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Vol. I

THE ORDNANCE SCHOOL

ORDNANCE SCHOOL TEXT

AMMUNITION - GENERAL

VOLUME 1

Parts I - II
Pages 1 - 79

MILITARY EXPLOSIVES, SMALL ARMS AMMUNITION

PREPARED BY
THE ORDNANCE SCHOOL
ABERDEEN PROVING GROUND, MARYLAND

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NOTE

This publication is a temporary expedient pending the incorporation of the information contained herein in an approved War Department Manual.

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Prepared under the direction of
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Third edition, November 1942
Supersedes all previous editions

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The Ordnance School
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PART I

MILITARY EXPLOSIVES

CHAPTER 1

GENERAL

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SECTION I

GENERAL

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Definition of an explosive	3
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1. PURPOSE. - The purpose of part I is to present ordnance personnel with a nontechnical knowledge of explosives. The necessary requirements of military explosives and the tests to determine such requirements are discussed. Finally, there is a brief exposition on the most widely used military explosives.

2. SCOPE. - Part I is concerned only with basic information required for a proper understanding of military explosives. More detailed and technical information may be obtained from TM 9-2900, Military Explosives.

3. DEFINITION OF AN EXPLOSIVE. - Any mixture or chemical compound which, under the influence of heat or mechanical action, undergoes a sudden chemical change with the liberation of energy and the development of high gas pressure, is called an explosive. The chemical change develops heat which further expands the liberated gas.

4. PRESENT MILITARY EXPLOSIVES AND THEIR USES. - Our military explosives and their principal uses are as follows:

a. Smokeless Powder ---------- Propellants.

b. Compound Propellants --------- Shotgun shell, fragmentation hand grenades, small-arms blank ammunition.

c. Black Powder ---------- Saluting charges, spotting charges, primers, delay fuzes, time train fuzes.

d. TNT, Amatol, Trimonite ---------- Bursting charge for high explosive shell, fragmentation and demolition bombs.

e. Explosive D ---------- Bursting charge for armor-piercing projectiles.

f. Picric Acid ---------- Manufacture of Explosive D.

g. Tetryl ---------- Boosters.

h. Mercury Fulminate, Lead Azide - Detonating agents.

i. Nitrostarch ---------- Demolition work.

j. PETN ---------- Detonating fuze.

SECTION II

PROPERTIES OF MILITARY EXPLOSIVES

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Determination of an explosive substance ----------	5
High and low explosives ----------	6
Basic requirements of an explosive ----------	7
Additional requirements of an explosive ----------	8
Stability ----------	9
Sensitivity ----------	10
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5. DETERMINATION OF AN EXPLOSIVE SUBSTANCE. - From the definition of an explosive given in section I, it can be seen that an explosive differs from other substances in three respects. It must be a chemical compound or mixture sensitive to the application of heat or a blow upon any surface of its mass. Secondly, it must decompose or react with extreme rapidity. Thirdly, it must yield gaseous products and evolve a considerable quantity of heat. These three qualities determine an explosive; the absence of any one or more differentiates other substances from explosives.

a. Example. - A solution of sodium chloride added to a solution

of silver nitrate, under certain conditions, will yield the solid product silver chloride. The reaction proceeds at a speed virtually immeasurable and may be considered instantaneous. One other quality of an explosive is missing, therefore, this compound cannot be classified as an explosive.

b. Example. - A mixture of nitrogen and oxygen can be made to react with great rapidity yielding a gaseous product. Because heat is not evolved, but rather absorbed, this mixture cannot be considered an explosive.

c. Example. - Hydrogen and oxygen, upon application of heat, will react with extreme rapidity. Heat is evolved and the product of the reaction, steam, is a gas. The mixture is an explosive since all necessary qualifications are fulfilled.

6. HIGH AND LOW EXPLOSIVES. - a. General. - Among the numerous compounds and mixtures, whether solids, liquids, or gases, which fulfill the requirements necessary to classify them as explosives, there are wide differences in the effects produced upon explosion. Some explosives may yield a greater quantity of heat or a greater quantity of gaseous products than others, and thus account for a difference in the force or power exhibited upon decomposition. Other compounds may evolve about the same amount of heat and gaseous products and yet differ markedly in explosive characteristics; this is due to a difference in the rate at which the heat and gas are evolved.

b. Definition. - If the decomposition, when once initiated, occurs with extreme rapidity, the substance is classed as a high explosive, while one having an appreciably lower rate of decomposition is often referred to as a low explosive. Smokeless powder, for example, has a rate of action in the gun that varies from 1 mm/sec., to 1 meter/sec. A high explosive has a rate of action varying from 5,000, to 8,000 meters/sec.

c. Basis. - The differences in the behavior of explosives as mentioned in paragraph 6b. above, have led to a distinction which is of assistance in considering the various uses to which explosives are applied. The principal distinction in behavior is the rate at which decomposition or reaction occurs when once initiated by heat or shock.

d. How classified. - There is no sharp line of demarcation, but with a full understanding of the properties of a given explosive, it is usually easy to recognize whether it falls into the one class or the other. Of the explosives commonly used in military ammunition, those employed as bursting charges for shells or bombs, and as charges for boosters and detonators are classified as high explosives, while black powder, smokeless powder, and most primer mixtures may be classified as low explosives.

7. BASIC REQUIREMENTS OF AN EXPLOSIVE. - a. General. - The basic requirements of explosive substances for military use are cheapness of manufacture, availability of raw materials, and safety of handling.

b. Necessary properties and measurements. - In order that the above be evaluated properly, it is necessary that the following properties and measurements be determined:

(1) Chemical equation involved in change of substance from liquid or solid to gaseous state.

(2) Thermochemical values as given in heats of formation of different compounds.

(3) Relative pressure, which may be developed by comparing equal parts of a new explosive with those of one well-known.

(4) Specific heats.

(5) Densities.

(6) Type and amount of energy required to initiate action.

(7) Rapidity of reaction.

(8) Relative power of the explosive.

8. ADDITIONAL REQUIREMENTS OF AN EXPLOSIVE. - a. General. - Additional requirements, differing from the fundamentals, must be established to make sure the explosive will perform properly under standard methods of loading. So that a charge can be cast in its shell, the explosive is required to have a melting point less than the temperature of low pressure steam. The explosive must not react with iron or steel, for both the shell and the charge could be weakened by the corrosion and its products. The reason why neither of these requirements is fundamental is that either, or both, can be overcome by the use of special methods and special materials.

b. Properties to be determined by tests. - In determining by tests whether a given explosive will meet the requirements, the following properties of the explosive must receive consideration:

(1) Stability.
(2) Sensitivity.

(a) To impact or shock.
(b) To detonation by means of initiators.

(3) Brisance.

9. STABILITY. - a. Definition. - The term stability refers to the capacity of an explosive to retain its chemical and physical properties unaltered during an indefinite period of storage under normal conditions.

b. Testing for stability. - Rapid tests to determine the deterioration of an explosive in storage are made by subjecting a sample to storage at higher than normal temperatures. The principle of this method is that the rate of a chemical reaction will increase with a rise in temperature. Thus the stability of the explosive can be established quickly and accurately.

(1) Length of time. - Since decomposition of an explosive is a chemical reaction, it is only necessary to determine the length of time that is required for measurable decomposition to occur at some more or less arbitrarily established temperature.

(2) Amount of decomposition products. - Another method that is used involves the determination of the amount of decomposition products which result from the heating of the explosive at a given temperature for a given time. It is necessary, of course, to compare the results with those obtained by the same method on some standard explosive whose stability has been established by actual demonstration of its capacity to withstand long periods of storage under ordinary conditions of storage.

10. SENSITIVITY. - a. Sensitivity to impact or shock. - (1) Definition. - Sensitivity to impact or shock refers to the ease with which an explosive can be detonated by the sudden application of mechanical force. It is generally true that sensitivity is not only a function of the amount of force that may be applied to a given explosive without causing detonation, but it is also a function of the rate at which the force is applied — for example, a pressure of 125,000 lbs. per sq. in. can be slowly applied in the loading of mercury fulminate or lead azide into a metal component, without causing detonation of either of these sensitive explosives, but if only a small fraction of this small force be suddenly applied, as might be done with a sharp blow of a hammer, the explosive will detonate readily.

(2) Determination of sensitivity. - Determination of the sensitivity of an explosive, therefore, does not involve so much the measurement of the amount of mechanical force that is required to effect detonation as it does the determination of the effect of the sudden application of some arbitrarily established force.

(a) The drop test, which is widely used to determine sensitivity, involves the measurement of the minimum height a given weight must fall in order to produce detonation of the explosive in question when it is confined in a standard manner. By comparing the different heights of fall required for the weight to cause detonation of various explosives, a com-

parative value for the sensitivity of each explosive can be obtained.

DROP TEST RESULTS

Substance	Weight	Minimum height to give detonation.
Mercury fulminate	100g.	5-10cms.
PETN	2000g.	10cms.
Tetryl	2000g.	18-20cms.
Black powder	2000g.	30-40cms.
TNT	2000g.	80-100cms.

b. Sensitivity to detonation by means of initiators. - Sensitivity to detonation by the action of initiating agents other than mechanical impact is ordinarily expressed in terms of the amount of mercury fulminate required to effect complete detonation of an explosive under a given set of conditions.

(1) The sand test is perhaps the most common test for this purpose. It involves pressing a definite weight of the explosive into a copper capsule of definite dimensions. Various amounts of mercury fulminate are placed above the explosive charge and pressed into intimate contact with the base charge. The caps are then surrounded by sand, granulated between 20 and 30 mesh in a bomb of definite capacity, and fired. Complete detonation is indicated by the amount of sand crushed finer than 30 mesh. The minimum amount of fulminate required to give complete detonation consistently is taken as an index of the sensitivity of the explosive.

c. Extreme cases of sensitivity. - (1) Some explosives are so insensitive that they cannot be detonated completely by mercury fulminate. In these cases the sensitivity is usually expressed in terms of the minimum amount of tetryl required to effect detonation.

(2) On the other hand, some explosives are so highly sensitive that no direct explosive action is required to initiate detonation, a flame being sufficient to produce the action.

(a) Such explosives are commonly referred to as initial detonators agents, since they can be used to take the spit of a primer or black powder grain and initiate, from this relatively weak combustion, a detonation in the train of high explosives in a shell or bomb. Mercury fulminate and lead azide are the most widely used initial initiating agents; there are, however, numerous explosives that have comparable sensitivity. These

more sensitive compounds may be either high or low explosives depending on their rate of decomposition when once ignited. The more effective of these sensitive compounds in initiating detonation of other explosives are in general those having the highest rates of decomposition, and hence the initial detonating agents in practical use are merely highly sensitive high explosives.

d. By means of the sand test and the drop test, it can be judged fairly accurately whether an explosive is suitable, in so far as sensitivity is concerned, for a given purpose, i.e., as an initial detonating agent, a booster charge, a charge for armor-piercing shell, etc.

11. BRISANCE. - a. Definition. - Brisance refers to the capacity of an explosive upon detonation to shatter any medium that may confine it. This property is quite different from the power or strength of an explosive, since the latter refers merely to the ability of the explosive to displace the medium which confines it. Power is dependent largely upon the amount of gas evolved and the temperature attained during explosion, whereas brisance depends more on the speed with which the explosion or detonation occurs. Black powder, for instance, is a fairly powerful explosive because of the amount of gas that it evolves upon explosion, but its brisance is very low because of the low rate at which the explosion occurs.

b. Determination of brisance. - While rate of detonation determinations will indicate quite accurately the brisance of an explosive, the most practical test is the fragmentation test as carried out at Picatinny Arsenal.

(1) In this test, the explosive is loaded into a standard metal container such as a 75-mm or 155-mm shell and exploded, by means of the regular booster system, in a large chamber filled with sand. The number of fragments into which the shell is broken by a given explosive, when compared with the number obtained from a standard explosive such as TNT, will indicate in practical terms the relative brisance of the explosive.

12. SELECTION OF AN EXPLOSIVE FOR A TYPE OF AMMUNITION. - a. General. - The above discussion of the properties of explosives and the distinctions among them is very general. It should be recognized that there are numerous characteristics which may vary widely within any one group, or class of explosives, and these must be carefully evaluated before an explosive can be selected as entirely suitable for a specific purpose. Mercury fulminate, and TNT, are both high explosives; but they are used for different purposes, and neither one could be substituted for the other with any degree of success. Furthermore, there are many explosives which have some characteristics closely similar to mercury fulminate, yet which cannot be seriously considered as substi-

tutes for the fulminate in military ammunition.

b. Conclusion. - Evidently then, there must be certain well-defined properties which an explosive must possess if it is to meet the rigid requirements demanded of a charge for the various ammunition components. If for example, the case of an explosive for use in loading artillery shells is considered, the specific requirements might be stated as follows:

(1) The explosive must not under go any change from its original condition upon long storage at either high or low temperatures.

(2) The explosive must be capable of withstanding the shocks that are inherently incident to the loading and transportation of the shell, and to firing from the weapon.

(3) The explosive must be capable of detonating completely under the action of a comparatively small amount of booster or priming explosive.

(4) The explosive, upon complete detonation, must be capable not only of rupturing the shell, but also of reducing it into fragments of fairly uniform size and number.

SECTION III

DETERMINATION OF PARTICULAR REQUIREMENTS

	Paragraph
General	13
Conclusion	14

13. GENERAL. - a. The degree to which a military explosive must possess the fundamental properties discussed above, depends to a great extent upon the purpose for which the explosive is intended. But for any particular purpose, it is only possible for the properties to vary within fairly narrow limits.

b. For instance, in choosing an explosive for use as a booster charge, it is imperative that it be sufficiently sensitive that it will detonate under the action of mercury fulminate, yet it must not be so sensitive that it will be liable to detonate from the shock incident to firing the shell from the gun. The explosive should also be highly brisant, more so than if it were to be used as a charge for shell, since the capacity of the booster explosive to initiate detonation of the shell charge is dependent largely on this property of brisance.

14. CONCLUSION. - It is, therefore, very important in designing an explosive system such as fuze, booster and shell, or fuze, booster and bomb, that each component be provided with an explosive that is consonant with the others of the system, in order that the detonation of a very small amount of explosive in the fuze shall transmit detonation to the booster charge and the booster then be capable of effecting detonation of the shell charge. If a sufficient margin of safety is not allowed in adjusting one explosive to another in the system, a comparatively slight variation in the loading density or in the quality of the explosive used, will cause erratic functioning or perhaps complete failures when the system is used in service.

SECTION IV

DESCRIPTION OF STANDARD MILITARY EXPLOSIVES

Paragraph
Low explosives ---------- 15
High explosives ---------- 16

15. LOW EXPLOSIVES. - a. Smokeless powder. - Smokeless powder is a gelatinized nitrocotton, granular in form, the grains varying in length and diameter. The granular form is achieved by forcing the powder through dies of the required diameter. After extrusion the grain is cut to the desired length. Smokeless powder is classified as follows:

(1) Pyro powder. - This powder is an early development in the smokeless powders; it is not flashless, and lacking any "waterproofing" agents, is hygroscopic.

(2) NH powder. - A standard powder, nonhygroscopic, it is flashless in certain of the lower caliber, longer barreled weapons. It is capable of long periods of storage without deterioration.

(3) FNH powder. - This is the most recently developed type of smokeless powder. It is nonhygroscopic, and by the addition of "cooling" agents is made virtually flashless in all calibers of guns. Despite the addition of substances rendering the powder flashless and nonhygroscopic its ballistic properties still compare favorable with those of the straight pyro powder.

b. Compound propellants. - Compound propellants are of two types:

(1) Double base powders. - Mixtures of nitroglycerine and nitrocellulose which are nonhygroscopic and are consequently relatively stable in storage.

(2) E. C. blank powder. - A semicolloided nitrocellulose to which 8% barium nitrate, and 8% potassium nitrate has been added to reduce the flash and to render the powder more ignitable.

c. Black powder. - Black powder is a mechanical mixture having the following composition: 75% potassium nitrate, 15% charcoal, 10% sulphur. It is classified according to the size of the grain from A-1 (coarse) to A-6 (fine). In addition there is a fuze powder that is of a very fine texture. Black powder in the grain form is usually coated with graphite to facilitate loading. It is very sensitive to heat and friction and if ignited when confined will detonate. The powder is strongly hygroscopic making extended storage a difficult problem.

16. HIGH EXPLOSIVE. - a. TNT. - (1) TNT (trinitrotoluene) is the army's most important high explosive shell filler.

(2) Properties. - TNT is insensitive to shock and friction, is nonhygroscopic, and is stable in storage over extended periods. It is strongly brisant and may be initiated by the detonation of a small charge of tetryl in contact with it. Trinitrotoluene has a low melting point (80.2 degrees C.) and is melt-loaded into the shell. It does not form sensitive explosive compounds with metals.

(3) Disadvantages. - TNT under certain conditions and when containing a high percentage of impurities will develop an oily exudate, somewhat toxic. Because TNT contracts in solidifying it has a tendency toward cavitation.

b. Amatol. - This explosive is a mechanical mixture of TNT and ammonium nitrate. It is produced in two different compositions, 80/20 amatol and 50/50 amatol. The former is 80% ammonium nitrate and 20% TNT. The latter is 50% ammonium nitrate and 50% TNT.

(1) Properties. - Amatol is insensitive to friction but can be detonated by severe shock. It does not form sensitive compounds with metals except in the case of copper. 50/50 amatol has a high degree of brisance, comparable to TNT. 80/20 amatol has slightly lower brisance and a lower rate of detonation. 50/50 amatol is melt-loaded into the shell but 80/20 amatol must be forced into the shell by means of an extruding machine.

(2) Disadvantages. - Amatol has similar disadvantages to TNT. It forms a toxic exudate and has a tendency toward cavitation. It is hygroscopic requiring precautions in loading and storing.

c. Trinonite. - Little detailed information is available on this explosive due to its limited use in the service.

(1) Properties. - Trimonite is composed of 90% picric acid and 10% alphanitronapthalene. The latter is added to reduce the melting point of picric acid to a point where it may be melt-loaded. The characteristics of trimonite are similar to TNT and 50/50 amatol with the exception that there is no danger of exudation.

(2) Disadvantages. - Because trimonite is 90% picric acid, shell casings must be lined to prevent action between acid and metal.

d. Explosive D. - Explosive D is the military designation for ammonium picrate.

(1) Properties. - Explosive D is the least sensitive of all service explosives making it the standard bursting charge for all armor-piercing projectiles. It has a high melting point necessitating pressure loading.

(2) Disadvantages. - Explosive D is hygroscopic and reacts with metals when moist. It cannot be melt-loaded and will detonate if heated. Its explosive strength is inferior to TNT.

e. Picric acid. - Because picric acid forms sensitive compounds with many metals it is not used generally as a military explosive in this country. Its use in the manufacture of Explosive D, however, lends it a certain importance.

f. Tetryl. - Tetryl (trinitrophenylmethylnitramine) is the most powerful military explosive used in this country.

