD FUZE 0.05-SEC DELAY IMPACT

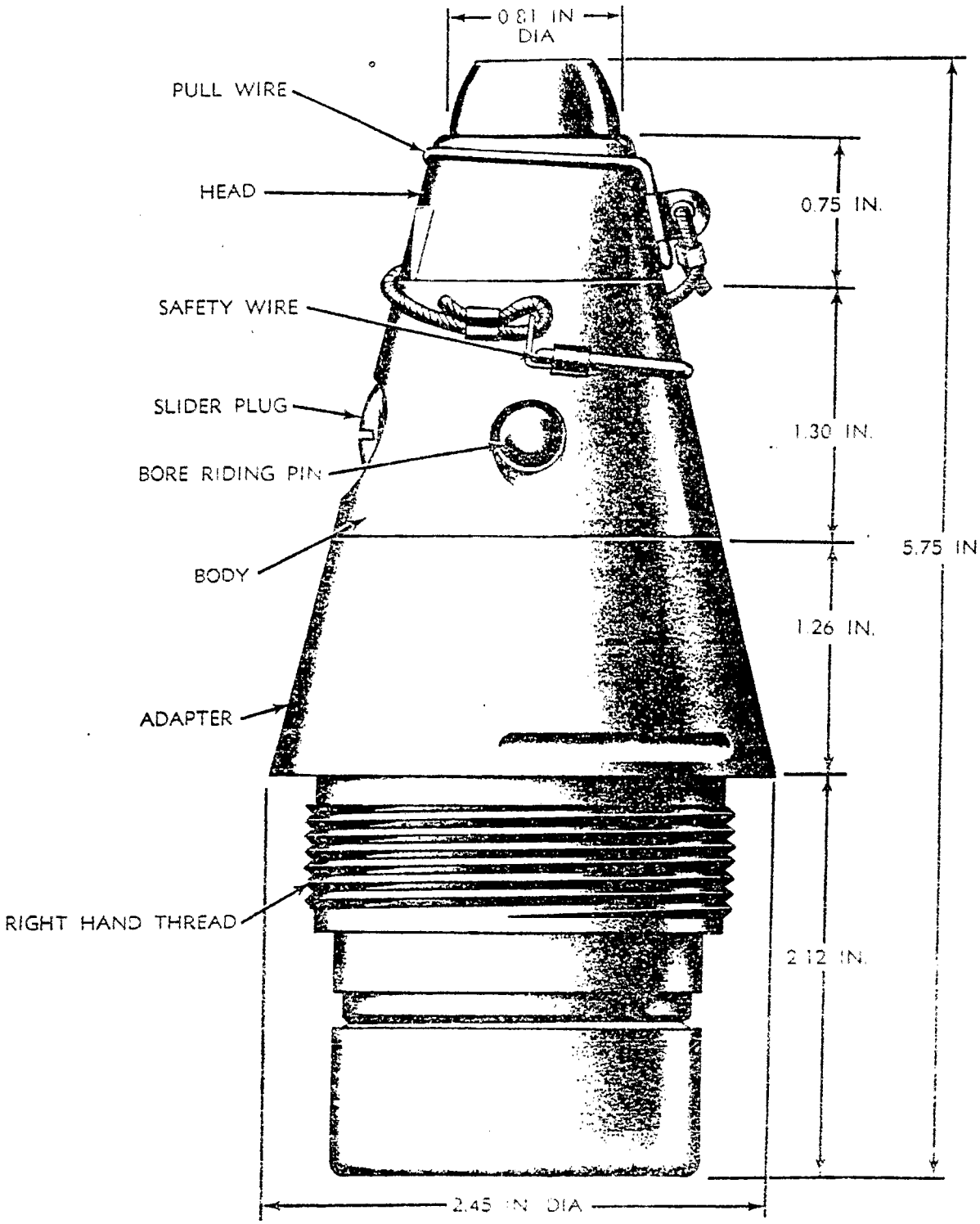


M501A1 MECHANICAL TIME AND SUPERQUICK (MTSQ)

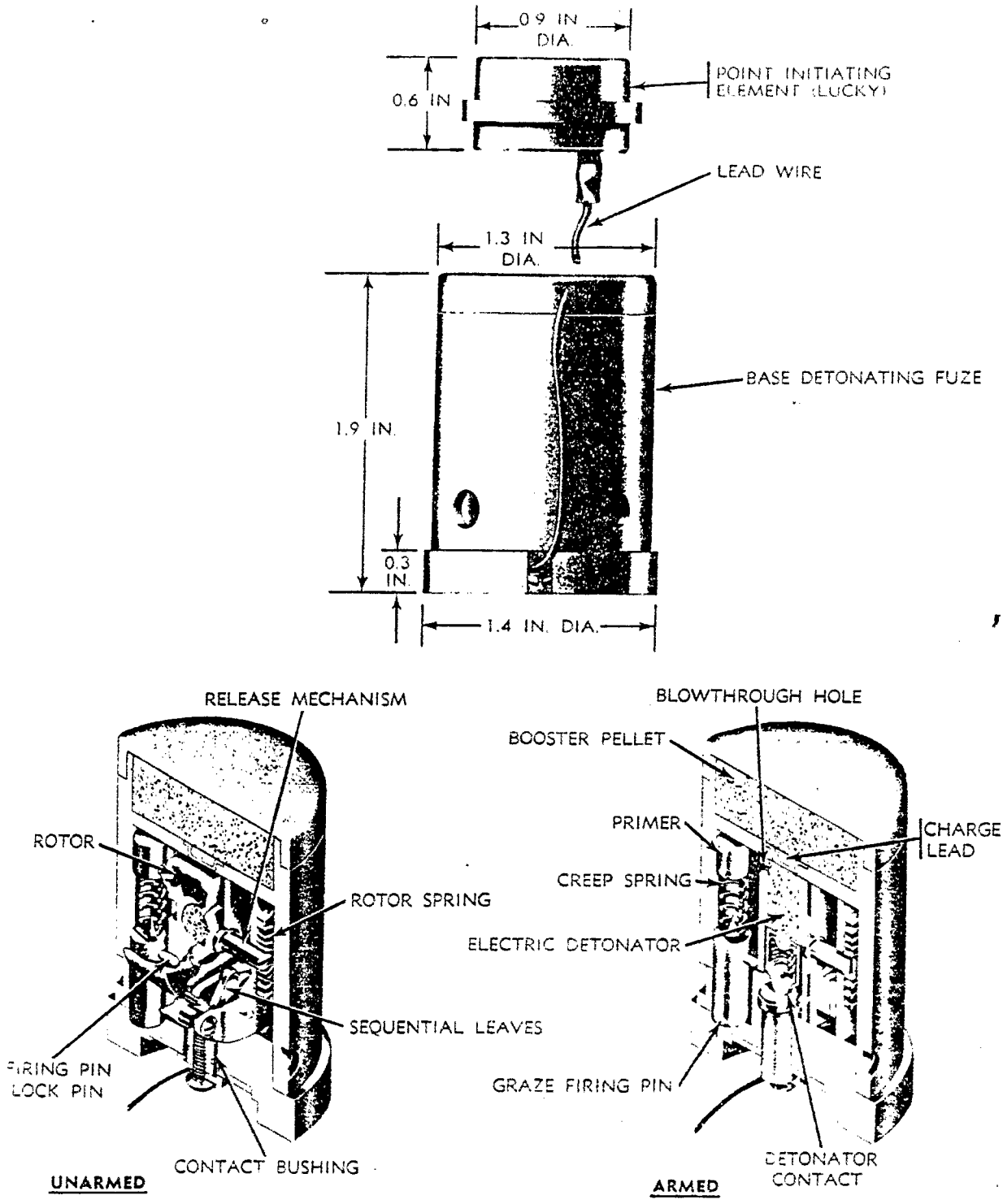


M500A1 MECHANICAL TIME AND SUPERQUICK (MTSQ)

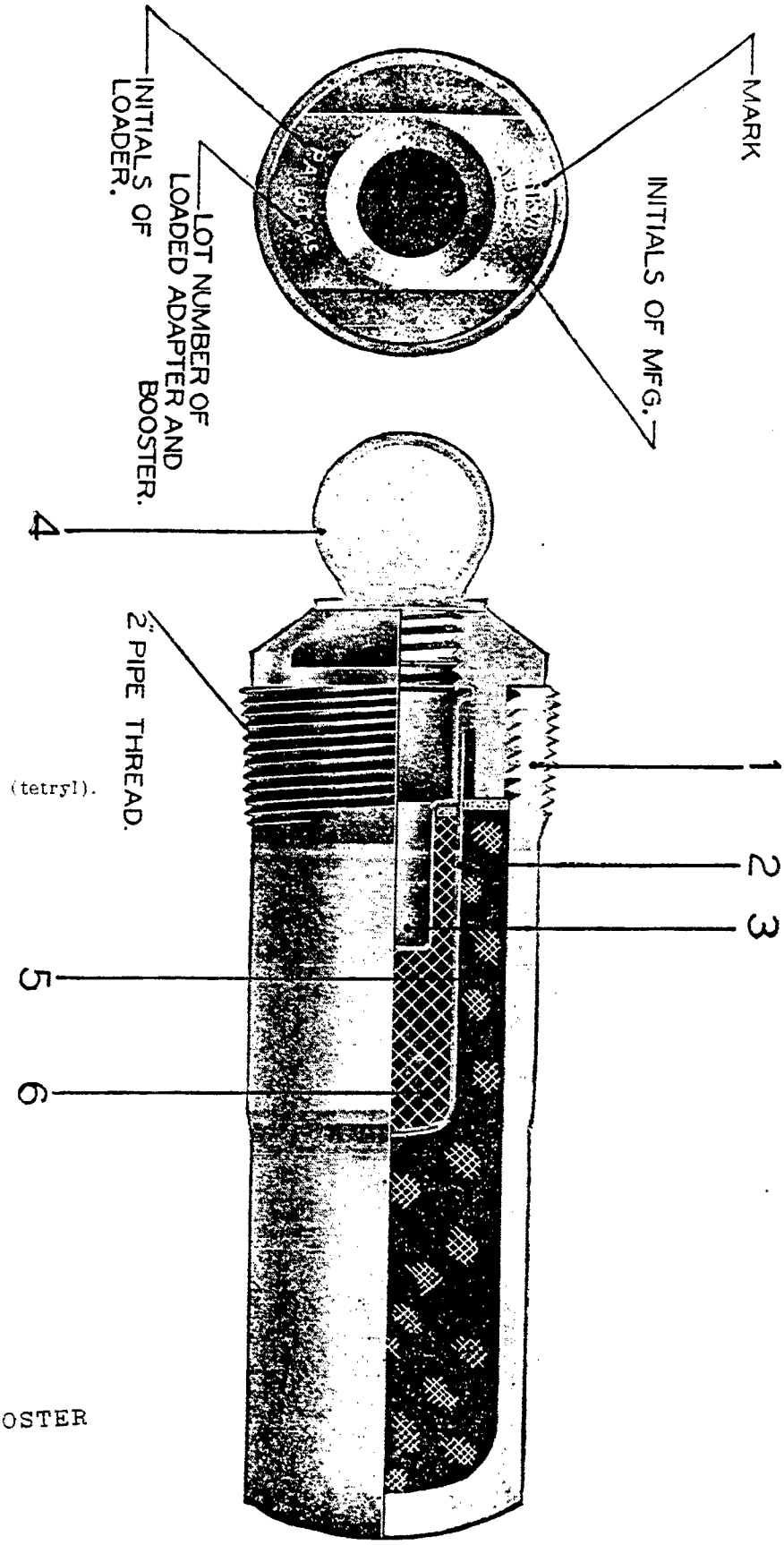
TYPICAL ARTILLERY FUZES



PULL WIRE SAFETY FEATURE

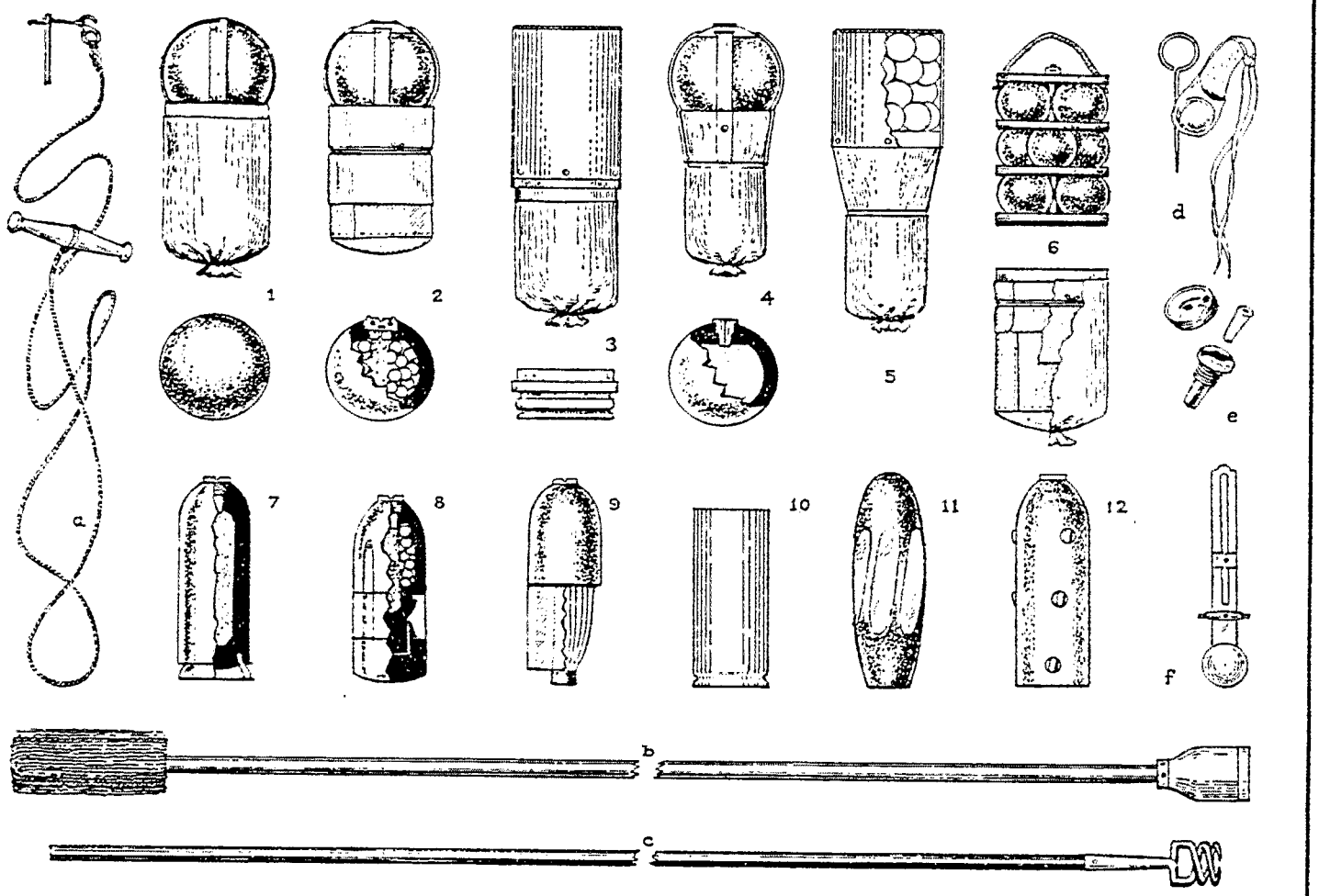


POINT INITIATING BASE DETONATING FUZE



1. Exterior booster casing.
2. Interior booster casing.
3. Fuze socket.
4. Adapter plug.
5. Booster charge (TNT).
6. Auxiliary or interior booster charge (tetryl).

ADAPTER BOOSTER



Artillery ammunition and accessories: Smoothbore ammunition—(1) solid shot with fixed round having protective paper cap in place; (2) spherical case with fixed round for gun; (3) canister for gun, fixed-round canister sabot; (4) common shell, fixed round for howitzer; (5) canister fixed round, showing contents; (6) grapeshot and separate cartridge. Ammunition for rifles—(7) cutaway view of Parrott shell; (8) cutaway view of Hotchkiss case shot; (9) Schenkl case shot with papier-mâché sabot; (10) Hotchkiss canister; (11) Whitworth bolt; (12) shunt or studded shell for Armstrong and Blakely rifles. Accessories—(a) friction primer and lanyard; (b) sponge and rammer; (c) worm for clearing bore; (d) vent pick and thumbstall; (e) Bormann fuze and paper fuze with metal fuze plug; (f) pendulum sight.

CIVIL WAR ERA ARTILLERY AMMUNITION AND ACCESSORIES

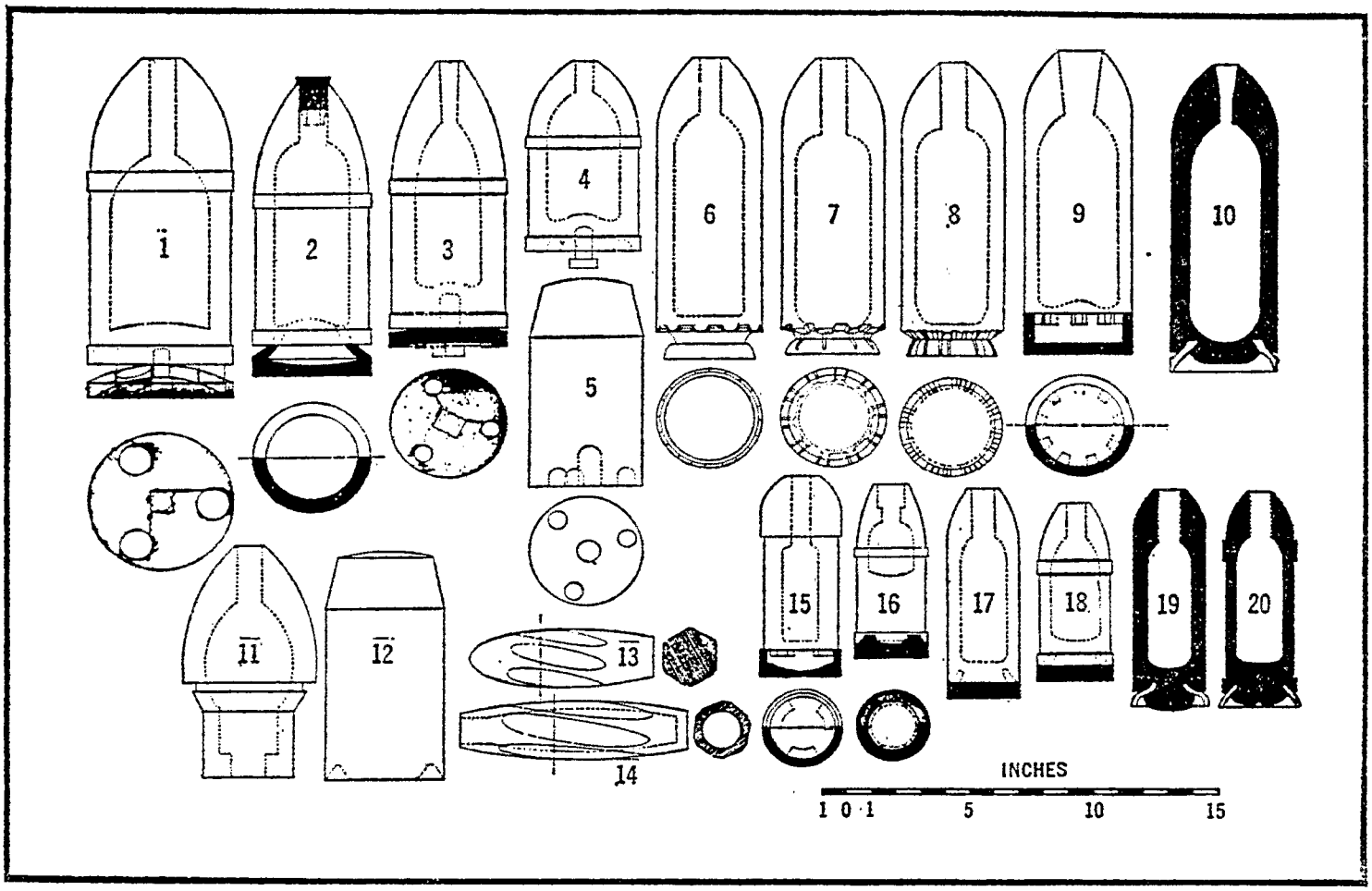


Fig. 5. Confederate siege and field rifle projectiles: (1) 24-pdr., weight 57.5 lbs.; (2) 12-pdr., weight 29 lbs., copper cup; (3) 12-pdr., weight 28 lbs.; (4) 12-pdr., weight 21.5 lbs., plate missing; (5) 12-pdr., weight 32 lbs., plate missing; (6) 9-pdr., weight 25 lbs., copper ring missing; (7) 9-pdr., weight 25 lbs., copper ring missing; (8) 9-pdr., weight 25.5 lbs., copper ring missing; (9) 9-pdr., weight 26 lbs., copper ring, wooden fuze plug; (10) 9-pdr., weight 26 lbs., wrought iron cup, wooden fuze plug; (11) 18-pdr., weight 24 lbs. (defective); (12) 12-pdr., weight 40.5 lbs., solid wrought iron; (13) Weight 6.4 lbs.; (14) Weight 5.7 lbs.; (15) 3-pdr., weight 10 lbs.; (16) 3-pdr., weight 6.8 lbs.; (17) 3-pdr., weight 9 lbs.; (18) 3-pdr., weight 7 lbs.; (19) 3-pdr., weight 10 lbs.; (20) 3-pdr., weight 8 lbs. Classification: Class 1, Reed, wrought-iron cup (10, 19, 20); copper ring (2, 6, 7, 8, 9, 15, 16, 17, 18); Class 2, copper cup (1, 3, 4, 5); Class 3, copper "ratchet sabot"; Class 5, solid wrought iron (12); Class 6, Whitworth (13, 14); Class 9, Hotchkiss (11). (From H. L. Abbott's "Siege Artillery in the Campaigns against Richmond." Other Confederate artillery projectiles are shown in Fig. 6.)

CONFEDERATE SIEGE AND FIELD RIFLE PROJECTILES

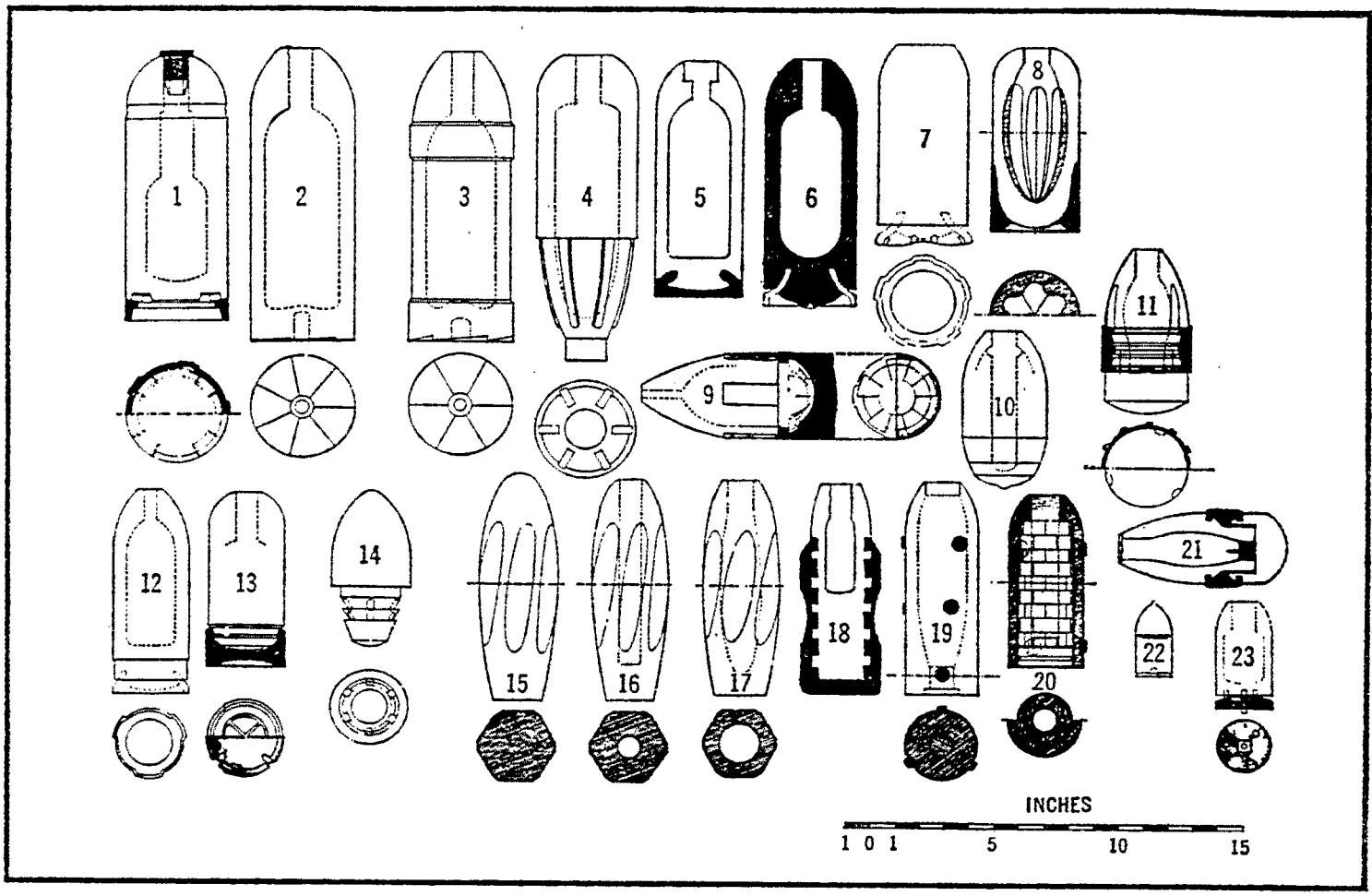


Fig. 6. Confederate siege and field rifle projectiles: (1) 9-pdr., weight 28 lbs.; (2) 9-pdr., weight 24.5 lbs., sabot missing; (3) 9-pdr., weight 25 lbs., sabot missing; (4) 9-pdr., weight 24.5 lbs., sabot missing; (5) 6-pdr., weight 14.5 lbs.; (6) 6-pdr., weight 17.7 lbs., wrought-iron cup; (7) 6-pdr., weight 19.5 lbs.; (8) 6-pdr., weight 14.5 lbs.; (9) 4-pdr., weight 11.5 lbs.; (10) 4-pdr., weight 11.5 lbs., sabot missing; (11) 4-pdr., weight 9.5 lbs.; (12) 3-pdr., weight 8 lbs.; (13) 3-pdr., weight 8 lbs., lead fuze plug; (14) 3-pdr., weight 8 lbs., sabot missing; (15) 3-pdr., weight 13.3 lbs.; (16) 3-pdr., weight 12.1 lbs.; (17) 3-pdr., weight 9.5 lbs.; (18) 3-pdr., weight 12.3 lbs.; (19) 3-pdr., weight 10 lbs.; (20) 3-pdr., weight 10 lbs.; (21) 3-pdr., weight 9.3 lbs.; (22) Weight 1.1 lbs., ring missing; (23) Weight 3 lbs. Classification: Class 1, Reed wrought-iron cup (6, 7, 12), copper ring (1, 5, 22); Class 2, copper cup (23); Class 3, copper "ratchet sabot" (2, 3); Class 4, lead sabot (8, 9, 10, 13, 14); Class 6, Whitworth (15, 16, 17); Class 7, Armstrong, lead-coated (18), shunt (19, 20); Class 9, Hotchkiss (11, 21); Class 10, Schenkl (4). (Abbott's "Siege Artillery in the Campaigns against Richmond.")

CONFEDERATE SIEGE AND FIELD RIFLE PROJECTILES

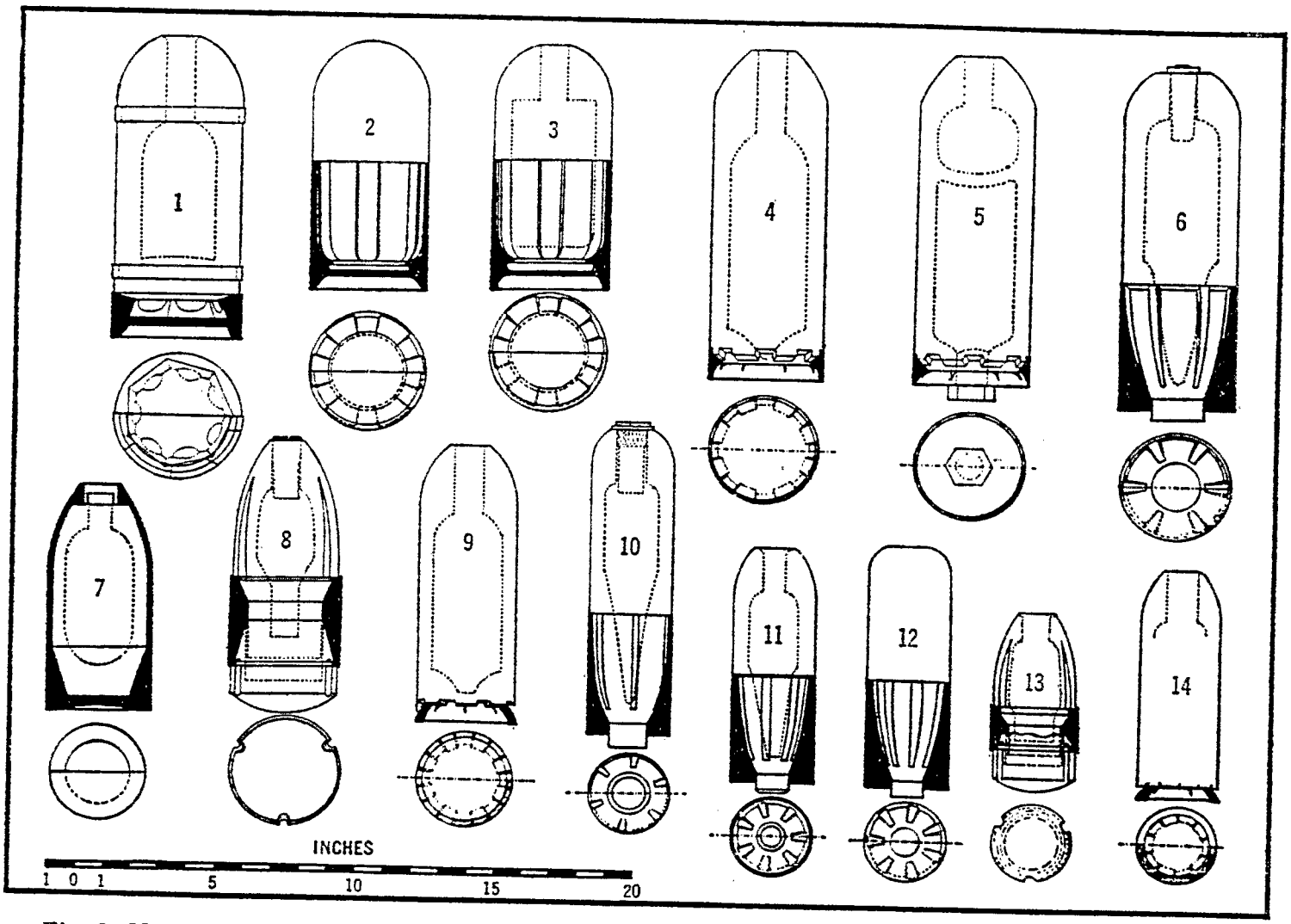
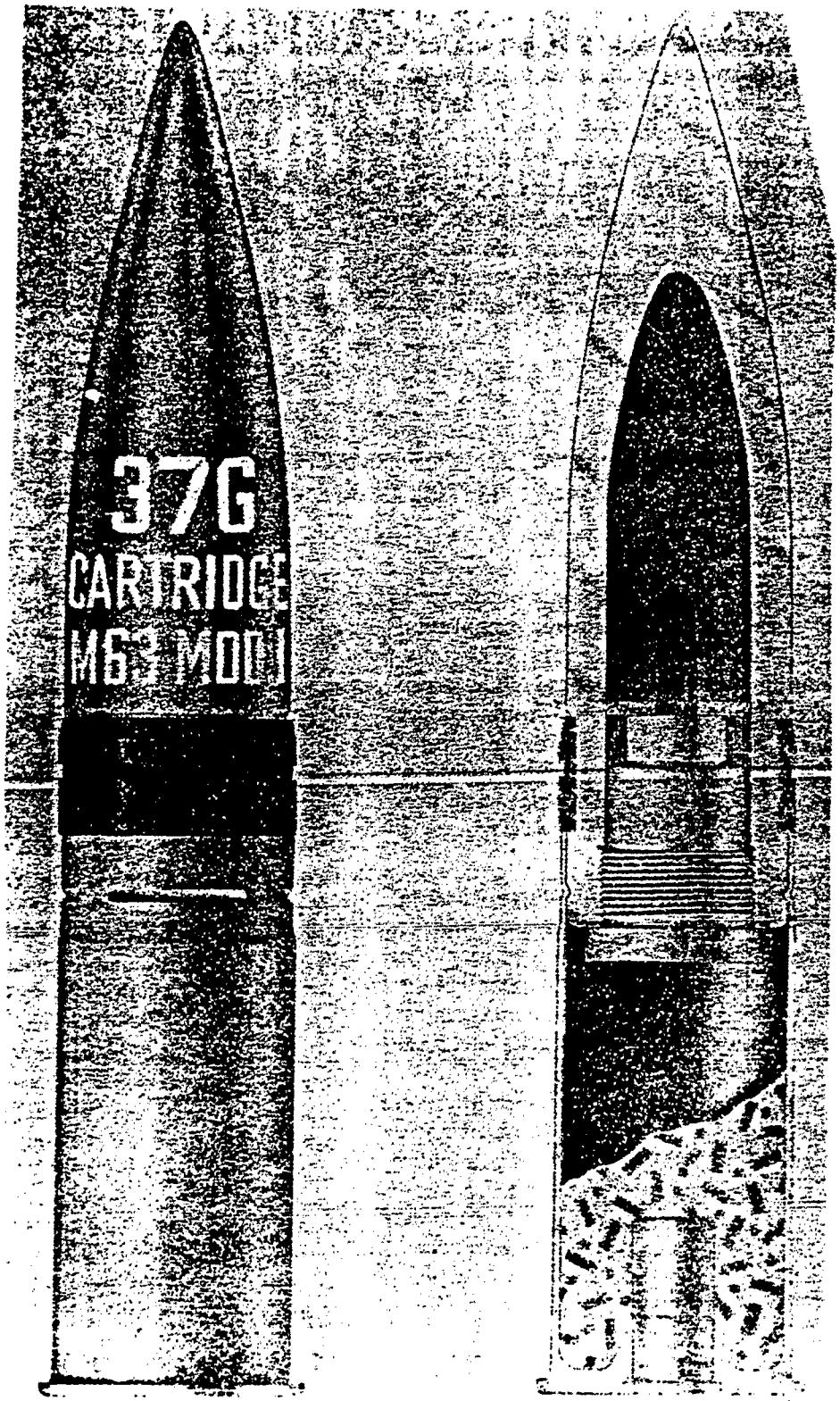
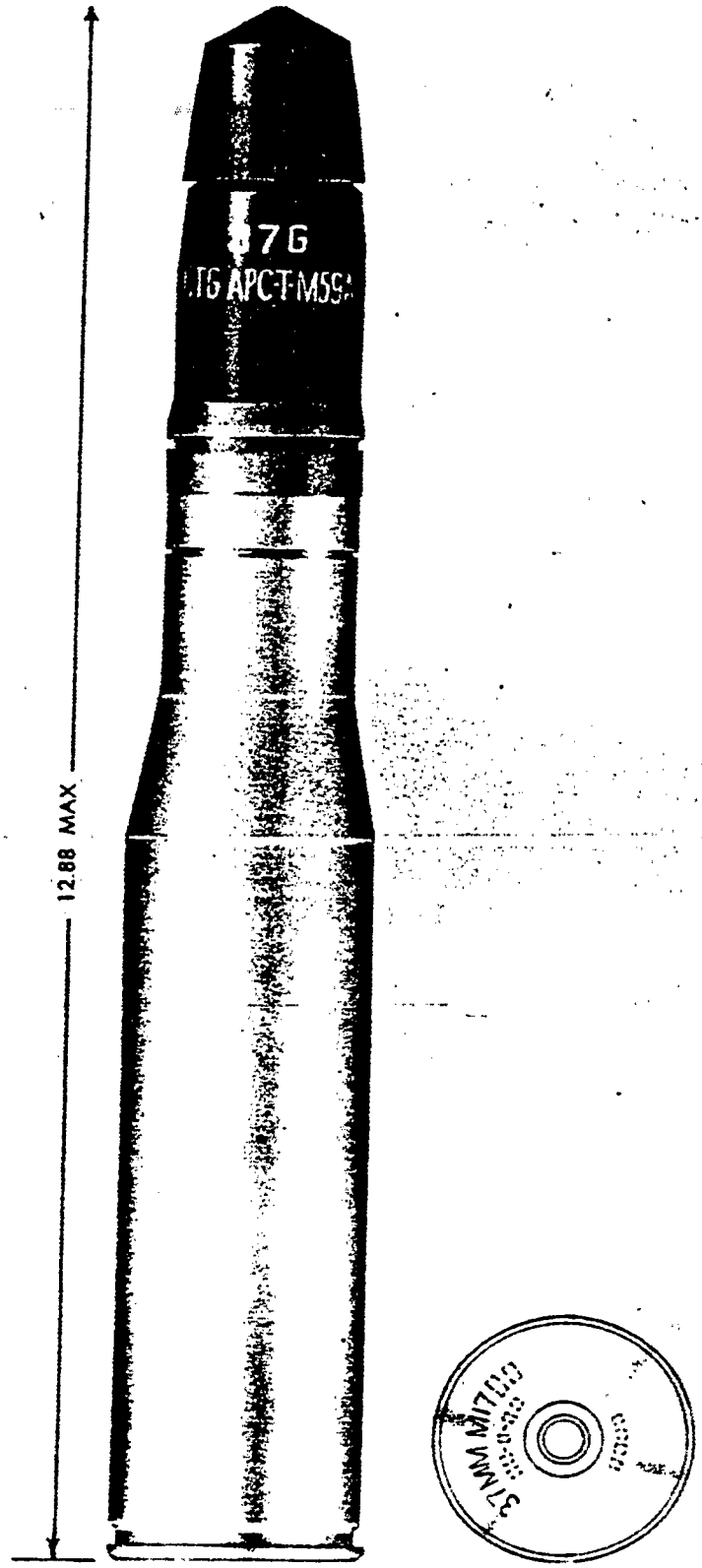


Fig. 8. U. S. siege and field rifle projectiles, 1864: (1) 11-pdr., weight 32.5 lbs.; (2) 11-pdr., weight 31 lbs.; (3) 11-pdr., weight 23 lbs.; (4) 9-pdr., weight 25 lbs.; (5) 9-pdr.; (6) 9-pdr., weight 24 lbs.; (7) 6-pdr., weight 13.2 lbs.; (8) 6-pdr., weight 19 lbs.; (9) 6-pdr., weight 16.5 lbs.; (10) 3-pdr., weight 16 lbs.; (11) 3-pdr., weight 7.8 lbs.; (12) 3-pdr., weight 9.2 lbs.; (13) 3-pdr., weight 9 lbs.; (14) 3-pdr., weight 9.2 lbs. Classification: Parrott, brass ring (4, 5, 9, 14); Schenkl, papier-mâché sabot (6, 10, 11, 12); Hotchkiss, compressed lead band (8, 13); Dyer, lead sabot (2, 3); Sawyer, lead sabot and lead-coated (7); Absterdam, lead sabot and bands (1). (From H. L. Abbott's "Siege Artillery in the Campaigns against Richmond.") See Figure 7 also.

