TM 9-1990

WAR DEPARTMENT TECHNICAL MANUAL

SMALL-ARMS AMMUNITION

WAR DEPARTMENT • SEPTEMBER 1947

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TM 9-1990

This manual supersedes TM 9-1990, 23 May 1942, including C 1, 22 September 1942, C 2, 7 June 1943, and C 3, 24 November 1943; OFSTB 1990-5, 20 September 1943; OFSTB 1990-7, 17 November 1943; OFSTB 1990-8 and TB 9-1990-8, 30 November 1943; and TB ORD 194 (a reprint of OFSTB 1990-6), 6 November 1943.

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WAR DEPARTMENT
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TM 9–1990, Small-Arms Ammunition, is published for the information and guidance of all concerned.

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For explanation of distribution formula see TM 38–405.

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CHAPTER 1

GENERAL

Section I. INTRODUCTION

1. Purpose

This manual is published for the information and guidance of all concerned. Personnel of the Ordnance Department who are responsible for the care, handling, storage, or issue of small-arms ammunition should be familiar with the provisions of this manual.

2. Scope

a. This manual furnishes complete information concerning the care, handling, and use of small-arms ammunition, that is, ammunition used in weapons having a bore of 0.60 inch or less (rifles, carbines, pistols, revolvers, machine guns, submachine guns) and in shotguns. The precautions and instructions with reference to care, handling, and use are intended for peacetime, but they should be followed so far as practicable at all times.

b. This manual differs from TM 9–1990, 23 May 1942, in omitting obsoleted cartridges, and practices, in describing new cartridges and practices, in rearranging subject matter, and in increasing descriptive and illustrative material.

Section II. GENERAL DISCUSSION

3. Cartridge Terminology

a. Figures 1 and 2 illustrate the use of terms applied particularly to modern military small-arms cartridges and their components.

b. The *cartridge* is a complete assembly consisting of all the components necessary to fire the weapon once, that is, the bullet, cartridge case, propellent powder, and primer.

c. The term *bullet* refers only to a small-arms projectile. The term *ball,* originally used to describe the actual ball of very early small-arms ammunition no longer accurately describes the shape of the modern solid bullet, but the term is still applied to the modern type of bullet and ammunition used for the same purpose. A bullet (or an artillery projectile) is said to be *boattailed* when the base end is tapered or conical; it is called a *square base* when the base end is cylindrical.

d. The type of cartridge used in shotguns has been referred to as a *shotgun shell, shotgun cartridge, shot shell,* or *shot cartridge.* For purposes of standardization and agreement with standard nomenclature (par. 4), the term used in this manual and in all military references will be "shotgun shell." However, the special caliber .45 cartridge containing pellets is known as a "shot cartridge." The *charge* or *load* of a shotgun shell consists of *shot* or *pellets, a single ball,* or a single cylindrical *slug.*

e. Other terms applied to small-arms ammunition components are discussed in chapter 2.

4. Nomenclature

Standard nomenclature is established in order that each item supplied by the Ordnance Department may be specifically identified by name. These names are published in WD Cat. ORD 11 Standard Nomenclature Lists. The use of standard nomenclature is mandatory for all purposes of record. It should be noted that this nomenclature completely describes the ammunition as to type, caliber, and model.

5. Classification

a. Small-arms cartridges, based upon type of case, are classified as *centerfire* or *rimfire.* Caliber .22 cartridges are the only current rimfire type used for military purposes. Centerfire cartridges may be classified as *rimless, semirimmed,* or *rimmed.* (See figure 2.)

b. Dependent upon its purpose, small-arms ammunition is classified as service or special as follows:

(1) *Service types.* (*a*) *Ball,* for use against personnel and light materiel targets.

(*b*) *Armor-piercing,* for use against armored aircraft and lightly armored vehicles, concrete shelters, and other bullet-resisting targets.

(*c*) *Incendiary,* for incendiary effect especially against aircraft.

(*d*) *Tracer,* for observation of fire. Secondary purposes are for incendiary effect and for signaling.

(*e*) *Armor-piercing-incendiary,* for combined armor-piercing and incendiary effect.

(*f*) *Armor-piercing-incendiary-tracer,* for combined armor-piercing and incendiary effect, with the additional tracer feature.

(*g*) *Shot,* for use in hunting small game.

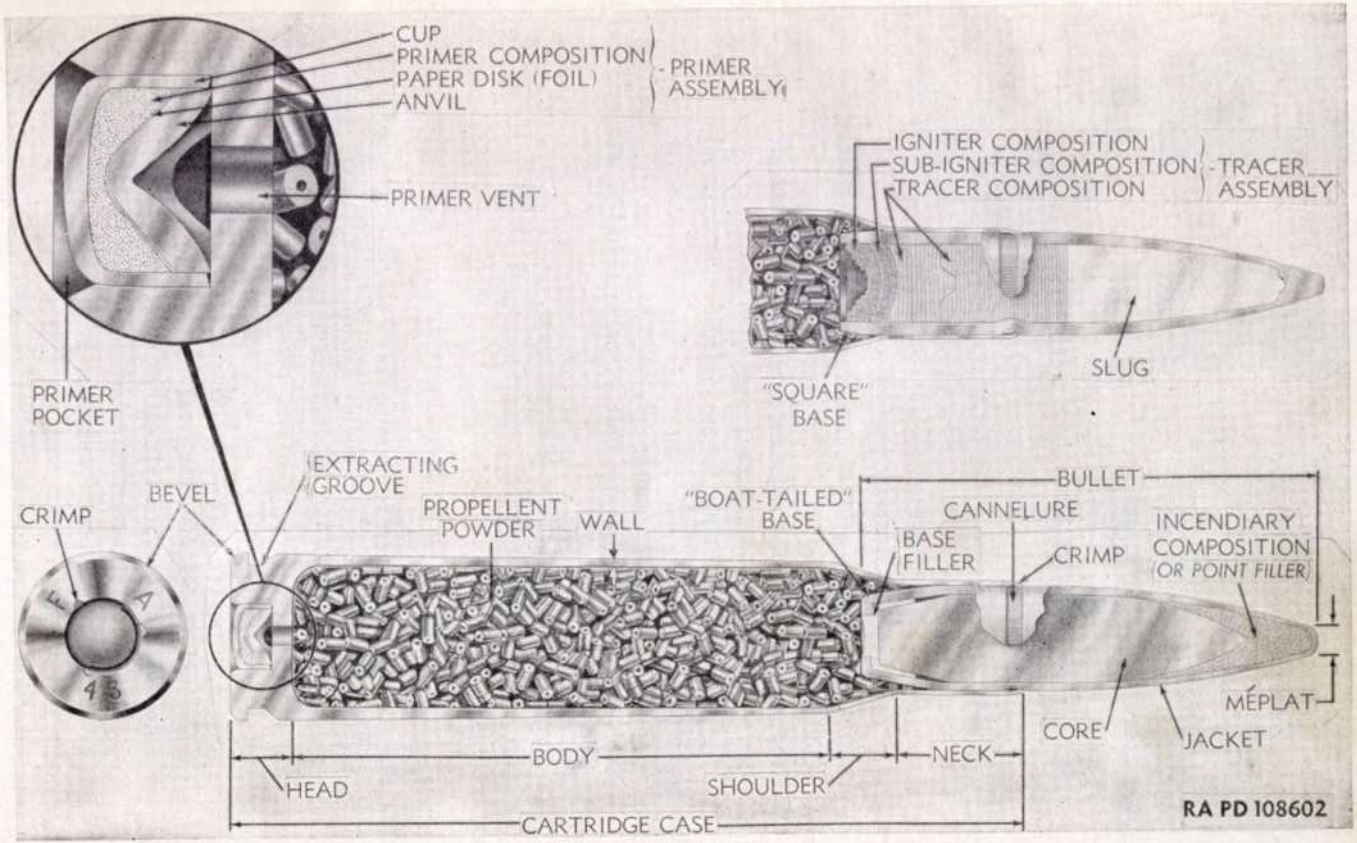


Figure 1. Cartridge terminology.

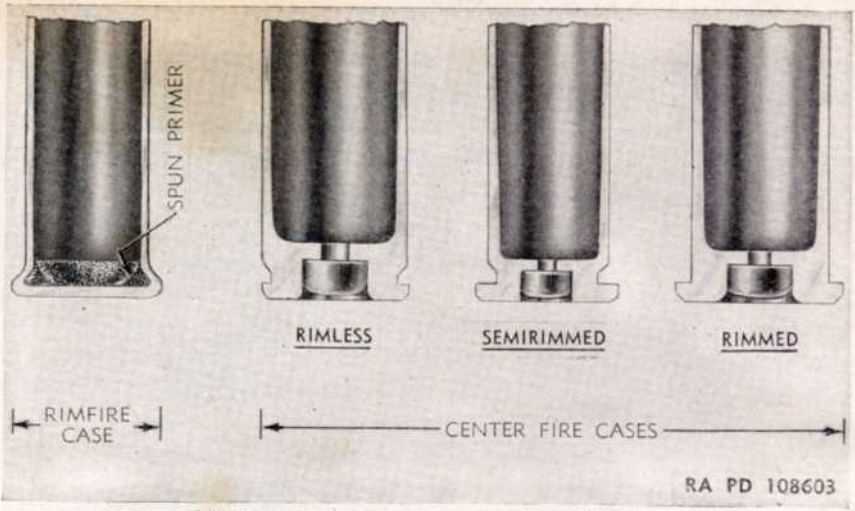


Figure 2. Cartridge terminology—continued.

(*h*) *Shotgun shells* are used for guard purposes, aerial gunner training, target practice, and hunting.

(*i*) *Grenade,* for use in projecting grenades by means of a rifle or carbine having a grenade launcher attached thereto.

(2) *Special types,* (*a*) *Blank,* for simulated fire, and for salutes (contains no bullet).

(*b*) *Dummy,* for training (completely inert).

(*c*) *High-pressure test,* for use only in proof firing of weapons and barrels.

(*d*) *Subcaliber,* for use in subcaliber weapons.

(*e*) *Frangible,* for target practice against aircraft (bullet disintegrates upon hitting target).

6. Grades and Uses

a. GENERAL. Ammunition is manufactured to rigorous specifications and is inspected and tested thoroughly before acceptance. Since the various types of weapons—rifles, ground machine guns, aircraft machine guns, etc.—have different requirements, production orders and specifications call for the classification of lots for use in specific weapons. Variations in manufacture may occur because of problems of mass production of ammunition. Considering variations from lot to lot and the different requirements for each type of weapon, grades are assigned to each lot of ammunition, in accordance with acceptance tests, to designate their use in the different types of weapons. It should be noted that grade designations do not signify that one grade is better than another, but that it is better for some particular class of weapon.

b. GRADES. Current grades of all existing lots of small-arms ammunition are established by the Chief of Ordnance as a result of inspection

and are published in WDSB 9–AMM 4. Grades are not marked on packing boxes or on slips inside the box. However, the grade appropriate to the packing and ammunition contained therein is indicated by the ammunition code symbol (AIC) which is stenciled on each box. No lot other than that of grade appropriate for the weapon, as specified in the current publication of WDSB 9–AMM 4, will be issued or fired.

(1) The grades for caliber .30 ammunition are as follows:
AC—Aircraft and antiaircraft machine guns.
ACorR—Aircraft and antiaircraft machine guns and rifles.
R—Rifles.
MG—Ground machine guns.
3—Unserviceable, not to be issued or used.

(2) The grades for caliber .30 carbine ammunition are as follows:
R—Carbines.
3—Unserviceable, not to be issued or used.

(3) The grades for caliber .50 ammunition are as follows:
AC—Aircraft and antiaircraft machine guns.
MG—Ground machine guns.
3—Unserviceable, not to be issued or used.

(4) The grades for caliber .45 ammunition are as follows:
1—Revolvers, pistols, and submachine guns.
2—Pistols and submachine guns, only (when available this grade should be issued for these weapons in preference to grade 1.)
3—Unserviceable, not to be issued or used.

(5) More than one grade may be authorized for certain weapons. For example, grades ACorR, AC, and R, may also be used for ground machine guns and grade MG or R may also be used for antiaircraft machine guns. Grade R and grade ACorR may be used in rifles. See WDSB 9–AMM 4 for authorized substitutes.

(6) When small-arms ammunition becomes unserviceable, it is designated as grade 3 and withdrawn from service. Ammunition which cannot be identified will be considered as grade 3. However, unidentified ammunition will not be classified as unserviceable for this reason until every effort has been made to establish its identity. In addition, ammunition placed in grade 3 due to loss of lot number, but which can be identified as having been in serviceable lots issued to a specific organization, may be reissued after visual inspection but only for local training purposes in ground machine guns. (See *h*(1), below.)

(7) The only two grades of small-arms ammunition suitable for use in infiltration courses: Grade AC and grade ACorR. See AR 750–10 for further precautions in firing in training.

(8) Small-arms ammunition which has been graded "For training use only" will not be fired over the heads of troops under any circumstances.

c. EXAMPLES. Some of the factors taken into consideration when grading ammunition are illustrated by the following examples:

(1) Ammunition to be used in the service rifle requires that the average net extraction effort shall not exceed 15 pounds. This is essential for uniform and reliable action in a manually operated weapon but is of lesser importance in automatic and semiautomatic weapons, such as aircraft and ground machine guns.

(2) Ammunition for use in synchronized and remote-controlled aircraft machine guns must be of selected uniformity and have a minimum variation in rate of ignition. These requirements are essential to assure continuous feeding during combat use of aircraft guns, where malfunctioning might result in destruction of propellers or create other hazards.

(3) Due to the rugged construction of ground-type machine guns, the continuous control exercised by the operator, and the lower rate of fire, less stringent test limits are required. Ammunition that meets the general specifications for accuracy, pressure, dimensions, etc., is satisfactory.

d. VELOCITY, PRESSURE, ACCURACY. Regardless of the weapon in which the ammunition is to be used, the requirements for velocity, pressure, and accuracy are uniform. However, due to uncontrollable factors, an ammunition lot meeting the special requirements of aircraft machine guns might be less accurate or develop higher or lower velocities than a lot graded for ground machine guns or for rifles.

e. REGRADING. Ammunition in storage is periodically retested to insure that its characteristics have not changed. If changes have occurred, as shown by surveillance tests, the ammunition is regraded and the new grades published in WDSB 9–AMM 4.

f. GRADES OF REPACKED LOTS. Cartridges packed in web belts and metallic link belts are assigned repacked lot numbers. (See par. 11.) The grades of these repacked lots and of cartridges packed in rifle clips are not published in WDSB 9–AMM 4 (except for clipped repacked lots suitable for overhead fire in training), but are considered to have the following grades indicated by the type of packing, pending possible regrading of the original lots:

	Grade
Caliber .30	
In 5- or 8-rd clips	R
In web belts	MG
In link belts	AC or MG*
In link belts in M1A1 metal ammunition box	MG
Caliber .50	
In link belts	AC or MG*
In link belts in M2 metal ammunition box	MG

* *Grade is dependent on grades of component ammunition lots comprising the repacked lot. The grade of the repacked lot may also be determined by the ammunition identification code symbol stenciled on each ammunition box. The component ammunition lots may be identified by the data card contained in each ammunition box of the repacked lot. The current grade of the component ammunition lots are published in WDSB 9–AMM 4.*

g. JOINT ARMY-NAVY (JAN) STANDARDS. Several cartridges have been adopted for aircraft use as Joint Army and Navy Standards. These are:

(1) CARTRIDGE, armor-piercing, cal. .30, M2
(2) CARTRIDGE, ball, cal. .30, M2
(3) CARTRIDGE, incendiary, cal. .30, M1
(4) CARTRIDGE, tracer, cal. .30, M1 (no requirement for use by Army Air Forces)
(5) CARTRIDGE, armor-piercing, cal. .50, M2
(6) CARTRIDGE, armor-piercing-incendiary, cal. .50, M8
(7) CARTRIDGE, ball, cal. .50, M2
(8) CARTRIDGE, incendiary, cal. .50, M1
(9) CARTRIDGE, tracer, cal. .50, M10

h. GRADE 3 AMMUNITION AT POSTS, CAMPS, AND STATIONS. Caliber .30 and caliber .50 ammunition which have become grade 3 because a proper record of its lot numbers has not been kept, fall into the following three classifications:

(1) *Ammunition that can be identified as having been in serviceable lots issued to a specific organization.* In this category are included caliber .30 and caliber .50 ammunition lots which are serviceable and suitable for use in machine gun training. After a visual inspection to eliminate defective rounds, these rounds may be reissued for immediate use to such units as directed by the senior tactical commander at the station, but only for local training purposes in ground machine guns.

(2) *Ammunition which cannot be identified as being in classification (1).* This ammunition is designated as "Grade 3 Ammunition Due to Loss of Identity."

(3) *Ammunition regraded to grade 3 by direction of the Chief of Ordnance during the period that such lot or lots have been in the possession of the organization that returns it.* This ammunition is designated as "Grade 3 Ammunition".

7. Priority of Issue

a. Subject to special instructions from the Chief of Ordnance, ammunition of appropriate type and model will be issued in the following order: limited standard, substitute standard, standard. Following this rule, ammunition which has had the longest or least favorable storage will be issued first whenever practicable; this includes lots of ammunition marked "Repacked, liners, not sealed."

b. Priority of issue for lots of small-arms ammunition is established by the Chief of Ordnance and published in WDSB 9–AMM 4, or in special instructions. Within any one grade, priority of issue and use will be given to lots indicated in WDSB 9–AMM 4, and to lots containing less than 20,000 rounds. See also AR 775–10.

c. To prevent the building up of excess stocks in the field, transfers may be arranged within the Army areas if no stock of appropriate grade for immediate use is on hand.

Section III. IDENTIFICATION

8. General

a. The type, caliber, model, and ammunition lot number, including the symbol of the manufacturer are necessary for complete identification of small-arms ammunition.

b. From the cartridge itself, the ammunition may be identified, except for lot number, by:

(1) The appearance of the cartridge and the painting on the bullet (see figs. 3, 4, and 5 and illustrations in ch. 3 and 4).

(2) The stamping on the base of the cartridge case. Because of its small size, the marking on small-arms ammunition is the stamping of the manufacturer's initials and year of manufacture on the base of the cartridge case. For example, "FA 45" means the lot was loaded at Frankford Arsenal in 1945. Ammunition manufactured during 1944, is stamped "4" or "44" to indicate the year of manufacture. On lots manufactured prior to 1940, the caliber is also stamped on the base of some cartridge cases. National Match ammunition has the initials "NM" stamped alongside the date of loading.

c. From packings and containers, and markings thereon, the ammunition can generally be completely identified by:

(1) Markings on the original packing boxes and cartons. See section IV, below.

(2) A repacked reference data card inserted in each packing box containing repacked lots of ammunition (par. 12). Formerly, an identification card, usually 6½ by 15 inches, was sealed inside the metal liner on top of ammunition in each box.

(3) Identification stamped on the pockets of each bandoleer (fig. 22 and pars. 13 and 31). Prior to 1 February 1945, a reference card was inserted in the bandoleer for ammunition packed in clips and bandoleers. This reference card is no longer required.

(4) The stamping of the repacked lot number on web belts.

9. Model

To distinguish a particular design, a model designation is assigned at the time it is classified as an adopted type. The model designation becomes an essential part of the standard nomenclature of the item and one of the means of identification. Prior to 1 July 1925, it was the practice to use the year in which the design was adopted as the model designation, for

example, CARTRIDGE, ball, cal. .45, M1911. The present system of model designation is to use the letter M followed by an arabic numeral, for example, CARTRIDGE, ball, cal. .50, M2.

10. Ammunition Lot Number

a. When ammunition is manufactured, an ammunition lot number, which becomes an essential part of the marking, is assigned in accordance with pertinent specifications. This lot number is marked on all packing boxes containing carton-packed cartridges, and on the cartons packed therein, and on the repacked reference data card inclosed in each packing box containing repacked lots. It is required for all purposes of record, including grading, use, and reports on condition, functioning, and accidents, in which the ammunition might be involved.

b. Since it is impracticable to mark the ammuntion lot number on each individual cartridge, every effort should be made to preserve, by tagging or marking, the ammunition lot number or the repacked lot number (par. 11) of the cartridges once they are removed from their original packing. Cartridges for which the ammunition lot number has been lost automatically become grade 3. Therefore, when cartridges are removed from their original packings they should be so marked that the ammunition lot number or the repacked lot number may be preserved.

c. The letter "S" appearing before the serial number of the lot number indicates a steel cartridge case. Older lots containing steel cased rounds may have the letter "X" at the end of the ammunition lot number. Ammunition lots having gilding metal clad steel or copper-plated steel bullet jackets may have the letter "C" as a suffix to the lot number.

11. Repacked Lot Numbers

a. Since ammunition packed in web belts and metallic link belts may consist of more than one type of cartridge and hence would require two or more lot numbers marked on packing boxes and entered in records, a single repacked lot number is assigned by the repacker to replace the original ammunition lot numbers. This repacked lot number is marked on the packing box or crate and on the repacked reference data card inclosed in the box.

b. The repacked lot number consists of the words "REPACKED LOT"; the repacker's initials; the letter "B" or "L" indicating belted or linked cartridges, respectively; and the serial number assigned by the repacker. Each such serial number may be assigned to one lot each of caliber .30 and caliber .50 repacked ammunition. Prior to 1 February 1945, caliber .30 ammunition lots which have been repacked in either 5- or 8-round rifle clips were assigned a repacked lot number which contains a prefix letter "C." Such lots of caliber .30 ammunition in either 5- or 8-round clips are now identified by their original ammunition lot

numbers bearing the letter "C" between the manufacturer's initials and the serial number.

12. Repacked Reference Data Card

A repacked reference data card is inserted in each ammunition box containing cartridges in clips, web belts, and metallic link belts. This card lists the ammunition lot or lots comprising the repacked lot and their ratios of packing.

13. Ammunition in Bandoleers

Cartridges in 5-round and 8-round clips packed in bandoleers were formerly identified by a reference card placed in one pocket of each bandoleer. The use of the reference card has been discontinued. Instead, the ammunition lot number, caliber, type, and model of the ammunition, and the type of functional packing is stamped centrally on the end pockets of each bandoleer.

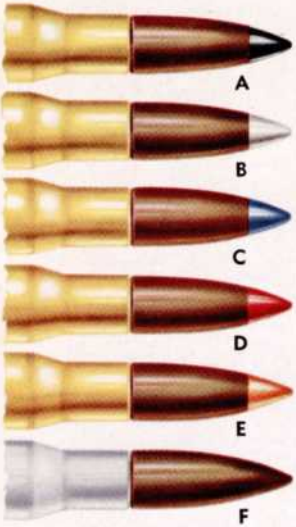
14. Identification of Ammunition Types

a. GENERAL. In general, all types of cartridges of one caliber have the same profile, and they may be identified, except as to ammunition lot number and grade, by the physical characteristics outlined below and illustrated in figures 3, 4, and 5. Care should be taken not to confuse original markings with any subsequent markings made with lithographic marking ink, which is used for an entirely different purpose, as described in paragraph 16.

b. COLOR. Table I indicates the type of ammunition indicated by the colored tips of bullets.

Table I. Identification of type of cartridges by color of bullet tip

Color of tip of bullet	Type of cartridge
No color	Ball.
Black	Armor-piercing.
Aluminum color	Armor-piercing-incendiary.
Blue	Incendiary.
Red	Tracer—cal..30 and cal..50, M1; cal..50 headlight tracer, M21; carbine, M16; and cal. .45, M26 (T30).
Maroon	Tracer—cal..50, M17 (T9).
Orange	Tracer—cal..50, M10; carbine, M27 (T43); and cal..30, M25 (T10).
Red w/aluminum color rear annulus.	Armor-piercing-incendiary-tracer.
Blue w/light blue rear annulus.	Incendiary—cal..50, M23 (T48) only.
Blue w/aluminum color rear annulus.	Armor-piercing-incendiary—cal..50, T49 only.
Green w/white rear annulus.	Frangible.



A—CARTRIDGE, ARMOR-PIERCING, CAL. .30, M2
B—CARTRIDGE, ARMOR-PIERCING, INCENDIARY, CAL. .30, MI4 (TI5)
C—CARTRIDGE, INCENDIARY, CAL. .30, M1
D—CARTRIDGE, TRACER, CAL. .30, M1
E—CARTRIDGE, TRACER, CAL. .30, M25 (T10)
F—CARTRIDGE, TEST, HIGH PRESSURE, CAL. .30, M1
G—CARTRIDGE, BALL, CAL. .30, M2
H—CARTRIDGE, DUMMY, CAL. .30, M2
I—CARTRIDGE, BLANK, CAL. .30, M1909
J—CARTRIDGE, BALL, FRANGIBLE, CAL. .30, M22 (T44)
K—CARTRIDGE, SUBCALIBER, CAL. .30, M1925

Figure 3. Cal. .30 cartridges.

Figure 4. Grenade, carbine, and cal. .45 cartridges.

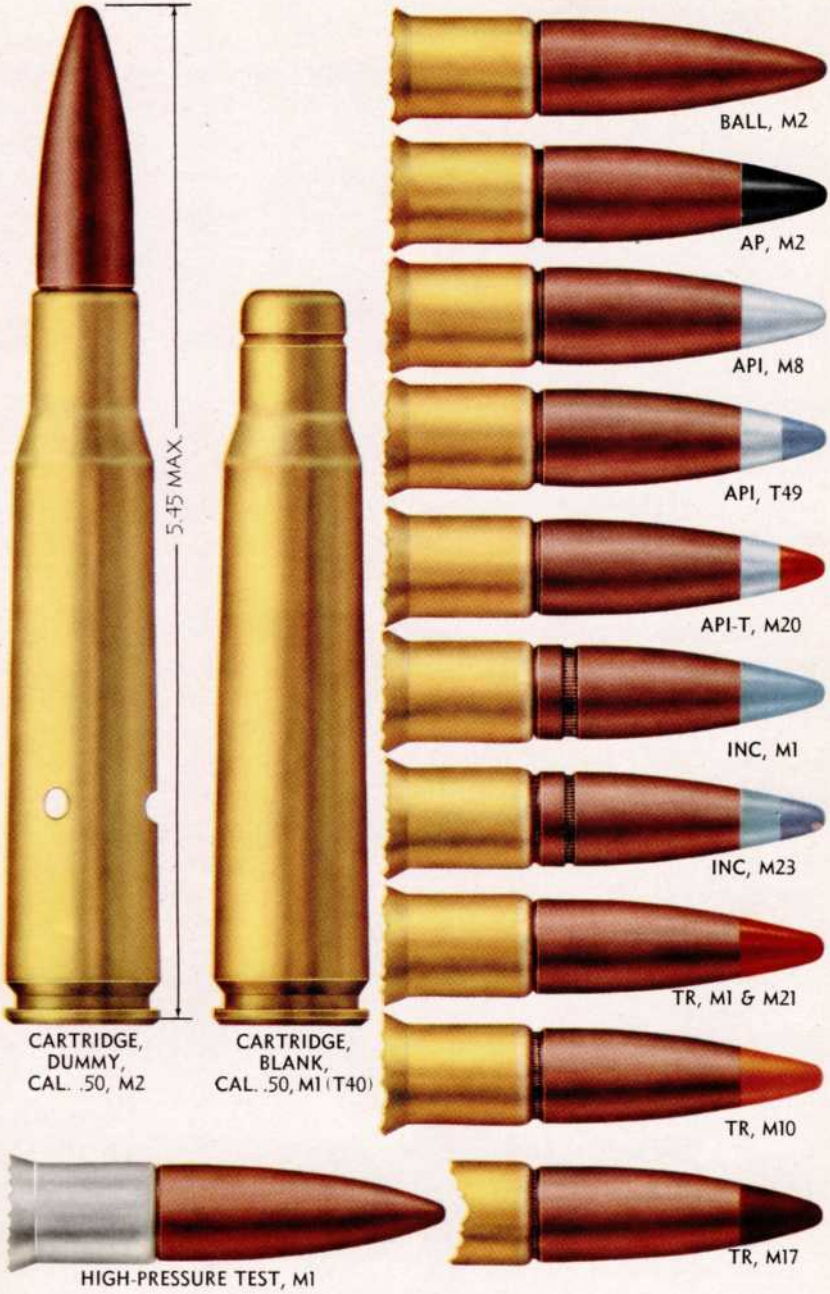


Figure 5. Cal. .50 cartridges.

c. TINNED CARTRIDGE CASE. Prior to March 1944, tinned cartridge case indicated either high-pressure test or dummy cartridges. After this date, a tinned cartridge case will indicate only high-pressure test cartridges.

d. NO BULLET PRESENT. This indicates blank or grenade ammunition. The grenade cartridge is readily identified by the characteristic rose petal crimp of the case mouth, whereas the blank cartridge is sealed at the mouth with a paper cup, disk, or wad.

Caution: The blank cartridge should not be confused with CARTRIDGE, shot cal. .45, M15, which is also sealed with a paper disk.

e. DRILLED HOLES IN CASE. These indicate dummy cartridges. In addition, dummy cartridges of recent manufacture have empty primer holes; those of older manufacture have inert primers.

15. Identification of Alternative Ammunition Types

Manufacturing alternatives of cartridges are indicated on ordnance drawings, packings, and certain records as "Alternative," for example, "CARTRIDGE, ball, cal. .30 M2 Alternative." Although this designation may be found on some packing boxes for purposes of issue and use of the ammunition lots, the word "Alternative" should be disregarded.

16. Identification in Target Practice

The number of hits made upon a target by a certain machine gun or group of machine guns when others are firing upon the same target is sometimes determined by coating the tips of the bullets with lithographic ink. The bullets of the cartridges for each weapon or group of weapons are coated with a distinctive color of ink, which, upon striking the target leaves a smear indicating the source of fire. For method of application, see TM 9–855. Cartridges which have been so coated must have the ink removed before return to storage. Lithographic marking ink is provided in seven colors, orange, red, green, yellow, brown, black and blue and are listed and reviewed in WD Supply Cat. ORD 3 SNL L–1.

Section IV. MARKING OF CONTAINERS

17. General

Small-arms ammunition boxes are either painted or stained dark brown (chocolate), with markings stenciled or printed in yellow, or are unstained with markings in black. The expendable steel boxes M1, M1A1, and M2, and metal cans are painted olive drab with stenciling in yellow.

18. Marking on Wooden Boxes

a. In addition to stenciled figure symbols (fig. 6 and par. 19) or formerly used color bands (par. 19) each box of small-arms ammunition

is marked with complete information necessary for identification, shipping, care, handling, and use, as follows (figs. 6 through 21):

(1) Name and address of consignee or code address (one side).*

(2) Shipping designation of contents (top).

(3) Quantity, caliber, type, and model of contents and their ratios (one side and one end).

(4) Ammunition Identification Code (AIC) symbol as published in WD Cat. ORD 11 Standard Nomenclature Lists, Group T (one side and one end).

(5) Gross weight in pounds and displacement in cubic feet (one side).

(6) Name or designation of consignor (one side).*

(7) Ordnance insignia and escutcheons (one side).*

(8) Name or designation of consignor (one side).*

(9) Ammunition lot number or repacked lot number (one side, one end, and on top).

b. Grade symbols will not be marked on ammunition boxes. The grade will be determined from the current publication of WDSB 9–AMM 4. However, the ammunition code symbol (AIC) stenciled on boxes indicates the grade as well as contents and type of inner packing.

c. Some lots are intended for special purposes and may be marked "For M.G. Training Only," "For Rifle Training Only," or "For M.G. Functioning Test Only." These lots do not always have a published grade and will NOT be disposed of as grade 3 since these stenciled markings are considered a substitute for the grade as published for service ammunition in WDSB 9–AMM 4.

19. Stenciled Figure Symbols

a. Stenciled figure symbols on boxes containing clipped, belted, and linked cartridges provide a means of quickly identifying the type of inner packing—packed in rifle clips, web belts, or linked belts. The symbols are vertical on boxes containing caliber .30 cartridges and diagonal for caliber .50 cartridges. (See figs. 6, 10, 11, 12, and 16.) The absence of stenciled figure symbols on boxes indicates carton packing. (See figs. 7, 8, 13, 14, 20, and 21.)

b. Prior to the use of stenciled figure symbols, color bands were used to indicate each type of cartridge or combination of cartridges as given in table II.

20. Markings on Cartons

Carton labels are marked to show the quantity, type, caliber, model, ammunition lot number, and manufacturer. The printing on the label is black, except in the case of high-pressure test cartridges, where it is red. In addition, the carton label for high-pressure test cartridges is marked

* May be omitted on individual package in carload shipments, provided shipments consist of packages of standard weights and dimensions containing standard quantities.

with the words "Dangerous—For Test Only," and that for blank revolver cartridges, caliber .45, "Dangerous within 10 feet." In future manufacture, information formerly printed on labels will be printed directly on the carton.

Table II. Color bands on packing boxes

Type of cartridge	Color band
Ball	Red.
Blank	Blue.
Dummy	Green.
Gallery practice	Brown.
Guard	Orange.
High-pressure test	Yellow.
Armor-piercing	Blue on yellow.
Tracer	Green on yellow.
Incendiary	Red on yellow.
Rifle grenade	2 blue bands ½ inch wide, ½ inch apart.
Armor-piercing and tracer	Blue, yellow, green (3 stripe band).
Ball and tracer	Yellow, red, and green.

21. Markings on Metal Ammunition Boxes, Cal. .30, M1 and M1A1, and Cal. .50, M2

a. The nomenclature of the box is stamped in the metal at time of manufacture. To provide proper identification, the abbreviated markings listed in table III are stenciled in yellow on each metal box, together with the repacked lot number. (See figs. 12 and 17.)

Table III. Markings on metal ammunition boxes

Code symbol	Marking	Code symbol	Marking
T1EDP	250 CAL..30 Belted 4AP–1TR	T1ICI	110 CAL..50 Belted 4AP–1TR.
T1EED	250 CAL..30 Belted 9AP–1TR	T1ICN	110 CAL..50 Belted 2AP–2I–1TR.
T1EGW	250 CAL..30 Belted 4B–1TR	T1IDF	105 CAL..50, MG Linked 4API–1TR.
T1EHC	250 CAL..30 Belted 9B–1TR	T1ICQ	105 CAL..50, AC Linked 2AP–21–1TR.
T1ICH	100 CAL..50 Belted 4AP–1TR	T1ICR	105 CAL..50, MG Linked 2AP–2I–TR.

Code symbols other than those listed above will be found in WD ORD 11 SNL T–1.

b. Stenciling on the M1 box is not less than 7/16 inch high. It is placed below the raised nomenclature identifying the box, on the smooth center panel of the long side not containing the handle.

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c. Stenciling on the M2 box is not less than 7/16 inch high. It is placed on the smooth rear panel of the long side, which is opposite the locking mechanism.

22. Markings on Terne-Plate Liners

Since markings on wooden boxes are often obliterated by handling and exposure to weather, boxes are broken, or the terne-plate liners are removed from the boxes, the following are marked in yellow on the terne-plate liner lids:

a. Ammunition code symbol.
b. Quantity of ammunition.
c. Caliber and method of inner packing.
d. Ratio of packing.
e. Lot number or repacked lot number.

Section V. PACKAGING

23. General

a. The containers and methods for packing small-arms ammunition are given in the drawings, specifications, and standard nomenclature lists. Containers presently being manufactured have been reduced to a few standard types designed to withstand all conditions commonly encountered in handling, storing, and transporting the ammunition. Table IV lists standard boxes and containers and their contents, dimensions, and weights.

b. With few exceptions, small-arms ammunition is issued in metal containers packed for shipment in wooden boxes. There are two types of metal containers: Hermetically sealed cans opened by means of a key and tear strip (figs. 7 through 21) and metal boxes having hinged covers sealed by means of a rubber gasket (figs. 12 and 18).

c. Packing materials used by Field Service for small-arms ammunition are listed in WD Cat. ORD 11 SNL T–5. These include bandoleers, ammunition belts, cartridge clips, metallic belt links and ends, boxes and cartons, and box-components such as box linings, thumb nuts, and hook screws.

24. Hermetically Sealed Cans

a. The metal cans have a tear strip with "herring-bone scoring" which prevents the cover and body from tearing loose prematurely. The opening key is attached to the tear strip tab. Each can (except the M13 grenade cartridge can) has an attached carrying handle.

b. Cans for caliber .45 and caliber .30 carbine ammunition can be temporarily resealed by means of an inclosed strip of nonhygroscopic adhesive tape which effects a waterproof seal with the cover and body.

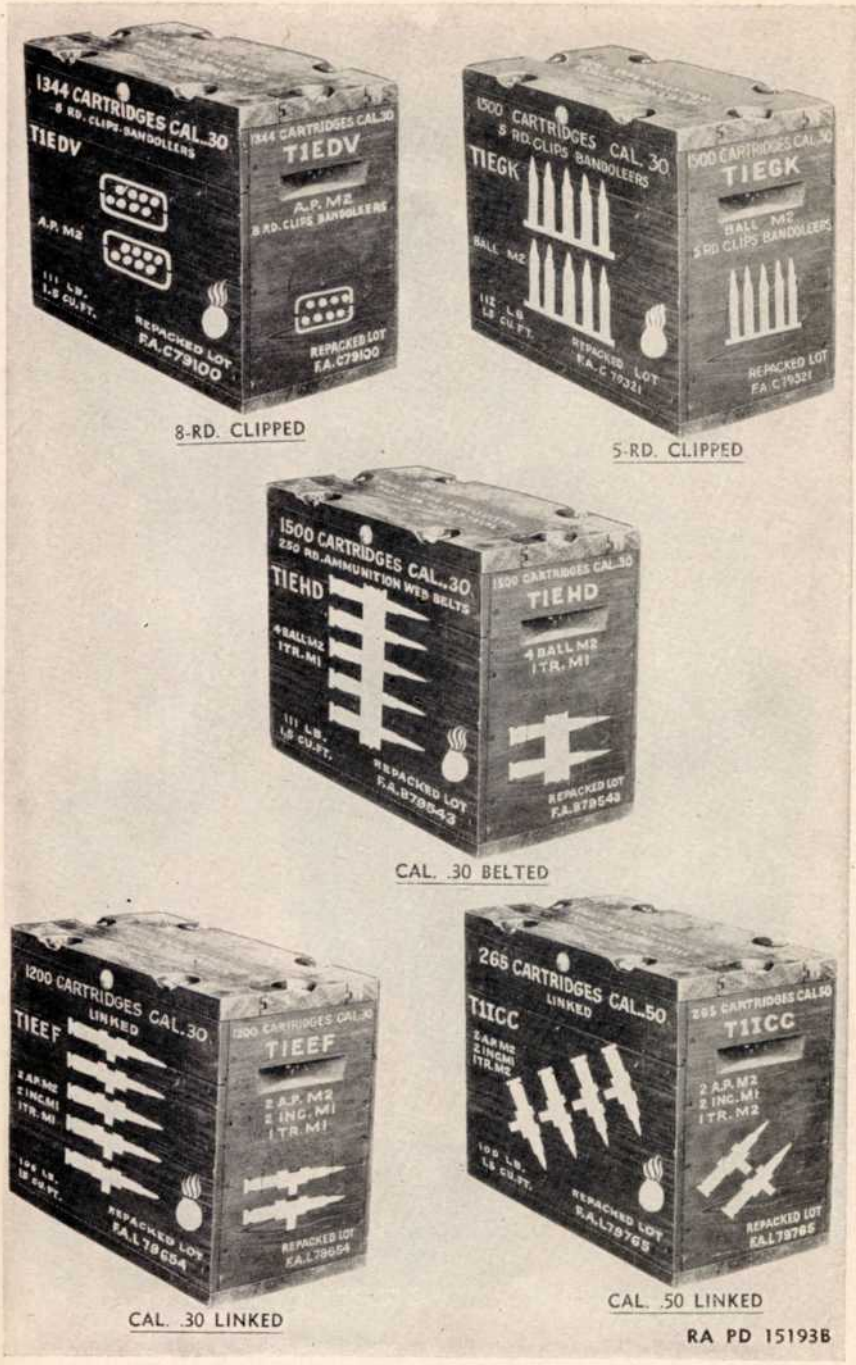

Figure 6. Packing symbols—small-arms ammunition.

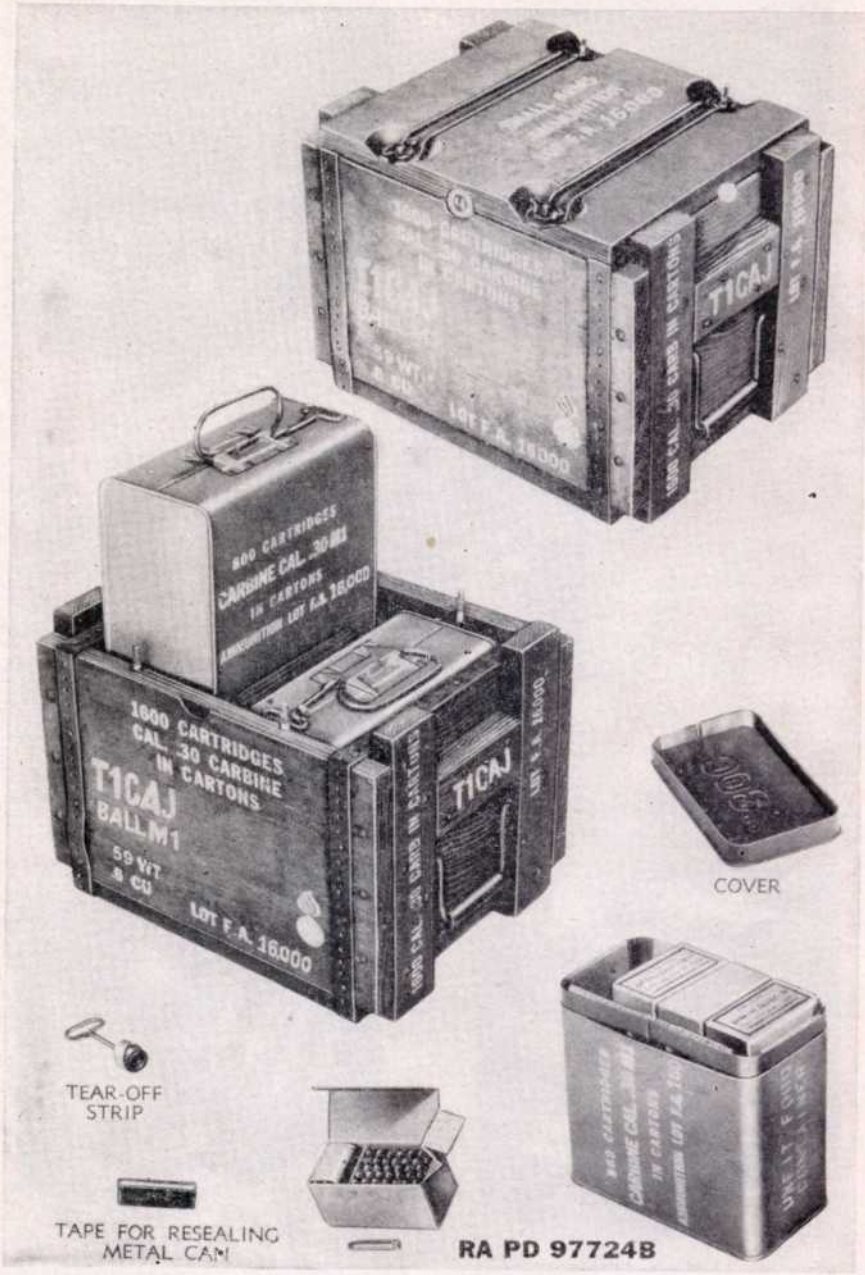

Figure 7. M7 Box containing cal..30 carbine cartridges in M6 metal cans.

Figure 8. M9 Box containing cal..30 cartridges in cartons in M8 metal cans.

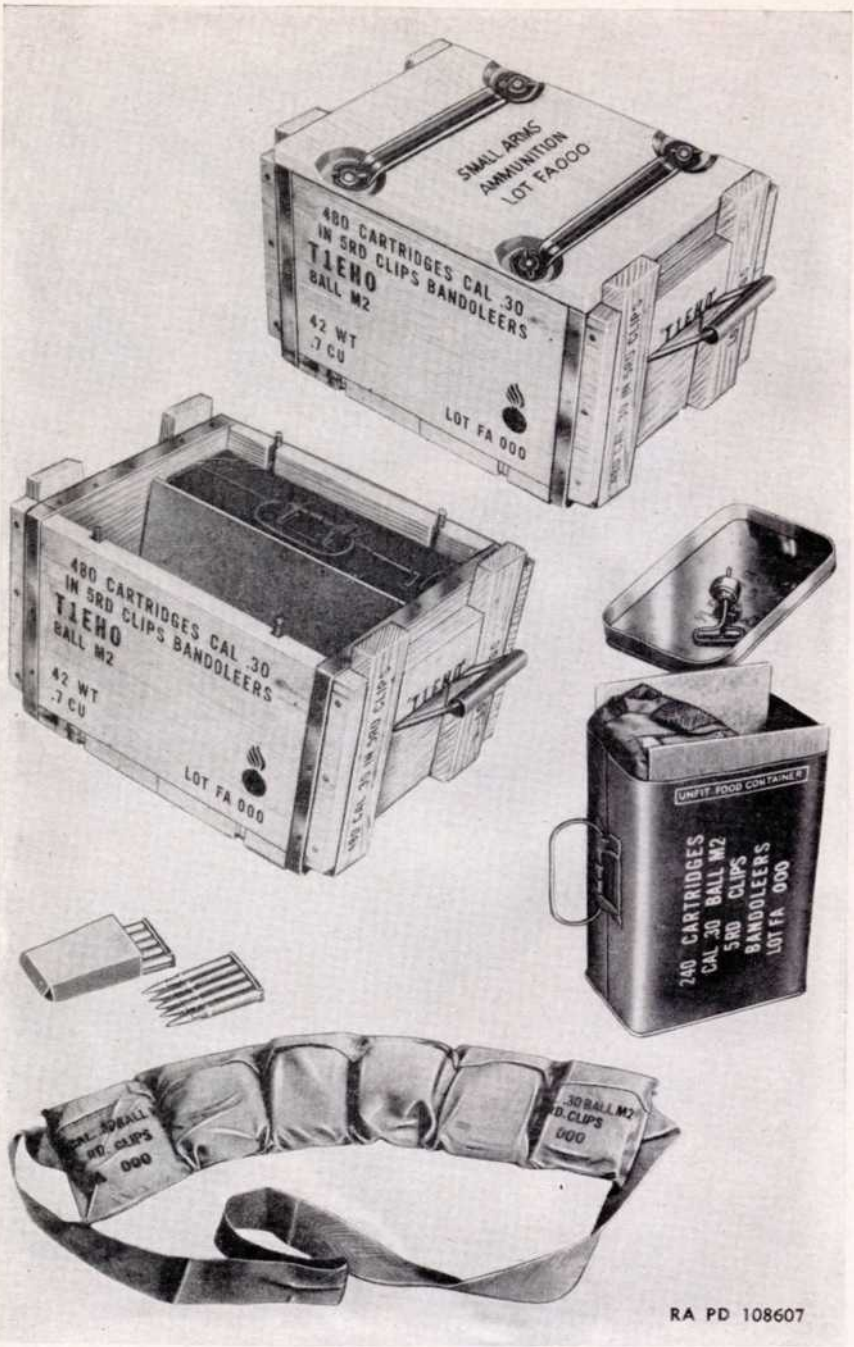

Figure 9. M9 Box containing cal..30 cartridges in 5-rd clips in bandoleers in M8 metal cans.

