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Robert Bolin , depositor
University of Nebraska - Lincoln, rbolin2@unl.edu

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A GUIDE TO THE COLLECTION OF TECHNICAL INTELLIGENCE

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A GUIDE TO THE COLLECTION OF TECHNICAL INTELLIGENCE

* This pamphlet supersedes Department of the Army Booklet "A Guide to the Collection of Technical Intelligence (Part I)" published July 1950.

FOREWORD

This pamphlet is designed to assist observers and other personnel in preparing reports of a technical nature concerning weapons and equipment. It is in the manner of a checklist which serves as a guide for reporting on various types of matériel. The accompanying series of illustrations gives the proper nomenclature of the more important features in the various categories of equipment.

It is anticipated that proper use of this pamphlet will simplify the task of technical reporting as well as materially improving the intelligence coverage on foreign matériel.

The use of this pamphlet for training purposes is encouraged.

CHAPTER 1

Armored Vehicles

INTRODUCTION

Although the most useful sources of information required in the preparation of intelligence studies of a highly technical nature are to be found in photographs, technical documents, or in actual physical testing of matériel, a very large amount of valuable information can be obtained by visual inspection or by interrogations. It is essential that observers, regardless of the extent of their technical knowledge, know exactly what is important and what to look for in the procurement of information.

During World War II, for example, an accurate forecast of the future combination of slope and thickness of German armor enabled the British to design the subsequently adequate 17-pounder.

While general knowledge of standard weapons must include performance, recognition factors, and maintenance and operational instructions, information on research and development must include the extent of advancement in specialized fields and the estimated dates when the fruits of such effort can be made available to the armies.

The tank commander must know at what ranges he can defeat and be defeated. Design and development departments must insure that United States weapons are second to none, while plans and operations staffs must know that they have the right tools for the right job.