U.S. SIEGE AND FIELD RIFLE PROJECTILES

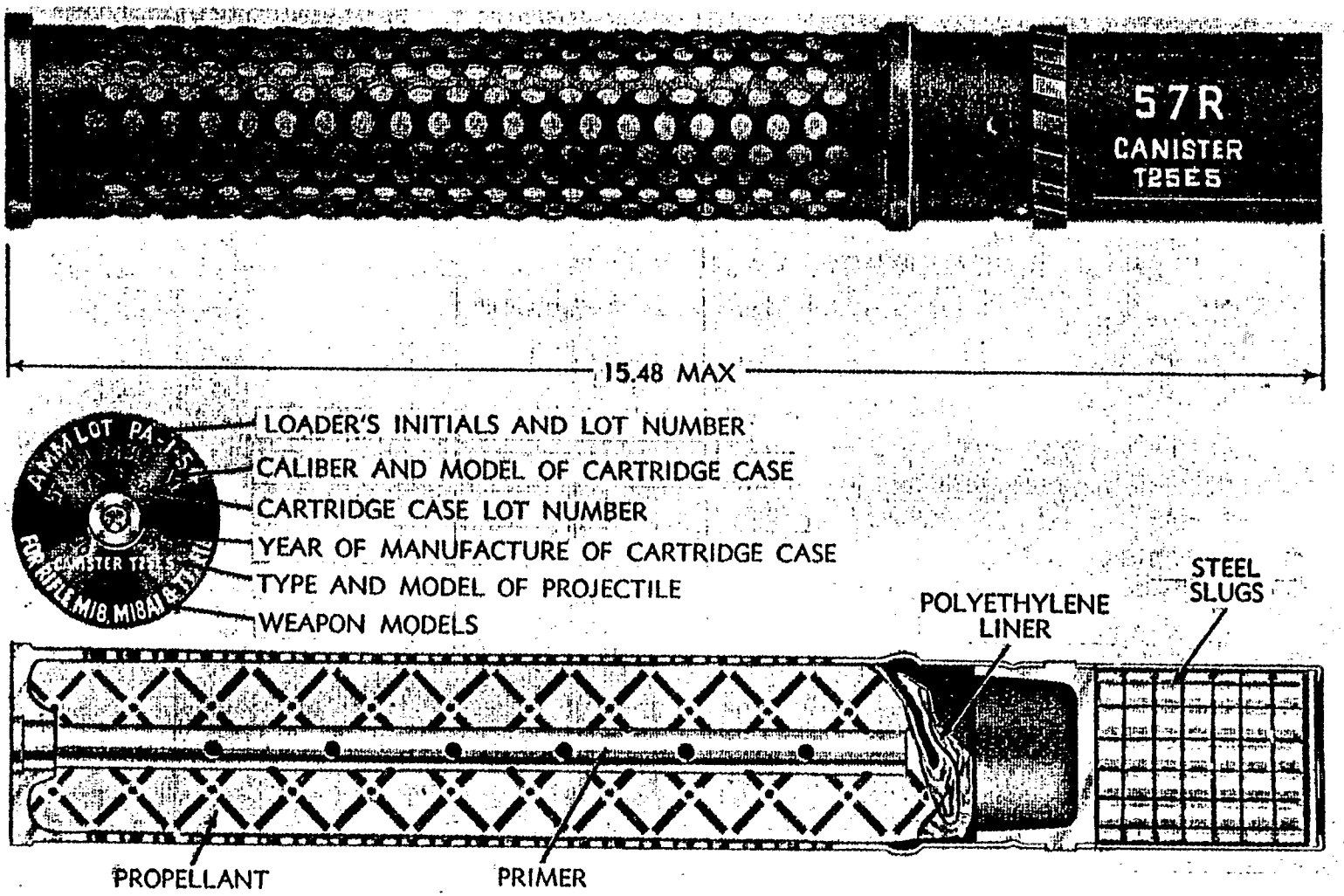


37MM TARGET PRACTICE CARTRIDGE

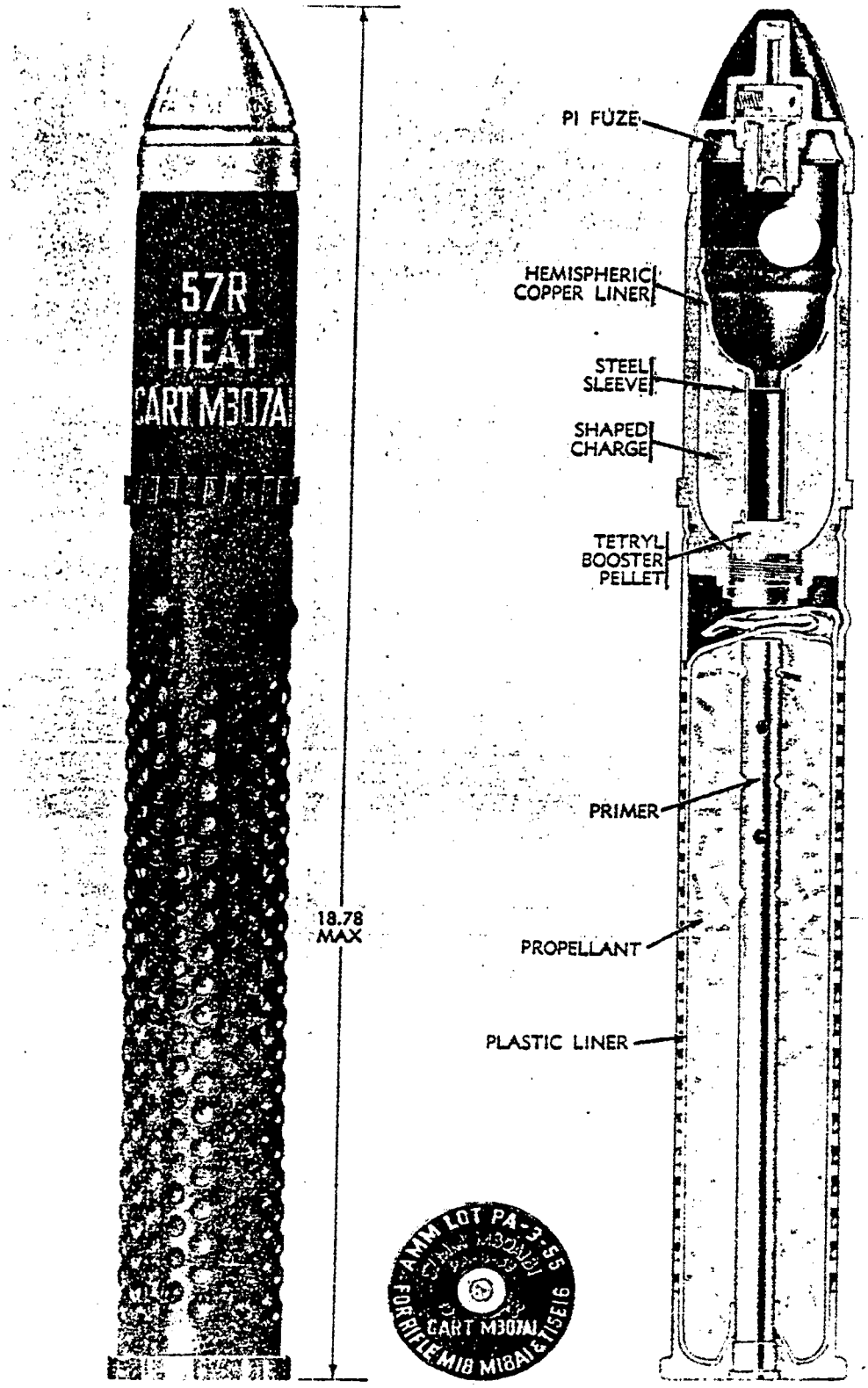


37MM ARMOR PIERCING-CAPPED CARTRIDGE

37MM HIGH EXPLOSIVE-TRACER CARTRIDGE

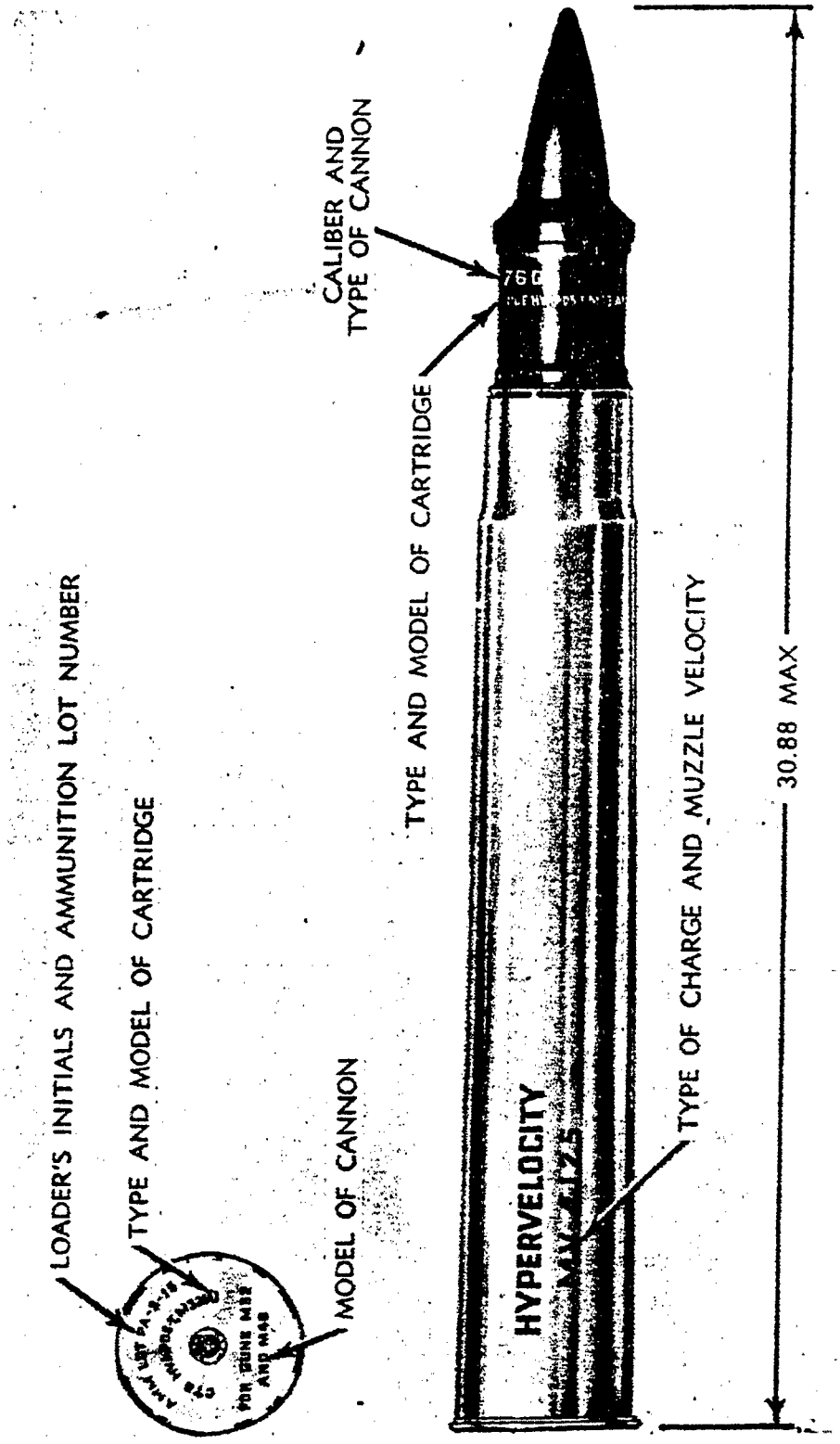


57MM CANISTER CARTRIDGE

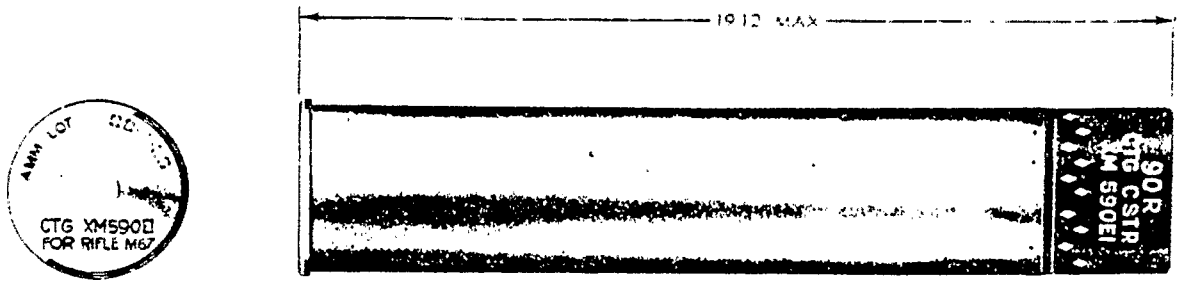


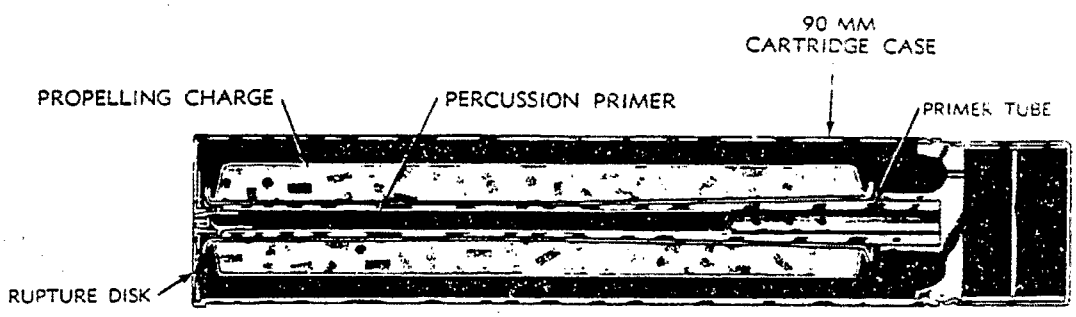
57MM HIGH EXPLOSIVE ANTI-TANK CARTRIDGE

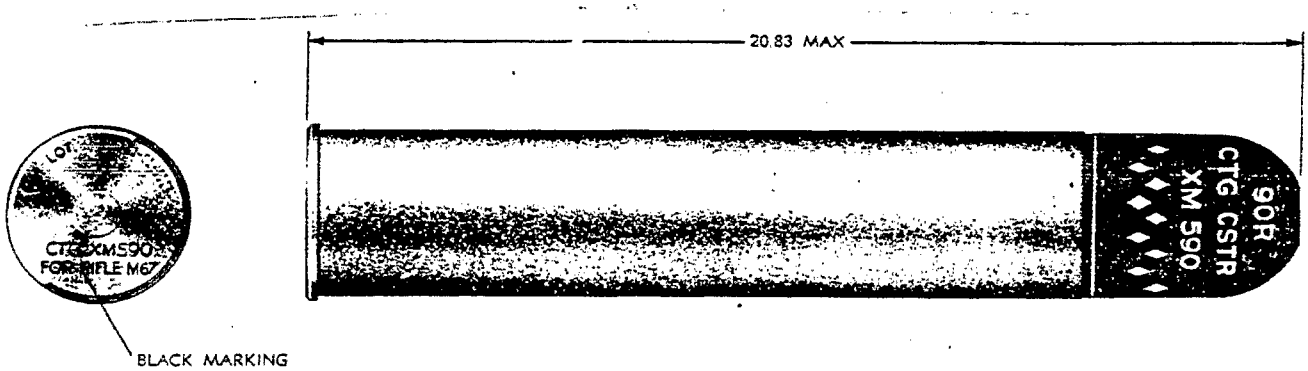
75MM HIGH EXPLOSIVE CARTRIDGE

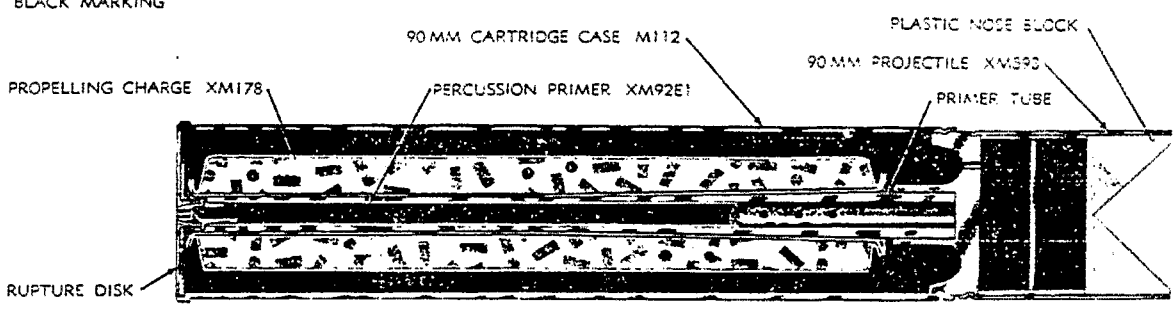


76MM HYPER-VELOCITY ARMOR PIERCING DISCARDING SABOT WITH TRACER CARTRIDGE

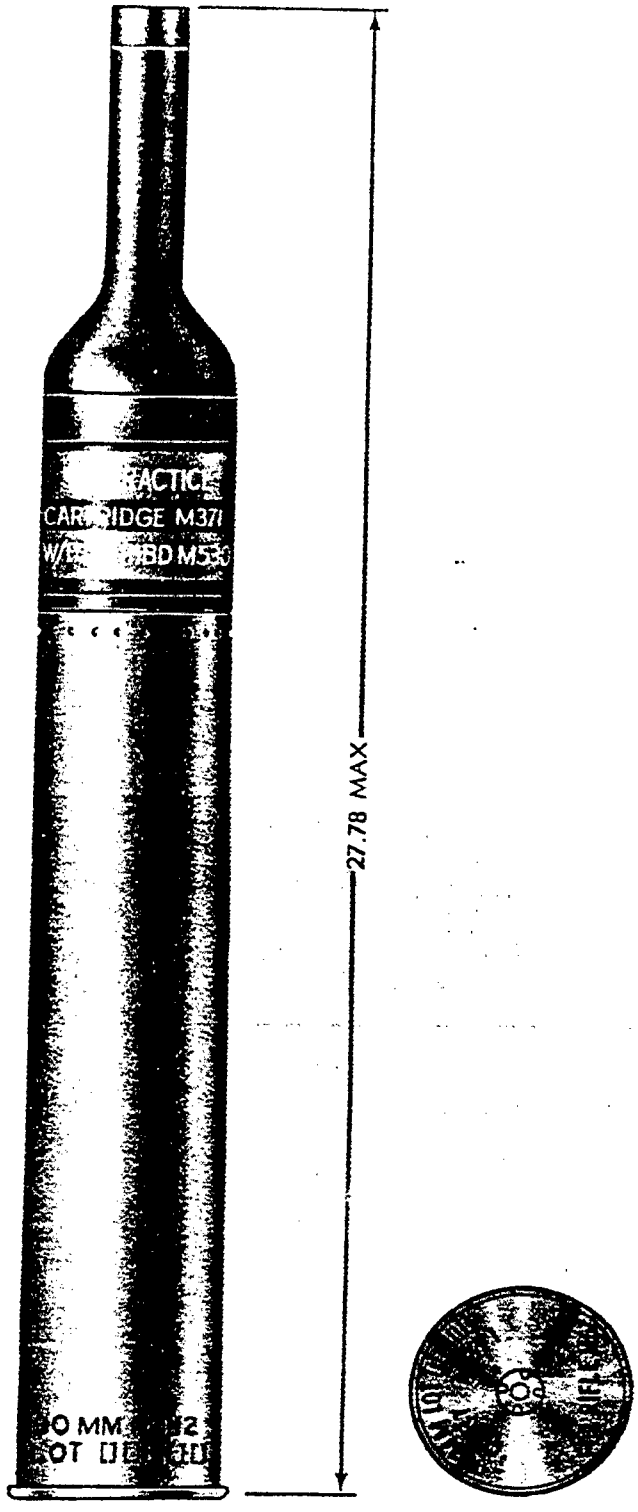




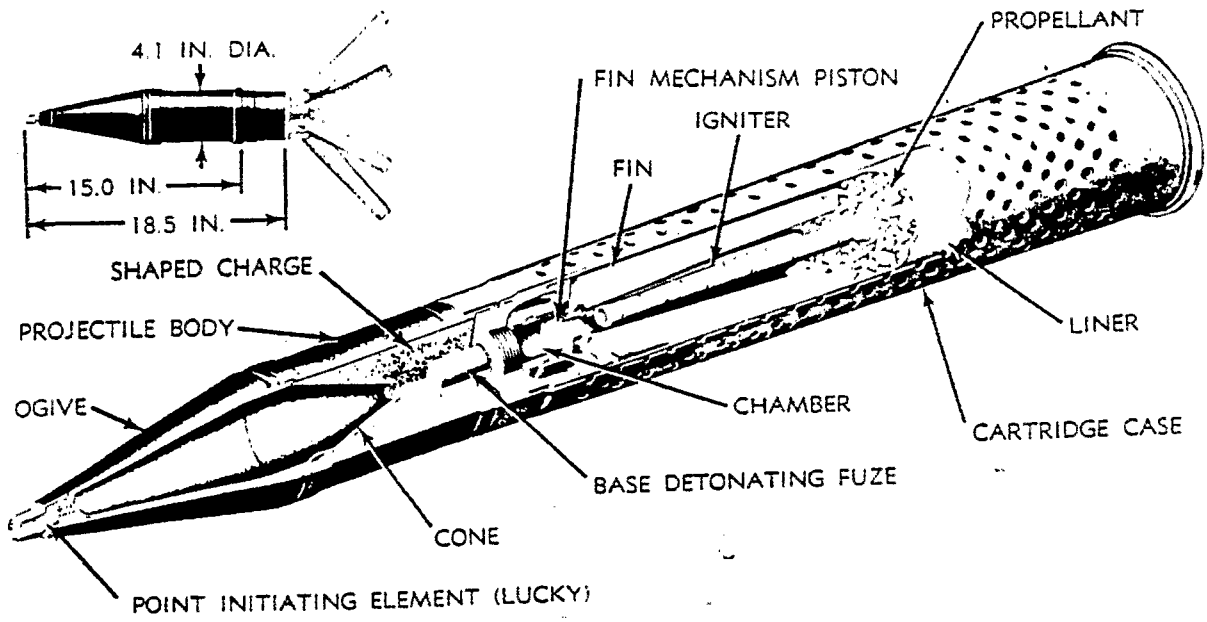




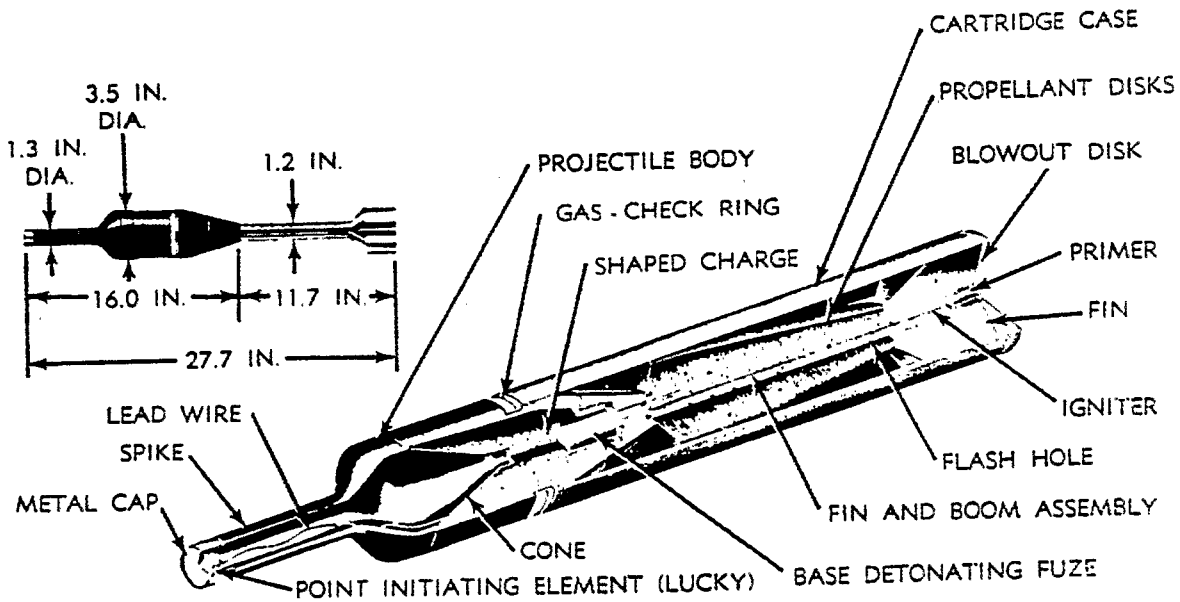
90MM CANISTER CARTRIDGES



90MM PRACTICE CARTRIDGE

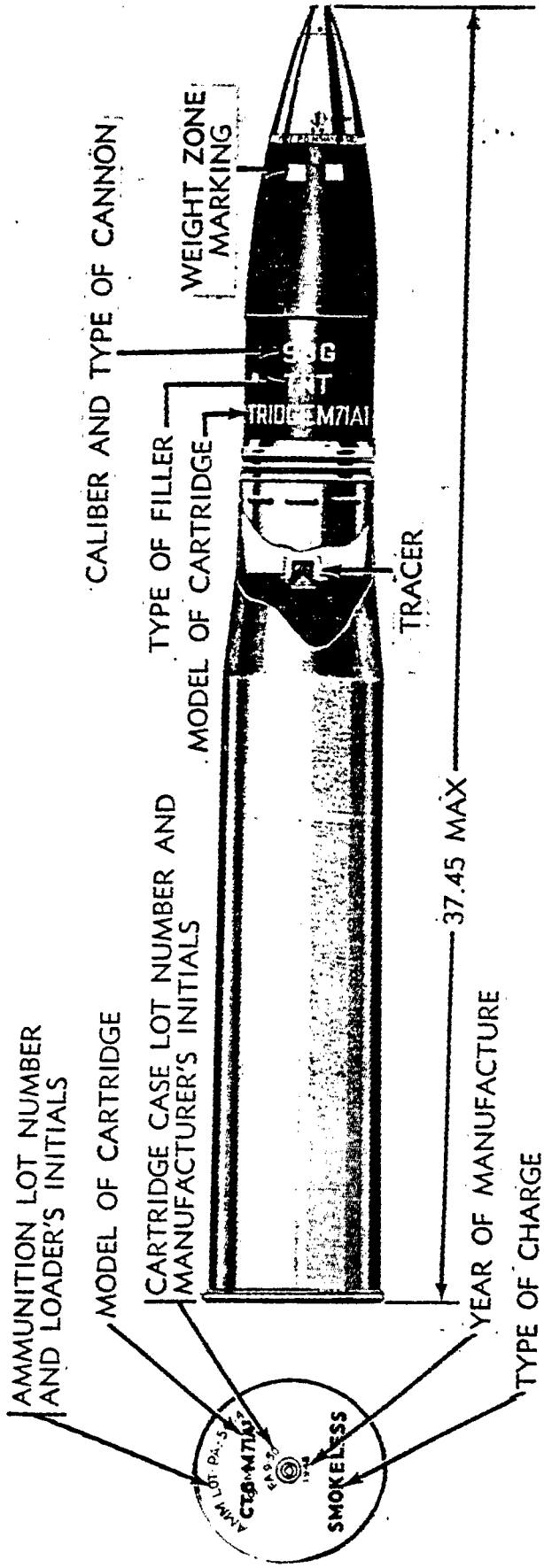


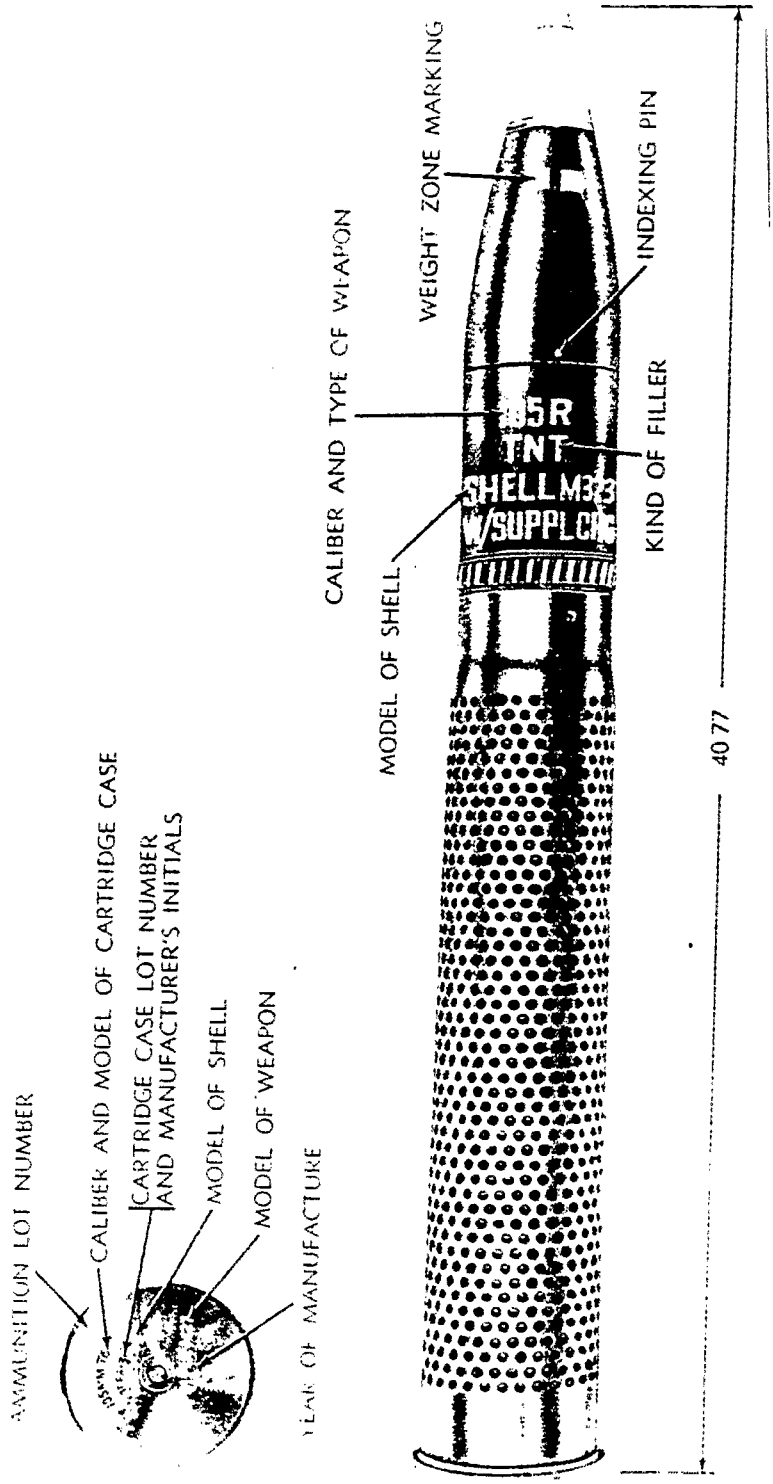
CARTRIDGE M344



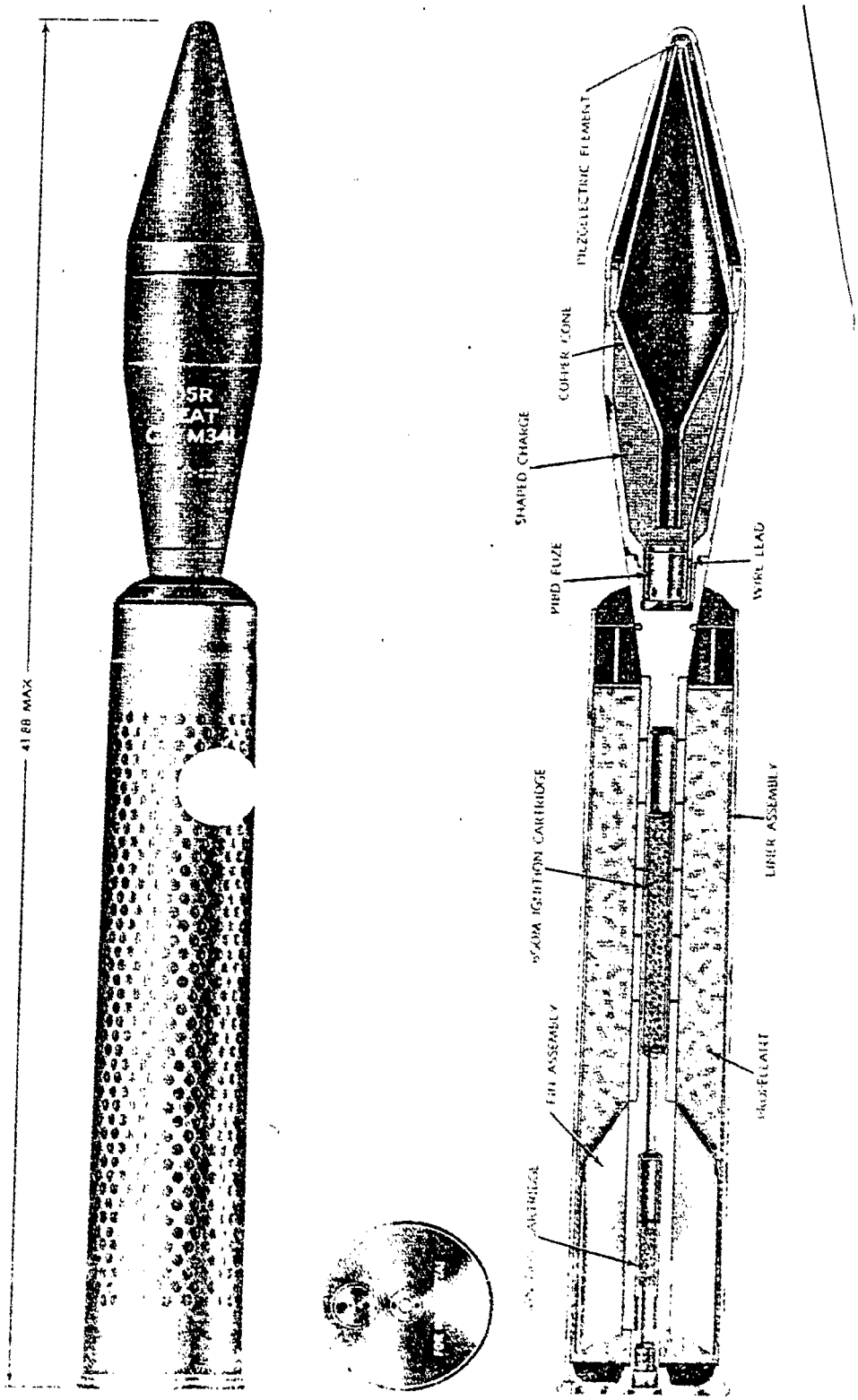
HIGH EXPLOSIVE ANTITANK CARTRIDGES

90MM HIGH EXPLOSIVE CARTRIDGE

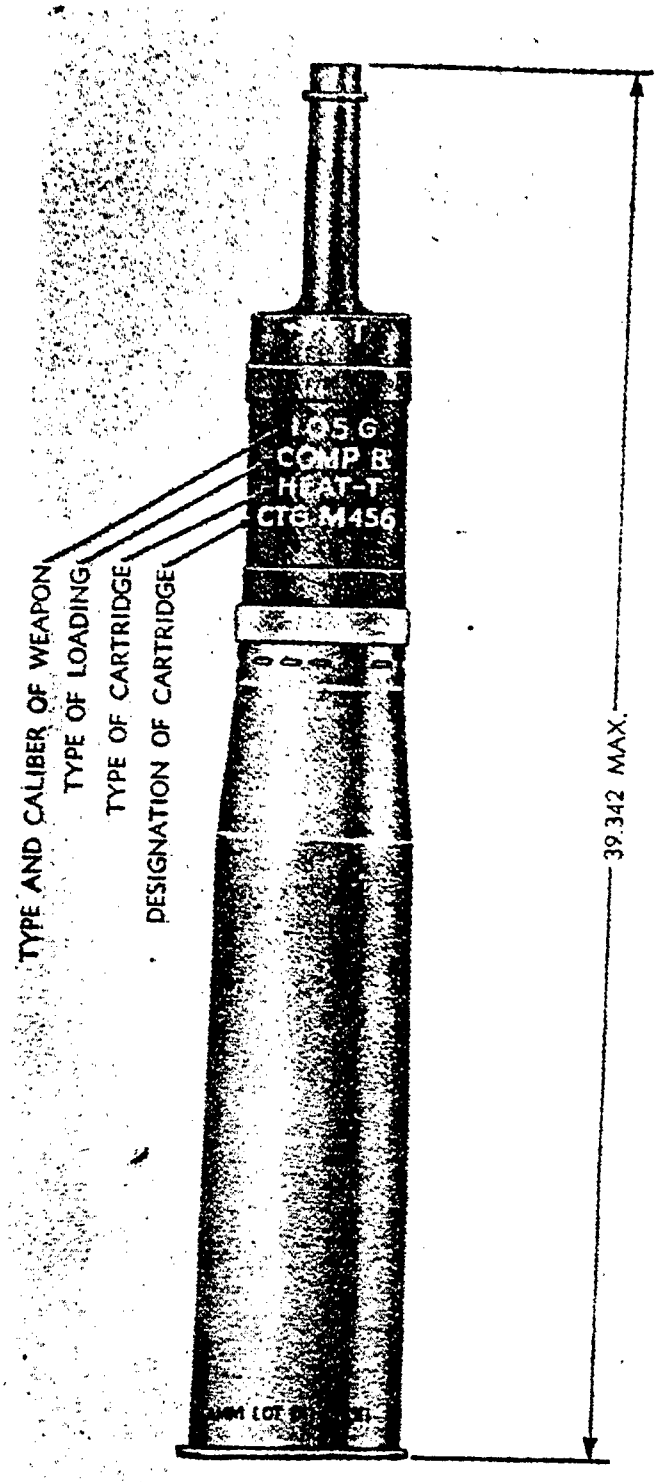




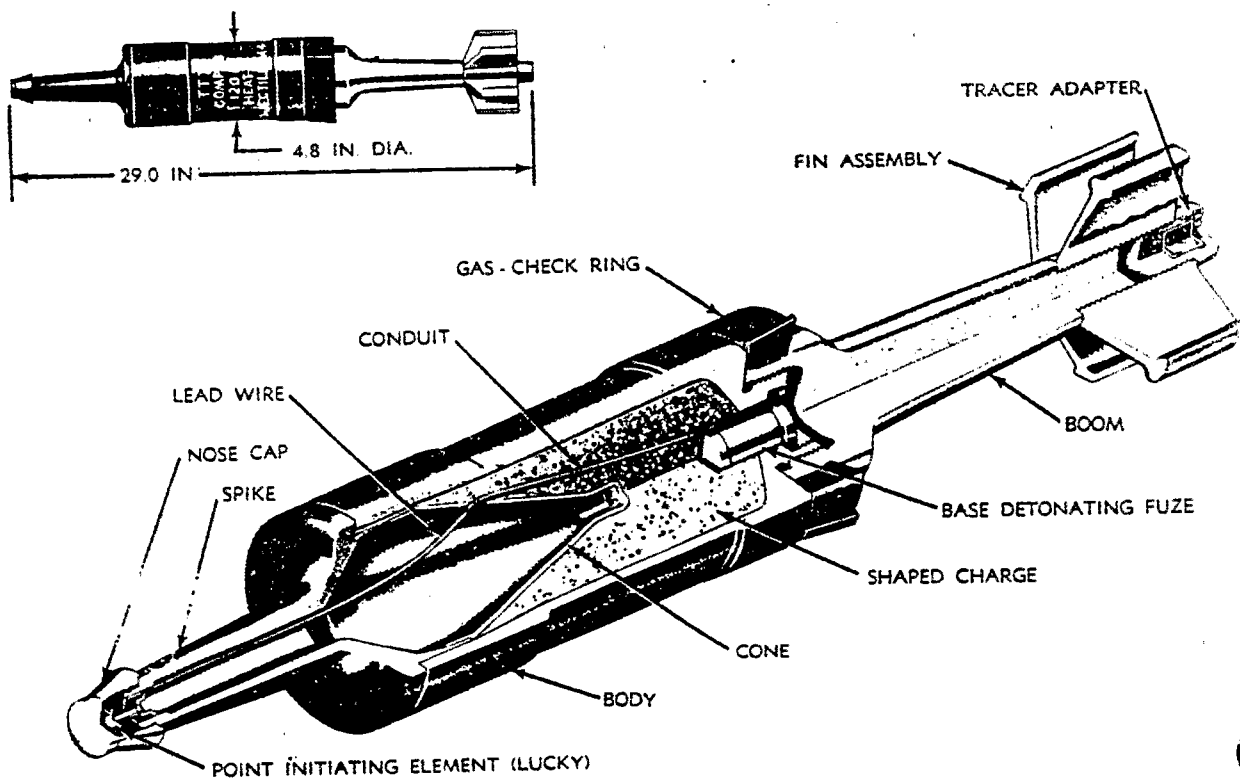
105MM HIGH EXPLOSIVE CARTRIDGE



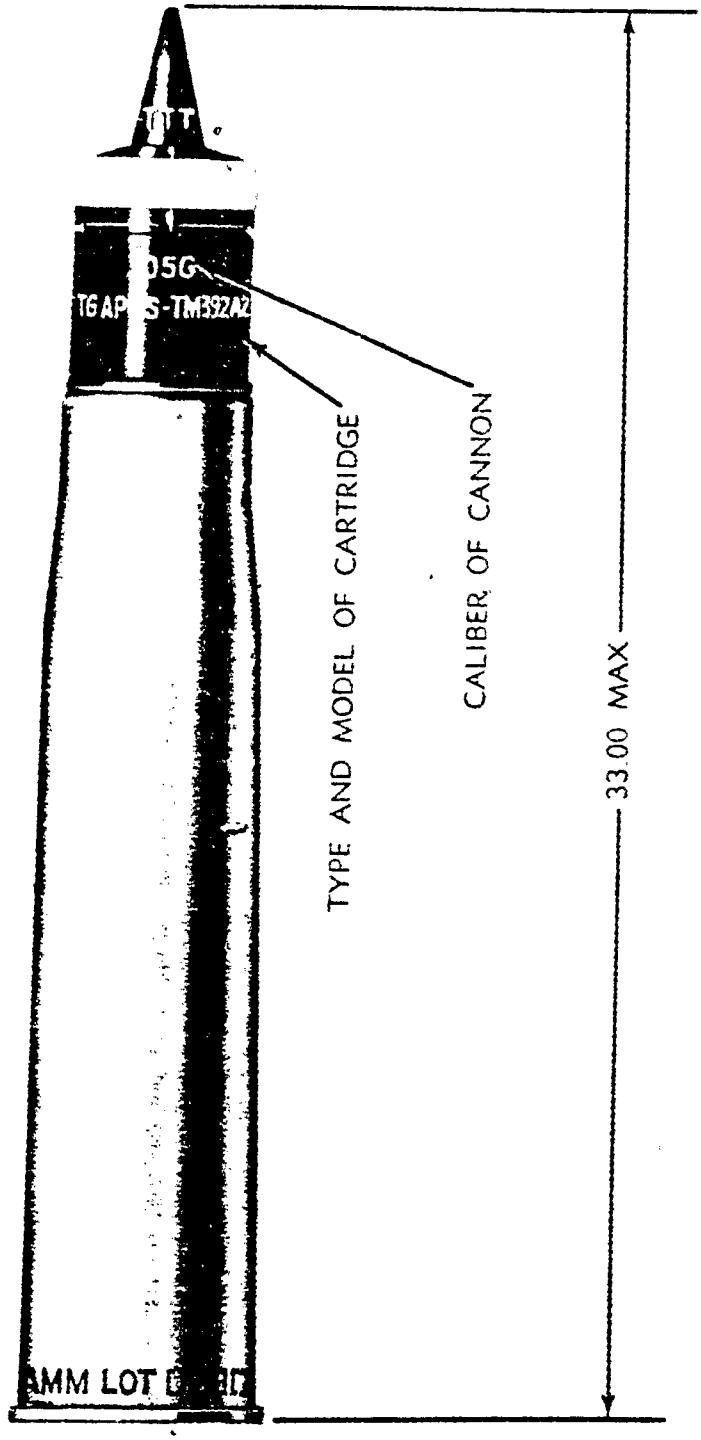
105MM HIGH EXPLOSIVE ANTITANK CARTRIDGE



105MM HIGH EXPLOSIVE ANTITANK WITH TRACER CARTRIDGE

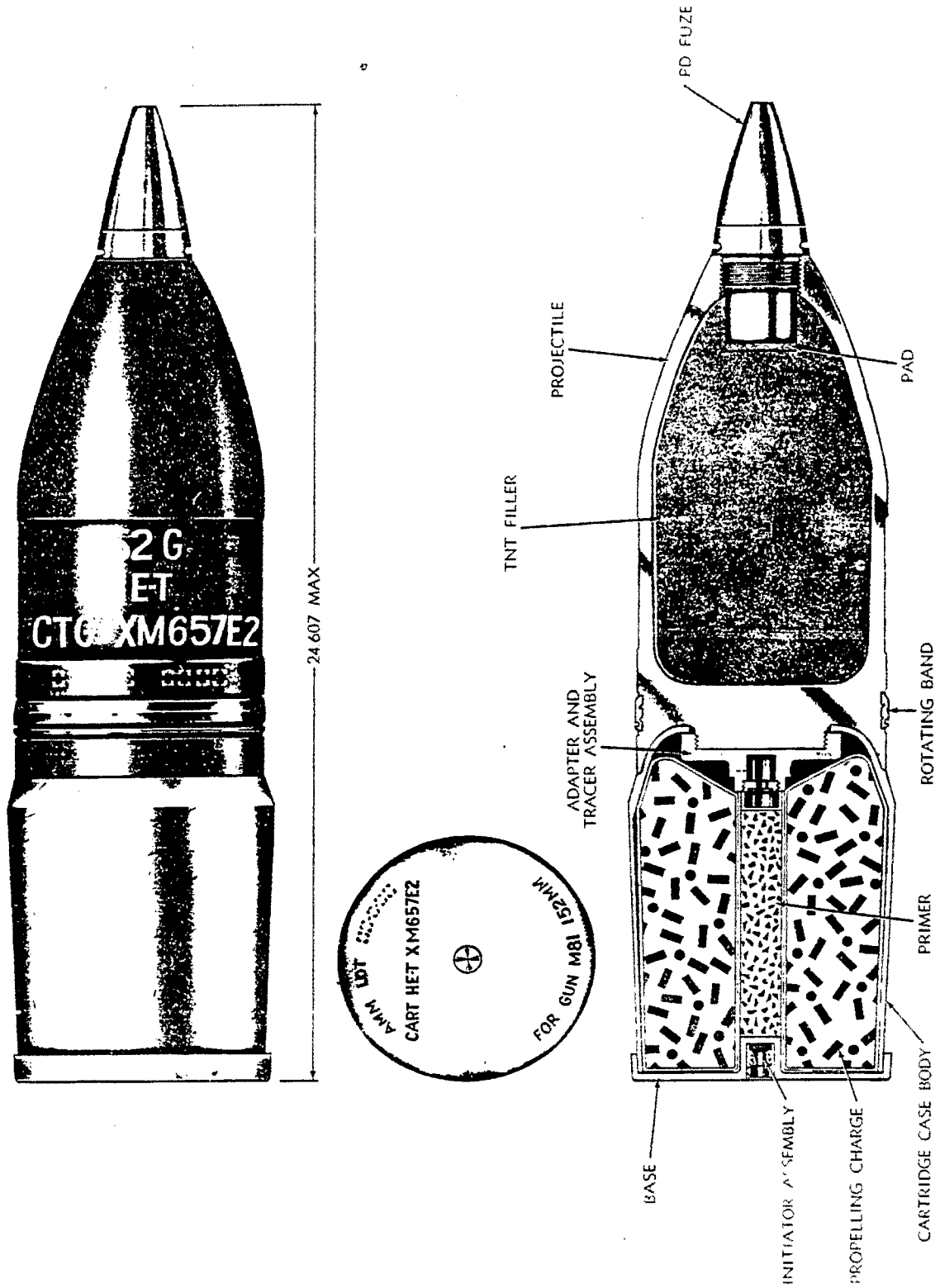


HIGH EXPLOSIVE ANTITANK PROJECTILE

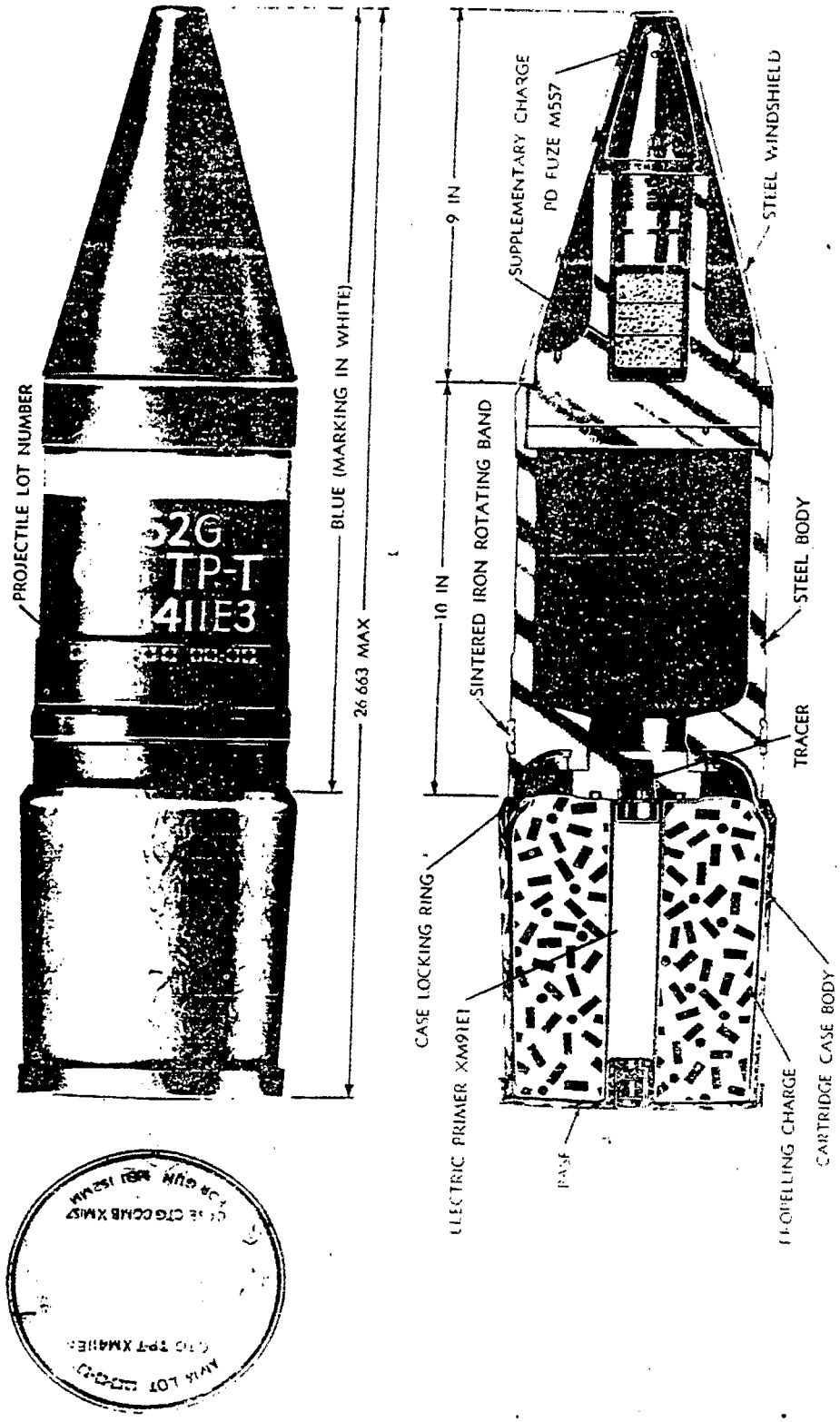


ARMOR-PIERCING DISCARDING SABOT

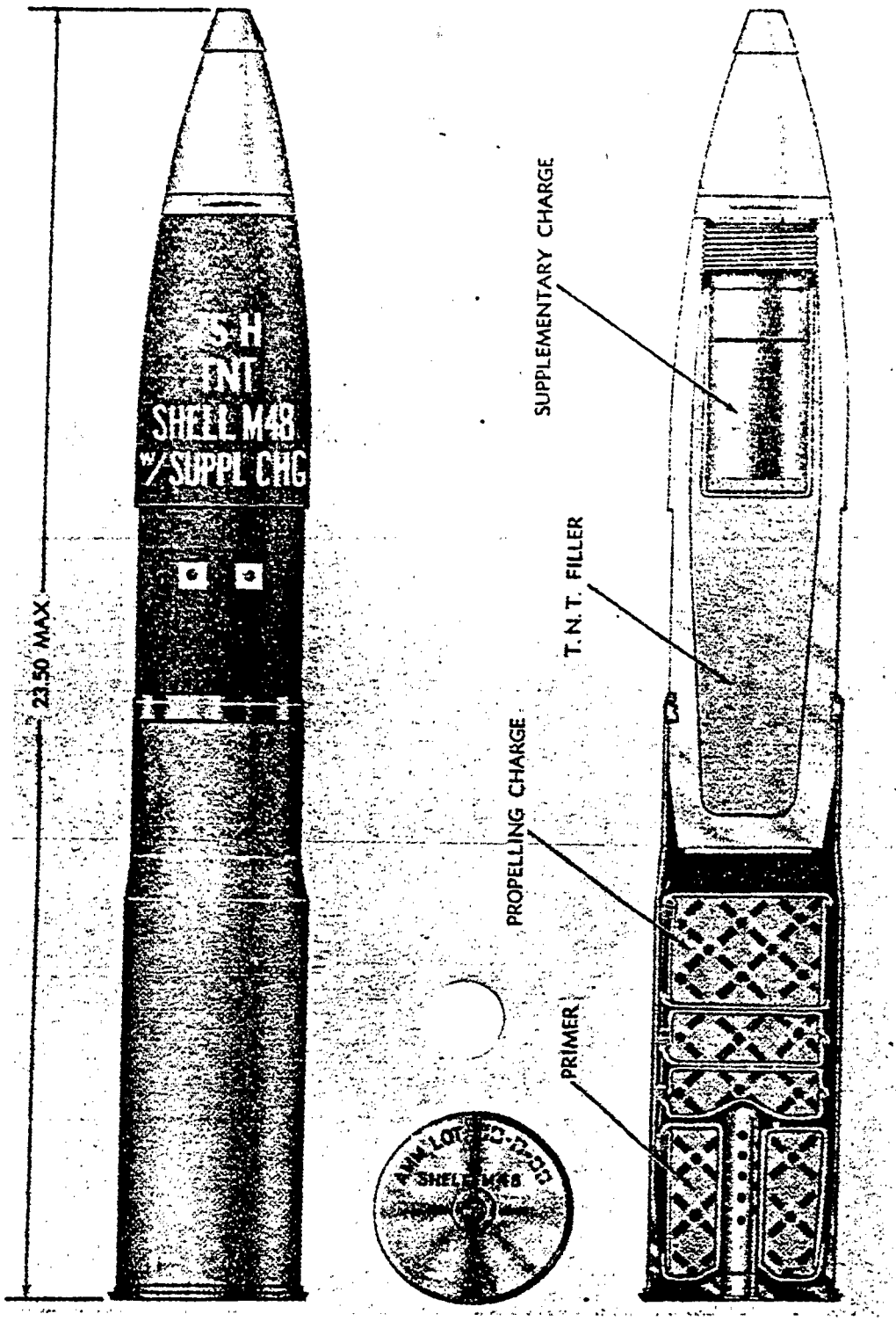
WITH TRACER CARTRIDGE



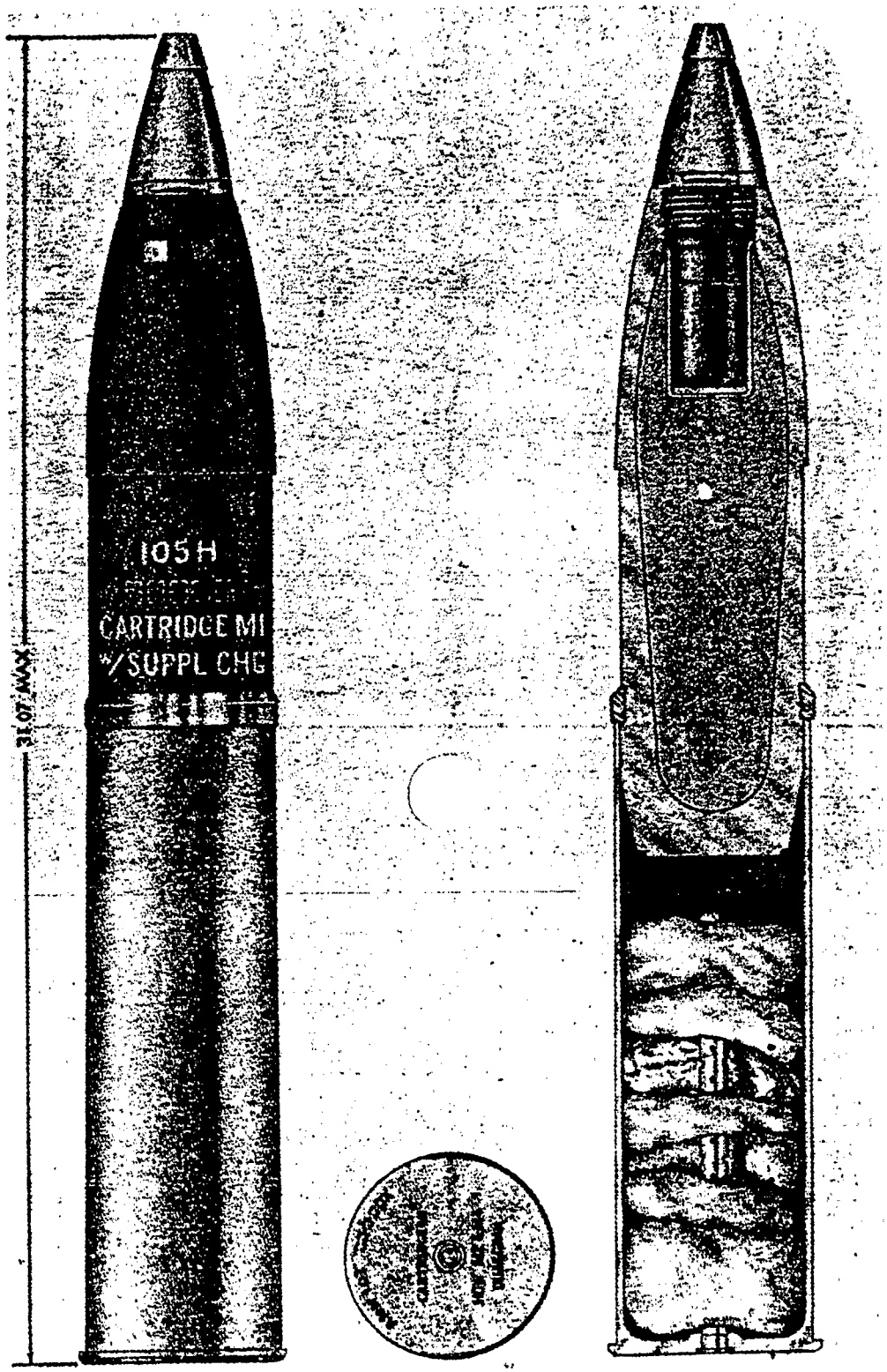
152MM HIGH EXPLOSIVE WITH TRACER CARTRIDGE



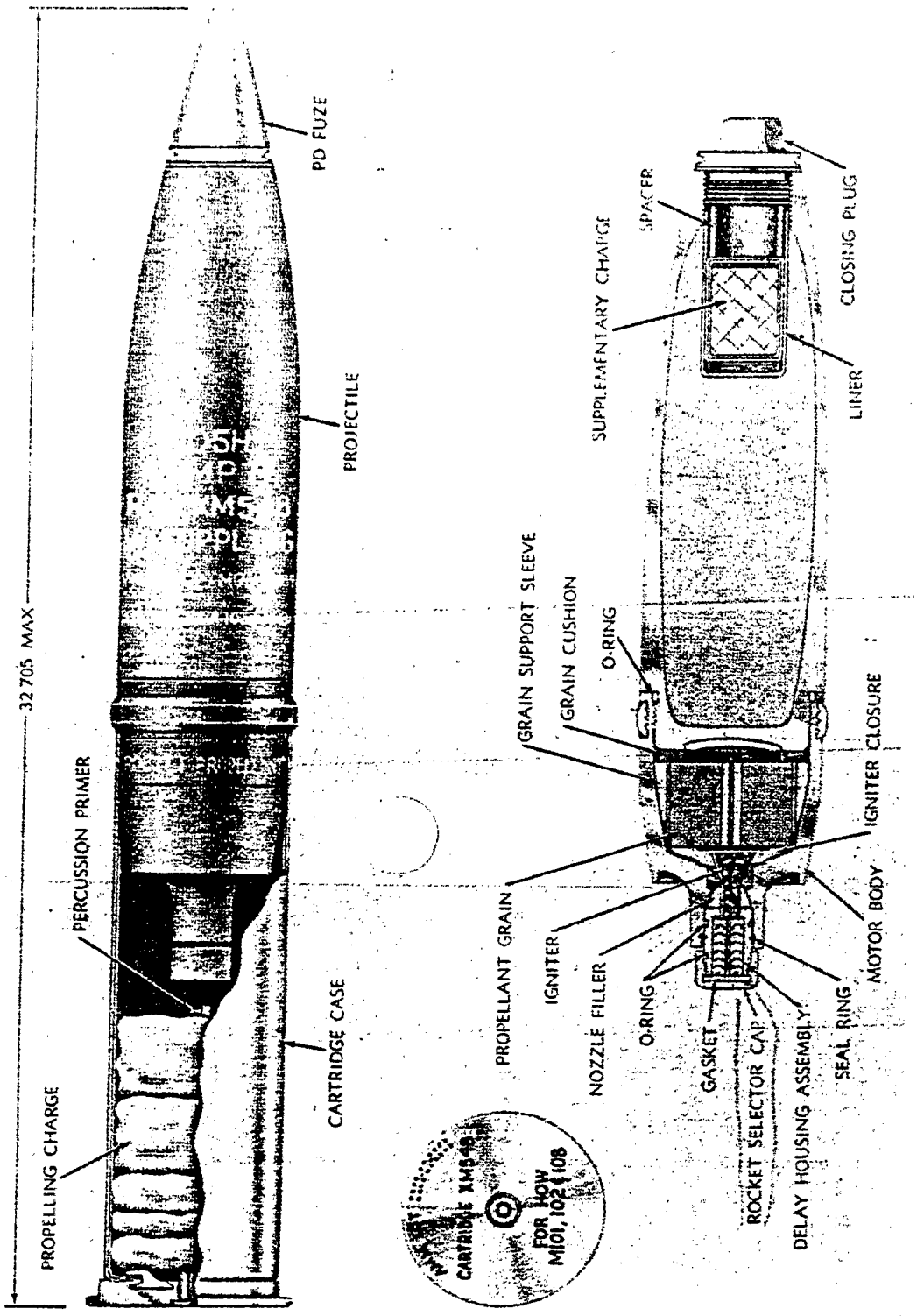
152MM TARGET PRACTICE WITH TRACER CARTRIDGE



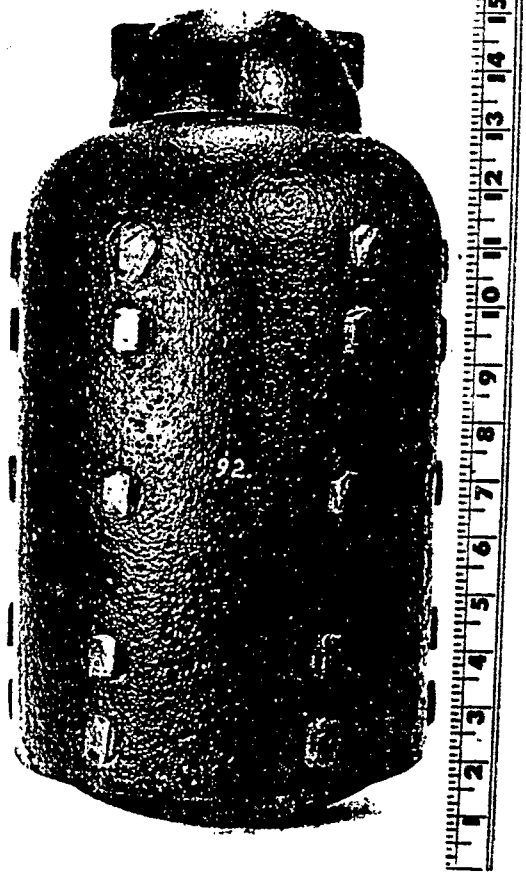
75MM HIGH EXPLOSIVE CARTRIDGE



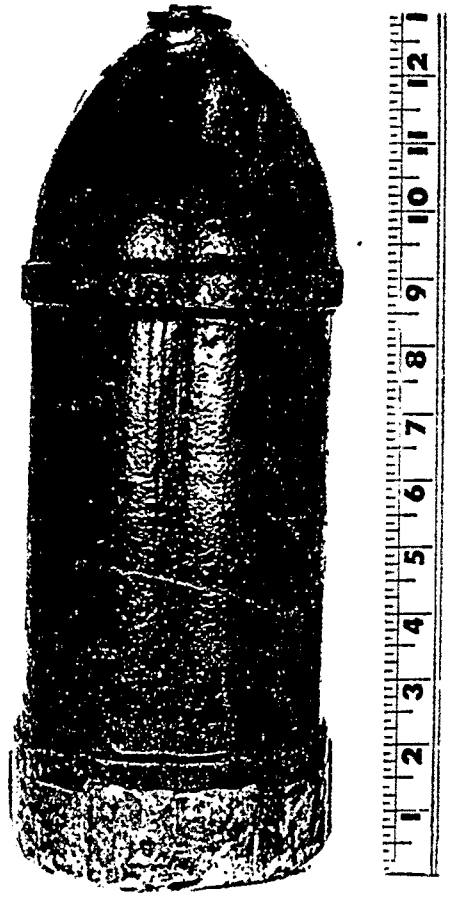
105MM HIGH EXPLOSIVE CARTRIDGE



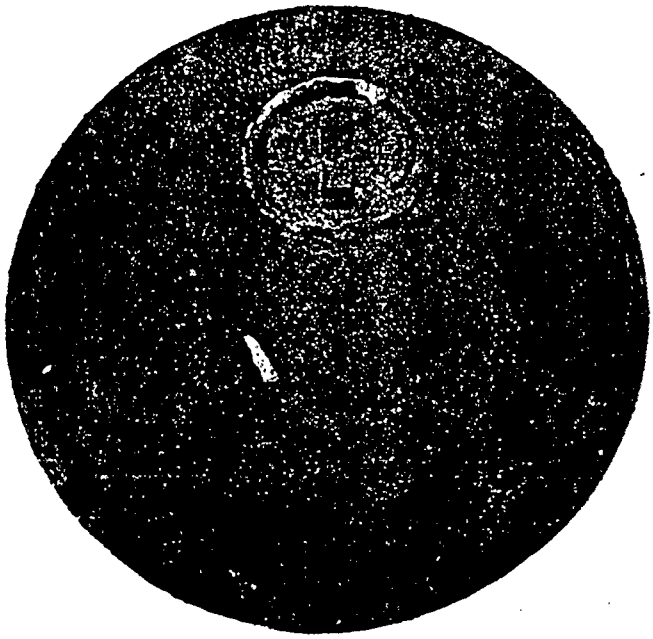
105MM HIGH EXPLOSIVE ROCKET ASSIST PROJECTILE



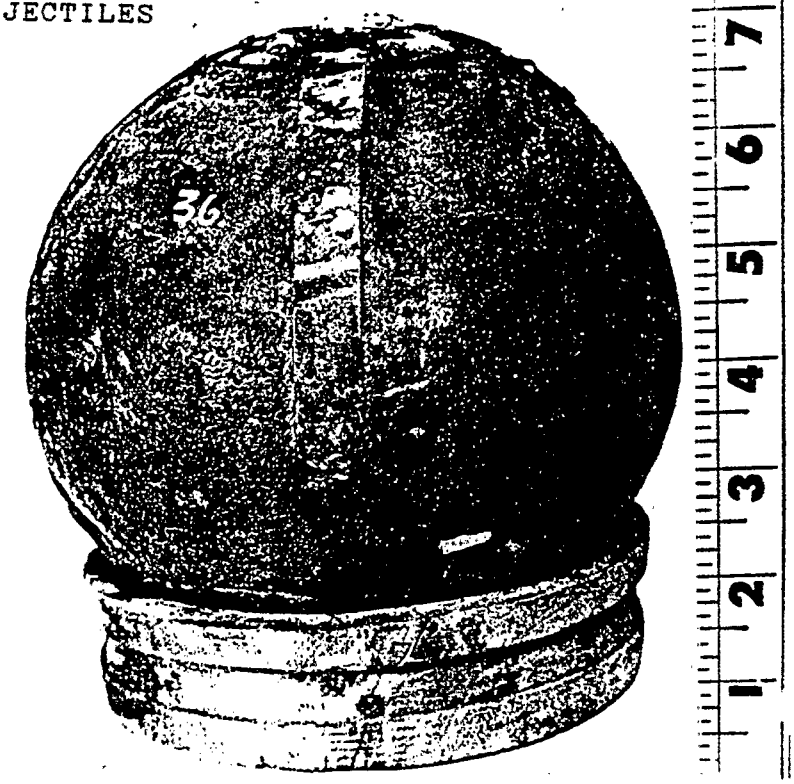
CIVIL WAR ERA PROJECTILES

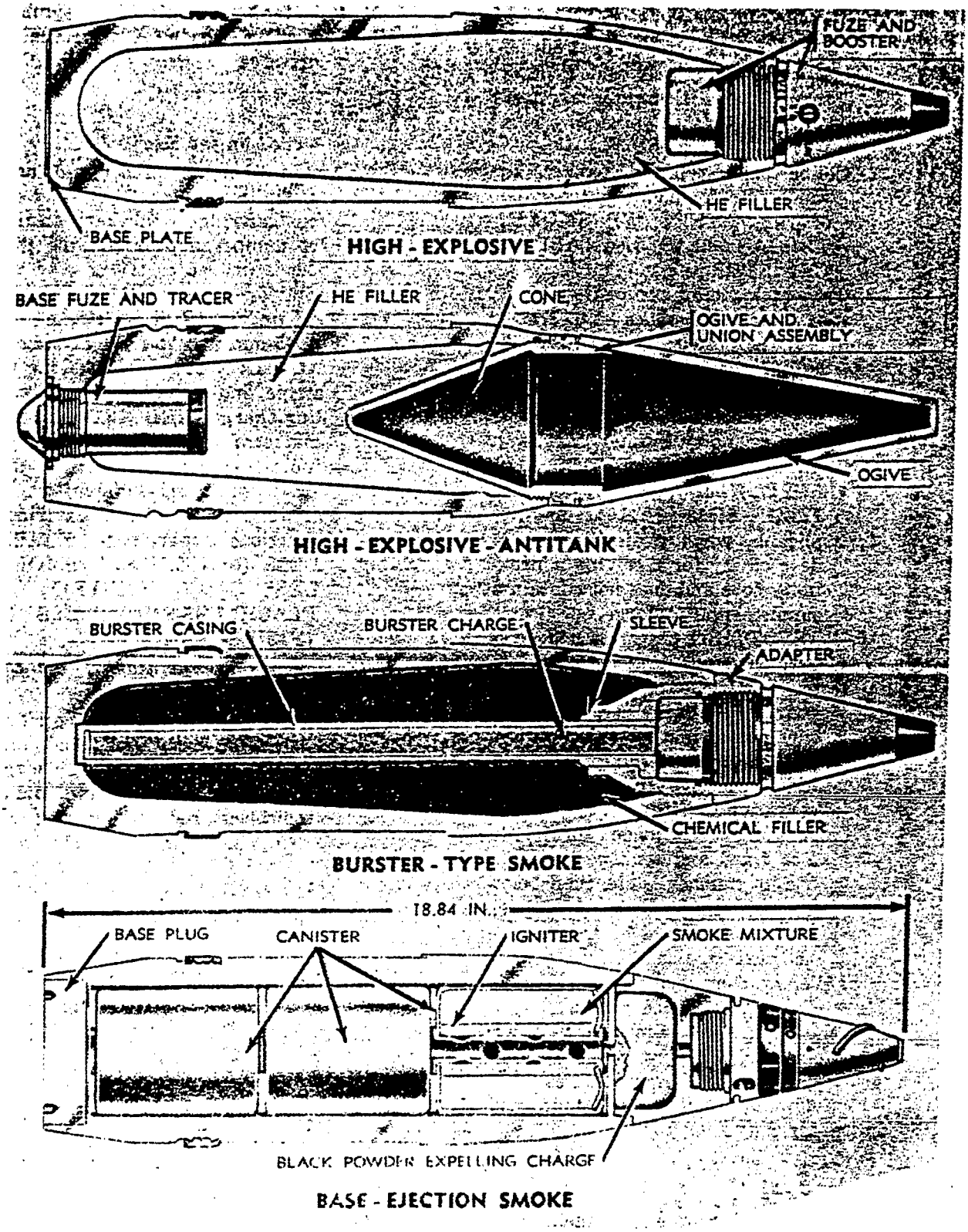


CIVIL WAR ERA PROJECTILES

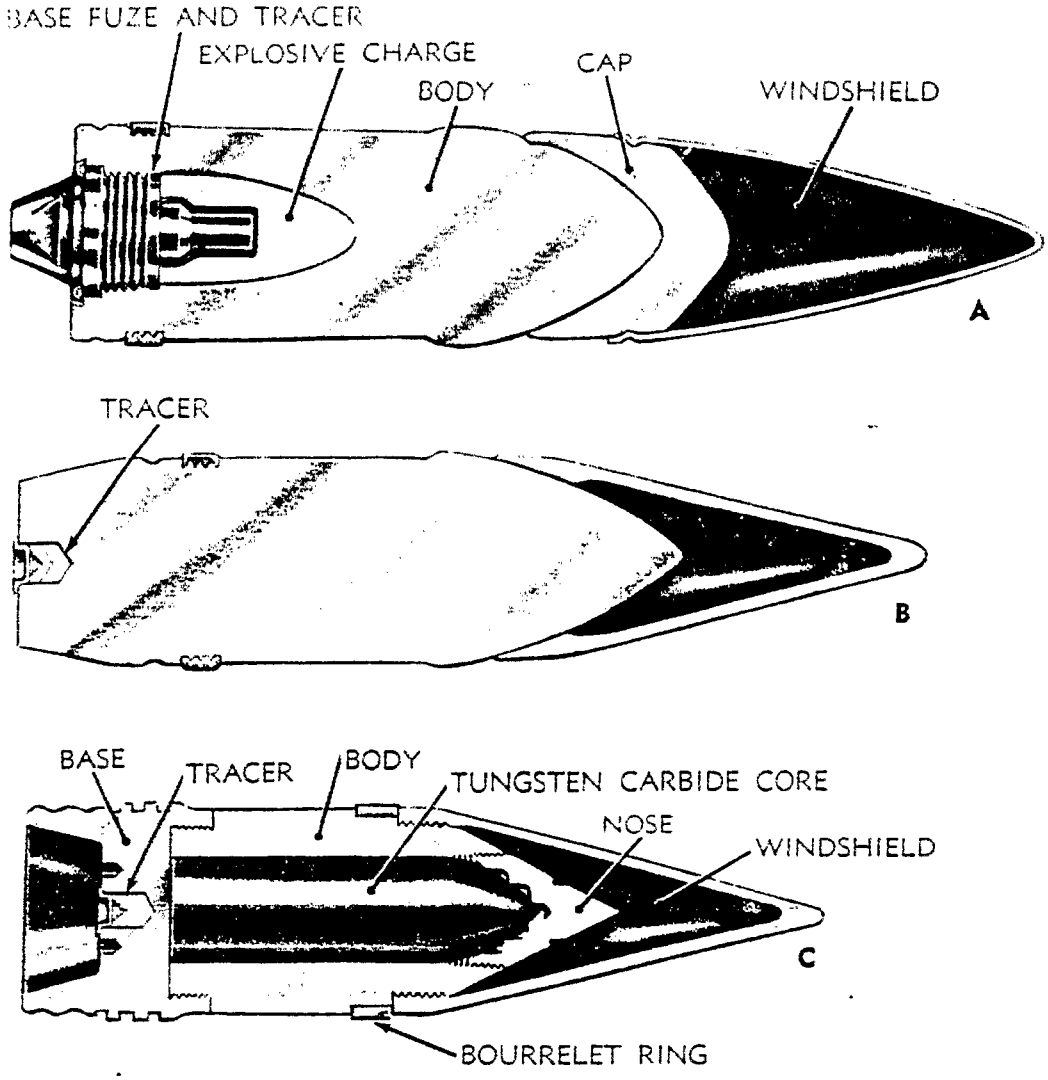


CIVIL WAR ERA PROJECTILES



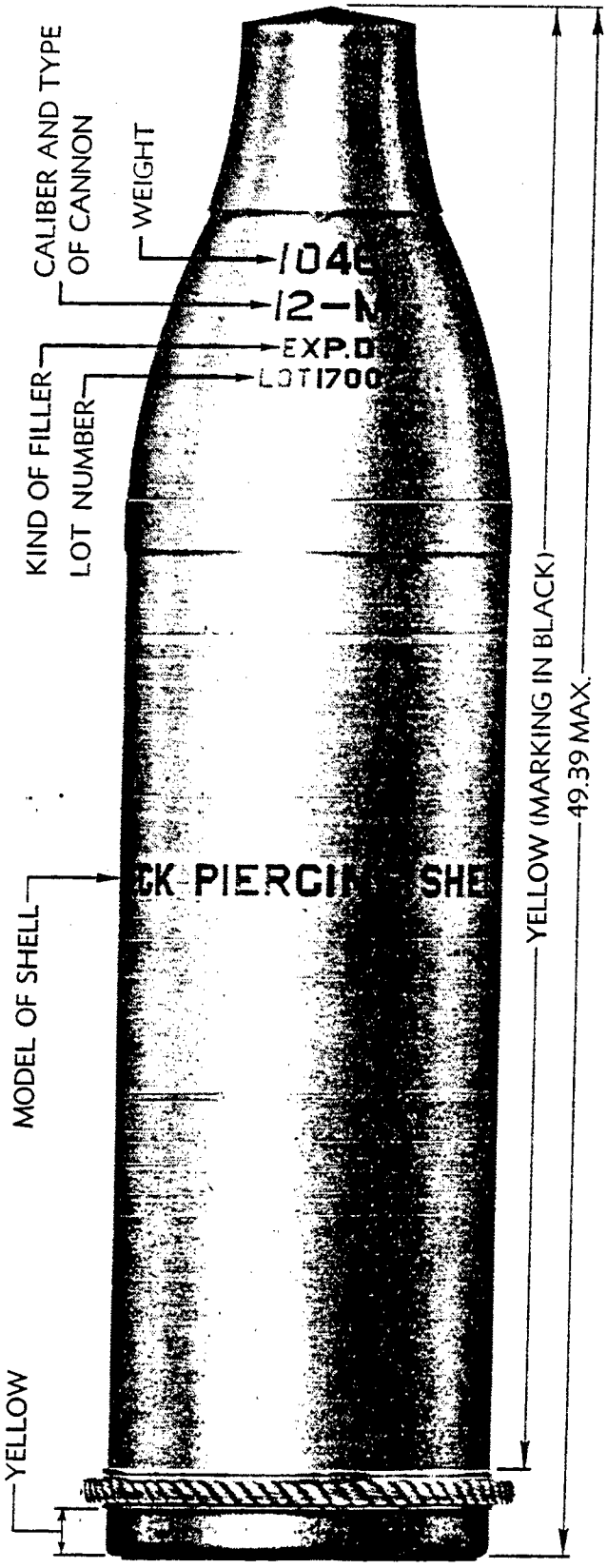


TYPICAL SEPARATE LOADING PROJECTILES

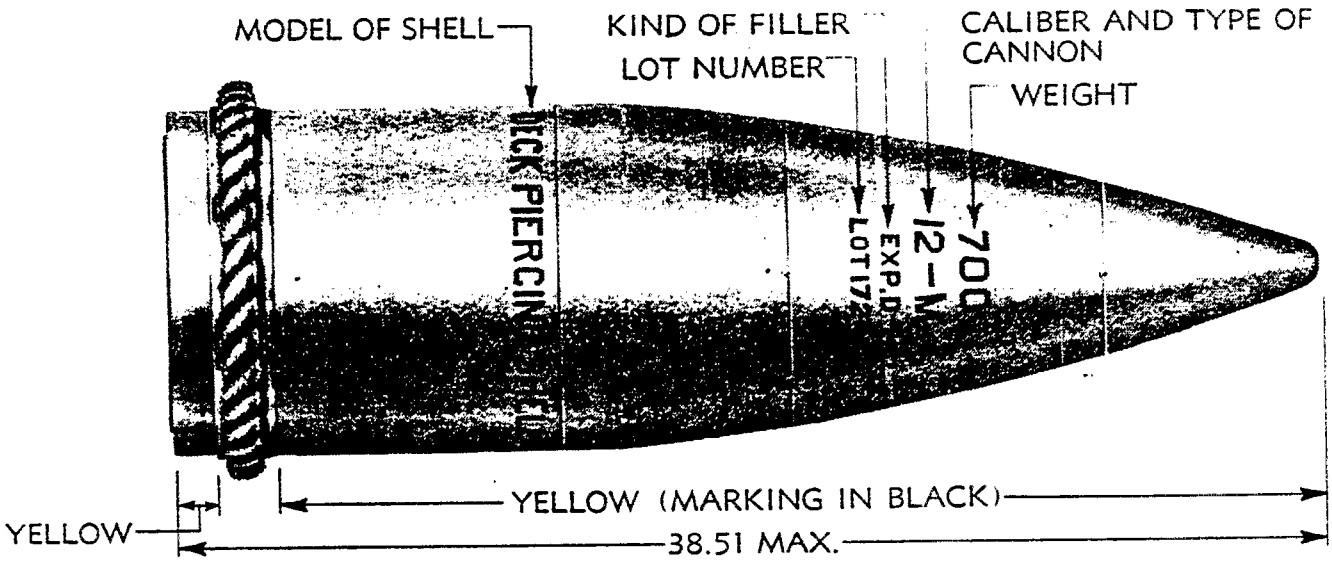


A—ARMOR-PIERCING-CAPPED PROJECTILE, WITH EXPLOSIVE FILLER (APC)
B—ARMOR-PIERCING SHOT (AP-T)
C—HYPERVELOCITY ARMOR-PIERCING SHOT (HVAP-T)
D—CANISTER

TYPICAL SEPARATE LOADING PROJECTILES

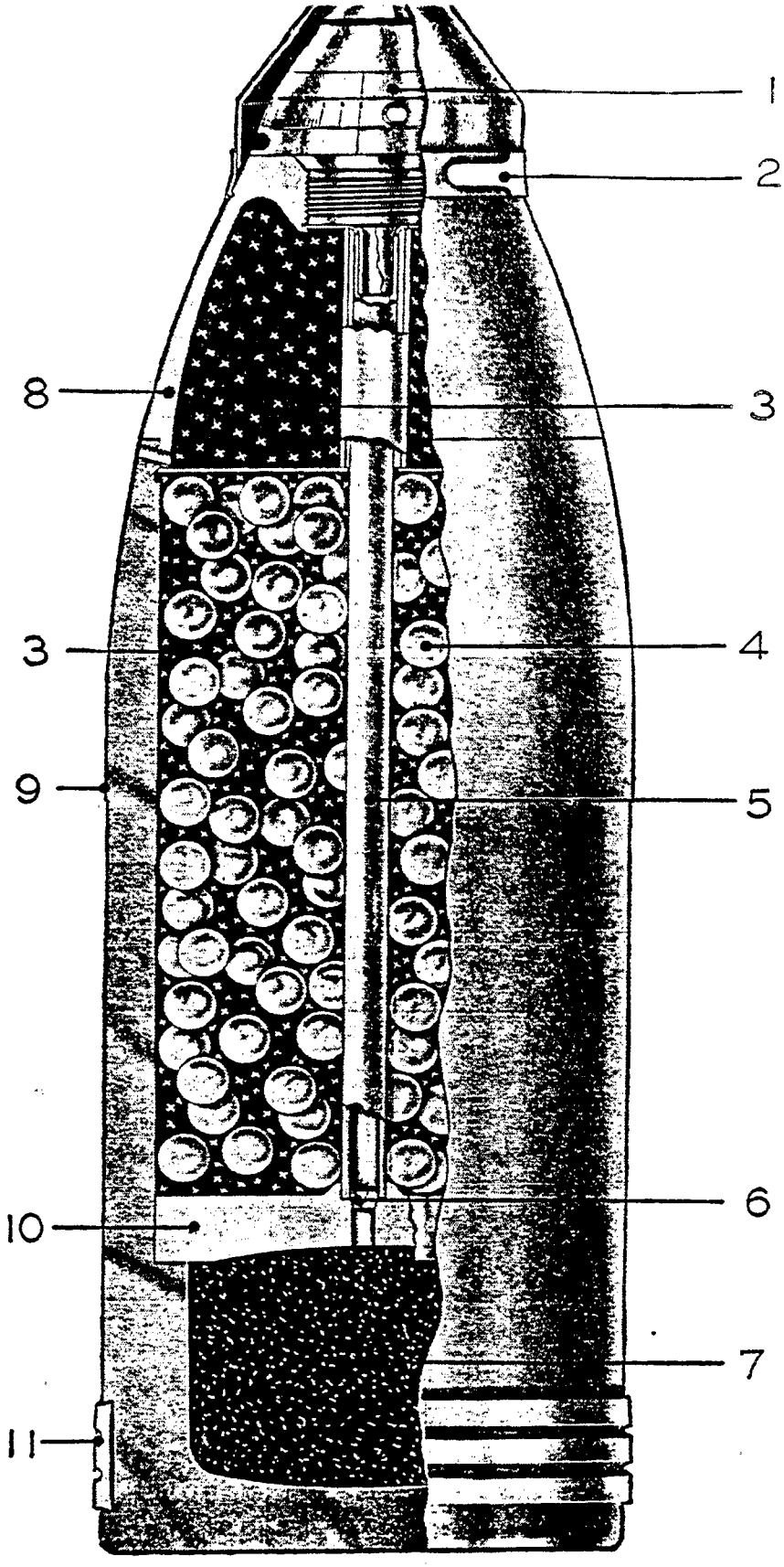


12" PRACTICE CAST IRON SHELL



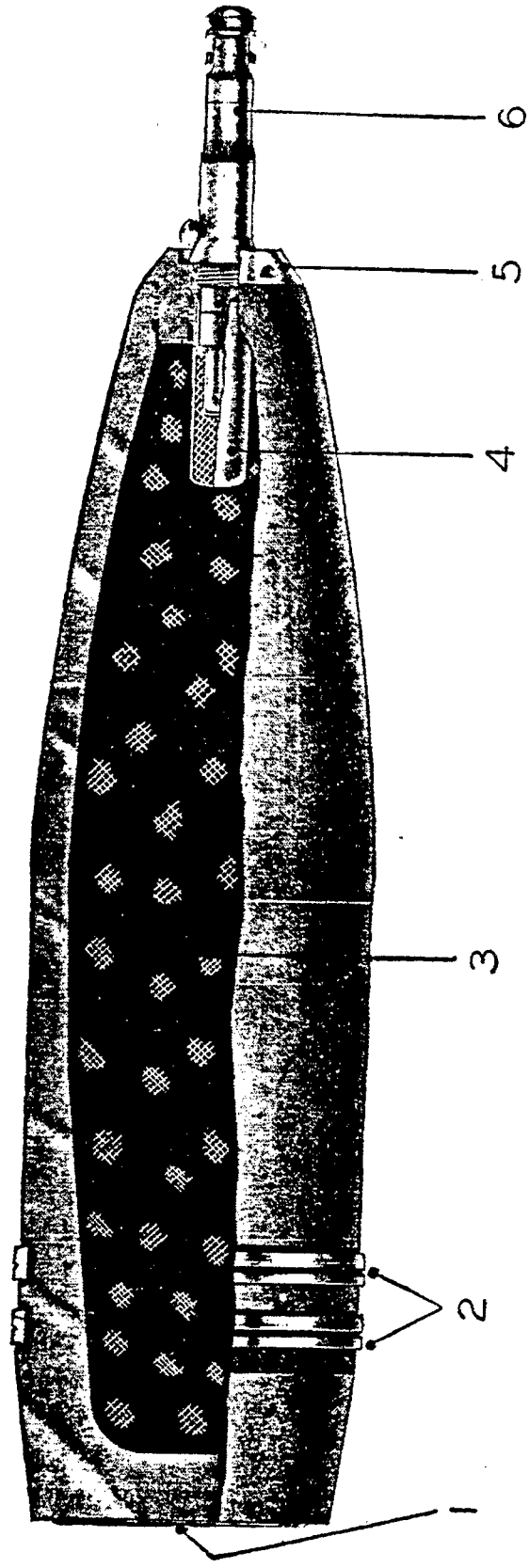
12" DECK PIERCING SHELL

1. 45-second combination fuze, M1907M.
2. Tear off or soldering strip of waterproof cover.
3. Matrix (resin).
4. Balls.
5. Central tube.
6. Fiber paper cup and cloth disk.
7. Base charge (loose black powder).
8. Head.
9. Bourrelet on shrapnel case.
10. Diaphragm.
11. Rotating band.

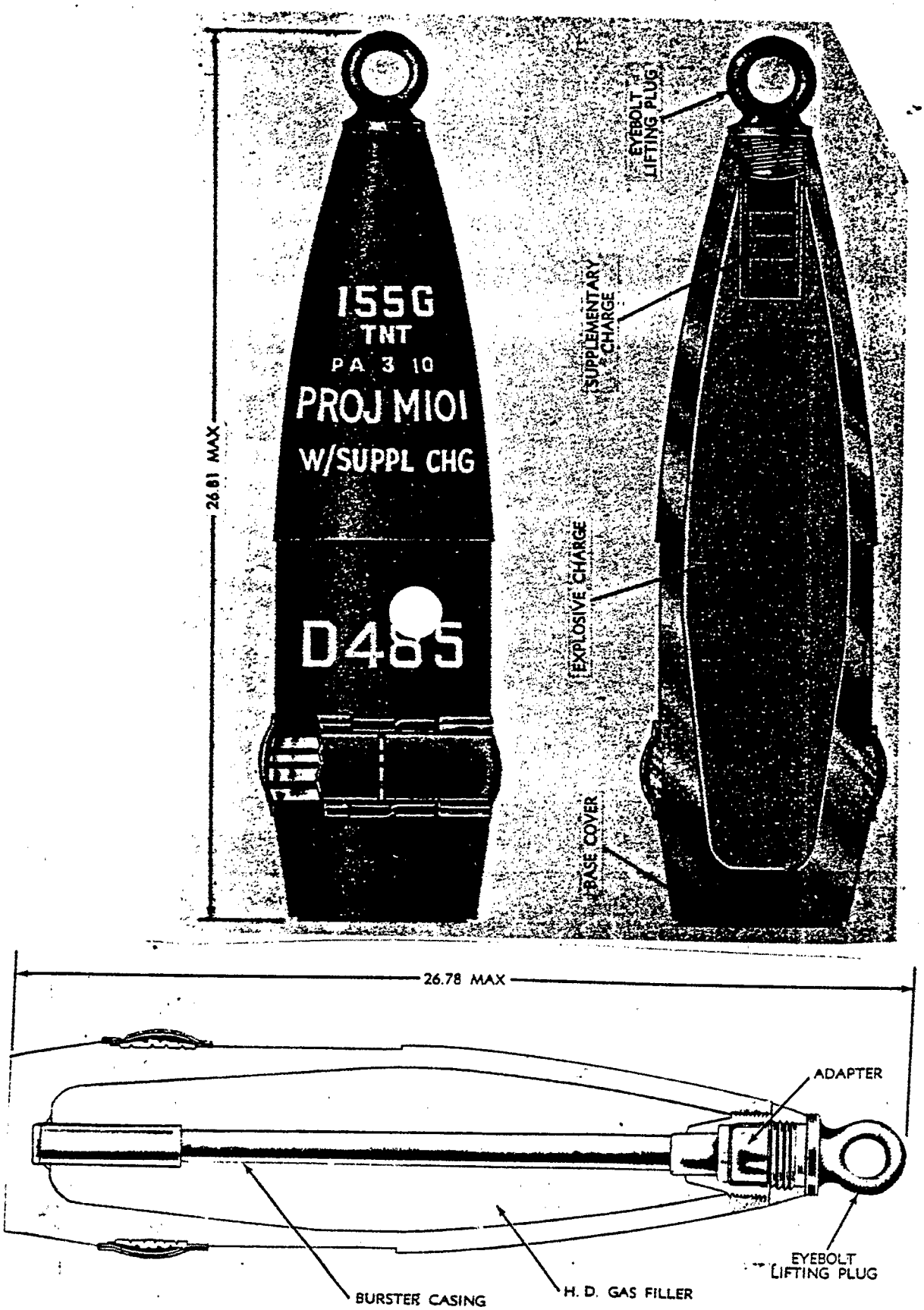


155MM SHRAPNEL SHELL

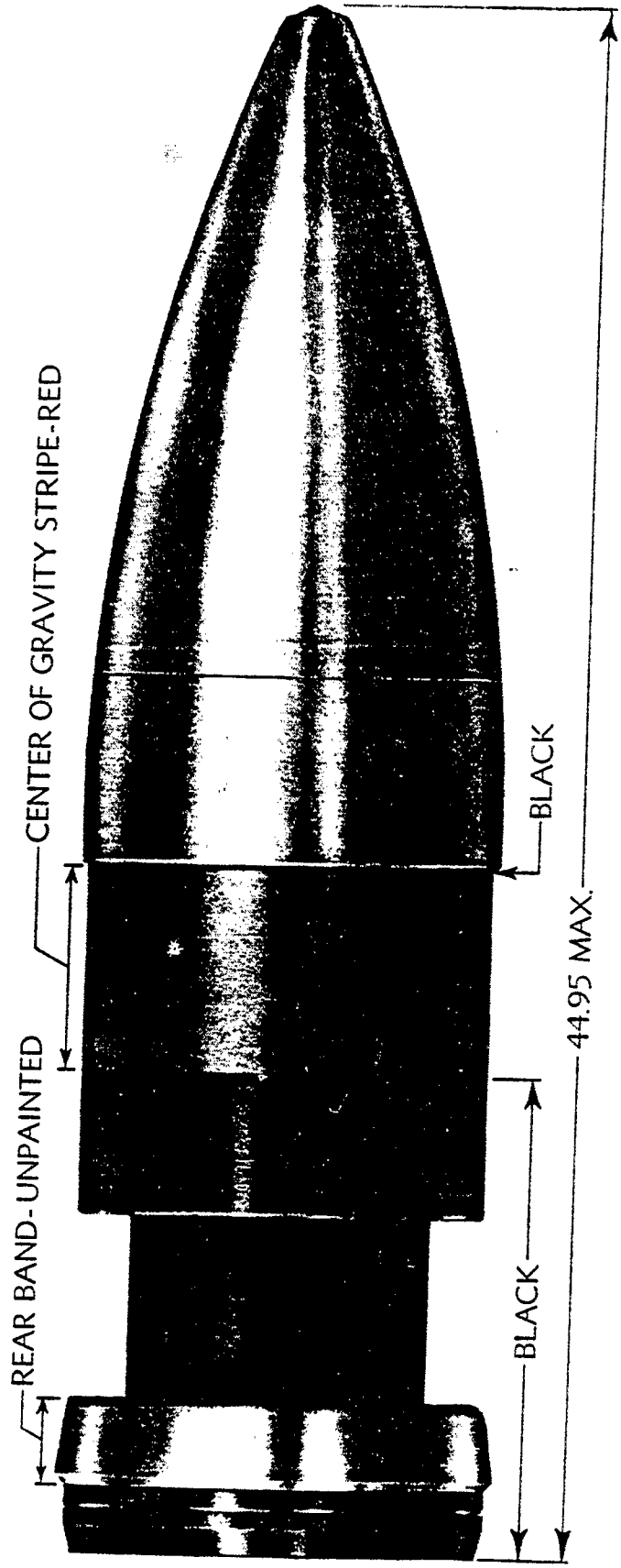
1. Base cover.
2. Rotating bands.
3. Bursting charge (TNT or amatol).
4. Booster.
5. Adapter.
6. Fuze (to be inserted at battery).



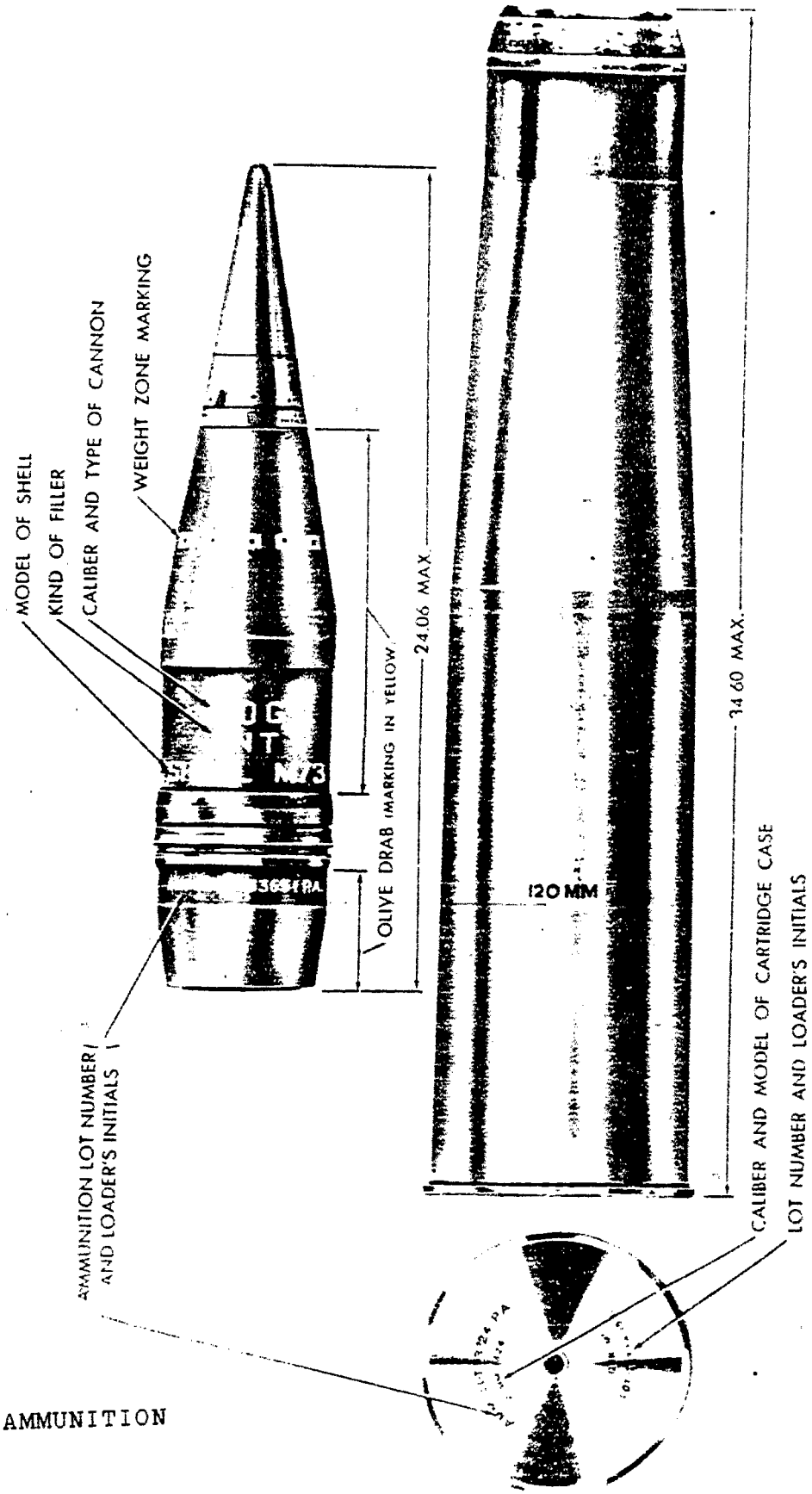
155MM HIGH EXPLOSIVE SHELL



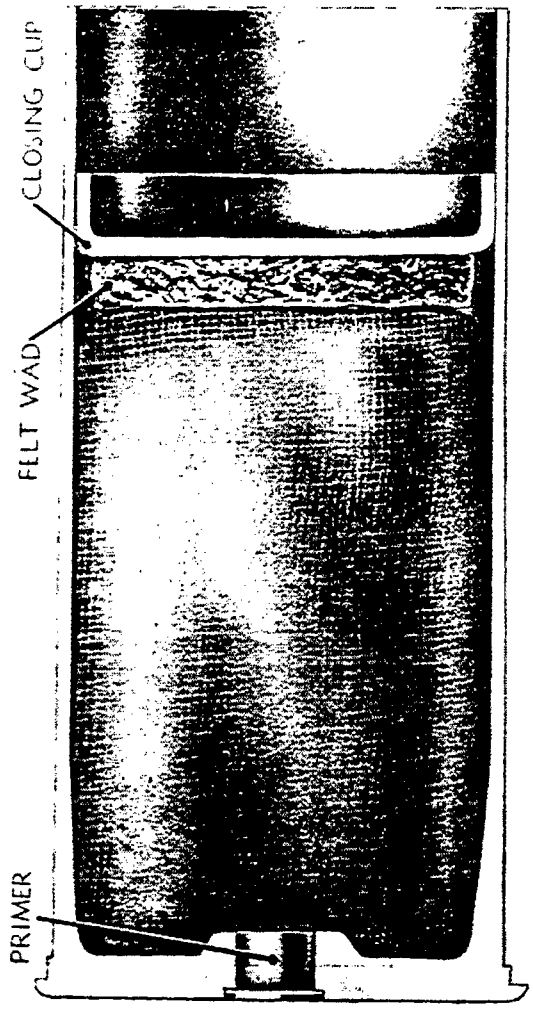
155MM HIGH EXPLOSIVE PROJECTILE



DUMMY PROJECTILE



120MM SEPARATED AMMUNITION



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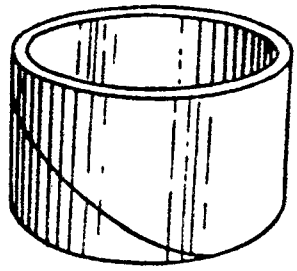
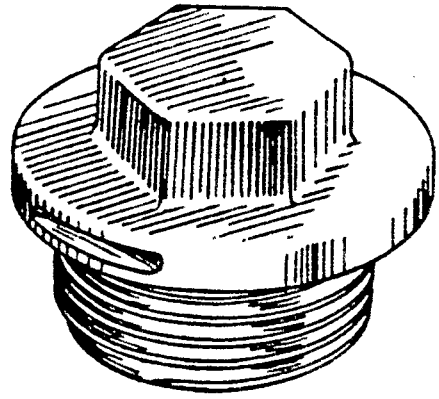
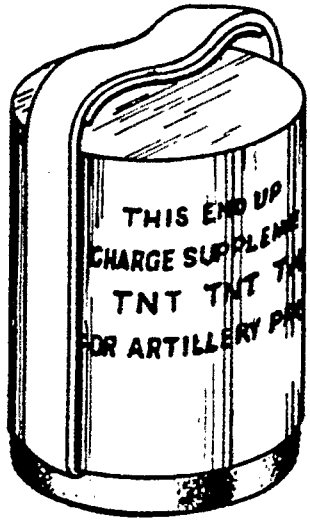