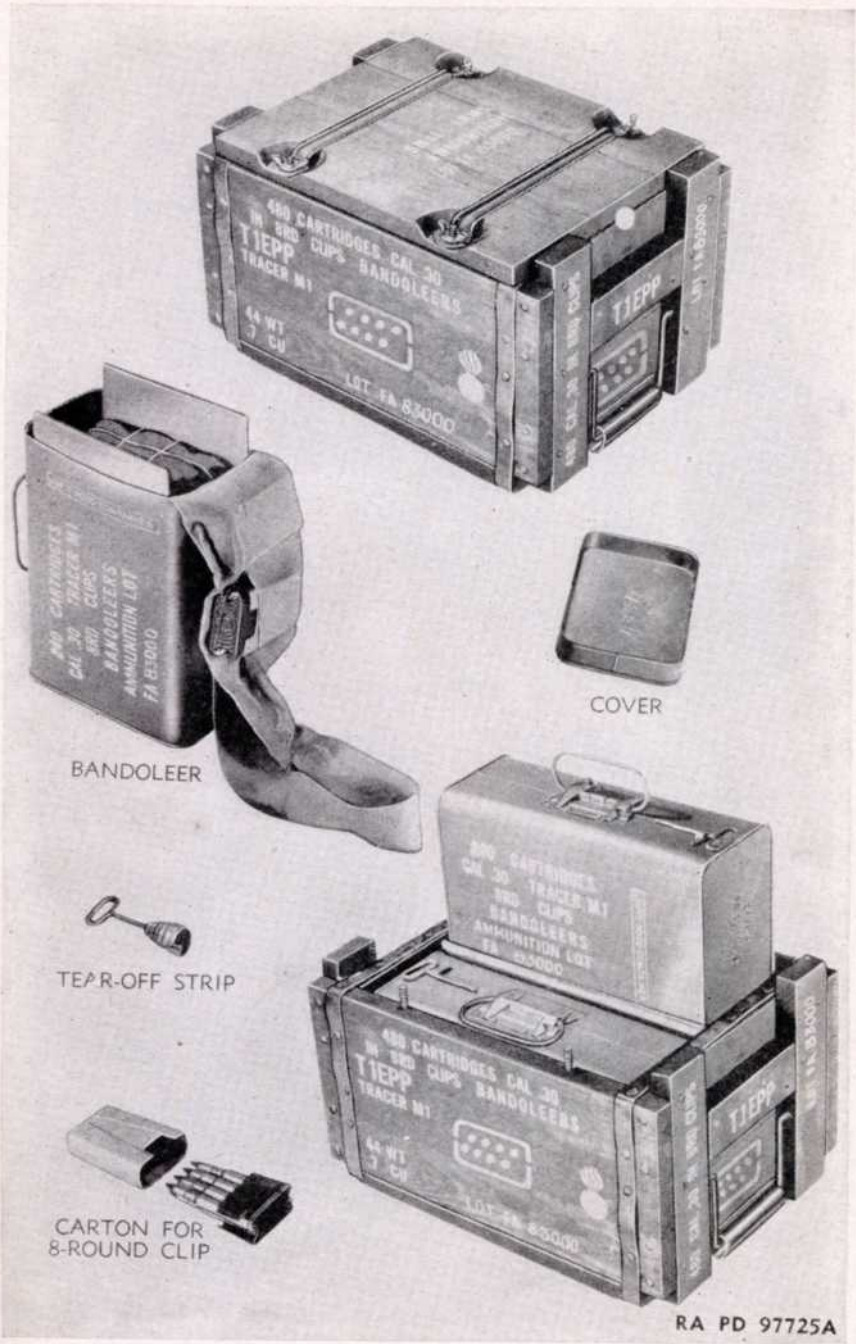

Figure 10. M9 Box containing cal..30 cartridges in 8-rd clips in bandoleers in M8 metal cans.

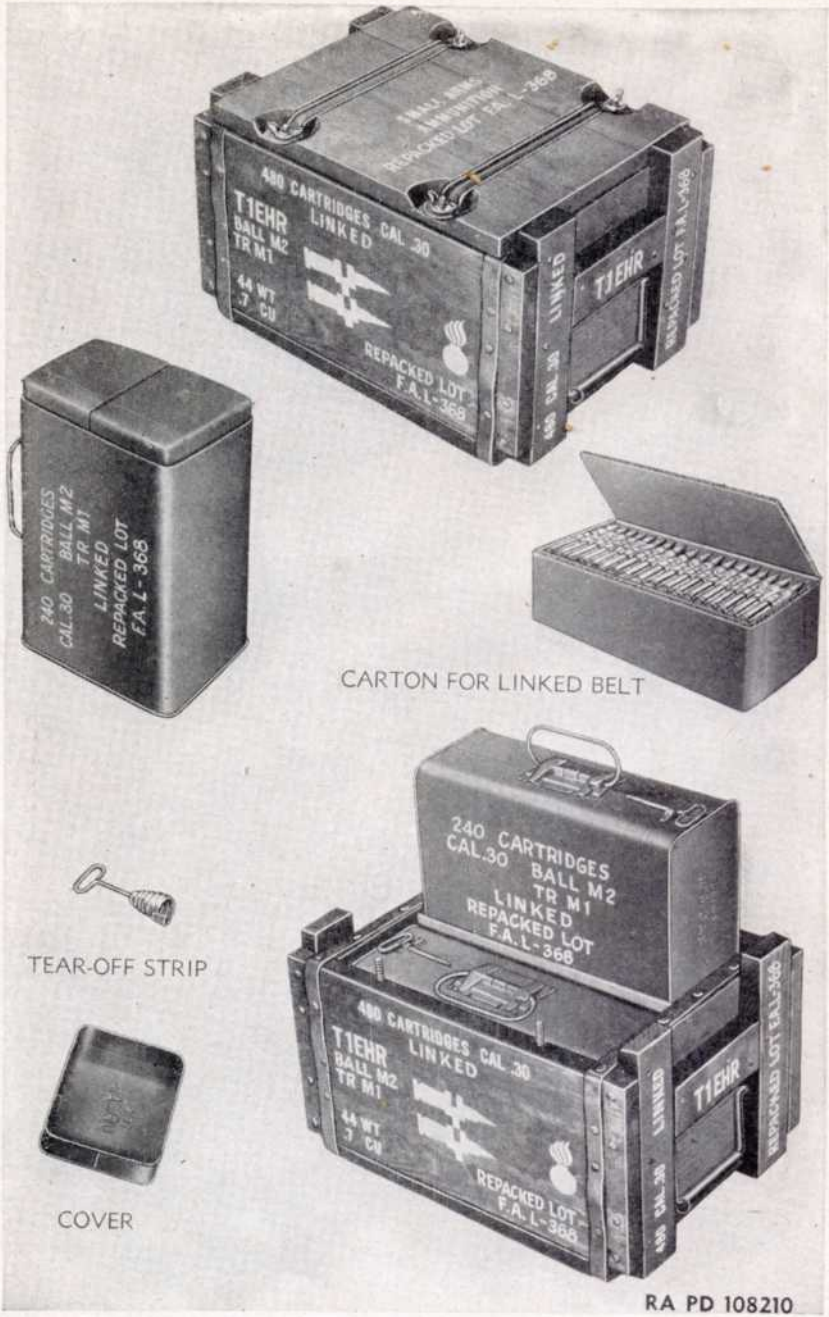

Figure 11. M9 Box containing linked cal..30 cartridges in cartons in M8 metal cans.

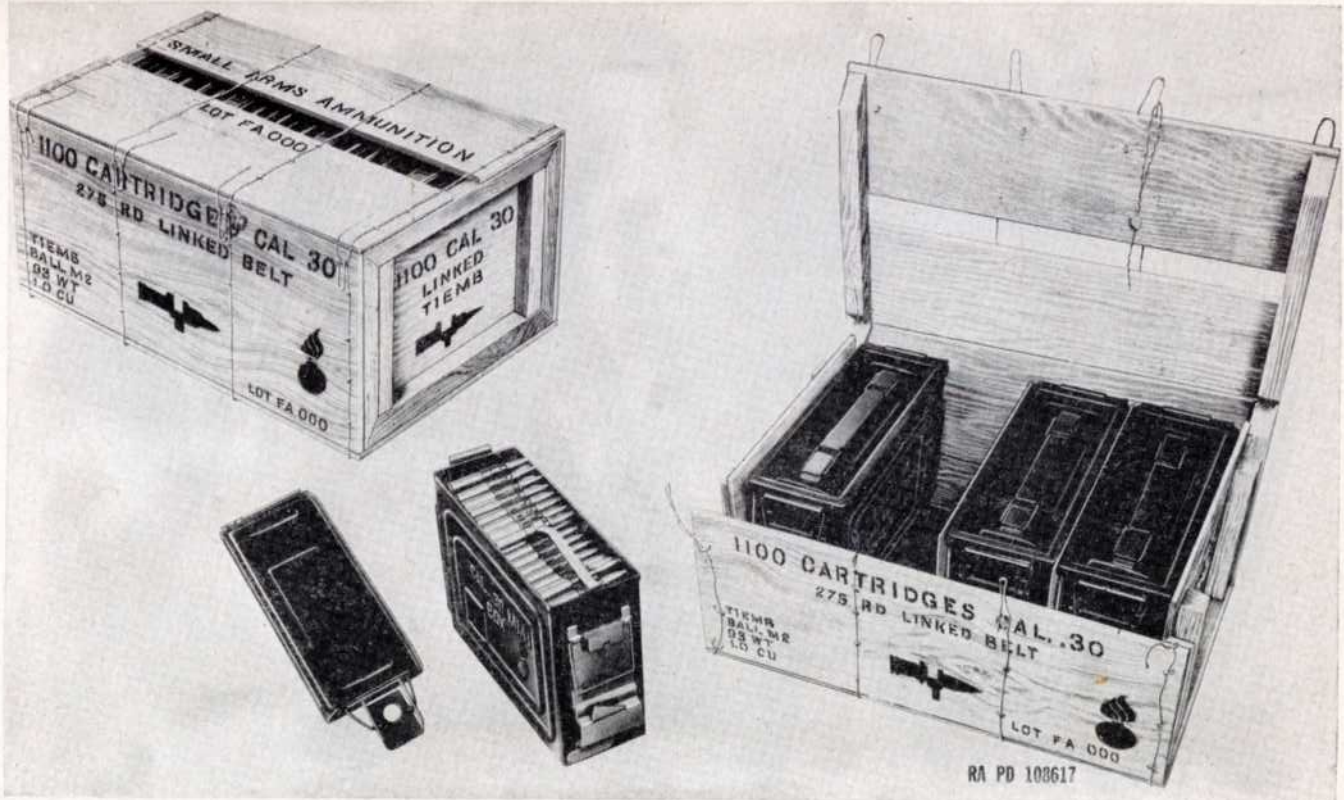

Figure 12. Wire-bound box containing linked cal..30 cartridges in four ammunition boxes, cal. 30, M1A1.

Figure 13. M3 Box containing cal..45 cartridges in M5 metal cans.

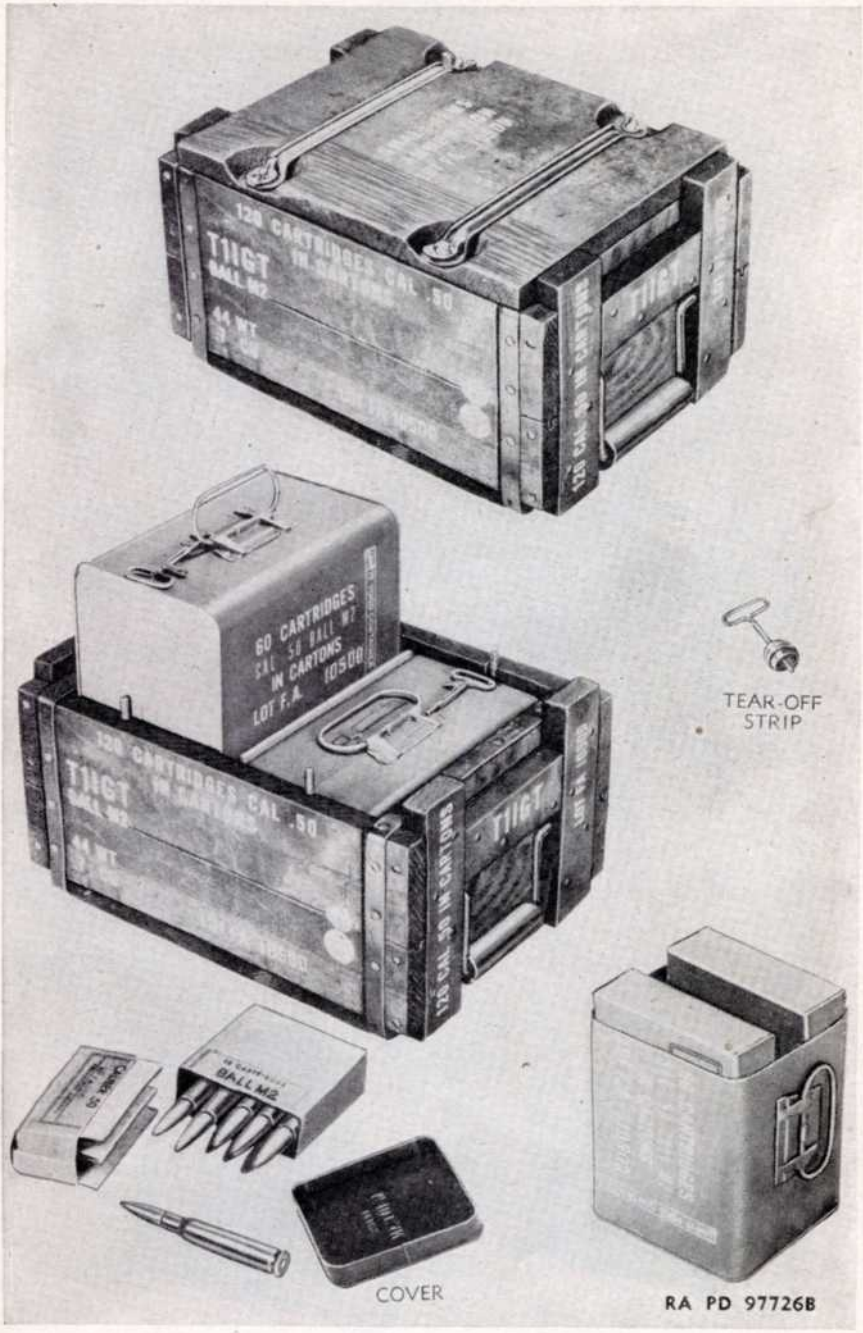

Figure 14. M12 Box containing cal..50 cartridges in cartons in M10 metal cans.

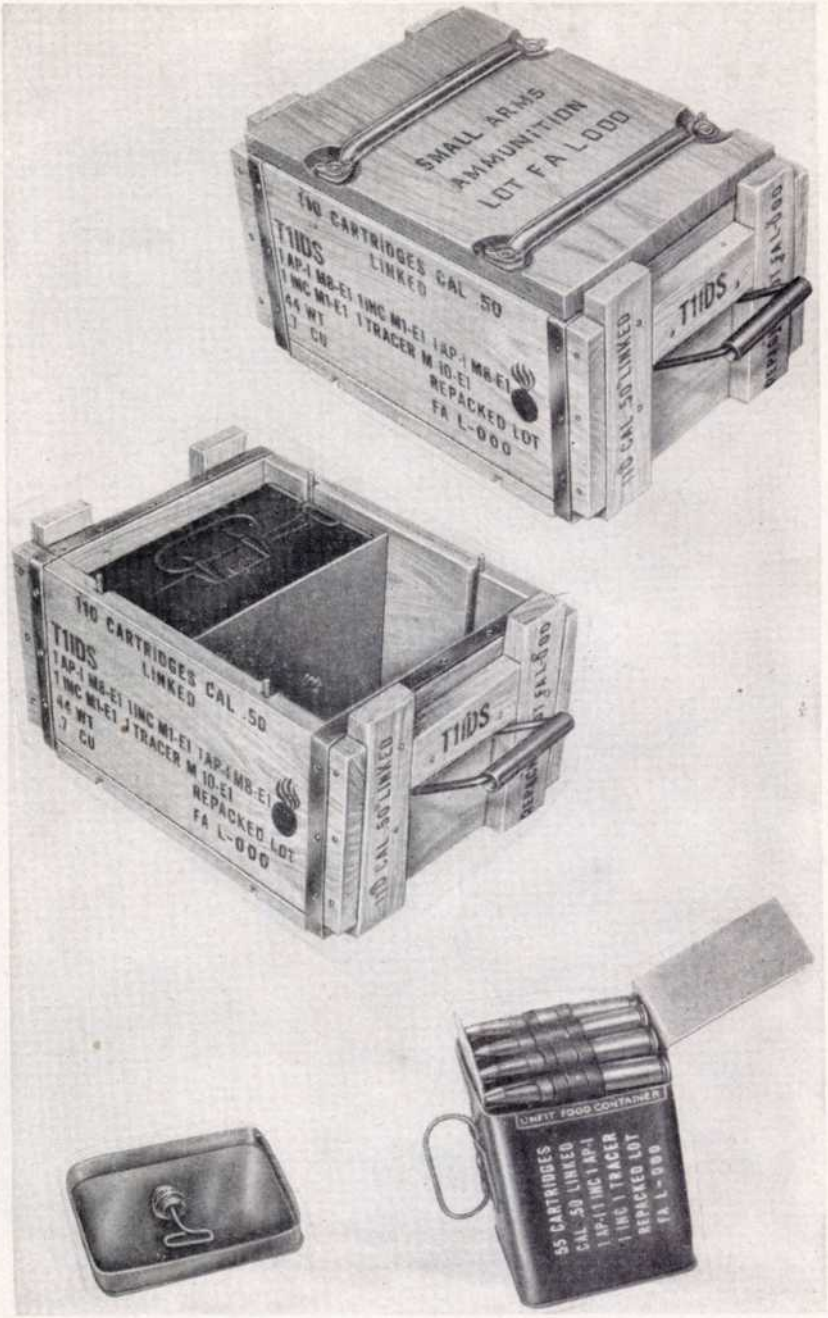

Figure 15. M12 Box containing linked cal..50 cartridges in M10 metal cans.

Figure 16. Wire-bound box for two ammunition boxes, cal..50, M2—closed.

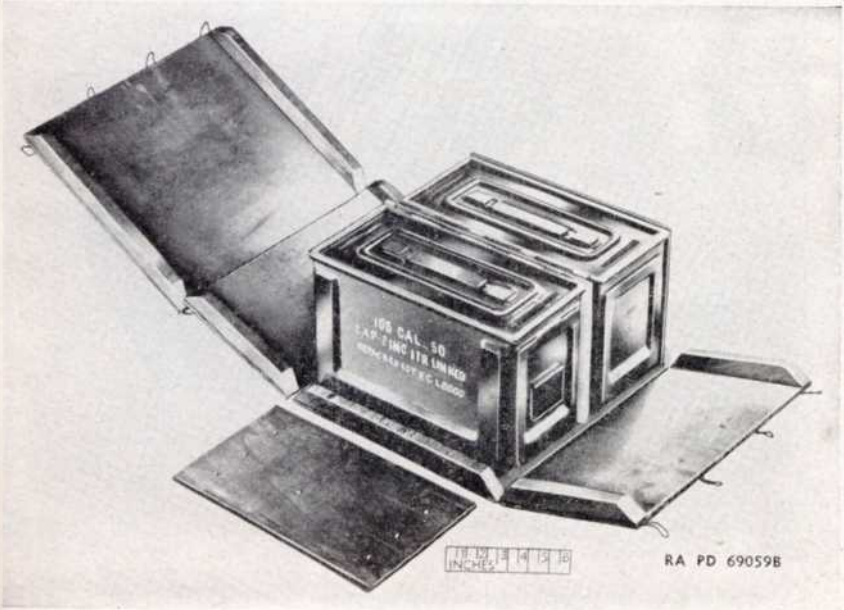

Figure 17. Wire-bound box for two ammunition boxes, cal..50, M2—opened.

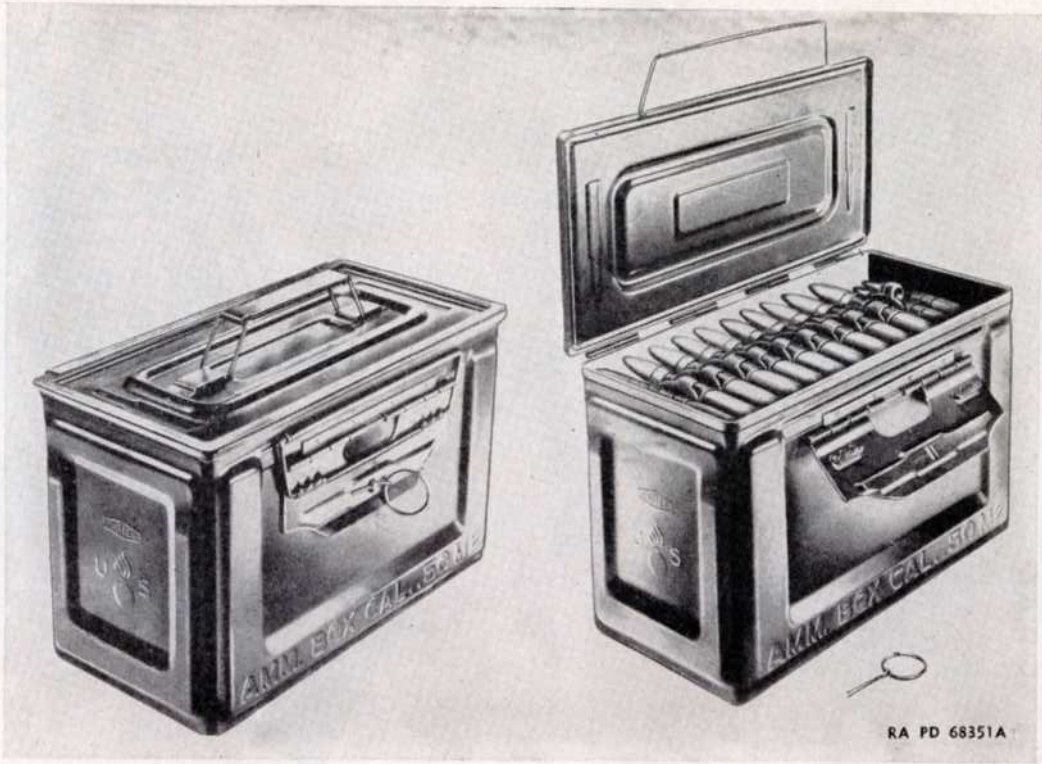

Figure 18. Ammunition box, cal..50, M2.

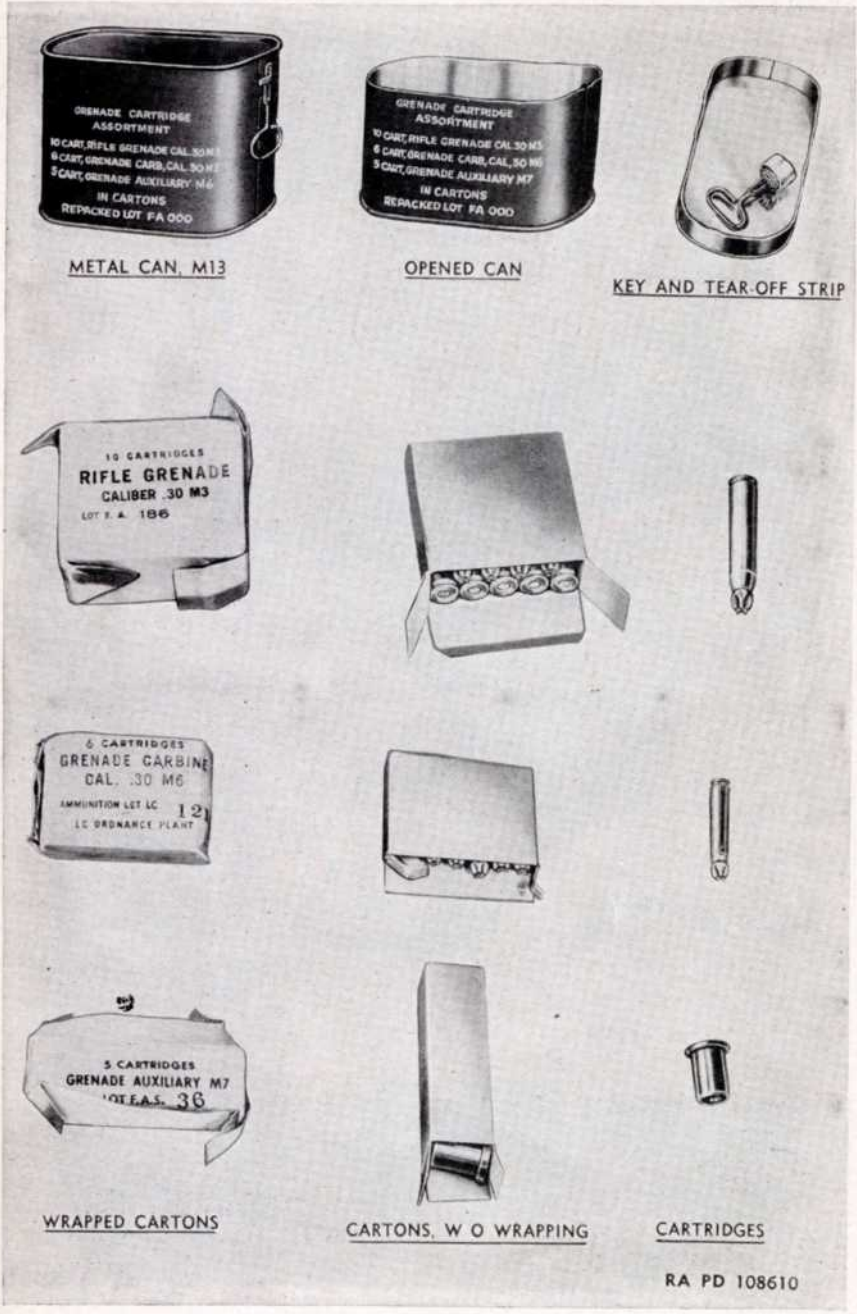

Figure 19. Grenade cartridge assortment A in metal can, M13.

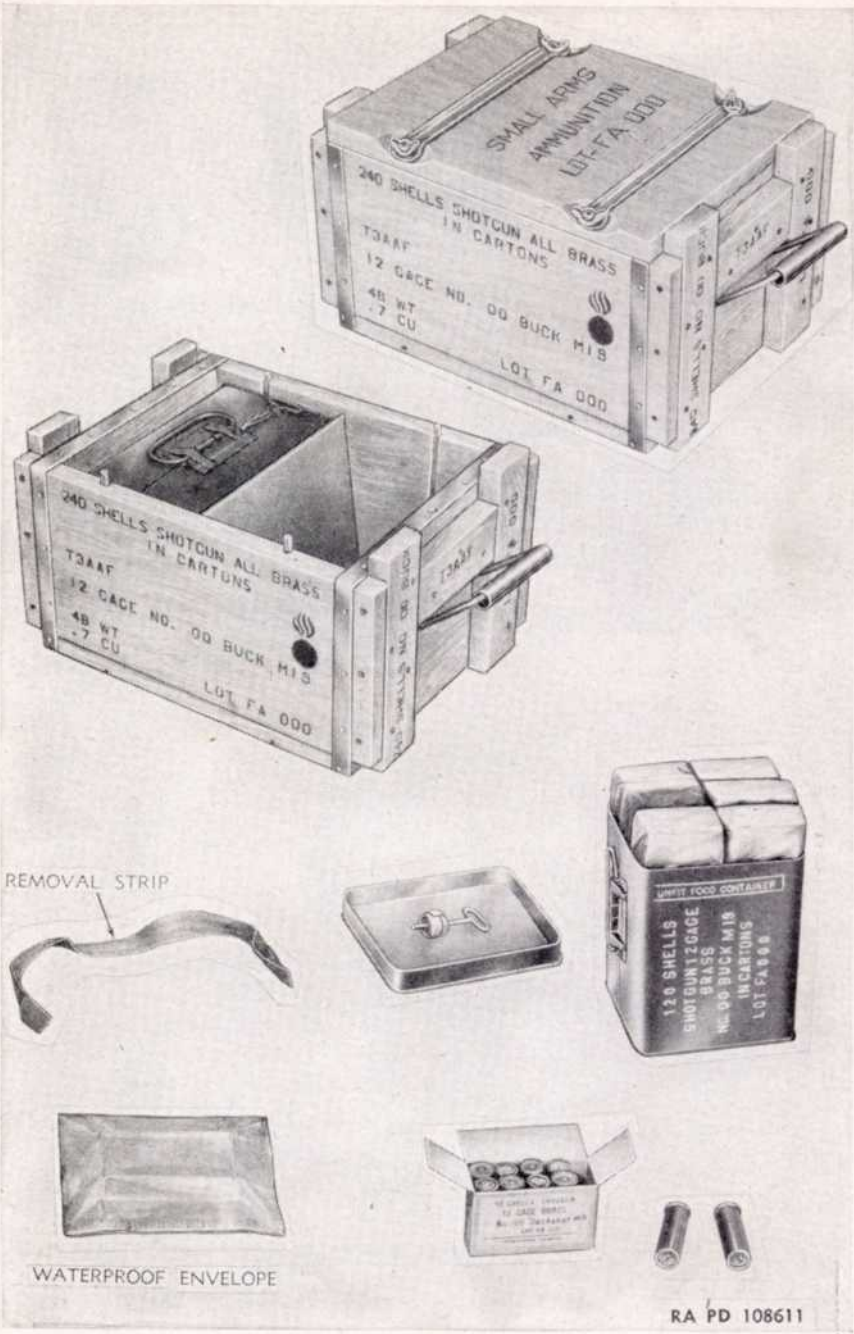

Figure 20. M12 Box containing 12-gage all brass shotgun shells, M19, in waterproof envelopes in M10 metal cans.

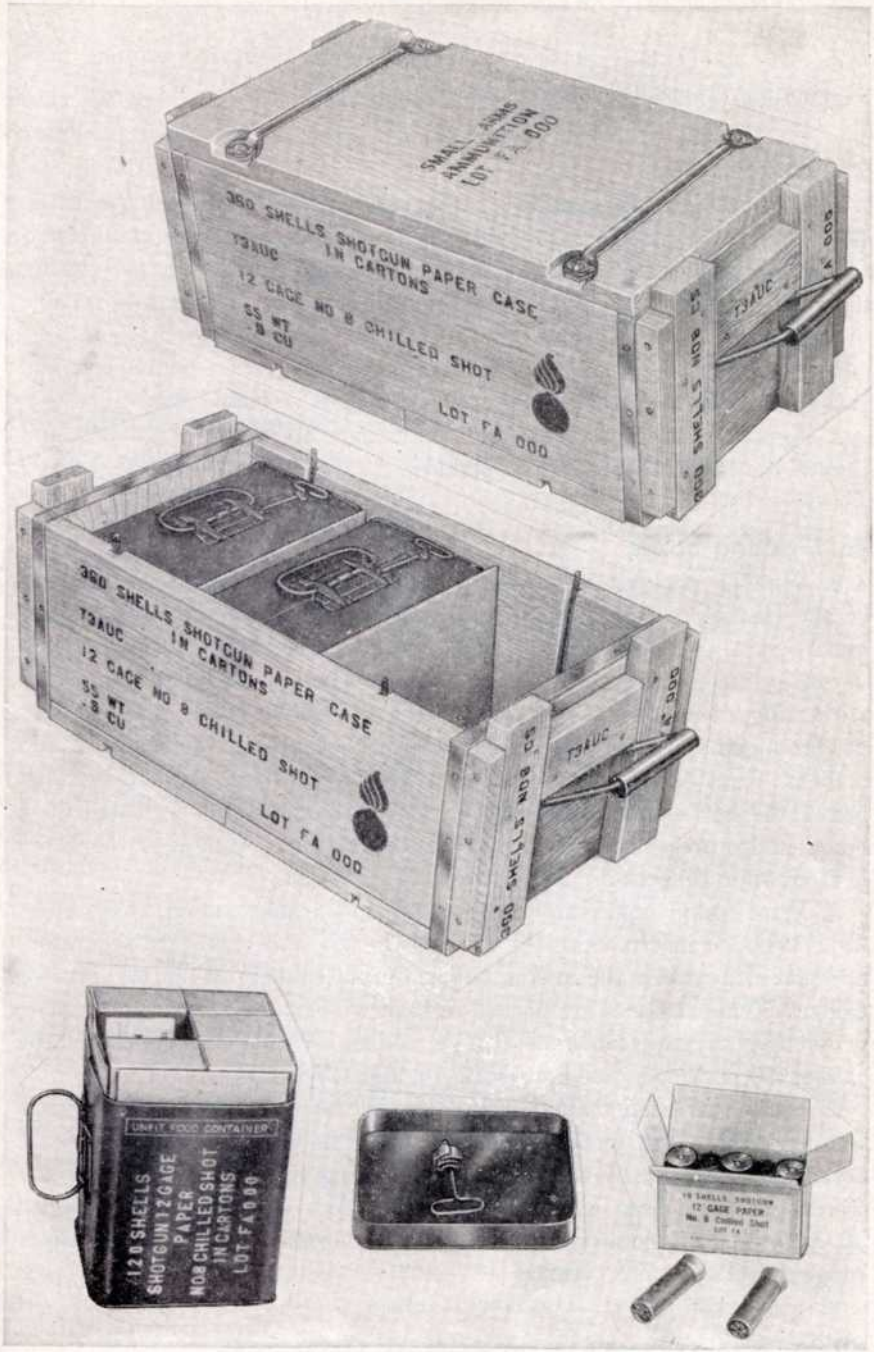

Figure 21. M15 Box containing 12-gage paper shotgun shells in cartons in M10 metal cans.

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c. Gross weight of these cans (excluding the M13) is from 15 to 28¼ pounds.

d. All cans (except those containing shotgun shells for training purposes only) are packed two per wooden box.

25. Metal Boxes

a. These boxes are standard for ground machine gun belt packings. Each box has a hinged cover which presses close against a circumferential rubber gasket sealing the contents against moisture. A toggle closing hasp and a carrying handle are assembeld to each. The box is capable of reclosure.

b. Four caliber .30 metal boxes are packed in a wire-bound box and two caliber .50 metal boxes are packed in its wire-bound box.

c. Approximate gross weight of the caliber .30 box is 22 pounds, and that of the caliber .50 box is 35 pounds.

26. Packing Boxes

a. Wooden packing boxes for hermetically sealed cans (par. 24) are of the cleated end type, reenforced with nailed metal strapping. Rigid metal straps across the cover prevent breakage of the cover. Bolts extend vertically through the sides and across the bottom of the box and together with wing nuts hold the top metal straps, wooden cover, and the box proper together. Carrying handles which consist of a formed wire and a metal hand ferrule are attached to the vertical end cross cleats just below the horizontal end cross cleat. This handle is to be installed on boxes under present and future procurement. Gross weight of the boxes is from 42 to 67 pounds. See figures 7 through 21.

b. Wire-bound boxes are used to ship metal ammunition boxes (par. 25). Wooden inserts close the ends of the box and chipboard separators are placed between the metal boxes. Four caliber .30 boxes or two caliber .50 metal boxes are packed in each wire-bound box. Approximate gross weights are 92 pounds for the caliber .30 and 75 pounds for the caliber .50 packings. See figures 12, 16, and 17.

c. Some small-arms ammunition is still being issued in early type wooden boxes with metal liners (fig. 6). The covers of the boxes are attached by means of screw hooks and wing nuts. The cover of the watertight metal liner is sealed with solder and is readily torn or ripped off by means of the attached wire handle. Gross weight of these boxes range from 91 to 115 pounds.

27. Packing for Caliber .30 Aircraft Ammunition

Caliber .30 cartridges in metallic link belts for aircraft use are packed in one 100-round belt per carton, 12 cartons per M1917 wooden box

(without metal liner); approximate gross weight is 105 pounds. Aircraft carton, M1 (CARTON, envelope-sealing, M1, cal. .30 cartridges in metallic link belt), an alternative for the metal liner in the M1917 box, was used to protect the cartridges against moisture. The waterproof envelope is laminated and sealed by application of heat.

28. Packing for Grenade Cartridge Assortments

Grenade cartridge assortments are packed in the M13 metal can which is a small unit container packed in shipping boxes with the various types of grenades and signals fired from grenade launchers on rifles and carbines. (See fig. 19.)

29. Moisture-Vaporproof Envelopes

Moisture-vaporproof envelopes are used for added protection to some small-arms ammunition carried by combat personnel in tropical areas. These envelopes are laminated and sealed by application of heat. Such items are caliber .22 cartridges, 12-gage and .410-gage shotgun shells, and caliber .45 shot cartridges in emergency jungle kits are packed in these envelopes. Cartons of grenade cartridges are also packed in this manner.

30. Cartons

Cartons are made of single, manila-lined chipboard. Cartons for caliber .30 ammunition contain 20 cartridges, those for caliber .50 cartridges contain 10 cartridges. Cartons for caliber .30 carbine and caliber .45 cartridges contain 50 cartridges. After packing, the carton is sealed by pasting a label over the top and sides. Some types of cartons have tearing strips or strings, but generally a small semicircular recess in the chipboard at the top of one of the sides is left as a means of opening the carton. The paper over this recess is easily punctured by the thumb and the carton opened by pulling up on the cover, shearing the paper label. Cartons of recent manufacture generally do not have labels, the necessary information being printed directly on the carton. New caliber .50 cartons have glued flaps at top and bottom and perforations around the circumference.

31. Bandoleers

a. The bandoleer provides a means of carrying ammunition in an easily accessible manner. It is made of olive-drab cotton cloth, has six pockets, and has attached a shoulder strap of webbing. Since 1 February 1945, ammunition identification data are stenciled on each end pocket of the bandoleers in place of the reference card formerly inserted in one pocket.

Table IV. Small-arms ammunition packaging

Ammunition	Inner container				Outer container				
	Container	Contents	Length width height (in.)	Weight (lb.)	Container	Contents	Length width height (in.)	Volume (cu ft)	Weight (lb)
Cal..22 long rifle	M10 can	60 50-rd cartons in commercial carton (3,000 rds)	6.162 5.476 8.438	24.	M12 box	2 M10 cans (6,000 rds)	14-3/16 10-1/8 7-7/8	0.7	59.
Cal..22 M24	Waterproof envelope	1 50-rd carton (50 rds)	2.5 1.35 1.2	0.44	E-14 Jungle kit (AAF)	—	—	—	—
Cal..30 carbine	M6 can	16 50-rd cartons (800 rds)	7.912 4.226 7.812	24.75	M7 box	2 M6 cans (1,600 rds)	11-13/16 9-1/2 9-11/16	0.6	58.
Grenade cartridges	M13 can	Assortment A: 10 M3, 6 M6, 5 M7 (21 rds)	3.766 1.953 3.	0.75	Packed with rifle grenades	—	—	—	—
		Assortment B: 10 M3, 6 M6 (16 rds)	....do...	0.625					
		Assortment C: 10 M3, 6 M6, 10 M7 (26 rds)	....do...	0.875					
Cal..30 rifle and machine gun	M8 can	12 20-rd cartons (240 rds)	6.917 4.167 10.56	16.	M9 box	2 M8 cans (480 rds)	13-13/16 10-1/8 8-5/8	0.7	42.
		12 5-rd clips in bandoleer, 4 bandoleers (240 rds)	....do...	17.	.....do.....	.....do.....	....do....	....do...	44.

Cal..30 rifle and machine gun		6 8-rd clips in bandoleer, 5 bandoleers (240 rds)	....do...	18.	.....do.....	.....do.....	....do....	....do...	46.
	M1A1 metal box	275-rd metallic link belt (275 rds)	11 3-13/16 7-1/4	22.	Wirebound box	4 M1A1 boxes (1,100 rds)	17-3/8 11-7/8 8-1/16	1.0	92.
Cal..45	M5 can	12 50-rd cartons (600 rds)	6.162 5.476 8.031	28.25	M3 box	2 M5 cans (1,200 rds)	14-3/16 9-11/16 7-7/8	0.6	69.
	Waterproof envelope	20 M15 shot ctgs in carton (20 rds)	5 1.5 1.2	0.75	E-12 Jungle kits (AAF)	—	—	—	—
Cal..50	M2 metal box	105-rd metallic link belt (105 rds)	12-1/4 6-11/32 7-1/2	34.75	Wirebound box	2 M2 boxes (210 rds)	14-11/16 12-11/16 8-1/16	0.92	84.
	M10 can	55-rd metallic link belt (55 rds)	6.162 5.476 8.438	17.5	M12 box	2 M10 cans (110 rds)	14-3/16 10-1/8 7-7/8	0.7	45.
		6 10-rd cartons (60 rds)	....do....	17.	.....do.....	2 M10 cans (120 rds)	....do....	....do...	44.
12-gage shotgun shell	M10 can	10 #00 buck shells per carton in waterproof envelopes, 12 envelopes (120 rds)	....do....	19.	.....do.....	2 M10 cans (240 rds)	....do....	....do...	48.
		10 #8 shells per carton, 12 cartons (120 rds)	....do....	15.	M15 box	3 M10 cans (360 rds)	19-3/4 10-1/8 7-7/8	0.9	55.

b. The M1906 bandoleer holds a carton of two 5-round clips in each pocket. The packed bandoleer weighs approximately 4 pounds. It is superseded in use by the M1 bandoleer.

c. The M1 bandoleer (fig. 22) holds either a carton containing one 8-round clip or two 5-round clips in each pocket. The packed bandoleer weighs about 3½ pounds when holding six 8-round clips, or 5 pounds when holding twelve 5-round clips.

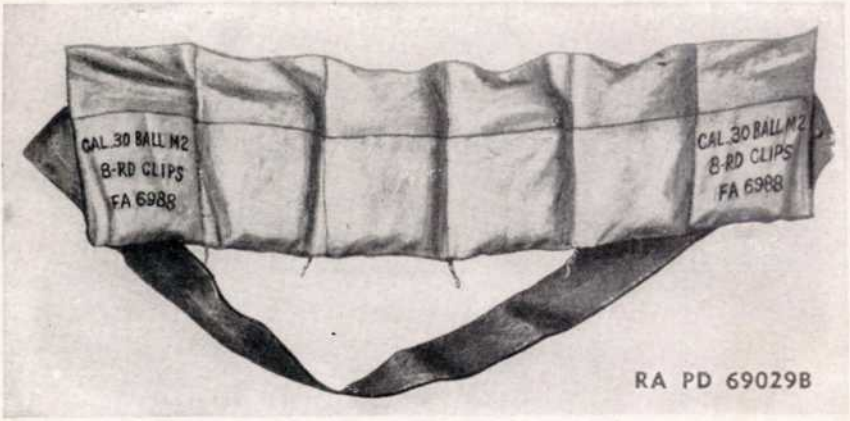

Figure 22. Bandoleer, M1 (for 5-rd and 8-rd clips).

Section VI. CARE, HANDLING, AND PRESERVATION

32. General

The provisions contained in this section are of a specific nature for small-arms ammunition only. Regulations which govern posts, camps, and stations which store limited quantities of ammunition are published in TM 9–1900. Regulations prescribed for ordnance depots and establishments are set forth in the Ordnance Safety Manual, O.O. Form 7224.

33. Care and Precautions in Handling

a. Boxes. (1) Small-arms ammunition, as compared with other types of ammunition, is not dangerous to handle. Care, however, must be observed to keep the boxes from becoming broken or damaged. All broken boxes must be repaired immediately. Transfer all markings to the new parts of the box. If a metal liner is present, it should be air-tested and sealed provided equipment for this work is available.

(2) Boxes should be opened carefully, as they are to be used as long as they are serviceable.

(3) An ammunition box or metal can should not be opened nor a metal liner broken until the ammunition is required for issue or use.

Ammunition removed from airtight containers, is apt to become unserviceable due to corrosion. This is especially applicable in damp climates.

b. HANDLING CARTRIDGES. (1) After a box of ammunition has been opened and cartridges issued, each man should take care of his own ammunition. The primer should be protected from blows by sharp instruments as such a blow might explode the cartridge.

(2) Ammunition should be protected from mud, sand, dirt, and water. If it gets wet or dirty, it should be wiped off at once.

(3) If verdigris or light corrosion form on cartridges, they should be wiped off with a dry wiping cloth. However, cartridges should not be polished to make them look better or brighter. The use of abrasives is forbidden.

(4) Ammunition should not be exposed to the direct rays of the sun for any length of time. If the powder is heated, it is likely to cause excessive pressure when fired and will affect the performance of the ammunition.

(5) The use of oil or grease on cartridge cases is prohibited. Greasing or oiling cartridges used in machine guns and automatic arms causes the collection of dust and other abrasives which are injurious. Grease or oil on cartridge cases or on the walls of the chamber in nonautomatic rifles creates excessive and hazardous pressure on the rifle bolt and will result in damage such as that described in TM 9–2210. When there is oil on the cartridge case, there is no adhesion of the case to the chamber. When the case expands upon firing, the case slips back, and the bolt receives a greater than normal rearward thrust. Use clean, dry wiping cloth for removing oil or grease from cartridges. An apparent exception exists in the case of caliber .22 and caliber .38 lead bullets; however, only the bullet is waxed or greased as issued.

(6) Whenever cartridges are taken from cartons and loaded into belts or clips, the latter will be tagged or otherwise so marked that the ammunition may be identified as to lot number. Such identification is necessary to prevent otherwise serviceable ammunition from being placed in grade 3, because of loss of lot number.

c. DEFECTIVE CARTRIDGES. (1) Cartridges having nonpermissible dents or scratches, cartridges with loose bullets, or otherwise defective rounds should not be fired. (See par. 40.) Lots having more than 5 percent of defective cartridges will be subjected to 100 percent inspection. Defective rounds will be culled out, the serviceable cartridges repacked prior to issue, and a report will be made to the Chief of Ordnance. If 20 percent or more are defective, the lot will be withdrawn from service and held for disposition. Particular attention should be paid to incipient cracks which are not easily detected unless the thumb is pressed against

the bullet, thus exposing the crack in the cartridge case. Defective cartridges will be considered as grade 3 ammunition.

(2) If a cartridge case becomes so corroded that a perceptible amount of metal is eaten away, it is dangerous to fire and should not be used.

d. Destruction of Ammunition. When it is necessary to destroy unserviceable small-arms ammunition locally, such destruction will be accomplished in accordance with TM 9–1900.

