TECHNICAL REGULATIONS
No. 1355–155B

WAR DEPARTMENT,
WASHINGTON, *November 25, 1927.*

MOBILE ARTILLERY AMMUNITION

AMMUNITION FOR 155-MM. FIELD GUNS, M1918MI (FRENCH G. P. F.)

Prepared under direction of the
Chief of Ordnance

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 155-mm. gun 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. Proper nomenclature for ammunition described herein is given in Standard Nomenclature List (S. N. L.) No. D11, "155-mm. gun matériel, M1918." This nomenclature is mandatory and will be used in all requisitions.

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

Projectile	Firing Table No.
Mk. III high-explosive shell	155 B 1.
Mk. VII chemical shell	
Mk. I shrapnel	155 C 1.

d. TR 1305–155C and 1305–155D 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 155-mm. guns, M1918 (G. P. F.) and M1918MI, both take the same types of ammunition. The ammunition is known as separate loading ammunition in that the loading of the gun is accomplished in three separate operations: First, inserting the projectile in the gun; second, inserting the propelling charge; and third, inserting the primer in the breech mechanism of the gun.

4. Types of ammunition.—*a. Characteristics.*—Three general types of ammunition are provided, as follows: High-explosive shell ammunition, chemical shell ammunition, and shrapnel ammunition. No more shrapnel will be manufactured for these guns after the present stocks are exhausted. A subcaliber gun is provided for these guns, the ammunition for which is described in TR 1370–C. Dummy projectiles and dummy cartridges are also provided, this ammunition being described in TR 1370–D.

b. Projectiles.—(1) High-explosive shell are issued unfuzed, an eyebolt lifting plug or an adapter plug being shipped assembled in the fuze seat. This type of shell is also issued unboxed, and the rotating band is protected by a rope grommet. To prepare the high-explosive shell for firing, it is necessary to remove the rope grommet and the plug in the nose of the shell and then insert a fuze.

(2) Chemical shell are issued unfuzed, an adapter plug being shipped assembled in the fuze seat. Chemical shell are shipped in wooden boxes, two shell per box. To prepare the chemical shell for firing, it is necessary to remove the adapter plug in the nose of the shell and insert a fuze in its place.

(3) Shrapnel are shipped completely fuzed and packed in wooden boxes, two shrapnel per box. To prepare the shrapnel for firing, it is necessary to remove the waterproof cover from the fuze, remove the safety wire, and give the fuze the desired time setting.

c. Propelling charges.—Propelling charges are shipped complete with the necessary igniting charge in waterproof containers, known

as "cartridge storage cases," one complete charge being packed in each cartridge storage case.

d. Primers.—Primers for the propelling charges are packed in waterproof cans, containing 50 primers to the can. These cans in turn are packed in wooden packing boxes, which contain 48 cans.

e. Round of ammunition.—(1) A complete round of the various types of ammunition is made up of the following components.

Component	High-explosive ammunition	Chemical ammunition	Shrapnel ammunition
Projectile	Mk. III	Mk. VII	Mk. I.
Adapter and booster	Mk. III–A	Mk. VI–B	None.
Fuze	P. D. Mk. III or IV Star	P. D. Mk. III	45-second combination.
Bursting charge	T. N. T. or amatol	T. N. T. booster charge	Black powder.
Filling		Gas or smoke	Lead balls and resin.
Propelling charge	Nitrocellulose smokeless powder.		
Primer	21-grain percussion, Mk. II–A.		

(2) It will be noted that a complete round of ammunition may be received in four distinct shipments, as follows:

(*a*) Projectile.
(*b*) Fuze.
(*c*) Propelling charge.
(*d*) Primer.

(3) In order that the using branches be informed of what constitutes a round of ammunition in instances such as this, where a round may be received in different shipments, "complete round

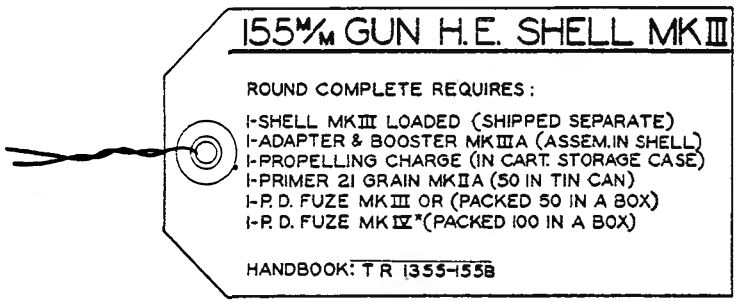


FIG. 1.—Complete round label 155-mm. gun high-explosive shell, Mk. III

labels" were adopted in 1924. In this system a complete round label is attached to the projectile by being wired to the rope grommet, eyebolt lifting plug, or other convenient place, the label being printed with full information as to what other components are required to complete the round. A typical complete round label is shown in Figure 1.

f. Weights.—The weights of the various components of the different types of ammunition are approximately as follows:

Component	High-explosive shell Mk. III	Chemical shell Mk. VII	Shrapnel Mk. I
	Pounds	*Pounds*	*Pounds*
Projectile (empty)	79. 47	79. 00	49. 44
Bursting charge	15. 17	.....	1. 21
Filling	.....	14. 00	42. 35
Adapter and booster	2. 00	2. 81	.....
Propelling charge	25. 00	25. 00	25. 00
Fuze	. 95	. 95	2. 00
Primer	. 025	. 025	. 025
Total weight of round	122. 615	121. 785	120. 025

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 in 1917, and in this system the first design of a certain component was called "Mark I," abbreviated as Mk. I, or in some cases, MI, the second design "Mark II," abbreviated as Mk. II, or, in some cases MII, and so on. The previous method was to designate the component as the model of a certain year, for instance, "M1917," indicating that it was designed in the year 1917.

SECTION III

PROJECTILES

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

a. Common steel or high-explosive shell, Mk. III.

b. Chemical shell, Mk. VII.

c. Shrapnel, Mk. I.

7. General remarks.—*a. Base cover.*—All projectiles containing high explosive are fitted with a base cover which is designed to prevent the gas from the propelling charge coming in contact with the high-explosive charge of the shell through possible defects in the base. The standard base cover for 155-mm. high-explosive projectiles is shown in Figure 2. It consists of a copper cup covering a lead disk, the copper cup being held in a groove in the base of the

projectile by means of a strip of lead calking wire which is hammered or pressed down to completely fill the groove and to bend in the flange of the copper cup.

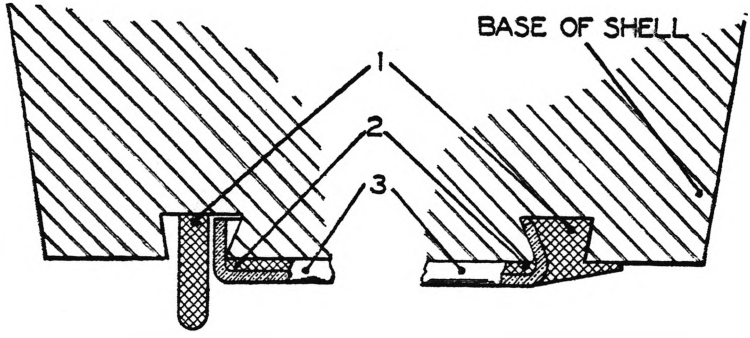


FIG. 2.—Base cover
1. Lead calking wire. 2. Lead disk. 3. Copper cup.

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 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 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 in the gun barrel, which is of a spiral or screw shape, and thus the projectile is forced out of the barrel of the gun with a

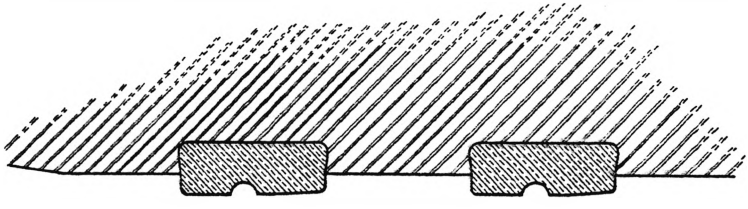


FIG. 3.—Rotating bands

rotating motion. Since the diameter of the 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. Figure 3 shows a cross section of the rotating band of 155-mm. gun projectiles. 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.

(*a*) Projectiles containing high explosive (T. N. T., amatol, etc.) such as the Mk. III shell are painted yellow.

(*b*) Projectiles containing chemicals (gas or smoke) such as the Mk. VII shell are painted blue-gray.

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

(2) Projectiles are also stenciled to show the caliber, type of cannon used in, ammunition lot number, kind of filling, etc.

8. Common steel or high-explosive shell, Mk. III.—*a. Description.*—(1) The design of this shell is an adaptation of the French design and represents a modern stream-line projectile. Figure 4 shows this shell in detail. The extreme front end of the ogive is rather blunt; however, the radius of the ogive itself is nearly 11 calibers.[1] This shell has a boat-tail base, tapered off at an angle of 8°. This combination of sharp nose and a tapered base adds to the efficiency in flight.

(2) This shell has two rotating bands, which is a distinguishing feature in comparison with the 155-mm. howitzer shell, which has one rotating band. The 155-mm. howitzer shell with one rotating band must never be fired in the 155-mm. gun, since this results in a different seating of the projectile in the gun, thus increasing the chamber space for the propelling charge, which would change the pressure in the gun and the muzzle velocity of the projectile. The howitzer shell will not give the proper range if fired in the 155-mm. gun. Some 155-mm. howitzer, Mk. I high-explosive shell have rotating bands 1.2 inches wide, which was a type that was adopted in an unsuccessful attempt to make the projectiles interchangeable in both

[1] By caliber is meant the diameter of the bore of the gun. A radius of ogive of 11 calibers is, therefore, a radius of 11 times 155 mm., or 1,705 mm.

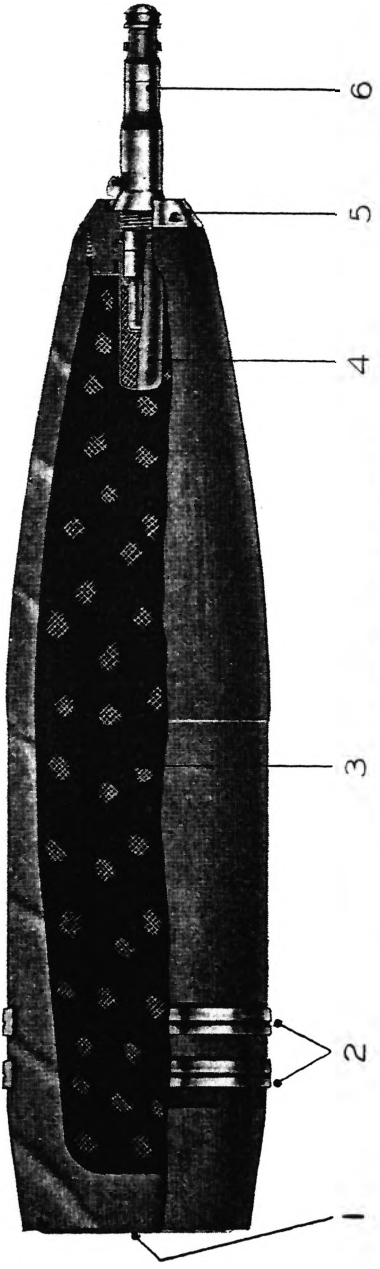


FIG. 4.—155-mm. high-explosive shell, Mk. III

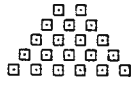
1. Base cover.
2. Rotating bands.
3. Bursting charge (T. N. T. or amatol).
4. Booster.
5. Adapter.
6. Fuze (to be inserted at battery).

the 155-mm. gun and howitzer. This shell is authorized for use in the howitzer but not in the gun.

(3) The explosive charge is about 15.2 pounds of T. N. T. Some shell are loaded with 50-50 and 80-20 amatol. 80-20 amatol-loaded shell which contain a smoke composition have been withdrawn from service since it has been found that in loading the explosive the smoke producer sometimes became displaced, leaving cavities which are believed to have been the cause of a number of prematures. Shell containing 80-20 amatol with the smoke composition may be distinguished from those containing 80-20 amatol without the smoke composition by a green band which is painted around the shell just beneath the stenciling, to denote the presence of smoke composition. No 80-20 amatol-loaded shell containing smoke composition should be fired, and should any be discovered in storage, they should be reported to the proper authority for disposition.