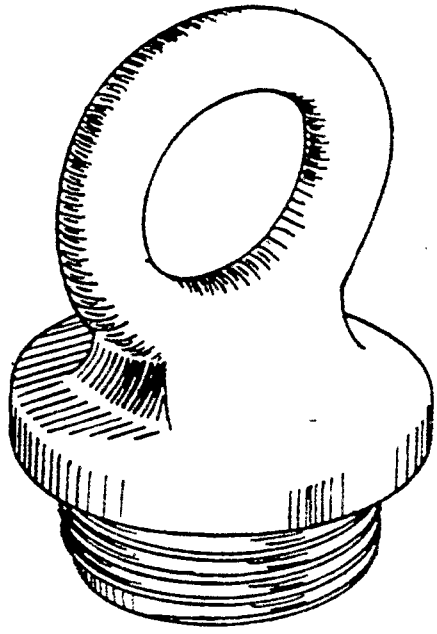
CARDBOARD SPACER



CLOSING PLUG

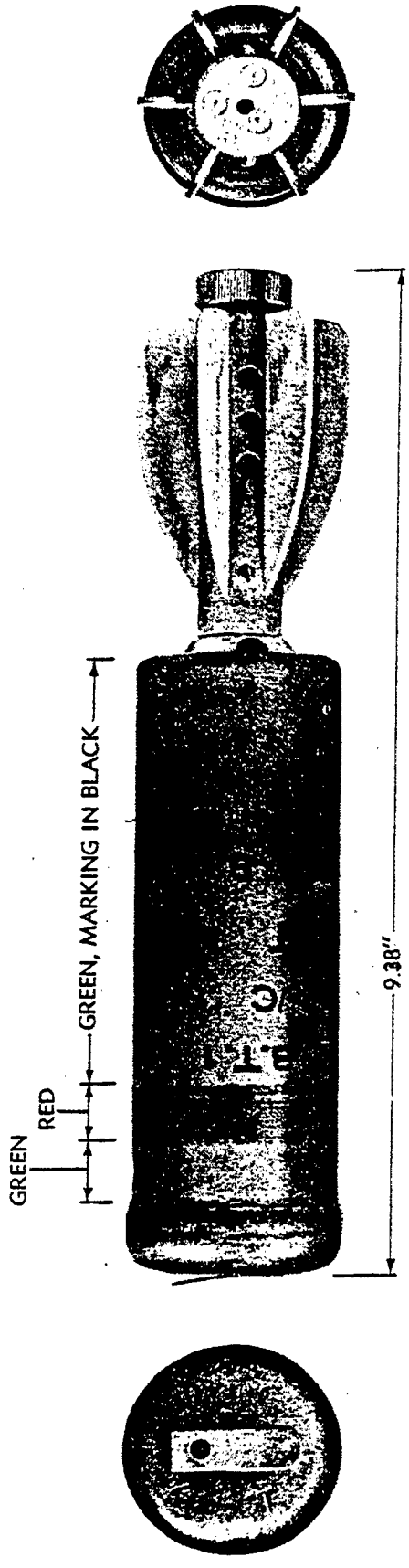


SUPPLEMENTARY CHARGE

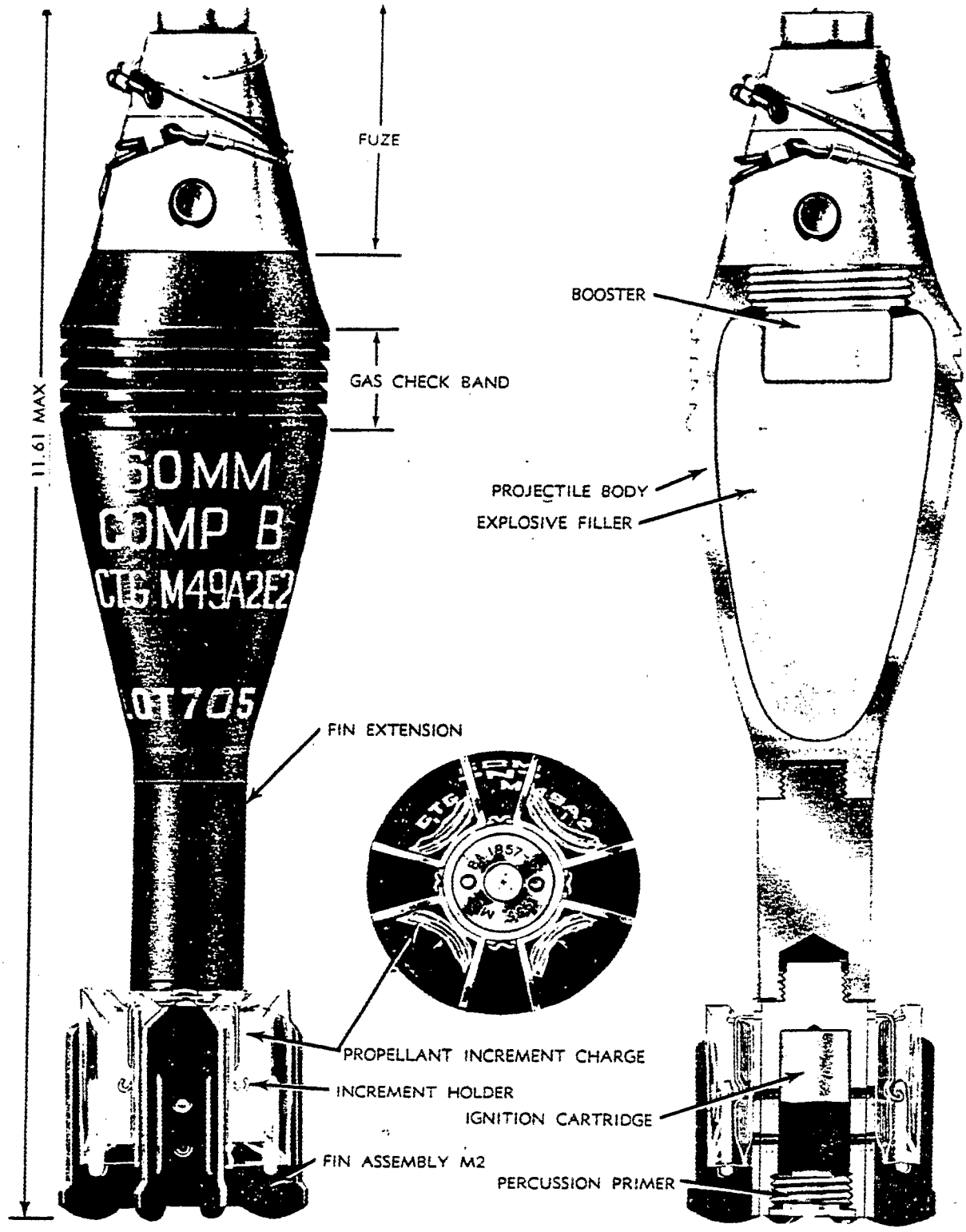


EYEBOLT LIFTING PLUG

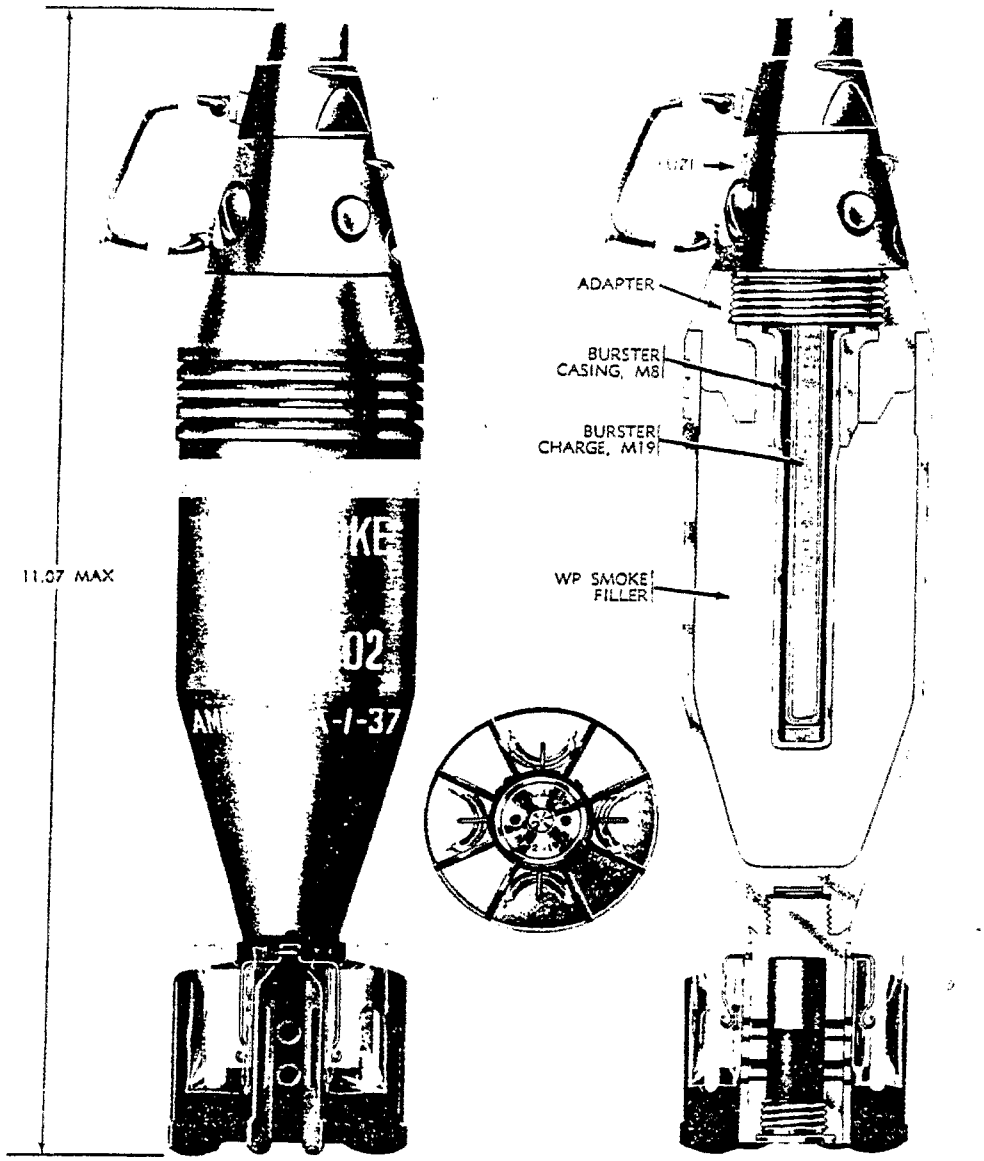
PROJECTILE ACCESSORIES



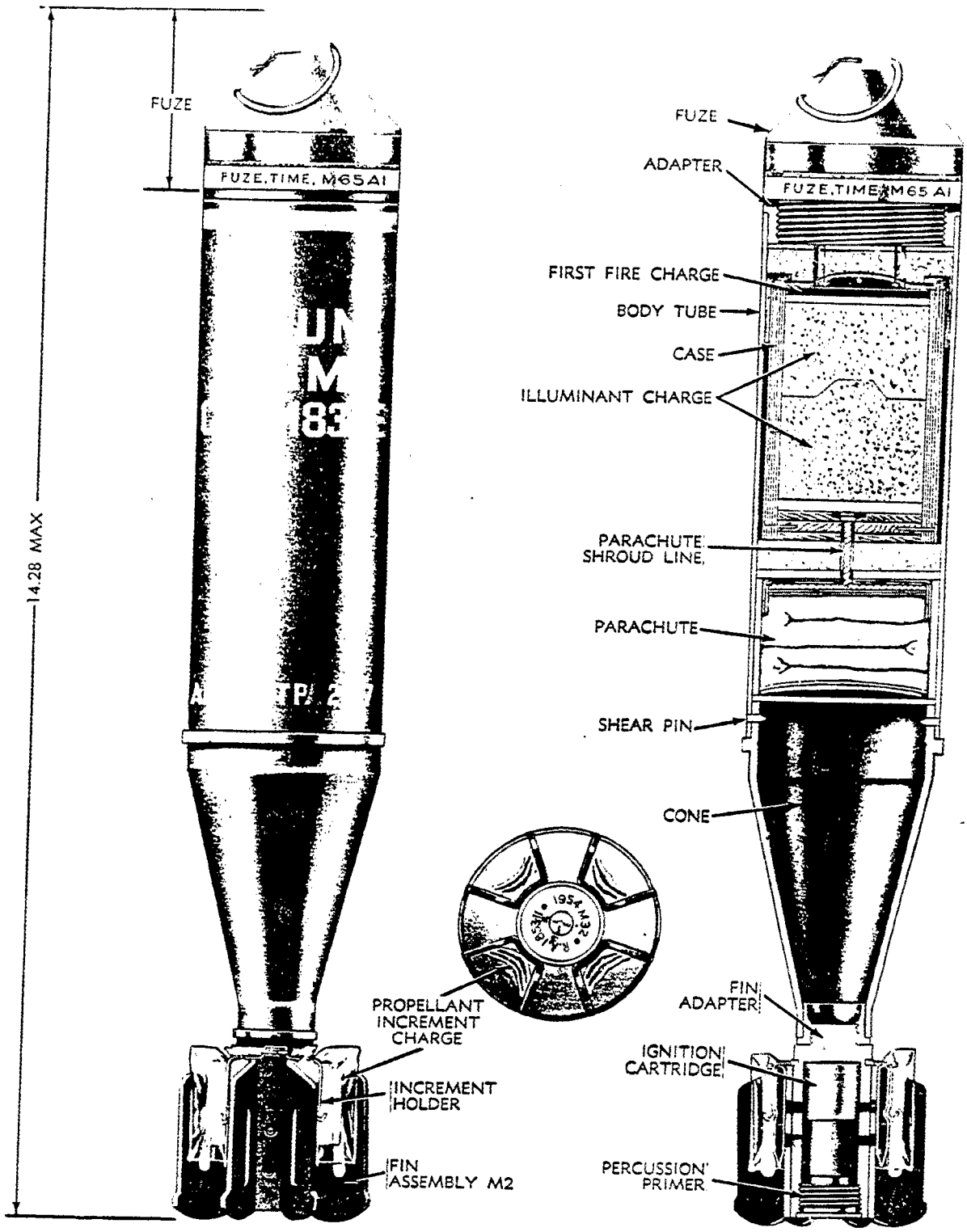
2" MORTAR SMOKE BOMB



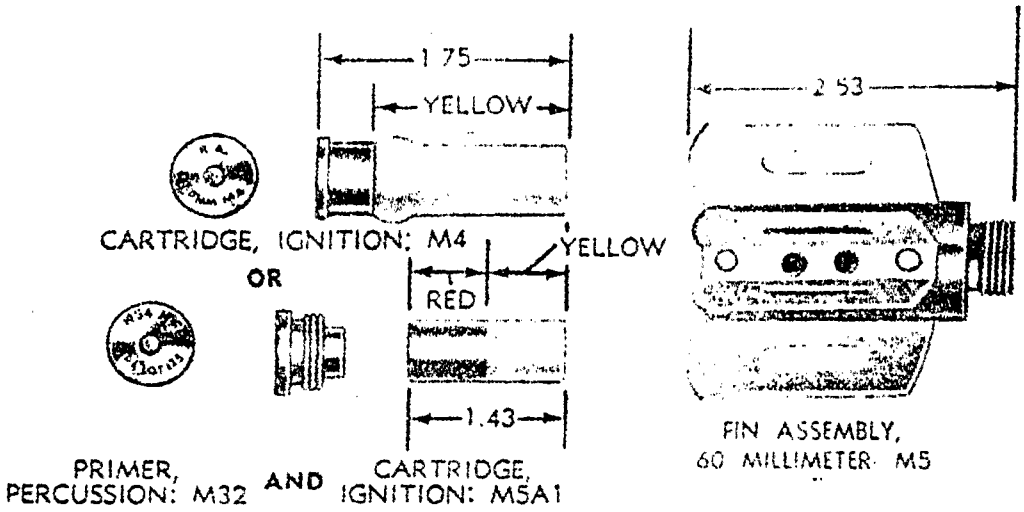
60MM HIGH EXPLOSIVE MORTAR CARTRIDGE

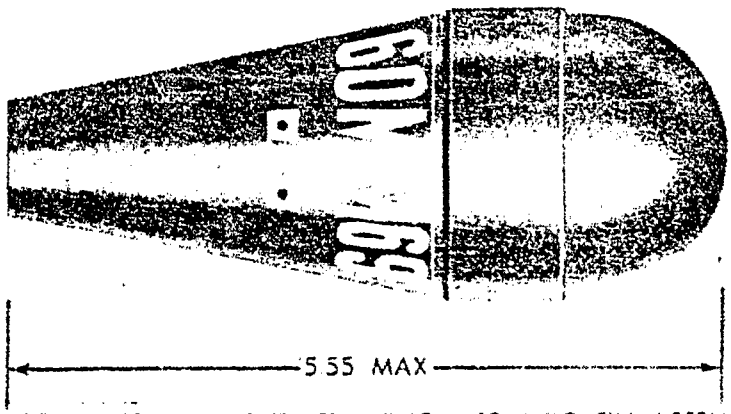


60MM WHITE PHOSPHOROUS SMOKE MORTAR CARTRIDGE



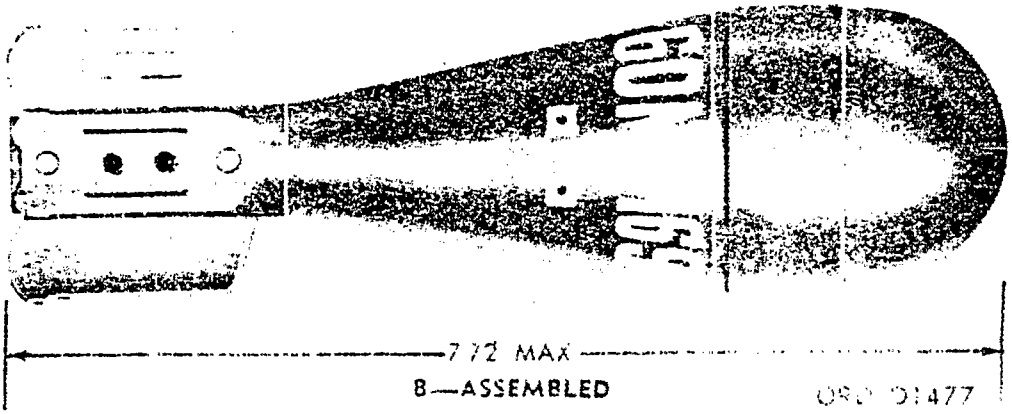
60MM ILLUMINATING MORTAR CARTRIDGE





PROJECTILE, 60 MILLIMETER TRAINING, M69, W/O FIN ASSEMBLY

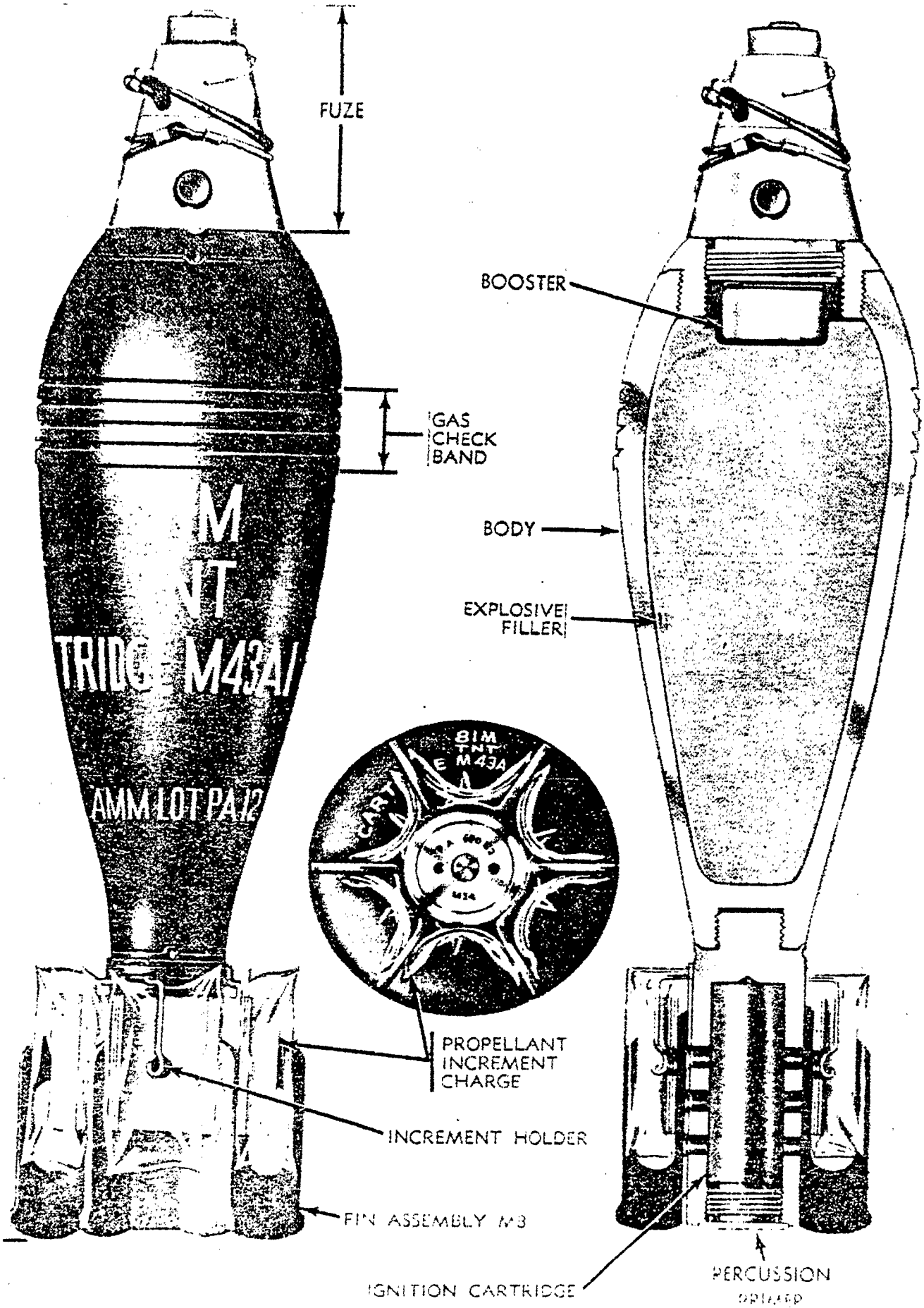
A—COMPONENTS



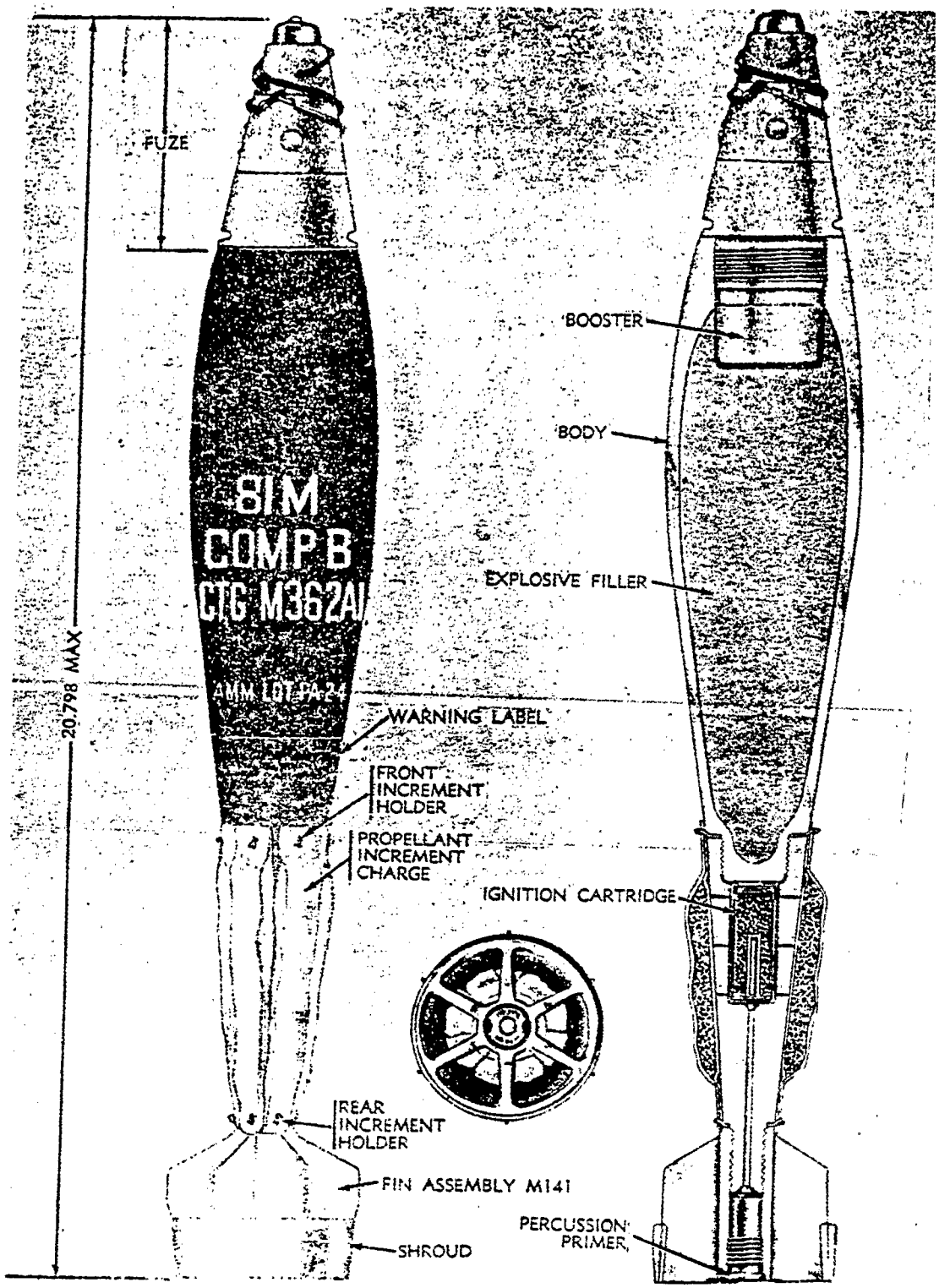
B—ASSEMBLED

ORD 01477

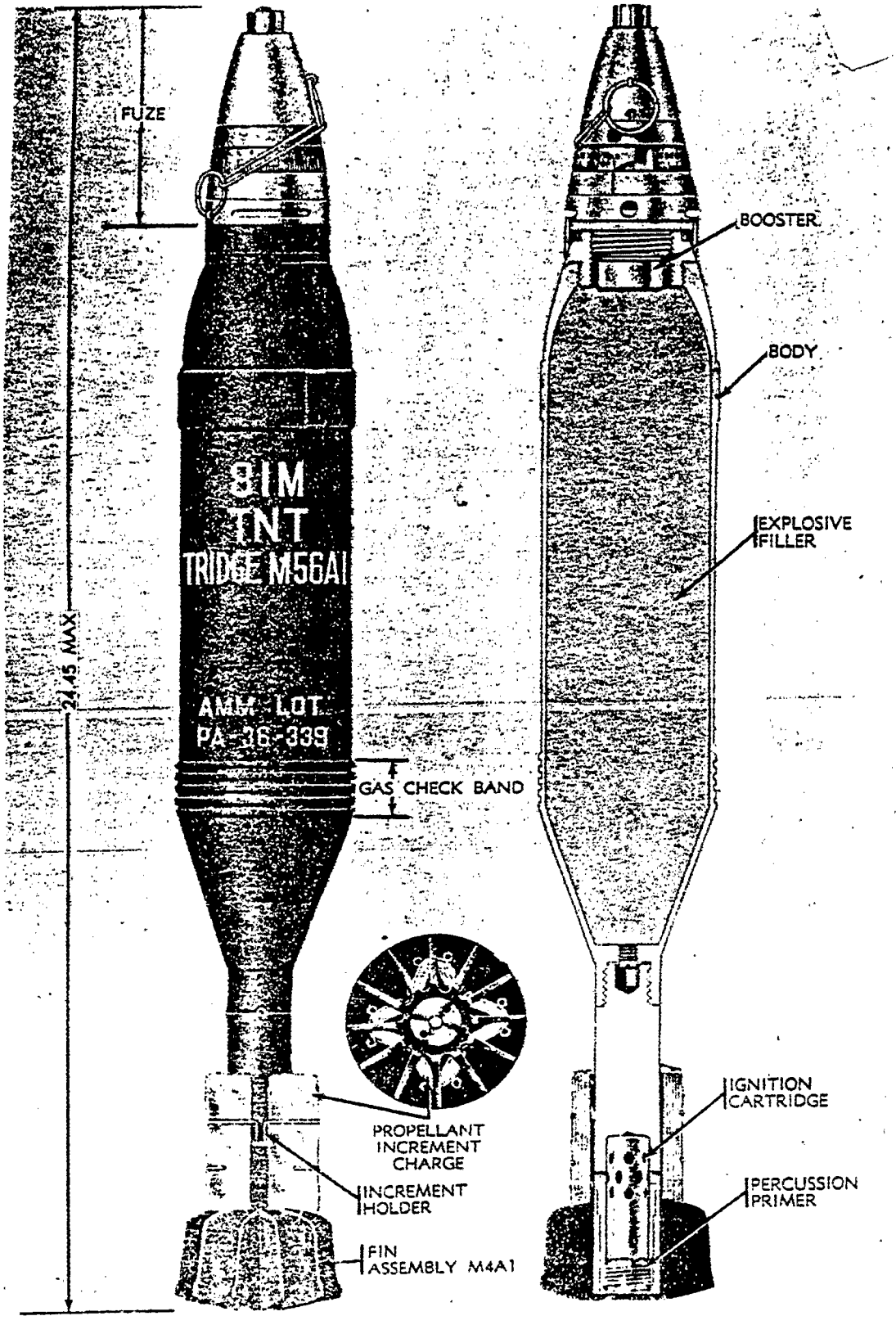
60MM PRACTICE MORTAR CARTRIDGE



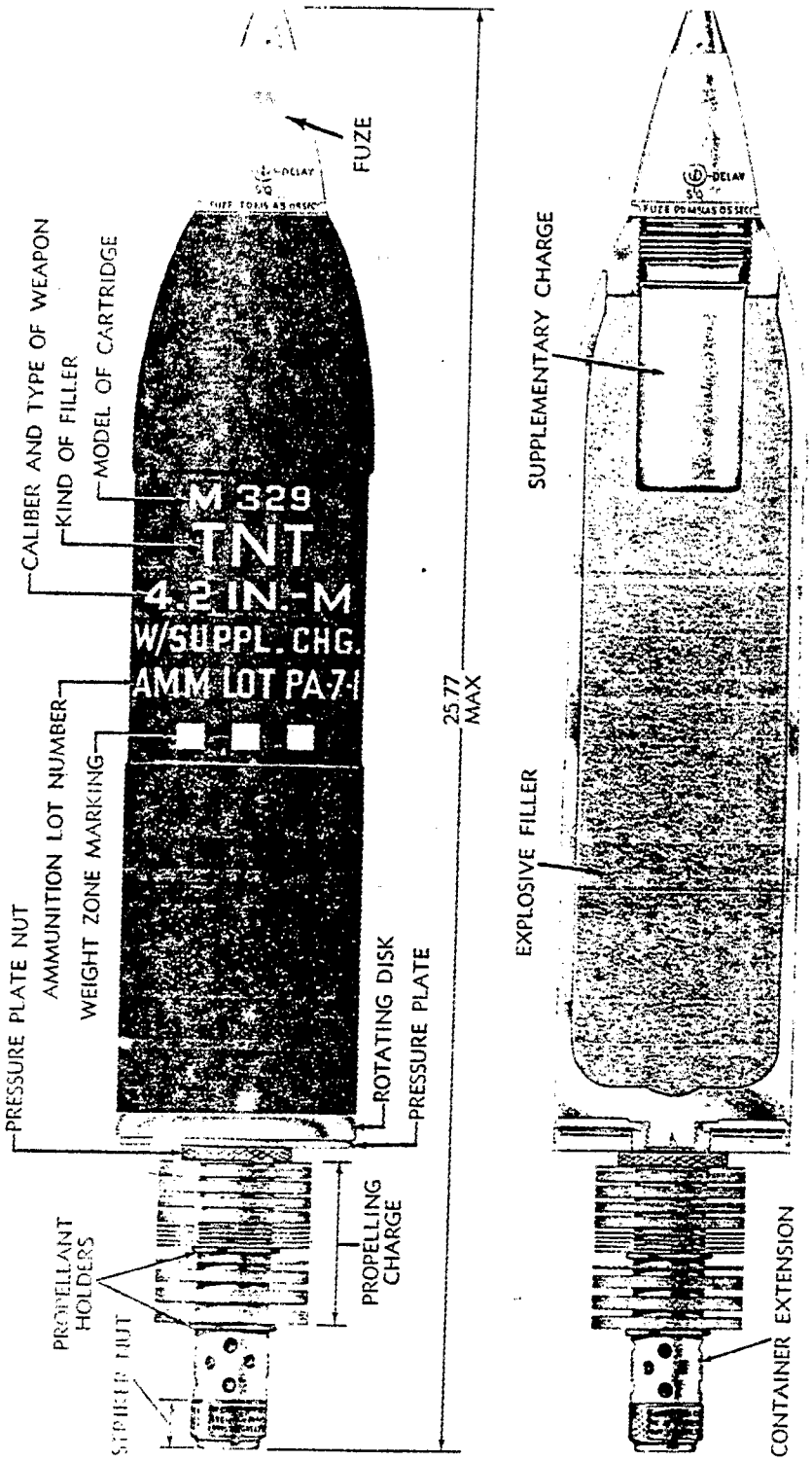
81MM HIGH EXPLOSIVE MORTAR CARTRIDGE



81MM HIGH EXPLOSIVE MORTAR CARTRIDGE



81MM HIGH EXPLOSIVE MORTAR CARTRIDGE



4.2" HIGH EXPLOSIVE MORTAR CARTRIDGE

ROCKET AMMUNITION
AND
COMPONENTS

ROCKETS HAVE SEEN MILITARY USE FOR CENTURIES. THE U.S. HAS EMPLOYED ROCKETS FROM AS SMALL AS ABOUT AN INCH IN DIAMETER TO SEVERAL FEET IN DIAMETER.

GENERAL STATEMENTS:

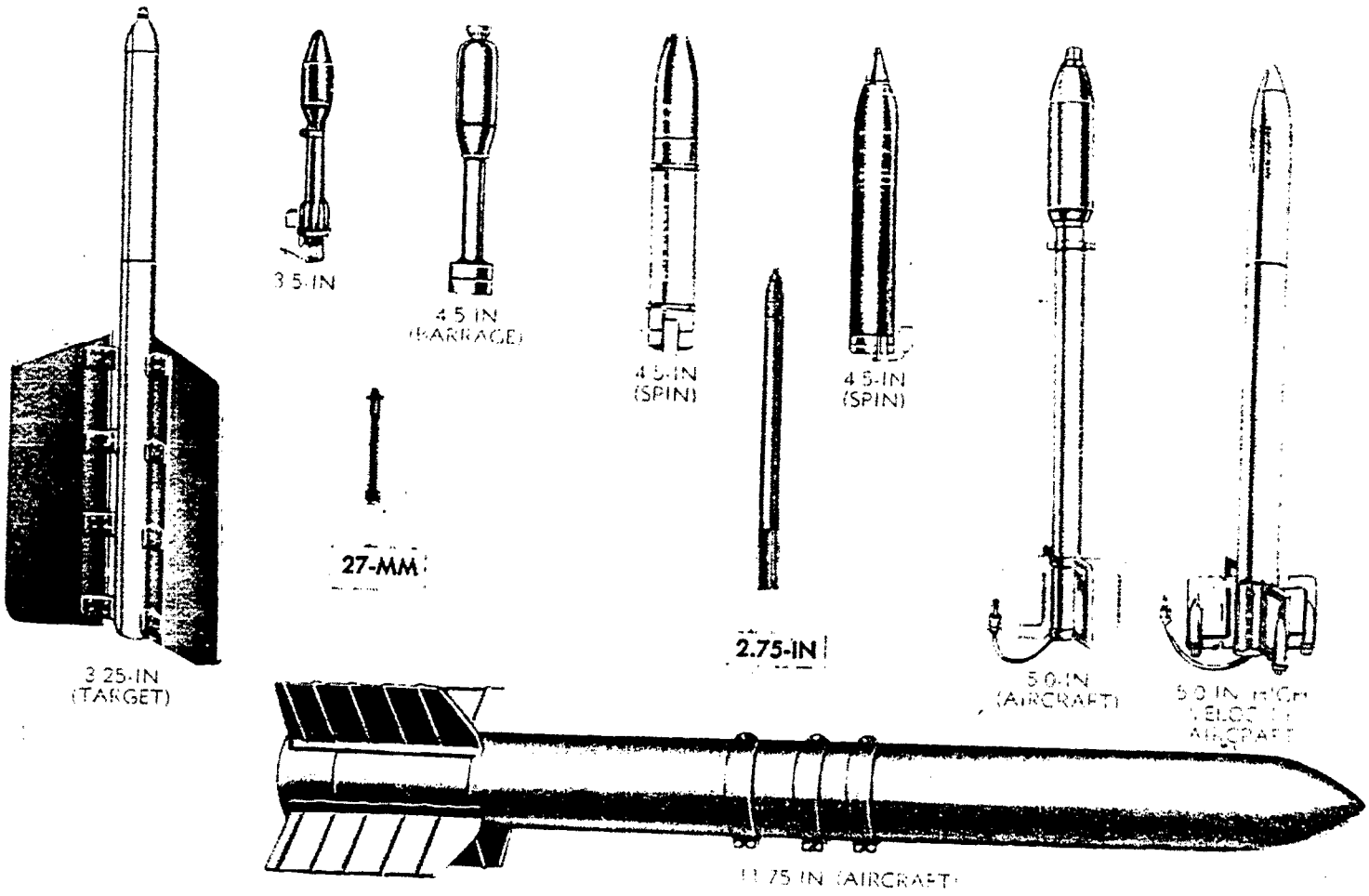
ROCKETS HAVE THREE MAIN COMPONENTS: A HEAD (OR IN MORE MODERN TERMS, A WARHEAD), A FUZE, AND A ROCKET MOTOR.

ROCKET MOTORS MAY BE IGNITED EITHER BY FLAME (OFTEN FROM A PRIMER) OR ELECTRICITY.

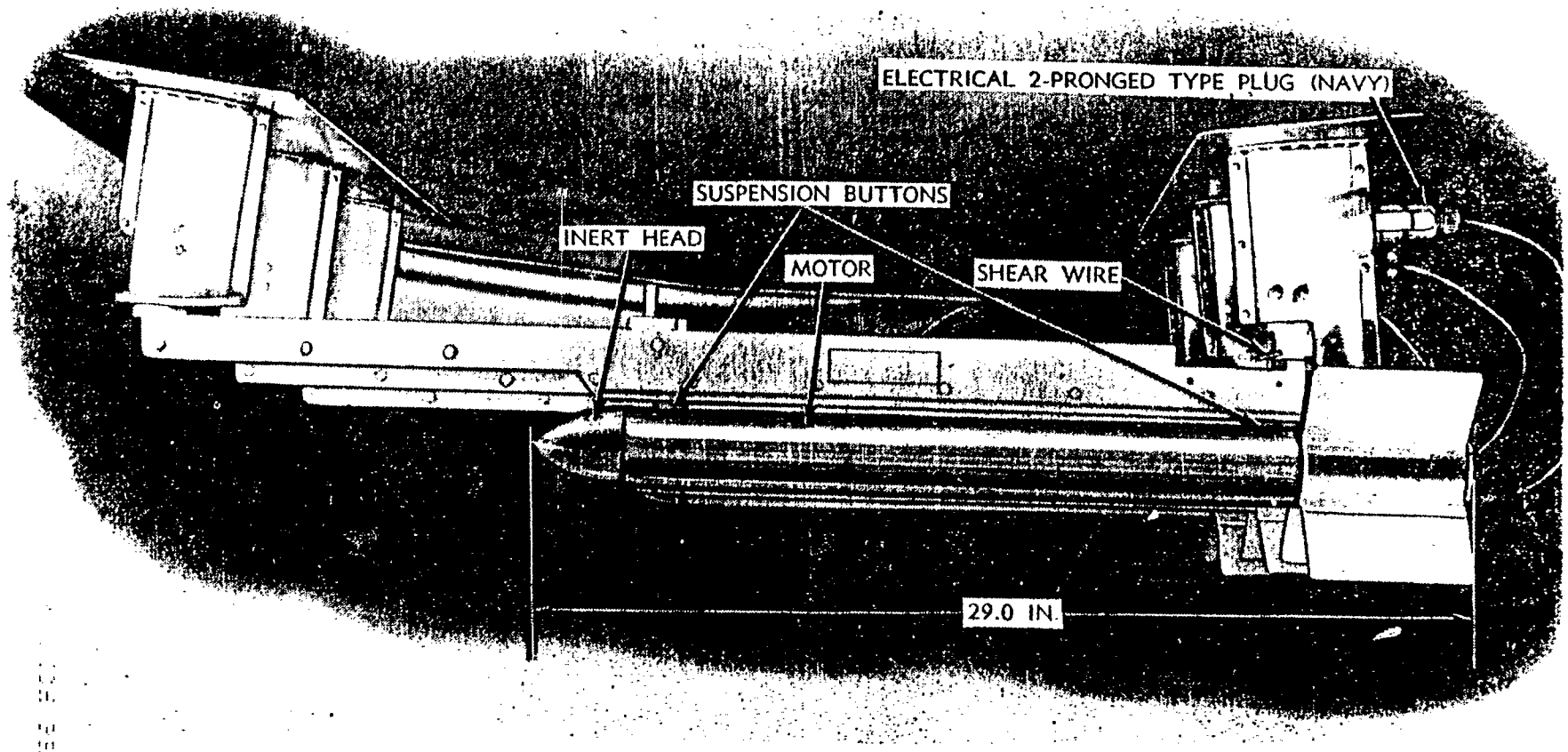
UNFIRED ROCKET MOTORS, ESPECIALLY WHEN ASSEMBLED TO HEADS, IF INADVERTANTLY IGNITED WILL TRY TO FLY.

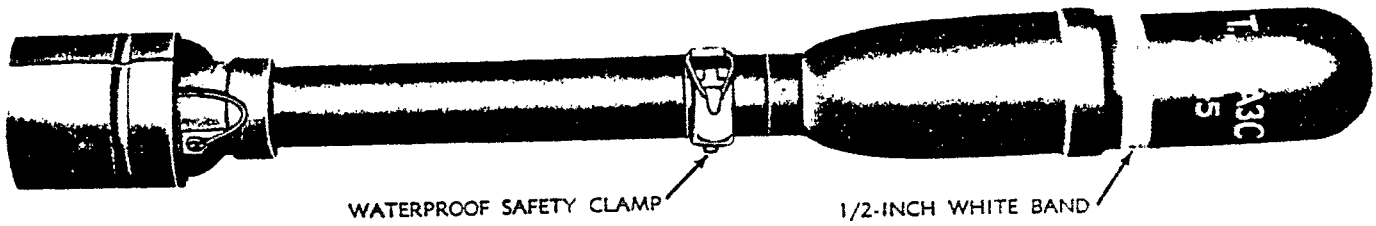
ROCKETS MAY BE IDENTIFIED BY THE PRESENCE OF ONE OR MORE ROCKET MOTOR NOZZLES.

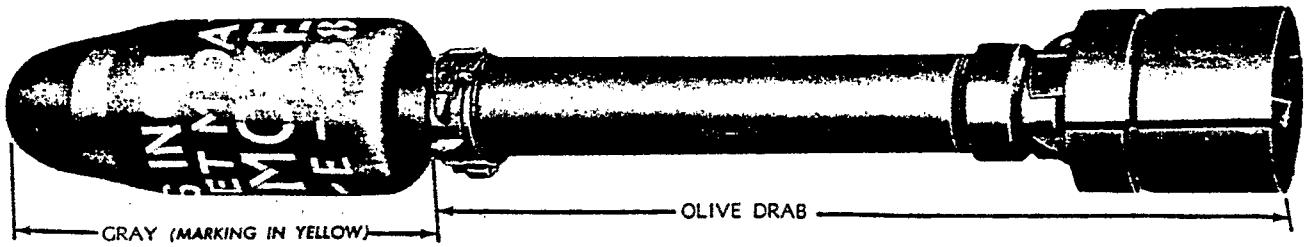
ROCKETS HAVE BEEN DEVELOPED TO CARRY ALL TYPES OF HEADS, FROM INERT, HIGH EXPLOSIVE, SMOKE, TOXIC CHEMICAL TO NUCLEAR.



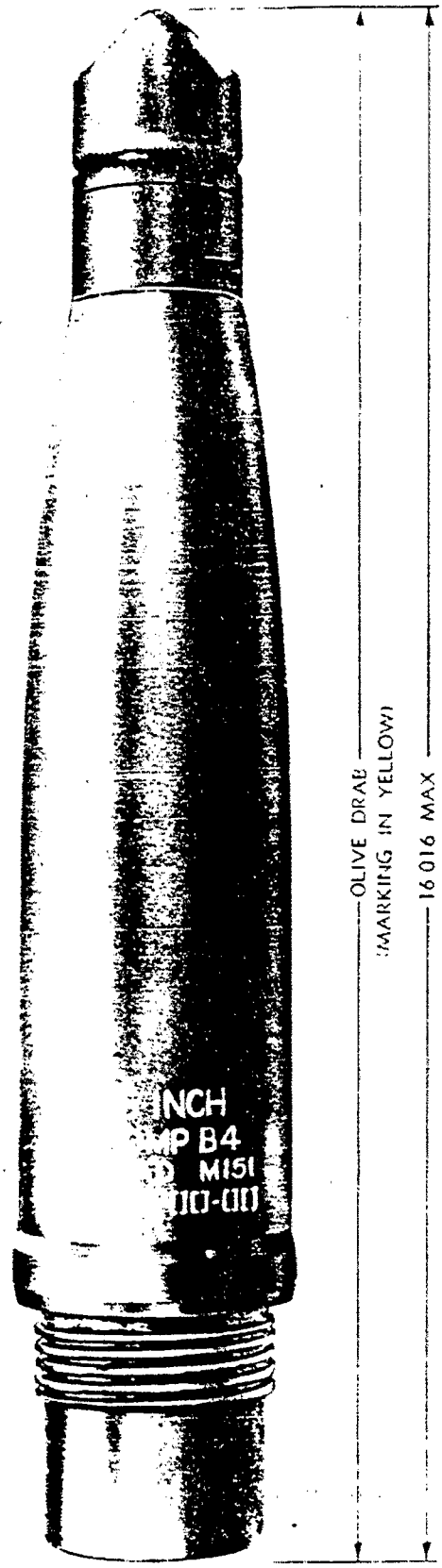
TYPICAL EXAMPLES OF MILITARY ROCKETS AND THEIR RELATIVE SIZES

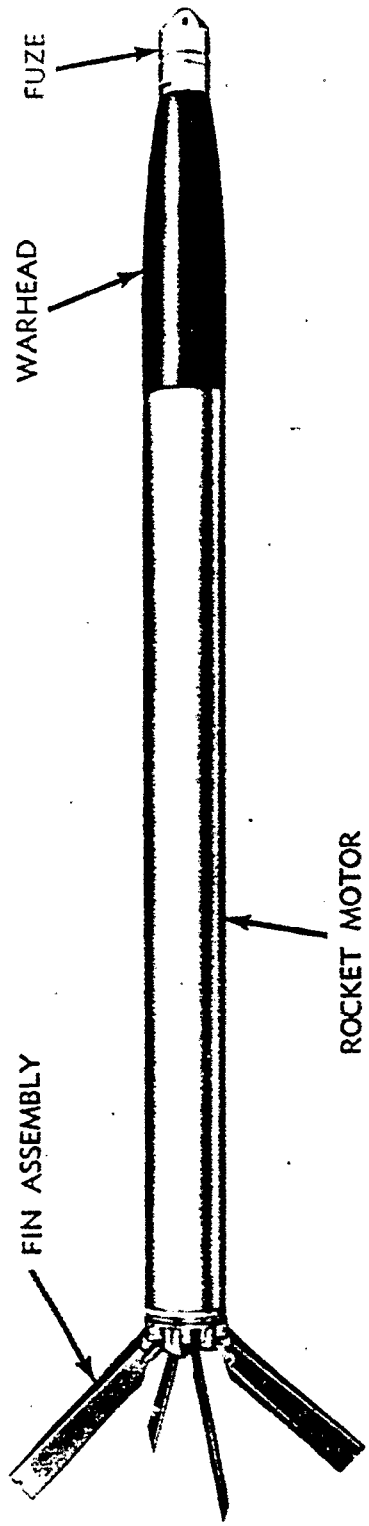

ELECTRICAL 2-PRONGED TYPE PLUG (NAVY)
SUSPENSION BUTTONS
INERT HEAD
MOTOR
SHEAR WIRE
29.0 IN.

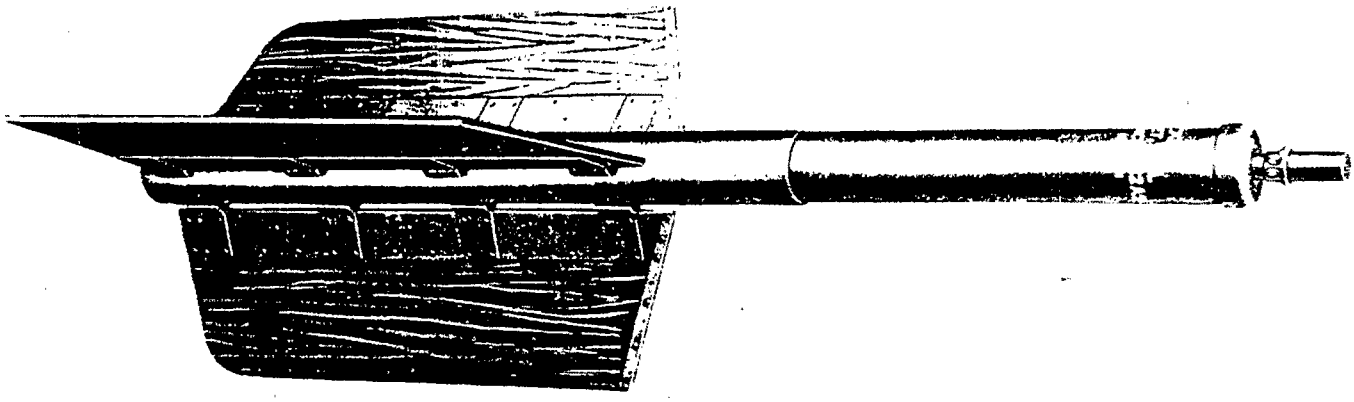




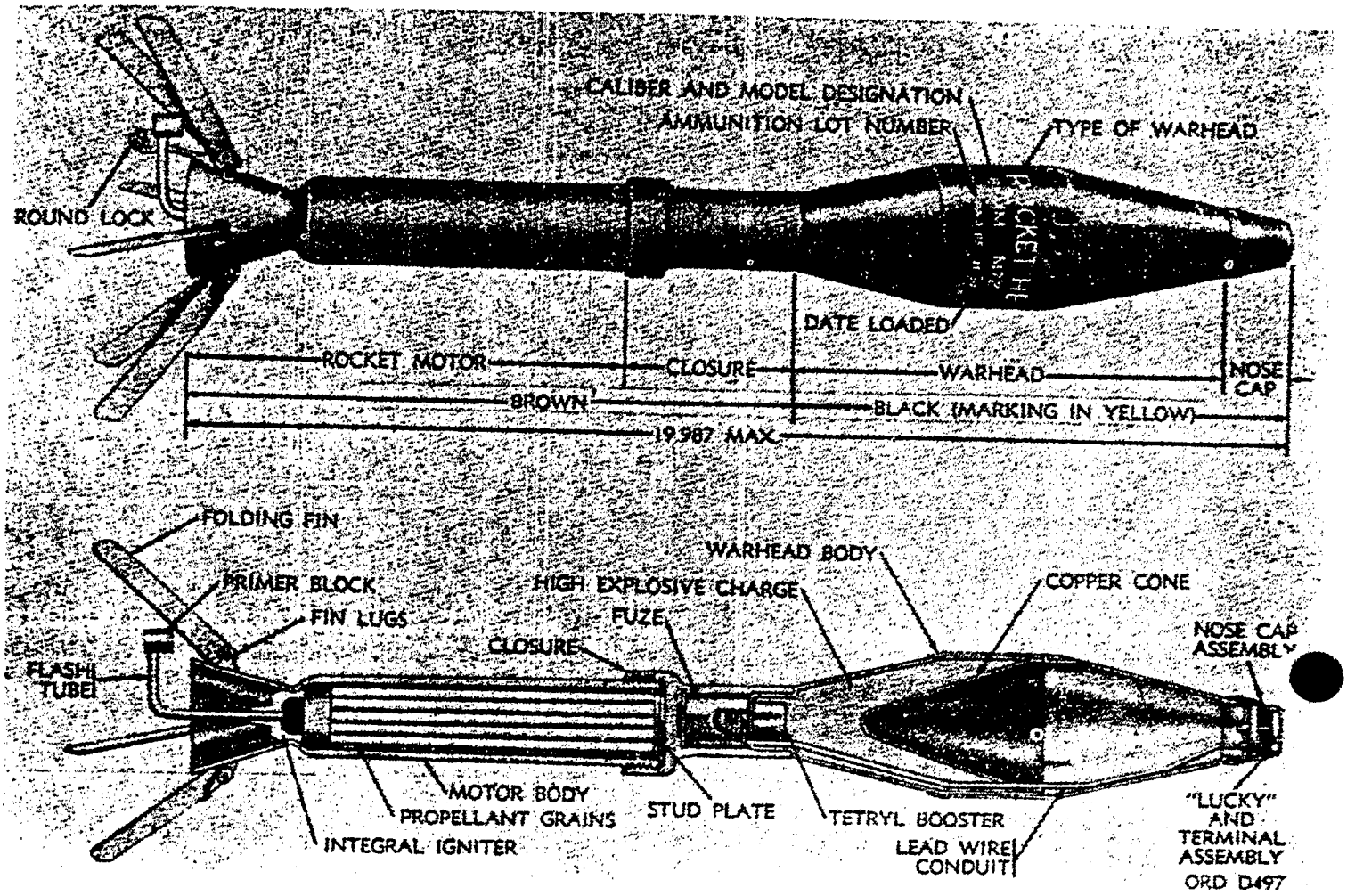
2.36 INCH ROCKETS


INCH
MP B4
M151
OLIVE DRAB
MARKING IN YELLOW
16.016 MAX


FUZE
WARHEAD
ROCKET MOTOR
FIN ASSEMBLY

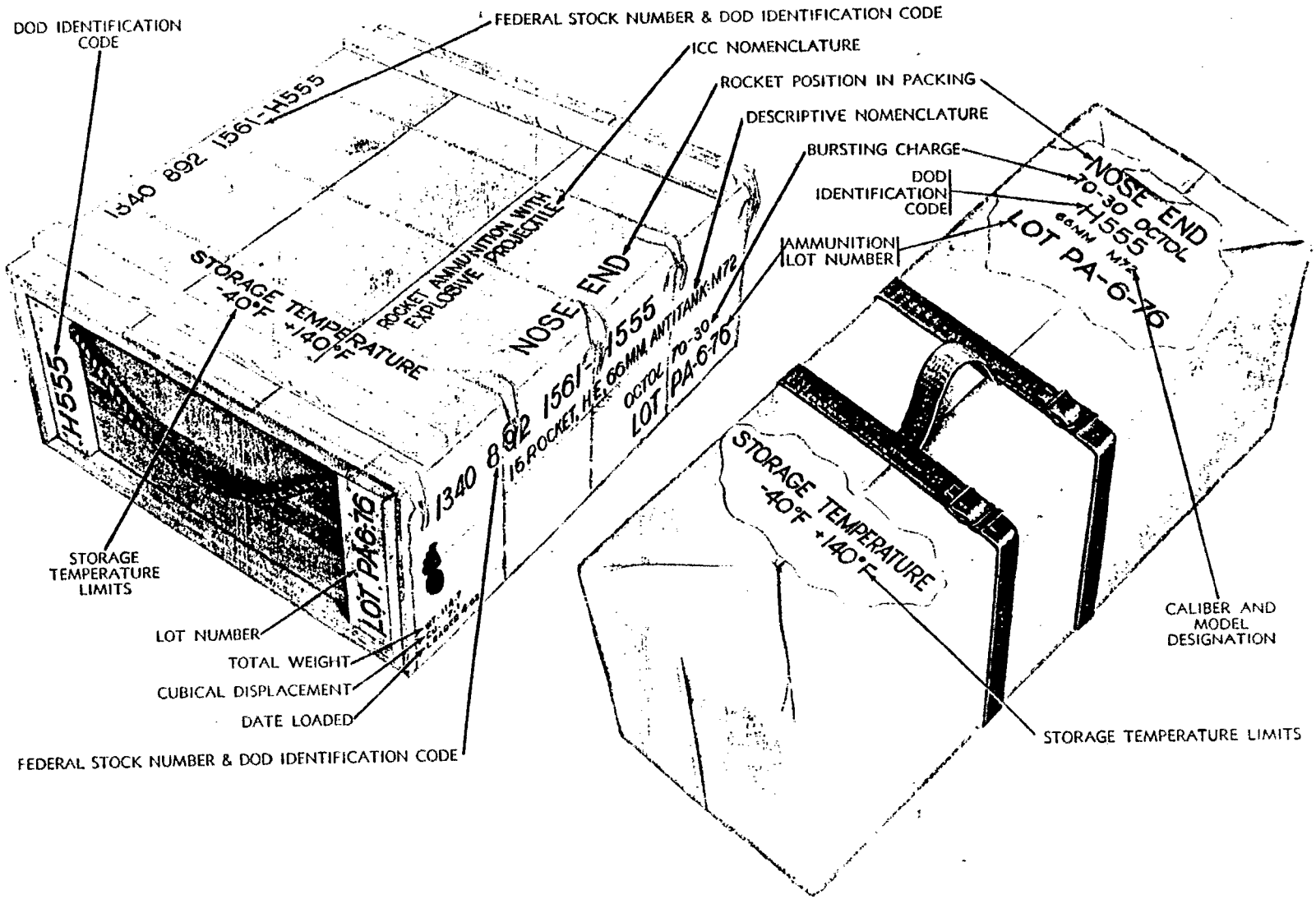


3.25
2.25 INCH TARGET ROCKET

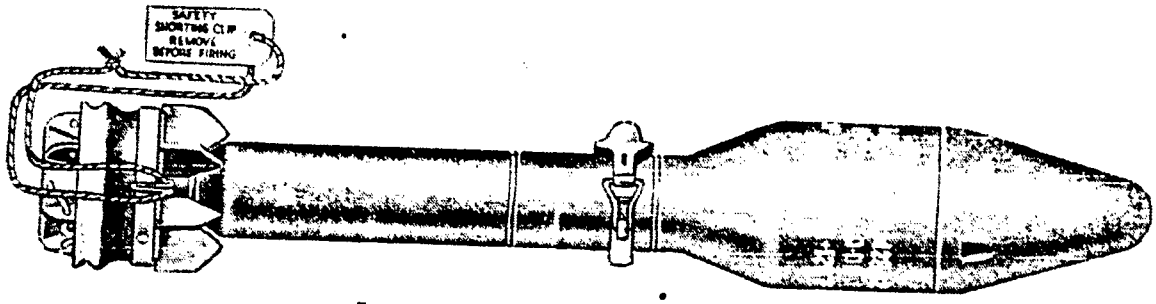

CALIBER AND MODEL DESIGNATION
AMMUNITION LOT NUMBER
TYPE OF WARHEAD
ROUND LOCK
DATE LOADED
ROCKET MOTOR
CLOSURE
WARHEAD
NOSE CAP
BROWN
BLACK (MARKING IN YELLOW)
19.987 MAX
FOLDING FIN
PRIMER BLOCK
FIN LUGS
FLASH TUBE
CLOSURE
HIGH EXPLOSIVE CHARGE
FUZE
WARHEAD BODY
COPPER CONE
NOSE CAP ASSEMBLY
MOTOR BODY
PROPELLANT GRAINS
INTEGRAL IGNITER
STUD PLATE
TETRYL BOOSTER
LEAD WIRE CONDUIT
"LUCKY" AND TERMINAL ASSEMBLY
ORD D497

66 MM ROCKET

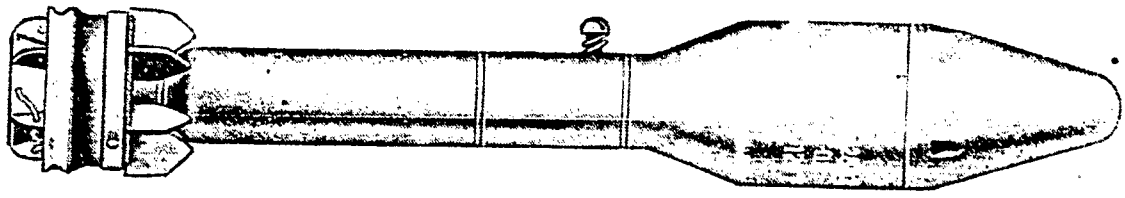
66 MM ROCKET (LAW) LAUNCHER IN THE CLOSED POSITION



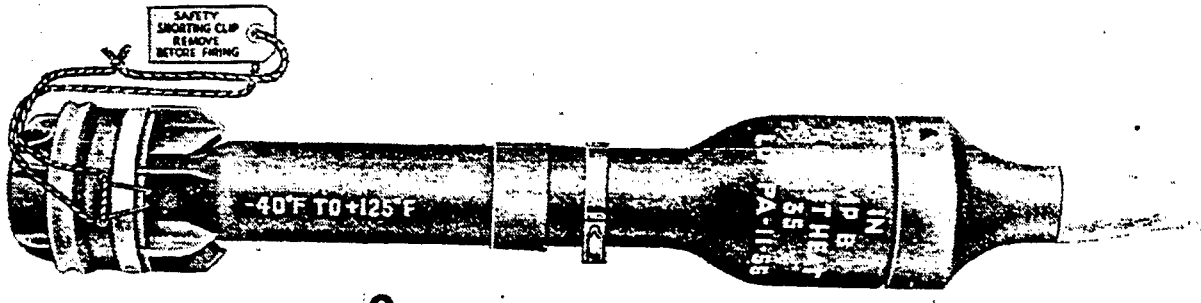
PACKAGING FOR THE 66 MM ROCKET



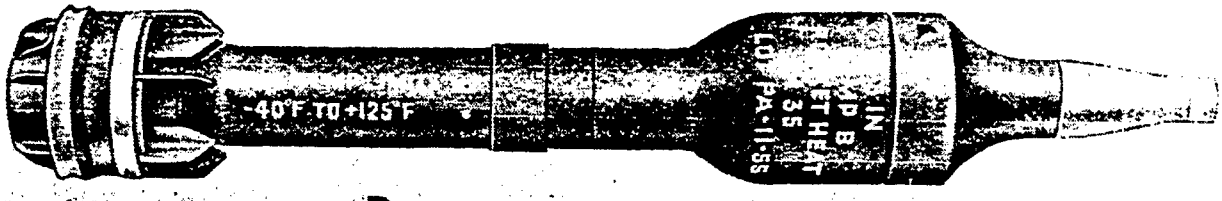
A—ROCKET M28A2, AS PACKED



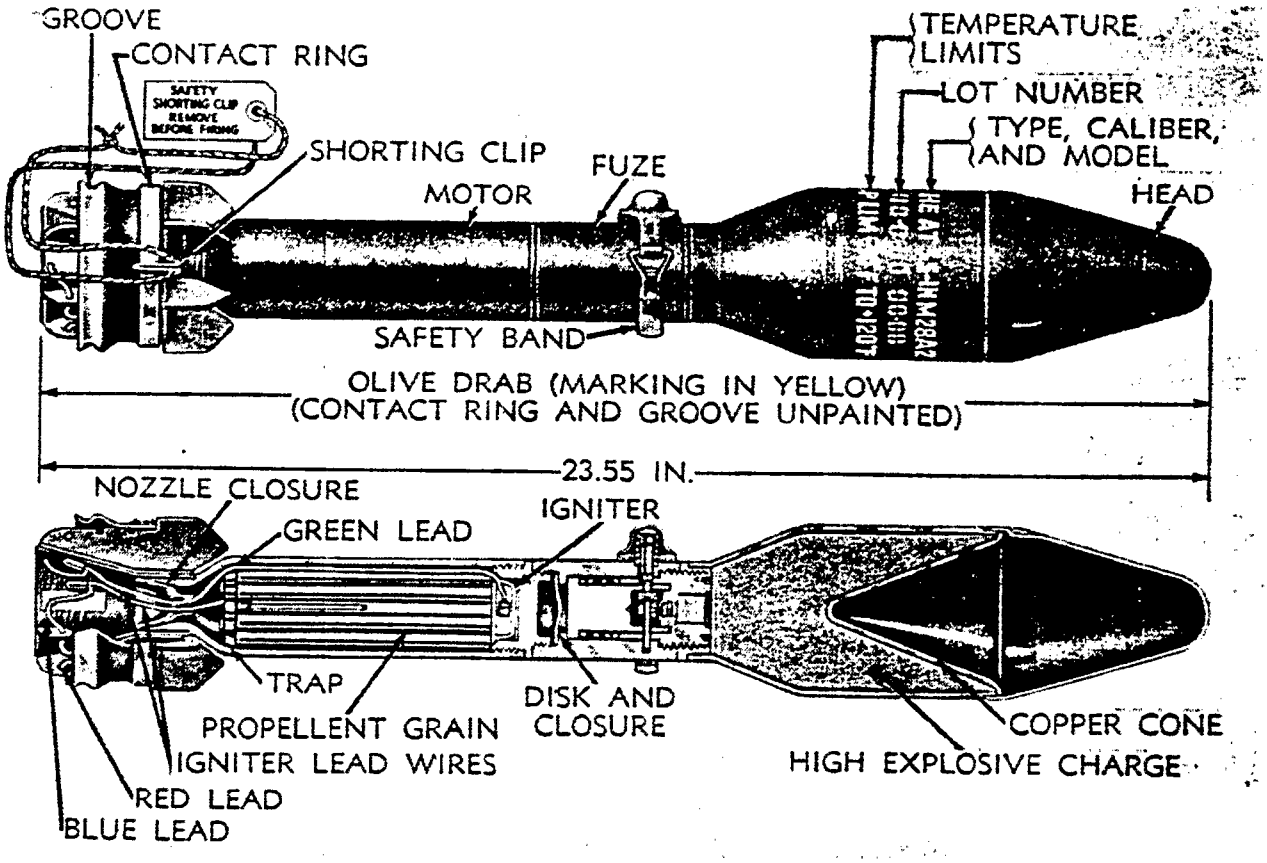
B—ROCKET M28A2, AS FIRED



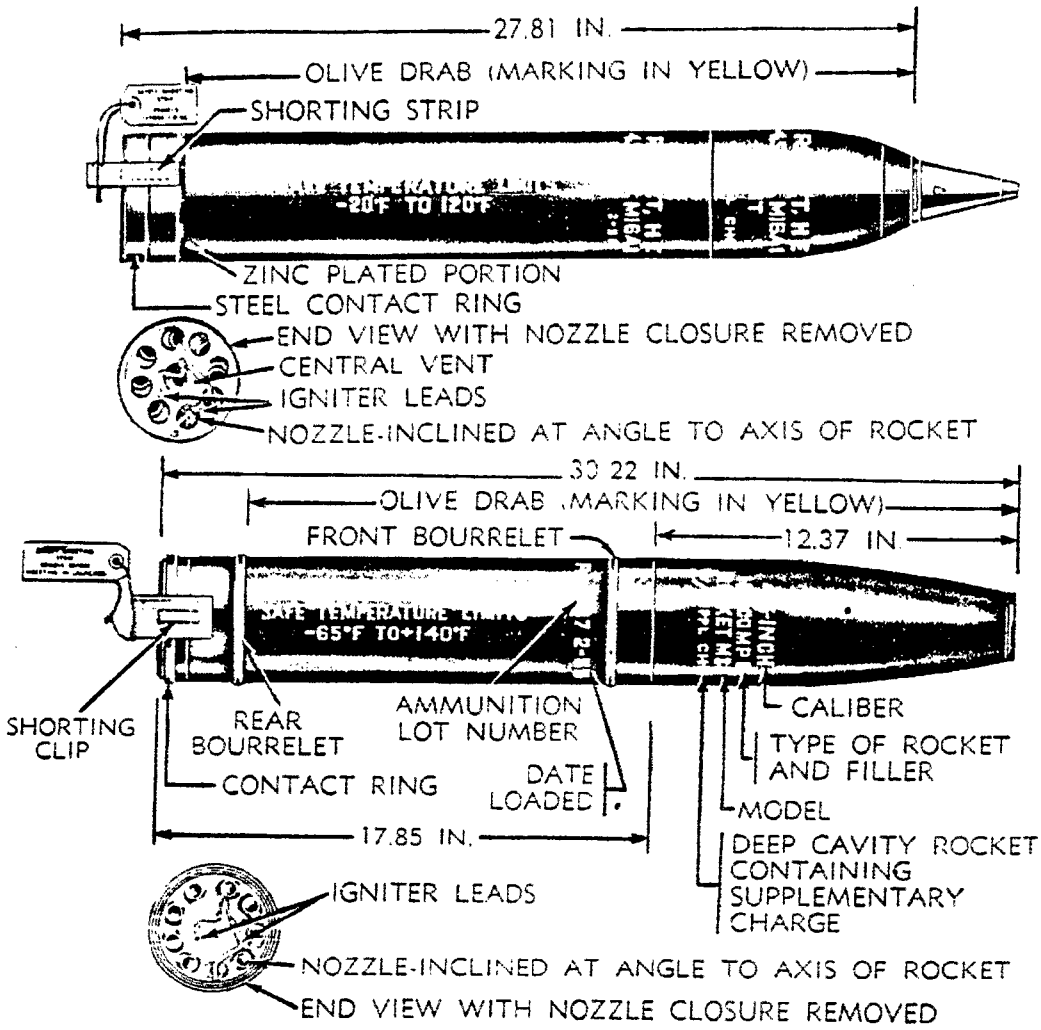
C—ROCKET M35, AS PACKED



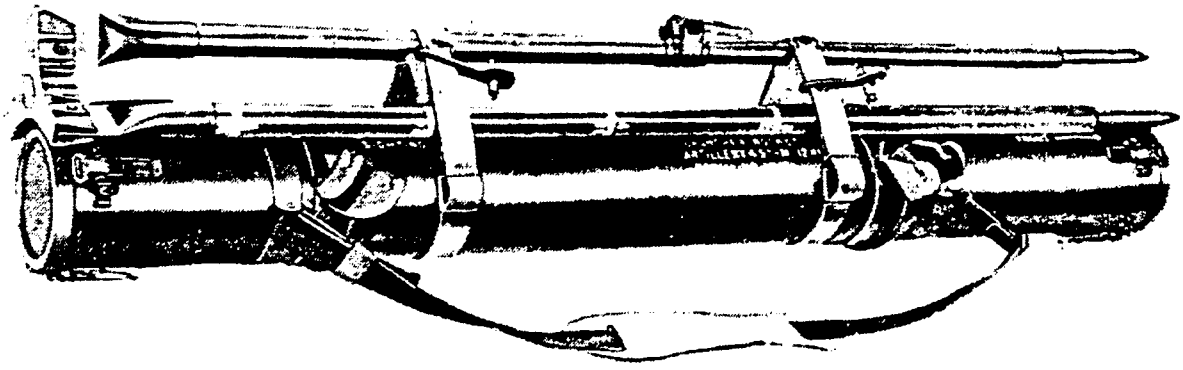
D—ROCKET M35, AS FIRED



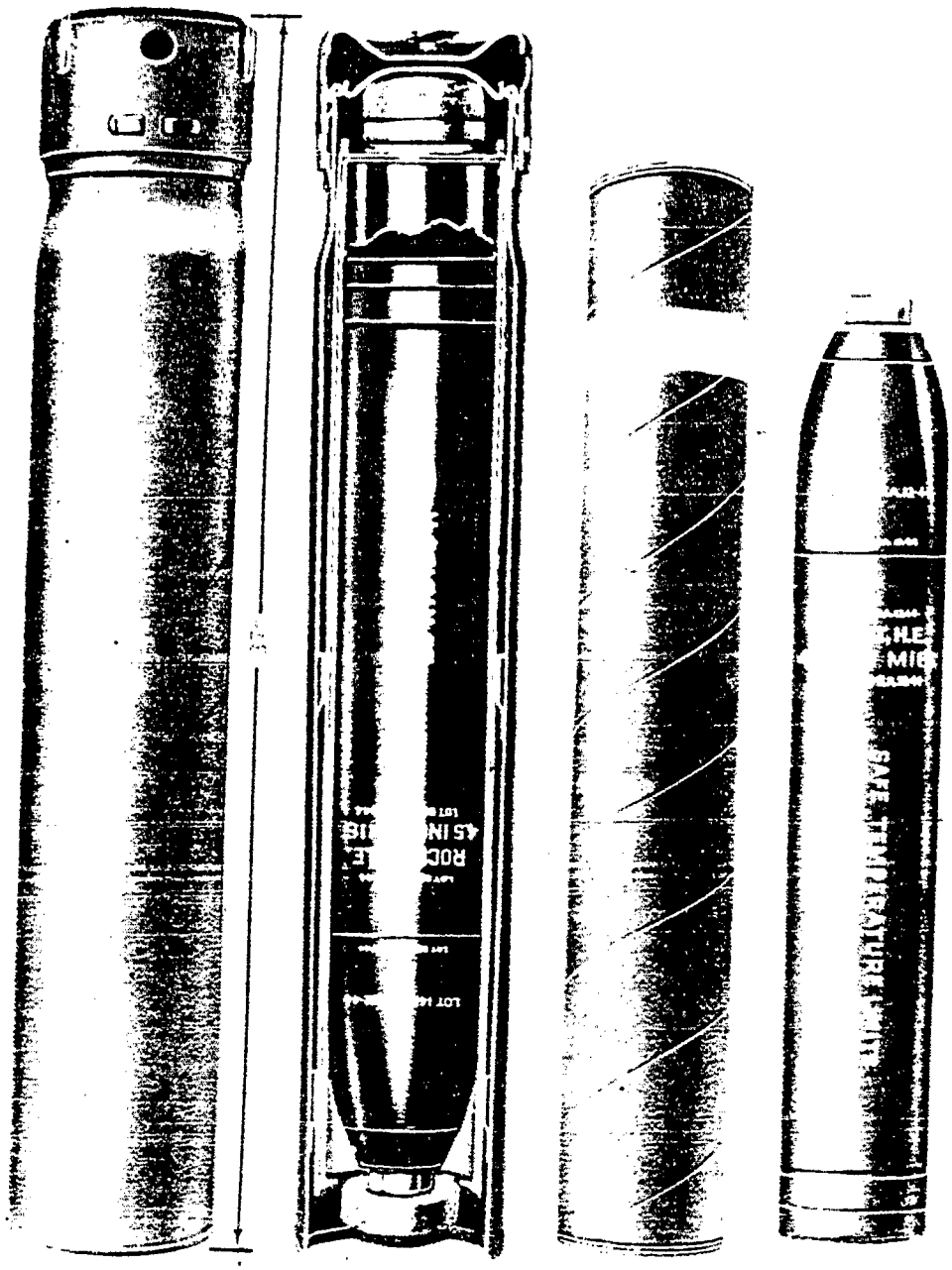
3.5 INCH ROCKET



4.5 INCH ROCKETS AND EXPENDABLE LAUNCHER



4.5 INCH ROCKET

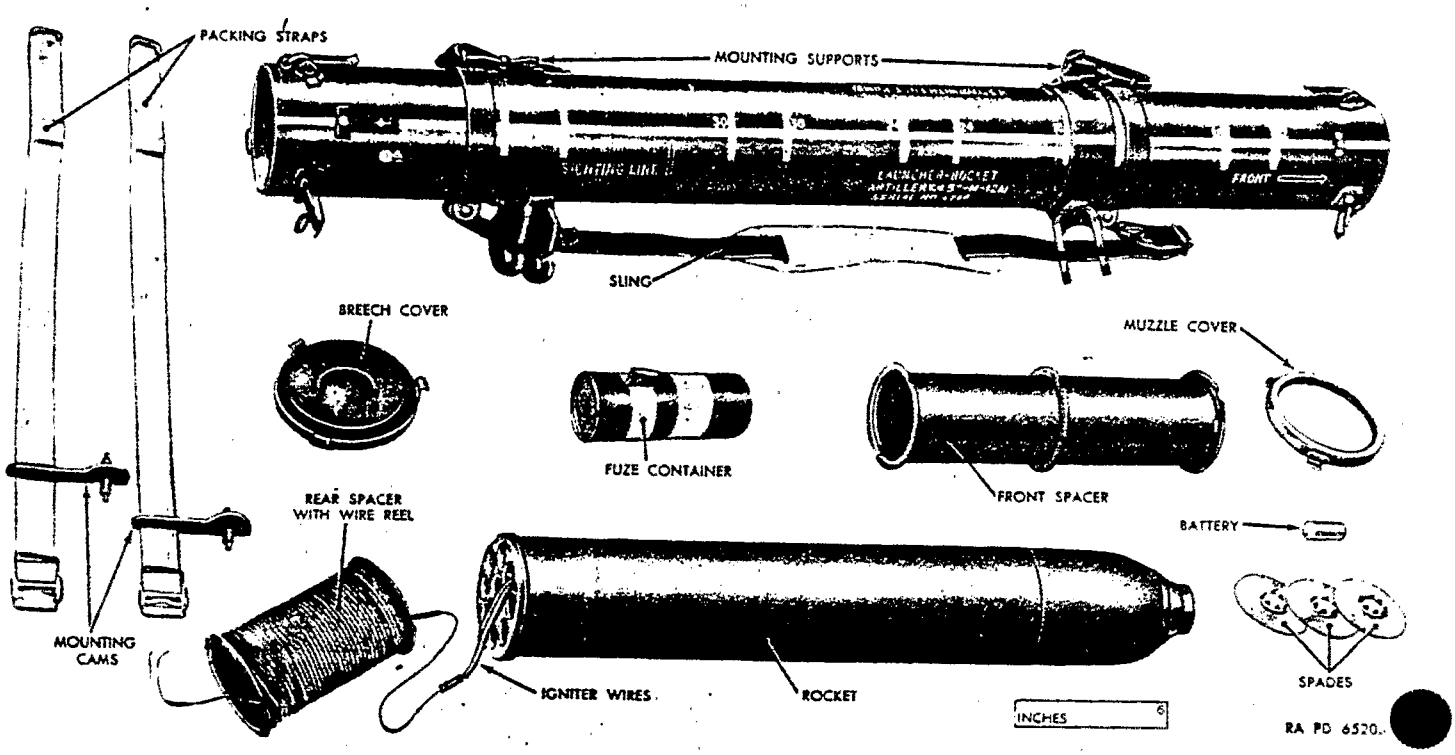


OUTER METAL CONTAINER SHOWING ROCKET AND INNER CONTAINER IN PLACE

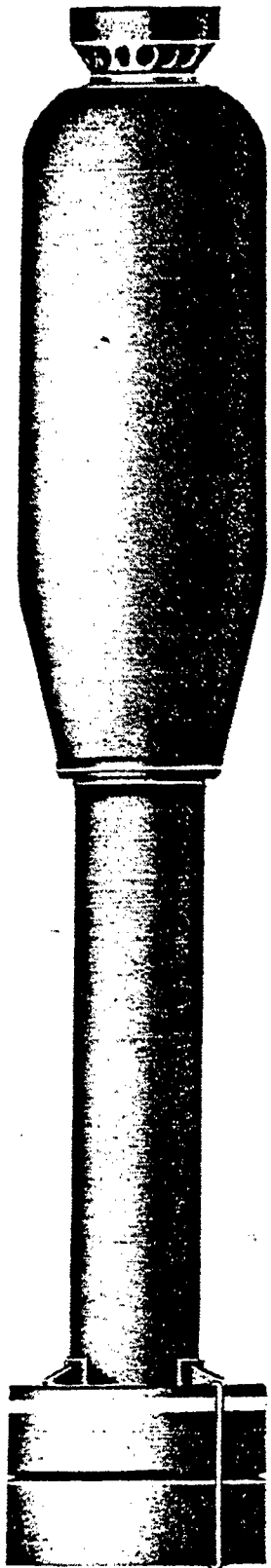
INNER FIBER CONTAINER

ROCKET WITH NOSE PLUG

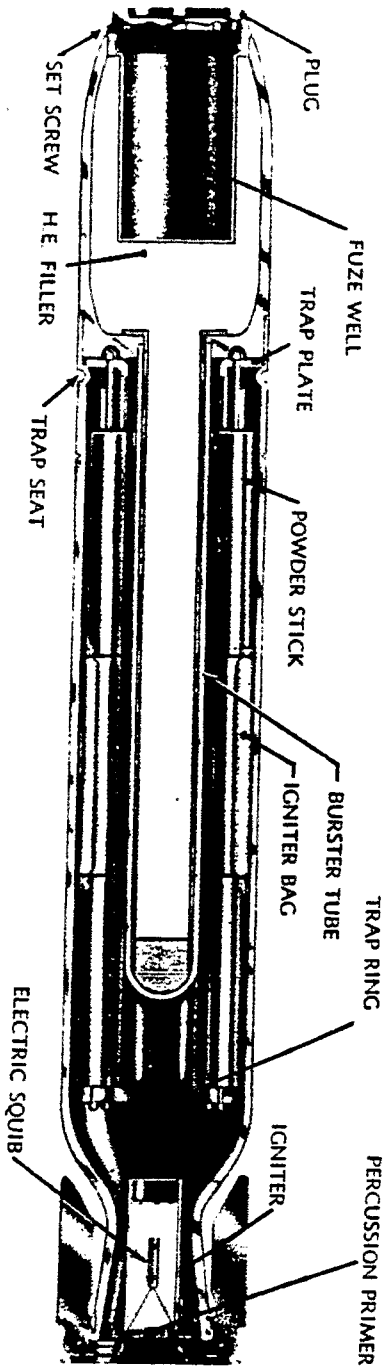
TYPICAL PACKING CONFIGURATIONS FOR 4.2 INCH ROCKETS

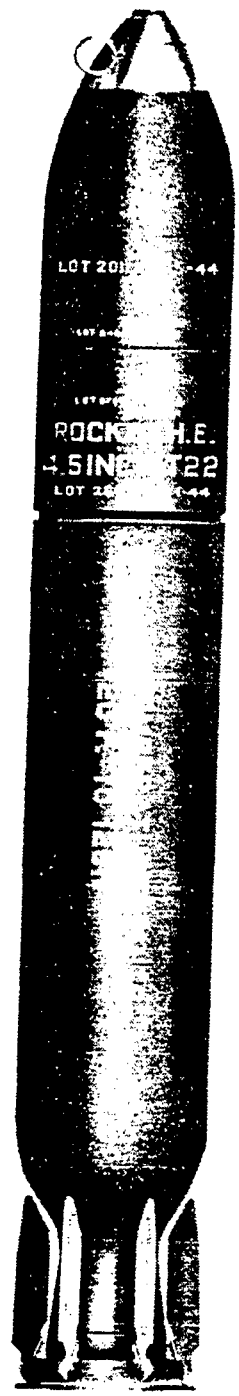


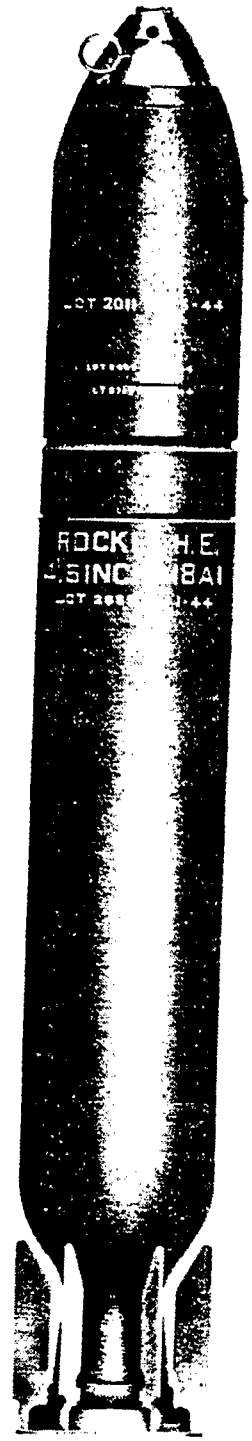
4.5 INCH SPIN ROCKET WITH ACCESSORIES



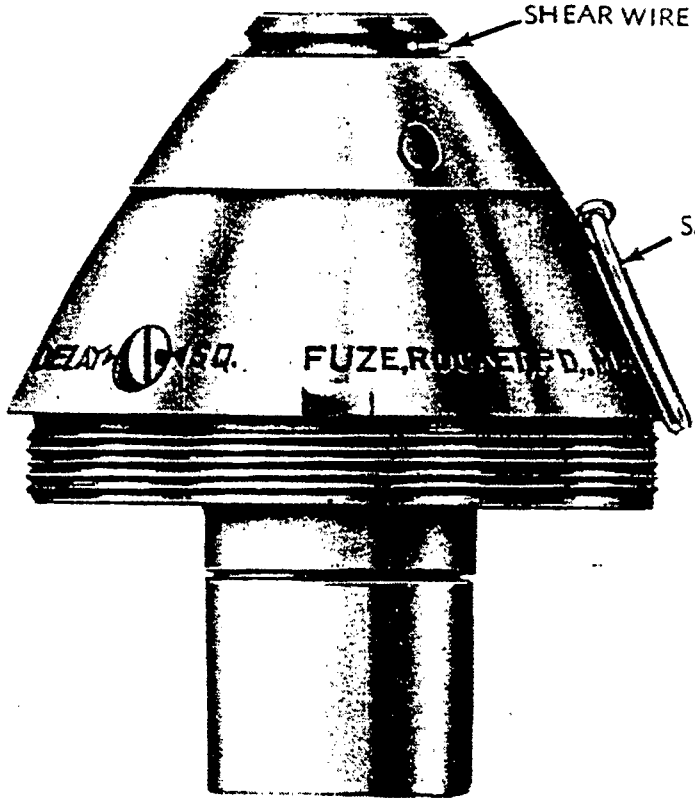
4.5 INCH BARRAGE ROCKET



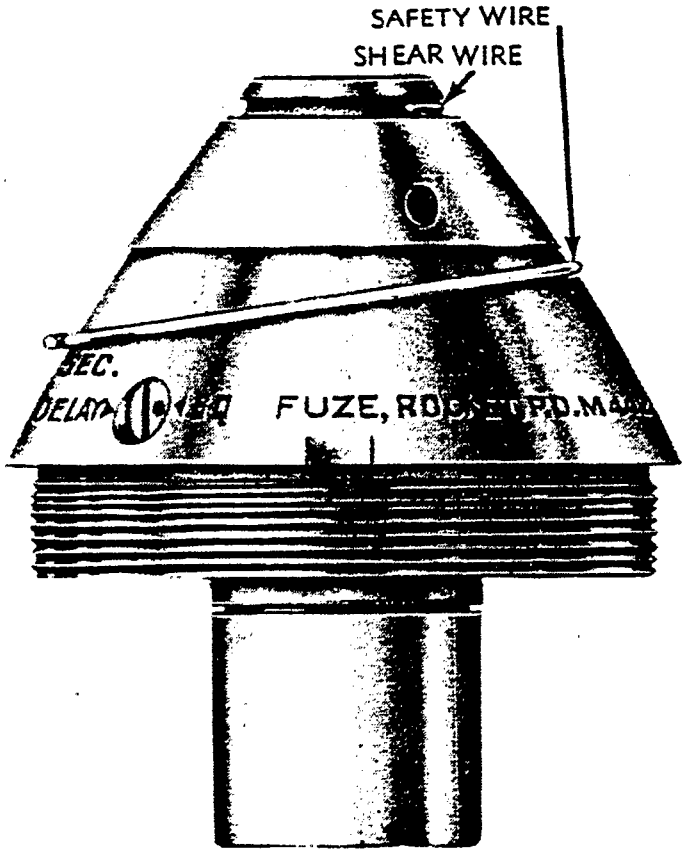




4.5 INCH FIN ROCKETS

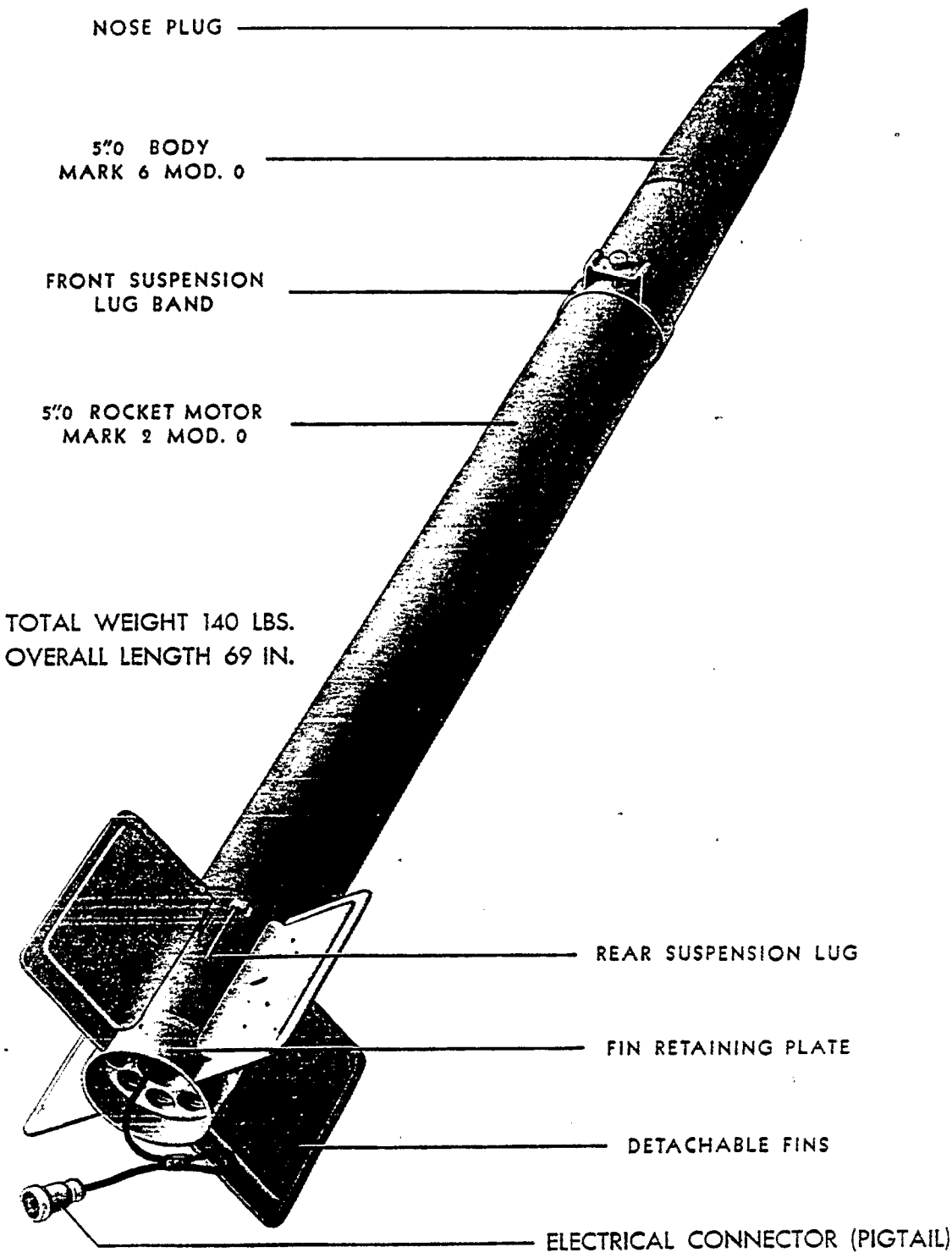


M4

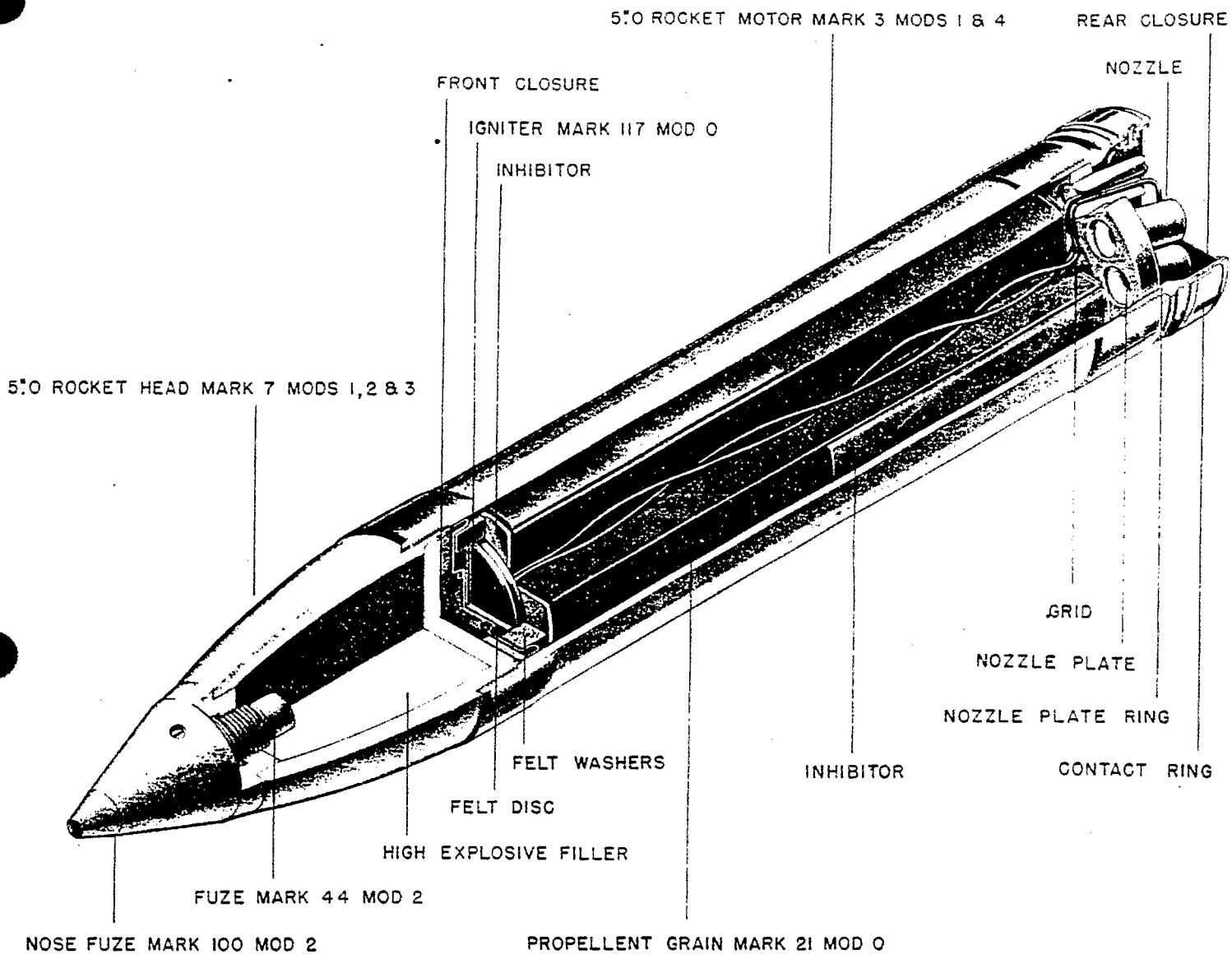


M4A2

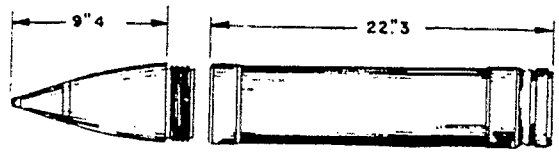
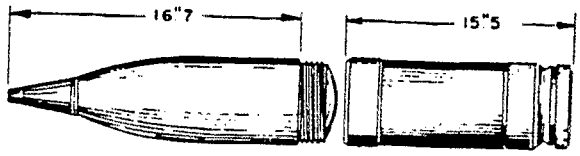
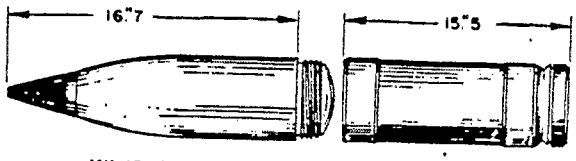
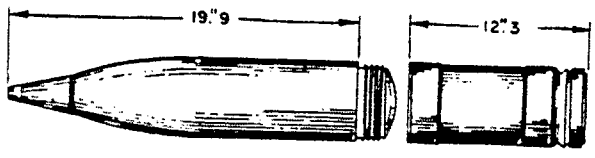
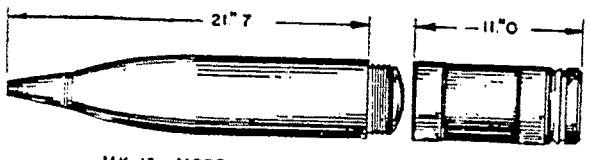
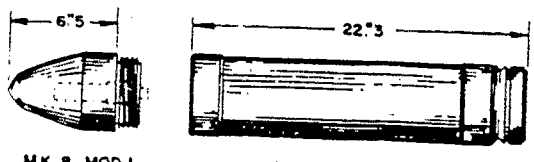
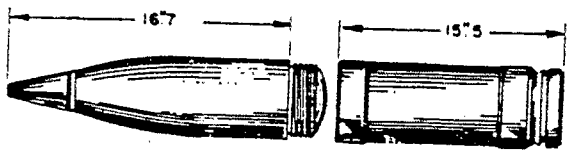
TYPICAL ROCKET FUZES



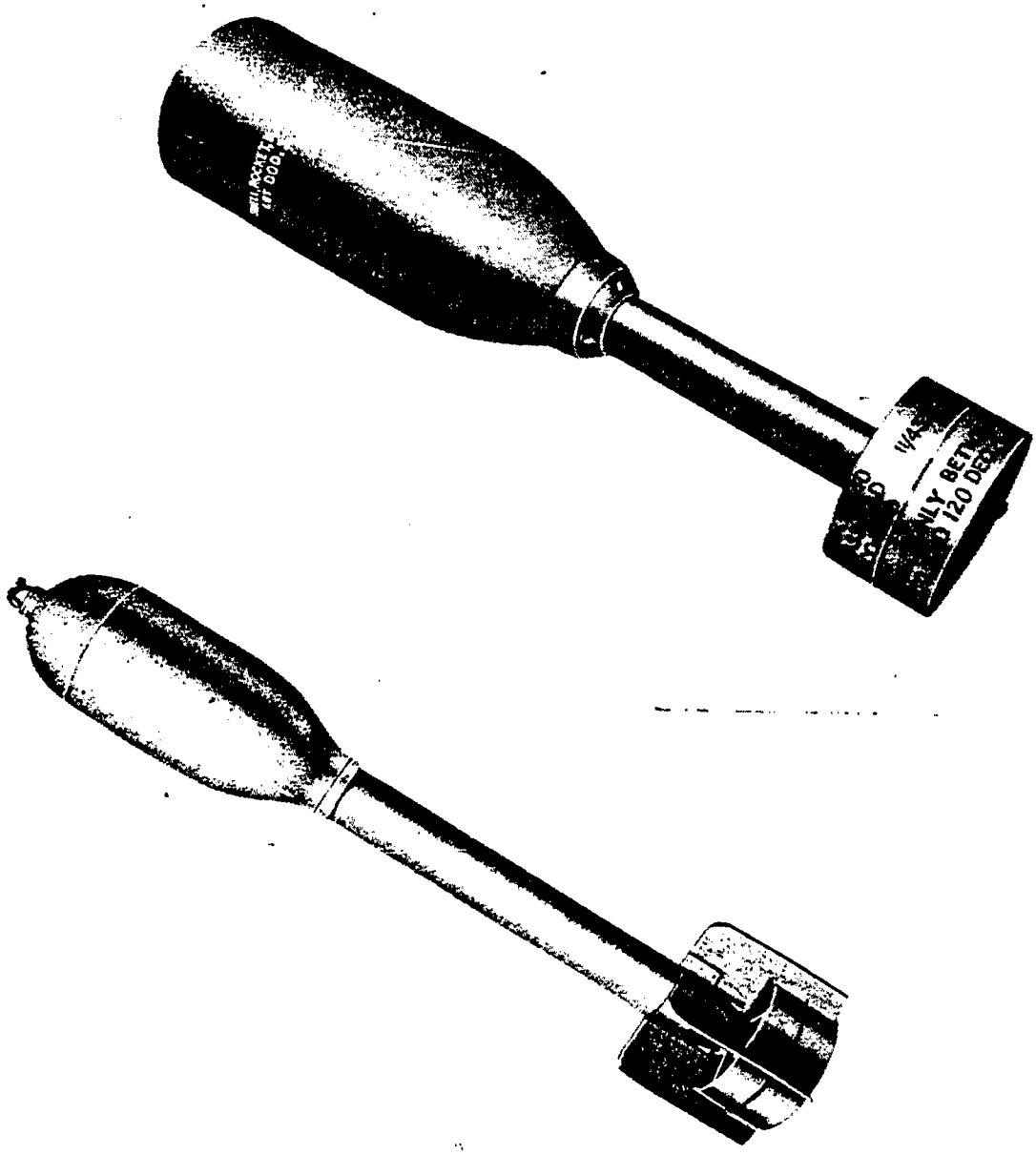
5 INCH ROCKET



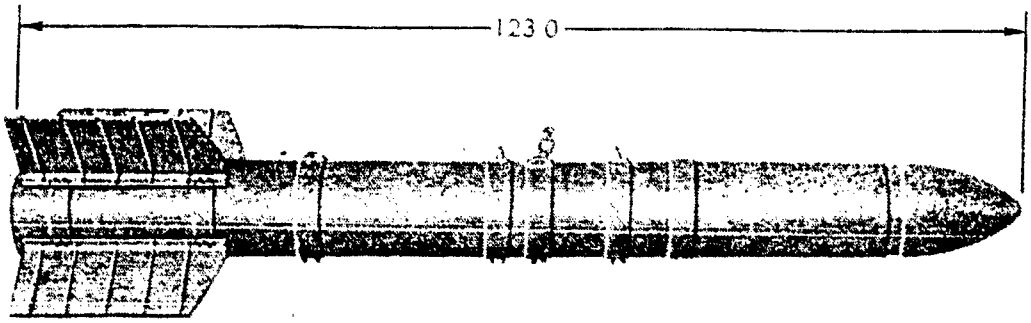
5 INCH SPIN ROCKET

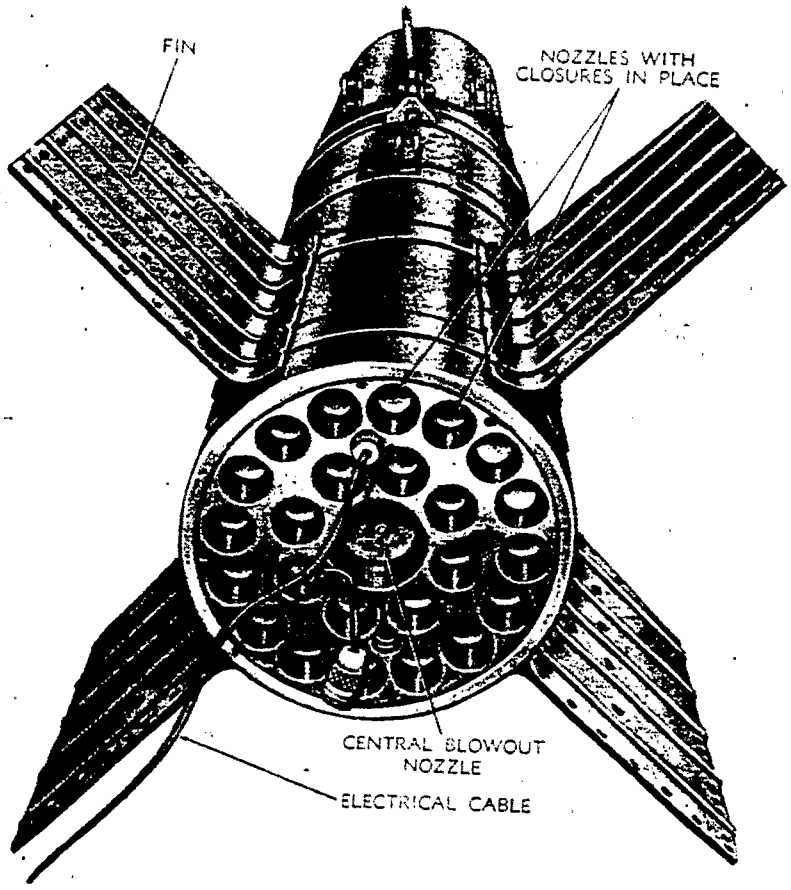
FUZE	HEAD	MOTOR	ROUND DESIGNATION
MK 100 MOD 2	 MK 7 MODS 1,2,3	MK 3 MODS 1,4	5"0 ROCKET (SURFACE, GEN. PURPOSE SS) MK 7 MOD 0 PRACTICE ROUND - MK 8 MOD 0 (INERT HEAD, LIVE MOTOR) DUMMY ROUND - MK 9 MOD 0 (INERT HEAD AND MOTOR)
MK 30 MODS 3,4	 MK 10 MODS 6-10	MK 4 MODS 1,4	5"0 ROCKET (SURFACE, HIGH CAPACITY SS) MK 10 MOD 0 PRACTICE ROUND - MK 11 MOD 0 DUMMY ROUND - MK 12 MOD 0
VT MK 173 MOD 4	 MK 10 MOD 11	MK 4 MODS 1,4	5"0 ROCKET (SURFACE, HIGH CAPACITY SS) MK 10 MOD 1 PRACTICE ROUND - MK 11 MOD 0 DUMMY ROUND - MK 12 MOD 0
MK 30 MODS 3,4	 MK 12 MODS 0-4	MK 5 MODS 1,4	5"0 ROCKET (SURFACE, HIGH CAPACITY SS) MK 13 MOD 0 PRACTICE ROUND - MK 14 MOD 0 DUMMY ROUND - MK 15 MOD 0
MK 30 MODS 3,4	 MK 13 MODS 0-4	MK 6 MODS 1,4	5"0 ROCKET (SURFACE, HIGH CAPACITY SS) MK 16 MOD 0 PRACTICE ROUND - MK 17 MOD 0 DUMMY ROUND - MK 18 MOD 0
MK 31 MOD 0	 MK 8 MOD 1	MK 3 MODS 1,4	5"0 ROCKET (SURFACE, COMMON SS) MK 24 MOD 0 PRACTICE ROUND - MK 8 MOD 1 DUMMY ROUND - MK 9 MOD 1
DUMMY NOSE PLUG	 MK 10 MODS (PRACTICE SS)	MK 9 MOD 0 (SURFACE DUMMY)	5"0 ROCKET (SURFACE DUMMY) MK 25 MOD 0 FOR CYCLING TEST IN MK 102 LAUNCHER ONLY

SEVERAL DIFFERENT HEAD AND MOTOR CONFIGURATIONS



7.2 INCH ROCKETS





11.75 INCH ROCKET

HAND. RIFLE AND 40 MM GRENADES

ALTHOUGH PRIMITIVE TYPES OF GRENADES ARE REPORTED TO HAVE BEEN USED AS FAR BACK AS THE CIVIL WAR, THE MODERN MECHANICAL-TYPE FUZED GRENADES WERE FIRST USED ON 1904. THE U.S. PRODUCED ITS FIRST MODERN GRENADES FOR USE IN WORLD WAR I. WORLD WAR II SAW AN INCREASE IN BOTH THE NUMBERS AND TYPES OF GRENADES. AROUND THAT TIME RIFLE GRENADES ALSO CAME ON THE SCENE. WITH THE EXCEPTION OF A FEW FRAGMENTATION TYPE GRENADES, MOST OF THE HAND THROWN AND RIFLE PROJECTED GRENADES HAVE CHANGED RELATIVELY LITTLE SINCE THAT TIME. PROBABLY THE MOST SIGNIFICANT IMPROVEMENT HAS BEEN THE INTRODUCTION OF 40 MM GRENADE CARTRIDGES IN THE 1950'S AND LATER.