(1) Properties. - Tetryl, because it melts at a high temperature (130 degrees C.), must be press-loaded. It is more sensitive than TNT to initiation by lead azide or mercury fulminate. Tetryl is nonhygroscopic and stable under usual storage conditions. It has a rapid rate of detonation, roughly 23,000 feet per second.

(2) Disadvantages. - Tetryl or tetryl dust is toxic and precautions should be taken in handling or packing. Tetryl is sensitive to shock detonation being effected by penetration of a rifle bullet. In compressed pellet form it can withstand the set-back action of firing.

g. Lead azide. - Lead azide is a member of the class of high explosives known as "initators."

(1) Properties. - Lead azide is sensitive to shock but less so than mercury fulminate. It detonates completely under the action of a spit of flame. Unless mixed with abrasive compounds it will not react to the stab action of a firing pin. Lead azide is a cream-colored powder, nonhygroscopic and stable in storage. It is stored and shipped under water.

h. Mercury fulminate. - Mercury fulminate is also classed as an initiator.

(1) Properties. - Mercury fulminate is a brownish-yellow or grayish powder that detonates completely under the action of shock, flame, or friction. It reacts quickly with metals necessitating a lacquer coating for components loaded with this explosive. It is insoluble and nonhygroscopic but when stored under water deteriorates with a speed dependent on the temperature. Mercury fulminate must, however, be stored and shipped under water to decrease its sensitivity to shock and friction.

(2) Mercury fulminate may be widely replaced by lead azide in the near future for at least two reasons. Firstly, lead azide is considered a more efficient initiator. Secondly, mercury, the most important component of mercury fulminate is a strategic material of wartime production.

i. Nitrostarch. - Nitrostarch during World War I was used extensively as an explosive filler for hand grenades and trench mortar shell. Today its prime importance lies in demolition work wherein it has replaced TNT for issue.

(1) Properties. - Nitrostarch can be detonated by shock and its rate of burning is so rapid as to be considered explosive in nature. It does not exude, nor it is toxic. It is relatively nonhygroscopic and is liable to decompose in the presence of heat.

j. PETN. - PETN is one of the newer service explosives and consequently little information regarding it is available. PETN (pentaerythritoltetranitrate) has a relatively high brisance appearing in brisance tables between tetryl and TNT. Its sensitivity is as shown in the table of drop test results (see par. 10).

PART II

SMALL-ARMS AMMUNITION

CHAPTER 1

GENERAL

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SECTION I

GENERAL

	Paragraph
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Components of small-arms ammunition	20
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Primers	22
Bullets	23
Powder charge	24
Methods of packing	25
Ammunition lots	26
Grades and uses of small-arms ammunition	27

17. PURPOSE. - The purpose of part II of this text is to furnish information regarding the construction, functioning, characteristics, and identification of the different classes, grades, and types of small-arms ammunition. The nature of the information contained herein is such as to enable personnel to readily identify the various types, classes, and grades, and to recognize the common defects when found on inspection.

18. SCOPE. - a. Information of a technical nature is included herein. Detailed description of various types, components, and accessories, including weights, identification marks, methods of packing, markings, ballistics, grades, classification, and precautionary measures to be observed, is set forth in the text. Only a brief discussion is given of safety precautions, storage, and shipment, as these subjects are amplified in AR 30-1270 and Ordnance Safety Manual No. 7224.

b. Proper nomenclature for ammunition described herein is given in standard nomenclature lists as follows:

S.N.L. No.	Title
T-1	Ammunition, Rifle and Automatic Gun.
T-2	Ammunition, Revolver and Automatic Pistol.
T-3	Shells, Shotgun.
T-4	Miscellaneous Service Components of Small-Arms Ammunition and Instruction Material, for Field Service Account.
P-4	Ammunition, Fixed, Including Subcaliber Ammunition, for Harbor Defense, Heavy Field, and Railway Artillery.

c. The use of standard nomenclature as given in the above publications is mandatory and will be used for all purposes. Packing box dimensions and ordnance drawing numbers for the different items are listed in each standard nomenclature list.

d. Firing tables, based on the use of the various types of small-arms ammunition in the different weapons, are listed in Standard Nomenclature List No. F-69.

e. Specific instructions for the use of the different grades of small-arms ammunition in various classes of fire, the disposition of fired cartridge cases, etc., and accounting for expenditures are published in AR 775-10. These regulations are supplemented by Ordnance Field Service Bulletin No. 3-5, and changes thereto, giving the grade of each lot of ammunition, priority of issue, and the use of lots within any given grade. These two publications are essential to the proper issue and use of service ammunition and are referred to throughout this text.

19. TYPES OF SMALL-ARMS AMMUNITION. - a. Cartridges with bullets less than 0.6" in diameter are generally classified as small-arms ammunition. The caliber of the bullet refers to the diameter of the bore of the weapons in which it is used, and unless otherwise stated, is understood to infer inches. Cal..30 ammunition is used in shoulder rifles, automatic rifles, machine rifles, machine guns, and carbines. Cal..30 subcaliber ammunition is used in subcaliber tubes. Cal..45 ammunition is used in automatic pistols, the Thompson submachine guns, and revolvers. Shotgun shells are used in sporting and riot type shotguns. Cal..22 ammunition is used in gallery practice rifles, cal..22 machine guns and pistols. Cal..50 ammunition is used in machine guns.

b. The following is a list of the different types of small-arms ammunition, not all of which will be discussed in this text, grouped according to caliber:

Cal..30.

Cartridge, carbine, M1.
Cartridge, ball, M1906, M1, and M2.
Cartridge, incendiary, M1.
Cartridge, armor-piercing, M1, and M2.
Cartridge, tracer, M1, and M2.
Cartridge, dummy, M1906.
Cartridge, dummy, range, M1.
Cartridge, blank, M1909.
Cartridge, guard, M1, and M1906.
Cartridge, rifle grenade, M3.
Cartridge, subcaliber, M1925.

Cal..45.

Cartridge, ball, M1911.
Cartridge, tracer, M1.
Cartridge, dummy, M1921.
Cartridge, blank, revolver, M1.

Cal..50.

Cartridge, ball, M1, and M2.
Cartridge, incendiary, M1.
Cartridge, armor-piercing, M1, and M2.
Cartridge, tracer, M1, and M2.
Cartridge, blank, M1.
Cartridge, dummy, M1, and M2.

Cal..22.

Cartridge, ball, long rifle.
Cartridge, blank.

Shotgun shells. — Commercial types, 12 gage.

c. Several of the older models of small-arms cartridges are no longer standard for manufacture as they have been superseded by improved types. The older models, however, are usually retained for issue until the supply is exhausted.

20. COMPONENTS OF SMALL-ARMS AMMUNITION. - The components of the cartridge in general, consists of the case, primer, bullet, and propelling charge.

21. CASES. - a. Construction. - The cal..30 and cal..50 car-

tridge cases have a conical-shaped body, joined to the neck by a sharper cone called "the shoulder." The neck is the seat of the bullet and is very nearly cylindrical. The front end of the case is called "the mouth" and the rear end the "head." The case is made from a circular disk, cut from a flat strip of brass. The disk is first punched into the form of a cup, and then drawn out in successive operations by being forced, by punches, through dies successively diminishing in diameter. After the cupping operation and after each of the draws, except the last one, the case is annealed to remove the hardening strains caused by the drawing process. The head of the case and the primer pocket are formed in a press; the body is then annealed by passing the case through a gas-jet flame, this is followed by a reduction of the neck and shoulder, or the tapering operation. The extractor groove is turned into the head and the case is then primed.

b. Function. - The function of the case, in addition to holding the primer, propelling charge, and bullet, is to seal the breech of the gun. The thin walls of the case are expanded in the chamber by the powder gas, and a tight joint is made preventing the escape of gas to the rear. The case also serves as a waterproof container for the propelling charge. The extractor groove, mentioned above, provides a means of extracting the case from the chamber of the barrel. Present specifications on brass for cartridge cases require an alloy of approximately 70% copper and 30% zinc. Fired cartridge cases will be disposed of in accordance with AR 775-10.

c. Cal..30 carbine and cal..45 cases. - The cases for these cartridges are similar in methods of construction and function, to the cases for the cal..30 and .50 cases. The only exception is that the carbine cartridge case and the cal..45 cases have no neck.

d. Steel cases. - As a result of this country's entry into World War II, zinc, component of a cartridge case brass, has become a strategic metal. The Ordnance Department anticipating the situation had long experimented with steel cartridge cases. Many difficulties were encountered; the important difficulty being the tendency of such a case to seize in the breech. Continuing metallurgical research, however, has virtually solved this problem. Another and major difficulty was corrosion of the case. No paints, lacquers, or similar coatings may be used. Plating with some noncorrosive metal will probably be the answer. In the present war this problem of corrosion recedes in importance as storage periods of any ammunition will be relatively short.

22. PRIMERS. - a. Description. - Primers for cal..30 and cal..50 ammunition are similar in construction although of a different size. They are both of the center-fire type and consist of a cup, the priming mixture, a disk of shellacked manilla paper, and an anvil (see fig. 1).

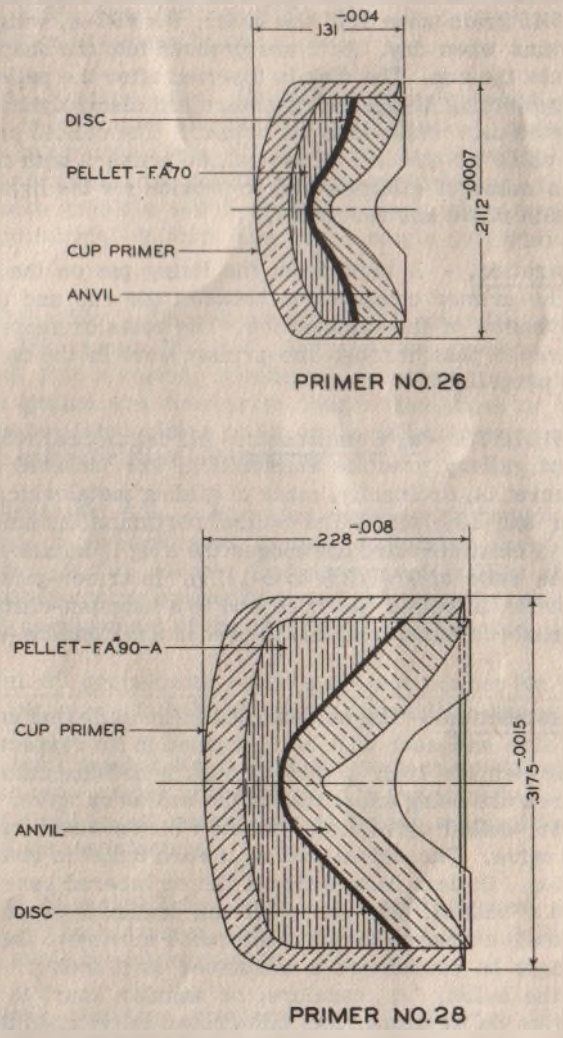


FIGURE 1. - CAL..30 AND CAL..50 PRIMERS.

The metal parts of the primers are made of cartridge case brass. The composition of the primer mixtures is classified as confidential: in Primer No. 26 (cal..30), it is designated FA #70; in Primer No. 28 (cal..50), it is designated FA #90-A. The former, FA #70, weighs approximately 0.45 grain when dry, the latter, FA #90-A, weighs approximately 2.1 grains when dry. Both are pressed into the shape of a pellet for loading into the cup. The disk is inserted after the pellet, holding it in place and protecting it against moisture and electrolytic action. The anvil is inserted last and closes the primer. The cal..45 primer is essentially the same as the cal..30 and cal..50 primers with the exception that its cup is made of gilding metal to provide for the lighter action of the firing pins in rifles and revolvers.

b. Operation. - A blow from the firing pin on the primer cup compresses the primer composition between the cup and the anvil and causes an explosion of the composition. The holes or vents in the anvil allow the flame to pass through the primer vent in the cartridge case and ignite the propellant.

23. BULLETS. - a. Components. - All cal..30, cal..45, and cal..50 bullets, except gallery practice ammunition, are jacketed with a hard metal. The jacket is, ordinarily, made of gilding metal which is an alloy of 90% copper and 10% zinc. The central portion of the bullet is called the slug and in most standard cartridges the slug is an alloy of lead and antimony in the ratio of 97-1/2% to 2-1/2%. In armor-piercing bullets the central portion is called the core and is a tungsten-chromium-steel alloy. An alternate core material that is used is a manganese-molybdenum alloy.

b. Construction. - The bullets used in the different calibers vary in shape and size and each will be discussed in its respective section. Pointed bullets achieve their points through a definite curvature of the nose, this curvature being expressed in the radius of ogive. The curvature of the nose, called ogive, is an arc of a circle whose radius is also the radius of ogive. The ogival radius of each bullet is given in its respective section. Bullets have either a flat or tapered base. A tapered base is called a "boattail" and has a definite degree of taper. A tapered base refers to the change in the circumference moving to the rear of the bullet, and might be considered a misnomer as it does not refer to the rear face of the bullet. A cannelure, or annular knurl is pressed or machined into the bullet jacket. Into this groove is crimped the cartridge case with sufficient force to require considerable pressure to remove the bullet.

24. POWDER CHARGE. - There are various types of powders authorized for use in small-arms ammunition. The exact weight of the charge is not constant but depends upon the particular lot of powder; the

charge weight for each powder lot being adjusted to give the standard velocity with a maximum pressure within the limits prescribed for the weapon in which it is fired. A complete description of the manufacture and properties of smokeless powder will be found in TM 9-2900, Military Explosives. Brief descriptions of the types of powder used in small-arms ammunition are given below:

a. Cal..30 propellants. - (1) IMR 1185 (Improved Military Rifle). - This powder is no longer standard for loading cal..30 ammunition. It is found in the cartridges, ball, M1; A.P., M1; and in early lots of tracer, M1. It is a nitrocellulose powder containing powdered tin or tin salts, and coated with graphite which gives it a black, shiny appearance. The powder is cylindrical in form and has a single perforation through its long axis.

(2) IMR 4678. - This is the standard powder for loading the cartridges, ball, M2; tracer, M1; A.P., M2; and rifle grenade, M3, currently manufactured. It is a coated, cylindrical, monoperforated, nitrocellulose powder. Its grains are shorter in length than those of the IMR 1185 powder. This powder contains no tin or tin salts but has a small quantity of potassium salts for flash elimination.

(3) HiVel No. 6.5. - A powder, coated with graphite, in the form of cylindrical, monoperforated grains, containing approximately 20% nitroglycerine. It was used in loading some 4 million rounds of high velocity armor-piercing ammunition and is currently in use as the propellant in the development of the cartridge, rifle grenade, cal..50, M1.

b. Cal..45 propellants. - (1) Bulls-eye powder No. 2. - A double base powder whose use in ball and tracer ammunition has been suspended.

(2) Pistol powder No. 5. - A single base or so-called "straight" nitrocellulose type powder presently used in the manufacture of ball ammunition and used in all recent lots of tracer ammunition prior to the suspension of its manufacture.

c. Cal..50 propellants. - The present standard propellant for standard cal..50 ball, tracer, and A.P. ammunition is IMR 4814. No information is available concerning it.

d. Blank cartridge powders. - E. C. powder (Explosives Co. powder) is granulated into small shot-like grains, pink or yellow in color. It is used in cal..30, cal..45, and cal..50 blank ammunition.

25. METHODS OF PACKING. - a. General. - There are several methods used in packing small-arms ammunition. The method employed for any particular type of cartridge can be found under the section de-

voted to the type in question. Following are the general methods:

(1) In clips and bandoleers, in metal-lined wooden packing boxes.

(2) In cartons, in metal-lined wooden packing boxes.

(3) In clips in cartons, in metal-lined packing boxes.

(4) In cartons, in wooden packing boxes (without metal lining).

(5) In machine gun belts, in various types of outside containers.

b. Identification. - (1) To assist in readily identifying types of ammunition, a system was devised which consists of painting different colored bands on the sides and ends of the packing box. The table below indicates the color scheme for each type and also the method of packing. Cal..30 and cal..45 packing boxes have vertical stripes on the front and rear faces and horizontal stripes on the ends just above the handle cuts. Cal..50 packing boxes have a diagonal stripe running from the upper right hand corner to the lower left hand corner on the front and rear faces; a diagonal stripe running from the lower right hand corner to the upper left hand corner on the ends. Just above the handle cuts is an oblong stripe half the width of the diagonal stripes. (See fig. 2.)

Types	Large Band	Superimposed Band	Packing
Cartridge, ball, cal..30	red	-	6-rd. clips in cartons 6-rd. clips in bandoleers 8-rd. clips in bandoleers fiber MG belts metal link MG belts
Cartridge, ball, cal..45	red	-	cartons
Cartridge, ball, cal..50	red	-	cartons metal link belts
Cartridge, carbine, cal..30	red	-	cartons
Cartridge, A.P., cal..30	yellow	blue	cartons metal link belts
Cartridge, A.P., cal..50	yellow	blue	cartons metal link belts
Cartridge, tracer, cal..30	yellow	green	cartons

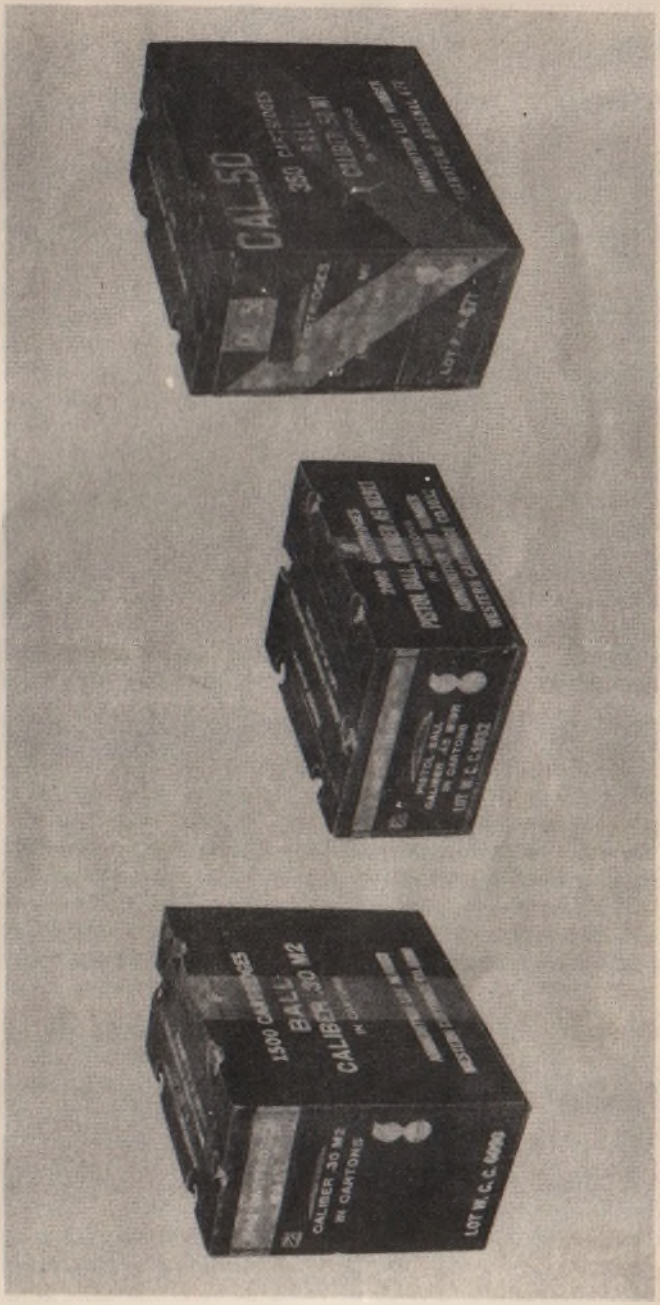


FIGURE 2. - PACKING BOXES FOR SMALL-ARMS AMMUNITION.