(4) The Mk. III high-explosive shell is marked for identification, as shown in Figure 5.

b. Weights.—The weights of loaded and unfuzed Mk. III shell, assembled with the adapter and booster, vary from approximately 91 pounds 3 ounces to approximately 96 pounds 12 ounces, and obviously 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 five 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 mean or normal weight, in pounds, which is stenciled directly below the weight marks, is the mean weight of that particular weight zone. Some shell may be found in service with this mean or normal weight expressed in kilograms. The weight zones and the identification marks which are placed on the shell to indicate the particular weight zone are as follows:

From—		To—		Normal weight	Weight mark
Pounds	Ounces	Pounds	Ounces		
				Pounds	
91	3	92	5	91. 75	
92	5	93	6	92. 85	
93	6	94	8	93. 95	
94	8	95	10	95. 05	
95	10	96	12	96. 20	

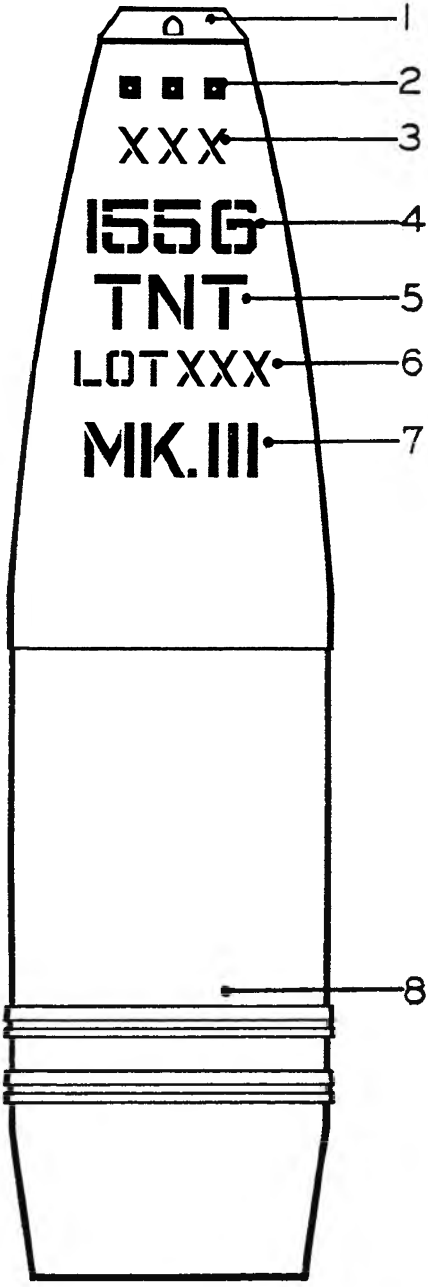


FIG. 5.—Marking for 155-mm. high-explosive shell for gun

1. Adapter may or may not be painted. (For stamping on adapter, see fig. 10.)
2. Weight zone marks (□□, □□□, □□□□, □□□□□, □□□□□□).
3. Mean or normal weight of shell (unfuzed) in pounds.
4. Caliber and type of cannon (G = gun).
5. Filler. Initials indicate kind of explosive. (May be as shown or AM 50–50 or AM 80–20, for amatol loaded shell.)
6. Lot number of filled shell.
7. Mark number of shell.
8. Caliber and type of cannon, mark number of shell, lot number of unfilled shell, initials or symbol of machining plant, and inspection marks (stamped on shell, under paint).

NOTE.—All stenciling is with black paint.

9. Chemical shell, Mk. VII.—*a. Description.*—This type of shell differs from the high-explosive shell Mk. III only in regard to the threads in the nose for the adapter and booster and in that it does not contain a base cover. In the Mk. VII chemical shell these threads are tapered or pipe threads. When the adapter and booster is tightly screwed into place a gas-tight joint is formed. This shell is known as a "chemical shell" because of the nature of the filler. The filler may be a lachrymatory gas or a smoke compound. When the shell bursts, the chemical filler produces a gas or smoke cloud in contradistinction to the effect of the high-explosive shell, which depends upon the blast of explosion and the fragmentation of the shell body.

b. Identification.—(1) All Mk. VII chemical shell are painted blue gray. A change in the marking of chemical ammunition was made during 1925 and since it is not contemplated re-marking the chemical shell now in service marked in accordance with the old system and as chemical shell marked in accordance with both systems will be encountered in service for some time to come, both systems will be described in these regulations. The old marking system consisted of using a series of different-colored bands painted around the shell to designate both the specific type of chemical filler and also its effect, whereas in the new marking system, for chemical shell containing gas, the bands painted around the shell are green in color and the number of bands indicates the degree of persistency of the filler, the specific type of chemical filler being designated by lettered symbols stenciled on the shell.

(2) The old marking system is shown in Figure 6. The symbol of the chemical filler corresponding to the bands on the shell and the stencil markings on the shell to show the type of chemical filler are as follows:

Symbol of shell filler	Color of bands		Stencil marking
	First band	Second band	
W. P	Yellow	None	Smoke.
F. M	Yellow	Yellow	Smoke.

(3) The new marking system is shown in Figure 7. In this system, for the purpose of marking, all fillers are divided into two classes, nonpersistent and persistent. Nonpersistent fillers are indicated by one green band and persistent fillers by two green bands, as follows:

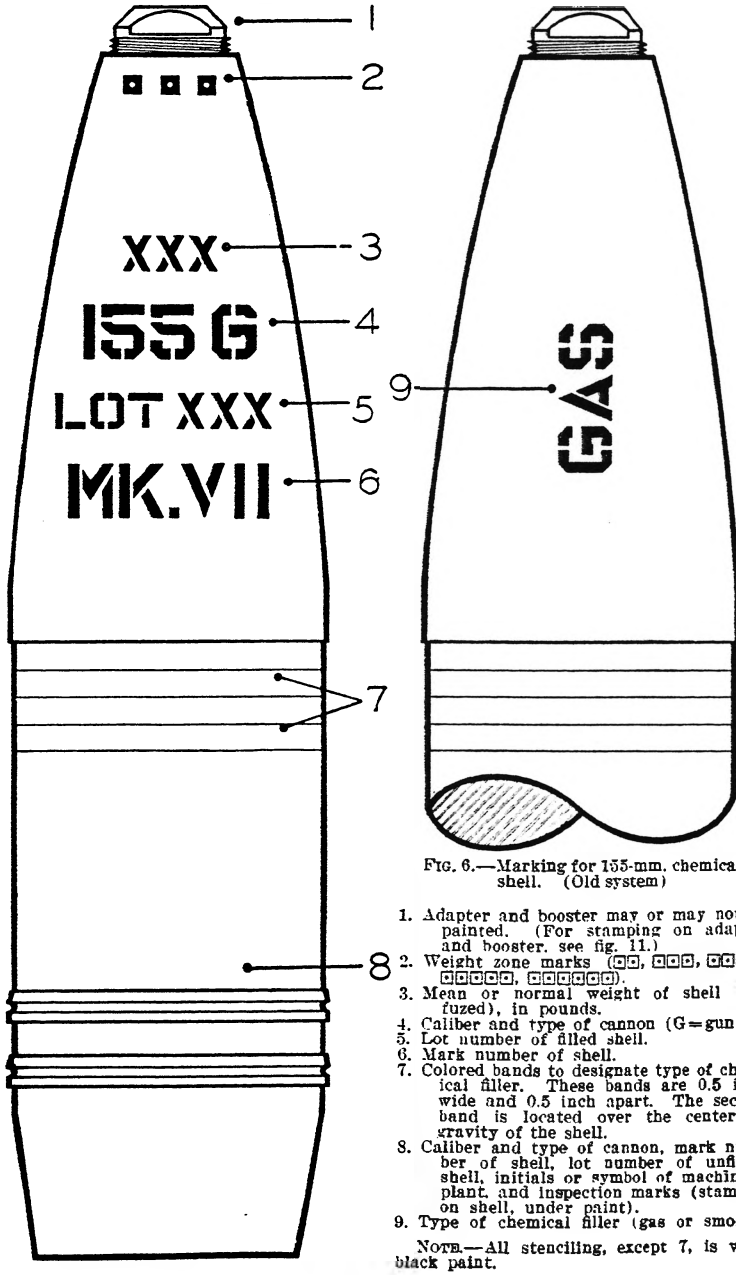


FIG. 6.—Marking for 155-mm. chemical shell. (Old system)

1. Adapter and booster may or may not be painted. (For stamping on adapter and booster, see fig. 11.)
2. Weight zone marks (□□, □□□, □□□□, □□□□□, □□□□□□).
3. Mean or normal weight of shell (unfuzed), in pounds.
4. Caliber and type of cannon (G=gun).
5. Lot number of filled shell.
6. Mark number of shell.
7. Colored bands to designate type of chemical filler. These bands are 0.5 inch wide and 0.5 inch apart. The second band is located over the center of gravity of the shell.
8. Caliber and type of cannon, mark number of shell, lot number of unfilled shell, initials or symbol of machining plant, and inspection marks (stamped on shell, under paint).
9. Type of chemical filler (gas or smoke).

NOTE.—All stenciling, except 7, is with black paint.

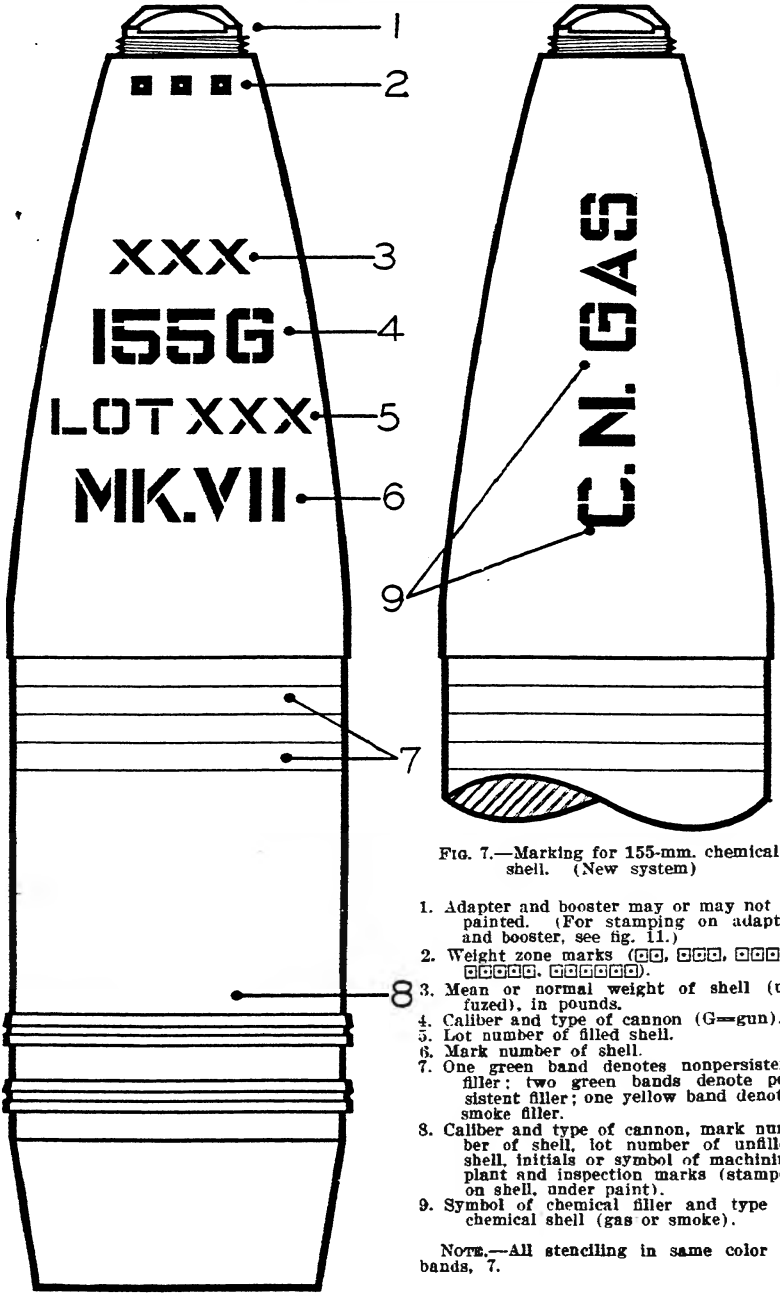


FIG. 7.—Marking for 155-mm. chemical shell. (New system)

1. Adapter and booster may or may not be painted. (For stamping on adapter and booster, see fig. 11.)
2. Weight zone marks (□□, □□□, □□□□, □□□□□, □□□□□□□).
3. Mean or normal weight of shell (unfuzed), in pounds.
4. Caliber and type of cannon (G=gun).
5. Lot number of filled shell.
6. Mark number of shell.
7. One green band denotes nonpersistent filler; two green bands denote persistent filler; one yellow band denotes smoke filler.
8. Caliber and type of cannon, mark number of shell, lot number of unfilled shell, initials or symbol of machining plant and inspection marks (stamped on shell, under paint).
9. Symbol of chemical filler and type of chemical shell (gas or smoke).

NOTE.—All stenciling in same color as bands, 7.

Persistent filler			Nonpersistent filler		
Symbol of shell filler	Number of green bands	Stencil marking	Symbol of shell filler	Number of green bands	Stencil marking
CN	2	CN Gas		1	

Additional information relative to chemical ammunition will be published in supplementary regulations.