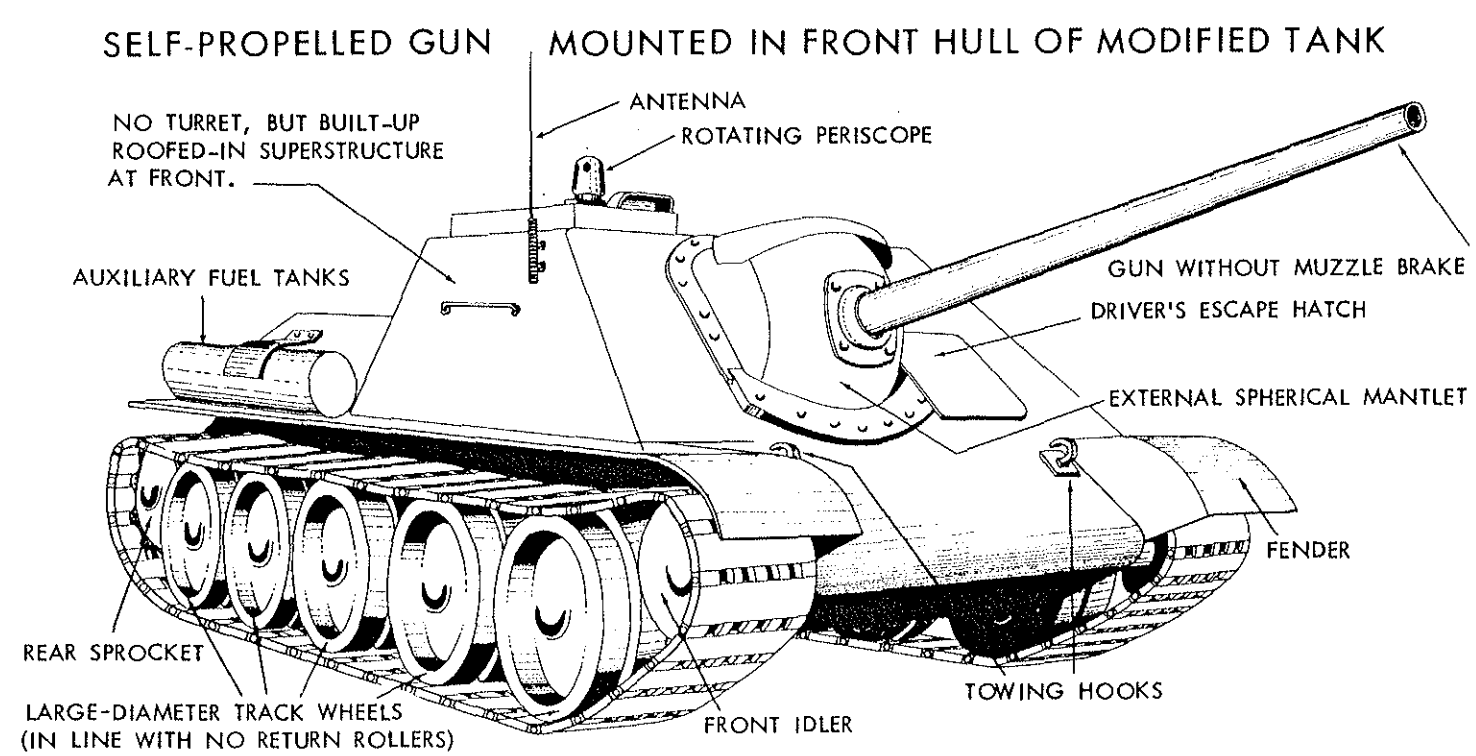

Figure 1.