Types	Large band	Superimposed band	Packing
Cartridge, tracer, cal..45	yellow	green	cartons
Cartridge, tracer, cal..50	yellow	green	cartons
Cartridge, incendiary, cal..30	yellow	red	cartons
Cartridge, incendiary, cal..50	yellow	red	cartons
Cartridge, rifle grenade, cal..30	two, 1" blue stripes, 1" apart		
Cartridge, ball, cal..30 Cartridge, tracer, cal..30 together in MG belt	composite band red-left, yellow-center, green-right		metal link MG belts
Cartridge, ball, cal..50 Cartridge, tracer, cal..50 together in MG belt	composite band red-left, yellow-center, green-right		metal link MG belts
Cartridge, blank, cal..30	blue	-	5-rd. clips in cartons
Cartridge, blank, cal..45	blue	-	cartons
Cartridge, blank, cal..50	blue	-	cartons
Cartridge, dummy, cal..30	green	-	5-rd. clips in cartons
Cartridge, dummy, cal..45	green	-	cartons
Cartridge, dummy, cal..50	green	-	cartons
Cartridge, guard, cal..30	orange	-	5-rd. clips in cartons
Cartridge, gallery practice, cal..30	brown	-	cartons

Types	Large band	Superimposed band	Packing
Cartridge, A.P., cal..30 Cartridge, incendiary, cal..30 Cartridge, tracer, cal..30	no color stripes		metal link MG belts
Cartridge, A.P., cal..50 Cartridge, incendiary, cal..50 Cartridge, tracer, cal..50	no color stripes		metal link MG belts
Cartridge, A.P., cal..30 Cartridge, tracer, cal..30	composite band blue-left, yellow-center, green-right		metal link MG belts
Cartridge, A.P., cal..50 Cartridge, tracer, cal..50	composite band blue-left, yellow-center, green-right		metal link MG belts

(2) A new system of identification is included in Ordnance Field Service Technical Bulletin No. 1990-1, 1900-6.

c. Clips, bandoleers, and cartons. - (1) Clips. - (a) Cal..30 cartridges for use in the M1903 and M1917 service rifle are assembled in clips, 5 to each clip (see fig. 3a). The standard clip consists of a body and spring, both of brass. The clip holds five cartridges and with care may be used a number of times. The old clip, manufactured up to the end of World War I, and found with wartime ammunition, differs from the present clip only in the type of spring and the method by which the spring is secured to the body.

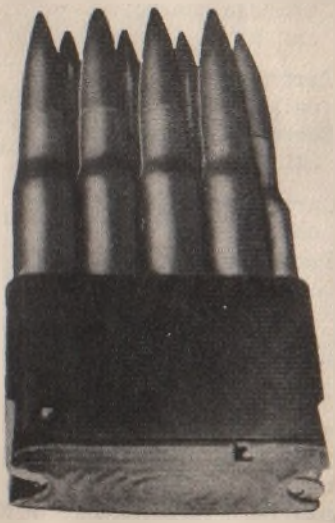
(b) Cal..30 dummy cartridges were formerly assembled in a special clip. It has been determined, however, that the tension obtained with the spring in the present standard clip, after a slight modification, is equally as good for the purpose. Accordingly, the standard clip, without tongues, marked for use with dummy ammunition has been accepted.

(c) Cartridges for use in the M1 rifle are assembled in a clip, 8 rounds to a clip (see fig. 3b). The clip is made of steel and holds the cartridge in a staggered fashion. The clip is issued with the ammunition and is expendable in wartime.

(d) In order to adapt the cal..45 ball ammunition for use in re-



a. Cal..30 clip for use in M1903 and M1917 cal..30 rifle.



b. Cal..30 clip for use in M1 cal..30 rifle.



c. Cal..45 clip for use in cal..45 revolver.

FIGURE 3. - CARTRIDGE CLIPS.

volvers, the cartridges must be assembled in a semicircular steel clip (see fig. 3c). This clip is designed to hold three cartridges in the form of a revolver cylinder which has a capacity of two loaded clips. As the ammunition does not have a projecting rim, the clip acts as a stop for the cartridges, and affords a means of extracting the empty cases by giving a surface against which the extractor acts.

(2) Bandoleers. - (a) The purpose of the bandoleer is to afford an easy means of carrying ammunition in an accessible manner. The bandoleer is made of olive-drab cotton cloth and is divided into 6 pockets. A shoulder strap of webbing and a safety pin are attached to provide an easy means of carrying it on the person. In one pocket of the bandoleer a reference card is inserted showing the type, ammunition lot number, manufacturer, and powder lot with which the ammunition is loaded. Twenty-five bandoleers are packed in the standard packing box (see fig. 4); older packings had 20 bandoleers per box.

(b) The bandoleer, M1908, is designed to hold a carton of two 5-round clips in each pocket. The packed bandoleer weighs approximately 4 pounds.

(c) The bandoleer, M1, is designed to hold a carton containing one 8-round clip in each pocket. The packed bandoleer weighs about 3-1/2 lbs.

(3) Cartons. - Cartons for packing cal..30 ammunition other than carbine, consist of small cardboard boxes made of single, manila-lined chipboard (see fig. 5). Each carton contains 20 cartridges separated by a strawboard or chipboard comb and 9 strawboard or chipboard separators. Cal..50 cartridges are packed 10 per carton in a similar manner. After packing the cartridges in the cardboard box, the box is sealed by pasting a piece of paper over the top and sides. This paper serves as a label and contains information similar to that shown on the reference cards packed in bandoleers. The color scheme used for marking boxes of each type of ammunition previously listed, is also reproduced on the carton labels. Some types of cartons are provided with tearing strips as a means of opening, others with a tearing string, while the most common method is to leave a small semicircular recess in the chipboard at the top of one of the sides. This recess is covered by the label. The label is easily punctured by the thumb. Placing the thumb in the opening and pulling up on the cover will shear the label, thereby opening the carton. Cartons for cal..30 carbine ammunition are described in paragraph 107, volume 2 of this text.

d. Packing boxes. - Ammunition for small arms is packed for shipment and storage in wooden packing boxes having watertight terneplate liners. Because of heavy wartime production and the great demands

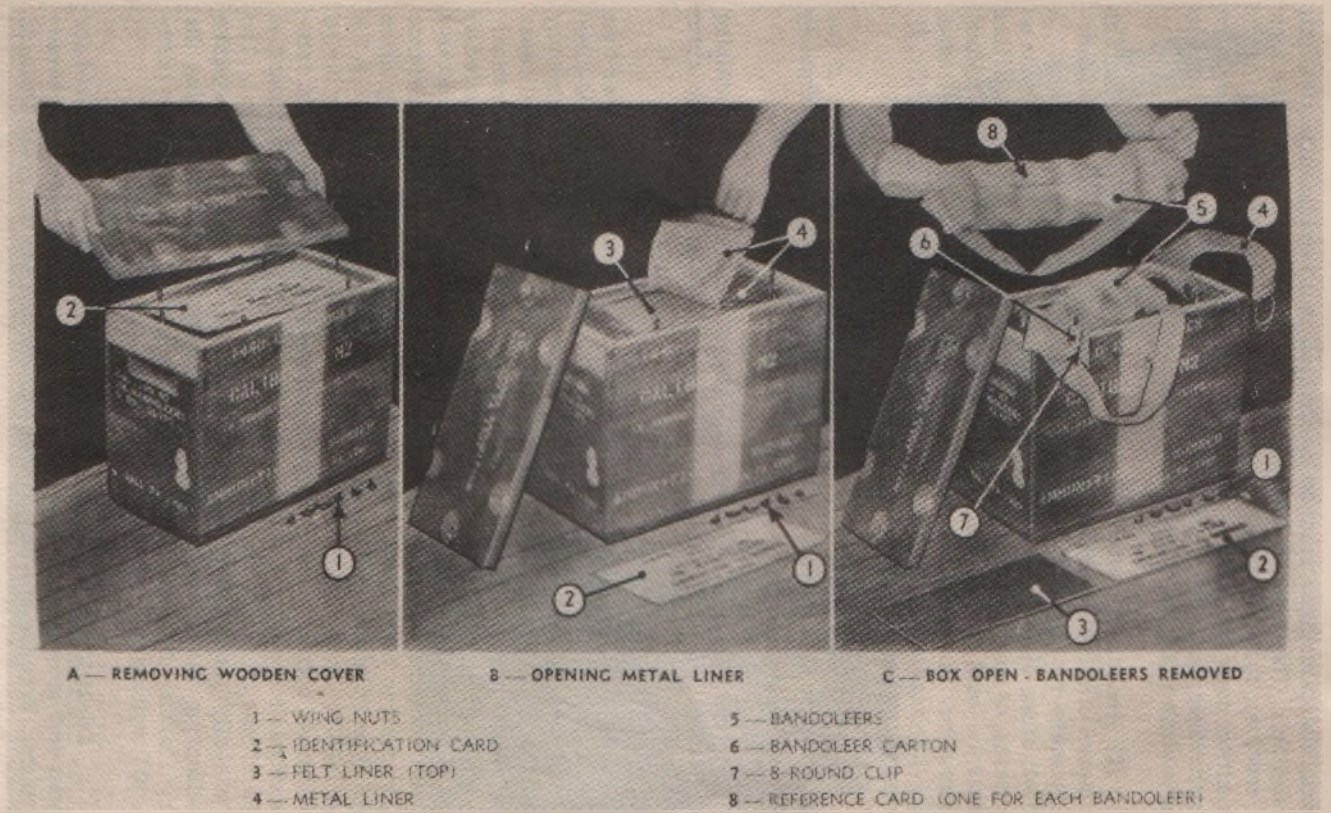


FIGURE 4. - CORRECT METHOD OF OPENING STANDARD AMMUNITION BOX.



FIGURE 5. - AMMUNITION CARTONS.

on steel production the use of terneplate liners is being gradually reduced and a heavy waxed paper liner is being introduced. The outer or wooden cover of the packing box itself is held in place by 6 wing nuts, which may easily be removed. The cover of the metal liner is closed by soldering and can be readily torn or ripped off by pulling on the wire handle provided for this purpose. The correct method of opening an ammunition box is illustrated in figure 4. The boxes are sealed at the place where packed, and marked with a description of the ammunition. Unless this information has been defaced, the contents can be easily determined without opening. A standard packing box for cal..30 ammunition, complete with lid and metal liner, weighs approximately 20 lbs. (See fig. 2.) It is designed to hold 1,200 rounds in bandoleers or 1,500 rounds in cartons. The same box is used for cal..50 ammunition but holds only 300 rounds packed in cartons. (See fig. 2.) The cal..45 ammunition packing box is of different dimensions and holds 100 cartons of 20 rounds each, or 2,000 rounds. (See fig. 2.) Information concerning the cal..30 carbine ammunition packing box may be found in paragraph 107, volume 2.

e. Ammunition box, M1. - This box is the standard container for cal..30 belted machine gun ammunition as used by ground forces. It is made of steel, painted a dark olive-drab, and has 4 handles conveniently located for removal or carrying (see fig. 6). The box is sealed and is air and watertight. It is in use at present in all armored vehicles and will be issued to machine gun squads. 250-round web MG belts loaded with 225 rounds of ball and tracer ammunition in the ratio of 4 to 1 respectively are packed 1 belt per box. At the present time the loaded boxes are in turn loaded in the standard cal..30 wooden packing box. Inasmuch as the steel boxes fit loosely in the wooden box it is safe to assume that in the near future a special packing box for the ammunition box, M1, will be developed. The steel box has a latch which tightly closes the cover and with the cover removed the latch also serves to fix the box to the machine gun mount. The box, once used, is expendable. A box similar to the ammunition box, M1, to be loaded with belted cal..50 ammunition has been recently standardized but no information is at present available concerning it.

f. Links. - Ammunition for cal..30 aircraft machine guns and all cal..50 machine guns is assembled for firing into metal links, (see fig. 7) usually 100 rounds in links composing a belt. The links are designed so that when the fired case is extracted from the chamber the link is free to fall, the cartridge alone holding the links together.

g. Marking. - For quick and sure identification the Ordnance Department has drawn up regulations describing the method of marking packing boxes, cartons, and ammunition identification cards.

(1) Packing boxes. - All packing boxes according to regulations

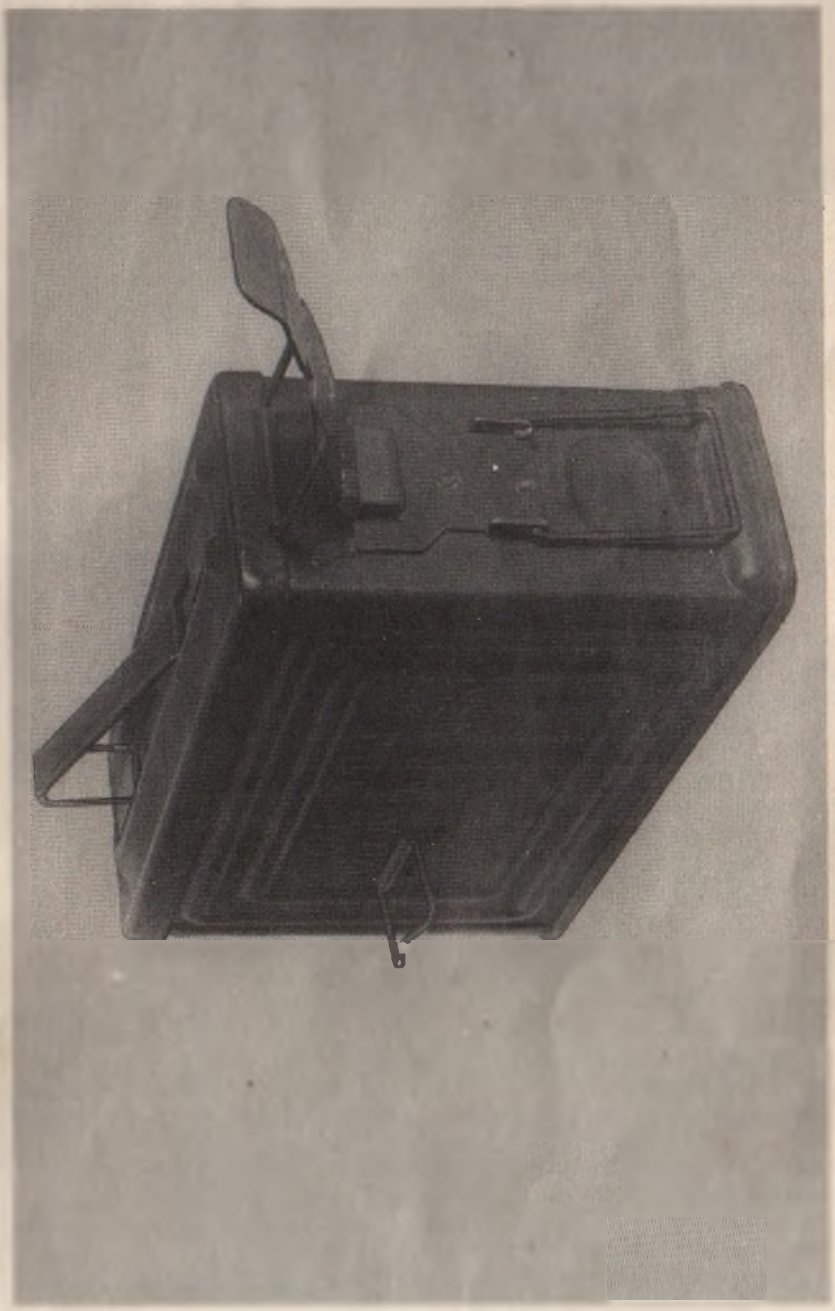


FIGURE 6. - AMMUNITION BOX, M1.

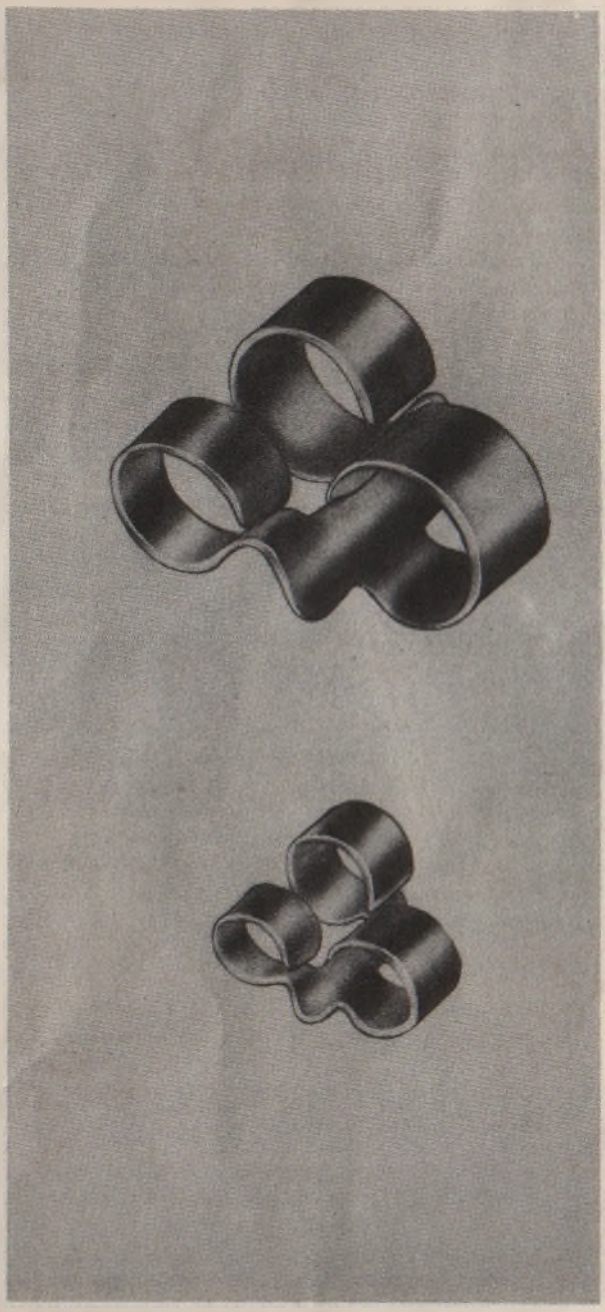


FIGURE 7. - CAL..30 AND CAL..50 METALLIC LINK BELTS.

are painted brown and in addition bear the color stripes described above. The markings (fig. 2) include:

(a) Name and address of consignee (one side).
(b) Shipping designation of contents (top).
(c) Quantity and standard nomenclature of contents (4 sides).
(d) Gross weight in pounds and displacement in cubic feet (1 side).
(e) Number of shipping ticket and number of package (1 side).
(f) The letters, U.S. (in several conspicuous places).
(g) Order number or contract number (1 side).
(h) Ordnance insignia and escutcheons (both ends).
(i) Name or designation of consignor (1 side).
(j) Ammunition lot number (top and 4 sides).
(k) Month and year packed.
(l) Inspector's stamp.