(4) All screening smoke fillers are indicated by one yellow band, and the symbol of the smoke filler, followed by the word "Smoke," is stenciled on the shell. All stenciling on the shell in the new marking system is of the same color as the band or bands.

c. General remarks.—It is difficult to define persistency as applied to the various chemical fillers since the length of time during which a cloud persists varies greatly for the different fillers and even for the same filler under different conditions. Therefore, chemical shell must be used only with a full understanding of the characteristics of the particular filler and after careful consideration of the effect of existing conditions. Two green bands are a general indication that the cloud will persist for a considerable length of time after being released. One green band is a general indication that the cloud will be quickly dissipated.

d. Weights.—The filled and unfuzed Mk. VII chemical shell are divided into five weight zones in the same manner as described for the Mk. III high-explosive shell. The weight zones and the identification marks are placed on the shell to indicate the particular weight zone. (See par. 8*b*.)

10. Shrapnel, Mk. I.—*a. General remarks.*—Shrapnel for the 155-mm. guns is obsolete for future manufacture. Its use is authorized for the present time while the stock on hand lasts. This is the only projectile that may be fired interchangeably in either the 155-mm. gun or 155-mm. howitzer. It is fitted with a rotating band approximately 1.25 inches wide. The Mk. I shrapnel is issued with the 45-second combination fuze, M1907M assembled in place, the fuze being set at safe. Great care should be taken to keep the shrapnel in a dry condition.

b. Description.—The Mk. I shrapnel is shown in Figure 8.

The base or bursting charge consists of about 1.21 pounds 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 carries a central tube, which conducts the flame from the fuze to the base charge. The shrapnel fill-

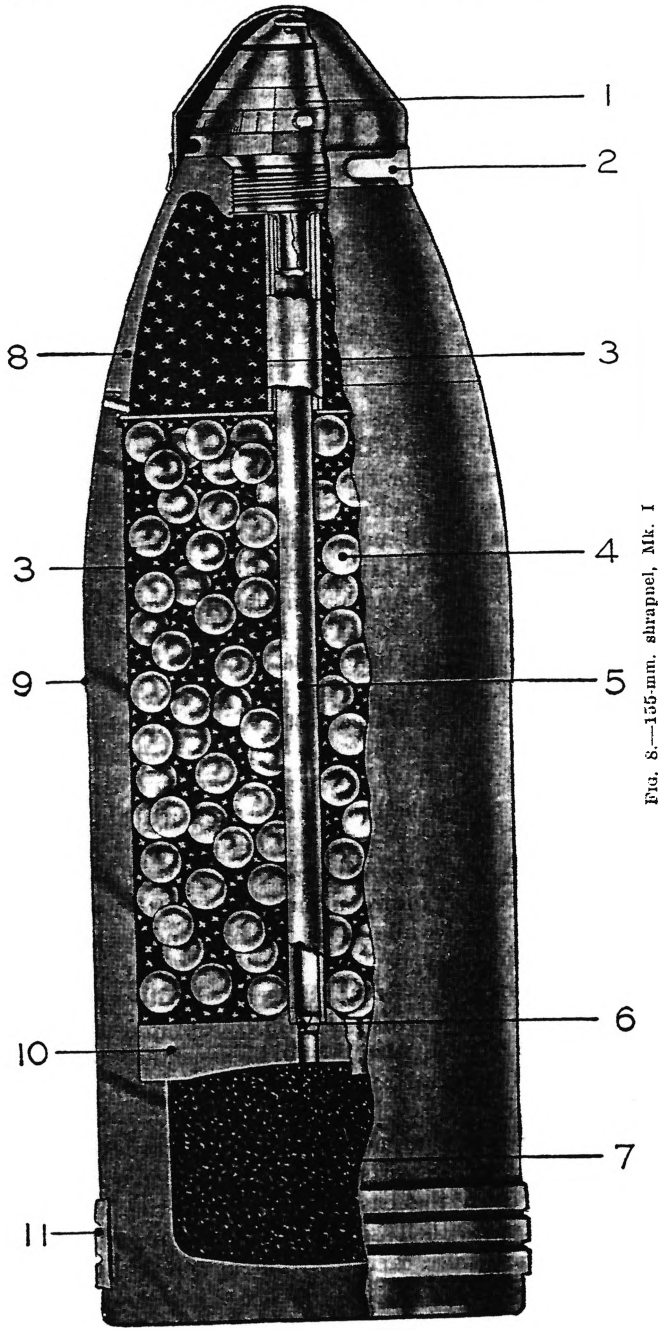


FIG. 8.—155-mm. shrapnel, Mk. I

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

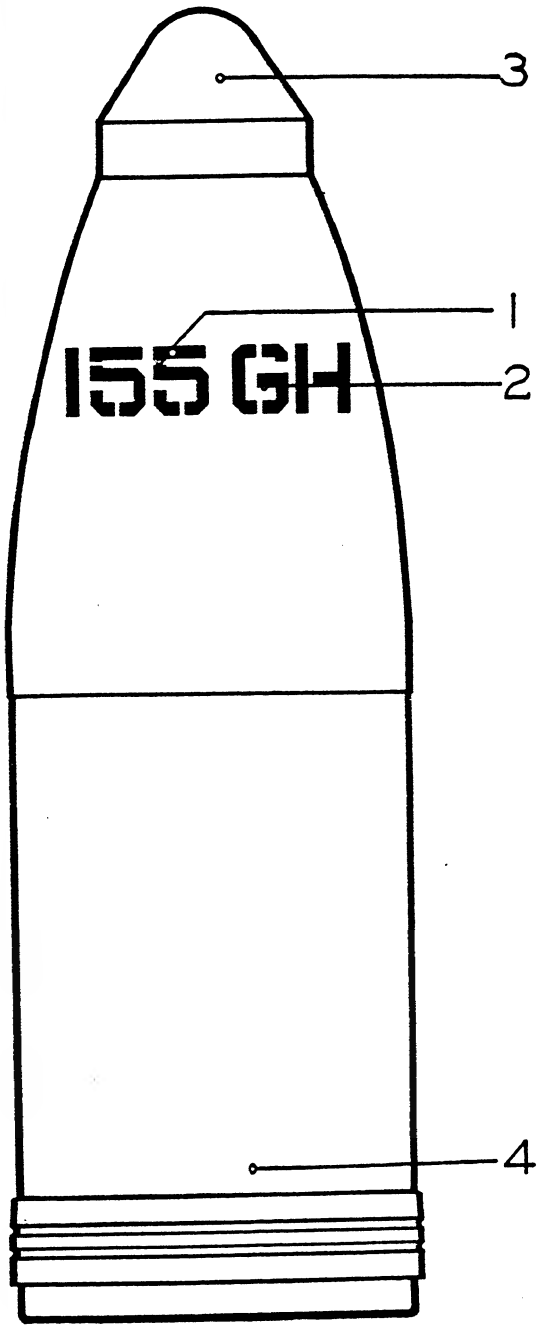


FIG. 9.—Marking for 155-mm. shrapnel (gun and howitzer)

1. Caliber of cannon.
2. Type of cannon (G = gun; H = howitzer; G H signifies suitability for use in either gun or howitzer).
3. Fuze and waterproof cover are stamped with model of fuze, lot number, initials or symbol of manufacturer, and month and year of loading.
4. Caliber and type of cannon, mark number of shrapnel, lot number of unfilled shrapnel, initials or symbol of machining plant, and inspection marks (stamped on shrapnel, under paint).

ing is composed of about 800 lead balls, approximately 0.6 inch in diameter, averaging 23 to the pound, the total weight of balls being about 34 pounds. The balls are held in a matrix of melted resin, poured into the shrapnel case during the loading of the balls. A steel head closes the shrapnel case and forms an adapter for the 45-second combination fuze. The inside of the head is filled with molten resin.

c. Action.—In action, the shrapnel is really a complete gun in itself. When the time fuze has burned its predetermined time the magazine charge flashes through the central tube of the shrapnel and ignites the black powder base charge. 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.

d. Identification.—Shrapnel are painted red to indicate that the filler charge is a low explosive. They are also stenciled for identification as shown in Figure 9. Some shrapnel may be found stenciled "155 G" or "155 H." These are identical with those properly stenciled "155 G H" and are suitable for use in either the 155-mm. gun or the 155-mm. howitzer.

e. Weight.—Weight markings are not placed on shrapnel, as there is seldom a variance of more than 1 per cent from the normal weight, fuzed, of 95 pounds. The weight is adjusted in manufacture by assembling more or fewer balls than prescribed, as may be necessary.

Section IV

ADAPTERS AND BOOSTERS

11. Function.—Adapters and boosters are used in all shell, both high-explosive and chemical, that are fired in 155-mm. guns. The adapter is a bushing that fits into the nose of the shell, thus adapting the shell to fit the fuze. Attached to the adapter is a booster casing, containing high explosive, which acts as a booster charge for the fuze, since the detonator of the fuze is not powerful enough to dependably detonate the charge in the high-explosive shell. In the chemical shell the function of the booster is to break up the shell

and disperse the chemical filler. These two assembled components are known as the "adapter and booster." The Mk. III–A and the Mk. VI–B adapters and boosters are used in 155-mm. gun high-explosive shell and chemical shell, respectively. The adapter and booster is issued assembled to the shell.

12. Adapter and booster, Mk. III–A.—The adapter and booster, Mk. III–A, is used in 155-mm. high-explosive shell, Mk. III. Figure 10 shows this adapter and booster, and gives the names of the principal parts, together with the stamping identifications. A fuze socket protects the booster charge from moisture. As fuzes are never assembled in the shell until just prior to firing, a lifting plug is supplied, which acts as a protection against the entrance of foreign substances, prevents injury to the fuze seat threads in the

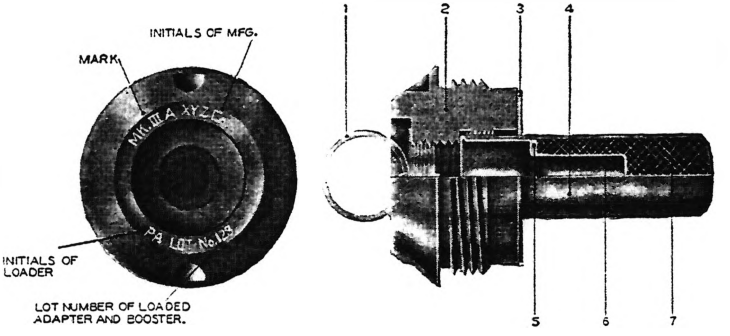


FIG. 10.—Adapter and booster, Mk. III–A

1. Adapter plug.
2. Adapter.
3. Felt washer.
4. Booster casing.
5. Felt washer.
6. Fuze socket.
7. Booster charge (tetryl).

adapter, and facilitates handling of the shell. The lifting plug is made of steel and a ring or eye is formed on one end, through which a hook or bar may be passed in handling the shell. Some shell will be received in which a die-cast white metal plug or a felt adapter plug is used instead of the eyebolt lifting plug. The booster charge consists of approximately 1 ounce of tetryl. Some boosters are loaded with half tetryl and half T. N. T., the tetryl being placed around the fuze socket.