34. Storage

a. General. Small-arms ammunition is not an explosive hazard in storage, although under adverse conditions of storage it may become a fire hazard.

b. Piling by Lot. Small-arms ammunition should be stored and piled according to type and ammunition lot number. Extreme care must be exercised to prevent the mixing of ammunition lots in one pile. When small-arms ammunition is received, issued, checked, stacked, or restacked, reliable personnel should be in charge and a check made of the ammunition lot number on each box.

c. Protection. (1) Whenever practicable, small-arms ammunition should be stored under cover. This applies particularly to tracer and shotgun ammunition. Tracer ammunition is subject to rapid deterioration if it becomes damp, and may even ignite spontaneously. Shotgun shells are normally not packed in waterproof metal-lined boxes except for oversea shipment.

(2) Although small-arms ammunition is packed in metal containers in wooden boxes, actual tests have shown that leaks may develop in handling and shipping. The leaks, though small, will admit moisture if the ammunition is exposed to the weather or extreme variations in temperature.

(3) Should it become necessary to leave small-arms ammunition out-of-doors, it should be raised on dunnage at least 6 inches from the ground and the pile covered with a double thickness of serviceable tarpaulin. The tarpaulin should be so positioned as to offer the maximum protection to the ammunition and to allow free circulation of air. Suitable trenches should be dug to prevent water from flowing under the pile.

d. High Temperatures. Small-arms ammunition in storage should be protected from extreme heat to avoid decomposition of the propellent powder. The combination of high temperature and a damp atmosphere is particularly detrimental to the powder.

e. Opened Boxes. When only a part of a box is used, the remaining ammunition in the box should be protected against unauthorized handling and use by fastening the cover firmly in place.

f. Fire Hazard. If placed in a fire, small-arms ammunition does not explode violently. There are small individual explosions of each cart-

ridge, the case flying in one direction and bullet in another. It is unlikely that the bullets and cases will fly over 200 yards.

35. Precautions in Firing Service Ammunition

a. The general precautions concerning the firing and handling of ammunition in the field as prescribed in AR 750–10 and in TM 9–1900 will be observed. See paragraph 51 for general discussion of danger zones and protection of personnel. Precautions particularly applicable to small-arms ammunition are given in the following paragraphs.

b. No small-arms ammunition—other than blank ammunition, caliber .22 cartridges, and shotgun shells—will be fired until it has been positively identified by ammunition lot number and grade, as published in the latest revision or change to WDSB 9–AMM 4.

c. The use of armor-piercing cartridges is prohibited in demonstrations in which tanks are used.

d. In using armor-piercing ammunition, it is well to remember that the cores of bullets that fail to penetrate the target will rebound. The radius of rebound for armor-piercing ammunition depends on several factors but may safely be taken at a maximum of 100 yards for caliber .30 and 200 yards for caliber .50.

e. Small-arms ammunition graded and marked "For training use only," will not be fired over the heads of troops under any circumstances.

f. Before firing, the firer must be sure that the bore of the weapon is free from any foreign matter such as cleaning patches, mud, sand, snow, and the like. A weapon fired with any obstruction in the bore will be damaged and may injure the firer.

g. When a bullet lodges in the bore of a rifle, pistol, or machine gun, it should be removed by the application of pressure from the muzzle end of the weapon. To attempt to shoot the bullet out with another cartridge is dangerous and is prohibited.

h. Misfires and Hangfires. (1) Because a misfire cannot immediately be distinguished from a hangfire, it is unsafe to open the bolt of a rifle for at least 10 to 15 seconds when a misfire occurs. When the rifle, caliber .30, M1, fails to fire, it should be recocked by operating the trigger guard, and refired before opening the bolt. When the M1903 rifle fails to fire it should be recocked by drawing back the cocking piece and refired before opening the bolt. The M1917 rifle cannot be recocked without opening the bolt; in case of misfire, wait a full minute before the bolt is opened. When the caliber .30 carbine fails to fire, pull the operating slide to the rear. If the operating slide goes fully home, aim and fire. To avoid injury in case of hangfire, hold the hand so that no part of the palm or wrist can be struck by the operating slide in its rapid rearward movement.

(2) When a hangfire occurs in any lot, its use should be suspended and a report made to the post ordnance officer, giving the number of the lot involved. The lot thus affected will be withdrawn and replaced by serviceable ammunition.

36. Precautions in Firing Blank Ammunition

a. It is dangerous to fire blank cartridges at personnel representing an enemy at distances less than 20 yards as the wad or paper cup may fail to break up.

b. No blank cartridges, other than those authorized below, will be used for blank firing. Precautions prescribed in the following subparagraphs will be observed carefully.

(1) All cartons are plainly marked and markings should be strictly checked before the ammunition is issued. The M1909 blank cartridge is similar in appearance to some of the caliber .30 grenade cartridges, used for propelling rifle grenades. The carton markings, however, show the difference.

(2) Only blank ammunition packed in the original package or carton will be issued for use in machine guns or automatic rifles. Ammunition once removed from the original package or carton and on hand (usually termed "broken" or "loose" ammunition) should be reissued for use in bolt-action rifles only. These instructions are for the purpose of eliminating the danger of firing a high-pressure blank cartridge or a blank cartridge fitted with a felt or thick paper wad in an automatic weapon equipped with a blank ammunition firing attachment, which would greatly endanger personnel and probably damage the gun.

(3) Blank cartridges with felt or thick paper wads should not be used in any weapon. The mark of distinction between the paper cup and felt wad closing is the depth of seating in the neck of the cartridge; the paper cup being seated much deeper (approximately ¼ inch) than the felt wad, which is approximately 1/16 inch deep. Ammunition containing the felt wad is cannelured at a point approximately 1/10 inch from the mouth of the cartridge case whereas that containing the paper cup is cannelured at 2/10 inch from the mouth. For comparison of closing wads see figure 51.

(4) Only ammunition containing the paper cup will be used in automatic arms.

c. Misfires in which the primer explodes but fails to ignite the powder charge are dangerous when blank ammunition is fired in automatic arms. In such misfires, some of the powder is blown into the bore of the weapon. A series of such rounds will result in an accumulation of powder sufficient to cause serious damage when ignited by the firing of a normal

cartridge. When misfires are encountered in blank ammunition in excess of 5 percent, the lot will be suspended and reported to the Chief of Ordnance.

37. Propellent Powder

a. VOLATILES. The volatile material in smokeless powder is composed of residual amounts of solvent (alcohol-ether mixture) and moisture. A certain amount of residual solvent is allowed to remain in the finished powder to insure toughness of the colloid and also to retard decomposition of the powder. Grains that have lost a considerable part of their residual solvent become brittle and burn faster, resulting in high pressures and erratic performance.

b. MOISTURE. The amount of moisture which powder will absorb increases with the humidity of the atmosphere. A definite percentage of moisture is therefore left in the finished powder to minimize changes in moisture content of the powder as atmospheric conditions change. By keeping constant the original content of both solvent and moisture, changes in pressure and velocity are avoided. Hence, smokeless powder is always kept tightly sealed either in fixed ammunition or standard packing containers. Storage in damp atmosphere will cause powder to absorb moisture. This will result in deterioration, especially in a hot climate.

c. EFFECT OF HEAT. The weight of charge for a given lot of powder is usually established by test firings with a powder temperature of 70° F. A weight of charge is determined which will cause a certain muzzle velocity of the bullet. When the temperature of smokeless powder is increased, the powder burns faster and consequently can produce a greater muzzle velocity. An increase in temperature above 70° F increases the muzzle velocity above the established muzzle velocity and a decrease in powder temperature below 70° F decreases the muzzle velocity below the established velocity. Since it is not always possible to have the powder temperature at exactly 70° F, velocity corrections for temperature variations have been calculated. The change in velocity per degree Fahrenheit is approximately 1.5 feet per second for pyro DG powder and 1.7 feet per second for coated powder.

d. LIFE OF SMOKELESS POWDER. The life of powder, or the period during which it remains serviceable, varies from about 5 to 20 years or more, depending upon the care exercised in its manufacture and storage. Smaller grains tend to decompose more rapidly than larger grains because of the greater surface exposed. Powder in a state of decomposition is unsafe to store because of the danger of spontaneous combustion, since heat is emitted during the process of decomposition. An accumulation of such heat further increases decomposition, producing more heat until the ignition temperature is reached.

38. General

Surveillance includes in part, the observation, inspection, investigation, and test of explosives and ammunition both in storage and in use. All firings in acceptance tests of small-arms ammunition are done in weapons required by detailed specifications, and the methods of such firing are in accordance with the applicable sections of Frankford Arsenal Manual of Test Methods for Small-arms Ammunition. The Chief of Ordnance exercises general supervision over the surveillance of explosives and ammunition, prescribes the tests, and maintains records of the condition of all lots in service and in storage.

39. Small-Arms Ammunition Tests

Tests to which small-arms ammunition is subjected for acceptance and, subsequently, for surveillance and grading are: Visual examination, velocity test, waterproof test, pressure test, functioning and casualty tests in specified weapons; hangfire test, bolt-lift test, accuracy test, tracer test, loading and unloading test, stripping test, penetration test, caliber .45 bullet fit test, screen perforation test for blank ammunition; pattern test for shotgun shells and shot cartridges; and bullet pull test. Some of these tests are described below.

a. Visual Inspection. Examination of sample for season cracks, corrosion, or other visual defects is described in paragraph 40.

b. Velocity Test. Standard methods are used for conducting velocity tests. Screens are placed a definite distance apart and the velocity of the bullet is calculated from the time of flight in traveling from the first screen to the second. In the Boulengé test the first screen is placed 3 feet from the gun muzzle and the second screen is placed 150 feet from the first. The velocity determined from the time of flight between the two screens is the velocity at 78 feet from the muzzle. A modification of the above test where space is limited requires the screens to be spaced 100 feet apart, and the calculated velocity is the velocity at 53 feet from the muzzle of the gun. Other modifications of the test are to ascertain the velocities at the same average distance from the muzzle of the gun.

c. Waterproof Test. Cartridges are immersed in water for 24 hours and then fired in the appropriate velocity weapon.

d. Pressure Test. This test in conducted in a pressure barrel. The barrel has a small hole drilled in the side of the chamber into which is inserted a small piston (fig. 23). On firing the cartridge, the pressure of the gases forces the piston against a copper cylinder and compresses it. The amount of compression of the cylinder is an index of the pres-

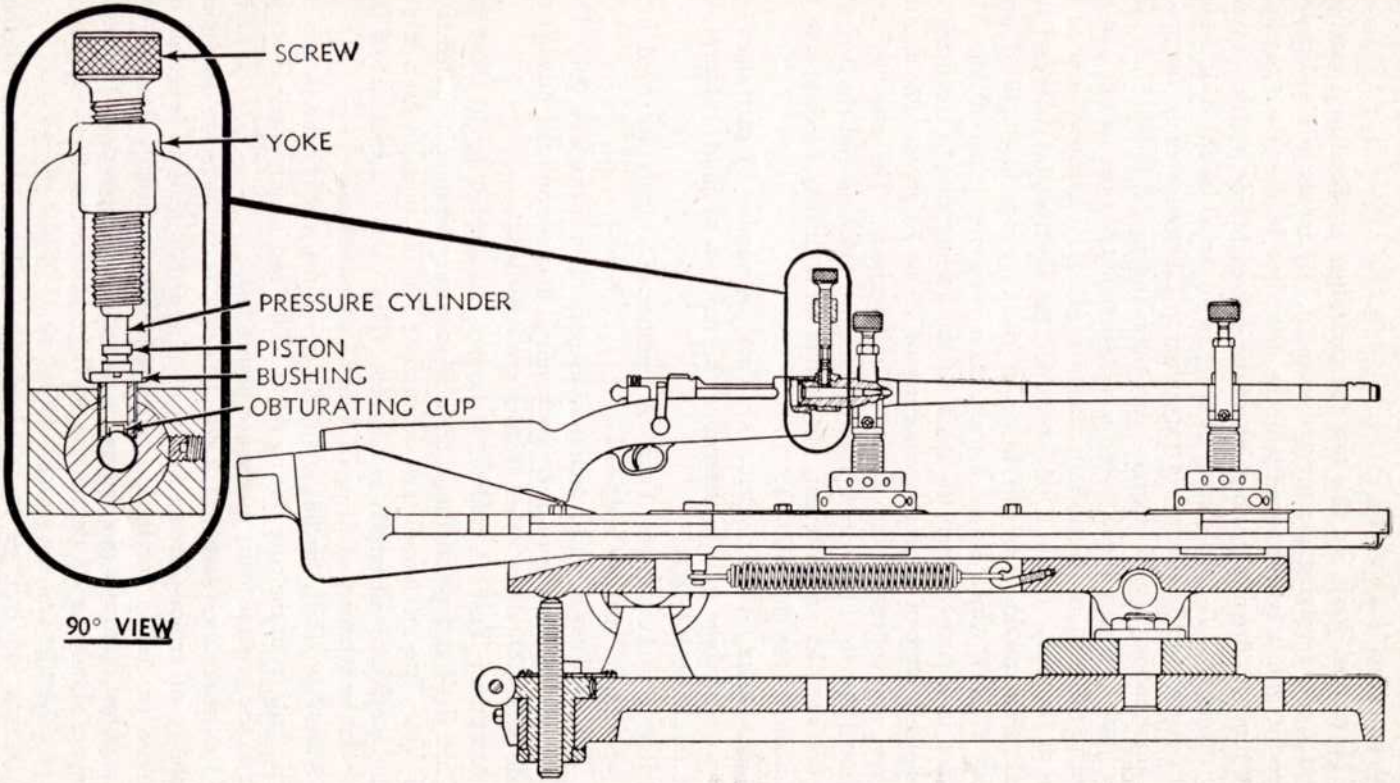

Figure 23. Pressure barrel for cal..30 cartridges.

sure developed. When firing for pressure, velocities are usually taken at the same time for a check.

e. HANGFIRE TEST. In this test the cartridges are fired in a machine gun at a disk revolving at a prescribed speed. By means of a mechanical device the gun is synchronized with the disk; that is, the gun is mechanically timed to fire at a given point on the disk each time it makes a complete revolution. A small group of holes is produced on the disk, which must not exceed 15 degrees, corresponding to 1.39 milliseconds, for grade AC ammunition, nor 27 degrees, corresponding to 2.5 milliseconds, for other grades, when the disk speed is 1,800 revolutions per minute. In an alternate method, an electrostatic hangfire (ESHF) recorder is used in place of the disk. In the ESHF recorder, the electrostatic charge of the muzzle flash produced by the firing of the cartridge is amplified producing a spark which leaves a mark on a revolving paper drum. The distance is measured from the mark of the leading shot to the mark of the slowest shot of a group consisting of 25 to 75 shots. The figures obtained are converted into terms of milliseconds. The diameter and rotational speed of the drum for the hangfire machine and electrostatic hangfire recorder are different, but results on both may be compared in milliseconds (see data above).

f. MACHINE GUN FUNCTIONING TEST. A number of cartridges are fired in a machine gun to determine the number of jams, ruptures, or other mechanical defects.

g. RIFLE FUNCTIONING TEST. A number of rounds are fired in a rifle whose head space is specified.

h. TRACER TEST. Tracer ammunition is fired in a machine gun. The number of shots failing to trace the required distance and the number of muzzle bursts, blinds, or other erratics are recorded.

i. ACCURACY TEST. A number of targets, usually having 10 shots for each are fired at a given range from an accuracy weapon mounted in a fixed rest. The mean radii are determined for the shots in each target and an average of all targets is obtained. This value is a measure of the dispersion or accuracy of firing of a lot of ammunition.

j. STRIPPING TEST. In this test it is determined whether the jackets of bullets strip from the core during flight. This test is only made if strips occur in the general firing of the acceptance test.

k. PENETRATION (IMPACT) TEST. This test is conducted to determine the ability of armor-piercing bullets fired at armor plate to penetrate or perforate (as called for in specifications). This is usually done at 100 yards against an armor plate properly mounted and supported. The angle of impact should be 85 degrees to 90 degrees between the longitudinal axis of the bullet and the plate.

l. CALIBER .45 BULLET FIT. This test is used to determine whether the bullet in the cartridge case is so held as to prevent its forward motion

in the cylinder of a revolver while the other cartridges in the cylinder are being fired.

m. Screen Perforation, Blank Ammunition. This test is used to determine whether the shellacked cup or wad of blank cartridges will penetrate a paper screen placed 15 feet in front of the muzzle of the weapon.

n. Pattern Test for Shotgun Shells and Shot Cartridges. The number of pellets falling within a circle of 30-inch diameter is counted and its percentage of the total number of pellets in the ammunition is determined. For shotgun shells, the distance of the target from the muzzle is 40 yards, for caliber .45 cartridges, the distance is 25 feet.

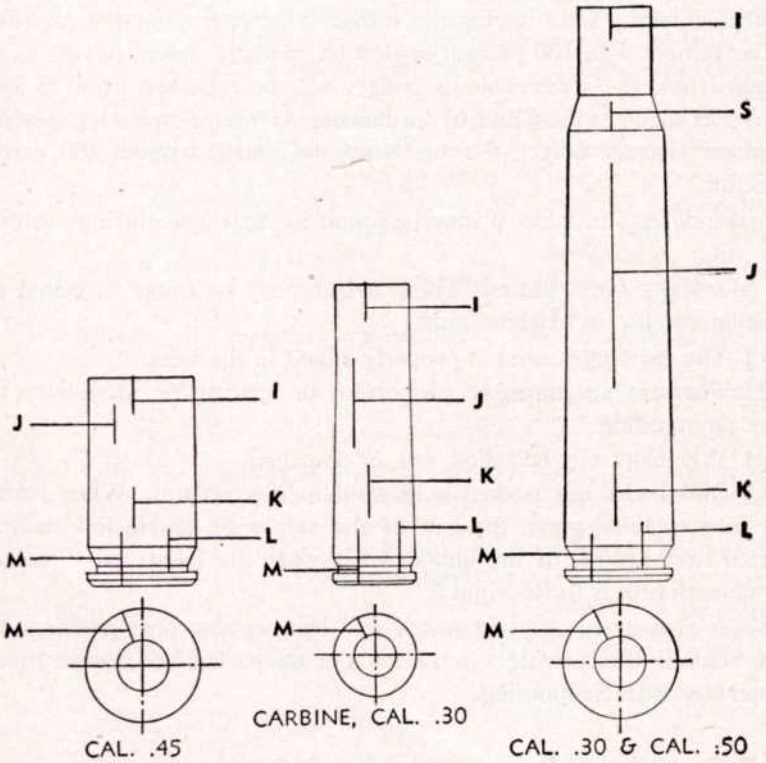

Figure 24. Location of splits in cartridge case.

o. BULLET PULL. This test is made in a mechanical device which registers the force required to pull the bullet from the cartridge case. The following are the required bullet pulls for the different calibers of ammunition:

(1) Caliber .22 long rifle—not less than 28 pounds.

(2) Caliber .30 and caliber .30 carbine—not less than 45 pounds.

(3) Caliber .45—not less than 40 pounds.

(4) Caliber .50—not less than 200 pounds.

40. Defects Found on Visual Examination

a. Before issue of small-arms cartridges, AR 775–10 provides for careful examination of the cartridges. The cartridges in one to five boxes from each lot, depending on the size of the lot, will be examined for physical defects. Lots having more than 5 percent defective cartridges will be subjected to 100 percent inspection, visually defective rounds will be culled out, the serviceable cartridges will be repacked prior to issue, and report made to the Chief of Ordnance. Ammunition having less than 5 percent visually defective rounds may be issued without 100 percent inspection.

b. The defects in table V may be found in cartridges during examination.

c. MACHINE GUN BELTS. These defects may be found in belted ammunition for use in machine guns:

(1) The cartridges are not properly alined in the belts.

(2) There is an improper proportion or spacing of incendiary and tracer ammunition.

(3) Web belts may be soiled, wet, or damaged.

(4) Link belts not packed with double loop on top. When loading belts into machine guns, the end of the belt with double link must be inserted first (points of the bullets are toward the front and the double loop of each link is to the right).

(5) A stiff or improperly sewed web belt, or improper packing, may cause dents in the cartridges in the folds of the packed belt, severe enough to interfere with chambering.

41. Defects Found During and After Firing

a. Splits and ruptures in cartridge cases are shown in figures 24 and 25.

b. MISFIRE. Misfired cartridges should be handled with care as subsequent rough handling may cause the cartridge to explode. Misfires fall into the following categories:

(1) The primer shows a normal impression of the firing pin indicating that a blow sufficiently hard to ignite a primer in perfect condition has

Table V. Defects found on visual examination before firing

Name of defect	How to recognize	Causes—effects—precautions
Cartridge		
(1) Short rounds	Bullet seated too deep.	Not serious unless it is so deep as to affect density of charge and chamber pressure. May not function machine gun unless short round device is present.
Cartridge Case		
(2) Corrosion	Coloring of cases (green, blue, yellow, or white colors). Also appearance of chemical deposit. Not to be confused with true discoloration or blackening of case due to annealing.	Metal eaten into and weakened will cause rupture when cartridge is fired. Deposit interferes with chambering. Cartridges showing advanced corrosion should not be fired.
(3) Season crack	Split in neck of case. Definite longitudinal cracking when exposed to severe weathering conditions or certain reagents. Check by pressing diagonally down on the bullet end.	Due to distortion of the normal crystalline structure of the metal as a result of drawing or tapering operations (not to be confused with split necks occurring after firing).
(4) Dent and bur	Indentions and burring.	Rough handling. Dangerous pressure only if dent is large. Cartridges may fail to chamber.
Bullet		
(5) Loose bullet	Bullet is loose in case. A defect if bullet can be moved by twisting, pushing, or pulling while cartridge is held in hand.	May cause short round stoppage or bullet may remain in bore if cartridge is removed from gun without firing. Should not be fired.
(6) Split bullets (tracer)	Longitudinal cracks in the bullet.	Do not use for overhead fire, i.e., infiltration courses, etc.

been delivered (fig. 26). Such a misfire indicates that the primer is defective. This defect may be caused by:

(*a*) Thick metal in the base of the primer cup.
(*b*) Thick primer pellet which cushions the blow.
(*c*) No primer mixture or insufficient primer mixture.
(*d*) No anvil.
(*e*) No vent.
(*f*) Excess moisture.

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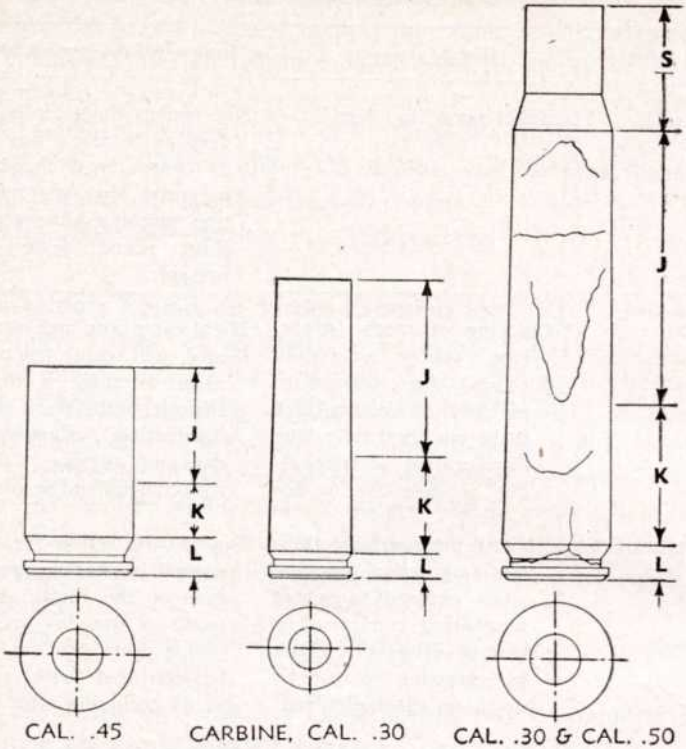

Figure 25. Location of ruptures in cartridge case.

Figure 26. Light, normal, and heavy blow of firing pin.

(*g*) Various combinations of these defects.

(2) Primer shows light impression of firing pin indicating that the force of the blow struck was not sufficient to ignite the primer (fig. 26). This may be caused by:

(*a*) A mechanical defect in the weapon.

(*b*) A short or broken firing pin.

(*c*) A weak firing-pin spring.

(*d*) The bolt of the weapon is not being completely locked.

(*e*) Grease in the firing pin hole which cushions the blow of the firing pin.

(*f*) A very short primer cup inserted in a very deep primer pocket, in which case the primer travels deeper into the pocket with the motion of the firing pin.

(*g*) Primer seated too deep in the primer pocket.

(*h*) Improper angle of the shoulder of the cartridge case allowing the cartridge case to go forward.

(*i*) A defective primer as in subparagraph *b*. (1), above.

(3) Primer shows normal impression of firing pin, but off center. This is caused by a defect in the weapon.

c. Primer Shows Heavy Impression of Firing Pin. This defect (fig. 26) may be due to:

(1) Primer too high in primer pocket.

(2) A long firing pin.

(3) Excessively high chamber pressure.

d. Partial Ignition of Propellent Powder. The powder fails to ignite properly and sufficient pressure is developed to drive the bullet from the cartridge case but not entirely through the gun barrel. The excessive pressure developed by the following round due to the obstruction in the bore of the gun may cause the barrel to burst or bulge at the point where the first bullet is lodged. See TM 9–2210. This defect may be caused by:

(1) Insufficient primer mixture in the primer.

(2) Excessive moisture in the primer or propellent powder.

(3) Excessive coating of powder grains or other retarding cause in powder.

(4) Light blow of firing pin.

e. Hangfire. Delayed ignition of the powder in the cartridge may be caused by a small or decomposed primer pellet, damp powder, or a light blow of the firing pin caused by dirt or a defect in the weapon. While a hangfire is a serious defect if the delay is long enough to permit the bolt to be opened before the powder burns completely, such delay is rarely found in practice. Should a hangfire of several seconds delay occur, and the bolt be opened before the powder explodes, injury to the firer or

damage to the weapon, or both, may result. For precautions to be observed in case of hangfire, see paragraph 35.

f. Pierced Primer (Perforation of the Primer Cup by the Firing Pin). This may be caused by an imperfect pin or very thin, hard, or defective metal in the base of the primer cup. There are various degrees of this perforation. A very small perforation will show, by means of a discoloration around the indent made by the firing pin, the escape of gas. The disk from a large perforation may be blown into the action of the gun with such an escape of gas as to lower the velocity of the bullet. Hot gases escaping through such perforated primers will cause erosion and roughening of the firing pin and thereby result in subsequent perforations of subsequent primers.

g. Primer Leak. Gas generated by the explosion of the powder charge escapes between the walls of the primer cup and the primer pocket, causing discoloration around the primer and the head of the cartridge case. The discoloration may be slight, indicating a small primer leak, or heavy, indicating a large primer leak. The primer leak may be the result of too small a primer, too large a primer hole, defective or hard metal, or excessive pressure generated by the propelling charge.

h. Loose Primer. There are various degrees of this defect, the most serious being the falling out of the primer when the bolt is retracted after firing. In addition, there may be the failure of the primer cup to obturate gases from the explosion of the cartridge. This may be caused by a primer of too small a diameter, too large a primer pocket, or metal of the primer cup being too hard. This defect should not be confused with a "blown primer." This defect is overcome by crimping primers into their primer seats at time of manufacture.

i. Blown Primer. On firing the cartridge, the primer is blown completely from the pocket of the cartridge case and both the cartridge case head and primer pocket are enlarged and distorted. This is a serious defect, seldom encountered. It is caused by excessive pressure, too quick burning developed by the propellant, or a case with a soft head. A similar rupture or distortion of the primer may be caused by a lack of a vent between the primer pocket and the propellent powder.

j. Primer Setback. Pressure developed by the explosion of the propellent charge forces the primer back against the face of the bolt. On examination it will be seen that the primer protrudes above the head of the cartridge case. The setback of the primer may be slight or heavy and is due to a defective cartridge, excessive pressure, or improper headspace.

k. Leak in Back of Case. The gas escapes into the action of the weapon. The discoloration due to this escape is along the body of the cartridge case. It is caused by draw scratch, season crack, scale, corrosion, or soft metal.

l. FAILURE OF CASE TO EXTRACT. This may be due to a defective extractor, a defective cartridge, or dust in the chamber.

m. BLOWBACK. An escape of gas under pressure to the rear is commonly referred to as a blowback. Pierced primer, primer leak, blown primer, primer setback, and ruptured cartridge result in blowback.

n. SPLIT NECK. The neck of the cartridge case splits in firing and is accompanied by an escape of gas. This should not be confused with a split neck due to season cracking which can be observed before firing.

o. SPLIT BODY. A more or less regular longitudinal split in the body of the case allows gas to escape, thereby reducing the velocity of the bullet. This defect is generally found in cartridge cases which have a deep draw scratch or in those which are made from defective brass.

p. STRETCH. A continuous ring around the body of a fired cartridge case shows that the metal was stretched to such an extent when the cartridge was fired that slightly more stretching would probably result in a partial or complete rupture. This is generally due to improper timing, failure of bolt to lock, or improper headspace. See figure 27.

q. COMPLETE RUPTURE. This is circumferential separation of the metal completely around the body of the fired cartridge case causing it to separate into two parts. If such a rupture occurs, upon extraction, the forward portion of the fired cartridge case remains in the chamber of the weapon. This is a serious defect, and will cause the next round of ammunition to jam. It is usually due to bad bolt locking, improper timing, excessive headspace, a defective cartridge case or a combination of these. See figure 27.

r. PARTIAL RUPTURE. This is a partial circumferential separation around the body of the fired cartridge case. Like a complete rupture this is a serious defect. This defect is also usually due to improper timing, bad bolt locking, excessive headspace, or a defective cartridge case.

s. STRIPPED JACKET. The jacket of the bullet separates from the slug (core) of the bullet on leaving the muzzle. This is caused by the gas, under high pressure, entering between the jacket and core. This cannot occur with a boattailed bullet, unless its cannelure is cut so deep into the jacket that the jacket can be twisted off by the rotational motion of the bullet in its passage through the bore of the weapon.

t. FLUTING NEAR SHOULDER. A characteristic fluting may be found near the shoulder indicating excessive pressure resulting from grease or oil in the chamber or on the case. See figure 27.

u. DEFORMED CARTRIDGE CASE. This may take the form of stretching of the body, shortening of the neck, or an annular bulge toward the rear of the cartridge case. This is generally due to excessive headspace, defective chamber, or improper timing. An annular bulge immediately forward from the thick head section may be due to excessive pressure and is generally accompanied by flattening of the primer cup. (See fig. 27.)

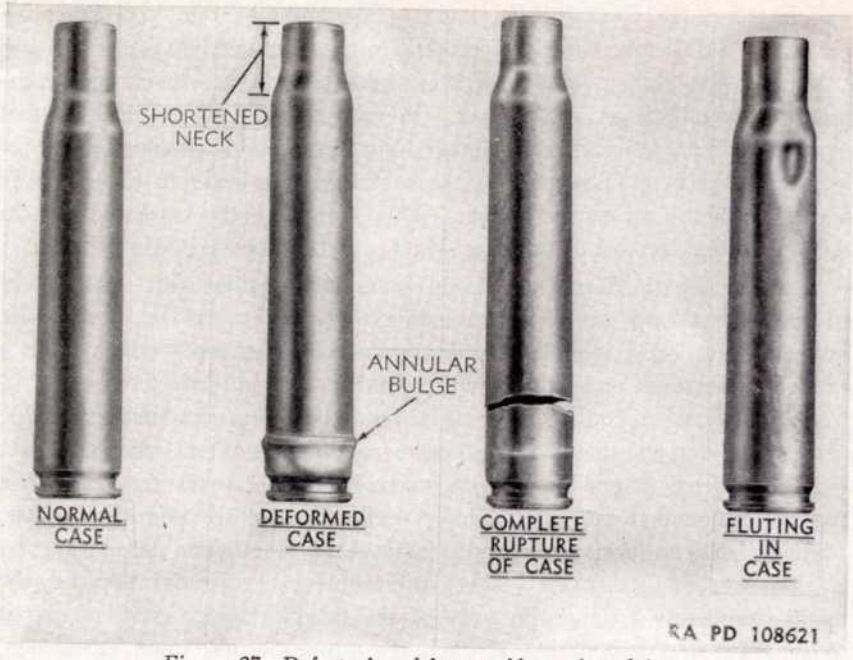

Figure 27. Defects found in cartridges after firing.

Section VIII. FIELD REPORT OF ACCIDENTS

42. Field Report of Accidents

a. Any serious malfunctions of ammunition must be reported promptly to the ordnance officer under whose supervision the material is maintained and issued. It is only by making immediate and complete reports of all abnormal functioning of ammunition, thereby permitting prompt investigation, that danger may be eliminated and a reliable supply of ammunition maintained. Hangfires, which are especially dangerous in rifles, and other dangerous malfunctions should be reported promptly and the lot of ammunition suspended temporarily from use. Immediately after the occurrence of an accident, all parts of the gun, the cartridge case involved in the accident, and the remaining cartridges in the box from which the defective cartridge was taken should be collected and preserved carefully, pending instructions from the ordnance officer or the board appointed to investigate the accident.

b. AR 750–10 requires an immediate report of accidents by the ordnance officer to the Chief of Ordnance. In making reports of malfunctions, as much of the following information as possible should be promptly furnished the post ordnance officer:

(1) *Data pertaining to weapon.* (*a*) Caliber, type, and model.

(*b*) Name of manufacturer (plant or arsenal).

(*c*) Serial number.

(*d*) Type of fire (slow, rapid, etc.).

(*e*) Elevation.

(*f*) Length of recoil.

(*g*) Range to target.

(*h*) Condition of weapon before malfunction.

(*i*) Description of weapon after malfunction (including any photographs, sketches, and measurements of important features).

(*j*) Number of rounds fired in weapon on day of malfunction.

(*k*) Total number of rounds fired in weapon to date.

(*l*) Such other pertinent information as may be available.

(2) *Ammunition markings.* (*a*) Standard nomenclature (type, caliber, and model).

(*b*) Manufacturer.

(*c*) Lot number or repacked lot number (given on outside of packing box).

(*d*) Lot number (as shown on bandoleer or bandoleer ticket, machine-gun belt or belt tag, or carton).

(*e*) Initials marked on head of cartridge case.

(*f*) Method packed (whether in bandoleers, metallic link or web belts, or cartons).

(3) *Visual inspection.* (*a*) Total number of rounds visually inspected.

(*b*) Number of season cracks found out of total inspected.

(*c*) Condition of case as to corrosion, and cause of corrosion—either caused by stains (due to metal strains) or actual verdigris formed above the surface of the cartridge.

(*d*) Number of bullets that can be extracted by hand from the cartridge case.

(*e*) Condition of box and metal liner.

(*f*) Nature of other defects; whether deformed cartridge cases are found.

(*g*) Condition of storage with reference to type of building; whether boxes were properly separated by spacers.

(*h*) Quantity remaining on hand.

(4) *Firing data for defective lot of ammunition.* (*a*) Approximate number of rounds fired.

(*b*) Number of hangfires and approximate time of each.

(*c*) Number of blown-out primers.

(*d*) Number of cartridge cases failing to extract normally.

(*e*) Number of cartridge cases which were difficult to extract normally.

(*f*) Number of ruptured cartridge cases.

(*g*) Number of shots failing to reach target.

(*h*) Number of shots failing to leave the bore.

(5) *Additional data pertaining to tracer ammunition.* (*a*) Number of muzzle bursts.

(*b*) Number of bullets failing to trace the required distance.

(*c*) Other defects encountered.

(6) *Details of accident.* (*a*) Name of man firing weapon.

(*b*) List of eyewitnesses.

(*c*) A detailed description of the accident, and other pertinent data not covered above.

Section IX. DESTRUCTION OF SMALL-ARMS AMMUNITION TO AVOID CAPTURE

43. Method

When time and materials are available, ammunition may be destroyed as follows: Break out all packed ammunition from boxes and cartons. Stack the ammunition in a heap. Stack or pile wood, or gasoline and oil in cans and drums, around the ammunition. Throw onto the pile all available inflammable material such as scrap wood and brush. Pour any remaining gasoline or oil over the pile. Sufficient inflammable material must be used to insure a very hot fire. Ignite the materials and take cover. Thirty to sixty minutes will be required to destroy the ammunition carried by small combat units.

Caution: Use sufficient length of safety fuse when igniting free gasoline.

CHAPTER 2

CARTRIDGE COMPONENTS AND ACCESSORIES

Section I. COMPONENTS

44. General

a. In most types of small-arms ammunition, a cartridge consists of a cartridge case, primer, propelling charge, and bullet. Instead of a bullet, shot cartridges and shotgun shells contain shot. Construction of a typical cartridge and its components is illustrated in figures 1 and 2. Types of military cartridges are shown externally in figures 3, 4 and 5 and sectioned in figure 28.

b. Cartridge components are described in this section. Details of construction and assembly for specific cartridges are described and illustrated in chapters 3 and 4.

45. Cartridge Case

a. CLASSIFICATION. Cases are either of the *centerfire* or *rimfire* type (par. 5 and fig. 2). Centerfire cases are *rimmed, semirimmed* or *rimless* (fig. 2) and have either *solid heads* or *folded heads* (fig. 29). Semirimmed and rimless cases always have solid heads, whereas rimmed cases used for low pressure loading may have either solid or folded heads. From the standpoint of shape, cases are known as *straight, straight taper,* or *bottle-neck* (cal. .45, carbine cal. .30, and cal. .30 or .50 of fig. 30, respectively). See also figure 31. For shotgun shell cases see subparagraph *h,* below.

b. FUNCTIONS. The cartridge case has three functions. It is the means whereby the other components, primer, propelling charge, and bullet, are assembled into a unit. It also provides a waterproof container for the propelling charge. When the cartridge is fired, it prevents the escape of gases to the rear as the thin side walls of the case are forced against the walls of the chamber by the pressure. This process of sealing by expansion is termed *obturation.*

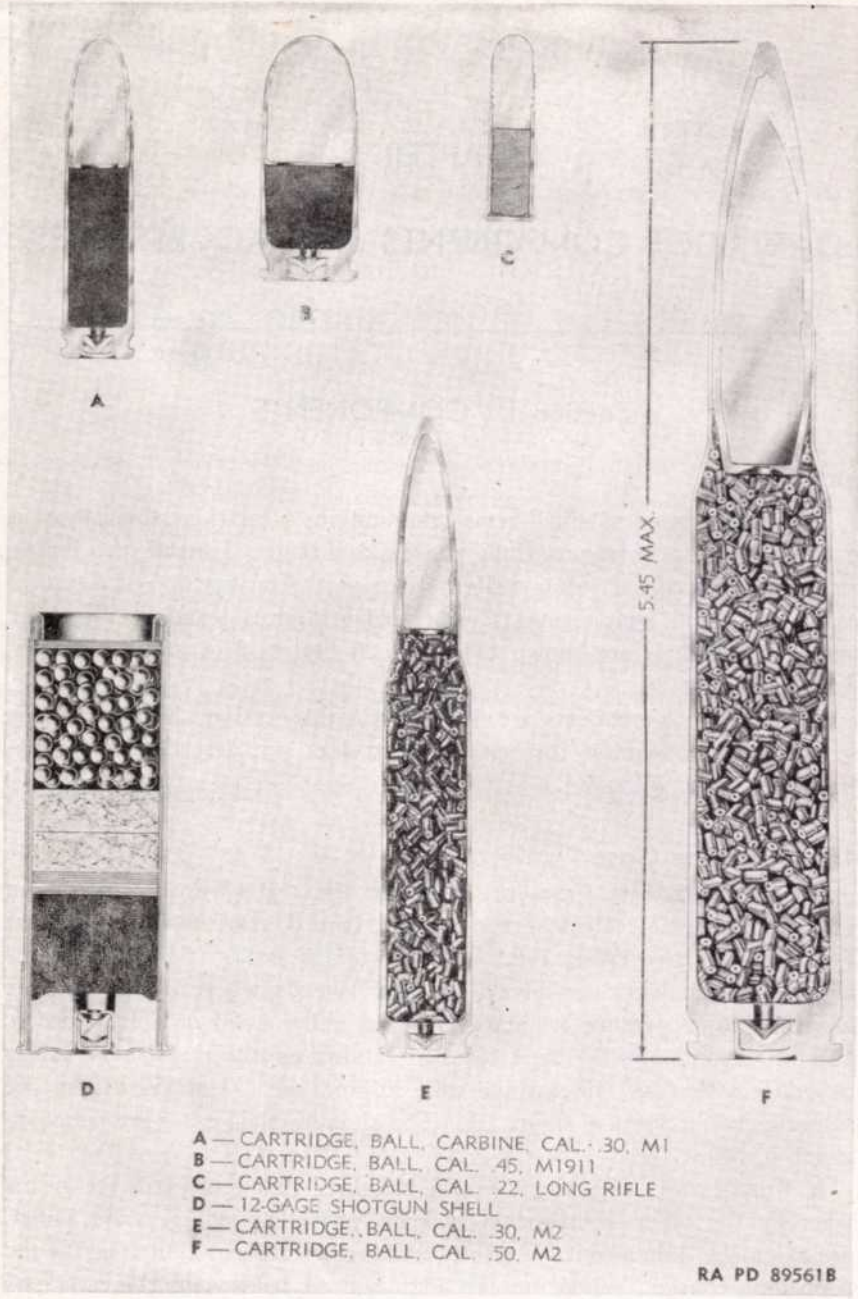

Figure 28. Types of small-arms ammunition—sectioned.

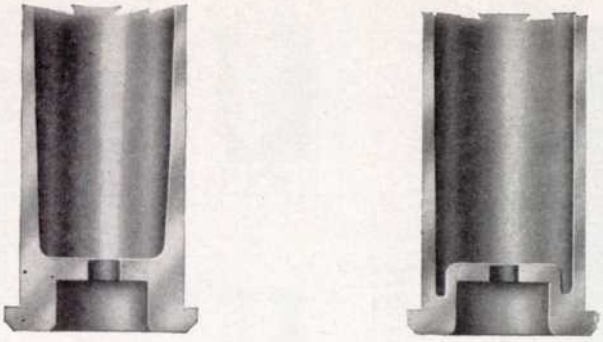

Figure 29. Types of cartridge cases.

c. MANUFACTURE. The cartridge case is made from a circular disk of brass which is punched into the form of a cup and drawn through successive dies into shape. The closed end is pressed into shape to form the head in which the primer pocket and vent are then formed. An extractor groove is machined around the head to provide a grip for the mechanical extractor of the weapon. Pistol ammunition cases are cylindrical; carbine ammunition cases taper slightly; rifle and machine gun ammunition cases taper slightly from the head to the shoulder—approximately ¾ of the length—then sharply at the shoulder to the cylindrical neck. After punching or drawing operations, the case is annealed to remove strains. The annealing process is intended to give the proper hardness and toughness to the case. The final case has a hard and tough head. The rim is hardened to withstand the pull of the extractor, and the side walls are rendered soft but resilient enough to spring back after expansion. The mouth is annealed to a dark or bluish discoloration about the neck; this is done to prevent "season cracking." Caliber .22 cases have been made of either brass or copper. Small-arms cartridge cases have also been made of steel for certain calibers and cartridges (see *e* below).

d. ASSEMBLY. The primer is pressed into the primer pocket and staked or crimped, and the joint is sealed by a drop of shellac or lacquer. The cartridge case is then loaded with a charge of propellent powder and the inside of the neck coated with lacquer or other waterproofing compound. The bullet is then inserted, and the mouth of the case crimped into the cannelure of the bullet. For caliber .30 carbine and caliber .45 cartridges, the mouth of the case is not crimped to the bullet but is held in place by its tight fit in the case. In some revolver cartridges a cannelure in the case prevents the bullet from being seated too deeply.

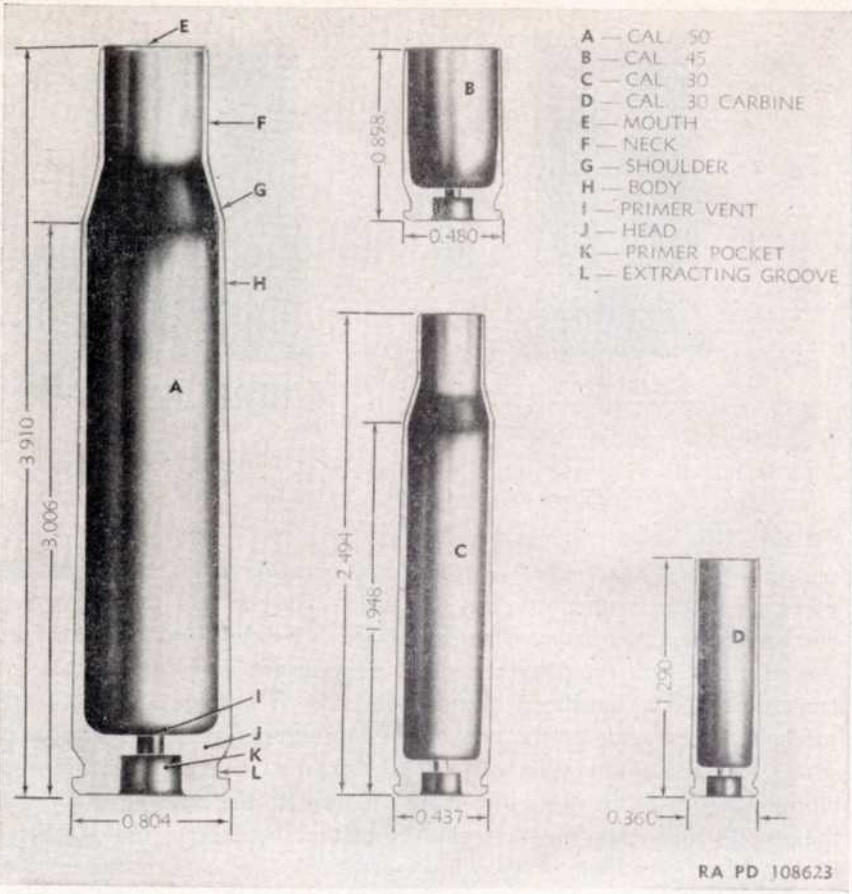

Figure 30. Cartridge cases—sectioned.

e. Steel Cases. Cartridge cases made of steel are zinc-plated and treated chemically to inhibit rusting. They are given either a parkerizing or a cronak treatment which produces a finish similar to that of a brass cartridge case. Only the following types and calibers of small-arms ammunition assembled with steel cartridge cases are authorized for unrestricted use:

CARTRIDGE, ball, cal. .22, long rifle
CARTRIDGE, ball, carbine, cal. .30 M1 (for training only)
CARTRIDGE, dummy, carbine, cal. .30, M13
CARTRIDGE, blank, cal. .30, M1909
CARTRIDGE, dummy, cal. .30, M2
CARTRIDGE, ball, cal. .45, M1911
CARTRIDGE, blank, cal. .45, M9
CARTRIDGE, dummy, cal. .45, M1921

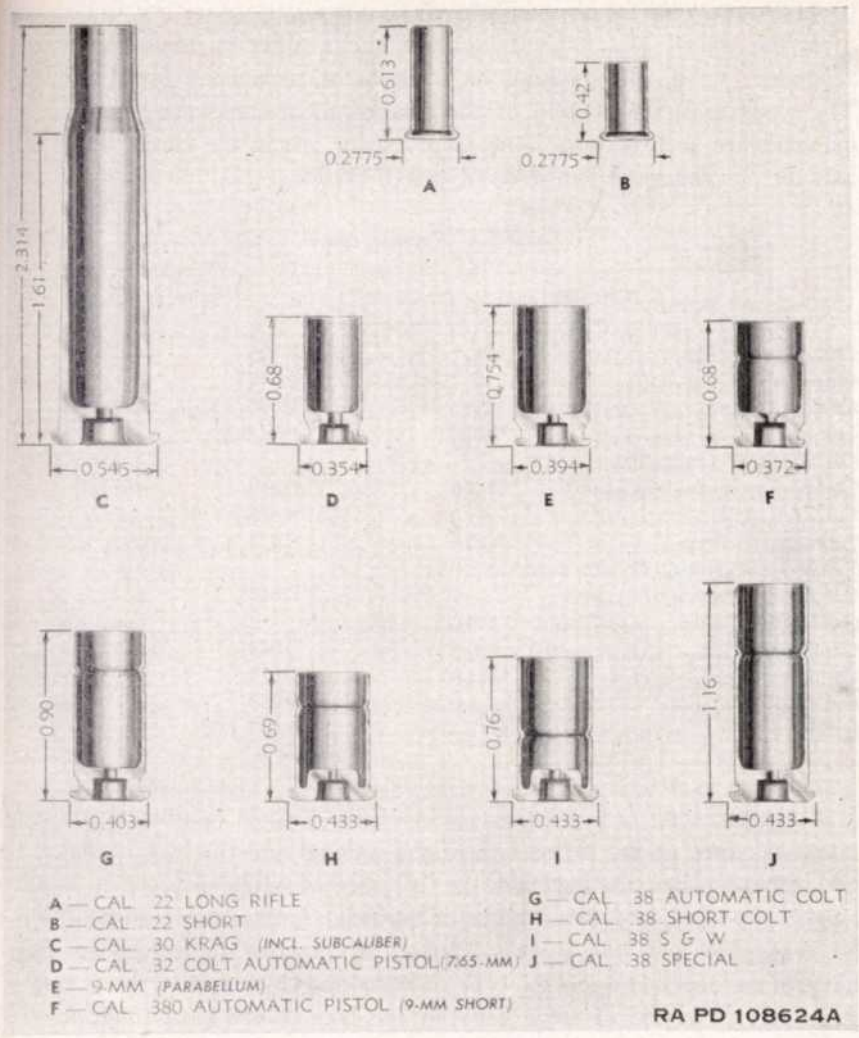

Figure 31. Cartridge cases—sectioned—continued.

