TECHNICAL REGULATIONS
No. 1360–3A

WAR DEPARTMENT,
WASHINGTON, *March 19, 1928.*

ANTIAIRCRAFT AMMUNITION

AMMUNITION FOR 3-INCH ANTIAIRCRAFT GUNS, M1917, M1918, AND M1925

Prepared under direction of the
Chief of Ordnance

This pamphlet supersedes Ordnance Department pamphlet No. 2019

SECTION I

GENERAL

1. **Purpose and scope.**—These regulations are intended for the using branches. They give all necessary information regarding the construction, functioning, and identification of the different classes of 3-inch antiaircraft ammunition and the components thereof.

2. **References.**—*a.* Before attempting to handle ammunition of any type, personnel should be thoroughly familiar with TR 1370–A.

b. For the preparation and use of blank ammunition for these guns, see TR 1370–B.

c. Proper nomenclature for ammunition described herein is given in Standard Nomenclature List (S. N. L.) D–8, "Gun, Antiaircraft, 3-inch, M1917, Gun, Antiaircraft, 3-inch, M1918."

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d. The following firing tables are based upon the use of the ammunition herein described:

Projectile	Firing Table No.
3-inch antiaircraft gun, M1917, firing antiaircraft shrapnel, Mk. I, or antiaircraft shell, Mk. I, Mk. III antiaircraft fuze	3AA-J-1
3-inch antiaircraft gun, M1917, firing antiaircraft shell, Mk. IX, Mk. III antiaircraft fuze	3AA-K-1
3-inch antiaircraft gun, M1918, firing antiaircraft shrapnel, Mk. I, or antiaircraft shell, Mk. I, Mk. III antiaircraft fuze	3AA-I-1
3-inch antiaircraft gun, M1918, firing antiaircraft shell, Mk. IX, Mk. III antiaircraft fuze	3AA-L-1

e. TR 1310–3A, 1310–3B, and 1410–3A describe the operation, care, and maintenance of the guns and carriages for which this ammunition was designed.

SECTION II

GENERAL DISCUSSION

3. General remarks.—The ammunition used in these guns is known as fixed ammunition, in that the round of ammunition is issued with the cartridge case, containing a primer and propelling charge, firmly attached to the projectile. (Fig. 1.)

This is accomplished by forcing the projectile into the cartridge case and crimping the cartridge case at four equidistant places into each of two grooves in the projectile at the rear of the rotating band. Thus all components of the round are loaded into the gun as a unit and by one operation. The ammunition for these two models of gun differs only in the cartridge case and the amount of the propelling charge.

4. Types of ammunition.—*a. Characteristics.*—(1) Two general types of ammunition are provided, as follows: High-explosive shell ammunition and shrapnel ammunition. Both types of ammunition are issued complete, with the fuze in place, but before firing it is necessary to remove the waterproof cover over the fuze and give the fuze the proper time setting.

(2) Dummy drill cartridges are also provided for these guns, this ammunition being described in TR 1370–D.

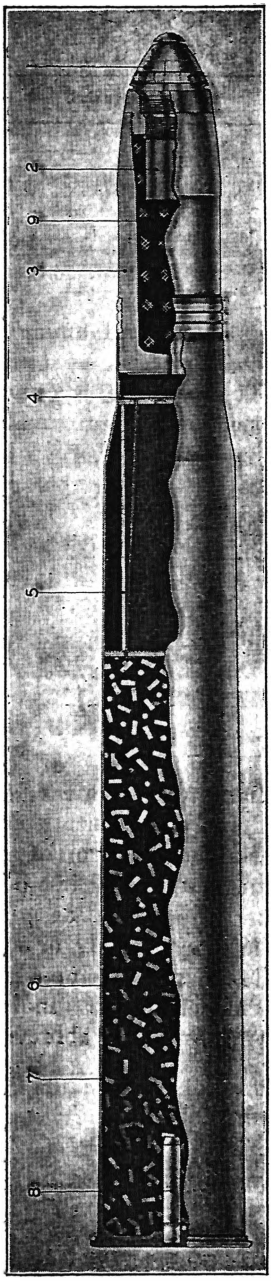


FIG. 1.—Complete round 3-inch antiaircraft ammunition

1. Antiaircraft time fuze, Mk. III
2. Antiaircraft booster, Mk. X
3. Common steel shell, Mk. IX
4. Diaphragm
5. Distance wad
6. Propelling charge
7. Cartridge case
8. 110-grain percussion primer
9. Bursting charge (TNT)

b. Components.—These different types of ammunition are made up of the following components:

Component	High-explosive shell	Shrapnel
Projectile	Mk. I; Mk. IX	Mk. I.
Cartridge case for M1917 gun	Mk. I; Mk. I, MI	Mk. I.
Cartridge case for M1918 gun	Mk. II; Mk. II, MI	Mk. II.
Booster	Mk. X, antiaircraft	None.
Filling		Lead balls and resin.
Bursting charge	TNT	Black powder.
Fuze	Mk. III, antiaircraft time	
Propelling charge	Nitrocellulose smokeless powder	
Primer	110-grain percussion primer	

c. Weights.—The weight of a round of ammunition as shipped varies somewhat with the kind of projectile used and with the model of gun in which it is used. The weight of a round of ammunition and the weights of its components are approximately as follows:

Component	High-explosive shell, Mk. I	High-explosive shell, Mk. IX	Shrapnel, Mk. I
Projectile (empty)	11.81	9.72	6.78
Bursting charge	1.72	.91	.17
Filling			7.05
Cartridge case for M1917 gun (with primer, etc.)	8.56	8.48	8.56
Cartridge case for M1918 gun (with primer, etc.)	6.75	6.66	6.75
Propelling charge for M1917 gun	5.31	5.62	5.31
Propelling charge for M1918 gun	4.63	4.94	4.63
Fuze	1.25	1.25	1.25
Booster	.81	.81	
Total weight of round	40.84	38.39	40.50

5. Identification of components.—For identification purposes, practically all assembled units or components are given a mark number or model. The mark-number form of identification was adopted about 1917 and in this system the first design of a certain component was called "Mark I," the second design "Mark II," and so on. This is usually abbreviated as "Mk. I," or sometimes as "MI." The previous method was to designate the component as the model of a certain year, for instance, "Model of 1917," indicating that it was designed in the year 1917. This is usually abbreviated as "Mod. of 1917," or sometimes as "M1917."

SECTION III

PROJECTILES

6. Types.—The two types of projectiles authorized for use in these guns are made of steel and are—

a. Common steel or high-explosive shell, Mks. I and IX.

b. Shrapnel, Mk. I.

7. General remarks.—*a. Base cover.*—All projectiles containing high explosive are fitted with base covers, which are designed to prevent the gases from the propelling charge coming in contact with the explosive charge of the shell through possible defects in the base. Two types of base covers are in use, the older type, found only on the Mk. I shell, consisted of a slightly dished brass plate, covering a lead disk, the brass plate being crimped into the base of the projectile. The new type, found only on the Mk. IX shell, consists of a disk of sheet brass or steel sweated to the base of the projectile with solder.

b. Rotating band.—(1) The functions of the rotating band are to impart rotation and thus to maintain the stability of the projectile during flight and also to prevent the propelling-charge gases from escaping past the projectile when the gun is fired. The rotating band is a cylindrical ring of copper pressed into a groove near the base of the projectile. The surface of this groove is knurled or roughened to prevent the rotating band from slipping while the projectile is being rotated in the bore of the gun.

