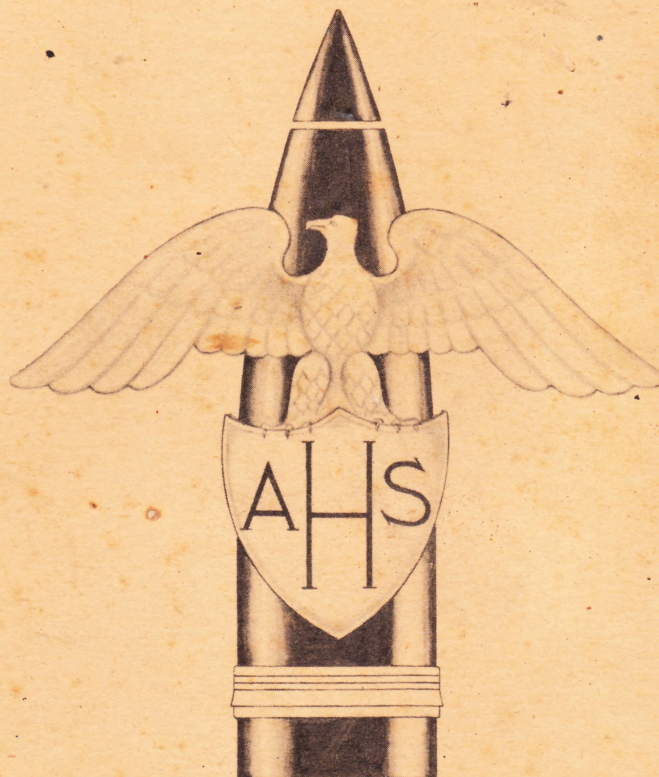


CONFIDENTIAL

INSTRUCTIONAL PAMPHLET 2

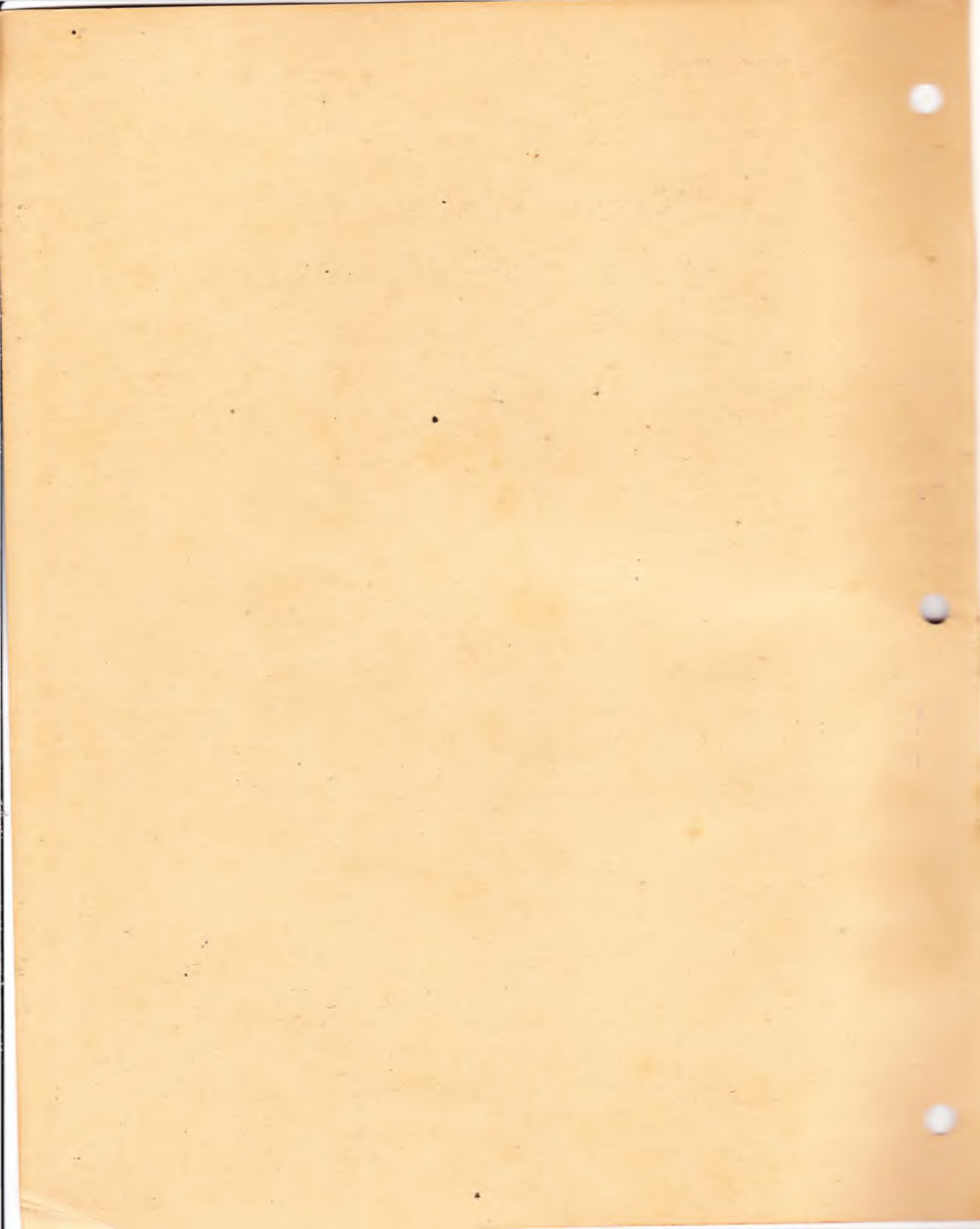
UNITED STATES NAVY GUN AMMUNITION



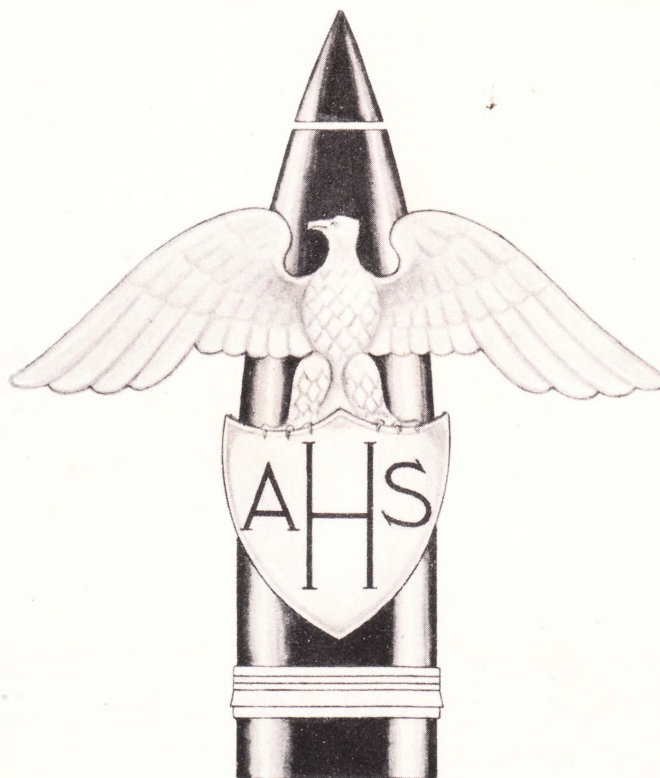
APRIL 15, 1945

NAVAL TRAINING SCHOOL (Ammunition Handling)

U. S. N. A. D., HINGHAM, MASSACHUSETTS



UNITED STATES NAVY GUN AMMUNITION

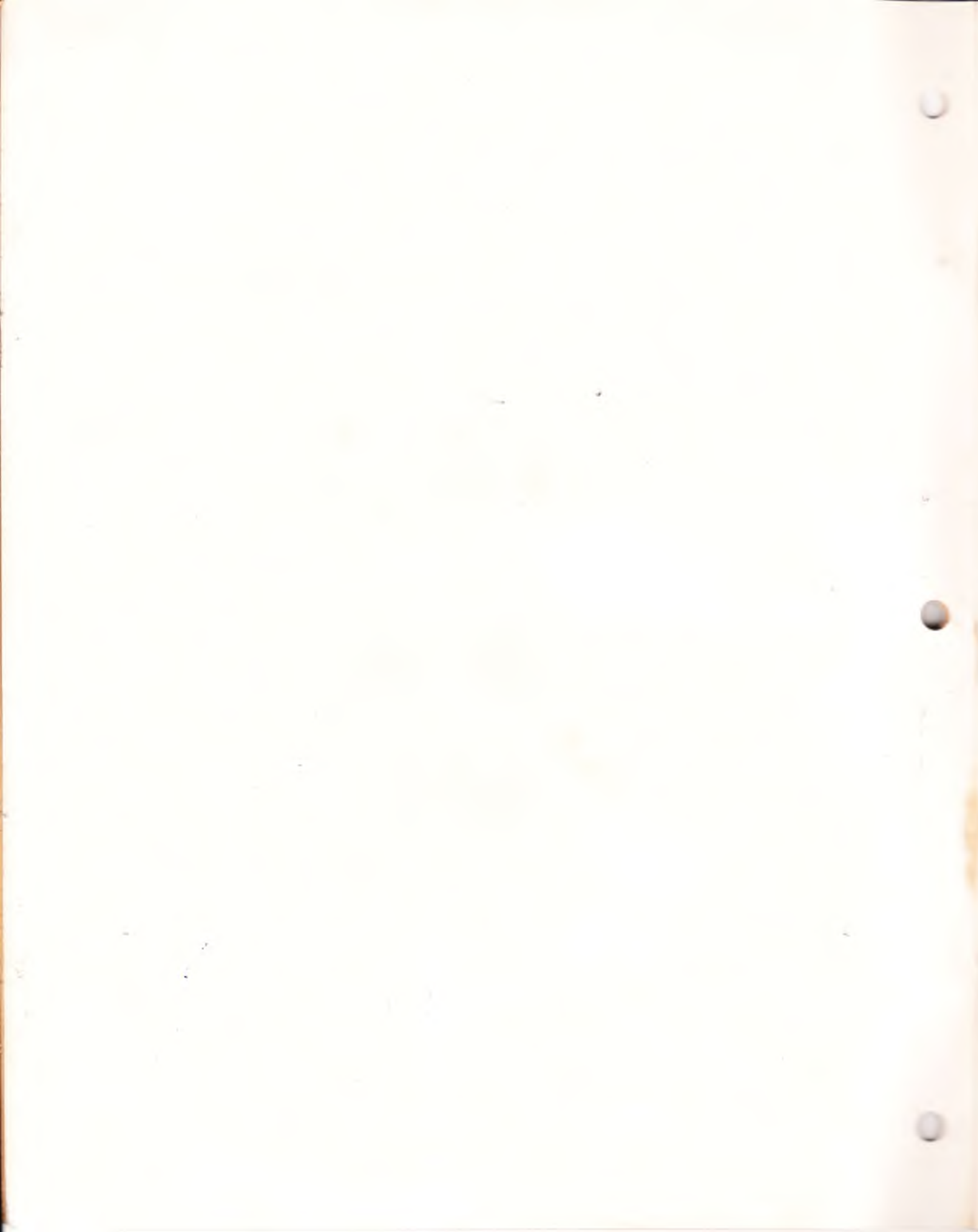


APRIL 15, 1945

This publication was compiled for use in instruction in the Ammunition Handling School. While it is believed to be accurate it is not an official publication. Since it contains both confidential and restricted information it should be handled in accordance with Article 76 of U. S. Navy Regulations, 1920.

NAVAL TRAINING SCHOOL (Ammunition Handling)

U. S. N. A. D., HINGHAM, MASSACHUSETTS



INDEX

	<i>Page</i>
Introduction	5
Primers	7
Cartridge Cases	15
Powder Bags	17
Projectile Fuzes and Nose Plugs	19
Projectile Tracers	23
Projectiles — Introduction	25
Projectiles — 20 mm, 1".10/75 cal., 40 mm	26
Projectiles — 3"/23 cal. through 16"/50 cal.	37
Assembly of Gun Ammunition	67
Ammunition Lot Number System	77
Gun Ammunition Containers	91
Glossary of Gun Ammunition Terms	108
Gun Ammunition Abbreviations	110

ILLUSTRATIONS INDEX

	<i>Page</i>
Types of Gun Ammunition	6
Primers	10
Percussion Cap	10
Case Percussion Primer	11
Case Percussion Ignition Primer	12
Case Combination Ignition Primer	13
Lock Combination Primer	14
Fuzes and Nose Plugs	22
Tracers	23
External Tracer — Internal Tracer — Direct Ignition Tracer	24
20 mm Anti-Aircraft Ammunition	27
20 mm Anti-Aircraft Ammunition (Color Markings)	33
20 mm Aircraft Cannon Ammunition	30
20 mm Aircraft Cannon Ammunition (Color Markings)	34
1".10/75 Cal. Anti-Aircraft Ammunition	31
1".10/75 Cal. Anti-Aircraft Ammunition (Color Markings)	35
40 mm Anti-Aircraft Ammunition	32
40 mm Anti-Aircraft Ammunition (Color Markings)	36
Armor Piercing Projectile	38
Special Common Projectile	39
Common Projectile	41
Old Common Projectile	42
Anti-Aircraft Projectile	43
Anti-Aircraft Common Projectile	44
High Capacity Projectile	46
Illuminating Projectile	47
WP Projectile	49
W Projectile	50
Target Projectile	51
Standard Color Chart	57
Projectiles (Color Markings)	58
Projectiles (Color Markings)	59
Projectiles (Color Markings)	60
Fixed Ammunition	61
Semi-Fixed Ammunition	62
Bag Gun Ammunition	63
Powder Bag Charges	64
Bag Gun Projectiles	65
Dummy Drill Ammunition	66
Fixed Cartridge	72
Semi-Fixed Cartridge	73
Stacked Bag Charge — Unstacked Bag Charge	74
Ammunition Details	75
Ammunition Details	76
Fixed Cartridge Boxes	94
Fixed Cartridge Boxes	95
Fixed Cartridge Tanks	96
Semi-Fixed Cartridge Tanks	97
Powder Bag Tanks	98
Powder Bag Tanks	99
Fixed Cartridge Boxes (Color Markings)	102
Fixed Cartridge Boxes (Color Markings)	103
Fixed Cartridge Box and Tanks (Color Markings)	104
Fixed Cartridge Tanks (Color Markings)	105
Fixed Cartridge Tanks (Color Markings)	106

NAVY GUN AMMUNITION

INTRODUCTION

The term gun ammunition as used in the Navy refers to ammunition used in guns which are larger than caliber .60. It includes the three types: (a) fixed ammunition; (b) semi-fixed ammunition; (c) bag gun ammunition.

The following classes of gun ammunition are produced in all of the types mentioned above: (a) service ammunition — produced for regular service battle use only; (b) target ammunition — produced for target practice only; (c) dummy drill ammunition — produced with inert materials to simulate service ammunition for practice in loading guns, magazines, and hoists only.

Fixed ammunition includes that ammunition in which the primer and the projectile are securely fixed in the cartridge case containing the smokeless powder propelling charge. Loading this type of ammunition into a gun is accomplished in one operation. The following guns use fixed ammunition: 20 mm, 1.10"/75 cal., 40 mm, 1, 3, and 6 pounders, 3"/23 cal., 3"/50 cal., 4"/50 cal., 5"/25 cal.

Semi-fixed ammunition includes that ammunition in which the primer and a cork sealing plug are securely fixed to the cartridge case containing the propelling charge and the projectile is separate. Loading this type of ammunition into a gun is accomplished in two operations. The following guns use semi-fixed ammunition: 5"/38 cal., 5"/51 cal., 5"/54 cal., 6"/47 cal.

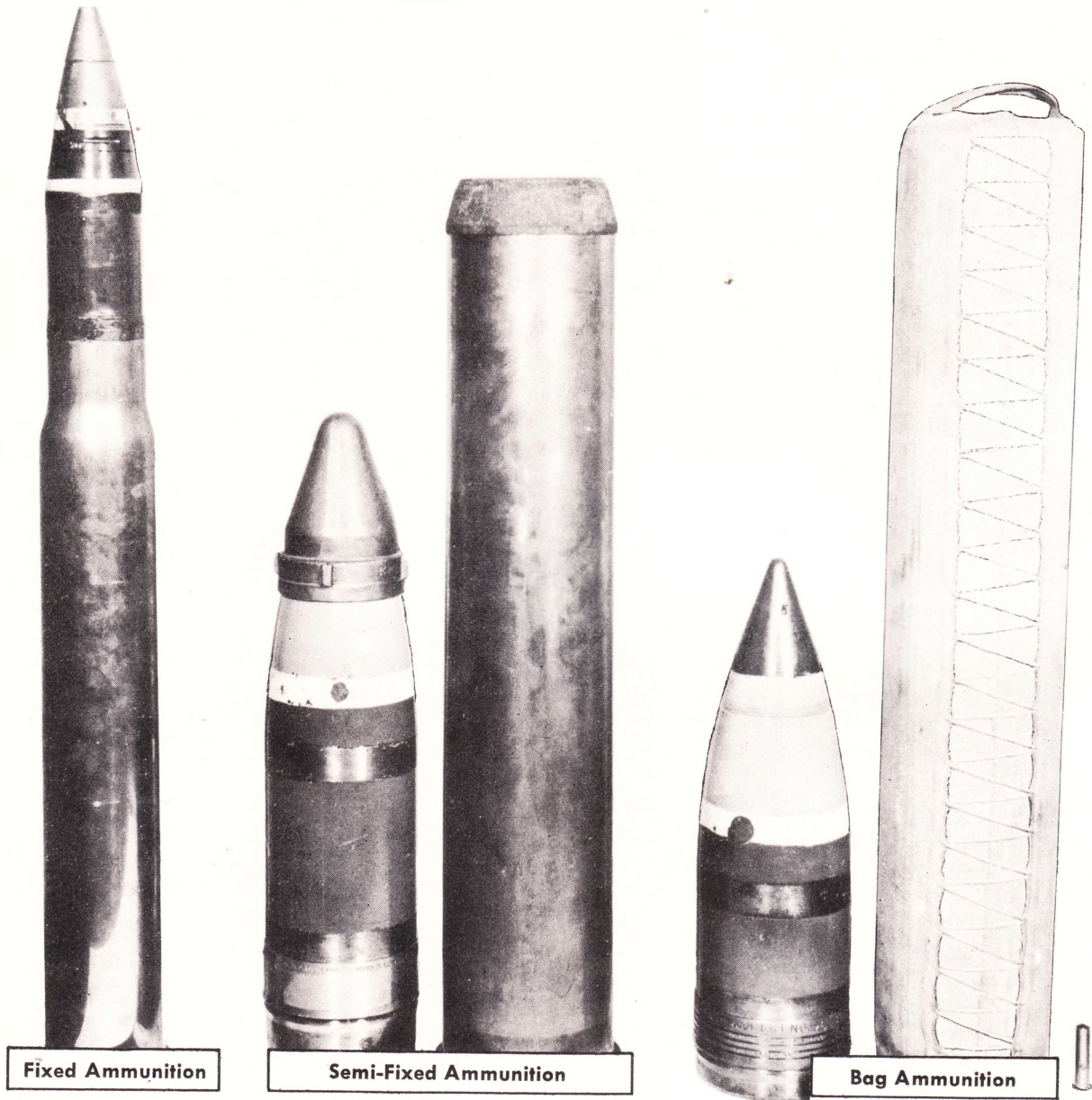
Bag gun ammunition includes that ammunition in which the propelling charge (contained in one or more silk powder bags), the primer, and the projectile are loaded into the gun separately. Loading this type of ammunition into a gun is accomplished in

three or more operations depending on the number of powder bags or sections required for a full charge. The following guns use bag gun ammunition: 5"/50 cal., 5"/51 cal., 6"/47 cal., 6"/50 cal., 6"/53 cal., 7"/45 cal., 8"/55 cal., 12"/50 cal., 14"/45 cal., 14"/50 cal., 16"/45 cal., 16"/50 cal.

The Navy procures 37 mm, 75 mm, 90 mm, 4."2, 105 mm, and 155 mm ammunition from the Army and these will be discussed in a separate bulletin dealing with Army Ammunition.

This bulletin is designed to impart the basic knowledge necessary for the intelligent and safe handling and stowage of gun ammunition. To that end, the various components which compose a complete round of gun ammunition will be discussed in this bulletin individually, including their structure, operation and function, with emphasis on marking and identification. Following this, the various operations necessary to completely assemble a round of gun ammunition will be discussed and the various ammunition details will be introduced which are necessary for the protection, handling and packaging of gun ammunition. A separate section will be included in this bulletin dealing with containers for gun ammunition with emphasis again on their marking and identification.

A complete round of gun ammunition comprises all of the components necessary to fire the gun once. The components generally include the propellant and high explosive projectile filler which are discussed in another bulletin; also primer, cartridge case or powder bag, fuzes, tracer, and projectile which are discussed in this bulletin individually in the order named.



TYPES OF GUN AMMUNITION

CONFIDENTIAL

PRIMERS

DEFINITION:

A primer is a device for initiating the burning of a propellant charge. (Primers are also used as an integral part of a fuze to initiate detonation.) With the exception of primers for bag guns, primers are made of brass and assembled in cartridge cases and surrounded by the propellant. Primers are designed for either a push fit or a screw fit in the cartridge case.

CLASSES:

1. Percussion type. Contains a sensitive explosive fired by impact or friction. Examples: percussion caps in small arms ammunition and case percussion primers and case percussion ignition primers used in medium caliber cases.

2. Combination type. Contains a sensitive explosive fired by either percussive or electrical means. Examples: Case combination ignition primer used in medium caliber cases and lock combination primers used with bag gun ammunition.

3. Electrical type. Contains a sensitive explosive fired by electrical means only. Example: MK 25 used in ammunition for Projector Mk 10.

REPRESENTATIVE TYPES:

A. Percussion Caps:

1. Components and structure. Contains (a) a soft metal cap, (b) a priming or percussion mixture which typically contains fulminate of mercury (initiator), potassium chlorate (oxygen supplier), antimony sulphide (to prolong the flame), and ground glass (friction agent), (c) a disk of shellacked manila paper, and (d) a metallic anvil affording flame vents.
2. Operation. A blow from the firing pin on the cap compresses the percussion mixture between the cup and anvil. The combined effect of impact and friction fires the mixture, and the flame passes through flame vents of the anvil to ignite the propelling charge.
3. Sensitivity. Different percussion caps vary considerably as to sensitivity; certain types of ammunition requiring a more sensitive cap than others because of lighter blows delivered by firing pins. Sensitivity is controlled by varying the proportion of components in the percussion mixture, varying the weight and physical properties of the metal in the cap and anvil,

and loading the percussion mixture in the cup using different pressures.

4. Use. The primers of small arms and 20 mm ammunition are relatively simple percussion caps and all of the more complex percussion and combination primers contain simple percussion caps to initiate the firing.

B. Case Percussion Primers, (CPP) e.g. Mk 10 Mod 9, Mk 19, Mk 21 Mod 2, Mk 21 Mod 3, Mk 22:

1. Components and structure. Consists of a percussion cap to which a long perforated tube filled with black powder is attached. Some case percussion primers have a brass firing plug beneath the percussion cap as illustrated in drawing.
2. Operation. A blow from the firing pin fires the percussion cap and the initial flame from the cap ignites the fine grain black powder in the lower end of the perforated tube. Burning of the latter burns out the separating disk and ignites the black cannon powder in the upper end of the perforated tube, and the more intense flame from this passes through the several flash holes to ignite the propelling charge.
3. Use. Mk 10 Mod 9 (1, 3, 6 pounders, 3"/23 cal.); Mk 19 (1".10/75 cal.); Mk 21 Mods 2 and 3, Mk 22 (40 mm).

C. Case Percussion Ignition Primer, (CPIP) e.g. Mk 14:

1. Fundamentally similar to the Mk 10-9 except that it has a firing plug below the percussion cap and a central longitudinal ignition tube and thus it is called an ignition primer. This primer is fired percussively only.
2. Operation. In its operation the firing pin strikes the firing plug and the latter in turn strikes and fires the percussion cap. Flame from the percussion cap ignites the fine grain black powder in the ignition tube and flames from this burning powder pass through flash holes in the tube to ignite the black cannon powder charge of the primer which surrounds the ignition tube. This in turn ignites the propellant.
3. Use. 3"/50 caliber.

D. Case Combination Ignition Primer, (CCIP) e.g. Mk 13, Mk 20:

1. Components and structure. Similar to Mk 14 except that incorporated above the percussion cap there is a platinum resistance wire surrounded by a wisp of gun cotton which provides for electrical firing in addition to percussive firing. The entire assembly below the platinum wire must be insulated from the rest of the primer so that electric current will pass through the resistance wire.
2. Operation. Percussion operation is similar to that in the Mk 14. When fired electrically, the platinum resistance wire is heated by electric current passing from the firing pin in the gun through it which ignites the wisp of gun cotton surrounding it. Flame from the burning gun cotton passes through the flash channel into the ignition tube to ignite the fine grained black powder contained in the tube. Flames from this burning powder then pass through flash holes in the tube to ignite the granular black cannon powder which surrounds the ignition tube and this in turn ignites the propellant.
3. Use. 4"/50 to 6"/47 caliber case guns inclusive.

E. Lock Combination Primer, (LCP) e.g. Mk 15 Mod 1 and 2:

1. Components and structure. This primer is smaller than the Mk 13 but it is fundamentally similar to the latter in structure and operation. The main differences are: (a) there is no ignition tube, (b) the primer case is made of special high tensile strength bronze designed to prevent sticking in the primer seat in the firing lock in the breech plug when the primer is used to fire bag guns, and (c) the primer case has no flash holes, the mouth being closed with a paper disk and crimped brass prongs to facilitate the flame being thrown forward through the mushroom stem in the breech plug to ignite the black powder ignition charge attached to the rear of the bag propelling charge. Lock combination primers are packed and shipped separately in hermetically sealed metal boxes — 24 to a box.

2. Use. All bag guns of the United States Navy and torpedo impulse charges.

ADDITIONAL USES OF PRIMERS:

In addition to being used to initiate the burning of propelling charges in guns, primers are also used in aircraft engine starter cartridges, torpedo impulse charges, catapult impulse charges, and depth charge impulse charges. Examples:

	Mark No.	Type
Torpedo impulse charge	Mk 15-1	LCP
Catapult impulse charge	Mk 14-1	CPIP
Depth charge impulse charge	Mk 20	CCIP
Projector Mk 10 Ammunition	Mk 25	Electric

DEFECTIVE PRIMERS:

To function properly, primers must be free from such surface defects as folds, wrinkles, scratches, scales or dents. Other primer defects are cocked, broken, or inverted anvils; scratched, torn, or dirty cups; and missing anvils, discs, and pellets.

Misfires are often due to worn firing pins in the gun, too much grease on firing-pin springs causing cushioning of the blow, or insufficient lubrication which increases the friction of the firing pin, weak firing-pin spring, wet priming mixture, or defective cap due to manufacture.

Because of the detrimental effect moisture has on black powder, failures may occur in the form of misfires or hangfires as the result of the unpredictable performance of black powder in the primer. This failure may result from improper sealing of the flash holes. These holes are sealed with paper and shellac, but age or rough handling may crack the shellac and cause a weak spot where moisture may enter to affect the black powder within.

TESTING PRIMERS:

It is virtually impossible to determine the serviceability of a primer by visual inspection alone. Therefore, before primers of old or doubtful lots are issued for service or before primers (unassembled or assembled in cases) which may have been subjected to unfavorable conditions of storage are issued or turned into stock, they are tested. From 5 to 10 per cent of the entire number, selected at random, shall be tested as follows:

- (1) Percussion primers. These shall be seated in a hole of dimensions similar to the primer seat and

CONFIDENTIAL

struck with a 1-pound weight falling 12 inches. The end of the firing point shall be hemispherical in shape with 0.06" radius.

- (2) Combination primers. These shall be tested to determine the resistance of the bridge, which must be between 0.55 and 0.70 ohms. A portion of the number under electrical test shall also be tested for percussion as described above.

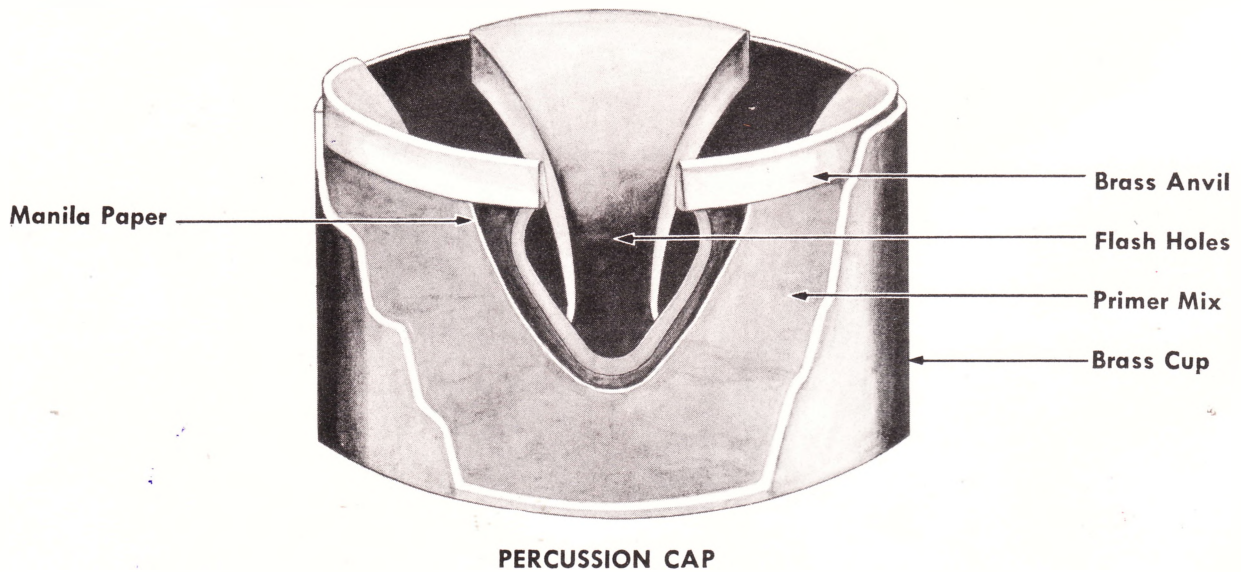
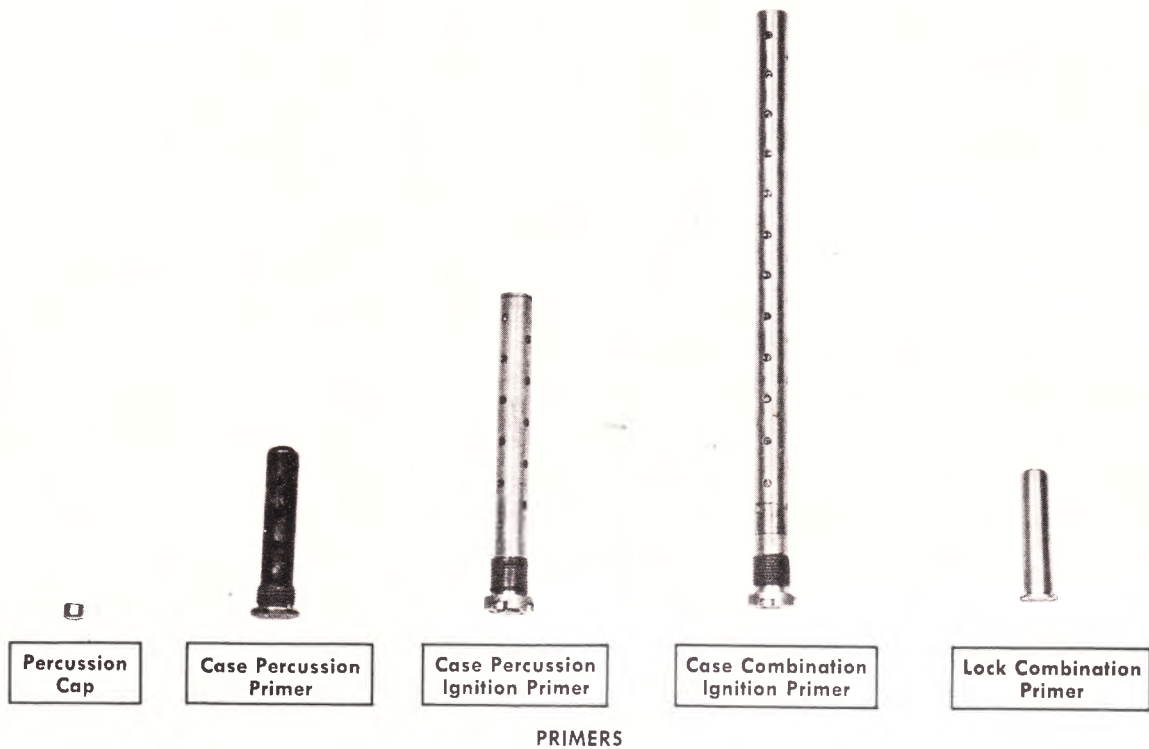
If more than 1 per cent of the number actually tested fail to give satisfactory results, the primers will not be reissued, but will be reported to the Bureau of Ordnance for instructions regarding the disposition of same.

After a case combination ignition primer is assembled in a cartridge case, it is tested with the Primer Testing Set Mk 1 to determine the resistance of the platinum wire bridge. This is accomplished by passing a very small current through the primer. Although the current is small, the test should never be run on ammunition assembled with the propellant. There is the remote possibility of the resistance bridge wire heating to the extent of igniting the gun cotton. Those which do not come within the established limits may be used for drill purposes or turned in to an ammunition depot.

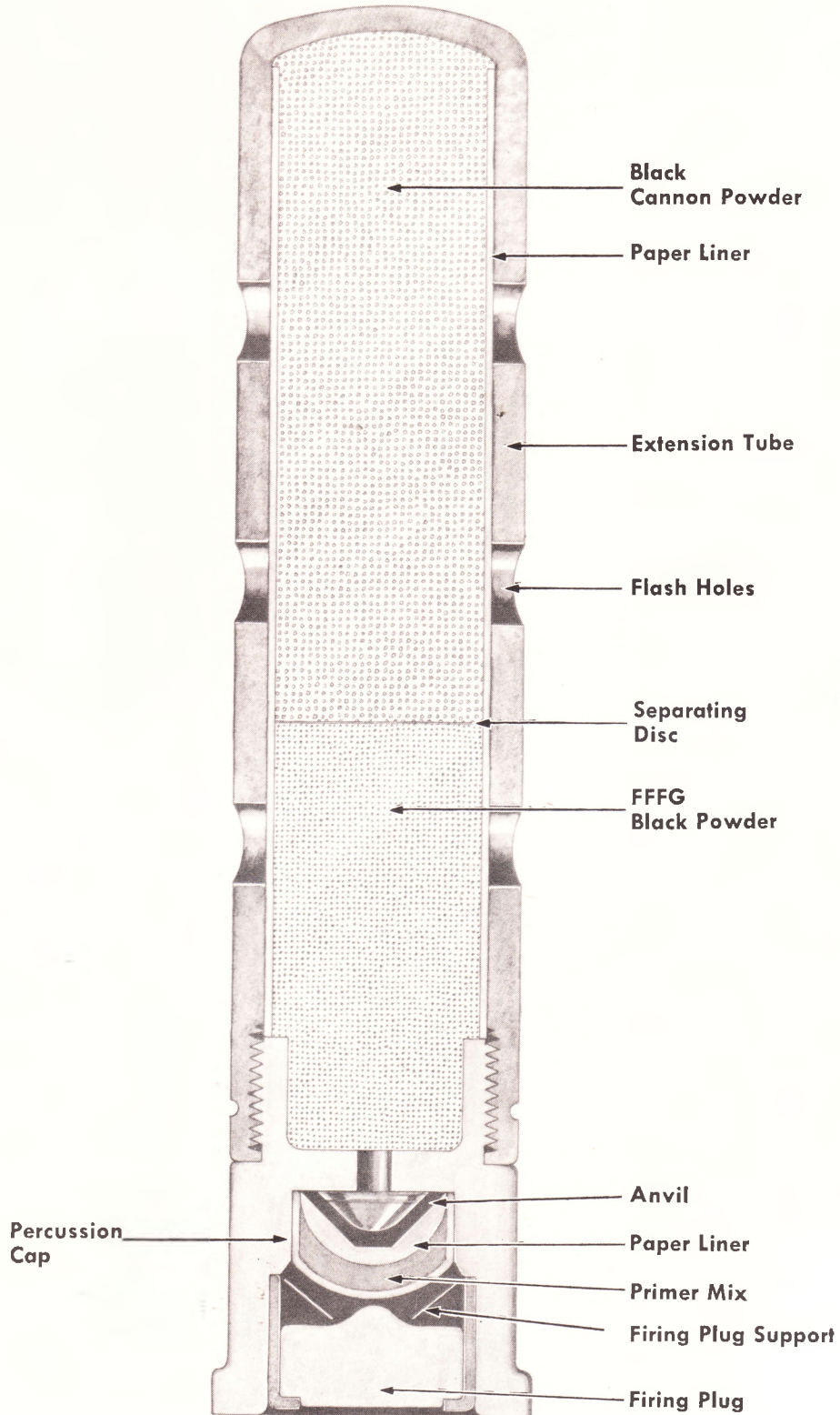
HANDLING AND STOWING PRIMERS:

- (1) Primers shall be stowed in primer magazines or may be stowed with small arms or ignition fuzes.
- (2) Care should be exercised in stowing primers to take all precautions against accidents and fires which may result in the loss of primers and other munitions.
- (3) Primers are considered a fire hazard only and the quantity stowed in any one place is unlimited except that consideration should be given to disposal of large quantities into several stows so as not to hazard the entire supply in the event of fire.
- (4) To insure proper functioning, primers should receive gentle handling and should never be exposed to unfavorable stowage conditions or drops or jolts which might break the resistance wire or the shellac seal. Primers in boxes of ammunition should be kept cool, dry, and in air-tight containers.

It must be remembered that all fixed ammunition and semi-fixed ammunition cartridges have primers assembled in them and thus all precautions applying to primers alone also apply to these assemblies.