CARTRIDGE, shot, cal. .45, M12
CARTRIDGE, shot, cal. .45, M15
CARTRIDGE, test, high-pressure, cal. .45, M1
CARTRIDGE, dummy, cal. .50, M2
SHELL, shotgun, 12-gage

f. Powder Space. This is of the total inside volume of the case with the bullet seated. It is important in the design of the cartridge because it determines the maximum quantity of propellent powder that may be used. The pressure of the expanding gases resulting from the explosion of the powder is dependent upon this volume. The manner in which

propellent powder burns is influenced by any empty space left in the case after the charge was loaded. Shotgun shells differ as to powder space dependent upon specific kind or formula of propellent powders used. The wads and construction of the base of these shells are regulated in manufacture so that there is no empty space left in the case. Table VI lists the powder space for several types of cartridges.

Table VI. Powder space

Cartridge	Volume (cu in.)
Cal..22 long rifle	0.016
Cal..22 short	0.0107
Cal..30 carbine	0.056 (0.042, tracer)
Cal..30	0.22-0.25
Cal..30 Krag (subcaliber)	
Cal..32 Colt auto. (7.65-mm)	0.019
Cal..32 S. & W.	0.026
9-mm parabellum	0.033
Cal..380 auto. pistol (9-mm short)	
Cal..38 super auto. Colt	0.049
Cal..38 short Colt	
Cal..38 S. & W.	0.043
Cal..38 special	0.079
Cal..45	0.058
Cal..50	1.013-1.03

g. HEADSPACE. (1) Headspace has been defined as the space between the face of the closed bolt of the weapon and the base of the cartridge head when the cartridge is fully seated; this distance is in the neighborhood of four thousandths of an inch. A more practical definition of headspace and one that is applied in practice to headspace gage dimensions depends upon the type of cartridge case used in the weapon. It is defined as the distance between the face of the closed bolt to the seating point that stops forward movement of the cartridge into the chamber of the weapon.

(2) For rimless bottle-neck cartridges, such as caliber .30 and caliber .50, headspace is the distance from the shoulder of the chamber against which the shoulder of the cartridge case rests to the face of the closed bolt.

(3) For other rimless cartridges, such as caliber .30 carbine and caliber .45, headspace is the distance from the shoulder of the chamber against which the neck of the case rests to the face of the closed bolt. It is thus very closely equal to the length of the cartridge case.

(4) For rimfire and rimmed and semirimmed centerfire cartridges such as caliber .22 and caliber .38, and shotgun shells, the extractor rim of the case stops the forward motion of the cartridge. Therefore, head-

space is equal to the distance from the rear face of the chamber to the face of closed bolt. This is very closely equal to the thickness of the extractor rim.

(5) Table VII lists headspace values.

Table VII. Headspace

Caliber and type	Headspace (in.)	Seating point of weapon
Cal..22 long rifle	0.043	Rear face of chamber
Cal..22 short	0.043	Rear face of chamber
Cal..30 carbine	1.290	Muzzle end of chamber
Cal..30	1.946	Sloping chamber shoulder
Cal..30 Krag (subcaliber)	0.066	Rear face of chamber
Cal..32 Colt auto. (7.65-mm)	0.045	Rear face of chamber
Cal..32 S. & W.		Rear face of chamber
9-mm parabellum	0.750	Muzzle end of chamber
Cal..380 auto. pistol (9-mm short)	0.68	Muzzle end of chamber
Cal..38 super auto. Colt	0.047	Rear face of chamber
Cal..38 short Colt	0.060	Rear face of chamber
Cal..38 S. & W.	3.000	Rear face of chamber
Cal..38 special	0.072	Rear face of chamber
Cal..45	0.060	Muzzle end of chamber
Cal..50	0.060	Sloping chamber shoulder
Shotguns	0.898	Rear face of chamber

h. SHOTGUN SHELLS. The case consists of a brass or steel head and a paper case or shell body, or the case may be made entirely of brass for guard and combat loads. The head is reinforced by a base of compressed paper in which the primer pocket is formed. Some paper shells have a steel reinforcement, called the lining, under the metal head. The paper shell body is waterproofed. The head is attached to the shell body by crimping. (See figs. 28, 66, and 67.)

46. Primer

The primer, which is crimped into the primer pocket in the head of centerfire cartridge cases, consists of a soft metal cup, a priming or percussion composition, a disk of shellacked manilla paper, and an anvil. A blow from the firing pin on the primer cup compresses the priming composition between the cup and the anvil, thereby initiating a flame which passes through the vents in the anvil and cartridge case, and ignites the propelling charge. Figure 32 shows details of several primers. Figure 33 shows the primer components separated. The cup of the caliber .30 or caliber .50 primer is made of brass, whereas the cup of the caliber .45 primer is made of gilding metal, because the lighter blow of the firing pins of pistols and revolvers necessitates a softer material. Some primer components may be nickel-plated. The priming composition

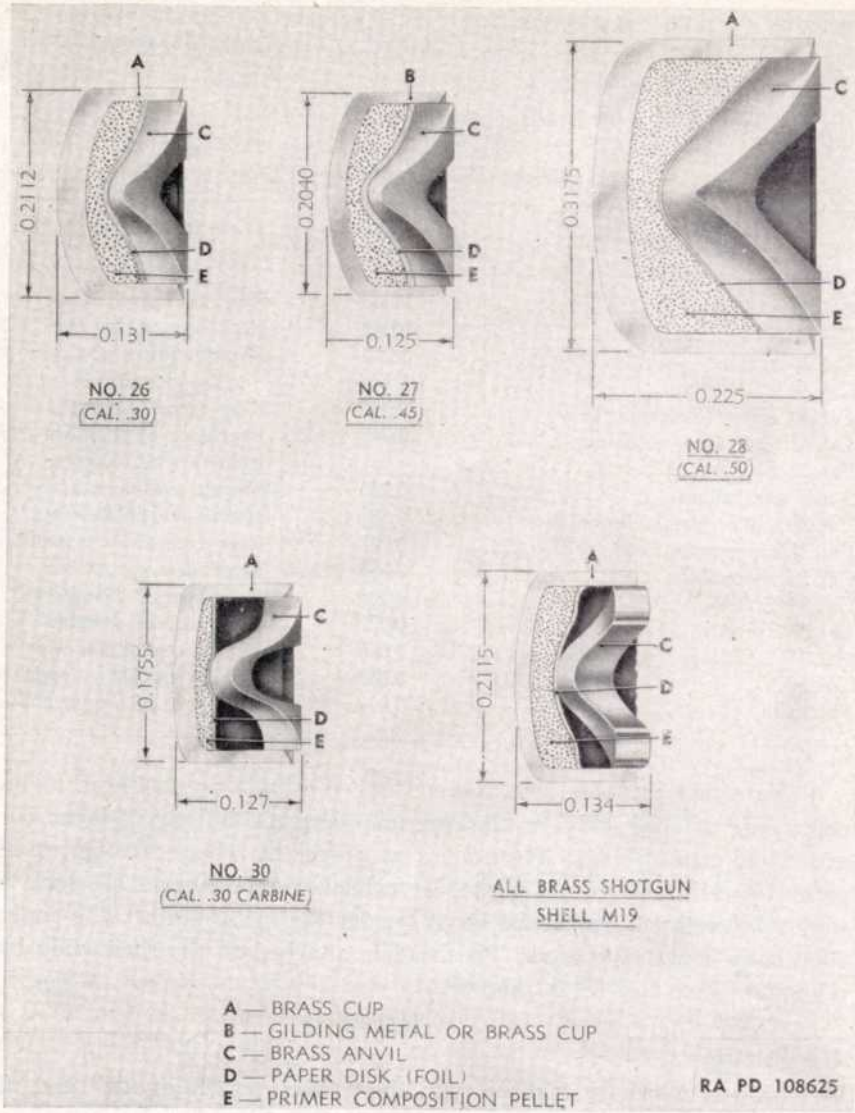

Figure 32. Primers—sectioned.

in the cup is held in place and protected from moisture and electrolytic action by a paper disk. The brass anvil is inserted last. Table VIII gives the designation and weight of primers and primer compositions. Recent primers of the noncorrosive, nonmercuric type are used in the caliber .30 carbine cartridge and in some caliber .45 cartridges. To function properly, primers must be free from such surface defects as folds, wrinkles, scratches, scales or dents. Other primer defects in cartridges

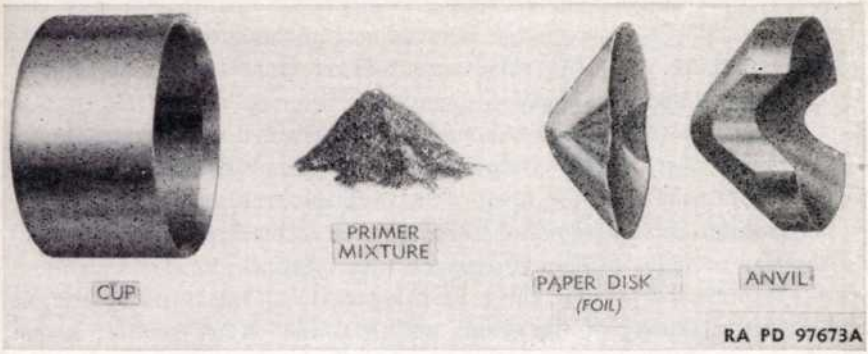

Figure 33. Components of Primers—separated.

Table VIII. Primers

Caliber of cartridge	Primer		Primer composition	
	Designation	Weight, in grains (approx)	Designation	Weight, in grains (approx)
Caliber .22	Rimfire type	.....	.....	0.24
Caliber .30 carbine* and 9-mm parabellum	See footnote*	3.00	Nonmercuric, Noncorrosive	0.32
Caliber .30	Primer No. 26	5.594	FA 70	0.45
Caliber .32, Caliber .38	Small pistol primer†	3.065	Nonmercuric, Noncorrosive	0.3
Caliber .45	Primer No. 27	4.524	FA 70	0.39
Caliber .50	Primer No. 28	19.06	FA 90A	2.1
All brass shotgun shell..	Primer, B7640983		Nonmercuric, Noncorrosive	0.4

* Approved primers for cal..30 carbine cartridges are:
Primer No. 30 containing Primer Mixture FA 675.
Western Primer No. 116 containing Primer Mixture No. 768.
Winchester Primer No. 116 containing Primer Mixture No. 22B2.
Remington Primer No. 44 containing Primer Mixture No. 1348.
Remington Primer No. 44 containing Primer Mixture No. J-232.
† Diameter 0.275 inch: Remington and Western No. 1½, Winchester No. 108, Peters No. 15.

are cocked, broken, or inverted anvils; scratched, torn, or dirty cups; and missing anvils, disks, or pellets. Caliber .22 rimfire cartridges do not have a separate primer but the primer composition is spun into a circular recess inside the rim of the case.

47. Propelling Charge

a. GENERAL. The propelling charge of a cartridge consists of a quantity of smokeless powder. Black powder was the first small-arms propellant but its use as such has been almost completely superseded by smokeless powder. The weight of the charge is not constant. It is adjusted for each powder lot to give the required bullet velocity with

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chamber pressure within the limits prescribed for the weapon in which it is fired. The powder charge is contained in the cartridge case. Acceptance requirements for small-arms smokeless powders are outlined in U.S. Army specifications.

b. Black Powder. Almost completely superseded as a propellant by smokeless powder, it is an intimate mixture of saltpeter, charcoal, and sulfur. It is usually in the form of small, black grains which are glazed with graphite. Size designations are assigned to black powder according to the size of holes in standard sieves which permit its passage. These sizes are indicated as FG, FFG, FFFG, etc., FFFG being the finest; G indicates the glazing of the grains with graphite. Black powder is one of the most dangerous explosives to handle because it is very easily ignited by heat, friction, or spark. Since more than half of its products of combustion are solids, it produces a heavy smoke and quickly fouls the barrel of the weapon. Its use necessitates cleaning a weapon after 8 to 10 shots. Its only use in small-arms ammunition at present is as an ingredient of Lesmok powder, used in caliber .22 cartridges, and of blank cartridge powders.

c. Smokeless Powder. The term "smokeless powder" is a misnomer since it is not entirely smokeless nor is it a powder. It is essentially gelatinized nitrocellulose to which chemicals have been added to increase stability and to control rate and temperature of powder burning. Small-arms smokeless powder charges are manufactured in the form of small flakes, strips, pellets, sheets, spherical grains, or perforated grains. There are two types of smokeless powder, single-base and double-base.

d. Single-Base Propellants. This powder consists of straight nitrocellulose. Its use is prevalent in military cartridges and is also popular for many sporting type cartridges. Pyro D.G., an early single-base powder, contained diphenylamine, a stabilizer or deterioration inhibitor, and graphite, in addition to the pyro powder or pyrocellulose (nitrocellulose of 12.60 percent nitrogen).

e. Compound or Double-Base Propellants. Powders which burn rapidly are necessary for short-barreled weapons such as pistols and revolvers. Such a powder is the compound propellant or "double-base" powder which contains both nitrocellulose and nitroglycerin. Small percentages of inorganic salts are often incorporated to reduce flash or render the powder more easily ignited. Generally, the grains are in the form of strips or flakes, and sometimes in the shape of spherical powder grains.

f. Shotgun Powders. Shotgun shell propellent powders burn more rapidly than rifle powders for two reasons: (1) The forward portion of shotgun barrels are made light in construction and, hence, the pressure can only be high near the breech; (2) a low pressure at the muzzle is essential for distribution of emerging shot in a uniform pattern. Shotgun powders are known either as bulk powders or dense powders. Bulk

powder, which is a single-base powder, originally was intended to be loaded in shotgun shell on a bulk-for-bulk basis with black powder; today, no bulk powders are bulk-for-bulk equivalents of black powder. Dense powder for shotgun shells may be single- or double-base; an example of a double-base powder is ballistite, composed of 60 percent nitrocellulose and 40 percent nitroglycerin. "Bulk" smokeless powder, 3-dram equivalent or approximately 23-grain charge, is used in 12-gage sporting and hunting loads and, generally, "dense" smokeless powder, approximately 26 grains, is used in guard or combat loads. The Du Pont MX smokeless powders are termed "multi-base" powders since they contain nitrocellulose, nitroglycerin, and other nitro organic compounds which serve both as deterrents to control rate of burning and as stabilizers to prevent deterioration.

g. BALL-GRAIN POWDER. A recent development in the manufacture of small-arms powders is the ball-grain powder. Dense and homogeneous grains in the shape of small balls of nitrocellulose are formed under water. These grains are then coated with nitroglycerin and with an outer coating of a deterrent such as centralite. The grains are finally glazed with graphite and then blended.

h. CHARACTERISTICS. Smokeless powder for small-arms ammunition is usually glazed with graphite to facilitate machine loading, and thus presents a black polished appearance. Single-perforated grains are usually used as military small-arms propellants. For caliber .30 rifle ammunition, the diameter is 0.032 inch. Since the powder grains are small, they ignite more rapidly and burn more quickly than cannon powder. When moisture is present or abnormal temperatures prevail, small-arms powders are subject to more rapid deterioration than larger grains. Smokeless powder is not as sensitive to friction as black powder, but all precautions used in handling black powder should be observed for small grain powders. A more complete description of smokeless powders in general will be found in TM 9–1900, Ammunition, General, in TM 9–2900, Military Explosives, and in paragraph 37, section VI, chapter 1.

i. TYPES. Types of small-arms propellent powders now in use are given in table IX. These types are also described as follows:

(1) *Single-base powders.* (*a*) *Pistol powder No. 5.* A pistol and revolver powder made in the form of round flakes.

(*b*) *E.C. blank powder.* A pink or yellow powder granulated into small shot-like grains—used in blank cartridges.

(*c*) *I.M.R. 1185.* A coated powder, containing powdered tin or tin salts, made in the form of cylindrical monoperforated grains. Until 1941, it was used in caliber .30 ball M2 cartridges, but is now superseded by I.M.R. 4676.

(*d*) *I.M.R. 4676.* A coated powder, containing a small proportion of potassium salts for flash elimination, made in the form of cylindrical monoperforated grains of shorter length than I.M.R. 1185.

Table IX. Small-arms propellent powders

Caliber and type	Model of powder	Type	Average charge (grains)
Cal..22 long rifle.....		Single-base	1.7
	Lesmok A	85 black powder—15 guncotton	3.
Cal..22 short (high-velocity)		Single base	1.5
Cal..30 carbine	Western, type I or II.	Double-base, ball (12% NG)	14.
	Herc. 3950.8B	Double-base, flake (12% NG)	13.
Cal..30:			
All	I.M.R. 4676	Single-base	53.
	I.M.R. 4895	Single-base	50.2
AP-I	I.M.R. 4951	Single-base	48.
Auxiliary grenade, M7....	I.M.R. 4809	Single-base	20.
Cal..30 carbine grenade.....	I.M.R. 4809	Single-base	20.
	60-mm mortar ignition powder	Single-base	1.
Cal..30 rifle grenade.....	I.M.R. 4895	Single-base	40.
	Black powder	FFFG	5.
Cal..30 frangible, M22.....	S.R. 4759	Single-base	11.3
Cal..30 subcaliber	Pyro D.G.	Single-base	35.
Cal..32 S. & W.	Bullseye	Double-base (20% NG)	1.4
Cal..32 Colt auto.	Bullseye.....	Double-base (20% NG)	2.3
	Pistol powder No. 5..	Single-base	2.6
	Pistol powder No. 6..	Single-base	2.2
9-mm (parabellum)	S.R. 4898	Single-base	
Cal..380 auto. (9-mm short)	Bullseye	Double-base (20% NG)	2.5
Cal..38 super auto. Colt....	Bullseye	Double-base (20% NG)	4.
	Pistol powder No. 5..	Single-base	5.
Cal..38 short Colt	Bullseye	Double-base (20% NG)	2.5
	Pistol powder No. 5..	Single-base	3.5
Cal..38 S. & W.	Pistol powder No. 5..	Single-base	3.8
Cal..38 special	Bullseye	Double-base (20% NG)	3.6
	Pistol powder No. 5..	Single-base	5.0
	Pistol powder No. 6..	Single-base	4.0
Cal..45	P-4768	Single-base	6.0
	Pistol powder No. 5..	Single-base	5.4
	Bullseye No. 2	Double-base (20% NG)	4.7
Cal..50:			
Ball, AP	I.M.R. 4814	Single-base	235.
Inc M1, AP-I	I.M.R. 4903	Single-base	235.
Tr	I.M.R. 4903	Single-base	225.
Inc M23	I.M.R. 4831	Single-base	237.

Table IX Small-arms propellent powders—continued

Caliber and type	Model of powder	Type	Average charge (grains)
AP-I	I.M.R. 5010	Single-base	234.
Tr	I.M.R. 5010	Single-base	240.
Shotgun shells:			
12-gage	Du Pont M4X	Single- or double-base	23.
16-gage	Du Pont MX	Single- or double-base	21.5
20-gage	Du Pont MX	Single- or double-base	18.5
.410-gage	Du Pont MX	Single- or double-base	7.0

I.M.R.—Improved Military Rifle
S.R.—Sporting Rifle
D.G.—Diphenylamine—graphited

(*e*) *S.R. 4759.* A powder intended primarily for use in rifle cartridges with reduced or mid-range loads (used in cal. .30 frangible cartridge M22).

(*f*) *Lesmok.* A powder used in caliber .22 cartridges and consists of a mixture of 85 percent nitrocellulose and 15 percent black powder.

(2) *Double-base powders.* (*a*) *Bullseye powder.* A pistol and revolver powder made in the form of cylindrical solid disks, 0.0028 inch thick.

(*b*) *Bullseye Powder No. 2.* A pistol and revolver powder used in caliber .38 and caliber .45 cartridges. It is more easily ignited than pistol powder No. 5 and more suitable for reduced charges. Its use in military small-arms ammunition has been suspended.

(*c*) *Ballistite.* A shotgun shell powder made in the form of square flakes 0.005 inch thick.

(*d*) *Hi-Vel No. 2.* A rifle powder, suitable for bottle-neck cartridges having metal-jacketed bullets, made in the form of cylindrical, monoperforated grains.

48. Bullet

a. General. Two types of bullets are described in this manual—the lead bullet and the metal-jacketed or "full patch" bullet. The first type of lead bullet was in the shape of a ball; with the advent of rifling in weapons, this ball was replaced by a cylindrically shaped lead bullet which woud engage the rifling. Lead balls or pellets are still used in shotgun shells and shot cartridges (par. 49). Lead cylindrical bullets of modern design are used in caliber .22 ammunition and in many revolver cartridges. Modern military cartridges and pistol cartridges have bullets which consist of metal jackets surrounding the lead alloy or steel core. Bullets are illustrated sectioned in chapters 3 and 4.

b. Lead Alloy Bullets. The lead used in these bullets is combined with tin, antimony, or both, for hardness. This alloying reduces "leading" of the barrel of the weapon, that is, the tendency of the lead to

adhere to the barrel in patches. It also helps to prevent the bullet from "stripping," that is, jumping the rifling of the weapon. Lead bullets are generally lubricated with a grease or lubricating compound which further prevents leading of the barrel. Two or more cannelures, or grooves, around the bullet contain the lubricant. "Outside lubricated" bullets, like the caliber .22 and caliber .38 short Colt, have cannelures and lubricant on the outside when the bullet is assembled in its cartridge case. The cannelures and lubricant of "inside lubricated" bullets are beneath the neck of the cartridge case and, hence, are not visible in the assembled cartridge.

c. JACKETED BULLETS. For high velocities where a lead bullet cannot be used and in automatic pistols where lead bullets may be damaged by the loading mechanism, metal jacketed bullets are used. The bullet consists, in general, of a core covered by a gilding metal (90 copper-10 zinc) jacket, a gilding metal clad steel jacket, or a copper-plated steel jacket. A cannelure is cut or rolled in the jacket to provide a recess into which the mouth of the case may be crimped at assembly. The cannelure also serves to hold the jacket and core together more firmly. Caliber .30 carbine and caliber .45 bullets do not have a cannelure since they are held by their tight fit in the cartridge case.

d. CALIBER. The caliber of a weapon is the diameter of the bore (measured between opposite *lands*) expressed in inches, or for weapons of foreign origin in millimeters. The *lands* of the rifling of a weapon are the raised spiral portions of the rifling formed by cutting spiral *grooves,* generally 0.003 or 0.004 inch deep, into the surface of the bore. The diameter of a lead alloy bullet is generally 0.003 inch greater than the bore diameter between grooves. The diameter of a jacketed bullet generally should not be more than 0.001 inch greater than the bore diameter between grooves. Typical comparisons of the various diameters are given in table X.

Table X. Comparison of weapon and bullet diameters

	Diameters (in inches)		
	Cal..30 (Jacketed bullet)	Cal..38 special (Lead alloy bullet)	Cal..22 (Lead alloy bullet)
Weapon:			
Across the lands *(caliber).*	0.300	0.346	0.214
Across the grooves.	.308	.353	.221
Bullet	.3085	.359	.223

It will be noted that caliber .38 is a nominal assignment, .35 being closer to the definition of caliber. Bullet diameters for cartridges described in this manual are listed in table XI.

Table XI. Bullet diameters

Caliber and type	Diameter (inches)
Cal..22	0.223–0.226
Cal..30 carbine	.3075
Cal..30	.3085
Cal..32 auto. Colt (7.65-mm)	.314
Cal..32 S. & W.	.314
9-mm (parabellum)	.3555
Cal..380 auto. (9-mm short)	.356
Cal..38 auto. Colt	.359
Cal..38 short Colt	.375
Cal..38 S. & W.	.359
Cal..38 special	.359
Cal..45	.4505
Cal..50	.5110

e. SHAPE. The body of the bullet is cylindrical. The nose may be round, as in the carbine, pistol, and revolver bullets, or ogival (curved taper) as in all service rifle and machine-gun bullets. The length of ogive or taper for caliber .30 and .50 bullets is approximately 2½ calibers. The base may be "square"—that is, cylindrical—or "boattailed" —that is, having a conical taper. A special type of bullet is the wad-cutter, or mid-range, which is entirely cylindrical and has a square front in order that it may cut the target cleanly.

f. TYPES. (1) *Ball.* Lead alloy ball bullets are described in subparagraph *b*, above. The metal-jacketed ball bullets contain a core of antimony-lead alloy except the caliber .50 bullet wherein the core is of soft steel in order to insure similar ballistic properties for ball and armor-piercing cartridges. Caliber .30 carbine and caliber .45 ball bullets are similar, differing essentially in diameter. The caliber .30 ball bullet is the shortest of the caliber .30 service bullets. Unlike other ball bullets, the caliber .50 ball bullet is boattailed, contains a point filler of hardened lead, and has a soft steel core.

(2) *Armor-piercing.* Armor-piercing bullets contain a core of hardened steel—either a tungsten-chromium steel or a manganese-molybdenum steel. The caliber .30 armor-piercing bullet has a point filler of lead and a gilding metal base filler, between the core and the jacket, whereas the caliber .50 armor-piercing bullet has only an antimony-lead alloy point filler. Both bullets have smooth cannelures cut into the jacket for crimping of the cartridge case.

(3) *Armor-piercing-incendiary.* These bullets have hardened steel cores and instead of a point filler of metal, one consisting of an incendiary mixture.

(4) *Armor-piercing-incendiary-tracer.* These bullets are similar to the armor-piercing-incendiary bullets but in addition, have a tracer composition in the base end of the bullet.

(5) *Incendiary.* These bullets contain a core of incendiary mixture. An antimony-lead alloy slug is present at the base end of the bullet. A hollow steel cylindrical body or a clad steel container may be inserted within the jacket and before the base slug. The presence of two knurled cannelures is mandatory on caliber .30 and caliber .50 incendiary bullets, M1.

(6) *Tracer.* These bullets contain an antimony-lead alloy slug in the forward position, and a tracer composition in the rear. They all have square bases. Gilding metal clad steel jackets are more prevalent than plain gilding metal jackets in tracer bullets of recent manufacture. An igniter composition is also present which is ignited by the burning propellent gases and which, in turn, ignites the tracer composition. The red-tipped M1 tracer bullets are visible starting at the muzzle, the orange-tipped tracer bullets have a dim trace for a short distance from the muzzle and a bright trace thereafter, and the maroon-tipped tracer bullets have a comparatively long trace. A special headlight tracer bullet (red-tipped) has a very bright trace when viewed from the front; its tracer charge is a fast-burning igniter composition. At time of manufacture tracer and igniter composition may be loaded under pressure into the bullets in more than one step.

49. Shot

a. General. Shotgun shells and caliber .45 shot cartridges contain a charge of small pellets or shot instead of a single bullet.

b. Gage. Instead of caliber, shotgun shells are identified as to size by "gage". The gage of a shotgun refers to the number of pure lead balls of the diameter of the bore required to weigh 1 pound. The .410-gage is an exception in that the diameter of the bore is 0.410 inch. The bore of a 12-gage shotgun measures 0.729 inch in diameter, thus 12 lead balls of 0.729 inch would weigh 1 pound. See table XII for gage sizes and diameter of wadding used in shotgun shells.

Table XII. Shotgun gages

Gage	Diameter of bore (inches)	Diameter of wadding (inches)
10	0.775	0.784
12	.729	.738
16	.662	.671
20	.615	.623
.410	.410	.415

c. TYPES OF SHOT. Shot are classed as *soft* or *drop shot* if they are made of lead and as *chilled* shot if made of the harder antimony-lead alloy. There is also a tracer type of shot which consists of a capsule containing a tracer composition which is ignited by the burning propellent gases. This special capsule may not have the same weight as that of regular shot, hence their trajectories may not be the same.

CHILLED AND DROP SHOT

ACTUAL SIZE	SIZE NO.*	CHILLED SHOT NO./OZ.	DROP SHOT NO./OZ.	DIAMETER (IN.)*
	9	585	568	0.08
	8	409	399	.09
	7-1/2	345	338	.09-1/2
	6	223	218	.11
	5	172	168	.12
	4	136	132	.13
	3	109	106	.14
	2	88	86	.15
	1	73	71	.16

*DISREGARDING DECIMAL POINTS, SIZE NO. PLUS DIAMETER IN INCHES EQUALS 17. THUS, FOR NO. 8 SHOT, 8+9=17.

BUCK SHOT

ACTUAL SIZE	EASTERN SIZE NO.	APPROX. NO./LB.	DIAMETER (IN.)
	1	175	0.30
	0	·144	.32
	00	122	.34

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Figure 34. Comparison of shot.

d. SIZES OF SHOT. The sizes and weights of various chilled, drop, and buck shot are given in figure 34 together with illustrations of the actual size of the shot.

Section II. PENETRATION

50. Penetration Data

Penetration of light armor depends upon the hardness of the bullet material or core, the shape of the bullet, the ballistic stability of the bullet, the striking energy, the type of armor plate, and the angle of impact. Penetration is adversely affected by yaw or wobble in flight. Greatest penetration occurs at normal, that is, head-on, impact. Up to angles of 20 degrees from normal, the degree of penetration is affected very little; over 45 degrees from normal, ricochets and slight penetration may be expected at low and normal velocities. For armor-penetration data, see TM 9–1907 and chapter 3.

51. Danger Zones and Protection of Personnel

AR 750–10 prescribes the regulations for firing ammunition in time of peace. It specifies the minimum thickness of various kinds of cover required for positive (maximum) protection against bullets fired from small-arms weapons. Table XIII below reproduces these data:

Table XIII. Minimum cover thickness for positive protection

Nature of cover	Thickness in inches	
	Caliber .30	Caliber .50
Concrete	4	8
Sandstone or granite soil	6	10
Broken stone	20	30
Dry sand	24	32
Wet sand	36	48
Logs wired together (oak)	40	60
Earth, packed or tamped	48	60
Undisturbed compact earth	52	66
Earth, freshly turned	56	72

Section III. ACCESSORIES

52. General

Accessories used with small-arms ammunition, such as clips, metallic belt links, and web belts are described below. These items are listed and packed as indicated in WD Cat. ORD 11 SNL T–5.

53. Clips

a. General. Caliber .30 cartridges for use in the M1903 and M1917 service rifles, are assembled in 5-round clips; those for the M1 rifle are assembled in 8-round clips. In time of peace 8-round clips are nonexpendable items. Caliber .45 pistol cartridges are adapted for use in revolvers by means of a 3-round clip.

b. 5-Round Cal. .30 Cartridge Clap. The 5-round clip (fig. 35) consists of a body and spring, both of brass or steel; those of recent manufacture are made of steel. Stop lugs on the exterior side of the body seat the clip in its slots in the receiver of the rifle. The top edges of the sides are folded inward, forming flanges which fit into the grooves in the cartridge case heads, thereby holding the cartridge in place. The spring is provided with narrow tongues which, when the clip is filled,

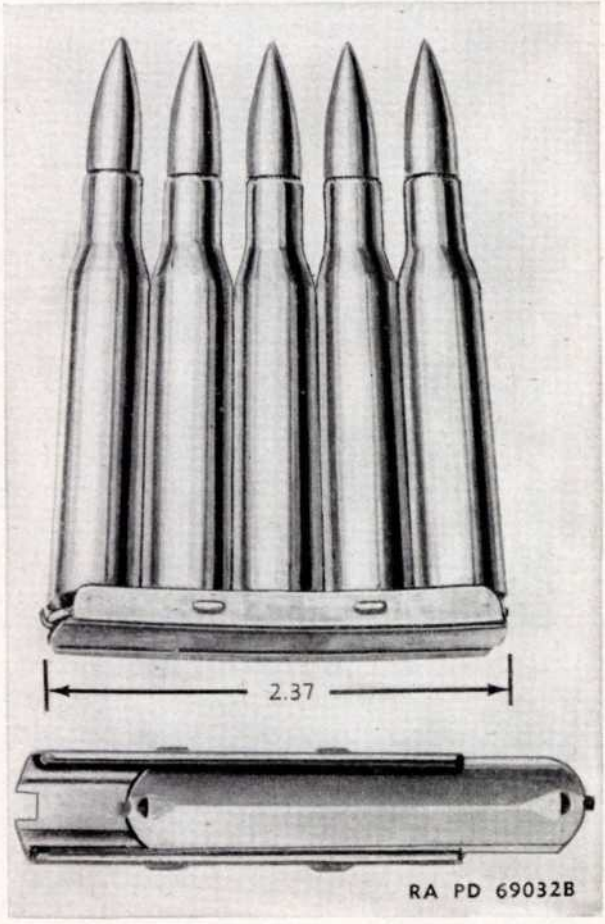


Figure 35. 5-Round cal..30 cartridge clip.

are pressed into the grooves of the outside cartridges, holding them securely in the clip. The 5-round clip weighs approximately 119 grains, is 2.37 inches long, and is 0.63 inch wide.

c. Clips for Dummy Cartridges. Caliber .30 dummy cartridges were formerly assembled in a special 5-round clip. Present practice is to use the standard 5-round clip without tongues, marked for use with dummy cartridges (fig. 36).

d. 8-Round Cartridge Clip for U.S. Rifle, Cal. .30, M1. The 8-round clip (fig. 37) consists only of a case made of steel. It is indented near the base along the sides to form an inner rib which engages the extractor groove in the cartridges. The sides are inclined sufficiently to clamp the cartridges firmly in place. The cartridges are held in two staggered rows. Experience has proven that it is preferable to have the

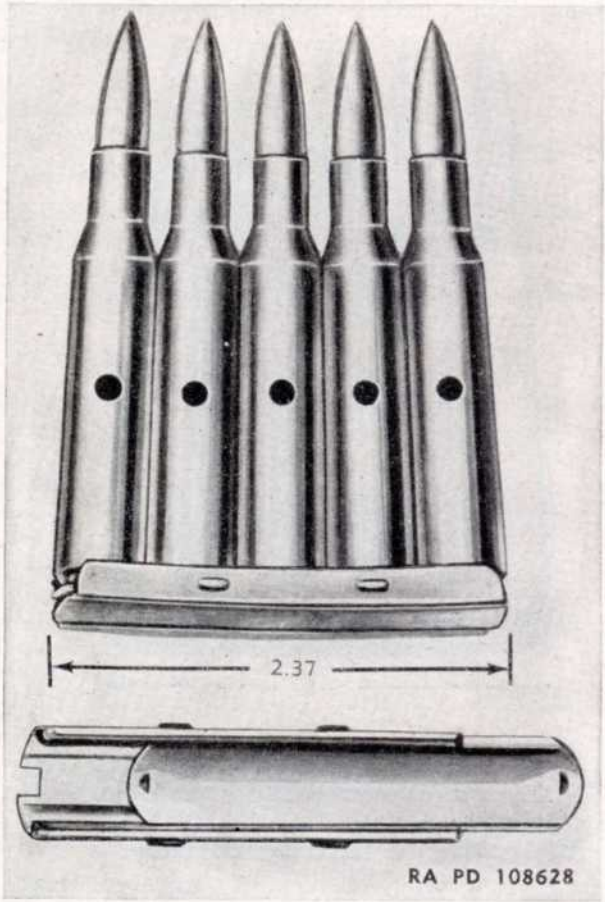


Figure 36. 5-Round cal..30 dummy cartridge clip.

uppermost cartridge in the right side of the clip although the follower slide of the gun adjusts itself for loading on either left or right side. The sides are curved at the ends to hold the cartridges securely in the clip. The 8-round clip weighs approximately one ounce; it is 2.12 inches long, 1.06 inches wide, and 1.32 inches high.

e. 3–Round Caliber .45 Revolver Clip. When used in the revolver, it is necessary to assemble the cartridge into clips (fig. 38). They are

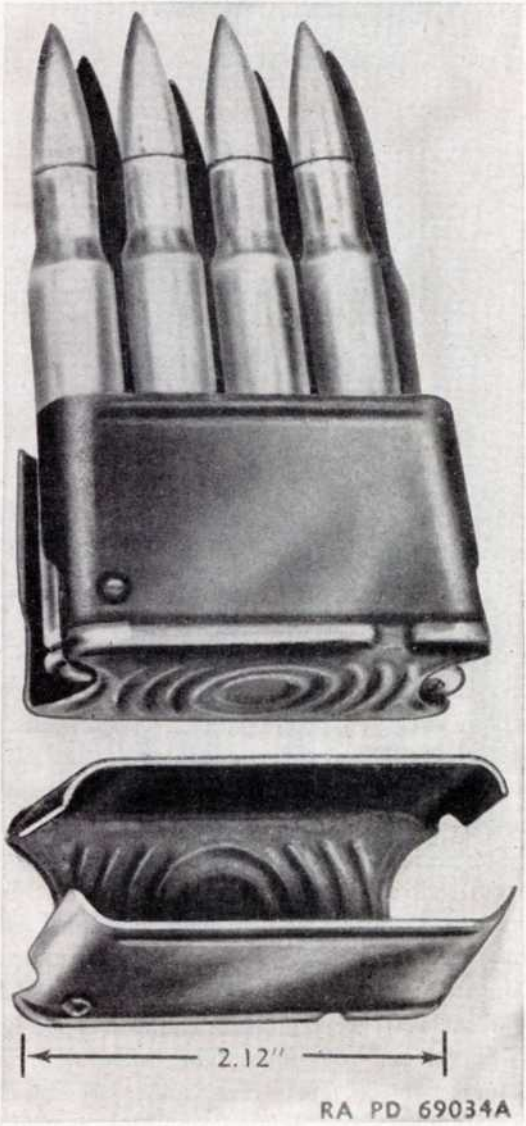


Figure 37. 8-Round cartridge clip for U.S. rifle, cal..30, M1.

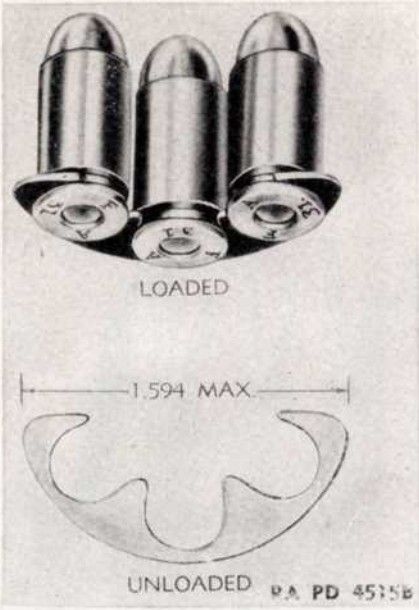
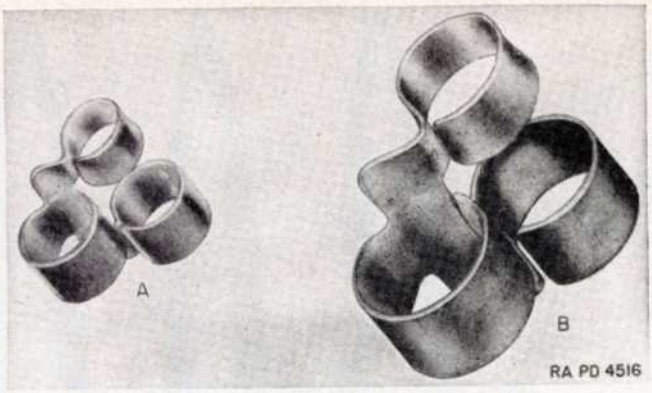


Figure 38. 3-Round cal..45 revolver clip.

packed separately for assembly in the field. The caliber .45 revolver clip weighs approximately 8 grains; it is 1.59 inches long, 0.80 inch wide, and 0.040 inch thick.

54. Metallic Belt Links

a. Links. For use in automatic weapons, caliber .30 and caliber .50 ammunition is issued in metallic link belts. These belts are assemblies of unit links, one for each cartridge. Each link (fig. 39) has two loops fitting about one cartridge and a third loop fitting around one adjacent cartridge. Thus each cartridge in a metallic link belt, except the cartridges on the ends, has two links attached to it (figs. 40 and 41). Each link is made from strip steel, which has been processed to prevent rusting. The links are manufactured to meet specified extraction tests. Metallic belt link, caliber .30, M1, must present an extraction pull of 5 to 10 pounds and metallic belt link, caliber .50, M1 or M2, must present an extraction pull of 10 to 25 pounds. The caliber .30 link weighs 67.2 grains or 0.96 pound per 100 links. The caliber .50 link weighs 267 grain or 3.8 pounds per 100 links. The caliber .50 link M2 is standard and the caliber .50 link M1 is limited standard; a slight difference in design exists between the two links.



A. Metallic belt link, cal..30, M1 B. Metallic belt link, cal..50, M2

Figure 39. Metallic belt links.

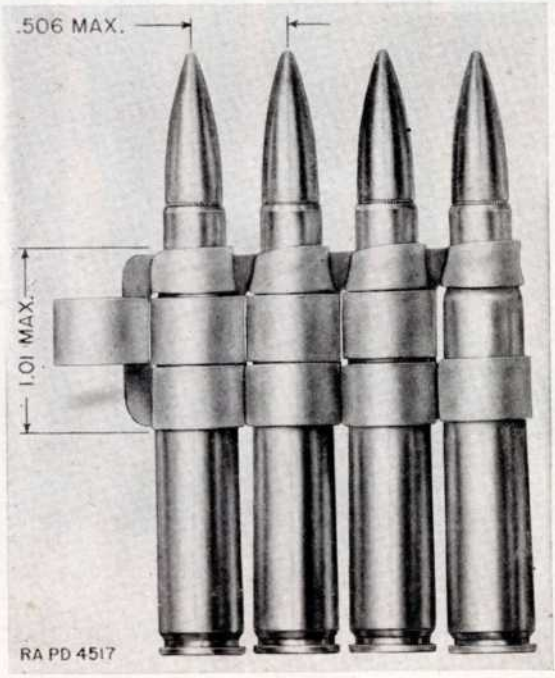


Figure 40. Section of cal..30 linked belt.

b. METALLIC BELT ENDS. A metallic belt end, cal. .30, M1 (fig. 42) is assembled to linked belts of caliber .30 cartridges packed in caliber .30 M1A1 metal boxes for ground machine gun use. The belt end facilitates starting the belt through the weapon, as well as aiding in locating the end of the belt in the box. A metallic belt end may also be required for some aircraft gun installations.

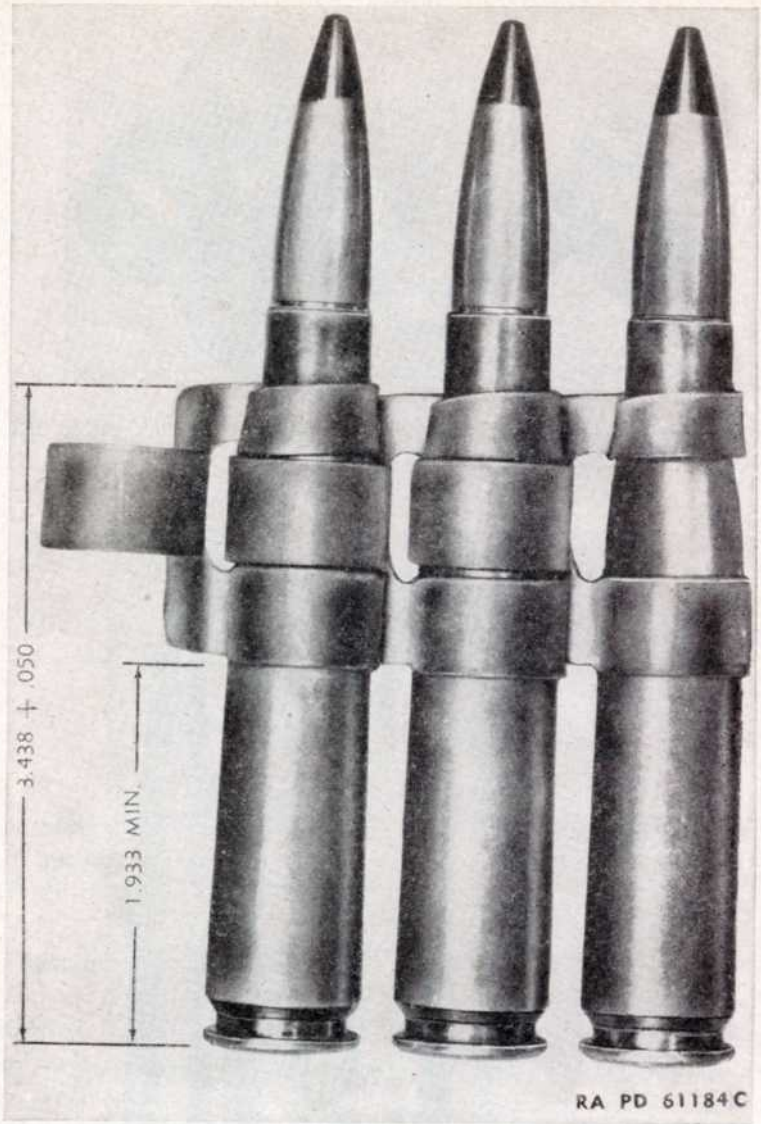


Figure 41. Section of cal..50 linked belt.