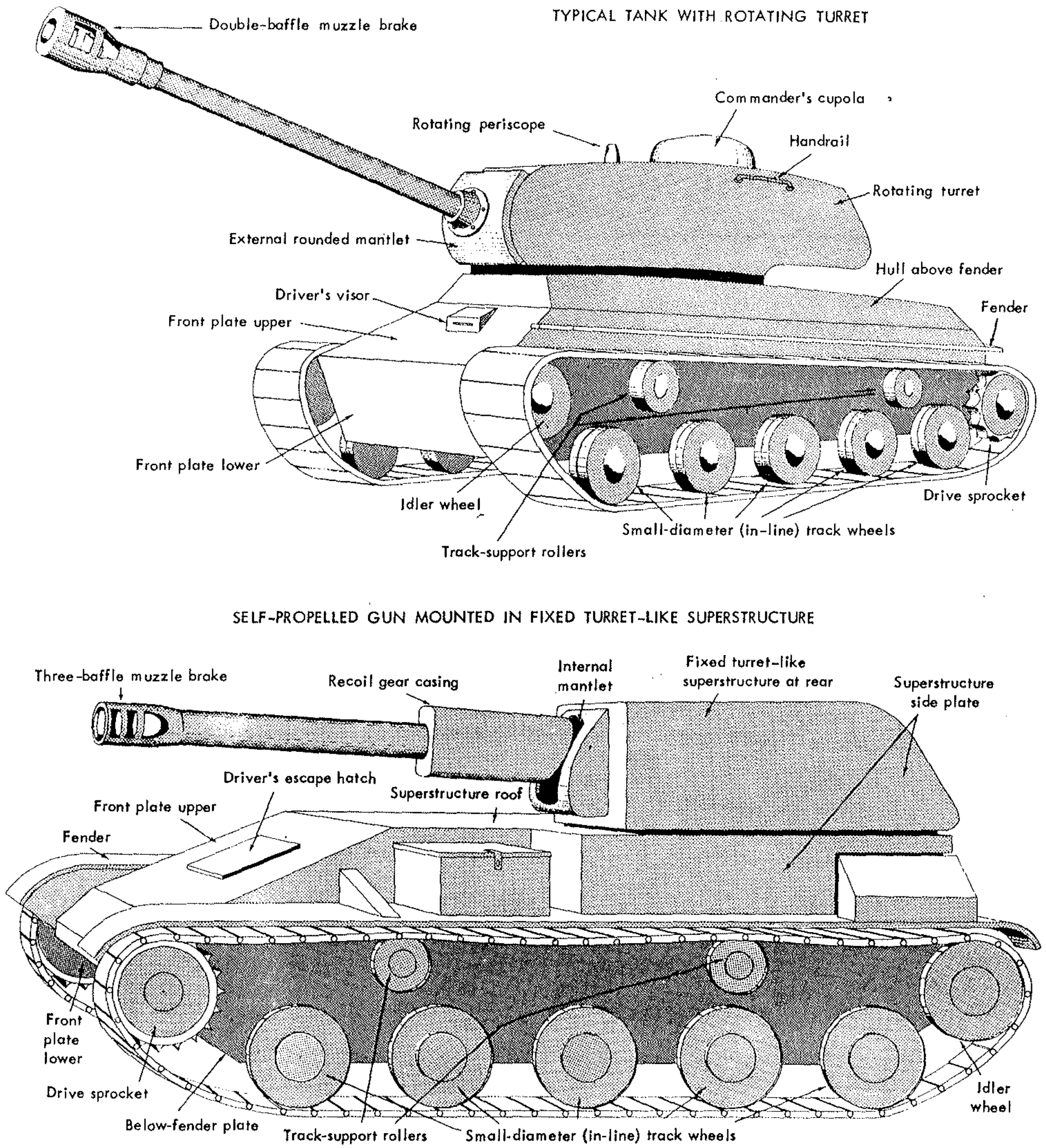

Figure 2.

TECHNICAL DISCUSSION

As a guide as to what is important and what to look for in the preparation of reports upon armored combat vehicles, the following checklist has been prepared covering the important points of: (1) a tank; (2) an armored car; and (3) a self-propelled gun. As used here, the following definitions apply:

a. Tank—an armored combat vehicle running on tracks and provided with a gun fitted in an inclosed turret having 360° traverse (fig. 2).

b. Armored Car—a relatively lightly armored and lightly armed vehicle carried on a semi-tracked or wheeled chassis.

c. Self-Propelled Gun—a field or antitank gun which is mounted on an armored chassis, usually a tank chassis, with a fixed superstructure giving limited traverse, or an antiaircraft gun with 360° traverse in a very lightly armored combat compartment (figs. 1 and 2).

TANKS
Hull

1. *Side View.*

a. Is idler wheel at front or rear? (This wheel has no gear teeth.)

b. Is drive sprocket at front or rear? (The drive sprocket is toothed on modern tanks so as to drive the tracks.)

c. What is length of track on ground, i.e., distance between centers of front and rear track wheels? (These are often called bogie wheels.)

d. What is number of track support rollers?

e. What are number and approximate diameter of track wheels, and are they single or double?

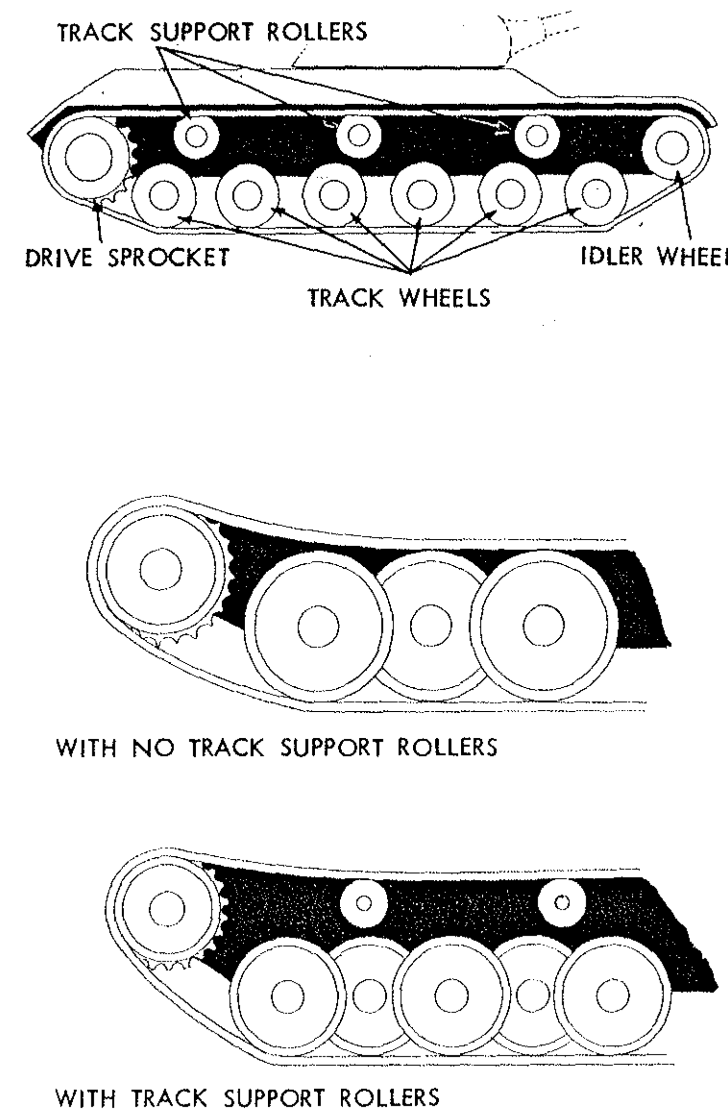

Figure 3.