(2) Cartons. - Cartons bear a label upon which is printed in black the quantity, type, caliber, model, ammunition lot number, and manufacturer (see fig. 5). Color stripes similar to those on the packing boxes are marked on the labels, except that for blank ammunition the label itself is blue and for dummy ammunition it is green.

(3) Ammunition identification cards. - An identification card, approximately 6-1/2" by 15", showing the quantity, type, caliber, model, ammunition lot number, and the symbol of the manufacturer is sealed inside the metal liner on top of the ammunition in each box. A similar card, 10" by 13", is packed with cal..45 ball ammunition.

26. AMMUNITION LOTS. - a. Ammunition lot numbers are assigned at the time of manufacture to all types of service ammunition. Small-arms ammunition is manufactured in lots which may be a fixed number of rounds, say 200,000, or which may be one day's production at the factory, which in some cases will run into a million or more rounds.

b. The ammunition lot number serves to identify one combination of component lots assembled by one manufacturer under uniform conditions. As the various component lots become exhausted, the ammunition lot number is changed to indicate the incorporation of new component lots in the assembly. This grouping of like components results in an ammunition lot, the rounds of which may be expected to function in a uniform manner during its serviceable life.

c. The ammunition lot number is the means by which all service ammunition is identified and its importance is paramount. The incorrect reporting of an ammunition lot might result in the condemning of large quantities of serviceable ammunition or the issue of condemned ammunition to the service. The only letters used in connection with lots of, M1,

and M2 ammunition are the initials of the manufacturer. In reporting ammunition, the following is the correct way to describe a particular lot; "Cartridge, ball, cal..30, M1, lot F.A. 900," or "Cartridge, tracer, cal..50, M1, lot F.A. 28," etc.

27. GRADES AND USES OF SMALL-ARMS AMMUNITION. - a. Reasons for grading. - Owing to the peculiar characteristics of each type of weapon, or the manner in which it is mounted or used, the peculiarities and uses of these weapons must be considered in the mass production of ammunition of a given type and caliber. Therefore, the production orders and specifications call for the manufacture of lots for use in specific weapons.

b. Examples. - (1) Production orders for ammunition for use in the service rifle require that the average of the 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) Production orders for ammunition for use in synchronized remote controlled aircraft machine guns require that the ammunition be of selected uniformity in dimensions and weight, and minimum variation in rate of ignition. These requirements are essential to insure continuous feeding during the 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 control exercised by the operator; and the lower rate of fire; less stringent test limits are required. As the amount of extraction pull is not a factor in machine gun functioning, ammunition that meets the general specifications for accuracy, pressure dimensions, etc., is satisfactory.

c. Velocity, pressure, and 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 must be less accurate or develop higher or lower pressures or velocities than a lot manufactured for ground machine guns or rifles.

d. Designation of grades. - (1) Cal..30 ammunition is generally grouped into one of the following four grades or combination of grades. The authorized use of the ammunition in each of the grades is also shown.

For cal..30 or cal..50. —

AC ---------- For aircraft machine guns.
AC, MG, or R ---------- For antiaircraft machine guns, cal..30.
AC or MG ---------- For antiaircraft machine guns, cal..50.
R ---------- For rifles, semiautomatic and automatic rifles. For armor-piercing and tracer ammunition only, grade AC may be used if grade R is not available.
MG, AC or R ---------- For ground machine guns, cal. 30.
MG or AC ---------- For ground machine guns, cal..50.
3 ---------- Unserviceable, not to be used.

(2) It will not be noted that more than one grade is authorized for certain weapons (see fig. 8). This action is taken to provide flexibility in the issue and use of stocks on hand. The first grade indicated for each of the several weapons is the preferred grade, and will be habitually issued and used, except where stocks on hand will not permit, in which case advantage will be taken of the substitute grades. The substitutions authorized above may be made, either in use in the field or by issue depots without reference to the requisitioning source. Grade substitution may be made by the using services.

(3) For cal..45. —

1 ---------- For cal..45 revolvers, pistols, and submachine guns.
2 ---------- For cal..45 pistols, and submachine guns only. When available, this grade should be issued for these weapons in lieu of grade 1.
RT ---------- Not to be used, requires roll test.
3 ---------- Not to be used. Unserviceable.

(4) For other calibers the only symbol used is grade 3, which indicates unserviceability.

e. Grade 3 ammunition. - (1) When small-arms ammunition becomes unserviceable it is designated as "grade 3" and withdrawn from service. Ammunition of this grade is generally unfit for service and must not be issued or used under any circumstances, except as specifically listed below. Ammunition which cannot be identified because of obliterated markings or because of loose cartridges mixed in packing boxes, 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.

(2) Reuse of grade 3 ammunition at posts, camps, and stations. - The following instructions from the Office of the Chief of Ordnance, dated August 1, 1942, are of importance in considering the possible uses of grade 3 ammunition. It refers only to that ammunition that has become

GRADES AND USES-SMALL ARMS AMMUNITION

ILLUSTRATING INTERCHANGEABILITY OF GRADES

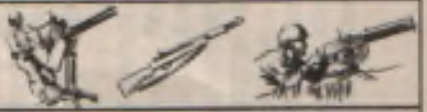
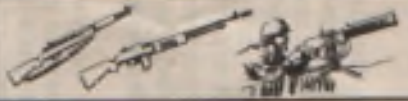
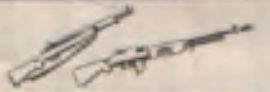
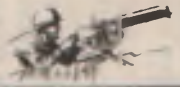
GRADES	WEAPON AUTHORIZED	ADDITIONAL WEAPONS
AC		
AC OR R		
R		
MG		NON
3	NONE	NONE



FIGURE 8. - GRADES AND USES OF SMALL-ARMS AMMUNITION.

grade 3 ammunition due to the failure to maintain a proper record of its lot numbers. Because of loss of identity, such ammunition, upon its return to the ordnance officer of the post, camp or station, has had to be automatically classified as grade 3 ammunition.

(a) Grade 3 ammunition is to be divided into three classifications as follows:

1. Small-arms ammunition that can be identified as having been issued to a specific organization. Ammunition in this classification, after a visual inspection to eliminate defective rounds may be reissued for immediate use, but only for local training purposes. Before reissue this ammunition must be reclassified to the lowest of grade of any of the small-arms ammunition originally issued by the ordnance officer to the organization that returned it as unidentified ammunition.

2. Small-arms ammunition that cannot be identified as in classification 1. Ammunition in this classification should be graded as grade 3 ammunition, and shipped to a field service depot, in accordance with existing regulations.

3. Small-arms ammunition that is known to contain rounds from one or more lots of ammunition that have been regraded to grade 3 ammunition by direction of the Chief of Ordnance during the period that such lot or lots of ammunition have been in the possession of the organization that returns it. Ammunition in this classification must be automatically graded as grade 3, and should be shipped to a field service depot, in accordance with existing regulations.

(b) These instructions are not intended in any way to relax the present regulations regarding the necessity of the Ground Forces, Air Forces, and Services of Supply to maintain the identity of small-arms ammunition through keeping an accurate record of its lot numbers.

(3) More frequently in time of peace, when ammunition is subjected to long storage, certain characteristics are revealed in surveillance tests which impair the efficiency of the ammunition for the use in the guns for which initially graded. In this case the lots are regraded into one of the lower classifications. For example, grade AC might be regraded as grade R or grade MG, but grade MG may not be regraded as grade R or grade AC.

(4) From the above discussion it must not be assumed that in combat if a grade of ammunition suitable for firing in a particular weapon is not available, that the weapon will not be used. As can be noted from the use and grades listed above, there is considerable flexibility in the grading — ammunition is adaptable to several weapons. Furthermore,

in actual combat, while every effort is made to provide the correct grades of ammunition for the using troops, they will fire what they have and what is supplied to them.

(5) The peace time use of the different grades of small-arms ammunition is described in AR 775-10 and OFSB 3-5.

CHAPTER 2

ARMOR-PIERCING CARTRIDGES

		Paragraphs
SECTION I.	Cartridge, A.P., cal..30, M2	28-32
II.	Cartridge, A.P., cal..50, M2	33-37
III.	Cartridge, A.P., cal..50, M1	38-42

SECTION I

CARTRIDGE, A.P., CAL..30, M2

	Paragraph
General description	28
Identification	29
Grades and uses	30
Packing	31
Exterior ballistics	32

28. GENERAL DESCRIPTION. - a. Development and tactical use. - The cartridge, A.P., cal..30, M2, was standardized in 1940; it replaces the cartridge, A.P., cal..30, M1, which is classified as limited standard. This cartridge was developed to obtain a round whose bullet would give better penetration of light armor plate than was obtained with the A.P. cartridge, M1. Intended for firing from aircraft against aircraft, it may also be used in antiaircraft, antitank, tank, and shoulder weapons. In the Air Forces the cartridge, A.P., cal..30, M2, has replaced the cal..30 ball cartridge; in the Ground Forces it is in the process of replacing ball machine gun ammunition for all but target and proof firing, and this conversion will be completed as rapidly as manufacturing facilities permit (see par. 56a).

b. Components. - The cartridge consists of the case, primer, propelling charge, and bullet. Waterproofing is applied in the neck before assembly; the joint between the walls of the primer and the primer pocket of the case is waterproofed with a visible material. The components are described as follows (see fig. 9):

(1) Propelling charge. - The propelling charge is a progressive-burning powder, IMR 4676 (see par. 24). Sufficient powder is loaded into the case to give an instrumental velocity of 2,730 ± 30 ft. per sec. at a distance of 53 feet from the muzzle. The propellant ordinarily weighs approximately 53 grains, and there is no great variation in the amounts of powder loaded into the cases of cartridges of different lot numbers.

(2) Bullet. - The bullet has a maximum weight of 168 grains, or with alternative core material, 168.5 grains. It has a maximum length of 1.390" and a radius of ogive not exceeding 2.1". Beginning at a point

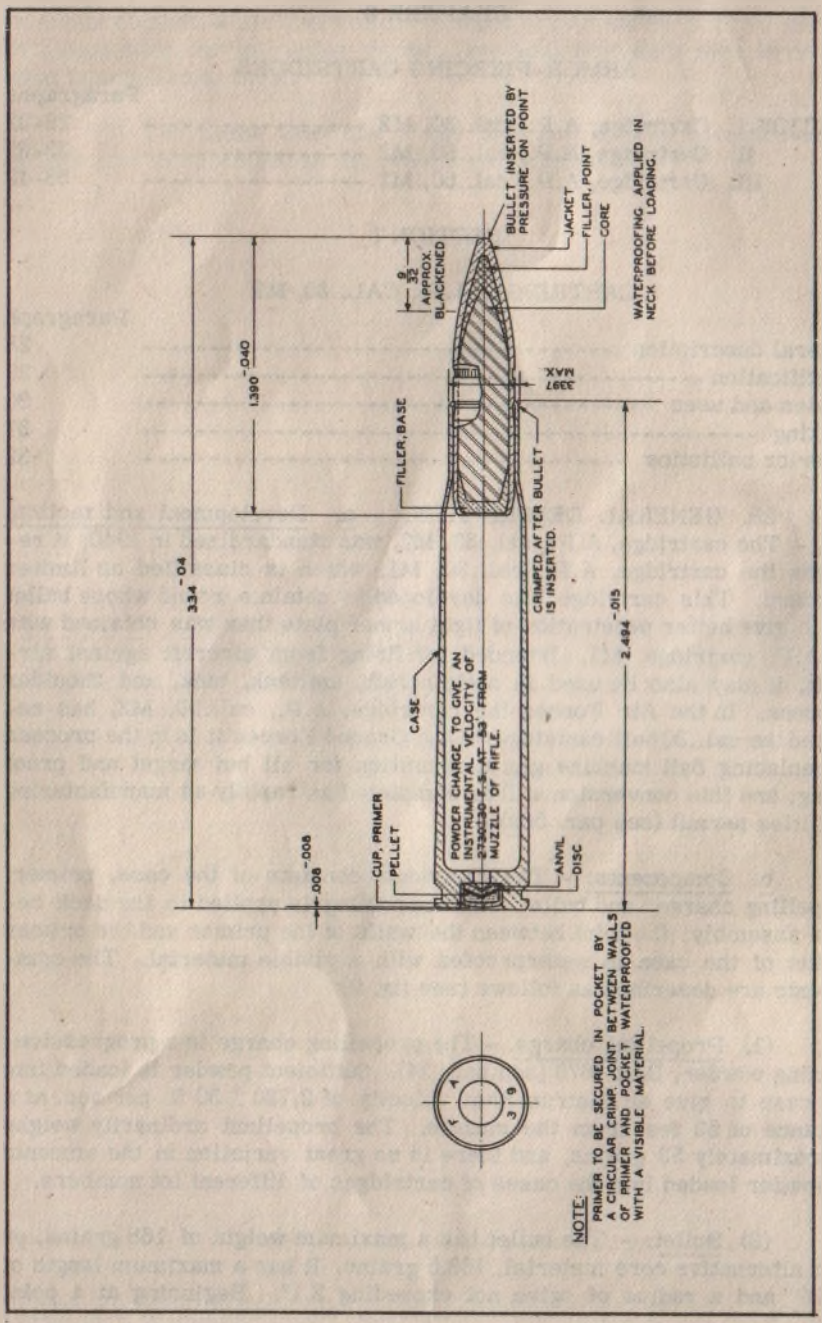


FIGURE 9. CARTRIDGE, A.P., CAL..30, M2.

0.093" from the rear of the bullet, the base is tapered at an angle of 5° (forming an included angle of 10°). A jacket of gilding metal encloses a base filler of gilding metal, a point filler "T" shot, and a core of tungsten chromium steel, or alternatively, manganese molybdenum steel. The base filler is inserted to provide a tight seal in the base of the bullet, thus aiding in the prevention of the stripping away of the jacket. The bullet is secured to the case by crimping the mouth of the case into the French cut after the bullet is inserted into the case. In order to distinguish the cal..30, M2, cartridge from the M1, the M2 is manufactured with both a French cut and a cannelure in the jacket of the bullet; the French cut is lacking in the M1. The minimum pull required to extract the bullet from the case is 250 lbs.

(3) Case. - The cartridge case is made of brass and weighs no more than 200 grains.

(4) Primer. - The primer standard for assembly in this cartridge is designated as primer No. 26 (see par. 22). It is secured in the pocket of the case by a circular crimp.

(5) Weights. -

Item	Weight in grains
Cartridge, complete (approximate)	414.
Cartridge case	200. -20
Primer, complete	5.594 -0.224
Bullet	168. -5
Bullet (alt. core mat.)	168.5 -5
Jacket	65. -1.5
Core	84. -2
Core (alt. mat.)	82.4 -2
Filler, base	7.7 -0.5
Filler, point	36 pellets to 1 oz.
Powder charge (approximate)	53.

29. IDENTIFICATION. - a. The type, caliber, ammunition lot number, and manufacturer's initials are the essential factors in identifying the cartridge, A.P., cal..30, M2.

(1) Marking on original packing box (see par. 25).

(2) Marking on cartons (see par. 25).

(3) An identification card is in each box of ammunition (see par. 25).

(4) The manufacturer's initials and the numerals 40, or above, indicating the year of manufacture, are stamped on the head of the cartridge case.

(5) To identify cal..30 A.P., M2, ammunition positively, proceed as explained in paragraph 44b.

b. The M1 and the M2 cartridges may be clearly distinguished by the fact that the cannelure of the M2 bullet is machined into the jacket and is located approximately 1/8" in front of the French cut, into which the case is crimped.

30. GRADES AND USES. - The cartridge, A.P., cal..30, M2, is graded "AC," "AC or R," "R," "MG," and "3." For the primary use of each of these grades and possible substitutions of one grade for another (see par. 27.)

31. PACKING. - The cartridge, A.P., cal..30, M2, is packed in cartons, in clips in bandoleers, in fabric MG belts, and in metallic link belts. At the present time, M2 cartridges packed in cartons are loaded into boxes having a heavy waxed cardboard liner, which replaces the customary terneplate liner. (See par. 25.)

32. EXTERIOR BALLISTICS. -

Maximum range (approximate)	yards	3,500
Effective range		*
Muzzle energy	ft.-lbs.	2,780
Pressure, average maximum	p.s.i.	50,000

Velocity

Standard instrumental velocity at 78' from muzzle	ft./sec.	2,715
Standard instrumental velocity at 53' from muzzle	ft./sec.	2,730
Standard theoretical velocity at muzzle	ft./sec.	2,775

Penetration

Average penetrations against 7/8" homogenous armor plate with a Brinell hardness of 380-430 is approximately 1/2".

*Effective range is dependent on the thickness and type of armor plate against which the bullet is fired.

SECTION II

CARTRIDGE, A.P., CAL..50, M2

	Paragraph
General description	33
Identification	34
Grades and uses	35
Packing	36
Exterior ballistics	37

33. GENERAL DESCRIPTION. - a. Development and tactical use. - The cartridge, A.P., cal..50, M2, was standardized in 1939. It was developed for firing against light armor, such as that on aircraft or lightly armored vehicles. In the Air Forces this cartridge has replaced the cal..50 ball cartridge; in the Ground Forces it is in the process of replacing ball machine gun ammunition for all but target and proof firing, and this conversion will be completed as rapidly as manufacturing facilities permit (see par. 56a).

b. Components. - The cartridge consists of the case, primer, propelling charge, and bullet. Waterproofing is applied in the neck before assembly; the joint between the walls of the primer and the pocket in the case is waterproofed with a visible material. The components described are as follows (see fig. 10):

(1) Propelling charge. - The propelling charge is a progressive-burning powder, IMR 4814. (See par. 24.) Sufficient powder is loaded into the case to give an instrumental velocity of 2,900 ± 30' per sec. at a distance of 78' from the muzzle. The propellant ordinarily weighs approximately 235 grains, and there is no great variation in the amounts of powder loaded into the cases of cartridges of different lot numbers.

(2) Bullet. - The bullet has a maximum weight of 718 grains, or with alternative core material, 708 grains. It has a maximum length of 2.31" and a radius of ogive not exceeding 4.5". Beginning at a minimum distance of 0.386" from the rear of the bullet, the base is tapered at an angle of 9° (forming an included angle of 18°). A jacket of gilding metal encloses a point filler of lead-antimony and a core of tungsten chromium steel, or alternatively, manganese molybdenum steel. In order to distinguish the cal..50, M2, A.P. cartridge from the M1, the M2 is manufactured with both a cannelure and a French cut in the jacket of the bullet; the French cut is lacking in the M1. The bullet is secured to the case by crimping the mouth of the case. The minimum pull required to extract the bullet from the case is 400 lbs.