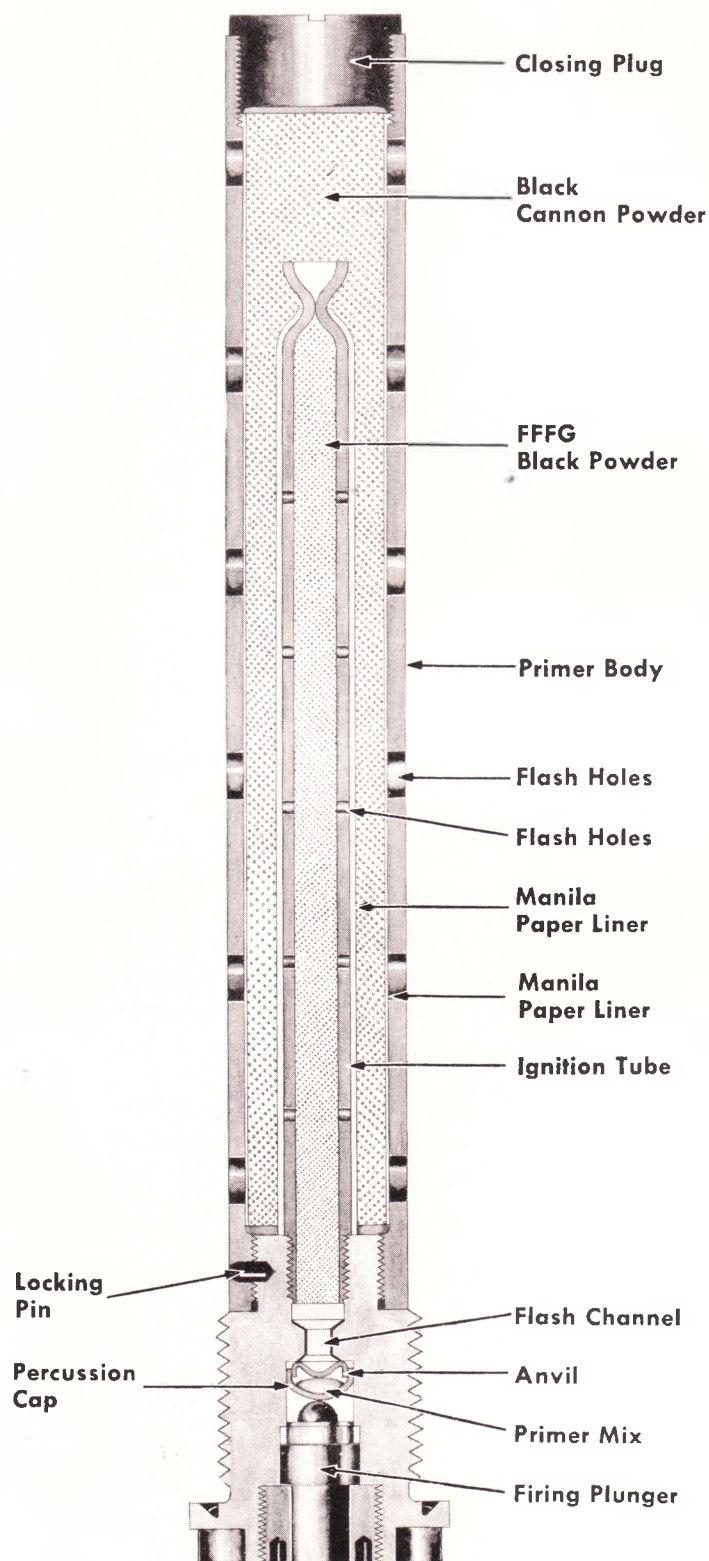
CONFIDENTIAL



CASE PERCUSSION PRIMER

CONFIDENTIAL

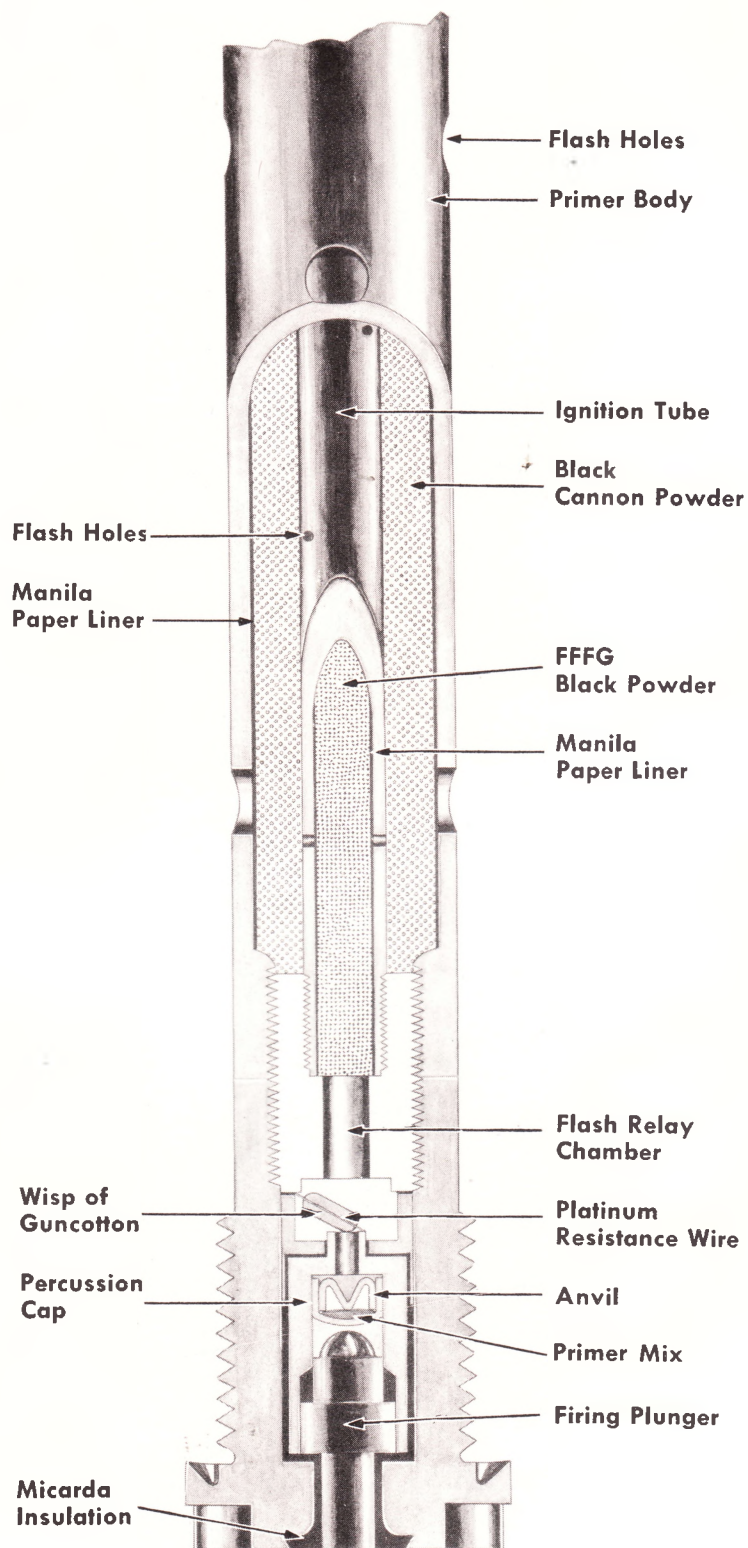
CONFIDENTIAL



CASE PERCUSSION IGNITION PRIMER

CONFIDENTIAL

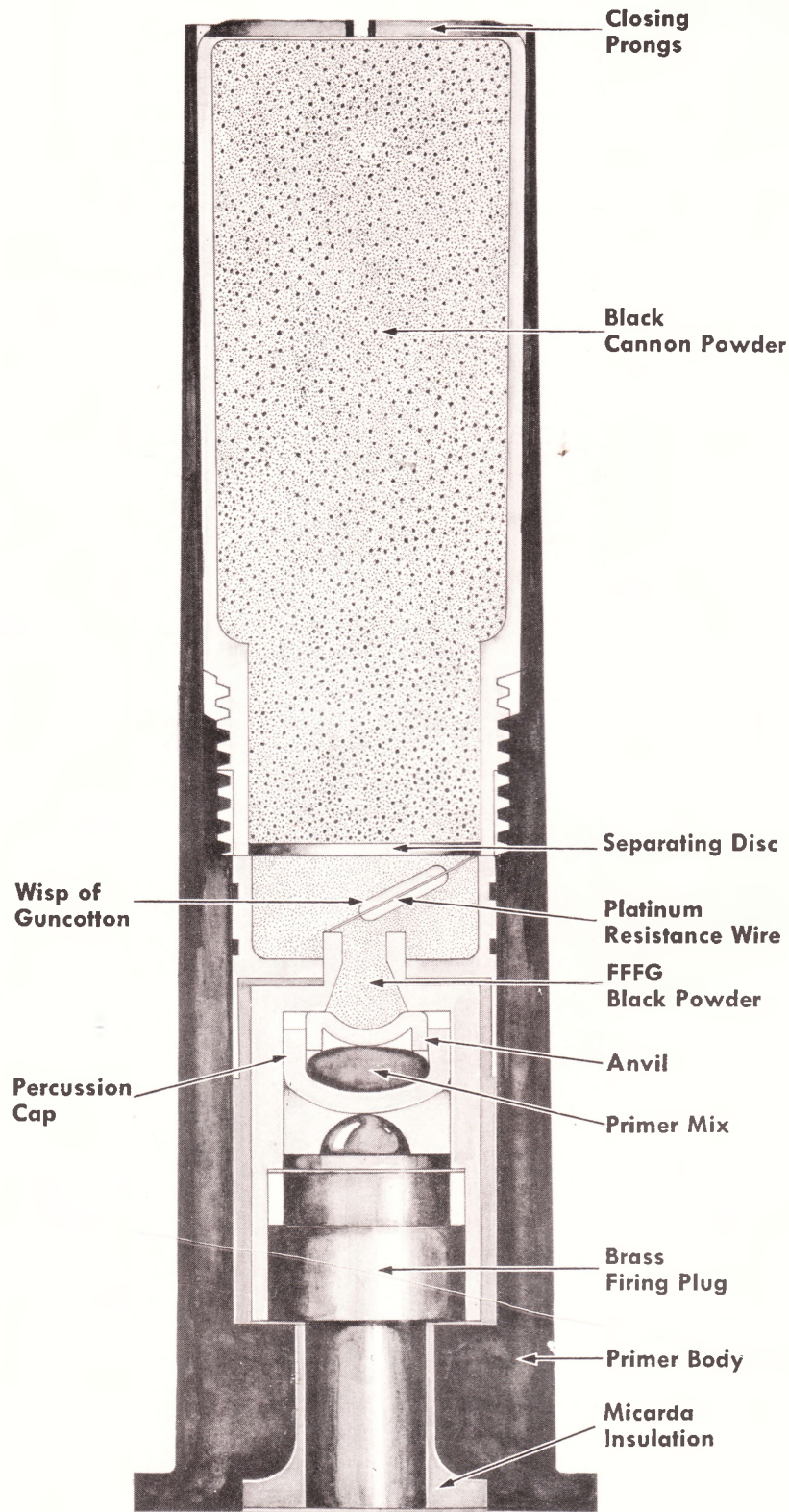
CONFIDENTIAL



CASE COMBINATION IGNITION PRIMER

CONFIDENTIAL

CONFIDENTIAL



LOCK COMBINATION PRIMER

CONFIDENTIAL

CARTRIDGE CASES

Cartridge cases are flat headed, hollow, brass, steel or plastic cylinders shaped to fit the chamber of a gun and contain the primer and the propelling charge. If the projectile is secured to the case, the ammunition is classified as fixed since it consists of one unit and is loaded into the gun as such. Cases under this designation are as follows: 20 mm, 1".10/75, 40 mm, 1 pdr., 3 pdr., 6 pdr., 3"/23, 3"/50, 4"/50, and 5"/25.

If on the other hand the cartridge is a complete unit by itself, not attached to the projectile but sealed with a cork plug, it is classified as semi-fixed and the cartridge and projectile are loaded into the gun separately in two operations. Cases falling in this designation are the 5"/38, 5"/51, 5"/54, and 6"/47.

Note: A plastic plug, which breaks up into small pieces upon firing, has been designed to replace cork plugs to seal semi-fixed cartridges. Future semi-fixed cartridges may be assembled with these plastic plugs.

ADDITIONAL USES OF CARTRIDGE CASES:

In the case of impulse ammunition, cartridge cases are used to contain the necessary impulse charge to propel depth charges from SDCP, torpedoes from their tubes and planes from catapults.

Cartridge cases are also used to hold a lock combination primer for testing firing circuits both local and director on vessels mounting 4"/50, 5"/25, 5"/38 and 6"/47 guns. Short cases of these calibers are provided for this purpose and are called "test cases." The diameters of test cases are the same as the corresponding diameters of service cases for the same guns.

"Short" cartridges are also provided to dislodge a projectile jam in a gun in the following sizes: 1".10/75, 3"/23, 3"/50, 4"/50, 5"/25, 5"/38, and 6"/47.

MANUFACTURE OF CASES:

Brass cartridge cases are manufactured by a process known as drawing. Special cartridge case metal is used consisting of 70 per cent copper and 30 per cent zinc. A disc of this metal is placed in a die and a hydraulic ram is brought down upon it which transforms the disc into a cup. By repeating this kind of operation several times the cup is drawn out into a case of the desired length and thickness. The 4"/50 cartridge case, for example, requires two

cupping operations and six drawing operations. Of course the diameter and thickness of the brass disc used in this process is dependent upon the desired finished dimensions of the case. In between each drawing operation, the case must be annealed to soften the metal for further drawing without tearing or splitting the case.

After the final drawing operation, the flat head of the cartridge case is formed by pressing in a hydraulic press and the necessary machining operations are carried out to form the extracting lip, drill the primer hole, and trim the case to the proper length.

A final heat treatment of the finished case is also necessary as a means to imparting an elastic property especially to the forward part of the case which must be capable of expanding in the chamber of the gun to provide an effective gas seal and then returning to approximately its original size so as not to jam in the gun. Cases are tapered and sometimes bottle-necked prior to the final above-mentioned heat treatment.

Steel cartridge cases are produced by methods similar to those for the production of brass cases but with considerable difference in the heat treatment applied. At the present time, some 20 mm, 40 mm, .45 cal., and 3"/50 cartridge cases are made of steel. Steel cartridge cases are comparatively new and were developed to ease the brass shortage. All of the manufacturing and functioning difficulties encountered have not been overcome as yet and thus the manufacture of steel cases is rather limited.

At the present time there is under development cartridge cases for 6"/47 cal. and 8"/55 cal. guns which will be of the semi-fixed type manufactured of plastic with metal bases. These cases are designed to be used only once and then scrapped.

REPEATED USE OF CASES:

Brass cartridge cases are so designed that they may be used over and over again by reforming. In some cases they can be used twenty to thirty times, and a minimum of six times in all cases except 20 mm, 1".10/75 cal., 37 mm, 40 mm and small arm cases which are not to be reformed and are to be handled as scrap. However, there are some cases which have been manufactured from scrap brass which are to be used only once and are marked "Not To Be Reformed" on the bottom of the case. This is

necessary since the scrap brass used in their manufacture does not contain sufficient virgin copper to permit reforming for use again. Steel cases of any caliber are not to be reformed and are handled as scrap.

Note: At the present time most brass cartridge cases which have been fired or derived from breakdown are not reformed nor used again.

DEFECTS IN CASES:

The common defects found in cartridge cases making them unfit for service are as follows:

1. Season cracking — a crack, usually near the lip, caused by improper heat treatment of the case during manufacture. Season cracking becomes evident after long periods of storage especially in the presence of organic nitrogen.
2. Dents — caused by rough handling.
3. Pitting — caused by defects in the metal itself.

CARE OF CASES:

Since most brass cartridge cases may be reloaded and used again, they must be given considerable care so that when they are returned to an ammunition depot they may be prepared for reissue. They must be kept free from salt and moisture at all times whether empty or loaded. When empty they should be stowed on their base or in the tanks or boxes in which they are received rather than being laid on their sides or stacked horizontally without tanks. After firing, cases must be cleared of possible inflam-

mable gases by standing on their bases in the open air for a period of ten minutes before being stowed below. Cases must be dry when replaced in cartridge tanks or boxes.

MARKING OF CARTRIDGE CASES:

Cases are marked with information as follows:

Base (Stamped information):

- (1) Caliber
- (2) Mark Number
- (3) Manufacturer
- (4) Date of Manufacture
- (5) Inspector's Stamp
- (6) If the cartridge case has been reformed the letter "R" is stamped on the base. An * is added for each successive reforming.

Base (Stencilled information):

- (1) Index of smokeless powder. The letters FP stencilled in red follow this if flashless pellets have been added to the powder. (This information is stencilled on the side of the case for 40 mm.)
- (2) Date and manufacturer of primer. (Not always included.)

Side (Stencilled information):

- (1) Red stencilling to indicate the weight of flashless pellets added to the smokeless powder if any. If flashless powder is used, the words "Flashless Powder" are stencilled in bright red letters.
- (2) Ammunition Lot Number.

POWDER BAGS

In ammunition for larger caliber guns, use is made of powder bags as containers for the propelling charge. This type of ammunition is called bag gun ammunition. The three components — primer, propelling charge and projectile — are each separate from the others and are each loaded into the gun in separate operations. The guns in which bag ammunition is employed, are as follows: 5"/50, 5"/51, 6"/47, 6"/50, 6"/53, 7"/45, 8"/55, 12"/50, 14"/45, 14"/50, 16"/45, and 16"/50.

MANUFACTURE OF POWDER BAGS:

The material of which the powder bags are made is a special raw silk cloth which is produced in two weights, light and heavy. The body of the bag is made from the heavy cloth sewed with silk thread and laced up with silk cord after filling. This heavy cloth is manufactured to meet the following specifications:

1. Strong enough to securely contain the weight of the smokeless powder charge and withstand handling and transportation.
2. Woven closely enough to contain dusty powder.
3. Permeable to flash.
4. Able to withstand acid chemical reactions which may occur in the powder.
5. Capable of being entirely consumed in the burning process.
6. Free from acids which may react with the powder.

Light weight carmine-red dyed silk cloth is used to contain ignition charges of black powder. One ignition charge is sewed to one end of every bag. The light weight of this cloth permits its being burned through quite readily by flame from the primer. Ignition pads with their black powder content are machine quilted in order to keep the black powder evenly distributed and it is worthy of note that the quilting operation is regarded as hazardous and is one in which bronze (non-sparking) needles are employed.

The end of powder bags opposite from the ignition end is fitted with a heavy silk strap for handling the bag. This handling strap is strongly made to withstand the required handling in withdrawing the bag from its tank and loading the bag into the gun.

LOADING POWDER BAGS:

Bag charges up to 8" (with the exception of the 6"/47) are loaded with smokeless powder by merely dumping the required amount of powder into the bag, which is made to the proper shape and size, and then securing the bag by lacing. These are called unstacked or dump charges. However, service bag charges for 6"/47 and 8" to 16" guns inclusive, are loaded by stacking the individual grains in layers in the bag. The process of loading by stacking is carried out almost automatically by a stacking machine. The advantages of stacked charges are:

1. Faster, more even burning.
2. No sharp edges to cut the bag.
3. Greater volume of powder can be put in bag.
4. Greater ballistic stability is possible.

Bag charges have their disadvantages in that:

1. The bags sometimes loosen up after handling and have to be tightened.
2. Chance for error in loading bag guns is possible when more than one bag is required to make up a service charge.
3. Bag guns require gas ejection systems to clear the gun of any remaining particles which might set off the next charge prematurely.

Bag charges are kept in air tight metal containers to help prevent decomposition of the smokeless powder and these are stowed according to the rules governing the stowage of smokeless powder. Particular care is exercised to keep moisture and friction away from the ignition end which contains black powder.

NOMENCLATURE OF BAG CHARGES:

At the present time, the following types of bag charges are being assembled and are identified as:

- (a) Service (Ser) — For use with AP or HC projectiles at full velocity.
- (b) Target (Tar) — For use with target projectiles.
- (c) High Capacity (HC) — For use with HC projectiles.
- (d) Special (Spec) — Any other than those listed above.
- (e) Charges suitable for use with either HC or target projectiles as 8"/55 caliber 2300 f.s. charges have been referred to as "HC Special Charges."

CONFIDENTIAL

In order to provide the fleet with a single charge for use with either HC or target projectiles, a new "reduced charge" is to be assembled. As the term "service charge" has also resulted in confusion, the new nomenclature will be as follows:

- (a) Full Charge — For use with AP or HC projectiles at full velocity (same as present "service charge").
- (b) Reduced Charge — For use with AP, Target or HC projectiles at reduced velocity.
- (c) Special Charge — Any charge other than those listed above.

Note: Until the change over to the new "reduced charges" can be accomplished, the present HC charges and target charges will be prepared.

The new reduced charges will use different granulations of smokeless powder than are now being used for HC and target charges, and will result in different velocities than are now being obtained with HC charges.

The present type of charge will continue to be assembled until the new granulations of powder are available.

MARKING OF BAG CHARGES:

All bag gun charges are marked by stencilling on each bag in black letters parallel to and on the opposite side from the lacing, with the following data:

1. Caliber of gun (SC — Short Chamber, LC — Long Chamber, if required).
2. Index of powder.
3. Weight of smokeless powder contained in bag.
4. Proportion bag bears to full or reduced charge.
5. Initial velocity.
6. Ammunition Lot Number.

The ignition ends of bags are always stencilled to indicate the weight of black powder contained therein.

PROJECTILE FUZES AND NOSE PLUGS

DEFINITION:

A fuze is a device for initiating, directly or indirectly the action of an explosive filler. With regard to the explosives which they contain and their mechanical structure, fuzes are among the most sensitive and delicate of ammunition components and must be handled accordingly.

EXPLOSIVE COMPONENTS OF FUZES:

In general the explosive components of fuzes are of the more sensitive type: initiators such as mercury fulminate, lead azide and lead styphnate; sensitive high explosives such as tetryl; and black powder.

PROJECTILE FUZE TYPES:

While projectile fuzes may be classified in various ways, in this bulletin they are divided into classes according to:

1. Location in the projectile:

- (a) Nose fuze. (Point)
- (b) Base fuze.

2. Type of action:

(a) Ignition fuzes: Produced for base assembly. They contain an initiating explosive (fulminate of mercury or non-fulminate mix) and a magazine of black powder. The action of the initiator ignites the black powder and this in turn ignites the explosive filler of the projectile (i.e., black powder or a mixture of black powder and TNT). Ignition fuzes may be shipped separately or they may be assembled in projectiles prior to their shipment.

Separate stowage of non-assembled ignition fuzes is the most desirable stowage but they may be stowed with primers, or small arms ammunition or both.

(b) Detonating fuzes: Produced for both nose and base assembly. They contain an initiating explosive (usually mercury fulminate or lead azide) and a booster (tetryl in the majority of cases) and in some base fuzes a delay element of black powder or other comparatively slow burning explosive. The action of the initiating explosive detonates the booster and this in turn detonates the projectile filler or detonates the filler with the aid of an auxiliary detonating fuze. Detonating fuzes may be shipped separately or assembled in the projectile prior to their shipment. They may be stowed separately or with detonators.

Certain kinds of detonating fuzes, namely some of the point detonating fuzes, as in 20 mm ammuni-

tion, require only a relatively moderate impact to cause them to detonate. They are, therefore, among the most sensitive of ammunition components and should be handled with particular care.

(c) Auxiliary detonating fuzes: Produced for assembly under nose fuzes in 3" through 16" projectiles and contain an initiating explosive (usually mercury fulminate) and a tetryl booster. The primary function of this class of fuze is to augment the action of a nose fuze, that is, they build up the detonating wave to sufficient strength to detonate the main filler. They are never shipped separately to the fleet and are found assembled in all AA, AA Common and HC projectiles 3" and larger. Auxiliary detonating fuzes are never used alone to detonate a projectile but in conjunction with nose fuzes. They must arm during the flight of the projectile and this feature provides a safety factor in that premature or accidental functioning of the nose fuze will not actuate the auxiliary detonating fuze.

(d) Time fuzes: Produced for nose assembly only. Their use is to initiate the detonation of the projectile after a predetermined amount of time in flight and in this regard they are of two kinds: mechanical and pyrotechnic or powder train. Pyrotechnic time fuzes have been eliminated for use by the United States Navy because the black powder of the delay train deteriorates and because of its erratic burning as the projectile passes through varying altitudes. General information regarding the shipment and stowage of time fuzes is the same as for ignition fuzes as discussed above, particularly in regard to protection from moisture since they all contain black powder.

NOMENCLATURE:

In order to arrive at the correct nomenclature for projectile fuzes, the two classifications, location and type of action, are combined as follows:

Base Ignition Fuze — BIF

Point Detonating Fuze — PDF

Base Detonating Fuze — BDF

Auxiliary Detonating Fuze — Aux. Det. — ADF

Mechanical Time Fuze — MTF

USE:

Base Ignition Fuzes — at the present time are used only in those projectiles which are filled with black powder or a mixture of black powder and TNT

i.e.: pounders and old type common projectiles 3"/23 cal., 3"/50 cal., 4"/50 cal., 5"/50 cal., 5"/51 cal.

Point Detonating Fuzes — are used in 3" through 16" high capacity projectiles and in 20 mm, 1".10 and 40 mm AA projectiles. These fuzes are of the superquick type which provide for instantaneous detonation of the explosive filler of the projectile upon impact in order to obtain maximum blast and fragmentation effect. The fuzes for use in 3" through 16" HC projectiles contain very little explosive since their action is augmented by auxiliary detonating fuzes. However, they are very sensitive to impact and must be handled with extreme care to prevent partial premature action which will render the fuze useless.

Base Detonating Fuzes — are used in all common and armor piercing projectiles which are loaded with Ex "D." A delay ranging from .01 second to .035 second will be incorporated in these fuzes to allow for proper penetration of the projectile after impact before detonation. Base detonating fuzes without delay action are also used in high capacity and anti-aircraft common projectiles in order to provide non-delay detonation upon impact when the projectile does not use a point detonating fuze. However, a base detonating fuze of this type will have an inherent delay of about .003 second which is unavoidable in all base fuzes and which will allow for some penetration before detonation of the projectile. Old type bombardment projectiles also use base detonating fuzes with appropriate delay action when penetration of shore installations is desired before detonation.

Auxiliary Detonating Fuzes — are never used alone but in conjunction with nose fuzes of the point detonating or mechanical time type. Auxiliary detonating fuzes are assembled in all high capacity, anti-aircraft, and anti-aircraft common projectiles in the 3" through 16" range.

Mechanical Time Fuzes — are always assembled in the nose of anti-aircraft, and anti-aircraft common projectiles from 3" through 16". They may also be used in high capacity projectiles although they are not assembled in those projectiles as the projectile is shipped out. Mechanical time fuzes function to detonate the projectile after a predetermined time in flight depending on their time setting. Mechanical time fuzes are also used in illuminating, WP and W projectiles to initiate the action of the expelling

charge in the projectile. Mechanical time fuzes were formerly coated with a waterproofing compound called RD 1154. A thick application of this substance was applied to the entire external surface. Recently this practice has been discontinued because it was found that RD 1154 provided sufficient lubrication between the two external moving parts of the fuze to cause slippage of these parts in flight which brought about a change in fuze setting during flight of the projectile.

At the present time no external means of waterproofing is used and instead, mechanical time fuzes are now being made waterproof as far as possible by construction.

These fuzes are of the most sensitive and delicate of ammunition components since they are constructed with a very light clock-work mechanism. Extreme care must be used in their handling to prevent damage, premature action, or malfunction.

Pyrotechnic Time Fuzes — although now obsolete were used in anti-aircraft projectiles.

Nose Plugs. High capacity projectiles (with the exception of the 3"/50 cal.), as they are shipped, have nose plugs assembled to them in place of a nose fuze. Mechanical time fuzes and point detonating fuzes are shipped separately with the projectile for assembly aboard ship. Cork gaskets are assembled under nose plugs and must be removed before assembling a nose fuze. Nose plugs are made to the same outer dimensions and shape as a nose fuze but of solid, inert construction of specially treated armor piercing steel, and thus are called armor piercing nose plugs. However they are not used against armor plate.

Since a high capacity projectile carries a base detonating fuze, the projectile may be fired with the nose plug in place depending on the type of target.

ASSEMBLY OF FUZES. Point detonating fuzes, mechanical time fuzes and AP nose plugs for 3" through 16" projectiles do not screw directly into the nose of the projectile, but into the top of an adapter ring. The auxiliary detonating fuze screws into the bottom of the adapter ring and the adapter ring itself screws into the nose of the projectile. Base detonating or base ignition fuzes screw into the base of the projectile directly or into a base plug or adapter which is already assembled in the base of the projectile.

Point detonating fuzes for 20 mm, 1".10/75 and 40 mm projectiles screw directly into the nose of the projectile.

SIZES OF NOSE FUZES, PLUGS, AND ADAPTER RINGS. Projectiles 3" through 16" were so designed at the nose that only two sizes of point detonating fuzes, AP nose plugs and mechanical time fuzes are required to conform with the ogive of the projectile and cover this range. One size of the above items will fit 3" and 4" projectiles while the larger size will fit 5" through 16" projectiles. However, there are two exceptions to this general rule: (1) 4"/50 illuminating projectiles are so designed that a mechanical time fuze of the 5" through 16" size must be used. (2) The two projectiles for the new dual purpose guns 5"/54 cal. and 6"/47 cal. are so designed that a mechanical time fuze of the same outer dimensions as the 3" and 4" size fuze must be used. Two sizes of adapter rings are necessary; one size with outer dimensions to fit 3" and 4" projectiles and a larger size to fit 5" through 16" projectiles. Auxiliary detonating fuzes are all of the same thread size and will fit in either size adapter ring.

MARKING AND IDENTIFICATION. Point detonating fuzes for 3" through 16" projectiles are never painted and are readily recognizable by their characteristic plastic body construction either black or light tan in color.

Mechanical time fuzes are never painted and are characterized by brass and other metal construction upon which is engraved, near the base of the fuze, time settings up to 30 seconds for the 3" and 4" size and up to 45 seconds for the 5" through 16" size. These fuzes will also have lugs or grooves on the fuze which fit in a fuze setter to accomplish the time setting of the fuze.

AP nose plugs are painted green at the present time which is their chief external identifying feature.

Base detonating fuzes are of plated metal construction and are characterized by long cylindrical bodies of fairly small diameter. Since this fuze has a long body, it extends for a considerable distance into the explosive filler of the projectile and is of itself sufficient for detonation of the filler. These fuzes come in lengths varying from 4.86" to 7.80" depending on the size of the burster cavity.

Auxiliary detonating fuzes are constructed of plated metal and are cylindrical in shape and about

2" long. Since they are assembled into the bottom of the adapter ring, they extend for a considerable distance down into the explosive filler in the projectile.

ARMING. Most projectile fuzes are in the safe or unarmed condition prior to firing the projectile from a gun. The principal forces used in arming or preparing fuzes for action are (1) setback, the force of inertia or resistance to linear acceleration, and (2) centrifugal force, the tendency of an object rotating about an axis to move further from the axis. Many Navy fuzes use a combination of both these forces in arming the fuze. The force of setback is one which exists only during the time that the projectile is in the bore of the gun, while centrifugal force exists from the instant that the projectile begins its rotational movement until detonation occurs. Setback is, in general, used to shear safety pins, fire percussion elements, and to initiate operation of mechanical clocks. Centrifugal force serves to release detents (or locking pins), fire the operating mechanism of mechanical clocks, revolve rotor blocks, clear interruptor blocks and align half-block units.

HANDLING OF FUZES AND FUZED PROJECTILES. Although fuzes are not armed until projectiles are in flight, fuzed projectiles must nevertheless be handled with extreme care at all times. Dropping a fuzed projectile should not cause the fuze to completely function but additional drops or the shock of firing may cause a fuze action or damage a fuze sufficiently to cause malfunction. For this reason, the Bureau of Ordnance has declared that a projectile which has been dropped from a height exceeding five feet shall be set aside and turned in to an ammunition depot. Such a projectile shall be clearly marked to show its condition and shall be handled with the greatest care. Upon receipt at a naval ammunition depot it shall be defuzed and the fuze scrapped. (This rule also applies to dropping a fixed or semi-fixed cartridge.)

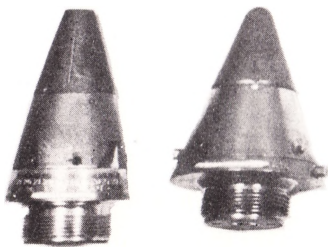
There is no effort made in this bulletin to give mark numbers of fuzes now used in the various projectiles because projectile fuzes are constantly being improved and changed with a corresponding change in mark or mod number.



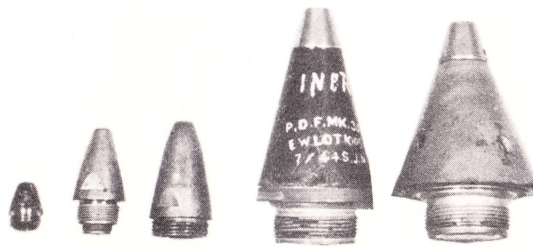
Base Detonating Fuzes



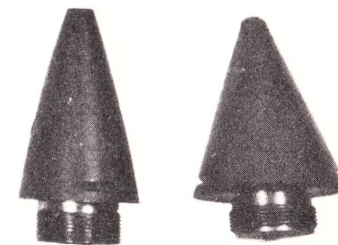
Auxiliary Detonating Fuzes



Mechanical Time Fuzes



Point Detonating Fuzes



Armor Piercing Nose Plugs

FUZES AND NOSE PLUGS

PROJECTILE TRACERS

DEFINITION:

Tracers are devices which are designed to leave a trace of flame showing the path of the projectile during its time of flight. They are assembled in the base of the great majority of naval projectiles in order to aid in fire control of the gun.

STRUCTURE:

Essentially, tracers are columns of pyrotechnic mixture consisting of an after end starter mixture which is capable of easy ignition and an illuminant designed to burn during the flight of the projectile. This unit is sealed to exclude moisture by means of a celluloid or light metal disc.

CLASSIFICATION:

Tracers may be integral with respect to the projectile or base fuze in which case they are press-loaded directly into a cavity provided. They also may be separate units which are first loaded into a tracer body and then screwed or pressed into the base of the projectile or base fuze. Tracers are either internal or external with respect to the projectile.

OPERATION:

Actuation of tracers is accomplished by one of two methods: (a) directly by the hot propellant gases igniting the starter mix which in turn ignites

the illuminant or tracer mix, and (b) indirectly by the propellant gas pressure or setback actuating a striker and detonator to fire the starter mix.

TRACER COLORS:

The tracer colors now standard in the Naval service are red, white and orange. Red or white tracers are used in projectiles up to 6"/47 cal. Orange tracers are used exclusively in 6"/47 cal. through 16"/50 cal. projectiles. The tracer body is painted to indicate the tracer color.

SELF-DESTRUCTIVE TRACERS:

Some tracers are designed to detonate the explosive charge in self-destroying projectiles of the 40 mm and 1".10/75 cal. size. This is accomplished by the illuminant material burning through and igniting a relay of black powder which in turn detonates the main charge.

TRACER ADAPTERS:

It is sometimes desirable to use a tracer in a projectile which does not carry a base fuze. In some projectiles the hole in the base or base adapter plug is of the right size to accommodate a separate tracer directly. However, if the base hole should be too large, use is made of a device known as a tracer adapter which merely reduces the size of the base hole so that a tracer can be screwed into it.



External Tracer



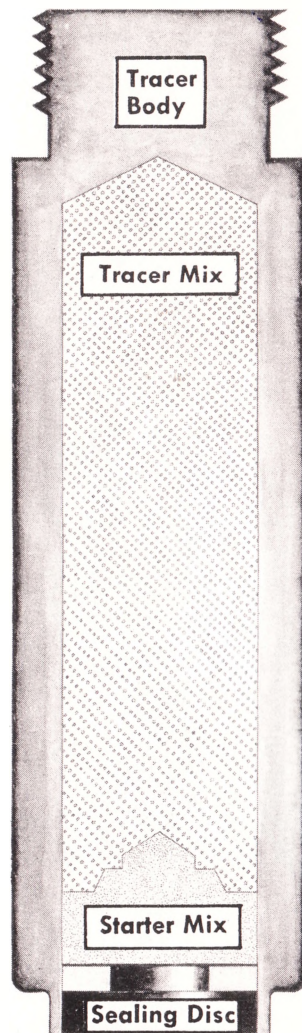
Internal Tracer



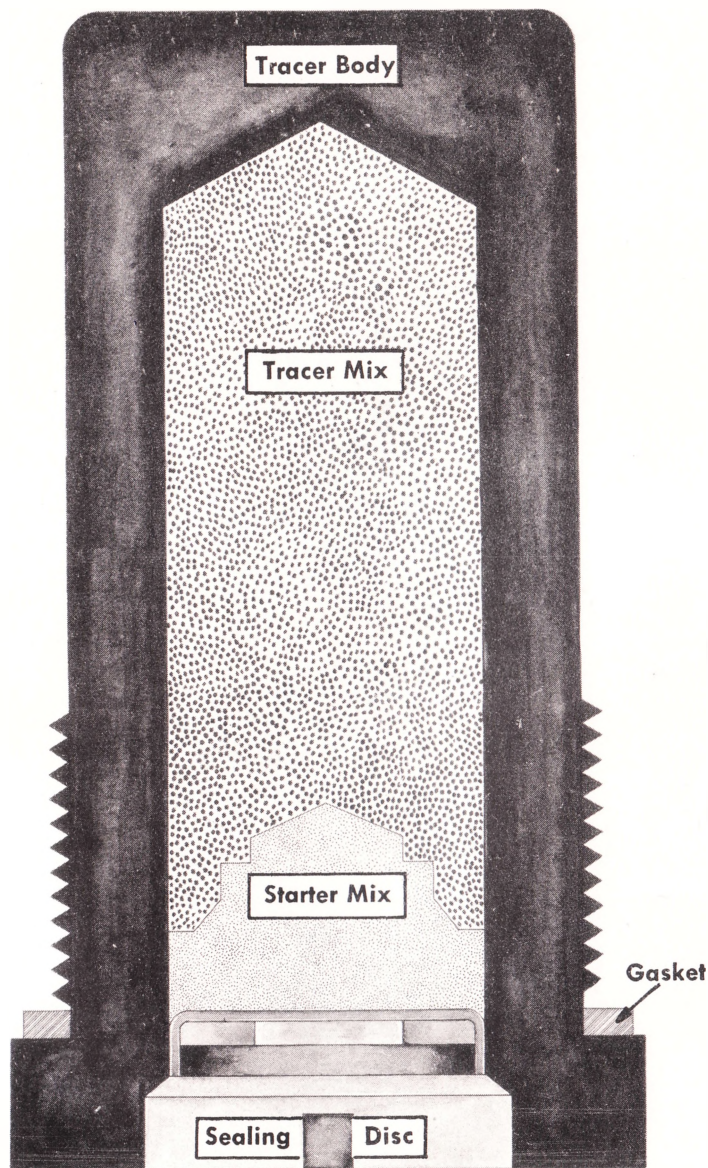
Self-Destructive Tracer

TRACERS

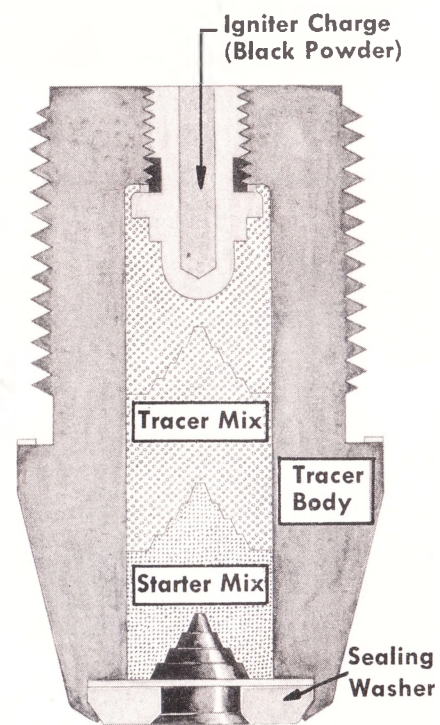
CONFIDENTIAL



EXTERNAL TRACER



INTERNAL TRACER

DIRECT IGNITION TRACER
(Self-Destruction)

CONFIDENTIAL

PROJECTILES

INTRODUCTION:

The word "projectile" is the standard name employed by the Bureau of Ordnance. The word "shell" is not standard and should not appear in Naval correspondence and literature.

STRUCTURE:

While different types of projectiles may have structural characteristics which are peculiarly their own, certain features are common to all projectiles as follows:

1. *Nose* — the forwardmost part of the projectile. It may be composed of lightweight metal (as in the windshield of AP, Com, SpCom projectiles), a nose fuze (as in AA, AA Com projectiles), a nose plug (as in HC projectiles), or it may be a continuation of the body wall (as in the older so-called common or bombardment projectiles).

2. *Ogive* — the curved forward portion of a projectile. This curved portion is formed according to a complex formula and is designed to give maximum range and accuracy to the projectile. The shape of the ogive is generally expressed by stating its radius in terms of calibers. Frequently, the ogival shape is secured by the combination of several arcs of different radii. As a general rule long ogives are conducive to long range.

3. *Bourrelet* — a smooth machined surface which acts as a bearing surface for the projectile during its travel through the bore of the gun. It has the greatest diameter of any part of the projectile excepting the rotating band and its width is usually one-sixth caliber. It is between .015"-.023" smaller in diameter than the bore of the gun in order to obtain sufficient clearance as the projectile goes through the bore. Some projectiles have only one bourrelet (forward) and the rotating band on such projectiles serves as a second bearing surface. Other projectiles have two bourrelets, one forward and one aft, with the after bourrelet just forward or just aft of the rotating band. Bourrelets are not painted (except in the 20 mm, 40 mm and some 3"/50 projectiles) but are coated with grease (petrolatum) to prevent rusting.

4. *Body* — the main part of the projectile containing the greatest mass of metal. It is made slightly smaller in diameter than the bourrelet and it is given only a rough machine finish since this has no bearing on dispersion or accuracy of the projectile.

5. *Rotating Band* — a circular band, made of

commercially pure copper or copper alloys, seated in a score-cut in the after portion of the projectile body. For all minor and medium caliber projectiles, rotating bands are made of commercially pure copper, or gilding metal which is 90 per cent copper, 10 per cent zinc; major caliber projectiles make use of a cupro-nickel alloy containing 2.5 per cent nickel. Rotating bands are usually one third caliber in width and some are designed with a lip on the after end to provide a good gas seal and to prevent over-ramming in the gun. As the projectile passes through the bore of the gun a certain amount of copper will be wiped back on the rotating band and will form a skirt of copper on the after end of the band as the projectile leaves the muzzle. This condition is known as "fringing" and is prevented by providing grooves called cannelures in the rotating band, and by undercutting the lip on the after end of the band to provide a place for this excess copper which is wiped back. The three primary functions of the rotating band are: (a) to provide a gas seal, (b) to serve in rotating the projectile as it engages in the rifling and passes through the bore of the gun, (c) to act as a rear bourrelet in the case of projectiles with only one real bourrelet. There must be a reasonable distance between the rotating band and the bourrelet of the projectile to prevent wobble of the projectile in flight.

6. *Base* — the after end of the projectile. A removable base plug is provided in projectiles which require loading of explosive filler to be done through the base. A fuze hole is drilled and tapped in the center of this base plug. Some projectiles which have large openings in the nose to accommodate nose fuzes are loaded through the nose and for this reason require no base plugs but are provided with a fuze hole in the center of the solid base if necessary. The sharp edge formed by the sidewalls and the base of the projectile is usually broken slightly to give additional range to the projectile. The after end of some projectiles are coned down to the base and thus altering their cylindrical shape. This procedure is known as "boat-tailing."

7. *Explosive Cavity* — projectile cavity designed to receive a burster charge (filler) of high explosive.

For ease in presentation in this bulletin, projectiles are divided into two groups; (1) 20 mm, 40 mm, 1".10/75 cal. projectiles (2) 3"/23 cal. through 16"/50 cal. projectiles.

Individual types of projectiles will be discussed under each group.

PROJECTILES (20 MM, 1".10/75 cal., 40 MM)

Basically, all of the following types of projectiles are called Anti-Aircraft (AA): They are designated by additional names according to their structure and function.

20 MM ANTI-AIRCRAFT (AA) AMMUNITION

These projectiles are produced in seven types for use in 20 mm AA guns only.

A definite color system is provided in order to easily identify each type. The entire body of the projectile is painted with the exception of the rotating band and base. The data on the types of projectiles and their color markings are as follows:

which does not light up until the projectile is some distance from the gun muzzle. The characteristics of this dark ignition tracer are as follows:

- (a) The dark ignition period to tracer light-up is approximately 100 yards.
- (b) The dark ignition period is characterized by a faint streaking action.
- (c) The over-all burning time of the tracer is approximately 4 seconds.

This type of 20 mm AA ammunition has been approved for service issue. It is designated as 20 mm HET-DI.

Designation	Number of Projectile Cavities	Filler	Tracer	Projectile Color
HE — High Explosive	1	Tetryl	None	White
HEI — High Explosive Incendiary	1	Tetryl-Incendiary	None	Red
HET — High Explosive Tracer	2	Tetryl-Tracer	Integral	Gray
Drill, Dummy	1	Clay	None	Seal Brown
AP-T — Armor Piercing Tracer	1 (Tracer)	Tracer	Integral	Black
BL and T — Blind Loaded and Traced	2	Clay-Tracer	Integral	Dark Green with 1/8" yellow band
BL and P — Blind Loaded and Plugged	1	Clay	None	Dark Green

Note: Dummy drill cartridges are characterized by three holes in the side of the cartridge case. They are used for drill in loading magazines only.