GENERAL STATEMENTS:

THE MAIN SAFETY FEATURE OF HAND THROWN GRENADES IS THE SAFETY PIN IN THE FUZE.

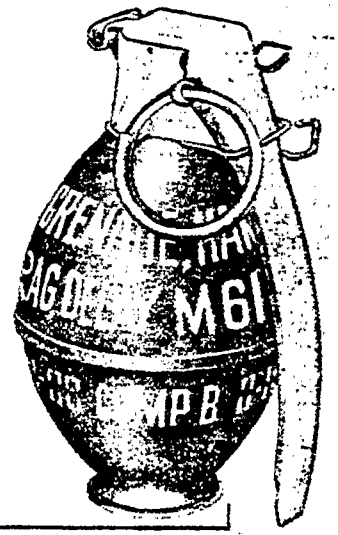
GRENADE MUNITIONS HAVE BOTH PRACTICE ROUNDS CONTAINING A PYRO-TECHNIC CHARGE AND TRAINING ROUNDS WITH NO EXPLOSIVES THAT APPEAR IDENTICAL TO SERVICE AMMUNITION.

ILLUMINATING

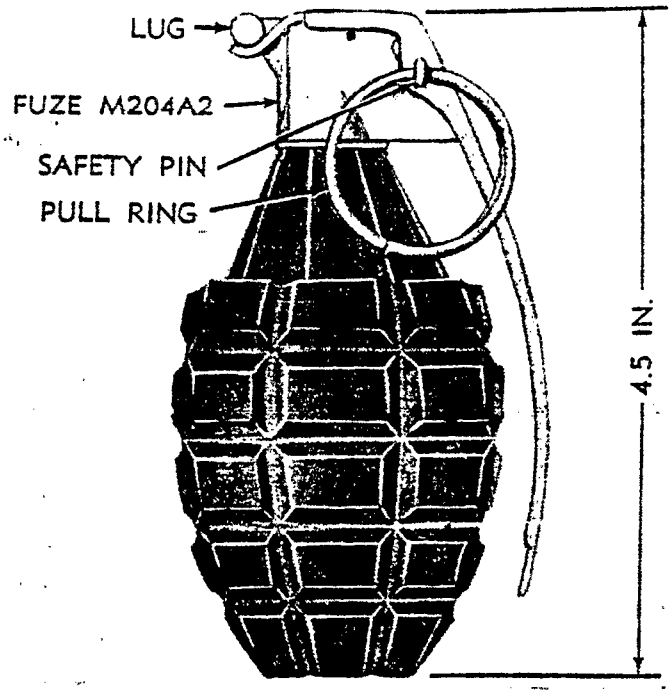
OFFENSIVE

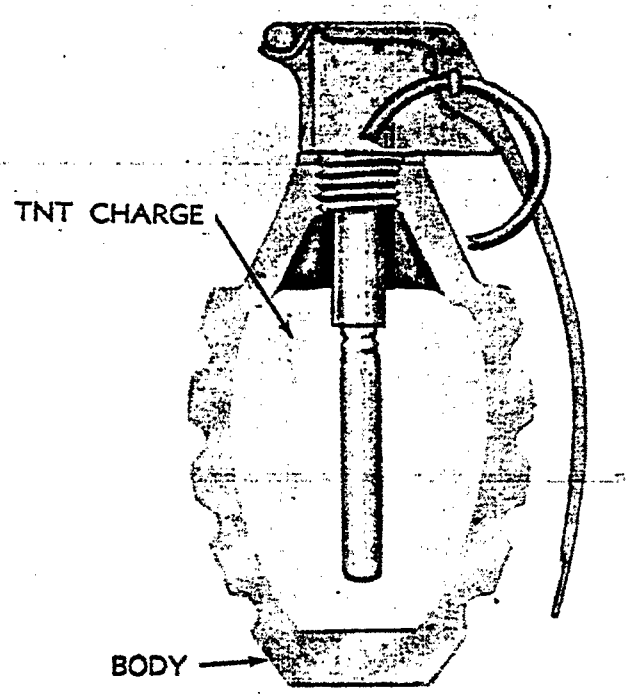
CHEMICAL

PRACTICE

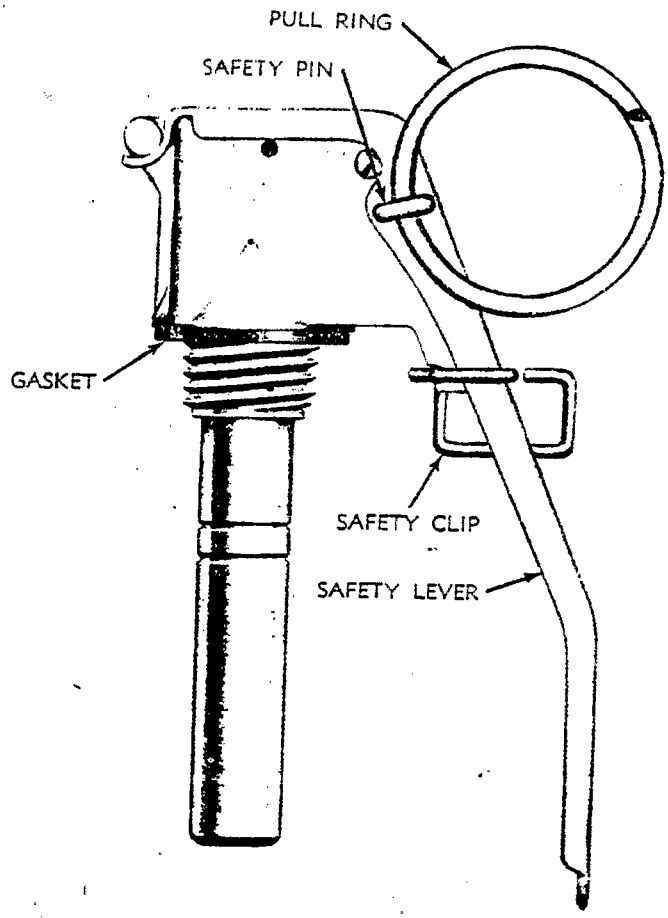


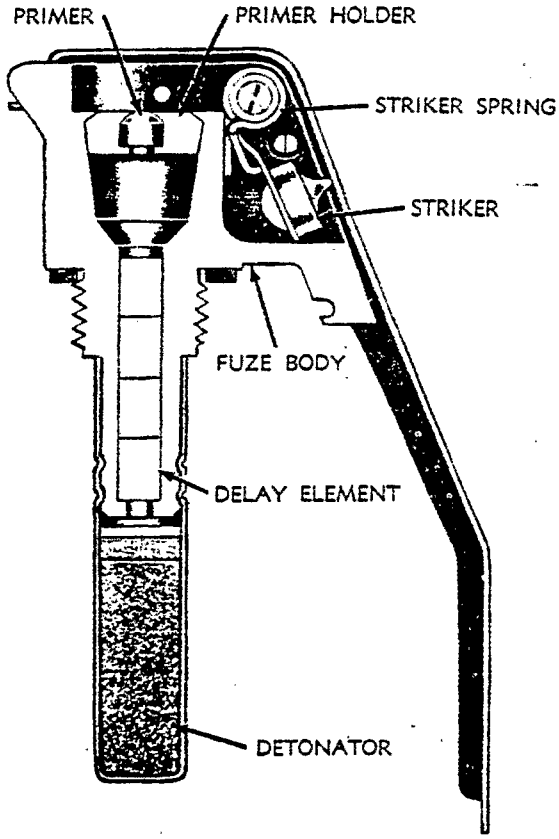
FRAGMENTATION

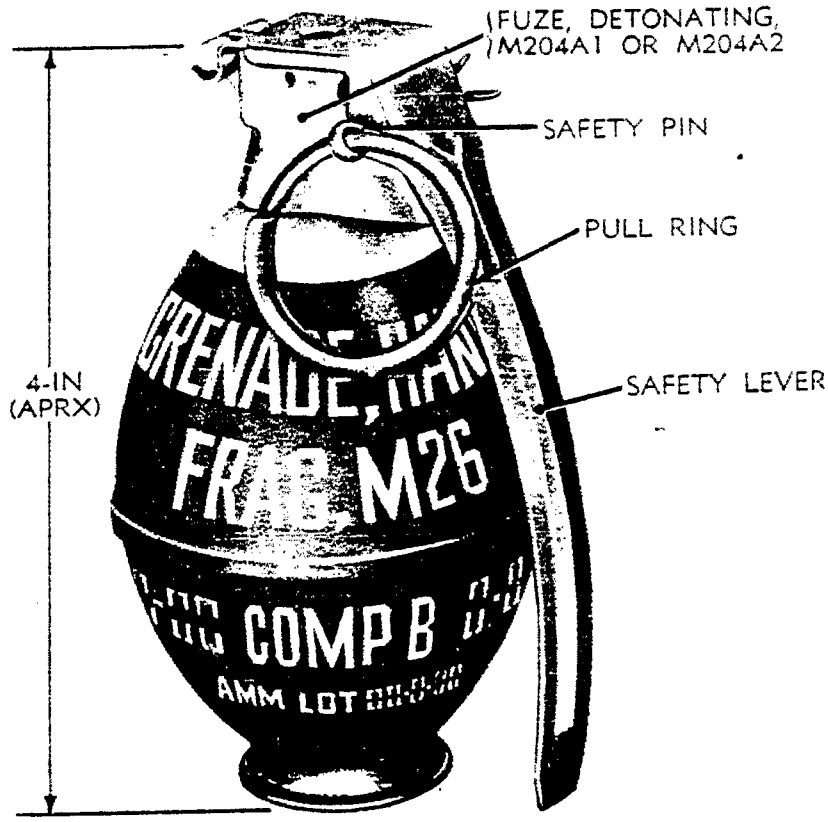




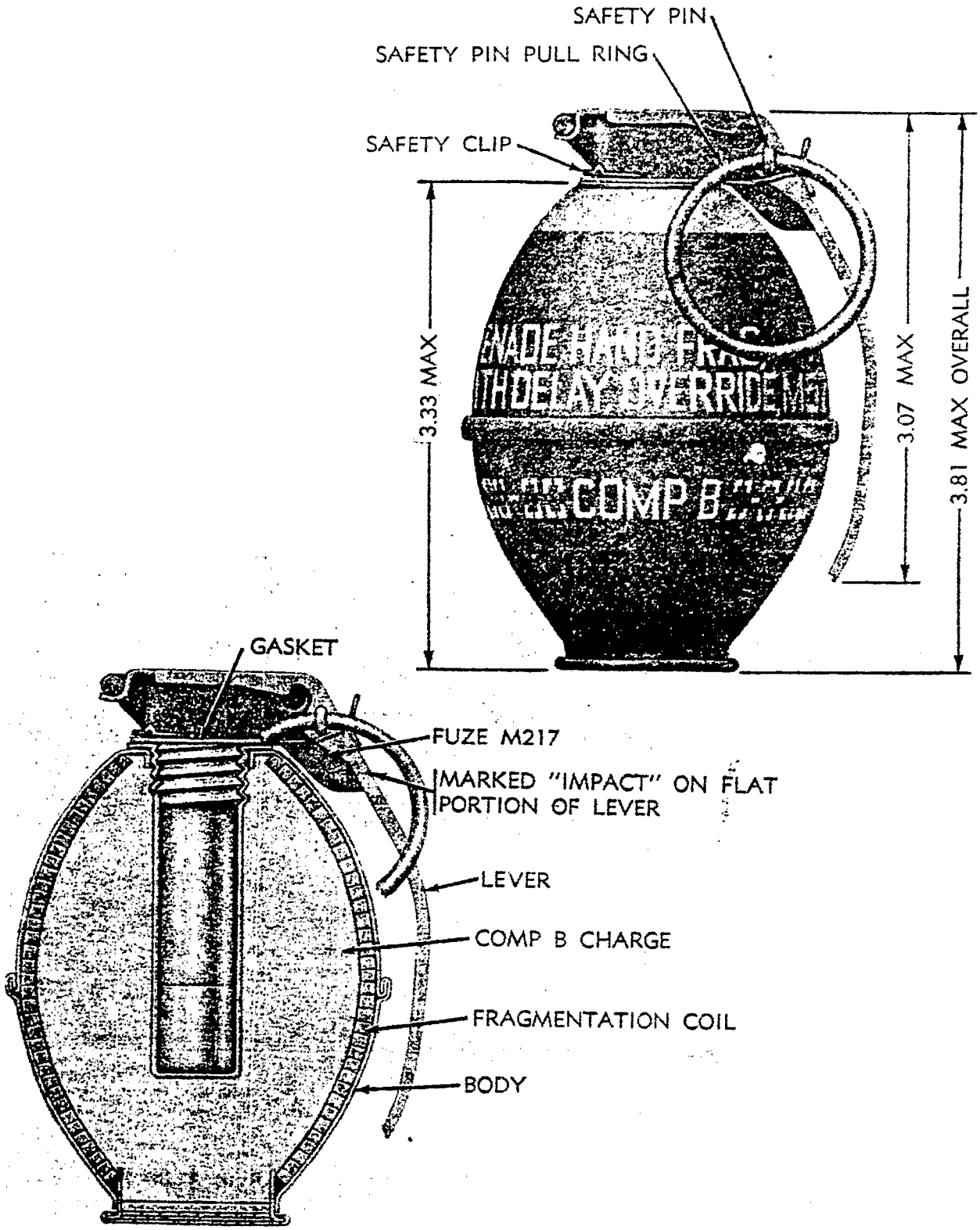
FRAGMENTATION GRENADE, MK2


PULL RING
SAFETY PIN
GASKET
SAFETY CLIP
SAFETY LEVER

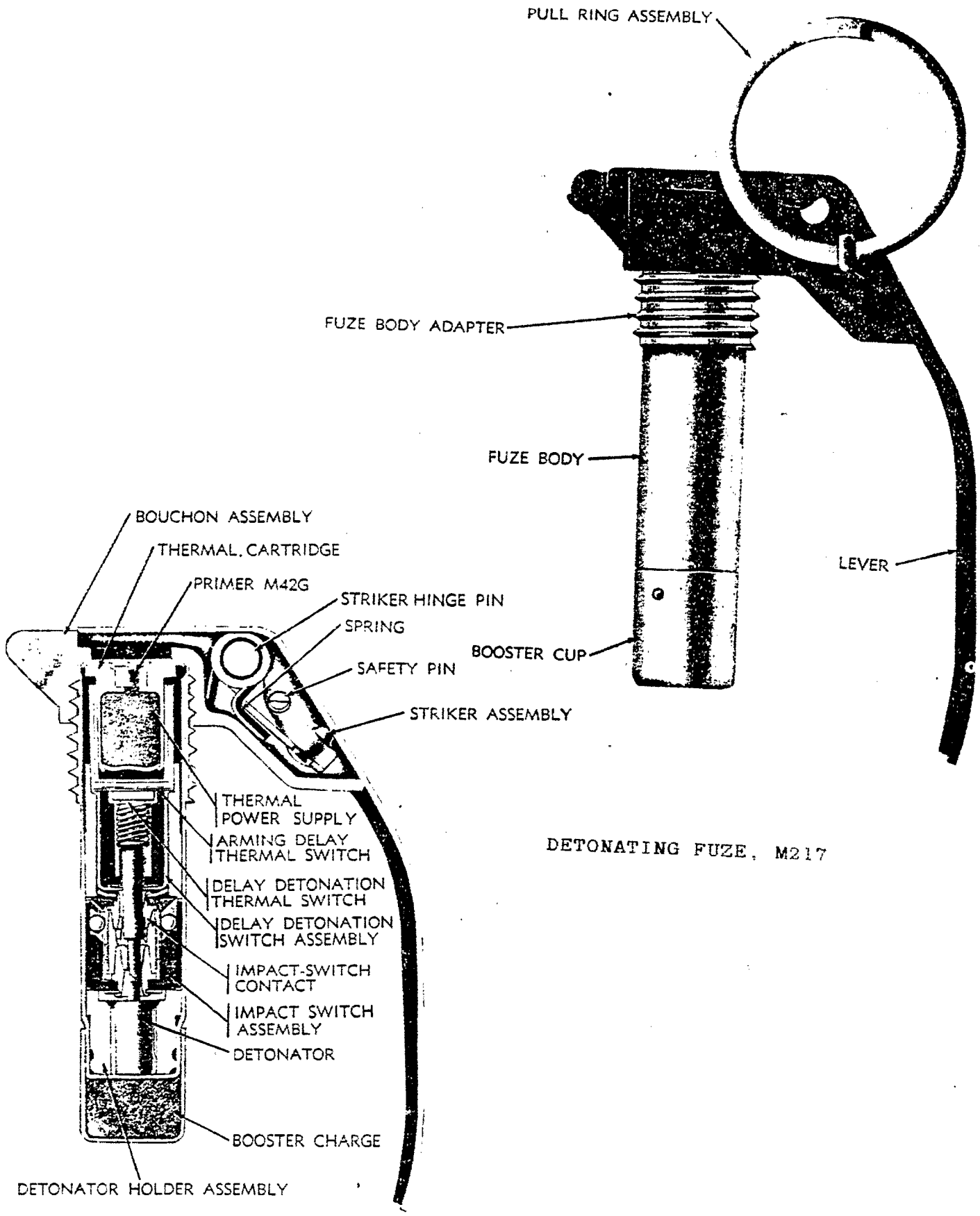

PRIMER
PRIMER HOLDER
STRIKER SPRING
STRIKER
FUZE BODY
DELAY ELEMENT
DETONATOR



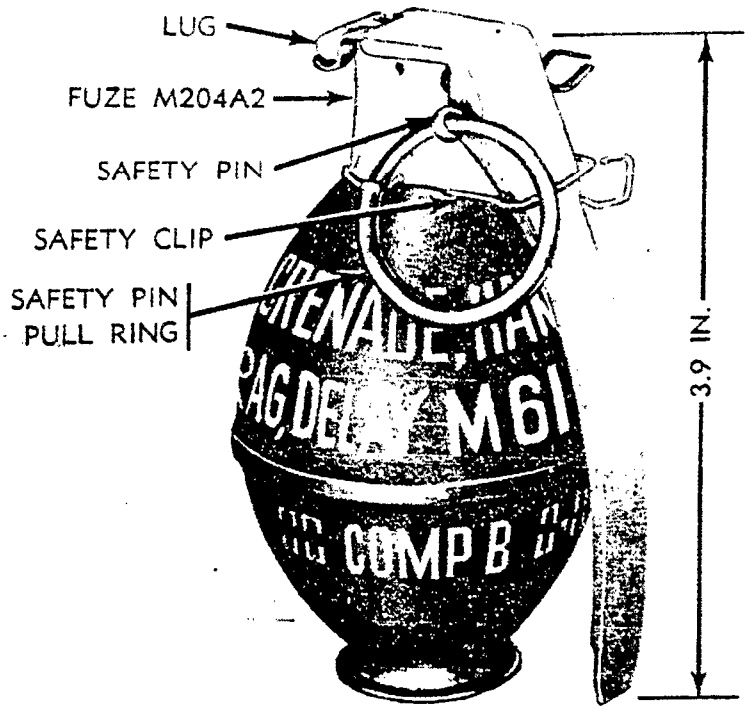
FRAGMENTATION GRENADE, M26

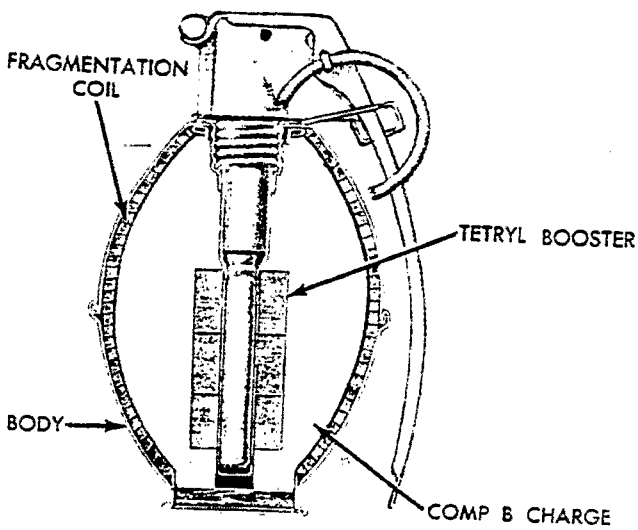


FRAGMENTATION GRENADE, M57

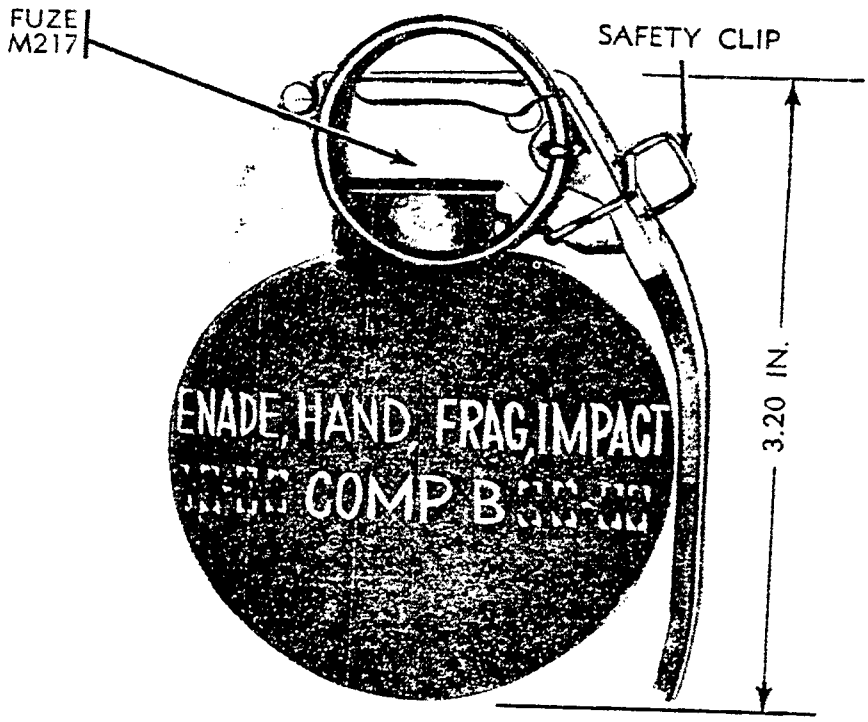


DETONATING FUZE, M217

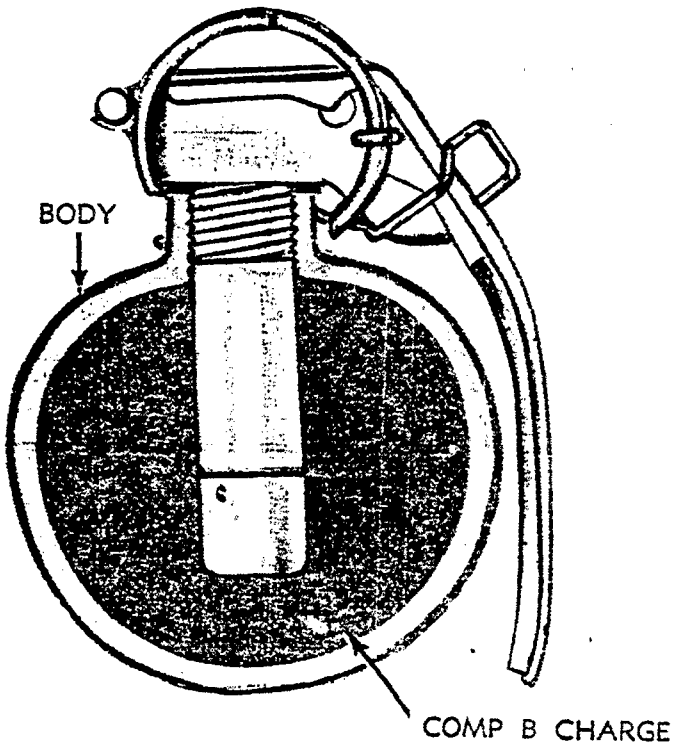


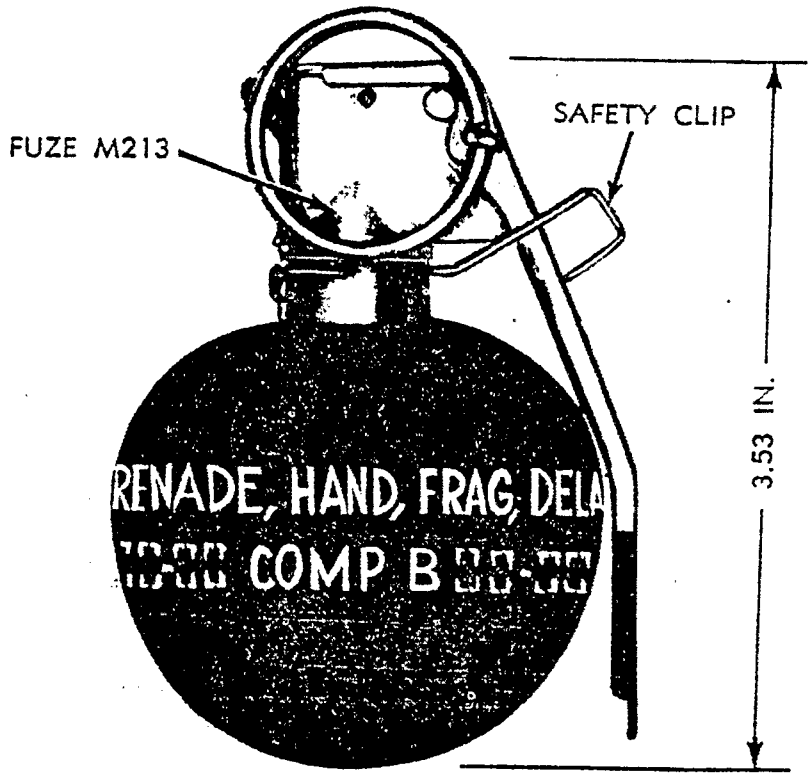


FRAGMENTATION GREANADE, M61

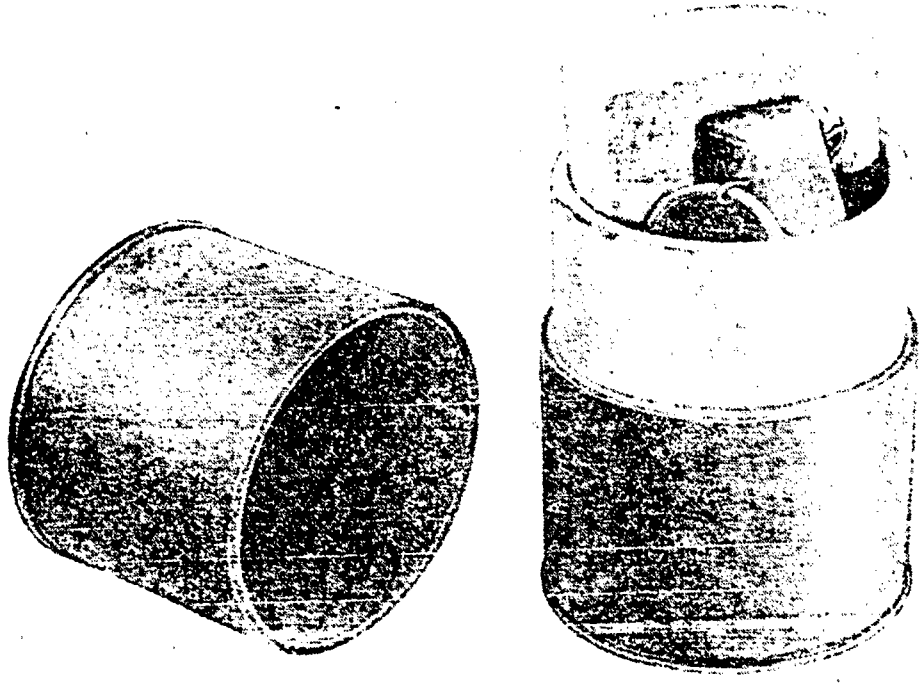


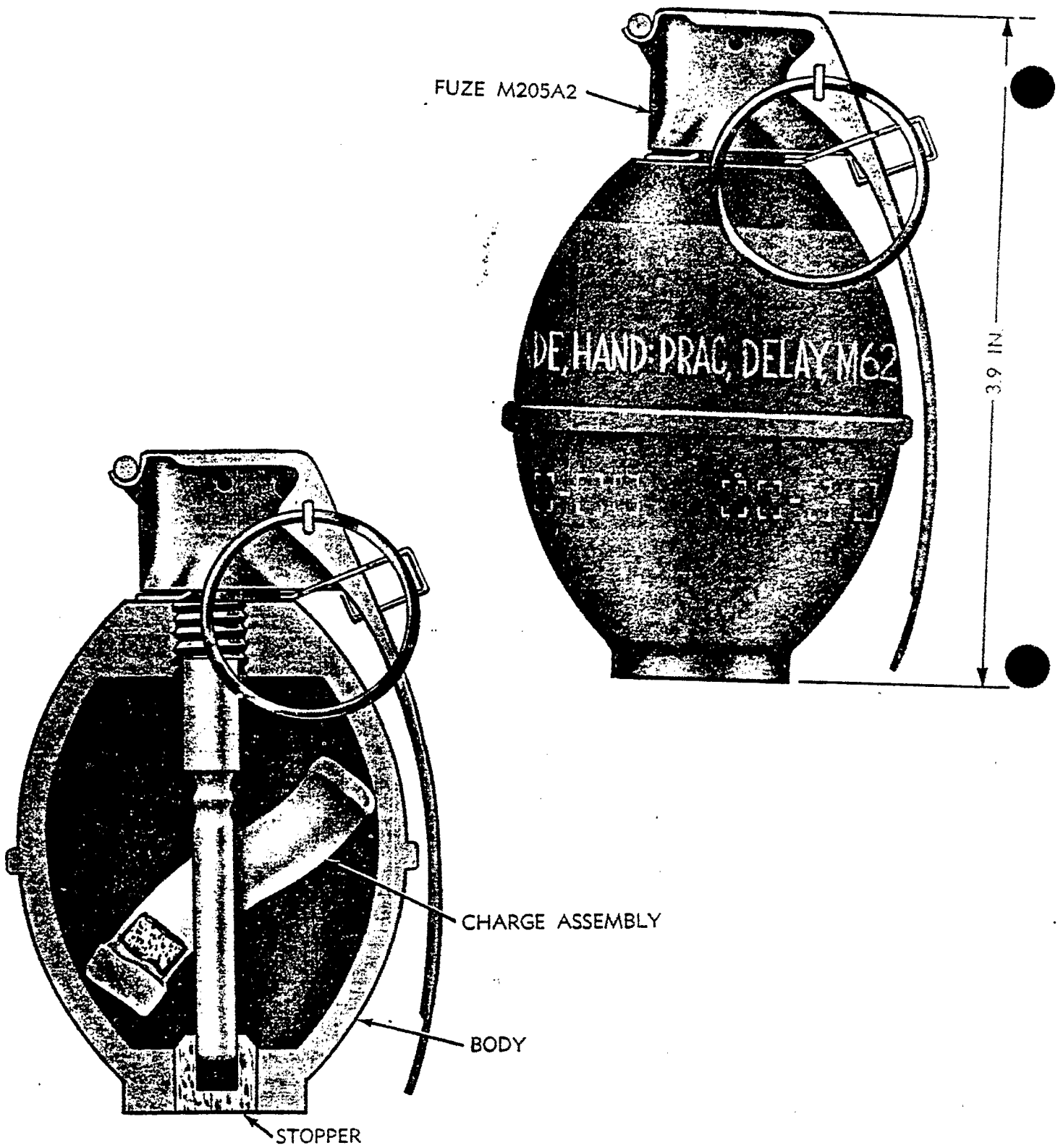
FRAGMENTATION GRENADE, M68



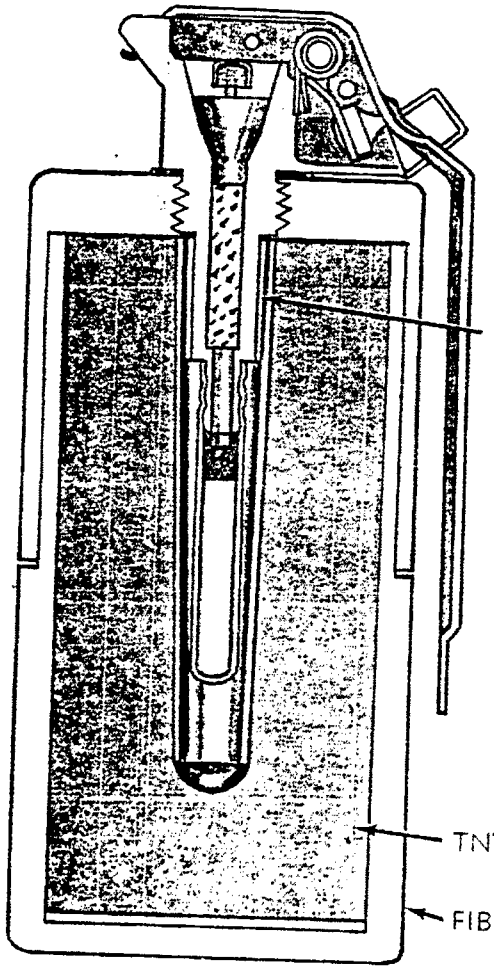


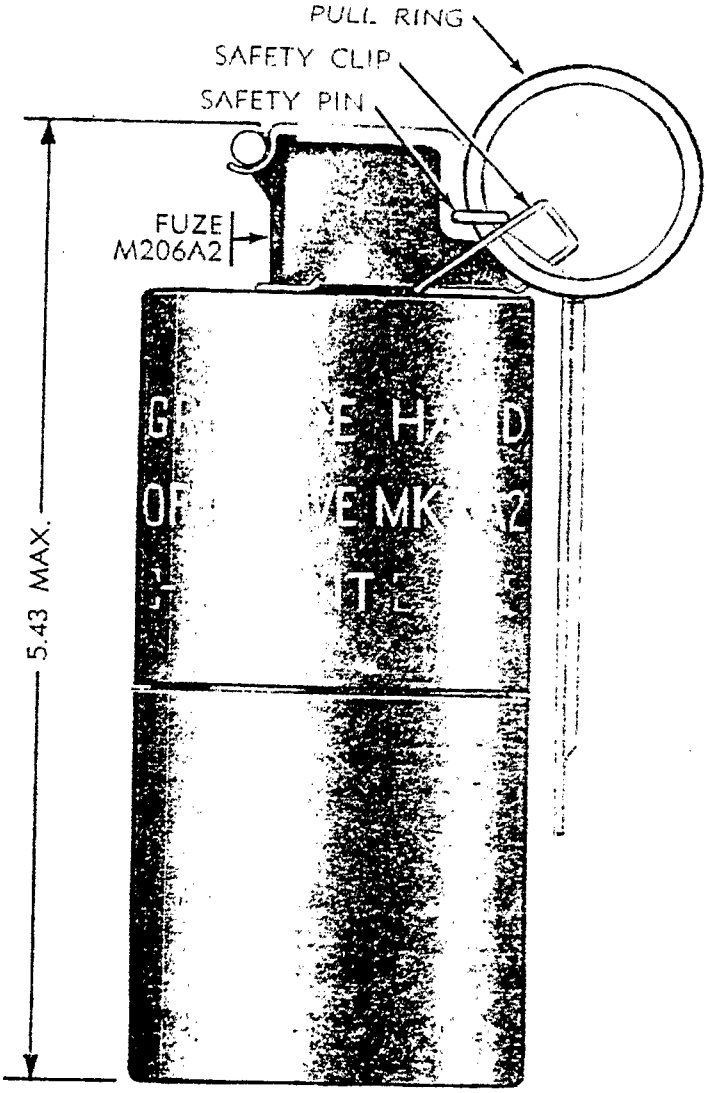
FRAGMENTATION GRENADE, M67





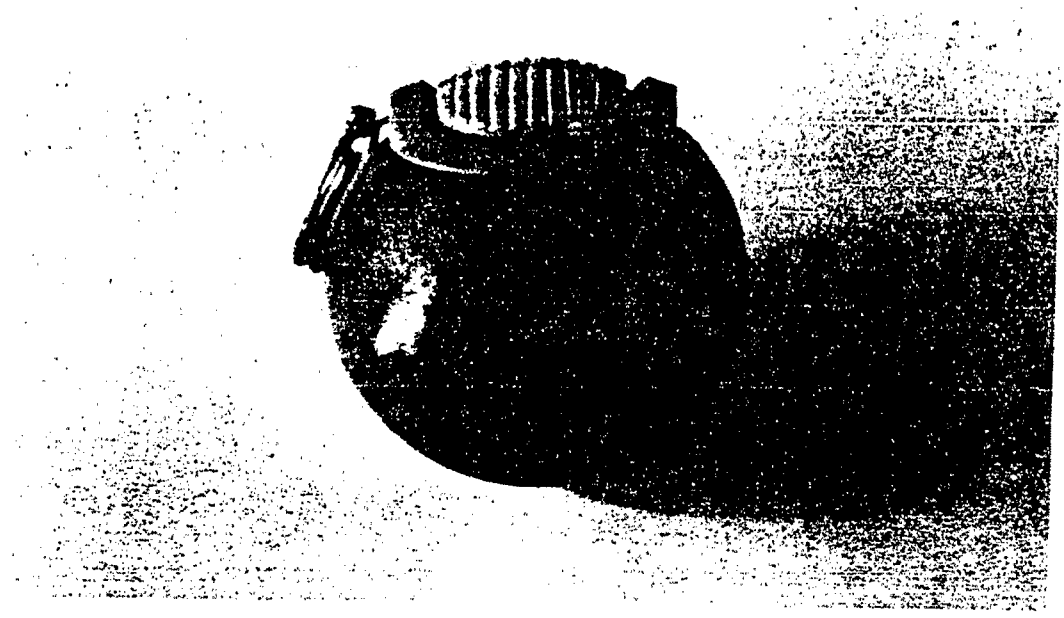
PRACTICE GRENADE, M62

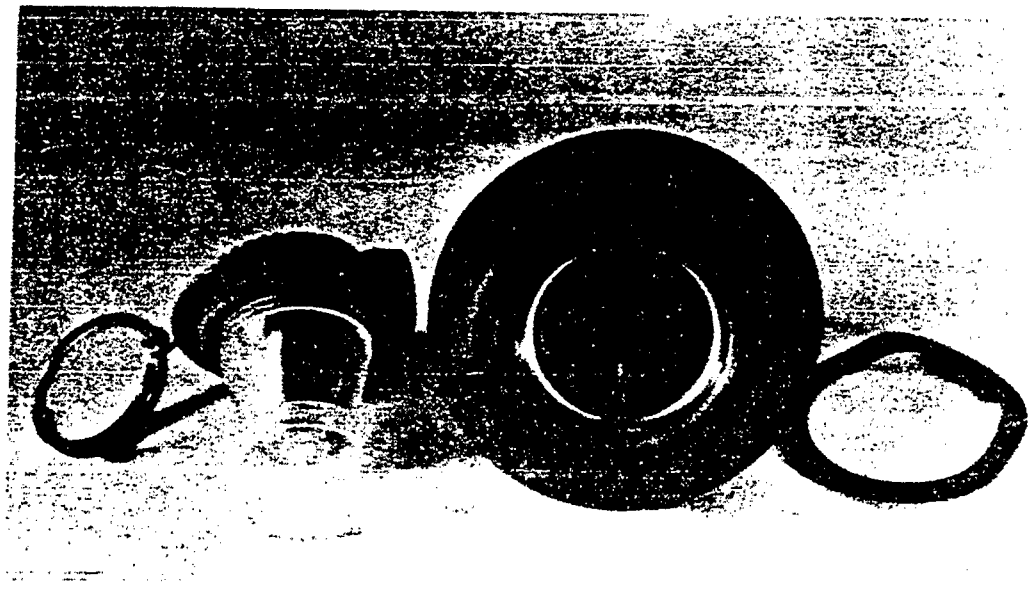




OFFENSIVE GRENADE, MK3A2

SMOKE TORCH, M I





SMOKE HAND GRENADE (WP), T28

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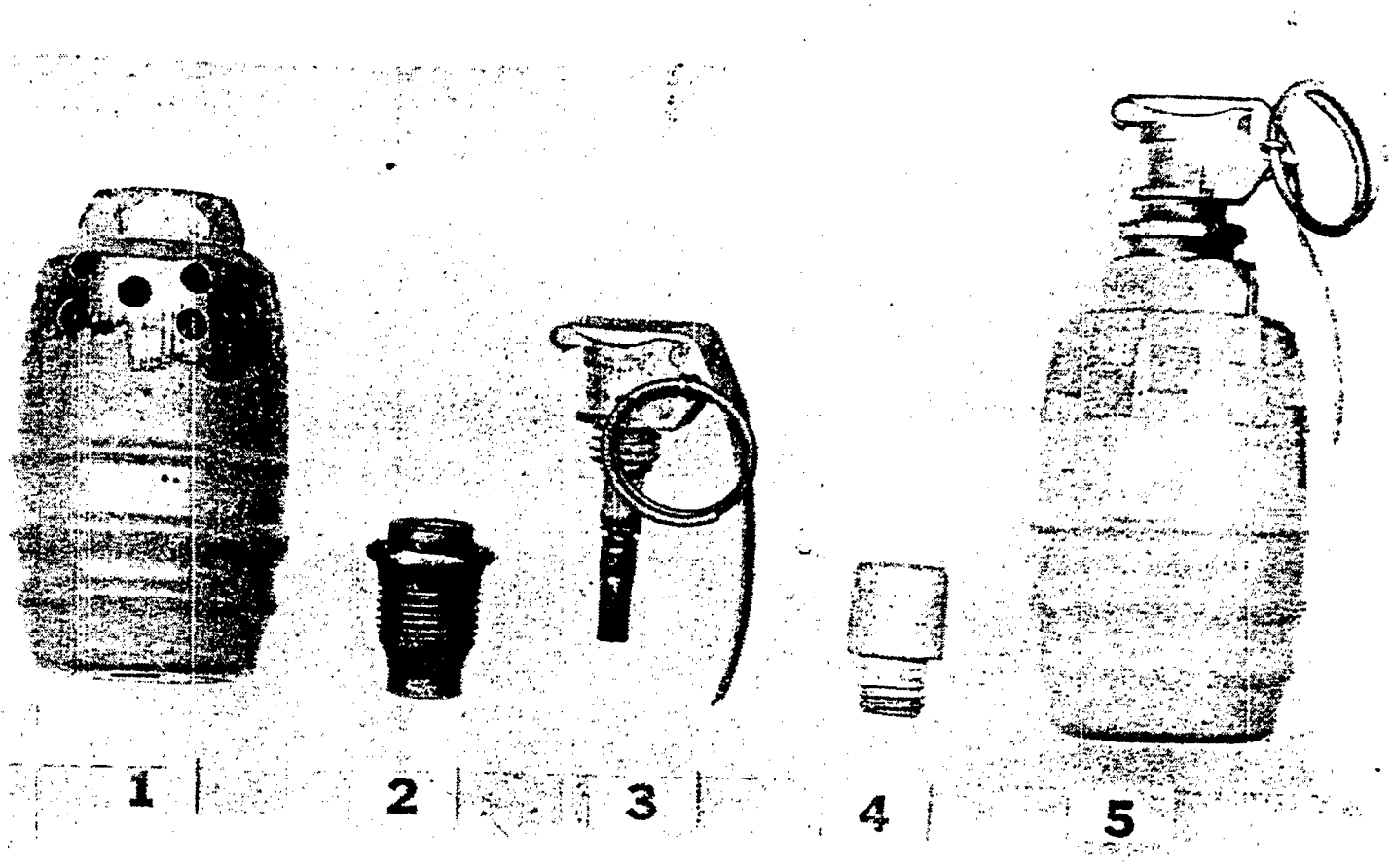
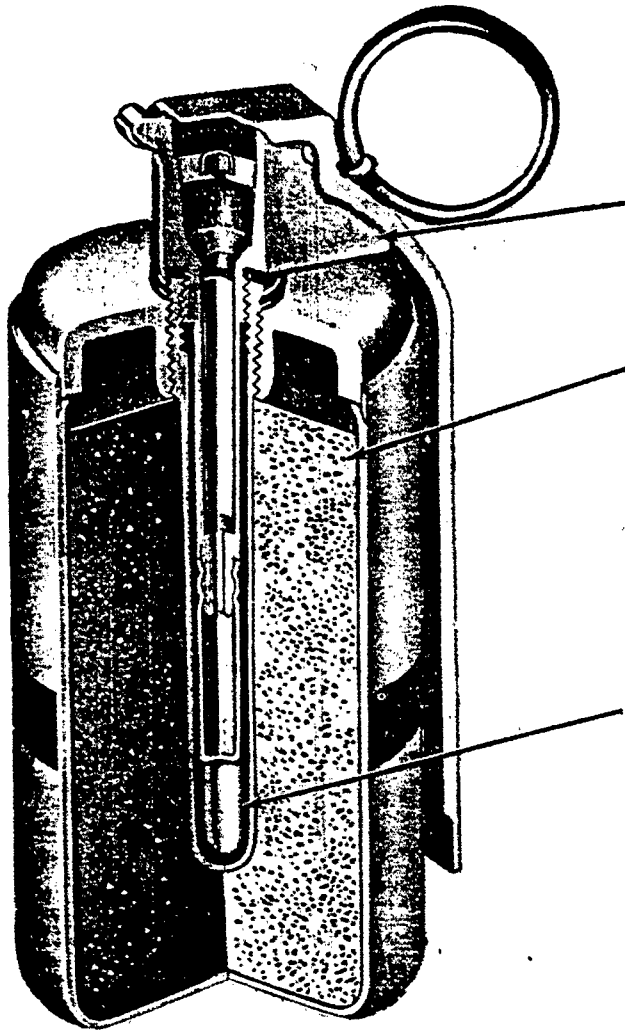
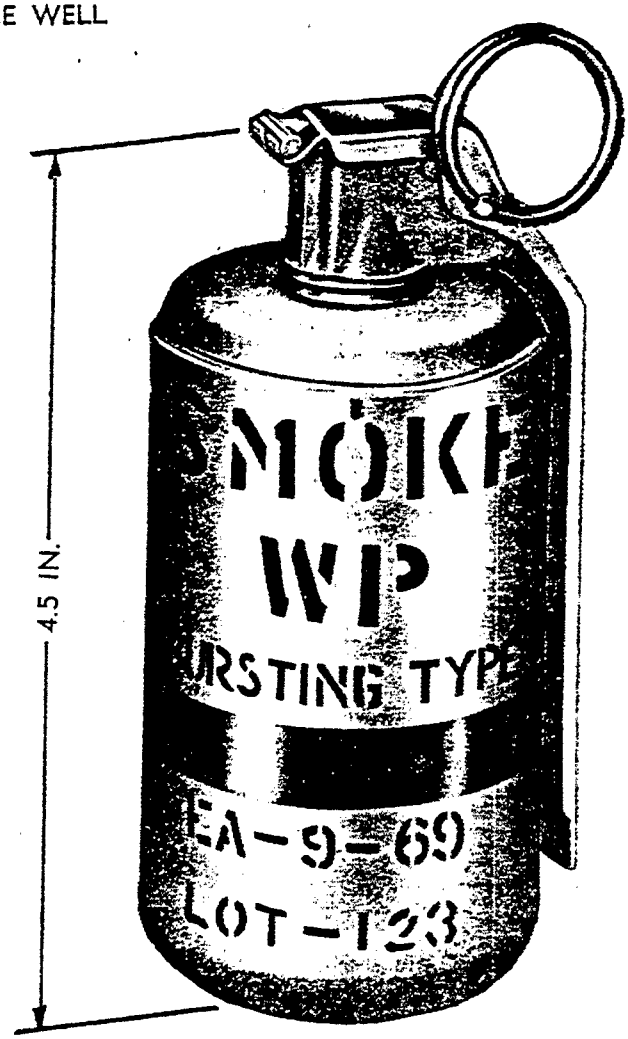


SMOKE GRENADES AND COMPONENTS

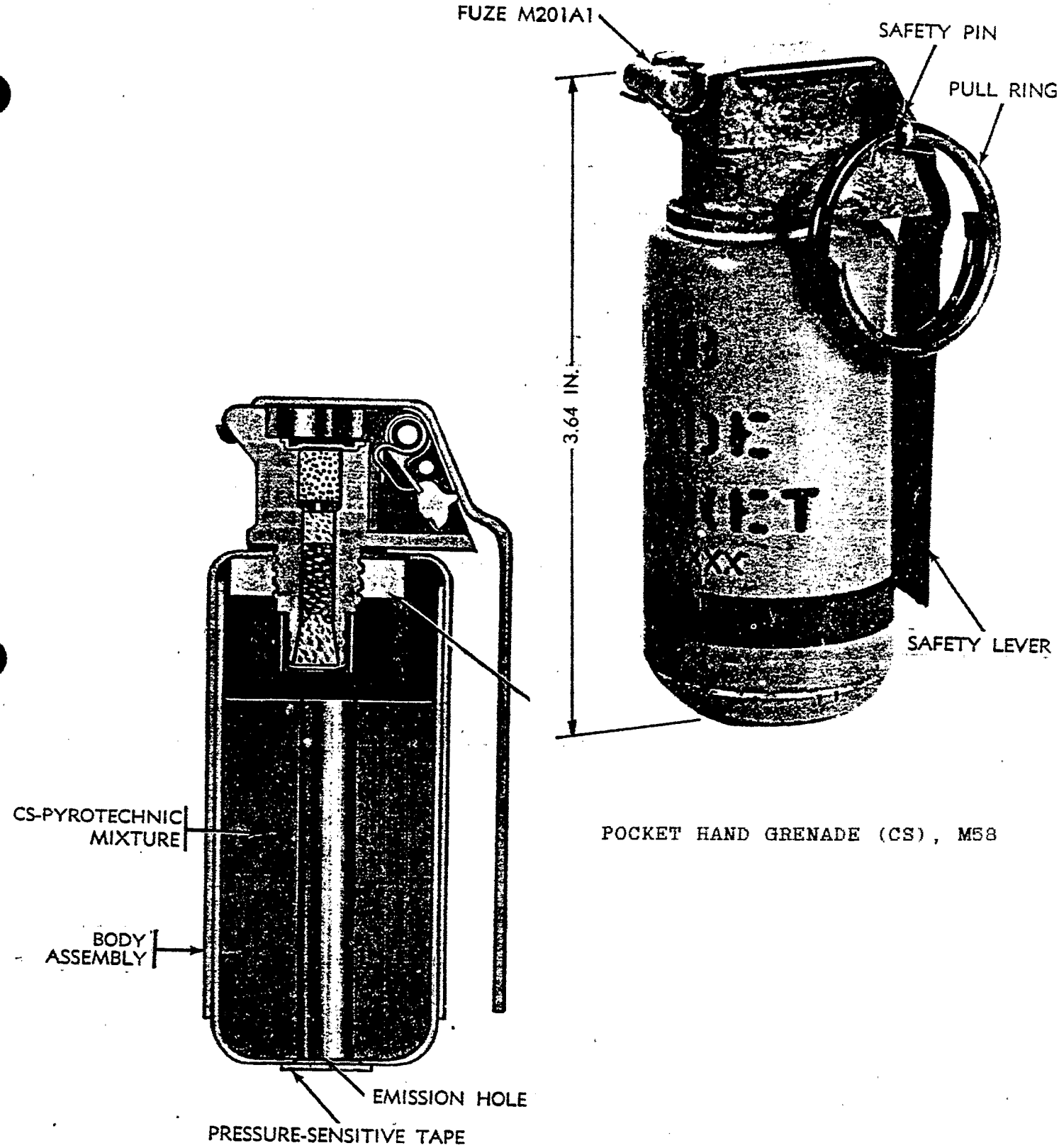
GAS HAND GRENADE (KJ), M II AND SMOKE HAND GRENADE (WP), M II



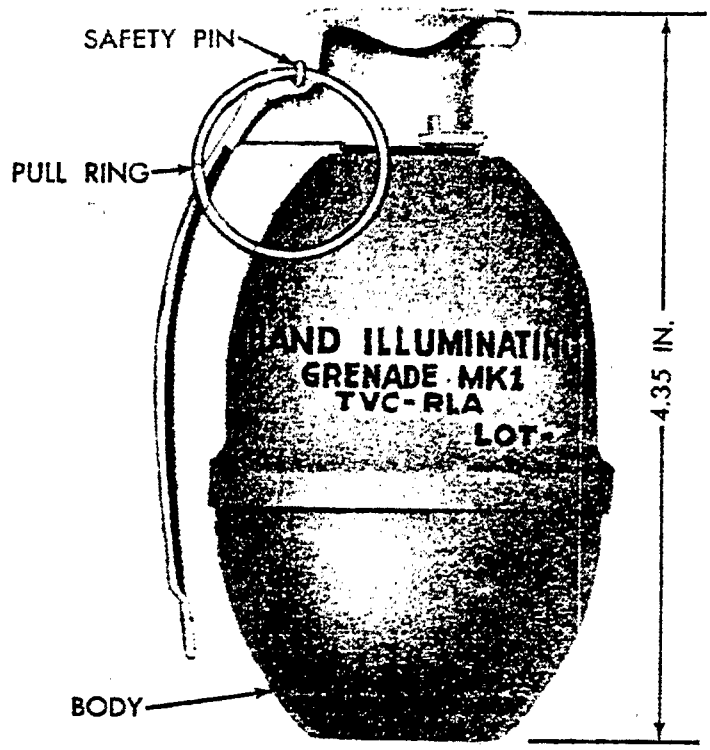
SMOKE HAND GRENADE (WP), M15

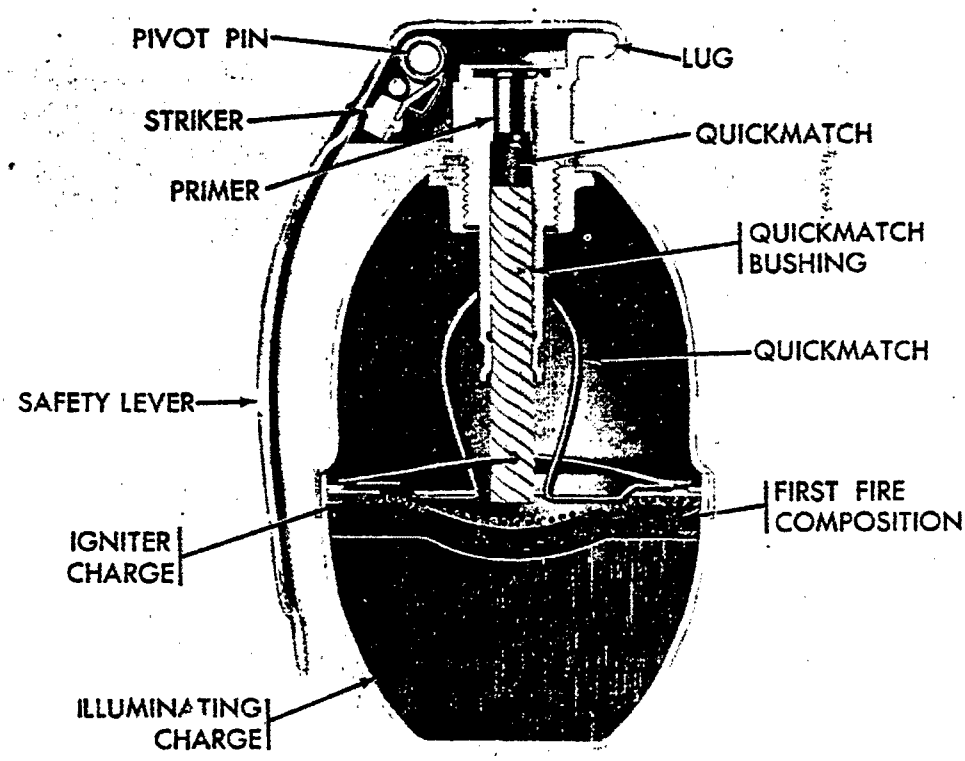


SMOKE HAND GRENADE (WP), M34

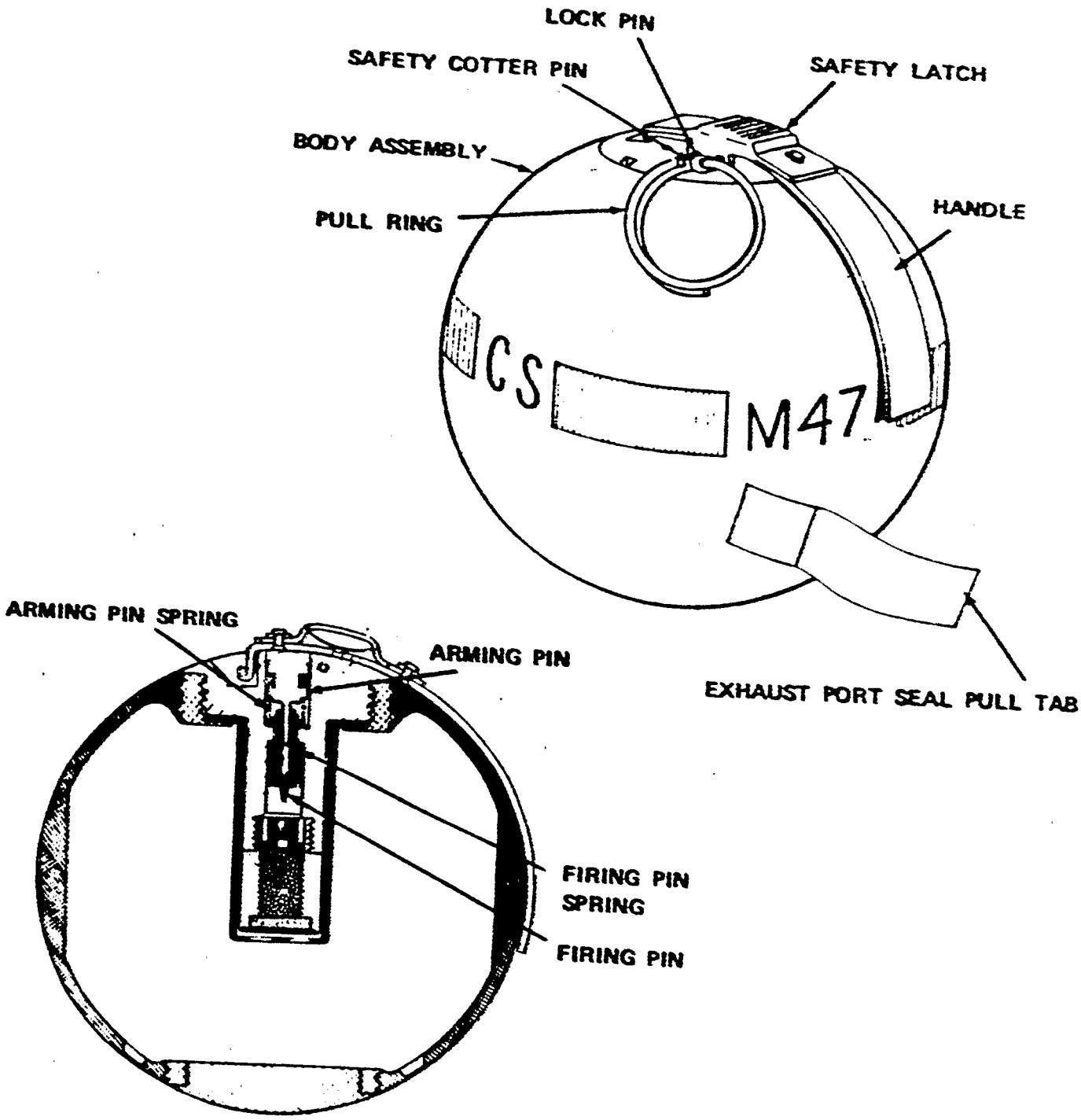


POCKET HAND GRENADE (CS), M58

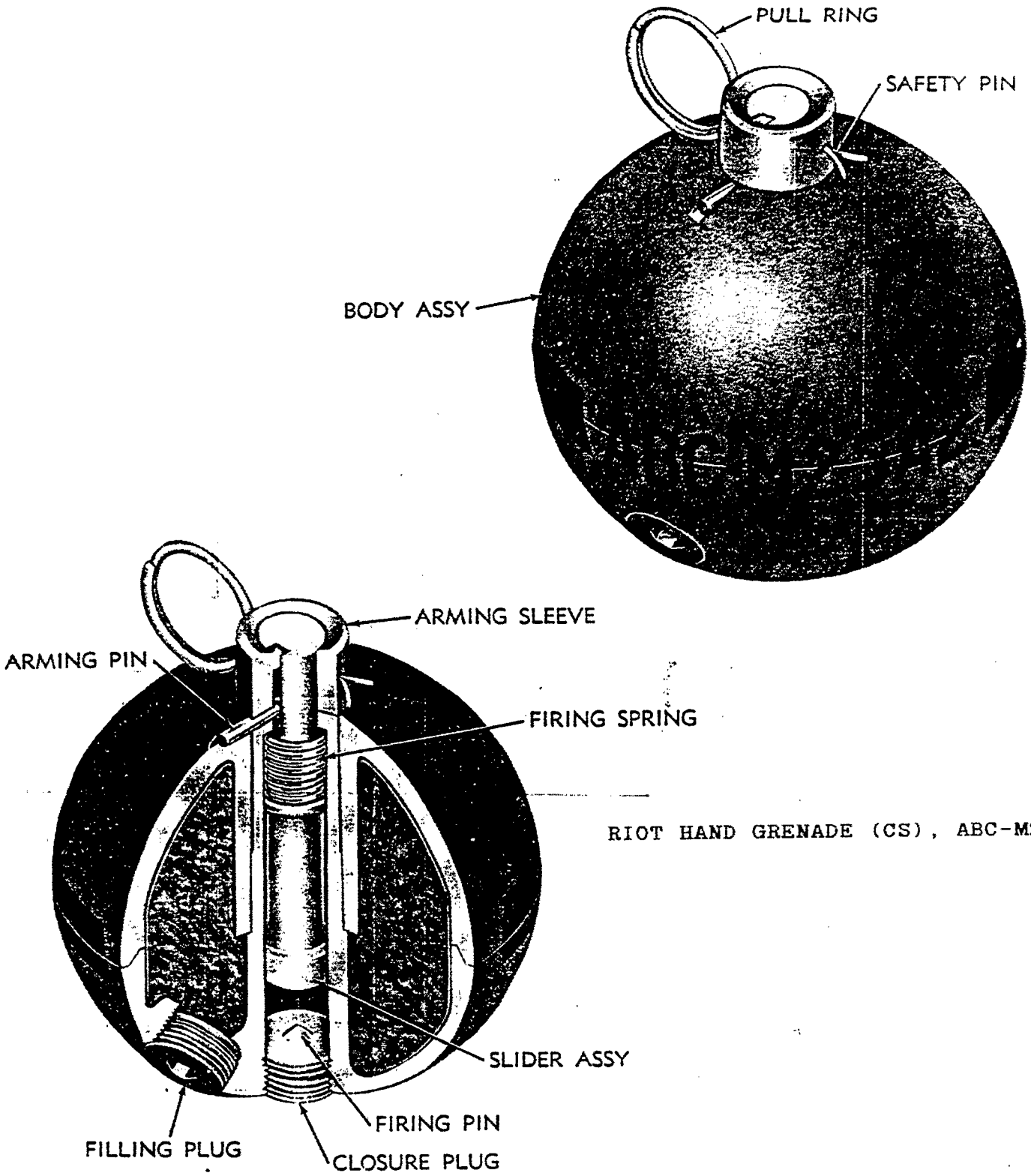




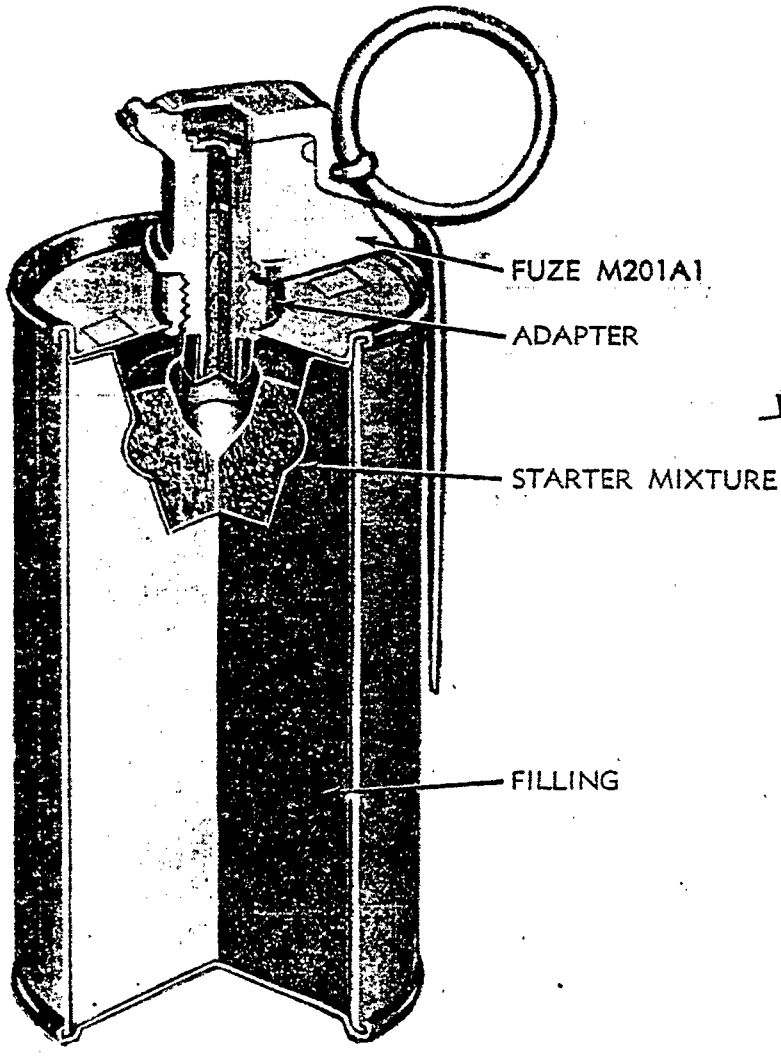
ILLUMINATION HAND GRENADE, Mk 1

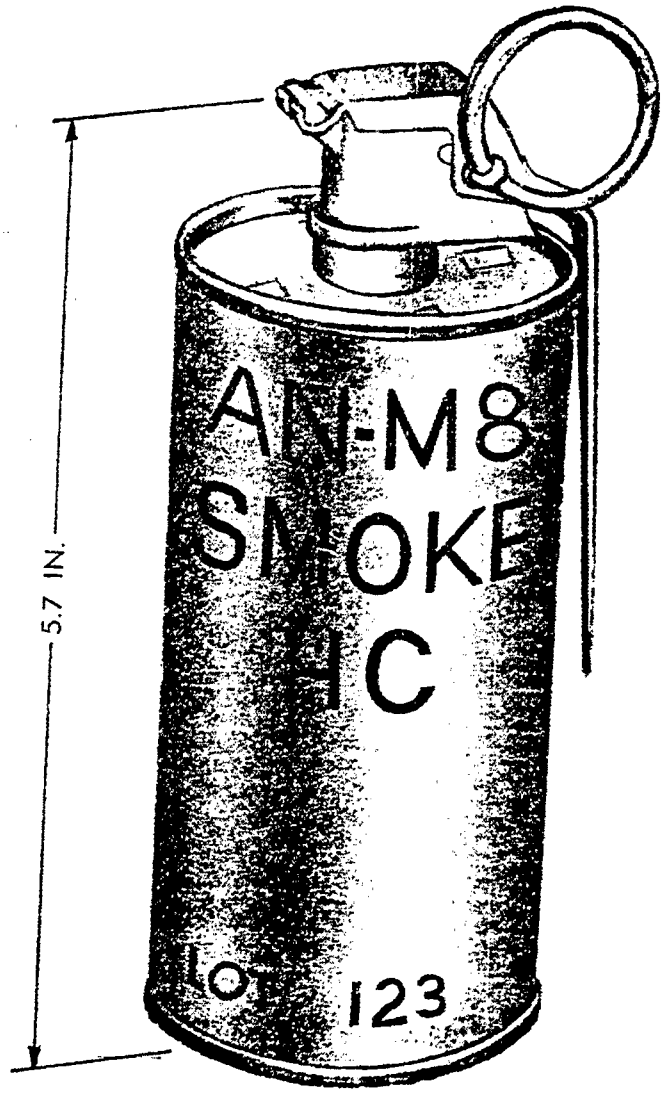


RIOT HAND GRENADE (CS), M47



RIOT HAND GRENADE (CS), ABC-M25





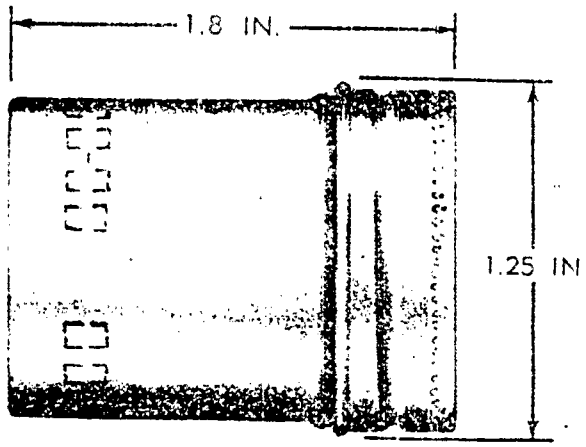
SMOKE HAND GRENADE (HC), AN-M8

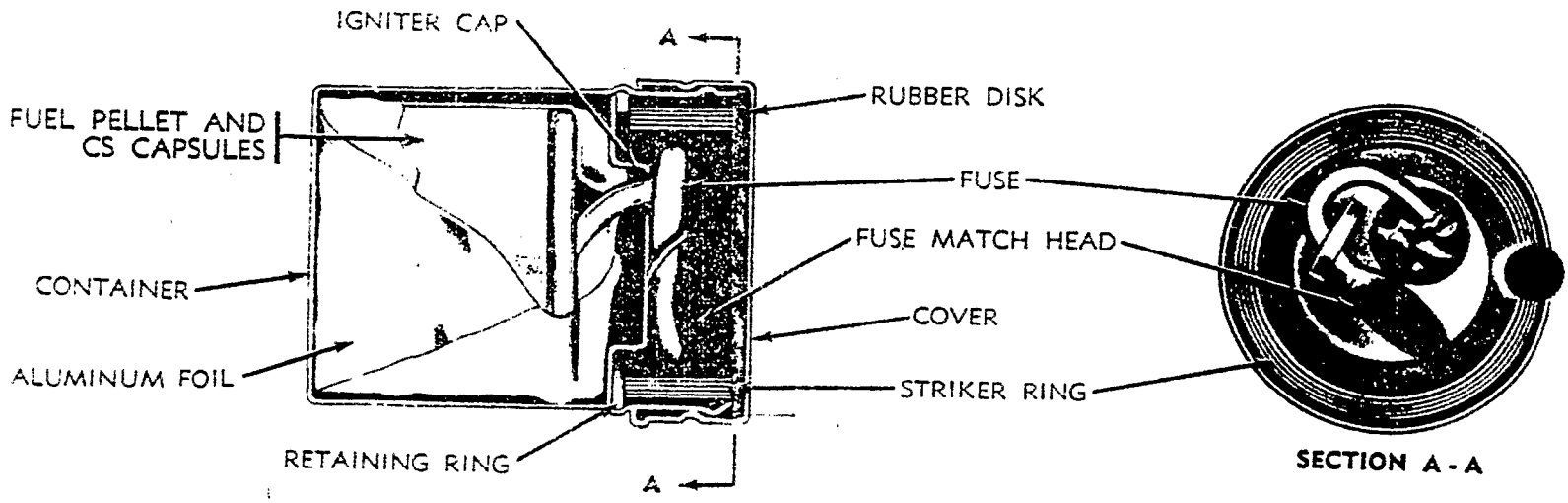
CHEMICAL GRENADES THAT USE THE SAME METAL PARTS

MODEL	TYPE	FILLER	OLD COLOR CODE	NEW COLOR CODE
AN-M8	WHITE SMOKE	HC	GRAY BODY W/ YELLOW BAND, YELLOW MARKINGS	LIGHT GREEN BODY W/WHITE OR BLACK MARKINGS[1]
M54	RIOT CONTROL	CS	GRAY BODY W/RED BAND, RED MARKINGS	GRAY BODY W/RED BAND, RED MARKINGS
M18	COLORED SMOKE		GRAY BODY W/YELLOW BAND, YELLOW MARKINGS [2]	LIGHT GREEN BODY W/BLACK MARKINGS[2]
AN-M14	INCENDIARY	TH	GRAY BODY W/PURPLE BAND, PURPLE MARKINGS	LIGHT RED BODY W/BLACK MARKINGS
M7 M7A1	RIOT CONTROL	CN	GRAY BODY W/RED BAND, RED MARKINGS	GRAY W/RED BAND, RED MARKINGS
M6	RIOT CONTROL	CN DM	GRAY BODY, W/RED BAND, RED MARKINGS	GRAY W/RED BAND, RED MARKINGS

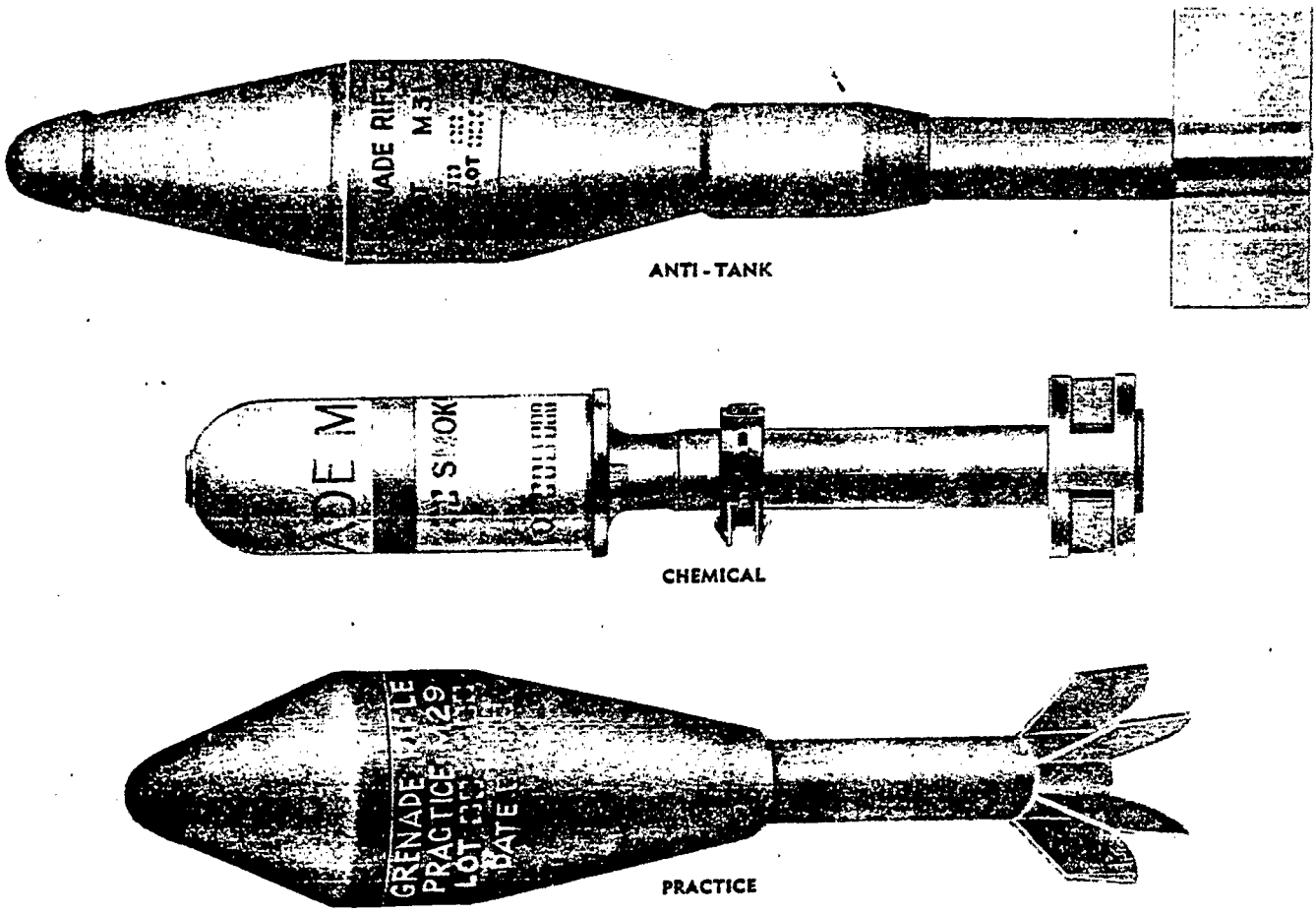
[1] THE TOP OF THESE GRENADES MAY BE PAINTED WHITE TO REPRESENT THE COLOR OF SMOKE THEY PRODUCE.