(2) When the gun is fired the rotating band engages with the rifling of the gun, which is of a spiral or screw shape, and thus the projectile is forced out of the barrel of the gun with a rotating motion. Since the diameter of the rotating band is greater than the greatest diameter of the rifling in the gun, the rotating band completely fills the bore of the gun and prevents the propelling-charge gases from escaping past the projectile.

(3) Rotating bands must be made of a comparatively soft metal that will flow readily and fill the rifling grooves in the gun barrel. The material must be sufficiently soft to prevent excessive wear of the lands in the gun barrel and at the same time not so soft as to strip under the resistance met in rotating the projectile. The rotating-band material should have a high melting point. Copper is

probably the best available material and is used for all rotating bands. Care should be exercised to avoid rough handling of the projectile so as not to deform the rotating band. Such handling may result in deformation to such an extent that the projectile can not be loaded in the gun.

c. Painting and marking.—(1) All projectiles are painted, both as a means of ready identification and as a rust preventive.

(2) Projectiles containing high explosives (TNT), such as the Mks. I and IX shells, are painted yellow.

(3) Projectiles containing low explosive (black powder), such as the Mk. I shrapnel, are painted red.

(4) Projectiles are also stenciled to show the caliber, lot number, kind of filling, etc.

8. Common steel or high-explosive shell, Mk. I.—*a. Description.*—(1) This design of shell was developed during the World War and represents the older type of shell in use before the Mk. IX shell was developed. The Mk. I shell is obsolete and no more will be manufactured. Figure 2 shows this shell, together with the names of its principal parts. The radius of the ogive on this shell is approximately 7 calibers,[1] and the base is cylindrical or straight in shape. It is fitted with the older type of base cover as described in paragraph 7*a*. The rotating band on this shell is .55 inch wide. Mk. I shell of the latest manufacture are provided with a groove cut into the steel of the shell body immediately to the rear of the rotating band. Earlier manufactured shell did not have this groove. This groove was incorporated to take care of the surplus copper of the rotating band, which is forced to the rear when the shell is fired, and thus prevents " fringing " of the rotating band, which causes erratic flight of the projectile.

(2) Mk. I shell should not be fired in either model of 3-inch antiaircraft gun rifled 1 turn in 40 calibers, since, when fired from such guns, this shell is unstable in flight and accurate shooting will not be obtained. This shell is stable in guns rifled 1 turn in 25 calibers, but the Mk. IX shell should be fired in guns rifled 1 turn in 40 calibers for best results.

(3) The different kinds of rifling in these guns may be distinguished by the model numbers of the guns, as follows:

(*a*) 3-inch antiaircraft guns, M1917 or M1917MI, have rifling increasing in twist from 1 turn in 50 calibers to 1 turn in 25 calibers.

[1] By caliber is meant the diameter of the bore of the gun. A radius of ogive of 7 calibers is, therefore, a radius of 7 times 3 inches, or 21 inches.

(*b*) 3-inch antiaircraft guns, M1917A1 or M1917MI A1, have a uniform twist of rifling of 1 turn in 25 calibers. (These are M1917 or M1917MI guns which have been retubed.)

(*c*) 3-inch antiaircraft guns, M1917 A2 or M1917MI A 2, have a uniform twist of rifling of 1 turn in 40 calibers. (These are M1917 or M1917MI guns which have been retubed.)

(*d*) 3-inch antiaircraft guns, M1917MII, have a uniform twist of rifling of 1 turn in 40 calibers.

(*e*) 3-inch antiaircraft guns, M1918 or 1918MI, have rifling increasing in twist from 1 turn in 50 calibers to 1 turn in 25 calibers.

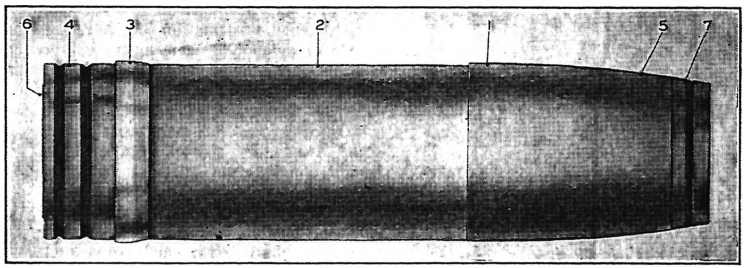


FIG. 2.—3-inch antiaircraft common steel shell, Mk. I

1. Bourrelet
2. Body
3. Rotating band
4. Base (straight or cylindrical)
5. Ogive
6. Base cover
7. Adapter

(*f*) 3-inch antiaircraft guns, M1918 A1 or 1918MI A1, have a uniform twist of rifling of 1 turn in 25 calibers. (These are M1918 or M1918MI guns which have been retubed.)

(*g*) 3-inch antiaircraft guns, M1918 A2 or M1918MI A 2, have a uniform twist of rifling of 1 turn in 40 calibers. (These are M1918 or M1918MI guns which have been retubed.)

(*h*) 3-inch antiaircraft guns, M1925MI, have a uniform twist of rifling of 1 turn in 40 calibers.

(4) The explosive charge in the Mk. I shell is about 1.72 pounds of TNT. The round containing this shell is marked for identification as shown in Figure 3.

b. Weights.—The weights of loaded Mk. I shell, assembled with the Mk. X antiaircraft booster and fuze, vary from approximately 14 pounds 5 ounces to approximately 15 pounds 5 ounces, and ob-

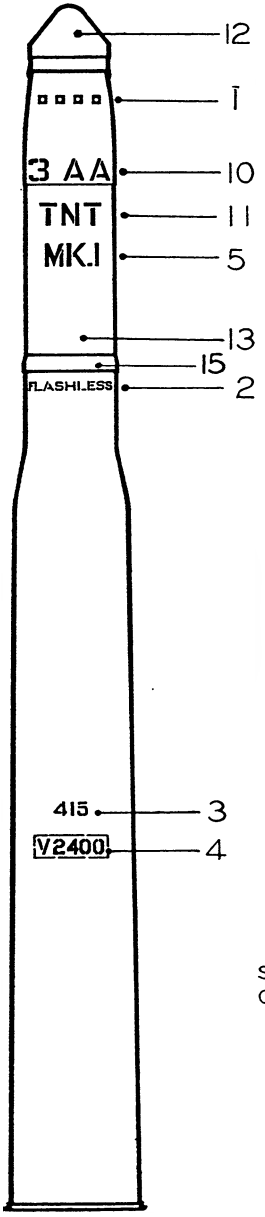
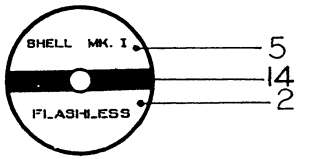