(3) Case. - The cartridge case is made of brass and weighs no more than 850 grains.

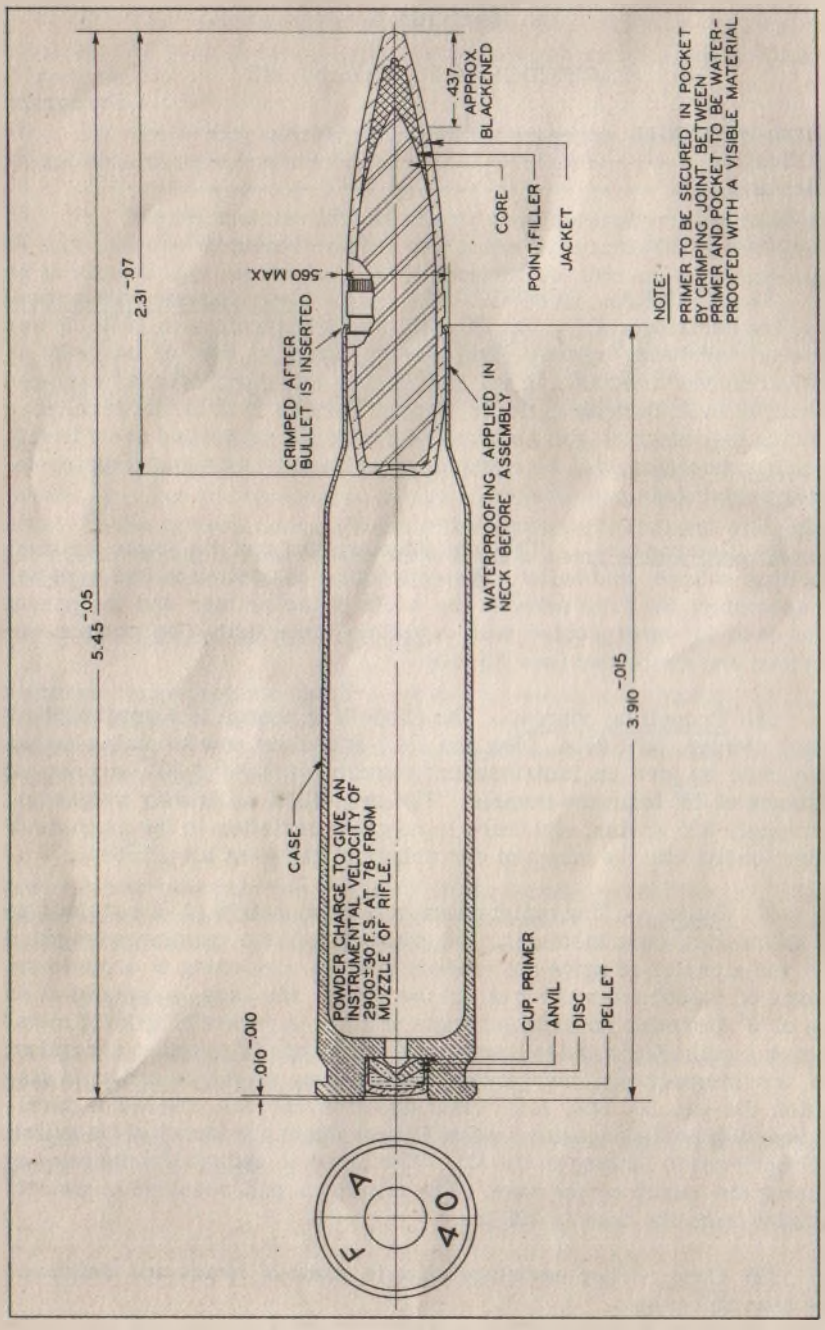


FIGURE 10 - CARTRIDGE, A.P., CAL..50, M2.

(4) Primer. - The primer standard for assembly in this cartridge is designated as primer No. 28 (see par. 22).

(5) Weights. -

Item	Weight in grains
Cartridge, complete (approximate)	1822. -68
Cartridge case	850 -50
Primer, complete	18.06 -1.11
Bullet	718. -17.
Bullet, alt. core mat.	708. -22
Jacket	253. -5
Core	410. -10
Core (alt. mat.)	400. -15
Point filler	56.5 -2
Powder charge (approximate)	235.

34. IDENTIFICATION. - a. The type, caliber, ammunition lot number, and manufacturer's initials are the essential factors in identifying the cartridge, A.P., cal..50, M2.

(1) Marking on original packing box. (See par. 25.)

(2) Marking on cartons. (See par. 25.)

(3) An identification card is in each box of ammunition. (See par. 25.)

(4) The manufacturer's initials and the numerals 39, or above, indicating the year of manufacture, are stamped on the head of the cartridge case. However, since cal..50 cartridge cases are resized and used again, the numerals are not a sure test of the year of assembly of the cartridge.

(5) The bullet point of this cartridge is blackened for a distance of 7/16".

(6) To identify cal..50, M2, A.P. ammunition positively, proceed as explained in paragraph 44b.

b. The M1 and M2 cartridges manufactured at the same time may be clearly distinguished by the fact that the cannelure of the M2 bullet is located approximately 1/8" in front of the French cut into which the case is crimped. Since manufacture of the M1 has been discontinued, however, the cannelure has been omitted on some lots of the M2 cartridge in order to save time by cutting out an additional operation in manufacture.

35. GRADES AND USES. - The cartridge, A.P., cal..50, M2, is graded "AC," "MG," and "3." For the primary use of each of these grades and the possible substitutions of one grade for another, see paragraph 27.

36. PACKING. - The cartridge, A.P., cal..50, M2, is packed either in cartons or in metallic link belts. (See par. 25.)

37. EXTERIOR BALLISTICS. -

Maximum range (approximate)	yards	7,200
Pressure, average maximum	p.s.i.	52,000

Velocity

Standard instrumental velocity at 78' from muzzle	ft./sec.	2,900
Standard theoretical velocity at muzzle	ft./sec.	2,935

Penetration

Confidential.

SECTION III

CARTRIDGE, A.P., CAL..50, M1

	Paragraph
General description	38
Identification	39
Grades and uses	40
Packing	41
Exterior ballistics	42

38. GENERAL DESCRIPTION. - a. Development and tactical use. - The cartridge, A.P., cal..50, M1, was standardized in 1931. It is now classified as limited standard, having been superseded by the cal..50 A.P., M2.

b. Components. - The cartridge consists of the case, primer, propelling charge, and bullet. Waterproofing is applied in the neck before assembly; the joint between the walls of the primer and the pocket in the case is waterproofed with a visible material. The components are described as follows (see fig. 11):

(1) Propelling charge. - The propelling charge is a progressive burning powder, IMR 1185. (See par. 24.) The powder charge is determined for each lot of powder so as to give an instrumental velocity of 2,500 ft. per second at a distance of 78' from the muzzle. The propellant weighs approximately 240 grains.

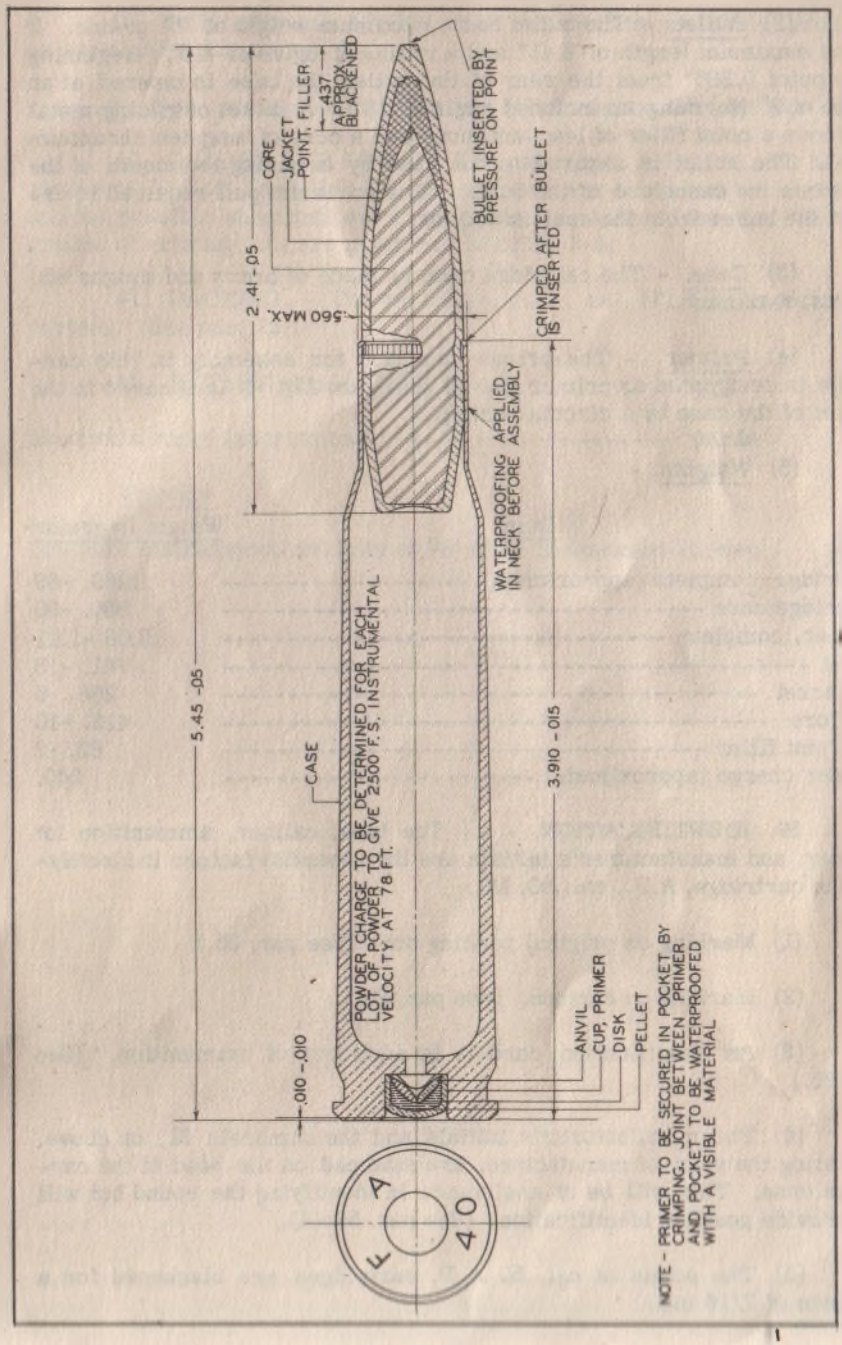


FIGURE 11. - CARTRIDGE, A.P., CAL..50, M1.

(2) Bullet. - The bullet has a maximum weight of 761 grains. It has a maximum length of 2.41" and a radius of ogive of 4.5". Beginning at a point 0.386" from the rear of the bullet, the base is tapered at an angle of 9° (forming an included angle of 18°). A jacket of gilding metal encloses a point filler of lead-antimony and a core of tungsten chromium steel. The bullet is secured to the case by crimping the mouth of the case into the cannelure of the bullet. The minimum pull required to extract the bullet from the case is 400 lbs.

(3) Case. - The cartridge case is made of brass and weighs 850 grains, maximum.

(4) Primer. - The primer standard for assembly in this cartridge is designated as primer No. 28 (see par. 22). It is secured in the pocket of the case by a circular crimp.

(5) Weights. -

Item	Weight in grains
Cartridge, complete (approximate)	1869. -69
Cartridge case	850. -50
Primer, complete	19.08 -1.11
Bullet	761. -18
Jacket	266. -6
Core	413. -10
Point filler	82. -2
Powder charge (approximate)	240.

39. IDENTIFICATION. - a. The type, caliber, ammunition lot number, and manufacturer's initials are the essential factors in identifying the cartridge, A.P., cal..50, M1.

(1) Marking on original packing box. (See par. 25.)

(2) Marking on cartons. (See par. 25.)

(3) An identification card is in each box of ammunition. (See par. 25.)

(4) The manufacturer's initials and the numerals 31, or above, indicating the year of manufacture, are stamped on the head of the cartridge case. This will be of assistance in identifying the round but will not provide positive identification. (See par. 58b(4).)

(5) The points of cal..50 A.P. cartridges are blackened for a distance of 7/16 inch.

(6) To identify cal..50, M1, A.P. ammunition positively, proceed as explained in paragraph 44b.

b. For means of identifying the M1 from the M2 (see par. 34b).

40. GRADES AND USES. - The cartridge, A.P., cal..50, M1, is graded "AC," "MG," and "3." For the primary use of each of these grades and the possible substitutions of one grade for another (see par. 27). The grades of existing lots are published in OFSB 3-5.

41. PACKING. - The cartridge, A.P., cal..50, M1, is packed in cartons. (See par. 25.)

42. EXTERIOR BALLISTICS. -

Maximum range (approximate) ----------	yards	7,125
Velocity		
Standard instrumental velocity at 78' from the muzzle-	ft./sec.	2,500

CHAPTER 9

BALL CARTRIDGES

		Paragraphs
SECTION I.	Cartridge, ball, cal..30, M2	43-46
II.	Cartridge, ball, cal..30, M1	47-50
III.	Cartridge, ball, cal..45, M1911	51-55
IV.	Cartridge, ball, cal..50, M2	56-60

SECTION I

CARTRIDGE, BALL, CAL..30, M2

	Paragraph
General description	43
Identification	44
Grades, uses, and packing	45
Exterior ballistics	46

43. GENERAL DESCRIPTION. - The cartridge, ball, cal..30, M2, is the standard ball cartridge at the present time, having superseded the cartridge, ball, cal..30, M1. The cartridge has adequate power and range to satisfy the requirements of non-belt-fed weapons. It has less recoil and is therefore less fatiguing than the M1 cartridge, when used in shoulder weapons. It also has the advantage of causing less corrosion.

a. The cartridge consists of a case, primer, charge of smokeless powder, and bullet. The primer is secured in the pocket in the case by a circular crimp. The joint between the walls of the primer and the pocket is waterproofed with a visible material, the material used being at the discretion of the manufacturer. Waterproofing material is applied in the neck prior to loading of the powder charge and insertion of the bullet. The components are described as follows (see fig. 12):

(1) Propelling charge. - The propelling charge is a progressive burning powder, IMR 4676. (See par. 24.) Sufficient powder is loaded into the case to give an instrumental velocity of 2,740 ± 30' per second at a point 78' from the muzzle of the rifle. There is no great variance in the amounts of powder loaded into the cases of cartridges of different lots and the propellant ordinarily weighs approximately 50 grains.

(2) Bullet. - The bullet, weighing approximately 150 grains, has a gilding metal jacket over a lead antimony slug. It has a maximum length of 1.123", a radius of ogive not exceeding 2.1" (7 calibers), and a flat base. The mouth of the cartridge case is crimped into the cannelure of the bullet, thereby securing the bullet to the case. The minimum pull required to extract the bullet from the case is at least 100 lbs., and may be 150 lbs.

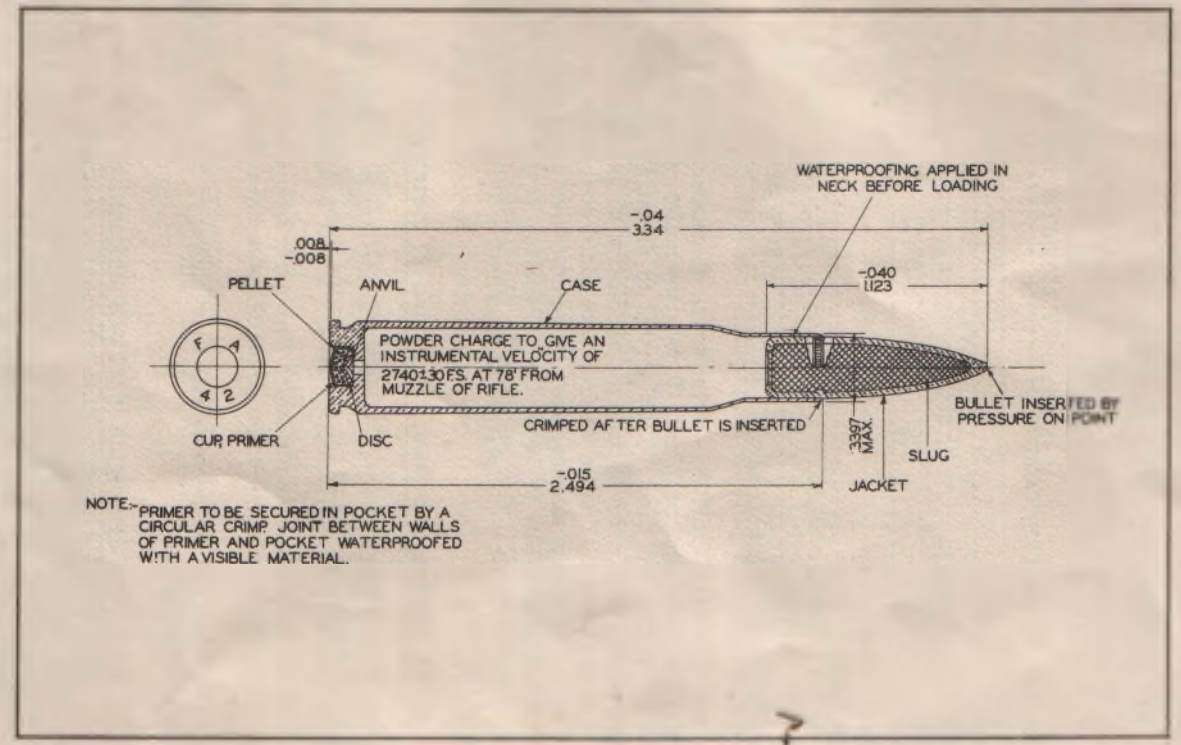


FIGURE 12. - CARTRIDGE, BALL, CAL..30, M2.

(3) Primer. - The primer standard for assembly in this cartridge is primer No. 26 (see par. 22).

(4) Weights; cartridge and components. -

Item	Weight in grains
Cartridge, complete (approximate)	396.
Cartridge case	200. -20.
Bullet	152. -3.
Jacket	52.5 -1.5
Slug	99.5 -1.5
Primer	5.594 -0.224
Anvil	1.168 -0.06
Cup, primer	3.44 -0.1
Disk	0.024 -0.004
Pellet	0.45 -0.06
Propellant powder (approximate)	50

44. IDENTIFICATION. - Prior to the discontinuance of the manufacture of the cartridge, ball, cal. .30, M1, the bullet of the M2 cartridge was coated with a tin wash. This served to distinguish one cartridge from the other and to prevent the loss of identity of lots of bullets at the place of manufacture. The tin wash was an added cost factor and necessitated an extra step in manufacture; therefore when manufacture of the M1 cartridge ceased late in 1940, the tin coating of the M2 bullet also ceased. Improved ballistics resulted as the tin wash tended to cause fouling in the bore.

a. To distinguish between the M2 and M1 cartridges:

(1) The M2 case has the numerals 38 or higher on the head. The M1 case has the numerals 25 through 41 on the head of the case.