STRUCTURE:

In the following drawings it will be noted that there are three basic types of projectile construction: (1) projectile bodies with one cavity used in the manufacture of HE, HEI, BL and P, Dummy Drill (2) projectile bodies with two cavities used in the manufacture of HET, BL and T (3) AP-T Type projectiles with a hollow windshield attached to the body which has no burster cavity but a small after-cavity for an integral tracer.

All of the above projectiles, which are of the burster type, are fuzed with point detonating fuzes only.

Note: In order to eliminate the blinding flash characteristic of standard 20 mm AA HET ammunition when fired at night, the Bureau of Ordnance has developed and placed in production a tracer

In order to identify this ammunition a one-eighth inch bright red band is painted around the gray projectile body midway between the bourrelet and rotating band.

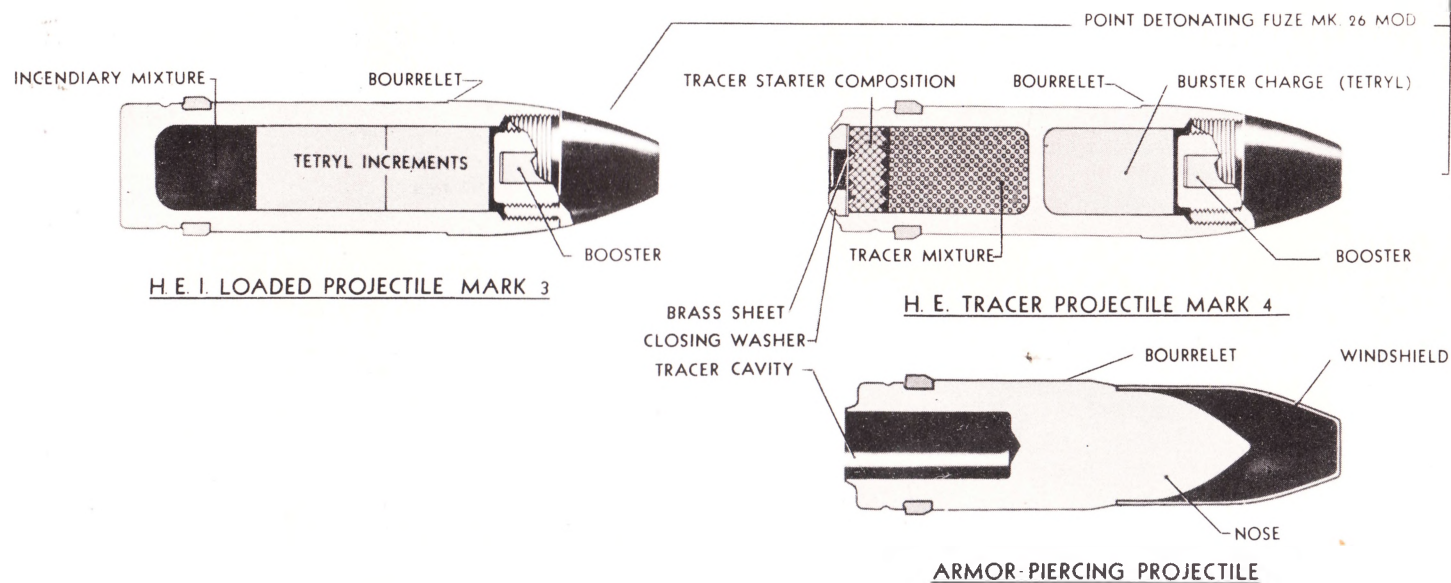
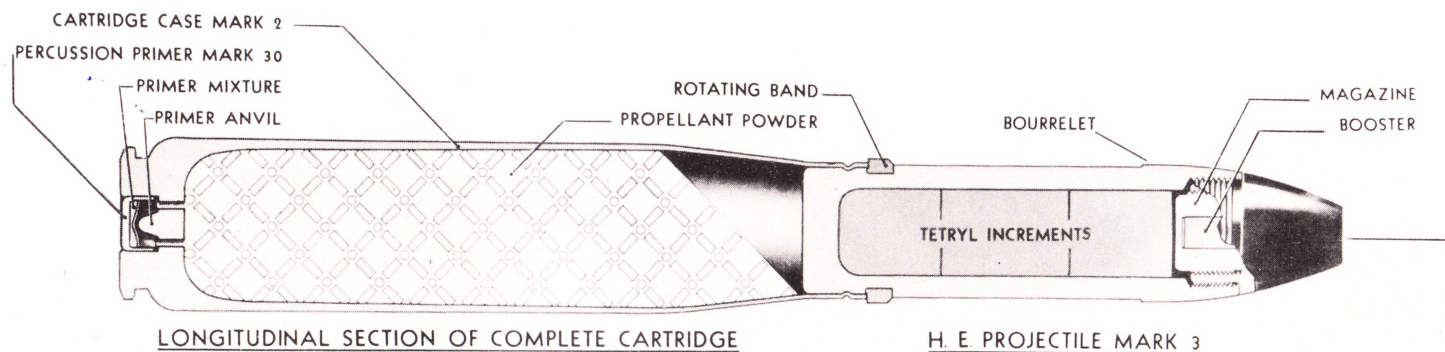
20 MM AIRCRAFT CANNON (AC) AMMUNITION

This is Army ammunition adopted by the Navy for use only in Aircraft Cannon. 20 mm AA and 20 mm AC ammunition are not interchangeable due to radical differences in design. (See Drawing.)

A new series of 20 mm AC ammunition is now being issued to replace the old series as follow:

New Series	Replaces	Old Series
HE-I		HE-I
AP-T		AP-T
I — (Incendiary)		—
PRAC — (Practice)		Ball

CONFIDENTIAL



CONFIDENTIAL

20 M.M. ANTI-AIRCRAFT CARTRIDGE AND DETAILS

STRUCTURE:

HE-I projectile is loaded with tetryl and incendiary mixture and fuze with a point detonating fuze.

AP-T projectile is not loaded with explosive and has a hollow windshield and integral tracer.

I projectile has no fuze but a light nose piece in its place which crushes on impact igniting the incendiary mixture which is loaded into the body and nose piece.

PRAC projectile is not loaded and has a nose piece in the nose.

COLOR MARKINGS OF NEW SERIES:

HE-I — (1) fuze is unpainted; (2) ogive is painted yellow; (3) body is painted red.

AP-T — entire projectile except rotating band painted black with white stencil markings.

I — (1) nose piece painted blue; (2) body of projectile painted gray with black stencil markings.

PRAC — body of projectile painted black with white stencil markings.

It is important to note that the older series of 20 mm AC ammunition was not satisfactory due to extreme variations between types in weight, shape and muzzle velocity. Rounds of the old series and the new series cannot be used interchangeably. Guns must be re-boresighted to accommodate the new series.

The new series is matched ballistically so that all projectiles have approximately the same weight, shape and muzzle velocities.

40 MM ANTI-AIRCRAFT (AA) AMMUNITION

1. Ammunition for this gun is produced in the following types:

Type	Performance	Service Status
AP	Same projectile as AP-T except tracer cavity is plugged.	This ammunition is not standard allowance. Available for distribution by appropriate commanders. Standard allowance.
AP-T	Solid projectile with windshield. Tracer is integral part of projectile.	
HE-P	Bursts on impact. No tracer and no self-destruction.	Being replaced by HE-I-P.
HE-T-SD	Bursts on impact or self destroys at approximately 4,000 yards. Red tracer.	Replaced by HE-I-T-SD as standard service ammunition.
HE-SD	Standard HE cartridge except assembled with non-luminous tracer which initiates self-destruction at approximately 4,300 yards.	Only 100,000 rounds issued for service test. New issue to be HE-I-SD.
HE-I-T-SD	Same as HE-T-SD except has added incendiary feature. Incendiary does not reduce blast or fragmentation and is particularly effective against gasoline and oil targets.	Has replaced HE-T-SD as standard service ammunition.
HE-I-P	Same as HE-P except has added incendiary feature.	Has replaced HE-P.
HE-I-SD	Same as HE-SD except for added incendiary feature.	Standard allowance as it becomes available.

1."10/75 CAL. ANTI-AIRCRAFT (AA) AMMUNITION

Ammunition for this gun is produced in the following types:

HE-T — High Explosive, (Mk I projectile)

HET-SD — High Explosive Self-Destroying (Mk II projectile)

BL and T — Blind Loaded and Traced

BL and P — Blind Loaded and Plugged

STRUCTURE:

With the exception of the BL and P all of the projectiles carry integral red tracers. The tracer is the self-destroying feature in the HET-SD projectile. The burster type projectiles are filled with Exp "D" to a loading factor of four per cent and are fuze with point detonating fuzes. The blind loaded projectiles use inert fillers and dummy nose fuzes and may or may not carry a tracer.

THE PROJECTILE COLOR MARKINGS ARE AS FOLLOWS:

HET — projectile unpainted except for $\frac{1}{4}$ " to $\frac{1}{2}$ " in diameter yellow dot aft of the fuze to indicate Exp "D" burster charge — $\frac{1}{4}$ " to $\frac{1}{2}$ " in diameter red dot forward of rotating band to indicate red tracer.

HET-SD — Color markings as above.

BL and T — Marked with red dot only. Yellow dot omitted since the projectile is not loaded with Exp "D."

BL and P — Projectile completely unpainted.

CONFIDENTIAL

Type	Performance	Service Status
HE-I-T	Same projectile loading as standard HE-I-T-SD except self-destruction feature has been omitted.	Special issue to amphibious forces for bombardment.
HE-I-T(DI)-SD	Same as standard HE-I-T-SD except standard tracer has been replaced by a dark ignition tracer which does not light up until projectile is approximately 300 yards from gun muzzle. Self-destruction at approximately 4,600 yards. Tracer is dim and not as visible as regular tracers.	500,000 rounds to be issued for service test.
BL-T	Projectile is inert loaded, dummy fused, and assembled with standard red tracer. Otherwise same as standard service cartridge.	Will gradually replace BL-P in service for shooting through muzzle covers. Used at AATC's for drone target practice.
BL-P	Same as BL-T except tracer is replaced by a tracer plug.	Issued 24 rods per barrel for use in breaking muzzle covers. Production on this type has been stopped in favor of BL-T.

The high explosive and high explosive incendiary type projectiles are loaded with pressed TNT or TNT and incendiary mixture to a loading factor of five per cent and use point detonating fuzes only. If the projectile is self-destroying, this action is brought about due to the tracer burning through into the burster cavity and thus detonating the explosive filler.

NOTE: A non-luminous or dark burning tracer will have the following characteristics:

- Slight streak due to starter action for approximately 150 yards.
- No visible tracer between end of starter action and self-destruction.

2. The projectile color markings are as follows:

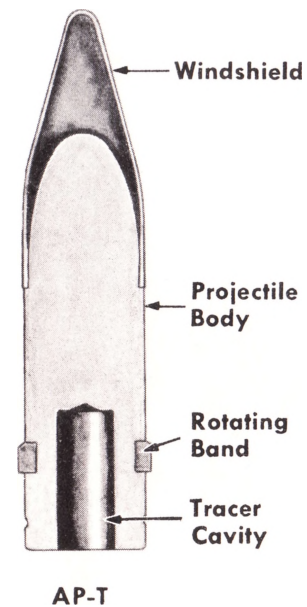
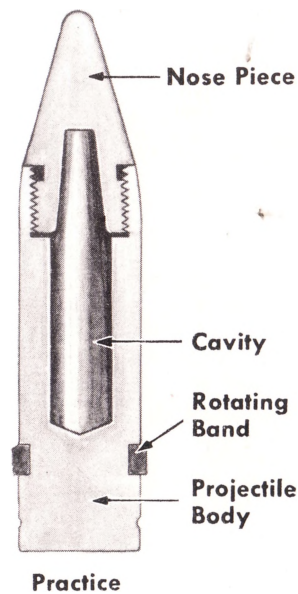
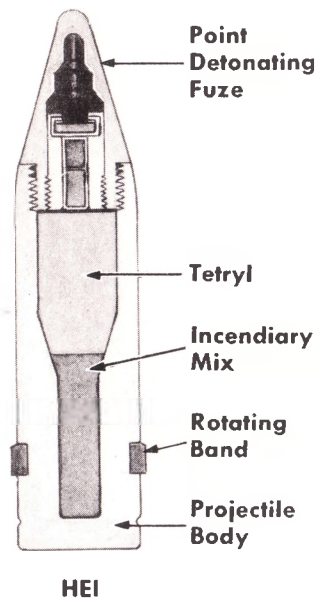
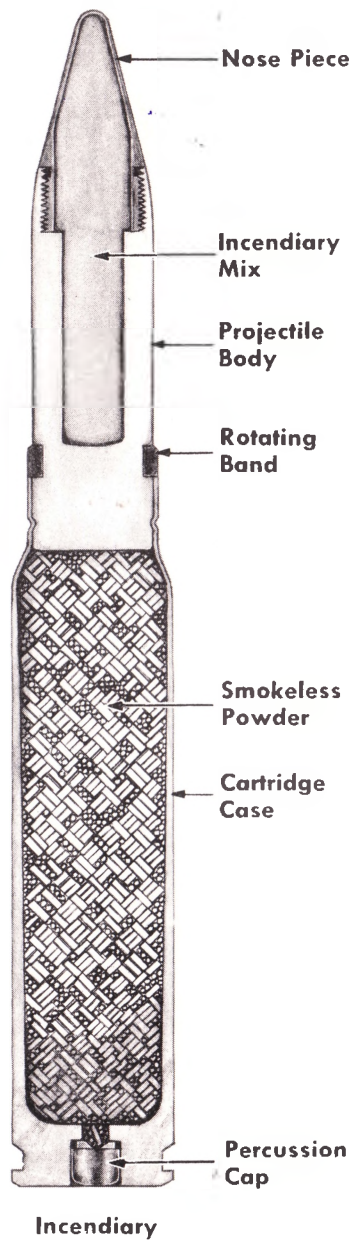
AP	Entire projectile forward of rotating band painted black.
AP-T	Entire projectile painted black with white band aft of the nose.
HE-P	Entire projectile forward of the rotating band painted green.
HE-T-SD	Forward $\frac{1}{2}$ of fuze painted green. After $\frac{1}{2}$ of fuze painted white. Body of projectile painted green.
HE-SD	Forward $\frac{1}{2}$ of fuze painted green. After $\frac{1}{2}$ of fuze painted black. Body of projectile painted green.
HE-I-T-SD	Forward $\frac{1}{2}$ of fuze painted red. After $\frac{1}{2}$ of fuze painted white. Body of projectile painted green.
HE-I-P	Fuze painted red. Body of projectile painted green.
HE-I-SD	Forward $\frac{1}{2}$ of fuze painted red. After $\frac{1}{2}$ of fuze painted black. Body painted green.
HE-I-T	Forward $\frac{1}{2}$ of fuze painted red. After $\frac{1}{2}$ of fuze painted white. Body of projectile painted green with black band.
HE-I-T(DI)-SD	Forward $\frac{1}{2}$ of fuze painted red. After $\frac{1}{2}$ of fuze painted yellow. Body of projectile painted green.
BL-T	Forward $\frac{1}{2}$ dummy fuze painted red. After $\frac{1}{2}$ dummy fuze painted white. Body of projectile painted red.
BL-P	Entire projectile painted red.

3. It is realized that the many different 40-mm types complicate logistics but their development was necessitated by varying requirements of forces afloat. The intent of the Bureau of Ordnance is to standardize on the following service types which should meet all requirements that can be foreseen at this time.

AP-T	(For destroying mines and small craft)
HE-I-T-SD	(For day use)
HE-I-SD	(For night use director control)
HE-I-T	(For bombardment)
HE-I-T(DI)-SD	(For night use director or tracer control)
	(BL & T is not considered service)

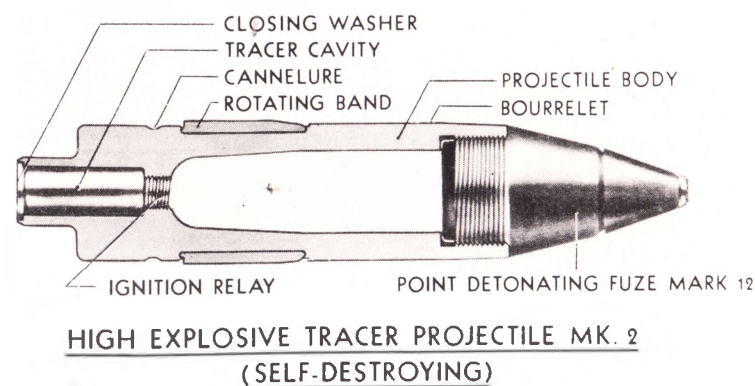
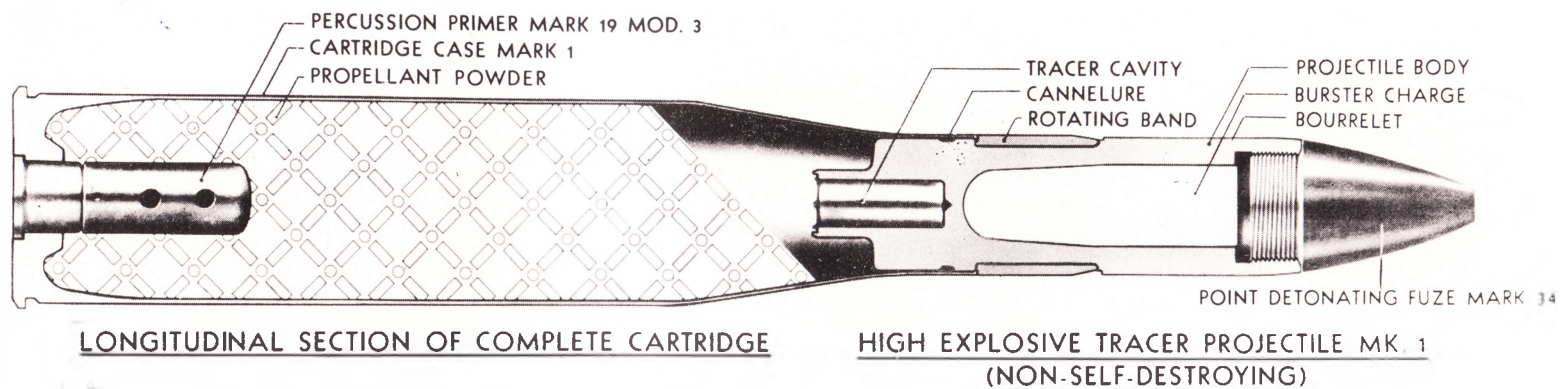
4. Development work will be continued to increase the time to self-destruction and as such tracers are proved they will be used in their respective type of cartridge. Development has also begun on a more smokeless propellant for daytime use in response to recommendations from forces afloat. The propellant now used in all 40-mm rounds is flashless, which makes more smoke than a normal smokeless propellant. When an acceptable smokeless propellant is developed it will be loaded in appropriate daytime types listed above.

CONFIDENTIAL

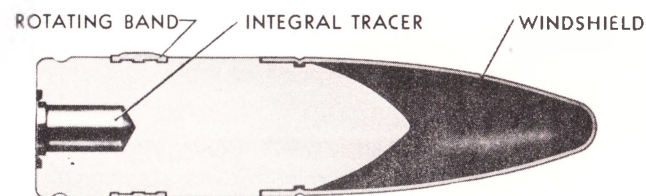
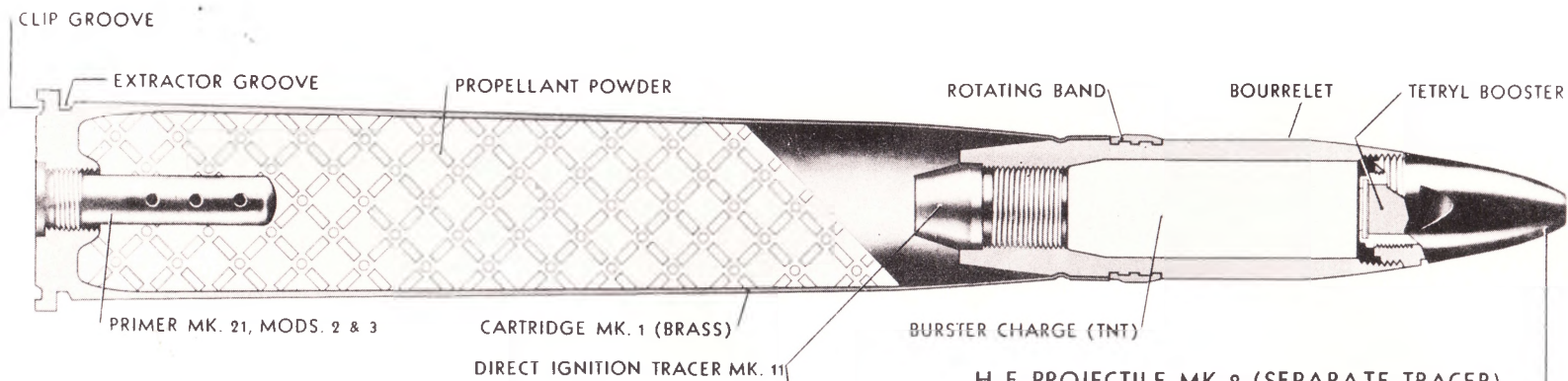


20 MM AIRCRAFT CANNON AMMUNITION

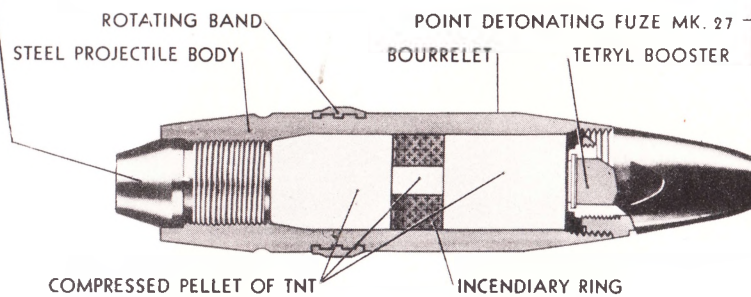
CONFIDENTIAL



1".10/75 CALIBER CARTRIDGE AND DETAILS



A. P. PROJECTILE M81A1

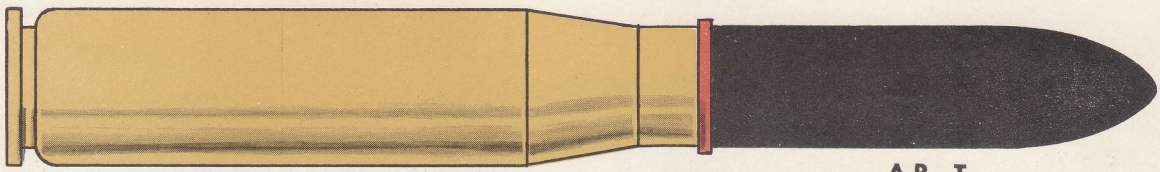


H. E. I. LOADED PROJECTILE

40 MM CARTRIDGE AND DETAILS

CONFIDENTIAL

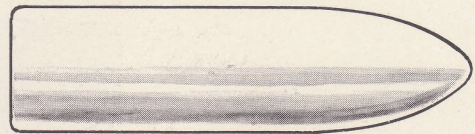
CONFIDENTIAL



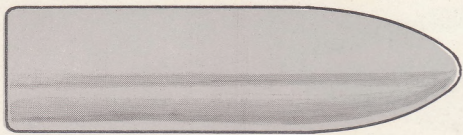
AP-T



HEI



HE



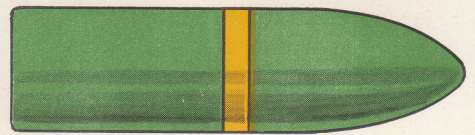
HET



BL & P

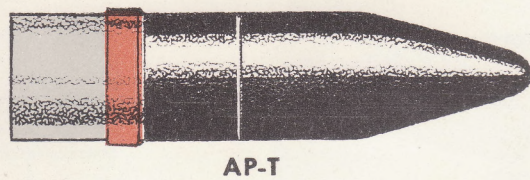
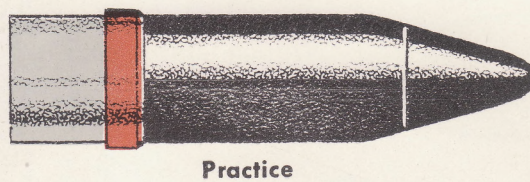
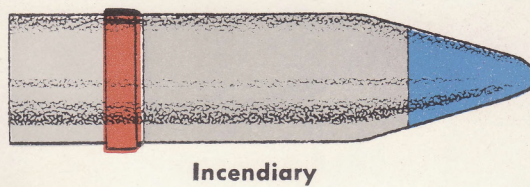
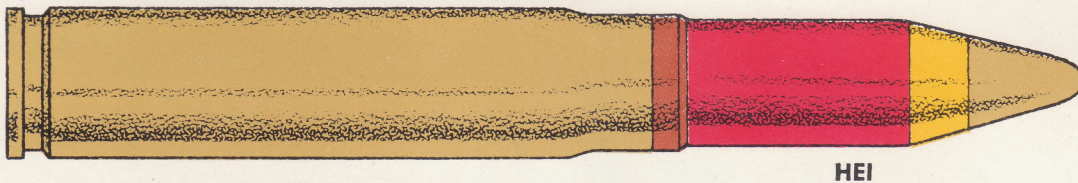


Dummy Drill



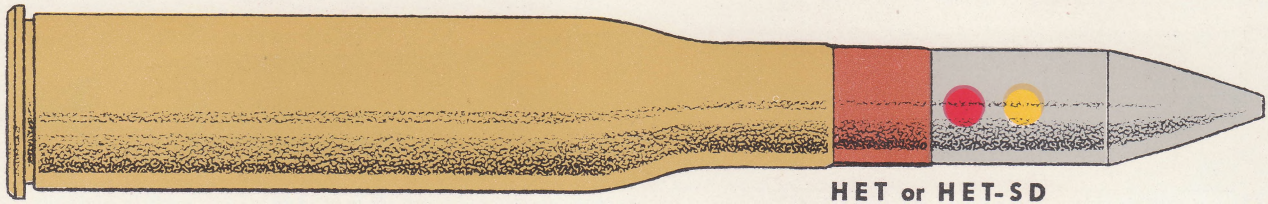
BL & T

20 MM ANTI-AIRCRAFT AMMUNITION



20 MM AIRCRAFT CANNON AMMUNITION

CONFIDENTIAL



HET or HET-SD



BL & T

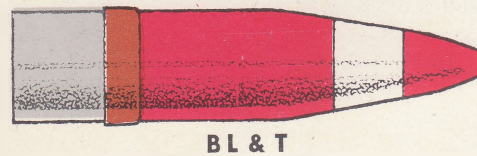
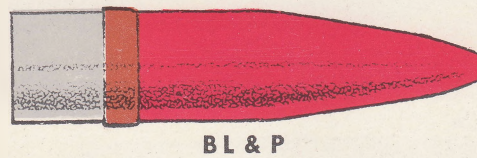
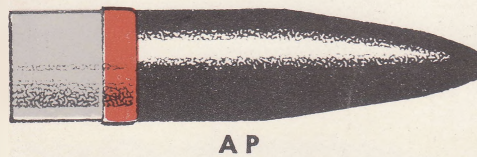
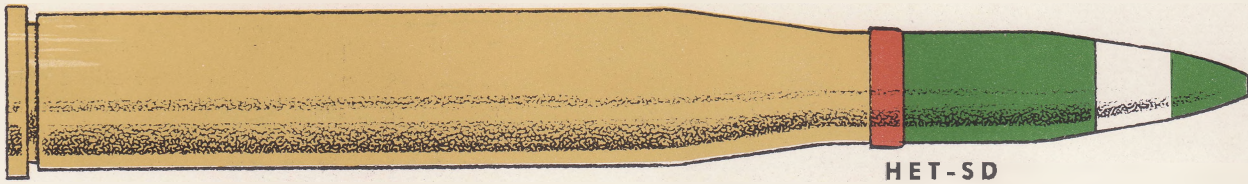


BL & P

1.10"/75 CALIBER
ANTI-AIRCRAFT AMMUNITION

CONFIDENTIAL

CONFIDENTIAL



40 MM ANTI-AIRCRAFT AMMUNITION

CONFIDENTIAL

PROJECTILES 3"/23 CAL. THROUGH 16"/50 CAL.

Projectiles in this range are divided into several types according to their structure and function. All types of projectiles are not produced in all calibers. However, projectiles of one type are basically the same regardless of caliber. The most important types of projectiles are as follows:

PENETRATIVE TYPES

1. *Armor Piercing (AP)*

Construction: Characterized by three-piece construction as follows:

- (a) A specially treated steel body, the head of which is exceedingly hard with the hardness gradually decreasing to the base with an increase in toughness. This hardening process is known as decremental hardening. The hard head is to effect the smashing of the armor plate's face while the tough rear is to support the head and stand the breaking strain of angle impact.
- (b) An armor piercing cap with a fairly blunt nose to effect penetration is secured to the body by peening the skirt of the cap into notches cut in the ogive of the projectile body and by soldering. Caps are made of the same kind of steel as the projectile body and decrementally hardened. The function of the cap is to cause an initial strain on the armor plate, allowing the body nose to reach an already strained surface and then provide powerful circumferential support to the point and nose as they begin to penetrate the hard face, maintaining the support until they are well into the plate. The cap also enables a projectile to penetrate when impact is at extreme oblique angles. It happens occasionally that caps become loosened by rough handling. Such projectiles should be returned to an ammunition depot for recapping.
- (c) A hollow windshield made of either forged mild steel, steel stamping, or aluminum is secured to the A.P. cap by means of threads and then set by means of a center punch. The windshield has no special strength other than that necessary to prevent destruction due to handling or setback upon firing. The primary function of a windshield is to streamline the

projectile for maximum range and it crushes immediately upon impact with armor plate. Windshields sometimes become loosened in handling and in that event they should be tightened and reset. Some armor piercing, common, and special common projectiles carry a water soluble, powdered, spotting dye in the windshield. The function of this dye is to color the spray set up by the projectile when it hits the water for spotting purposes in the case of a "near miss." Spotting dye colors used by the Navy are red, orange, blue, and green. When this dye is used in projectiles, the design of the windshield is such that there are elongated ports covered by a light brass cap called a dye cap in the forward part to allow water to enter the windshield, and small round ports plugged with light copper discs in the after part of the windshield to allow water to leave the windshield after it has mixed with the dye.

Loading Factor: Since A.P. projectiles must necessarily be of heavy construction, they have very small burster cavities and will accommodate only 1½ per cent to 2½ per cent of explosive "D" which is the explosive filler.

Fuzing: All A.P. projectiles, which are loaded with explosive, make use of base detonating fuzes with .020 to .035 seconds delay to allow for the proper penetration before detonation.

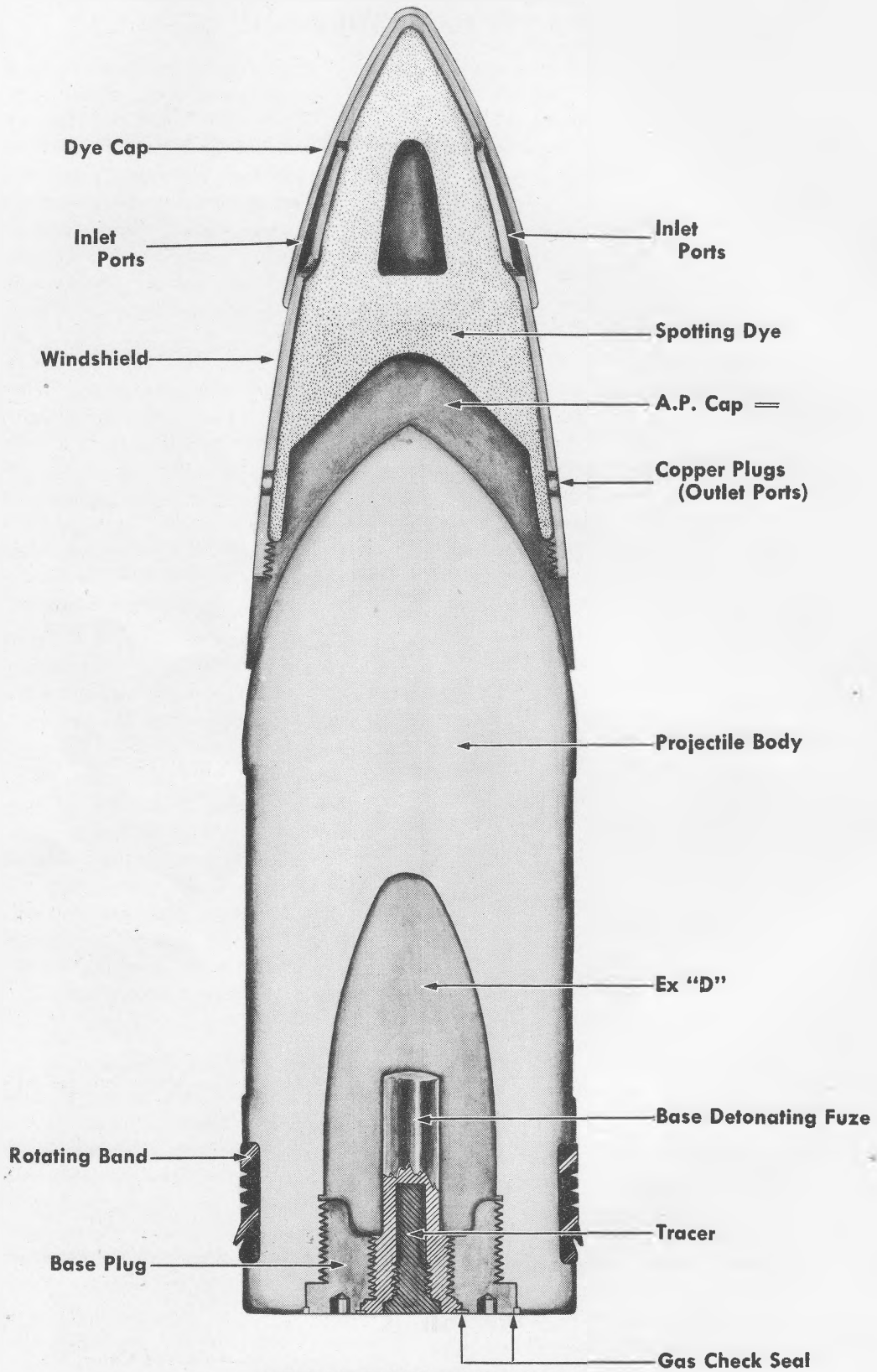
Use: Primarily for use against Class A (face-hardened) armor plate but also effective against Class B armor plate (not face-hardened and designed to resist glancing blows). They will penetrate Class A armor plate to a distance of one caliber.

2. *Special Common (SpCom)*

Construction: Characterized by three-piece construction as follows: Similar in construction to an armor piercing projectile except an armor piercing hood of lighter construction replaces the heavy armor piercing cap used on AP projectiles. Windshield and body construction is identical to AP projectiles with the exception of a larger burster cavity in the body.

Loading Factor: Because it has a larger burster cavity than the AP projectiles the SpCom can

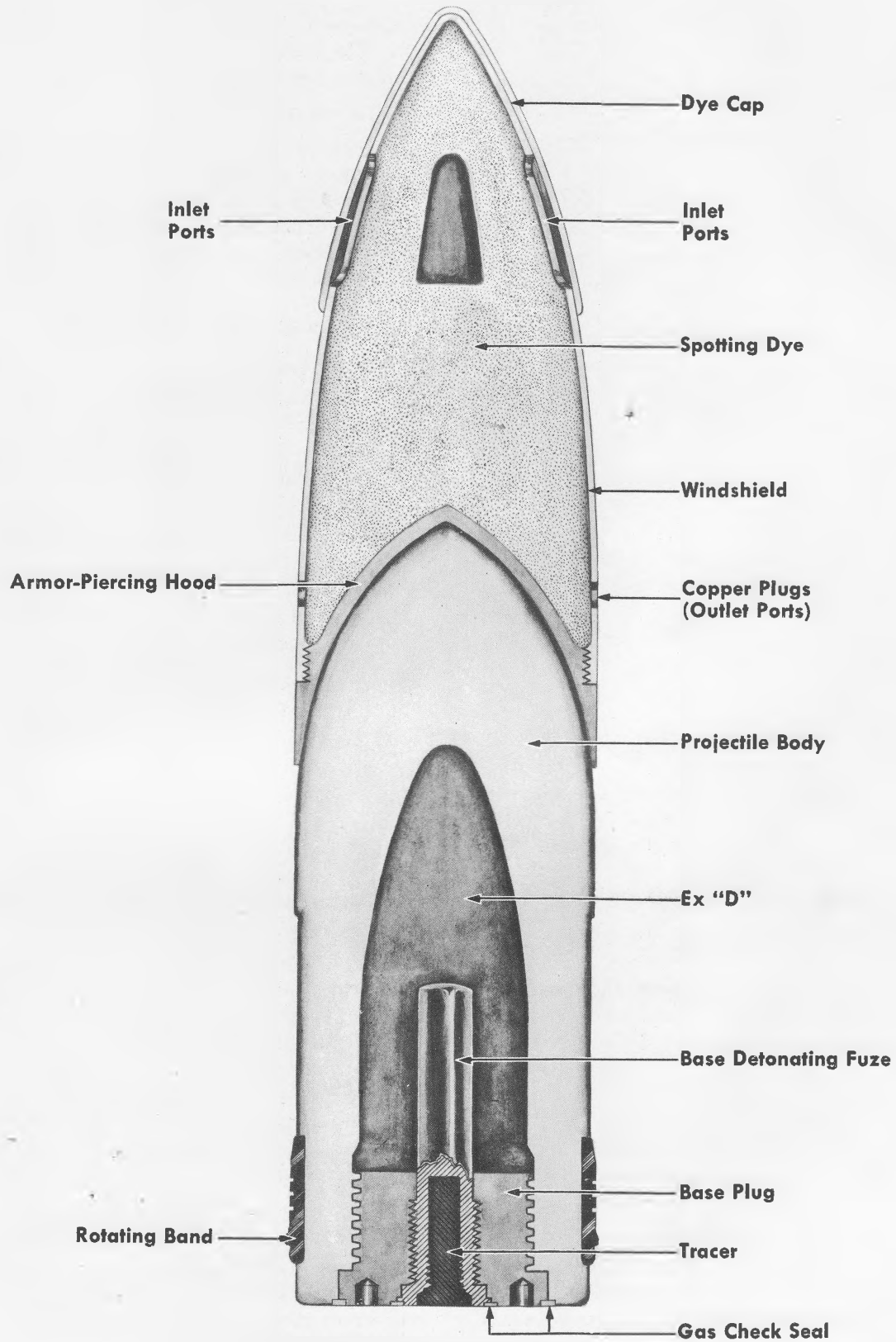
CONFIDENTIAL



ARMOR PIERCING PROJECTILE

CONFIDENTIAL

CONFIDENTIAL



SPECIAL COMMON PROJECTILE

CONFIDENTIAL

accommodate 2 per cent to 4 per cent of explosive filler which is explosive "D."

Fuzing: Base detonating fuzes with .01 second delay action to allow for penetration before detonation are used in these projectiles.

Use: Designed for use against Class B armor plate to penetrate a distance of $\frac{1}{2}$ caliber.

3. *Common (Com)*

Construction: Characterized by two piece construction as follows: Consists of body and windshield similar to armor piercing projectiles with the omission of the armor piercing cap. In this case the windshield is secured by means of threads directly to the body of the projectile and the body is of lighter construction.

Loading Factor: Due to the lighter construction of the body the burster cavity is larger to accommodate 4.5 per cent to 5.5 per cent explosive filler, which is explosive "D."

Fuzing: Base detonating fuzes with .01 second delay action are used in these projectiles.

Use: Primarily for use against Class B armor plate and lightly armored shore installations to penetrate a distance of $\frac{1}{3}$ caliber.

4. *Old Type Common (Com)*

Construction: Characterized by one-piece construction with burster cavity.

Loading Factor: Burster cavity will accommodate 4.5 per cent to 5.5 per cent explosive filler which is either Black Powder or a 50/50 mixture by weight of Black Powder and TNT. (6"/50 cal. old common projectile is loaded with Exp. "D").

Fuzing: Base ignition fuzes are used in these projectiles with no delay action.

Uses: Old type common projectiles are fast becoming obsolete and are produced in only a few calibers. They were not designed for any particular penetration but are probably capable of some penetration with right angle impact. Impact at slight angles will probably cause ricochet without penetration due to the extreme pointedness of the nose in contrast to the fairly blunt cap, nose, or hood construction of A.P., Com, and SpCom projectiles.

Note: It should be noted that the terms old type common and special common (projectiles) are not used by the Bureau of Ordnance but are used in this

publication for purposes of clarification in instruction. The Bureau of Ordnance refers to all three types of common projectiles as "common."

HIGH CAPACITY TYPES

In contrast to penetrative types of projectiles, high capacity projectiles are designed not to affect penetration of armor plate nor heavily reinforced shore installations, but instead, to develop maximum blast and shrapnel effect upon detonation. For this reason, they will have the maximum loading factor possible and yet have sufficient structural strength to withstand setback in the gun.

1. *Anti-Aircraft (AA)*

Construction: Characterized by one-piece, comparatively thin-walled construction with a large burster cavity and a large opening in the nose to accommodate a nose fuze.

Loading Factor: The large burster cavity permits a loading factor of about 6 per cent of cast TNT explosive filler.

Fuzing: Two fuzes are used in this projectile: A mechanical time fuze is used in the nose and under this there is a auxiliary detonating fuze.

Use: These projectiles are designed for aerial burst against aircraft.