13. Adapter and booster, Mk. VI–B.—The adapter and booster Mk. VI–B is used in 155-mm. chemical shell, Mk. VII. Figure 11 shows this adapter and booster, and gives the names of the principal parts, together with the stamping indentifications. This component differs from that which is used in the high-explosive shell in that

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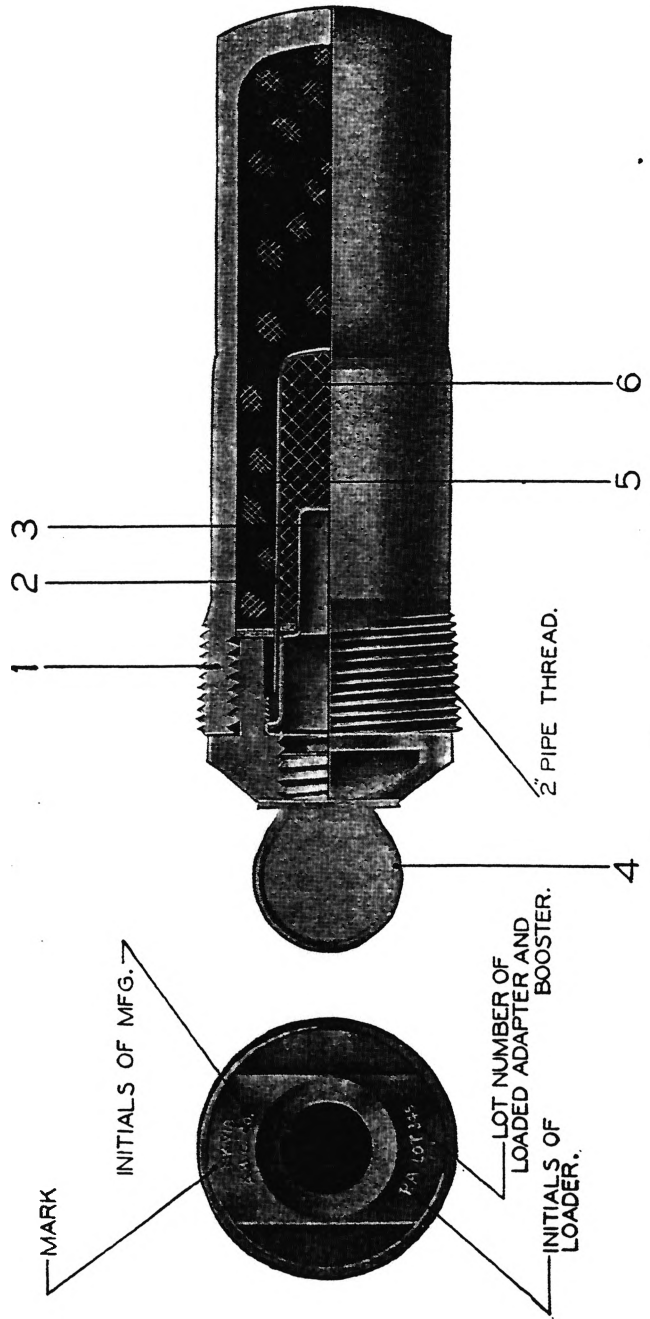


FIG. 11.—Adapter and booster, Mk. VI-B

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

the adapter and booster is made in one piece and the threads, by which it is assembled to the shell. are tapered or pipe threads instead of being straight, this type of thread and the one piece construction being necessary to make a gas-tight assembly. The joint made by the tapered threads is the only place where the gas can escape from the shell due to defective assembly. Due to the facts—first, that quite a large booster charge is required to break up the chemical shell, and second, that the fuze alone would not dependably detonate this large booster charge—an auxiliary booster was found necessary. The auxiliary booster is exactly the same as the booster used in the Mk. III–A adapter and booster, the charge being approximately 1 ounce of tetryl. The charge of the main booster is approximately 9 ounces of T. N. T.

SECTION V

FUZES

14. Types.—*a.* A fuze is a device inserted in a projectile and used to detonate or explode the bursting charge at the time and under the circumstances desired. The following types of fuzes are authorized for use with 155-mm. gun projectiles:

(1) Point detonating fuze, Mk. III or III–A (fig. 12).
(2) Point detonating fuze, Mk. IV–star (fig. 13).
(3) 45-second combination fuze, M1907M (fig. 14).

b. General instructions prescribing the percentage of the several types of authorized fuzes to be issued with each type of projectile can not be given. The allowances depend on the availability of supply, and since stocks of all types may not always be available the use of certain other types of fuzes than those authorized is permitted. The permissible fuzes for 155-mm. gun high-explosive and chemical shell are as follows:

Projectile	Permissible fuzes			
	Mk. III or III–A	Mk. IV	Mk. IV–star	Mk. V
Mk. III high-explosive shell ≠	Yes	No	Yes	No.
Mk. VII chemical shell	Yes	No	(*)	No.

"Yes" indicates that this fuze is prescribed for the projectile in question.
"No" indicates that this fuze is either unsafe for use or that it will not function in this gun.
"*" indicates that this fuze is not prescribed, but that there is no reason against its use from the standpoint of safety or certainty of functioning.
≠ Mk. III or III–A fuzes fitted with a centrifugal interrupter can not be used in 155-mm. high-explosive shell.

15. Point detonating fuze, Mk. III.—*a. Description.*—(1) The point detonating fuze, Mk. III (P. D. F. Mk. III), is a superquick fuze; it is used when it is desired to secure a quick burst above ground with the least possible penetration of the projectile. It is authorized for use in the Mk. III high-explosive shell and the Mk. VII chemical shell. The design of this fuze is practically the same as that of the French 24/31 I. A. L. M1916 (Instante Allongé Lefevre, or the instantaneous elongated fuze of the Lefevre design). Figure 12 shows this fuze, together with the names of the principal parts. The Mk. III–A fuze differs from the Mk. III only in a different arrangement of the upper detonator. These two fuzes are very similar in appearance and are fully interchangeable in use.

(2) The centrifugal plunger or interrupter (11) is a safety feature incorporated in the American design. Mks. III and III–A fuzes both with and without this feature are in service. The interrupter interferes with the Mk. III–A adapter in 155-mm. Mk. III high-explosive shell, so that the fuze can not be screwed home; therefore, only Mks. III and III–A fuzes without the interrupter can be used in this shell. Some adapters have been modified to permit the use of the fuzes with the interrupter. Boxes containing fuzes with the interrupter are plainly marked "Not for use in 155-mm. H. E. shell." This interference does not exist in the case of the Mk. VII chemical shell; therefore, either type of fuze may be used. The Mk. III fuze weighs approximately 0.95 pound.

b. Safety device.—The centrifugal plunger or interrupter (11) constitutes a partial bore-safety device[2] and is operated by centrifugal force. It is set at an angle so that linear acceleration tends to oppose the centrifugal force. While the shell is being accelerated in the bore of the gun this plunger remains in the safe position and prevents any premature action of the upper detonator (8) or primer (7) from reaching the lower detonator (14), thus making the fuze bore-safe to that extent. After linear acceleration ceases centrifugal force moves the plunger (11) outward and opens the channel (10) between the two detonators (8) and (14).

c. Action upon firing.—The firing pin (6) is held away from the primer (7) by means of a spiral (2) and a safety pin (5). The spiral (2) is composed of a split ring (1) assembled to a brass ribbon (4) having a weighted end. This ribbon (4) will not unwind until after the shell is out of the bore of the gun. At this time centrifugal

[2] A bore-safe fuze is one in which the detonating train is interrupted between the detonator and the shell charge until the projectile has cleared the muzzle of the gun. This prevents premature action of the shell charge in the bore of the gun, due to malfunctioning of the more sensitive elements of the fuze.

force acting upon the weighted end of the ribbon unwinds it, taking the split ring (1) with it. The safety pin (5) holds the firing pin (6) during flight.

d. Action at target.—Upon impact with the target the safety pin (5) bends or breaks and the firing pin (6) functions the primer (7). The primer (7) causes the upper detonator (8) to explode. The flame from this explosion passes through the open channel (10) to the lower detonator (14), causing it to function. This detonation is transmitted to the booster and in turn is transmitted to the explosive charge of the shell. These explosions follow in such rapid succession as to make the bursting of the shell practically simultaneous with the first impact of the firing-pin head.

e. Shipment.—These fuzes are never assembled in projectiles before shipping but are packed in waterproof boxes, 50 fuzes to each box, and form a separate shipment. The spiral is held in position during shipment by means of a piece of tarred tape (15). A lead-foil cap is fitted over this tape as a waterproof cover and is cemented to the fuze with a mixture of tar and rubber or other waterproofing compound.

f. General information.—(1) Previous to placing the projectile in the gun the fuze is screwed tightly into the adapter, using the wrench provided. Before placing the projectile in the gun the tape and waterproof cap are removed from the fuze by pulling on the loose end of the tape, which is exposed.

(2) Never screw a fuze into a shell if the tarred tape and lead-foil cap are not in their proper places.

(3) After the fuze is screwed into the shell and the tape removed from the neck of the fuze, examine the spiral (brass ribbon) and safety pin to see that they are in their proper places. If the ribbon is broken, the fuze can not function, for centrifugal force is not sufficient to arm the fuze unless the weighted end of the ribbon is in place. If the spiral is not in place there is danger of a premature explosion in the gun. In either case the fuze will be removed and destroyed. The gun personnel should become familiar with the appearance of this fuze.

g. Marking.—The point detonating fuze, Mk. III, is identified by a ½-inch blue-gray band painted just below the waterproof cover. In addition it has the following stamping on the body:

(1) Initials or symbol of metal parts manufacturer.
(2) P.D.F., Mk. III (Mk. number of fuze).
(3) Lot number of loaded fuze.
(4) S.Q. (superquick).

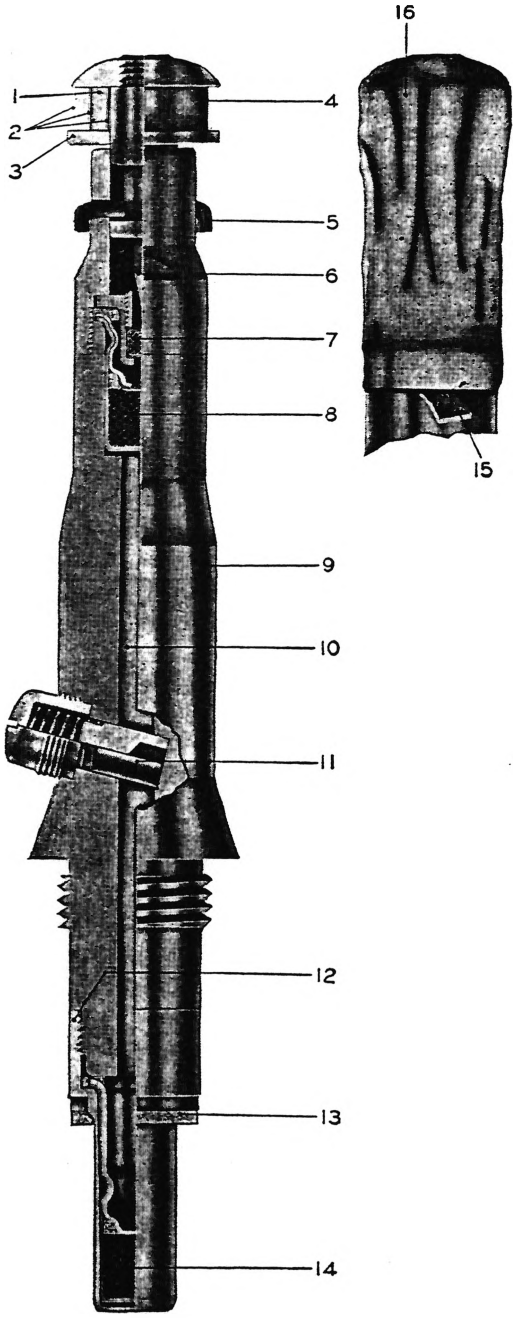


FIG. 12.—Point detonating fuze, Mk. III

1. Half ring or split ring.
2. Spiral.
3. Supporting washer.
4. Brass ribbon.
5. Safety pin.
6. Firing pin.
7. Primer.
8. Upper detonator.
9. Fuze body.
10. Central channel.
11. Centrifugal plunger or interrupter.
12. Detonator socket.
13. Felt washer.
14. Lower detonator.
15. Tape.
16. Waterproof cover.

(5) Initials or symbol of loading plant.
(6) Month and year of loading.

16. Point detonating fuze, Mk. IV–star.—*a. Description.*—(1) The point detonating fuze Mk. IV–star (P. D. F. Mk. IV–star) is made primarily for use in guns of comparatively high muzzle velocity, and is used when a slight delay action is desired. It is authorized for use in the Mk. III high-explosive shell. The design was practically copied from the French (24/31, M1899—1915). Figure 13 shows this fuze, together with the names of the principal parts. This fuze weighs approximately 0.35 pound.

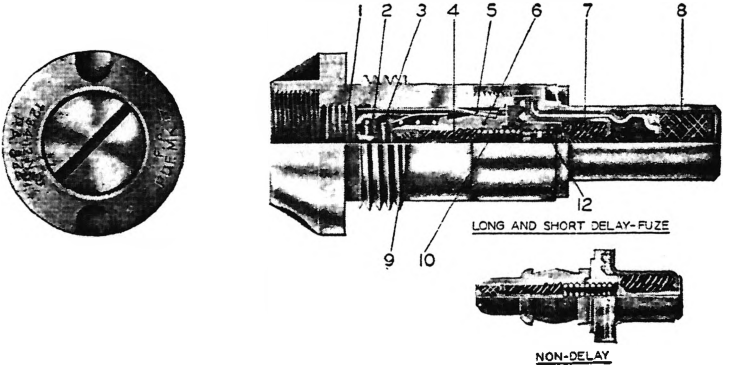


FIG. 13.—Point detonating fuze, Mks. IV and IV–star

1. Firing pin.
2. Arming casing.
3. Arming spring.
4. Black powder pellet.
5. Safety casing.
6. Percussion plunger.
7. Relay powder.
8. Detonator.
9. Percussion primer.
10. Retard spring.
12. Delay pellet.