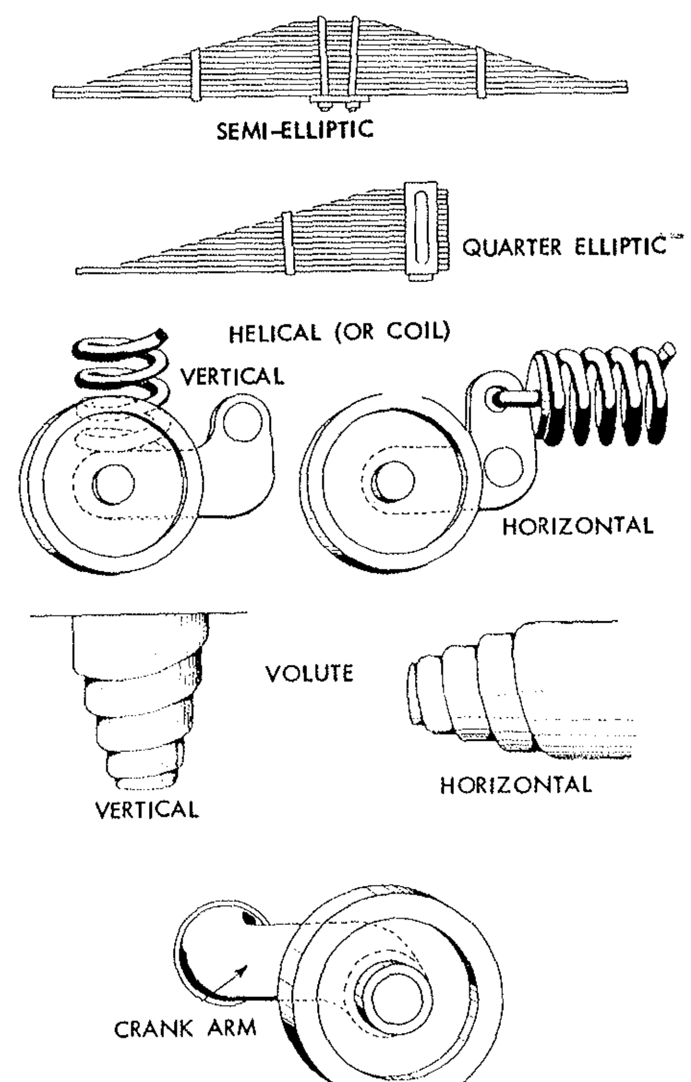

Figure 4.

f. Are track wheels in line, or overlapped, and have they track support rollers (fig. 3)?

g. Is the springing internal or external, and what is its type? Internal springing can be identified by a crank arm. Spring types are shown in figure 4.

h. Design (figs. 5 and 6): (1) Angles of plate to vertical (approx). (2) Approximate thickness. (3) Whether plates are welded, riveted, or bolted, or are a combination of all three. (4) Is plate-interlocking employed? (5) What is the nose shape, and what shape of hull is employed?

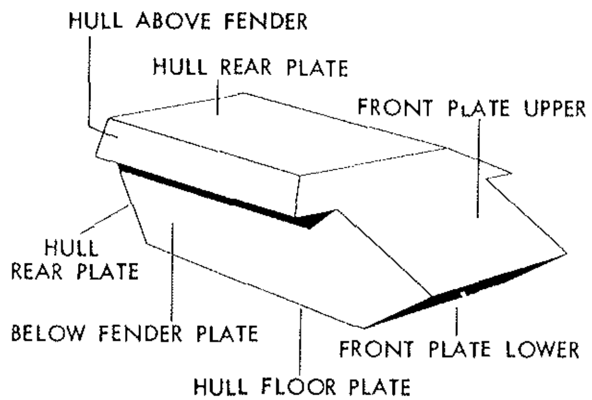

Figure 5.

i. Is armor "rolled plate" (i.e., flat slabs, welded, or joined as above), or is it cast? (If cast, it may be recognized by rounded corners and "bumpy" surface of armor. Care should be taken, however, to distinguish between rough casting and a coating of antimagnetic plaster).