55. Ammunition Belts (Web Belts)

Ammunition belts are made of two strips of cotton stitched together so as to form pockets for individual cartridges. Every 25th pocket is marked with the number of cartridges, such as, "25," "50," "75," etc. The 250-round ammunition belt, cal. .30 M1917 is limited standard for use in ground machine guns and is to be retained for Zone of the Interior

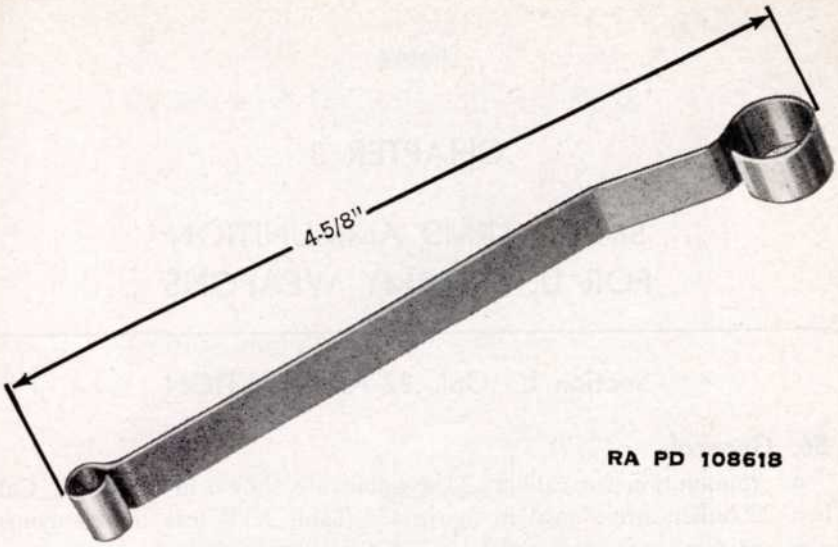


Figure 42. Metallic belt end, cal..30, M1.

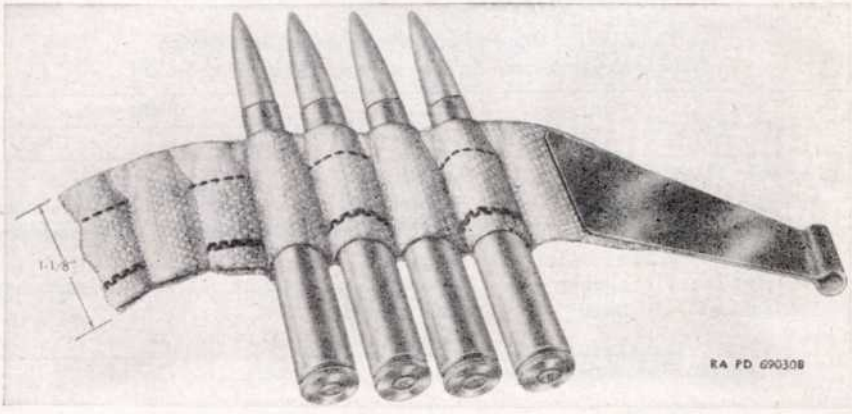


Figure 43. 250-Round ammunition belt, cal..30, M1917 (web belt).

training purposes. It is never used in aircraft machine guns because of the possibility of the empty free part of the belt catching in the gun mechanism. Alternate pockets of this belt have black stitching. A metal tab is fastened to one end of the belt. (See fig. 43.) The empty belt weighs 0.4 pound and its length is 15½ feet. The belt must present an extraction pull of 3 to 11 pounds. For a short time, caliber .50 cartridges were also issued in web belts.

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CHAPTER 3

SMALL-ARMS AMMUNITION FOR U. S. ARMY WEAPONS

Section I. Cal. .22 AMMUNITION

56. General

a. Ammunition for caliber .22 weapons are shown in figure 44. Caliber .22 bullets are shown in figure 45. Table XIV lists the component parts of these cartridges and table XV lists the weights of cartridges and components.

b. Caliber .22 cartridges differ from other types and calibers in being of the rimfire type. (See pars. 45*a* and 46, and figs. 2 and 28.)

Table XIV. Component parts of cal..22 ammunition
(Rimfire type primer used in all cartridges listed below)

Cartridge	Cartridge case	Propellent powder	Bullet	
			Jacket	Core (slug)
Long rifle (lead bullet)	Brass, copper, or gilding metal*	Smokeless or Lesmok A	.....	Lead-antimony
Long rifle, M24..		Smokeless	Gilding metal	Lead-antimony
Short (high-velocity)		Smokeless	.....	Lead-antimony
Blank (short) ...		Black powder, FFFFG	.....	.....

* Long rifle cartridges of recent procurement may have steel cases.

Table XV. Weights of cal..22 ammunition
(In grains; maxima permitted in manufacture)

Cartridge	Complete cartridge (approx)	Cartridge case	Powder charge (approx)	Bullet		
				Complete	Jacket	Core (slug)
Long rifle (lead bullet)	52.[1] or 53.5[2]	10	1.7[1 2]	40.	.....	.....
Long rifle, M24.	53.	10	2.5	40.5	6.5	34.
Short (high-velocity)	36.62		1.5	29.	.....	.....
Blank (short) ..	11.2		2.7	.....	.....	.....

[1] For smokeless powder load.
[2] For Lesmok A load, 3 grains.

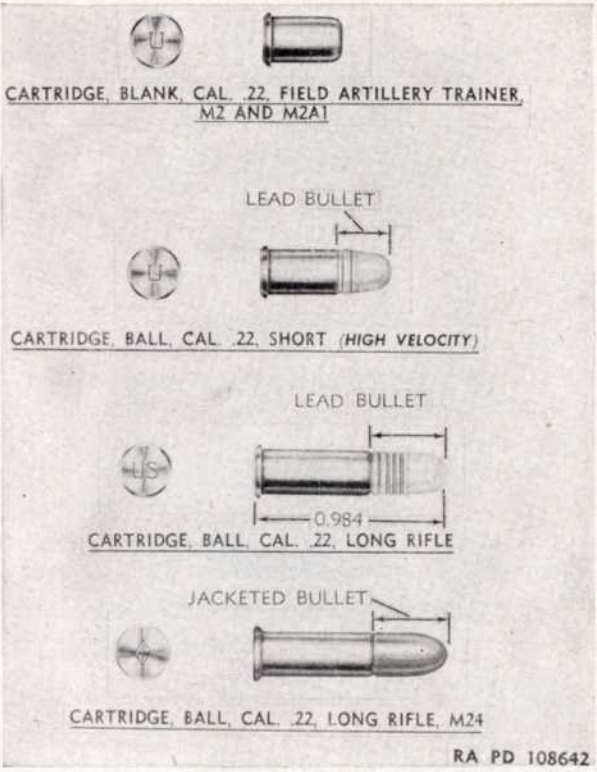


Figure 44. Cal..22 cartridges.

57. Ballistic Data

Ballistic data are given in table XVI and additional data in the paragraph on each cartridge. Caliber .22 cartridges of different manufacture, may vary somewhat in ballistic properties.

Table XVI. Ballistic data for cal..22 ammunition

Cartridge	Powder space (cu in.)	Ballistic coefficient (ft-lb/sq in.)	Average maximum chamber pressure (psi)	Time of flight to 100 yards (sec)	Muzzle energy (ft-lb)	Average velocities (fps)		Maximum range	
						Muzzle	At 25 feet	Elev (deg)	Range (yd)
Long rifle (lead bullet)	0.016	0.129	20,000[1] 22,000[2]	0.292	113	1,130	1,100	30	1,500
Long rifle, M24.			22,000[3]				1,275[5]		
Short (high-velocity)	0.0107		17,000[4]		86	1,155			

[1] In gilding metal cartridge case.
[2] In brass case.
[3] Average pressure obtained is 19,000 pounds per square inch.
[4] Normal pressure.
[5] Minimum velocity at 25.5 feet at time of acceptance is 1100 feet per second.

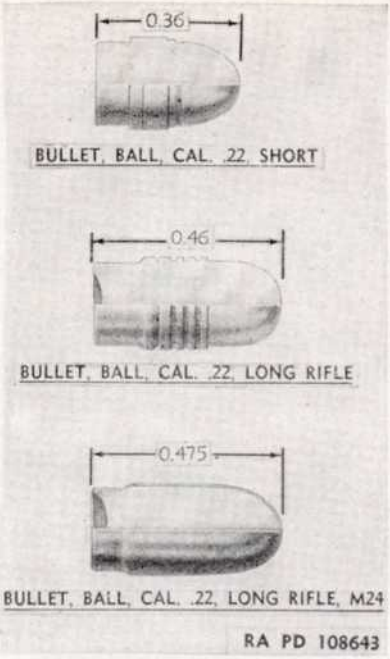


Figure 45. Cal..22 bullets—sectioned (twice actual size).

58. Cartridge, Ball, Cal. .22, Long Rifle

a. CARTRIDGE. (1) This cartridge is for use in the califer .22 U.S. rifles, M1922, M1, and M2, in the caliber .22 rifle, Remington Model 513T, Stevens Model 416–2, and Winchester Model 75, in caliber .22 machine guns, in machine-gun trainers, M3, M4, and M5, in pistols for gallery practice and training purposes, and in caliber .22 subcaliber rifles. These cartridges are procured by the Ordnance Department from several commercial manufacturers. They are all of the same general appearance, but differ slightly in the shape of bullet, primer composition and powder used, and ballistic qualities. This ammunition contains a noncorrosive, nonmercuric, primer composition. The cartridge is 0.985 inch long.

(2) Since this cartridge is of commercial design, it does not have any model designation. The manufacturer of these cartridges can be determined by the following marks which are stamped on the head of the case:

Federal cartridges have an initial "F."
Peters cartridges have an initial "P."
Remington cartridges have an initial "U."
United States Cartridge Co. cartridges have the initials "U.S."
Winchester cartridges have an initial "H."
Western cartridges have the figure of a diamond.

(3) Packing cases are marked with the manufacturer's name, the quantity and type of ammunition, and generally the type of powder used. Containers of this ammunition are marked by the manufacturer with the caliber, type of ammunition, type of powder, and such trade names as "Kleanbore," "Lubaloy," "Rustless," "Staynless," "Tackhole," "Filmkote," "Copperheads," etc. Caliber .22 ammunition has the manufacturer's lot number stamped on the wooden packing box and the cartons contained therein. This provides a means of identifying and reporting any ammunition of this type which may be become defective. Boxes which do not have a metal liner are stamped "NOT METAL-LINED."

b. CARTRIDGE CASE. The cartridge case is made of brass, copper, or gilding metal. Cartridges of recent procurement may have zinc-plated or parkerized and oiled steel cartridge cases. Cases are 0.613 inch long.

c. BULLET. The bullet is made of lead, and contains grease or wax in its cannelures for lubrication purposes in the bore of the weapon. The bullet is 0.46 inch long.

d. ACCURACY. The mean radii of all targets at time of acceptance will not be more than 0.6 inch at 25 yards range. As determined by firings to date, the accuracy of this cartridge is given in table XVII and in the last column of table XVIII.

Table XVII. Accuracy of cal..22 long rifle cartridge

Range	Diameter of group circle	Range	Diameter of group circle
Yards	Inches	Yards	Inches
25	0.5	100	3.0
50	1.0	200	8.0

e. TABLE OF FIRE. See table XVIII.

Table XVIII. Table of fire for cal..22 long rifle cartridge

Range (yards)	Velocity	Bullet energy	Time of flight	Drop at target	Ordinate of trajectory half range	Mean accuracy	Angle of departure
	Feet per second	Foot-pounds	Seconds	Inches	Inches	Inches	Minutes
0	1,100	102	.....	.....	.....	.....	.....
25	1,070	95	0.068	0.89	0.24	0.14	3.5
50	1,020	89	.140	3.17	.98	.33	7.6
75	980	84	.214	8.06	2.28	.45	11.7
100	950	79	.292	14.82	4.08	.57	15.8
125	920	75	.372	24.73	6.78	.80	20.5
150	890	71	.455	36.64	10.02	.98	24.9
175	860	67	.541	50.80	14.20	1.13	29.6
200	840	64	.630	72.93	19.10	1.25	34.3
225	810	61	.720	93.04	28.30	1.45	39.7
250	790	58	.812	118.21	31.87	1.65	44.7
275	770	55	.911	147.20	39.87	1.88	50.8
300	750	52	1.005	177.12	48.69	2.12	55.7

f. ANGLES OF DEPARTURE. See table XIX.

Table XIX. Angles of departure for cal..22 long rifle cartridge

Range	Angle of departure		Range	Angle of departure	
Yards	Degrees	Minutes	Yards	Degrees	Minutes
100.....		16	900.....	6	13
200.....		34	1,000.....	7	44
300.....		56	1,100.....	9	32
400.....	1	29	1,200.....	11	41
500.....	2	10	1,300.....	14	16
600.....	2	56	1,400.....	19	00
700.....	3	51	1,450.....	25	00
800.....	4	56			

g. PENETRATION. When fired into 1-inch pine boards, spaced 1 inch apart at a range of 15 feet, the bullet will penetrate the first five boards and 1/8 inch into the sixth board.

59. Cartridge, Ball, Cal. .22 Long Rifle, M24

a. CARTRIDGE. This cartridge is intended for use in caliber .22/.410-gage shotguns for hunting small game. For this purpose it is packed in Army Air Force E12 or E14 jungle kits. The components are the same as those described in paragraph 58 except for the bullet, which is jacketed. The cartridge is 1.0 inch long.

b. BULLET. The bullet consists of a gilding metal jacket, 0.008 inch thick, and a lead-antimony core. The bullet is 0.475 inch long.

c. ACCURACY. At time of acceptance, the mean radii of all targets is 1.25 inches at 100 yards.

60. Cartridge, Ball, Cal. .22, Short (High Velocity)

a. CARTRIDGE. The caliber .22 short cartridge is intended for use in those weapons chambered for its use. It can be fired from weapons chambered for the caliber .22 long rifle cartridge. Continual use in this manner will cause erosion of the chamber just forward of the mouth of the case. Although this erosion does not impair accuracy when firing the long rifle cartridge, extraction of the long rifle case is made difficult. The cartridge is 0.69 inch long.

b. CARTRIDGE CASE. This cartridge case is the same as that for the long rifle cartridge except for its length, which is 0.42 inch long.

c. BULLET. The bullet is of lead-antimony alloy and is shorter and lighter than the caliber .22 long rifle bullet. The caliber .22 short bullet is 0.36 inch long.

d. MID-RANGE TRAJECTORY. The mid-range trajectory at 100 yards is 4.1 inches.

61. Field Artillery Trainer Ammunition

a. BALL, STEEL, 1-INCH DIAMETER, FIELD ARTILLERY TRAINER, M2, M2A1, AND M3. This is an ordinary commercial steel ball which has been hardened ground, and polished. It is used as the projectile in the field artillery trainer M2, M2A1, and M3. A caliber .22 blank cartridge formerly served as the propelling charge, but the only means of propulsion now used is compressed air. The ball weighs approximately 1,024 grains, and may be reused if kept clean and polished. It is packed as required; see WD Cat. ORD 11 SNL R–7. If stocks are exhausted, BALL, chr-alloy-S., grade 2, 1 in., piece-mark CCAX1M, stored, issued and reviewed in WD Cat. ORD 5 SNL H–2, may be used.

b. CARTRIDGE, BLANK, CAL. .22, FIELD ARTILLERY TRAINER, M2 AND M2A1. This cartridge is a rimfire cartridge of commercial manufacture. It was formerly the standard item used as the propelling charge for the 1-inch steel ball projectile in the field artillery trainers M2 and M2A1. However, the M2 and M2A1 trainers have been converted to compressed air propulsion. The case is the same as that used with the caliber .22 short cartridge. This blank cartridge is 0.42 inch long.

c. TABLE OF FIRE. See T M6–225, for complete range and elevation table of field artillery trainer M3, firing 1-inch steel ball, approximate weight 1,024 grains, for sighting, laying, calibration, conduct of fire, etc. The range of the projectile is changed or adjusted by micrometer adjustment of the interior length of the barrel, and by spacers inserted in the barrel, thereby changing the length of travel of the ball within the barrel. Adjustments in length of barrel may be made to calibrate the individual trainers with any battery, also to obtain for any given range setting with the trainer, 1/100 of the range of the weapon being simulated. The range scale on the trainer is graduated 1/100 of the range of the 75-mm gun M1897, firing Mk 1, HE, shell (w/M46 or M47 fuze), for which the maximum range is 9,000 yards. The estimated velocity is 100 feet per second. A range of 150 yards, however, is practicable. An air pressure of 60 pounds is used and is kept constant by a pressure-regulating valve.

Section II. CAL. .30 CARBINE AMMUNITION

62. General

a. Ammunition for caliber .30 carbines is shown in figure 46. Caliber .30 carbine bullets are shown in figure 47. Table XX lists the component parts of these cartridges and table XXI lists the weights of cartridges and components.

b. The carbine grenade cartridge is described in chapter 3, section IV.

c. The cartridge case for carbine cartridges has a slight taper from the base to a short distance from the mouth and is cylindrical for the re-

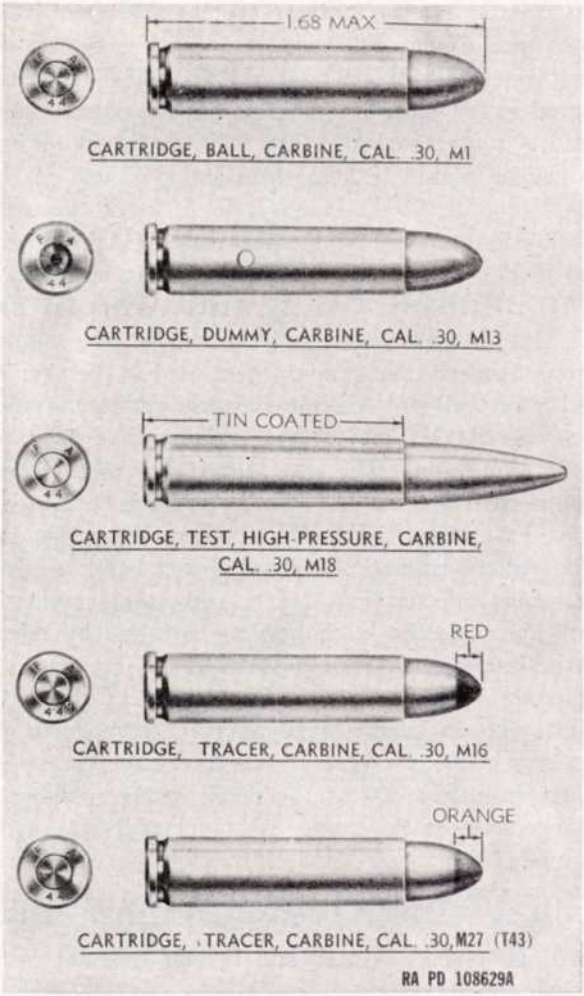


Figure 46. Cal..30 carbine cartridges.

maining portion of its length. Present cases have a taper of 0.027-inch inclination to the cylindrical portion which extends 0.32 inch at the mouth end of the case. Cases manufactured prior to 11 June 1943 had a taper of 0.031-inch inclination to the cylindrical portion which extended 0.39 inch at the mouth end of the case. Steel cartridge cases were used in some lots.

Table XX. Component parts of cal..30 carbine ammunition
(Primer, No. 30, or equivalent, used in all cartridges listed below)

Cartridge	Cartridge case	Propellent powder	Bullet		
			Jacket	Core (slug)	Base filler
Ball, M1....	Brass*	Smokeless powder	Gilding metal or Gilding metal clad steel	Lead-antimony	——
Dummy, M13	Brass*	Smokeless powder	Gilding metal or Gilding metal clad steel	Lead-antimony	——
High-pressure test, M18..	Brass	Smokeless powder	Gilding metal or Gilding metal clad steel.	Lead-antimony	——
Tracer, 16....	Brass	Smokeless powder	Gilding metal clad steel.	Lead-antimony	Tracer and igniter composition.
Tracer, M27 (T43)	Brass	Smokeless powder	Gilding metal clad steel.	Lead-antimony	Tracer and igniter composition.

* Recent lots may be made of steel.

Table XXI. Weights of cal..30 carbine ammunition
(In grains; maxima permitted in manufacture)

Cartridge	Complete (approx)	Cartridge case	Powder charge (approx)	Primer	Bullet			
					Complete	Jacket	Core (slug)	Tracer and igniter composition
Ball, M1....	193	71*	14.5	3.1	111 or 108	28	83	——
Dummy, M13	177	71*	——	——	111 or 108	28	83	——
High-pressure test, M18..	234	71	14	3.1	152	52.5 or 49.5	99.5 or 102.5	——
Tracer, M16.	187	71	13	3.1	107	40.5	55	11.5
Tracer, M27 (T43).....	181	71	13	3.1	101	40.5	55	6.75

* Steel cartridge cases weigh 57 grains.

63. Ballistic Data

Ballistic data are given in table XXII and additional data in the paragraph on each cartridge.

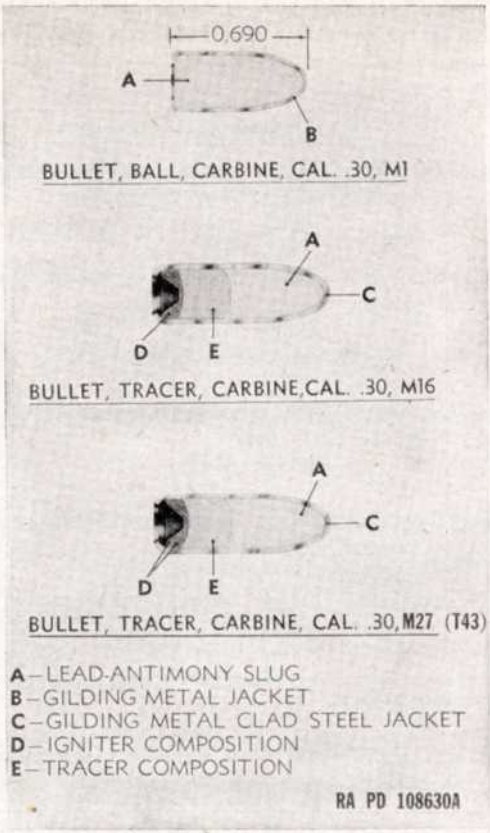


Figure 47. Cal..30 carbine bullets—sectioned.

Table XXII. Ballistic data for cal..30 carbine ammunition

Cartridge	Powder space (cu in.)	Ballistic coefficient (ft-lb/sq in.)	Average maximum chamber pressure (psi)	Muzzle energy (ft-lb)	Average velocities (fps)			Maximum Range		Range of trace (yd)
					Muzzle	At 53 feet	At 78 feet	Elev (deg)	Range (yd)	
Ball, M1....	0.056	0.179	40,000	956[1] 930[2]	1,970	1,900	1,860	30	2,200	—
Tracer, M16	0.042	0.154	40,000	866	1,910	1,850	1,825	23	1,680	570
Tracer, M27 (T43).	0.042		40,000	815	1,910	1,850	1,825	25	1,600	Dim, 75±25; Bright to 500[3]

[1] With 111-grain bullet.
[2] With 108-grain bullet.
[3] Minimum range of trace is 400 yards.

64. Cartridge, Ball, Carbine, Cal. .30, M1

a. CARTRIDGE. This cartridge is a current standard item of issue for use in caliber .30 carbines. It is intended for use against personnel and light materiel targets for ranges up to 300 yards. Its length is 1.68 inches.

b. BULLET. The bullet consists of two parts, a lead alloy core and the jacket of either gilding metal or gilding metal clad steel. It is 0.69 inch in length. It is similar in appearance to the caliber .45 ball bullet M1911. Bullets manufactured prior to 14 February 1942 had a hollow cup formation in the base of the core. Those of present manufacture have a solid flat base core.

c. ACCURACY. When test fired for accuracy, it will group within a mean radius of 4 inches at 300 yards. Actual firing table results indicate the mean radii and extreme spreads in table XXIII.

Table XXIII. Accuracy of carbine ball cartridge, cal..30, M1

Range (yards)	Mean radius (inches)	Extreme spread (inches)
100	0.7	2.2
200	1.5	4.7
300	3.1	10.5
400	4.0	11.2
500	5.8	16.3

d. TABLE OF FIRE. See table XXIV.

Table XXIV. Table of fire for carbine ball cartridge, cal..30, M1
(Velocity 1,900 ft per sec at 53 ft from muzzle; based on ft 0.30–I–1)

Range (yards)	Elevation (mils)	Angle of fall (mils)	Time of flight (seconds)	Terminal velocity (feet per second)
0	0.0	0.0	0.00	1974
100	1.5	1.7	0.17	1580
200	3.5	4.8	0.38	1265
300	6.2	9.4	0.64	1062
400	9.7	15.6	0.94	946
500	14.0	23.5	1.28	865

e. DRIFT. Drift for this cartridge is negligible.

f. PENETRATION. The bullet will penetrate twelve 7/8-inch pine boards at 100 yards, eight boards at 200 yards, and seven boards at 300 yards.

65. Cartridge, Tracer, Carbine, Cal. .30, M16

a. CARTRIDGE. This cartridge is a limited standard item of issue for use in caliber .30 carbines. It is intended for use against personnel and light materiel targets and has an incendiary effect as well as illuminating the path of flight. Its length is 1.68 inches.

b. BULLET. The bullet consists of three parts: A gilding metal clad steel jacket, a lead alloy slug, and a tracer and igniter composition. The over-all length of this bullet is 0.88 inch and the point is painted red for a distance of approximately 1/8 inch.

c. ACCURACY. Average of mean radii at 300 yards is 8.42 inches, at 200 yards it is 5.38 inches, and at 100 yards it is 3.67 inches.

d. PENETRATION. The bullet will penetrate eleven 7/8-inch pine boards at 100 yards, eight boards at 200 yards, and seven boards at 300 yards.

66. Cartridge, Tracer, Carbine, Cal. .30, M27 (T43)

a. CARTRIDGE. This cartridge is a standard item for use in caliber .30 carbine. It is intended for use against personnel and light materiel targets and has an incendiary effect as well as illumniating the path of flight. It has a dim trace, for a short distance of flight from the muzzle, which is followed by a bright trace. Its length is 1.68 inches.

b. BULLET. The bullet consists of three parts: A gilding metal clad steel jacket, a lead alloy slug, and a tracer and igniter composition. The over-all length of this bullet is 0.88 inch and the point is painted orange for a distance of approximately 1/8 inch.

c. ACCURACY. Average of mean radii at 100 yards is 4.0 inches.

67. Cartridge, Dummy, Carbine, Cal. .30, M13

This cartridge is a current standard item of issue and is used for training personnel in the operation of loading and unloading carbines and simulating carbine fire. The cartridge is 1.68 inches long. Cartridges manufactured after 6 March 1944 are identified by an empty primer pocket and two holes drilled in the cartridge case; the case is not tinned. Prior to this date, the cartridges had a tinned case with no drilled holes. Prior to 7 December 1943, this cartridge was known as the M1 dummy cartridge and was used only in the inspection of weapons.

68. Cartridge, Test, High-Pressure, Carbine, Cal. .30, M18

a. CARTRIDGE. This cartridge is used for proof-firing of carbines. It is loaded with a powder charge sufficient to produce a chamber pressure of 45,000 minimum to 50,000 maximum pounds per square inch. Due to this excessive pressure, and the consequent danger involved in firing, the guns under test are fired from a fixed rest under a hood by means of a mechanical device. This cartridge will be fired only by authorized personnel. Its length is 2.0 inches. The cartridge is identified by its tinned

cartridge case. Cases manufactured prior to 9 December 1943 may not have been tinned.

b. BULLET. The bullet consists of a gilding metal or gilding metal clad steel jacket and a lead alloy slug and has a square base. Prior to 20 May 1943, the ball bullet, cal. .30, M2, was used in this cartridge. The present bullet is similar in appearance to the ball bullet, cal..30, M2, except that it does not have a cannelure in its jacket. The bullet is 1.123 inches long.

Section III. CAL. .30 RIFLE AND MACHINE GUN AMMUNITION

69. General

a. Ammunition for caliber .30 rifles and machine guns is shown in figures 48 and 49. Caliber .30 bullets are shown in figure 50. Table XXV lists the component parts of these cartridges and table XXVI lists the weights of cartridges and components.

b. Caliber .30 cartridges not covered in this section are:

(1) Caliber .30 grenade cartridges (See ch. 3, sec. IV.)

(2) Caliber .30 frangible cartridges for use only in machine gun trainer, cal. .30, T9, (See ch. 3, sec. V.)

(3) Subcaliber caliber .30 cartridges for seacoast subcaliber guns, (See ch. 3, sec. VI.)

70. Ballistic Data

All caliber .30 service types for aircraft use, match their ballistics at 600 yards. The time of flight to this distance does not differ by more than 1/10 second under specified conditions. Ballistic data are given in table XXVII and additional data in the paragraph on each cartridge.

71. Cartridge, Armor-Piercing, Cal. .30, M2

a. CARTRIDGE. This cartridge is a limited standard item of issue and is fired from machine guns and rifles. It is intended for use against personnel, light armor, and light materiel. The length of the complete round is 3.34 inches. This cartridge may be identified by a black bullet tip.

b. BULLET. The bullet consists of four parts: A gilding metal jacket, a hard alloy steel core, a lead "T" shot point filler, and a gilding metal base filler. The over-all length of this bullet is 1.39 inches. An annular knurl may be present on some bullets but this is not a mandatory feature in manufacture.

c. ACCURACY. Average of mean radii of all targets at 500 yards, not greater than 9.0 inches; at 600 yards, not greater than 10.0 inches.

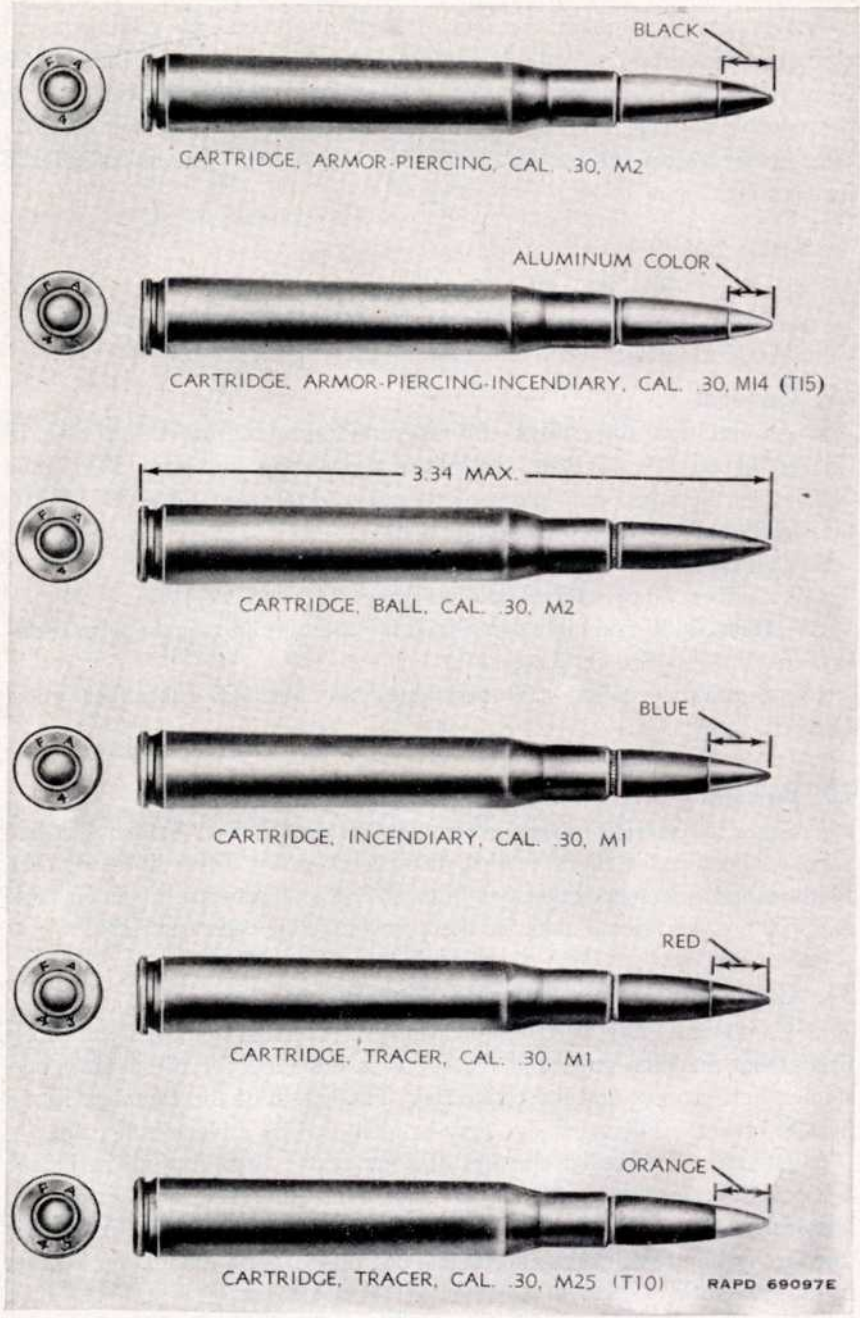


Figure 48. Cal..30 cartridges.

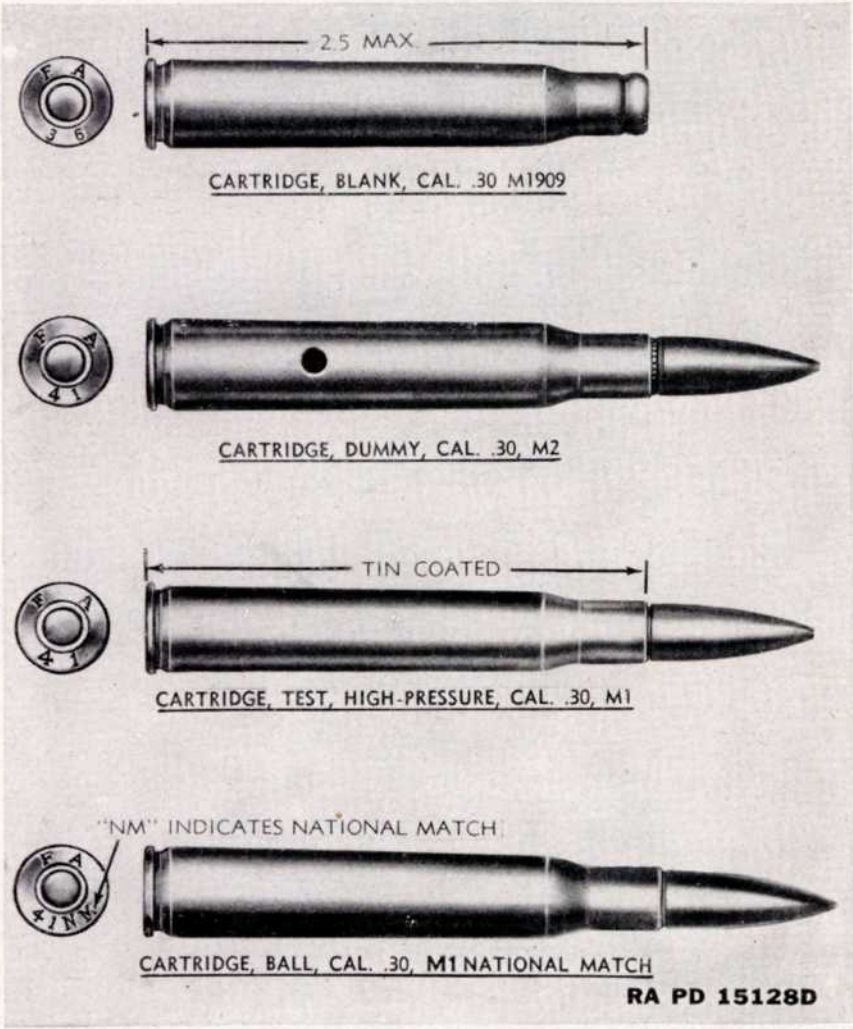


Figure 49. Cal..30 cartridges—continued.

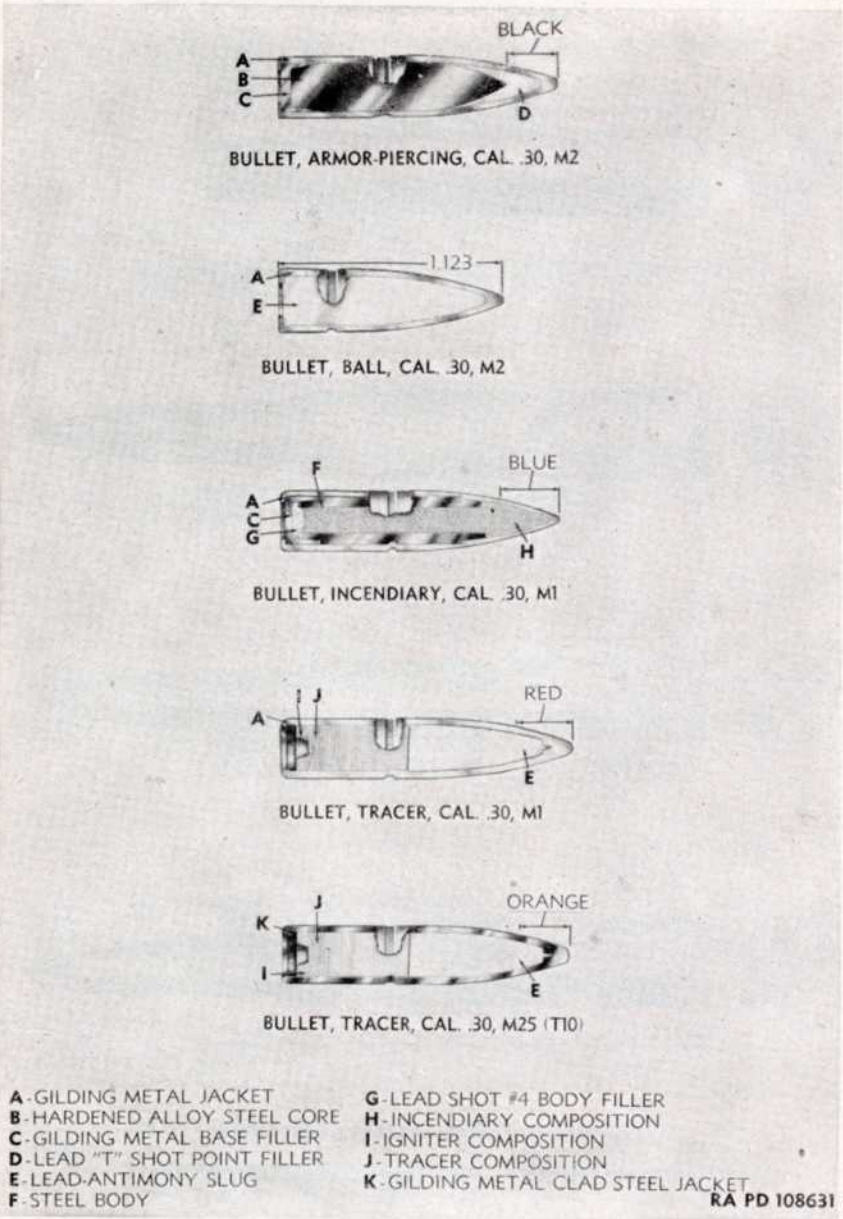


Figure 50. Cal..30 bullets—sectioned.

Table XXV. Component parts of cal..30 ammunition
(Primer, No. 26, used in all cartridges listed below)

Cartridge	Cartridge case	Propellent powder	Bullet			
			Jacket	Core (slug)	Point filler	Base filler
AP, M2.....	Brass	Smokeless	Gilding metal	Tungsten-chrome steel or Manganese-molybdenum steel	Lead "T" shot.	Gilding metal.
API, M14 (T15)	Brass	Smokeless	Gilding metal	Tungsten-chrome steel or Manganese-molybdenum steel	Incendiary comp.	Gilding metal.
Ball, M2	Brass	Smokeless	Gilding metal or Gilding metal clad steel	Lead-antimony[1]	——	——
Blank, M1909 ...	Brass[2]	EC blank	——	——	——	——
Dummy, M2	Brass[2]	None	Gilding metal or Gilding metal clad steel.	39-1 lead-antimony.	——	——
High-pressure test, M1	Brass	Smokeless	Gilding metal or Gilding metal clad steel	Lead-antimony	——	——
Incendiary, M1..	Brass	Smokeless	Gilding metal	Lead body plug. Steel body.	Incendiary comp.	Gilding metal.
Tracer, M1	Brass	Smokeless	Gilding metal or Gilding metal clad steel.	39-1 lead-antimony.	——	Tracer and igniter comp
Tracer, M25 (T10)	Brass	Smokeless	Gilding metal clad steel.	39-1 lead-antimony.	——	Tracer and igniter comp.

[1] 97.5-2.5 lead-antimony. Formerly 90-10 antimony.
[2] Cartridge case may be made of steel.

Table XXVI. Weights of cal..30 ammunition
(In grains; maxima permitted in manufacture)

Cartridge	Complete (approx)	Cartridge case	Powder Charge (approx)	Primer	Bullet				
					Complete	Jacket	Core (slug)	Point filler	Base filler
AP, M2	414 or 412.5	200	53	5.594	168.5 or 166	65.5	84 or 82	11	7.7
API, M14 (T15)	398	200	50	5.594	156	——	——	—	——
Ball, M2	396 or 397.	200	50	5.594	152	52.5 or 49.5	99.5 or 102.5	—	——
Blank, M1909...	207	200[1]	12	5.594	(Wad, 0.25)	——	——	—	——
Dummy, M2	340 or 341	200[1]	——	——	152 or 153	52.5 or 49.5	99.5 or 103	—	——
High-pressure test, M1	420 or 433[2] or 418 or 431[2]	200 or 213	52	5.594	174.5 or 173	59 or 54.5	115.5 or 118.5	—	——
Incendiary, M1..	386 or 388	200	54	5.594	140 or 138.5	——	——	—	——

Table XXVI. Weights of cal..30 ammunition—continued
(In grains; maxima permitted in manufacture)

Cartridge	Complete (approx)	Cartridge case	Powder charge (approx)	Primer	Bullet				
					Complete	Jacket	Core (slug)	Point filler	Base filler
Tracer, M1	396 or 387	200	50	5.594	152.5 or 143.5	83 or 74	52.5	—	Tracer and igniter comp.—17
Tracer, M25 (T10)	386	200	50	5.594	141	74	52.5	—	Tracer and igniter comp.—16

[1] Weight of steel case, which may be used, is 180 grains.
[2] Difference of 13 grains between weights because of two types of cartridge case.

Table XXVII. Ballistic data for cal..30 rifle and machine gun ammunition

Cartridge	Powder space (cu in.)	Ballistic coefficient (ft-lb/ sq in.)	Average maximum chamber pressure (psi)	Time of flight to 600 yards	Muzzle energy (ft-lb)	Average velocities (fps)			Maximum range		Range of trace (yd)
						Muzzle	At 53 feet	At 78 feet	Elev (deg)	Range (yd)	
AP, M2	0.23	0.283	50,000	0.96	2,868[1]	2,770	2,730	2,715	30	3,160	——
					2,825[2]						
API, M14 (T15).	.22	.230	54,000	.88	2,771	2,830		2,750	30	3,300	——
Ball, M2	.25	.21	50,000	.89	2,643	2,800	2,755	2,740	30	3,500	——
Incendiary, M1..	.22	.181	52,000		2,832[3]	3,020	2,960	2,935	30	2,875	——
					2,802[4]						
Tracer, M1	.223	.355	50,000		2,550[1]	2,750[3]		2,700[3]	30	3,350[3]	1,000
					2,338[2]	2,710[4]	2,680[4]	2,665[4]		3,200[4]	
Tracer, M25 (T10)	.223	.355	50,000		2,297	2,710	2,680	2,665	30	3,200	Dim, 150 Bright to 1,000

[1] 168.5-grain bullet.
[2] 166-grain bullet.
[3] Bullet with gilding metal jacket.
[4] Bullet with gilding metal clad steel jacket.

d. TABLE OF FIRE. See table XXVIII.

Table XXVIII. Table of fire for armor-piercing cartridges cal. .30, M2.
(MV 2,700 ft per sec; based on ft 0.30–J–1)

Range (yd)	Angle of elevation (mil)	Angle of fall (mil)	Time of flight (sec)	Maximum ordinate (yd)
200	1.6	2	0.24	0
400	3.5	5	0.56	0
600	6.1	9	0.96	1
800	9.7	17	1.44	2
1,000	14.8	30	2.01	5
1,200	21.4	46	2.69	9
1,400	29.8	65	3.45	16
1,600	39.9	89	4.31	25

Table XXVIII. Table of fire for armor-piercing, cartridge, cal..30, M2—continued
(MV 2,700 ft per sec; based on ft 0.30–J–1)

Range (yd)	Angle of elevation (mil)	Angle of fall (mil)	Time of flight (sec)	Maximum ordinate (yd)
1,800	52.1	122	5.25	36
2,000	67.2	168	6.31	54
2,200	86.2	232	7.57	78
2,400	110.9	328	9.11	113
2,600	145.3	469	11.03	167
2,800	198.0	677	13.60	260
3,000	291.2	981	17.50	438

e. DRIFT. The drift to the right in indicated in table XXIX.

Table XXIX. Drift for armor-piercing cartridge, cal..30, M2

Range (yd)	Drift right (mil)	Range (yd)	Drift right (mil)
200	0	1,600	1
400	0	1,800	2
600	0	2,000	3
800	0	2,200	4
1,000	0	2,400	5
1,200	1	2,600	7
1,400	1	2,800	10
		3,000	15

f. PENETRATION. See table XXX.

Table XXX. Penetration in inches for armor-piercing cartridge, cal..30, M2
(MV 2,765 ft per sec)

Material	At 200 yards		At 600 yards		At 1,500 yards	
	Average	Max	Average	Max	Average	Max
Armor plate (homogeneous)	——	0.5	——	0.3	——	0.1
Armor plate (face hardened)	——	0.3	——	0.2	——	0.1
Sand (100 lb dry weight/cu ft)	7	8	9	11	7	9
Clay (100 lb dry weight/cu ft)	16	18	13	15	9	10

The ballistic limit at normal impact against 3/8-inch face-hardened armor plate is 2,285 ft/sec; ballistic limit at 30 degrees from normal is 2,151 feet per second.