(2) During the period in which both cartridges were being manufactured simultaneously, the bullet of the M2 was tin-coated.

(3) Cases having the numerals 42 or higher on the head are cases of the M2 cartridge only.

b. Positive identification of M2 ball ammunition. - In examining a box of ammunition for identification, proceed as follows: Examine the outside of the packing box, the carton, or the bandoleer card. If the ammunition lot number on the packing box agrees with the ammunition lot number stamped or printed on the carton or bandoleer card, the lot is positively identified by that number. This lot number should be checked against the listing of lot numbers for that type of cartridge in the OFSB

3-5 to determine the grade and use of the cartridge, whenever conditions permit. With the exception of the contained number of cartridges and the caliber, no number appears on the packing box except the ammunition lot number.

(1) THIS SYSTEM OF POSITIVE IDENTIFICATION OF AMMUNITION BY AMMUNITION LOT NUMBER SHOULD BE FOLLOWED WHENEVER AMMUNITION IS TO BE USED.

45. GRADES, USES, AND PACKING. - a. Grades and uses. - Cartridge, ball, cal..30, M2, is graded "AC," "AC or R," "R," "MG" and "3." For the primary use of each of these grades and the possible substitutions of one grade for another (see par. 27). The grades of existing lots are published in OFSB 3-5.

b. Packing. - Cartridge, ball, cal..30, M2, is packed in cartons; in clips in cartons; in clips in bandoleers; and in machine gun belts; (see par. 25.) For pertinent data as to methods of packing and box markings refer to appropriate Standard Nomenclature List. For color stripes refer to paragraph 25.

(1) The packing box with metal liner weighs approximately 20 pounds. The weights for various types of packings are as follows:

Number of rounds	Types of packing	Weight, pounds exclusive of packing box
1,200	Clips and bandoleers	76
1,500	Clips and cartons	94
1,500	Cartons	89

46. EXTERIOR BALLISTICS. - The following proving ground data gives the general characteristics of the cal..30, M2, ball cartridge when fired from rifles and machine guns. Complete firing tables published under direction of the Chief of Ordnance are listed in Standard Nomenclature List No. F-69.

Maximum range (approximate)	yards	3,500
Pressure, average maximum	lbs./sq.in.	50,000

Velocity

Standard instrumental velocity at 78' from the muzzle - ft./sec.	2,740
Standard instrumental velocity at 53' from the muzzle - ft./sec.	2,755
Standard theoretical velocity at the muzzle - ft./sec.	2,805

SECTION II

CARTRIDGE, BALL, CAL..30, M1

	Paragraph
General description	47
Identification	48
Grades, uses, and packing	49
Exterior ballistics	50

47. GENERAL DESCRIPTION. - The cartridge, ball, cal..30, M1, was adopted in the early part of 1926, after a series of experiments with various types of bullets. The development work was undertaken primarily to gain increased range and superior accuracy over the wartime M1906 cartridge. The cartridge, ball, cal..30, M1, is now limited standard, its manufacture having been discontinued.

a. The cartridge consists of the case, primer, charge of smokeless powder, and the bullet. Waterproofing is accomplished by shellacking or varnishing the inside of the neck of the case before seating the bullet and placing a drop of shellack on the joint between the primer and the case. The components are described as follows: (See fig. 13.)

(1) Propelling charge. - The propelling charge is a progressive burning powder, IMR 1185. (See par. 24.) Sufficient powder is loaded into the case to give an instrumental velocity of 2,600 per second at a distance of 78' from the muzzle. There is no great variance in the amounts of powder loaded into the cases of cartridges of different lot numbers and the propellant ordinarily weighs approximately 50 grains.

(2) Bullet. - The bullet has a maximum weight of 174.5 grains consisting of a gilding metal jacket enclosing a lead-antimony alloy slug. The bullet is 1.33" long and has a radius of ogive not exceeding 2.1" (7 calibers). Beginning at a point approximately 0.25" from the base line of the bullet, the rear part is tapered from the cylindrical part at an angle of 9° (forming an included angle of 18°). The bullet is secured in the cartridge case by crimping the mouth of the case into the cannelure of the bullet. The minimum pull required to extract the bullet from the case is 150 lbs.

(3) Primer. - The primer standard for assembly in this cartridge is designated primer No. 26 (see par. 22).

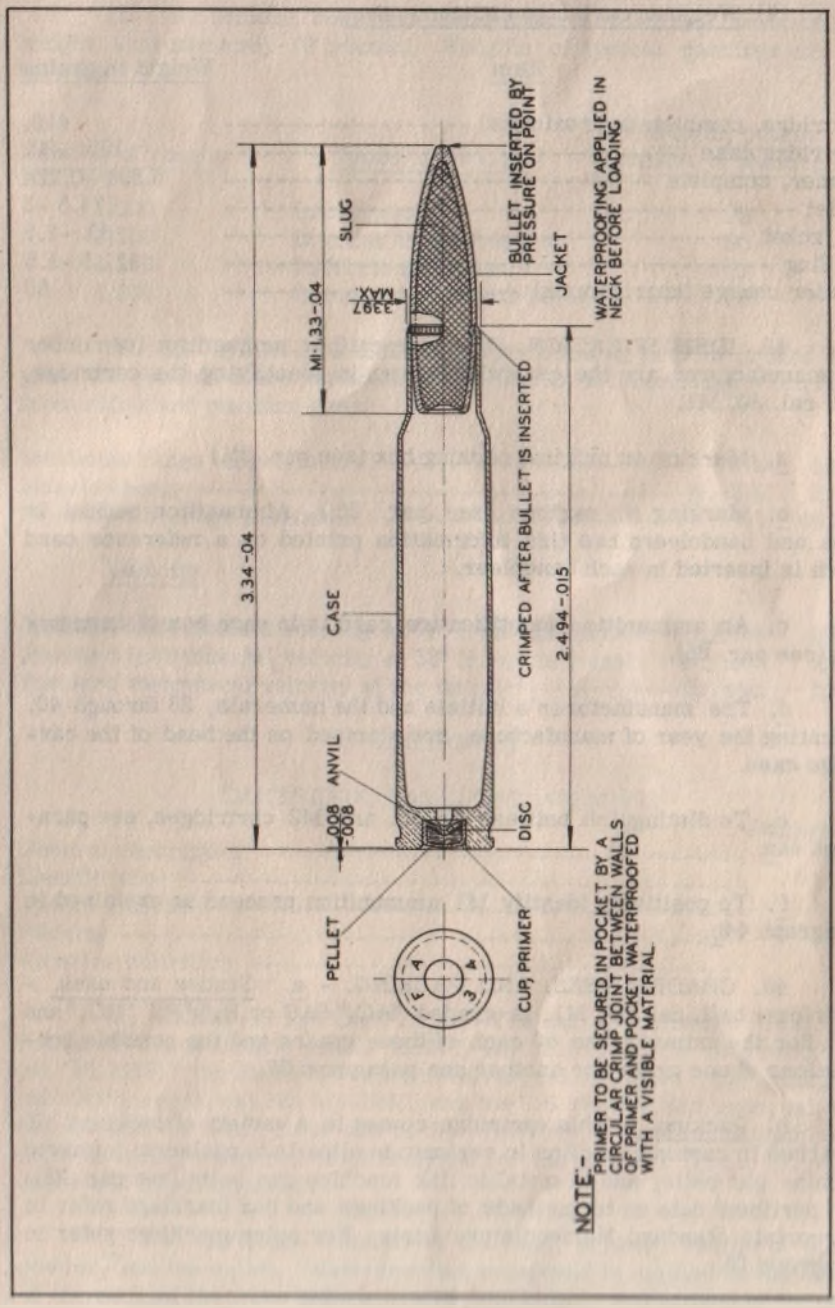


FIGURE 13. - CARTRIDGE, BALL, CAL. .30, M1.

(4) Weights; cartridge and component. -

Item	Weight in grains
Cartridge, complete (approximate)	415.
Cartridge case	195. -20.
Primer, complete	5.594 -0.224
Bullet	174.5 -3
Jacket	63. -1.5
Slug	111.5 -1.5
Powder charge (approximate)	50

48. IDENTIFICATION. - The type, caliber, ammunition lot number and manufacturer are the essential factors in identifying the cartridge, ball, cal..30, M1.

a. Marking on original packing box (see par. 25.)

b. Marking on cartons (see par. 25.) Ammunition packed in clips and bandoleers has this information printed on a reference card which is inserted in each bandoleer.

c. An ammunition identification card is in each box of ammunition (see par. 25).

d. The manufacturer's initials and the numerals, 28 through 40, indicating the year of manufacture, are stamped on the head of the cartridge case.

e. To distinguish between the M1 and M2 cartridges, see paragraph 44a.

f. To positively identify M1 ammunition proceed as explained in paragraph 44b.

49. GRADES, USES, AND PACKING. - a. Grades and uses. - Cartridge, ball, cal..30, M1, is graded "AC," "AC or R," "R," "MG," and "3." For the primary use of each of these grades and the possible substitutions of one grade for another see paragraph 27.

b. Packing. - This cartridge comes in a variety of packings. It is packed in cartons; in clips in cartons; in clips in bandoleers; in fabric machine gun belts; and in metallic link machine gun belts (see par. 25). For pertinent data as to methods of packings and box markings refer to appropriate Standard Nomenclature Lists. For color markings refer to paragraph 25.

(1) The packing box, with metal liner, and without ammunition, weighs approximately 20 pounds. Weights of typical packings are as follows:

Number of rounds	Types of packing	Weight, pounds exclusive of packing box
1,500	In cartons.	95
1,200	In clips, in bandoleers.	80
1,250	In fabric MG belts.	81
1,200	In metallic link MG belts.	88

50. EXTERIOR BALLISTICS. - The following proving ground data gives the general characteristics of the cal..30, M1, cartridge when fired from rifles and machine guns.

Maximum range (approximate)	yards	5,500
Muzzle energy	ft.-lbs.	2,675
Pressure, average maximum	p.s.i.	48,000

Velocity

Standard instrumental velocity at 78' from the muzzle --ft./sec.	2,600
Standard instrumental velocity at 53' from the muzzle --ft./sec.	2,620
Standard theoretical velocity at the muzzle ----------ft./sec.	2,650

SECTION III

CARTRIDGE, BALL, CAL..45, M1911

	Paragraph
General description	51
Identification	52
Grades and uses	53
Packing	54
Exterior ballistics	55

51. GENERAL DESCRIPTION. - The cal..45 cartridge, M1911, is for use in the automatic pistol, M1911, and M1911A1; the Colt revolver, cal..45, M1917; the Smith & Wesson revolver, cal..45, M1917; the Thompson submachine guns, cal..45, M1928A1; and the U.S. submachine guns, cal..45, M1 and M2. To adapt it for use in the revolvers, it must be assembled in clips of spring tempered steel designed for the purpose. These clips are described in paragraph 25.

a. The cartridge consists of the case, primer, charge of pistol powder, and the bullet. Waterproofing compound is applied to the inside of the neck of the case before seating the bullet, and a drop of colored

shellac is placed on the joint between the primer and the case. The components are described as follows (see fig. 14):

(1) Cartridge case. - The case is manufactured of brass as described in paragraph 21. In earlier lots, a cannelure was pressed into the case which prevented the bullet from being seated beyond its proper depth. The case may be crimped into the jacket of the bullet at the discretion of the manufacturer.

(2) Bullet. - The bullet has a round nose and a flat base. It consists of a lead slug, hardened with antimony, enclosed in a gilding metal jacket.

(3) Primer. - The primer assembled in the cartridge is similar in design and function to that assembled in the cal..30 cartridges. For a description of this primer refer to paragraph 22.

(4) Propellant. - The propellant loaded into this cartridge is designated as pistol powder No. 5 (see par. 24.) Sufficient powder is loaded into the case to provide the specified velocity and this charge generally weighs approximately 5 grains. It will be noted that the hitting power of this bullet is dependent upon the weight of the bullet rather than the velocity that it attains as is true of the cal..30 bullets.

b. Component weights. -

Item	Weight in grains
Cartridge (approximate)	327.
Cartridge case (unprimed)	87. -10
Primer (loaded)	4.524 -0.204
Bullet	234. -6.
Jacket	37. -3
Slug	197. -3.
Propellant (approximate)	5.

52. IDENTIFICATION. - a. The cartridge, ball, cal..45, M1911 is readily identified by its characteristic shape and size. No marks of any kind are permitted on the cartridge case except the initials of the manufacturer and the numerals indicating year of manufacture (see fig. 14). The first bullet jackets were made of cupronickel providing a silvery appearance. This was later changed to gilding metal which was given a thin tin wash. This tin wash has a close resemblance to the cupronickel jacket. The practice of tinning the jackets has since been discontinued and the bullets now have the natural copper color of gilding metal.

b. For other identifying features common to all small-arms ammunition refer to paragraph 25.

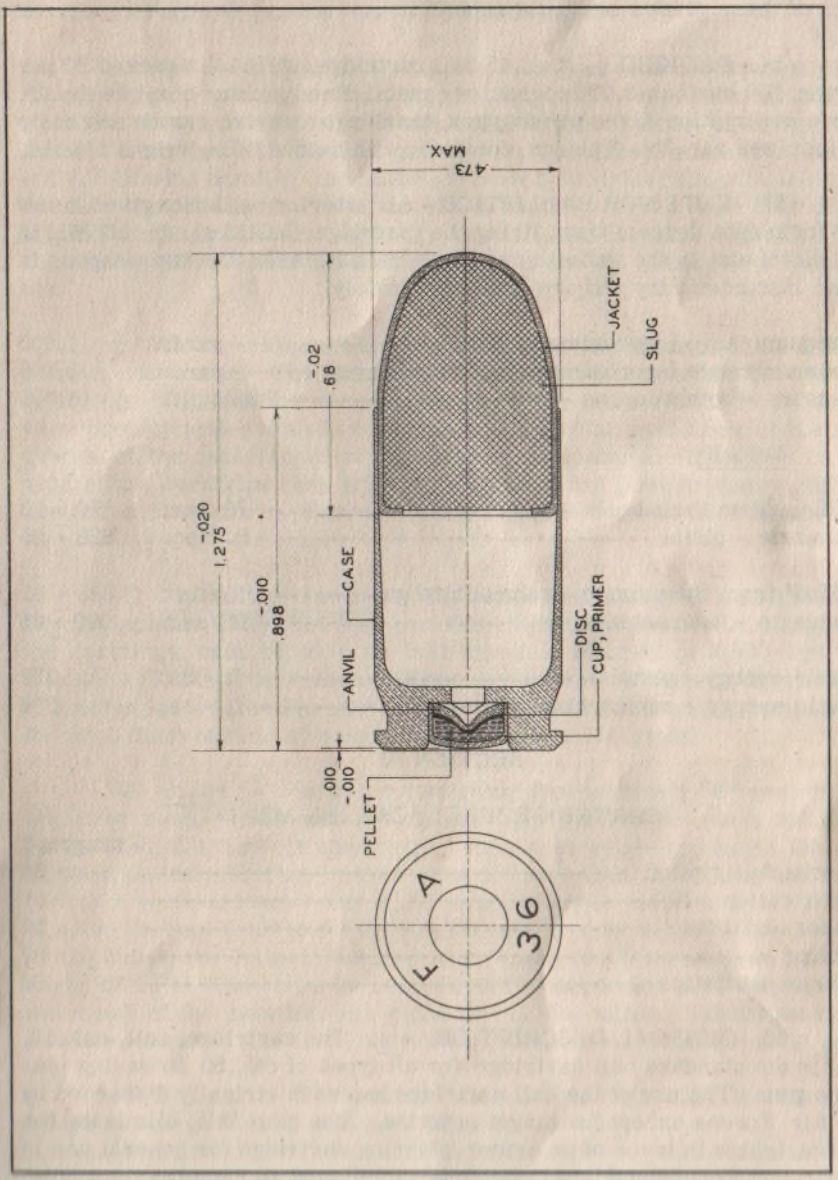


FIGURE 14. - CARTRIDGE, BALL, CAL..45, M1911.

53. GRADES AND USES. - As explained in paragraph 27, cal..45 ammunition is classified in four grades, that is, 1, 2, 3, and RT. For the uses of these grades see paragraph 27.

54. PACKING. - Cal..45 ball cartridge, M1911, is packed 20 per carton, 100 cartons (2,000 rounds) per metal-lined packing box (see fig. 2). For a description of the packing box, markings thereon, carton and color stripes (see par. 25). The box, complete with ammunition, weighs 110 lbs.

55. EXTERIOR BALLISTICS. - All exterior ballistics given below are from data derived from firing the cartridge, ball, cal..45, M1911, in the pistol and in the submachine gun. Ballistics for the two weapons in some instances vary and are listed separately.

Maximum range (approximate) pistol	yards	1,600
Maximum range (approximate) submachine gun	yards	1,700
Pressure - both weapons	lbs./sq.in.	14,000

Velocity

At 22.5 from the muzzle - pistol	ft./sec.	820 ± 25
At muzzle - pistol	ft./sec.	825 ± 25
At 22.5' from the muzzle - submachine gun	ft./sec.	885 ± 25
At muzzle - submachine gun	ft./sec.	890 ± 25
Muzzle energy - pistol	ft.-lbs.	329
Muzzle energy - submachine gun	ft.-lbs.	383

SECTION IV

CARTRIDGE, BALL, CAL..50, M2

	Paragraph
General description	56
Identification	57
Grades and uses	58
Packing	59
Exterior ballistics	60

56. GENERAL DESCRIPTION. - a. The cartridge, ball, cal..50, M2, is the standard ball cartridge for all types of cal..50 Browning machine guns. The use of the ball cartridge has been virtually discarded by the Air Forces except for target practice. The plan is to eliminate the ball cartridge in favor of an armor-piercing cartridge for general use in the Ground Forces and this is being accomplished as rapidly as possible. The main use of this cartridge in the near future will then be for proof and target firing since it is cheaper to manufacture than the armor-

piercing cartridge. This shift away from the ball cartridge in favor of a more specialized cartridge is true of the cal..30 ball cartridges as well, insofar as machine-gun ammunition is concerned.

b. The cartridge, ball, cal..50, M2, was standardized in 1941 superseding the cartridge, ball, cal..50, M1, which was declared limited standard. It was developed to obtain a higher velocity ball cartridge than the ball cartridge M1. The M2 cartridge varies little from the M1 except in the following details: the bullet of the M2 is lighter than the bullet of the M1; the powder charge of the M2 is slightly lighter than that of the M1; the complete M2 cartridge is lighter than the complete cartridge M1; the velocity of the M2 is greater than that of the M1 although its range is less.

c. The cartridge consists of a case, primer, charge of smokeless powder, and bullet. The primer is secured in the pocket in the case by crimping. The joint between the walls of the primer and the pocket is waterproofed with a visible material, the material used being at the discretion of the manufacturer. Waterproofing material is applied in the neck of the cartridge case prior to loading of the powder charge and insertion of the bullet. The components are described as follows (see fig. 15):

(1) Propelling charge. - The propelling charge is a progressive burning powder, IMR 4814 (see par. 24). Sufficient powder is loaded into the cartridge case to give an instrumental velocity of 2,900 feet per second at 78' from the muzzle. There is no great variance in the amounts of powder loaded into the cases of cartridges of different lot number and the propellant ordinarily weighs approximately 235 grains.