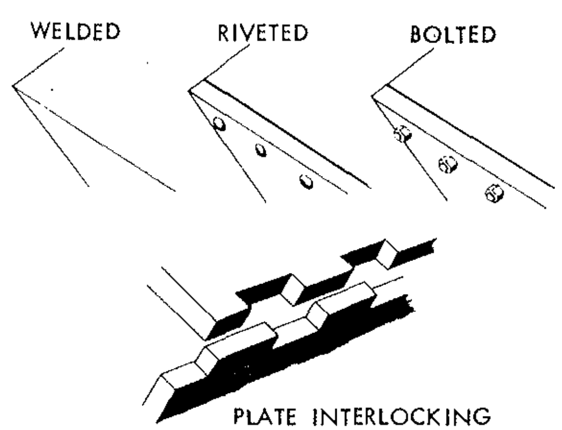

Figure 6.

j. What is overall length of tank (excluding the overhang of the main armament)?

k. What is the sponson arrangement (fig. 7)?

2. *Front View.*

a. Width over tracks.

b. Width overall, if greater than width over tracks.

c. Angle to vertical of hull above fender plate.

d. Angle to verticle of hull below fender plate.

e. Width of each track.

f. Type of hull construction.

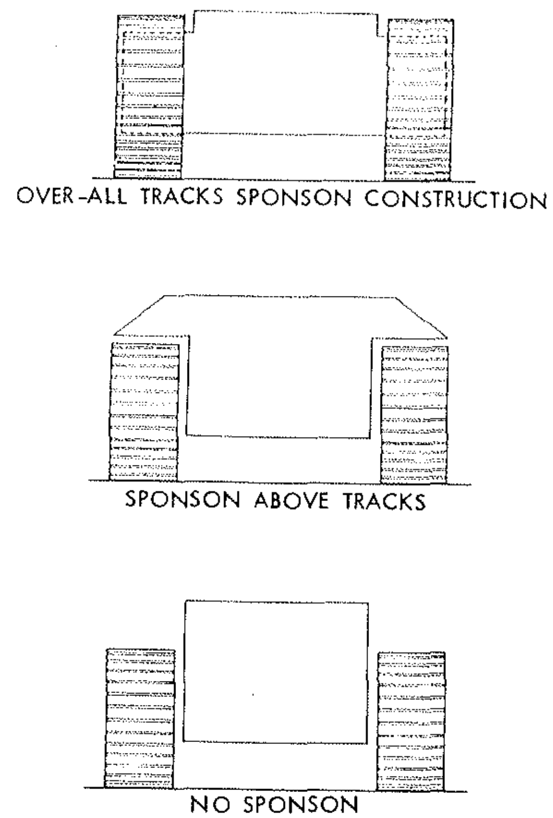

Figure 7.

Turret

1. *Front View.*

a. Is armor cast or welded rolled plate?

b. Is the commander's cupola fitted and, if so, on what side is it located?

c. What is the angle of the side plates to vertical?

2. *Plan View.*

What is the shape of the turret?

3. *Side View.*

a. What is the shape of the turret roof, and what are the angles to vertical?

b. What is the shape of the turret front, and what is the angle to vertical? Is the gun mantlet internal or external, flat or curved (fig. 8)?

c. What is angle of turret rear plate to vertical?

4. *Mantlet Designs.*

What type of mantlet is fitted?