(2) This fuze should not be confused with the point detonating fuzes Mks. IV and V, which are similar in design and appearance, except that the Mks. IV and IV–star have flat heads. The difference in design between the Mk. IV–star and the Mk. V fuze is that the Mk V fuze is provided with an additional arming device, known as the "head safety feature." The Mk. V fuze is designed for use in 75-mm. field guns and must not be used in 155-mm. gun projectiles. The Mk. IV and IV–star fuzes are exactly alike in every way except that the Mk. IV–star fuze has a stronger retard spring. To distinguish the Mark IV–star fuze from the Mark IV fuze the bevel edge of the head of the Mark IV–star fuze is painted green; also, a star is stamped on the head of the Mark IV–star fuze immediately following the mark number.

(3) The following types of Mk. IV-star fuzes have been manufactured, but the short-delay is the only type authorized for use in 155-mm. guns. The amount of delay is indicated by color markings.

(*a*) Nondelay (N. D.)—white head.

(*b*) Short delay (S. D.)—approximately 0.05 second—black head.

(*c*) Long delay (L. D.)—approximately 0.15 second—black head and violet detonator socket.

b. Action upon firing.—In action the arming casing (2) through its inertia or setback[3] at the impulse of the propelling charge compresses the arming spring (3). The sides of the arming casing disengage the prongs of the safety casing (5) from the percussion plunger (6), while the prongs of the arming casing (2) engage the collar on the sides of the percussion plunger (6). The arming casing (2) is thus held back, exposing the percussion primer (9) and completing the arming of the fuze. The percussion plunger (6) is held from creeping forward during flight by the retard spring (10).

c. Action at target.—On impact the percussion plunger (6) moves forward, and the primer (9) is exploded by the firing pin (1). The flame of this explosion is transmitted to the powder pellet (4) below the primer (9) to the delay pellet (12) or to the relay powder (7) in the case of the nondelay. The gases from powder pellet (4) are necessary to carry ignition to the relay powder (7) after the delay pellet (12) has burned. The relay powder (7) supplies hot gases which explode the detonator (8), consisting of approximately 30 grains of mercury fulminate. This detonates the booster, which in turn detonates the shell filler.

d. Shipment.—These fuzes are never assembled in projectiles for shipment but are packed in waterproof boxes, 100 fuzes to each box, and form a separate shipment. When the shell is ready to be placed in the gun the fuze is screwed tightly into the adapter, using the wrench provided. It is necessary that a felt washer be placed under the detonator socket flange to hold the fuze in the adapter properly.

[3] 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.

e. Marking.—The point detonating fuze, Mk. IV–star, is identified by the following markings:

(1) Stamping—

(*a*) Initials or symbol of metal parts manufacturer.
(*b*) PDF, Mk. IV ★ (mark of fuze).
(*c*) Lot number of loaded fuze.
(*d*) NON (for nondelay).
S. D. (for short delay)—0.05 second.
L. D. (for long delay)—0.15 second.
(*e*) Initials or symbol of loading plant.
(*f*) Month and year of loading of fuzes.

(2) Marking—

(*a*) The head of the nondelay fuze is painted white.
(*b*) The head of the short-delay fuze is painted black.
(*c*) The head of the long-delay fuze is painted black and the detonator socket violet.
(*d*) The bevel edge of the head of all types of Mark IV–star fuzes is painted green.

17. 45-second combination fuze, M1907M.—*a. General description.*—(1) The 45-second combination fuze is used with shrapnel. It can be set and reset at any time from 0, for canister effect, to 45.2 seconds—the longest time that the fuze will burn after firing. It is made of brass and bronze and weighs 2 pounds.

(2) The fuze is always assembled to the shrapnel for shipment. It is protected from moisture by a waterproof cover which is removed and thrown away when the fuze is set for time of flight. Before setting the fuze it is necessary to remove the safety wire at the top of the fuze. This safety wire is incorporated for safety in transportation, due to the low arming resistance of the concussion plunger.

(3) This fuze does not have a detonating element, as it is designed to ignite the base charge of black powder in the shrapnel. If the time element of the fuze fails to function, or the setting is too long, the percussion element will cause the shrapnel to function upon impact, the term "combination" thus being derived from this double-action feature. Figure 14 shows a view of the fuze with the waterproof cover (19) 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. Canister action.—(1) When the setting is at 0[4] for canister effect the action is as follows: When the gun is fired the concussion

[4] This should cause the shrapnel to burst within 50 feet of the muzzle of the gun.

plunger (2) will slip through the resistance ring (3), due to inertia or the setback action in the projectile. The concussion primer (4), which is held in the concussion plunger, is thus exploded by the firing pin (5). The flame from this primer (4) passes through a hole in the body and ignites the powder pellet (16), which is in the upper time-train ring (6). The flame from this pellet (16) is transmitted to the ignition pellet (17), which is located in the lower or graduated time-train ring (8). The flame from this pellet ignites the ignition pellet (18) of the body (11). The magazine charge (13) is exploded and the flame of same passes through the central tube of the shrapnel to the base charge.

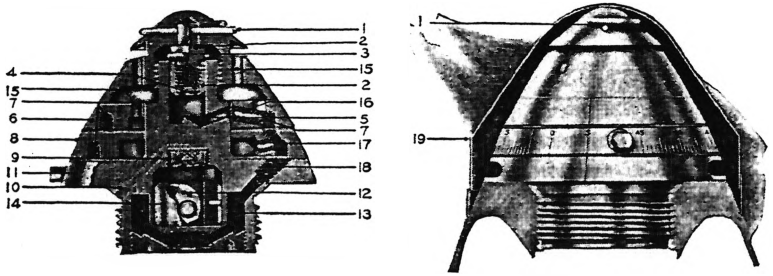


FIG. 14.—45-second combination fuze, M1907M

1. Safety wire.
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. Percussion primer.
10. Channel.
11. Body.
12. Percussion firing pin.
13. Magazine charge (black powder).
14. Percussion plunger.
15. Vents.
16. Powder pellet.
17. Powder pellet.
18. Powder pellet.
19. Waterproof cover.

(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 (13) by means of powder pellets. The powder train (7), which is responsible for the time feature, does not enter into this action.

c. Time action.—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 (16) as previously described. This powder pellet (16) ignites the powder train (7). The powder train (7) is ma-

chined in both the upper and lower time-train rings in the shape of a horseshoe; that is, there is a solid section of metal at the beginning and end of the powder train. The ignition pellet (17) of the lower 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 (17), the powder train (7) of the lower or graduated time-train ring will begin to burn. When the flame reaches ignition pellet (18) in the body (11) the action is as previously described. The gases from the powder train (7) escape to the atmosphere by means of the vents (15).

d. Percussion action.—The combination feature of this fuze is that it will also function on impact. In the percussion plunger (14) the percussion firing pin (12) is armed by centrifugal force; that is, the firing pin is unlocked and revolves to the armed position, so that on impact it will function the percussion primer (9). The flame from this primer passes through the channel (10) in the body to the magazine charge (13), thus firing the shrapnel.

e. 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 from 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 marks on the body and the upper time-train ring, it is said to be "safe." At this setting the solid metal section of the upper time-train ring is completely covering the ignition pellet (17) 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 (18) in the body which connects with the magazine charge (13). It would be possible for both power trains (7) to burn completely, but no flame could reach the ignition pellet (18), and, therefore, the shrapnel would not explode except by percussion action. When firing shrapnel for percussion action the fuze should be set at "S." These fuzes are always issued set "safe," and if not used after making a setting they should be reset to "safe" again and the safety wire replaced before handling.

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

(1) 1907M (model, or mark number of fuze).
(2) Lot number.
(3) Initials or symbol of manufacturer.
(4) Month and year of loading.
(5) Some fuzes are also stamped with the drawing and revision numbers.

Practically this same stamping also appears on the waterproof cover.

SECTION VI

PRIMER

18. 21-grain percussion primer, Mk. II–A.—*a. Type.*—The 155-mm. gun uses a percussion primer; that is, the gun is fired by the primer being struck by the point of the firing pin of the gun in a manner similar to the way that a rifle cartridge is fired. The primer is called a "21-grain percussion primer (Mk. II–A)" because it contains 21 grains of black powder. Figure 15 shows the 21-grain percussion primer, Mk. II–A.

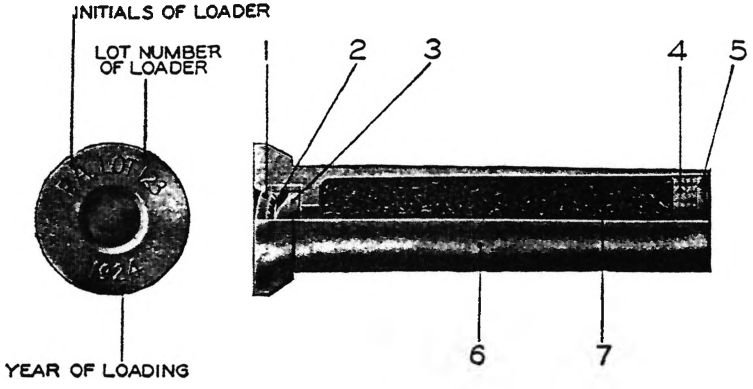


FIG. 15.—21-grain percussion primer, Mk. II–A

1. Percussion cup.
2. Percussion composition.
3. Anvil.
4. Wax.
5. Shellac.
6. Case.
7. Black powder.

b. Action.—When the firing pin strikes the percussion cup (1) it indents the cup and crushes the percussion composition (2) against the anvil (3), causing this composition to explode. The flame from

the explosion of the percussion composition passes through a hole and ignites the black powder charge (7) which, in turn, ignites the igniter of the propelling charge. 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 height of 3 inches may cause it to function.

c. Marking.—Identification marks are stamped on the bottom of the primer case as shown in Figure 15.

d. Shipment.—Primers are shipped packed in waterproof tin packing cans, 50 primers to each can. They are affected by moisture, and care should be taken that they are kept dry after the can has been opened.

SECTION VII

PROPELLING CHARGE

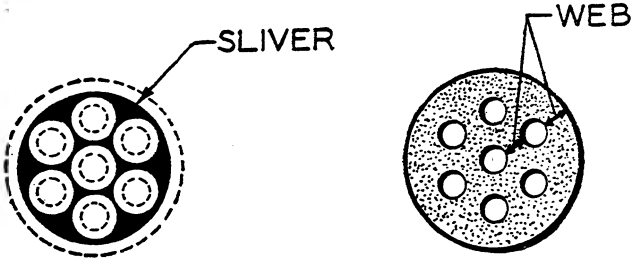
19. Propelling charge.—*a. General.*—The propelling charge for the 155-mm. gun is nitrocellulose smokeless powder. A grain of powder will burn freely in the open and has none of the characteristics of an explosive until it is confined. If the powder is confined in a chamber the rate of burning is very rapid, as the rate of burning increases as the gases are liberated and the pressure in the chamber increases.

b. Action.—(1) The pressure of gases from the burning powder expels 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 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 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. Since the grain 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 were solid. The size of the grain for the 155-mm. gun is about five-sixteenths inch in diameter by about thirteen-sixteenths inch long, with seven 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 16 shows the end view of a typical grain of powder and also the progressive burning action until the grain is practically consumed. The dotted lines show the original shape of the grain of powder. The small triangular sections are called "slivers." These slivers will burn if the powder is properly designed.

(3) The maximum allowable pressure in the 155-mm. gun is 31,500 pounds per square inch and the muzzle velocity with the full charge is 2,410 feet per second.



Burning of powder End view of powder before burning

FIG. 16.—Grain of powder

20. Cartridge bags.—*a. Use.*—Cartridge bags are used with separate loading ammunition, forming a suitable and convenient means of containing the smokeless powder propelling charge. Two classes of cloth are used in the manufacture of cartridge bags, known as cartridge-bag cloth and cartridge-igniter cloth. These two classes of cloths are both divided into five grades, according to their respective tensile strengths. The grades are lettered "A" to "E," "A" being the strongest grade and "E" the weakest. For the 155-mm. gun grade "E" cartridge-bag cloth and grade "C" cartridge-igniter cloth are ordinarily used, since the bags are relatively small in size.

b. Cartridge-bag cloth.—Cartridge-bag cloth is made of pure silk, wool, or mohair, raw silk having been found to be the most practical material. This cloth is used in the manufacture of all components of the bags, except those components containing the black igniting powder. It is necessary that the cartridge-bag cloth have sufficient strength to withstand service conditions and at the same time it must be entirely consumed during combustion of the propelling charge.

c. Cartridge-igniter cloth.— Cartridge-igniter cloth is made of pure silk and has properties similar to cartridge-bag cloth, but is more closely woven to prevent the igniting powder from sifting through the cloth. All igniters used with cartridge bags are manufactured from cartridge-igniter cloth. In order to avoid any possibility of error and to clearly indicate that they contain black powder, all igniters are dyed bright red.

21. Type of charge.—*a. Description.*—(1) The cartridge bags containing the propelling charge for 155-mm. guns are known as the "base and increment type," in that they consist of a base section and one increment section, permitting two zones of fire. The base section contains an igniter pad, holding 8 ounces of black igniting powder. This igniter pad forms the rear end of the base section. Four tying straps are sewed to the front end of the base section, by means of which the increment section is attached to the base section, thus forming a unit of the full propelling charge. Both the base section and the increment section are wrapped spirally with strips of cartridge-bag cloth to make the bags firm and compact for handling. The full charge is shown in Figure 17.