2. *Anti-Aircraft Common (AA Com)*

Construction: Characterized by one piece construction similar to AA projectiles but with openings in both nose and base to accommodate fuzes.

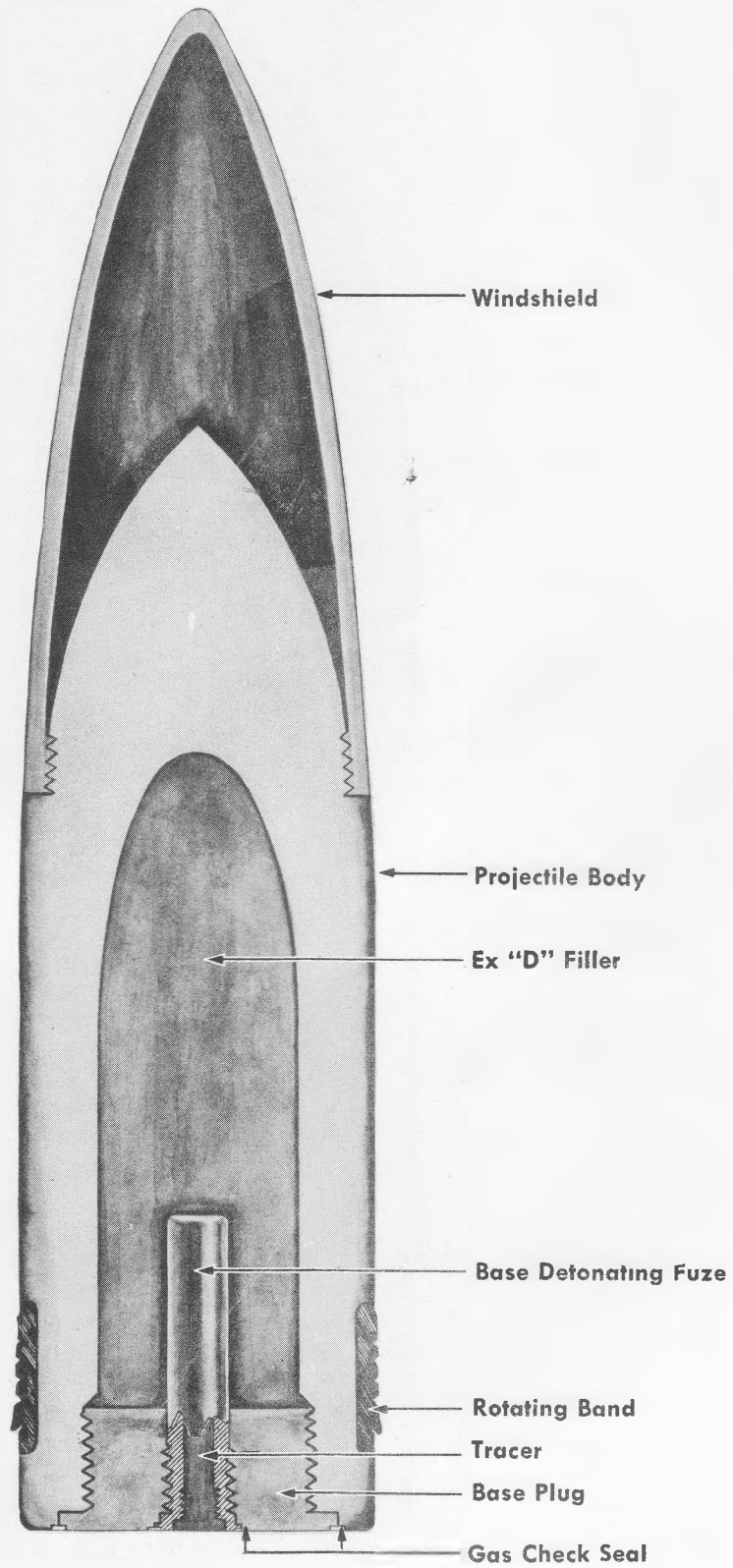
Loading Factor: Due to the extremely large burster cavity, these projectiles will accommodate 13 per cent of explosive "D" filler.

Fuzing: These projectiles are fuzed in the nose with mechanical time fuzes and auxiliary detonating fuzes and in the base with base detonating fuzes with non-delay action.

Use: AA Com projectiles were designed for use in dual-purpose guns against aircraft or surface ships and shore installations. The latter use is accomplished by setting the mechanical time fuze on "Safe."

Note: 5"/38 and 5"/25 AA Com projectiles and 3"/50 AA projectiles are often fuzed with a special variable time (v. t.) nose fuze (MK 45, 53) when the projectile is to be used for anti-aircraft. This special fuze screws directly into the nose of the projectile

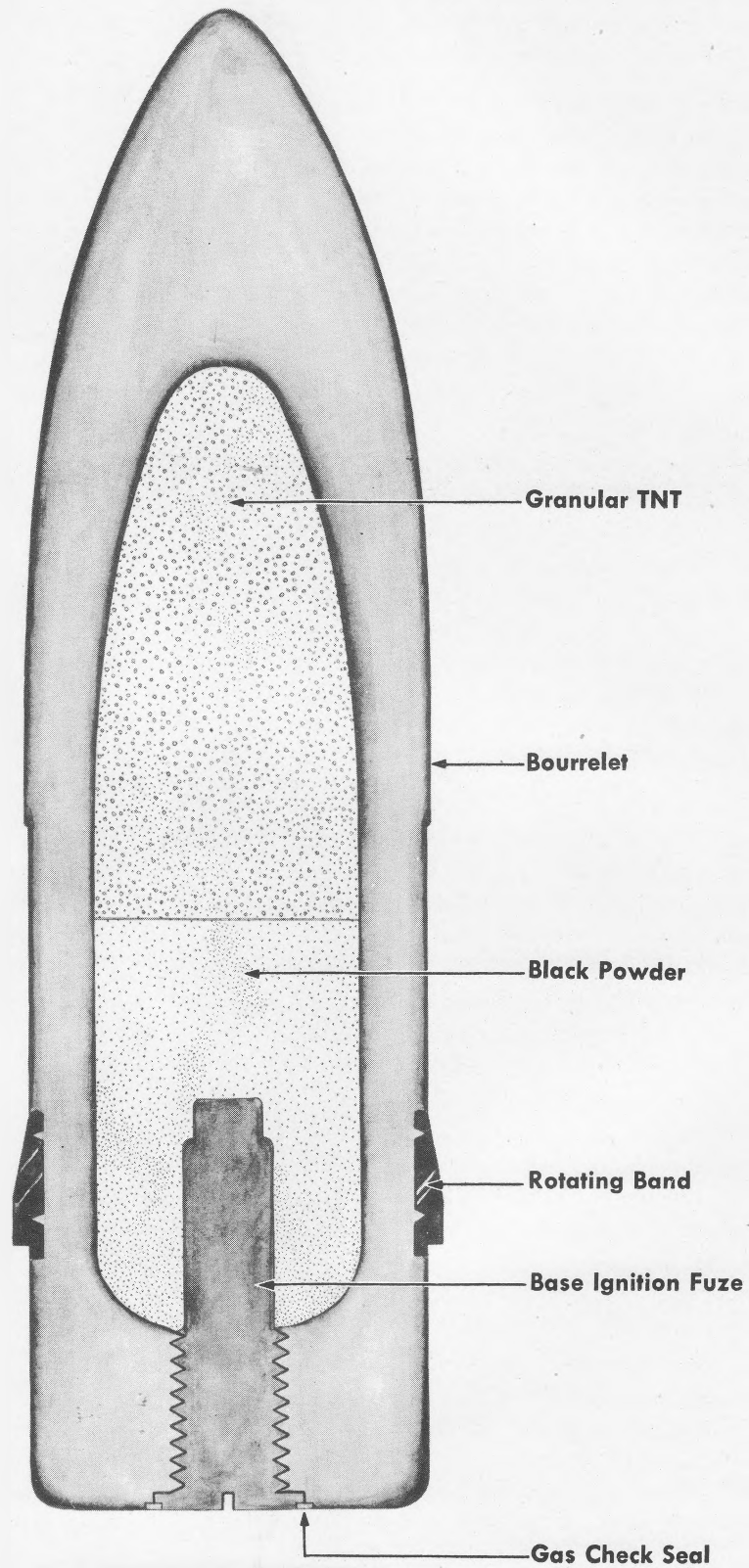
CONFIDENTIAL



COMMON PROJECTILE

CONFIDENTIAL

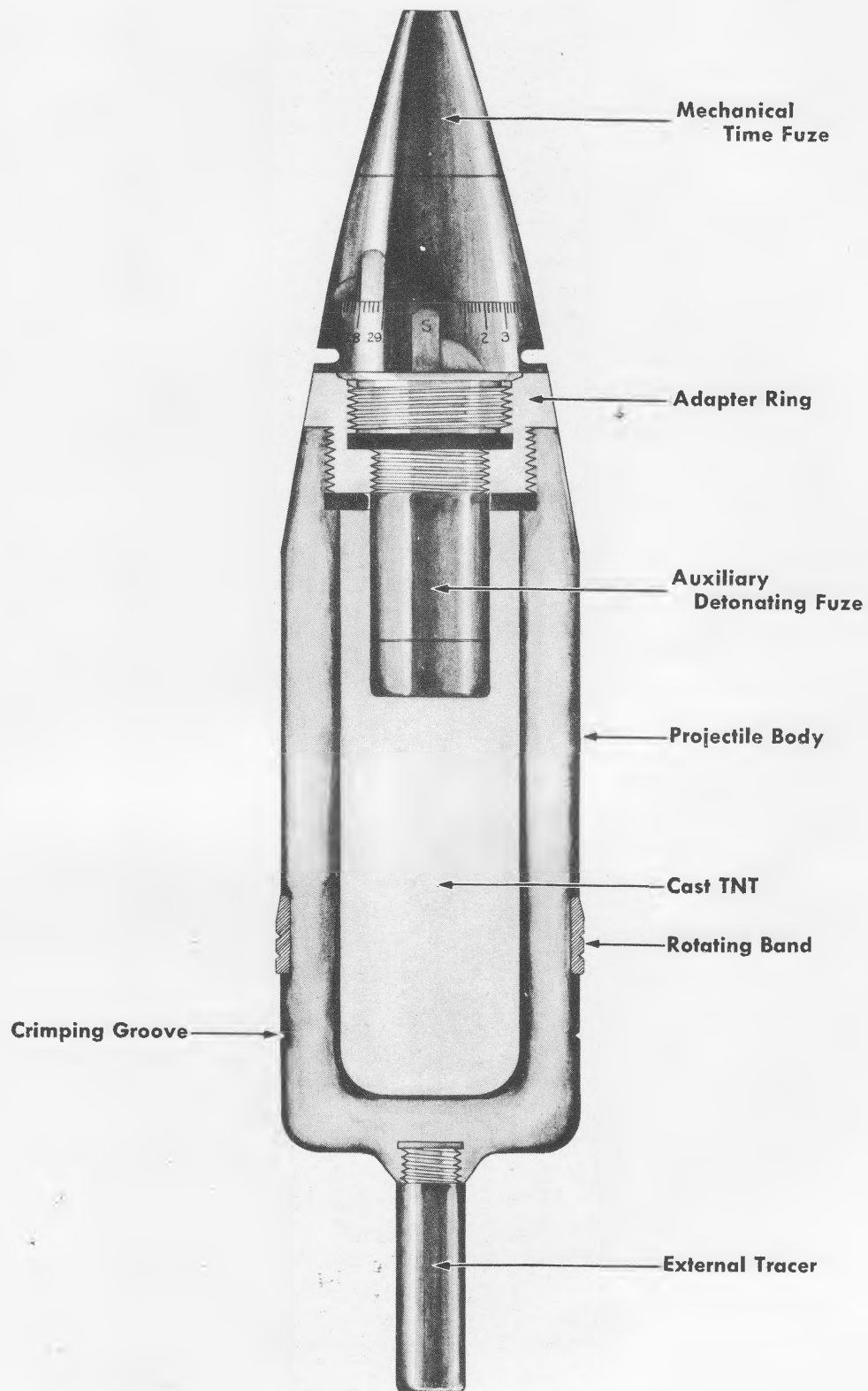
CONFIDENTIAL



OLD COMMON PROJECTILE

CONFIDENTIAL

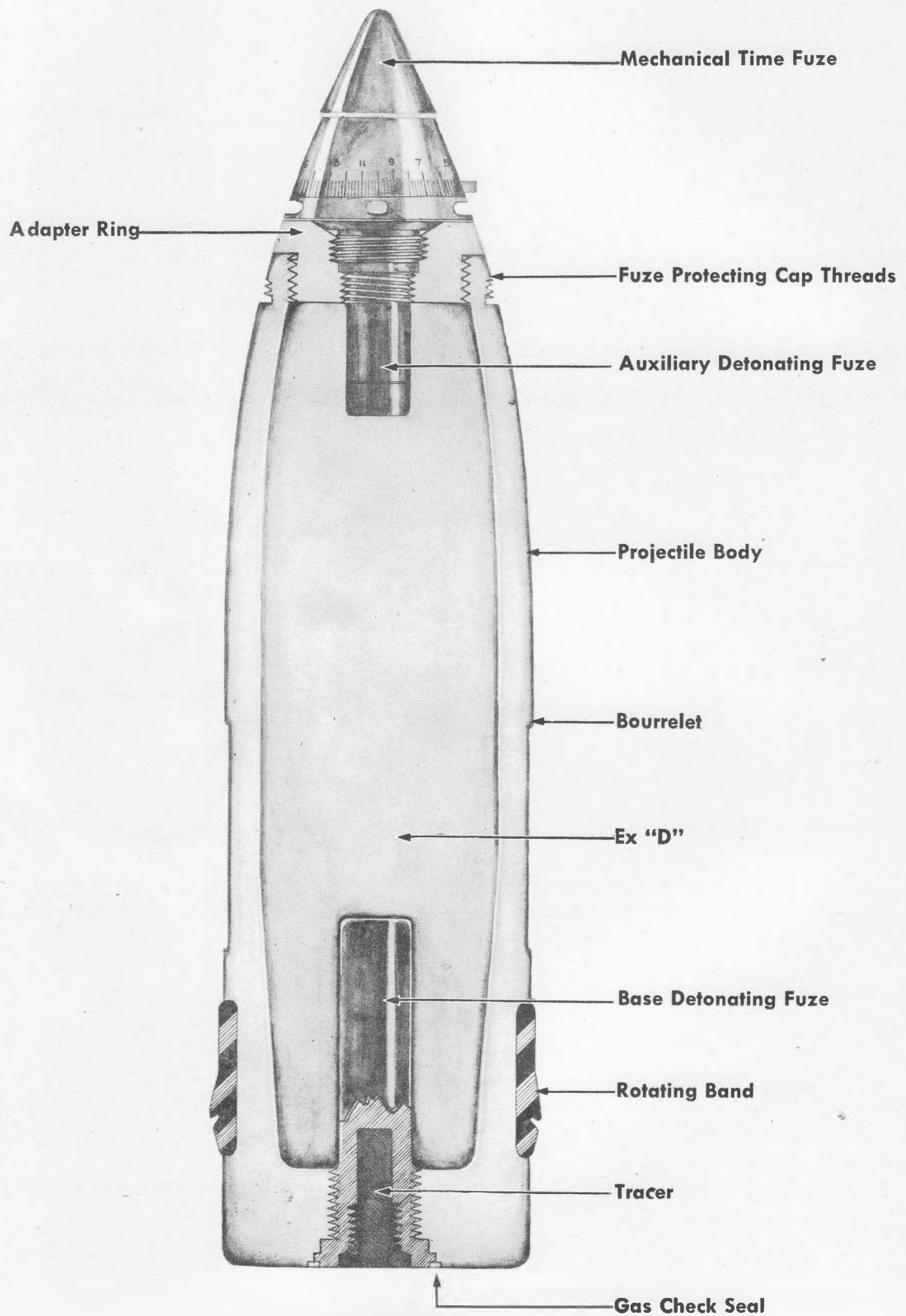
CONFIDENTIAL



ANTI-AIRCRAFT
PROJECTILE

CONFIDENTIAL

CONFIDENTIAL



ANTI-AIRCRAFT
COMMON PROJECTILE

CONFIDENTIAL

and does not require the use of an adapter ring — the auxiliary detonating fuze screws into the base of this special fuze. Neither a base detonating fuze nor a tracer is used in this special assembly and thus the base fuze hole is plugged. Projectiles fuzed with this assembly will carry a $\frac{1}{2}$ " red band painted $\frac{1}{2}$ " aft the fuze protecting cap.

3. High Capacity (HC)

Construction: Characterized by one piece construction similar to AA Com projectiles.

Note: 12"/50, 14"/45-50, 16"/45-50 H.C. projectiles are constructed to take two adapter rings in the nose. A pressed TNT booster is secured to the lower adapter ring and an auxiliary detonating fuze is secured to the upper adapter ring. Other calibers of HC projectiles do not have TNT boosters in the nose and consequently have only one adapter ring to which is secured the auxiliary detonating fuze.

Loading Factor: The large burster cavity will accommodate 7 per cent to 13 per cent of explosive "D" filler.

Fuzing: These projectiles are issued to ships with an armor piercing nose plug and auxiliary detonating fuze in the nose and a base detonating fuze with no delay or .01 second delay in the base. When the projectile is issued for use, a mechanical time fuze and a point detonating fuze are shipped separately with the projectile in varying ratios for selective assembly aboard ship.

Use: These projectiles were designed for versatility in use. (1) They may be fired from the gun with the nose plug in place when bombarding shore installations where penetration is desired. (2) When the projectile is to be fired against aircraft the nose plug is replaced by the mechanical time fuze. (3) If maximum blast and shrapnel effect are desired for demolition of ship's superstructure or shore structures, the nose plug is replaced by the point detonating fuze.

Note: (1) In the future the tendency will be to fuze 8" through 16" high capacity projectiles with a base detonating fuze incorporating an .01 second delay element plus the usual auxiliary detonating fuze and nose plug. This type of fuzing will allow high capacity projectiles to penetrate heavy concrete shore installations of about 8 foot thickness before detonation of the projectile which is often desirable

when these projectiles are used for shore bombardment. (2) 3"/50 cal. high capacity projectiles are always issued with a point detonating fuze and an auxiliary detonating fuze assembled in them; they are never issued with AP nose plugs or base detonating fuzes assembled in them.

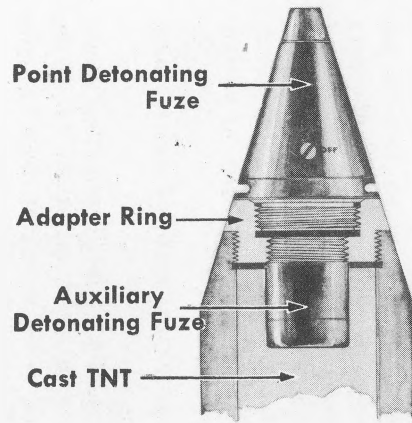
MISCELLANEOUS TYPES

1. Illuminating (Ill. or SS)

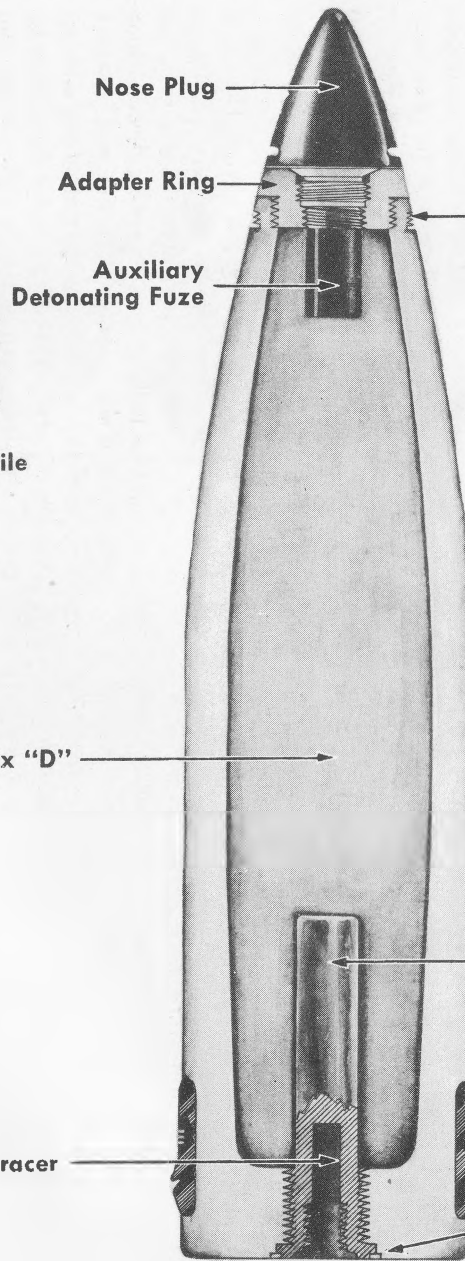
Construction: These are not burster type projectiles but have thin-wall construction with a base plug lightly secured to the projectile with pins. A very small expelling charge of black powder contained in a silk bag is located just abaft the nose fuze and the remainder of the filler consists of a star or candle attached to a parachute. The explosion of the expelling charge forces out the base and the interior assembly. The star or candle is a steel container in which is packed, under heavy pressure, an illuminating compound in which magnesium is an important constituent. The explosion of the expellant ignites the star or candle. The closed end of the star container is attached to the stranded wires of the parachute. The parachute is carefully folded, and with its strand wires, is rolled so that upon expulsion it opens, thereby suspending the candle or star. The empty projectile then continues in flight. Because of the high velocity at which the projectile is travelling when ejection takes place, it is necessary to slow down the star-parachute assembly before the parachute comes into full action. This is done by a retarding device which consists of a short center wire, one end of which is secured to the center of the parachute and the other to the star. This device holds the parachute nearer the star than when in full release and causes the parachute to spill air thereby preventing a too heavy initial strain on the parachute. After the star has burned for a few seconds the end of the short center wire is released from its point of attachment to the star. This permits the parachute to open fully and give its greatest support to the star.

Fuzing: These projectiles are fuzed with mechanical time fuzes.

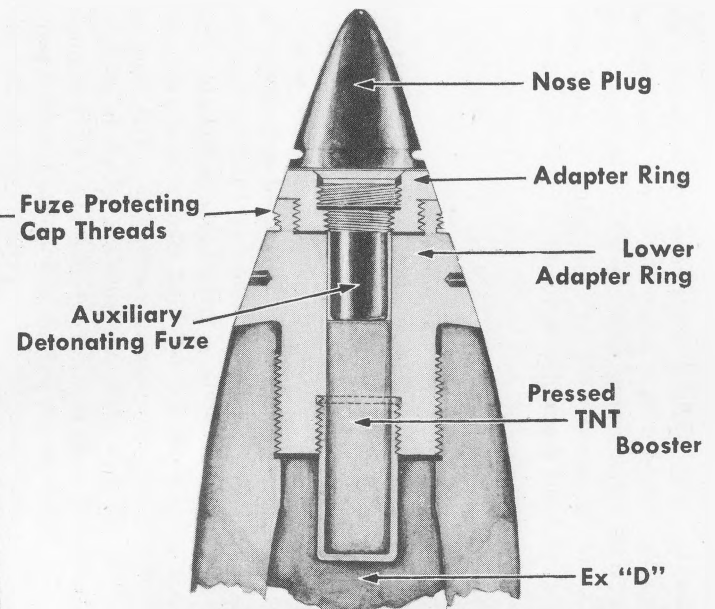
Use: Primarily designed for illuminating enemy ships or targets in night operations. It is the general practice to assign one or more batteries



High Capacity Projectile
3"/50 Cal.
(No Base Fuze)



HIGH CAPACITY PROJECTILE

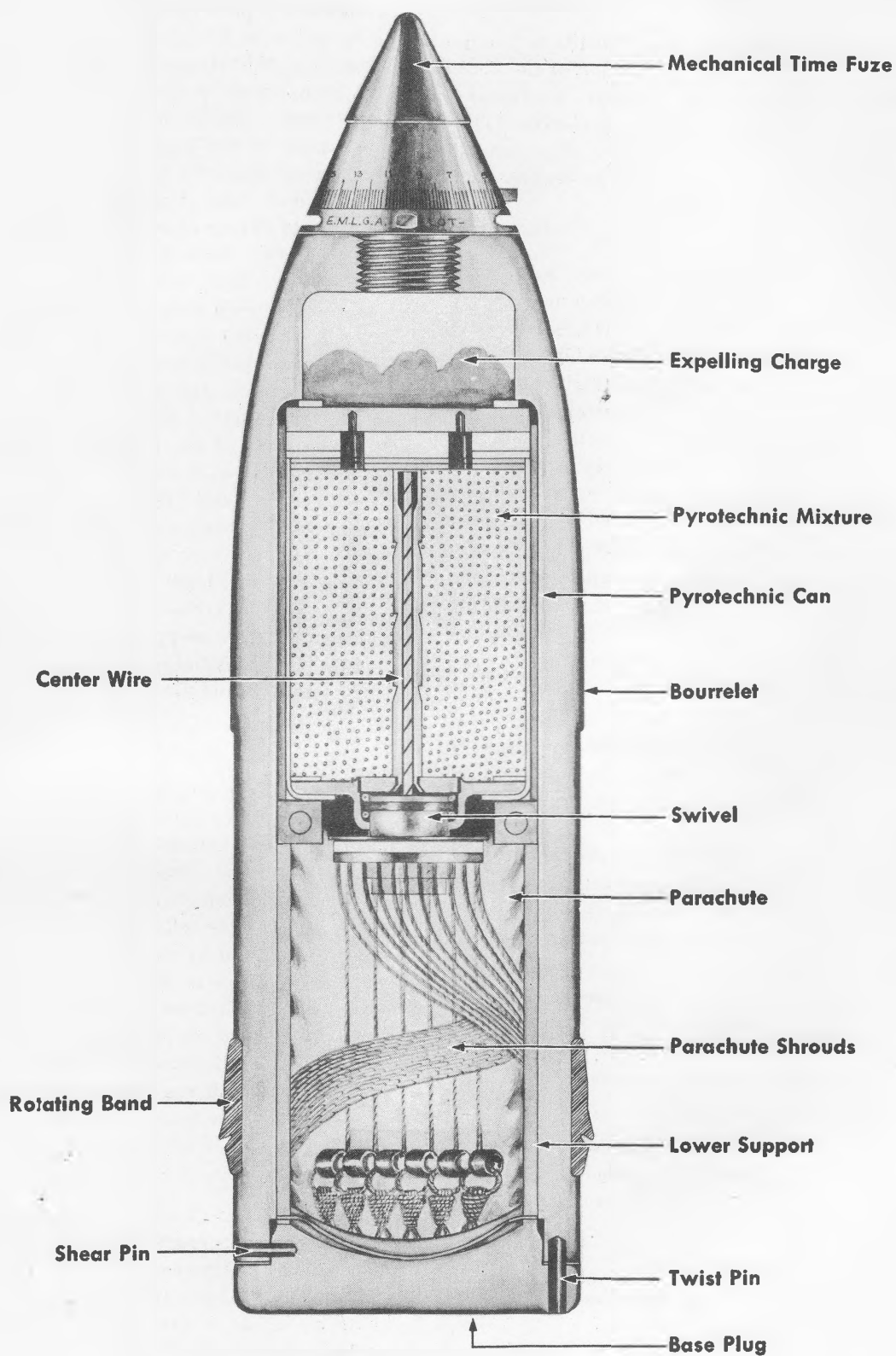


High Capacity Projectile
(12", 14", 16")

CONFIDENTIAL

CONFIDENTIAL

CONFIDENTIAL



CONFIDENTIAL

aboard ship to fire only illuminating projectiles during an engagement.

In order for an illuminating projectile to function properly as regards proper ejection of the illuminating contents, a special heat treatment is now given to the body of the projectile. These projectiles are designated as HT (heat treated) to distinguish them from those projectiles which have not been heat treated.

2. 5"/38 White Phosphorus (WP)

Construction: At the present time, some 5"/38 illuminating projectiles are being loaded with white phosphorus in place of the usual pyrotechnic candle and parachute. The white phosphorus is packed in a total of 168 small metal tubes contained in a cannister. A central burster tube filled with ballistite and fitted with a black powder delay is inserted through the center of the cannister. There is a 2½ ounce expelling charge of black powder resting on a baffle plate above the white phosphorus and burster tube assembly.

Fuzing: A mechanical time fuze is assembled into the nose of this projectile. However, authorization has been granted to refuze these projectiles with a point detonating fuze aboard ship if desired.

Operation: Upon fuze action the expelling charge functions to ignite the delay in the upper end of the burster tube and to blow the base plug and interior assembly out of the projectile through the base. The delay then sets off the burster tube which ruptures the case of the cannister and distributes the W.P. filled steel tubes through the air. Upon contact with the air, the W.P. readily burns giving off a dense white smoke.

Use: 1. Primary use is in laying smoke screens.

2. May be used as an incendiary against very inflammable targets.

3. Anti-personnel weapon.

4. May be used for spotting.

3. 5"/38 Window (W)

In addition to 5"/38 WP projectiles some 5"/38 illuminating projectiles are loaded with special contents in place of the usual pyrotechnic candle and parachute.

Description:

Three types of window loads have been developed, as described below:

Projectile Load (Window) Mk 1 Mod 1. This load consists of a pack of metal foil strips, each of which is 3/16 inch wide by 8 inches long. The strips (approximately 13,800) are stacked within a stepped cylindrical form, which is encased in a longitudinally split steel sleeve. The loaded sleeve is then inserted into the cavity of the projectile. Weight of the loaded and fuzed projectile is approximately 53.8 pounds.

Projectile Load (Window) Mk 2 Mod 0. This load consists of 19 rolls of metal foil (occasionally referred to as "rope") stacked withing a longitudinally split steel sleeve. Each roll consists of a length of metal foil one-half inch wide by approximately 600 feet in length. In order to insure streaming out of the rolls, a cardboard disc is fixed to one end of each roll. The diameter of the roll is approximately 3.90 inches. Rolls are separated from one another by aluminum discs. Weight of the loaded and fuzed projectile is approximately 54.6 pounds.

Projectile Load (Window) Mk 4 Mod 0. This load consists of two stacks of metal foil strips which are 5.1 inches long by 3/16 inch wide. There are approximately 13,800 strips in each stack, giving a total of 27,600 strips in each load. The strips are stacked within a stepped cylindrical form, which is encased in a longitudinally split steel sleeve. Weight of the loaded and fuzed projectile is approximately 53 pounds.

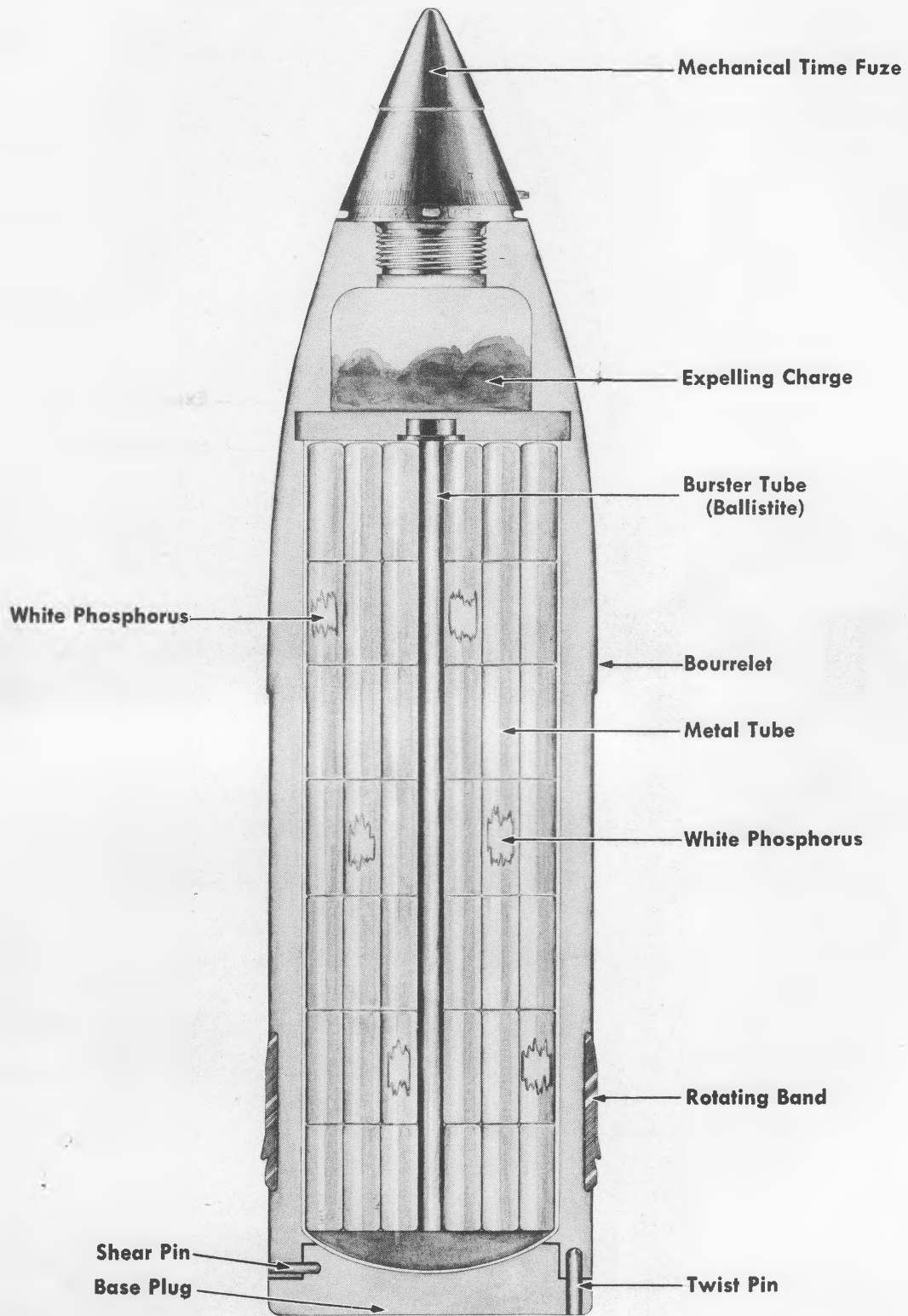
Operation:

Window projectiles are fuzed with standard mechanical time fuzes. Directly below the fuze there is a 2½ ounce black powder ejection or expelling charge contained within a silk or rayon bag. Directly below the ejection charge there is a steel baffle plate which rests on the split steel tube. When the ejection charge is ignited by the fuze, the resulting pressures on the baffle plate force the steel sleeve and the window load out from the base end of the projectile, after forcing out the base plug. Upon ejection, the foil strips are dispersed, forming a metallic cloud which drifts with the wind, while falling slowly to the surface of the water. The foil will sink within a few minutes after hitting the surface.

4. Target (Tar)

Construction: Target projectiles are designed similar to service projectiles in exterior shape, weight and balance. However, economy requires that they be made of the least expensive materials. Therefore, they are made of cast iron or semi-steel. A good

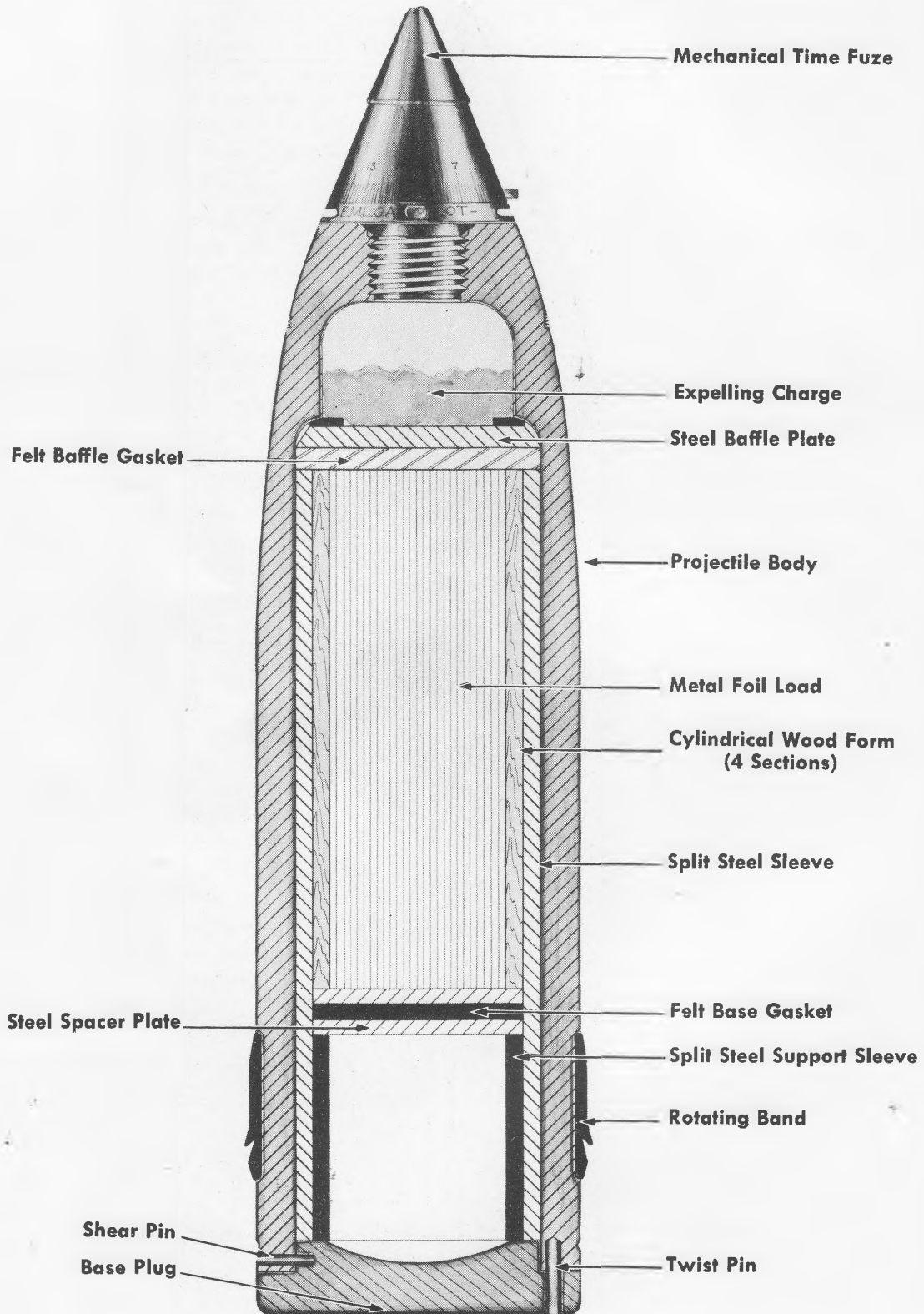
CONFIDENTIAL



WP PROJECTILE

CONFIDENTIAL

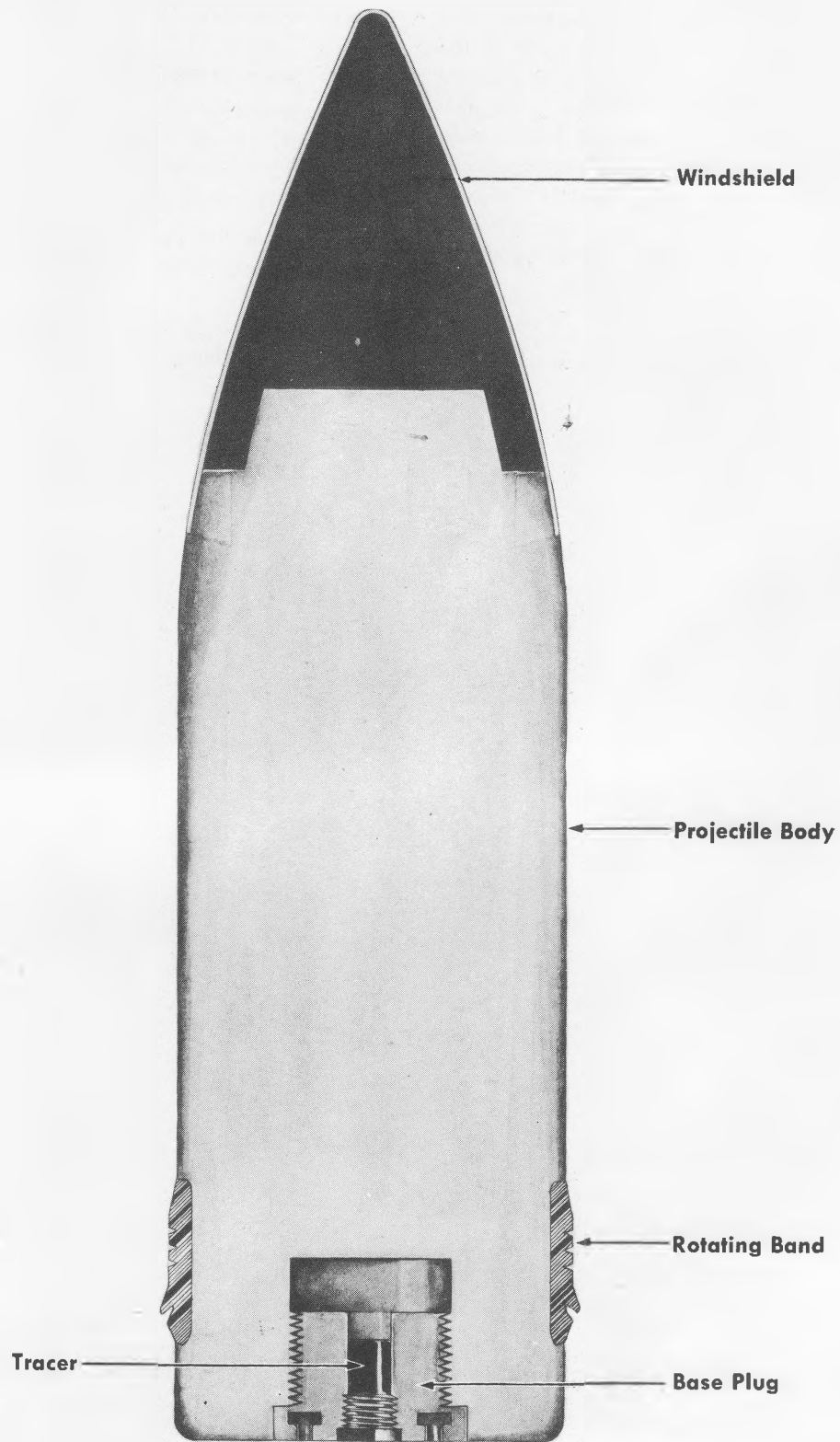
CONFIDENTIAL



W PROJECTILE

CONFIDENTIAL

CONFIDENTIAL



TARGET PROJECTILE

CONFIDENTIAL

grade of metal and efficient methods of casting are necessary, however, to insure that setback and centrifugal force do not cause fracture, either in the gun or in initial flight. No economy can be effected in the rotating band, as it must function in the normal way. These projectiles are usually loaded with sand.