(2) Bullet. - The bullet, weighing approximately 700 grains, has a gilding metal jacket over a lead antimony point filler and a soft steel core. The point filler is used to give additional weight and to fill the void between the core and the jacket. It is no more than 2.31" long and has a radius of ogive not exceeding 4.5" (the permissible variation in the radius of ogive is from 4.45" to 4.5"). Beginning at a point 0.368" from the rear of the bullet, the base is tapered at an angle of 9° (forming an included angle of 18°). The bullet is secured in the cartridge case by crimping the mouth of the case into the cannelure of the bullet. The bullet has a concave recess in the base, sufficient in depth to expose the steel core.

(3) Primer. - The primer standard for assembly in this cartridge is primer No. 28 (see par. 32).

(4) Cartridge case. - The cartridge case is made of brass and is annealed at manufacture (see par. 81). Cases for cal..50 ammunition are not salvaged for scrap but are collected and returned to the loading

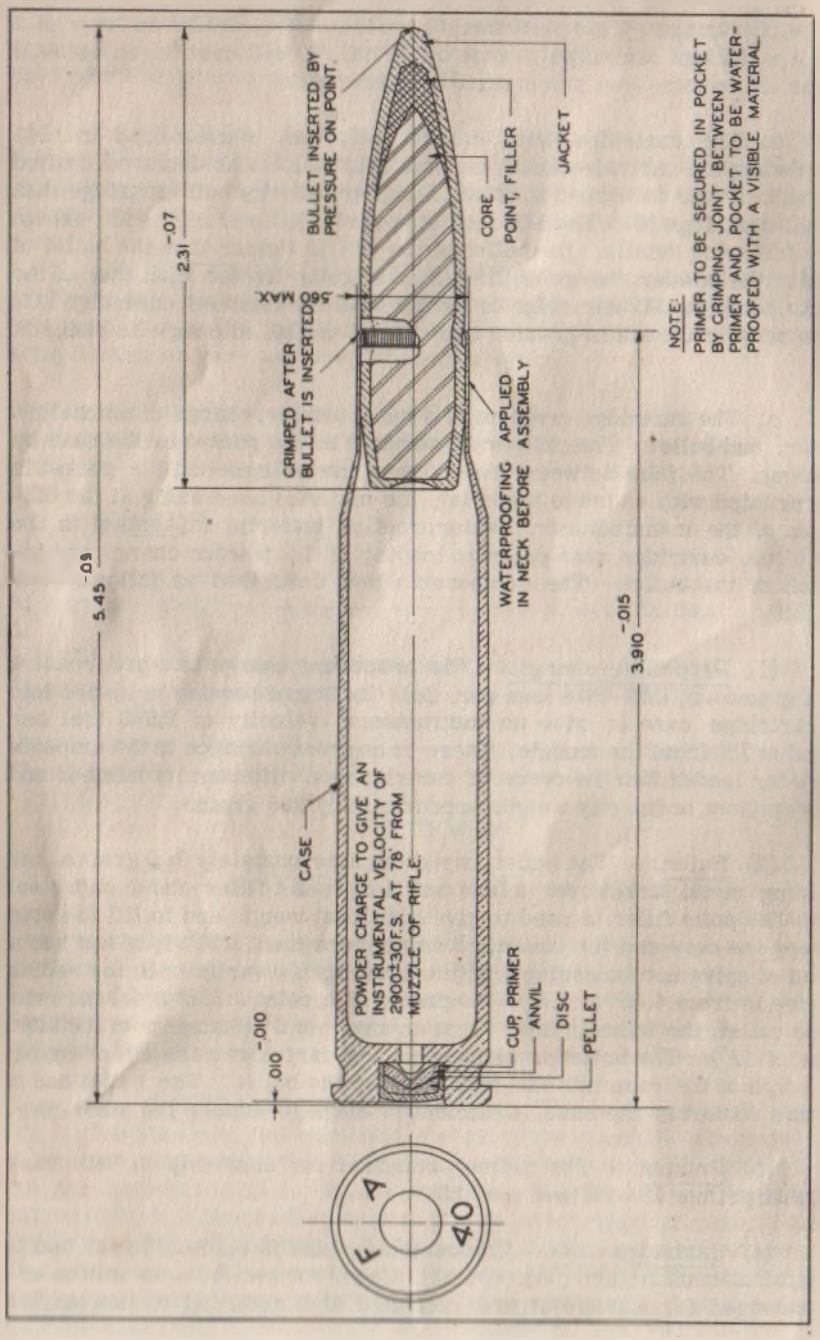


FIGURE 15. - CARTRIDGE, BALL, CAL..50, M2.

establishment. There they are resized and reused.

(5) Weights; cartridge and components. -

Item	Weight in grains
Cartridge, complete (approximate)	1813.
Cartridge case	850. -50.
Bullet	709.5 -22.
Core	400. -15
Jacket	253. -5.
Point filler	56.5 -2.
Primer	18.05 -1.11
Anvil	5.4 -0.4
Cup, primer	11.5 -0.5
Disk	0.06 -0.01
Pellet	2.1 -0.2
Propellent powder (approximate)	235

57. IDENTIFICATION. - a. The type, caliber, ammunition lot number, and manufacturer are the essential factors in identifying the cartridge, ball, cal..50, M2.

(1) To positively identify this ammunition proceed as explained in paragraph 44b. This system of positive identification by ammunition lot number should be followed whenever ammunition is to be used.

b. The cartridge, ball, cal..50, M1, has been declared limited standard. However, there is still a certain amount for issue, particularly for training and target firing. While the manufacture of this ammunition ceased in 1940, the numerals stamped on the heads of the cartridge cases cannot be considered as a means of identification. Since there is little difference between the M1 and the M2 ammunition, it is difficult to distinguish between the two. The M2 is approximately 60 grains lighter than the M1; the cartridge case of the M2 (if a resized M1 case is not used) is 0.005" shorter than that of the M1; and the bullet of the M1 is 0.1" longer than the bullet of the M2. Of these three measureable differences, no one will serve to quickly identify the two cartridges. It is impossible to distinguish between the two cartridges unless the weights are known and a method of weighing is available.

c. It is apparent that the system of positive identification mentioned above be followed and that the markings on the boxes and cartons be carefully observed.

58. GRADES AND USES. - a. Cal..50 ball ammunition is graded as follows "AC," "MG," and "3" (see par. 27).

b. The grades of existing lots are published in OFSB 3-5. Issues for training purposes are governed by AR 775-10.

59. PACKING. - a. The cartridge, ball, cal..50, M2, is packed in cartons and in metallic link machine gun belts only (see par. 25). Information as to weights and packing may be found in the appropriate Standard Nomenclature List.

b. For information as to the packing box and cartons in which this cartridge is packed, refer to paragraph 25.

60. EXTERIOR BALLISTICS. -

Maximum range	yards	7,000
Effective range, approximately	yards	5,000
Pressure, average maximum, approximately	lbs./sq.in.	52,000

Velocity

Standard instrumental velocity at 78' from the muzzle	ft./sec.	2,900
Standard theoretical velocity at the muzzle	ft./sec.	2,935

CHAPTER 4

TRACER CARTRIDGES

		Paragraphs
SECTION I.	Cartridge, tracer, cal..30, M2	61-62
II.	Cartridge, tracer, cal..30, M1	63-67
III.	Cartridge, tracer, cal..46, M1	68-69
IV.	Cartridge, tracer, cal..50, M2	70-72
V.	Cartridge, tracer, cal..50, M1	73-77

SECTION I

CARTRIDGE, TRACER, CAL..30, M2

	Paragraph
General	61
Tentative information	62

61. GENERAL. - a. The cartridge, tracer, cal..30, M2, was developed and standardized in 1942 for the use of the Air Forces. It is intended for use in machine guns mounted in aircraft. A limited number of lots were manufactured but because of defects in its performance, manufacture was discontinued and experimentation and development continued. The cartridge will be satisfactory in a short time and will then be generally issued.

b. The cartridge was developed to provide a trace that ignites soon after leaving the gun and whose total burning time measured in distance traveled, is relatively short. The point of the M2 cartridge is moderately heavy giving the bullet better ballistics and penetrating power than found in the M1.

62. TENTATIVE INFORMATION. - The following information is provided for the benefit of ordnance personnel so that they will not be totally unfamiliar with the cartridge. It is the latest information available, although incomplete in many respects. It must be remembered that the cartridge is undergoing development and that the following information will, in all probability, be changed to some degree.

a. Description of components (see fig. 18). - (1) Cartridge case. - The cartridge case is the same as that assembled with the cartridge, tracer, cal..30, M1 (see par. 63c(2)).

(2) Bullet. - By comparing figures 17 and 18, it will be noted that the bullet of the M2 cartridge, while approximately the same size, has a reduced charge of tracer and igniter mixture. This allows the tracer to burn out more quickly and through a variation in the tracer composition, provides for a more rapid burning. The point of the M2 bullet is heavier,

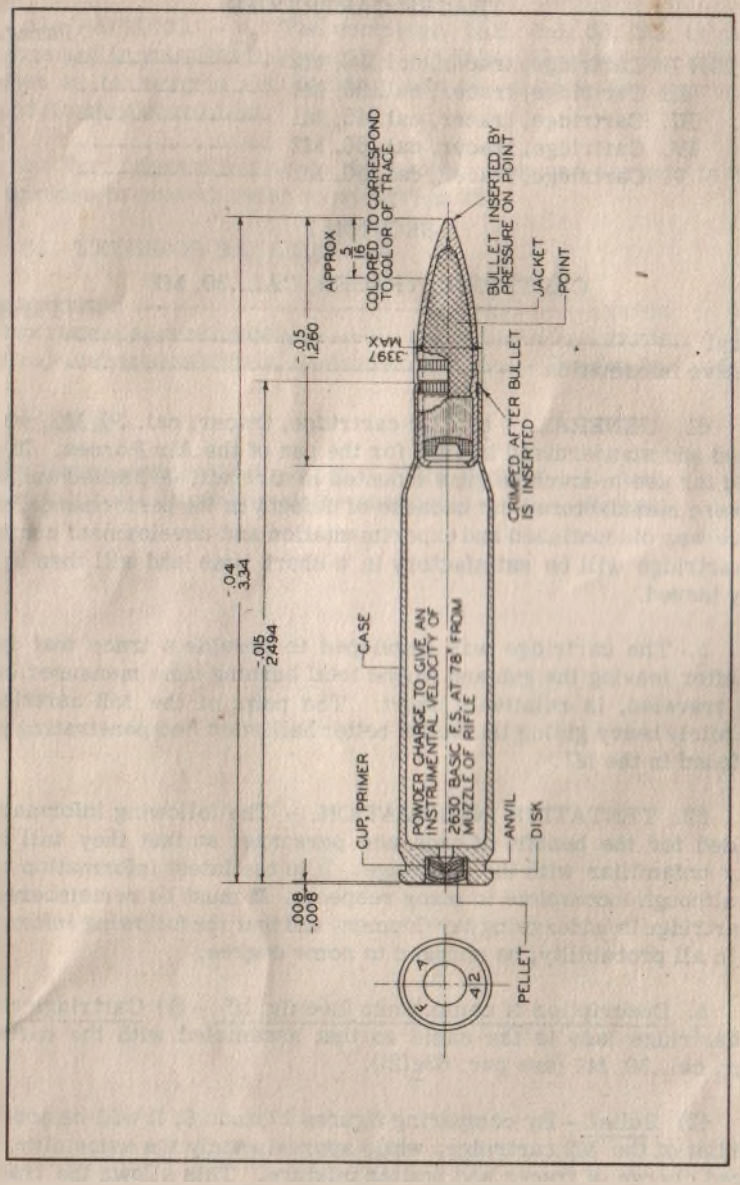


FIGURE 18. - CARTRIDGE, TRACER, CAL..30, M2.

imparting better ballistic qualities to the bullet. The M2 bullet is similar than the M1 bullet. The two bullets are being manufactured simultaneously and to assist in their identification an additional annular knurl is machined into the bullet of the M2. A gilding metal jacket encloses the lead antimony point and the tracer and igniter compositions. The base of the bullet is not tapered but the jacket is curved slightly at the base. The tracer and igniter compositions are inserted by means of a charging machine.

(3) Primer. - The primer is the same as that assembled in the M1 tracer cartridge (see par. 63c(4)).

(4) Propellant. - The propellant used is a progressive burning powder IMR 4676 (see par. 24). This is the same powder used in the M1 tracer. Sufficient powder is loaded into the case prior to insertion of the bullet to provide an instrumental velocity of 2,630' per second at 78' from the muzzle. There is no great variance in the amount of powder loaded into the cartridge cases of rounds of different lots and the propellant ordinarily weighs approximately 50 grains.

(5) Waterproofing. - Waterproofing is accomplished in a similar manner to that accomplished in the M1.

b. Identification. - (1) Positive identification of this cartridge will be carried out as explained in paragraph 44b.

(2) The only perceptible difference between the M1 and the M2 cal..30, tracer cartridges will be the additional annular knurl machined into the bullet of the M2. Since the cartridge case of the M2 is crimped into the rearmost of the two cannelures the additional cannelure (annular knurl) will be prominent and serve to readily identify the M2.

(3) The packing box will be clearly marked as will be the cartons (see par. 25).

(4) The cartridge, tracer, cal..30, M2, can be distinguished from other types of cartridges by the fact that the tip of the bullet is painted to correspond to the color of the trace (see fig. 17).

c. Packing. - No information is available concerning packing. It may be safely assumed, however, that the cartridge will be packed in metallic link belts for aircraft use, inasmuch as the cartridge was designed for use in the Air Forces. It will probably be packed in cartons also, so that Air Forces units may belt ammunition in various combinations depending on the tactical mission.

d. Exterior ballistics. - No information is available, except the

range of trace concerning the exterior ballistics of this cartridge. The tracer ignites and begins to burn visibly at a distance of approximately 125 yards from the muzzle of the gun and continues to burn for a distance of from 500 to 600 yards.

e. Grades and uses. - Inasmuch as only two lots of this ammunition have been manufactured at the time of printing of this text, little information is available concerning the possible regrading of this cartridge. The cartridge is authorized for use in aircraft machine guns only, and consequently is graded only AC. For the duration of the war, there will be little opportunity for extended storage of this cartridge and little need for regrading.

SECTION II

CARTRIDGE, TRACER, CAL..30, M1

	Paragraph
General description	63
Identification	64
Grades and uses	65
Packing	66
Exterior ballistics	67

63. GENERAL DESCRIPTION. - a. The cartridge, tracer, cal..30, M1, contains a bullet, a portion of the interior of which is filled with an inflammable substance which is ignited by the propellant powder when the cartridge is fired. This burns with a bright red flame and enables the course of the bullet to be followed with the eye. Tracers are used in both machine guns and rifles. Their use in aircraft machine guns has proved so effective that an improved tracer cartridge has been designed exclusively for that use (see sec. I).

b. While tracer bullets were primarily intended to direct machine gun fire there are cases where they can be advantageously used in rifles. They may be used to designate targets, assist in range estimation, for signal and incendiary purposes.

c. The cartridge consists of a bullet, cartridge case, propellant, and primer. The various components are described as follows (see fig. 17):

(1) Bullet. - The bullet consists of 3 parts: the gilding metal jacket; the lead antimony point; and the tracer and igniter composition. After the point has been inserted in the jacket, the tracer composition is pressed in, followed by the igniter composition, care being exercised to maintain a uniform density in charging. The igniter composition assists the ignition of the tracer as the tracer alone is difficult to ignite. The

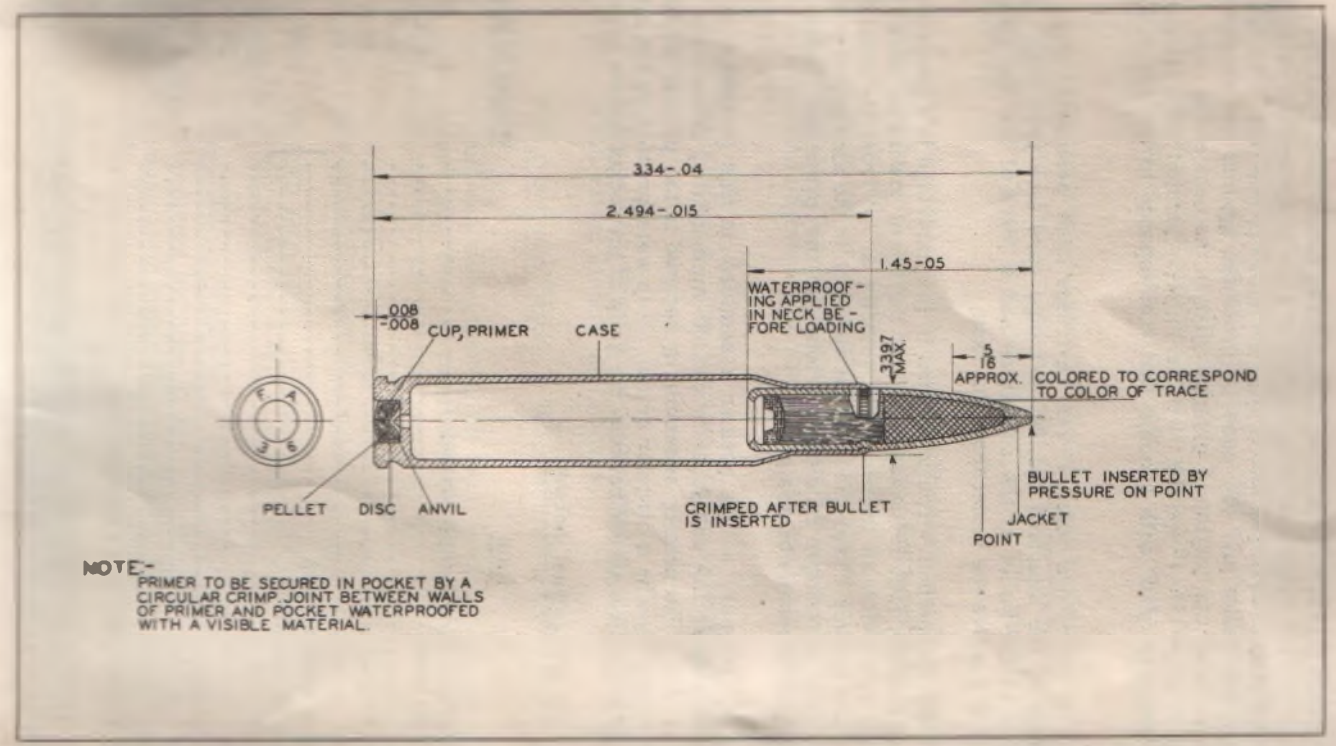


FIGURE 17. - CARTRIDGE, TRACER, CAL..30, M1.

bullet is not tapered at the base, although the jacket is curved inward at the base line. A cannelure is machined into the jacket and the neck of the cartridge case is crimped into it after the bullet is inserted. The opening between the bullet and the case is protected against the entrance of moisture by an application of waterproofing in the neck of the case. The radius of ogive is 2.1" and the tip of the bullet is painted for a distance of approximately 5/16" with a color that corresponds to the color of the trace.