72. Cartridge, Armor-Piercing-Incendiary, Cal. .30, M14 (T15)

a. CARTRIDGE. This cartridge is a current standard item for use in aircraft and ground machine guns in lieu of using both armor-piercing

and incendiary cartridges. The cartridge is 3.34 inches in length. The cartridge is readily identified by its characteristic aluminum color bullet tip.

b. BULLET. The bullet is 1.44 inches in length. It contains an armor-piercing bullet M2 core with an incendiary mixture in place of the lead point filler.

c. ACCURACY. Average of mean radii of all targets at 600 yards is 15.00 inches.

d. PENETRATION. At normal impact at 100 yards against 7/8-inch homogeneous armor plate, penetration is 5/8 inch. At 30 degree angle of impact at 100 yards against 3/8-inch face-hardened plate, penetration is 3/32 inch.

73. Cartridge, Ball, Cal. .30, M2

a. CARTRIDGE. This cartridge is a current standard item of issue and is used in machine guns and rifles against personnel and light materiel targets. It is also authorized for guard purposes. The length of the complete round is 3.34 inches. Cartridges do not have any paint or markings on bullet tips.

b. BULLET. The bullet consists of two parts, a gilding metal or gilding metal clad steel jacket and a lead alloy core composed of 97½ percent lead and 2½ percent antimony. The bullet has a "square" base. The length of this bullet is 1.123 inches. The bullet with gilding metal clad steel jacket may be 1.135 or 1.123 inches in length. Prior to 23 March 1942, the M2 bullet had a core consisting of 90 percent lead and 10 percent antimony and was 1.145 inches in length.

c. ACCURACY. From an accuracy rifle, average of mean radii of all targets at 500 yards is not greater than 6.5 inches; at 600 yards it is not greater than 7.5 inches.

d. TABLE OF FIRE. See table XXXI.

Table XXXI. Table of fire for ball cartridge, cal..30, M2
(MV 2,700 ft per sec; based on ft 0.30–A–4)

Range (yd)	Angle of elevation (mil)	Time of flight (sec)	Maximum ordinate (yd)	Angle of fall (mil)
100	0.7	0.12	0.0	1
200	1.5	.25	.1	2
300	2.4	.38	.2	3
400	3.4	.53	.4	4
500	4.6	.70	.6	6
600	6.0	.89	1.0	9
700	7.7	1.11	1.7	12
800	9.6	1.35	2.4	17
900	11.9	1.62	3.6	22
1,000	14.9	1.91	5.1	28

e. DRIFT. See table XXXII.

Table XXXII. Drift for ball cartridge, cal..30, M2 (MV 2,700 ft per sec; based on ft 0.30–A–4)

Range (yd)	Drift right (mil)	Range (yd)	Drift right (mil)	Range (yd)	Drift right (mil)
100	0.0	1,000	0.4	1,800	1.8
200	.0	1,100	.5	1,900	2.2
300	.0	1,200	.6	2,000	2.6
400	.1	1,300	.8	2,100	3.0
500	.1	1,400	.9	2,200	3.6
600	.2	1,500	1.1	2,300	4.2
700	.2	1,600	1.3	2,400	5.0
800	.2	1,700	1.5	2,500	5.8
900	.3				

f. PENETRATION. See table XXXIII.

Table XXXIII. Penetration in inches for ball cartridge, cal..30, M2 (MV 2,800 ft per sec)

Material	At 200 yards		At 600 yards		At 1,500 yards	
	Over	Max	Over	Max	Over	Max
Armor plate (homogeneous)...	—	0.3	—	—	—	—
Sand (100-lb dry weight/cu ft)	6	7	8	10	6	7
Clay (100-lb dry weight/cu ft)	14	16	12	14	7	9
Concrete (1:2½:5, cement: sand: crushed stone)	—	1	—	1	—	1
Oak (2½" by 12" joists to give thickness of 24")....	13	18	11	15	10	11

74. Cartridge, Incendiary, Cal. .30, M1

a. CARTRIDGE. This cartridge is a limited standard item of issue for aircraft caliber .30 machine guns. It is 3.35 inches long and may be identified by the blue bullet tip.

b. BULLET. The bullet is similar in size and shape to the caliber .30 armor-piercing bullet. It contains a lead shot #4 or lead antimony body plug and a tubular steel body. The core and point of the bullet contains an incendiary composition.

c. ACCURACY. Mean radii of all firings at 600 yards is 15 inches.

75. Cartridge, Tracer, Cal. .30, M1

a. CARTRIDGE. This cartridge is restricted to Navy aircraft use and to training purposes only. It has been replaced by the M25 (T10) tracer for ground machine gun use. It is intended for use with other ammunition to show the gunner, by its trace, the path of the bullets. While tracer cartridges were primarily intended for machine gun use, there are cases wherein they can be advantageously used in rifles, for example, for

signal and incendiary purposes, target designation, range estimation, and target practice. The cartridge is 3.34 inches long and is readily identified by the red bullet tip, red indicating the color of the trace.

b. BULLET. The bullet consists of three parts: A gilding metal or gilding metal clad steel jacket, a lead alloy slug, and a tracer and igniter composition. The over-all length of this bullet is 1.45 inches. It has a "square" base which contains an inflammable substance which is ignited by the propelling charge when the cartridge is fired. The tracer composition burns with a bright red flame which enables the course of the bullet to be followed by the gunner. Trace begins at a distance not greater than 125 yards from weapon and bullets continue tracing to at least 750 yards from weapon. The trace may continue to 1,000 yards.

c. ACCURACY. Average of mean radii of all targets at 600 yards is less than 15 inches.

76. Cartridge, Tracer, Cal. .30, M25 (T10)

a. CARTRIDGE. This cartridge is intended for use in ground machine guns. It differs from the M1 and M2 tracers in having a dim trace, for a short distance of flight from the muzzle, which is followed by a bright trace. Its length is 3.34 inches. The cartridge is readily identified by its characteristic orange bullet point indicating the dim trace type of tracer bullet.

b. BULLET. The bullet consists of three parts: A gilding metal clad steel jacket, a lead alloy slug, and a tracer and igniter composition. The tracer bullet M25 is very nearly the same as the tracer bullet M1 with gilding metal clad steel jacket in weight and components. It differs principally from the M1 tracer bullet in containing a dim trace as well as a standard trace composition. Dim trace begins at 35 to 50 yards from the muzzle and continues to 150 $\pm$ 75 yards where the bright trace begins and continues to approximately 1,000 yards. The minimum acceptable distance for range of trace is 900 yards.

c. ACCURACY. Average of mean radii of all targets at 600 yards is 15.12 inches. The extreme spread of hits is 44.30 inches.

77. Cartridge, Blank, Cal. .30, M1909

a. CARTRIDGE. This cartridge is a current standard item of issue and is used in the rifles for simulated fire during maneuvers, for signaling purposes, and for firing salutes. It is also used in machine guns and automatic rifles equipped with blank firing attachments, in order to operate these weapons for instructional purposes. The cartridge is 2.494 inches in length before canneluring. It is readily identified since it has no bullet, and furthermore, a cannelure is present in the neck of the case.

b. COMPONENTS. In manufacture, a paper cup or wad of thin paper is inserted in the neck of the case against the cannelure and sealed in place

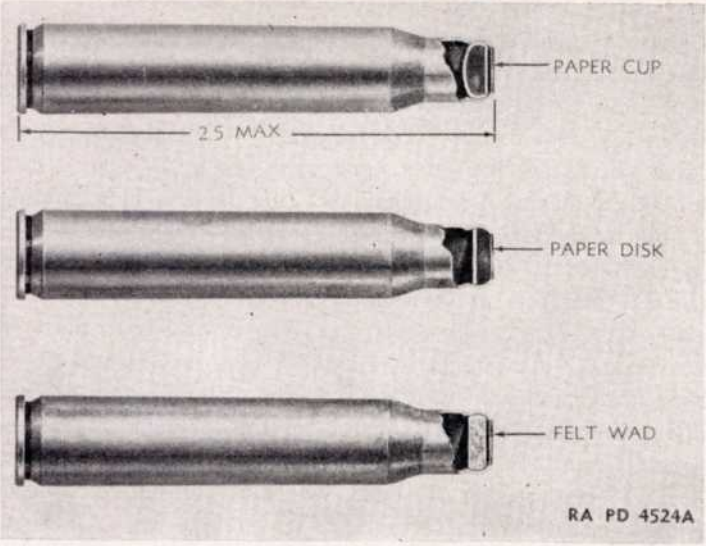


Figure 51. Blank cartridges, cal..30, M1909—necks in section showing wads.

with lacquer. The mouth of the case is then crimped to keep the wad in place. Prior to January 1925, a felt wad was used but its use was discontinued because of accidents resulting from the clogging of gas escape holes in the blank firing attachment of machine guns and automatic rifles. See figure 51 showing the three types of wads. Second-class cartridge cases having small dents, scratches, or other minor defects may be used in the assembly of this ammunition. Steel cartridge cases are approved as a substitute when the supply of brass is critical.

78. Cartridge, Dummy, Cal. .30, M2

a. CARTRIDGE. This cartridge is the current standard item of issue. It is used for training personnel in the operation of loading and unloading rifles and simulating rifle fire, and in the inspection of weapons. It is 3.30 inches long. This cartridge is easily identified by the three holes drilled in the cartridge case and the absence of a primer. Prior to March 1944, the case and the bullet were tin-coated.

b. COMPONENTS. The cartridge consists only of a cartridge case and bullet. The bullet consists of a gilding metal or gilding metal clad steel jacket encasing a lead alloy core. It had a ball bullet M2 until November 1943, and prior to 20 September 1940, this bullet was tin-coated for further identification. A new bullet similar to the ball bullet M2 was used after November 1943 and this bullet was tin-coated until March 1944. The new bullet has a length of 1.123 inches. Second class components may be used in the assembly of this cartridge.

79. Cartridge, Test, High-Pressure, Cal. .30, M1

a. CARTRIDGE. This cartridge is used for proof-firing of rifles, automatic rifles, machine guns, and barrels. It is loaded with a powder charge sufficient to give a breech pressure of 66,000 to 70,000 pounds per square inch. Due to this excessive pressure, and the consequent danger involved in firing, the guns under test are fired from a fixed rest under a hood by means of a mechanical firing device. This cartridge will be fired only by authorized personnel. It is 3.34 inches long. The cartridge is identified by its tinned cartridge case. Some models have the word "TEST" stamped on the head.

b. COMPONENTS. (1) The cartridge case is similar to those used in service cartridges. An alternative cartridge case may also be used which is lighter (200 grains total weight) than the standard high-pressure test case (213 grains total weight) since it has thicker metal at the head but thinner metal for the rest of the case. Standard cartridge cases have the word "TEST" stamped on the head, where as alternative cases have in its stead the year of manufacture.

(2) The bullet consists of a gilding metal or gilding metal clad steel jacket encasing a hardened lead core, and has a cylindrical base. Its overall length is 1.22 inches for the bullet with gilding metal jacket and 1.23 inches for the bullet with gilding metal clad steel jacket.

Section IV. GRENADE CARTRIDGES

80. General

By the use of special blank cartridges (fig. 52), rifles and carbines assembled with launchers are used to project antitank and fragmentation grenades, chemical grenades, and signals. Thus, the range that can be reached by throwing a grenade and the minimum range for light mortar fire is covered. There are three special grenade cartridges: One for use in the carbine, one for use in the rifle, and an auxiliary cartridge colloquially referred to as the "vitamin pill." The carbine and rifle grenades cartridges are identified by the characteristic 5-petal rose crimp of the mouth. The auxiliary grenade cartridge resembles a caliber .45 blank revolver cartridge but its base does not contain a primer. These grenade cartridges are packed with antitank, fragmentation, and chemical grenades; rifle signals; or grenade-projection adapters. For separate packing of these cartridges, see WD Cat. ORD 11 SNL–4.

81. Cartridge, Grenade, Carbine, Cal. .30, M6

This cartridge is loaded with approximately 1 grain of 60–mm mortar shell ignition powder and 20 grains of smokeless powder adjusted to give the M11A2 practice rifle grenade a velocity of 145 ± 5 feet per second

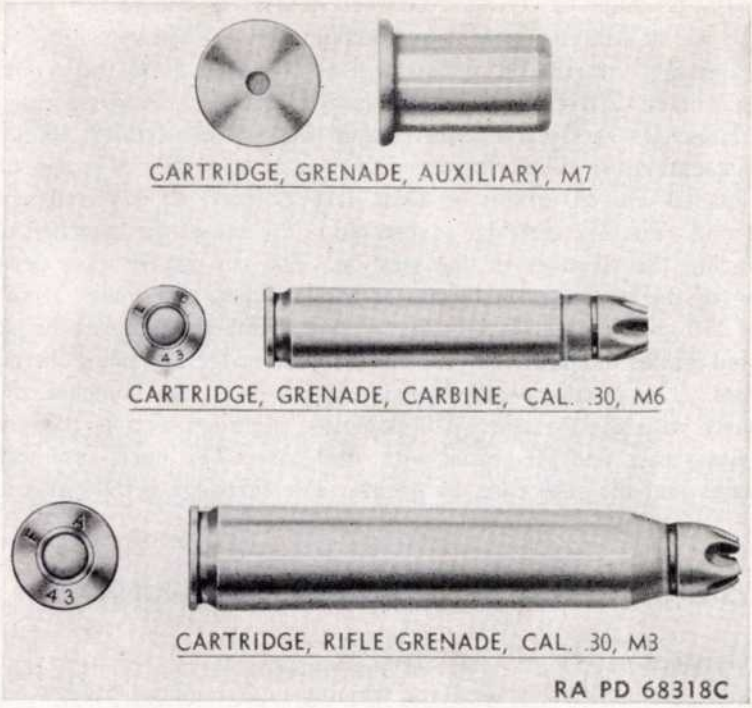


Figure 52. Grenade cartridges.

at 5 feet. The complete cartridge weighs 103 grains and is 1.68 inches long. The case weighs 77 grains.

82. Cartridge, Rifle Grenade, Cal. .30, M3

This cartridge is loaded with approximately 5 grains of very fine black powder and 40 grains of smokeless powder adjusted to give the M9A1 antitank grenade a velocity of 180 ± 15 feet per second at 5.5 feet. The complete cartridge weighs 246 grains and is 2.49 inches long. The case weighs 200 grains.

83. Cartridge, Grenade, Auxiliary, M7

a. General. This cartridge is used only in combination with the M3 or M6 grenade cartridges to give additional range. The force exerted by this cartridge increases the velocity of the grenade 40 to 90 feet per second, with a corresponding increase in range. It is used with the M3 grenade cartridge to gain 60 to 100 yards greater range. It will be used with the carbine only in an emergency when the increased range is necessary. Its use in all weapons is restricted to give additional range beyond that obtained with the standard grenade cartridge. The weapon should

be fired at an angle of elevation between 25 degrees and 45 degrees with the grenade at full engagement on the launcher. When using the auxiliary cartridge, the rifle or carbine will not be fired from the shoulder. This auxiliary cartridge will not be used in firing "A1" ground signals from launchers as these signals contain their own auxiliary charge.

b. DESCRIPTION. This cartridge consists of a caliber .45 case draw piece loaded with 20 grains of IMR 4809 powder. It is sealed with a paper wad. The M7 cartridge is inserted in the end of the launcher, open end facing the chamber of the weapon. The rim on the case permits seating of the cartridge on the lip of the launcher. The flame from the M3 or M6 grenade cartridge in the weapon chamber penetrates the paper wad and ignites the powder in the auxiliary cartridge producing increased pressure. The auxiliary cartridge is ejected from the launcher simultaneously with the grenade. The complete cartridge weighs 108 grains with brass case and 99 grains with steel case. The brass case weighs 90 grains and the steel case, 81 grains. The cartridge is 0.80 inch long.

Section V. CAL. .30 FRANGIBLE AMMUNITION

84. General

Frangible ammunition is used for training and simulates combat conditions. The bullet of this ammunition disintegrates on contact with the target plane without injuring personnel. It is for use by Army Air Forces in the machine gun trainer, cal. .30, T9; this weapon is an aircraft machine gun modified by addition of a short round device and a muzzle booster to operate at velocities lower than service ammunition velocities. The only cartridge for use in this weapon is the frangible ball cartridge, cal. .30, M22 (T44), shown in figure 53. Component parts and weights are listed in table XXXIV.

Table XXXIV. Component parts and weights of frangible ball cartridge, cal..30, M22 (T44)
(Weights in grains; maxima permitted in manufacture)

	Component parts	Weights
Complete cartridge	———	314. (approx)
Cartridge case	Brass	200.
Powder charge	Smokeless powder	11.3 (approx)
Primer	Primer, No. 26	5.594
Bullet	50 bakelite: 50 powdered lead	108.5

85. Ballistic Data

Ballistic data for the frangible ball cartridge, cal. .30, M22 (T44) are given in table XXXV and additional data in paragraph 86.

Table XXXV. Ballistic data for frangible ball cartridge, cal..30, M22 (T44)

Powder space (cu in.)	
Ballistic coefficient (ft-lb/sq in.)	0.163
Average maximum chamber pressure (psi)	6,000
Time of flight to 600 yd (sec)	
Muzzle energy (ft-lb)	445
Average velocities (fps):	
At muzzle	1,360
At 53 ft	1,320
At 78 ft	1,304
Maximum range:	
Elev (deg)	
Range (yd)	

86. Cartridge, Ball, Frangible, Cal. .30, M22 (T44)

a. CARTRIDGE. This cartridge is for use only in machine gun trainer, cal. .30, T9. It is readily identified by the bullet tip which is green with a white annulus to the rear. The bullet has a slightly mottled appearance. The cartridge is 3.29 inches long. The cartridge case and primer are the same as those used with other caliber .30 rifle and machine ammunition.

b. BULLET. The bullet is composed of 50 percent powdered lead bonded with 50 percent bakelite, and has approximately the same profile as the ball bullet, cal. .30, M2. The frangible ball bullet is 1.185 inches long. It breaks up completely on normal contact with 3/16-inch dural sheet at a distance of 25 yards.

c. ACCURACY. At time of acceptance, the average of mean radii of all targets is 12 inches at 300 yards or 4 inches at 100 yards. In actual firings, mean radii of all targets at 300 yards is 7.14 inches.

Section VI. CAL. .30 SUBCALIBER AMMUNITION (SEACOAST)

87. General

The subcaliber cartridge, cal. .30, M1925, intended for firing from the subcaliber tube of 3-inch (15-pdr) seacoast guns, is shown in figure 54.

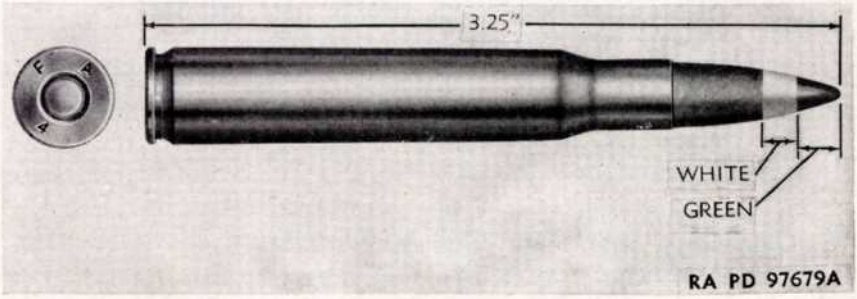


Figure 53. Frangible ball cartridge, cal..30, M22 (T44)

An older type of subcaliber cartridge used for the same purpose as the M1925 cartridge, is known as CARTRIDGE, subcaliber, cal. 30, OLD STOCK, which is characterized by its round-nosed bullet with cupronickel jacket. Both types of cartridges are limited standard; the OLD STOCK cartridges on hand are given priority of issue. Under no circumstances will these subcaliber cartridges be used in other than "Krag" type rifle barrel chambers. These cartridges differ from caliber .30 rifle and machine gun ammunition in that the cartridge case has an extracting rim instead of a groove and a different contour. The cartridge case is 2.314 inches long. The primer used in these cartridges has a primer cup of Monel metal so that it may function on the light blow of a rifle firing pin as well as on the heavy blow of that of a gun. Component parts and weights are listed in table XXXVI.

Table XXXVI. Component parts and weights of cal..30 subcaliber ammunition

	Component parts		Weight (grains)	
	Old stock	M1925	Old stock	M1925
Complete cartridge ...	———	———	438.5[2]	385.5[2]
Cartridge case	Brass	Brass	173.	173.
Primer	Double cup, brass	Monel metal cup	10.1	5.37
Bullet	———	———	220.	172.
Jacket	Cupronickel	Gilding metal	57.	
Core (slug)	Lead-antimony	Lead-antimony	163.	
Propellent powder ...	Smokeless[1]	Smokeless[1]	35.[2]	35.[2]

[1] Pyro D.G. powder
[2] Approximate

88. Ballistic Data

Ballistic data for caliber .30 subcaliber cartridges are given in table XXXVII and additional data in paragraph 89.

Table XXXVII. Ballistic data for cal..30 subcaliber cartridge, M1925

Powder space (cu in.)	
Ballistic coefficient (ft-lb/sq in.).....	
Average maximum chamber pressure (psi)	40,000
Time of flight to 600 yd (sec)	1.193
Muzzle energy (ft-lb)	1,511
Average velocities (fps):	
At muzzle	1,990
At 53 ft	1,960
Maximum range:	
Elev (deg)	
Range (yd)	4,300

89. Cartridge, Subcaliber, Cal. .30, M1925

a. CARTRIDGE AND BULLET. This cartridge may be identified by its "Krag" type cartridge case with extracting rim, its pointed bullet with

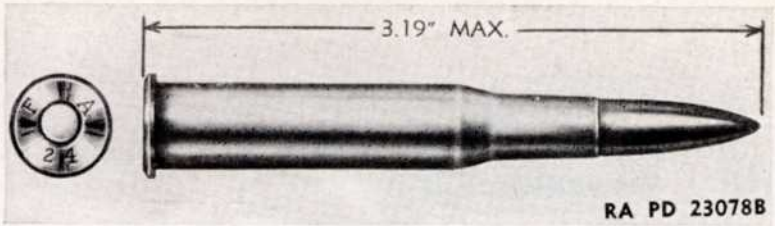


Figure 54. Subcaliber cartridge, cal..30, M1925.

gilding metal jacket and its Monel metal primer cup. The bullet used is the ball bullet, cal. .30, M1, formerly used with caliber .30 rifle and machine gun cartridges. The cartridge is 3.191 inches long and the bullet is 1.33 inches long.

b. Table of Fire. The firing data for this cartridge will only be published herein in table XXXVIII and in FT 0.30–E–4, which is based on a 172-grain bullet with muzzle velocity of 1,990 feet per second.

Table XXXVIII. Table of fire for subcaliber cartridge, cal..30, M1925

Range	Elevation			Time of flight
yd	mil	deg	min	sec
100	1.3		4.4	0.157
200	2.8		9.4	.329
300	4.4		15.0	.517
400	6.3		21.4	.723
500	8.5		28.7	.948
600	10.9		36.9	1.193
700	13.7		46.2	1.457
800	16.8		56.6	1.737
900	20.2	1	8.0	2.032
1,000	23.9	1	20.6	2.341
1,100	27.9	1	34.2	2.663
1,200	32.2	1	48.8	2.996
1,300	36.8	2	4.4	3.341
1,400	41.8	2	21.1	3.697
1,500	47.0	2	38.7	4.065

Section VII. CAL. .45 AMMUNITION

90. General

a. Ammunition for caliber .45 weapons is shown in figure 55. Caliber .45 bullets are shown sectioned in figure 56 and sectioned views of shot cartridges in figure 57. Table XXXIX lists the component parts of these cartridges and table XL lists the weights of cartridges and components.

b. A caliber .45 blank line-throwing cartridge, which is very different from the caliber .45 cartridges described in this section is described in chapter 4, section V.

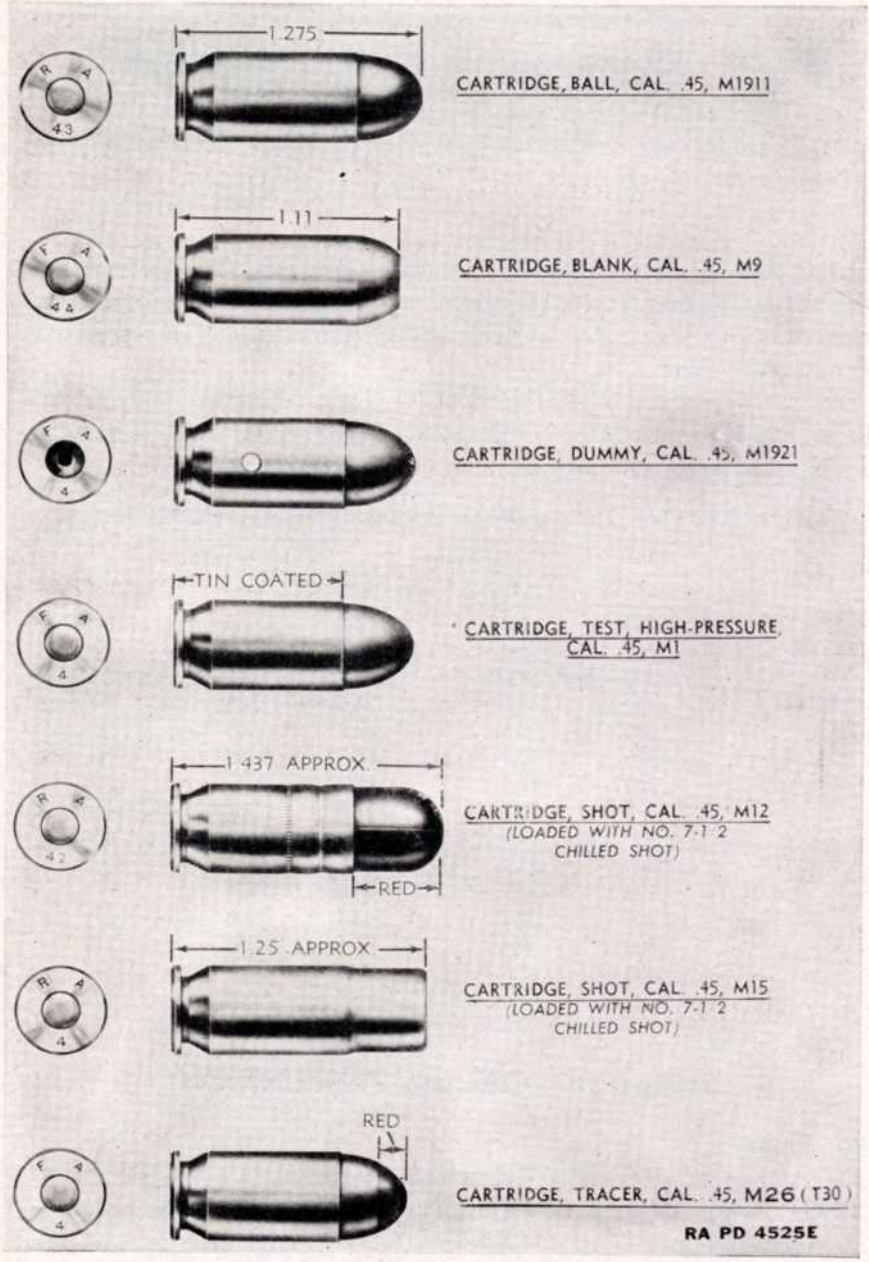


Figure 55. Cal..45 cartridges.

Table XXXIX. Component parts of cal..45 ammunition (Primer, No. 27, used in all cartridges listed below)

Cartridge	Cartridge case	Propellent powder	Bullet		
			Jacket	Slug	Tracer
Ball, M1911....	Brass or steel	Smokeless powder	Gilding metal or steel[1]	39 lead: 1 antimony	———
Blank, M9.....	Steel	E. C. blank	———	———	———
Dummy, M1921	Brass or steel	———	Gilding metal or steel[1]	39 lead: 1 antimony	———
HPT, M1.....	Brass or steel	Smokeless powder	Gilding metal or steel[1]	39 lead: 1 antimony	———
Shot, M12.....	Brass	Smokeless powder	Paper	#7½ chilled shot	———
Shot, M15.....	Brass	Smokeless powder		#7½ chilled shot	———
Special, reduced load...	Brass or steel	Smokeless powder	Gilding metal or steel[1]	39 lead: 1 antimony	———
Tracer, M26 (T30).	Steel	Smokeless powder	Steel[1]	39 lead: 1 antimony	Tracer and igniter composition

[1] Copper-plated steel or gilding metal clad steel.
[2] Cartridge case serves as jacket.

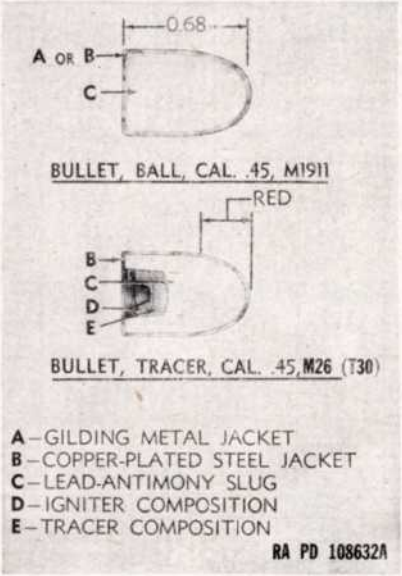
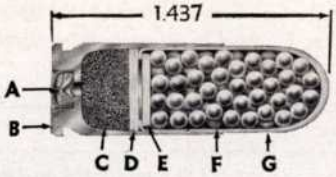
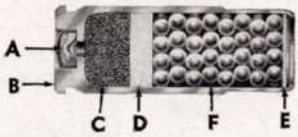


Figure 56. Cal..45 bullets—sectioned.



CARTRIDGE, SHOT, CAL. .45, M12



CARTRIDGE, SHOT, CAL. .45, M15

A—PRIMER
B—BRASS CARTRIDGE CASE
C—PROPELLENT POWDER
D—SEATING WAD
E—SHOT RETAINER
F—#7-1/2 CHILLED SHOT
G—RED PAPER JACKET

RA PD 108633

Figure 57. Cal..45 shot cartridges—sectioned.

Table XL. Weights of cal..45 ammunition
(In grains; maxima permitted in manufacture)

Cartridge	Complete (approx)	Cartridge case	Powder charge (approx)	Primer	Bullet			
					Complete	Jacket	Slug	Tracer
Ball, M1911....	322[1]	87	5	4.524	234	37	197	—
	or	or			or	or		
	310[2]	78			231	34		
Blank, M9.....	91	85	7	4.524	(0.6)[3]	—	—	—
Dummy, M1921.	313[1]	87	—	—	234	37	197	—
	or	or			or	or		
	301[2]	78			231	34		
HPT, M1.....	324[1]	87	7	4.524	234	37	197	—
	or	or			or	or		
	312[2]	78			231	34		
Shot, M12.....	255	87	6	4.524	171[3]	8.1	162[4]	—
Shot, M15.....	272	110	5	4.524	151.9[5]	[7]	149[6]	—
Special, reduced load...		87		4.524	234	37	197	—
		or			or	or		
		78			231	34		
Tracer, M26 (T30).....	293	78	6	4.524	210	34	171	8

[1] Brass case and gilding metal jacketed bullet.
[2] Steel case and steel-jacketed bullet.
[3] Weight of closing wad.
[4] Average weight of 125 to 131 #7½ chilled shot.
[5] Weight of seating wad, closing wad, and shot.
[6] Average weight of 113 to 123 #7½ chilled shot.
[7] Cartridge case serves as jacket.

91. Ballistic Data

Ballistic data are given in table XLI and additional data in the paragraph on each cartridge.

Table XLI. Ballistic data for cal..45 ammunition

Cartridge	Powder space (cu in.)	Ballistic coefficient (ft-lb/sq in.)	Average maximum chamber pressure (psi)	Time of flight to 100 yards (sec)	Muzzle energy (ft-lb)	Average velocities (fps)		Maximum range		Range of trace (yd)
						Muzzle	At 25.5 feet	Elev (deg)	Range (yd)	
Ball, M1911	0.058	0.112	17,000	0.34	358[1 3]	830[1]	820[1]	30	1,640[1]	——
					439[2 3]	920[2]	910[2]	30	1,760[2]	
Shot, M12..	None	——	17,000		——	——	820[4]			——
Shot, M15..	None	——	17,000		——	——	820[4]			——
Tracer, M26					388[1]	890[1]	850[1]	30	1,600[1]	
(T30).	850	——	17,000		480[2]	990[2]	950[2]	30	2,300[2]	260[5]

[1] In pistol and revolver.
[2] In submachine gun.
[3] For 234-grain bullet.
[4] At 40 feet; minimum velocity at this distance is 750 feet per second.
[5] A minimum of 90 percent of rounds fired shall be tracing at 150 yards when fired from a 10½-inch barrel.

92. Cartridge, Ball, Cal. .45, M1911

a. CARTRIDGE. This cartridge is a current standard item of issue and is used against personnel in the caliber .45 automatic pistols, revolvers, and submachine guns. It is also authorized for guard purposes. To adapt it for use in the revolvers, it must be assembled in clips designed for this purpose (par. 53 *e*). The cartridge is 1.275 inches long.

b. BULLET. The bullet consists of two parts: A gilding metal, gilding metal clad steel, or copper-plated steel jacket and a slug of lead hardened with antimony. In early designs bullet jackets were made of cupronickel and had a silvery appearance. This was later changed to gilding metal which was given thin tin wash resembling the cupronickel jacket. The practice of tinning the jackets has since been discontinued and the bullets of current design have the natural copper color of gilding metal. The over-all length of the bullet is 0.68 inch.

c. ACCURACY WITH MUZZLE REST. In the automatic pistol M1911 and M1911A1, the mean variations for several targets is given in table XLII.

Table XLII. Accuracy of ball cartridge, cal..45, M1911, in pistol

Range	Mean radii
Yards	*Inches*
25	0.86
50	1.36
75	2.24

749850°—48—8

d. TABLE OF FIRE. (1) For submachine guns, M1A1, and M3, muzzle velocity, 920 feet per second, the table of fire is given in table XLIII.

Table XLIII. Table of fire for ball cartridge, cal..45, M1911, in submachine guns, M1A1 and M3 (MV 920 ft per sec)

Range (yd)	Angle of elevation (mil)	Angle of fall (mil)	Time of flight (sec)	Terminal velocity (fps)	Maximum ordinate (yd)
0	0.0	0.0	0.00	920	—
50	3.0	3.3	.17	871	0.0
100	6.2	6.8	.34	831	.2
150	9.6	10.7	.52	798	.3
200	13.2	14.9	.71	769	.7
250	17.0	19.6	.91	743	1.1
300	20.9	24.5	1.11	719	1.7
350	25.1	30.0	1.32	696	2.3
400	29.4	36.0	1.54	673	3.2
450	34.0	42.6	1.77	650	4.2
500	38.8	49.8	2.00	628	5.4

(2) For table of fire for Thompson submachine gun, M1928A1, see FM 23–40.

e. PENETRATION. Penetration, using the automatic pistol M1911 and M1911A1, in white pine, is given in table XLIV.

Table XLIV. Penetration in white pine for ball cartridge, cal..45, M1911, fired from pistol

Depth	Range
Yards	*Inches*
25	6.0
50	5.8
75	5.6
100	5.5
150	5.2
200	4.6
250	4.0

The penetration in moist loam at 25 yards is about 10 inches. The penetration in dry sand at 25 yards is about 8 inches.

f. SPECIAL, REDUCED LOAD. This cartridge with a reduced charge of smokeless powder is used in the inspection and testing of weapons.

93. Cartridge, Shot, Cal. .45, M12 (Loaded with #7½ Chilled Shot)

a. CARTRIDGE. This cartridge is a substitute standard item of issue for use in caliber .45 pistols only. It is intended for use in hunting small game with the caliber .45 pistol. The cartridge must be chambered in the pistol by hand since its length, 1.437 inches, is too great to permit

magazine feeding. If it is necessary to remove the unfired cartridge from the chamber, the magazine must be removed, and the slide drawn back; the cartridge then drops through the magazine slot. The cartridges are packed 20 in a carton.

b. BULLET. The bullet consists of a red paper jacket held in the cartridge case by a plain groove and a knurled groove. The neck of the case has waterproofing applied before loading. The bullet contains 125 to 133 #7½ chilled shot and is held in place by a cardboard shot retainer in the base of the bullet. The bullet is 1.01 inches long.

c. PATTERN. For acceptance, fifty percent of the pellets must fall within a circle of 30-inch diameter when fired in a new barrel at 25 feet. The percentages of shot falling in a 30-inch circle in new and worn barrels at different ranges in performance tests, are given in table XLV.

Table XLV. Percentage of shot in 30-inch circle upon firing shot cartridge, cal..45, M12

	20 Feet	30 Feet	40 Feet
New barrel	80%	55%	46%
Worn barrel	87%	63%	55%

94. Cartridge, Shot, Cal. .45, M15 (Loaded with #7½ Chilled Shot)

a. CARTRIDGE. This cartridge is a standard item of issue for use in caliber .45 pistols only. It is intended for use in hunting small game with the caliber .45 pistol. In the firing of the M15 cartridge, it is necessary to remove the magazine in order to facilitate extraction of the fired shell; the fired case is then readily extracted by permitting it to drop through the magazine well upon drawing back the slide. Length of the cartridge is 1.265 inches. The cartridges are packed 20 in a carton. Two cartons are inserted in each AAF B–2 and B–4 emergency kit.

b. COMPONENTS. The cartridge case holds the primer and propelling charge, and also serves as a jacket for the chilled shot. The charge of 113 to 123 #7½ chilled shot is closed by a paper closing wad. A seating wad separates the shot from the propellent powder.

c. PATTERN. In a new barrel, 67 percent of the shot will fall within a 30-inch diameter circle at 25 feet. The percentages of shot falling in a 30-inch circle in new and worn barrels at different ranges are given in table XLVI.

Table XLVI. Percentage of shot in 30-inch circle upon firing shot cartridge, cal..45, M15

	20 Feet	30 Feet	40 Feet
New barrel	92%	66%	58%
Worn barrel	92%	86%	67%

95. Cartridge, Tracer, Cal. .45, M26 (T30)

a. CARTRIDGE. This cartridge is standard for use in all caliber .45 weapons for observation of fire, incendiary, and signal purposes. It is essentially the M1911 ball bullet with a tracer-filled cavity in the base. Early manufacture of T30 tracer cartridges was similar to that of the M1 tracer cartridges, now obsolete, except for a steel cartridge case and a different propellent powder. Length of the cartridge is 1.275 inches.

b. BULLET. The bullet consists of three parts: A copper-plated steel, or gilding metal clad steel jacket, which is painted red for a distance of approximately 3/16 inch from the tip, a slug of lead hardened with antimony in the forward portion of the jacket, and a tracer mixture in the rear portion The over-all length of the bullet is 0.690 inch. In early manufacture, T30 tracer bullets were 0.855 inch long and weighed 221 grains.

c. ACCURACY. Fires within a mean radius of 8 inches at 100 yards and 5 inches at 50 yards.

96. Cartridge, Blank, Cal. .45, M9

This cartridge is a current standard item of issue for use in caliber .45 automatic pistols and by the use of 3-round clips in caliber .45 revolvers. It is used for signaling purposes, firing salutes, training horses and dogs, and in maneuvers where simulated fire is desired. This cartridge can be fired single shot only in the automatic pistol. Its length is 1.108 inches. The cartridge is identified by the absence of a bullet and its tapered mouth.

97. Cartridge, Dummy, Cal. .45, M1921

This cartridge is a current standard item of issue and is used to train personnel in the operation of loading and unloading revolver and to simulate firing. It is also used as a range dummy cartridge in the automatic pistol. In this latter use it is mixed with live ammunition in pistol magazines, the purpose being to detect and correct flinching and faulty trigger squeeze. The cartridge is 1.275 inches long. This cartridge was formerly identified by its tinned case which either had no primer or had holes drilled in the side. Since March 1944, the dummy cartridge has been manufactured without a tinned case; this latter design can be identified by the empty primer pocket and two holes drilled in the side of the case. The ball bullet M1911 is used in this cartridge.

98. Cartridge, Test, High-Pressure, Cal. .45, M1

This cartridge is used for the proof-firing of caliber .45 weapons and barrels at the place of their manufacture. It contains a powder charge which will develop a breech pressure of approximately 21,000-23,000 pounds per square inch, this pressure being approximately 4,000 pounds in excess of that required in caliber .45 service ammunition. Due to the

danger involved in firing this cartridge, it should only be fired from a fixed rest under a hood, by means of a mechanical firing device, and only by authorized personnel. This cartridge is 1.275 inches long. It is readily identified by its tinned cartridge case. The gall bullet, M1911, is used in this cartridge.

Section VIII. CAL. .50 AMMUNITION

99. General

Ammunition for caliber .50 weapons is shown in figures 58 through 62. Caliber .50 bullets are shown sectioned in figures 63 and 64. Table XLVII lists the component parts of these cartridges and table XLVIII lists the weights of cartridges and components.

100. Ballistics

The trajectories of caliber .50 service types, except the incendiary M23 and API T49 cartridges, for aircraft use match at 600 yards. The time of flight does not differ by more than 1/10 second under specified conditions. The incendiary M23 and API T49 cartridges whose bullets weigh approximately 500 grains and have muzzle velocities of 3,450 feet per second, also have matched ballistics. Ballistic data are given in table XLIX and additional data in the paragraph on each cartridge.

101. Cartridge, Armor-Piercing, Cal. .50, M2

a. CARTRIDGE. This cartridge is a limited standard item of issue for caliber .50 machine guns. It is designed for use against armored aircraft, armored vehicles, concrete shelters, and similar bullet-resisting targets. The cartridge is 5.45 inches long. It may be identified by the black bullet tip.

b. BULLET. The bullet consists of three parts: A gilding metal jacket, a hardened core of tungsten-chrome or manganese molybdenum steel, and a point filler of an antimony-lead alloy. The over-all length of the bullet is 2.31 inches. The base has a 9-degree taper beginning 0.386 inch from the base.

c. ACCURACY. At the time of acceptance, this ammunition will group within a mean radius not greater than 10 inches at 600 yards.

d. TABLE OF FIRE. See table L.

e. DRIFT. For data see last column of table L.

f. PENETRATION. (1) Penetration in inches is given in table LI.

(2) Number of rounds required to defeat heavy reinforced concrete at 25 degree obliquity is given in table LII.

102. Cartridge, Armor-Piercing-Incendiary, Cal. .50, M8

a. CARTRIDGE. This cartridge is a current standard cartridge for caliber .50 machine guns. It replaces the incendiary cartridge M1 and

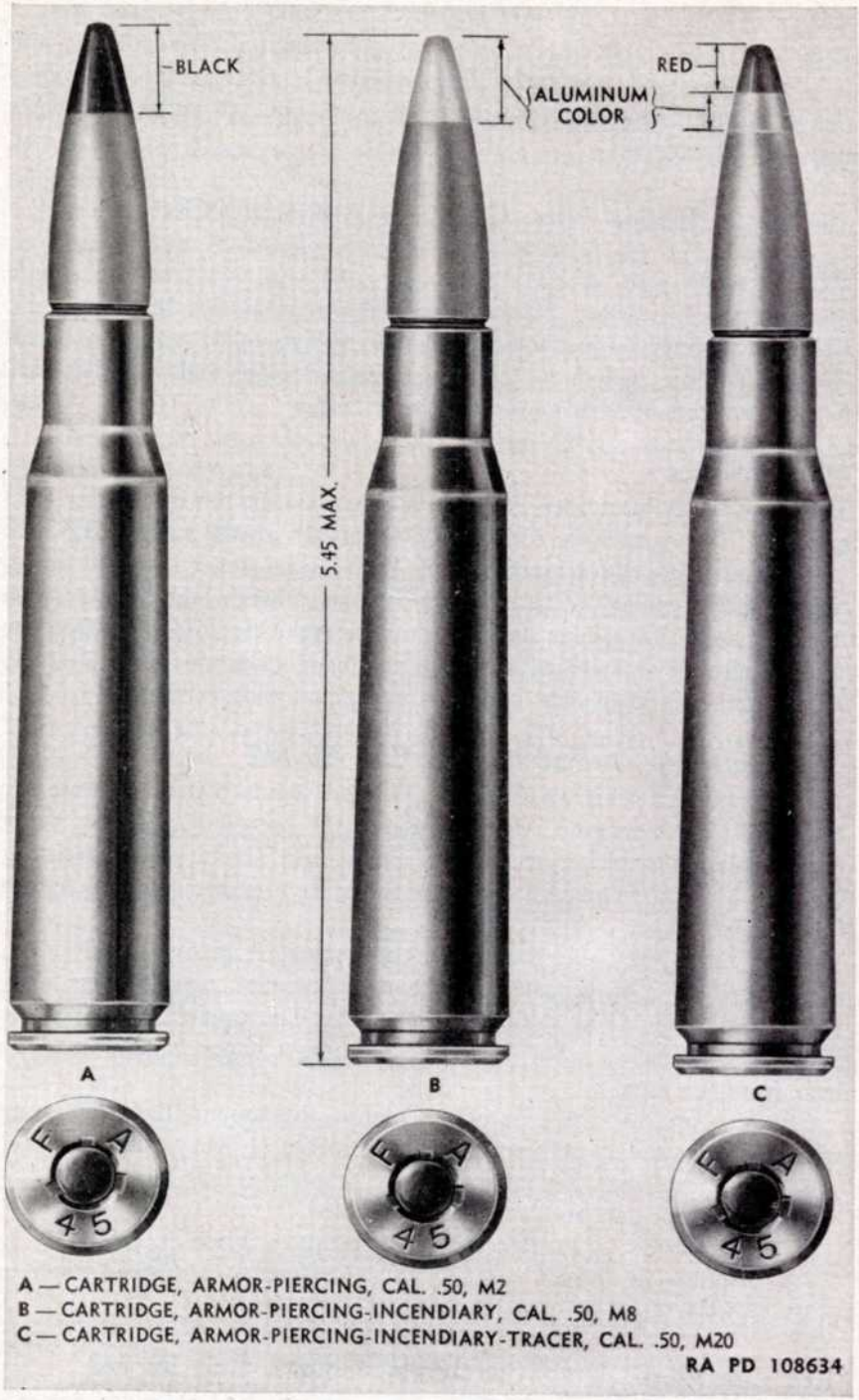


Figure 58. Cal..50 cartridges.