Some projectiles, which were normally designed for service use and are declared defective or obsolete, may be sand loaded, repainted red, and assigned for target use.

Fuzing: None.

Use: Designed for target practice, ranging and

proving ground work. These projectiles are never to be used for battle service use.

5. *Dummy Drill (Drill)*

Construction: Characterized by construction of wood or some other material to exact size and weight of service ammunition. They do not contain explosive filler or fuzes.

Use: For drill in loading guns, loading machines, hoists, etc. They cannot be fired from a gun.

The following is a tabulation of types of projectiles by caliber and their filler and fuzing:

CONFIDENTIAL

TYPES OF PROJECTILES BY CALIBER

Caliber	AP	Sp Com (3-pc. Con- struction)	Com (2-pc. Con- struction)	Old Com (1-pc. Con- struction)	AA	HC	AA Com	SS	T
20 mm/70 cal.	AP-T				AA (1)				BL and P BL and T
1".10/75 cal.					AA (2)				BL and P BL and T
40 mm/60 cal.	AP AP-T				AA (3)				BL and P BL and T
1 pdr./40 cal.				Old Com					T
3 pdr./50 cal.				Old Com					T
6 pdr./40 cal. 42 cal. 45 cal. 50 cal.				Old Com					T
3"/23 cal.				Old Com	AA			SS	T
3"/50 cal.	AP			Old Com	AA	HC		SS	T
4"/50 cal.		SpCom		Old Com		HC		SS	T
5"/25 cal.							AA Com	SS	T
5"/38 cal.		SpCom	Com				AA Com (4)	SS W WP	T
5"/50 cal.				Old Com					T
5"/51 cal.				Old Com		HC	(4)	SS	T
6"/47 cal.	AP		Com			HC (5)		SS	T
6"/50 cal.				Old Com				SS	T
6"/53 cal.		SpCom	Com			(5)		SS	T
7"/45 cal.	AP								T
8"/55 cal.	AP	SpCom	Com			HC			T
12"/50 cal.	AP					HC			T
14"/45 cal.	AP					HC			T
14"/50 cal.	AP					HC			T
16"/45 cal.	AP					HC			T
16"/50 cal.	AP					HC			T

(1) Includes High Explosive, High Explosive Incendiary, and High Explosive Tracer.

(2) Includes High Explosive and High Explosive Self-destroying.

(3) Includes High Explosive and High Explosive Incendiary.

(4) The 5"/38 AA Com projectile Mk 35 can be used in 5"/51 guns.

(5) The Mk 34 6"/47 cal. HC projectile may also be used in the 6"/53 cal. gun.

CONFIDENTIAL

FILLER BY TYPE OF PROJECTILE

Armor-Piercing

20 mm — no filler
 40 mm — no filler
 3"/50 — no filler or "D"
 6"/47 — "D"
 7"/45 — "D"
 8"/55 — "D"
 12"/50 — "D"
 14"/45 — "D"
 14"/50 — "D"
 16"/45 — "D"
 16"/50 — "D"

Special Common (officially designated as Com)

4"/50 — "D"
 5"/38 — "D"
 6"/53 — "D"
 8"/55 — "D"

Old Common (officially designated as Com)

3"/23 — BP and TNT
 3"/50 — BP and TNT
 4"/50 — BP and TNT
 5"/50 — BP and TNT
 5"/51 — BP and TNT
 6"/50 — "D"
 1 pdr — (40 cal.) BP
 3 pdr — (50 cal.) BP and TNT
 6 pdr — (40, 42, 45, 50, cal.) BP and TNT

Common

5"/38 — "D"
 6"/47 — "D"
 6"/53 — "D"
 8"/55 — "D"

Anti-Aircraft Common

5"/25 — "D"
 5"/38 — "D"

Anti-Aircraft

20 mm — Tetryl
 40 mm — TNT
 1.10/75 — "D"
 3"/23 — Cast TNT
 3"/50 — Cast TNT

High Capacity

3"/50 — Cast TNT
 4"/50 — "D"
 5"/51 — "D"
 6"/47 — "D"
 8"/55 — "D"
 12"/50 — "D"
 14"/45 — "D"
 14"/50 — "D"
 16"/45 — "D"
 16"/50 — "D"

Illuminating (SS)

3"/23 — BP expelling charge
 3"/50 — BP expelling charge
 4"/50 — BP expelling charge
 5"/25 — BP expelling charge
 5"/38 — BP expelling charge
 5"/51 — BP expelling charge
 6"/47 — BP expelling charge
 6"/50 — BP expelling charge
 6"/53 — BP expelling charge

WP Smoke

5"/38 — White phosphorus loaded

W

5"/38 — Aluminum foil loaded

CONFIDENTIAL

FUZING BY TYPE OF PROJECTILE

Type of Projectile	Mechanical Time Fuze	Point Detonating Fuze	AP Nose Plug	Auxiliary Detonating Fuze	Base Detonating Fuze	Base Ignition Fuze
*Armor Piercing					BDF	
Armor Piercing 20 mm-40 mm						
Special Common					BDF	
Old Common						BIF
Common					BDF	
Anti-aircraft 3"/23-3"/50	MTF			ADF		
Anti-aircraft 20 mm-1.10"/75-40 mm		PDF				
3"/50 High Capacity		PDF		ADF		
†Other High Capacity			AP Plug	ADF	BDF	
AA Common	MTF			ADF	BDF	
Illuminating	MTF					
WP	MTF or PDF					
W	MTF					

*Some 3"/50 cal. AP projectiles are not loaded with explosive filler and thus do not use a BDF.

†Mechanical time fuzes and point detonating fuzes are shipped and issued with these high capacity projectiles. Since high capacity projectiles are more often fired with point detonating fuzes in place rather than with mechanical time fuzes, the following shipboard allowances for these fuzes has been set up by the Bureau of Ordnance:

Class Vessels	Caliber Guns	Ratio of Fuzes to HC Projectiles	
		MTF	PDF
BB, CB	12", 14", 16"	1:10	1:2
	5"/51	1:5	1:2
CA, CL, PG	6", 8"	1:10	1:2
SS	6", 5", 4"	None	1:1
All types not otherwise noted	5"/50, 5"/51 and 4"/50	1:5	1:2

MARKING OF PROJECTILES 3"-16"

All projectiles prepared for the Naval service are marked for identification. Markings include:

1. Stencilled information on the side of the projectile:
 - a. Caliber, mark and modification of the projectile.
 - b. Mk and Mod of fuzes.
 - c. Explosive filler and density of loading.
 - d. Abbreviated name of loading depot.
 - e. Initials of chief inspector.
 - f. Date of filling, marking, and painting.
 - g. Ammunition lot number (semi-fixed and bag gun projectiles only — on side cartridge case for fixed ammunition).
2. Stamped information on rotating band:
 - a. Mk and Mod of projectile.
 - b. Caliber and type of projectile.
 - c. Lot number.
 - d. Inspector's seal and initials.
 - e. Manufacturer of projectile (sometimes).
3. Stamped information on base of projectile:
 - a. Mk and Mod of projectile.
 - b. Caliber and type of projectile.
 - c. Lot number.
 - d. Inspector's seal and initials.
 - e. Manufacturer of projectile.
 - f. Previously (before 1 July 1944) weights before and after filling.

In addition to the markings mentioned above, individual components such as fuzes and tracers are marked with lot number, mark number, and sometimes the manufacturer.

4. Color markings on projectiles:

The color system employed and the standard colors used on projectiles and containers are as follows:

a. To indicate type of explosive filler, ogive is painted for a distance of one caliber aft starting from the nose or immediately aft of the nose fuze or nose plug.

Yellow Explosive "D"
Dark green TNT
Slate gray Black powder

Slate gray and green Black powder and TNT (Gr.)
No paint or red Inert
Medium Blue Composition A

b. To indicate tracer, a one inch wide white band is painted immediately aft of the filler color. Three equally spaced dots (120° apart), the color of the tracer, may appear on this band.

c. To indicate a spotting dye, a band one inch wide the color of the dye is painted aft of the tracer band or in its absence aft of the filler color. It may be red, blue, green, or orange.

d. To indicate the type of projectile, the body (except base, rotating band and bourrelet) is painted as follows:

AP Black
HC Green
AA Green
AA Com Green
Common (All types) Gray
Target No paint or if previously painted and later issued as target, it may be painted red. If another type of projectile is issued as target ammunition, it may be painted red.
Illuminating Light blue with two white stars 180° separated on the body. The letters HT are painted on each star if the projectile has been heat treated.

Note: (1) 5"/38 cal. WP — White phosphorus projectiles are marked as follows:

Slate Gray — for a distance of 2 inches aft of the nose fuze.

Red — for a distance of 2 inches aft of the black color.

Body is painted ocean gray with 1/2 inch yellow band around the middle.

The words "WP SMOKE" are stencilled on the body with yellow paint.

(2) 5"/38 cal. W — Window projectiles are coated with aluminum paint with the letter "W" stencilled in black on opposite sides of the projectile.



Slate Gray



Red



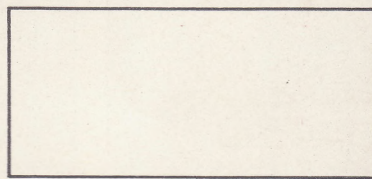
Green



Yellow



Black

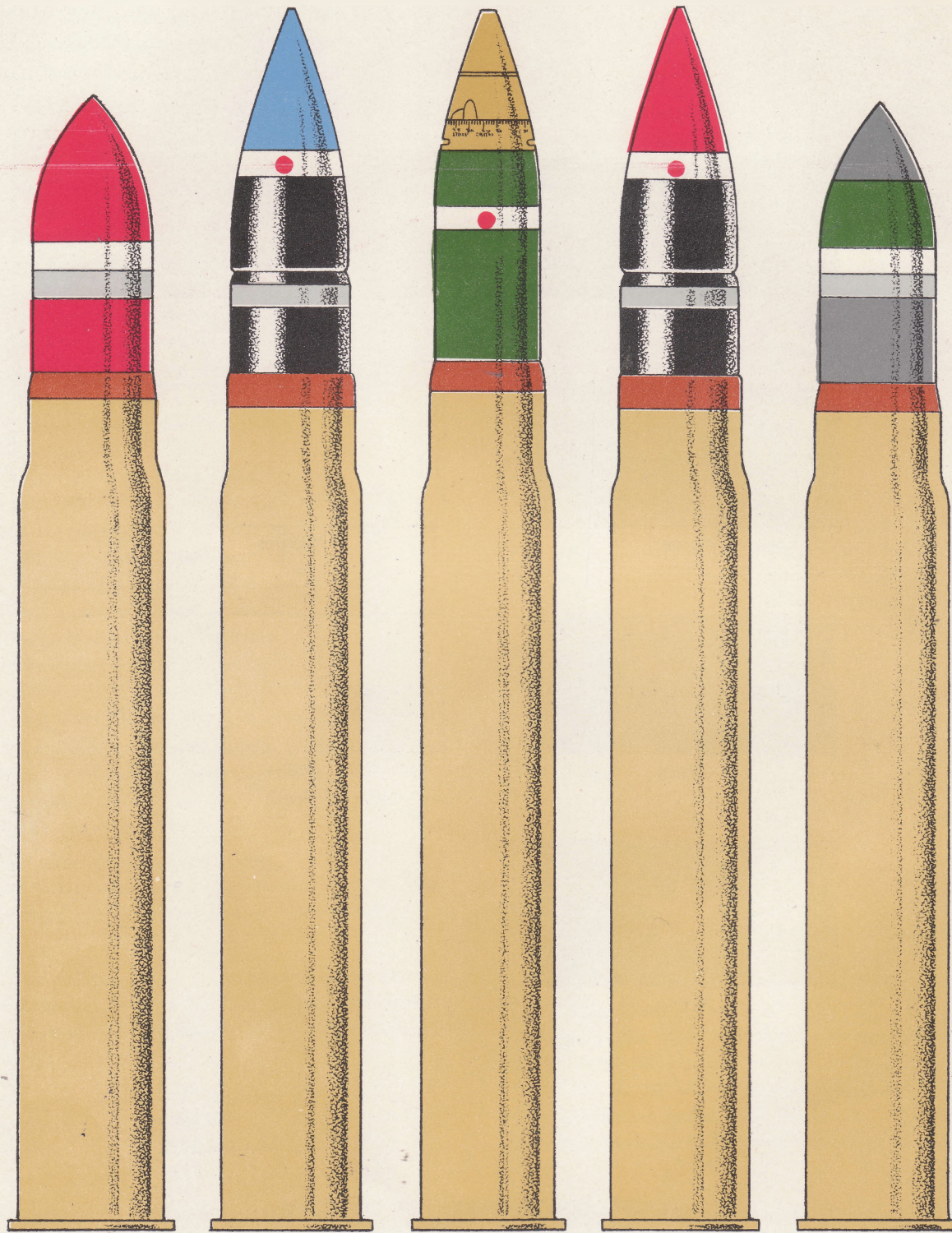


White



Blue

**STANDARD COLOR CHART FOR PAINTING
PROJECTILES AND CONTAINERS**



Target

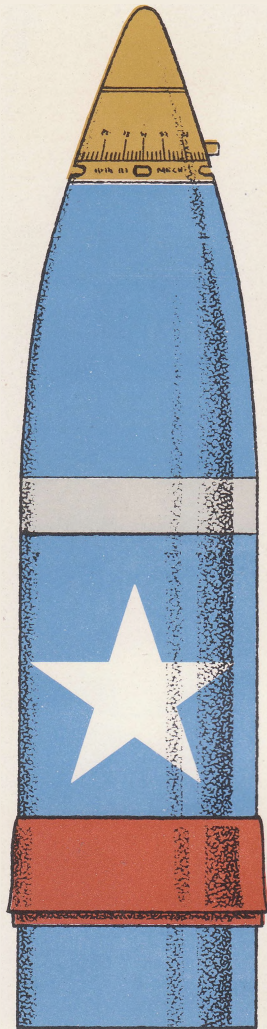
AP
(Comp A Load)

AA

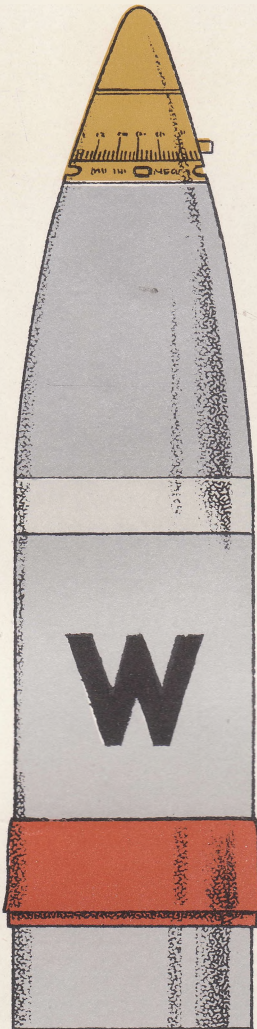
AP
(No Load)

Old Com

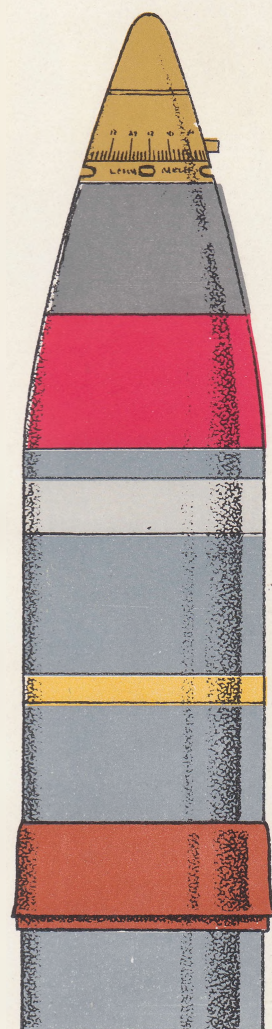
FIXED CARTRIDGES



ILL (SS)

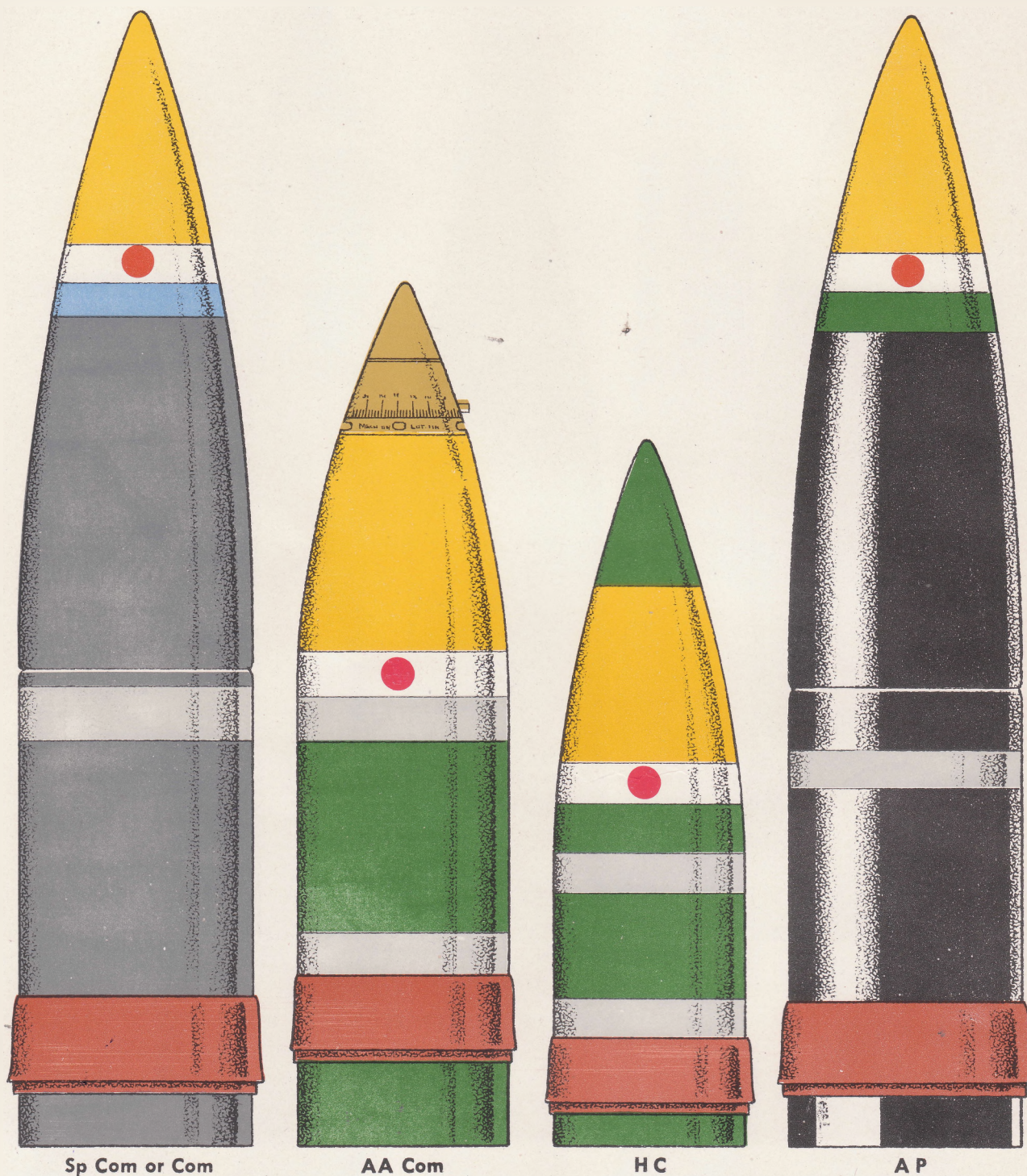


W



WP

SEMI-FIXED PROJECTILES



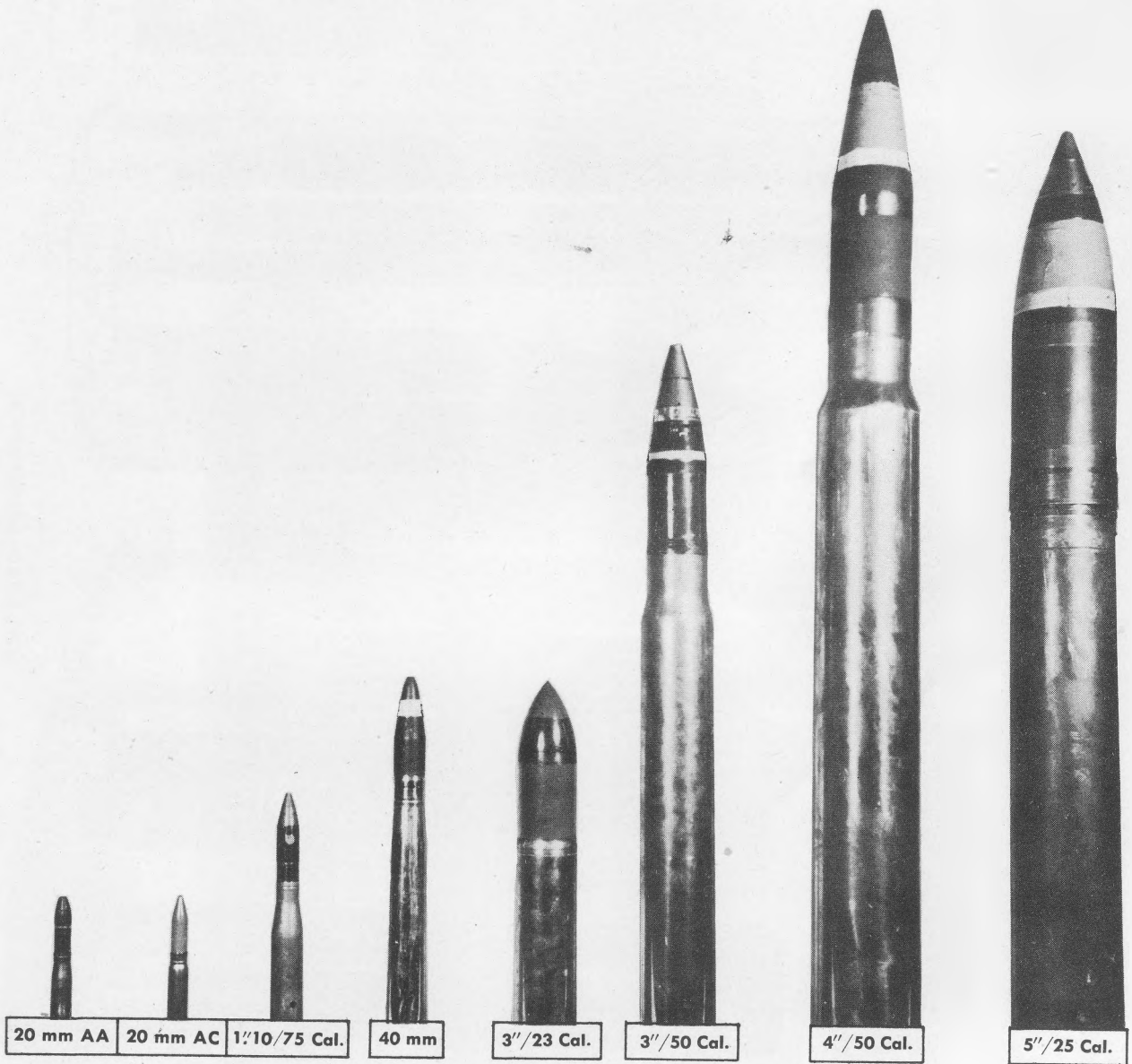
Sp Com or Com

AA Com

HC

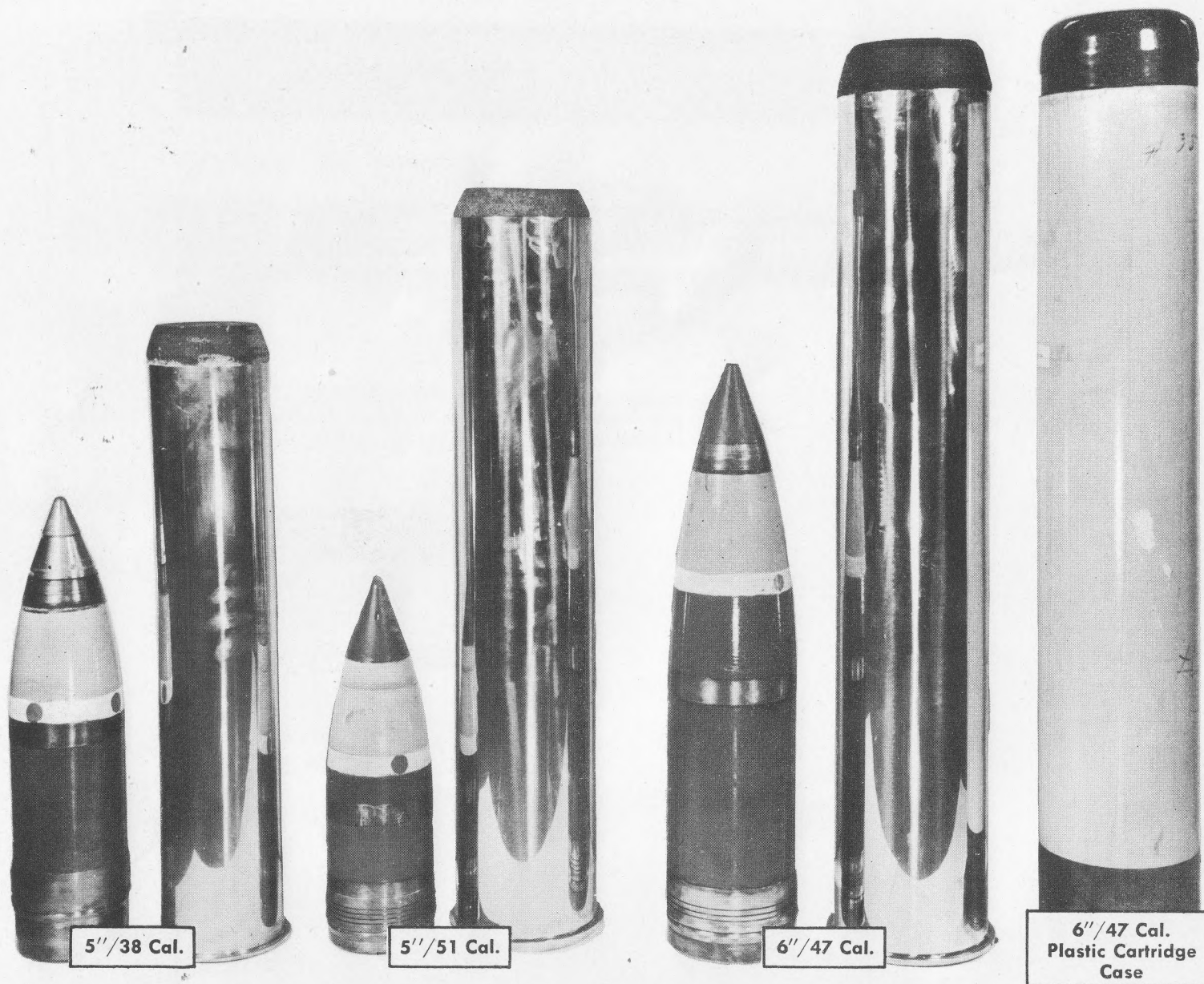
AP

SEMI-FIXED PROJECTILES



FIXED AMMUNITION

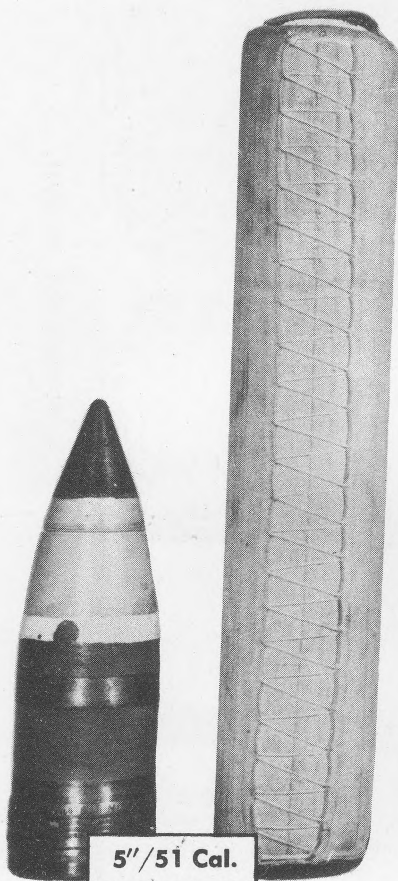
CONFIDENTIAL



SEMI-FIXED AMMUNITION

CONFIDENTIAL

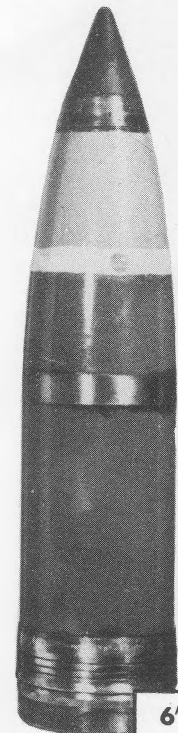
CONFIDENTIAL



5"/51 Cal.



6"/50 Cal.

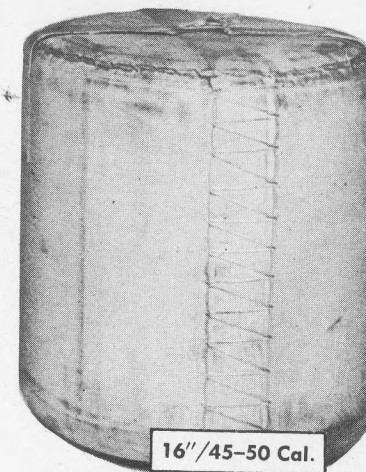
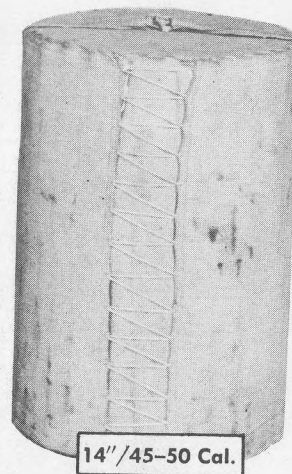
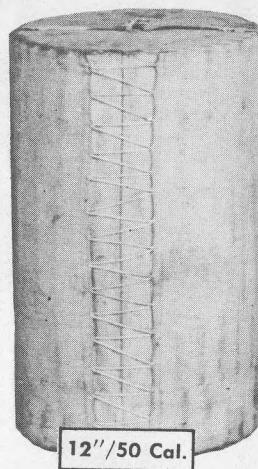
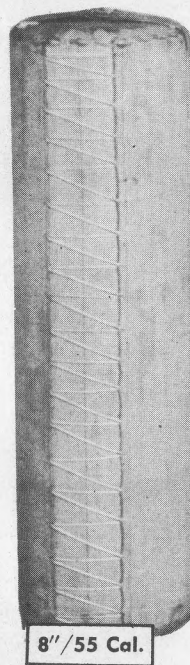
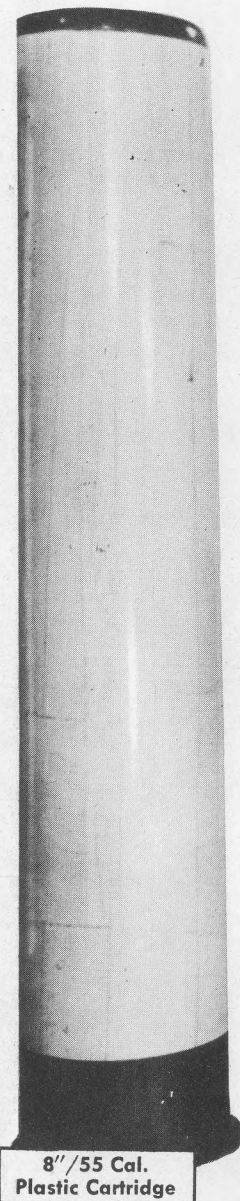


6"/53 Cal.

BAG GUN AMMUNITION

CONFIDENTIAL

CONFIDENTIAL



POWDER BAG CHARGES

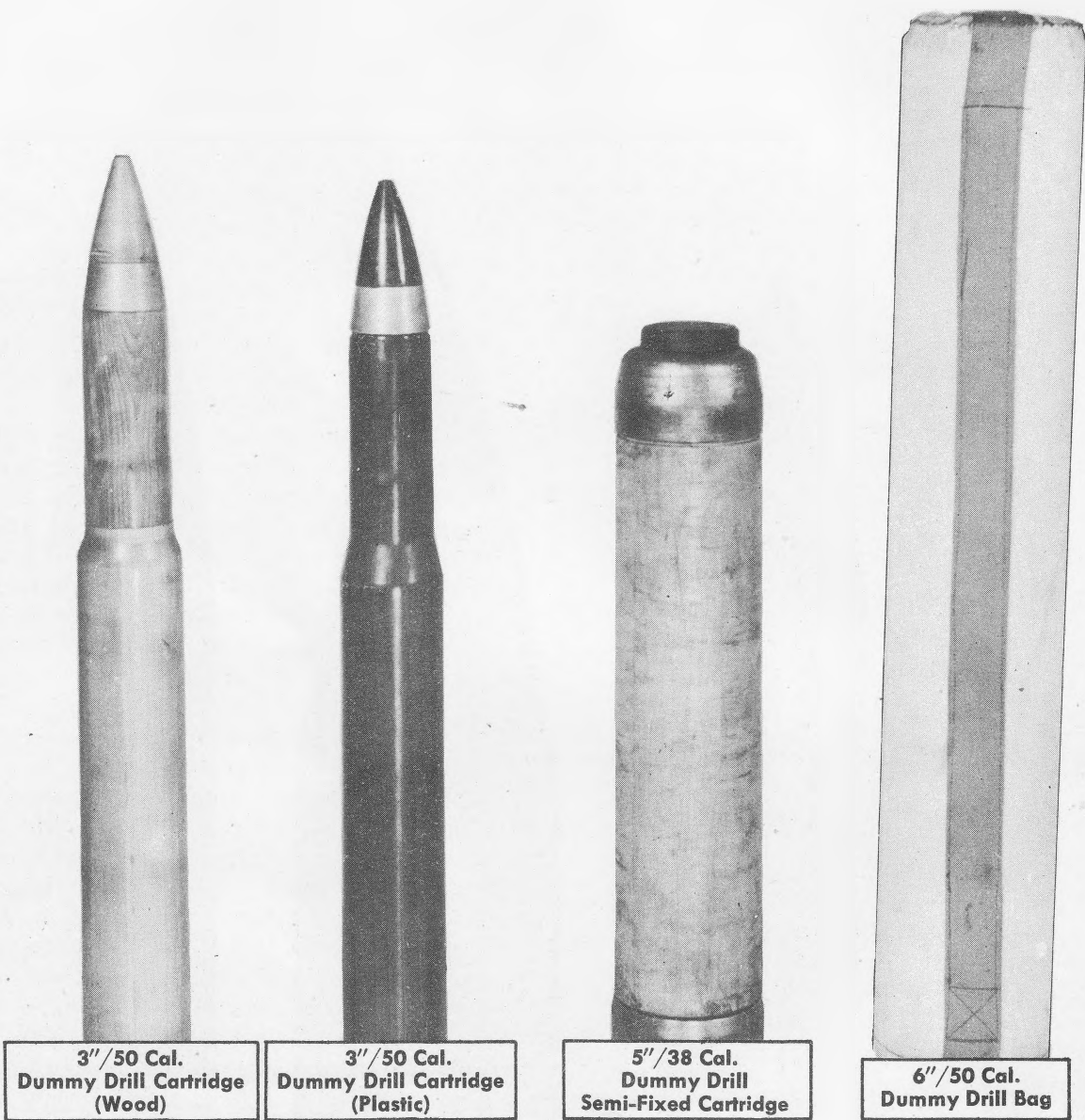
CONFIDENTIAL

CONFIDENTIAL



BAG GUN PROJECTILES

CONFIDENTIAL



DUMMY DRILL AMMUNITION

ASSEMBLY OF GUN AMMUNITION

The foregoing sections of this publication have dealt with structure, function, use, and marking of gun ammunition components. This section will be devoted to the assembly of the various components and details in order to prepare a complete round of gun ammunition.

LOADING OF PROJECTILES:

In many instances the impact damage which a projectile does is secondary to that which results from its burst. The design of many naval projectiles is such as to fulfill the following purposes: (a) carry a quantity of explosive into a target and provide for its detonation after entering the target, or (b) carry a quantity of explosive against or near a target and provide for its detonation as a means of producing a damaging explosion and producing missiles which are impelled by the action of the explosive. Thus the great majority of naval projectiles contain bursting charges.

Naval projectiles are loaded with the following explosives: TNT (e.g., 3" AA, 40 mm), black powder (e.g., expelling charge in illuminating projectiles, burster charge in one pounder projectiles), mixtures of TNT and black powder (e.g., three and six pounder and old type common projectiles), tetryl (e.g., 20 mm), and Exp. "D" (all other types of projectiles).

Note: Comp A is now being experimentally loaded into some projectiles.

There are certain factors which must be considered when selecting an explosive filler for projectiles. Since the effectiveness of a projectile depends primarily on its bursting power, it is desirable to use an explosive with as high a rate of detonation as possible. However, as a general rule, the sensitivity of explosives increases with the rate of detonation, and for this reason, the limiting factor in choosing an explosive for projectiles is its insensitivity to certain conditions of shock. To be more explicit the explosive used in projectiles must be sufficiently insensitive so that (1) detonation will not occur during the usual handling of the projectile, (2) detonation will not occur due to the terrific force of setback in the gun upon firing, (3) detonation will not occur, except by fuze action, when penetrative types of projectiles (AP, SpCom, Com) strike and enter armor plate. The explosive which meets these

requirements and yet has a relatively high rate of detonation is Exp "D," and, for this reason, the great majority of Naval projectiles are loaded with this explosive.

In general, the preparation of projectiles for loading is similar regardless of filler. The projectiles are cleaned, inspected, gauged and the cavity painted with an acid-resisting paint. The fuzes at the same time are inspected, gauged, and, if necessary, painted (never in 3" or larger). Two general types of projectile loading are used, being classed as loose fillers (e.g., black powder, black powder and TNT) and compact fillers (e.g., Exp "D," Cast TNT, Tetryl, Comp A). In the former, the density of the bursting charge is that of the loose, granular explosive, while in the latter, a greater density is obtained by a compression or casting of the explosive. The density of the bursting charge, which is referred to as the density of loading, is very rigidly controlled in order to insure the maximum rate of detonation of the projectile. The density of loading is specified for each particular projectile by the Bureau of Ordnance according to the filler and loading factor in order to give the maximum rate of detonation.

Projectiles which are to be loaded with loose fillers do not require base plugs but merely a hole in the solid base to accommodate a base fuze. When compact fillers which require pressing are used in projectiles which must be loaded through the base, a base plug must be employed which can be removed so that a ram of suitable size may enter the projectile to accomplish pressing. All openings in the base (around base plugs and base fuzes) must be sealed by gas check rings which consist of a tapered, soft lead washer encased in a copper ring. This is to prevent the hot propellant gases and flame from seeping through these openings and detonating the explosive filler in the gun when the projectile is fired from the gun.

LOADING WITH BLACK POWDER:

The projectile is placed nose down in a holder; a copper funnel is inserted in the base and the required amount of black powder is poured in. The powder is settled by tapping with a rawhide mallet or by a special settling table, which gives a bumping motion to the projectile carrier. A wooden former in the shape of the fuze, is then forced gently down, making a cavity the exact size of the fuze, the funnel

having been removed. The fuze threads are then cleaned with a small brush dipped in alcohol, and the fuze, on the threads of which a luting (resin base water-proofing compound) has been applied, is then entered and screwed home. The final setting home of the fuze is accomplished in a room barricaded by a concrete wall from the other operations. A special fuze wrench, or fuzing machine, is used for the purpose.

LOADING WITH BLACK POWDER AND TNT (granular):

Equal parts of explosive by weight are used in projectiles loaded with this mixed filler. The method employed is similar to the black powder loading method. The granular TNT is placed in the cavity first, the projectile is bumped or agitated, the Black Powder is added, and then the fuzes are assembled.

LOADING WITH CAST TNT:

The TNT is melted and poured into the projectile and allowed to cool and harden. In order to provide cavities for fuzes, holes of proper size are drilled into the TNT after casting, and the fuzes are then assembled.

LOADING WITH TETRYL (20 mm):

Granular tetryl, which is first consolidated into pellets in a pelleting machine, is used for this type of loading. The tetryl pellets are then pressed into the projectile burster cavity in two increments — two pellets for the first consolidation, and a third pellet for the second consolidation. After this, the surplus of tetryl pressed into the projectile is faced to the proper height before the assembly of the fuze.

An alternate method consists of pressing the granular tetryl into the projectile directly in increments without first consolidating the tetryl into pellets.

In the case of 20 mm HEI projectiles, which contain an incendiary mix in addition to tetryl, the incendiary mix is put into the projectile cavity first with the tetryl pellets next, and the entire filler is consolidated as previously explained.