(2) The full charge is used for maximum-range firings and the reduced charge is used for ranges reached with the lower muzzle

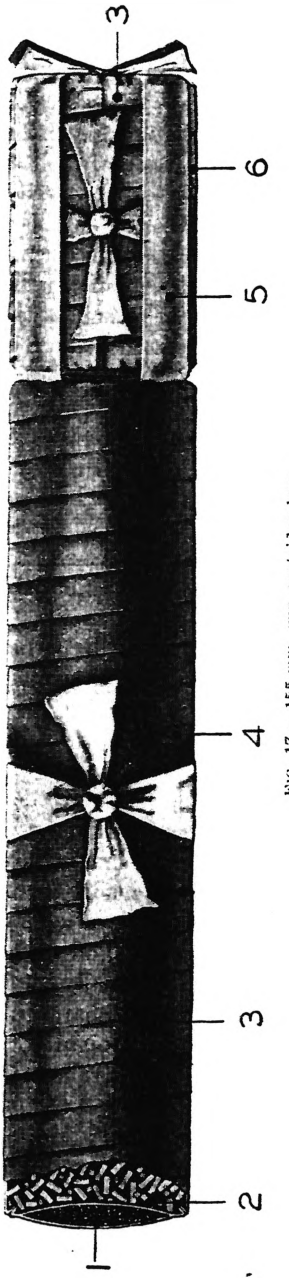


FIG. 17.—155-mm. gun cartridge bag

velocity obtained when the increment section is removed and the base section only is used. When it is desired to use the reduced charge the tying straps are untied and the increment charge is removed. The tops of the bags are stenciled to show which is the base and which the increment charge, although this is readily determined by a comparison of their sizes, the base section being approximately three times as long as the increment section.

(3) The base section contains approximately 19 pounds of smokeless powder and the increment section contains approximately 6 pounds of smokeless powder. The full charge gives a muzzle velocity of 2,410 feet per second, with a pressure of approximately 28,500 pounds per square inch. The reduced charge gives a muzzle velocity of 1,955 feet per second, with a pressure of approximately 17,000 pounds per square inch. These weights of powder and pressures vary slightly with different lots of powder, since the powder charge is so adjusted as to give the specified muzzle velocity.

b. Marking.—(1) The base section is stenciled on the rear end with the words "IGNITING POWDER," and on the front end with the words "155-MM. GUN—BASE."

(2) The increment section is stenciled on one end with the words "155-MM. GUN—INCREMENT."

(3) Each complete charge has a tag attached to it, usually tied to one of the tying straps, containing the following information:

(*a*) Name of loading plant.
(*b*) Date loaded (day, month, and year).
(*c*) Caliber and model of gun.
(*d*) Weight of projectile.
(*e*) Powder lot number.
(*f*) Name of manufacturer of powder.
(*g*) Size and model of gun or howitzer for which the powder was made in case of a lot of powder being used in a different gun or howitzer from the one for which it was originally intended.
(*h*) Weight of charge in both base and increment sections, weight of igniter, and velocity and pressure obtained with both full and reduced charge.

(4) Before inserting the charge in the gun this tag must be removed.

c. Primer protector cap.—(1) In order to protect the igniting charge of black powder in the rear end of the charge, a "primer protector cap" is furnished. This consists of a cup-shaped cloth cover about 5 inches deep which fits over the rear end of the charge

and is fastened to the charge by means of a draw string. The primer protector cap is made of heavy cloth with a disk of felt sewed on the inside of the bottom. A cloth handle is sewed on the outside of the bottom to facilitate the removal of the primer protector cap. The primer protector cap must be removed from the charge before loading the charge in the gun. Stenciled on the bottom of the primer protector cap are the words "Remove cap before inserting in gun."

(2) Most charges in service will be found to be fitted with primer protector caps of the type used during the World War. This consisted of a heavy paper bag about 6 inches deep, with a disk of felt in the bottom. This bag was placed over the rear end of the charge in the same manner as the new cloth type primer protector caps.

22. Storage.—All propelling charges are stored and shipped in cartridge storage cases. A full description of the cartridge storage cases, their markings and the method of their shipment is contained in paragraph 25.

SECTION VIII

PACKING

23. Projectiles.—*a. High-explosive shell.*—(1) The high-explosive shell, Mk. III, are shipped without being crated or boxed. An eyebolt lifting plug or adapter plug is fitted in the fuze seat in the adapter of these shell to facilitate handling and to protect the fuze seat. The rotating band is protected by a rope grommet, as shown in Figure 18. These shell must be firmly secured against movement for transportation.

(2) Figure 19 shows a satisfactory method of packing these shell in freight cars for shipment. In this method of shipment the shell should preferably be stood on their bases, and they must be properly braced to prevent excessive movement. Rows of shell should be separated by pieces of board to prevent the rotating band from being damaged should the rope grommet slip out of place. If the shell are shipped on their sides they must be separated by pieces of board, so as to prevent the shell coming in contact with each other.

b. Chemical shell, Mk. VII and shrapnel Mk. I.—(1) Chemical shell, Mk. VII and shrapnel Mk. I, are packed in wooden boxes for shipment, two projectiles in each box. The packing box for chemi-

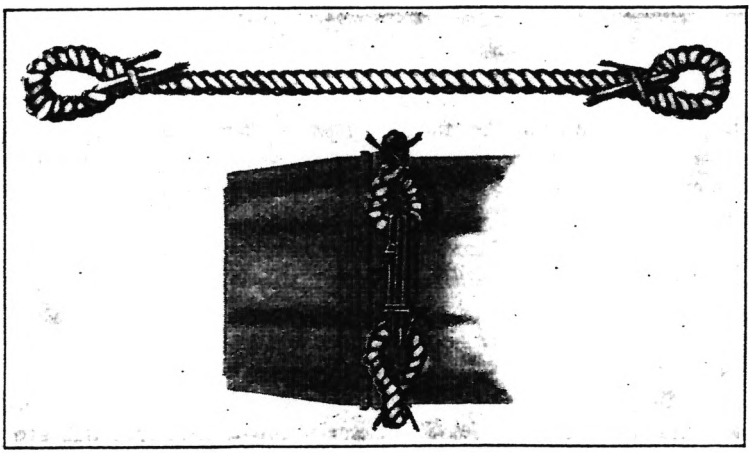


FIG. 18.—Rope grommet

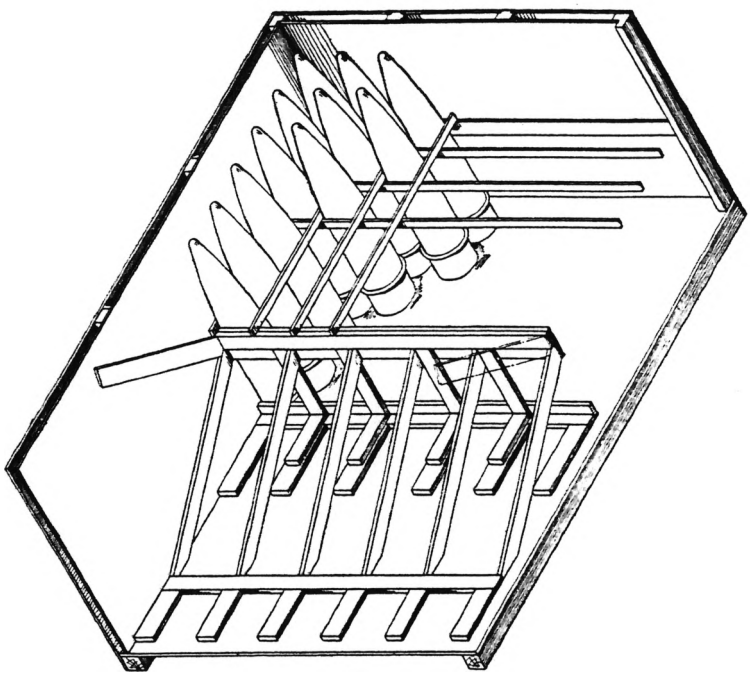


FIG. 19.—Method of packing projectiles in freight cars

cal shell measures approximately 14⅝ inches wide, 9⅜ inches high, and 28⅛ inches long. The packing box for shrapnel measures approximately 14⅝ inches wide, 7¾ inches high, and 23⅛ inches long. The total weights for the boxed chemical shell and shrapnel are about 219 pounds and 216 pounds, respectively.

(2) The system of marking packing boxes for Mk. VII chemical shell was changed when the system of marking the chemical shell was changed. The old marking system is shown in Figures 20 and 21 and the new marking system is shown in Figures 20 and 22.

(3) The marking which appears on the packing box for the Mk. I shrapnel is shown in Figures 20 and 23.

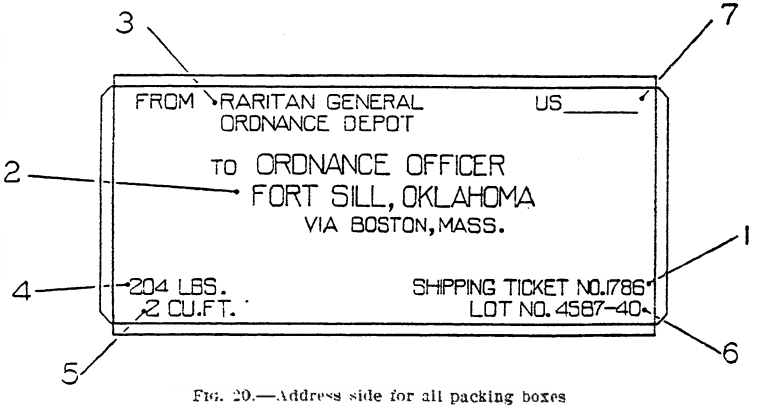


FIG. 20.—Address side for all packing boxes

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 car-load shipments.

24. Packing boxes for fuzes.—*a. Type.*—The point detonating fuzes, Mk. III and Mk. IV–star, are never assembled in projectiles for shipment. They are shipped in separate metal-lined wooden boxes. The fuzes are packed in trays which prevent excessive movement in shipment. There are 50 Mk. III or 100 Mk. IV–star fuzes in a box. The exterior dimensions of the box are exactly the same for both fuzes, the difference being in the tray. The cover is hinged and is held in place by two thumb nuts. A wire is tacked to the lid and to the side of the box and sealed, thus preventing tampering with the contents of the box without destroying the seal. The marking on this packing box is shown in Figures 20 and 24.

b. Metal lining.—The boxes have a metal lining which makes them waterproof, this lining being a complete box in itself. The

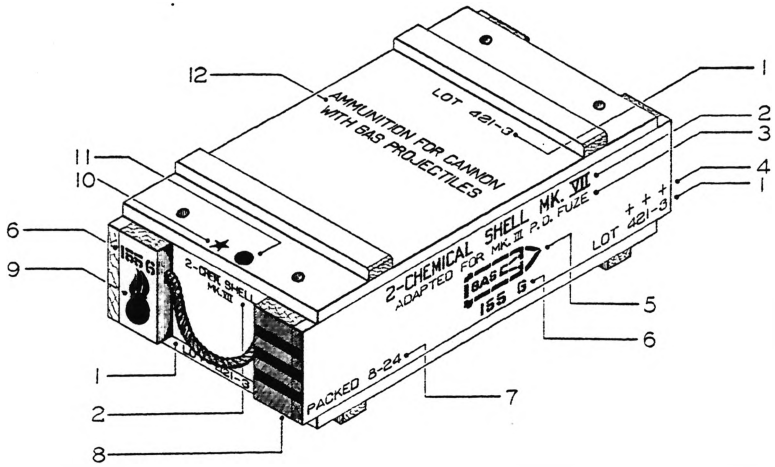


FIG. 21.—Marking of packing box for 155-mm. chemical shell. (Old system.)

1. Ammunition lot number.
2. Number of shell, type of projectile, and condition.
3. Statement of fuze to be used.
4. Weight zone marks.
5. Symbol of ammunition in box.
6. Caliber and type of cannon.
7. Month and year of packing.
8. Colored stripes on blue-gray background to designate type of chemical filling of shell.
9. Ordnance insignia.
10. Inspector's stamp.
11. Name of place where packed.
12. 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 20.