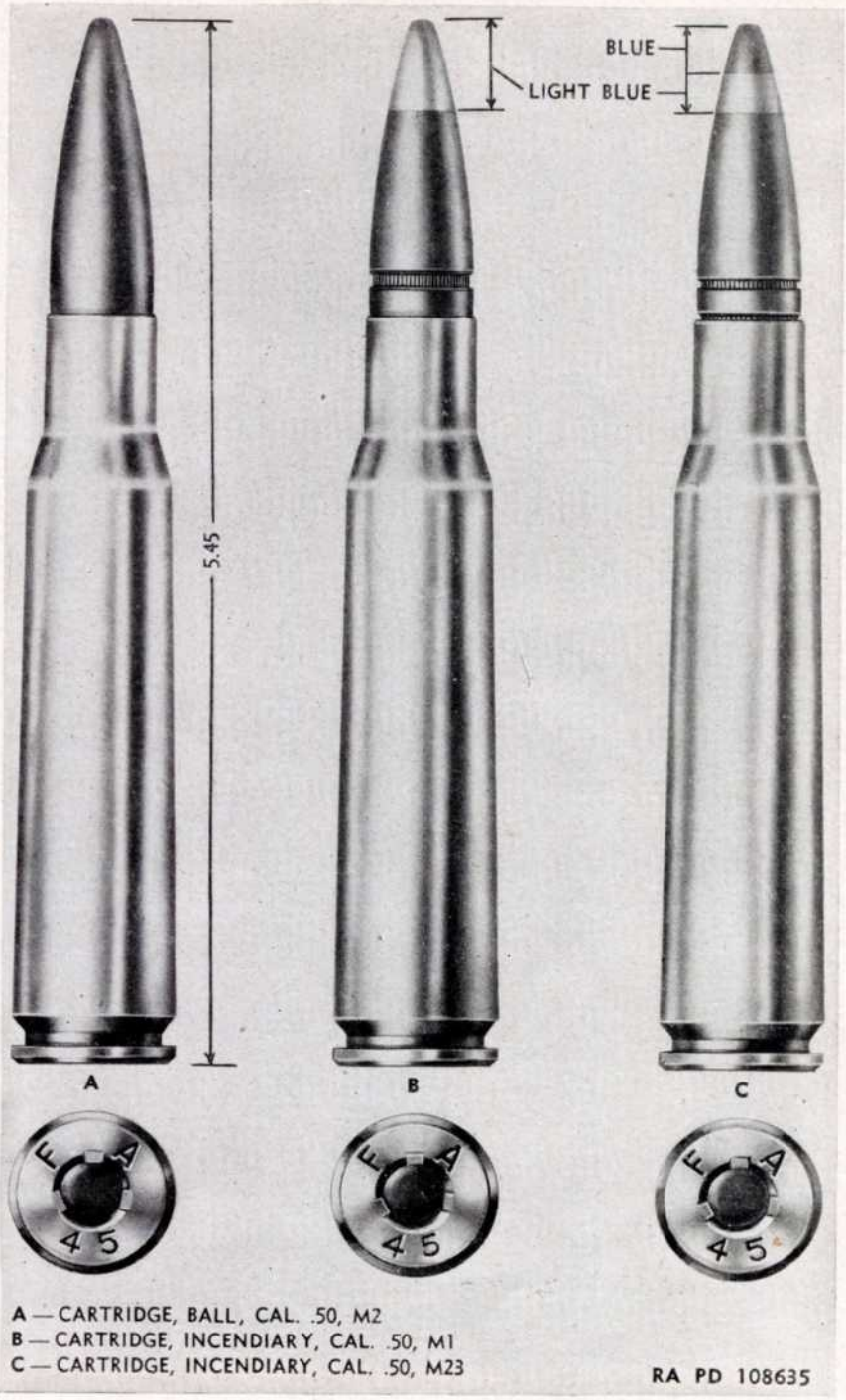


Figure 59. Cal..50 cartridges—continued.

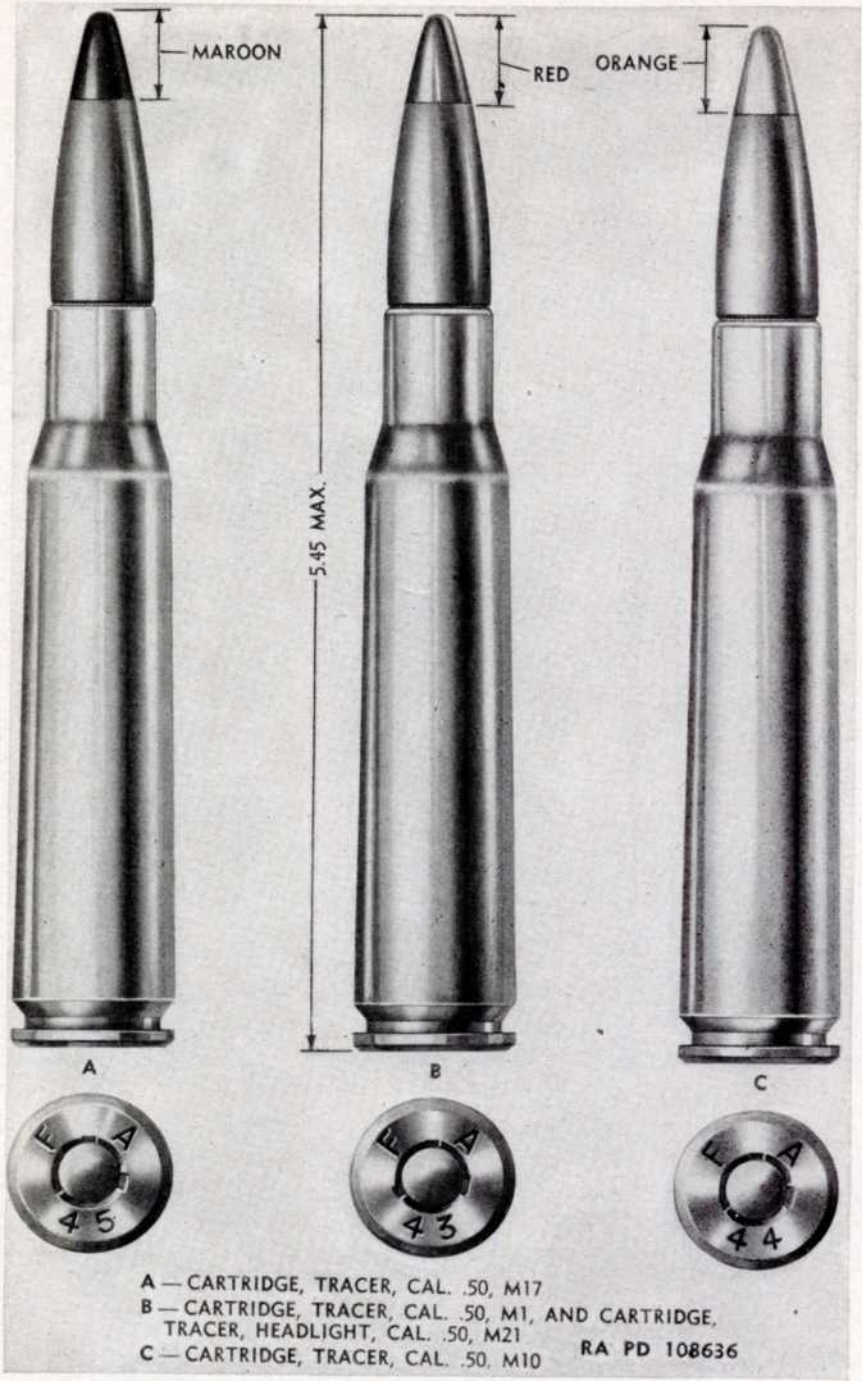


Figure 60. Cal..50 cartridges—continued.

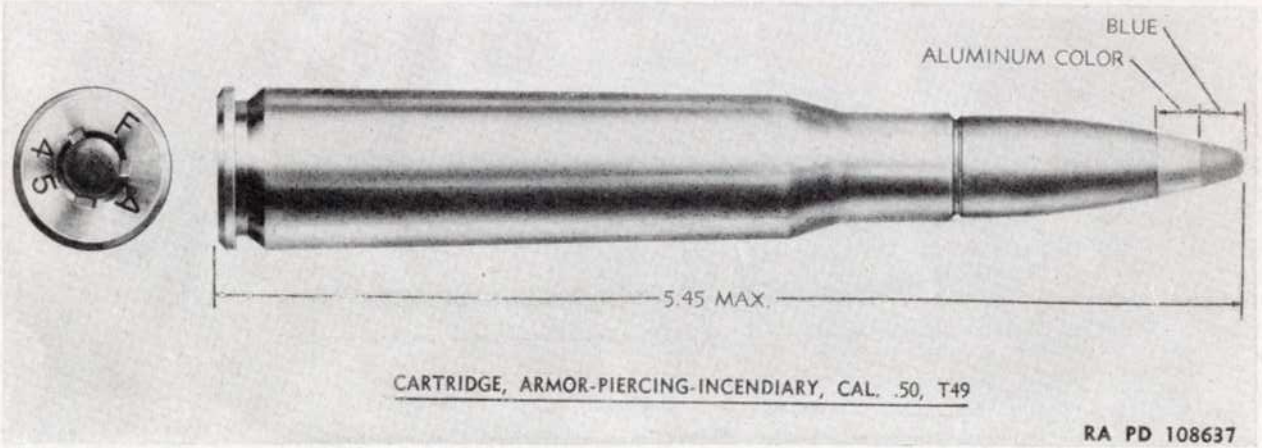


Figure 61. Cal..50 cartridges—continued.

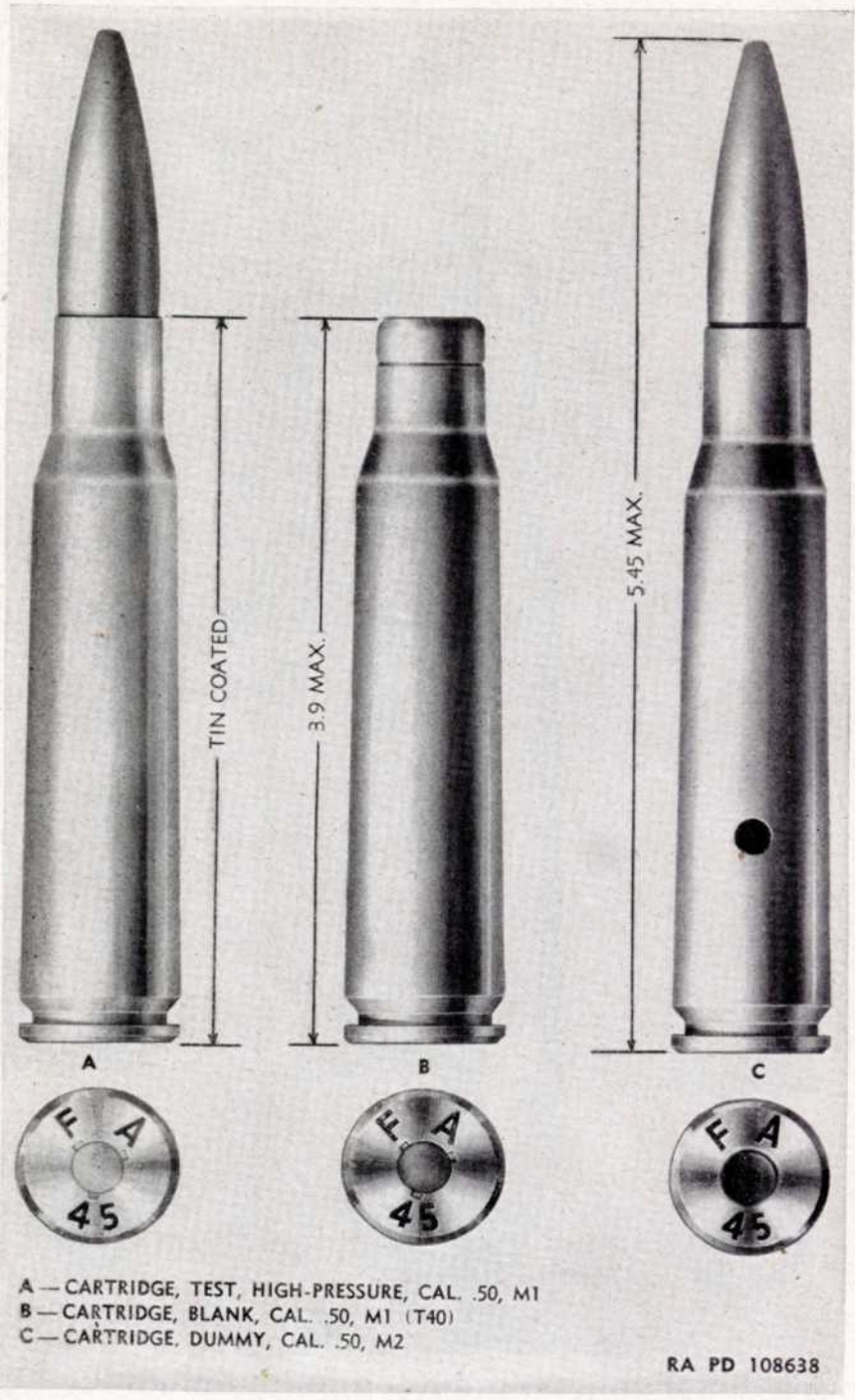


Figure 62. Cal..50 cartridges—continued.

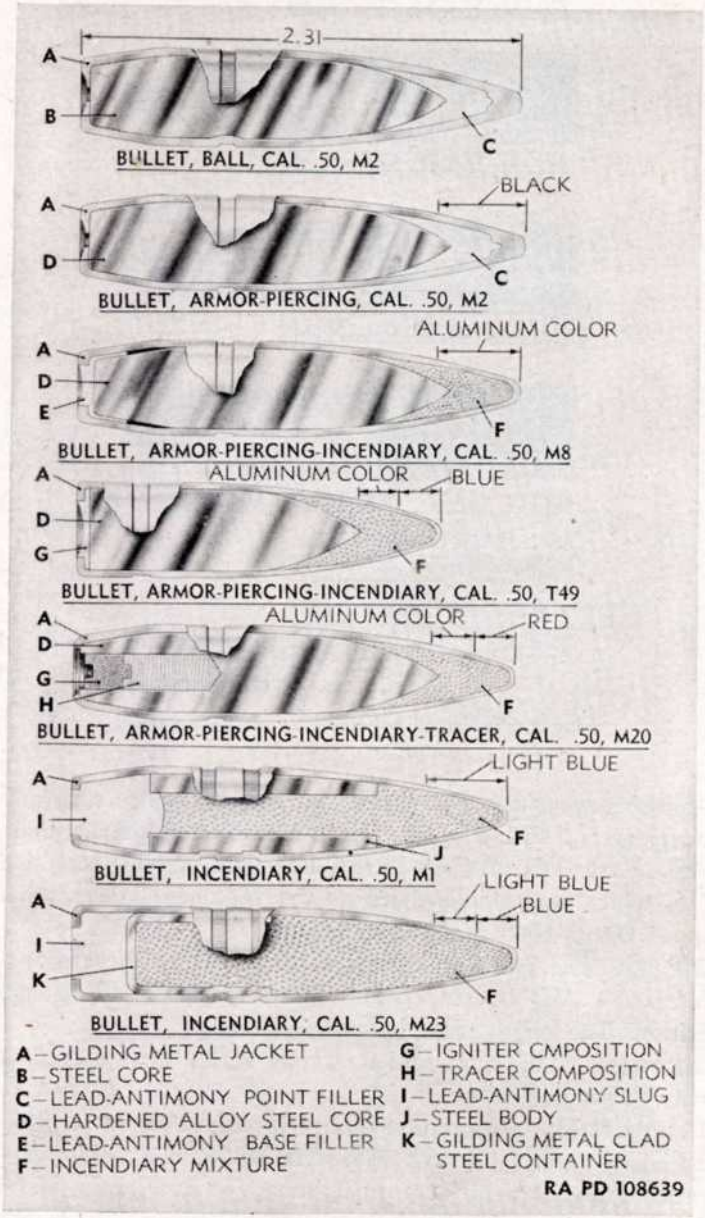


Figure 63. Cal..50 bullets—sectioned.

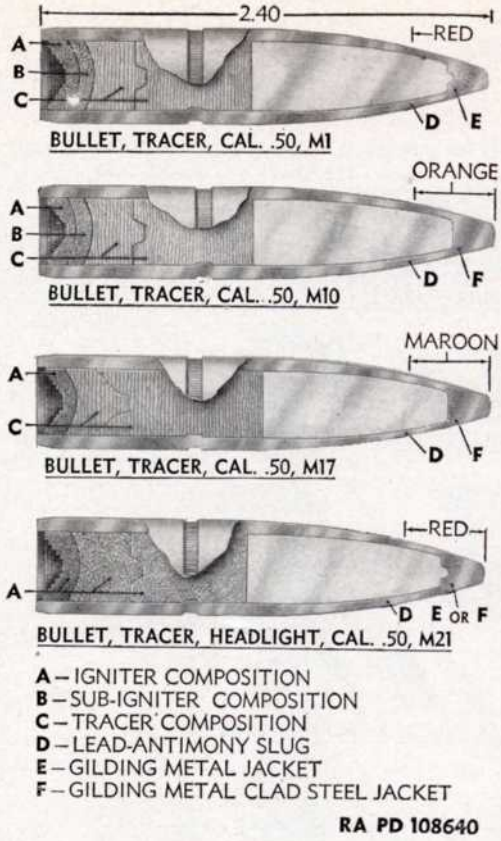


Figure 64. Cal..50 bullets—sectioned—continued.

armor-piercing cartridge M2 as standards for manufacture and issue. This cartridge is 5.45 inches long. It is identified by the aluminum color bullet tip. Early lots of CARTRIDGE, armor-piercing-incendiary, cal. .50, T16, which was standardized as the M8, had bullets which were blue-tipped with a black annulus to the rear.

b. BULLET. The bullet contains the same core as the armor-piercing bullet, cal. .50, M2, but the point filler is replaced by an incendiary composition. The length of the bullet is 2.31 inches.

c. ACCURACY. This ammunition groups within a mean radius of 12 inches at 600 yards.

d. PENETRATION. Penetration ability is almost equal to that of the armor-piercing bullet, cal. .50, M2. The bullet will perforate 7/8-inch homogeneous armor plate at normal impact at 100 yards, and 5/8-inch face-hardened plate at 30 degree impact at 100 yards. The ballistic limit at normal impact against 3/8-inch face-hardened plate is 2,467 feet per second, the ballistic limit at 30 degrees from normal is 2,264 feet per second.

Table XLVII. Component parts of cal..50 ammunition (Primer, No. 28 is used in all cartridges listed below)

Cartridge	Cartridge case	Propelling powder	Bullet			
			Jacket	Core (slug)	Point filler	Base filler
AP, M2	Brass	Smokeless powder	Gilding metal	Tungsten-chrome steel[2]	Lead-antimony	—
API, M8	...do...	....do...	..... do	..... do	Incendiary comp.	Lead
API, T49	...do...	....do...	..... do	Manganese-molybdenum steel	....do....	.... do ....
API-T, M20 (T28)	...do...	....do...	..... do	Tungsten-chrome steel[2]	Incendiary comp.	Tracer and igniter comp.
Ball, M2	...do...	....do...	..... do	Steel	Lead-antimony	—
Blank, M1 (T40)	...do...	EC blank	—	—	—	—
Dummy, M2:						
w/steel bullet	Brass[1]	—	Steel	[3]	[3]	—
w/gilding metal bullet jacket	...do...	—	Gilding metal	[3]	[3]	—
HPT, M1	Brass	Smokeless powder	..... do	Front / Rear: Lead-antimony	—	—
Incendiary, M1	...do...	....do...	..... do	Steel body Lead-antimony slug	Incendiary comp.	—
Incendiary, M23 (T48)	...do...	....do...	..... do	Clad steel container Lead-antimony slug	Incendiary comp.	—
Tracer, M1:						
w/gilding metal jacket	...do...	....do...	..... do	Lead-antimony	—	Tracer and igniter comp.
w/clad steel jacket	...do...	....do...	Gilding metal clad steel	..... do	—	
Tracer, M10	...do...	....do...	..... do	..... do	—	.... do ....
Tracer, M17 (T9)	...do...	....do...	..... do	..... do	—	.... do ....
Tracer, headlight, M21 (T1E1):						
w/gilding metal jacket	...do...	....do...	Gilding metal	..... do	—	.... do ....
w/clad steel jacket	...do...	....do...	Gilding metal clad steel	..... do	—	

[1] May also be manufactured with steel cartridge case.
[2] Alternative material is manganese-molybdenum steel.
[3] After 1 January 1943, no core, slug, or filler was used in manufacture of M2 dummy cartridge bullets.

Table XLVIII. Weights of cal..50 ammunition
(In grains; maxima permitted in manufacture)

Cartridge	Complete (approx)	Cartridge case	Powder charge (approx)	Primer	Bullet				
					Complete	Jacket	Core (slug)	Point filler	Base filler
AP, M2.....	1,822 or 1,812[1]	850	235	19.06	718 or 708[1]	253	410 or 400[1]	56.5	——
API, M8.....	1,739 or 1,726[1]	850	233	19.06	622 or 649[1]	—	—	——	——
API, T49.....	1,591	850	252	19.06	501	—	—	——	——
API-T, M20 (T28).....	1,698 or 1,686[1]	850	230	19.06	624 or 612[1]	—	—	——	Tracer and igniter comp.—14
Ball, M2.....	1,813	850	235	19.06	709.5	253	400	56.5	——
Blank, M1 (T40).....	891	850	46	19.06	——	—	—	(Wad, 1.5)	——
Dummy, M2: w/steel bullet.....	1,214	850[2]	—	——	364	364	[3]	[3]	——
w/gilding metal bullet	1,254	850[2]	—	——	404	404	[3]	[3]	——
HPT, M1.....	2,108	850	240	19.06	999	263	Front—325 Rear—411	——	——
Incendiary, M1.	1,703	850	240	19.06	628.5	—	—	——	——
Incendiary, M23 (T48)..	1,581	850	237	19.06	512	—	—	——	——
Tracer, M1: w/gilding metal jacket	1,789	850	240	19.06	681	408	207	——	Tracer and igniter comp.—70
w/clad steel jacket.....	1,750	850	240	19.06	641	368	207	——	
Tracer, M10....	1,750	850	240	19.06	641	368	207	——	Tracer and igniter comp.—70
Tracer, M17 (T9).....	1,742	850	225	19.06	648	368	207	——	Tracer and igniter comp.—77
Tracer, headlight, M21 (T1E1): w/gilding metal jacket	1,779	850	240	19.06	704	408	207	——	Tracer and igniter comp.—93
w/clad steel jacket.....	1,739	850	240	19.06	664	368	207	——	

[1] Weight with alternative manganese-molybdenum steel core.
[2] Steel cartridge case which may be used weighs 750 grains.
[3] After 1 January 1943, no bullet core, slug, or filler was used in manufacture of M2 dummy cartridges.

Table XLIX. Ballistic data for cal..50 ammunition

Cartridge	Powder space (cu in.)	Ballistic Coefficient (ft-lb/sq in)	Average maximum chamber pressure (psi)	Time of flight to 1000 yards (sec)	Muzzle energy (ft-lb)	Average velocities (fps)		Maximum range		Range of trace (yd)
						Muzzle	At 78 Feet	Elev (deg)	Range (yd)	
AP, M2.....	1.03	0.472	55,000	1.38[1]	12,846[1 3]	2,840[1]	2,810[1]	35	7,275[1]	——
					13,673[2 3]	2,930[2]	2,900[2]		7,400[2]	
API, M8.....	1.03	.443	55,000	1.40	12,780[1 3]	2,950[1]	2,910[1]	30	6,375[1]	——
					13,661[2 3]	3,050[2]	2,980[2]		6,470[2]	
API, T49.....			58,000		11,903[1]	3,450[1]	3,400[1]	30	5,500[1]	——
API-T, M20...	1.03	.443	55,000	1.40[1]	12,046[1 3]	2,950[1]	2,910[1]	30	6,375[1]	Dim, 300; Bright to 1,750
					12,877[2 3]	3,050[2]	2,980[2]		6,470[2]	
Ball, M2.....	1.03	.467	53,000	1.38[1]	12,694[1 3]	2,840[1]	2,810[1]	35	7,275[1]	——
					13,512[2 3]	2,930[2]	2,900[2]		7,400[2]	
Incendiary, M1.	1.02	.413	54,000	1.362	12,464[1]	2,990[1]	2,950[1]	35	5,960[1]	——
					13,312[2]	3,090[2]	3,050[2]		6,050[2]	
Incendiary, M23	1.03		58,000		13,518[1]	3,450[1]	3,400[1]	30	5,500[1]	——
Tracer, M1: w/gilding metal jacket..	1.013	.30	55,000	1.366	11,259[1]	2,730[1]	2,700[1]	30	5,470[1]	1,800
					12,356[2]	2,860[2]	2,830[2]		5,575[2]	
w/clad steel jacket.....	1.013	.468	55,000	1.366	11,958[1]	2,900[1]	2,860[1]	35	5,350[1]	1,800
					13,054[2]	3,030[2]	2,990[2]		5,450[2]	
Tracer, M10....	1.013	.45	52,000		11,958[1]	2,900[1]	2,860[1]	35	5,350[1]	Dim, 150; Bright to 1900
					13,054[2]	3,030[2]	2,990[2]		5,450[2]	
Tracer, M17....	1.013		54,000		12,089[1]	2,900[1]	2,860[1]	35	5,350[1]	2,450
					13,197[2]	3,030[2]	2,990[2]		5,450[2]	
Tracer, headlight, M21: w/gilding metal jacket	1.013				11,639[1]	2,730[1]	2,700[1]	30	5,470[1]	550
					12,774[2]	2,860[2]	2,830[2]		5,575[2]	

[1] Fired from 36-inch barrel.
[2] Fired from 45-inch barrel.
[3] Calculation based on weight of standard bullet.

103. Cartridge, Armor-Piercing-Incendiary, Cal. .50, T49

a. CARTRIDGE. This cartridge is a limited procurement item for use only in caliber .50 aircraft machine guns. It has a higher velocity than the API cartridge, cal. .50, M8 and is intended for use with the incendiary cartridge, cal. .50, M23 (T48), since it has similar exterior ballistics. This cartridge is 5.45 inches in length. It may be identified by the bullet tip, which is painted medium blue with an aluminum color annulus to the rear.

b. BULLET. The bullet has a square base and is shorter, being 1.935 inches in length, than API bullet, cal. .50, M8.

c. ACCURACY. At time of acceptance, average mean radius of all targets at 600 yards is not to exceed 12 inches. In actual firings, 5.52 and 6.16 inch mean radii at 600 yards have been obtained.

Table L. Table of fire for armor-piercing cartridge, cal..50, M2, in a 36-inch barrel (MV 2,800 ft per sec; based on ft 0.50–H–1)

Range (yd)	Angle of elevation (mil)	Angle of fall (mil)	Time of flight (sec)	Maximum ordinate (yd)	Remaining velocity (fps)	Drift right (mil)
0	0	0	0.00	—	2,800	0.0
200	1.3	1.5	.22	0	2,558	.0
400	2.8	3.3	.47	0	2,324	.1
600	4.6	5.6	.74	1	2,100	.1
800	6.6	8.6	1.04	1	1,885	.2
1,000	8.9	12.4	1.38	2	1,685	.2
1,200	11.6	17.4	1.76	4	1,502	.2
1,400	14.8	24.1	2.18	6	1,339	.3
1,600	18.5	32.8	2.66	10	1,199	.3
1,800	22.9	43.3	3.18	14	1,092	.4
2,000	28.1	55.5	3.74	19	1,027	.5
2,200	34.1	69.0	4.35	27	982	.6
2,400	40.7	83.7	4.98	36	941	.7
2,600	48.1	99.5	5.63	47	906	.8
2,800	56.1	116.3	6.31	60	875	.9
3,000	64.8	134.2	7.02	75	847	1.0

Table LI. Penetration in inches for armor-piercing cartridge, cal..50, M2 in 45-inch barrel (MV 2,935 ft per sec)

Material	At 200 yards		At 600 yards		At 1,500 yards	
	Average	Max	Average	Max	Average	Max
Armor plate (homogeneous)	—	1.0	—	0.7	—	0.3
Armor plate (face-hardened)	—	0.9	—	0.5	—	0.2
Sand (100 lb dry wt/cu ft)	12	14	9	12	14	16
Clay (100 lb dry wt/cu ft)	25	28	24	27	19	21

Table LII. Number of armor-piercing cartridges, cal..50, M2, required to defeat reinforced concrete at 25 degree obliquity

Thickness of concrete (feet)	Range	
	100 yards	200 yards
2.....	300	1,200
3.....	450	1,800
4.....	600	2,400
5.....	750	3,000

d. PENETRATION. The penetration ability is equal to that of the API bullet, cal. .50, M8.

104. Cartridge, Armor-Piercing-Incendiary-Tracer, Cal. .50, M20 (T28)

a. CARTRIDGE. This cartridge is a current standard item of issue for caliber .50 machine guns. It is similar to the armor-piercing-incendiary cal. .50, M8 cartridge, with the addition of a tracer element. Its use makes tracer cartridges unnecessary in machine gun belts. The cartridge is 5.45 inches long. It is identified by the tip of the bullet which is painted red with an aluminum annulus to its rear. Early lots of the T28 cartridge, now standardized as the M20, were identified by an olive-drab bullet tip.

b. BULLET. The bullet is similar to the armor-piercing-incendiary bullet, cal. .50, M8, but it differs in having a trace. Dim trace begins at approximately 20 feet from the muzzle to approximately 300 yards, where it changes to a bright trace which continues to approximately 1,750 yards, but not less than 1,600 yards.

c. ACCURACY. Average of mean radii shall not exceed 12 inches for targets at 600 yards.

d. PENETRATION. Complete penetration of 7/8-inch homogeneous armor plate, normal angle of incidence is obtained at 100 yards.

105. Cartridge, Ball, Cal. .50, M2

a. CARTRIDGE. This cartridge is a standard item of issue for caliber .50 machine guns. It is 5.45 inches long. The cartridge has no identification markings except for the conventional stamping on the base. The tip of the bullet is not painted.

b. BULLET. The bullet consists of three parts: A gilding metal jacket, a soft steel core, and a point filler of antimony-lead alloy. The over-all length of the bullet is 2.31 inches. The base has a 9-degree taper beginning at a point 0.386 inch from the base.

c. ACCURACY. At the time of acceptance, this ammunition will group within a mean radii not greater than 8.0 inches at 500 yards, or 9.0 inches at 600 yards, when fired from an accuracy rifle held in a V-block.

d. TRAJECTORY. The trajectory of this ammunition is the same as the trajectory of the armor-piercing cartridge, cal. .50, M2. Table L, paragraph 101 *d* is applicable to this cartridge.

e. PENETRATION. See table LIII.

106. Cartridge, Incendiary, Cal. .50, M1

a. CARTRIDGE. This cartridge is a limited standard item of issue for use in caliber .50 machine guns. The cartridge is 5.45 inches long. It may be identified by the bullet tip which is painted light blue, and by a second knurled cannelure rolled into the bullet jacket.

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Table LIII. Penetration in inches for ball cartridge, cal..50, M2, in 45-inch barrel (MV 2,935 ft per sec)

Material	At 200 yards		At 600 yards		At 1,500 yards	
	Average	Max	Average	Max	Average	Max
Sand (100 lb dry wt/cu ft)	12	14	9	12	14	16
Clay (100 lb dry wt/cu ft)	25	28	24	27	19	21
Concrete	—	2	—	1	—	1

b. BULLET. The bullet is similar in size and shape to the armor-piercing bullet, cal. .50, M2. Some incendiary bullets M1 may have a flat base; because of their low ballistic coefficient, cartridges containing these bullets have been regraded as grade MG. The incendiary bullet, cal. .50, M1 consists of a gilding metal jacket, a hollow cylindrical steel body, a lead-antimony base slug, and a core and point filler of incendiary composition. The bullet is 2.35 inches long.

c. ACCURACY. At time of acceptance, average mean radius of all targets at 600 yards is not to exceed 12 inches.

107. Cartridge, Incendiary, Cal. .50, M23 (T48)

a. CARTRIDGE. This cartridge is a standard item of issue for use only in caliber .50 aircraft machine guns. It has a higher velocity than the incendiary cartridge M1 and is more effective as an incendiary against aviation kerosene. The cartridge is 5.45 inches long. It may be identified by the bullet tip, which is painted medium blue with a light blue annulus to the rear.

b. BULLET. The bullet is similar in external appearance to the incendiary bullet M1. The M23 bullet consists of a gilding metal jacket, a clad steel container, a lead-antimony base slug, and an incendiary composition. The weight of incendiary composition is greater than that in the incendiary bullet M1. The length of the M23 bullet is 2.290 inches.

c. ACCURACY. At time of acceptance, average mean radius of all targets at 600 yards is not to exceed 12 inches.

108. Cartridge, Tracer, Cal. .50, M1

a. CARTRIDGE. This cartridge is a limited standard item for observation of fire in caliber .50 ground machine guns. It is limited to use in the continental United States and for training purposes only. It is replaced for combat (service) use by the tracer cartridge, cal. .50, M17. Care must be exercised when using this cartridge to prevent it from igniting dry vegetation on the range. This cartridge is 5.45 inches long. It is identified by the tip of the bullet which is painted red.

b. BULLET. The bullet consists of three parts: A gilding metal or a gilding metal clad steel jacket, a hardened lead slug which fills the forward end of the jacket, and tracer and igniter compositions which fill the balance. Unlike the bullets for armor-piercing and ball cartridges, this

Figure 65. 12-gage shotgun shells.

bullet is cylindrical to the base which is open to permit the propelling charge to ignite the tracer composition. The over-all length of the bullet is 2.40 inches. The trace begins at a distance not greater than 250 feet from the weapon; the range of the trace is about 1,600 to 1,800 yards.

c. ACCURACY. At the time of acceptance, this ammunition will group within a mean radii not greater than 20 inches at 600 yards.

109. Cartridge, Tracer, Cal. .50, M10

a. CARTRIDGE. This cartridge is standard for issue for observation of fire in all caliber .50 aircraft machine guns. It serves the same purposes as the tracer cartridge M1. The cartridge is 5.45 inches long. It may be identified by the bullet tip which is painted orange.

b. BULLET. The description and exterior ballistics for the tracer bullet M1 with gilding metal clad steel jacket are applicable to the tracer bullet M10, except that the M10 has a dim trace for the first 150 yards of flight followed by a bright trace to 1,600 to 1,900 yards.

110. Cartridge, Tracer, Cal. .50, M17 (T9)

a. CARTRIDGE. This cartridge is a substitute standard for the API–T cartridge, cal. .50, M20. It replaces the tracer cartridge M1, for use in caliber .50 ground machine guns, and may also be used in aircraft guns. The cartridge is 5.45 inches long. It may be identified by the bullet tip, which is painted maroon.

b. BULLET. The description and exterior ballistics for the tracer bullet M1 with gilding metal clad steel jacket are applicable to the tracer bullet M17, except that the M17 has a bright trace to approximately 2,450 yards of flight. Trace begins at a point not greater than 250 yards from the weapon.

111. Cartridge, Tracer, Headlight, Cal. .50, M21 (T1E1)

a. CARTRIDGE. This cartridge is standard for issue for caliber .50 aircraft machine guns for use in combat against other aircraft. When viewed from the front its trace is approximately three times as brilliant

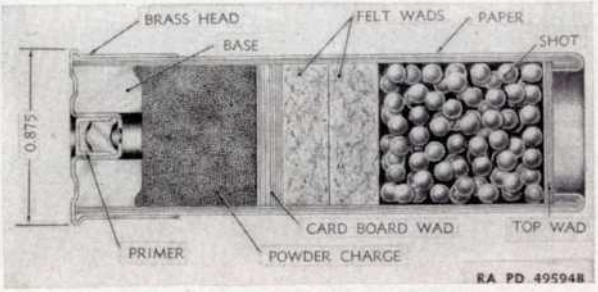

Figure 66. Paper shotgun shell—sectioned.

as the trace of the tracer bullet M1. This is due to the use of fast-burning tracer mixtures. The tracer M21 has some incendiary effect at 150 and 350 yards, but is negligible at 600 yards. The cartridge is 5.45 inches long. It may be identified by the bullet tip, which is painted red.

b. BULLET. The description and exterior ballistics of the tracer bullet M1 are applicable to the tracer bullet M21, except that the M21 has a very bright trace to approximately 550 yards.

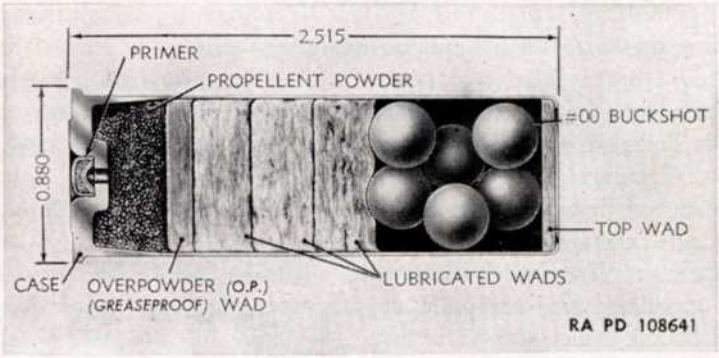

Figure 67. All brass shotgun shell—sectioned.

112. Cartridge, Blank, Cal. .50, M1 (T40)

This blank cartridge is a standard item for use in aircraft caliber .50 machine guns when these weapons are fitted with blank firing attachments for training operations. The cartridge is 3.910 inches long. It is identified by the absence of the bullet. The cartridge case has a slight annular groove about ¼ inch from the mouth; this serves as the seat for the wad. The wad is a disk punched out of strawboard sheet 1/16 inch thick; it is lacquered on both sides before insertion into the mouth of the case. After loading, a heavy coat of vermillion lacquer is applied to the wad and the mouth is crimped.

113. Cartridge, Dummy, Cal. .50, M2

a. CARTRIDGE. This cartridge is standard for use in all caliber .50 machine guns for training purposes. It may also be used for testing the mechanism of the gun. The cartridge is 5.45 inches long. Prior to March 1944, this cartridge was distinguished from live ammunition by the tin-coated cartridge case with three holes drilled in the side and an empty primer pocket. Cartridges of current manufacture are not tin-coated. Some cases of current manufacture may be of steel instead of brass.

b. BULLET. Bullets manufactured prior to 7 January 1943, of three parts, a tin-coated gilding metal jacket, a soft steel core, and a

point filler of hardened lead. Present manufacture does not use any core or point filler, but only a gilding metal or gilding metal clad steel jacket, making the cartridge lighter by about 315 grains. The bullet is 2.40 inches long and has a "square" (cylindrical) base.

114. Cartridge. Test, High-Pressure, Cal. .50, M1

a. CARTRIDGE. This cartridge is used for proof-firing of caliber .50 machine guns at the place of manufacture. The cartridge is loaded with a powder charge sufficient to develop a breech pressure from 60,000 to 65,000 pounds per square inch for any 10 consecutive shots. Due to this excessive pressure and the danger involved in firing, the guns under test are fired from a fixed rest under a hood by means of a mechanical firing device. This cartridge should be fired only by authorized personnel. The cartridge is 5.45 inches long. It is distinguished from other caliber .50 cartridges by the tinned cartridge case. Dummy cartridges manufactured prior to March 1944, which also have tinned cases, have holes drilled through the case.

b. BULLET. The bullet consists of a gilding metal jacket and a core made up of two lead-antimony slugs, a front slug and a rear slug. The length of the bullet is 2.42 inches. The bullet has a square base.

Section IX. 12-GAGE SHOTGUN AMMUNITION

115. General

a. Shotgun shells (shot shells) are procured by the Ordnance Department from several manufacturers for use in authorized 12-gage sporting and riot-type shotguns of pump action and autoloading types, of 2¾-inch chamber. Standardized shotgun shells of 12-gage are shown externally in figure 65 and sectioned in figures 66 and 67.

b. The 12-gage shotgun shells which have been standardized are:

(1) SHELL, shotgun, all brass, 12-gage, #00 buck, M19 (formerly: SHELL, shotgun, 12-gage, brass, loaded with smokeless powder and #00 buckshot).

(2) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #00 buckshot.

(3) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #7½ chilled shot.

(4) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #8 chilled shot.

(5) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #9 chilled shot.

c. Shotgun shells of 12-gage which have not been standardized but which are procured and handled by the Ordnance Department are:

(1) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #0 buckshot.

(2) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #4 chilled shot.

(3) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #4 drop shot.

(4) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #5 shot (chilled or drop).

(5) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #6 chilled shot.

(6) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder and #6 drop shot.

(7) SHELL, shotgun, 12-gage, paper, loaded with smokeless powder, #8 chilled shot and tracer.

d. Some 12-gage shotguns of earlier manufacture have 2⅝-inch chambers. Shotgun shells made to be fired in these 2⅝-inch chamber shotguns may be fired in the standard 2¾-inch chamber shotguns. Shotgun shells must not be fired in shotguns having chamber lengths less than those for which designed and those marked on packing cartons and boxes, because dangerously high chamber pressures may develop. Shotgun shells should only be fired in authorized issue shotguns. Upon proper authorization they may be fired in shotguns chambered for the particular shells described, having Fluid Steel barrels, and having actions in good condition. Under no circumstances should these shotgun shells be fired in shotguns having Damascus or other Twist Steel barrels.

116. Use

The intended use of different loadings of shotgun shells are given in table LIV.

Table LIV. Intended use of different shotgun shell loads

Shotgun shell loaded with—	Use	
	Service and Training	Hunting
#00 buckshot	Standard for combat and guard purposes only.	———
#0 buckshot	Combat and guard	———
#4 shot	———	Ducks, geese.
#5 shot	———	.....do.....
#6 shot	———	Ducks, geese, hawks, squirrels, rabbits.
#7½ shot (1¼ oz)..	Formerly standard for trap shooting. Replaced by #8 shot loaded shell.	Squirrels, rabbits.
#7½ shot (1⅛ oz)..	Formerly standard for trap and skeet shooting. Replaced by #8 shot loaded shell.	.....do.....
#8 shot	Standard for both trap and skeet shooting.	Woodcock, snipe, plover.
#9 shot	Formerly standard for skeet shooting. Replaced by #8 shot loaded shell.	.....do.....

117. Identification

a. CASE. These shells have waterproofed paper cases and metal heads. Most shells for guard and combat use have metal heads 0.80 inch or more in length; however, some have low metal heads of 0.35-inch length, or an all-brass case. Shells for sporting and hunting use have a head which is 0.35-inch minimum length, generally being ½ inch in length. Dimensions for 12-gage case are 0.797 inch in diameter at the mouth and 0.880 inch in diameter at the rim.

b. MARKING ON TOP WAD. Numerals and letters marked on top wads indicate the quantities of propellant and the weight and size of shot load, for example "3—1⅛—8C" indicates 3 drams equivalent of bulk smokeless powder and 1⅛ ounces of No. 8 chilled shot. In addition, the name or symbol of the manufacturer of the shell and of the powder may be stamped on the top wad.

c. MARKING ON CASE. Some shotgun shells have the information stamped on the closing wad repeated on the paper case. The trade name and type of load (for example, "Trap," "Skeet," etc.) is sometimes stamped on the case.

d. MARKING ON METAL HEAD. The stamping on the metal head generally consists of initials and symbol of manfacturer, gage size of shell, and trade name for the particular type of shotgun shell. Table LV lists these markings.

Table LV. Markings on metal heads of shotgun shells

Manufacturer	Marking on head for—	
	Guard and combat load	Sporting load
Federal Cartridge Co...	Federal No. 12 Hi Power	Federal No. 12 Monark.
Peters Cartridge Co.....	P-Peters No. 12 DeLuxe Target	P-Peters No. 12 Victor.
	P-Peters No. 12 High Velocity	
	P-Peters No. 12 Ideal	
	P-Peters No. 12 Premier	
Remington Arms Co....	Rem UMC No. 12 Arrow	Rem UMC No. 12 Shur-shot.
	Rem UMC No. 12 Nitro Express	Rem No. 12 Economy.
Western Cartridge Co...	Western No. 12 Record	Western No. 12 Xpert.
	Western No. 12 Super X	
Winchester Repeating Arms Co.....	WRA 12 Leader	WRA 12 Ranger.
	WRA 12 Superspeed	
U.S. Cartridge Co.....	U.S. No. 12 Ajax	U.S. No. 12 Defiance.

e. PACKING CONTAINERS. Cases and cartons of this ammunition bear the commercial markings of the manufacturer and also the lot number, type of load, and the phrase "U.S. Property." These markings generally include manufacturer's name and address, quantity, gage size, gun chamber length, type of ammunition, type of propellent powder, and trade names as indicated in table LV.

118. Description

Shotgun shell cases are described in paragraph 45 *h*, primers in paragraph 46, and smokeless powder, "bulk" and "dense," in paragraph 47. The shot used in these shells, together with the definition of "gage" and the sizes and diameters of weapon bore, wads, and shot, are described in paragraph 49; see table XII and figure 34. Table LVI lists the weights of 12-gage shotgun shells and their components.

Table LVI. Weights of 12-gage ammunition

Cartridge	Complete approx (grains)	Propelling charge (grains)	Shot (ounces)	No. of shot
#00 buck, all brass, M19	930	26[1]	1⅛	9
#00 buck, paper	800	26[1]	1⅛	9
#0 buck		26[1]	1⅜	12
#4, drop		23[2]	1⅛	149
#4 chilled		23[2]	1⅛	153
#5 drop		23[2]	1⅛	189
#5 chilled		23[2]	1⅛	194
#6 drop		23[2]	1⅛	245
#6 chilled	720	23[2]	1⅛	251
#7½ chilled[3]		23[2]	1⅛	388 ± 15
#7½ chilled[4]	794	23[2]	1¼	431
#8 chilled	775[5]	23[2]	1⅛	460 ± 20
#9 chilled	741	23[2]	1⅛	660 ± 40

[1] Weight in grains of "dense" smokeless powder of which a 26-grain charge is a 3¾-dram equivalent of bulk smokeless powder.
[2] Weight in grains of "bulk" smokeless powder of which a 23-grain charge is a 3-dram equivalent.
[3] Procured in accordance with spec. 50–5–1B.
[4] Procured in accordance with spec. 50–5–1A.
[5] Weight when loaded with #8 chilled shot and tracer is 745 grains.

119. Ballistic Data

a. Patterns. Shotgun shells and their shotguns are so designed or chosen as to produce the desired pattern of pellets at the desired distance. Thus, trap loads are most effective at 40 yards from the muzzle with a full choke barrel, and skeet loads at 25 yards with a cylinder bore barrel. Patterns are generally expressed as the percentage of total shot falling within a 30-inch circle at a distance of 40 yards from the muzzle. The type of barrel boring of the weapon is classified according to these patterns as given in table LVII. To about 20 feet, there is little difference in patterns for any type of barrel boring or degree of choke. After the shot have traveled to 10 to 15 yards, the pattern begins to spread rapidly and to show the effect of type of barrel boring.

b. Table of Data. Although there are slight differences in shotgun shells of different manufacture (powder charge, etc), the data in table LVIII are considered substantially correct.

c. Table of Fire. Table LIX indicates the pattern or dispersion as a percentage of the total number of shot falling within a circle of 30-inch

Table LVII. Type of barrel boring used in shotguns

Barrel boring	Pattern percentage in 30-inch circle at 40 yards
Full choke	70%
Modified choke	60%
Improved cylinder	50%
Cylinder	40%

Table LVIII. Ballistic data for 12-gage shotgun shells.