[2]THERE ARE FOUR VERSIONS OF THIS GRENADE, EACH PRODUCING A DIFFERENT COLOR OF SMOKE. THE TOP OF EACH TYPE IS PAINTED THE COLOR OF THE SMOKE THAT IT PRODUCES - RED, GREEN, YELLOW OR VIOLET.

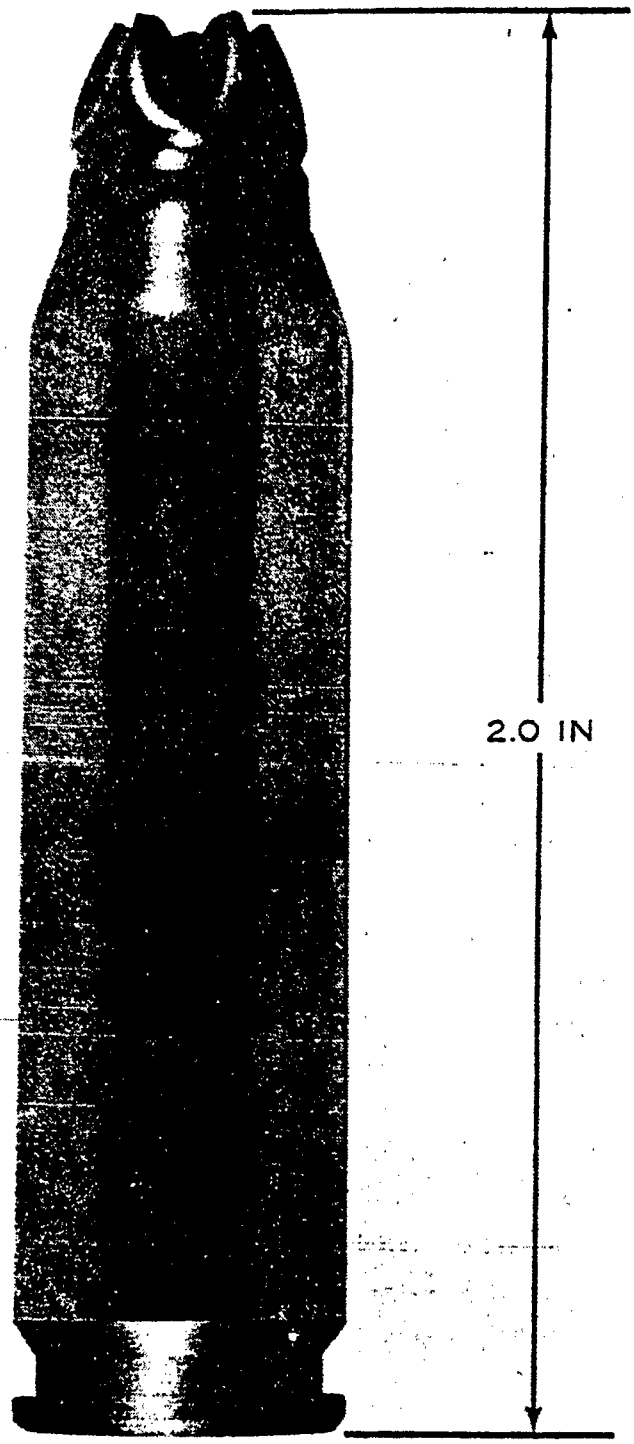




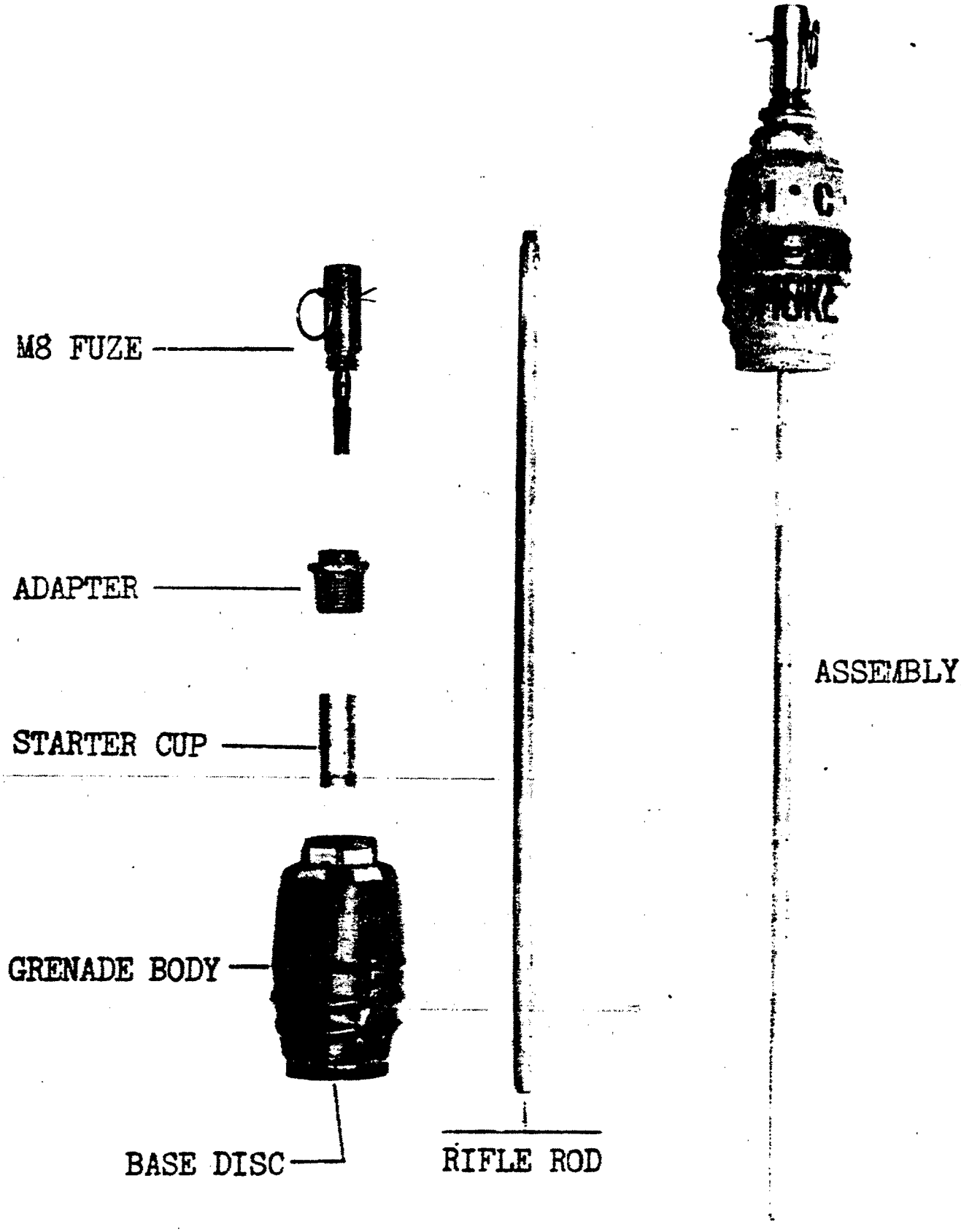
MINIATURE CS HAND GRENADE



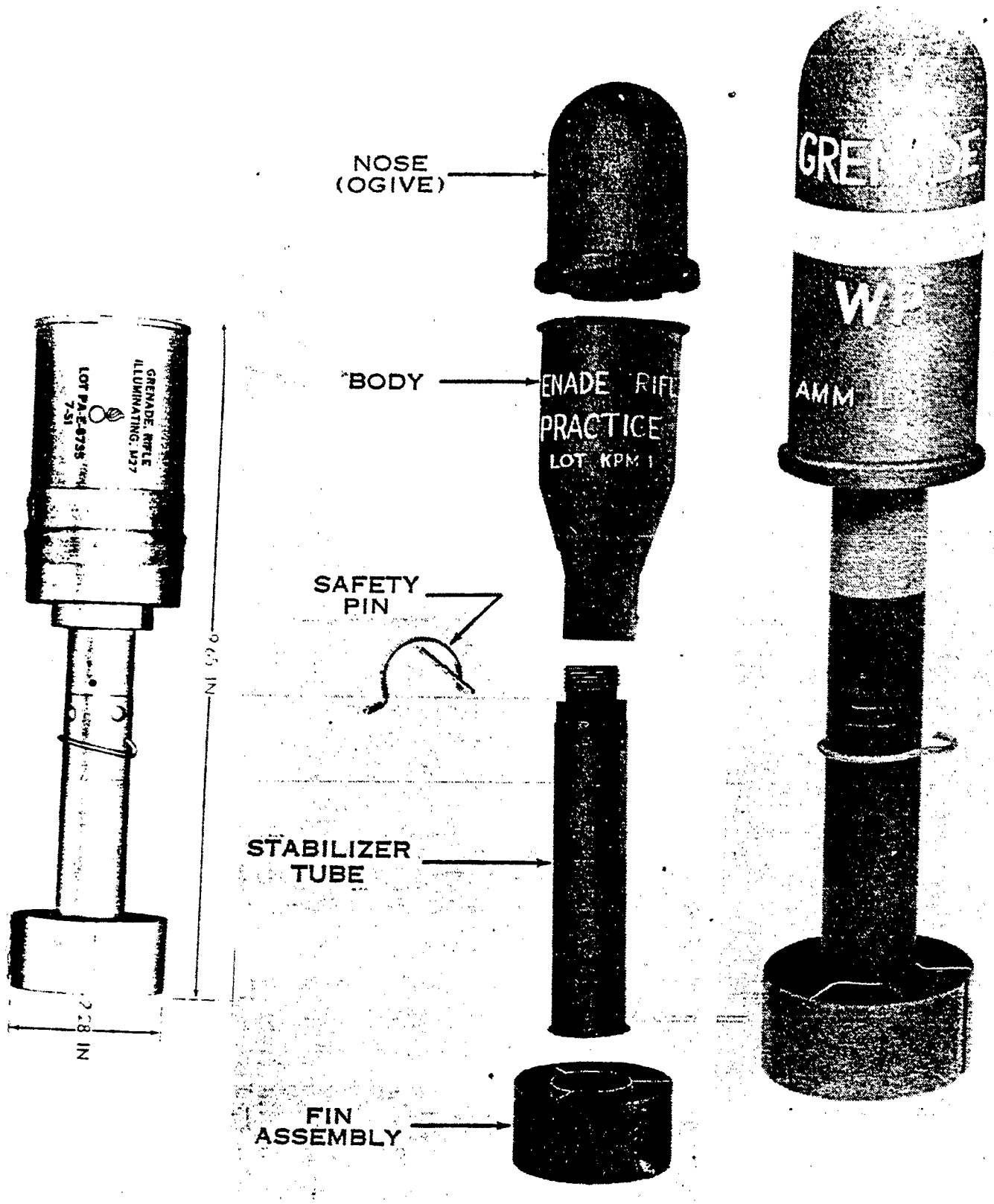
TYPICAL RIFLE GRENADES



RIFLE GRENADE CARTRIDGE



SMOKE RIFLR GRENADE (HC)

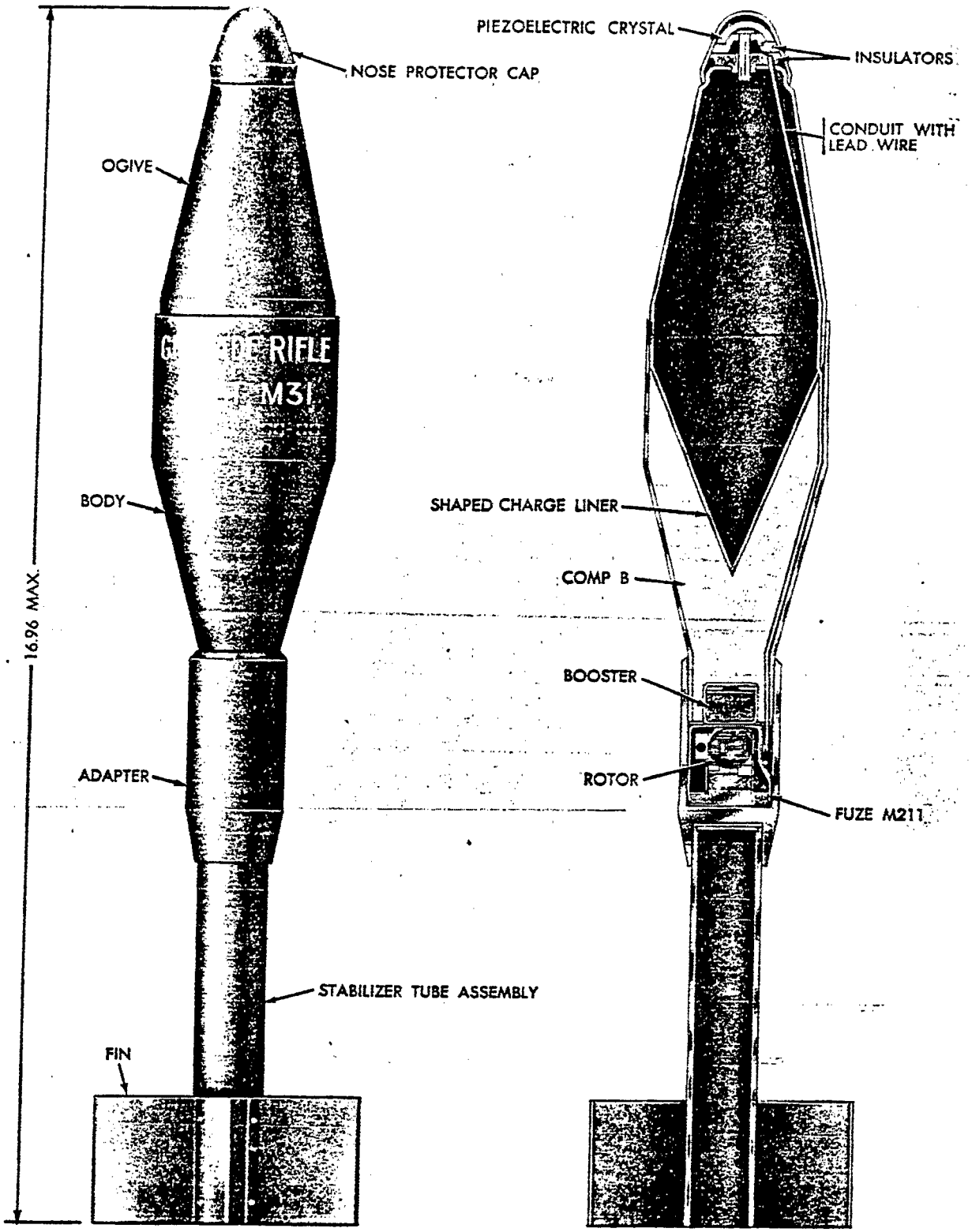


ILLUMINATING GRENADE, M22; INERT PRACTICE RIFLE GRENADE; SMOKE (WP) GRENADE, M19

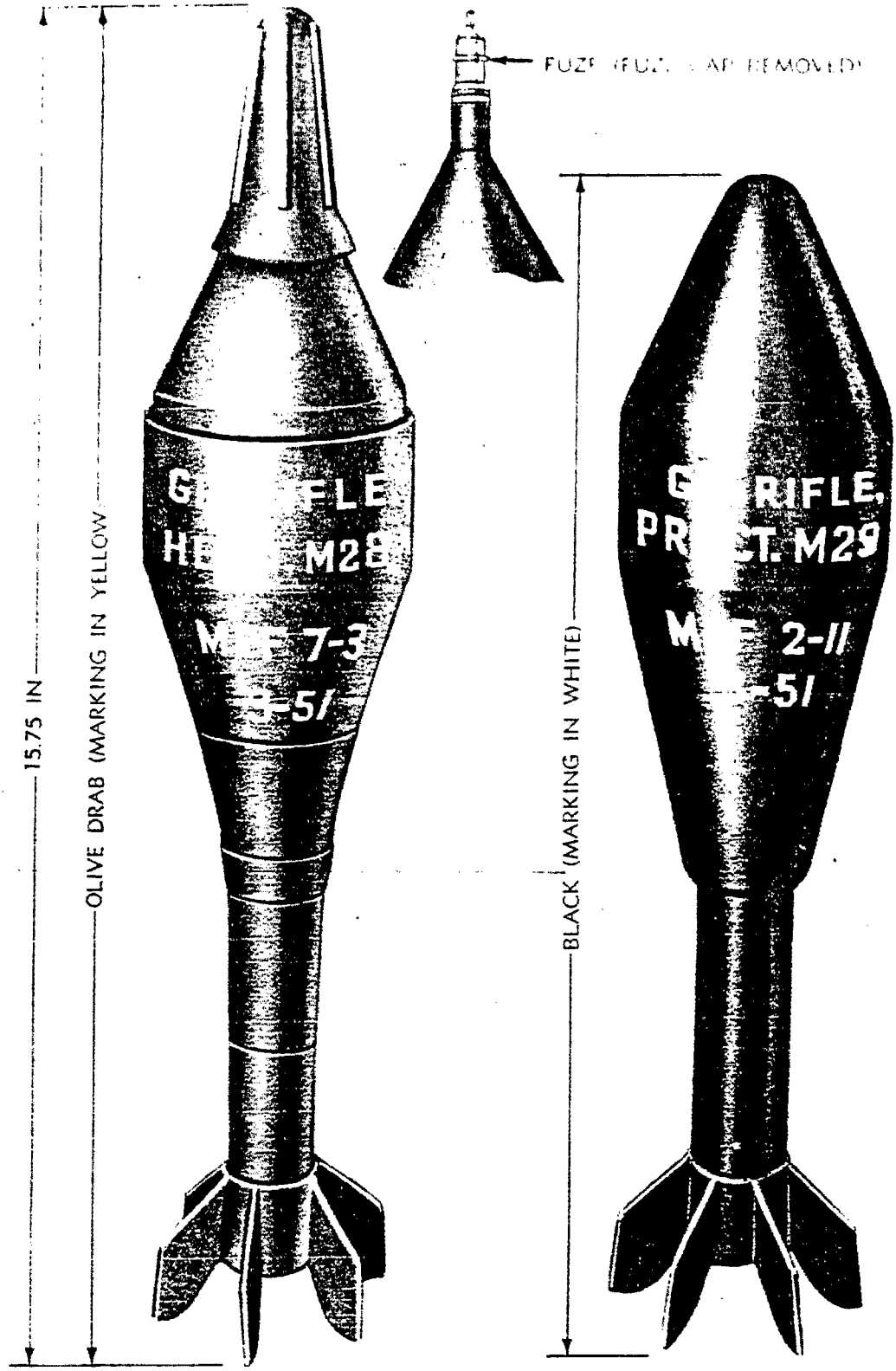
RIFLE GRENADES THAT HAVE SIMILAR CHARACTERISTICS

MODEL	TYPE	FILLER	OLD COLOR CODE	NEW COLOR CODE
M19A1	SMOKE	WP	GRAY BODY W/YELLOW BAND, YELLOW MARKING, OLIVE DRAB STABILIZER	LIGHT GREEN BODY W/YELLOW BAND, LIGHT RED MARKING, OLIVE DRAB STABILIZER
M22 SERIES	COLORED SMOKE		GRAY BODY W/YELLOW BAND, YELLOW MARKING, OLIVE DRAB STABILIZER	LIGHT GREEN BODY W/BLACK OR WHITE MARKING[1]
M23 SERIES	COLORED STREAMER		GRAY BODY W/YELLOW BAND, YELLOW MARKING, OLIVE DRAB STABILIZER	LIGHT GREEN BODY W/BLACK OR WHITE MARKING[1]

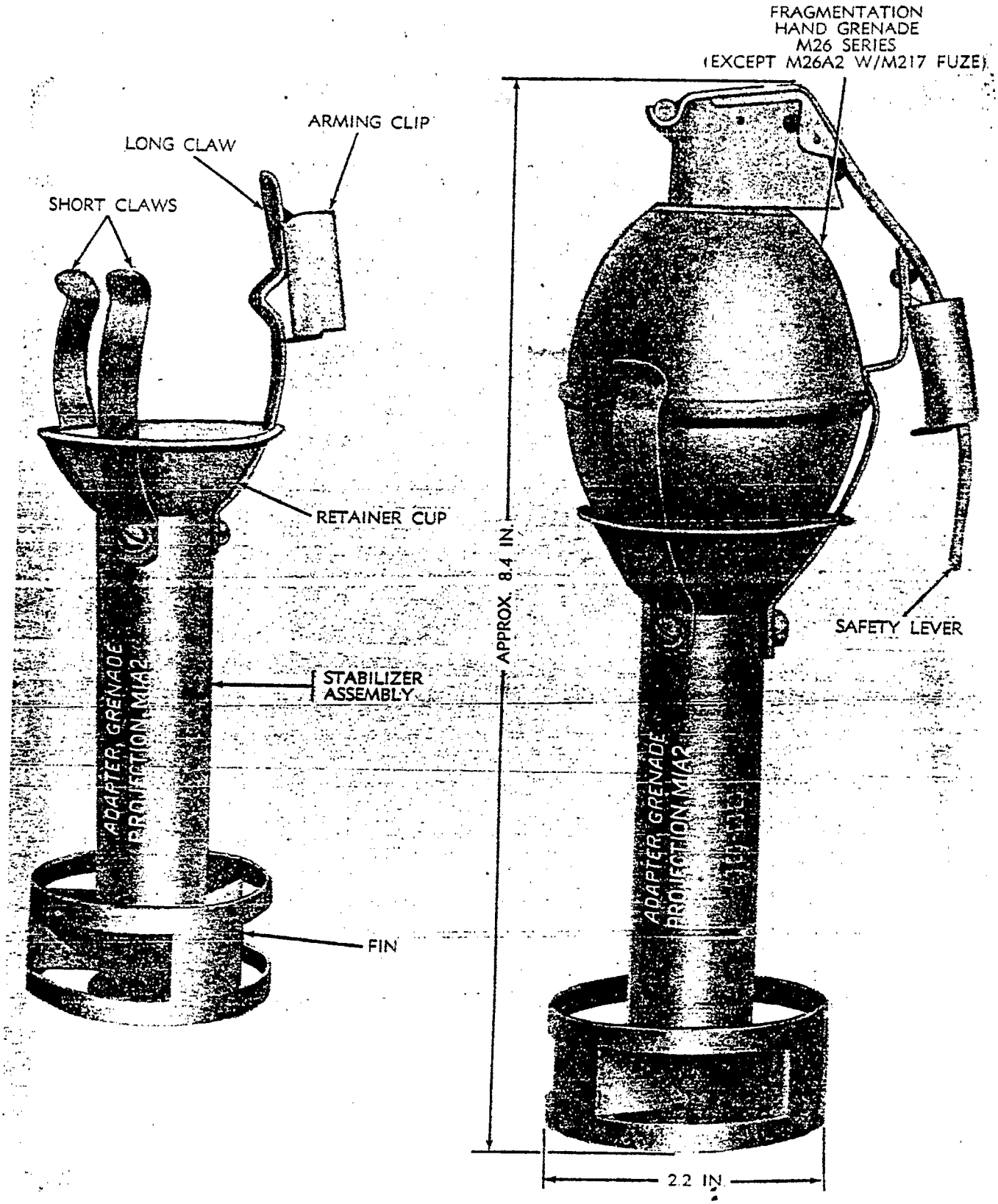
[1] THESE WILL HAVE A BAND OF THE LETTER "C"s AROUND THE OGIVE THE SAME COLOR AS THE SMOKE - GREEN, RED OR YELLOW - THAT THE GRENADE PRODUCES.

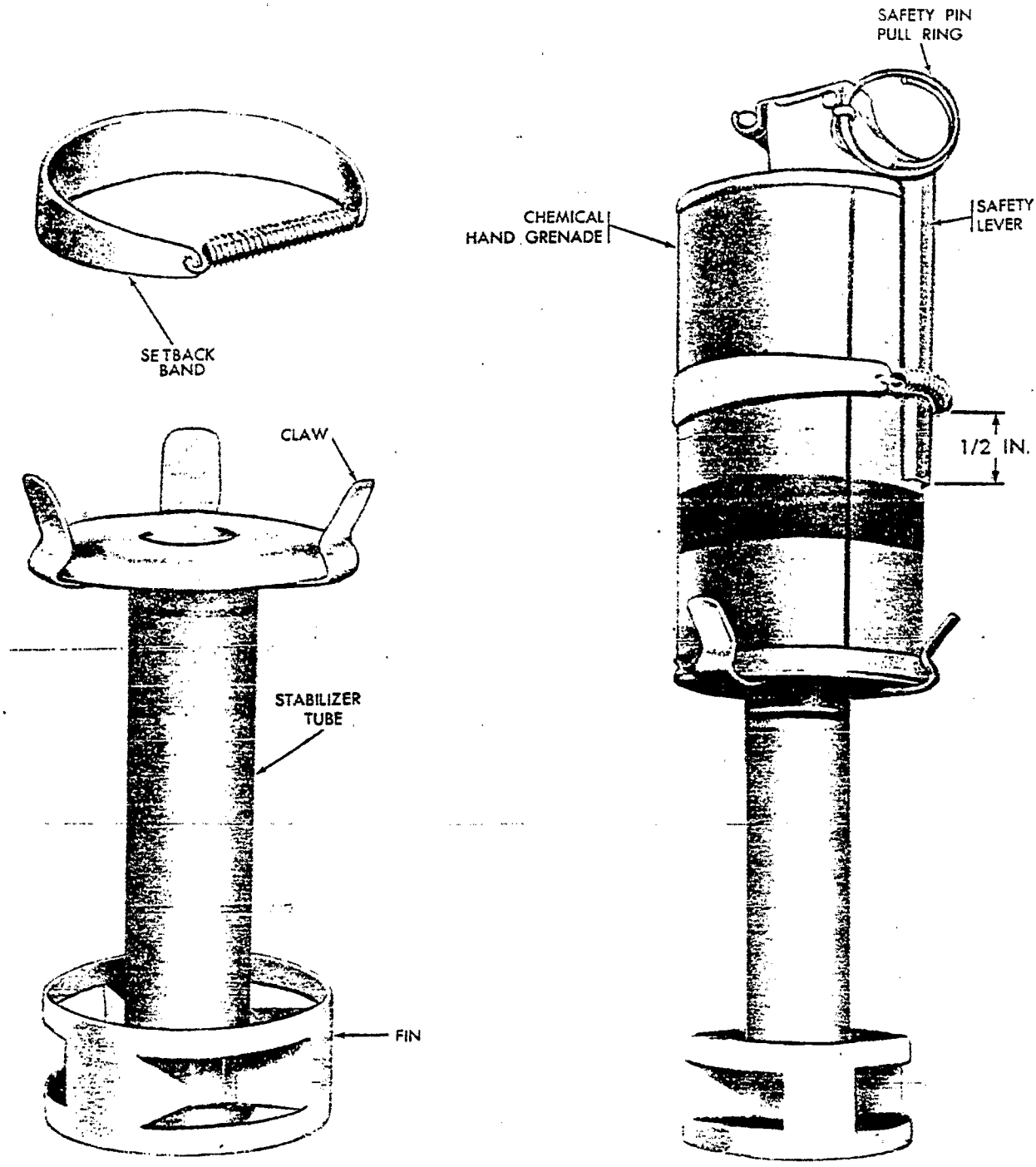


HIGH EXPLOSIVE ANTITANK RIFLE GRENADE, M31



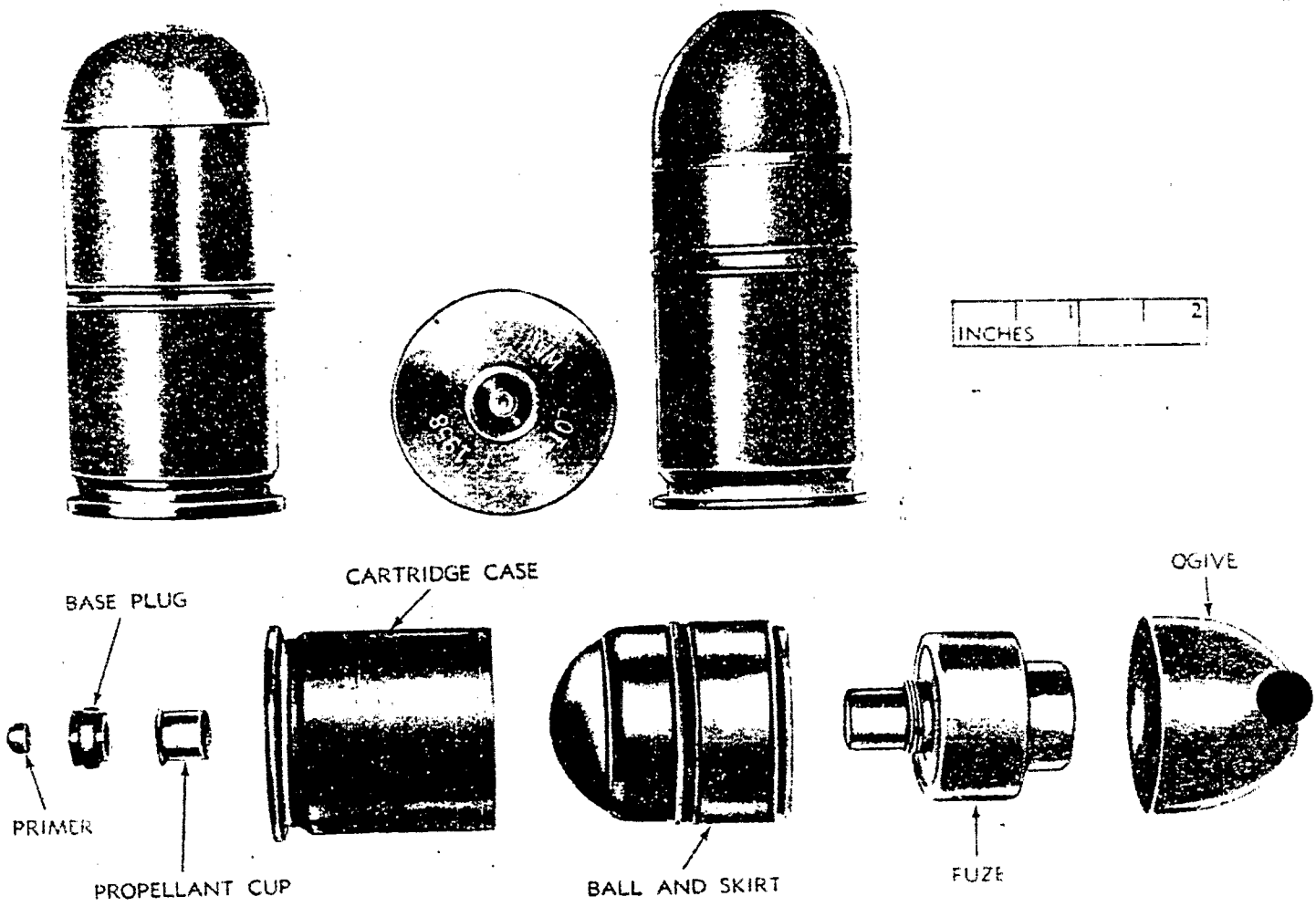
HIGH EXPLOSIVE ANTITANK RIFLE GRENADE, M28,
AND PRACTICE GRENADE, 29


FRAGMENTATION
HAND GRENADE
M26 SERIES
(EXCEPT M26A2 W/M217 FUZE)
ARMING CLIP
LONG CLAW
SHORT CLAWS
RETAINER CUP
STABILIZER
ASSEMBLY
FIN
ADAPTER, GRENADE
PROJECTION M1A2
APPROX. 8.4 IN.
SAFETY LEVER
2.2 IN.

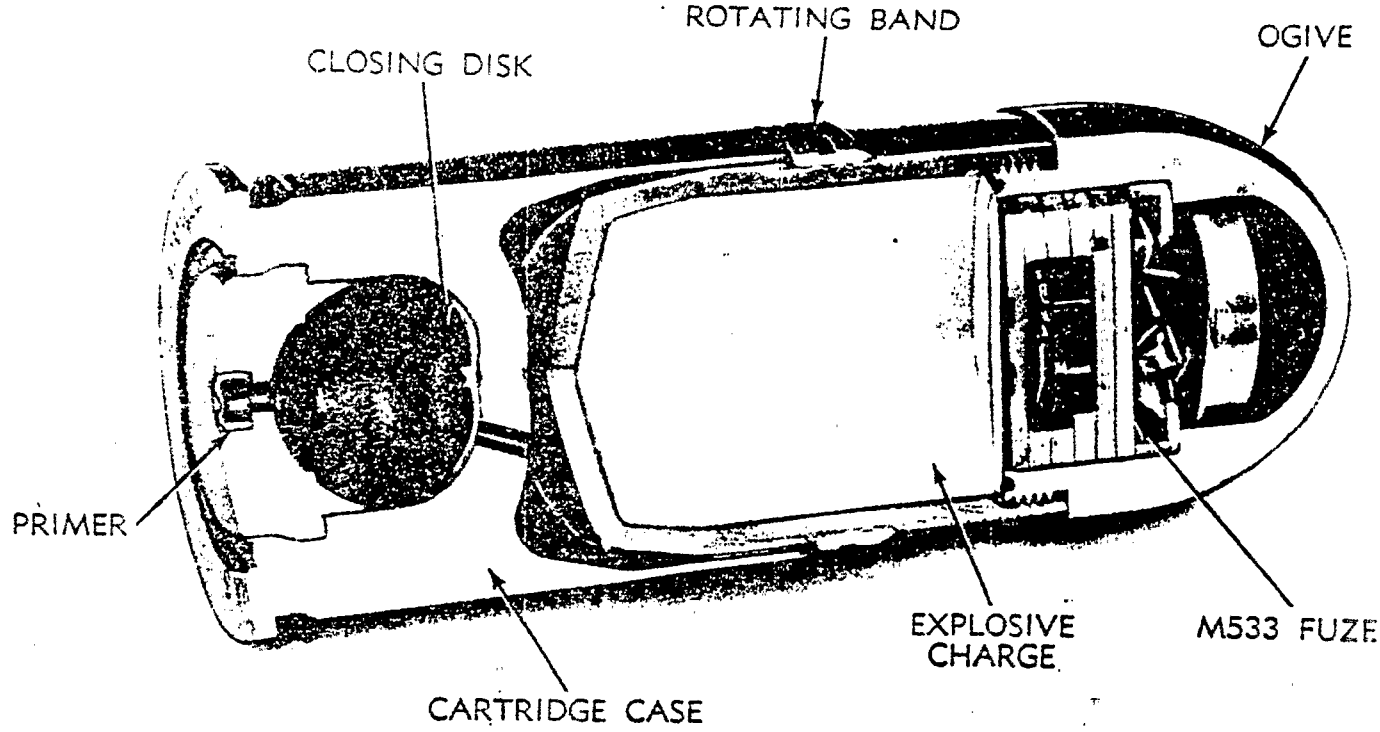


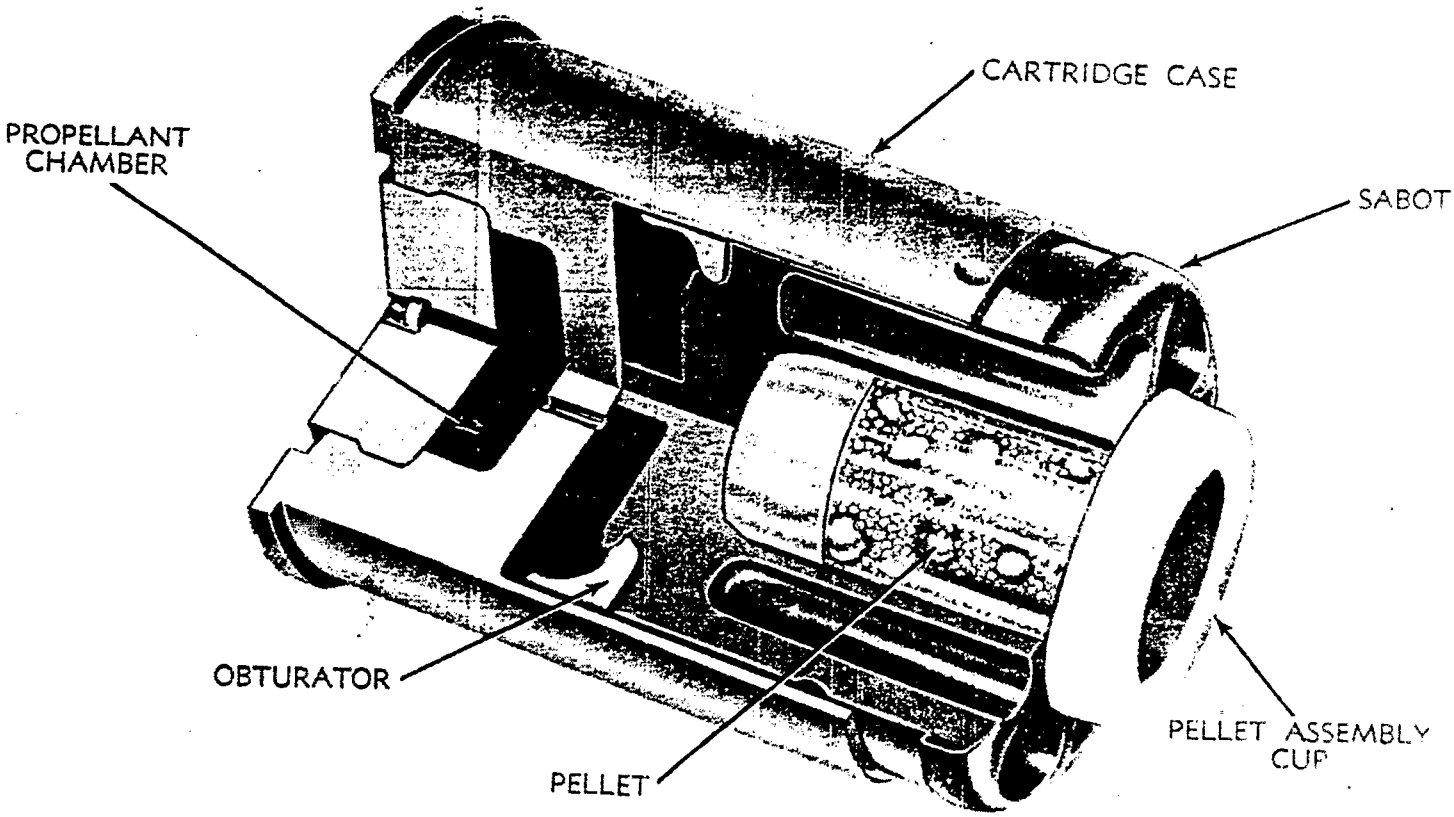
GRENADE PROJECTION ADAPTER, M2A1

TYPICAL 40MM GRENADE PROJECTILE

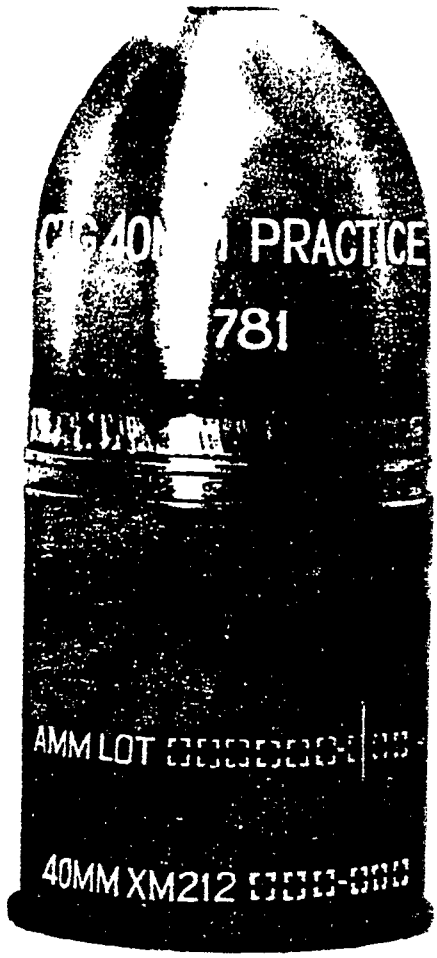


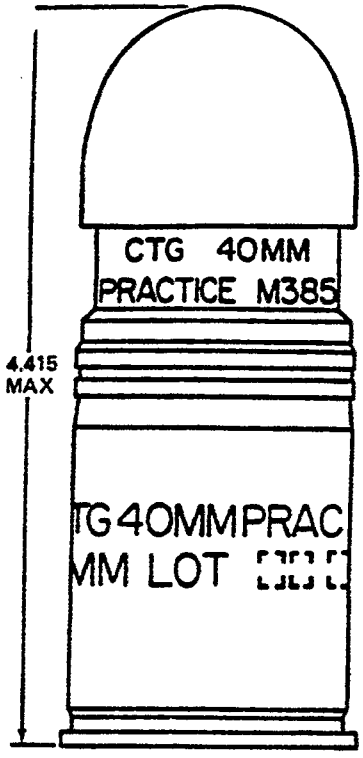
TYPICAL COMPONENTS OF A 40 MM GRENADE

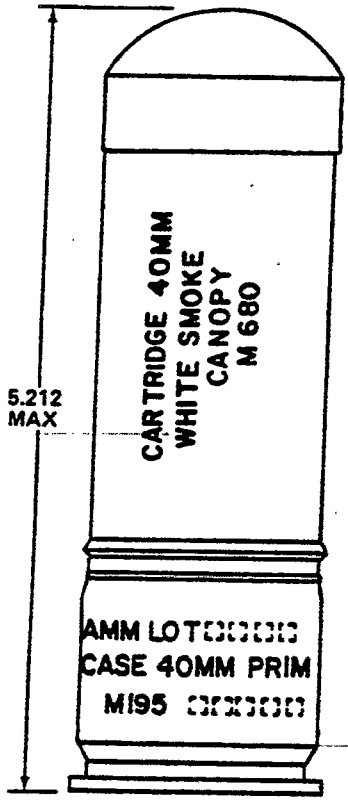




HIGH EXPLOSIVE 40 MM GRENADE AND ANTIPERSONNEL GRENADE







EXAMPLES OF VARIOUS SHAPES OF PROJECTILES

LAND MINES

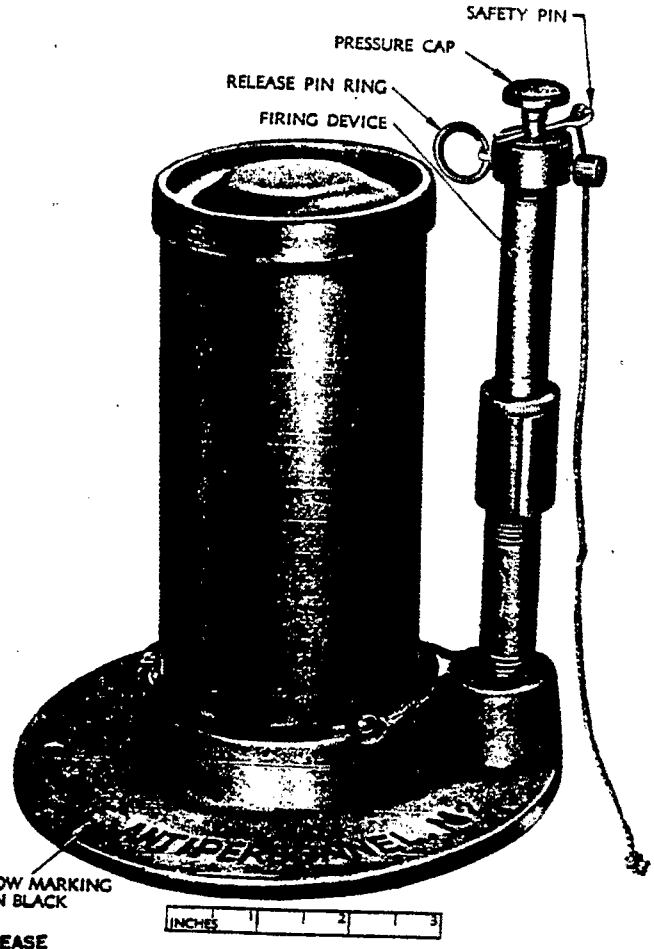
LAND MINES GENERALLY FALL INTO TWO CATEGORIES: ANTITANK (AT) AND ANTIPERSONNEL (AP). THE MINES WE WILL LOOK AT WERE EMPLOYED BY BURYING IN THE GROUND. ALTHOUGH THEY WERE INTENDED TO BE ACTIVATED BY A VEHICLE DRIVING OVER THEM OR SOMEONE STEPPING ON THEM, THERE WERE NUMEROUS SMALL DEVICES MADE THAT WOULD ALLOW MINES TO BE CONVERTED INTO BOOBY TRAPS AS WELL.

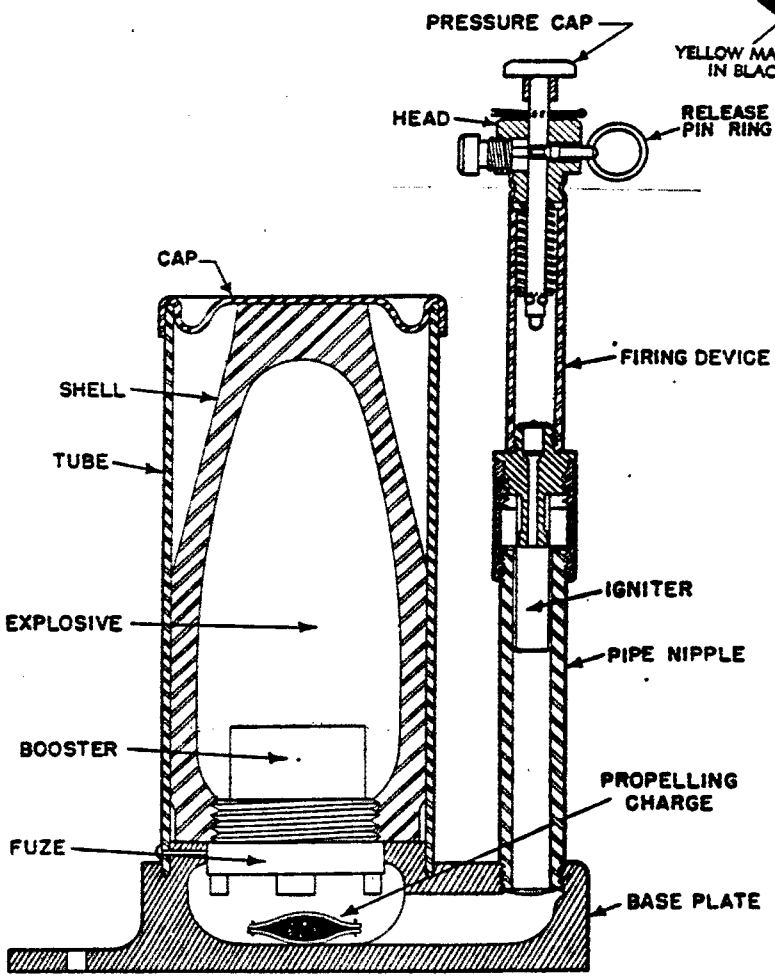
GENERAL STATEMENTS:

THE BUILT-IN SAFETY FEATURE ON MOST MINES WAS THAT SOME COMPONENT OF THEIR EXPLOSIVE TRAIN, TYPICALLY THE FUZE OR BOOSTER, WAS NOT INSTALLED UNTIL THEY WERE READY TO BE USED.

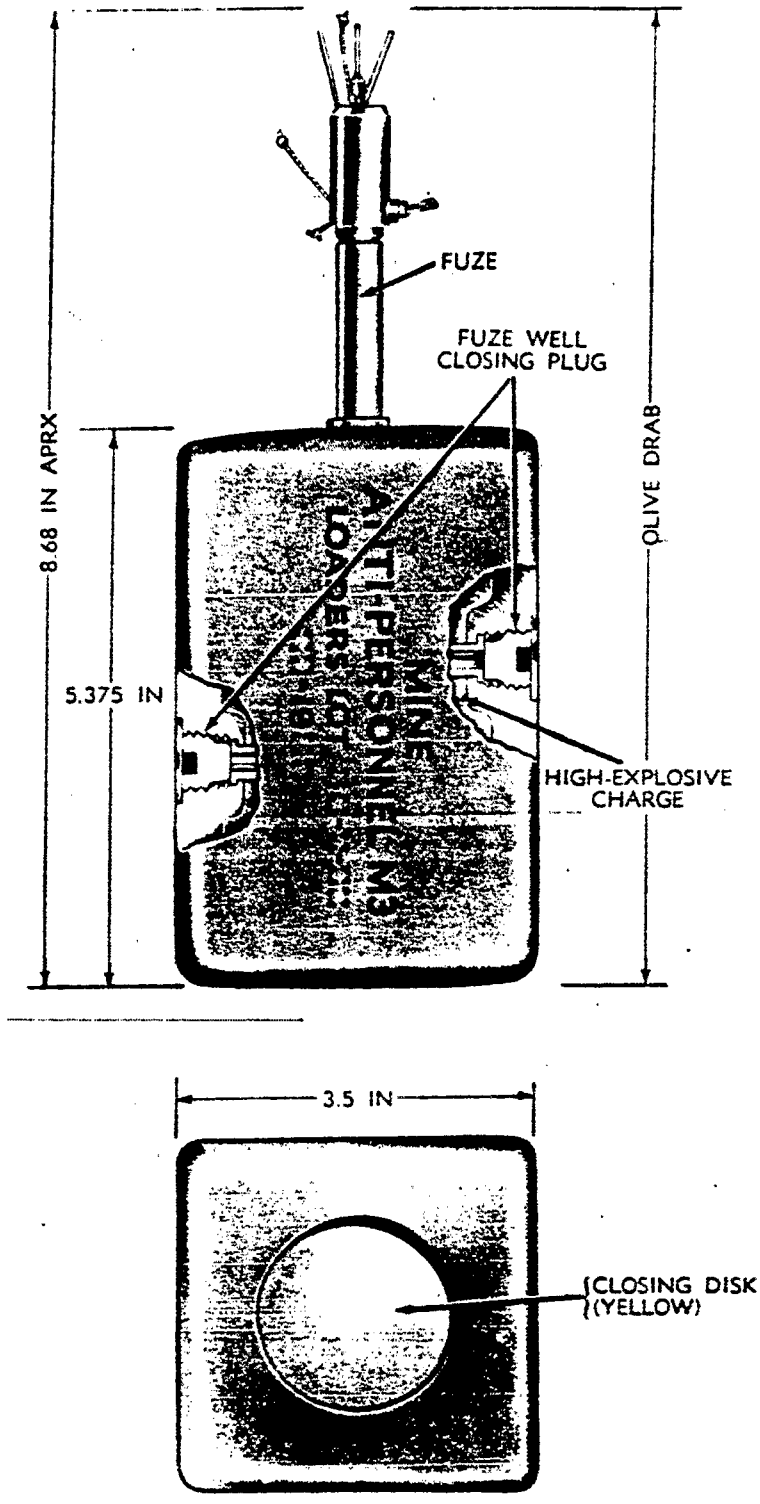
A SECOND SAFETY FEATURE THAT WAS FREQUENTLY EMPLOYED WAS THAT THE FUZE ALSO HAD SOME TYPE OF ADDITIONAL SAFETY DEVICE THAT MUST BE REMOVED OR MANIPULATED BEFORE THE MINE WAS ARMED.

MOST U.S. LAND MINES WERE RELATIVELY SMALL, WEIGHING ONLY A FEW POUNDS, SO THAT THEY COULD BE CARRIED AN EMPLOYED BY ONE MAN.