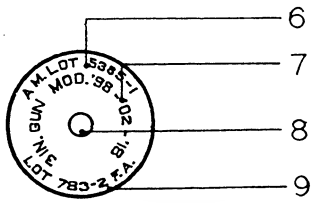
FIG. 3.—Marking for 3-inch high-explosive fixed ammunition for antiaircraft gun

1. Weight zone marks (see paragraphs 8*b* and 9*b*)
2. When flashless powder is used
3. Lot number of propelling charge powder
4. Muzzle velocity, in feet per second (rectangle as shown denotes service charge)
5. Mark number of shell
6. Ammunition lot number
7. Caliber and model of cannon
8. For stamping on primer, see Figure 9
9. Lot number of cartridge case and initials or symbol of manufacturer of cartridge case
10. Caliber and type of cannon
11. Symbol of explosive filler
12. Fuze and waterproof cover are stamped with model of fuze, lot number, initials or symbol of manufacturer, and month and year of loading
13. Caliber and type of cannon, mark number, lot number of unloading shell, initials or symbol of machining plant, and inspection marks (stamped on shell under paint)
14. One stripe as shown denotes service charge
15. Ammunition lot number (stamped on rotating band only when loaded shell are shipped unfixed)

NOTE.—1, 6, 7, 8, 9, 12, 13, and 15 are stamped on, others are stenciled in black paint.



STENCILLING ON BASE OF CARTRIDGE CASE



STAMPING ON BASE OF CARTRIDGE CASE

viously this variation in weight will result in considerable variation in range. In order that these variations in weight may be conveniently noted by the service, the shell are divided into four weight zones. Each particular lot number of ammunition contains only shell of one weight zone and more uniform ballistic results should be obtained by firing groups containing shell of the same weight zone. These weight marks are made with a prick punch and are in the center of ½-inch squares that are stenciled in black on the projectile. The weight zones and the identification marks which are placed on the shell to indicate the particular weight zone are as follows:

From—		To—		Mark
Pounds	*Ounces*	*Pounds*	*Ounces*	
14	5	14	9	⊡
14	9	14	13	⊡ ⊡
14	13	15	1	⊡ ⊡ ⊡
15	1	15	5	⊡ ⊡ ⊡ ⊡

9. Common steel or high-explosive shell, Mk. IX.—*a. Description.*—(1) In order to increase the life of the 3-inch antiaircraft guns and to reduce the rotation of the projectile, thus improving fuze action, the rifling of these guns was changed from a twist of 1 turn in 25 calibers to 1 turn in 40 calibers. With a twist of rifling of 1 turn in 40 calibers, the 3-inch antiaircraft Mk. I shell was found to be unstable and it was therefore necessary to design a new shell. This new shell is known as the Mk. IX shell and is suitable for firing in both models of 3-inch antiaircraft guns, rifled either 1 turn in 25 or 1 turn in 40 calibers. For the different types of rifling in the different models of 3-inch antiaircraft guns, see paragraph 8*a*(3).

(2) Figure 4 shows the Mk. IX shell, together with the names of its principal parts. This shell is shorter and lighter in weight and contains less high explosive than the Mk. I shell. The radius of ogive on this shell is the same as that on the Mk. I shell, namely 7 calibers, and the base is cylindrical or straight in shape. It is fitted with the new disk type of base cover, as described in paragraph 7*a*. The rotating band on this shell is almost twice as wide as that on the Mk. I shell, being 1 inch in width. A groove is cut into the steel of the shell body immediately to the rear of the rotating band to take care of the surplus copper of the rotating band which is forced to the rear when the shell is fired, thus preventing "fringing" of the rotating band, which results in erratic flight of the projectile.

Two circumferential grooves are also cut in the cylindrical part of the rotating band to serve a similar purpose.

(3) The explosive charge in the Mk. IX shell is about 0.91 pound of TNT. The round containing this shell is marked for identification as shown in Figure 3.

b. Weights.—The weights of loaded Mk. IX shell assembled with Mk. X antiaircraft booster and fuze do not vary as much as the weights of the Mk. I shell, but for the same reasons as given for weight-zoning Mk. I shell in paragraph 8*b*, the Mk. IX shell are divided into three weight zones. These identification marks are placed on the shell in the same manner as described for the Mk. I

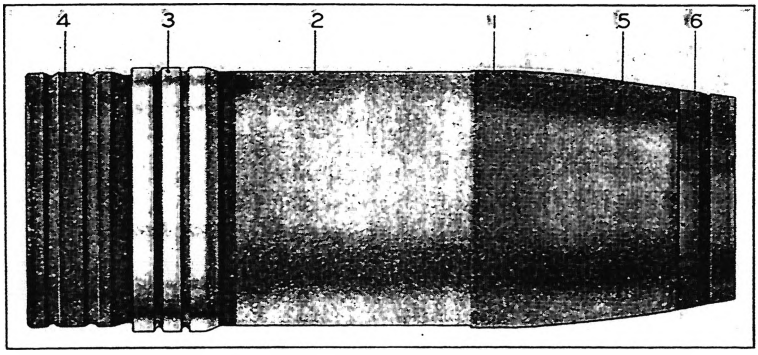


FIG. 4.—3-inch antiaircraft common steel shell, Mk. IX

1. Bourrelet
2. Body
3. Rotating band
4. Base (straight or cylindrical)
5. Ogive
6. Adapter

shell in paragraph 8*b*. The weight zones and the identification marks which are stenciled on the shell to indicate this weight zone are as follows:

Weight	Mark
Under 12 pounds, 9½ ounces	⊡
From 12 pounds, 9½ ounces to 12 pounds, 12 ounces	⊡ ⊡
Over 12 pounds, 12 ounces	⊡ ⊡ ⊡

10. **Shrapnel, Mk. I.**—*a. Description.*—The Mk. I shrapnel is shown in Figure 5. The base or bursting charge consists of 3 ounces of black powder, which is placed in the base of the projectile. A steel diaphragm acts as a cover for the base charge and supports the balls and matrix. The shrapnel also contains a central tube,