LOADING WITH EXP "D":

Since Exp "D" is the most widely used explosive filler for Naval projectiles, the method of loading it into projectiles will be discussed quite thoroughly in this publication.

COMPOSITION AND PROPERTIES OF EXPLOSIVE "D":

While the composition and properties of Exp "D" are discussed in a separate bulletin, it may be noted here that it is the chemical compound ammonium picrate which is produced in relatively fine crystalline form, yellow to orange in color. It cannot be melted without the danger of exploding and for this reason cannot be loaded by casting. If exposed to certain metals, including iron, it reacts to produce sensitive and dangerous picrates.

LOADING BY PRESSING:

The finely crystalline form of Exp "D" adapts it very well to pressing under constant pressure with a hydraulic ram and this is the method employed in loading projectiles. Since it is quite insensitive to friction or shock, this pressing operation is not unduly hazardous. However, the necessary precautions are taken as is the case in the handling of all explosives. The actual pressing is done automatically in a separate, explosion proof room so that operating personnel are protected in the event of an explosion. The necessary weighing and handling is carried on outside of the press room and entrance to the press room is gained through a heavy sliding door, which is closed during pressing operations. The actual pressing is controlled by the operator outside of the press room and may be observed through a periscope.

DENSITY OF LOADING:

Density of loading refers to the weight of the explosive per unit volume and in all cases it can be compared to the density of water (1 gram per cubic centimeter). Bulk or loose Exp "D" has a density of 0.88 (0.88 grams per cubic centimeter) and it may be safely pressed to a density of 1.70. When pressed to a greater density, "dead loading" may result which means that the explosive loses its capacity to detonate. The pressure applied to obtain the proper density of loading should never be greater than 10,000 lbs. per sq. inch, and in the actual practice of loading 5"/38 AA Common projectiles, for example, "D" is pressed at about 8,000 lbs. per sq. inch.

Density of loading and its uniformity throughout the explosive charge, are related to the maximum explosive force obtainable upon detonation, and each type of projectile is loaded to a predetermined density to achieve the best results.

LOADING BY INCREMENTS:

As a means of obtaining a uniform density throughout the cavity of the projectile, the "D" is pressed in small amounts, called increments, one at a time until the cavity is full.

The density of "D" required for each type of projectile is determined and specified by the Bureau of Ordnance and while the procedures for determining the total weight of "D," the number of increments, the weight of each increment, and methods of pressing are more or less standardized, they are in themselves very precise.

PRODUCTION PROCEDURES FOR 5"/38 AA COMMON:

Production procedures for 5"/38 AA common projectiles are herein described as being fairly representative of production procedures for the "D" loading of all types of projectiles.

The empty projectiles come from the manufacturer in wooden boxes. They are unboxed and the nose and base shipping plugs are removed and these are carefully preserved and returned to the manufacturer for reuse. The projectiles are thoroughly cleaned with turpentine or a substitute cleansing agent. The cavity is checked for complete cecaline coverage, cecaline being an asphaltic paint applied to all metal surfaces which will be exposed to "D" to prevent sensitive picrates from forming. The projectiles are thoroughly dried after cleaning (and cecalining, if this has been necessary) before they are sent to the gauging and painting operations.

All projectiles have the bourrelets gauged to check on the diameter. The rotating bands and all fuze hole threads are also gauged. The projectiles are then painted with a quick-drying paint, the idea being to have the color show clearly and have the paint as thin as possible. A colored band one caliber wide designating the burster charge (yellow for "D") is painted around the forward end of the empty projectile. If the projectile is to carry a tracer element, a white band one inch in width is painted below the painting applied to designate the burster charge. Tracer components other than white may be designated by three colored spots applied on the white band, e.g., red-spots for red tracer.

After painting, the empty projectiles are carefully weighed. This is a very important step since the finished projectiles must fall within a certain completed weight range (maximum 55.40 lbs.,

minimum 54.70 lbs.) and they are all filled with the same amount of "D." If the weight of the empty projectile does not fall within the specified limits (maximum 42.45 lbs., minimum 41.75 lbs.) it is rejected and returned to the manufacturer. The empty weight is clearly chalked on each projectile and the weighers stamp certain required data on each rotating band. After weighing and stamping and if left standing, the projectiles are covered to prevent foreign matter from falling into the cavity.

Prior to the actual loading of the projectiles, a brass base plug is screwed into the base and a brass ram guide is screwed into the nose. The ram guide prevents possible damages to the nose threads of the projectile by the ram. The first increment of Exp "D" is weighed out and put into the projectile; the projectile is clamped in the press and pressing operations are begun. Each succeeding increment is pressed in until the cavity is filled. In the case of a 5"/38 AA common projectile six increments are required as follows: 2.25 lbs., 1.60 lbs., 1.50 lbs., 1.10 lbs., 0.90 lbs., and 0.70 lbs.

In order to check the density of the pressed "D" in loaded projectiles, one projectile is selected from each eight-hour run and the pressed "D" is removed from the core and sidewalls in such a way that several samples in solid form and approximately one cubic inch each can be prepared. These are tested for density by mercury displacement according to very precise procedures.

After each projectile has been press loaded, the ram guide and base plug are removed, all threads in the base and nose of the projectile are thoroughly cleaned and drill guides are screwed into the base and nose. The holes are then drilled into the solidly pressed Explosive "D" to accommodate both a base and auxiliary detonating fuze. The depths of these holes are carefully gauged. Luting is applied to all base and nose fuze threads and non-sparking tools are used for inserting auxiliary detonators, fuzes and tracers. When the fuzing and tracing operation is completed, each projectile is carefully weighed to see that it meets specifications in this regard. A record of every projectile is kept as to mark, mod., lot of each component, empty projectile weight, loaded projectile weight, and amount of "D" actually in the projectile. The actual weight of Explosive "D" is stamped on the rotating band of each projectile.

After the final weighing of each projectile, a gas check seal is pressed into place around the base fuze,

and the fuze-protecting cap is screwed on. A protecting grommet is then secured around each rotating band and all the unpainted steel of the finished projectile is greased. Bronze or steel waterproof fuze covers which thread on to the projectile are used on all HC and AA Common projectiles 5"/38 and above. An older type waterproof fuze cover made of light weight copper secured to the body by a soldered tear strip is used on 5"/25 AA Com and some 5" and 6" SS projectiles. Grommets and waterproof fuze covers are not required on fixed projectiles since they are shipped in containers. A white vertical line is painted on the 5"/25 and 5"/38 AA com projectiles directly under the fixed lug on the mechanical time fuze to aid in positioning the projectile in the fuze setter.

LOADING WITH COMPOSITION A:

It should be noted here that at the present time some 3" AA and AP, 5" com, 6" AP and HC, and 8" AP projectiles are being loaded with Comp. A as an experimental lot. Comp. A is a new explosive consisting of wax-coated RDX — 91 per cent RDX, 9 per cent wax. Preliminary testing of Comp. A loaded projectiles have indicated that Comp. A has 35-40 per cent more power than TNT or Exp "D" and will produce 20 per cent higher velocity of fragments with 70-90 per cent more fragments upon detonation of AP projectiles.

Since Comp. A is a granular substance not adapted to melting and casting, it is press loaded into projectiles by methods very similar to Exp "D" loading.

All projectiles are loaded as herein described regardless of whether they are to be used in fixed, semi-fixed, or bag gun ammunition.

It is well to note that in the assembly of components to a projectile, anything that is pushed by the projectile in flight is assembled with a right hand thread and anything that is pulled by the projectile is assembled with a left hand thread, *i.e.* nose fuzes and adapter rings — right hand thread; auxiliary detonating fuzes — left hand thread; base fuzes and tracers — left hand thread. By following this procedure, the components threaded into the projectile will tend to tighten in flight rather than loosen since the projectile rotates to the right in flight.

CARE OF FINISHED PROJECTILES:

It cannot be emphasized too greatly that the manufacture of projectiles is a costly, precision job

and that the finished products should be treated with the utmost care if they are to be useful to the purpose for which they have been made. Under ordinary conditions, the proper stowage and handling of projectiles includes: (a) keeping the protecting grommets tightly secured, (b) keeping the waterproof fuze covers secured, (c) replenishing the grease covering on exposed steel, especially the bourrelet, (d) avoidance of pressure or strain on the waterproof fuze cover or fuze, (e) protection of the tracer and base fuze against moisture, (f) keeping the projectile clean, (g) protection against high temperatures, and (h) protection against rough handling.

ASSEMBLY OF FIXED CARTRIDGES:

The first step in the assembly of fixed ammunition is to secure the primer in the cartridge case which has been previously cleaned, gauged and marked. The primer may be of the screw fit or push fit type but in either case luting is applied to the threads or taper of the primer to effect a water tight seal. If the primer is of the combination type it is immediately tested electrically after assembly to the cartridge case to determine the resistance of the platinum wire bridge and this must fall within certain specified limits.

The smokeless powder that is to be used in cartridges or powder bags must be screened and sorted before assembly. Standard hygrometric conditions — a minimum of 4° between wet and dry bulb thermometer readings — must exist before exposing smokeless powder to the atmosphere and then only a twenty-minute supply of powder is exposed at one time to prevent damage to the powder. The required amount of smokeless powder is weighed out and placed in the cartridge case. The required amount of lead foil or lead powder* is weighed out and placed on top of the smokeless powder. At this point a paper ammunition identification tag giving complete information about the round is placed in the cartridge case. Since the filling of a cartridge case completely with smokeless powder would result in too high a density of loading, a cardboard wad is inserted in the case and pushed down on top of the smokeless powder in order to hold it in place. A cardboard spacer or distance piece is then placed in the case on top of the wad in order to hold it in

* Lead foil or powder is assembled in cartridges to decopper the bore of a gun which becomes coppered by the projectile rotating band.

place. If flashless pellets* are required, they are weighed out and placed in the cartridge case around the distance piece. The final assembly operation consists of inserting the base of the projectile into the mouth of the cartridge case, pressing it down into position, and finally crimping the cartridge case to the projectile if required. The base of the projectile is shellacked prior to assembly to afford a water-tight seal. The projectile now bears against the distance piece and holds it in place. After the round is completely assembled, it is gauged in a chamber gauge which simulates the chamber of the gun for which the round was designed. The cartridges are then greased and boxed or tanked for shipment.

ASSEMBLY OF SEMI-FIXED CARTRIDGES:

The assembly of semi-fixed cartridges is identical to fixed cartridges with the exception of the final assembly operation. Instead of inserting a projectile into the cartridge case, it is sealed off with a heavy cork plug which is shellacked in place in the mouth of the case. The cork plug is graphite treated to make it moisture proof. This cork plug not only acts as a seal for the case to keep the smokeless powder airtight, but affords a bumper or buffer as the cartridge is loaded into the gun and rammed against the projectile.

Before tanking a semi-fixed cartridge, a device called an extractor is fitted around the lip of the

* Flashless pellets are assembled in cartridges in order to make smokeless powder flashless for night operations if it is not already made so in manufacture.

cartridge to protect the primer and to aid in the extraction of the cartridge from the tank. An extractor is also used on 3"/50 cartridges contained in tanks.

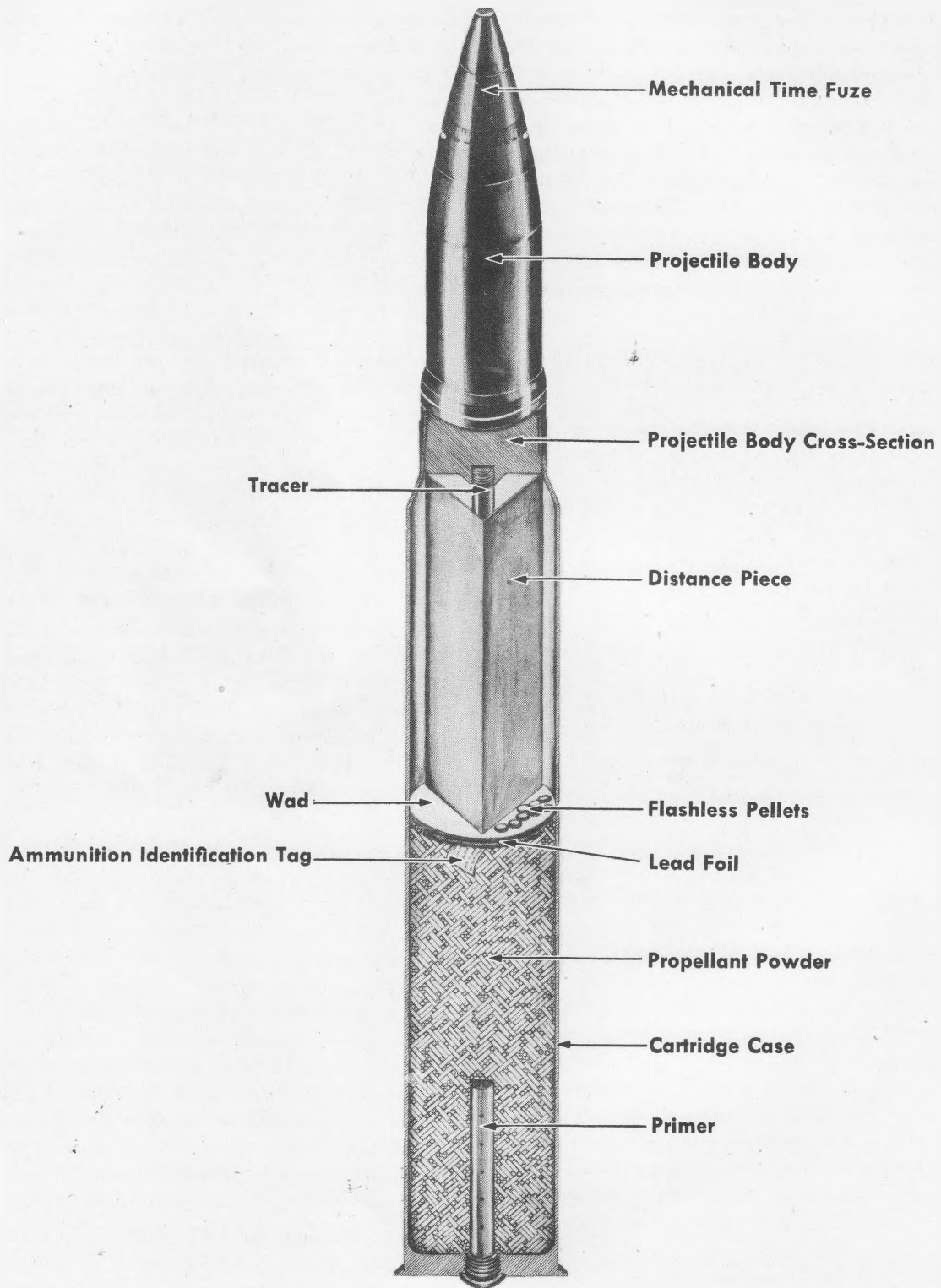
ASSEMBLY OF BAG CHARGES:

As previously explained, bag charges are either prepared by vertically stacking the grains of powder end to end into the silk bag, or by dumping the grains into the bag.

In the assembly of unstacked (dump) charges, the powder is merely weighed out and dumped into the properly identified powder bag to which the black powder ignition pad has previously been secured. Flashless pellets and lead foil or powder is then added if required and the bag is then laced closed with silk cord. After rolling the charge to form it as well as possible, a silk ammunition identification tag is placed under the lacing, the bag is gauged for length and diameter and placed ignition end down in its air tight tank in which a clean piece of wrapping paper has first been placed.

Stacked charges are prepared by employing special machines of which there are several different types differing at each depot in details of construction. The essential feature is the device for arranging the powder grains on end in layers and transferring the layers to the stacking cylinder from which they are placed in the bag. Following this, the lead foil or powder is placed on top of the powder, if required, and the bag is laced, gauged, and tanked as in an unstacked charge.

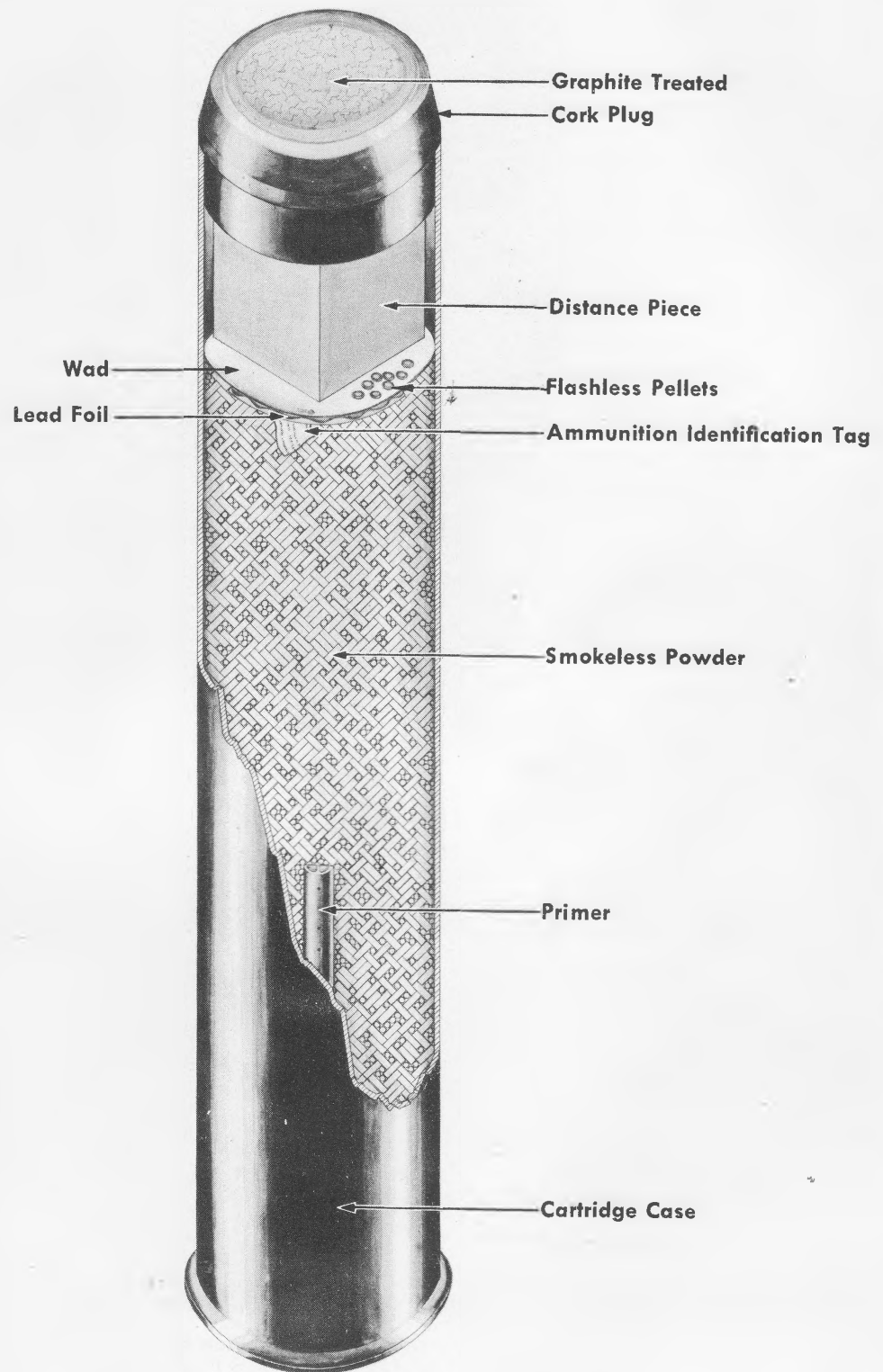
CONFIDENTIAL



FIXED CARTRIDGE

CONFIDENTIAL

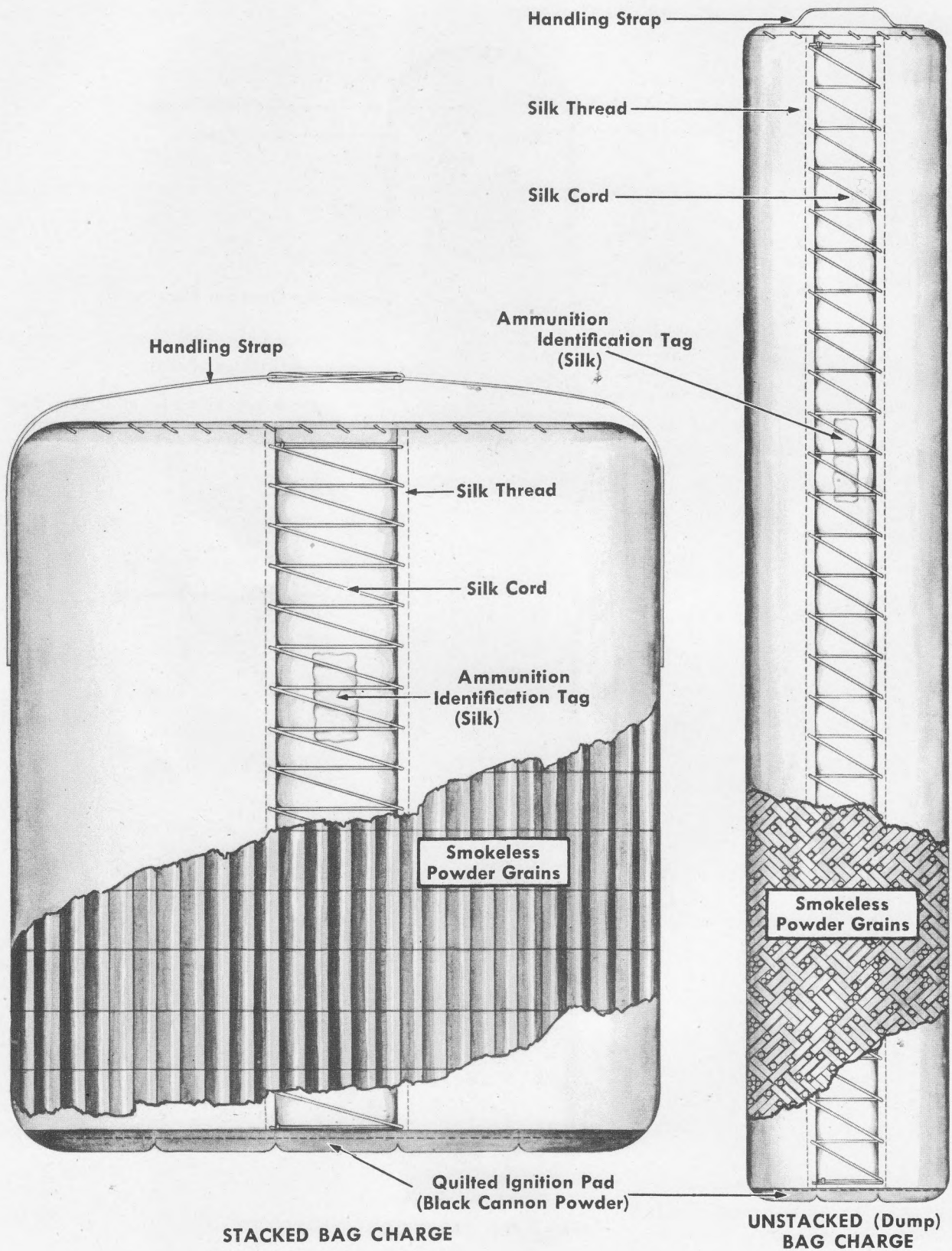
CONFIDENTIAL



SEMI-FIXED CARTRIDGE

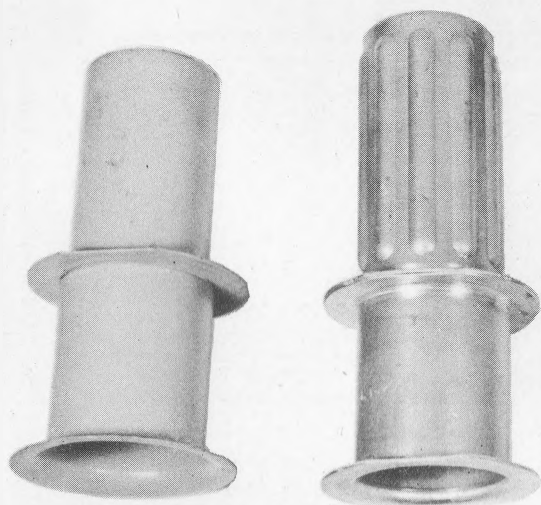
CONFIDENTIAL

CONFIDENTIAL

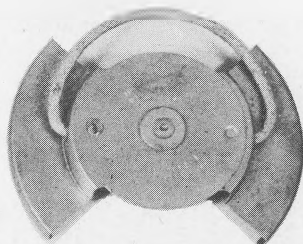


CONFIDENTIAL

CONFIDENTIAL



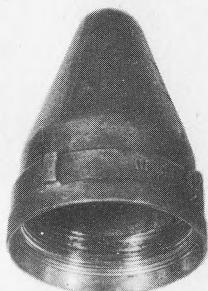
Projectile Nose Supports



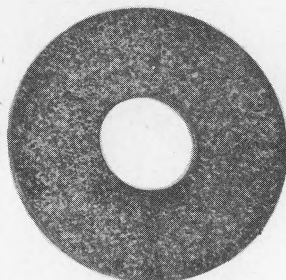
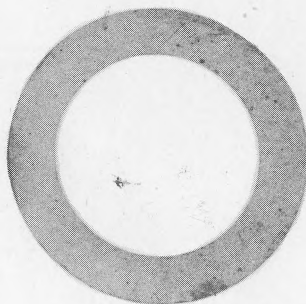
Adapter Rings

Gas Check Seal

Extractor



Fuze Protecting Cap



Space Blocks

CONFIDENTIAL

AMMUNITION DETAILS

CONFIDENTIAL

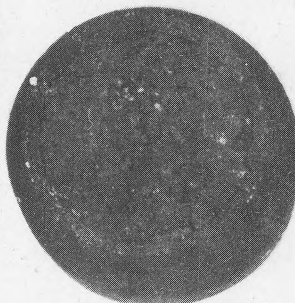
AMMUNITION DATA CARD					
Semi-Fixed Cartridge					
Caliber: 12 M/M		Ammunition Lot No. 11-136-1141			
Type: Service		Quantity in Lot: 400			
For Gun: French Battleship, CI Four					
Code No.: Requested		Date:			
Assembled By: Hingham, Mass.		Job Order: 4338			
Prep. Order: 124-11-41		Weight of Charge: 27.68 lbs		I.V. 270 E. S	
Powder Index: S.P. 13-1803		Lot: 125		CI Four	
Ammunition Officer: F.W. 13		Commanding Officer: A.H.B.			
Description of Ammunition		No. and Kind	Manufacturer	Lot No.	Year Mfg.
Cartridge Case		125 Round 125/127	Winchester	44	1942
Primer		125	Winchester	44	1942
Cartridge No.		125/127	Winchester	44	1942
Case No.		125/127	Winchester	44	1942

Ammunition Data Card

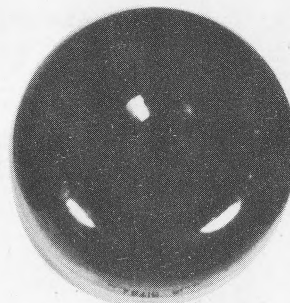
U. S. Naval Ammunition Depot, Hingham, Mass.	
Fixed Case Ammunition	
Caliber: 12 M/M	Case Gun: 1 Round
Code No.: Requested	Quantity in Lot: 400
Assembled By: Hingham, Mass.	Date:
Prep. Order: 124-11-41	Weight of Charge: 27.68 lbs
Powder Index: S.P. 13-1803	Lot: 125
Ammunition Officer: F.W. 13	Commanding Officer: A.H.B.

U. S. Naval Ammunition Depot, Hingham, Mass.	
Fixed Case Ammunition	
Caliber: 12 M/M	Case Gun: 1 Round
Code No.: Requested	Quantity in Lot: 400
Assembled By: Hingham, Mass.	Date:
Prep. Order: 124-11-41	Weight of Charge: 27.68 lbs
Powder Index: S.P. 13-1803	Lot: 125
Ammunition Officer: F.W. 13	Commanding Officer: A.H.B.

Ammunition Identification Tags



Cork Plug



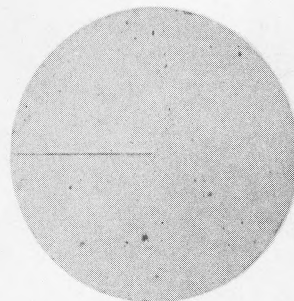
Plastic Plug



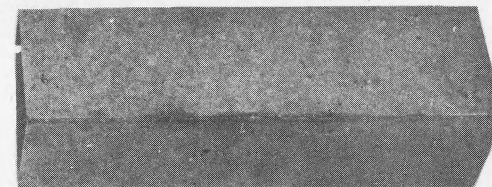
Grommet



Lead Foil



Wad



Distance Piece

AMMUNITION DETAILS

CONFIDENTIAL

AMMUNITION LOT NUMBER SYSTEM

An ammunition lot number identifies a given quantity of ammunition which has been assembled with homogeneous components in order to attain a consistent standard of operation.

The ammunition lot system provides the following:

(a) A single identifying number for complete rounds of ammunition. This number may be used for control purposes in recording, stowage, shipping and surveillance.

(b) A means whereby ammunition assembled with defective components may be withdrawn from the fleet or suspended from issue by the depot.

(c) Ammunition quality control by firing random samples of an ammunition lot.

STRUCTURE:

The ammunition lot number consists of:

(1) A *two letter prefix* for new assemblies to indicate the caliber and type of ammunition (see Table 1). The first letter in each case is the same letter now used in designating smokeless powder granulations for the caliber, while the second letter is a random assignment to specify certain types within the caliber — *i.e.* "AC" means 4"/50 HC ammunition.

In the case of reworked ammunition, a three letter prefix is used for the reworked ammunition, the first two letters of which are the same as for new assemblies and the third letter is an "R" to designate a reworked lot — *i.e.* "ACR" means 4"/50 HC ammunition which has been reworked.

(2) A *numerical group* assigned in sequence from 1 to 9999, beginning with lot 1 for the first lot started in each calendar year. New and reworked lots are assigned numbers in the same sequence.

(3) A *suffix* consisting of the depot's or manufacturer's designating letters and the year of assembly or rework — *i.e.* "H-44" stands for an assembly of ammunition at NAD Hingham in 1944 (see Table 2).

For example: AC-10-H-44

This is the tenth lot of 4"/50 HC ammunition assembled at Naval Ammunition Depot, Hingham, Massachusetts, in 1944.

An ammunition lot number identifies a complete round in the case of fixed ammunition but only part of a round in the case of separate loading ammunition — *i.e.* projectiles or cartridges in semi-fixed

ammunition and projectiles or bag charges in bag gun ammunition. In other words, in the case of ammunition other than fixed, there is one ammunition lot number for the cartridge or bag charge and another for the separate loading projectile.

AMMUNITION DATA CARDS:

(1) Complete information on all the components in an assembly lot of ammunition, as well as an identification of the guns in which the ammunition should be used, is given on the Ammunition Data Cards. An appropriate data card can be found in every ammunition box, cartridge tank, and powder tank which contains fixed, semi-fixed, or bag charge ammunition assembled or reworked under the ammunition lot system. No data card is placed in boxes containing separate loading projectiles or is attached to projectiles which are not boxed. However, several copies of the data card are furnished with any shipment of ammunition.

(2) Samples of Ammunition Data Cards are shown in Plates 1 through 5.

FACTORS DETERMINING AMMUNITION LOT NUMBER:

The ammunition lot system is applied to the assembly of all Navy type gun ammunition, including ammunition which is overhauled or assembled from components derived from breakdown. The following conditions govern the assembly of ammunition in one ammunition lot:

(1) There is only one mark and mod of each component. (Exceptions are the 5"/25 illuminating projectiles Mk 27 Mods 1 through 9 which may be assembled into ammunition lots in the groupings Mk 27 Mods 1-5 or Mk 27 Mods 6-9.)

(2) Only one index and weight of charge can be used. One lot cannot be assembled both with and without flashless pellets.

(3) The mark, mod, and lot number of the following components affect the assignment of an ammunition lot:

cartridge case
primer
projectile
nose fuze
base fuze
auxiliary detonator
tracer

Lot control on cartridge cases, projectiles and tracers may be dropped in some instances. However, only one color of tracer may be assembled in one ammunition lot.

(4) An ammunition lot may be packed in either boxes or tanks but not in both. Interchangeable boxes and tanks may be grouped by mod in one lot, however.

(5) Secondary components, such as plugs, gas checks, and waterproof protecting caps, have no effect on the assignment of an ammunition lot number. Similarly, the color of a separate windshield dye load or the absence of a dye load has no bearing, although, as a general rule, there would be only one color of dye.

The ammunition lot system is based on one standard for new assemblies and another for reworked ammunition.

COMPOSITION AND SIZE OF AMMUNITION LOTS — NEW ASSEMBLY:

(1) The ammunition lot system is applied to new assemblies of fixed ammunition, semi-fixed cartridges and separate loading projectiles as follows:

(a) Component Lots

Only components which have not been previously assembled are used in new assembly and those component lots are listed on the data card. It is permissible to use cartridge cases which have been previously assembled, as an exception to that rule, and when that is done, cartridge case lots are not required on the data card.

(b) Lot Sizes

The size of ammunition lots and component lots

is given in Table 3. The most desirable ammunition lot size is the maximum lot size.

(c) Number of Component Lots in an Ammunition Lot

The maximum number of component lots which may be used in an ammunition lot is given in Table 3. It is desirable both from an operating standpoint and a control standpoint to keep the number of component lots at a minimum. When it is necessary to assemble more than one lot of a component in an ammunition lot, then the lots should be made by the same manufacturer and they should be succeeding lots in order of number wherever possible.

The following example represents the ideal combination of component lots in one ammunition lot consisting of 1,000-5"/38 projectiles (see table below).

(d) Limitation on the Distribution of a Component Lot

In general, a component lot may not be assembled in more than the maximum number of ammunition lots as shown in Table 3. Assembling depots are authorized to exceed these limitations when reworking a large number of small lots and in the assembly of illuminating projectiles.

(e) Remnant Lot Distribution

A remnant lot is a component lot which is too small to be used in accordance with the general rules governing the assembly of ammunition in an ammunition lot. Remnant lots are accumulated and assembled into one ammunition lot. However, no more than five remnant lots of any one component can be assembled into an ammunition lot although there is no objection to the

Projectile	Nose Fuze	Base Fuze	Aux Fuze	Tracer
Mk 35-6	Mk 50-1	Mk 28-15	Mk 54-0	Mk 9-0(W)
Manufacturer	Loading Plt.	Loading Plt.	Loading Plt.	Loading Plt.
E.M.	F.A.	Bellevue	A.O.P.	N.O.P.M.
Yr. Spec. 1937	Yr. Ld. 1943	Yr. Ld. 1944	Yr. Ld. 1944	Yr. Ld. 1944
Lot	Lot	Lot	Lot	Lot
580	524	3041B	3390A	3896M
581				

CONFIDENTIAL

assembly of five remnant lots of each component in an ammunition lot. The quantity of each component can be evened off to the quantity in the ammunition lot by using a sixth and unbroken lot in the assembly.

Example for 5"/38 projectile lot:

(a) Explosive Components except Tracers

The lots of explosive components, such as nose fuzes, auxiliary detonators, base fuzes and primers, are recorded on the data card when these components are assembled into a rework ammunition lot. In general, this is possible be-

Projectile		Nose Fuze		Base Fuze		Aux Fuze		Tracer	
Mk 35-6		Mk 50-1		Mk 28-15		Mk 54-0		Mk 9-0 (W)	
Manufacturer		Loading Plt.		Loading Plt.		Loading Plt.		Loading Plt.	
E.M.		F.A.		Bellevue		A.O.P.		N.O.P.M.	
Yr. Spec. 1937		Yr. Ld. 1943		Yr. Ld. 1944		Yr. Ld. 1944		Yr. Ld. 1944	
Lot	Quan	Lot	Quan	Lot	Quan	Lot	Quan	Lot	Quan
582	496	516	51	3031B	71	3376A	8	3852M	5
		517	62	3032B	17	3377A	47	3853M	6
		518	101	3033B	82	3378A	54	3854M	10
		519	25	3034B	43	3379A	3	3855M	7
		520	16	3035B	10	3380A	5	3856M	21
		532	241*	3051	273*	3391	379*	3884	447*

*Unbroken lot

The quantities have been given in this example for purposes of illustration only. No component lot quantities are required on the data card. It is intended that the maximum number of remnant lots which can be assembled in one ammunition lot will be assembled as soon as they are accumulated.

(2) The ammunition lot system is applied to the original assembly of bag charges as follows:

(a) The quantity in an ammunition lot of bag charges is governed by the quantity specified on the preparation order (prep. order).

(b) Only one ammunition lot number is assigned by a depot to those bag charges which are assembled under one preparation order.

COMPOSITION AND SIZE OF AMMUNITION LOTS — REASSEMBLY:

(1) The ammunition lot system is applied to the reassembly of fixed ammunition, semi-fixed cartridges, and separate loading projectiles, calibers 3" through 16", as follows:

cause these components are new in reassembled ammunition. If any of these components which have been derived from breakdown can be used again, they are segregated by lot. However, the minimum size of a component lot which can be reassembled is 100, and such a lot cannot be reassembled in more than two ammunition lots.

(b) Inert Components and Tracers

The lots of projectiles, cartridge cases and tracers which have been derived from breakdown are not recorded on the data card and the word "Mixed" is written in the lot column. But, if new components are used, the lot numbers are recorded.

(c) Smokeless Powder

Smokeless powder derived from breakdown may be reassembled into either cartridges or bag charges under a rework ammunition lot number.

(d) Lot Sizes

The size of a reworked ammunition lot ranges between the minimum and maximum figures specified in Table 3.

CONFIDENTIAL

(e) Number of Component Lots in a Reworked Ammunition Lot

The maximum number of new lots of explosive components, such as nose fuzes, auxiliary detonators, base fuzes, and primers, which may be used in a reassembled ammunition lot is given in Table 3. When it is necessary to assemble more than one lot of a component in an ammunition lot, the lots must be made by the same manufacturer and should be, wherever possible, succeeding lots in order of number. Periodically, in order to effect disposition of remnants, the assembly of up to six lots of each component can be assembled into an ammunition lot. In the event that any of these components have been derived from breakdown, up to six lots may be assembled into an ammunition lot as long as all of the lots are from the same loading plant and each lot contains a minimum of 100.

There is no limitation on the number of lots of projectiles, cartridge cases, or tracers derived from breakdown, which may be reassembled into one ammunition lot.

The following example represents a reassembled lot of 1,000-5"/38 projectiles:

Projectile	Nose Fuze	Base Fuze	Aux Fuze	Tracer
Mk 35-6	Mk 50-1	Mk 28-15	Mk 54-0	Mk 9-0 (W)
Manufacturer	Loading Plt.	Loading Plt.	Loading Plt.	Loading Plt.
E.M.	F.A.	N.G.F.	A.O.P.	
Yr. Spec.	Yr. Ld. 1943	Yr. Ld. 1944	Yr. Ld. 1944	Yr. Ld.
Lot	Lot	Lot	Lot	Lot
Mixed	551	3026B	3396A	Mixed

(2) The ammunition lot system is applied to the reassembly of bag charges as follows:

(a) A new rework number is assigned to any bag charges which are assembled from powder derived from breakdown. Rebagging is also considered in this category. In addition, a new rework lot number is assigned whenever the weight of charge is changed or flashless pellets are added to an existing bag charge.

(b) The minimum number of bag charges within one index which can be reassembled and assigned a new rework lot number is as follows:

Caliber	Quantity
5"	125 charges
6"	75 charges
8"	35 charges
12"	5 charges
14"	5 charges
16"	5 charges

There is no limitation on the maximum number of charges from one index which can be assembled in one rework ammunition lot.

COMPOSITION AND SIZE OF AMMUNITION LOTS — OVERHAUL:

(1) The ammunition lot number is not changed when ammunition is overhauled. As a general rule, ammunition not assembled under a lot number is broken down with an exception in the case of bag charges. When fleet return bag charges of a single caliber, index and weight of charge not under an ammunition lot number are on hand in quantities greater than those specified in paragraph (b) below, depots are authorized to overhaul these charges and assign a rework lot number.

(2) The minimum quantity of one ammunition lot which can be overhauled is as follows:

(a) Fixed ammunition, semi-fixed cartridges, separate loading projectiles, calibers 3" through 16".

Caliber	Quantity
3" through 7"	100
8" through 16"	25

(b) Bag charges

Caliber	Quantity
5" through 8"	25
12" through 16"	5

These quantities do not include those rounds or charges which must be broken down for test

CONFIDENTIAL

purposes. Quantities smaller than those listed are handled on a breakdown — reassembly basis.

(3) When ammunition has been overhauled, the following note is placed on the original lot card: (Number of cartridges, projectiles or bag charges) were overhauled by (Depot name) on (given date).

COMPOSITION AND SIZE OF AMMUNITION LOTS — BREAKDOWN, REASSEMBLY OF NEW LOTS:

(1) A new rework lot number is assigned and a new data card made out when a new ammunition lot is broken down and reassembled. The ammunition lot number is not changed when ammunition is changed from boxes to tanks or vice versa.

(2) The same rule applies to the recording of component lots on the new data cards as was used in setting up the original card. If the ammunition lot was a new assembly, all component lots are recorded, whereas if the lot was a rework assembly, only explosive component and new inert component lots are recorded.

(3) The minimum quantity in an unissued ammunition lot which may be broken down and reassembled under a new rework lot number is as follows:

Caliber	Quantity
3" through 7"	100
8" through 16"	25

All new ammunition lots which are in stock in quantities less than those specified are reworked on the same basis as "Fleet Return" ammunition under Rework Order authority.

LOCATION OF AMMUNITION LOT NUMBER:

The Navy gun ammunition lot number can be found in the following locations:

(1) *Fixed Ammunition and Semi-Fixed Cartridges:*

- (a) Stencilled on the side of cartridge cases
- (b) Stencilled on all external containers.
- (c) Printed or stamped on all data cards.