5. *Main Armament.*

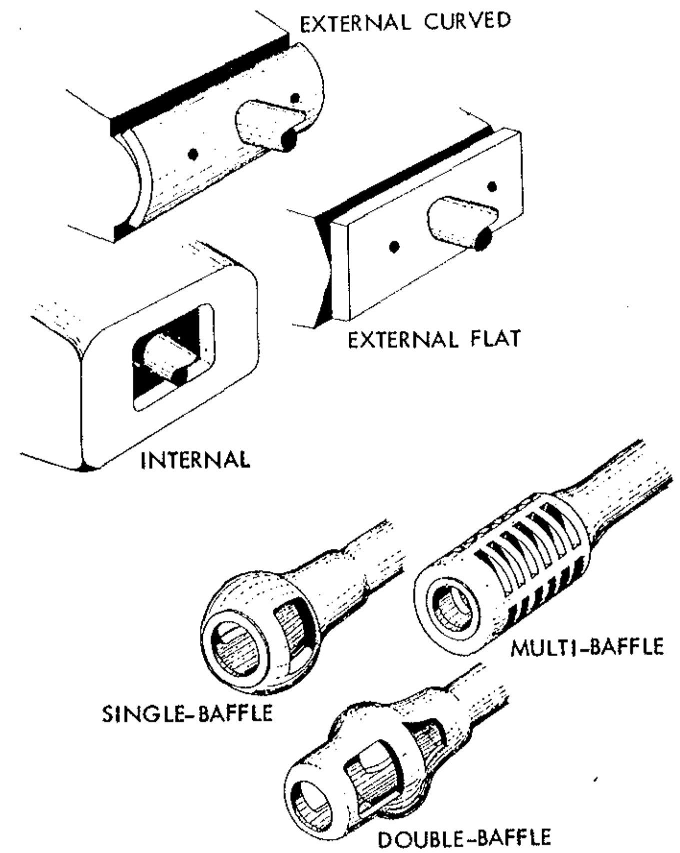

Figure 8.

a. Is gun long in relation to tank? If so, approximately how far does it project beyond nose or tail of tank?

b. Has it a muzzle brake? If so, is it of single-, double-, or multi-baffle type? Types are shown in figure 8.

c. Approximate length of ammunition and muzzle velocity of each type (hollow charge, HE, AP, HVAP).

d. Is ammunition "fixed" or "separate" (i.e., is projectile fixed to cartridge case, or are the two loaded separately)?

e. What are maximum angles of depression and elevation, in degrees?

f. What is the performance of the gun against armor (specify range and angle of attack); or, if it is a low-velocity weapon, what is its maximum range?

g. Is the gun mounted in orthodox fashion (i.e., with recoil gear), rigidly mounted, or of recoilless type?

h. What fire control devices are used (direct fire telescope, gun stabilization, infrared, or radar)?

6. *Auxiliary Armament.*

a. Is there a coaxial machine gun? If so, on which side of the main armament is it mounted? (The larger hole in the mantlet beside the main armament usually indicates the machine gun's position.)

b. Is there a front hull machine gun? If so, is it fixed or in a movable mount?

c. Are there any more machine guns, smoke or grenade dischargers, or other auxiliary weapons? (Flame-throwers, whether mounted in place of the main or subsidiary armament may generally be distinguished externally by their thin barrels.)

Miscellaneous

1. Type of engine—gasoline or Diesel? (Characteristics of the latter are blue exhaust smoke and deep-throated exhaust beat.) What is the horsepower output at specific number of r.p.m., and what is the maximum output? What is the number of cylinders? What is the cooling system?

2. What is the approximate maximum speed? (Specify on roads or cross country.)

3. Type of transmission—crash, synchro-mesh, or pre-selector, cross-drive or torqumatic—and number of speeds given, forward and reverse.

4. Type of steering gear (mechanical, mechanical with servo, electric or hydraulic assistance, or electric, hydraulic, or air-operated; controlled differential or clutch and brake.)

5. Is the turret traversed by power as well as by hand? High turning speed is the characteristic feature. Is power traverse electric or hydraulic? Is it operated from the vehicle engine or by a separate engine?

6. What is the tank's water-fording performance? Is it amphibious or submersible? If so, what special methods are used to drive it in the water, to seal the openings in the hull and turret, to communicate with other tanks or the shore when in the water, to guide it in water, and to ventilate it and supply air to the engine?

7. What are its official Army nomenclature and the manufacturer's nomenclature? Has the vehicle any nickname given to it by the troops? What is the manufacturing firm, and what is the serial number?

8. Bridge-laying vehicles on tank chassis (bridge-laying tanks) are easily distinguished by the bridge structure on top of the hull. The bridge may be rigid or folding and put into position mechanically or by hand.

9. What are the weight, combat-loaded, the ground clearance, height, number of crew, and fuel capacity of the main and auxiliary tanks? Range of action (specify roads or cross-country), maximum trench-crossing ability, vertical step, fording, and gradient?

ARMORED CARS

1. Armored cars may be either wheeled, semitracked, or have alternative wheel or track drive. Of which type is the car under examination?

2. If wheeled, how many wheels has it, and what is their arrangement?

3. How are the wheels driven?

4. How many wheels are, or can be, driven and steered?

5. If a wheel-cum-track design, how are the wheels changed over for tracks and vice versa, and how long does the operation require?