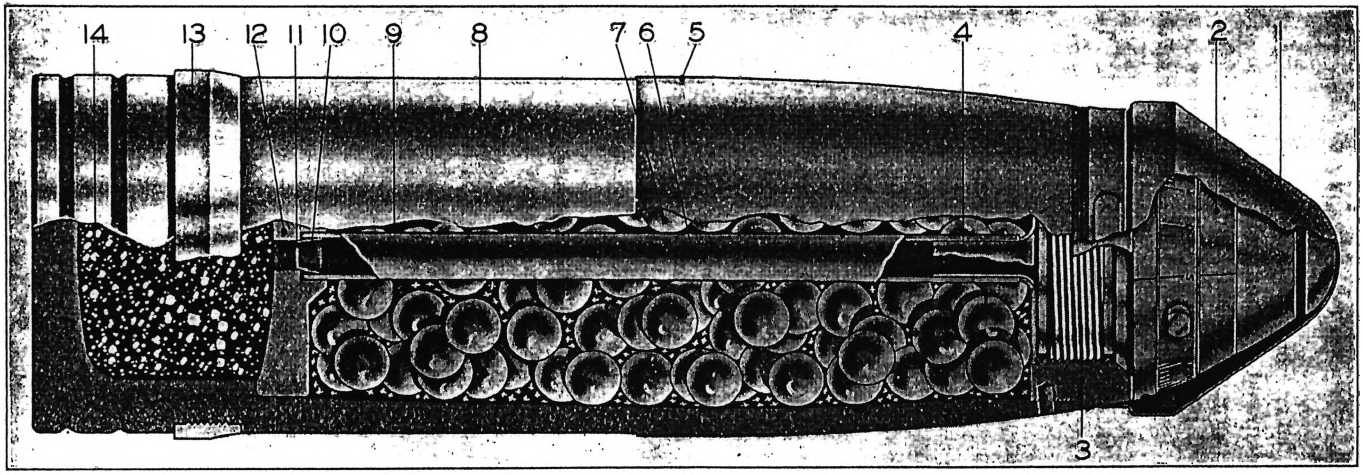


FIG. 5.—3-inch antiaircraft shrapnel, Mk. I

1. Waterproof cover
2. Antiaircraft time fuze, Mk. III
3. Head
4. Inner tube
5. Bourrelet
6. Central tube
7. Balls
8. Shrapnel case
9. Matrix (resin)
10. Fiber paper cup
11. Cloth disk
12. Diaphragm
13. Rotating band
14. Base charge (loose black powder)

which conducts the flame from the fuze to the base charge. The shrapnel filling is composed of about 253 lead balls approximately ½ inch in diameter, averaging 42 balls to the pound, the total weight of balls being about 6 pounds. The balls are held in a matrix of melted resin, which is poured into the shrapnel case during the loading of the balls. A steel head closes the shrapnel case and forms an adapter for the antiaircraft time fuze, Mk. III. The Mk. I shrapnel is suitable for use in guns rifled either 1 turn in 25 or 1 turn in 40 calibers.

b. Action.—In action, the shrapnel is really a complete gun in itself. When the time fuze has burned its predetermined time the magazine charge of the fuze flashes through the central tube and ignites the base charge in the shrapnel. The explosion of the base charge does not rupture the case but ejects the diaphragm, balls, head, etc., from the case with a velocity of about 350 feet per second, this velocity being in addition to that of the shrapnel at the time of burst. The balls are projected forward in the form of a cone, due to rotational velocity. The angle of this cone depends on the relation of the angular velocity of the outermost balls in the case and their linear velocity.

c. Identification.—Shrapnel are painted red to indicate that the bursting charge is a low explosive (black powder). The round containing the Mk. I shrapnel is marked for identification as shown in Figure 6.

d. Weights.—Weight zone markings are not placed on shrapnel, as there is seldom a variance of more than 1 per cent from the normal weight fuzed, of 15 pounds. The weight is adjusted in manufacture by assembling more or fewer balls than prescribed, as may be necessary.

Section IV

BOOSTER

11. Function.—The antiaircraft booster, Mk. X, is used in the 3-inch antiaircraft high-explosive shell, Mks. I and IX. Its function is to amplify or "boost" the explosion of the base charge of the fuze to a detonation of the high-explosive filler of the shell, since the explosion of the base charge of the fuze in itself will not detonate the high explosive in the shell. In addition the antiaircraft booster, Mk. X, contains a bore-safe device, whereby the detonating train is interrupted between the detonator of the booster and the booster

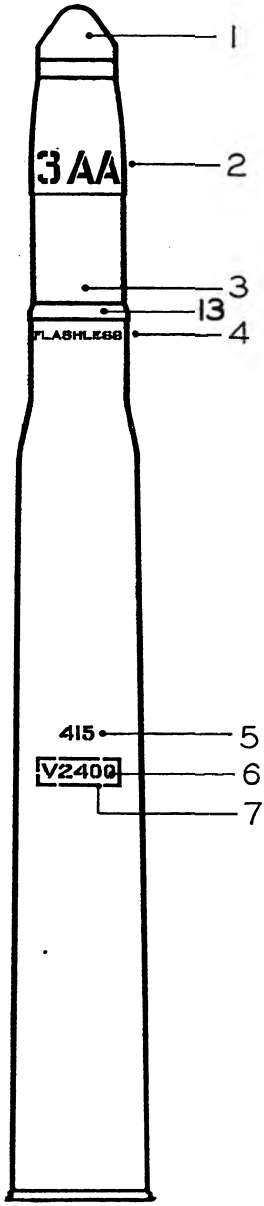
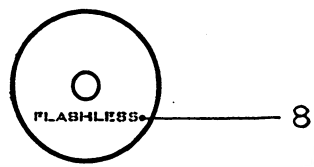


FIG. 6.—Marking for 3-inch shrapnel fixed ammunition for antiaircraft gun

1. Fuze and waterproof cover are stamped with model of fuze, lot number, initials or symbol of manufacturer and month and year of loading
2. Caliber and type of cannon
3. Caliber and type of cannon, mark number, lot number of unloaded shrapnel, initials or symbol of machining plant and inspection marks (stamped on shrapnel, under paint)
4. When flashless powder is used
5. Lot number of propelling charge powder
6. Muzzle velocity, in feet per second
7. Rectangle as shown denotes service charge
8. When flashless powder is used
9. Ammunition lot number
10. Caliber and model of cannon
11. For stamping on primer, see Figure 9
12. Lot number of cartridge case and initials or symbol of manufacturer of cartridge case
13. Ammunition lot number (stamped on rotating band only when loaded shrapnel are shipped unfixed)

NOTE.—1, 3, 9, 10, 11, 12, and 13 are stamped on, others are stenciled in black paint.



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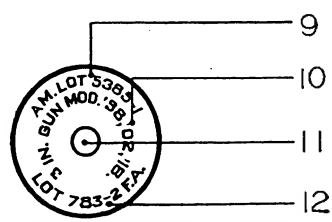

STAMPED ON BASE OF CARTRIDGE CASE

charge until the projectile has cleared the muzzle of the gun. This prevents premature action of the high-explosive charge of the shell in the bore of the gun, due to malfunctioning of the more sensitive explosive elements of the fuze and booster.

12. **Antiaircraft booster, Mk. X.**—*a.* Figure 7 shows this booster and gives the names of the principal parts. Practically