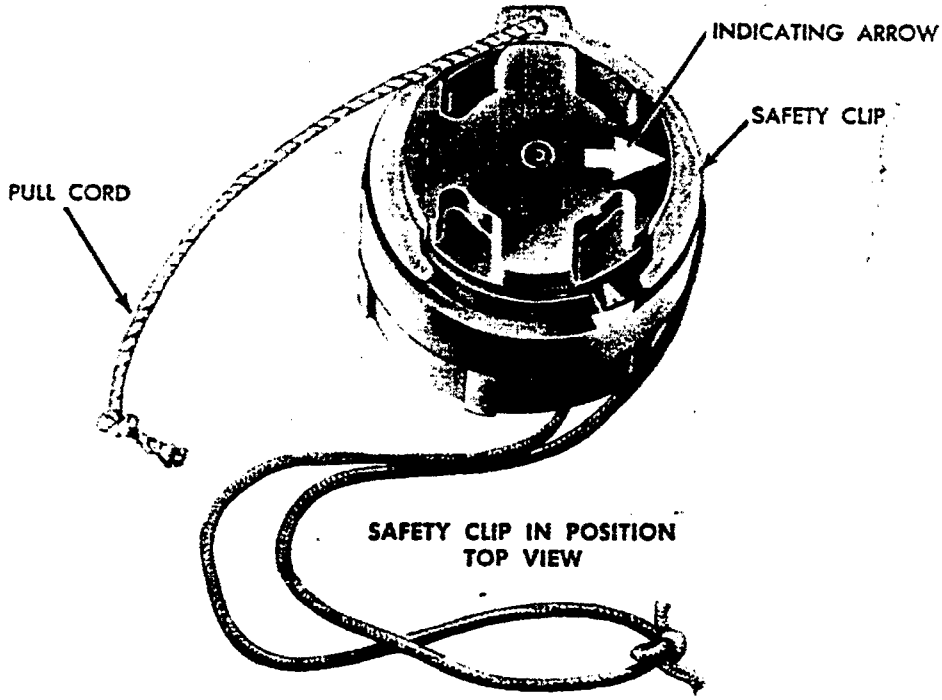


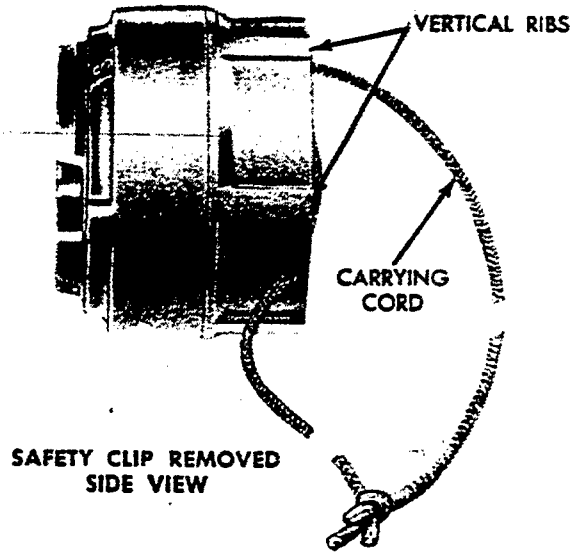


ANTIPERSONNEL MINE, M2

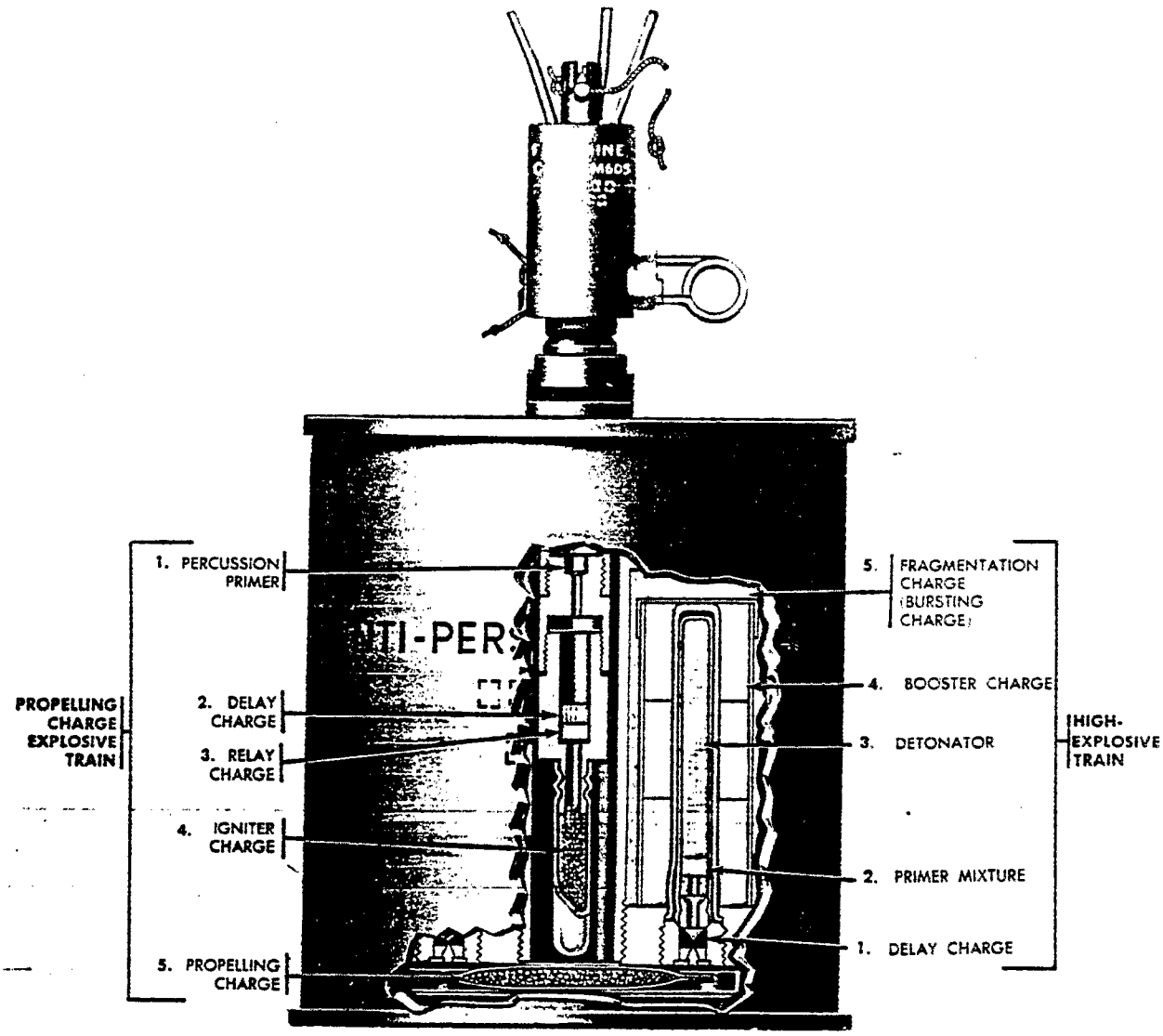


ANTIPERSONNEL MINE, M3

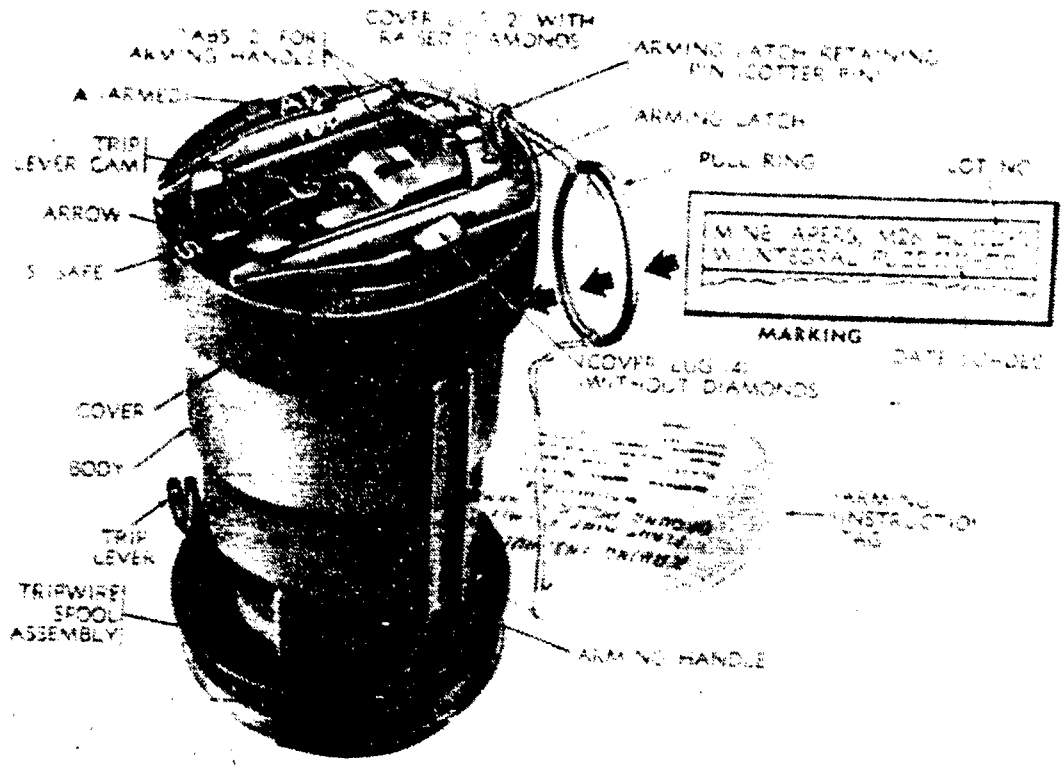




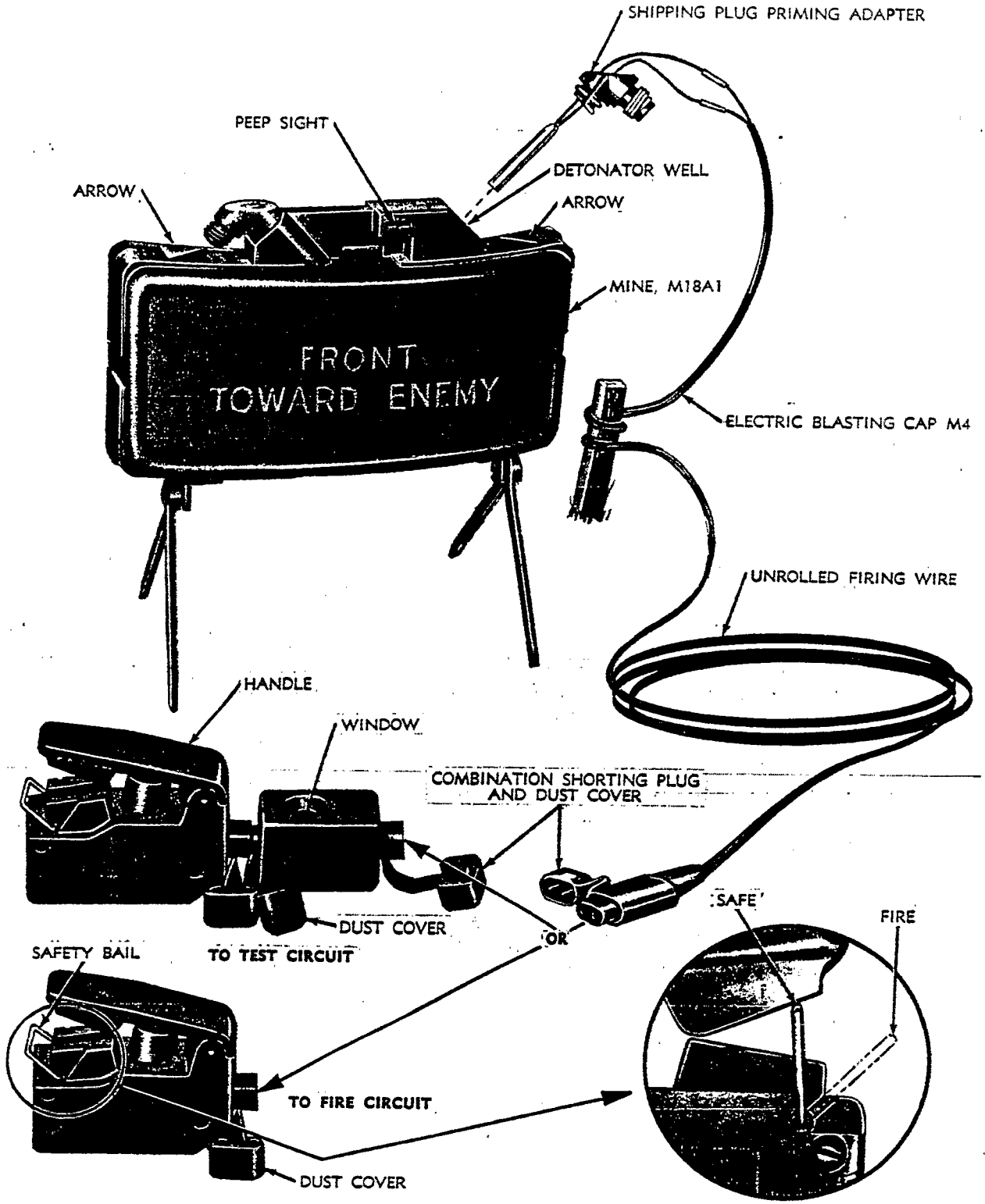
ANTIPERSONNEL MINE, NON-METALLIC, M14



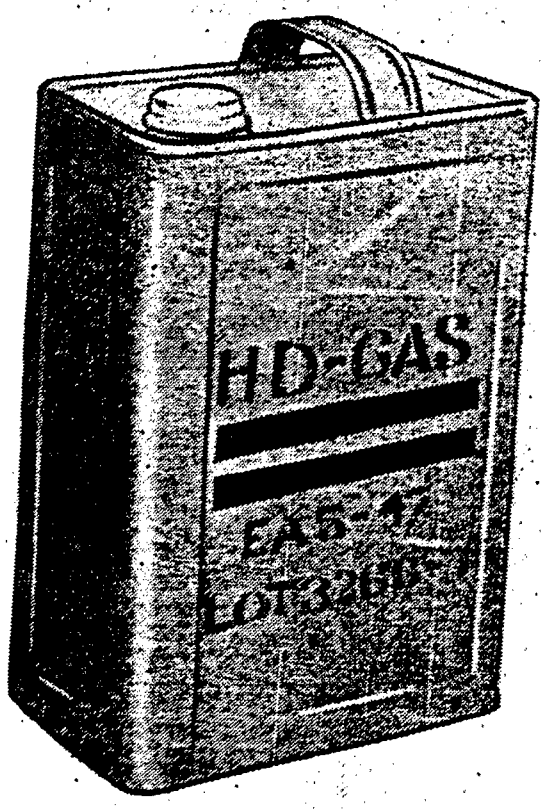
ANTIPERSONNEL MINE, M16



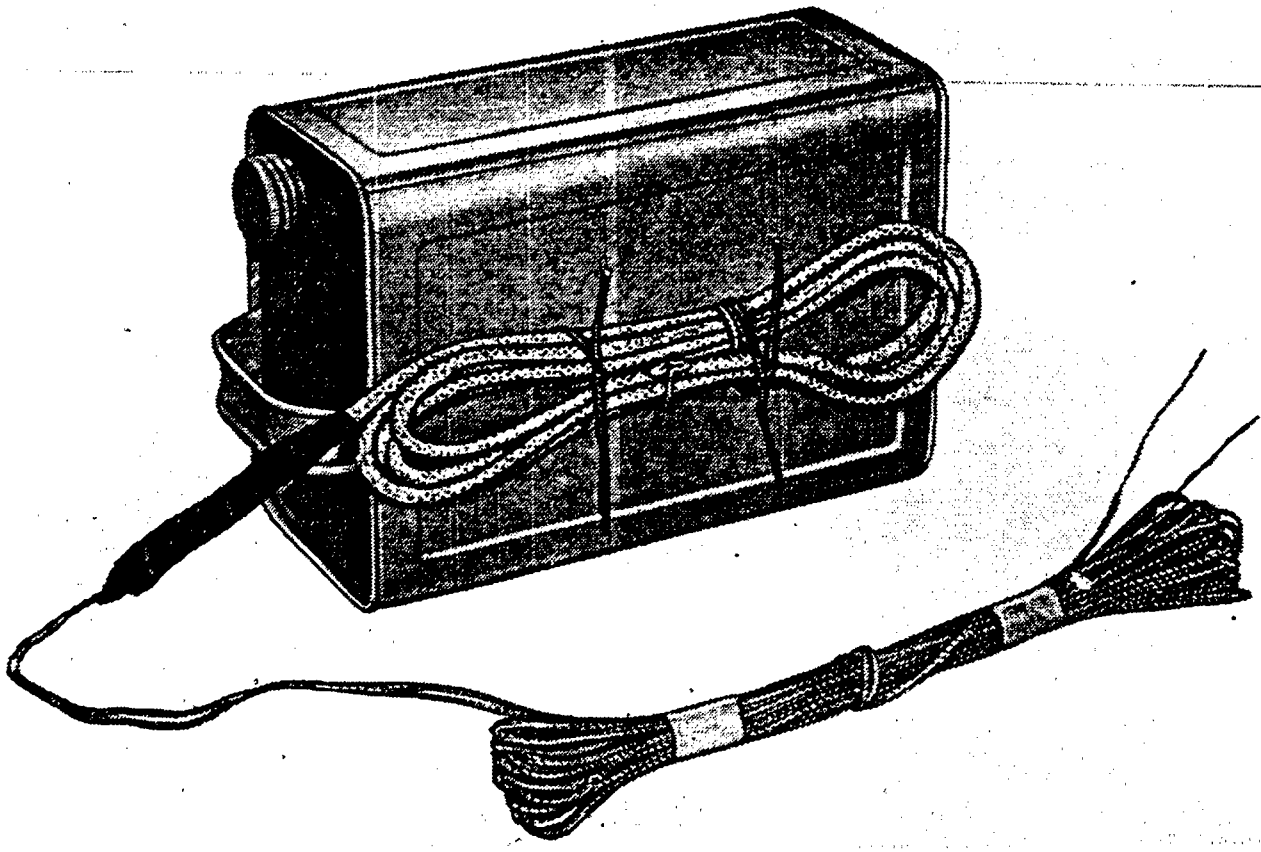
ANTIPERSONNEL MINE, M26

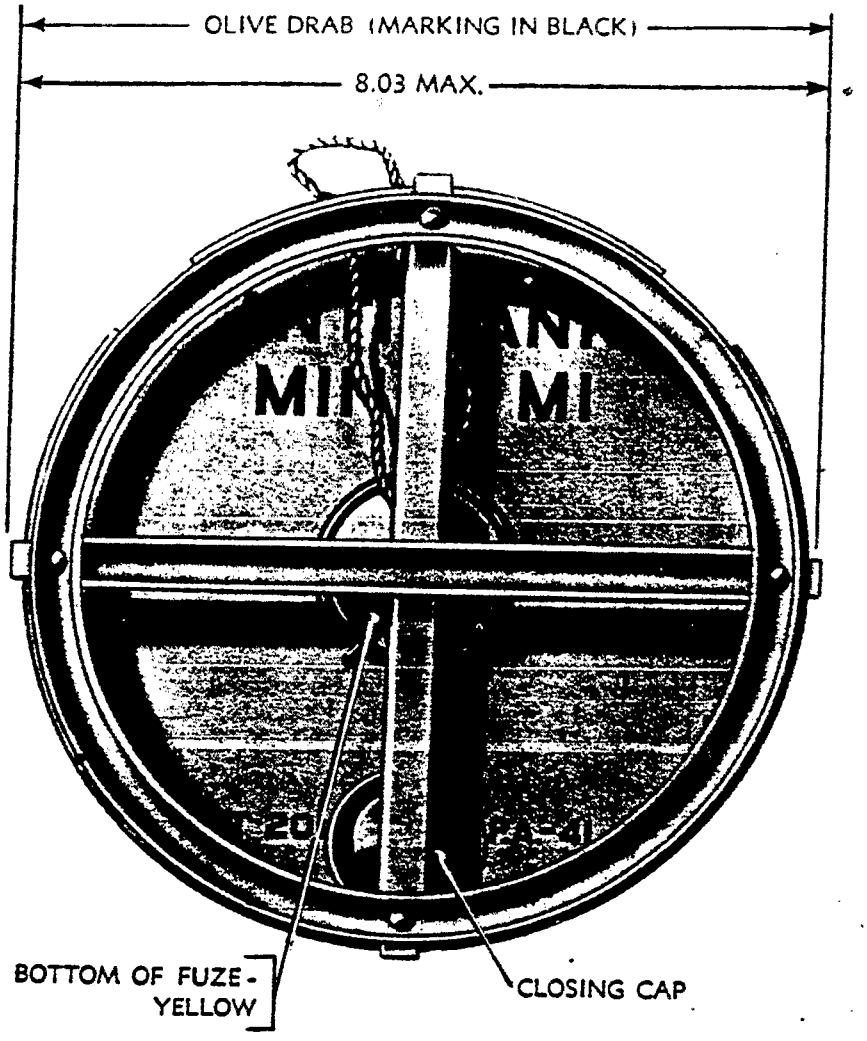


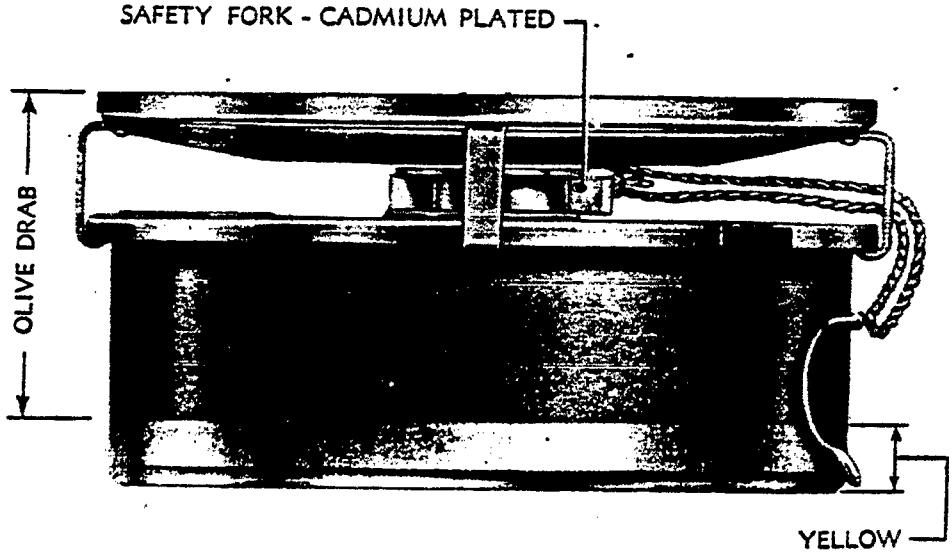
ANTIPERSONNEL MINE, M18A1



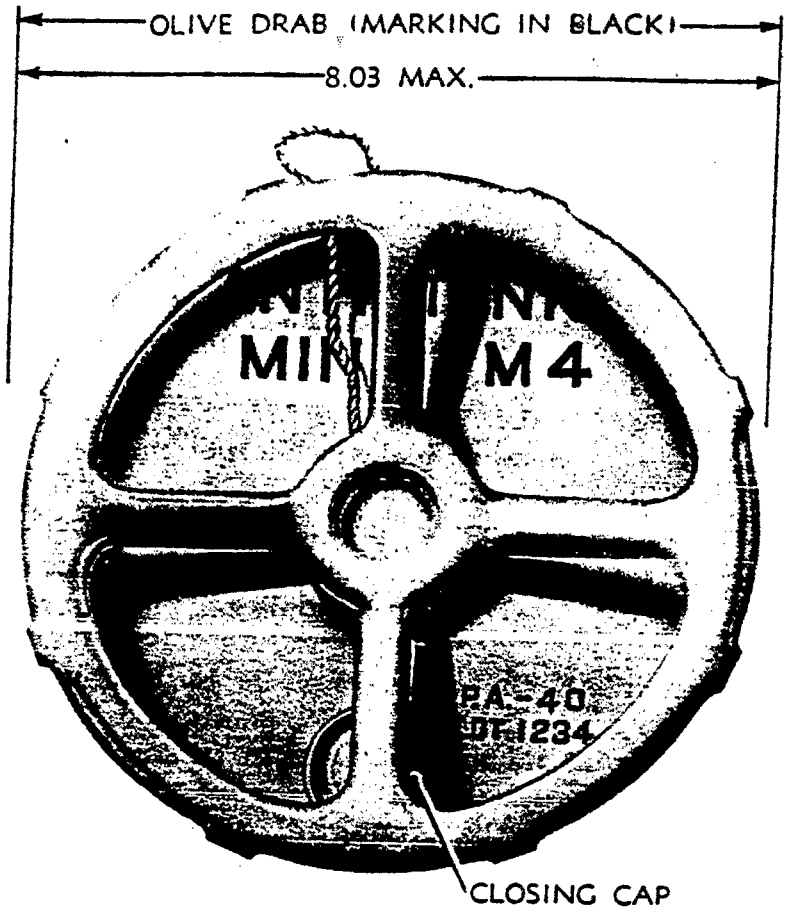
ONE GALLON CHEMICAL LAND MINE

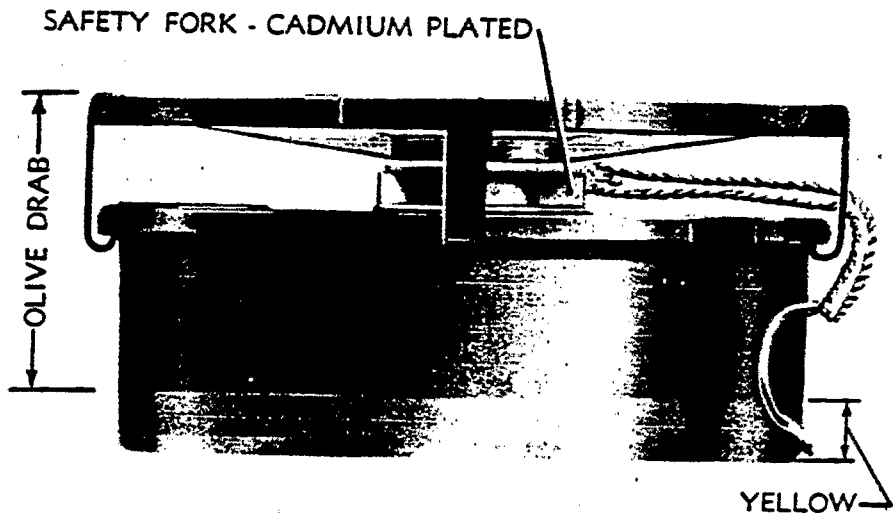




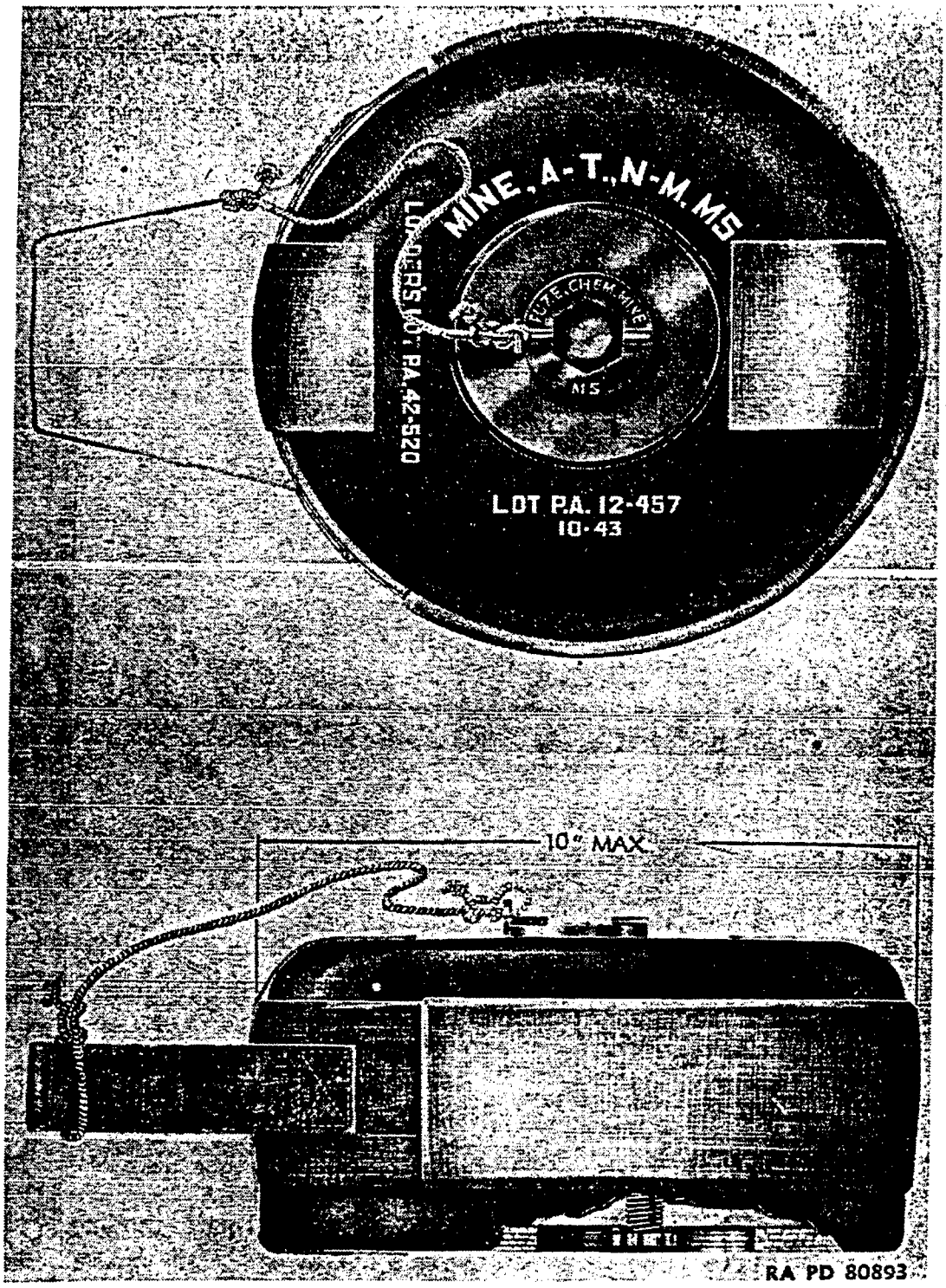


ANTITANK MINE, M1

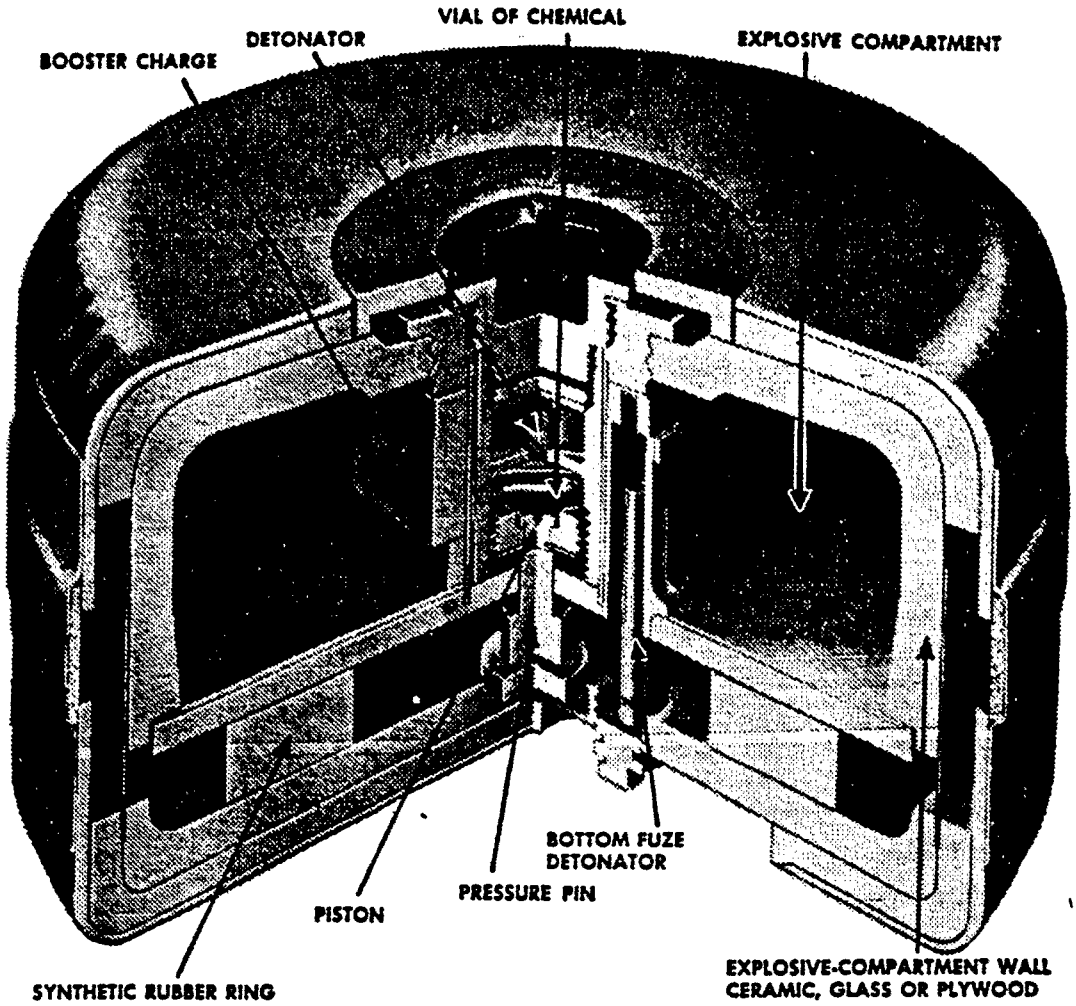




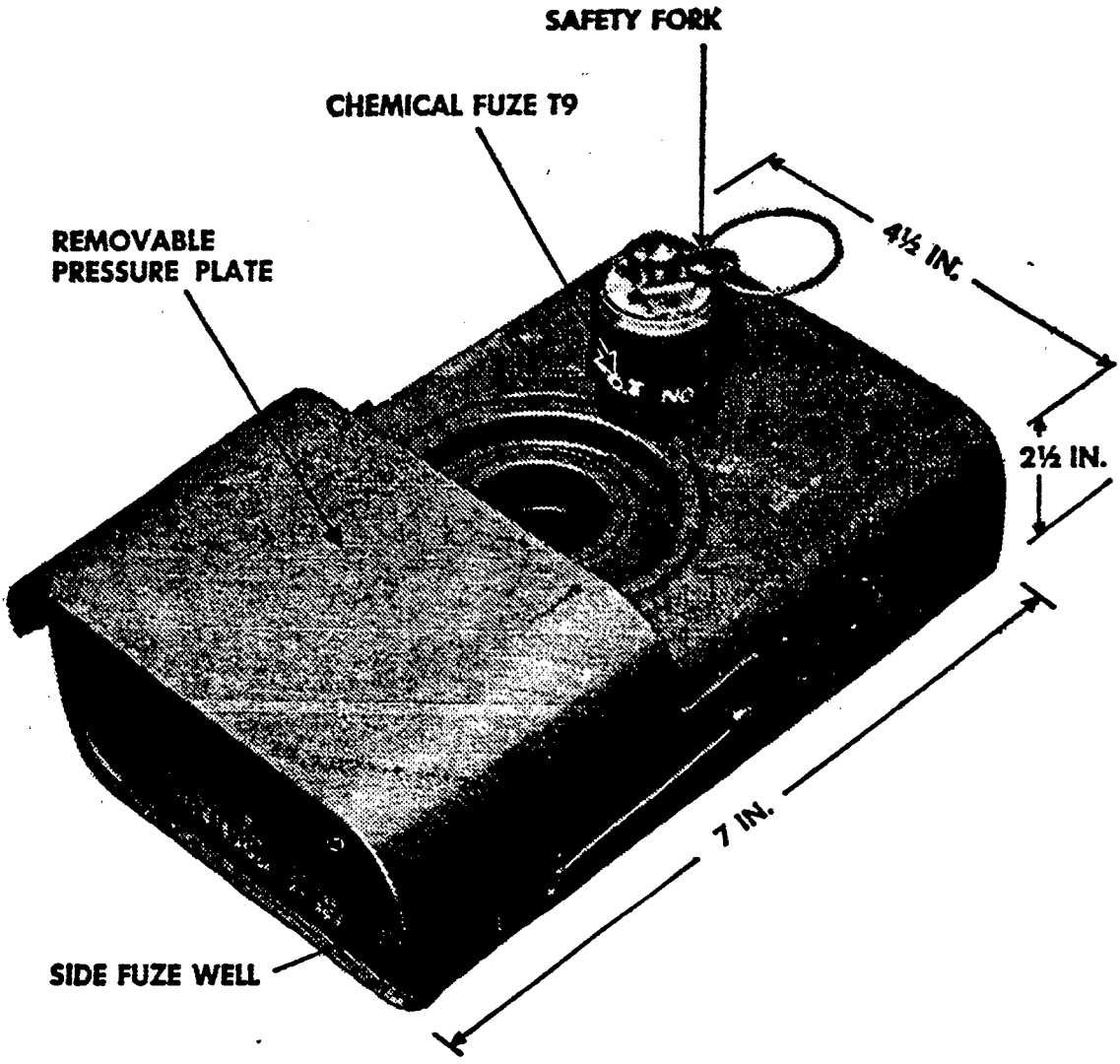
ANTITANK MINE, M4



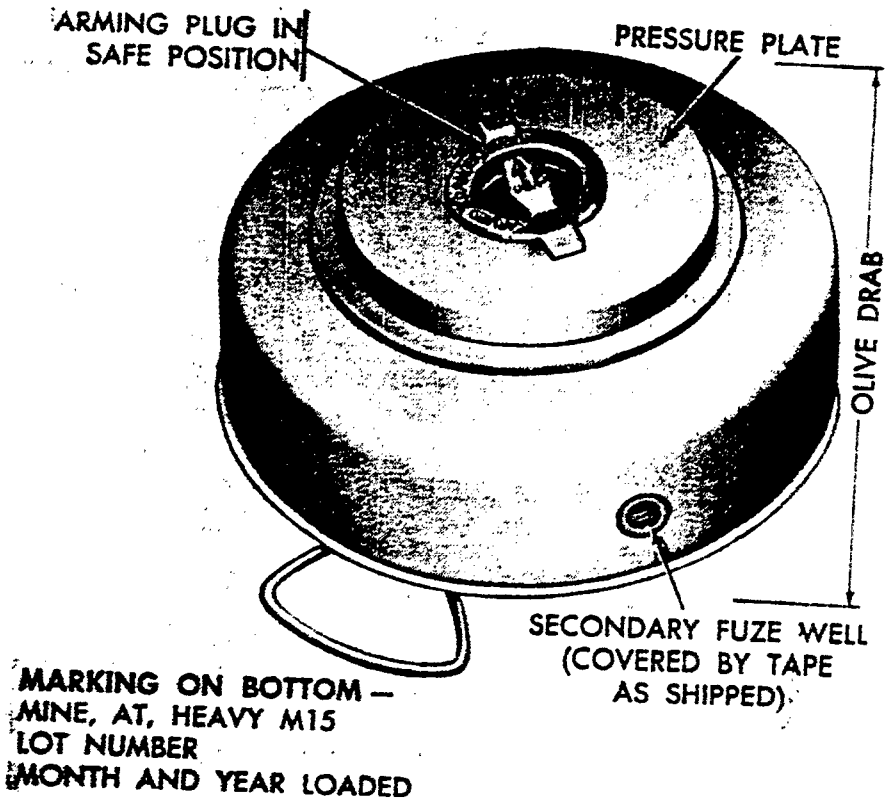
ANTITANK MINE, M5



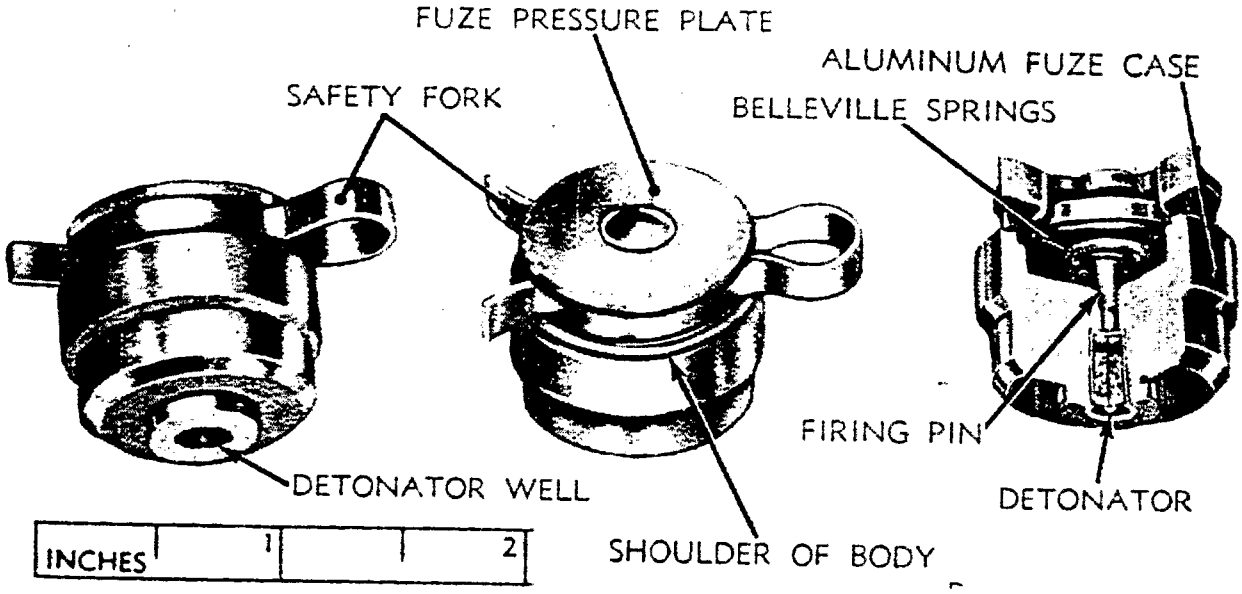
ANTITANK MINE, M5



ANTITANK MINE, T7

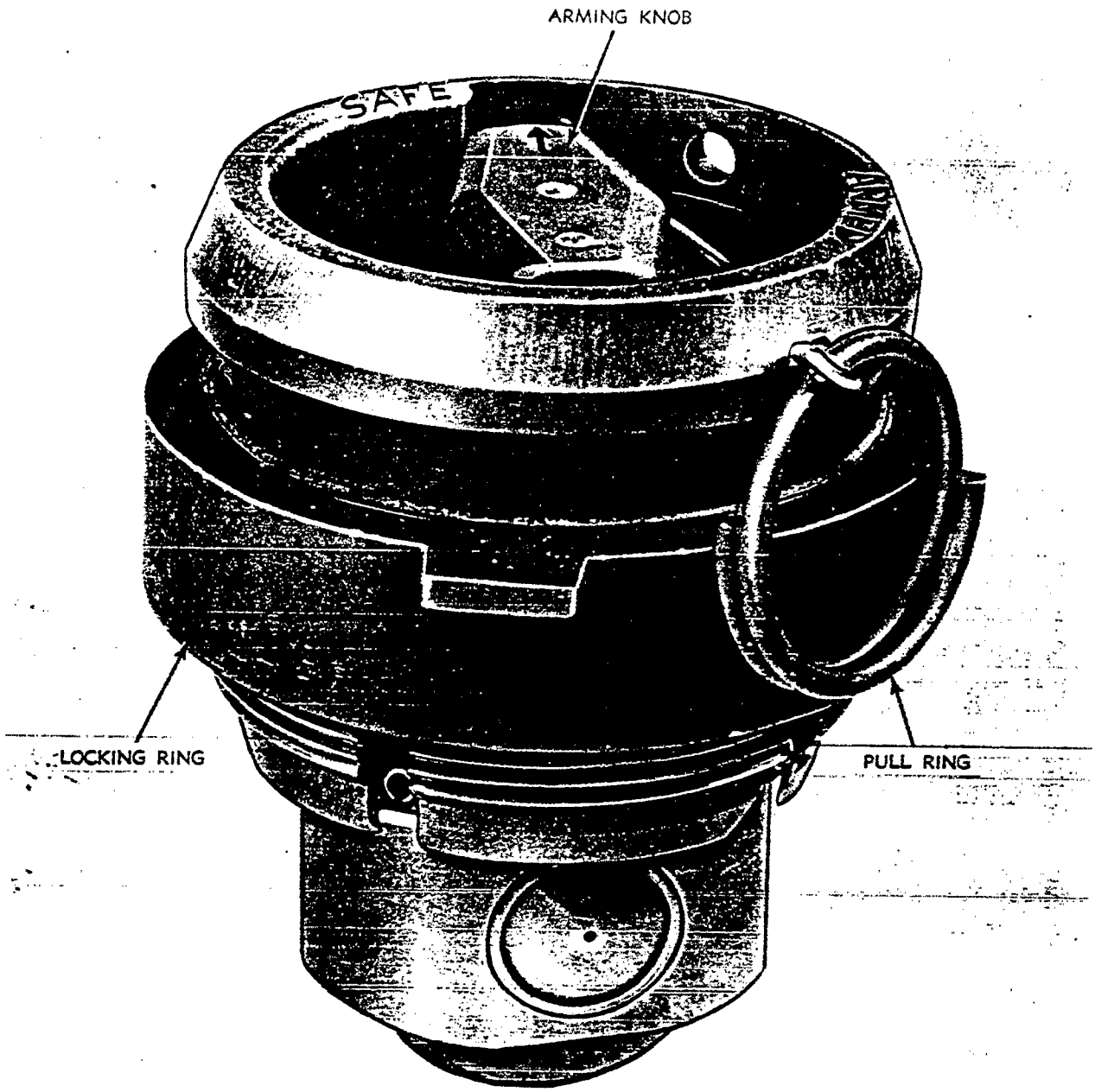


ANTITANK MINE, M15

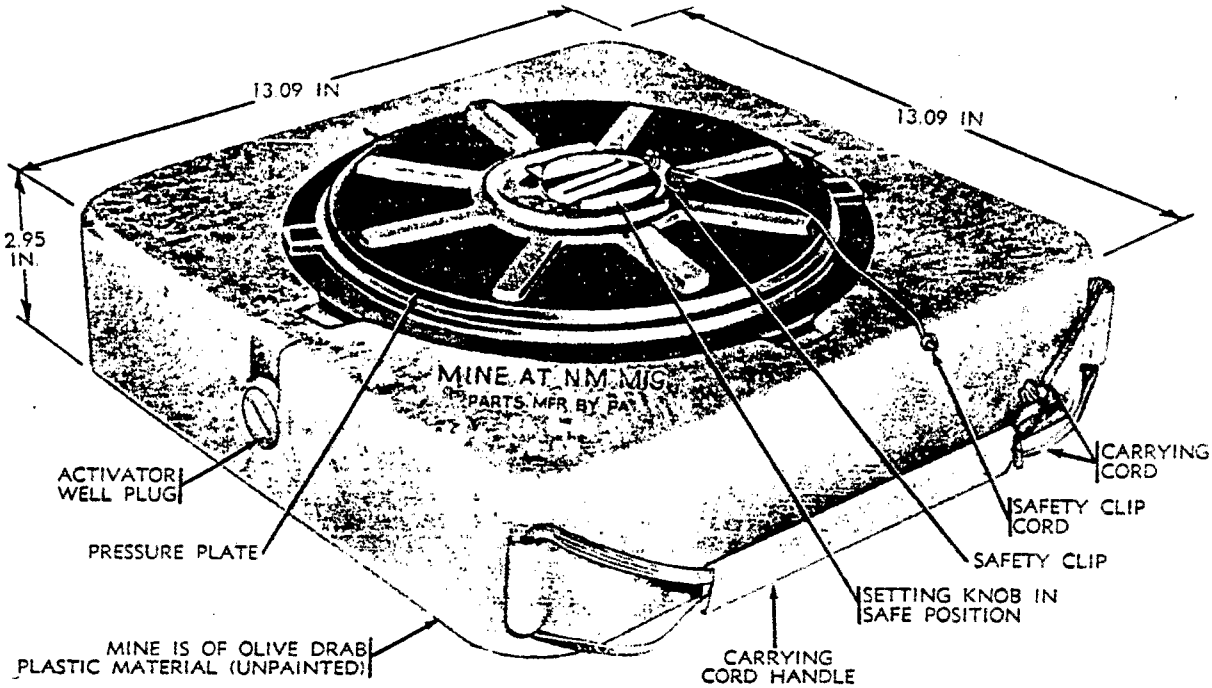


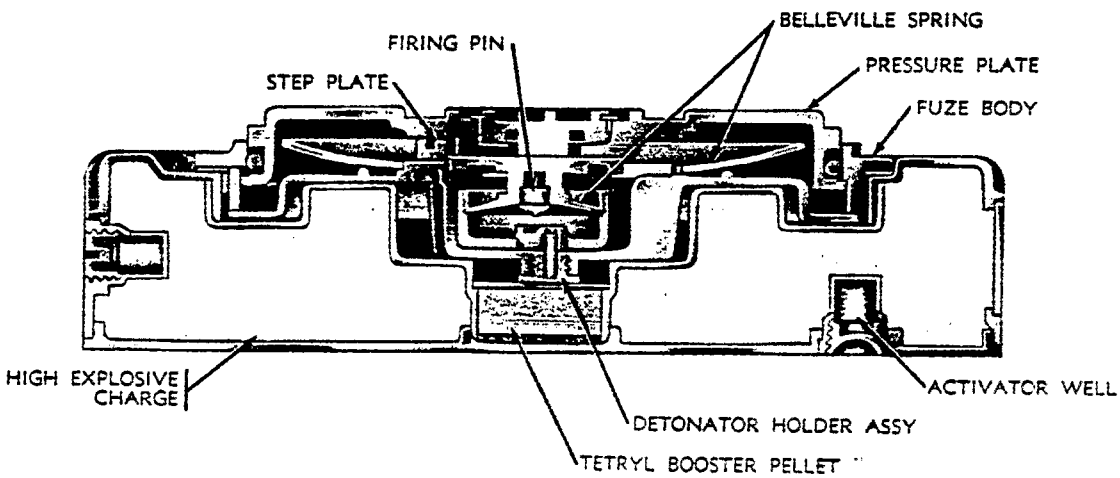
FUZE, ANTITANK, M603

FUZE, CHEMICAL, MINE, ANTITANK, T8E1

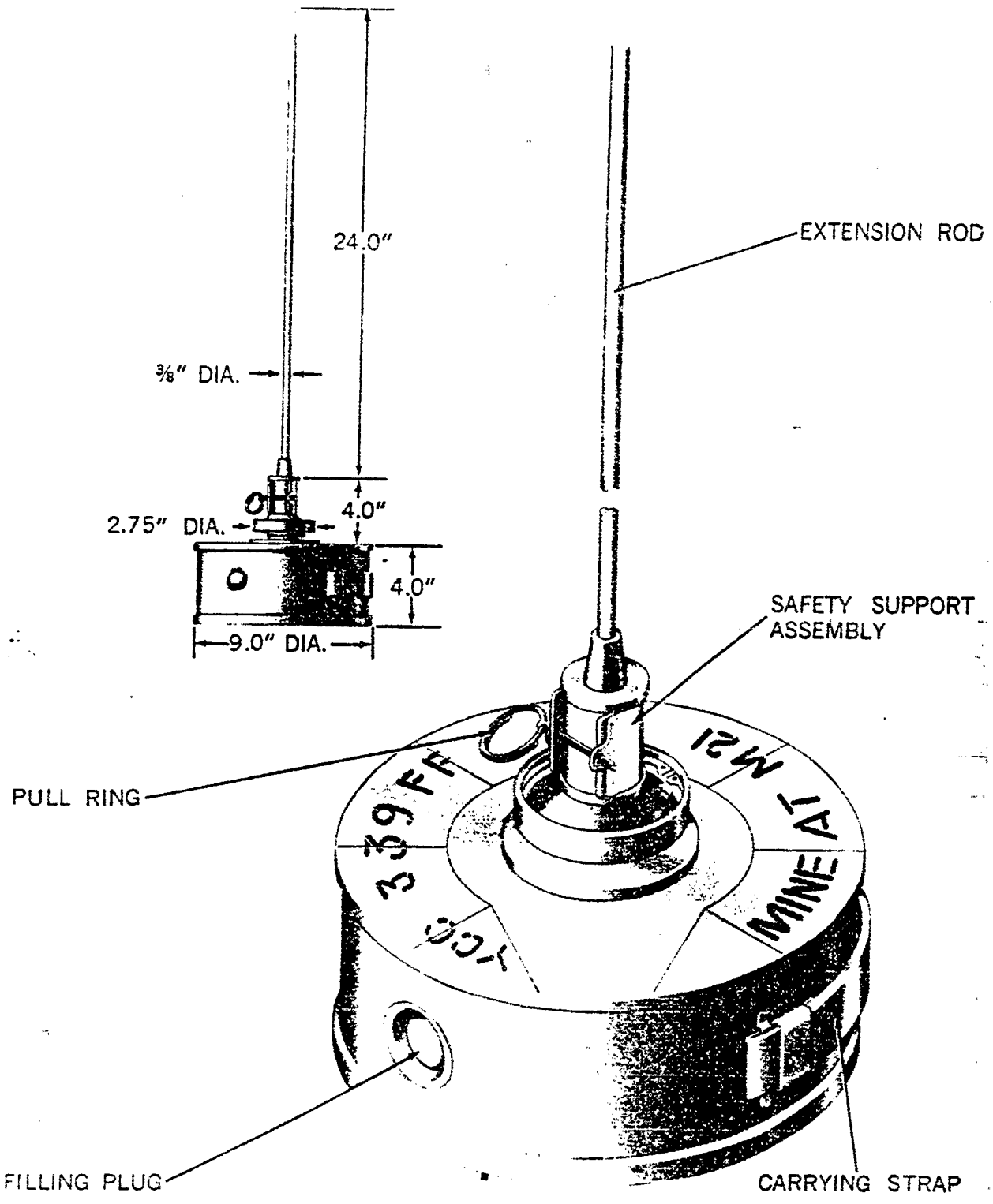


FUZE, ANTITANK MINE, M608

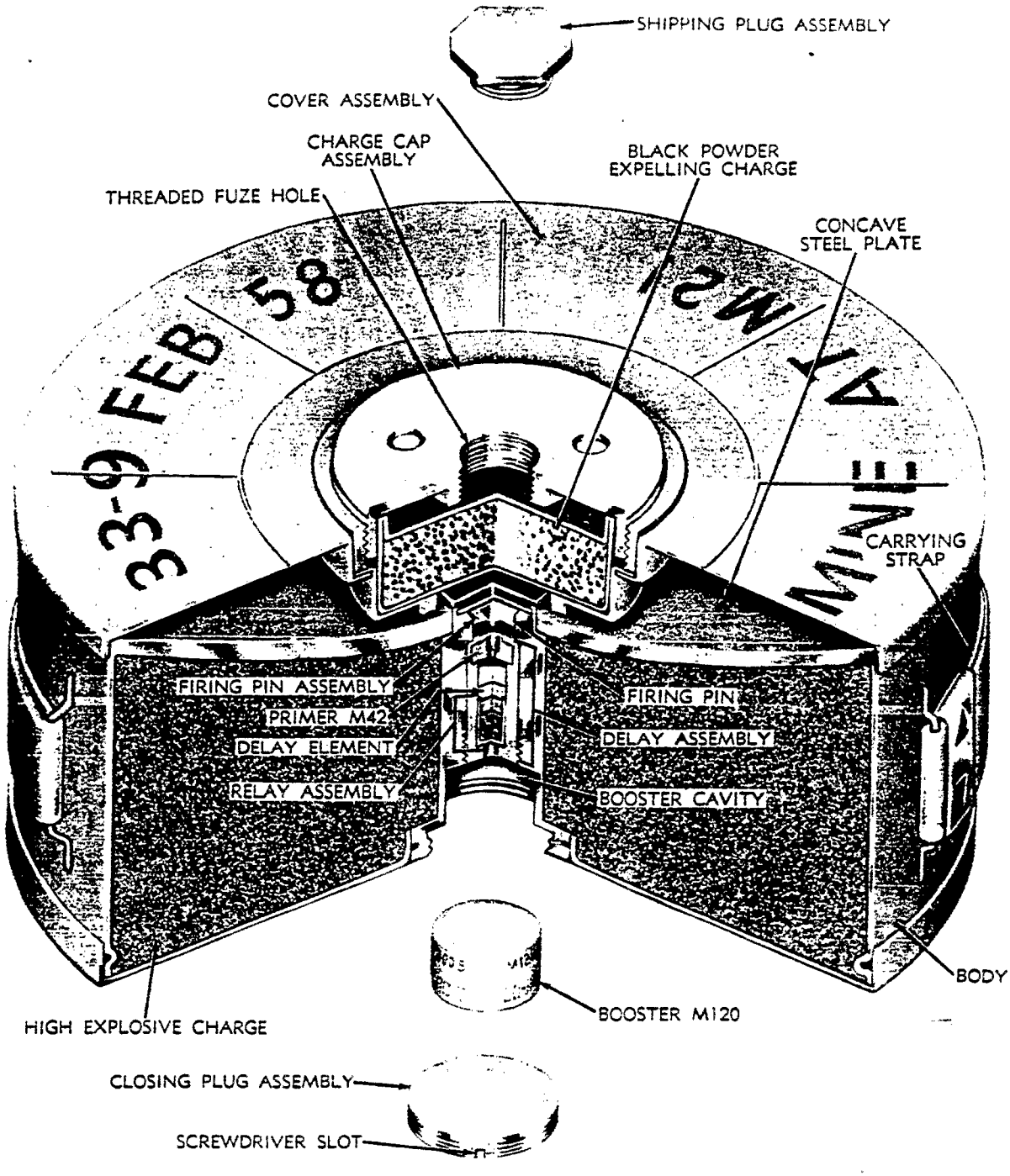




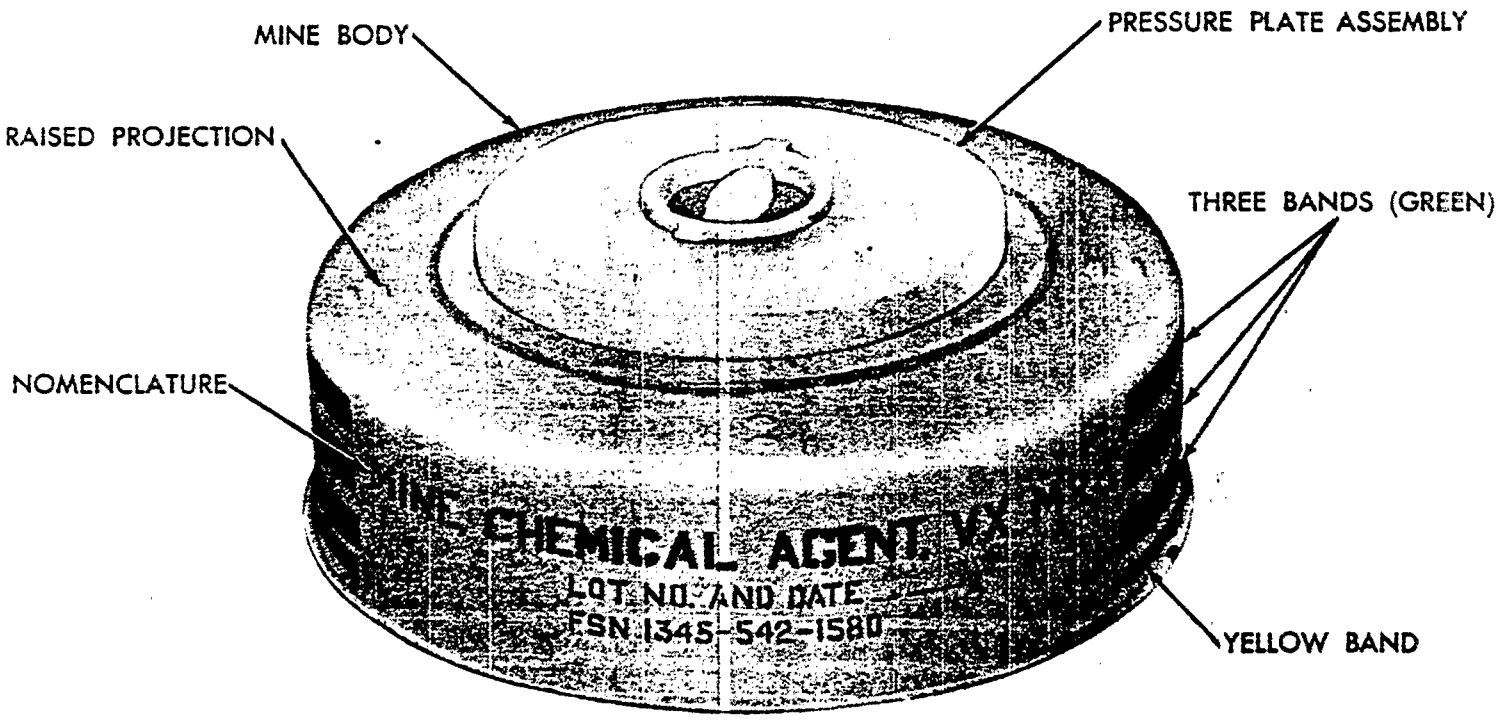
ANTITANK MINE, NON-METALLIC, M19



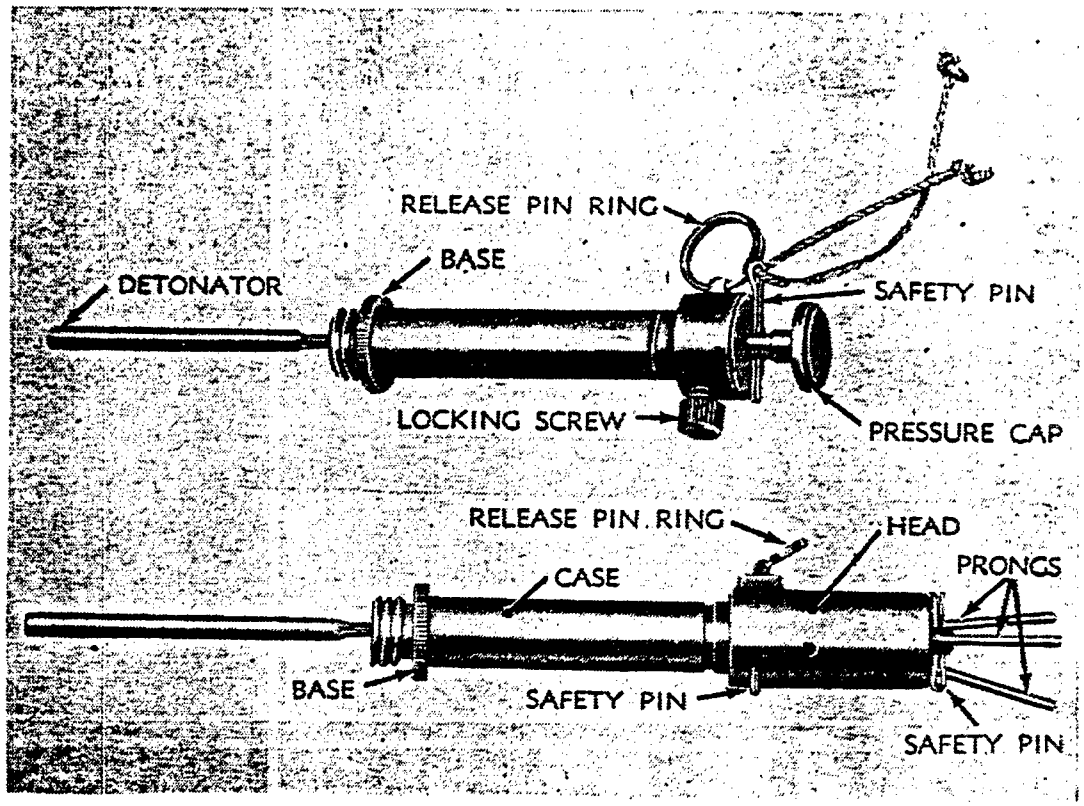
ANTITANK MINE, M21



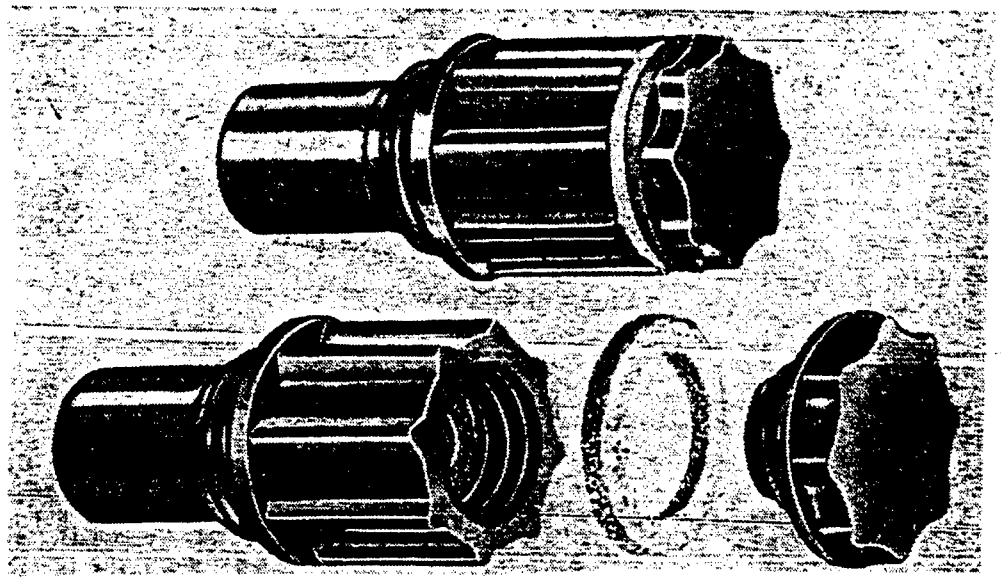
ANTITANK MINE, M21



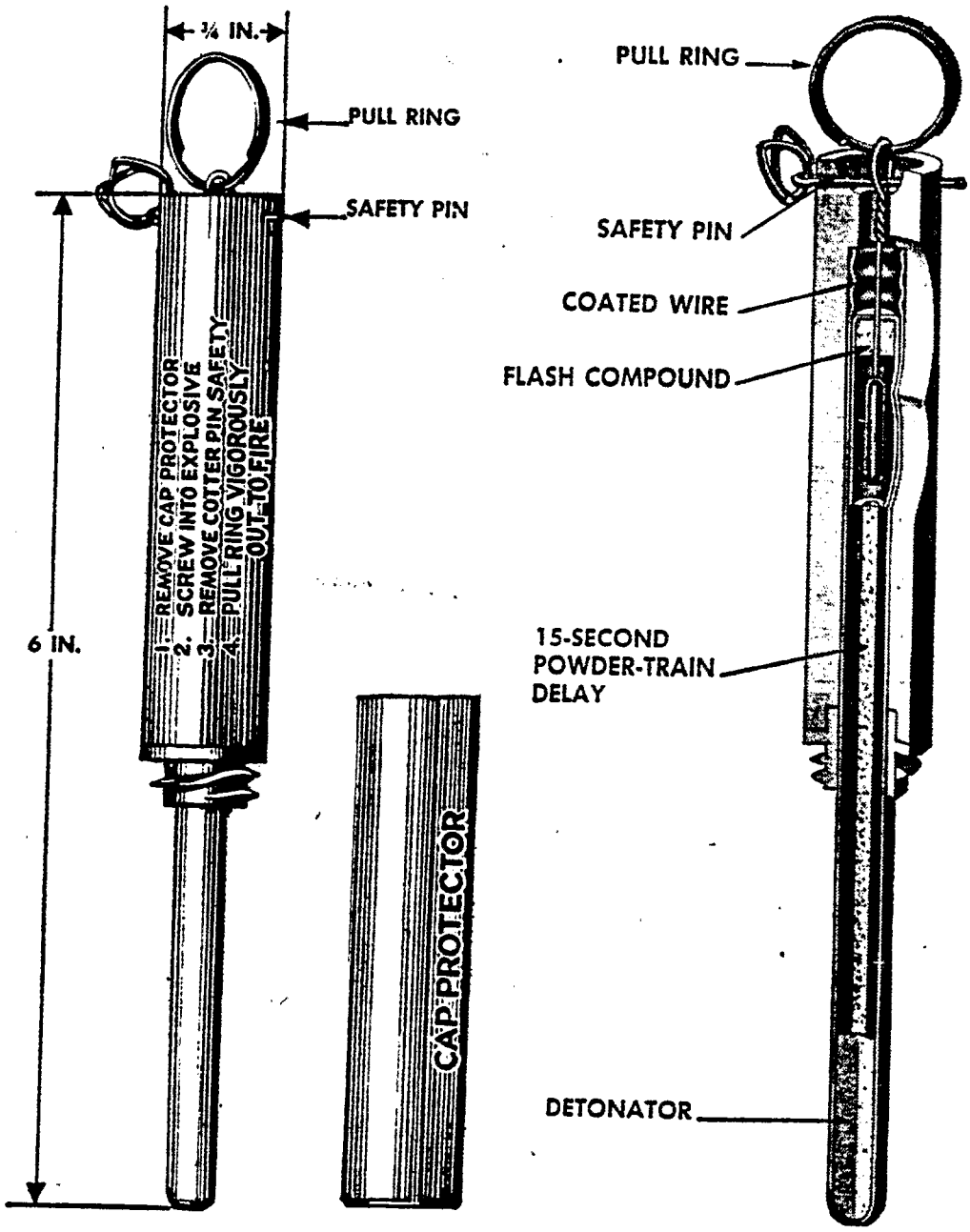
MINE, CHEMICAL AGENT, VX, M23



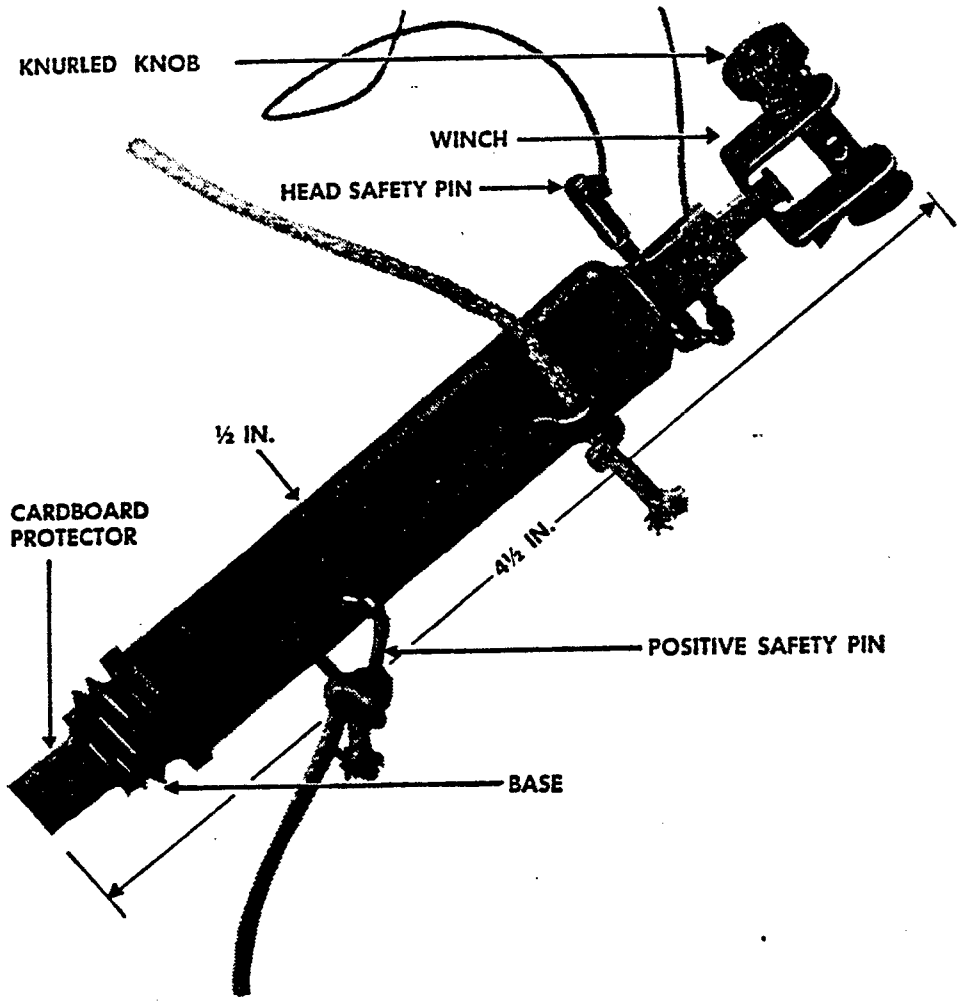
FUZES FOR AP MINE, M3



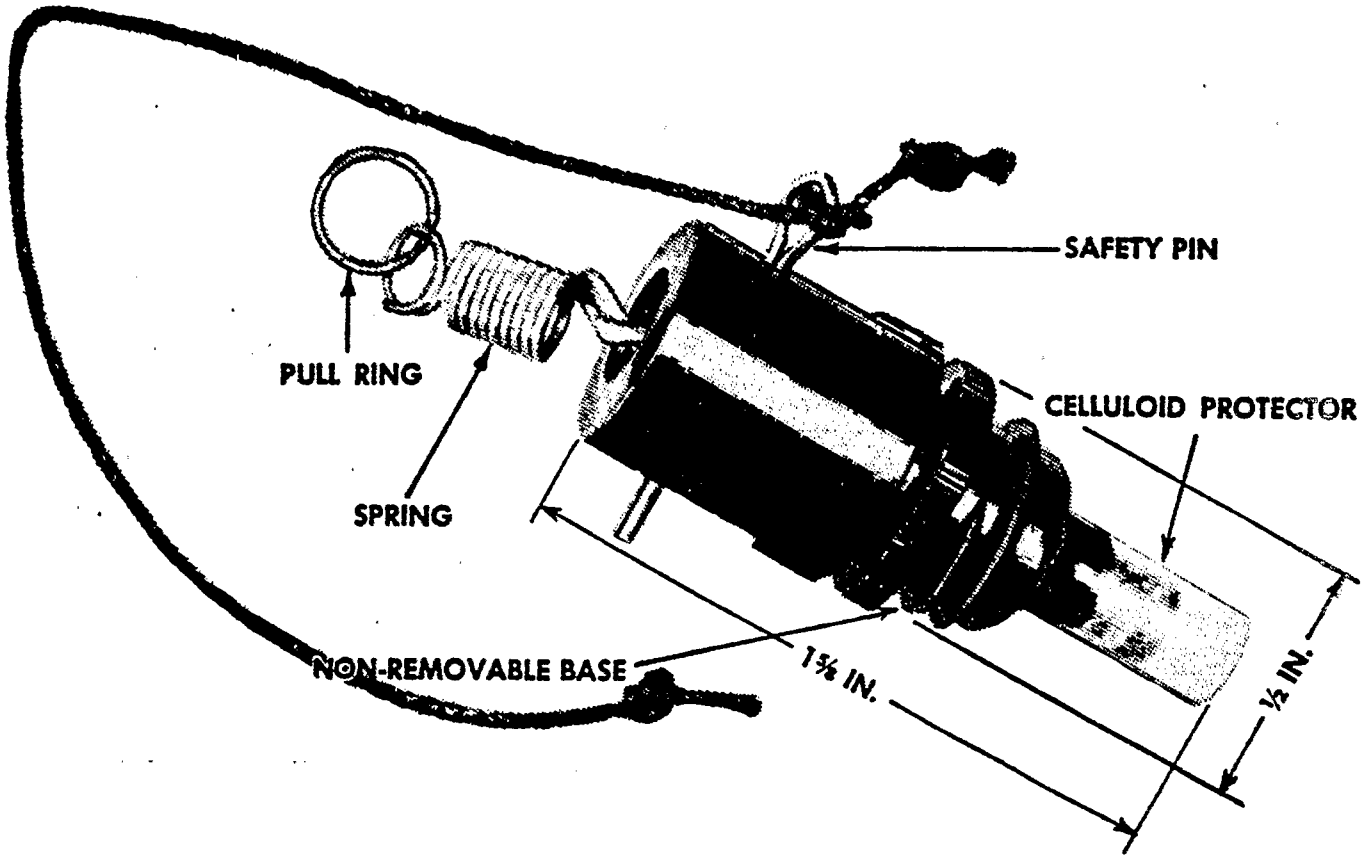
ACTIVATOR, M1

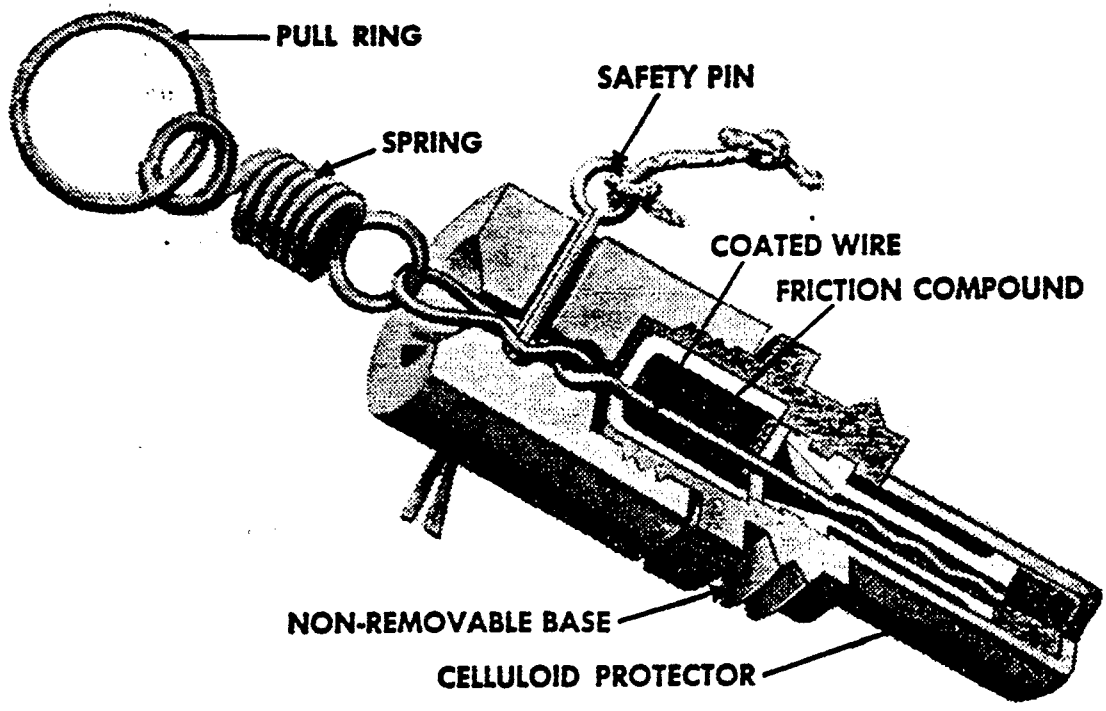


15 SECOND DELAY FUZE, M1

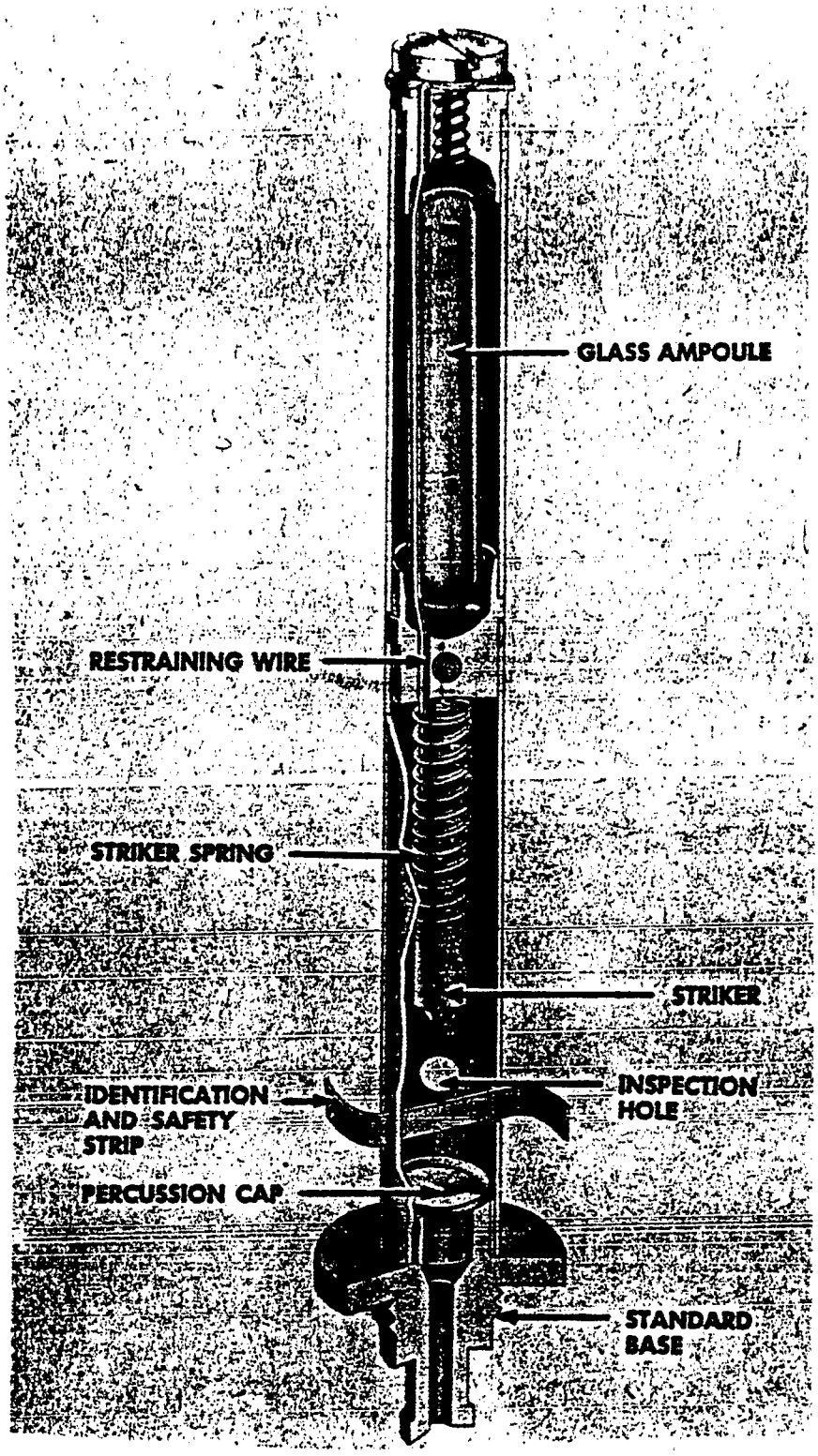


PULL-RELEASE FUZE, M3

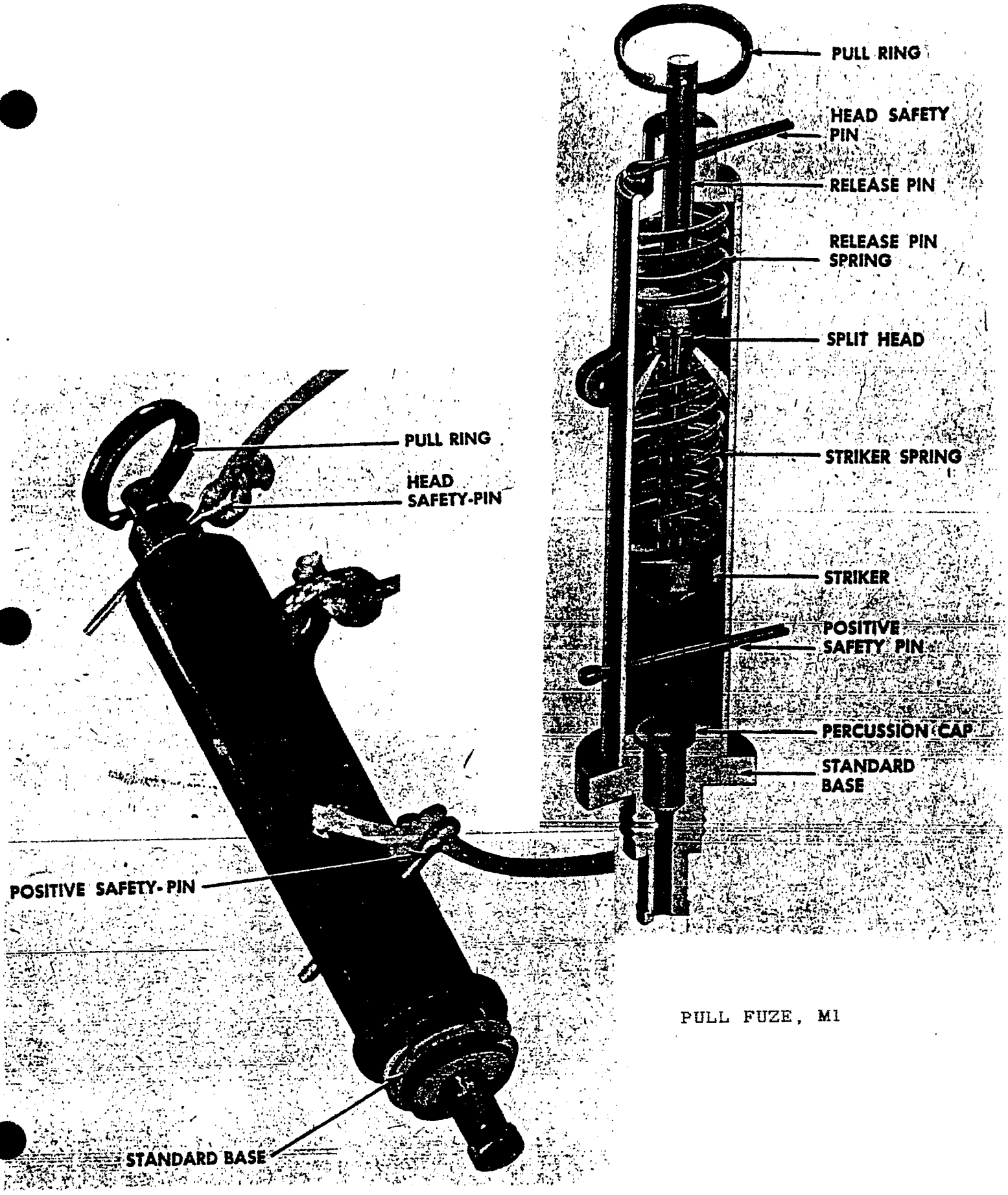




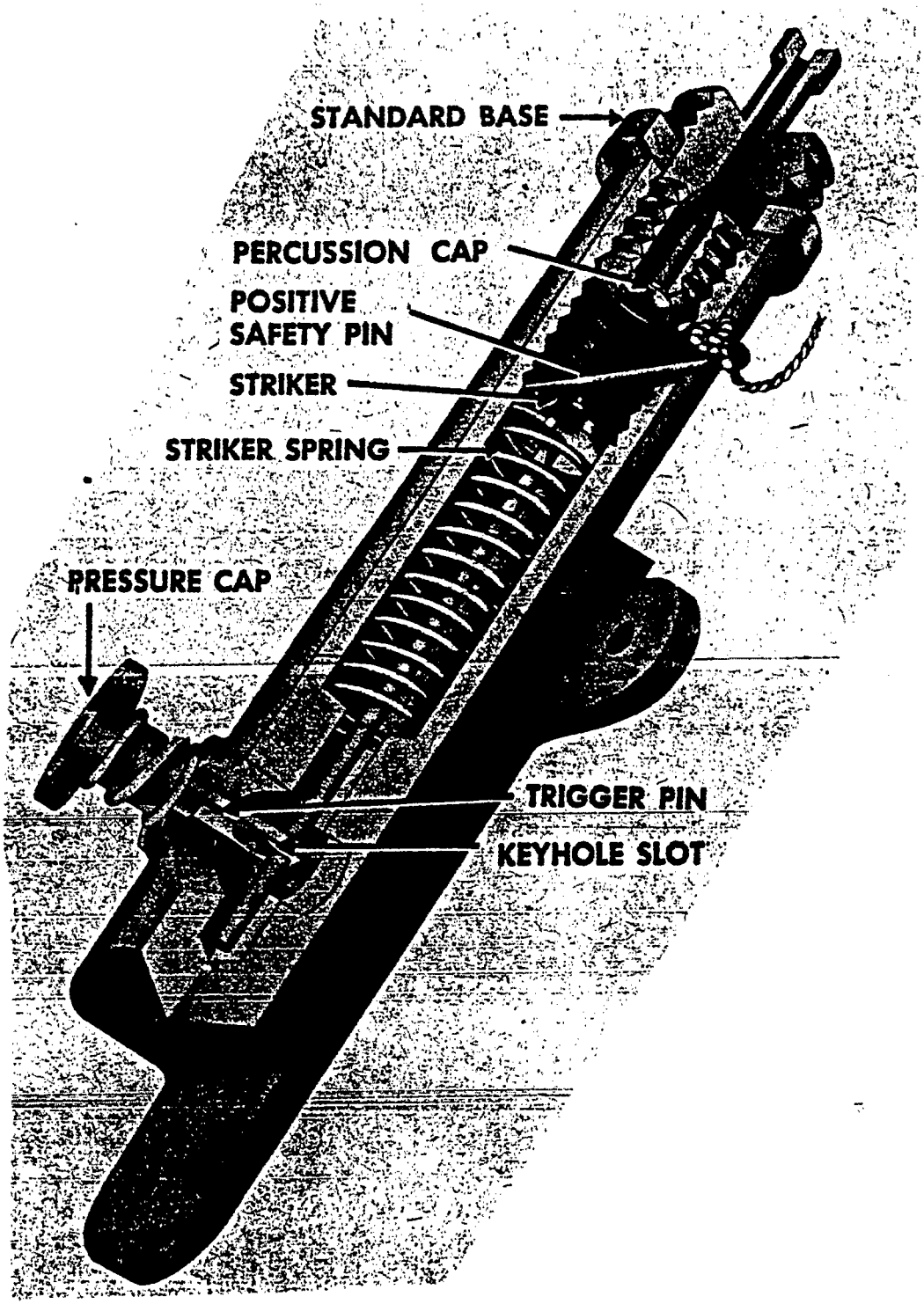
PULL FRICTION FUZE, M2



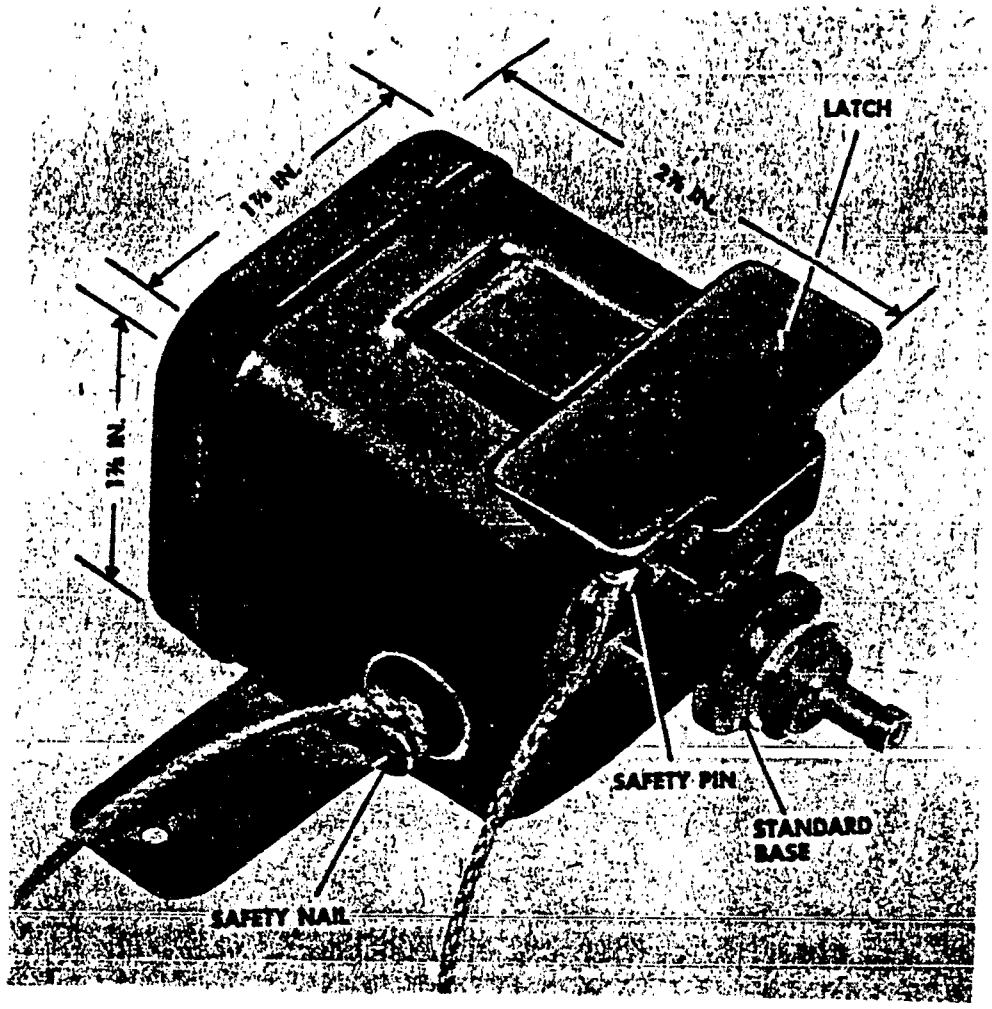
DELAY FUZE, M1


PULL RING
HEAD SAFETY PIN
RELEASE PIN
RELEASE PIN SPRING
SPLIT HEAD
STRIKER SPRING
STRIKER
POSITIVE SAFETY PIN
PERCUSSION CAP
STANDARD BASE
PULL RING
HEAD SAFETY-PIN
POSITIVE SAFETY-PIN
STANDARD BASE

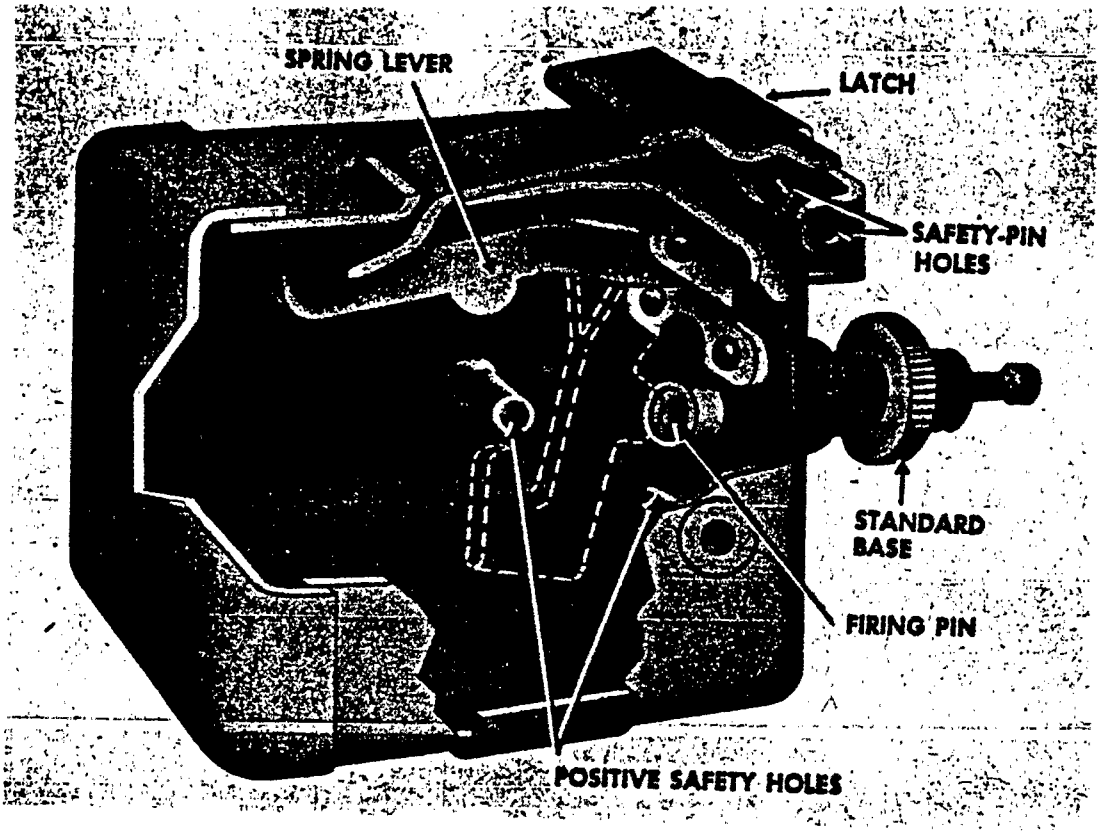
PULL FUZE, M1



PRESSURE FUZE, M1A1



RELEASE FUZE, M1



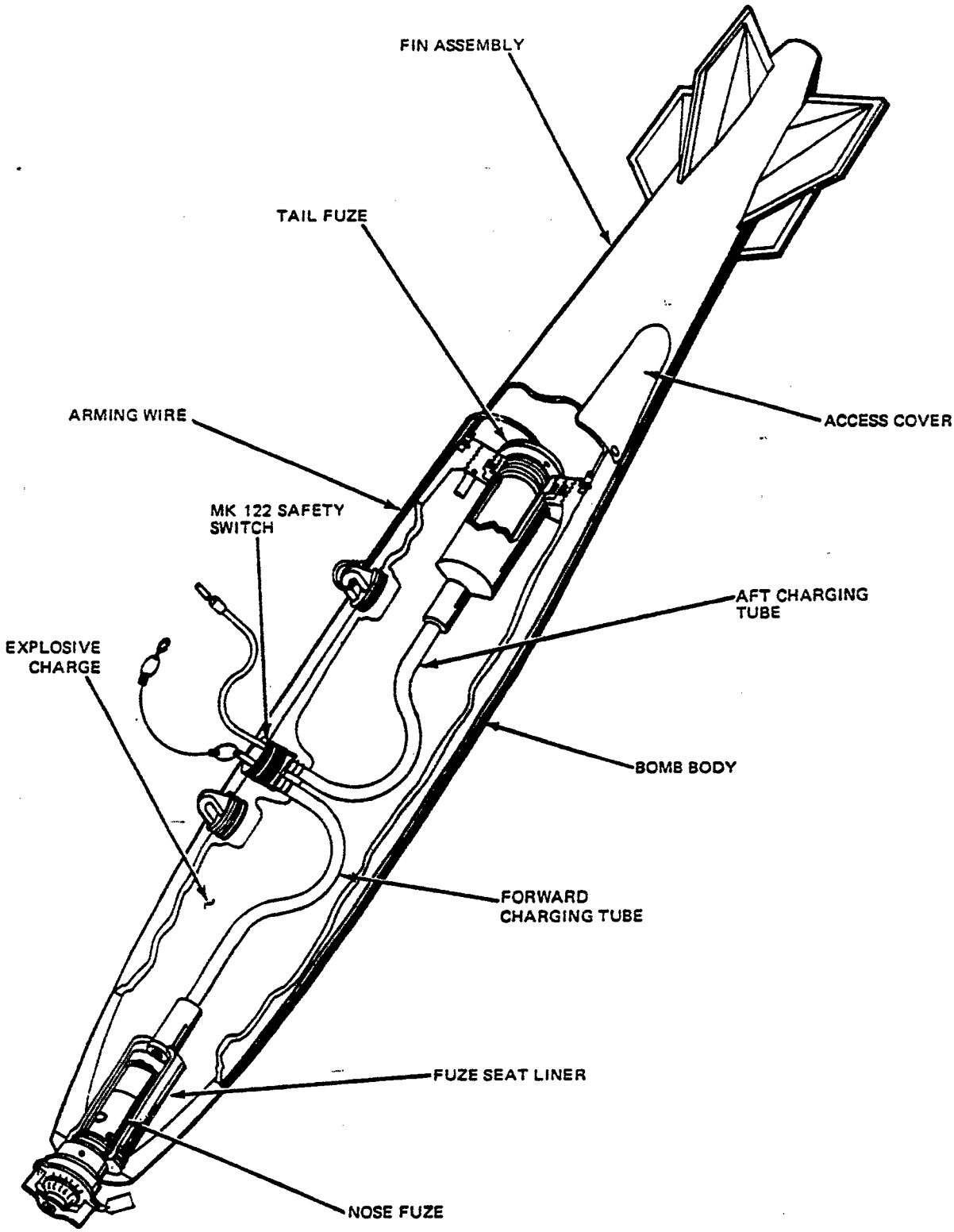
AIRCRAFT BOMBS

PARTIAL LISTING OF BOMB TYPES THAT HAVE AT TIMES BEEN USED

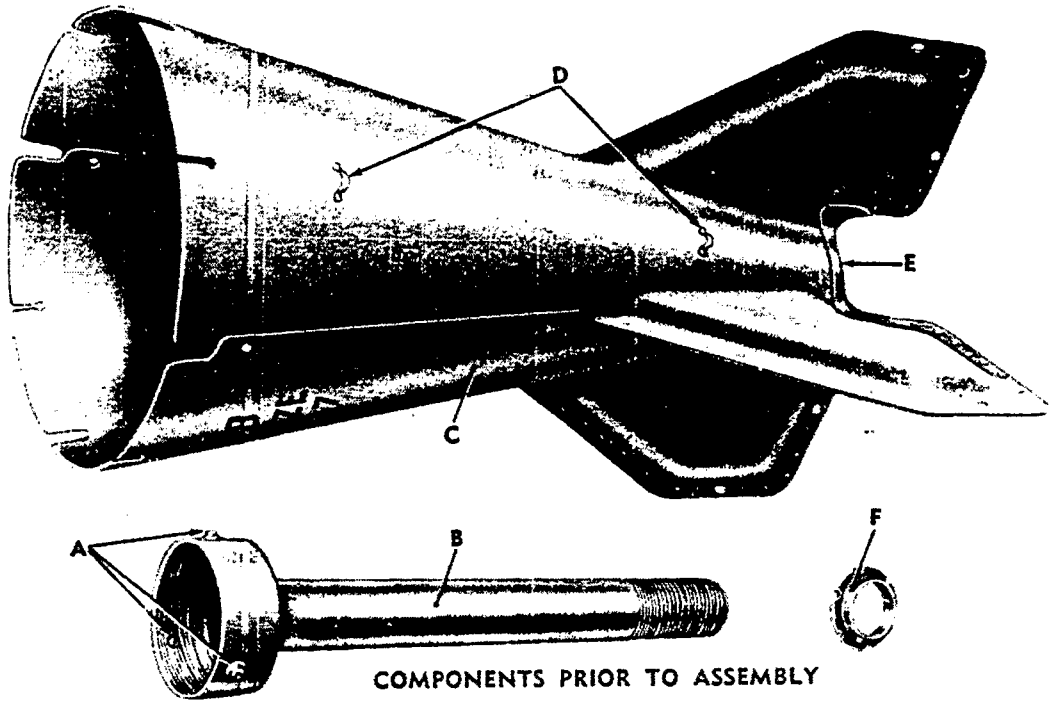
TYPE	NOMINAL WEIGHT
ARMOR PIERCING	1,000 LBS.
ARMOR PIERCING	1,600 LBS
DEPTH BOMB	350 LBS.
FRAGMENTATION BOMB	4 LBS.
FRAGMENTATION BOMB	20 LBS.
FRAGMENTATION BOMB	23 LBS.
FRAGMENTATION BOMB	90 LBS.
FRAGMENTATION BOMB	120 LBS.
FRAGMENTATION BOMB	220 LBS.
FRAGMENTATION BOMB	260 LBS.
GENERAL PURPOSE BOMB	100 LBS
GENERAL PURPOSE BOMB	250 LBS
GENERAL PURPOSE BOMB	500 LBS.
GENERAL PURPOSE BOMB	750 LBS.
GENERAL PURPOSE BOMB	1,000 LBS.
GENERAL PURPOSE BOMB	2,000 LBS.
GENERAL PURPOSE BOMB	12,000 LBS.
GENERAL PURPOSE BOMB	44,000 LBS.
DEMOLITION BOMB	300 LBS.
DEMOLITION BOMB	500 LBS.
DEMOLITION BOMB	600 LBS.
DEMOLITION BOMB	1,000 LBS.
DEMOLITION BOMB	1,100 LBS.
DEMOLITION BOMB	2,000 LBS.
LIGHT CASE BOMB	4,000 LBS.
LEAFLET BOMB	100 LBS.
LEAFLET BOMB	500 LBS.
PHOTOFLASH BOMB	100 LBS.
SEMI ARMOR PIERCING BOMB	500 LBS.
SEMI ARMOR PIERCING BOMB	1,000 LBS.
SEMI ARMOR PIERCING BOMB	2,000 LBS.
SEMI ARMOR PIERCING BOMB	25,000 LBS.
TARGET IDENTIFICATION BOMB	100 LBS.
TARGET IDENTIFICATION BOMB	250 LBS.
FRAGMENTATION CLUSTER BOMB	100 LBS.
FRAGMENTATION CLUSTER BOMB	500 LBS.
AIRCRAFT MINE	1,000 LBS.
AIRCRAFT MINE	1,660 LBS.
CHEMICAL CLUSTER BOMBS	VARIOUS WTS.
PRACTICE BOMB	3 LBS.
PRACTICE BOMB	4.5 LBS.
PRACTICE BOMB	23 LBS.
PRACTICE BOMB	100 LBS