(2) *Semi-fixed and Bag Gun Projectiles:*

- (a) Stencilled on the projectile body between the rotating band and the bourrelet.
- (b) Printed or stamped on all data cards.

(3) *Bag Gun Charges:*

- (a) Stencilled on the powder bag.
- (b) Stencilled on all external containers.
- (c) Printed or stamped on all data cards.

TABLE 1 LOT NUMBER PREFIX DESIGNATIONS

1. Tabulated below are the designating letters to be used in assigning ammunition lot numbers:

Designation	Type
ZA — 20 mm HE Cartridges	
ZB — 20 mm HET Cartridges	
ZC — 20 mm HEI Cartridges	
ZD — 20 mm AP Cartridges	
ZE — 20 mm APT Cartridges	
ZF — 20 mm BL and T Cartridges	
ZG — 20 mm BL and P Cartridges	
UA — 40 mm HE-P Cartridges	
UB — 40 mm HE-T-SD Cartridges	
UC — 40 mm AP Cartridges	
UD — 40 mm AP-T Cartridges	
UE — 40 mm BL-T Cartridges	
UF — 40 mm BL-P Cartridges	
UG — 40 mm HE-I-T-SD Cartridges	

Designation	Type
UH — 40 mm HE-SD Cartridges	
UJ — 40 mm HE-I-P Cartridges	
UK — 40 mm HE-I-SD Cartridges	
UL — 40 mm HE-I-T Cartridges	
YA — 1.1 AA Cartridges	
YB — 1.1 AA-SD Cartridges	
YC — 1.1 Tgt Cartridges	
VA — 1 pdr Com Cartridges	
VB — 1 pdr Tgt Cartridges	
TA — 3 pdr Com Cartridges	
TB — 3 pdr Tgt Cartridges	
SA — 6 pdr Com Cartridges	
SB — 6 pdr Tgt Cartridges	

CONFIDENTIAL

TABLE 1 — Continued

Designation	Type	Designation	Type
PA—3"/23 Com Cartridges		CA—6"/47 AP Projectiles (130#)	
PB—3"/23 AA Cartridges		CB—6"/47-50-53 Com Projectiles	
PC—3"/23 Ill Cartridges		CC—6"/47-53 HC Projectiles	
PD—3"/23 Tgt Cartridges		CD—6"/47-50-53 Ill Projectiles	
PE—3"/23 HC Cartridges		CE—6"/47 Tgt Projectiles (130#)	
		CF—6"/47-50-53 Projectiles (105#)	
PI—3"/50 Com Cartridges		CH—6"/47 Ser Ctgs. (2500 fs) (130# projectile)	
PJ—3"/50 AA Cartridges		CI—6"/47 Ser Ctgs. (2800 fs) (105# projectile)	
PK—3"/50 AP Cartridges		CJ—6"/47 HC Ctgs. (2250 fs) (105# projectile)	
PL—3"/50 Ill Cartridges		CK—6"/47 Tgt Ctgs. (2050 fs) (130# projectile)	
PM—3"/50 HC Cartridges		CL—6"/47 Tgt Ctgs. (2300 fs) (105# projectile)	
PN—3"/50 Tgt Cartridges		CN—6"/47 Ser Chgs. (2800 fs)	
		CO—6"/47 Tgt Chgs. (2300 fs)	
AB—4"/50 Com Cartridges, for Gun Mk 9 Mods 5-24 inclusive		CQ—6"/50 Ser Chgs. (2800 fs)	
AC—4"/50 HC Cartridges		CR—6"/50 Tgt Chgs. (2100 fs)	
AD—4"/50 Ill Cartridges		CT—6"/53 Ser Chgs. (3000 fs)	
AE—4"/50 Tgt Cartridges		CU—6"/53 HC Chgs. (2400 fs)	
AF—4"/50 Com Cartridges for Gun Mk 7		CV—6"/53 Tgt Chgs. (2300 fs)	
AG—4"/50 Com Cartridges for Gun Mk 9 Mods 1-4 inclusive			
BA—5"/25 AAC Cartridges		XA—7"/45 AP Projectiles	
BB—5"/25 Ill Cartridges		XB—7"/45 Fld Projectiles	
BC—5"/25 Tgt Cartridges		XC—7"/45 Bbt Projectiles	
BD—5"/25 HC Cartridges		XD—7"/45 Tgt Projectiles	
		XE—7"/45 Ser Chgs. (2700 fs)	
BE—5"/38 AAC Projectiles			
BF—5"/38 Com Projectiles		DA—8"/55 AP Projectiles (335#)	
BG—5"/38 Ill Projectiles		DB—8"/55 AP Projectiles (260#)	
BH—5"/38 Tgt Projectiles		DC—8"/55 Com Projectiles	
BI—5"/38 Ser Cartridges (2600 fs)		DD—8"/55 HC Projectiles	
BJ—5"/38 W Projectiles		DE—8"/55 Tgt Projectiles (335#)	
BK—5"/38 HC Projectiles		DF—8"/55 Tgt Projectiles (260#)	
BL—5"/50-51 Com Projectiles		DG—8"/55 Ser Chgs. (2500 fs) (335# projectile)	
BM—5"/50-51 Tgt Projectiles		DH—8"/55 Ser Chgs. (2800 fs) (260# projectiles)	
BN—5"/50-51 HC Projectiles		*DJ—8"/55 Tgt Chgs. (2000 fs) (335# projectile) or (2160 fs) (260# projectile)	
BO—5"/51 Ill Projectiles			
BP—5"/50 Ser Chgs. (3000 fs)		* Note: This supersedes paragraph 1(b) and 1(c) of BuOrd ltr NT1/S78 (Pr6d) dtd 28 February, 1944 "Ammunition Assembly Lot System."	
BQ—5"/51 Ser Chgs. (3150 fs)		DK—8"/55 HC and Tgt Chgs. (2300 fs) (260# projectile)	
BR—5"/51 Tgt and HC Ser Chgs. (2300 fs)			
BS—5"/51 Ser Ctgs. (3150 fs)		FA—12"/50 AP Projectiles (870#)	
BT—5"/54 AAC Projectiles		FB—12"/50 AP Projectiles (1140#)	
BU—5"/54 Ill Projectiles		FC—12"/50 HC Projectiles (740#)	
BV—5"/54 Ser Ctgs. (2650 fs)		FD—12"/50 HC Projectiles (940#)	
BX—5"/38 WP Smoke Projectiles		FE—12"/50 Tgt Projectiles (870#)	
BZ—5"/38 Reduced Ctgs. (1200 fs)		FF—12"/50 Tgt Projectiles (1140#)	

CONFIDENTIAL

TABLE 1 — Continued

Designation	Type	Designation	Type
FG-12"/50 Ser Chgs. (2900 fs) (870# projectiles)		HM-14"/50 Tgt Chgs. (1935 fs) (1500# projectile)	
FH-12"/50 Ser Chgs. (2500 fs) (1140# projectile)		HN-14"/50 Tgt Chgs. (2000 fs) (1400# projectile)	
FJ-12"/50 HC Chgs. (1850 fs) (940# projectile)			
FK-12"/50 HC or Tgt Chgs.		IA-16"/45 AP Projectiles (2100#)	
(HC-2125 fs with 740# projectile)		IB-16"/45 AP Projectiles (2240#)	
(Tgt 2100 fs with 870# projectile)		IC-16"/45-50 AP Projectiles (2700#)	
FL-12"/50 Tgt Chgs. (1800 fs) (1140# projectile)		ID-16"/45-50 HC Projectiles (1900#)	
		IE-16"/45 Tgt Projectiles (2100#)	
		IF-16"/45 Tgt Projectiles (2240#)	
		IG-16"/45-50 Tgt Projectiles (2700#)	
HA-14"/45-50 AP Projectiles (1500#)		IH-16"/45 Ser Chgs. (2600 fs) (2100# projectile)	
HB-14"/45 AP Projectiles (1400#)		II-16"/45 Ser. Chgs. (2520 fs) (2240# projectile)	
HC-14"/45-50 HC Projectiles (1275#)		IJ-16"/45 Ser. Chgs. (2300 fs) (2700# projectile)	
HD-14"/45-50 Tgt Projectiles (1500#)		IK-16"/50 Ser Chgs. (2500 fs) (2700# projectile)	
HE-14"/45-50 Tgt Projectiles (1400#)		IL-16"/45 HC Chgs. (2000 fs) (1900# projectile)	
HF-14"/45 Ser Chgs. (2600 fs) (1500# projectiles)		IM-16"/45 HC Chgs. (1900 fs) (1900# projectile)	
HG-14"/45 Ser Chgs. (2700 fs) (1400# projectiles)		IN-16"/50 HC Chgs. (1900 fs) (1900# projectile)	
HH-14"/45 HC Chgs. (2000 fs) (1275# projectile)		IO-16"/45 Tgt Chgs. (2000 fs) (2100# projectile)	
HI-14"/45 Tgt Chgs. (1935 fs) (1500# projectile)		IP-16"/45 Tgt Chgs. (1935 fs) (2240# projectile)	
HJ-14"/45 Tgt Chgs. (2000 fs) (1400# projectile)		IQ-16"/45 Tgt Chgs. (1800 fs) (2700# projectile)	
HK-14"/50 Ser Chgs. (2700 fs) (1500# projectile)		IR-16"/50 Tgt Chgs. (1800 fs) (2700# projectile)	
HL-14"/50 HC Chgs. (2000 fs) (1275# projectile)			

TABLE 2

**LOT NUMBER SUFFIX ASSIGNMENTS
FOR DEPOTS AND ASSEMBLY PLANTS**

Ammunition Depots		Ammunition Assembly Plants	
Balboa	BAL	Bermite Pdr. Co.	BPC
Charleston	CH	NF-Bristol	NFB
Crane	C	NF-Chillicothe	NFCH
Earle	E	NF-Cordova	NFC
Espiritu Santo	ES	Edgewood Arsenal	EA
Fall Brook	FA	NF-Elkton	NFE
Fort Mifflin	FM	Hunter Mfg.	HMC
Hastings	HA	Mayfield	MFM
Hawthorne	HAW	Nat. Munitions	NMC
Hingham	H	NF — West Hanover	NFH
Iona Island	II	N.O.P. Baldwin	BA
Lake Denmark	LD	Triumph	TEI
Mare Island	MI	Trojan Pdr. Co.	TPC
McAlester	McA	Unexcelled Mfg.	UNX
New Orleans	NO	U. S. Rubber	U
Oahu	OH	Victory Ord.	VO
Puget Sound	PS	Western Ctg. Co.	WC
Seal Beach	SB		
St. Juliens Creek	SJ		
Vieques	V		

CONFIDENTIAL

TABLE 3
FIXED AMMUNITION 1, 3, AND 6 PDR.
AMMUNITION AND COMPONENT LOT SIZES

Caliber	1 Pdr			3 Pdr			6 Pdr		
	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y
Maximum Ammunition Lot		5,000			5,000			5,000	
Minimum Ammunition Lot		600			600			600	
Projectile	1	5,000	3	1	5,000	3	1	5,000	3
Base Fuze	2	4,000	3	2	4,000	3	2	4,000	3
Tracer	5	1,000	3	5	1,000	3	5	1,000	3
Primer	1	10,000	4	1	10,000	4	1	10,000	4
Cartridge Case	1	5,000	3	1	5,000	3	1	5,000	3

X — This column indicates the maximum number of component lots which may be used in one ammunition lot.

Y — This column indicates the maximum number of ammunition lots into which a single component lot may be assembled.

FIXED AMMUNITION 3'', 4'', AND 5''
AMMUNITION AND COMPONENT LOT SIZES

Caliber	3''/23			3''/50			4''/50			5''/25		
	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y
Maximum Ammunition Lot		5,000			5,000			1,000			1,000	
Minimum Ammunition Lot		600			600			100			100	
Projectile*				1	10,000	4						
				1	7,500	4						
	5	1,000	3	5	1,000	3	1	1,000	3	2	500	3
Time Fuze*							1	5,000	7	1	5,000	7
	1	10,000	4	1	10,000	4	1	10,000	12	1	10,000	12
Point Detonating Fuze	1	5,000	3	1	5,000	3	1	5,000	7	1	5,000	7
Auxiliary Detonator	1	5,000	3	1	5,000	3	1	5,000	7	1	5,000	7
Tracer				6	1,000	3	1	1,000	3	1	1,000	3
Primer	1	10,000	4	6	1,000	3	1	1,000	3	1	1,000	3
Cartridge Case*	1	5,000	3	2	5,000	3	1	1,000	3	2	500	3
	1	10,000	4	2	10,000	4	1	5,000	7	1	5,000	7
Base Fuze*				1	10,000	4	1	3,000	5	1	3,000	5
	2	4,000	3	2	4,000	3	1	1,000	3	1	1,000	3

X — This column indicates the maximum number of component lots which may be used in one ammunition lot.

Y — This column indicates the maximum number of ammunition lots into which a single component lot may be assembled.

* These components have been manufactured in varying lot sizes.

CONFIDENTIAL

TABLE 3 — Continued
SEMI-FIXED CARTRIDGES 5" AND 6"
AMMUNITION AND COMPONENT LOT SIZES

Caliber	5"/38			5"/51			5"/54			6"/47		
	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y
Maximum Ammunition Lot		1,000			1,000			1,000			1,000	
Minimum Ammunition Lot		100			100			100			100	
Primer	1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3
Cartridge Case*	2	500	3	2	500	3	2	500	3	2	500	3
	1	5,000	7	1	5,000	7	1	5,000	7	1	5,000	7

X — This column indicates the maximum number of component lots which may be used in one ammunition lot.

Y — This column indicates the maximum number of ammunition lots into which a single component lot may be assembled.

* These components have been manufactured in varying lot sizes.

SEPARATE LOADING PROJECTILES 5"
AMMUNITION AND COMPONENT LOT SIZES

Caliber		5"/38			5"/50			5"/51			5"/54		
		X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y
Maximum Ammunition Lot			1,000			1,000			1,000			1,000	
Minimum Ammunition Lot			100			100			100			100	
Projectile	(COM)	1	3,000	5									
	(AAC)	1	1,000	3									
	(AAC)	2	500	3	2	500	3	2	500	3	2	500	3
Time Fuze*		1	5,000	7				1	5,000	7	1	5,000	7
		1	10,000	12				1	10,000	12	1	10,000	12
Point Detonating Fuze		1	5,000	7				1	5,000	7	1	5,000	7
Auxiliary Detonator		1	5,000	7				1	5,000	7	1	5,000	7
Base Fuze*		1	3,000	5				1	3,000	5	1	3,000	5
		1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3
Tracer		1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3

X — This column indicates the maximum number of component lots which may be used in one ammunition lot.

Y — This column indicates the maximum number of ammunition lots into which a single component lot may be assembled.

* These components have been manufactured in varying lot sizes.

CONFIDENTIAL

TABLE 3 — Continued

**SEPARATE LOADING PROJECTILES 6" AND 7"
AMMUNITION AND COMPONENT LOT SIZES**

Caliber	6"/47			6"/50			6"/53			7"/45		
	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y
Maximum Ammunition Lot		1,000			1,000			1,000			1,000	
Minimum Ammunition Lot		100			100			100			100	
Projectile*	1	1,000	3									
	2	500	3	2	500	3	2	500	3	2	500	3
Time Fuze*	1	5,000	7	1	5,000	7	1	5,000	7	1	5,000	7
	1	10,000	12	1	10,000	12	1	10,000	12	1	10,000	12
Point Detonating Fuze	1	5,000	7	1	5,000	7	1	5,000	7	1	5,000	7
Auxiliary Detonator	1	5,000	7	1	5,000	7	1	5,000	7	1	5,000	7
Base Fuze*	1	3,000	5	1	3,000	5	1	3,000	5			
	1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3
Tracer	1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3

X — This column indicates the maximum number of component lots which may be used in one ammunition lot.

Y — This column indicates the maximum number of ammunition lots into which a single component lot may be assembled.

* These components have been manufactured in varying lot sizes.

CONFIDENTIAL

TABLE 3 — Continued

**SEPARATE LOADING PROJECTILES 8", 12", 14" AND 16"
AMMUNITION AND COMPONENT LOT SIZES**

Caliber	8"/55			12"/50			14"/45			14"/50		
	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y	X	Lot Size	Y
Maximum Ammunition Lot		1,000			500			500			500	
Minimum Ammunition Lot		100			25			25			25	
Projectile	1	500	3	1	500	3	1	500	3	1	500	3
Point Detonating Fuze	1	5,000	7	1	5,000	7	1	5,000	7	1	5,000	7
Auxiliary Detonator	1	5,000	7	1	2,000	4	1	2,000	4	1	2,000	4
Base Fuze	1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3
Tracer	1	1,000	3	1	1,000	3	1	1,000	3	1	1,000	3
Caliber	16"/45			16"/50								
	X	Lot Size	Y	X	Lot Size	Y						
Maximum Ammunition Lot		500			500							
Minimum Ammunition Lot		25			25							
Projectile	1	500	3	1	500	3						
Point Detonating Fuze	1	5,000	7	1	5,000	7						
Auxiliary Detonator	1	2,000	4	1	2,000	4						
Base Fuze	1	1,000	3	1	1,000	3						
Tracer	1	1,000	3	1	1,000	3						

X — This column indicates the maximum number of component lots which may be used in one ammunition lot.

Y — This column indicates the maximum number of ammunition lots into which a single component lot may be assembled.

CONFIDENTIAL

AMMUNITION DATA CARD — FIXED AMMUNITION

U. S. NAVAL AMMUNITION DEPOT, ST. JULIENS CREEK

Date of Assembly: 1-45

BA-11-SJ-45

Ammunition Lot

CALIBER: 5"/25

TYPE: A. A. C.

QUANTITY IN LOT ~~1000~~ **998**

For Guns: Mk. 10, 11, 13, 17 and their Mods.

Prep. Order No. 672-SJ-44

Job Order No. 10083-45

Powder Index: SPDN. 8286

Wt. of Chg. 9.86 Lbs.

I. V. 2110 F. S.

Lead Foil: 75 Grams

Flashless Pellets, None

Burster Chg. "D" (Den. 1.42)

Ammunition Tank Mk. 3-0

CART. CASE Mk. 4-2	PRIMER Mk. 13-1	PROJECTILE Mk. 36-4	NOSE FUZE Mk. 18-4	BASE FUZE Mk. 28-15	AUX. DET. Mk. 54-1	TRACER Mk. 9-0 (R)
Manufacturer N. G. F.	Loading Plt. N.O.P.M.	Mfgr. F. A.	Loading Plt. T. A. E.	Loading Plt. Bellevue	Loading Plt. Dupont	Loading Plt. N.O.P.M.
Yr. Mfd. 1944	Yr. Ld. 1944	Yr. Spec. 1937	Yr. Ld. 1944	Yr. Ld. 1944	Yr. Ld. 1944	Yr. Ld.
Lot 3095	Lot 9M213	Lot 892 896	Lot 190	Lot 3330-B	Lot 227-D	Lot Mixed

REMARKS:

Plate 1

AMMUNITION DATA CARD - PROJECTILES

U. S. NAVAL AMMUNITION DEPOT HASTINGS, NEBR.

DATE OF ASSEMBLY. JANUARY, 1945

INSPECTED BY G.F.K.

BE-277-HA-45

AMMUNITION LOT

CALIBER 5/38 TYPE AAC.

QUANTITY IN LOT **983**

FOR GUNS MARK 12 ANY MODS.

PREP ORDER 646-HA-44

JOB ORDER NO. 442-44

PROJECTILE Mk. 35-6	NOSE FUZE Mk. 18-2	BASE FUZE Mk. 28-15	AUX. DET. Mk. 54-0	TRACER 9-0-(R)	BURSTER CHG. Ex. D
MANUFACTURER EM	LOADING PLT. ECL	LOADING PLT. NOPM	LOADING PLT. AOP	LOADING PLT. NOPM	DENSITY 1.42
Yr. SPEC 37	Yr. Ld. 44	Yr. Ld. 44	Yr. Ld. 44	Yr. Ld. 44	
LOT 4271	LOT 944	LOT 1377M 1375M 2475M 2486M	LOT 3109A 3074A 3036A 3113A 3111A 3097A	LOT 6058M 5906M 5876M 5866M 5872M 6112M	

REMARKS:

Plate 2

CONFIDENTIAL

AMMUNITION DATA CARD — BAG CHARGES		IK-4-H44
U. S. Naval Ammunition Depot, Hingham, Mass.		
Date of Assembly — Dec. 1944		Ammunition Lot
Caliber 16"/50	Type Service	Quantity in Lot 700
For Guns 16"/50 Mark 7		
Prep. Order No. 566-H-44		Job Order 3544
Powder Index	S.P.D. 7836	
Weight of Charge	664 Lbs.	
Initial Velocity	2500 F.S.	
Projectile Weight	2700 Lbs.	
Sections Per Charge	6	
Ignition Charge Per Section	350 Grams	
Lead Foil Per Charge	1200 Grams	
Flashless Pellets Per Charge	None	
Powder Tank	4	
REMARKS:		

Plate 3

AMMUNITION DATA CARD — FIXED AMMUNITION				PMR-12-SJ-45		
U. S. NAVAL AMMUNITION DEPOT, ST. JULIENS CREEK						
Date of Assembly: 1-45				Ammunition Lot 252		
CALIBER: 3"/50		TYPE: H. C.		QUANTITY IN LOT 252		
For Guns: Mk. 3 to 22 Incl. and their Mods. only.				Job Order No. O-1042-45		
Rework Order No. 4094-SJ-44				I. V. 2700 F. S.		
Powder Index SPDN. 5993 F. P.		Wt. of Chg. 4.07 Lbs.		Flashless Pellets 0.3 Lb.		
Lead Foil: None				Ammunition Box Mk. 6-0		
Bursting Chg. TNT CT (Den. 1.60)						
CART. CASE Mk. 7-1	PRIMER Mk. 14-0	PROJECTILE Mk. 27-3	NOSE FUZE Mk. 30-3	BASE FUZE	AUX. DET. Mk. 54-0	TRACER Mk. 4-0 (R)
Manufacturer S. M. C.	Loading Plt. N. O. P. M.	Mfgr. M. W. Corp.	Loading Plt. Bellevue	Loading Plt.	Loading Plt. N.O.P.M.	Loading Plt. N. O. P. M.
Yr. Mfd. 1943	Yr. Ld. 1943	Yr. Spec. 1937	Yr. Ld. 1944	Yr. Ld.	Yr. Ld. 1944	Yr. Ld. 1943
Lot 340	Lot 3M290	Lot 124	Lot 1013-B	Lot	Lot 8075-M	Lot 4262-M
REMARKS: This Amm. was assembled under Amm. Lot PM-50-FM-44. P. D. Fuze Mk. 30-2, Lot 17-B, replaced by P. D. Fuze Mk. 30-3, Lot 1013-B. Aux. Det. Mk. 46-0, Lot 178-D has been replaced by Aux. Det. Mk. 54-0, Lot 8075-M, on Jan., 1945.						

Plate 4

CONFIDENTIAL

AMMUNITION DATA CARD — PROJECTILES
U. S. NAVAL AMMUNITION DEPOT, ST. JULIENS CREEK

Date of Assembly: 1-45

BER-10-SJ-45

Ammunition Lot

CALIBER: 5"/38

TYPE: A. A. Com.

QUANTITY IN LOT 1000

For Guns: Mk. 12 and Mods.

Rework Order No. 4016-SJ-44

Job Order No. O-1027-45

PROJECTILE Mk. 35-5	NOSE FUZE Mk. 50-2	BASE FUZE Mk. 28-15	AUX. DET. Mk. 54-0	TRACER Mk. 9-0 (R)	BURSTER CHG. Ex. "D"
Manufacturer C. S. & I. Wks.	Loading Plt. E. M. D.	Loading Plt. Bellevue	Loading Plt. N. O. P. M.	Loading Plt. Mixed	Den. 1.42
Yr. Spec. 1937	Yr. Ld. 1944	Yr. Ld. 1944	Yr. Ld. 1944	Yr. Ld. 1944	
Lot Mixed	Lot 6	Lot 3134-B	Lot 8078-M	Lot Mixed	

REMARKS:

Plate 5

GUN AMMUNITION CONTAINERS

Fixed cartridges, semi-fixed cartridges, and bag charges are issued in special tanks or boxes for safe transportation and stowage. Each type of ammunition for each caliber has its assigned tanks and boxes. Stowage in ship's magazines is arranged for the type of ammunition container standard at the time the ship is built. Since the nose contours of the various projectiles in any one caliber vary, it is necessary to have nose supporting blocks suitable for each type in each cartridge tank. Care must be taken in replacing ammunition in containers that the proper nose supporting block is used for the ammunition on hand.

The following types of containers are in use for packaging gun ammunition:

- (1) (a) Wooden boxes.
- (b) Wooden boxes with metal tops and bottoms.
(The tops are secured to the boxes by means of cord on both types.)
- (2) Metal boxes usually fabricated of galvanized steel.
- (3) Metal tanks fabricated of steel or aluminum.

Since fixed cartridges do not fit tight longitudinally in tanks, cork or cardboard space blocks are provided of the proper thickness and diameter to take up the space to prevent the round from shifting in the tank.

Cartridge tanks and powder bag tanks are designed to interlock with one another in stowage either ashore or aboard ship. The tanks are required to be airtight, and before assembly at an ammunition depot, each tank is tested to determine whether it meets this requirement. It is important that daily inspections of magazines include a check of the covers of cartridge tanks to insure that they are tight, particularly if there is any noticeable odor of ether in the magazines.

After tanks are loaded and the covers are in place, a length of wire is secured by twisting to the tank covers and bodies. Usually, an inspection of this wire will indicate whether or not tank covers are tightly secured.

In tightening or removing the covers of cartridge tanks, only the wrenches furnished for the particular tank concerned should be used. Use of a smaller wrench may result in failure to tighten the cover properly while a larger wrench may carry away part of the tank or cover.

Since aluminum ammunition containers are particularly susceptible to denting, and since their lightness when empty is conducive to rapid handling, it is essential that all personnel concerned with the handling of ammunition exercise particular care that neither the containers themselves nor their contents are damaged in the handling processes.

All cartridge and powder tanks and particularly aluminum tanks must be kept dry to prevent corrosion. Any wetting of tanks due to accidental sprinkling or flooding of magazines, or other causes, will result in corroded tanks, particularly adjacent to top or bottom rings. When tanks are transported in boats, the tanks should be effectively covered to prevent wetting by the spray. If tanks become wet, it is necessary to dry them immediately. Wet or damp cases, cork spacers, extractors, projectile grommets, etc., are not to be stowed in cartridge or powder tanks.

Tanks are designed with reinforced protruding top and bottom rings which should be used for bearing surfaces in horizontal stowage. The side-walls of tanks are relatively light in construction and were not designed to carry any weight in stowage.

The following is a tabulation of the various containers used in packaging gun ammunition:

CONFIDENTIAL

FIXED CARTRIDGE CONTAINERS

Caliber	CONTAINER		STOWAGE DIMENSIONS					WEIGHT		REMARKS
			Height	Length	Width	Diameter	Volume			
	No. Ctgs.	Type	(Ins.)	(Ins.)	(Ins.)	(Ins.)	(Cu. Ft.)	Full	Empty	
20 mm (AA)	180	Steel Box	13.0	18.5	9.5		1.3	120	16	Cartridges packed in cardboard tubes.
20 mm (AC)	120	Wooden Box	10.5	18.0	13.5		1.5	95		
40 mm	16	Galv. Steel Box	22.0	12.0	12.0		1.8	115	36	Cartridges in clips 4 clips of 4 each
1 Pdr.	10	Wooden Box	17.0	31.5	10.5		3.3	240	75	
3 Pdr.	16	Wooden Box	22.5	12.5	12.5		2.0	115	21	
6 Pdr.	7	Steel Tank	22.0			10.5	1.4	90	24	
	11	Wooden Box	10.0	21.5	14.5		1.8	125	19	
1"/10/75	36	Galv. Steel Box	14.0	12.5	12.5		1.3	105	31	Cartridges nested in inner metal container
3"/23	7	Steel Tank	23.5			13.0	2.2	155	32	
	6	Wooden Box	9.5	23.0	13.0		1.6	125	20	
3"/50	1	Steel Tank*	37.0			6.0	0.8	33	8	*Some tanks of special design contain four cartridges
	4	Wooden Box	10.0	37.0	9.0		1.9	130	26	
4"/50	1	Steel Tank	52.0			7.0	1.5	85	17	
	1	Wooden Box	7.0	52.5	7.0		1.5	85	18	
5"/25	1	Steel Tank	46.5			8.0	1.7	100	19	

SEMI-FIXED CARTRIDGE CONTAINERS

Caliber	CONTAINER		STOWAGE DIMENSIONS			WEIGHT		WEIGHT OF PROJECTILE (Lbs.)
			Height	Diameter	Volume			
	No. Ctgs.	Type	(Ins.)	(Ins.)	(Cu. Ft.)	Full	Empty	
5"/38	1	Steel Tank	30.0	7.5	1.0	38	9	52.5-55.18
	1	Steel Tank	32.0	8.5	1.4	43	15	52.5-55.18
5"/51	1	Steel Tank	36.0	9.5	1.6	75	17	50.0-54.5
5"/54	1	Steel Tank	38.5	7.5	1.3	43	11	Projectile not in service at this time
6"/47	1	Steel Tank	44.0	10.0	2.6	85	16	105-130

CONFIDENTIAL

POWDER SECTION CONTAINERS

Caliber	CONTAINER			Bags Per Charge	STOWAGE DIMENSIONS			WEIGHT		WEIGHT OF PROJECTILE (Lbs.)
	No. Bags	Type	Containers Per Charge		Height (Ins.)	Diameter (Ins.)	Volume (Cu. Ft.)	Full	Empty	
5"/50	1 (Full Chg)	Bronze	1	1	32.5	7.5	1.0	44	21	50
5"/51	1 (Full Chg)	Steel	1	1	33.0	7.5	1.0	41	14	50-54.5
6"/47	1 (Full Chg)	Aluminum	1	1	37.5	8.5	1.6	48	10	95.4-105
6"/50	1 (Full Chg)	Steel	1	1	44.0	8.0	1.7	65	21	95.4-105
6"/53	1 (Full Chg)	Steel	1	1	50.5	8.0	1.9	75	22	95.4-105
7"/45	1 (1/2 Chg)	Steel	2	2	29.0	9.5	1.6	55	22	152-165
8"/55	1 (1/2 Chg)	Aluminum	2	2	30.5	11.0	2.1	75	17	260-335
		Steel	2	2	32.5	10.0	2.1	85	28	
12"/50	2 (1/2 Chg)	Steel	2	4	41.5	14.5	5.0	190	50	740-1140
14"/45-50	2 (1/2 Chg)	Steel	2	4	44.0	16.0	6.6	280	65	1275-1500
16"/45	2 (2/5 Chg)	Steel	2 1/2	5	39.5	19.0	8.2	330	85	1900-2700
	3 (1/2 Chg)	Aluminum	2	6	48.5	19.5	10.7	390	90	
16"/50	3 (1/2 Chg)	Aluminum	2	6	55.5	19.5	12.2	410	75	1900-2700
		Steel	2	6	55.5	19.5	12.2	430	95	

Weights and dimensions of projectiles, containers, etc., included in the preceding charts were taken from OD 2790 "Weights and Dimensions of Ammunition Components and their Containers." Variations in these weights will occur due to the type of projectile, type of container, type of powder charge, type of cartridge case, etc. It is suggested that more accurate information be used when an exact weight is desired on a specific Mark and Mod.

In order to roughly estimate the weight of a projectile, the formula $w = \frac{d^3}{2}$ may be used where "w" = weight of the projectile in pounds, and "d" = diameter of the projectile in inches.

MARKING OF GUN AMMUNITION CONTAINERS:

All containers for gun ammunition are clearly marked for identification. Complete stencilled information is located on the sides of all containers and in addition, the smokeless powder index number, and caliber of the ammunition is always stencilled on the top of all tanks and the ends of wooden boxes. An ammunition identification tag containing complete information about the round is wired to the handle of all tanks and secured to the ends of wooden boxes.

An ammunition data card, containing complete information about the ammunition, is placed in

each gun ammunition container on top of the ammunition. In the case of semi-fixed projectiles, which are not shipped in containers, ammunition data cards are sent with the shipment of projectiles.

In addition to stencilled information, the color system which applies to projectiles is used on all containers which contain fixed ammunition with the exception of 20 mm, 40 mm, and 1.10"/75 caliber.

The color system is as follows:

FIXED CARTRIDGE TANKS:

- (1) The bottom of the tank is painted a color to indicate the type of projectile contained in the tank and in the same colors as used on projectiles.
- (2) The top of the tank is painted a color to indicate the explosive filler used in the projectile and in the same colors as used on projectiles.
- (3) To indicate a tracer, a white ring is painted on top and bottom of the tank. If the tracer is red or orange, 3 dots of these colors will be painted on these white rings or on the side of the tank.
- (4) The tank body is given a protective coating of gray paint if made of steel or is unpainted if made of aluminum.

FIXED CARTRIDGE BOXES:

- (1) The body of the box which includes the sides, ends and bottom is painted a color to indicate

the type of projectile contained in the box, and in the same colors as used on projectiles.

- (2) The top, cover, or lid is painted a color to indicate the explosive filler of the projectile and in the same colors as used on projectiles.
- (3) To indicate a tracer, a two-inch white band is painted around the middle of the box parallel to the ends. If the tracer is red or orange, dots of these colors are painted on this white band.

Note: 3"/50 caliber AP cartridge tanks and boxes have their tops painted red when the projectile is not loaded with explosive filler.

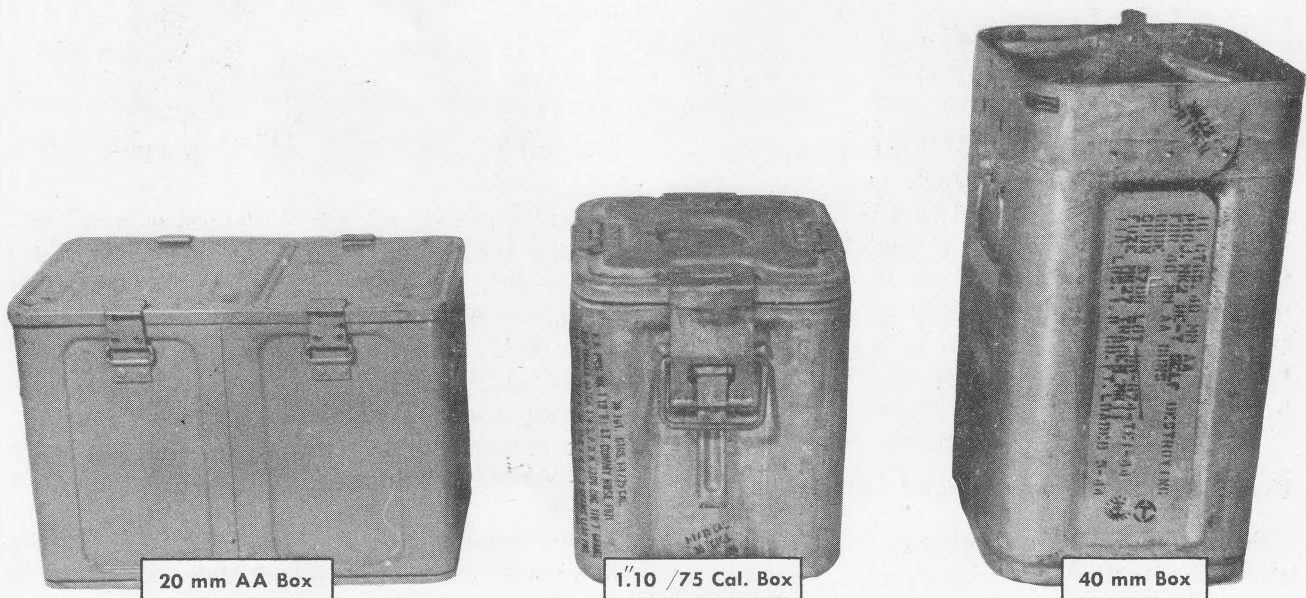
The above information applies to service or target gun ammunition only. Dummy drill gun ammunition is marked differently as follows:

Tanks: Top and bottom of the tank are painted half black and half white.

Boxes: Bottom half of box is painted black and top half of box is painted white. Stencilled information is included on the sides of tanks and boxes.

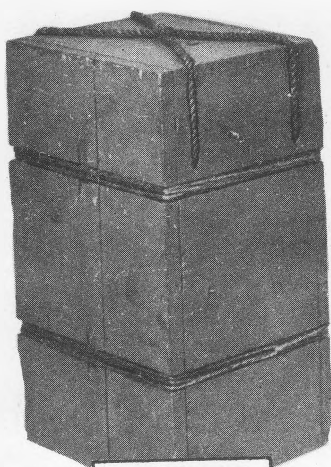
Since the tendency to abbreviate is prevalent in the stencilled information found on all gun ammunition and containers, the following samples of stencilled information commonly found on containers are given below in order to provide some familiarity with the types of abbreviations used:

Note: For the meaning of abbreviations used, refer to list of gun ammunition abbreviations.