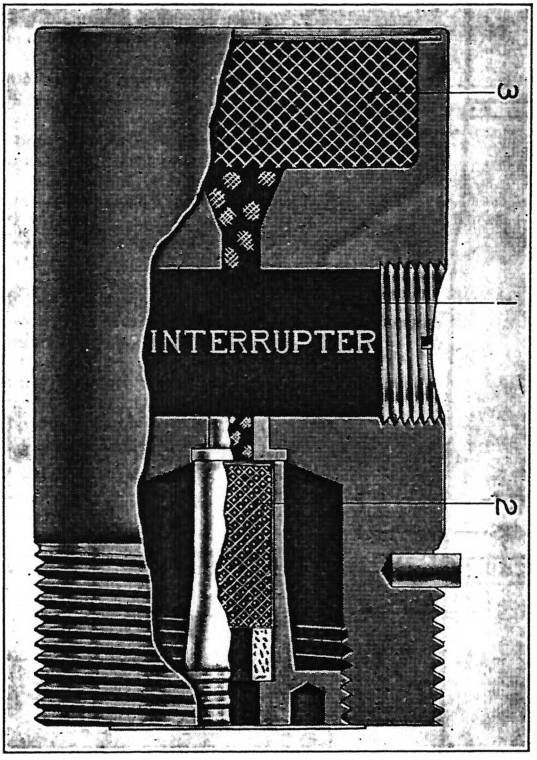

FIG. 7.—Antiaircraft booster, Mk. X

1. Interrupter 2. Detonator 3. Booster

all parts of this booster are made of brass. The interrupter (1) constitutes the bore-safe device mentioned in the foregoing paragraph, and it is operated by centrifugal force. It is placed at an angle so that linear acceleration tends to oppose centrifugal force; thus, when the shell is being accelerated in the bore of the gun, this interrupter remains in the unarmed or safe position and prevents any premature action of the detonator (2) from reaching the booster charge (3). After the shell has cleared the muzzle of the gun,

linear acceleration ceases and centrifugal force moves the interrupter (1) into the armed position.

b. When the time fuze has burned its predetermined time, its base charge will explode and function the detonator (2), which contains about 12 grains of mercury fulminate. This detonates the high-explosive column leading from the detonator (2) to the booster charge (3), which, in turn, detonates the booster charge (3), composed of about 170 grains of TNT, and the explosive charge of the shell.

SECTION V

FUZE

13. Function.—*a.* A fuze is a device inserted in a projectile and used to detonate or explode the bursting charge of the projectile at the time and under the circumstances desired. Only one type of fuze is authorized for use in 3-inch antiaircraft ammunition, this being the antiaircraft time fuze, Mk. III. It is used in the Mk. I and IX high-explosive shell and the Mk. I shrapnel.

b. Quantities of both Mk. I shell and Mk. I shrapnel now on hand are fitted with Bartlett-Hayward antiaircraft time fuzes and Mk. II, type "S," antiaircraft time fuzes (both modified and unmodified). Sufficient quantities of Mk. III antiaircraft time fuzes have been issued to replace these other fuzes. In preparing ammunition for firing the fuze should be examined; and if it be other than the Mk. III antiaircraft time fuze, it should be removed and replaced by a Mk. III antiaircraft time fuze.

14. Antiaircraft time fuze, Mk. III.—*a. Description.*—(1) The antiaircraft time fuze, Mk. III, is the same in outward appearance as the 21-second combination fuze, M1907 used in 75-mm. field guns, but differs from this fuze in that it has no percussion element and will therefore not function on impact. It is made of brass and bronze and weighs about 1.25 pounds. It can be set and reset at any time from 0, for canister effect, to 21.2 seconds, its maximum setting.

(2) This fuze is always assembled to the projectile for shipment. It is protected against moisture by a waterproof cover, which is removed and thrown away when the fuze is set for time of flight. The magazine charge of black powder in the base of the fuze functions the base charge of the Mk. I shrapnel or the detonator of the

Mk. X antiaircraft booster, which in turn functions the high-explosive charge of the Mks. I and IX shell. Figure 8 shows a view of the fuze with the waterproof cover (15) in place and the fuze set for 0 time of burning. It also shows a sectional view of the fuze set at 0, with the names of the principal parts.

b. Action.—(1) When the setting is at 0 as shown on Figure 8, the action of the fuze is as follows:

When the gun is fired, the concussion plunger (2) will slip through the resistance ring (3), due to inertia or the setback[2] action in the projectile. The concussion primer (4), which is held in the concussion plunger, is thus fired by the firing pin (5). The flame from this primer (4) passes through a hole in the body and ignites the powder pellet (12), which is in the upper time train ring (6). The flame from this pellet (12) is transmitted to the ignition pellet (13), which is located in the lower or graduated time train ring (8). The flame from this pellet ignites the ignition pellet (14) of the body (9). The magazine charge (10) in the body is exploded and the flame of same passes through the central tube to the base charge of the Mk. I shrapnel, or to the detonator of the Mk. X antiaircraft booster in the Mks. I and IX high-explosive shell.

(2) In the above action it is readily seen that when the fuze is set at 0, the action is merely a transmission of flame from the concussion primer (4) to the magazine charge (10) by means of powder pellets. The powder train (7), which is responsible for the time feature, does not enter into this action. Attention is called to the fact that the time fuze when set at 0 will cause the projectile to burst within 75 feet of the muzzle of the gun.

(3) When the fuze is set for time, 15 seconds for instance, the action is somewhat different. The lower or graduated time train ring (8) is moved counterclockwise until the 15 is in line with the lines on the body and the upper time train ring. The action of the concussion plunger (2) is the same, and the flame reaches the powder pellet (12), as previously described. This powder pellet (12) ignites the powder train (7). The powder train (7) is machined in both the upper and lower time train rings in the shape of a horseshoe; that is, there is a

[2] The term "setback" is the name given to the reaction to the force required to give any part of the projectile a forward movement in the gun. The total "setback" of a projectile is equivalent (frictional and rotational components neglected) to the total pressure exerted by the propelling-charge gases on the base of the projectile. In other words, the expansion of the gases from the propelling charge creates a pressure in the chamber and bore of the gun, which results in an acceleration of the projectile. The projectile, due to its inertia, resists this acceleration and tends to remain stationary. This resistance to the pressure on the base is "setback." Any part not rigidly supported in the projectile will be given a relative motion toward the base of the projectile by this force, when the projectile is being accelerated in the bore of the gun.