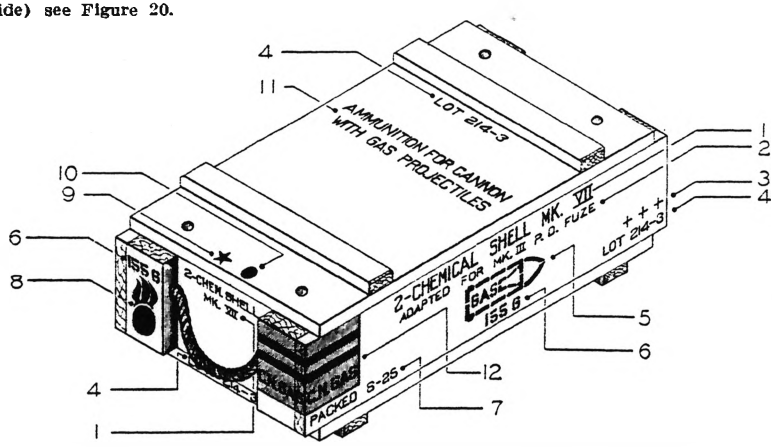


FIG. 22.—Marking of packing box for 155-mm. chemical shell. (New system.)

1. Number of shell, type of projectile, and condition.
2. Statement of fuze to be used.
3. Weight zone marks.
4. Ammunition lot number.
5. Symbol of ammunition in box.
6. Caliber and type of cannon.
7. Month and year of packing.
8. Ordnance insignia.
9. Inspector's stamp.
10. Name of place where packed.
11. To comply with I. C. C. regulations.
12. Colored bands on blue-gray background and symbol of chemical filler. One green band denotes nonpersistent filler; two green bands denote persistent filler; yellow band denotes smoke (phosphorus).

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 20.

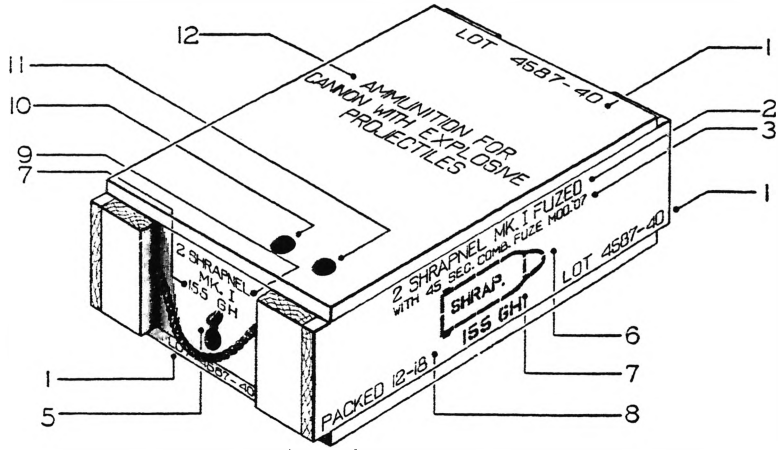


FIG. 23.—Packing box for 155-mm. shrapnel separate loading ammunition for howitzer and gun

1. Ammunition lot number.
2. Number, mark number, and condition of shrapnel.
3. Statement of fuze used.
5. Ordnance insignia.
6. Symbol of ammunition in box.
7. Caliber and type of cannon.
8. Month and year of packing.
9. Number and mark number of shrapnel.
10. Inspector's stamp.
11. Name of place where packed.
12. 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 20.

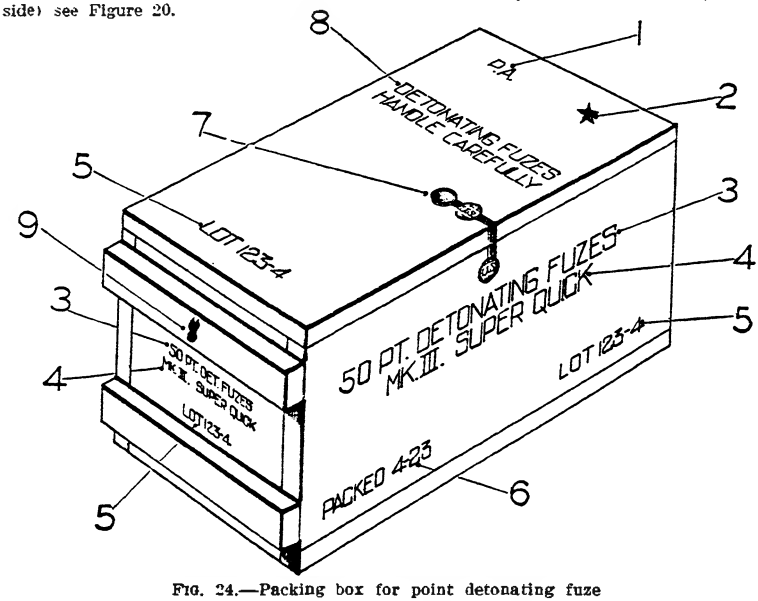


FIG. 24.—Packing box for point detonating fuze

1. Name of place where packed.
2. Inspector's stamp.
3. Quantity and kind of fuze.
4. Mark number and type of fuze.
5. Lot number.
6. Month and year of packing.
7. Seal.
8. To comply with I. C. C. regulations.
9. Ordnance insignia.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 20.

cover is secured by a soldering strip which must be entirely removed before removing the cover. After the fuzes have been packed in the lining and the cover soldered on, the lining is tested for leaks by applying an air pressure of 4 pounds per square inch through the hole in the cover. Leaks are indicated by an air-pressure gauge. After satisfactorily passing this test, the test hole is soldered over. If a box of fuzes is opened and for any reason part of the fuzes only are used during the season, the tin strip should not be resoldered, but the wood cover should be securely fastened in place and the box appropriately marked so that the remaining fuzes may be used at the first opportunity.

c. Size and weight.—The outside dimensions of the wooden box are 9⅝ by 8¾ by 17$\frac{3}{16}$ inches. It occupies about 0.9 cubic foot of space. The total weight packed with Mk. III fuzes is about 80 pounds and with Mk. IV–star fuzes about 70 pounds.

25. Cartridge storage cases.—*a. Purpose.*—The storage of the propelling charge is important, and since moisture affects the smokeless powder all charges are packed in waterproof containers, known as cartridge storage cases. Two types of cartridge storage cases are in service, one made of fiber and one made of metal. Both types contain one propelling charge each.

b. Fiber cartridge storage case.—(1) The fiber cartridge storage case consists of a round cylindrical tube made of several plies of fiber thoroughly cemented together and waterproofed. A metal cover is crimped over each end of the fiber tube. This container is approximately 6$\frac{5}{16}$ inches in diameter by approximately 37½ inches long. After the charge has been packed in the cartridge storage case and the metal cover crimped in place, the cartridge storage case is tested for leaks by applying an internal air pressure of 2 pounds per square inch through the testing connection in the top cover. Leaks are indicated by an air-pressure gauge. After satisfactorily passing this test the testing connection is sealed by means of a screw plug, the threads of which are coated with red lead or other sealing compound. To remove the charge the metal cover must be torn off, thus rendering the cartridge storage case unserviceable for further use.

(2) The bottom metal end has the following information stamped on it:

(*a*) Caliber and name of gun.
(*b*) Weight of projectile for which the propelling charge is intended.
(*c*) The initials of the manufacturer and year of manufacture.
(*d*) "Open opposite end."

(3) Each container is also stenciled on the outside wall or has a printed tag glued to the wall with the following information:

(*a*) Name of loading plant.
(*b*) Date loaded, day, month. and year.
(*c*) Number of propelling charges contained.
(*d*) Caliber and model of gun.
(*e*) Weight of projectile.
(*f*) Name of powder manufacturer.
(*g*) Powder lot number and size and model of gun or howitzer for which the powder was made, in case of a lot of powder being used in a different gun from the one for which it was originally intended.

(4) The propelling charge is held in the fiber container to prevent excessive movement by means of a disk of heavy cardboard placed on top of the charge, and on top of this disk is placed a triangular-shaped spacer made of this same heavy cardboard, of a length sufficient to take up the space between the cardboard disk on top of the charge and the top end of the cartridge storage case.

(5) Fiber cartridge storage cases are shipped in wooden boxes, four cases being packed in each box. This box is approximately 41⅝ inches long, 14¾ inches wide, and 14¾ inches high, and is fitted with a rope handle at each end. The inside of the box is lined with a heavy waterproof paper bag, which is sealed with a waterproof cement after the fiber cartridge storage cases are packed. Sheets of heavy cardboard are placed inside the waterproof paper lining to take up any lengthwise motion of the cases. These boxes are stenciled on both ends and one side with the same information that appears on the cartridge storage case described in (3) above.

c. Metal cartridge storage case.—(1) The cartridge storage case Mk. I is made of metal and is shown in Figure 25. This is a nonexpendable item, whereas the fiber cartridge storage case can be used but once. It is approximately of the same dimensions as the fiber cartridge storage case. It is made of heavy gauge sheet steel, the seam in the body and the joint where the bottom attaches to the body being welded. The cover (2) is clamped to the body (4) by a clamping spider (1), the hooked ends of which engage under the flange at the mouth of the cover. The cover is sealed to the body against the entrance of moisture by a rubber gasket (3). The clamp screw (7) is used to compress the rubber gasket between the cover and the body, thus insuring an air-tight seal. This rubber gasket should be examined frequently, and it should be replaced by a fresh rubber gasket when it has stretched or dried out to such an extent as to render leakage possible. To remove the charge it is necessary

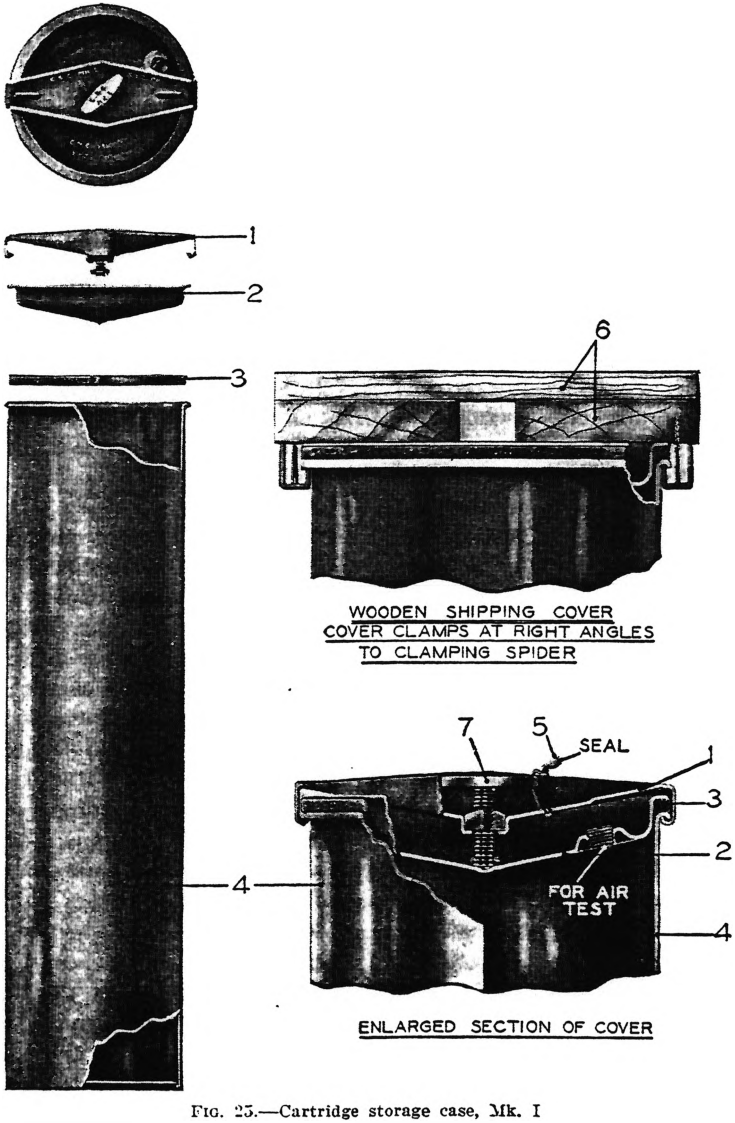


FIG. 25.—Cartridge storage case, Mk. I

1. Clamping spider.
2. Cover.
3. Rubber gasket.
4. Body.
5. Seal.
6. Wooden shipping cover.
7. Clamp screw.

to break the wire seal (5) between the clamp screw and the clamping spider, and to unscrew the clamp screw until the clamping spider is free to slide off, which will permit the cover to be removed.

(2) After the charge has been packed in this metal cartridge storage case and the cover clamped in place the cartridge storage case is tested for leaks by applying an internal air pressure of 5 pounds per square inch through the test hole in the cover. Leaks are indicated by an air-pressure gauge. After satisfactorily passing this test a pipe plug is screwed into the test hole to seal it.

(3) The body is embossed with the following information:

(*a*) C.S.C. Mk. I (cartridge storage case Mk. I).

(*b*) Initials or symbol of manufacturer.

(*c*) 155-mm. gun.