OLD COLOR CODING ASSOCIATED WITH BOMB ORDNANCE

TYPE	BODY	MARKINGS	BANDS
GENERAL PURPOSE	OLIVE DRAB	BLACK	YELLOW
FRAGMENTATKON	OLIVE DRAB	BLACK	YELLOW
PHOTOFLASH	GRAY	BLACK	NONE
PRACTICE	BLUE	WHITE	NONE
DRILL	OLIVE DRAB	BLACK	BLACK
SMOKE	GRAY	YELLOW	YELLOW
INCENDIARY	GRAY	YELLOW	PURPLE
PERSISTENT GAS	GRAY	GREEN	GREEN
NONPERSISTENT GAS	GRAY	GREEN	GREEN
IRRITATING (TEAR GAS)	GRAY	RED	RED



TYPICAL CONFIGURATION OF NEW 'LOW DRAG' BOMB WITH CONICAL FINS

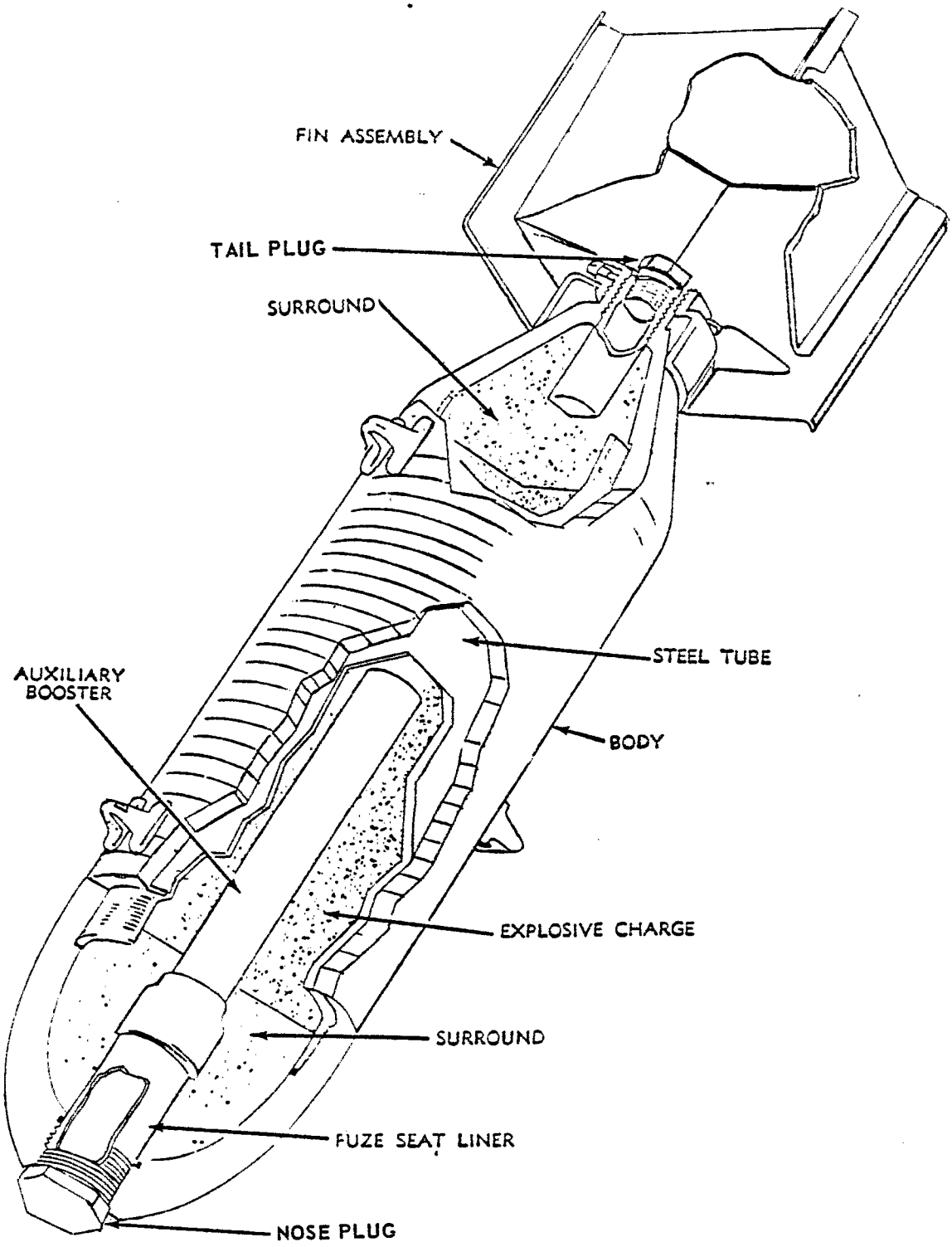


COMPONENTS PRIOR TO ASSEMBLY

A–SET SCREW
B–COUPLING TUBE ASSEMBLY
C–FIN ASSEMBLY
D–ARMING WIRE GUIDE
E–FIN WEB
F–FIN LOCK NUT

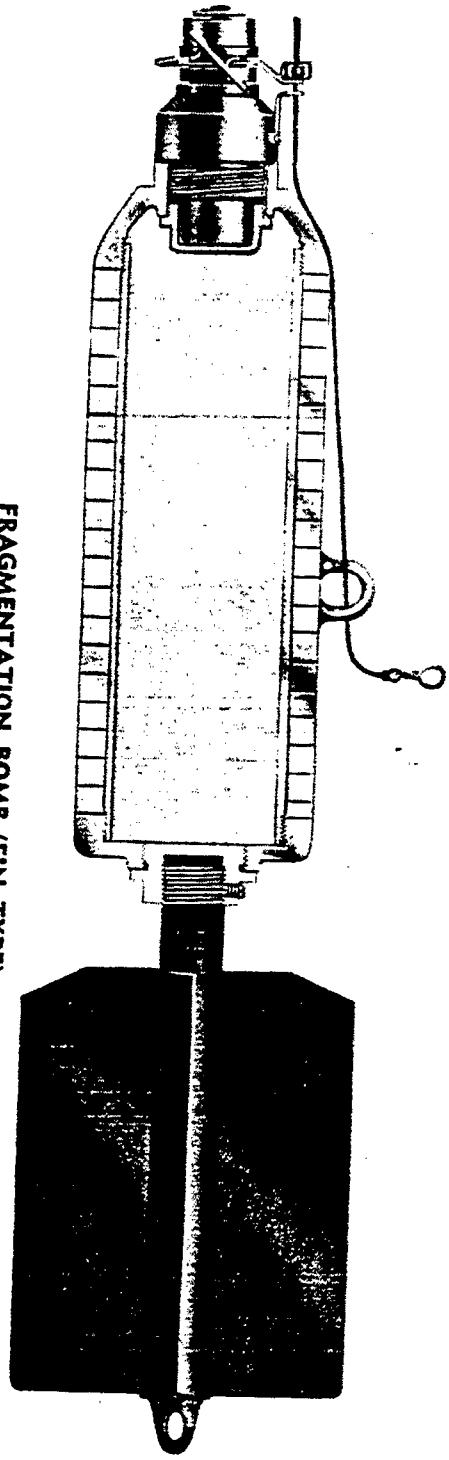
RA PD 116919A

EXAMPLE OF CONICAL FINS AND ASSOCIATED COMPONENTS

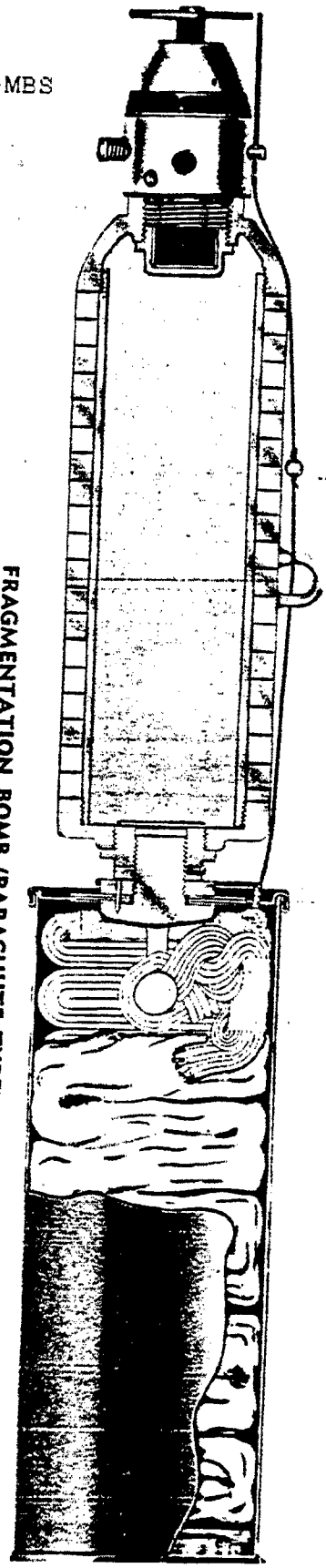


TYPICAL EXAMPLE OF OLD STYLE BOMB WITH BOX FINS

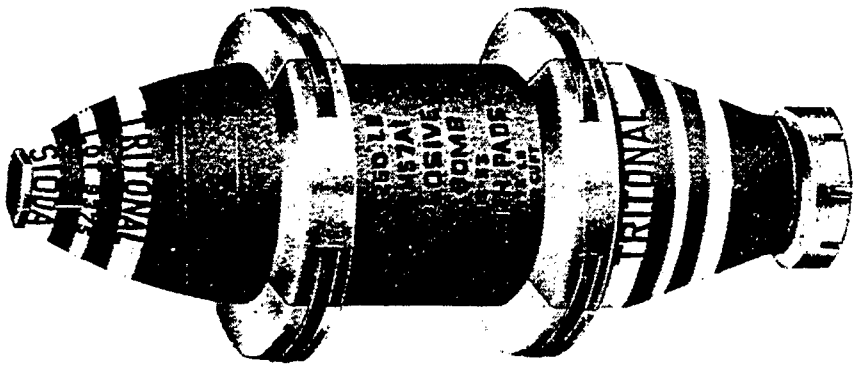
TYPICAL EXAMPLES OF FRAGMENTATION BOMBS

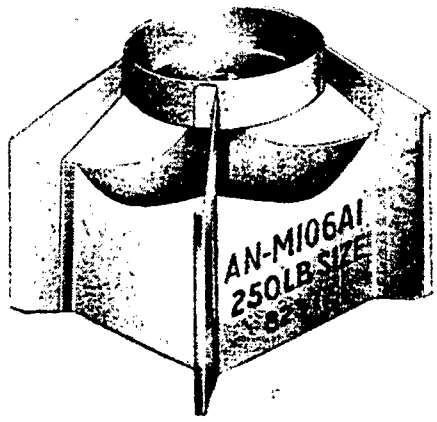


FRAGMENTATION BOMB (FIN TYPE)

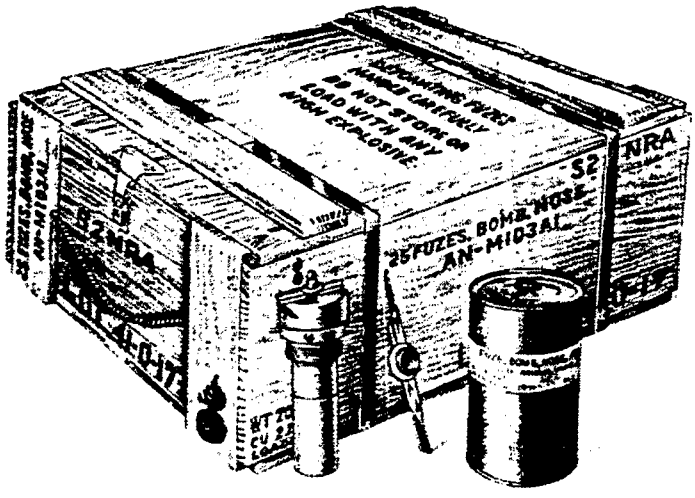


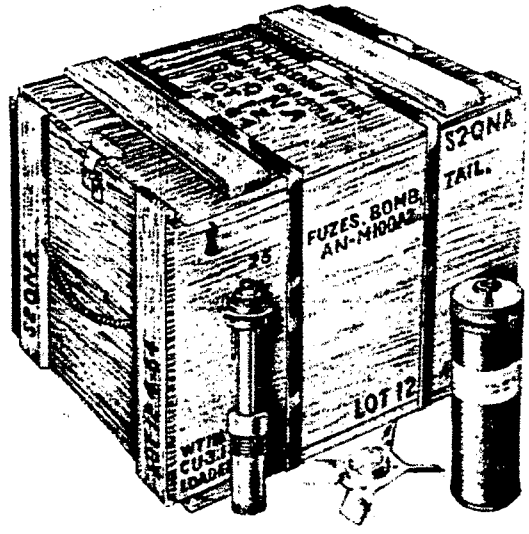
FRAGMENTATION BOMB (PARACHUTE TYPE)

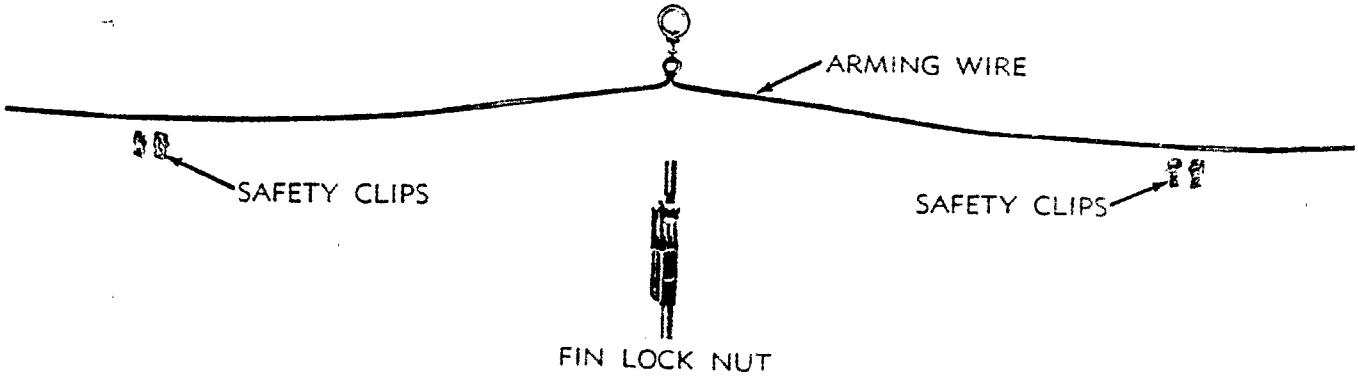


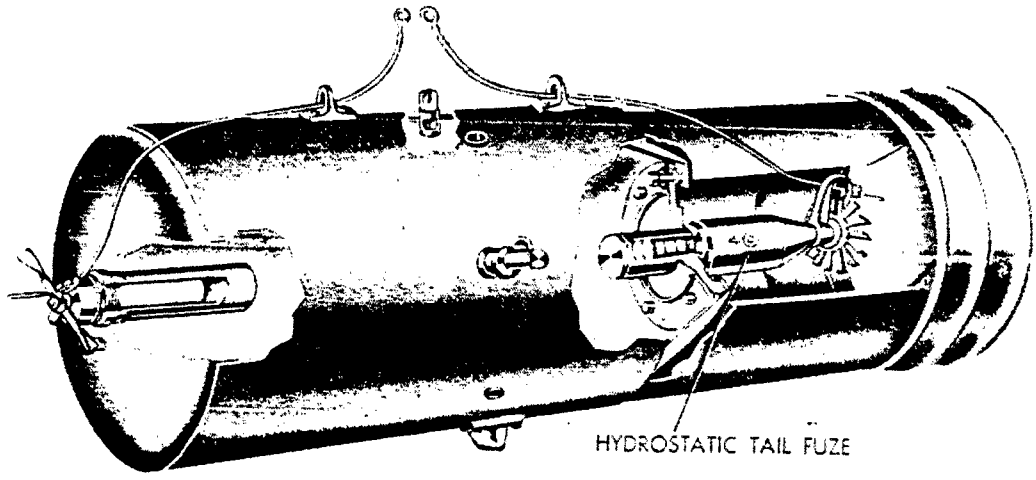


EXAMPLES OF OTHER BOMB COMPONENTS AND PACKAGING

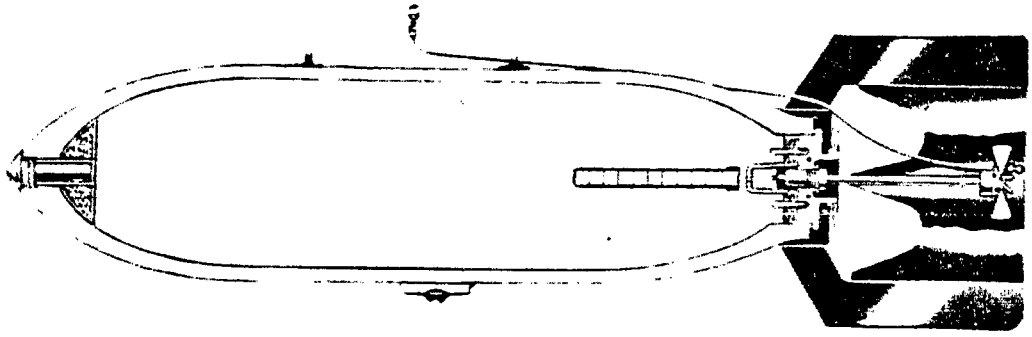


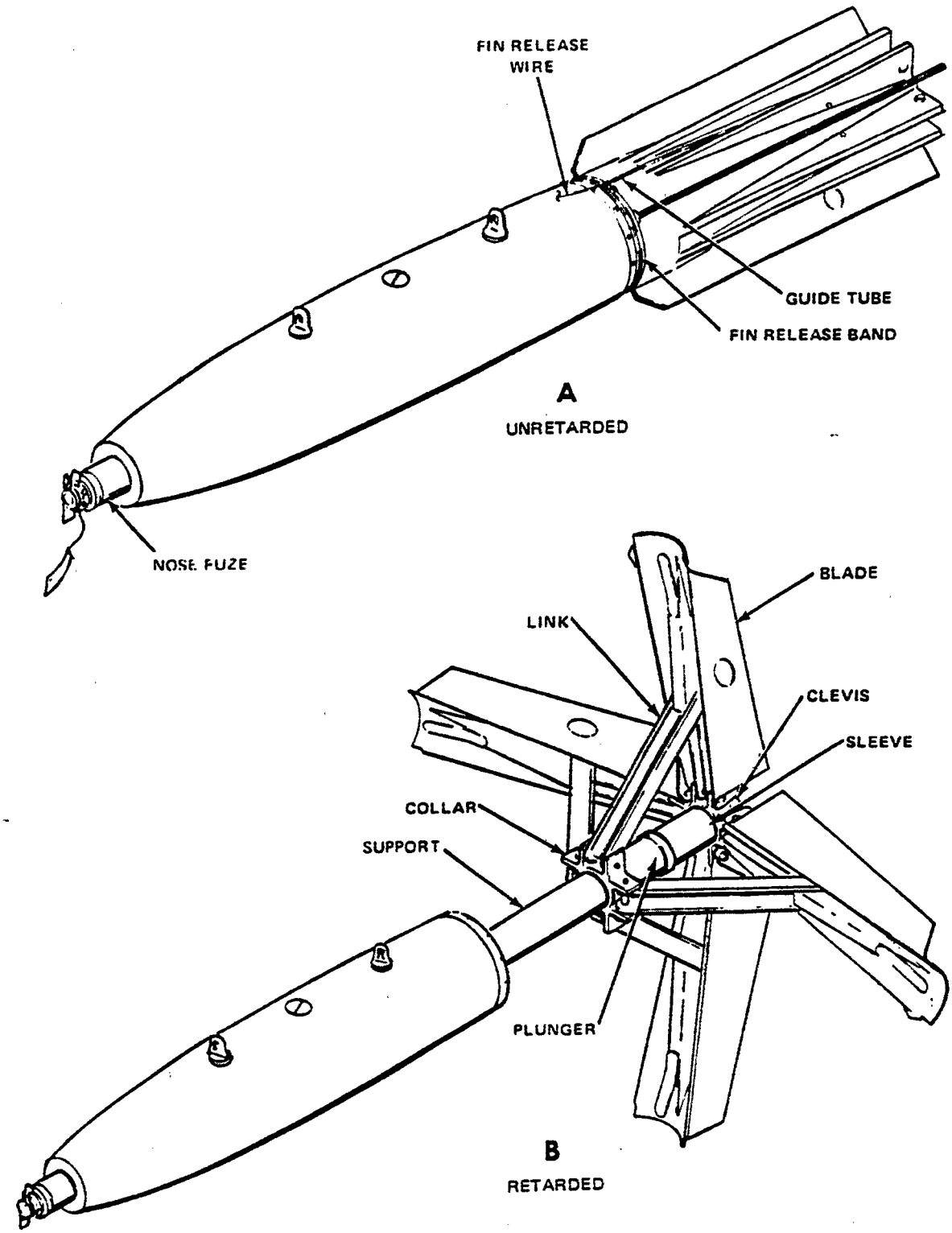




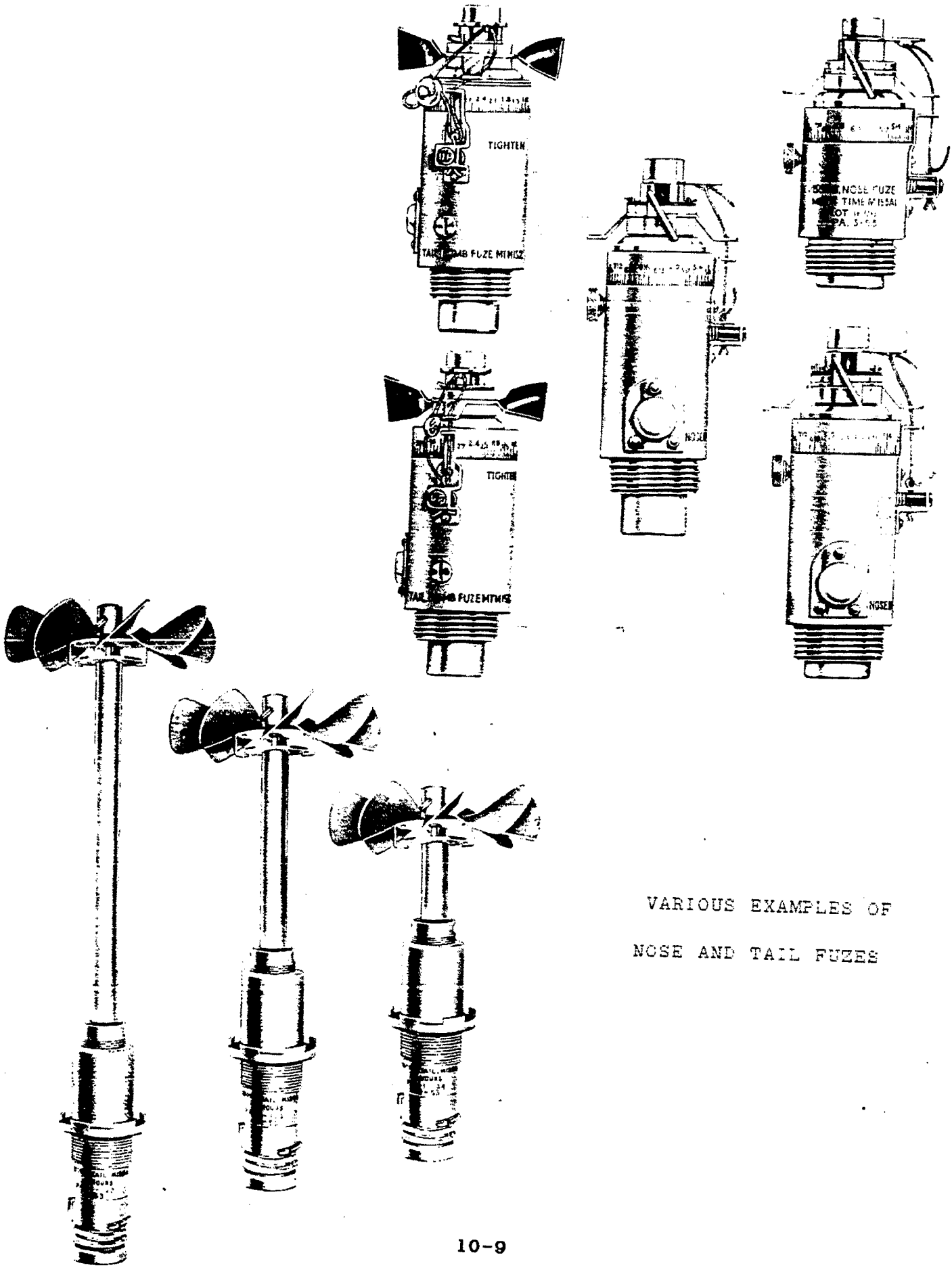


EXAMPLES OF DEPTH BOMB AND SEMI ARMOR PIERCING BOMB



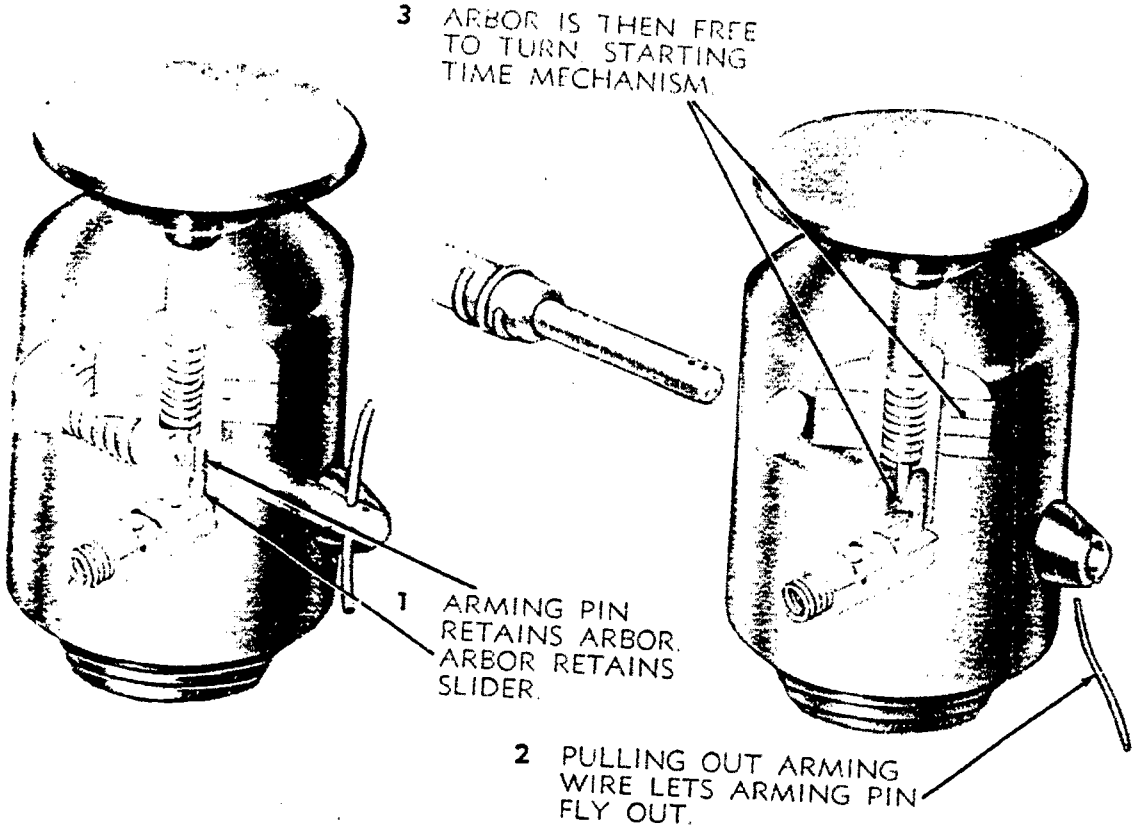


EXAMPLE OF LOW DRAG BOMB WITH RETARDER FINS CLOSED AND OPENED

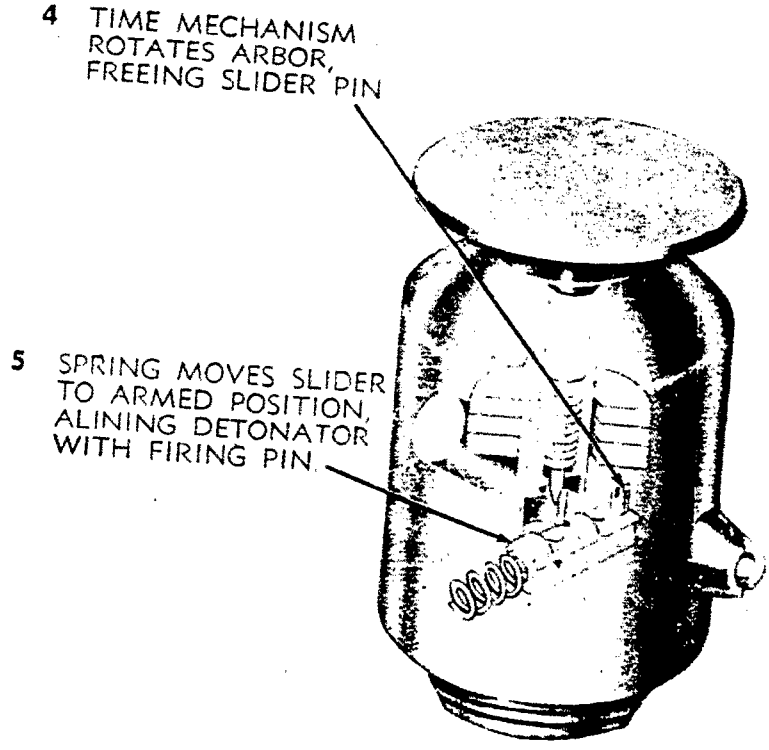


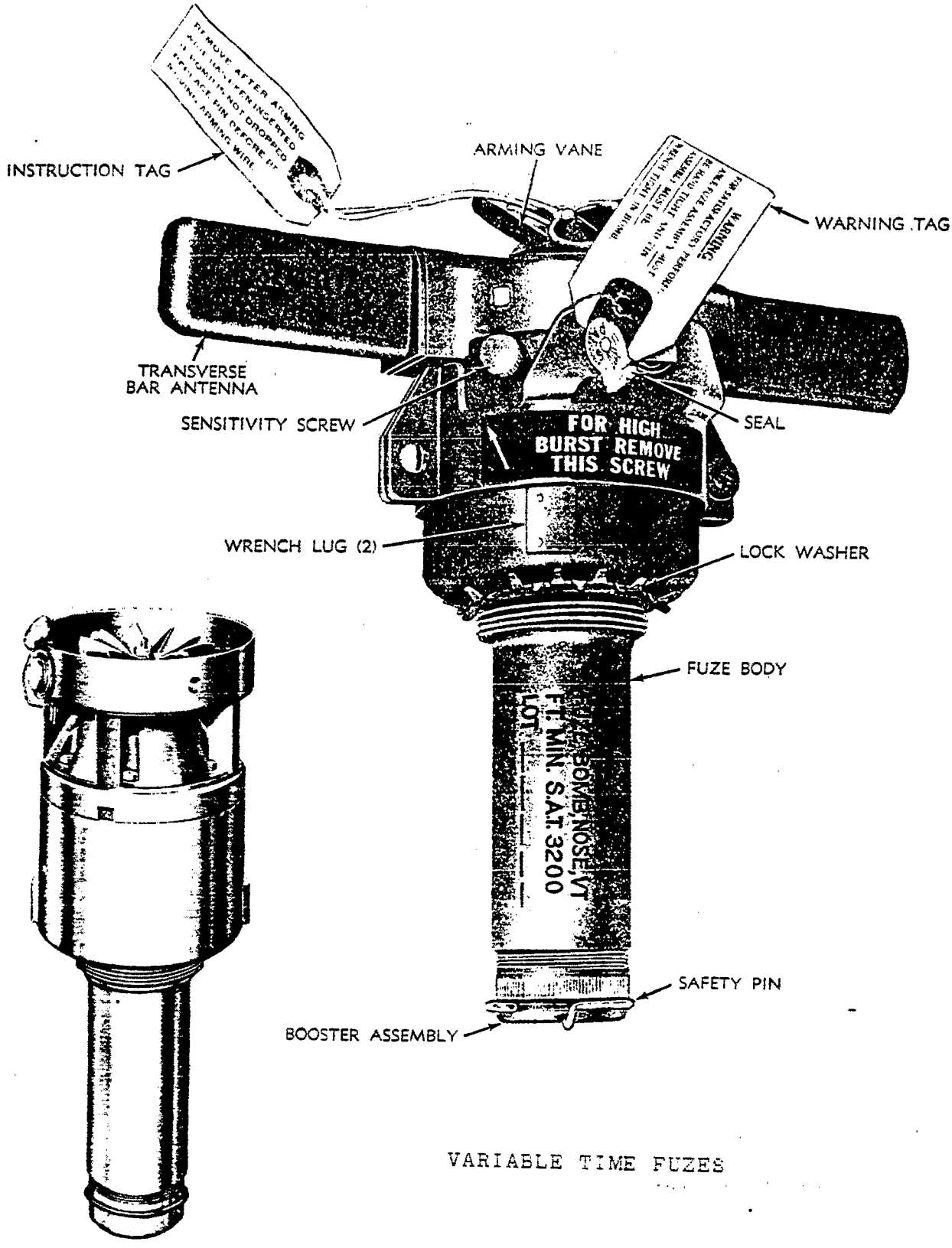
VARIOUS EXAMPLES OF

NOSE AND TAIL FUZES

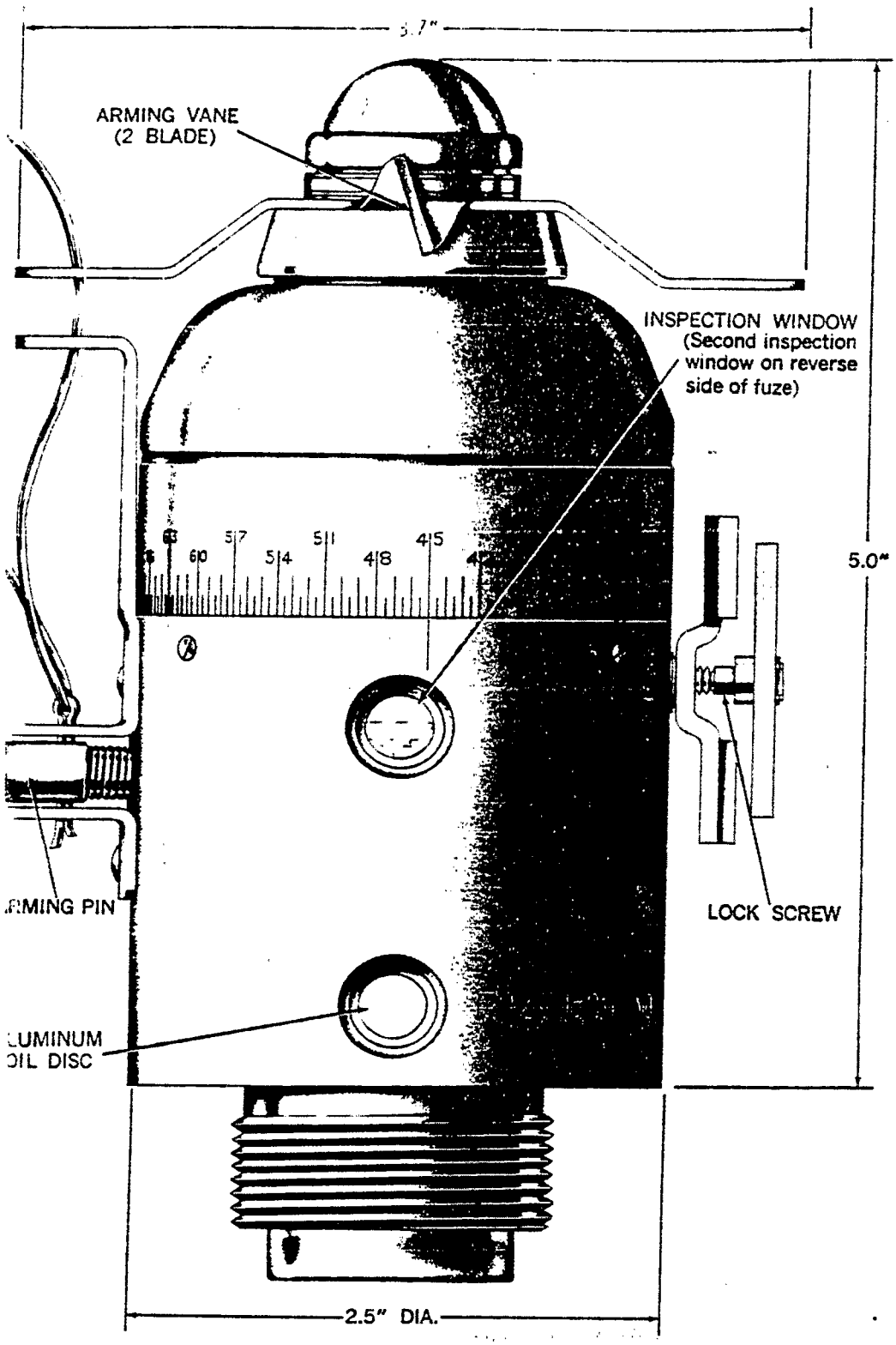


IMPACT BOMB FUZE

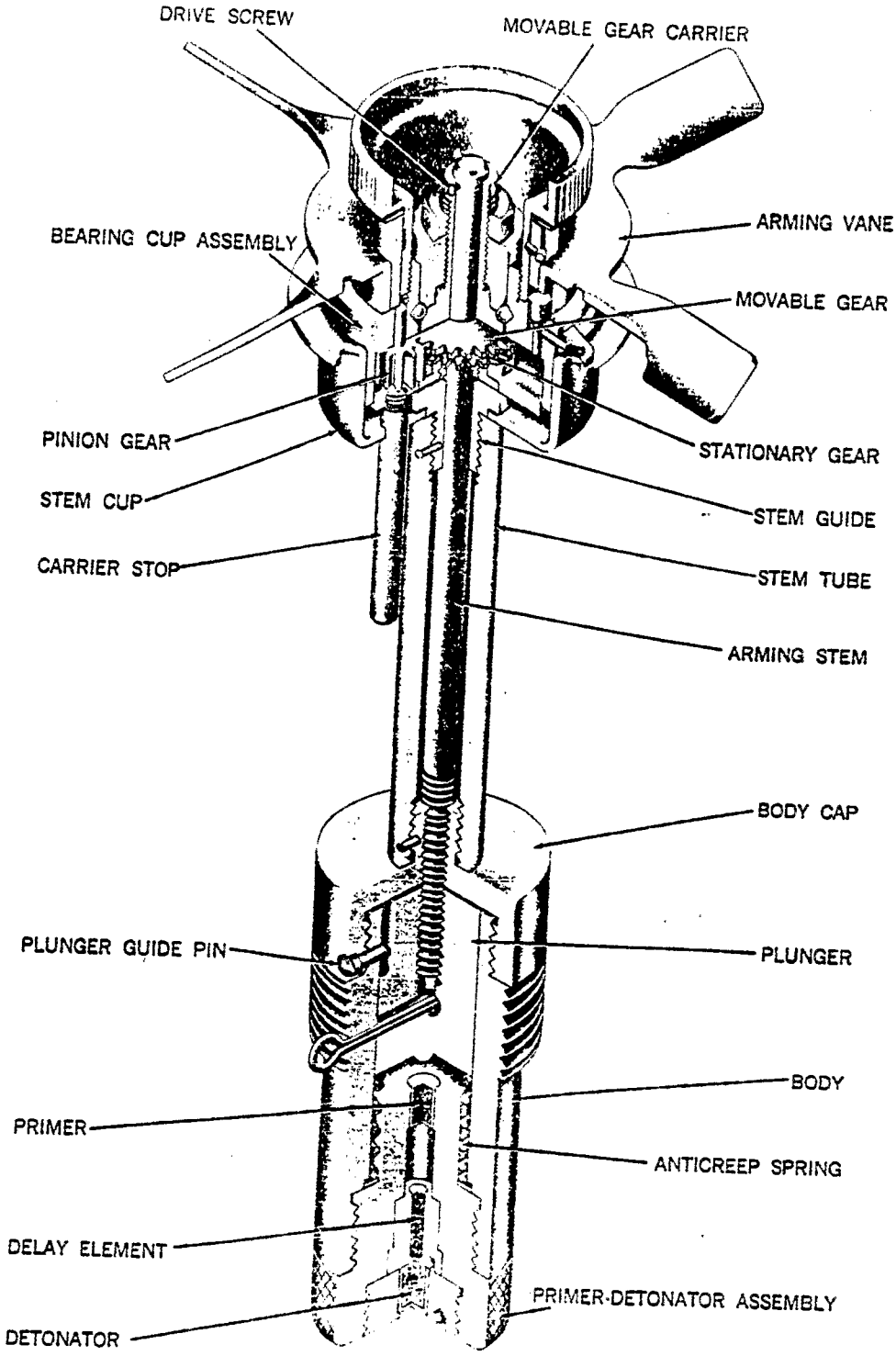




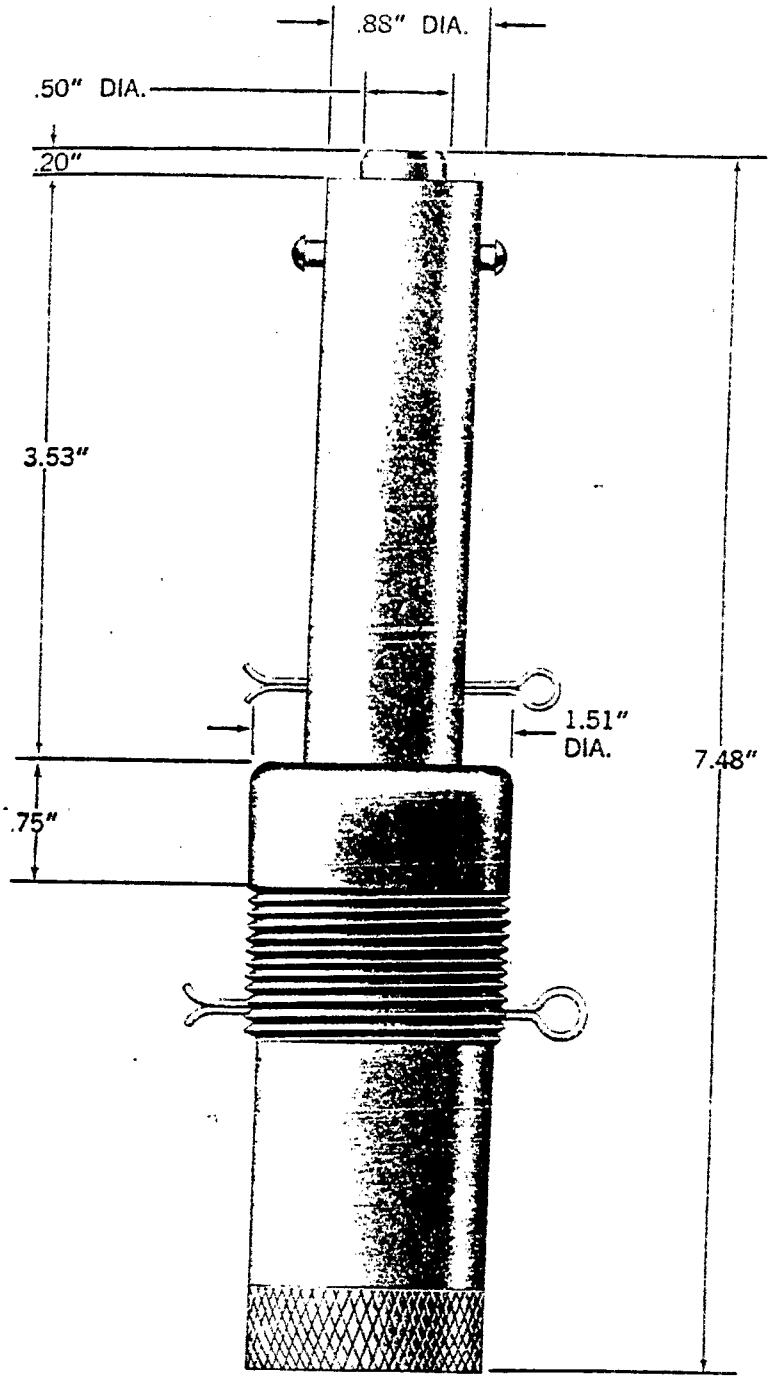
VARIABLE TIME FUZES



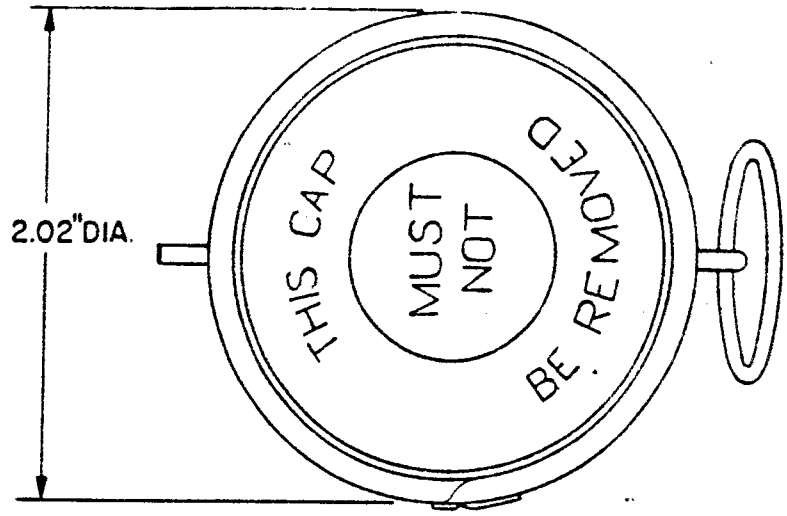
MECHANICAL TIME FUZE


DRIVE SCREW
MOVABLE GEAR CARRIER
ARMING VANE
BEARING CUP ASSEMBLY
MOVABLE GEAR
PINION GEAR
STATIONARY GEAR
STEM CUP
STEM GUIDE
CARRIER STOP
STEM TUBE
ARMING STEM
BODY CAP
PLUNGER GUIDE PIN
PLUNGER
BODY
PRIMER
ANTICREEP SPRING
DELAY ELEMENT
PRIMER-DETONATOR ASSEMBLY
DETONATOR

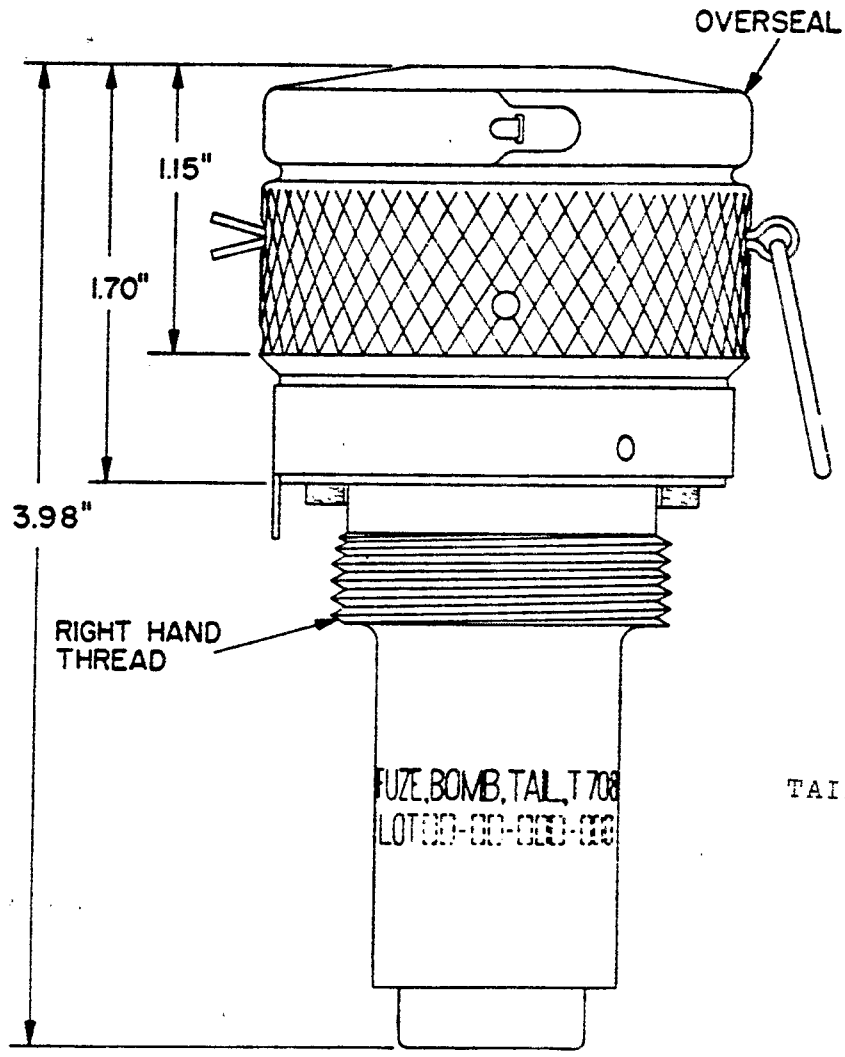
TAIL FUZE



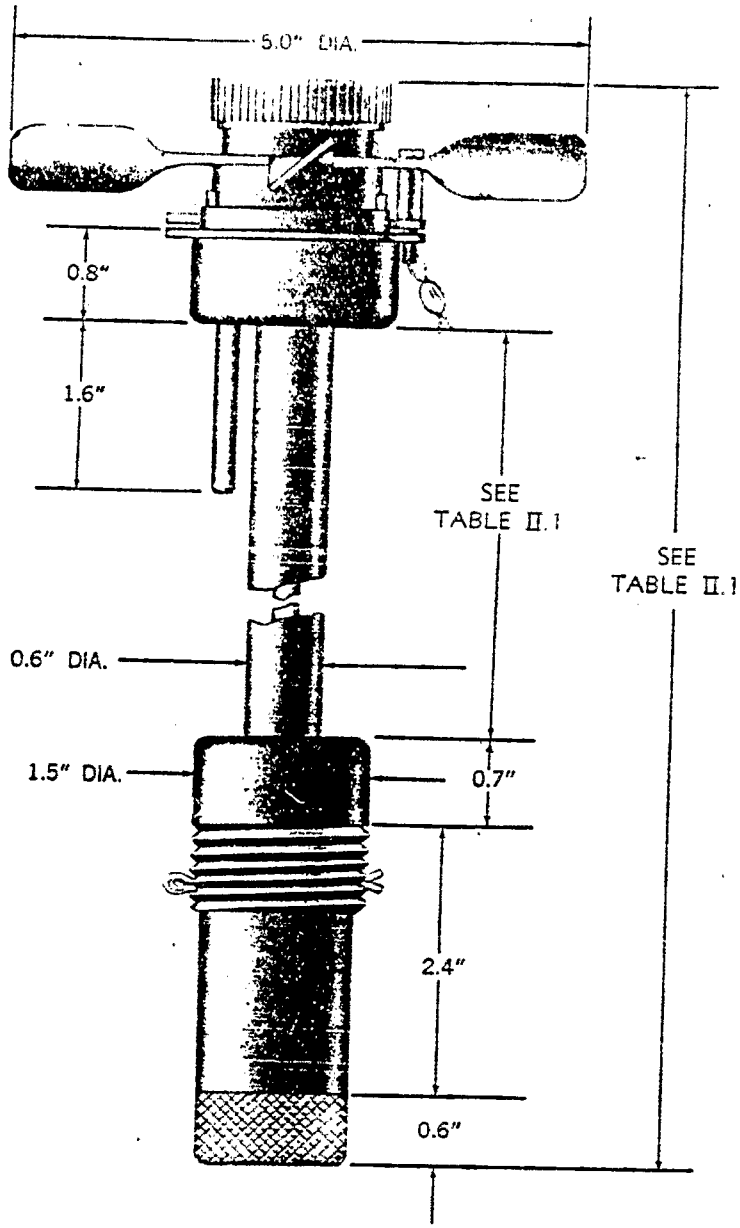
TAIL FUZE



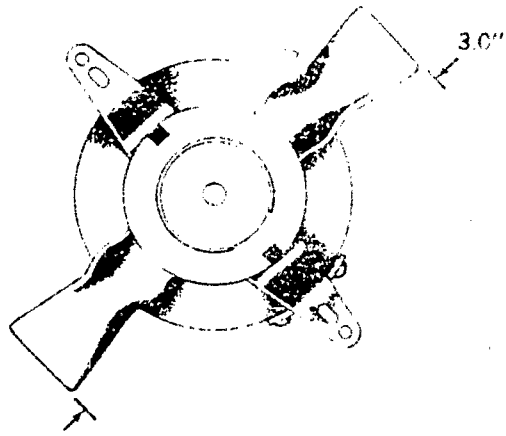
VIEW WITH CAP AND OVERSEAL

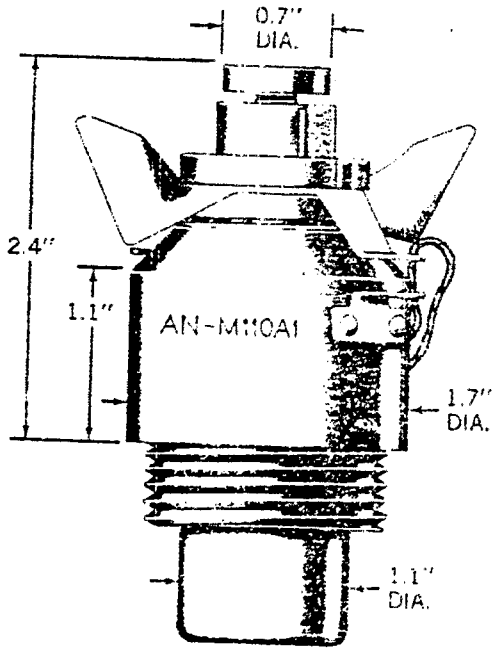


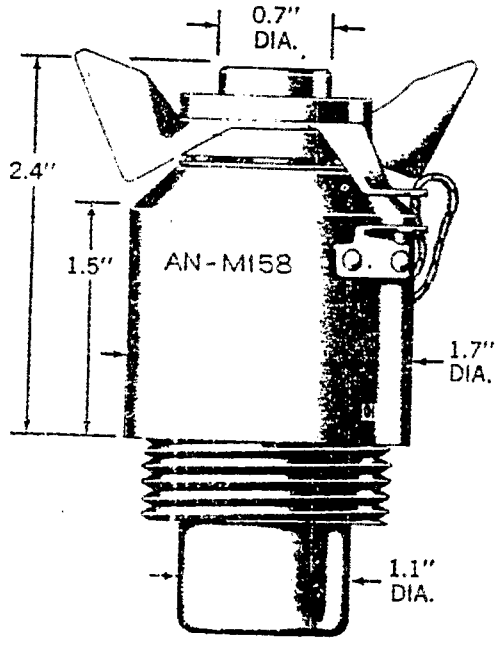
TAIL FUZE



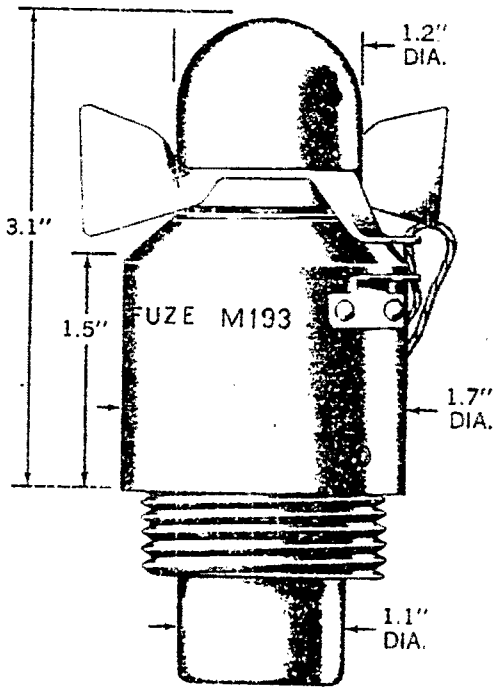
TAIL FUZE

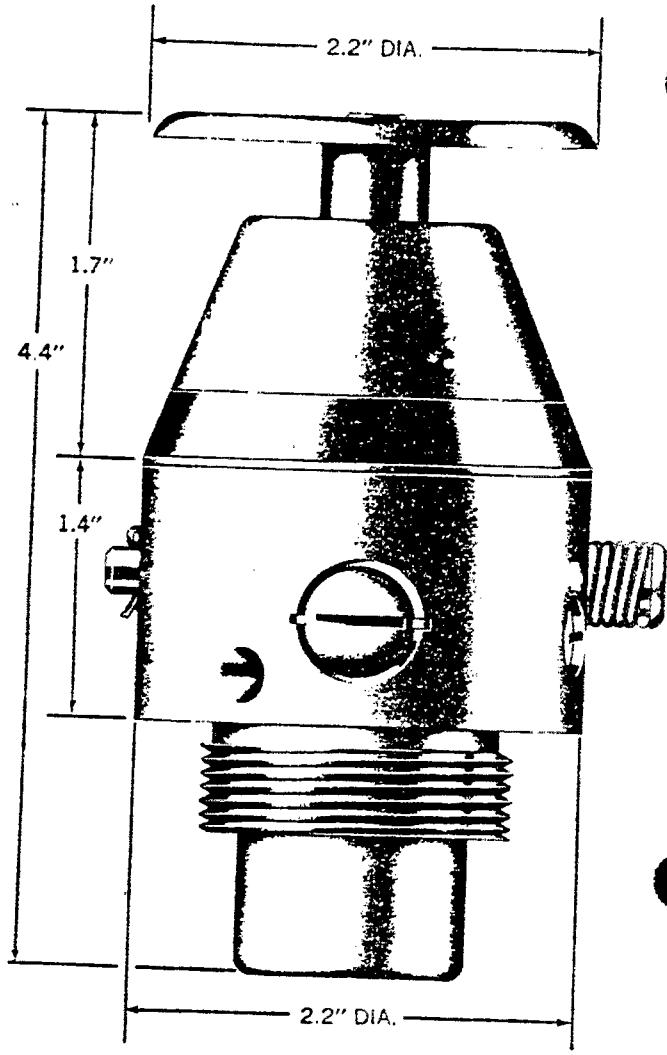

3.0"

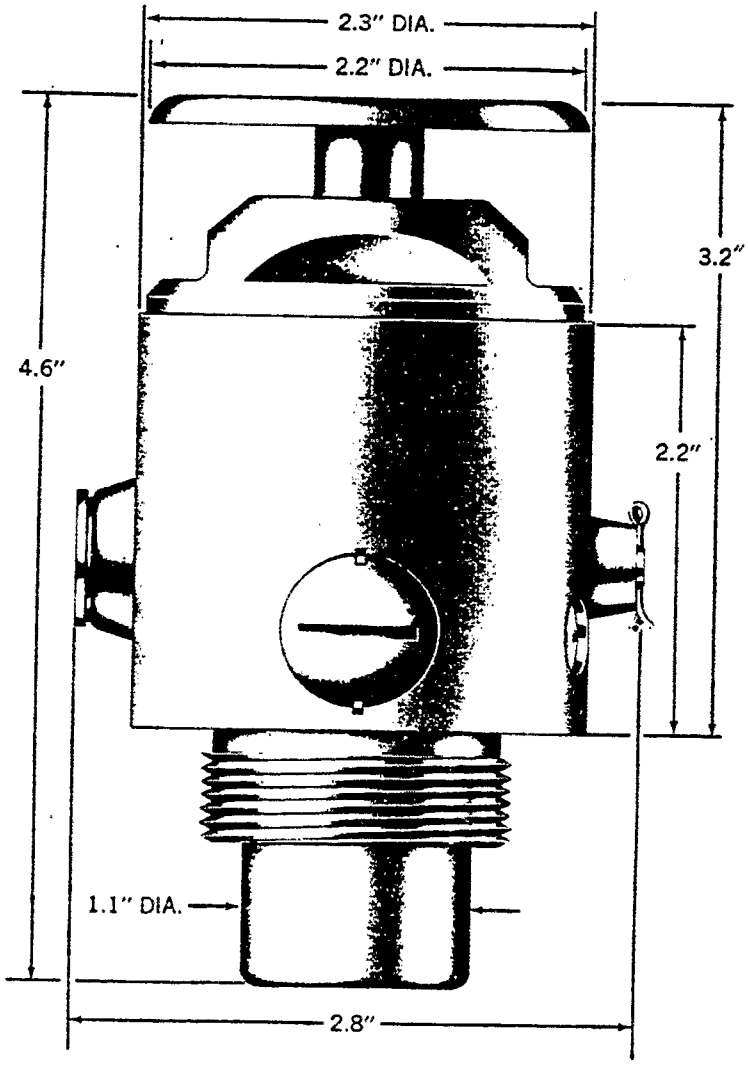

0.7" DIA.
2.4"
1.1"
AN-M110A1
1.7" DIA.
1.1" DIA.


0.7" DIA.
2.4"
1.5"
AN-M158
1.7" DIA.
1.1" DIA.

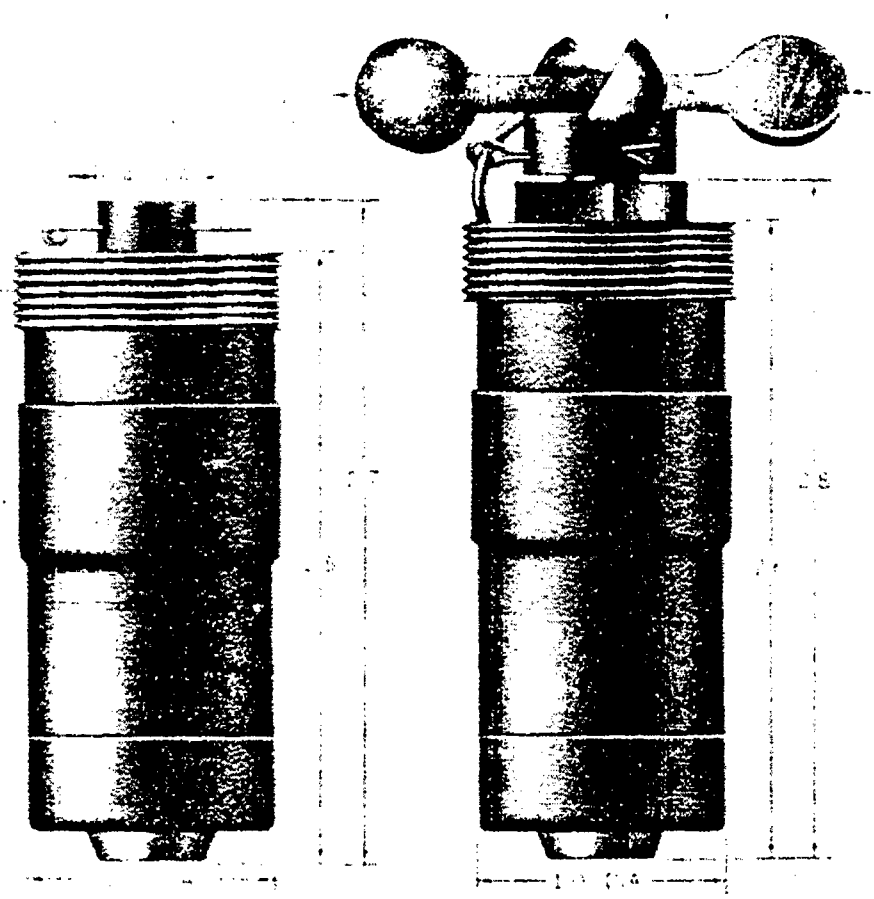
NOSE FUZES

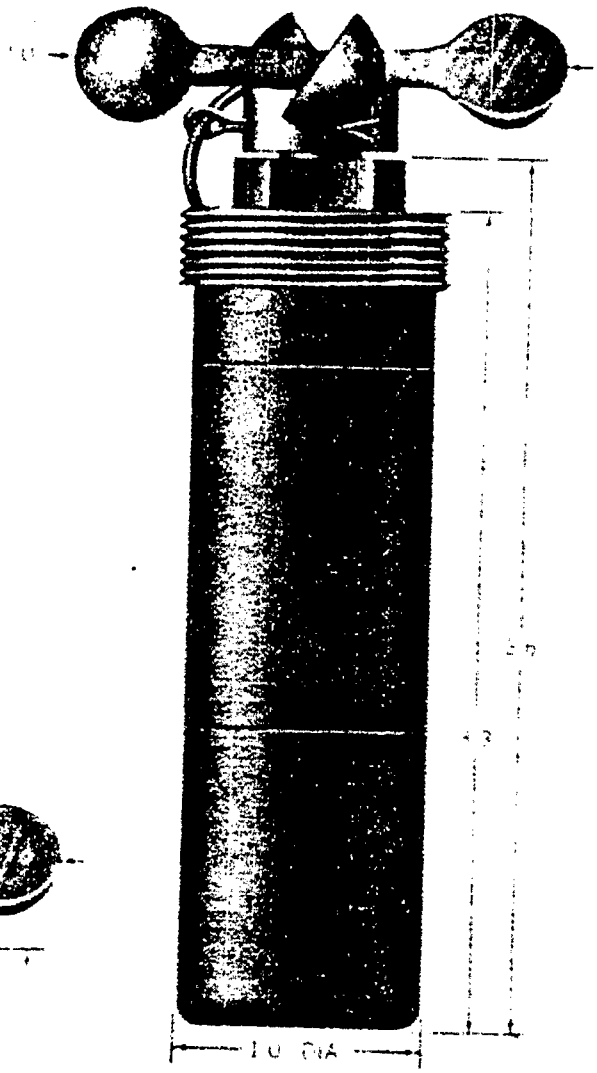

1.2" DIA.
3.1"
1.5"
FUZE M193
1.7" DIA.
1.1" DIA.