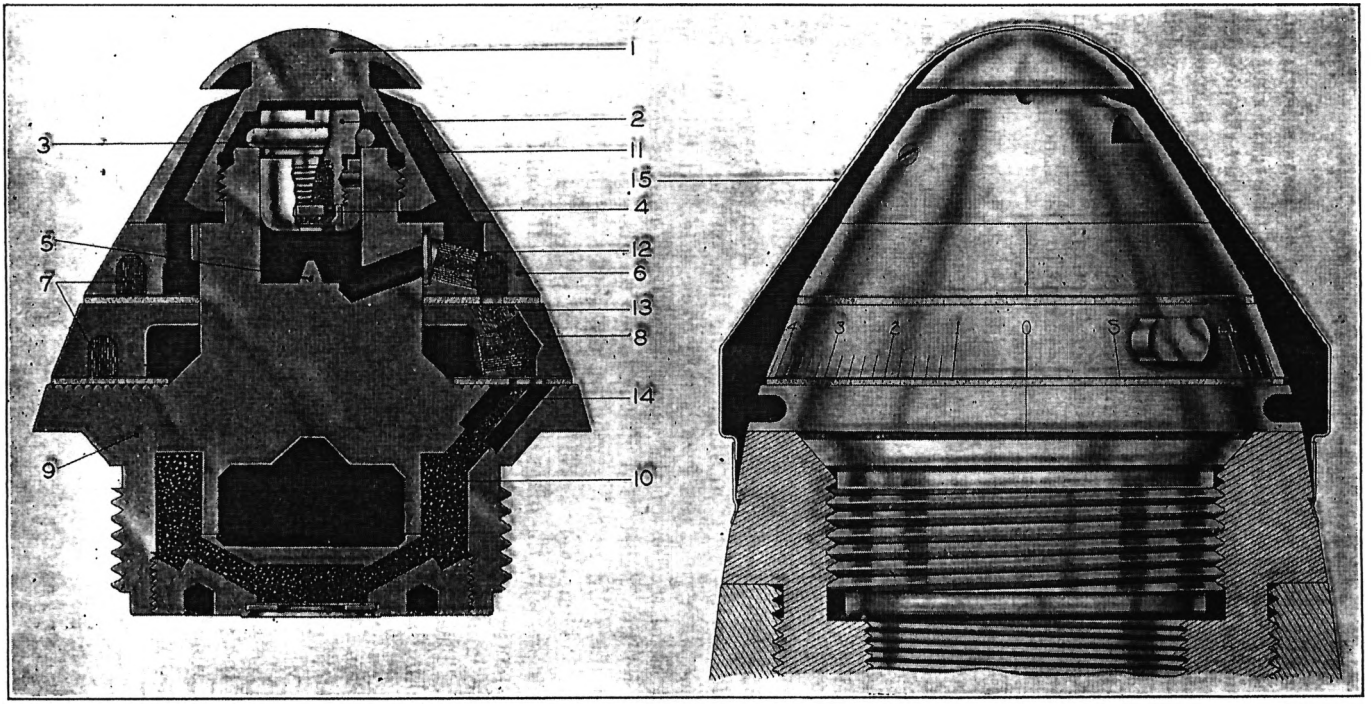

FIG. 8.—Antiaircraft time fuze, Mk. III

1. Closing cap
2. Concussion plunger
3. Resistance ring
4. Concussion primer
5. Concussion firing pin
6. Upper time train ring
7. Powder train
8. Lower or graduated time train ring
9. Body
10. Magazine charge (black powder)
11. Vents
12. Powder pellet
13. Powder pellet
14. Powder pellet
15. Waterproof cover

solid section of metal at the beginning and end of the powder train. The ignition pellet (13) of the lower or graduated time train ring (8) has been moved in setting the fuze, and it is necessary that the powder train (7) of the upper time train ring burn until this pellet is reached by the flame. Then with the ignition of the pellet (13), the powder train (7) of the lower or graduated time train ring will begin to burn. When the flame reaches ignition pellet (14) in the body (9), the action is as previously described for 0 setting. The gases from the burning of the powder trains (7) escape to the atmosphere by means of the vents (11) in the closing cap (1).

c. General notes.—(1) Every precaution should be taken to keep moisture away from this fuze. The fuze is protected by a waterproof cover and the powder trains (7) are covered with waxed paper, but short exposure in damp places will allow moisture to enter. A piece of felt cloth is on the underside of each powder train (7), which prevents the flame of the burning powder creeping faster than it should. If these pieces of felt cloth get wet, the powder will absorb some of the moisture, which will greatly alter the time of burning.

(2) When the lower or graduated time train ring (8) is set so that the mark "S" is in line with the lines on the body and the upper time train ring, the fuze is said to be safe. At this setting, the solid metal section of the upper time train ring is completely covering ignition pellet (13) in the lower or graduated time train ring and the solid metal section of the lower or graduated time train ring is completely covering ignition pellet (14) in the body which connects with the magazine charge (10). It would be possible for both powder trains (7) to burn completely, but no flame would reach the ignition pellet (14) and therefore the fuze would not function. These fuzes are always issued set "safe" and if not used after making a setting they should be reset to "safe" again before handling.

d. Marking.—This fuze may be identified by the following stamping, which appears on the bevel edge of the body:

1. Mk. III (mark number of fuze).
2. Lot number.
3. Initials or symbol of manufacturer.
4. Month and year of loading.

Practically this same stamping also appears on the waterproof cover.

SECTION VI

CARTRIDGE CASES

15. Cartridge cases.—*a. Description.*—The cartridge case is made of drawn brass. (Fig. 1.) A projecting rim or flange is formed on the head of the cartridge case, and the extractor of the gun engages this rim to eject the cartridge case from the gun after firing. This rim or flange also acts as a stop for the round when it is loaded into the gun. The primer (Fig. 9) is fitted in the center of the head of the case and is forced into its seat under a press. A diaphragm, consisting of a thin cup-shaped piece of brass, is soldered in the neck of the cartridge case, after the propelling charge has been assembled, to prevent the entrance of moisture.

b. Function.—The function of the cartridge case is to contain the propelling charge and to act as an obturator in preventing the propelling charge gases from escaping into the breech mechanism of the gun. The metal near the mouth of the cartridge case is thin and comparatively soft, so that the pressure of the propelling charge gases expands it tightly against the walls of the gun, thus preventing any leakage of gases past the cartridge case. The metal of the cartridge case, however, is springy enough so that when the gas pressure is released the cartridge case will contract and can be extracted from the gun without difficulty. Cartridge cases can be used many times, if resized and proper care taken of them. They should be handled carefully, since, being made of thin, comparatively soft metal, they are easily dented.

c. Types.—(1) Two general types of cartridge cases are provided, one for the M1917 guns and one for the M1918 guns. There is also a modification of each of these types, making a total of four different cartridge cases that are used in these guns. These four kinds of cartridge cases, their identification or mark number and the guns and projectiles with which they are used, are as follows:

Mark No.	Projectiles used	Gun used in—
Mk. I	Mk. I high-explosive shell and Mk. I shrapnel	M1917.
Mk. I, Mod. 1	Mk. IX high-explosive shell	M1917.
Mk. II	Mk. I high-explosive shell and Mk. I shrapnel	M1918.
Mk. II, Mod. 1	Mk. IX high-explosive shell	M1918.

(2) The Mk. I Mod. 1 and Mk II Mod. 1 cartridge cases are the same respectively as the Mk. I and Mk. II cartridge cases, except that

they are approximately 0.45 inch shorter. This is necessary for, as will be noted in (1) above, the Mk. I Mod. 1 and the Mk. II Mod. 1 cartridge cases are used with the Mk. IX high-explosive shell only, which, having a rotating band about 0.45 inch wider than the Mk. I high-explosive shell or the Mk. I shrapnel, makes it necessary to reduce the length of the cartridge case by this amount to insure proper seating of the round in the gun.

d. Marking.—Cartridge cases are stamped and stenciled for identification as shown in Figures 3 and 6.

SECTION VII

PRIMER

16. Primer.—*a. Type.*—The 3-inch antiaircraft gun ammunition uses a percussion primer; that is, the round is fired by the primer being struck by the point of the firing pin of the gun in the same way that a rifle cartridge is fired. The primer used is known as the "110-grain percussion primer" in that it is loaded with 110 grains of black powder; however, about 15 grains of this powder are subsequently lost in drilling the holes through the primer. This black powder acts as an igniter to the smokeless powder propelling charge in the cartridge case.