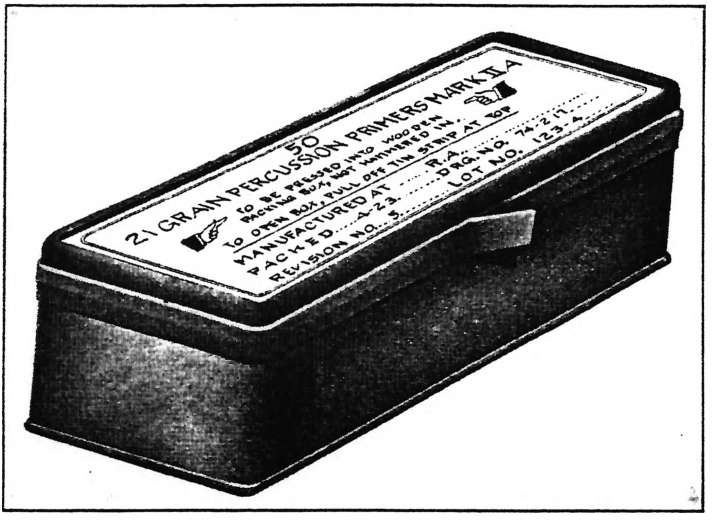


FIG. 26.—Packing can for 21-grain percussion primers, Mk. II–A

(4) The cover and clamping spider are embossed with the following information:

(*a*) C.S.C. Mk. I (cartridge storage case Mk. I).

(*b*) Initials or symbol of manufacturer.

(5) The clamp screw is embossed as follows: C.S.C. Mk. I (cartridge storage case Mk. I).

(6) Metal cartridge storage cases are painted battleship gray. Besides the marking mentioned in (3), (4), and (5) above, they are stenciled with the same information as on the fiber cartridge storage cases described in *b*(3) above. Since the metal cartridge storage

cases are not boxed for shipment, they are also stenciled with shipping instructions. In shipment for the purpose of protecting the cover end of the cartridge storage case this end is fitted with a wooden shipping cover (6).

(7) The propelling charge is held in the metal cartridge storage case to prevent movement of the charge in the same manner as that described for the fiber cartridge storage case in *b*(4) above.

26. Packing boxes for primers.—21-grain percussion primers, Mk. II–A, are packed in waterproof metal cans containing 50 primers. The primers are held in position by means of cardboard separators. These cans are about 5.7 inches long, 3 inches wide, and 2 inches high. The covers of these cans are secured in place by means of soldering strips. The marking on the packing cans is shown in Figure 26. The packing cans are packed in wooden packing boxes for quantity shipment. The standard wooden box contains 48 packing cans and 2,400 primers. This box is approximately 26½ inches long, 10⅞ inches wide, and 9⅞ inches deep. It occupies about 1.57 cubic feet of space and weighs about 85 pounds. Primers must always be stored in a dry place, as excessive moisture may cause them to fail to function.

[A. G. 062.12 (9–9–26).]

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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MOBILE ARTILLERY AMMUNITION

AMMUNITION FOR 155-MM. FIELD GUNS, M1918MI (FRENCH G. P. F.)

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON, *January 2, 1931.*

TR 1355–155B, November 25, 1927, is changed as follows:

2. References.

* * * * * * *

b. Proper nomenclature for ammunition described herein is given in the following Standard Nomenclature Lists:

S. N. L. No.	*Title*
P–1.	Target Practice Projectile, Separate Loading, for Medium and Major Caliber Seacoast Artillery and Heavy Field Artillery.
P–2.	High Explosive and Chemical Projectiles, Separate Loading for Medium and Major Seacoast Artillery and Heavy Field Artillery.
P–3.	Propelling Charges for Separate Loading Harbor Defense, Heavy Field and Railway Artillery.
P–6.	Fuzes, Primers, Miscellaneous Material, and Saluting Components for Harbor Defense, Heavy Field and Railway Artillery.
R–2.	Projectiles and Propelling Charges, All Types, Separate Loading, for Medium Field Artillery.
R–3.	Service Fuzes and Primers for Pack, Light, and Medium Field Artillery.
R–6.	Ammunition Instruction Material for Pack, Light, and Medium Field Artillery.

This nomenclature is mandatory and will be used in all requisitions.

* * * * * * *

[A. G. 062.12 (3–26–30).] (1930.)

4. Types of ammunition.—*a. Characteristics.*—Three general types of ammunition are provided, as follows: High-explosive shell ammunition, chemical shell ammunition, and shrapnel ammunition. A subcaliber gun is provided for these guns, the ammunition for which is described in TR 1370-C. Dummy projectiles and dummy cartridges are also provided, this ammunition being described in TR 1370-D.

* * * * * * *

[A. G. 062.12 (3–26–30).] (1930.)

10. Shrapnel, Mk. I.—*a. General remarks.*—This is the only projectile that may be fired interchangeably in either the 155-mm. gun or 155-mm. howitzer. It is fitted with a rotating band approximately 1.25 inches wide. The Mk. I shrapnel is issued with the 45-second combination fuze, M1907M, assembled in place, the fuze being set at safe. Great care should be taken to keep the shrapnel in a dry condition.

* * * * * * *

[A. G. 062.12 (3–26–30).] (1930.)

21. Type of charge.

* * * * * * *

b. Marking.

* * * * * * *

(5) There are on hand in ordnance depots propelling charges for 155-mm. gun marked to indicate that they are for the M1915, M1917, or M1918 guns, one model only being designated in the marking. The ballistics of the three models are the same and charges marked for a particular model may be used in any other model. There are no M1915 guns in the service, but a gun of this model was used at the proving ground in acceptance tests of a number of lots of powder, thus accounting for the markings indicating certain charges for the M1915 gun.

* * * * * * *

[A. G. 062.12 (3-26-30).] (1930.)

BY ORDER OF THE SECRETARY OF WAR:

DOUGLAS MACARTHUR,
General,
Chief of Staff.

OFFICIAL:

C. H. BRIDGES,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1933

MOBILE ARTILLERY AMMUNITION

AMMUNITION FOR 155-MM. FIELD GUNS, M1918MI (FRENCH G. P. F.)

CHANGES No. 2

WAR DEPARTMENT,
WASHINGTON, *January 2, 1932.*

TR 1355–155B, November 25, 1927, is changed as follows:

2. References.

* * * * * * *

b. (As changed by C 1, January 2, 1931.) Proper nomenclature for ammunition described herein is given in the following Standard Nomenclature Lists:

S. N. L. No. — Title

P–1. Projectiles, Separate Loading, for Medium and Major Caliber Seacoast Artillery and Heavy Field Artillery.
P–3. Propelling Charges for Separate Loading Harbor Defense, Heavy Field and Railway Artillery.
P–6. Fuzes, Primers, Miscellaneous Material, and Saluting Components for Harbor Defense, Heavy Field and Railway Artillery.
R–2. Projectiles and Propelling Charges, All Types, Separate Loading, for Medium Field Artillery.
R–3. Service Fuzes and Primers for Pack, Light, and Medium Field Artillery.
R–6. Ammunition Instruction Material for Pack, Light, and Medium Field Artillery.

This nomenclature is mandatory and will be used in all requisitions.

* * * * * * *

[A. G. 062.12 (12–30–31).] (1931.)

20. Cartridge bags.

* * * * * * *

c. Cartridge-igniter cloth.—Cartridge-igniter cloth is made of pure silk and has properties similar to cartridge-bag cloth, but is more closely woven to prevent the igniting powder from sifting through the cloth. All igniters used with cartridge bags are manufactured from cartridge-igniter cloth. In order to avoid any possibility of error and to clearly indicate that they contain black powder, igniters are dyed bright red. **However, there are on hand in the service, as well as in the ordnance depots, many propelling charges for 155-mm. guns in which the igniter pad is not dyed red.**

In these cases care must be taken to insure that the small, or increment section of the powder charge is loaded into the gun foremost. In case only the base section is used it must be loaded into the gun with the tie straps foremost. The igniter end can be identified from the quilting used to hold the black powder in position. When charges of old manufacture are fired in target practice by inexperienced enlisted men or by civilian components of the Army, especially when the increment is removed and only the base section used, great care should be exercised not to load the charge in the chamber in the reverse position. Such a condition might be the cause of a serious accident.

[A. G. 062.12 (12–30–31).] (1931.)

23. **Projectiles.**—*a. High-explosive and chemical shells.*—(1) The high-explosive shell, Mk. III, and chemical shell, Mk. VII, are shipped without being crated. An eyebolt lifting plug or adapter plug is fitted in the fuze seat in the adapter of these shell to facilitate handling and to protect the fuze seat. The rotating band is protected by a rope grommet, as shown in Figure 18. These shell must be firmly secured against movement for transportation.

* * * * * * *

[A. G. 062.12 (12–30–31).] (1931.)

b. Shrapnel, Mk. I.—(1) Shrapnel, Mk. I, are packed in wooden boxes for shipment, two projectiles in each box.

(2) For weight and volume see Standard Nomenclature List No. R–2.

* * * * * * *

[A. G. 062.12 (12–30–31).] (1931.)

Figure 21.—Marking of packing box for 155-mm. chemical shell. (Old system.)—Rescinded.

[A. G. 062.12 (12–30–31).] (1931.)

Figure 22.—Marking of packing box for 155-mm. chemical shell. (New system.)—Rescinded.

[A. G. 062.12 (12–30–31).] (1931.)

24. **Packing boxes for fuzes.**

* * * * * * *

c. Size and weight.—See Standard Nomenclature List No. P–6.

[A. G. 062.12 (12–30–31).] (1931.)

25. Cartridge storage cases.

* * * * * * *

c. Metal cartridge storage case.

* * * * * * *

(6) Metal cartridge storage cases are painted battleship gray. Besides the marking mentioned in (3), (4), and (5) above, they are stenciled with the same information as on the fiber cartridge storage cases described in *b* (3) above. The metal cartridge storage cases are crated for oversea shipment, two per crate. The crate is fitted with a rope handle at each end. In domestic shipments they are not crated and therefore for the purpose of protecting the cover end of the cartridge storage case this end is fitted with a wooden shipping cover (6), Figure 25.

(6½) Markings appearing on the packing crate are shown in Figure 27.

* * * * * * *

[A. G. 062.12 (12-30-31).] (1931.)

Figure 27 is added as follows:

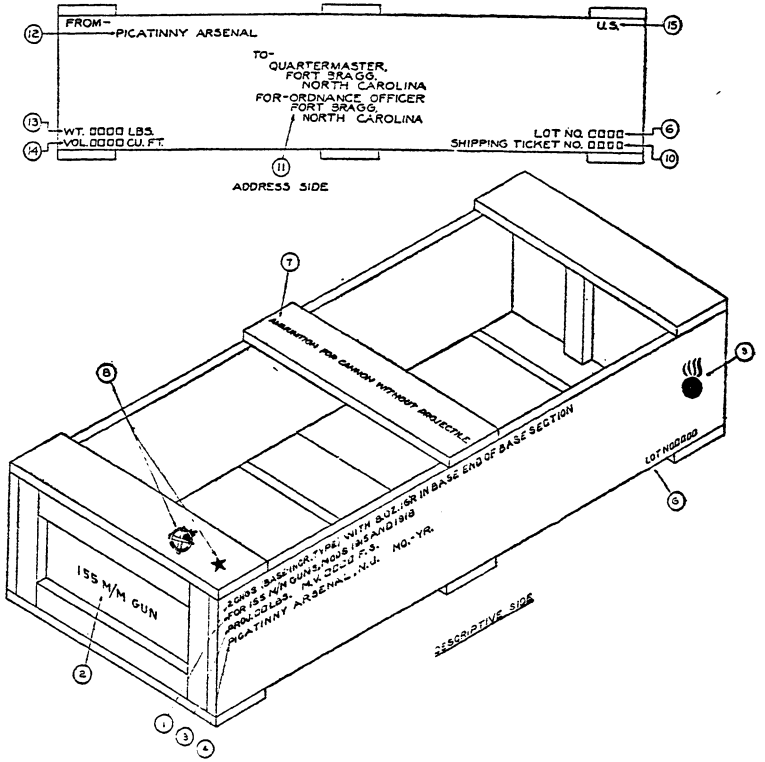

FIG. 27.—Descriptive and address sides of metal cartridge storage case packing crate

1. Quantity and description.
2. Type of ammunition (mark both ends alike).
3. Weight of projectile and muzzle velocity.
4. Place, month, and year of packing.
6. Powder lot number.
7. To comply with I. C. C. regulations.
8. Inspection stamps.
9. Ordnance flaming bomb—Red for experimental ammunition or ballistic samples.
10. Number of shipping ticket.
11. Designation and address of consignee as shown on shipping instructions.[1]
12. Consignor.[1]
13. Gross weight.
14. Cubical displacement.
15. To indicate United States property.

[1] Shipping officer may omit 11 and 12 on carload shipments.

[A. G. 062.12 (12-30-31).] (1931.)

BY ORDER OF THE SECRETARY OF WAR:

DOUGLAS MacARTHUR,
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