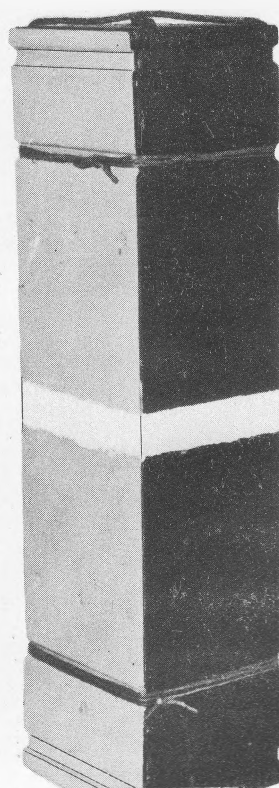


FIXED CARTRIDGE BOXES

CONFIDENTIAL

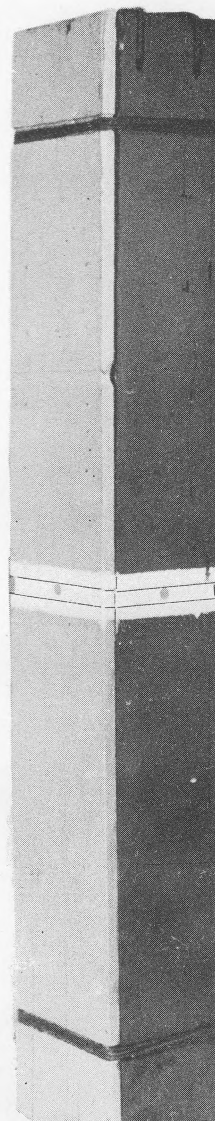


3"/23 Cal. Box



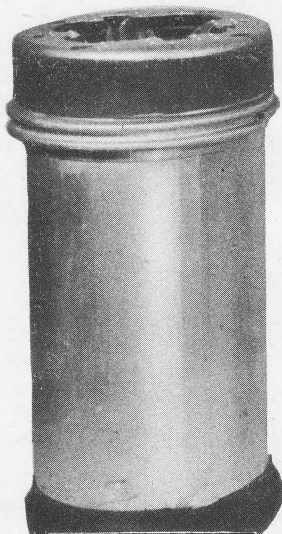
3"/50 Cal. Box

FIXED CARTRIDGE BOXES

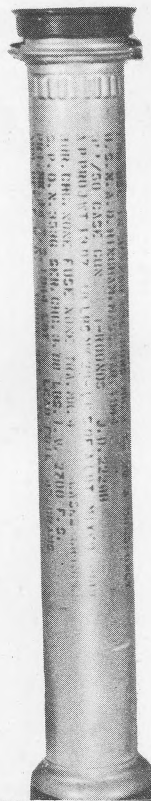


4"/50 Cal. Box

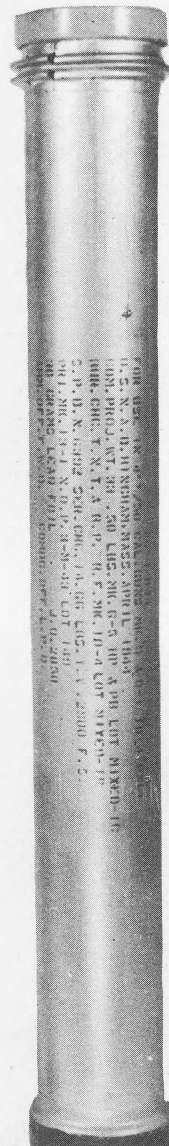
CONFIDENTIAL



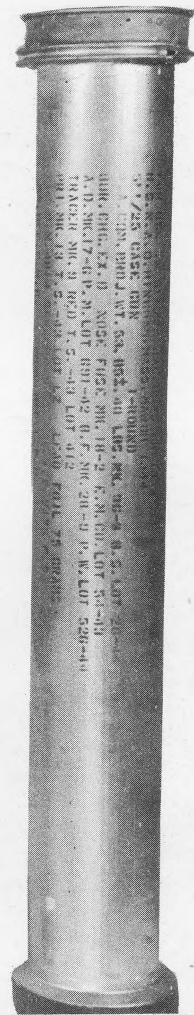
3"/23 Cal. Tank



3"/50 Cal. Tank

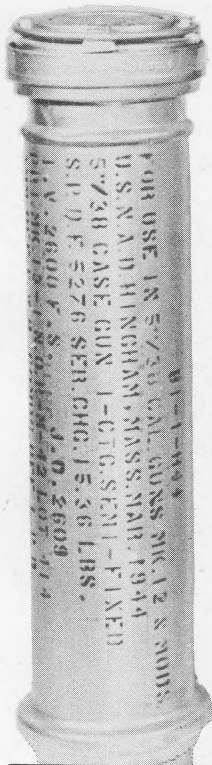


4"/50 Cal. Tank

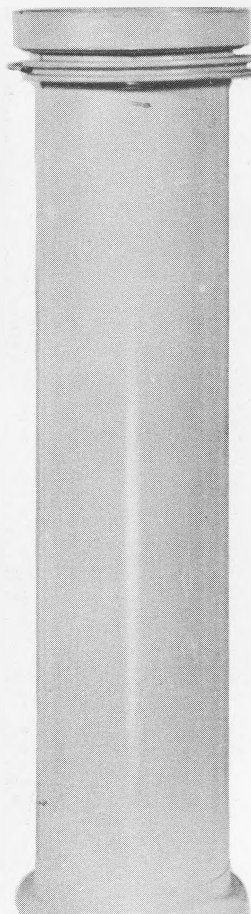


5"/25 Cal. Tank

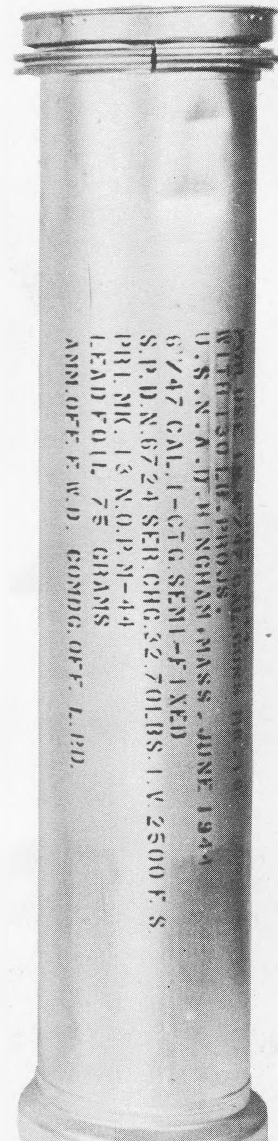
FIXED CARTRIDGE TANKS



5"/38 Cal. Tank



5"/51 Cal. Tank
(Cartridge)



6"/47 Cal. Tank

SEMI-FIXED CARTRIDGE TANKS



POWDER BAG TANKS

CONFIDENTIAL



POWDER BAG TANKS

CONFIDENTIAL

CONFIDENTIAL

STENCILLING ON CONTAINERS:

- I. ZC-187-NFM44
180 Ctg. 20 mm A.A.
Proj. HEI Tetryl
20 mm A.A. Guns MK 2 MK 4
BR MK II MK IV
SPDN 5161 Loaded 8-16-43
120 Lbs. 1.3 Cu. Ft.
- II. YC-155-SJ44
36 Tgt. Ctg. 1".10/75 Cal.
A.A. Proj. MK 1-18 BL and T Dummy Nose
Fuze
Red Tracer Batch 114 SPDN 3209 Chg.
119.7 Grams
I.V. 2700 F.S. C.P.P. MK 19-2 S.O.C.
2 Grams Lead Foil
Cases MK 1 BB-41 N.A.D. St. Juliens Creek,
Va.
- III. 16 Ctg. 40 mm A.A.
Proj. MK 2 HE-T TNT Self Destroying
For 40 mm A.A. Guns
SPDN 4164 Lot UB-329-TEI-43
Fuze MK 27 Tracer MK 10
110 Lbs. 1.8 Cu. Ft. Loaded 11-43
MK 22 Primer
- IV. PL-24-H44
For use in 3"/50 Cal Guns MK 3 to 22 and
Mods only
USNAD Hingham, Massachusetts, June 1944
3"/50 Case Gun 4-Rounds
Ill. Proj. Wt. 13 Lbs. MK 21-1 Mfg BS Co.
Lot 26-44
Exp. Chg. BP Fuze MK 22-3 E.M. Co.
Lot 998-44
SPDN 3463 FP Ser Chg. 3.98 Lbs. I.V. 2700 FS
Pri. MK 14 N.O.P.-2-M 1943
Amm. Off. F.W.D. Comdg. Off. L.P.D.
- V. PM-2-H43
For use in 3"/50 Cal. Guns MK 3 to 22 Mods
only
USNAD Hingham, Massachusetts, November
1943
3"/50 Case Gun 4-Rounds
H.C. Proj. Wt. 13.07±.18 Lbs. MK 27-1
B.W. Lot 137-37
Bur. Chg. Cast T.N.T. Fuze MK 30-1
Point Det. Lot 691-43
- R.D. 1154 Comp. App. Aux. Det. MK 17-2
P.M.C. Lot 691-42
Tracer MK 4 Red T.S.-43 Lot 412
Pri. MK 14 T.S. 1943 Lot L.Z. Lead Foil 45
Grams
SPDN 3535 FP Ser. Chg. 4.01 Lbs.
I.V. 2700 F.S.
Ord. Off. F.W.D. Comdg. Off. L.P.D.
J. O. 548-H-43/1
- VI. AG-3-H44
For use in 4"/50 Cal. Guns MK 9 and 9-1 to
4 only
USNAD, Hingham, Massachusetts, April
1944
Com. Proj. Wt. 33±.50 Lbs. MK 6-5 HP
and PB Lot mixed-16
Bur. Chg. T.N.T. B.P. B.F. MK 10-4 Lot
Mixed-18
SPDN 6392 Ser. Chg. 14.66 Lbs.
I.V. 2900 F.S.
Pri. MK 13-1 N.O.P. 3-M 1943 Lot 149
30 Grams Lead Foil J. L. 2858
Amm. Off. F. W.D. Comdg. Off. L.P.D.
- VII. CH-12-H44
For use in 6"/47 Cal. Guns MK 16
With 130 Lbs. Projs.
USNAD, Hingham, Massachusetts, June 1944
6"/47 Cal. 1-Ctg. Semi-Fixed
SPDN 6724 Ser. Chg. 32.70 Lbs.
I.V. 2500 F.S.
Pri. MK 13 NOPM-44
Lead Foil 75 Grams
Amm. Off. F.W.D. Comdg. Off. L.P.D.
- VIII. CT-18-H44
6"/53 Ser. SPD 4084 Wt. Chg. 43.95
I.V. 3000 F.S.
150 Grams B.P. 50 Grams Lead Foil
Amm. Off. F.W.D. Comdg. Off. L.P.D.
- IX. DK-2-H44
For use in 8"/55 Cal. Guns (S.C.)
MK 12 and Mods and MK 14 and Mods
8"/55 (S.C.) 1/2 Chg. H.C. SPD 2400
Wt. Chg. 33.45 Lbs.
I.V. 2300 F.S. 225 Grams Lead Foil per
Section
200 Grams B.C.P. per Section Assem. H-8-44

CONFIDENTIAL

X.

IK-27-H44

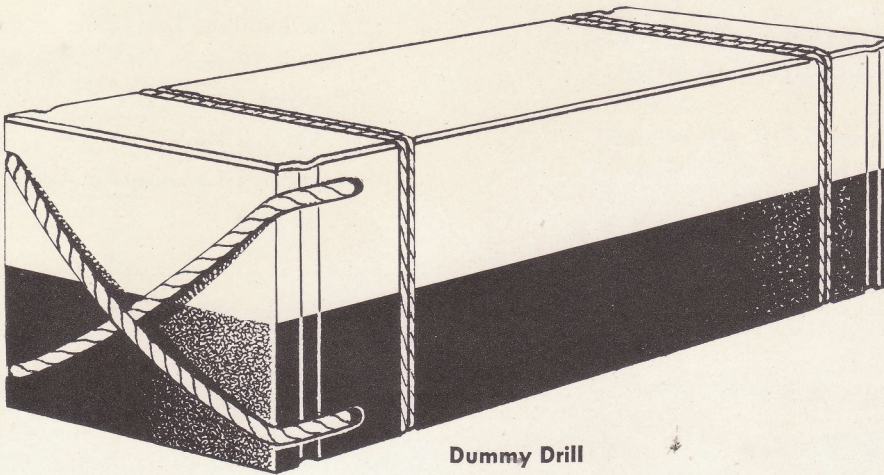
For use in 16"/50 Cal. Guns MK 7
With 16"/50 A.P. Proj. MK 8 and Mods
 $\frac{1}{2}$ Ser. Chg. 16"/50 Cal. SPD 7251
I.V. 2500 F.S.
Ign. 350 Grams B.C.P. per Section
Lead Foil 200 Grams per Section
J.O. 3016 P.O. 353-H-44
Amm. Off. F.W.D. Comdg. Off. L.P.D.

XI.

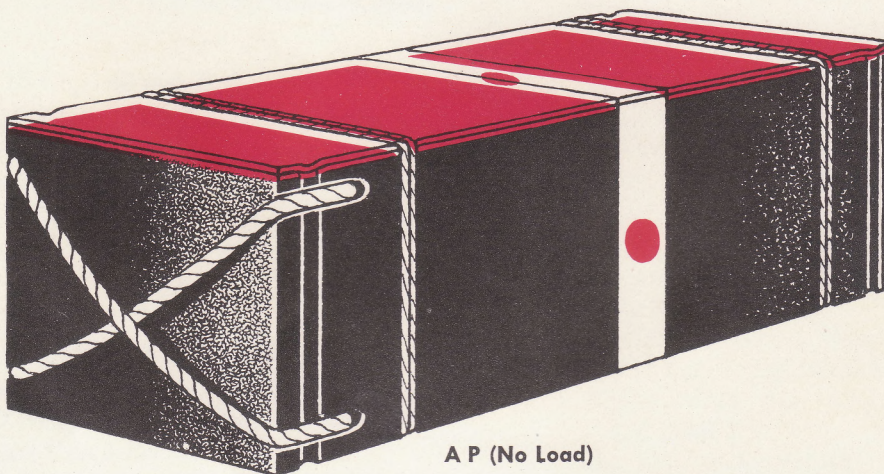
24

Combination Lock Primers Mark XV-1
Naval Torpedo Station, Newport, R. I.
Symbol Letter GY Manufactured Decem-
ber 1, 1943
Inspected December 5, 1943 Issued January
4, 1944

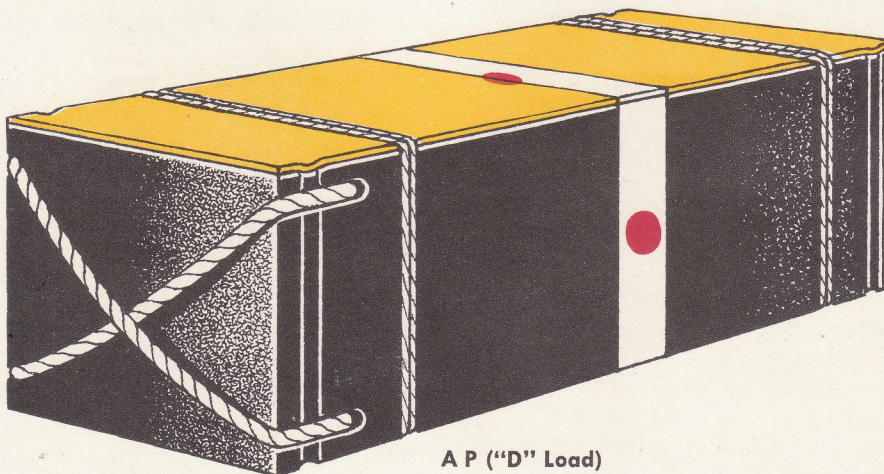
CONFIDENTIAL



Dummy Drill



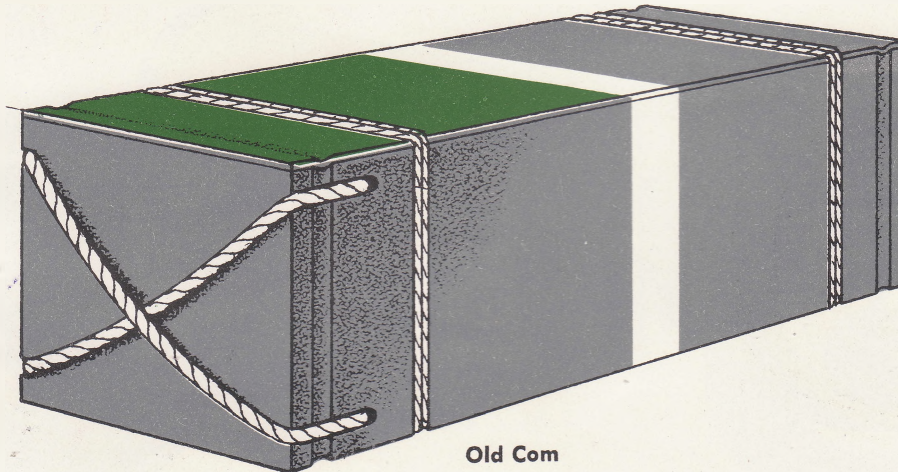
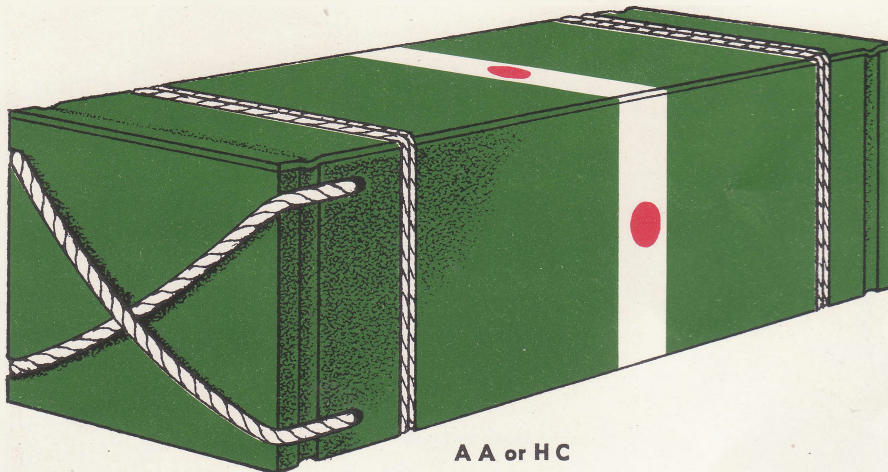
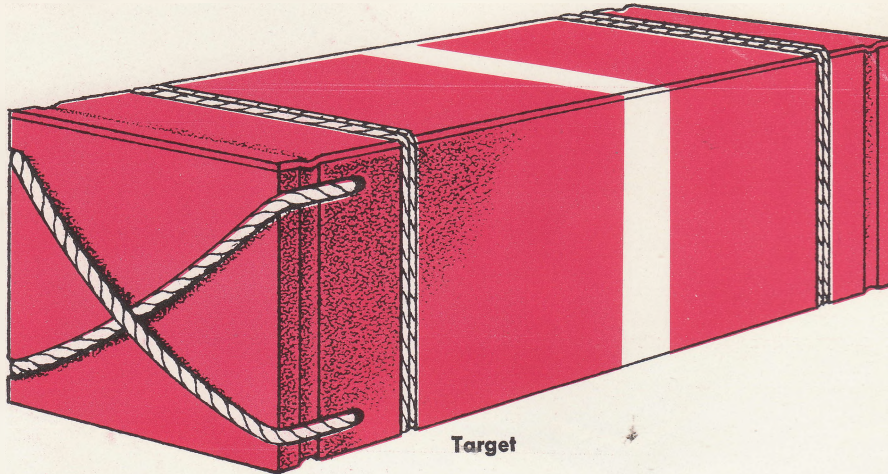
A P (No Load)



A P ("D" Load)

FIXED CARTRIDGE BOXES

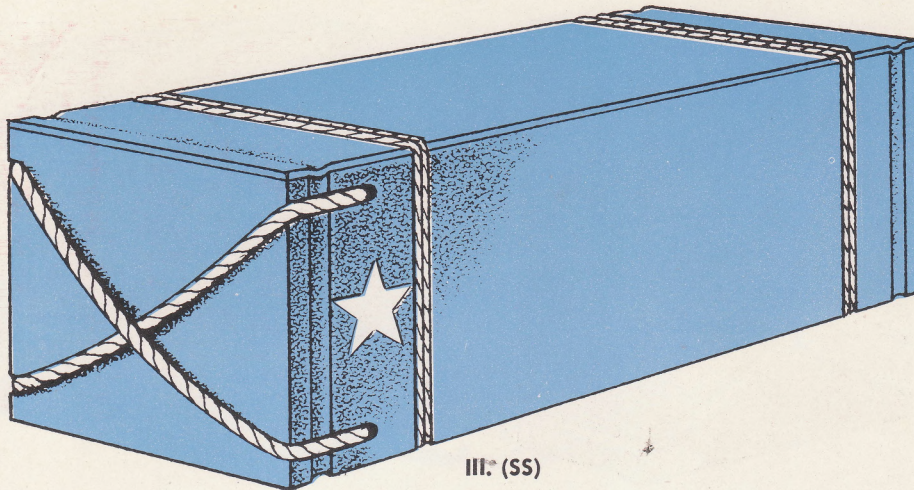
CONFIDENTIAL



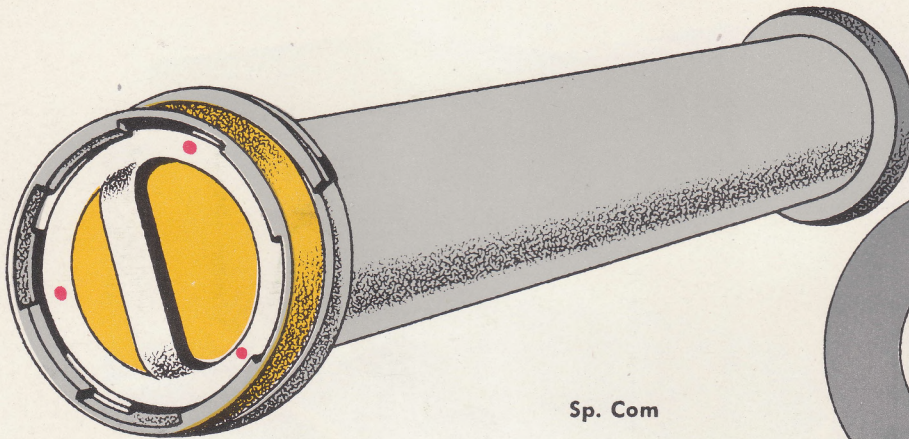
FIXED CARTRIDGE BOXES

CONFIDENTIAL

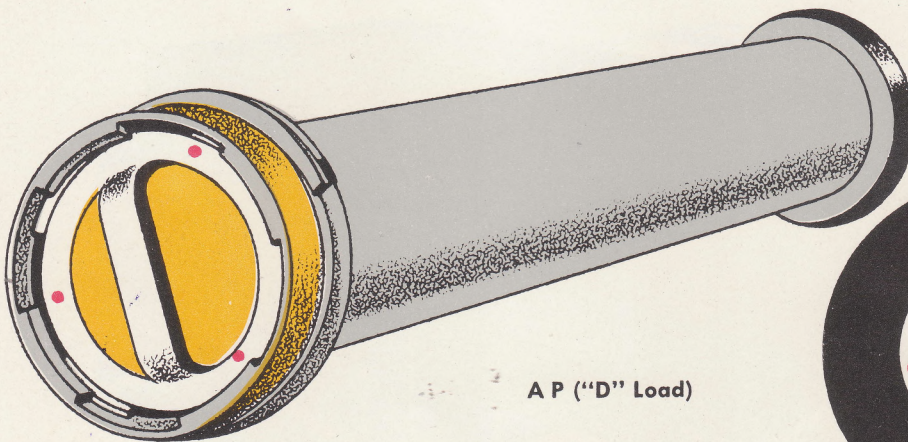
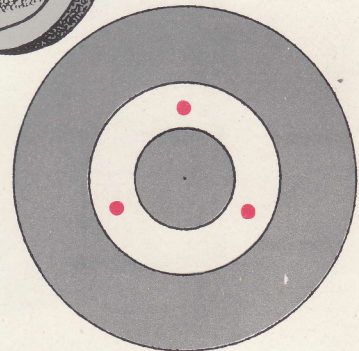
CONFIDENTIAL



III. (SS)



Sp. Com



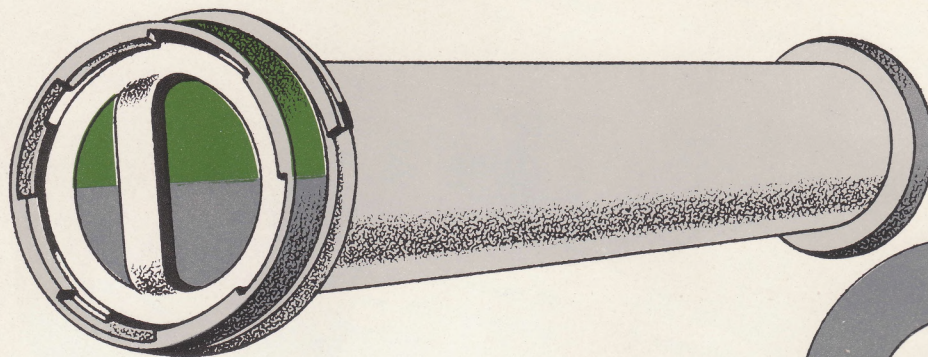
A P ("D" Load)



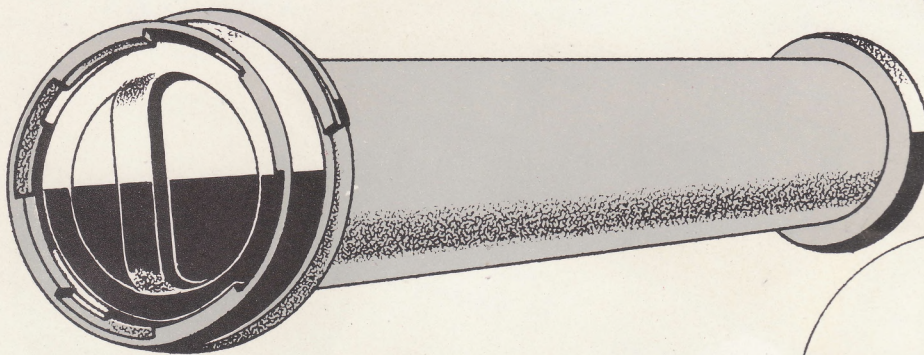
FIXED CARTRIDGE BOX AND TANKS

CONFIDENTIAL

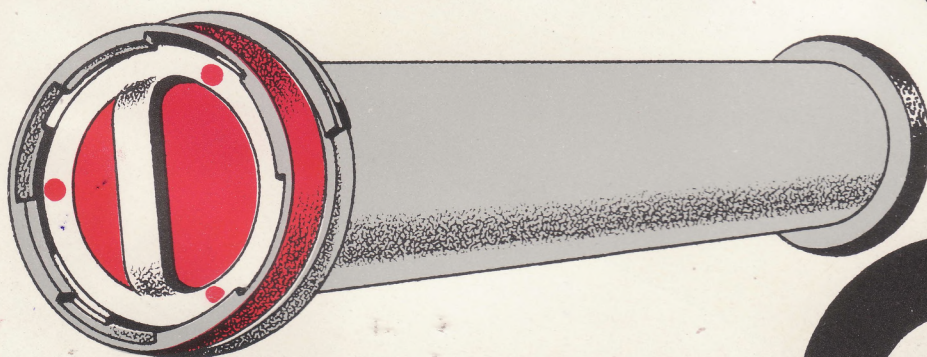
CONFIDENTIAL



Old Com



Dummy Drill

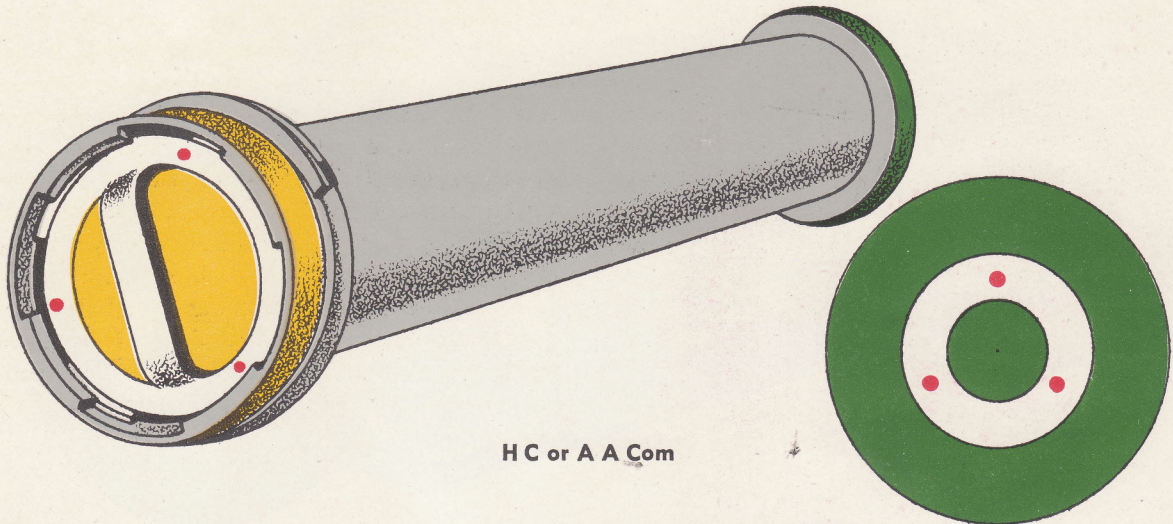


A P (No Load)

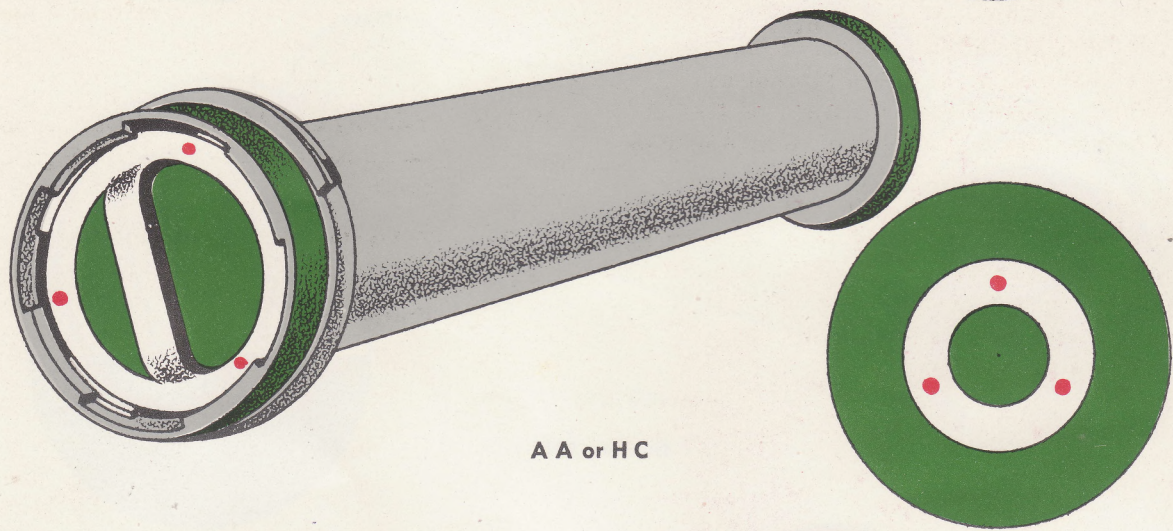
FIXED CARTRIDGE TANKS

CONFIDENTIAL

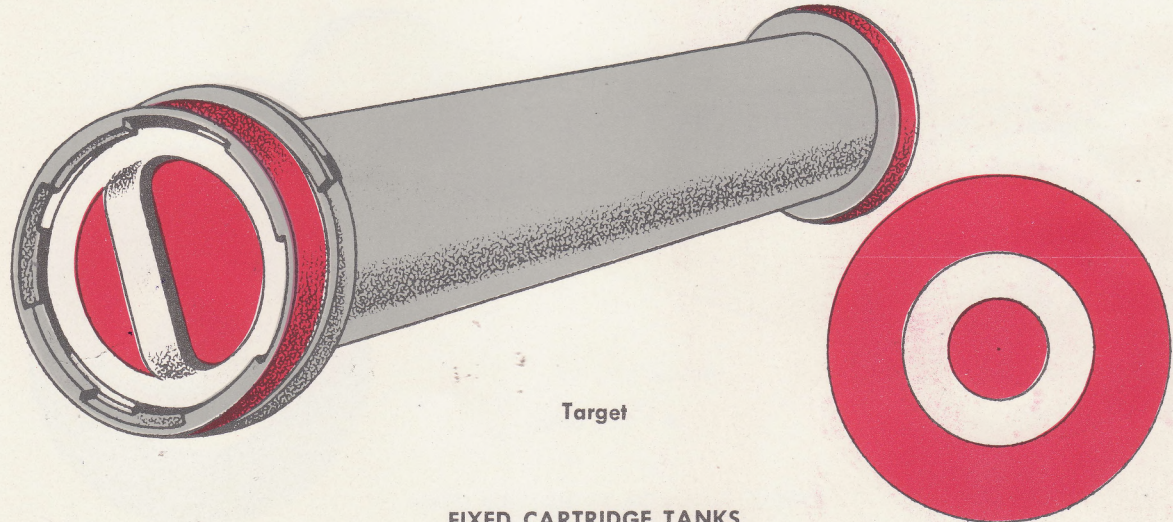
CONFIDENTIAL



HC or A A Com



A A or HC



Target

FIXED CARTRIDGE TANKS

CONFIDENTIAL

CONFIDENTIAL

SUMMARY:

While the information contained in this publication is believed to be accurate, it is not official and should not be used as such.

From time to time, the Bureau of Ordnance will authorize the assembly and issue of certain gun ammunition for a specific purpose which will not conform to the general rules laid down in this publication.

BIBLIOGRAPHY:

For more detailed and complete information on the subjects covered in this bulletin the following official publications are suggested reading:

OP 4 Ammunition Instructions for the Naval Service

OP 5 Ammunition Ashore
Bureau of Ordnance Manual

OD 5297 Ammunition Assemblies

OD 2790 Weights and Dimensions of Ammunition Components and their Containers

Bureau of Ordnance Circular Letters of the "A" series which furnish information on Gun Ammunition.

The information contained in OD 5297 — Ammunition Assemblies, and its revisions, is of tremendous value to those concerned with gun ammunition. This publication is indispensable for detailed information on proper issue, assembly and structure of serviceable gun ammunition.

Note: The system in use for marking projectiles, cartridges, powder bags and containers is being standardized at the present time and will involve various changes in the marking system presented in this publication. However, it will be considerable time until ammunition and containers marked according to this new system reaches the field in any great quantity, and ammunition stocks now in the field are marked according to the system herein presented. Therefore, it is well for those concerned with ammunition to be familiar with both systems. A supplement to this publication will be issued in which the new system will be presented, and the information may be found in the following official publications:

OS 3405 Specification for the Painting and Marking of 3" caliber and larger Gun Ammunition and Ammunition Components by Loading Activities.

OS 3410 Painting and Marking of Gun Ammunition Boxes and Tanks by Loading Activities.

OS 1351 Paints on Exteriors of Projectiles.

OS 1427 Marking, Painting, and Greasing of Projectiles.

OS 1356 Projectile Cavity Paint.

GLOSSARY OF GUN AMMUNITION TERMS

- ADAPTER.** Threaded bushing used to adapt a fuze to a projectile.
- AMMUNITION COMPONENTS.** Parts of a complete round which in themselves are integral units, *i.e.* fuze, primer, tracer, powder, cartridge case, etc.
- AMMUNITION DETAILS.** Accessories for ammunition which provide means for packing, handling, protection, surveillance, etc., *i.e.* boxes, tanks, grommets, magazine sample bottles, etc.
- AMMUNITION LOT.** A number of rounds each of which is manufactured by one manufacturer under uniform conditions, and which is expected to function in a uniform manner.
- AMMUNITION LOT NUMBER (Assembly lot number).** Number which identifies an ammunition lot.
- ARM.** To put a fuze in a condition whereby it can function.
- BAG GUN AMMUNITION.** Gun ammunition in which the primer, propelling charge (in silk bags) and projectile are separate.
- BASE DETONATING FUZE.** A detonating fuze located in the base of a projectile.
- BOOSTER.** A high explosive component which amplifies the explosion of a fuze to properly detonate the bursting charge of a projectile.
- BOURRELET.** The machined, raised portion of a projectile which bears on the lands of the gun during its travel through the bore.
- BURSTER (bursting charge).** The explosive filler of projectiles.
- CALIBER.** (1) the diameter of the projectile at the bourrelet expressed in inches or millimeters (2) the length of the bore of a gun in bore diameters.
- CANNELURE.** A circumferential groove in the projectile rotating band.
- CARTRIDGE.** A complete round of fixed ammunition and the complete assembly of cartridge case, primer and propelling charge for semi-fixed ammunition.
- CARTRIDGE CASE.** A metal or plastic case used to contain the propelling charge of small arms, fixed and semi-fixed ammunition.
- CEBALINE.** An asphaltic (acid resistant) paint used to paint the inside of projectiles which are to be filled with Explosive "D."
- COMBINATION PRIMER.** A primer fired by either percussive or electrical means.
- COMPLETE ROUND.** All the components of a round of any type of ammunition required to fire the gun once.
- DENSITY OF LOADING.** Weight of explosive per unit volume.
- DETONATION.** The very rapid explosive reaction of a high explosive as compared to a burning rate.
- DETONATOR.** A sensitive explosive or explosive component used to detonate other explosives.
- DISTANCE PIECE.** A cardboard piece used in connection with a wad in cartridge cases in which the powder does not completely fill the case, to keep the propellant charge positioned around the primer.
- DRILL AMMUNITION.** Inert or dummy ammunition used for training purposes etc.
- DYE CAP.** The forward brass part of a projectile windshield used to cover the ports through which water enters the windshield.
- EXPPELLANT (EXPPELLING) CHARGE.** A charge of explosive used to eject a component from its container.
- EXPLOSION.** A sudden reaction which generates a large volume of highly heated gases with resultant pressures.
- EXPLOSIVE.** A substance (compound or mixture) which may undergo very rapid chemical change producing a large amount of heat and a large volume of gas.
- EXPLOSIVE "D".** Ammonium picrate, a high explosive.
- EXPLOSIVE FILLER.** See burster.
- EXTRACTOR.** Device which fits over lip of cartridges to aid in their extraction from the tank. Also, device in a gun to extract fired cartridge cases.
- EXTRACTOR GROOVE.** The groove around the base of a cartridge case which provides a grip for the extractor mechanism.
- EXTRACTOR RIM.** A rim or flange around the base of a cartridge case which provides a grip for the extractor mechanism.
- FILLER.** See burster.
- FIXED AMMUNITION.** Gun ammunition in which all components are completely assembled and the projectile is rigidly attached to the cartridge case.
- FLARE-BACK.** The passing to the rear of unburned gases from the breech of a weapon, resulting in flame upon contact of the gases with the air.

FRAGMENTATION. The shattering into fragments of an item of ammunition by its bursting charge.

FUZE. A device for initiating the action of an explosive filler.

GRANULATION. The size and form of grains of explosive.

GROMMET. A band of canvas or fibre placed around the rotating band to protect it.

HANGFIRE. Temporary failure of a primer, igniter or propelling charge to function.

HIGH EXPLOSIVE. An explosive capable of reacting at a very high rate (detonating rate) instead of burning rapidly.

HIGH ORDER DETONATION. Complete detonation at a maximum rate.

HYGROSCOPIC. The property of a substance for absorbing moisture from the air.

IGNITION CHARGE. A charge of black powder used to ignite smokeless powder propellant charges contained in bags.

ILLUMINATING PROJECTILE. A projectile used for illuminating purposes. A fuze acts to set off an expelling charge to eject a parachute suspended flare.

INCENDIARY. An agent used to cause the ignition of combustible substances.

INCREMENT. A fraction of a total charge as used in Explosive "D" loading of projectiles.

LOADING FACTOR. Weight of explosive filler compared to total weight of projectile. (Expressed in per cent.)

LOCK COMBINATION PRIMER. A combination primer used in the breech firing lock of bag guns.

LOT NUMBER. See ammunition lot number.

LOW ORDER DETONATION. An incomplete or relatively slow detonation or both.

LUTING. A mixture of resin and linseed oil used for sealing threaded connections.

MAGAZINE. (1) Any structure that is used for storing ammunition or explosives, or (2) The black powder ignition charge in certain projectile fuzes.

MARK NUMBER. A numerical designation for ordnance items preceded by the word Mark or abbreviation Mk.

MECHANICAL TIME FUZE. A fuze whose time action is controlled by a clocklike mechanism.

MERCURY FULMINATE. A sensitive high explosive

commonly used to initiate the reaction of other explosives.

MOD. Abbreviation for modification. A Mod number usually follows a Mark number to indicate a revision in design of the item.

OGIVE. The forward curved portion of a projectile or other missile.

PERCUSSION PRIMER. A primer fired by percussive means.

PERCUSSIVE FIRING. The initiation of the reaction of an explosive by means of a blow.

POWDER TRAIN. Black powder element, the burning of which may control the functioning time of fuzes, etc.

PRIMER. A device for initiating the burning or detonation of an explosive charge.

PRIMER MIX (mixture). A mixture containing a very sensitive explosive (initiator) used in primers.

PROPELLANT. An explosive which, upon ignition, propels a projectile.

PROPELLING CHARGE. A quantity of explosive used as a propellant.

PYROTECHNIC. Material used to produce certain effects by means of fire.

ROTATING BAND. A raised, soft metal band near the base of a projectile to impart rotational movement to the projectile as it is fired.

SECTION. Bag charge.

SEMI-FIXED AMMUNITION. Gun ammunition in which cartridge case and projectile are separate.

SEPARATE LOADING AMMUNITION. Ammunition which is loaded into a gun in more than one operation.

STACKED CHARGE. Arrangement of powder grains end to end in a powder bag.

STAR. A pyrotechnic signal which burns as a single element.

TETRYL. A sensitive explosive commonly used as boosters and bursters.

TIME FUZE. A fuze designed to function after a predetermined time interval.

TRACER. An integral or separate component containing a pyrotechnic substance placed in the after end of a projectile. As the pyrotechnic substance burns, it traces the path of the projectile in flight.

TNT. A high explosive which is a bursting charge for projectiles.

CONFIDENTIAL

**COMMON ABBREVIATIONS
USED IN GUN AMMUNITION NOMENCLATURE**

AA	Anti-Aircraft	EX	Experimental
AAC or		EXP	Expellant or Explosive
AACom	Anti-Aircraft Common	Exp "D"	Explosive "D"
AC	Aircraft Cannon		
ADF or		F	Fuze
Aux. Det.	Auxiliary Detonating Fuze	FC	Full Charge
A/I	Notice of Ammunition Issued	FFFG	Fine Fine Fine Grain (Black Powder)
AIC	Ammunition Identification Code (Army)	FFG	Fine Fine Grain (Black Powder)
ALN	Ammunition Lot Number	FG	Fine Grain ((Black Powder)
AMM	Ammunition	FN	Flat Nose
AMSO	Ammunition Order — Shipment Order	FP	Flashless Pellets
A/O	Ammunition Order	Frag	Fragmentation
AP	Armor Piercing	FS	Fuze Setting
APT	Armor Piercing Tracer	FS	Foot Seconds
AQE	Ammunition Quality Evaluation		
ASSEM	Assembled	GMS	Grams
		GRNS	Grains
BBT	Bombardment	HC	High Capacity
BC	Bursting Charge	HE	High Explosive
BCP	Black Cannon Powder	HEI	High Explosive Incendiary
BDF	Base Detonating Fuze	HEIT	High Explosive Incendiary Tracer
BF	Base Fuze	HET	High Explosive Tracer
BIF	Base Ignition Fuze		
BL and P	Blind Loaded and Plugged	IGN	Ignition
BL and T	Blind Loaded and Traced	IN	Inert
BOSO	Bureau of Ordnance Shipment Order	INST	Instantaneous
BP	Black Powder	IV	Initial Velocity
BR	British		
BUORD	Bureau of Ordnance	JO	Job Order
BUR CHG	Bursting Charge		
		LC	Long Chamber
CAL	Caliber	L and F	Loaded and Fuzed
CCIP	Case Combination Ignition Primer	L and P	Loaded and Plugged
CHG	Charge		
COM	Common	M	Model (Army)
CPP	Case Percussion Primer	MCBD	Major Caliber Base Detonator
CTG	Cartridge	MFR	Manufacturer
CTN	Carton	MK	Mark
CT-TNT	Cast TNT	MM	Millimeter
		MOD	Modification
		MTF	Mechanical Time Fuze
		MV	Muzzle Velocity
D DR	Dummy Drill		
DEN	Density	N	Navy
DNF	Dummy Nose Fuze	NAD	Naval Ammunition Depot
DNP	Dummy Nose Plug	NAS	Naval Air Station
DWG	Drawing		

CONFIDENTIAL

NF	Nose Fuze	SC	Short Chamber
NM	Naval Magazine	SD	Self Destructive or Destroying
NOB	Naval Operating Base	SER	Service
NOP	Naval Ordnance Plant	SF	Semi-Fixed
NSB	Naval Section Base	SPEC	Special
		SPOT	Spotting
O/A	Original Assembly	SQ	Super Quick
OBS	Obsolete	SS	Illuminating (Star Shell)
OCL	Ordnance Circular Letter	STD	Semple Tracer Detonator
OD	Ordnance Data	STF	Semple Tracer Fuze
O/H	Overhauled		
OP	Ordnance Pamphlet		
OS	Ordnance Specification	TAR	Target
		TDF	Tracer Detonating Fuze
PDF	Point Detonating Fuze	TET	Tetryl
PDR	Pounder	TF	Time Fuze
PDR	Powder	TNT-CT	Cast TNT
PENT	Pentolite	TP	Target Practice
PERC	Percussion	TRA	Tracer
PO	Prep Order	TS	Torpedo Station
PRAC	Practice	T and SQ	Time and Super Quick
PRI	Primer		
PROJ	Projectile		
PS	Proof Shot	V	Velocity
RD	Round	W/O	Without
RO	Rework Order	WT	Weight
R/R	Receiving Report	WT CHG	Weight of Charge