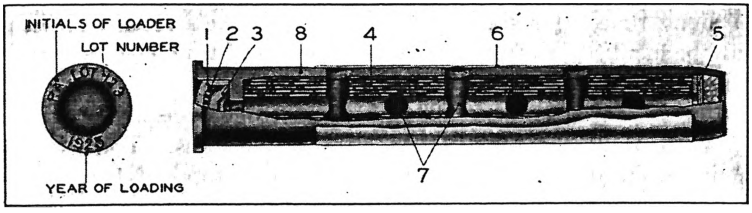

FIG. 9.—110-grain percussion primer

1. Cup
2. Percussion composition
3. Anvil
4. Compressed black powder
5. Cardboard closing disks
6. Tin-foil wrapper
7. Flash holes
8. Primer body

b. Action.—Figure 9 shows the 110-grain percussion primer. When the cup (1) is struck by the firing pin of the gun, it is indented and crushes the percussion composition (2) against the anvil (3), causing this composition to explode. The flame from this explosion passes through a hole and ignites the black powder (4) which in turn flashes through the holes in the side and end of the primer and ignites the propelling charge in the cartridge case. The percussion

composition (2) is sensitive and care must be taken that the cup (1) is not struck by any hard object. A blow simulating that of a firing pin attached to a 1-pound weight and dropped through a distance of 3 inches may cause it to function.

c. Marking.—Identification marks are stamped on the bottom of the primer body as shown in Figure 9.

SECTION VIII

PROPELLING CHARGE

17. Propelling charge.—*a. General.*—(1) The propelling charge used in the ammunition for the 3-inch antiaircraft guns is nitrocellulose smokeless powder. The amount used varies with the type of projectile used and with the model of the gun. The approximate weight of propelling charge used for the different types of projectiles and different models of guns, together with the muzzle velocity of the projectile, are as follows:

Projectile	Weight of charge (pounds)		Muzzle velocity (feet per second)	
	M1917 gun	M1918 gun	M1917 gun	M1918 gun
High-explosive shell, Mk. I	5.31	4.63	2,600	2,400
High-explosive shell, Mk. IX	5.62	4.94	2,800	2,600
Shrapnel, Mk. I	5.31	4.63	2,600	2,400

(2) The propelling charge is contained in a cartridge case. Since the propelling charge only partly fills the cartridge case, a distance wad is placed in the cartridge case on top of the propelling charge in order to keep the powder at the rear end of the cartridge case in close contact with the 110-grain percussion primer. This distance wad is composed of a cardboard cylinder with a cardboard disk at each end, these end disks being held to the cardboard cylinder by means of a piece of cord, as shown in Figure 1. A cup-shaped diaphragm made of sheet brass is soldered in the neck of the cartridge case after the propelling charge and distance wad have been assembled, thus forming a waterproof container for the propelling charge.

(3) A grain of powder will burn freely in the open and has none of the characteristics of an explosive until it is confined. When the powder is confined in a chamber the rate of burning is very

rapid, as the rate of burning increases as the gases are liberated and the pressure in the chamber increases.

b. Action.—(1) The gases from the burning of the propelling charge powder expel the projectile from the gun. If these gases are created too rapidly too much pressure will be developed and the gun may burst. On the other hand, if the gases are not generated rapidly enough the projectile will leave the muzzle of the gun before the powder grains are entirely burned, and at a lowered velocity. It is, therefore, necessary to make the grains of powder of such size that, when the projectile has reached the muzzle of the gun, they will have completely burned and the pressure will not have exceeded a certain prescribed limit. To meet this condition, it has been found convenient to make the grains of powder with a number of holes or perforations running lengthwise of the grain.

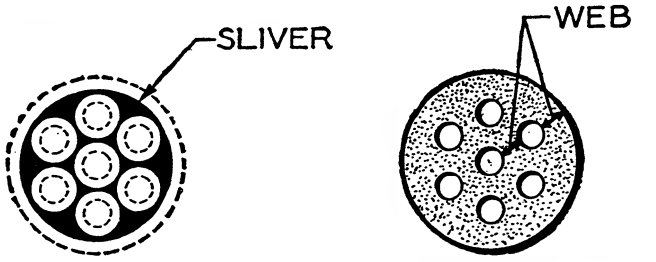

FIG. 10.—Grain of powder

Since the grain of powder is perforated, it will burn on the inside and outside surfaces at the same time, and gas will be created much faster than if the grain of powder were solid. The size of the grain of powder for the 3-inch antiaircraft guns is about $\frac{7}{32}$ inch in diameter by about ½ inch in length, with 7 perforations running lengthwise of the grain. The color varies from a light brown to a black.

(2) It is assumed that all the exposed surfaces of the grain of powder begin to burn at the same time. Figure 10 shows the end view of a typical grain of powder and also the progressive burning action until the grain of powder is practically consumed. The dotted lines show the original outline of the grain of powder. The small triangular sections are called "slivers," and these slivers will burn if the powder is properly designed.

(3) The maximum allowable pressure in the 3-inch antiaircraft guns is 36,000 pounds per square inch for the M1917 guns and 34,000

pounds per square inch for the M1918 guns. This powder is affected by moisture and great care should be taken to have the assembled rounds kept in a dry condition.

SECTION IX

PACKING

18. Packing for assembled round.—*a. General.*—The ammunition for these guns is packed in individual, hermetically sealed metal containers, which in turn are packed in a wooden packing box, four containers or four rounds of ammunition to the box. Some of the older ammunition in service is packed in metal-lined wooden packing boxes containing six rounds to the box. In this box the metal lining forms a complete box in itself. The cover of the metal lining must be torn off to remove the rounds, which are held in place in the metal lining by wooden supports. The lid of the wooden box is held in place by two hinges and two hasps, the hasps being sealed. These seals must be broken to open the lid. Rope handles are provided at each end to facilitate handling. No more of this type box will be manufactured.

b. Metal container.—The individual metal container is a round cylindrical can, made of tin or terneplate. The round of ammunition is supported in the container by the flange of the cartridge case resting on the corrugated top end of the container and by a fiber tube extending from the bottom end of the container to the rotating band of the projectile. The cover is held in place by means of a soldering strip, which is torn off to unpack the round. The cup or depression in the bottom of the cover is to protect the primer in the cartridge case. After the round has been packed in the container and the cover soldered on, the container is tested for leaks by applying an internal air pressure of 4 pounds per square inch through the hole in the bottom of the container. Leaks are indicated by an air-pressure gauge. After satisfactorily passing this test, the test hole is soldered over. The container is varnished externally after being sealed.

c. Packing box.—(1) The packing box for ammunition packed in individual metal containers is an end-opening box containing four rounds. The cover or end is secured by a wing nut fastened to a steel rod which extends to the opposite end of the box. The wing nut is locked in place with a cotter pin in order to prevent

its unscrewing in transportation. The wing nut and cotter pin are attached to the cover or end of the box and the cover or end of the box is attached to the side of the box by pieces of light metal chain, to prevent their being separated and lost from the box after the ammuntion is unpacked. A wire is tacked to the cover and to the side of the box and sealed, thus preventing tampering with the contents of the box without destroying the seal.