Shotgun shells loaded with Shot	Dram equivalent of "bulk" powder	Average maximum pressure (psi)	Time of flight to 40 yards (sec)	Average velocities over 40-yd range (fps)	Pattern in percent of shot in 30-in. circle at 40 yards	Maximum range: Elev (deg)	Maximum range: Range (yd)	Maximum effective range (yd)
#00 buck.....	3¾	11,000[1]	0.112	1,070[1]	33⅓%[2] 60%[3] 75%[1]	30	600[1]	75[1,3]
#0 buck.....	3¾	11,000[1]				30		
#4.....	3	11,000[1]	.127	945[1]		30		
#5.....	3	11,000[1]	.130	925[1]		30		
#6.....	3	11,000[1]	.133	905[1]		30		
#7½ (1⅛ oz)	3	11,000[1]	.138	870[1]	65%[1] 40%[3]	30		50[1] 35[3]
#7½ (1¼ oz)	3	11,000[1]	.141	850[1]	65%[1] 40%[3]	30		50[1] 35[3]
#8.....	3	11,000[1]	.140	855[1]	60%[1] 40%[3]	30	230[1]	50[1]
#8, w/tracer..	3	11,500[3]		1,000[4]	60%[1] 40%[3]	30	230[1]	50[1]
#9.....	3	11,000[3]	.154	815[1] 940[4]	60%[1] 40%[3] 50%[4]	30	210[1]	30[3]

[1] When fired in 30-inch full choke barrel.
[2] When fired in 20-inch cylinder bore barrel.
[3] When fired in 26-inch cylinder or skeet bore barrel.
[4] When fired in 26-inch cylinder or skeet bore barrel over 25 yards.

diameter at the range indicated. The approximate pattern spread is also indicated. These values are only approximate since there is considerable variation in shotgun ballistics. This variation may be due not only to a particular loading but also to atmospheric conditions.

d. Dispersion and Maximum Range. Table LX gives dispersion at target distance of 90 feet, and maximum range data for 12-gage shotgun shells. The guns listed in the note to the table are representative of all the 12-gage guns in use. It should be noted that two or more pellets of shot may stick together and due to increased mass will travel farther than a single pellet. Also, the tracer pellet (a small steel, lead-cored capsule) used in some No. 8 chilled shot loaded shell may travel to a greater distance than indicated in the table and requires additional protection for personnel in firings. Personnel located in the immediate

Table LIX. Percentage of shot in 12-gage shotgun shells falling within a 30-inch diameter circle

Range in yards	Guard or combat load[1]		Sporting trap or skeet load[2]		Sporting skeet load[3] fired in 26-inch cylinder bore barrel
	Fired in 30-inch full choke barrel	Fired in 26-inch cylinder bore barrel	Fired in 30-inch full choke barrel	Fired in 26-inch cylinder or skeet bore barrel	
5	100%	100%	—	—	—
10	100%	100%	—	—	—
15	100%	100%	—	—	—
20	100%	100%	100%	75%	87%
25	100%	100%	100%	57%	66%
30	100%	100%	90%	45%	59%
35	90%	70%	80%	40%	43%
40	75%	60%	70%	33%	33%
45	—	—	—	—	—
50	50%	38%	—	—	—
55	—	—	—	—	—
60	35%	25%	—	—	—
Maximum effective range	60-75 yd	60-75 yd	45-50 yd	30-35 yd	25-30 yd
Pattern spread per yd	¾ in.	1 in.	9/10 in.	1⅛ in.	1⅛ in.

[1] Contains 9 (1⅛ oz) No. 00 buckshot.
[2] Contains 1¼ oz or 1⅛ oz No. 7½ chilled shot. The 1¼ oz No. 7½ shot load is for trap shooting with 30-inch full choke barrel; the 1⅛ oz No. 7½ shot load is for either trap shooting with 30-inch full choke barrel or skeet shooting with 26-inch cylinder bore barrel.
[3] Contains 1⅛ oz No. 9 chilled shot.

Table LX. Dispersion at range of 90 feet and maximum range for 12-gage shotgun shells

Shotgun	Ammunition shot load	Elevation (degrees)	Range* yards (maximum)	Means of Extremes					
				Horizontal		Vertical		Spread	
				Inches	Mils	Inches	Mils	Inches	Mils
Ithaca, M37....	00 Buckshot.	25	570	17.55	16.6	17.05	16.1	20.00	18.9
Remington, M31.		29	590	19.98	18.8	22.30	21.0	25.06	23.6
Savage, M720...		26½	550	24.50	23.1	24.39	23.0	29.92	28.2
Ithaca, M37.....	No. 8 Chilled shot.....	31½	230	51.40	48.5	44.13	41.6	54.76	51.6
Remington, M31.		28½	222	66.33	62.6	61.30	57.8	72.60	68.5
Savage, M720...		30	220	65.55	61.8	70.95	66.9	78.55	74.1
Ithaca, M37.....	No. 9 Chilled shot.....	28	210	61.95	58.4	63.15	59.6	69.17	65.2
Remington, M31.		32	205	66.99	63.2	81.22	76.6	87.00	82.1
Savage, M720....		30	200	69.32	65.4	88.72	83.7	94.24	88.9

* Based on pellet giving longest range, corrected to approximately standard air density.

Note: The Ithaca, M37, No. 29416, with a 28-inch full choke tube.
The Remington, M31, No. 23612, with a 26-inch cylinder bore tube.
The Savage, M720, with a 20-inch cylinder bore tube.

vicinity of the line of fire should be protected by a suitable barrier having at least a double thickness of 1-inch boards on the exposed side.

e. MAXIMUM RANGE AT LOW ANGLES. Approximate maximum ranges may be determined for a gun held horizontal or at very slight elevation by Journée's formula. This formula states that the maximum range in yards is roughly 2,200 times the shot diameter in inches. Table LXI is based on this formula.

Table LXI. Maximum ranges of shot (based on Journée's formula)

Shot size	Diameter in inches (fig. 36)	Maximum range in yards
00 buckshot	0.34	748
0 buckshot	.32	704
1 buckshot	.30	660
1	.16	352
2	.15	330
3	.14	308
4	.13	286
5	.12	264
6	.11	242
7½	.095	209
8	.09	198
9	.08	176

It must be remembered that two or more pellets of shot which stick together will travel farther than a single pellet.

Section X. 10-GAGE BLANK AMMUNITION

120. Cartridge, Blank, 10-Gage, for 37-MM Guns, M1916, M3, and M6

The CARTRIDGE, blank 10-gage (fig. 68), is used with appropriate adapters in lieu of blank ammunition for 37-mm guns, M3, M6, and M1916. The adapters consist of a standard cartridge case modified in

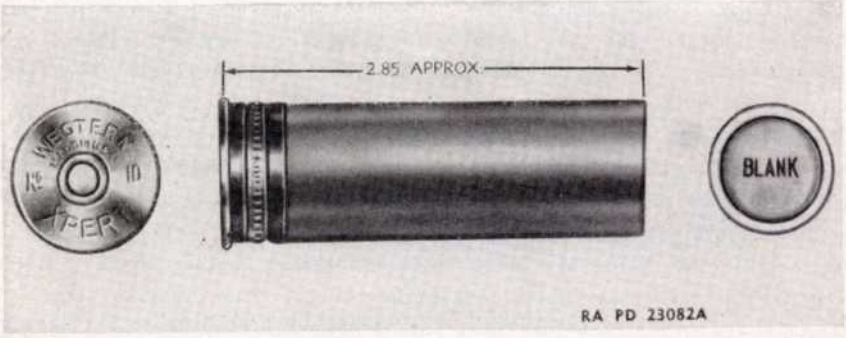

Figure 68. 10-Gage, blank cartridge, for 37-MM guns, M1916, M3 and M6.

accordance with GA 1785 for the M3 and M6 guns, and with GA 1786 for the M1916 gun. This cartridge was formerly listed as SHELL, shotgun, 10-gage, blank. This ammunition is of commercial manufacture. The charge is black powder weighing 8 grains, and is kept in place by means of dry felt pads. This cartridge is 2⅞ inches long and weighs approximately 280 grains.

Section XI. MACHINE GUN TRAINER, AA, M9, AMMUNITION

121. Description

a. This gun is similar in dimensions to a caliber .50 water-cooled AA machine gun. It is an electrically controlled pneumatic device for shooting ⅜-inch diameter plastic pellets on a 1/30 scale range at moving targets at a range of 50 feet, to simulate the time of flight of a caliber .50 bullet under actual firing conditions. There are two types of pellets, white pellets and red fluorescent pellets. The best visibility is obtained by shooting white pellets against a dark background. Red pellets are used to simulate night firing of tracers, and contain a fluorescent dye which causes them to become visible as they pass through the ultraviolet light on their course. The same pellets can be used many times if kept clean. Dirty pellets may be readily cleaned by washing in soapy water.

b. The time of flight of the pellet to 50 feet is 0.58 second; this is comparable to the time of flight of a caliber .50 bullet to 500 yards which is 0.60 second. The gun will normally discharge pellets accurately enough to place 75 percent of them in a 6-inch circle on a 50-foot range, which is equivalent to the accuracy of a caliber .50 machine gun. Pellets ejected from the machine gun trainer with the normal air pressure of 20 pounds have sufficient force to penetrate such material as heavy cardboard.

CHAPTER 4

MISCELLANEOUS SMALL-ARMS AMMUNITION

Section I. GENERAL

122. Scope

In this chapter the following cartridges are described: Caliber .32, caliber .38, and 9-mm ammunition; shotgun ammunition of 16-gage, 20-gage, and .410-gage; and the caliber .45 blank line-throwing cartridge. Ammunition lot numbers are ordinarily assigned by the manufacturer and should be used for reporting any defect or malfunctioning. Special ballistic and surveillance tests are directed by the Chief of Ordnance whenever there are indications that ammunition is unfit for use.

Section II. CAL. .32 AMMUNITION

123. General

The caliber .32 automatic Colt pistol (.32 A.C.P. or 7.65-mm) cartridge is shown in figure 69. The caliber .32 S. & W. revolver cartridge is also described in this section. Table LXII lists the weights of the caliber .32 A.C.P. and S. & W. cartridges and their comporents.

Table LXII. Weights of cal..32 ammunition (in grains)

	Cal..32 A.C.P.	Cal..32 S.&W.
Complete cartridge, approx.	115	120
Cartridge case		
Powder charge	(4.5, Du Pont No. 80 (2.2, Pistol powder No. 6 (2.6, Pistol powder No. 5 (2.3, Bullseye	(3.5, Du Pont No. 80 (1.4, Bullseye
Primer	3.065	3.065
Bullet	71 or 74	85 or 88
Jacket		—
Core		—

124. Ballistic Data

Ballistic data are given in table LXIII and additional data in the paragraph on each cartridge.

Table LXIII. Ballistic data for cal..32 ammunition

Cartridge	Powder space (cu in.)	Ballistic coefficient (ft-lb/sq in.)	Average maximum chamber pressure (psi)	Muzzle energy (ft-lb)	Average velocities (fps)		Maximum range	
					Muzzle	At 25 feet	Elev (deg)	Range (yd)
Cal..32 A.C.P.	0.019	0.123	14,000	(151[1] (158[2]	980	950		
Cal..32 S. & W.	0.026	0.112	8,000	(98[3] (101[4]	720	700		

[1] 71-grain bullet.
[2] 74-grain bullet.
[3] 85-grain bullet.
[4] 88-grain bullet.

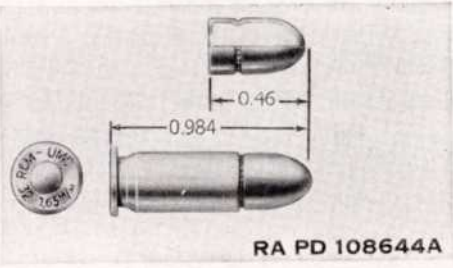

Figure 69. Ball cartridge, cal..32, colt automatic pistol, 71- or 74-grain bullet (7.65-MM).

125. Cartridge, Ball, Cal. .32, Colt Automatic Pistol, 71- or 74-grain Bullet (7.65-MM)

a. CARTRIDGE. This cartridge is of the semirimmed type and is for use in caliber .32 automatic pistols. It is also known as the 7.65–mm automatic pistol cartridge. The cartridge is 0.984 inch long and the case is 0.680 inch long. Diameter of the case at the head is 0.354 inch and at the mouth, 0.331 inch.

b. BULLET. The bullet consists of a gilding metal jacket and a lead alloy core. The jacket is cannelured at the point where the case is crimped to the bullet. The bullet is 0.46 inch long. It will penetrate five ⅞-inch pine boards.

126. Cartridge, Ball, Revolver, Cal. .32, S.&W., 85- or 88-Grain Bullet

a. CARTRIDGE. This cartridge is for use in revolvers chambered for the caliber .32 S. & W. cartridge, such as the caliber .32 S. & W. revolver, but may also be used in weapons chambered for the caliber .32

S. & W. long cartridge (also for the cal. .32 Colt New Police Cartridge), such as Pocket Positive and Police Positive revolvers. The cartridge is 0.92 inch long and the case is 0.60 inch long. Diameter of the case at the head is 0.374 inch and at the mouth, 0.336 inch.

b. BULLET. The bullet is made of lead-antimony alloy and is inside-lubricated, that is, the bullet cannelure containing the lubricating compound is hidden by the neck of the case in the assembled cartridge. The bullet is 0.54 inch long. It will penetrate 3½ pine boards, each ⅞ inch thick.

Section III. 9-MM AMMUNITION

127. Cartridge, Ball, 9-MM, M1, 116-Grain Bullet (Parabellum)

a. CARTRIDGE. This cartridge (fig. 70) may be fired in the submachine gun M3 converted to 9-mm operation by changing bolt and barrel; in Soumi submachine guns; in British 9-mm Sten and Lancaster machine carbines; in German 9-mm Pistole 08 (Luger), Pistole 38 (Walther), Machine Pistole 38 and 40, and Bergman and Solothurn machine carbines; and in Italian 9-mm (parabellum) Pistola 08 and Berretta machine carbine Mod 38. Table LXIV lists the weights of cartridge and components. The cartridge is 1.169 inches long and the case is 0.754 inch long. Diameter of the case at the head is 0.394 inch and at the neck, 0.377 inch.

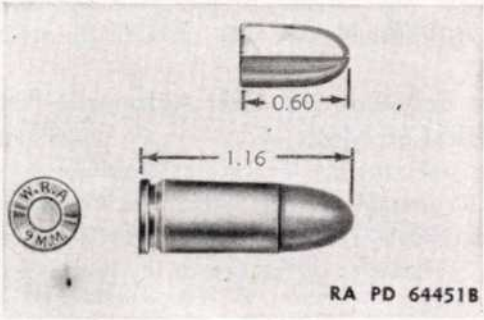

Figure 70. Ball cartridge, 9-MM, M1, 116-grain bullet (parabellum).

Table LXIV. Weights of ball cartridge, 9-MM, M1
(In grains; maxima permitted in manufacture)

Complete cartridge, approx	182
Cartridge case	57
Powder charge, approx	6
Primer, approx	3.00
Bullet	116
Jacket	24.5
Core	91.5

b. BULLET. The bullet consists of a gilding metal jacket and a lead-antimony slug. It is 0.60 inch long.

c. BALLISTIC DATA. Ballistic data for this cartridge is given in table LXV.

Table LXV. Ballistic data for ball cartridge, 9-MM, M1

Powder space (cu in.)	0.033
Ballistic coefficient (ft lb/sq in.)	
Average maximum chamber pressure (psi)	40,000
Time of flight to 100 yards (sec)	
Muzzle energy (ft-lb)	504
Average velocities (fps):	
At muzzle	1,400
At 25 feet	1,390 ± 25
Maximum range:	
Elevation (deg)	
Range (yd)	

d. PENETRATION. The bullet will penetrate ten 7/8-inch pine boards.

Section IV. CAL. .38 AMMUNITION

128. General

Ammunition cartridges and bullets, for caliber .38 weapons are shown in figure 71 and for caliber .38 special revolvers in figure 72. Cartridges for five types of caliber .38 weapons are covered in separate paragraphs in this section. Table LXVI lists the weights of cartridges and components.

129. Ballistic Data

Ballistic data for caliber .38 ammunition are given in table LXVII.

130. Cartridge, Ball, Automatic Pistol, Cal. .380, 95-Grain Bullet (9-MM Short)

a. CARTRIDGE. This cartridge may be fired from caliber .380 automatic pistols, such as Colt, Remington, Webley, Savage, Browning, Bayard, Italian 9-mm (short) Berretta Pistola, Mod 34, and others. It cannot be fired from Colt caliber .38 automatic pistols. The cartridge is 0.93 inch long and the rimless cylindrical case is 0.68 inch long. The diameter of the case head and body is 0.372 inch.

b. BULLET. The bullet consists of a metal jacket and lead alloy core. It has no cannelure and is 0.46 inch long. It will penetrate 5½ pine boards, each 7/8 inch thick.

749850°—48—10

Table LXVI. Weights of cal..38 ammunition (in grains)
(In addition to the components listed, the small pistol primer, 0.175 inch diameter, 3.065-grain weight is used)

Cartridge	Complete cartridge (approx)	Cartridge case	Powder charge (approx)	Bullet			
				Complete	Jacket	Core (slug)	Tracer
Cal..380, auto. pistol, ball (9-mm short)	146	48	2.5, Bullseye	95			—
Cal..38, super auto. Colt, ball..	200		4., Bullseye 5., Pistol powder No. 5	130			—
Cal..38, revolver, short Colt, ball...	168	37	2.5, Bullseye 3.5, Pistol powder No. 5	125 or 130	—	—	—
Cal..38 S.&W., revolver:							
Ball	218		2.3, Bullseye 3.8, Pistol powder No. 5	146	—	—	—
Blank	79.5				—	—	—
Cal..38 special, revolver:							
Ball	231	70	*	158	—	—	—
Ball (jacketed)	231	70	*	158			—
Ball (Super-Police)	273	70	4., Infallible	200	—	—	—
Ball (wad-cutter)	218	70		146	—	—	—
Tracer	193	70		120			
Tracer	231	70	*	158			
Blank	75	70		(wad)	—	—	—
High-pressure test	232	70		158	—	—	—

* 3.6, Bullseye; 5.0, Pistol powder No. 5; 4.0, Pistol powder No. 6; 7.0, Du Pont No. 80.

131. Cartridge, Ball, Cal. .38, Super Automatic Colt, 130-Grain Bullet, Metal Jacket

a. CARTRIDGE. This cartridge is a high-velocity, semirimmed type, resembling the 9-mm parabellum cartridge in size and appearance. It may be fired from Colt caliber .38 super automatic pistols. The cartridge is 1.27 inches long and the cartridge case is 0.90 inch long. Diameter of the case head is 0.403 inch and of the case body is 0.382 inch.

b. BULLET. The bullet consists of a metal jacket and a lead alloy core. It has one knurled cannelure into which the neck of the case is crimped. It is 0.58 inch long. The bullet will penetrate 10 pine boards, each 7/8 inch thick.

Table LXVII. Ballistic data for cal..38 ammunition.

Cartridge	Powder space (cu in.)	Ballistic coefficient (ft-lb/sq in.)	Average maximum chamber pressure (psi)	Muzzle energy (ft-lb)	Average velocities (fps)		Maximum range		Range of trace (yd)
					Muzzle	At 25 feet	Elev (deg)	Range (yd)	
Cal..380, auto. pistol, ball (9-mm short)..		0.167		198	970	940	25-30	1,089	—
Cal..38, super auto. Colt; ball	0.049	0.172	28,000	487	1,300	1,250			—
Cal..38, revolver, short Colt, ball.				164[1] 171[2]	770	750			—
Cal..38 S.&W. revolver, ball	0.043	0.145	15,000	180	745	725			—
Cal..38 special, revolver:									
158-grain ball	0.079	0.197	18,000	265	870	850			—
158-grain ball, jacketed ...	.079	.197	18,000	265	870	850			—
200-grain ball (Super-Police) ..		.177	16,000	246	745	725			—
146-grain ball (wad cutter)			14,000	193	770	750			—
120-grain tracer	.079								
158-grain tracer	.079	.197	18,000	265	870	850			353

[1] 125-grain bullet.
[2] 130-grain bullet.

132. Cartridge, Ball, Revolver, Cal. .38, Short Colt, 125- or 130-Grain Bullet

a. CARTRIDGE. This cartridge may be fired from the Colt Double Action revolver. It will also fire from the Colt caliber .38 revolvers chambered for the caliber .38 long Colt cartridge, and from all revolvers chambered for the caliber .38 special cartridge. The rimmed cartridge is 1.10 inches long and the case is 0.69 inch long. Diameter of the case head is 0.433 inch and of the case body is 0.383 inch.

b. BULLET. The bullet is of lead alloy and is outside-lubricated. One knurled cannelure is located above the crimp of the case to the bullet. The bullet is 0.56 inch long. It will penetrate 4 pine boards, each 7/8 inch thick.

133. Cal. .38 S. & W. Cartridges

a. CARTRIDGE, BALL, REVOLVER, CAL. .38, S. & W., 146-GRAIN BULLET. (1) *Cartridge.* This cartridge may be fired from weapons

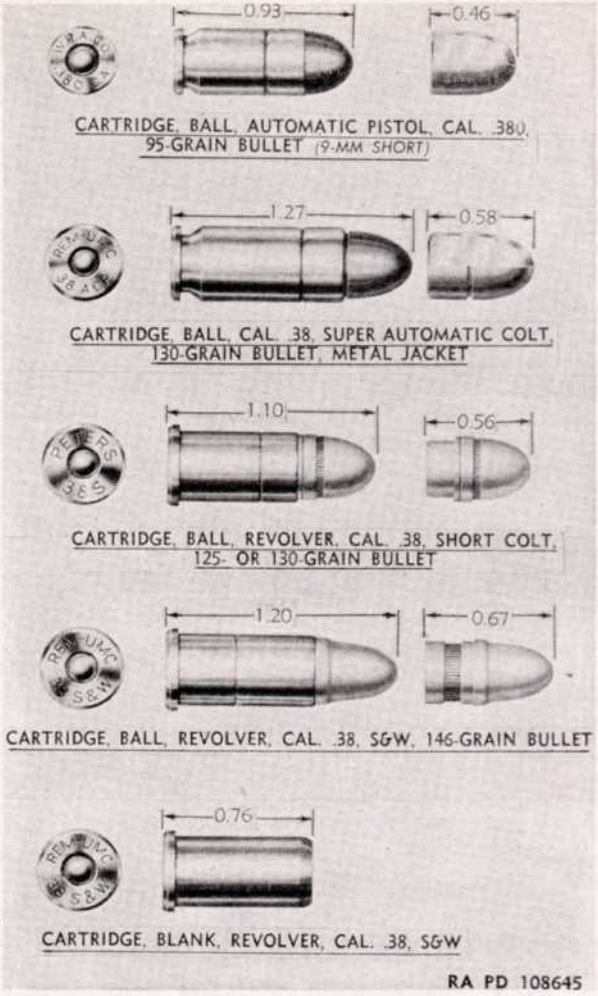

Figure 71. Cal..38 cartridges.

chambered for the caliber .38 S. & W. regular, for example: Colt Police Positive and Banker's Special, and S. & W. Regulation Police and Terrier models. The cartridge known as the caliber .38 Colt New Police is the same as the S. & W. cartridge except that the bullet used is flat-pointed. The S. & W. cartridge is 1.20 inches long and the case is 0.76 inch long Diameter of the case head is 0.433 inch and of the case body is 0.383 inch.

(2) *Bullet.* The bullet is of lead alloy and inside-lubricated. One knurled cannelure is located below the point of crimping in the assembled cartridge. The bullet is 0.67 inch long. It will penetrate 5 pine boards, each ⅞ inch thick.

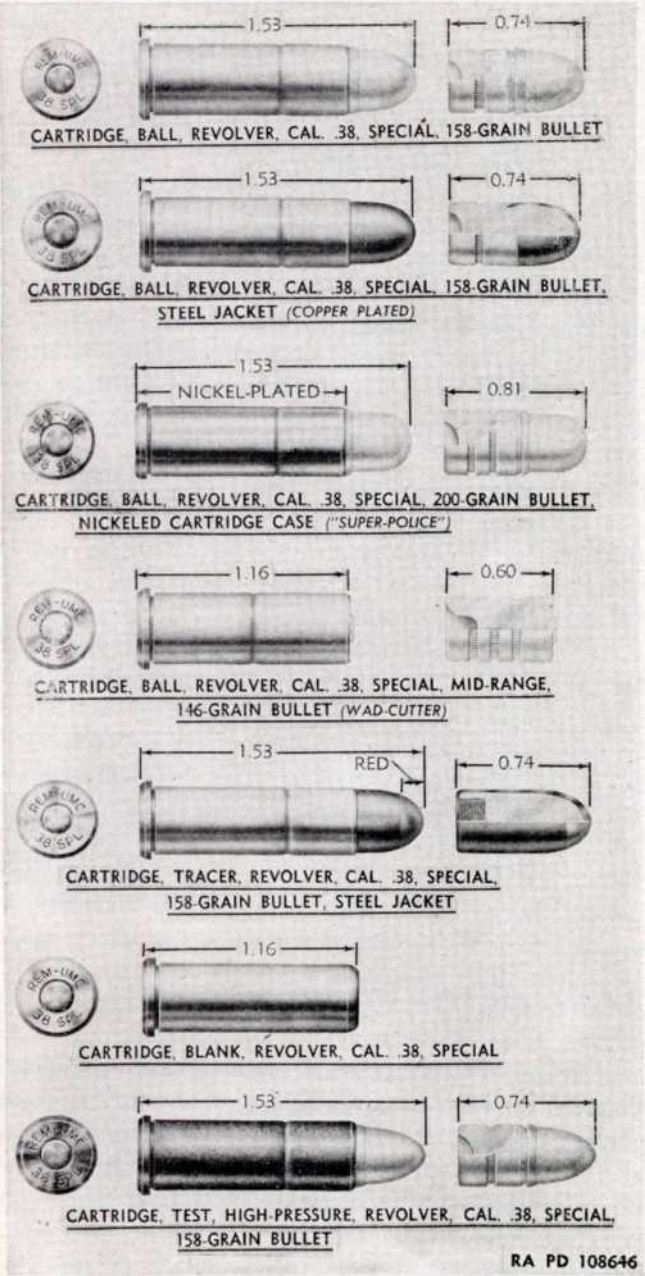

Figure 72. Cal..38 special cartridges.

b. CARTRIDGE, BLANK, REVOLVER, CAL. .38, S. & W. This cartridge is used for simulated fire and signaling in the same weapons listed in paragraph 133 *a* above. It uses the same cartridge case and primer as the service cartridge but has no bullet. The mouth is crimped and is closed by a wad. This blank cartridge is 0.76 inch long.

134. Cal. .38 Special Cartridges

a. GENERAL. These cartridges may be fired from the following Colt and S. & W. caliber .38 special revolvers: Colt Official Police, New Police, Officer's Model Target, New Service, Shooting Master, Police Positive Special, and Detective Special; Single Action Army; S. & W. Military and Police, .38-44, Outdoorsman, and Magnum. The cartridges are 1.53 inches long, except the blank and mid-range wad-cutter cartridges which are 1.16 inches long. The rimmed cartridge case is 1.16 inches long. Diameter of the case head is 0.433 inch and of the case body is 0.378 inch.

b. CARTRIDGE, BALL, REVOLVER, CAL. .38, SPECIAL, 158-GRAIN BULLET. (1) *Cartridge.* This cartridge is authorized for issue to the Counter Intelligence Corps on requisition by all Corps Areas, Departments (except the Philippines), Defense Commands, and Base Commands. The cartridge is 1.53 inches long.

(2) *Bullet.* The S. & W. special 158-grain bullet has a round tip, whereas the Colt special 158-grain bullet has a flattened tip. The bullet is of lead and its base end is cupped. The bullet is "inside-lubricated," having one cannelure containing a lubricant which lies below the neck of the case in the assembled cartridge. The cartridge case is crimped into a groove in the bullet. The bullet penetrates 7 pine boards, each 7/8 inch thick. The bullet is 0.74 inch long.

c. CARTRIDGE, BALL, REVOLVER, CAL. .38, SPECIAL, 158-GRAIN BULLET, STEEL JACKET (COPPER-PLATED). This cartridge is similar to that described in *b* above, except for the bullet which has a copper-plated steel jacket. The bullet will penetrate 7½ pine boards, each 7/8 inch thick.

d. CARTRIDGE, BALL, REVOLVER, CAL. .38, SPECIAL, MID-RANGE, 146-GRAIN BULLET (WAD CUTTER). This cartridge is used in target practice and contains a reduced charge of propellant for mid-ranges. The bullet is entirely enclosed in the cartridge case. It has three cannelures, a deep cup formation in the base of the bullet, and a flat front. Upon firing, it cuts clean holes in the target. The cartridge is 1.16 inches long and the bullet is 0.60 inch long.

e. CARTRIDGE, BALL, REVOLVER, CAL. .38, SPECIAL, 200-GRAIN BULLET, NICKELED CARTRIDGE CASE (SUPER POLICE). This cartridge uses the same case as other caliber .38 special cartridges. The case, however, is nickel plated. The bullet weighs 200 grains and is blunt-nosed

and of lead alloy. It is an "inside-lubricated" bullet having two cannelures below the case-to-bullet crimp groove. The base of the bullet is cupped. The bullet is 0.81 inch long. It penetrates 7½ pine boards, each ⅞ inch thick.

f. CARTRIDGE, TRACER, REVOLVER, CAL. .38, SPECIAL, 120-GRAIN BULLET, STEEL JACKET. This cartridge is for observation of fire, for incendiary purposes, and for signaling. It consists of the same case and primer as other caliber .38 special cartridges, but differs in having a 120-grain copper clad steel-jacketed bullet containing a tracer composition in its base. The tip of the bullet is painted red.

g. CARTRIDGE, TRACER, REVOLVER, CAL. .38, SPECIAL, 158-GRAIN BULLET, STEEL JACKET. This cartridge is for observation of fire, for incendiary purposes, and for signaling. It consists of the same case and primer as other caliber .38 special cartridges, but differs in having a 158-grain copper clad steel-jacketed bullet containing a tracer composition in its base. The tip of the bullet is painted red. The cartridge is 1.53 inches long. Average range of trace is 352 yards.

h. CARTRIDGE, BLANK, REVOLVER, CAL. .38, SPECIAL. This cartridge is used for simulated fire and signaling. It has no bullet. The mouth is crimped and closed by a wad. This cartridge is 1.16 inches long.

i. CARTRIDGE, TEST, HIGH-PRESSURE, REVOLVER, CAL. .38, SPECIAL, 158-GRAIN BULLET. This cartridge is for use only in inspection of weapons. The same components, except for the increased propelling charge, as those in the 158-grain lead bullet, caliber .38 special cartridge are used. Since this ammunition develops dangerously high chamber pressures, 21,600 to 24,000 pounds per square inch, it will not be used for any other purpose. Due to the danger involved in firing this cartridge, it should only be fired from a fixed rest under a hood, by means of a mechanical firing device, and only by authorized personnel. This cartridge is 1.53 inches long. It may be identified by the cartridge case which has a mottled brownish black coating.

Section V. CAL. .45 BLANK LINE-THROWING AMMUNITION

135. Cartridge, Blank, Cal. .45, M1, Line-Throwing

a. GENERAL. This blank cartridge (fig. 73) is for use only in the Lyle Life Saving Gun, caliber .45/70, a smooth bore shoulder rifle used by the U.S. Navy for line-throwing. The cartridge is 2.125 inches long and weighs approximately 216 grains. It is identified by its characteristic cylindrical-rimmed case and by the absence of a bullet.

b. COMPONENTS. This cartridge consists of cartridge case, primer, propelling charge, and felt wad. The cartridge case is made of brass and has an extracting rim. The diameter of the case at the rimmed base is 0.612 inch. The diameter of the body of the case tapers from 0.502 inch

near the rim to 0.463 inch near the mouth; diameter at the mouth is 0.484 inch. The primer used is a No. 2½ Winchester commercial primer. The propelling charge consists of 50.15 grains of black powder which is sufficient to propel the steel line-carrying projectile to a distance of at least 220 feet when barrel is elevated 30 degrees. The ⅛-inch felt wad is painted with shellac after it is assembled in the case; it seals the black powder charge against moisture.

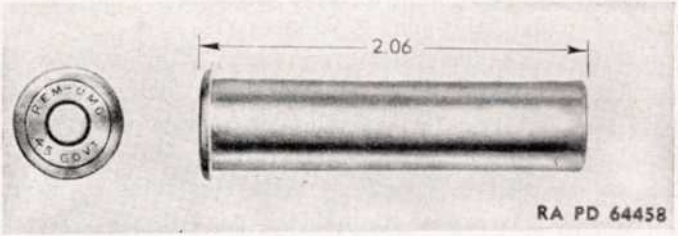

Figure 73. Blank cartridge, cal..45, M1, for line-throwing gun.

136. Accessories

a. PROJECTILE. The projectile is a steel, club-shaped rod. The portion to the rear is slightly less than bore diameter, and has a rounded end which fits into the open end of the blank cartridge when seated in the gun chamber. The front end of the projectile has a smaller diameter than the rear portion and terminates in a round, flattened end with an eye machined in it.

b. LINE. The line, ⅛-inch in diameter, is woven of flax. It is coiled on a spindle which is easily removed when the line is used.

Section VI. 16-GAGE SHOTGUN AMMUNITION

137. General

a. Shotgun shells of 16-gage are procured by the Ordnance Department from several manufacturers for use in 16-gage shotguns of 2-9/16-inch chamber. These shells may also be fired from guns chambered for 2¾-inch shells. Description, use, identification, patterns, and ranges are similar to those for 12-gage shotgun shells described in chapter 3, section IX. A 16-gage shotgun shell is illustrated in figure 74.

b. The 16-gage shotgun shells described in this section are:

(1) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #1 buckshot.

(2) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #1 chilled shot.

(3) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #2 chilled shot.

Figure 74. 16-Gage shotgun shell, loaded with #7½ chilled shot.

(4) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #3 chilled shot.

(5) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #4 chilled shot.

(6) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #6 chilled shot.

(7) SHELL, shotgun, 16-gage, paper, loaded with smokeless powder and #7½ chilled shot.

138. Description

Shotgun shell cases are described in paragraph 45 *h*, primers in paragraph 46, and smokeless powder, "bulk" and "dense," in paragraph 47. The shot used in these shells, together with the definition of "gage" and the sizes and diameters of weapon bore, wads, and shot, are described in paragraph 49, see table XII and figure 36. Table LXVIII lists the weights of 16-gage shotgun shells and their components. Diameter of the shell case at the head is 0.812 inch and at the mouth is 0.706 inch.

Table LXVIII. Weights of 16-gage ammunition

Cartridge	Complete, approx (grains)	Propelling charge (grains)	Shot (ounces)	No. of shot
#1 buckshot		†	1⅛	12
#1 chilled shot		21.5*	1	73
#2 chilled shot		21.5*	1	88
#3 chilled shot		21.5*	1	109
#4 chilled shot		21.5*	1	136
#6 chilled shot		21.5*	1	223
#7½ chilled shot	700	21.5*	1	345

* 2¼ dram equivalent for Du Pont MX powder.
† 3 dram equivalent.

139. Ballistic Data

Although there are slight differences in shotgun shells of different manufacture (powder charge, etc), the data in table LXIX are considered

substantially correct. For maximum ranges at low angles, see table LXI, paragraph 119 *c*.

Table LXIX. Ballistic data for 16-gage shotgun shells

Shotgun shells loaded with		Average maximum pressure (psi)	Time of flight to 40 yards (sec)	Average velocities over 40-yd range (fps)	Maximum range
Shot	Dram equivalent of "bulk" powder				Elev (deg)
#1 buck	3	11,500			30
#1 chilled	2½	11,500			30
#2 chilled	2½	11,500	0.126	955	30
#3 chilled.....	2½	11,500			30
#4 chilled	2½	11,500	0.130	925	30
#6 chilled	2½	11,500	0.137	885	30
#7½ chilled.....	2½	11,500	0.141	850	30

Section VII. 20-GAGE SHOTGUN AMMUNITION

140. General

a. Shotgun shells of 20-gage are procured by the Ordnance Department from several manufacturers for use in 20-gage shotguns of 2¾-inch chamber. Description, use, identification, patterns, and ranges are similar to those for 12-gage shotguns described in chapter 3, section IX. A 20-gage shotgun shell is illustrated in figure 75.

Figure 75. 20-Gage shotgun shell, loaded with #7½ chilled shot.

b. The 20-gage shotgun shells described in this section are:

(1) SHELL, shotgun, 20-gage, paper, loaded with smokeless powder and #4 chilled shot.

(2) SHELL, shotgun, 20-gage, paper, loaded with smokeless powder and #6 chilled shot.

(3) SHELL, shotgun, 20-gage, paper, loaded with smokeless powder and #7½ chilled shot.

141. Description

Shotgun shell cases are described in paragraph 45 *h*, primers in paragraph 46, and smokeless powder, "bulk" and "dense," in paragraph 47. The shot used in these shells, together with the definition of "gage" and the sizes and diameters of weapon bore, wads, and shot, are described in paragraph 49, see table XII and figure 34. Table LXX lists the weights of 20-gage shotgun shells and their components. Diameter of the shell case at the head is 0.755 inch and at the mouth is 0.448 inch.

Table LXX. Weights of 20-gage ammunition

Cartridge	Complete, approx (grains)	Propelling charge (grains)	Shot (ounces)	No. of shot
#4 chilled shot		18.5*	⅞	119
#6 chilled shot		18.5*	⅞	195
#7½ chilled shot	625	18.5*	⅞	302

* 2¼ dram equivalent for Du Pont MX powder.

Figure 76. .410-Gage shotgun shell, loaded with #7½ chilled shot, for 2½-inch chamber.

142. Ballistic Data

Although there are slight differences in shotgun shells of different manufacture (powder charge, etc), the data in table LXII are considered substantially correct. For maximum ranges at low angles, see table LXI, paragraph 119 *e*.

Table LXXI. Ballistic data for 20-gage shotgun shells

Shotgun shells loaded with		Average maximum pressure (psi)	Time of flight to 40 yards (sec)	Average velocities over 40-yd range (fps)	Maximum range
Shot	Dram equivalent of "bulk" powder				Elev (deg)
#4 chilled	2¼	12,000	0.130	925	30
#6 chilled	2¼	12,000	.136	885	30
#7½ chilled	2¼	12,000	.141	850	30

Section VIII. .410-GAGE SHOTGUN AMMUNITION

143. General

a. Shotgun shells of .410-gage are procured by the Ordnance Department from several manufacturers for use in .410-gage shotguns of 2½-inch and 3-inch chambers. Description, use, identification, patterns, and ranges are similar to those for 12-gage shotgun shells described in chapter 3, section IX. The two .410-gage shotgun shells are illustrated in figures 76 and 77.

b. The .410-gage shotgun shells described in this section are:

(1) SHELL, shotgun, .410-gage, paper, loaded with smokeless powder and #7½ chilled shot, for 2½-inch chamber.

(2) SHELL, shotgun, .410-gage, paper, loaded with smokeless powder and #7½ chilled shot, for 3-in. chamber.

Figure 77. .410-Gage shotgun shell, loaded with #7½ chilled shot, for 3-inch chamber.

144. Description

Shotgun shell cases are described in paragraph 45 *h*, primers in paragraph 46, and smokeless powder, "bulk" and "dense," in paragraph 47. The shot used in these shells, together with the definition of "gage" and the sizes and diameters of weapon bore, wads, and shot, are described in paragraph 49; see table XII and figure 34. Table LXXII lists the weights of .410-gage shotgun shells and their components. Diameter of the shell case at the head is 0.53 inch and at the mouth is 0.448 inch.

Table LXXII. Weights of .410-gage ammunition

Cartridge	Complete, approx (grains)	Propelling charge (grains)	Shot (ounces)	No. of shot
#7½, for 2½" chamber.....	304	7*	½	173
#7½, for 3" chamber.....	430	7*	¾	259

* 5/6 dram equivalent.

145. Ballistic Data

Although there are slight differences in shotgun shells of different manufacture (powder charge, etc), the data in table LXXIII are considered substantially correct. For maximum ranges at low angles, see table LXI, paragraph 119 *e*.

Table LXXIII. Ballistic data for .410-gage shotgun shells

Shotgun shells loaded with		Average maximum pressure (psi)	Time of flight to 25 yards (sec)	Average velocities over 25-yd range (fps)	Maximum range
Shot	Dram equivalent of "bulk" powder				Elev (deg)
#7½, for 2½" chamber.	5/8	12,500	0.126	950	30
#7½, for 3" chamber...	5/8	13,500	.126	950	30

APPENDIX

REFERENCES

1. Publication Indexes

The following publications indexes should be consulted frequently for latest changes or revisions of references given in this chapter and for new publications relating to materiel covered in this manual:

a. Ordnance Supply Catalog Introduction.....WD Cat. ORD 1
b. Ordnance Supply Catalog Index.....WD Cat. ORD 2
c. Ordnance Major Items and Combinations, and Pertinent Publications. WD SB 9–1
d. List and Index of War Department Publications.....FM 21–6
e. List of War Department Films, Film Strips, and Recognition Film Slides. FM 21–7
f. Military Training Aids.....FM 21–8

2. Standard Nomenclature Lists

a. Ammunition for Small Arms.

Ammunition, revolver, automatic pistol, and submachine gun. WD Cat. ORD 11 SNL T–2
Ammunition, rifle, carbine, and automatic gun. WD Cat. ORD 11 SNL T–1
Ammunition, small-arms, obsolete and nonstandard. WD Cat. ORD 11 SNL T–6
Miscellaneous service components of small-arms ammunition for Field Service Account, instruction material, and ammunition for simulated small-arms fire. WD Cat. ORD 11 SNL T–4
Packing materials used by Field Service for small-arms service ammunition. WD Cat. ORD 11 SNL T–5
Shells, shotgun.....WD Cat. ORD 11 SNL T–3

b. Rifle and Carbine Grenade Cartridges.

Grenades, hand and rifle, and fuzing components. — WD Cat. ORD 11 SNL S–4

c. Cleaning and Preserving Materials.

Cleaning, preserving, and lubricating materials; recoil fluids, special oils, and miscellaneous related items. — WD Cat. ORD 3 SNL K–1

d. Miscellaneous Cartridges.

Ammunition, blank, for pack, light and medium field, tank, and antitank artillery. — WD Cat. ORD 11 SNL R–5

Ammunition, fixed, including subcaliber ammunition for harbor defense, heavy field, and railway artillery. — WD Cat. ORD 11 SNL P–6

Ammunition, fixed and semifixed, including subcaliber, for pack, light and medium field, aircraft, tank, and antitank artillery, including complete round data. — WD Cat. ORD 11 SNL R–1

Land mines and fuzes, demolition material, and ammunition for simulated artillery and grenade fire. — WD Cat. ORD 11 SNL R–7

Small arms targets and target equipment. — WD Cat. ORD 3 SNL L–1

e. Tools and Supplies.

Ammunition surveillance, testing, and inspection equipment and supplies. — WD Cat. ORD 6 SNL N–10

3. Explanatory Publications

a. Regulations.

Administration: Posts, Camps, and Stations — AR 210–10

Corps of Engineers: Repairs and Utilities — AR 100–80

Finance Department: Accounting for Lost, Damaged and Destroyed Property. — AR 35–6640

Honors to Persons — AR 600–30

Qualifications in Arms and Ammunition Training Allowances. — AR 775–10

Range Regulations for Firing Ammunition for Training and Target Practice. — AR 750–10

Salutes and Ceremonies — AR 600–25

Supplies: Storage — AR 700–10

Transportation Corps: Transportation by Commercial Means; general. AR 55–105

Transportation Corps: Transportation by Water of Explosives, Inflammables, and Chemical Materials. AR 55–470

Transportation Corps: Transportation of Public Property (Except Animals) and Remains. AR 55–155

b. AMMUNITION, SMALL-ARMS.

Ammunition, General.....TM 9–1900

Ammunition, Inspection Guide.....TM 9–1904

Artillery Ammunition.....TM 9–1901

Ballistic Data, Performance of Ammunition.....TM 9–1907

Factory Control Inspection Manual for Small-arms Ammunition, Frankford Arsenal.

Hand and Rifle Grenades, Rocket, AT, HE, 2.36-inch...FM 23–30

Instruction Guide: Small-arms Accidents, Malfunctions, and Their Causes. TM 9–2210

Manual of Test Methods for Small-arms Ammunition, Frankford Arsenal.

Ordnance Safety Manual.....O. O. Form No. 7224

Saluting Charges for Cannon.....WD Circ 147 V–1946

Small-arms Ammunition.....WD SB 9–AMM 4

Small-arms Ammunition Inspection Manual, Supplement to General Inspection Manual, Frankford Arsenal.

Small-arms, Light Field Mortars, and 20-mm Aircraft Guns. TM 9–2200

c. AMMUNITION, MISCELLANEOUS.

Antiaircraft Machine Gun Trainer M9.....TM 9–221

Field Artillery Trainer M3.....TM 6–225

Shotgun and Skeet Shooting.....TM 1–1100

d. MISCELLANEOUS.

Aerial Gunnery Practice and Record Firing.....TM 1–270

Ammunition Condition Report.....O. O. Form No. 7235

Ammunition Identification Code (AIC).....WD SB 9–AMM 5

Ammunition: General.....WD SB 9–AMM 1

Ammunition: Net Prices.....WD Cat. ORD 5–3–6

Ammunition Supply.....FM 9–6

Ammunition: Supply Within the Continental United States. WD SB 9–AMM 6

Application of Suspensions and Releases on Ammunition. WD SB 9–AMM 11

Cleaning, Preserving, Sealing, Lubricating and Related Materials Issued for Ordnance Materiel. TM 9–850

Decontamination.....TM 3–220

d. Miscellaneous (continued)

Defense Against Chemical Attack.....FM 21–40
Dictionary of United States Army Terms.....TM 20–205
Inspection of Ordnance Materiel.....TM 9–1100
Inspection of Propelling Charges and Bulk Powder. WD SB 9–AMM 7
Military Explosives.....TM 9–2900
Military Sanitation and First Aid.....FM 21–10
Ordnance Ammunition Company, Ordnance Ammunition Battalion. FM 9–20
Ordnance Company, Depot.....FM 9–25
Ordnance Field Maintenance.....FM 9–10
Ordnance Service in the Field.....FM 9–5
Reports.....WD SB 9–AMM 8
Small-arms Ammunition.....WD SB 9–AMM 4
Targets, Target Material, and Training Course Lay-outs. TM 9–855
Thompson Submachine Gun, Caliber .45, M1928A1....FM 23–40
Unsafe Ammunition.....WD SB 9–AMM 2

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