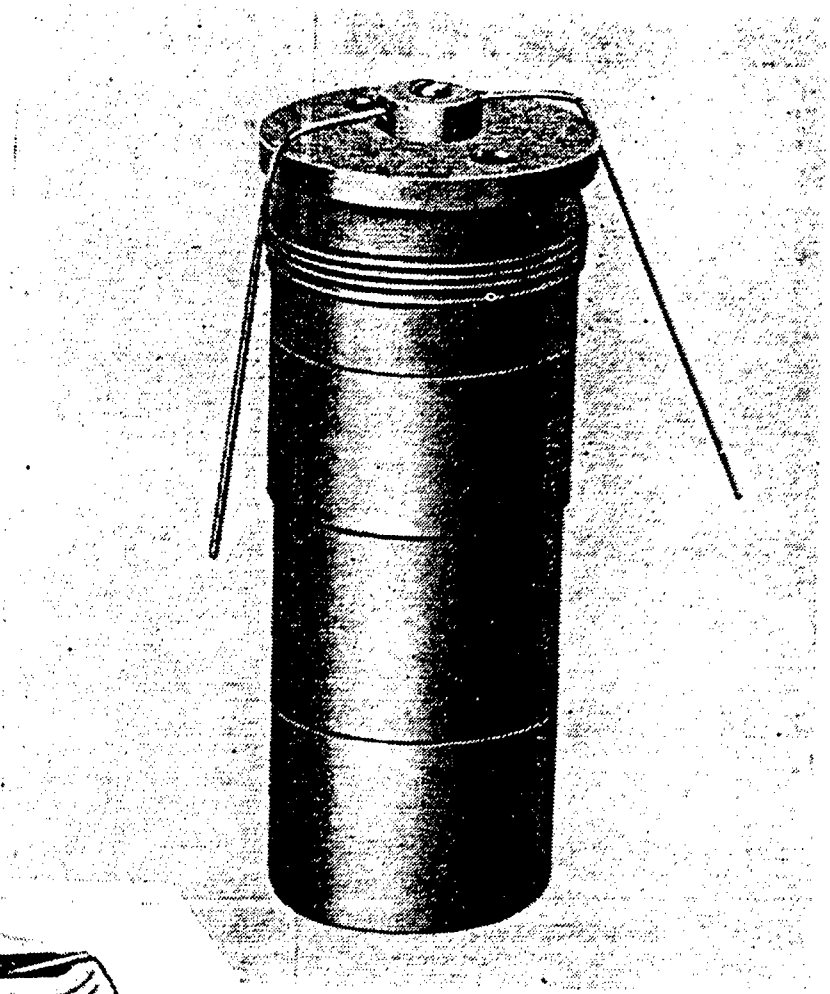


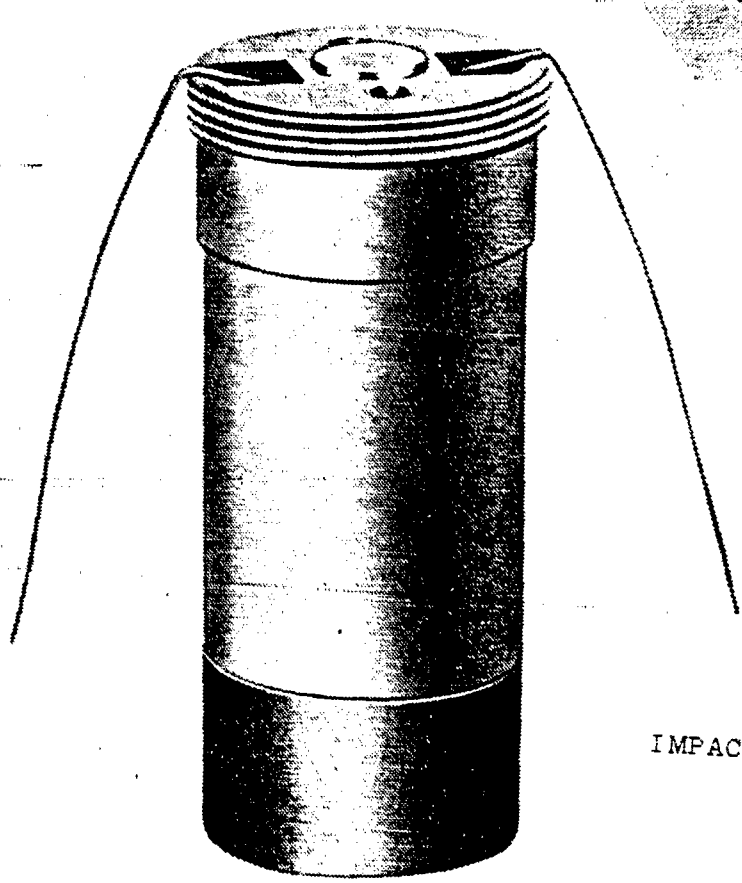
NOSE FUZES





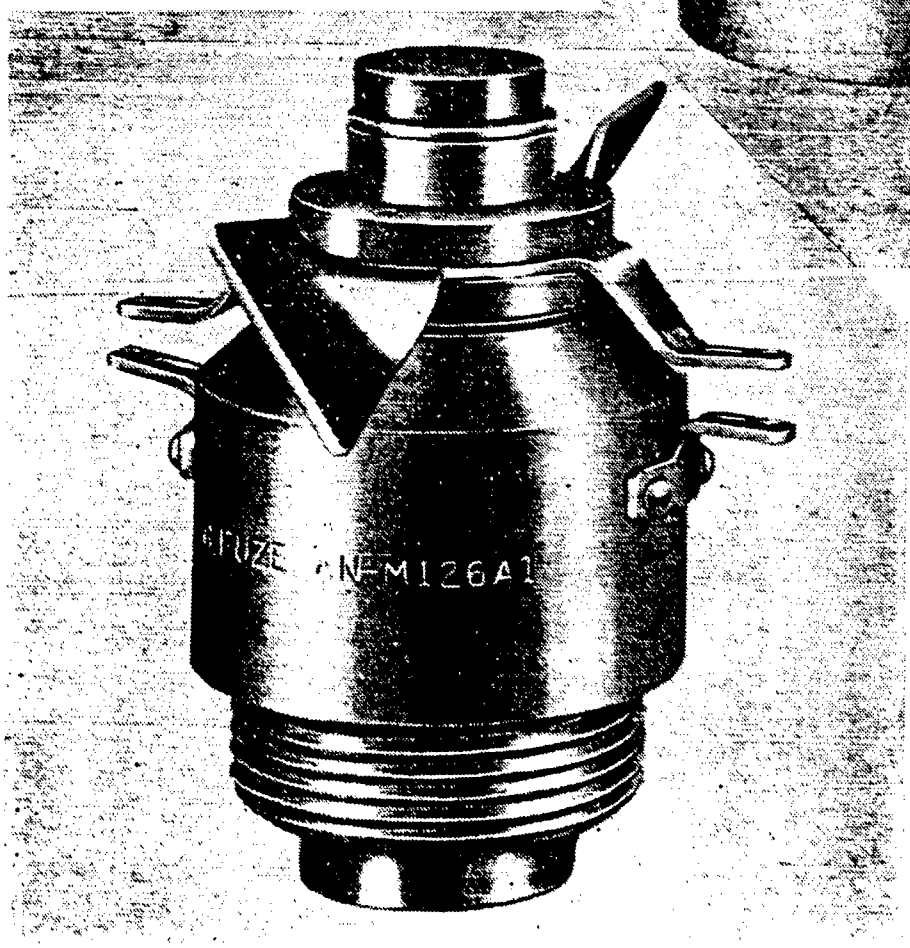
FIRE BOMB FUZES



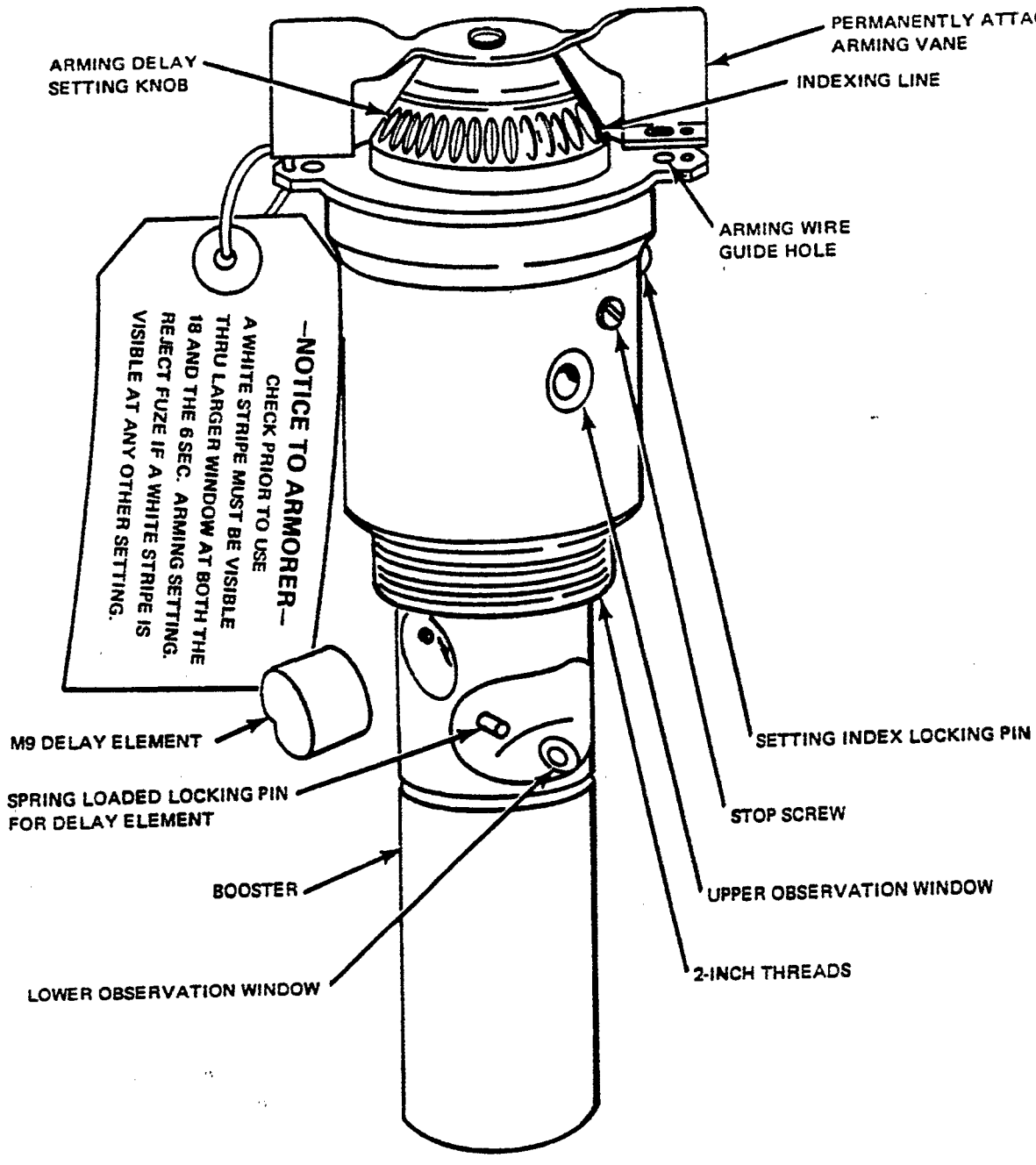


IMPACT FUZES FOR INCENDIARY BOMBS

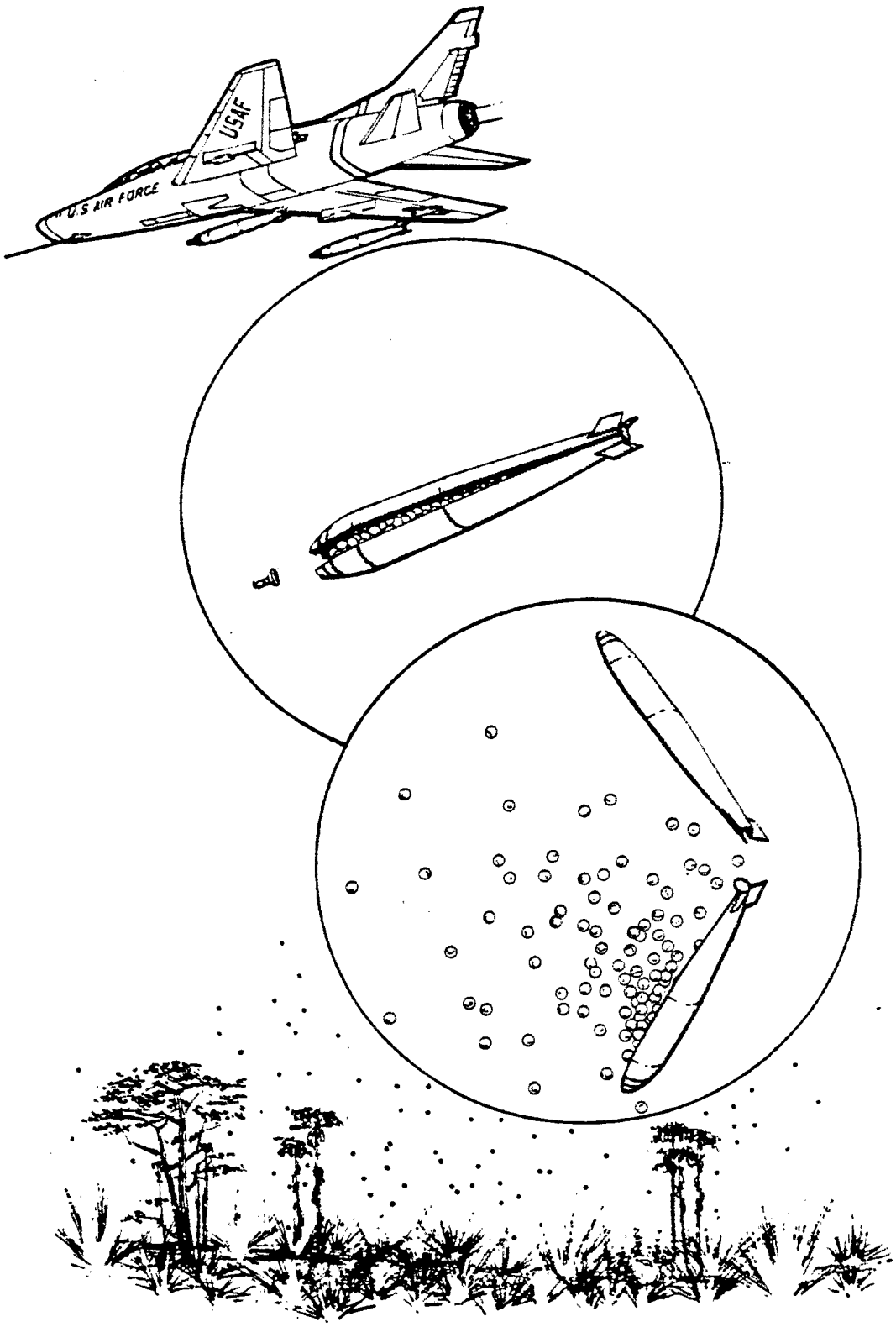
GAS BOMB FUZE



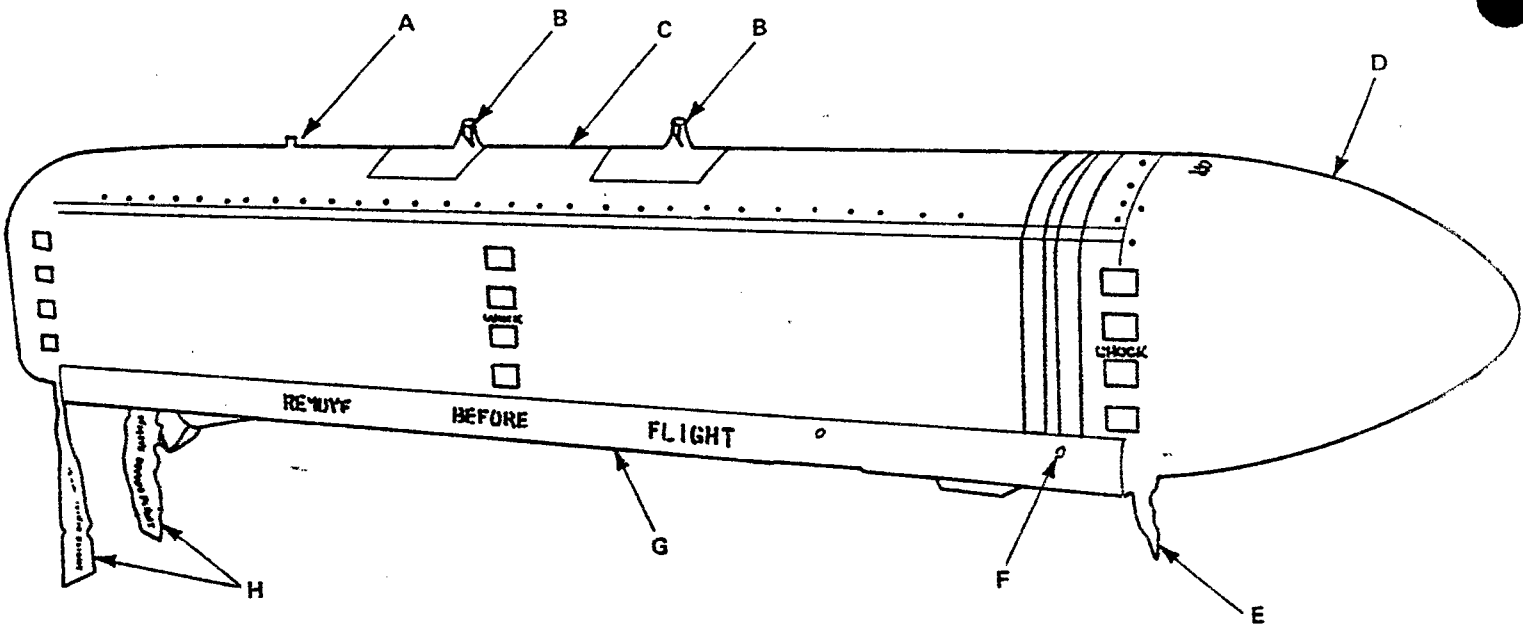
INCENDIARY AND
SMOKE BOMB FUZE


ARMING DELAY SETTING KNOB
PERMANENTLY ATTACHED ARMING VANE
INDEXING LINE
ARMING WIRE GUIDE HOLE
–NOTICE TO ARMORER–
CHECK PRIOR TO USE
A WHITE STRIPE MUST BE VISIBLE THRU LARGER WINDOW AT BOTH THE 18 AND THE 6 SEC. ARMING SETTING. REJECT FUZE IF A WHITE STRIPE IS VISIBLE AT ANY OTHER SETTING.
M9 DELAY ELEMENT
SPRING LOADED LOCKING PIN FOR DELAY ELEMENT
BOOSTER
LOWER OBSERVATION WINDOW
SETTING INDEX LOCKING PIN
STOP SCREW
UPPER OBSERVATION WINDOW
2-INCH THREADS

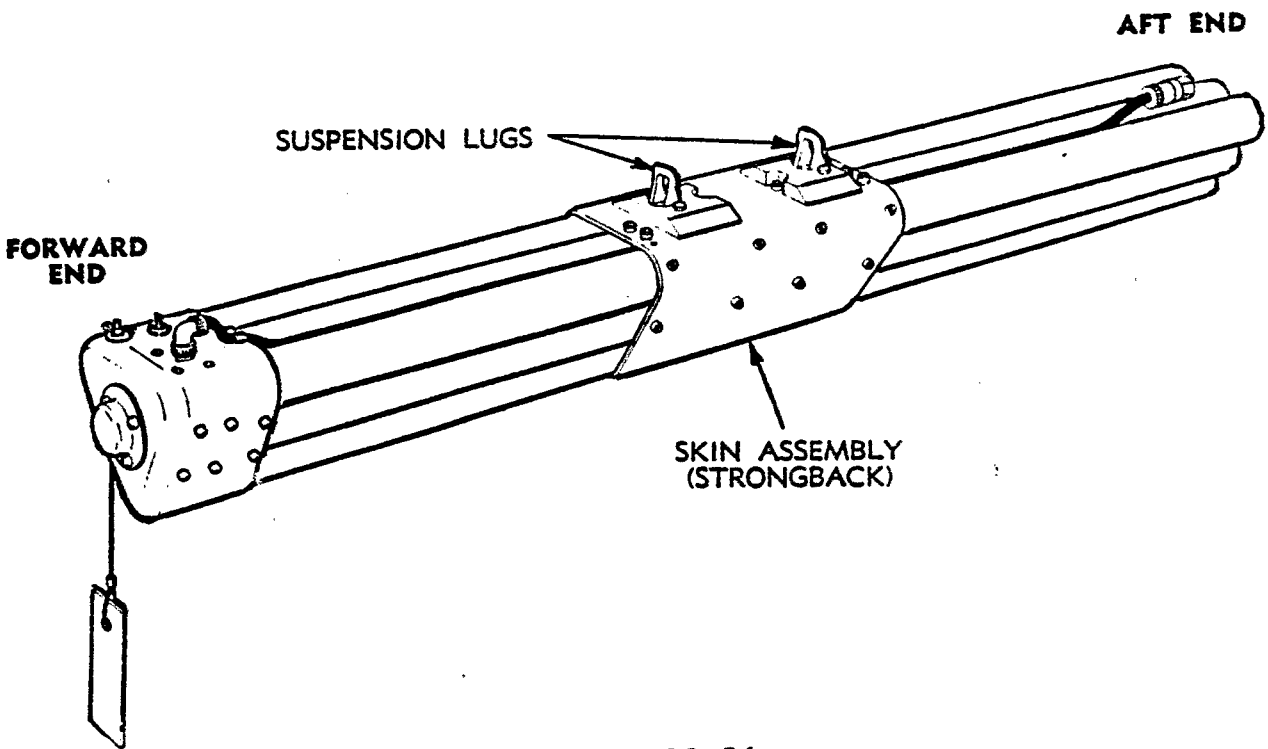
NOSE FUZE

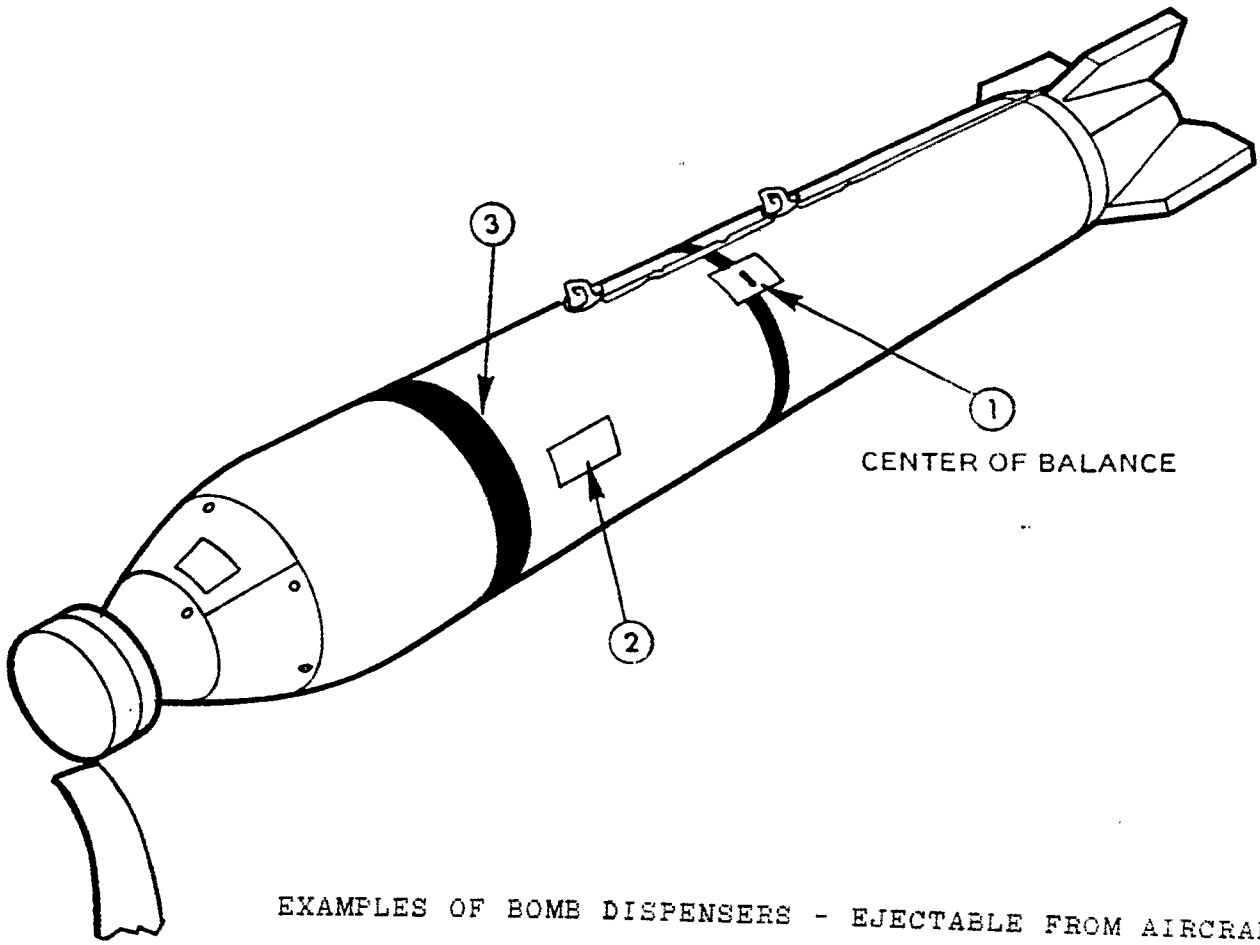


OPERATION OF NEWER CLUSTER BOMB

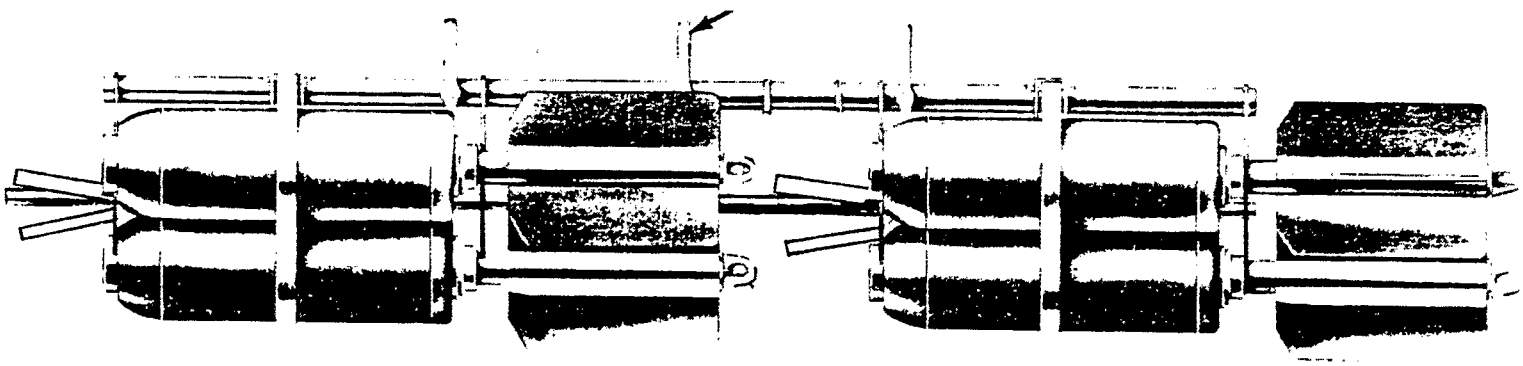


EXAMPLES OF BOMB DISPENSERS - NOT EJECTABLE FROM AIRCRAFT

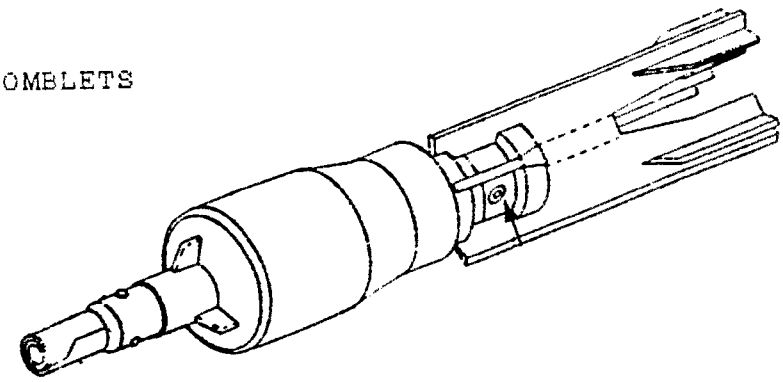


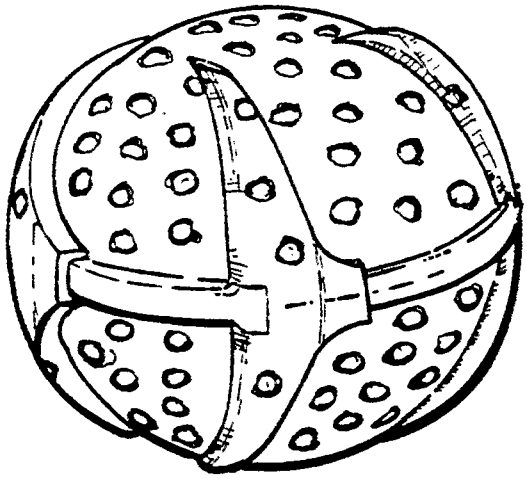


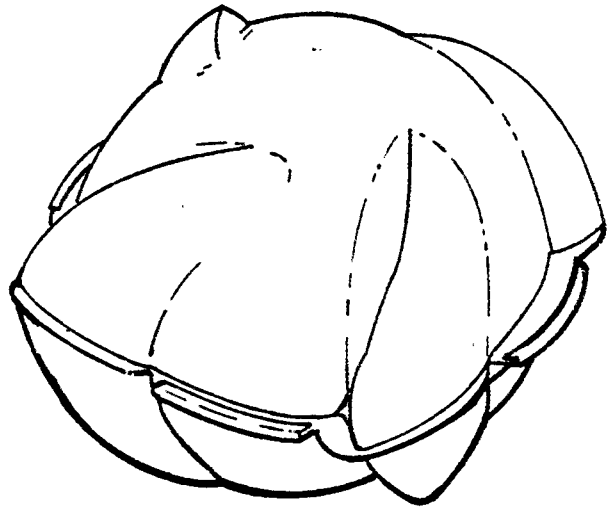
EXAMPLES OF BOMB DISPENSERS - EJECTABLE FROM AIRCRAFT

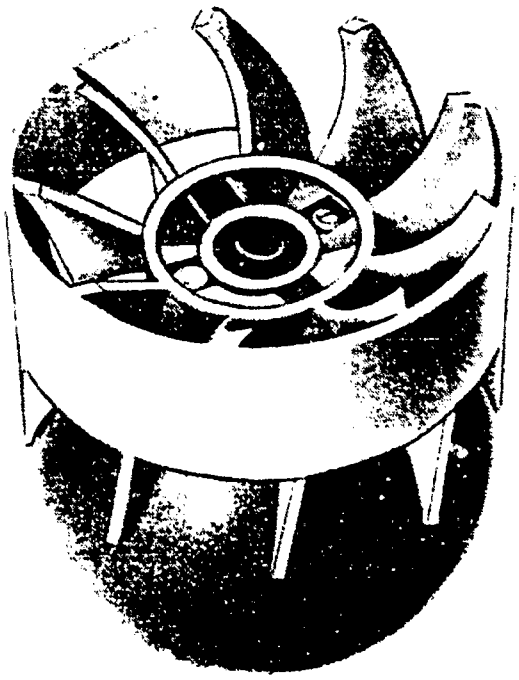


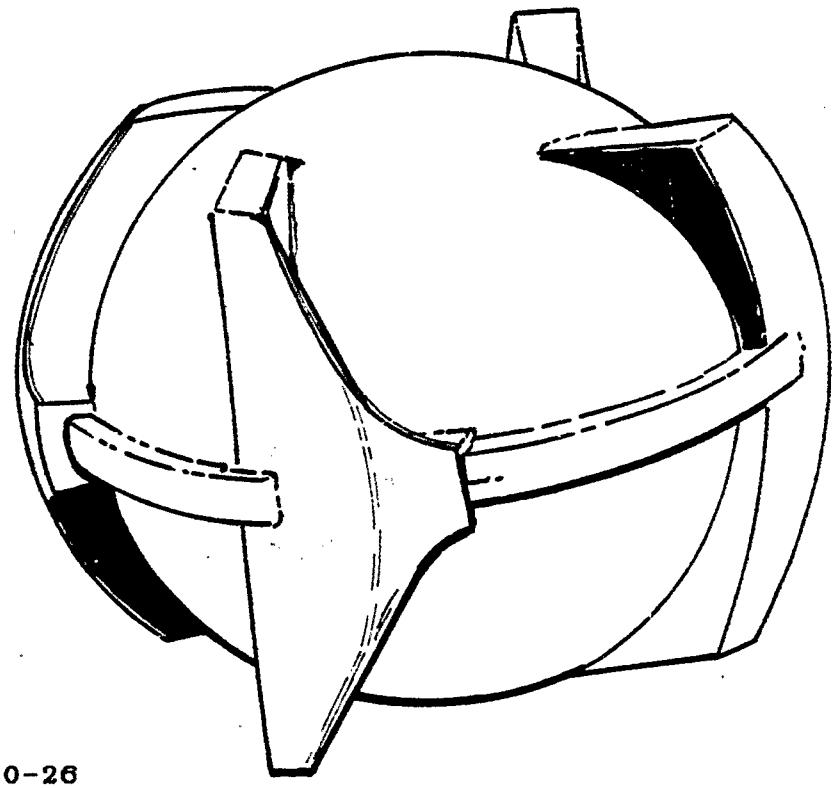
EXAMPLES OF HIGH EXPLOSIVE BOMBLETS

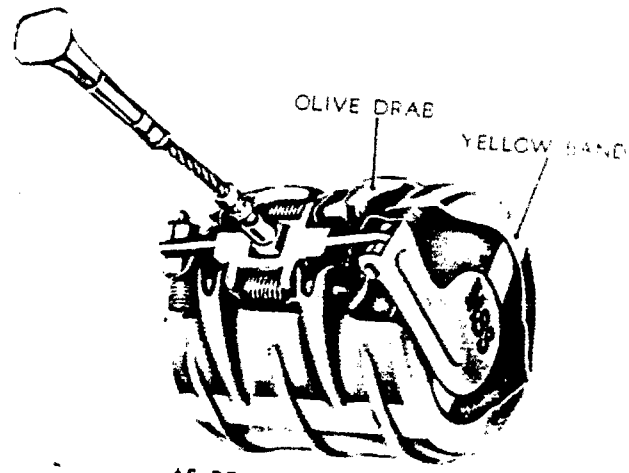




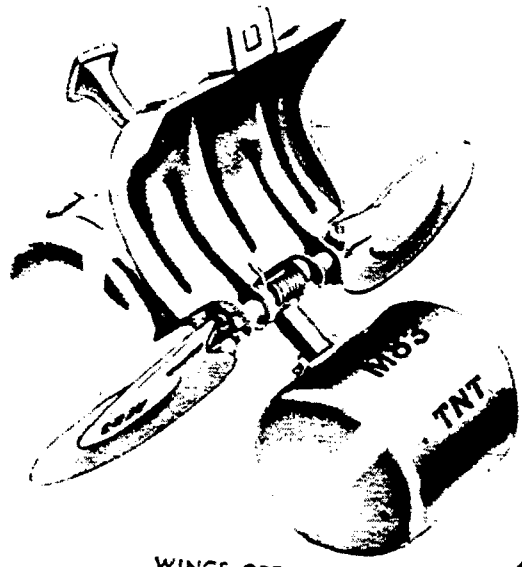




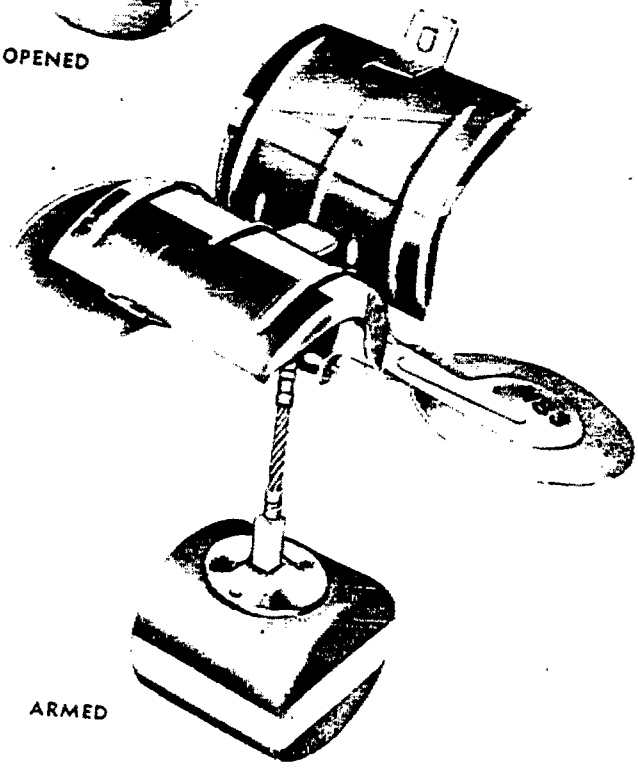




AS RELEASED FROM CLUSTER

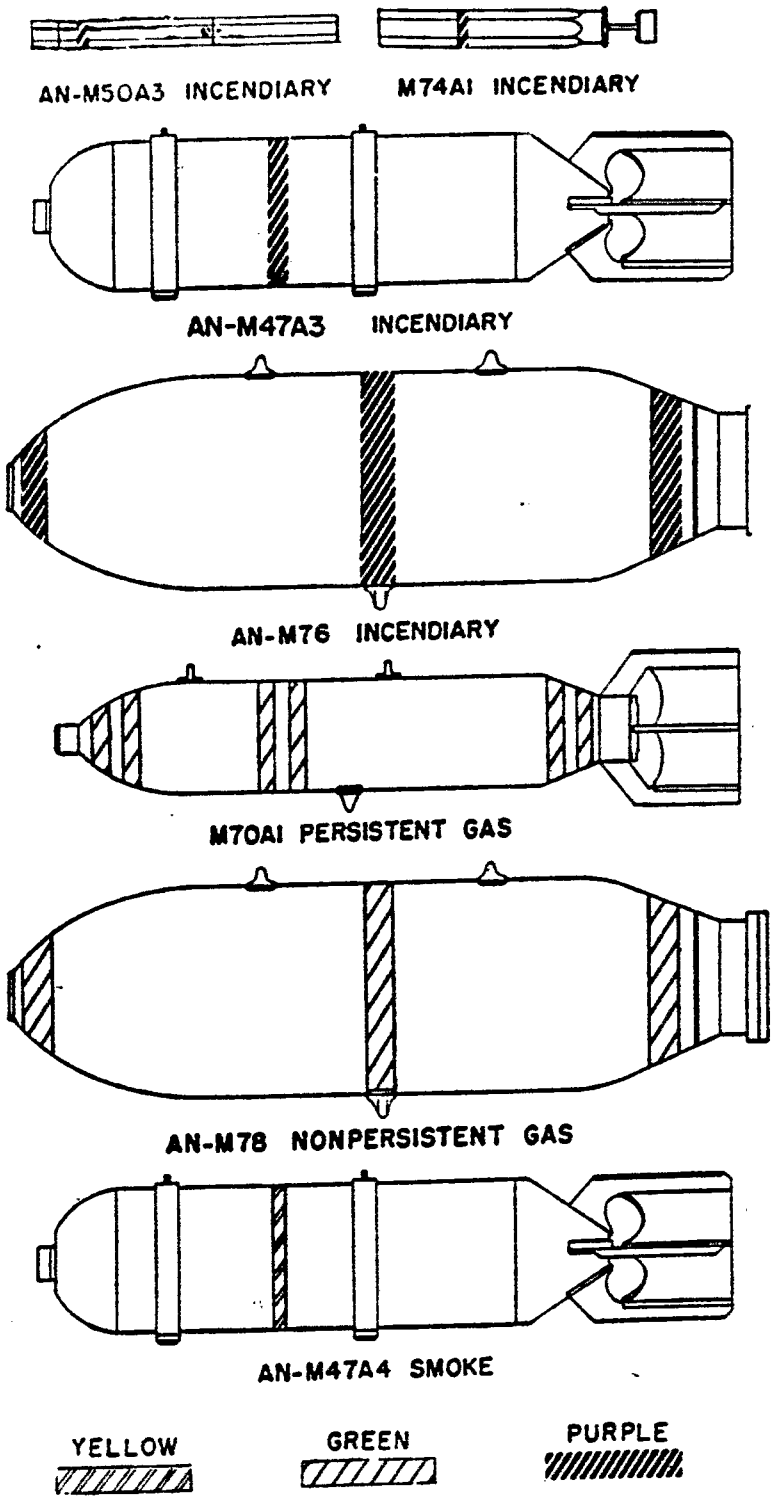


WINGS OPENED

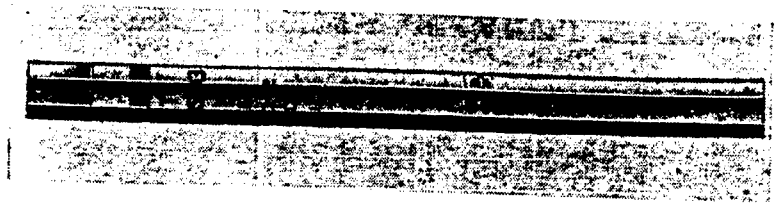


"BUTTERFLY" BOMBLET

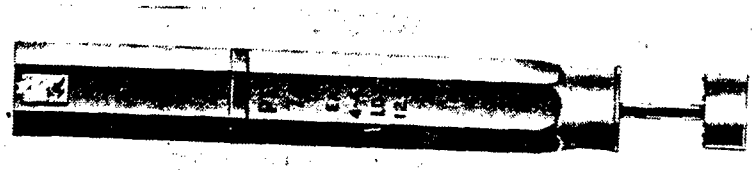
ARMED

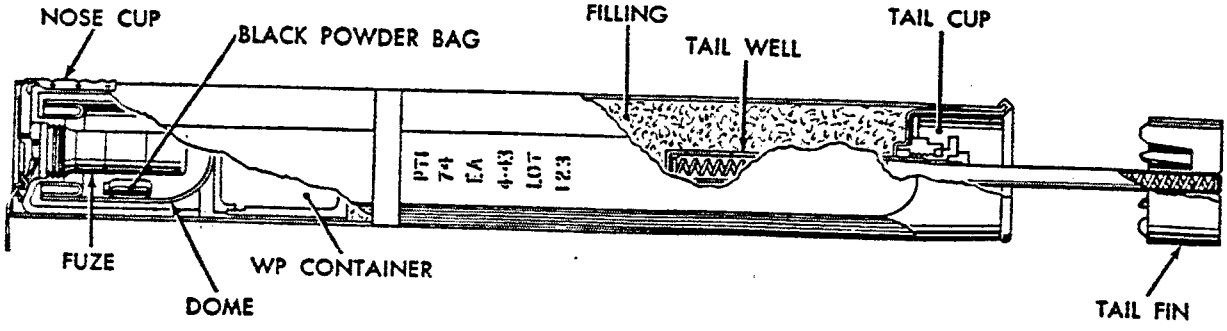


LOCATION OF COLOR CODE BANDS ON CHEMICAL BOMBS

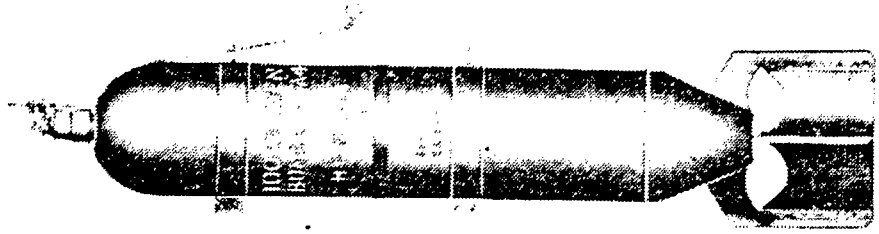


4 LB INCENDIARY BOMBS

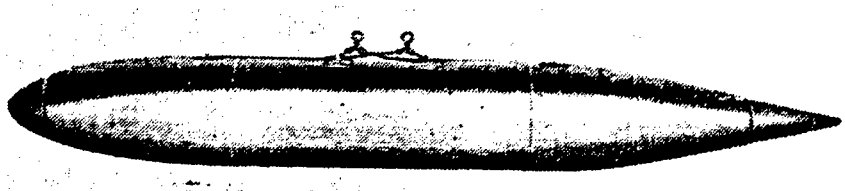




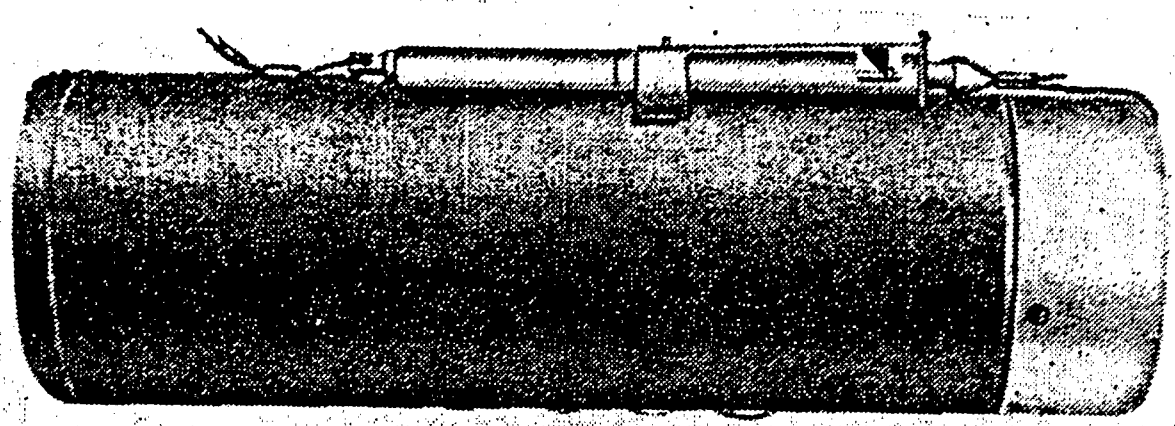
10 LB INCENDIARY BOMB

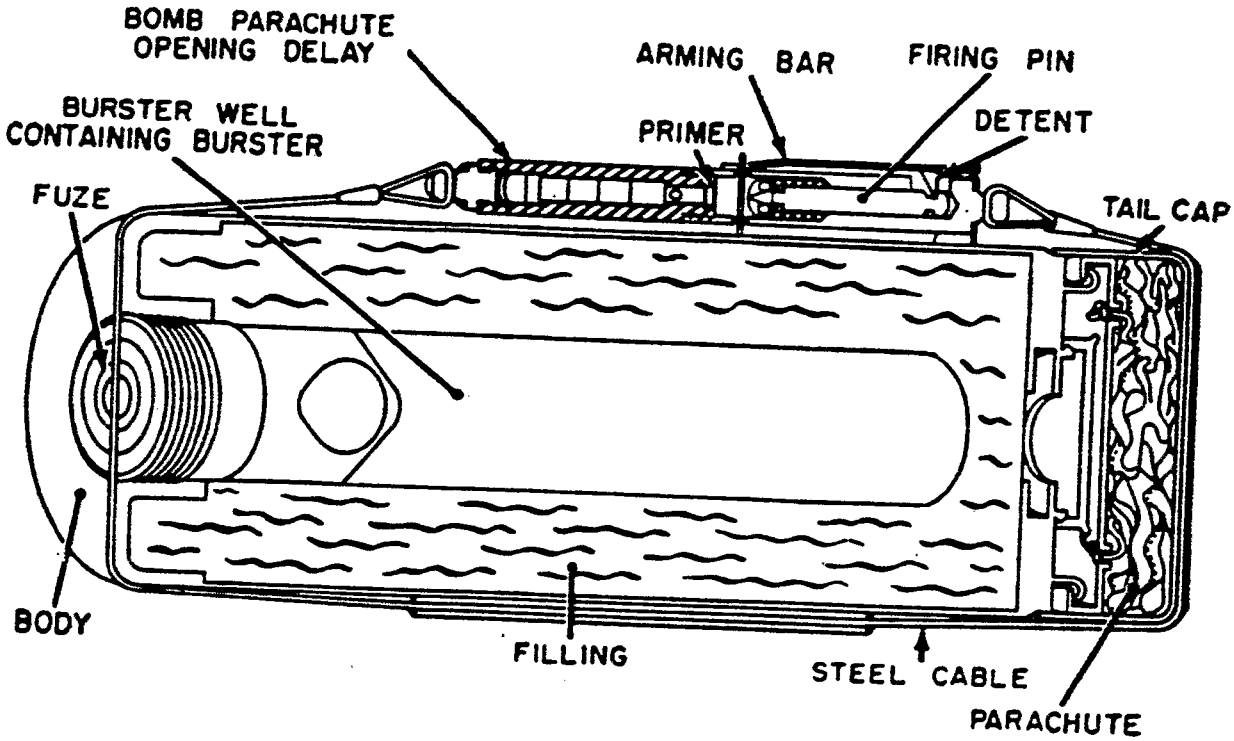


100 LB NAPALM INCENDIARY BOMB

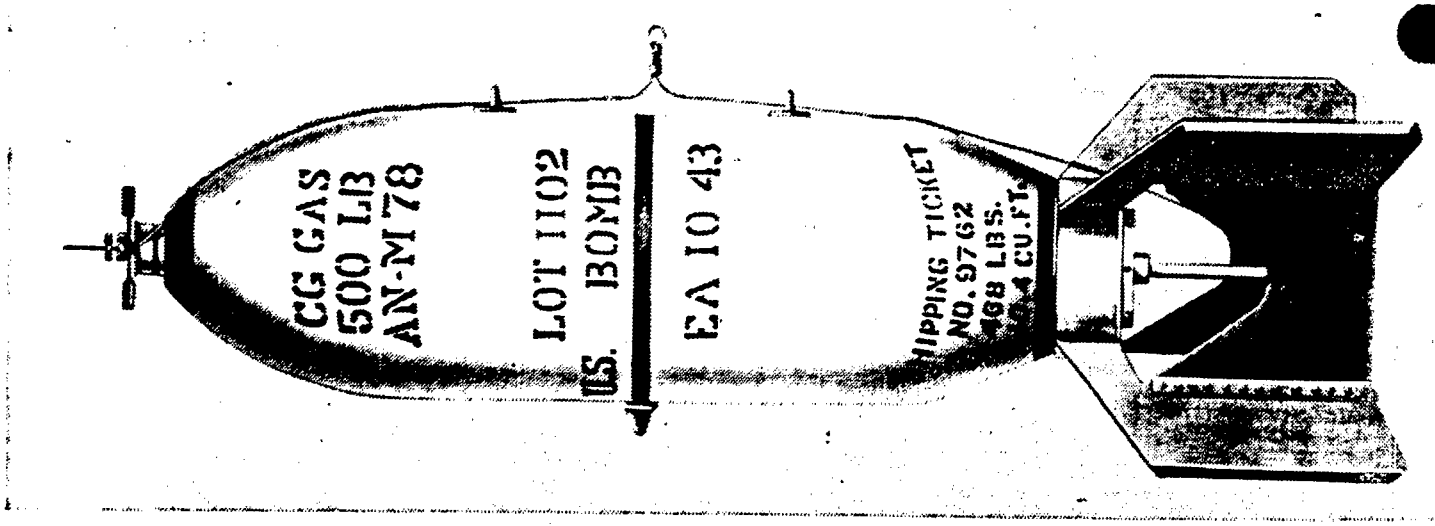


750 NAPALM INCENDIARY BOMB

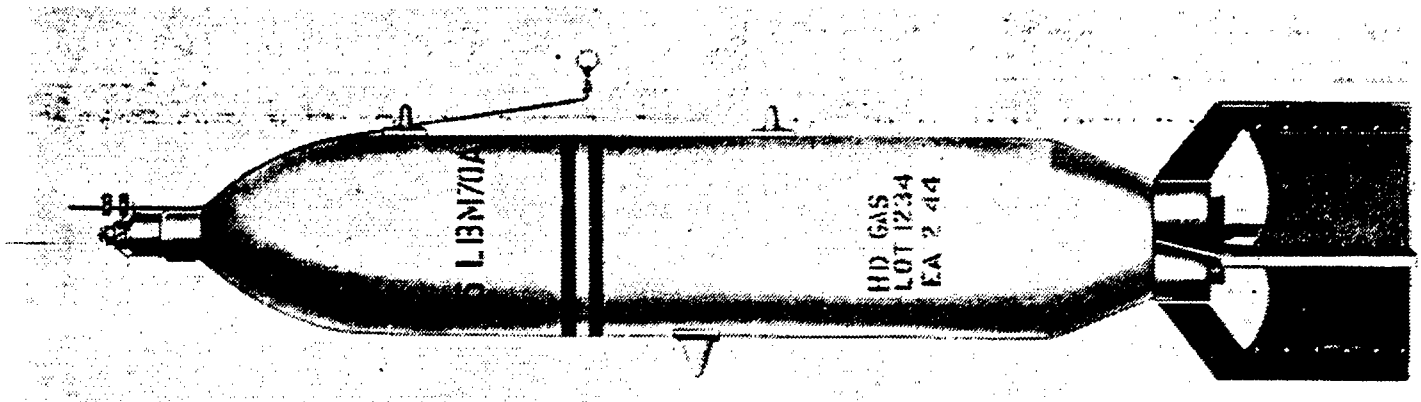




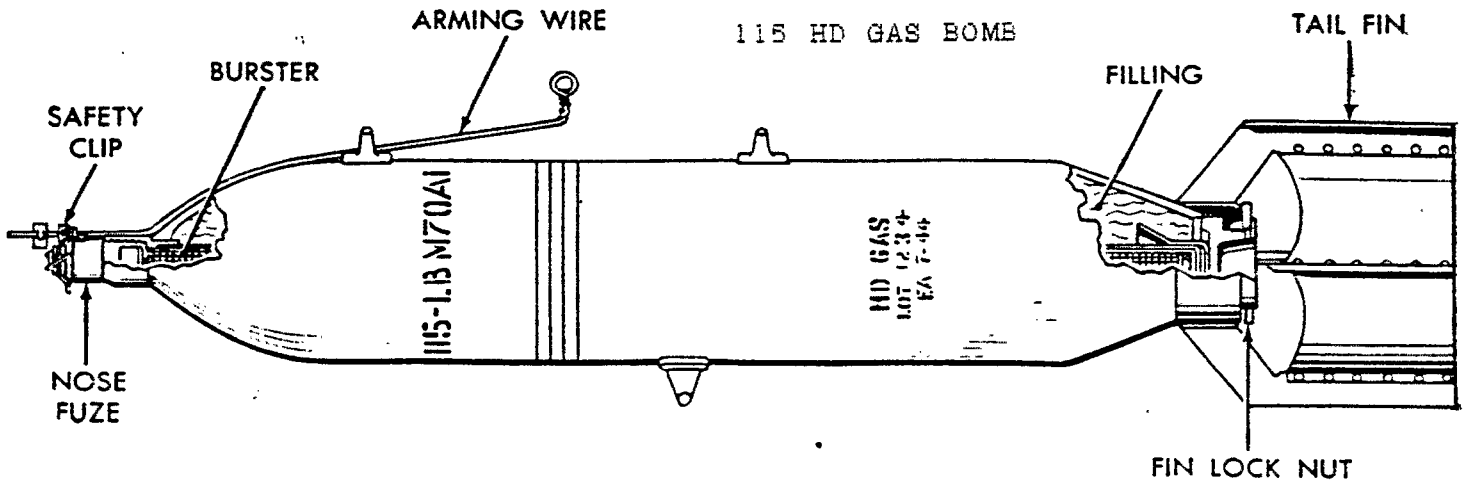
10 LB GB NONPERSISTENT GAS BOMB

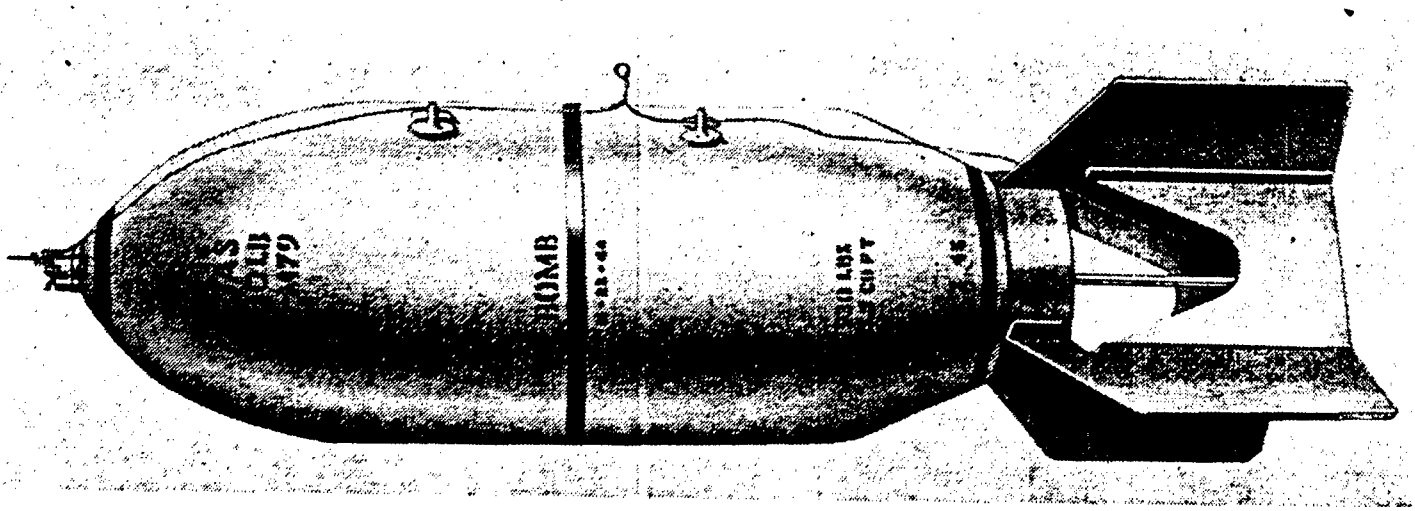


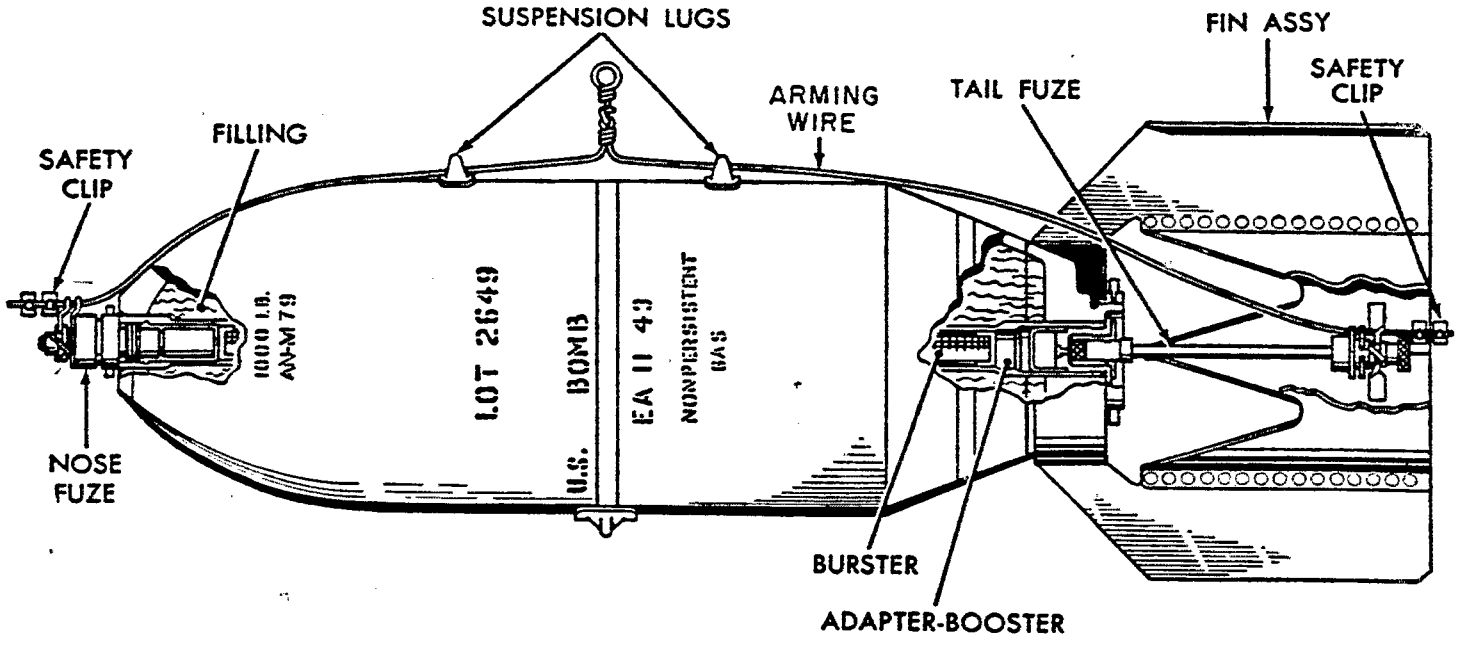
500 LB CG GAS BOMB



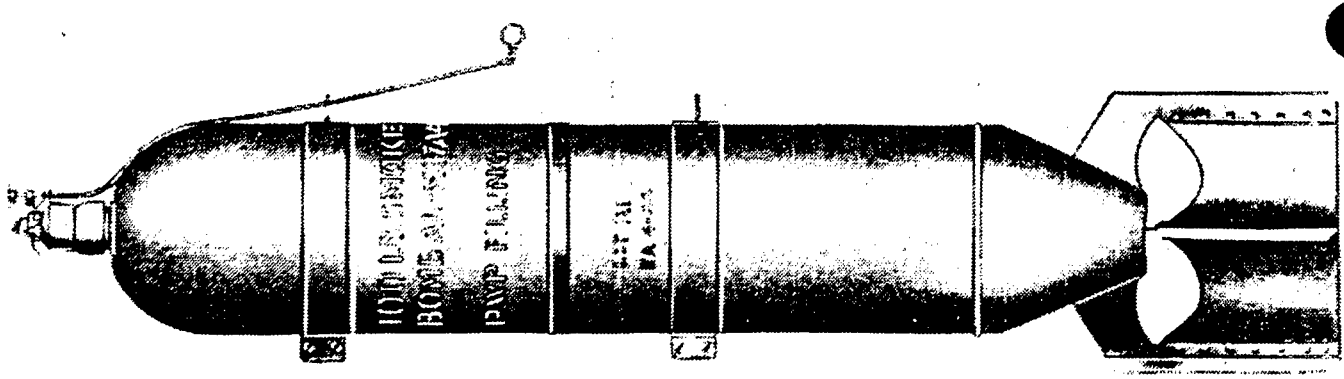
115 HD GAS BOMB

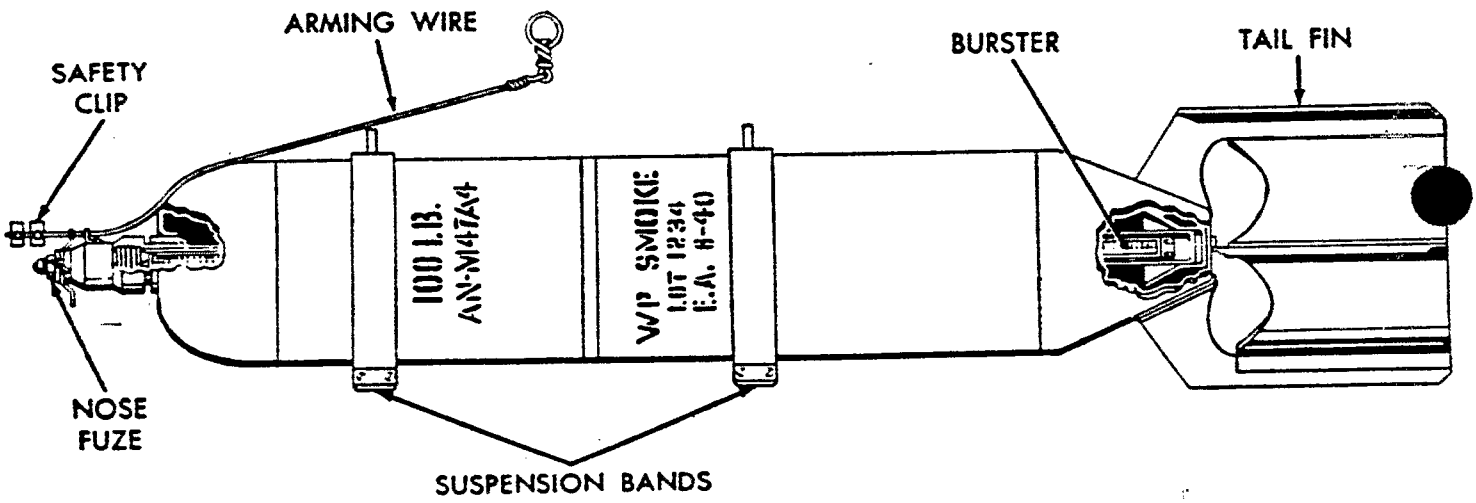




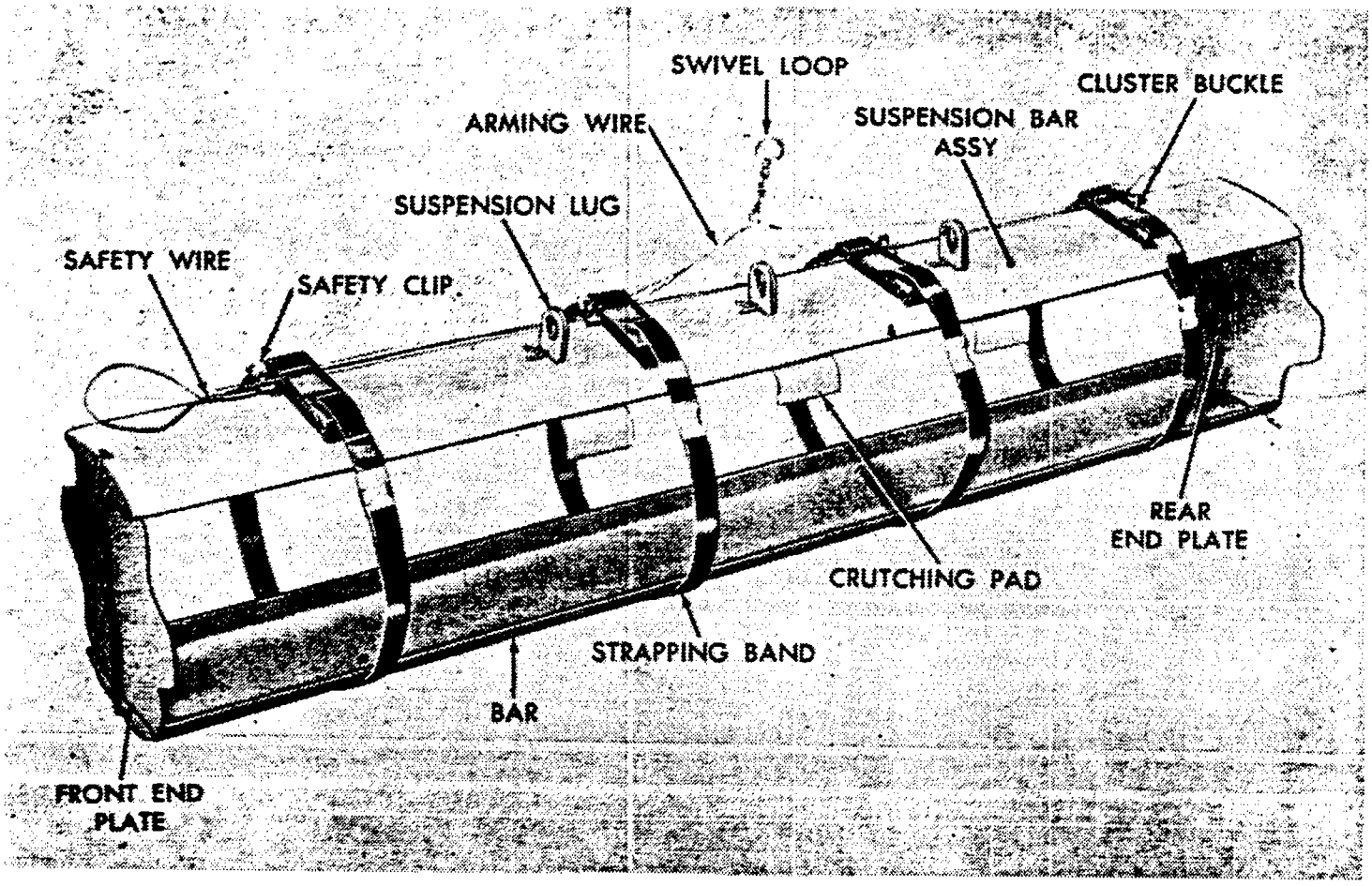


1,000 LB CG, AC, OR CK GAS BOMB

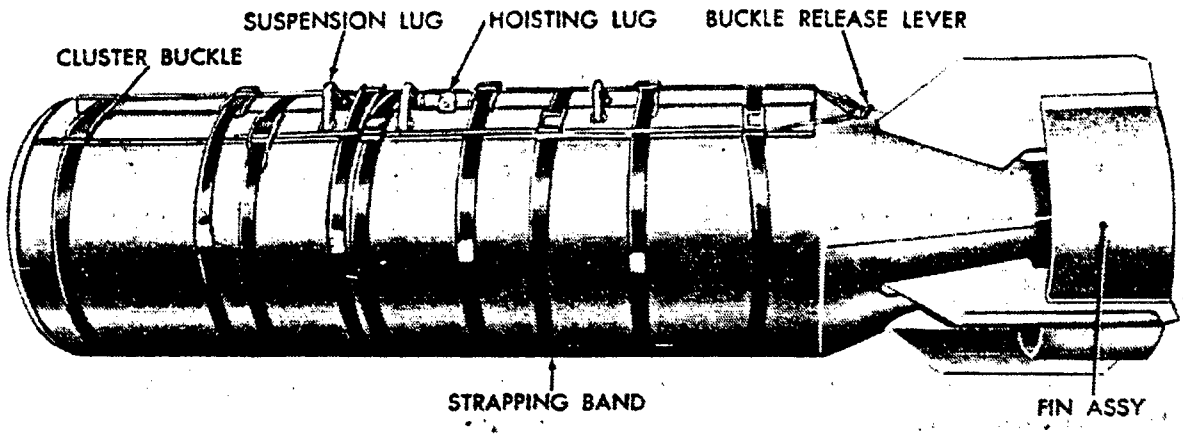




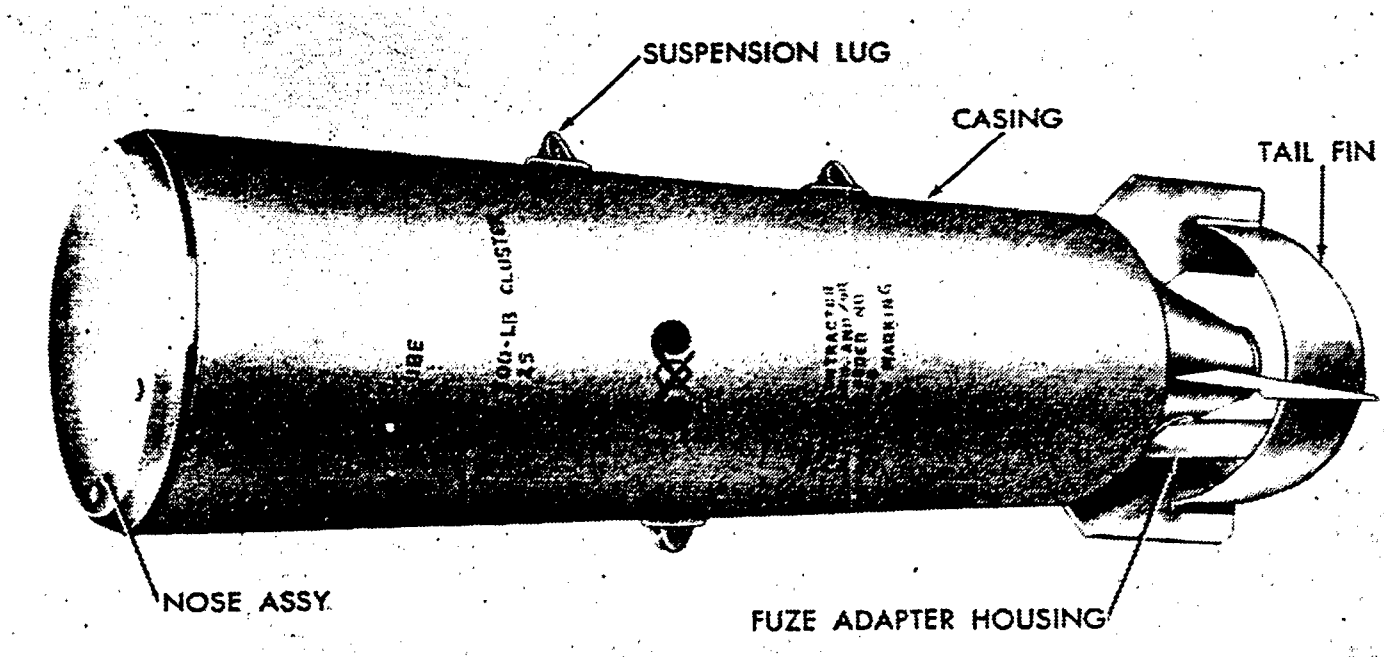
100 LB. PWP OR WP BOMB

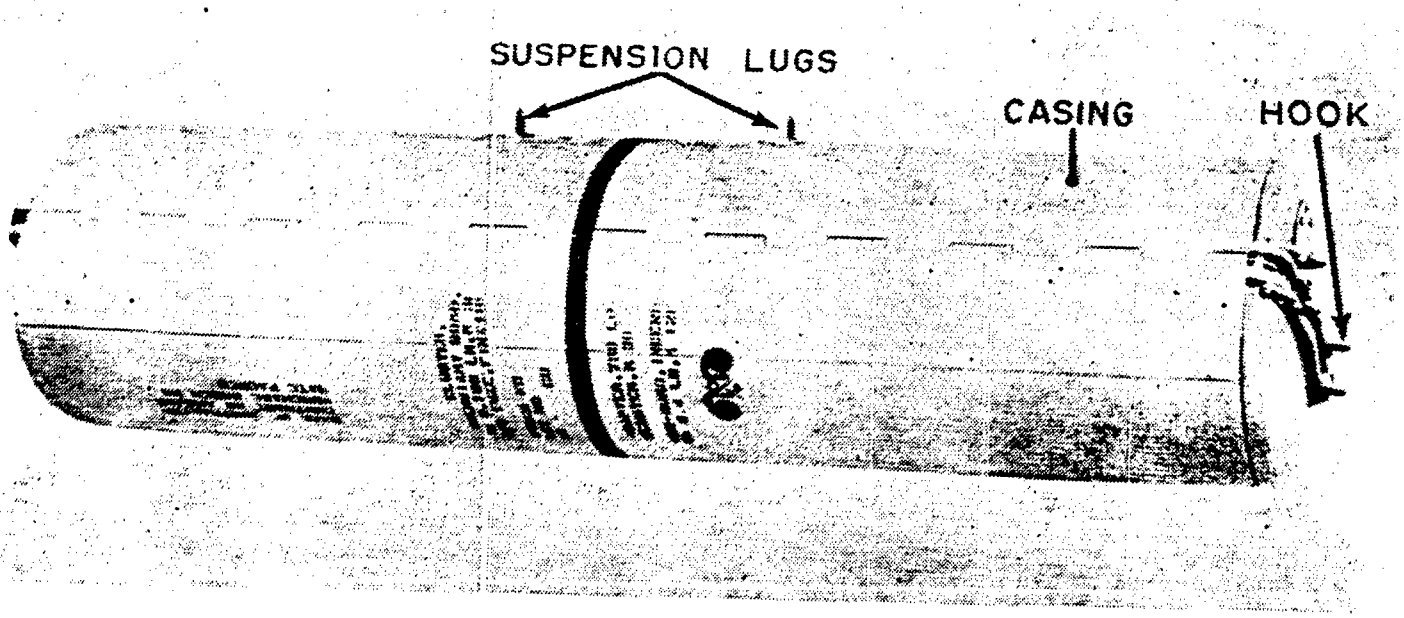


TYPICAL CLUSTER ADAPTER

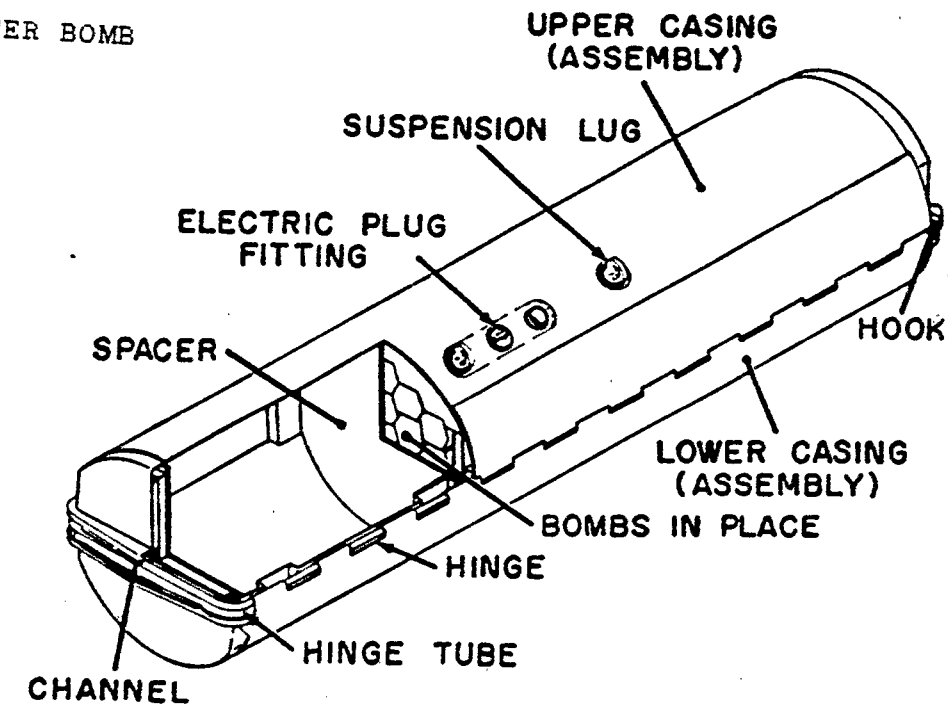


TYPICAL CLUSTER ADAPTERS

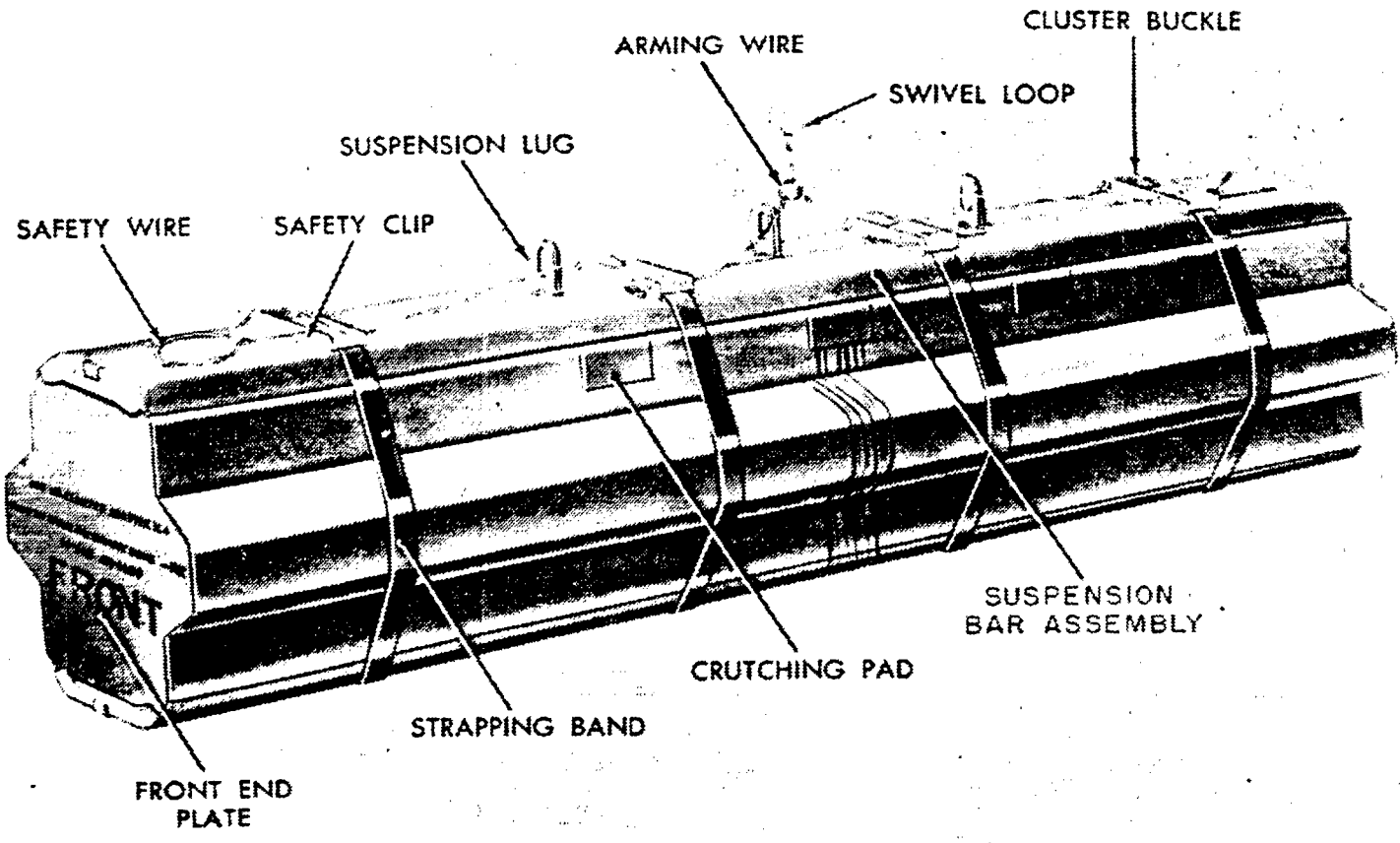




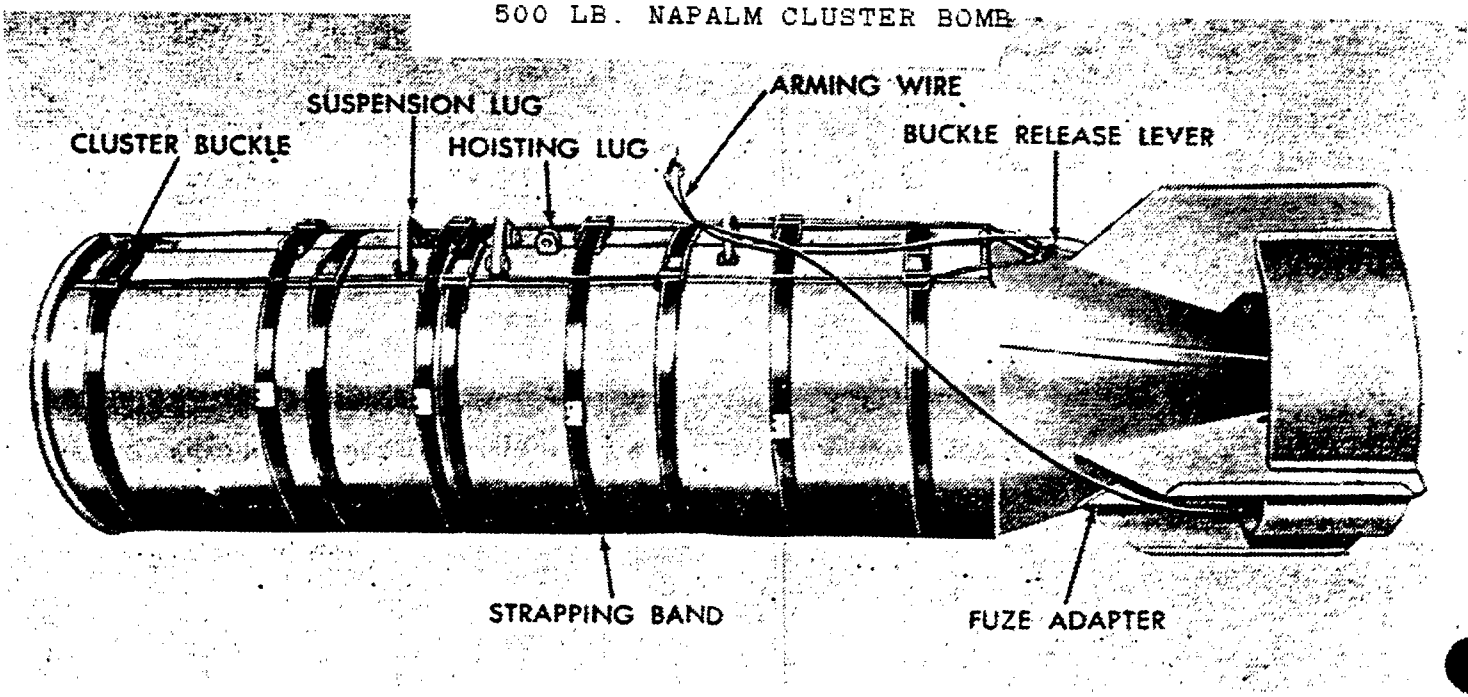
INCENDIARY CLUSTER BOMB

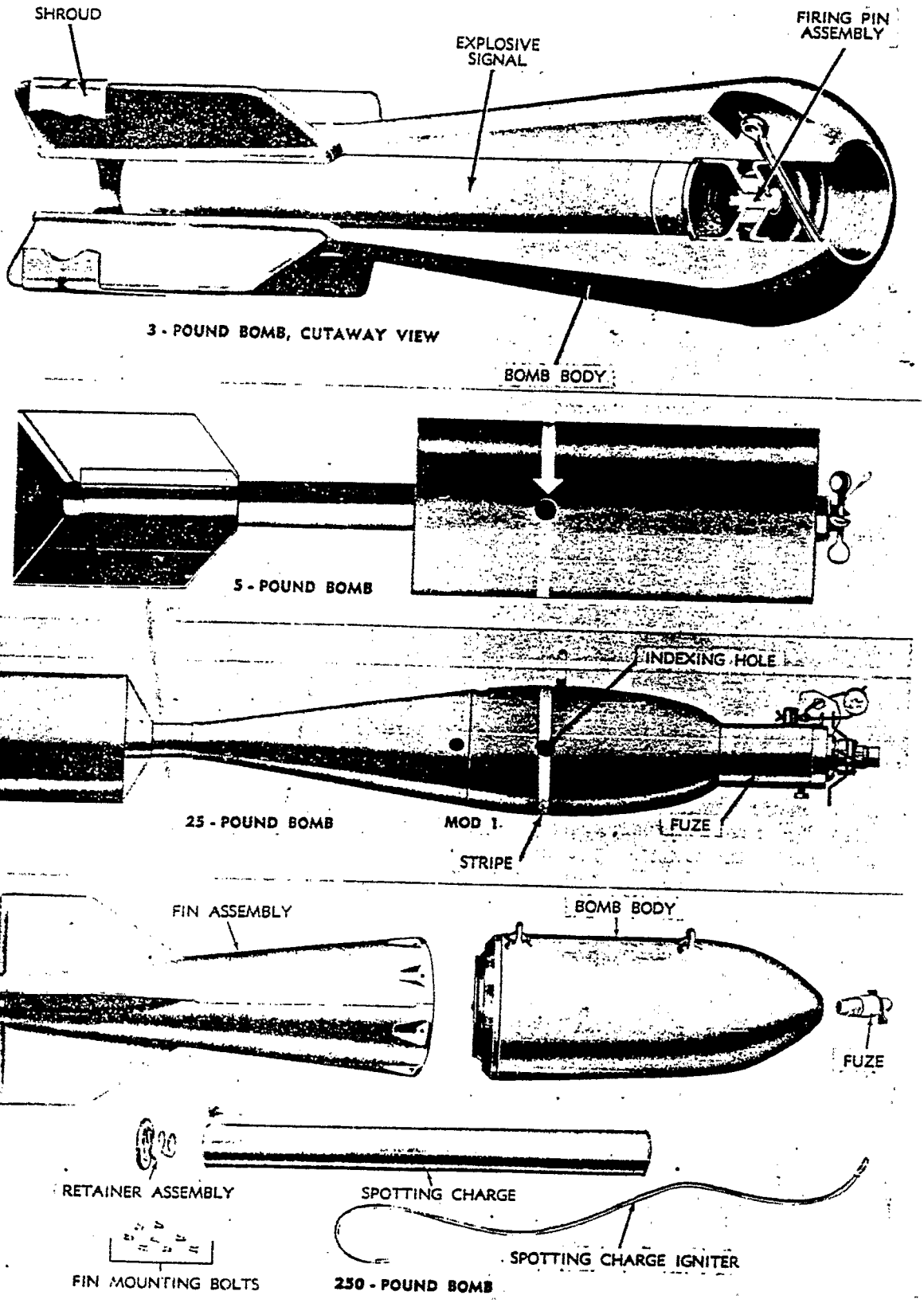


100 LB. NAPALM CLUSTER BOMB



500 LB. NAPALM CLUSTER BOMB





TYPICAL PRACTICE BOMB

RECOGNITION
AND
MARKING

POSSIBLE SOURCES OF AMMUNITION/EXPLOSIVES CONTAMINATION

MANUFACTURING FACILITIES

FIRING RANGES

DEMOLITION/BURNING GROUNDS

EXPLOSIVE TEST AREAS

PROVING GROUNDS

TYPES OF DECONTAMINATION

SURFACE DECONTAMINATION

MATERIAL ON OR NEAR THE SURFACE

VISUAL INSPECTION

ELECTRONIC DETECTION

LATER LIMITED USE OF THE LAND

MINIMUM DEPTH DECONTAMINATION

DEPTH OF SIX INCHES

RAKING/WINDROWING

MAGNET/ROCK PICKER

SPECIFIED DEPTH DECONTAMINATION

FUTURE USE MUST BE KNOWN

DECON TO BELOW ANTICIPATED USE

SAFETY PROCEDURES WITH UNEXPLODED ORDNANCE

SECURE THE AREA

EVALUATE DEGREE OF DANGER

PROTECTIVE MEASURES

REPORT THROUGH CHANNELS

PROVIDE EOD ACCESS

ESTABLISH LOCAL LIAISON

MARK LOCATION OF UNEXPLODED ORDNANCE

NO EXPLOSIVE HAZARD = RED FLAG

HIGH EXPLOSIVE HAZARD = YELLOW FLAG

UNKNOWN HAZARD = WHITE FLAG

EXPLOSIVE ORDNANCE DISPOSAL TELEPHONE NUMBERS:

DURING DUTY HOURS:

DSN: 367-5709 COMMERCIAL: 404-669-5709

AFTER DUTY HOURS:

DSN: 367-5222 COMMERCIAL: 404-669-5222

FT. McPHERSON, GA.