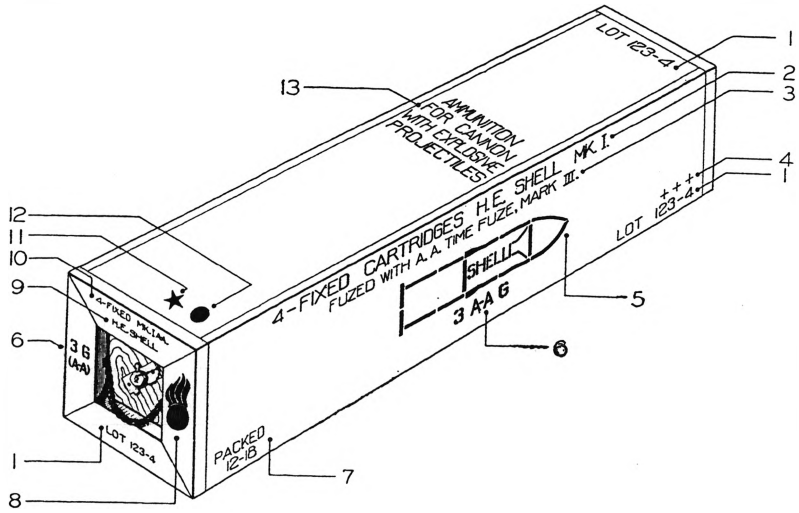

FIG. 11.—Marking of packing box for 3-inch high-explosive fixed ammunition for antiaircraft gun

1. Ammunition lot number
2. Number of complete rounds, type and mark number of projectile
3. Statement of fuze used
4. Weight zone marks
5. Symbol of ammunition in box
6. Caliber and type of cannon
7. Month and year of packing
8. Ordnance insignia
9. Type of projectile
10. Number of rounds and mark number of projectile
11. Inspector's stamp
12. Name of place where packed
13. To comply with I. C. C. Regulations

NOTE—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 12.

(2) Each packing box contains a completely filled in ammunition data card, which gives complete information regarding the lot number, manufacturer, date of manufacture, date of packing, etc., of the round of ammunition, together with similar information about each of the main components of the round.

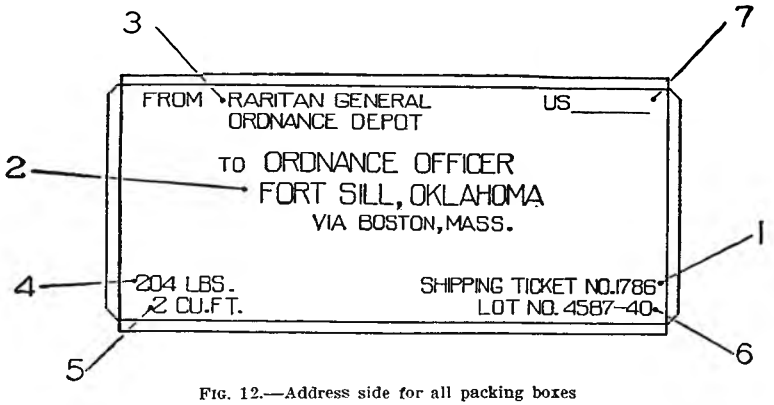

FIG. 12.—Address side for all packing boxes

1. Number of shipping ticket
2. Designation and address of consignee (as shown on shipping instructions)
3. Consignor
4. Gross weight, in pounds
5. Cubic displacement, in cubic feet
6. Ammunition lot number
7. To indicate United States property

NOTE.—Shipping officer may omit 2 and 3 in carload shipments.

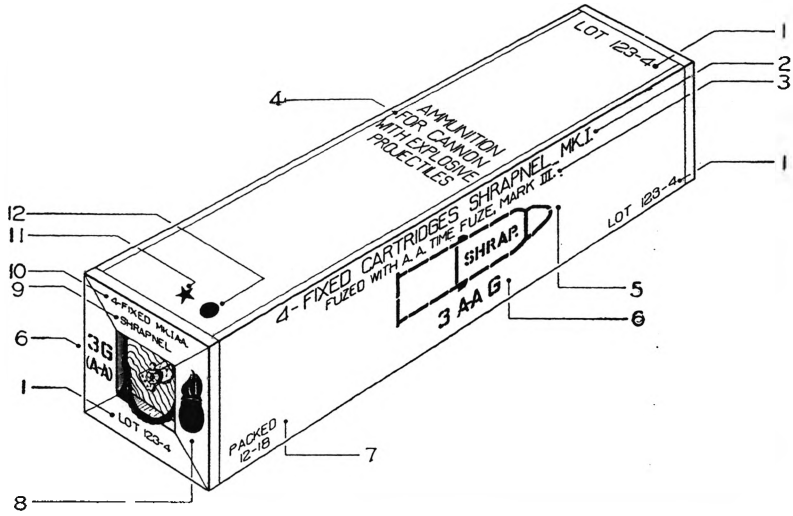

FIG. 13.—Marking of packing box for 3-inch shrapnel fixed ammunition for antiaircraft gun

1. Ammunition lot number
2. Number of complete rounds, type and mark number of projectile
3. Statement of fuzes used
4. To comply with I. C. C. regulations
5. Symbol of ammunition in box
6. Caliber and type of cannon
7. Month and year of packing
8. Ordnance insignia
9. Type of projectile
10. Number of rounds and mark number of projectile
11. Inspector's stamp
12. Name of place where packed

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 12.

d. Marking.—(1) The individual metal container is marked for identification as follows:

(*a*) A 2-inch wide band is painted around the center of the container to signify the type of projectile. This band is yellow in color for the Mks. I and IX high-explosive shell ammunition, and red for the Mk. I shrapnel ammunition.

(*b*) The ammunition lot number is stenciled on the side of the container in letters and figures about one-half inch high.

(*c*) The soldering strip on the cover is stamped with the name and mark number of the projectile and the model of the gun in which it is to be used.

(2) The marking that is stenciled on the packing box for the Mks. I and IX high-explosive shell ammunition is shown on Figures 11 and 12. The marking that is stenciled on the packing box for the Mk. I shrapnel ammunition is shown on Figures 12 and 13.

[A. G. 062.12 (5–13–27).]

BY ORDER OF THE SECRETARY OF WAR:

C. P. SUMMERALL,
Major General,
Chief of Staff.

OFFICIAL:

LUTZ WAHL,
Major General,
The Adjutant General.

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ANTIAIRCRAFT AMMUNITION

AMMUNITION FOR 3-INCH ANTIAIRCRAFT GUNS, M1917, M1918, AND M1925

CHANGES
No. 1

WAR DEPARTMENT,
WASHINGTON, *January 2, 1930.*

TR 1360–3A, March 19, 1928, is changed as follows:

14. Antiaircraft time fuze, Mk. III.

* * * * * * *

e. Fuzes shall not be altered.—The alteration of this fuze in the field, except upon specific direction of the Chief of Ordnance, is prohibited. The practice of inserting a punch in the fuze cap wrench notches and hammering to loosen the cap, thereby shearing the fuze cap lock, is dangerous and is prohibited.

[A. G. 062.12 (12–6–29).] (1929.)

BY ORDER OF THE SECRETARY OF WAR:

C. P. SUMMERALL,
General,
Chief of Staff.

OFFICIAL:
C. H. BRIDGES,
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The Adjutant General.

90999°—30

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