(2) Cartridge case. - The cartridge case assembled with this cartridge is the standard cal..30 cartridge case (see par. 21a). It is crimped to the bullet at the cannelure and a force of 300 lbs. must be applied to remove the bullet from the case.

(3) Propellant. - The propellant in this cartridge is a progressive burning powder, IMR 4676 (see par. 24). Sufficient powder is loaded into the case to provide an instrumental velocity at 78' from the muzzle of 2,700' per second. There is no great variance in the amounts of powder loaded into cartridges of different lots and the propellant ordinarily weighs approximately 50 grains.

(4) Primer. - The primer assembled in this cartridge is the standard primer for assembly in cal..30 ammunition, primer No. 26, (see par. 22). The primer assembly is secured in the primer pocket of the cartridge case by a circular crimp. It is waterproofed by the application of a visible material between the walls of the pocket and the primer.

(5) Component weights. —

Item	Weight in grains
Cartridge, complete (approximate)	396.
Cartridge case	200. -20
Bullet	152.5 -3.5
Jacket	83.0 -2.
Point	52.5 -1.
Tracer composition Igniter composition	17. -0.5
Primer	5.594 -0.224
Anvil	1.68 -0.08
Cup, primer	3.44 -0.1
Disk	0.024 -0.004
Pellet	0.45 -0.08
Propellant powder (approximate)	50.

64. IDENTIFICATION. - a. To positively identify the cartridge proceed as explained in paragraph 44.

b. The cartons, packing box, and ammunition identification card are explained in paragraph 25. Personnel should note the various packings of this ammunition and the color stripes painted on the packing boxes and cartons, so that they will be able to readily identify the ammunition.

c. The M1 tracer may be distinguished from the M2 tracer by the absence of an additional cannelure on the M1 cartridge, as explained in paragraph 62b.

d. The cartridge, tracer, cal..30, M1, may be distinguished from other types of cartridges by the fact that the tip of the bullet is painted to correspond to the color of the trace. In the M1 the tip is always painted red.

e. The manufacturer's initials and the numerals 25 or above will be stamped on the head of the cartridge case. The numerals 25-41 will serve as a means of identifying the M1 cartridge from the M2. Beginning with cartridges stamped with the numerals 42 or above, this will not be a positive means of identification. Beginning in 1942, the two cartridges were manufactured simultaneously and each will bear the same numerals.

65. PACKING. - a. The cartridge, tracer, cal..30, M1, is packed as follows:

(1) Alone. - In 5 round clips in bandoleers, in 8 round clips in bandoleers, all in boxes; in cartons, in boxes.

(2) With other cartridges. - With armor-piercing cartridge in link belts.

b. For information concerning the packing box, cartons and belts, refer to paragraph 25. For the color stripes applicable to the various types of packing refer to the table in paragraph 26.

c. For additional information concerning weights and packings, refer to the appropriate Standard Nomenclature Lists.

66. GRADES AND USES. - The cartridge, tracer, cal..30, M1, is graded "AC," "AC or R," "R," "MG," and "S," (see par. 27d).

67. EXTERIOR BALLISTICS. - The cartridge, tracer, cal..30, M1, is designed to direct the cone of fire of other cartridges. Its trajectory must be such as to cross the trajectories of the ball or armor-piercing cartridges at the effective range of the latter two bullets. The range at which the trajectory of the tracer, M1, crosses the trajectories of the ball, M2, and the armor-piercing, M2, is 600 yards. The trajectories of all three are approximately the same up to the 600 yard distance.

Maximum range (approximate)	yards	3,450
Range of trace (approximate)	yards	900
Pressure, average maximum	lbs./sq.in.	50,000

Velocity

Standard instrumental velocity at 78' from the muzzle	ft./sec.	2,700
Standard theoretical velocity at the muzzle	ft./sec.	2,715

SECTION III

CARTRIDGE, TRACER, CAL..45, M1

	Paragraph
General	68
Grades, uses, and packing	69

68. GENERAL. - a. The cartridge, tracer, cal..45, M1, has been discontinued for manufacture and present stocks will be issued until the supply is exhausted. It was intended for use with the cal..45 submachine guns to assist in directing the cone of fire. However, the tracer cartridge caused considerable fouling in the bore of the gun; therefore, in combination with the fact that submachine guns are fired at a short range, making a tracer unnecessary, it was decided to discontinue manufacture.

b. The components may be noted by a study of figure 18. Following is a listing of component weights:

Item	Weight in grains
Cartridge (approximate)	330.
Case	87. -10.
Bullet	226. -6
Jacket	75. -2
Slug	134. -2.
Primer	4.524 -0.204
Tracer composition Igniter composition	17. -2.
Propellant (approximate)	5.

c. Identification. - (1) The cartridge, tracer, cal..45, M1, may be readily identified by its characteristic shape, the painted tip of the bullet, and the star stamped on the head of the cartridge case.

(2) The cartridge must be identified positively prior to issue in the manner outlined in paragraph 44.

(3) The description of the packing box and cartons may be found in paragraph 26.

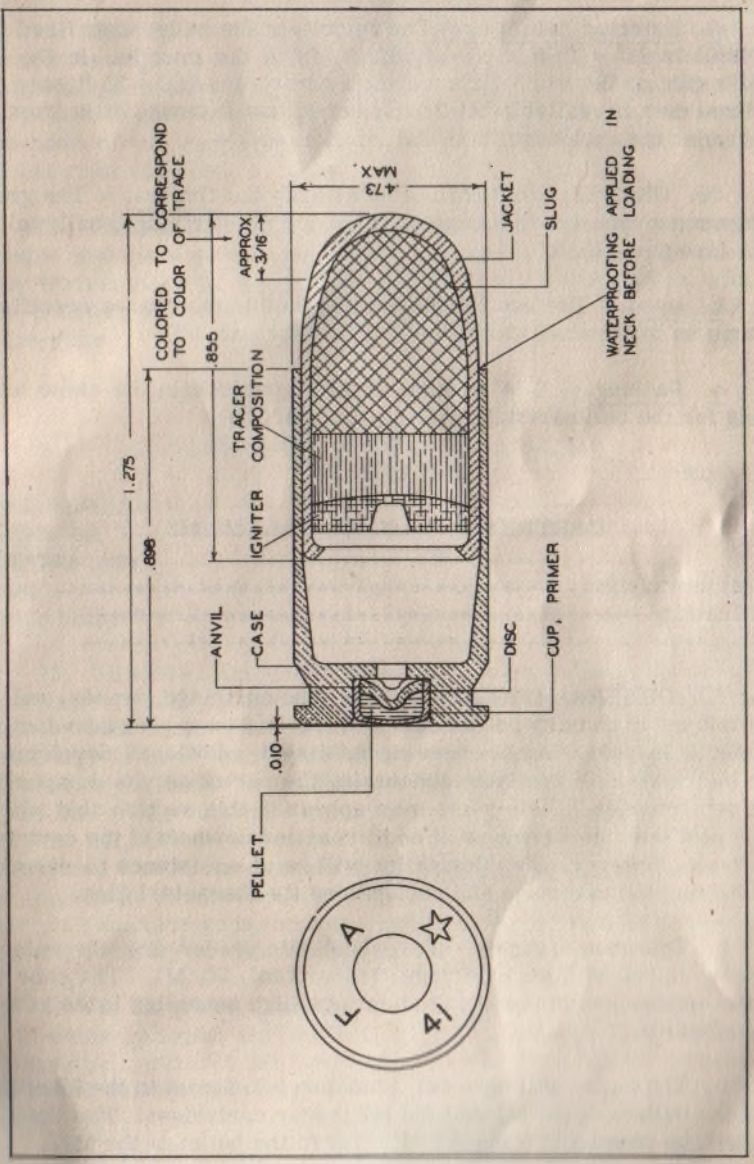


FIGURE 18. - CARTRIDGE, TRACER, CAL..45, M1.

(4) The manufacturer's initials and the numerals indicating the year of manufacture are stamped on the head of the cartridge case.

d. Exterior ballistics. - The velocity of the bullet when fired from the pistol is 925 ± 25 ft./sec. at 25.5 ft. from the muzzle. In the submachine gun, at the same distance the velocity is 1,000 ± 25 ft./sec. No additional data is available but it is assumed that it varies little from that listed under the cartridge, ball, cal..45, M1.

69. GRADES, USES, AND PACKING. - a. Grades. - The grades of this ammunition are the same as those for the cartridge, ball, cal..45, M1911 (see par. 53).

b. Uses. - The use of the cartridge within the grades specified is the same as for the ball cartridge, M1911 (see par. 53).

c. Packing. - The packing of this cartridge is the same as the packing for the ball cartridge, M1911 (see par. 54).

SECTION IV

CARTRIDGE, TRACER, CAL..50, M2

	Paragraph
General description	70
Identification	71
Packing	72

70. GENERAL DESCRIPTION. - The cartridge, tracer, cal..50, M2, is not yet in quantity production. Several lots have been manufactured but defects in performance have necessitated additional development. Little information is available concerning the cartridge, its components, or its performance. Statements may appear in this section that will not be true at a later date because of additional development of the cartridge. In the main, however, the information will be of assistance to personnel in identifying the cartridge and recognizing its characteristics.

a. The case, primer, and propellent powder are the same as those assembled with the cartridge, tracer, cal..50, M1. The case will have a star stamped on the head indicating a high annealing in the process of manufacture.

b. The bullet will have two cannelures to assist in the identification of the bullets of the M1 and the M2 tracer cartridges. The tip of the bullet will be painted in a manner similar to the bullet of the M1.

c. The tracer and igniter compositions will be composed to provide a rapid ignition. The length of burning time of the trace will be con-

siderably shortened to a distance of approximately 550 yards. This will be in accordance with its tactical use — in aircraft machine guns.

71. IDENTIFICATION. - The cartridge can be distinguished from the tracer cartridge, M1, by the additional cannelure on the bullet. It may be distinguished from cartridges of other types by the tip of the bullet being painted to correspond to the color of the trace and the star stamped on the head of the cartridge case. The cartridge must be positively identified prior to issue.

72. PACKING. - While no information is available concerning packing it may be assumed that it will be packed similarly to the cartridge, tracer, cal..50, M1. It will be packed in combination with the armor-piercing and the incendiary cartridge for firing from aircraft machine guns.

SECTION V

CARTRIDGE, TRACER, CAL..50, M1

	Paragraph
General description	73
Identification	74
Grades and uses	75
Packing	76
Exterior ballistics	77

73. GENERAL DESCRIPTION. - a. The cartridge, tracer, cal..50, M1, contains a bullet which has a portion of the interior filled with an inflammable substance. This filler is ignited by the powder charge when the cartridge is fired, and burns with a bright red flame which enables the course of the bullet to be followed with the eye. As successful has been the use of this cartridge in aircraft machine guns that a special cartridge, the M2, has been designed for that purpose and will soon be in manufacture. The M1 tracer will continue to be used in aircraft until the M2 is in quantity production. It is also used in ground machine guns and antiaircraft machine guns, and with the quantity production of the M2 attained will probably be used exclusively for such weapons.

b. The cartridge consists of a case, propellant, primer, and bullet. The case, primer, and propellant are the same as those used in the cartridge, ball, cal..50, M2 (see par. IV, chap. 3). The components are described as follows (see fig. 19):

(1) Cartridge case. - (See paragraph 21.) The cartridge case of the M1 tracer has stamped upon its head a star (see fig. 19) that is a means of identifying a tracer cartridge from cartridges of other types. The star stamped on the head indicates that the case has been highly

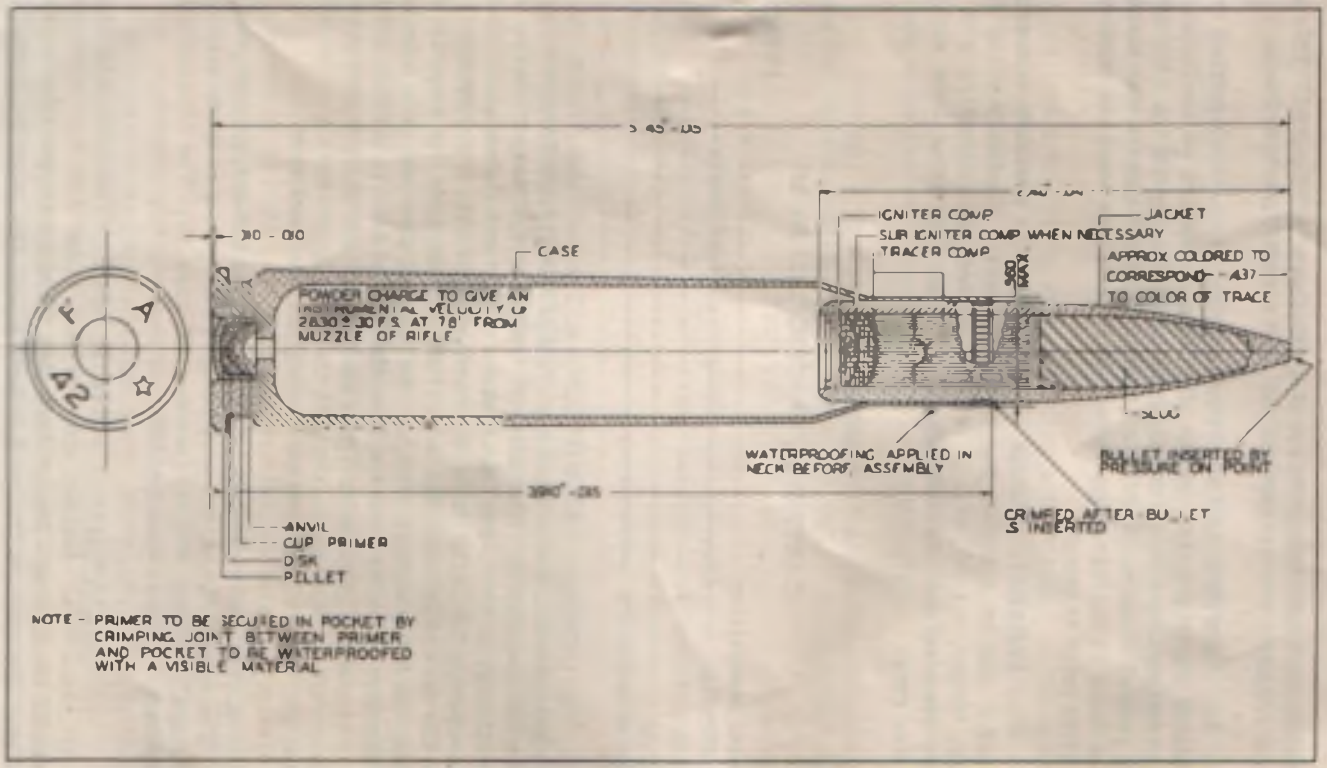


FIGURE 19. - CARTRIDGE, TRACER, CAL..50, M1.

annealed and is the only difference from the cases in other cal..50 ammunition.

(2) Propellant. - Sufficient powder is loaded into the case to provide a velocity at 78' from the muzzle of 2,830 ± 30 ft./sec.

(3) Bullet. - The bullet consists of a gilding metal jacket, a lead slug hardened with antimony encased in the jacket, and a tracer and igniter assembly in the rear half of the bullet (see fig. 19). Where necessary a subigniter assembly is pressed into the cavity of the bullet. The bullet retains its conical shape toward the base. Waterproofing is accomplished in the same manner as for the cartridge, ball, cal..50, M2.

c. Component weights:

Item	Weight in grains
Cartridge, complete (approximate)	1789. -68.
Cartridge case	850. -50
Primer	19.06 -1.11
Bullet	681. -17
Jacket	408. -10
Slug	267. -1.
Tracer composition	Approx. 70.
Subigniter composition	
Igniter composition	
Propellant (approximate)	240

74. IDENTIFICATION. - a. To distinguish this cartridge from the cartridge, tracer, cal..50, M2, see paragraph 71.

b. The cartridge may be identified as to type by the star stamped on the head of the cartridge case and the red tip of the bullet.

c. The cartridge must be identified positively prior to issue in the manner described in paragraph 44.

d. To assist in identification, personnel should be familiar with the markings on packing box and cartons described in paragraph 26.

75. GRADES AND USES. - The tracer cartridge, cal..50, M1, is [illegible] for the uses explained in paragraph 27. No information is available concerning the possible restrictions in its use following the quantity production of the cartridge, tracer, cal..50, M2.

76. PACKING. - a. This cartridge is packed in cartons, and in metallic link machine gun belts in combination with other types of cartridges.

b. For the color stripes and markings on the packing boxes and cartons refer to paragraph 25.

c. For weights and additional details regarding packing, refer to the appropriate Standard Nomenclature List.

77. EXTERIOR BALLISTICS. - The exterior ballistics of this cartridge are essentially the same as those of the cartridges with which it is fired in machine guns. Beyond the effective range of approximately 1,500 yards the trajectory of the tracer is less accurate than that for the ball, A.P., or incendiary cartridge. The extreme range of trace is approximately 2,000 yards. The ignition composition commences to burn at the muzzle and the tracer composition at a distance of approximately 150 yards from the muzzle. The velocity of the cartridge is increased to approximately 2,830 ft./sec. at a distance of 78' from the muzzle so that it can be fired accurately with the cartridges ball, M2, and armor-piercing, M2, both of these cartridges having a higher velocity than the cartridges that they superseded.

CHAPTER 5

INCENDIARY CARTRIDGES

	Paragraph
Cartridge, incendiary, cal..30, M1 ----------	78
Cartridge, incendiary, cal..50, M1 ----------	79

78. CARTRIDGE, INCENDIARY, CAL..30, M1. - a. The details concerning this cartridge are classified as confidential. Only that information believed essential to personnel for recognition of cartridge and its types of packing will be listed.

b. This cartridge was standardized in 1942 and in general appearance resembles the cartridge, ball, cal..30, M2. The tip of the bullet is painted blue in the same manner as the tracer cartridges. On the head of the case will be stamped the manufacturer's initials and the numeral 42 or above.

c. The cartridge is only for use in aircraft machine guns.

d. Packing. - The cartridge is packed in cartons in metal-lined packing boxes. It is packed for direct issue to the Air Forces in combination with other cartridges in metallic link belts.

79. CARTRIDGE, INCENDIARY, CAL..50, M1. - a. Details concerning this cartridge are also classified as confidential.

b. The cartridge, in general appearance resembles the cartridge armor-piercing, cal..50, M2. The tip of the bullet is painted blue. On the head of the case will be stamped the manufacturer's initials and the numeral 41 or above.

c. The cartridge is only for use in aircraft machine guns.

d. The cartridge is packed similarly to the cal..30 cartridge.

ORDNANCE SCHOOL

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