6. What is the weight of the vehicle when combat loaded?

7. What is the service or the manufacturer's nomenclature of the vehicle? What is the manufacturing firm, and what is the serial number?

8. What are the overall length, width, height, track, and wheelbase?

9. What is the main and auxiliary armament? Give details of ammunition (types and whether fixed or separate), number of rounds, performance at a specified range, and angle of attack against armor and muzzle velocity. What are maximum angles of depression and elevation of main and auxiliary armament?

10. Is a muzzle brake fitted to the main armament?

11. What are the armor thicknesses of front, sides, rear, roof, and bottom plate, and at approximately what angles to the vertical are they mounted?

12. Is provision made for driving from either front or rear?

13. What are maximum speed and radius of action on roads?

14. What type of transmission is provided, and how many speeds does it give forward and reverse?

15. What type of engine is mounted? How many cylinders has it, of what arrangement, and what is its output in horsepower at a specified number of revolutions per minute, and what is its maximum output?

16. How are the wheels sprung?

17. If semitracked, what type of track is fitted? Are the track pins dry or lubricated, and are they mounted in any type of antifriction bearing? Do the track links have rubber pads? How many track wheels are there? How are they sprung, and what is their arrangement?

SELF-PROPELLED ARTILLERY

1. A self-propelled gun is usually based on the chassis of a standard tank, carrier, or semitracked vehicle. On what chassis is this equipment based?

2. Its most noticeable characteristic is the lack of a turret which can traverse through 360°, although an armored, fixed superstructure somewhat resembling a turret may be fitted. Is the gun mounted—(*a*) In the hull front plate of the vehicle? (*b*) Above the superstructure roof behind a roofless bulletproof shield? (*c*) In a fixed armored "turret"?

3. What are the caliber and length in calibers of the gun?

4. What is the type of ammunition, and how many rounds are carried?

5. Is a muzzle brake fitted? If so, of what type?

6. What is the auxiliary armament?

7. Thicknesses and angles of armor plates, hull design, suspension, etc., as for tanks.

8. What is the official Army nomenclature of the equipment? Or, failing this, the manufacturer's or popular nomenclature? What is the manufacturing firm, and what is the serial number?

9. Main dimensions—overall length including gun, gun overhang, overall width, overall height, distance between track centers, and minimum ground clearance.

10. Traverse and elevation of main armament.

11. Is gun of recoiling, recoilless (i.e., with back-blast of gases on firing), or rigidly mounted to the vehicle?

12. If main armament is a single or multi-barrelled rocket projector, the projectile may be launched from guide rails, or from a trough or a tube superficially resembling the tube of an ordinary gun but distinguished by an outlet for the rearward thrusting gases (i.e., a series of holes arranged in an annulus round the muzzle). State type and number of launching rails, troughs or barrels, together with approximate caliber and weight of projectile.

CHAPTER 2

Artillery

INTRODUCTION

Even though artillery materiel has played a prominent part in battles throughout modern history, its development is far from complete, and there are no indications of its being rendered obsolete by the development of atomic and other unconventional weapons.

Among the many innovations that have appeared as a result of the stimulus of World War II are such weapons as the squeeze-bore gun, the rocket-assisted shell, and skirted and discarding sabot projectiles. Also, armies have begun to use rocket and recoilless guns on a large scale.

The commander in the field must know whether enemy guns at "A" can shell his troops at "B", and with what degree of accuracy. The performance of enemy antiaircraft and antitank artillery is no less important. Consequently, it is obvious that artillery design departments, as well as military planning staffs, must possess complete and accurate intelligence on the artillery capabilities of potential enemies.

The most useful sources of technical information on artillery—as with other matériel—are photographs, technical documents, or actual tests. However, even a casual observer can learn a great deal if he can recognize important characteristics and knows how to report them.

TECHNICAL DISCUSSION

Artillery matériel may be divided into several categories according to its role—field artillery, antitank artillery, antiaircraft artillery, and coast defense artillery (figs. 9, 10, and 11). The materiel also may be classified as light, medium, or heavy. Although normally fired from a wheeled carriage, an artillery piece may be mounted in fixed concrete fortifications or fired from a railway or self-propelled mount. Often it has a dual- or multi-purpose role, a fact which should always be noted by a military observer.

As a guide, the following checklist gives the most important points to be covered: (1) performance and technical data; (2) the barrel and its breech mechanism; and (3) the carriage or mounting.

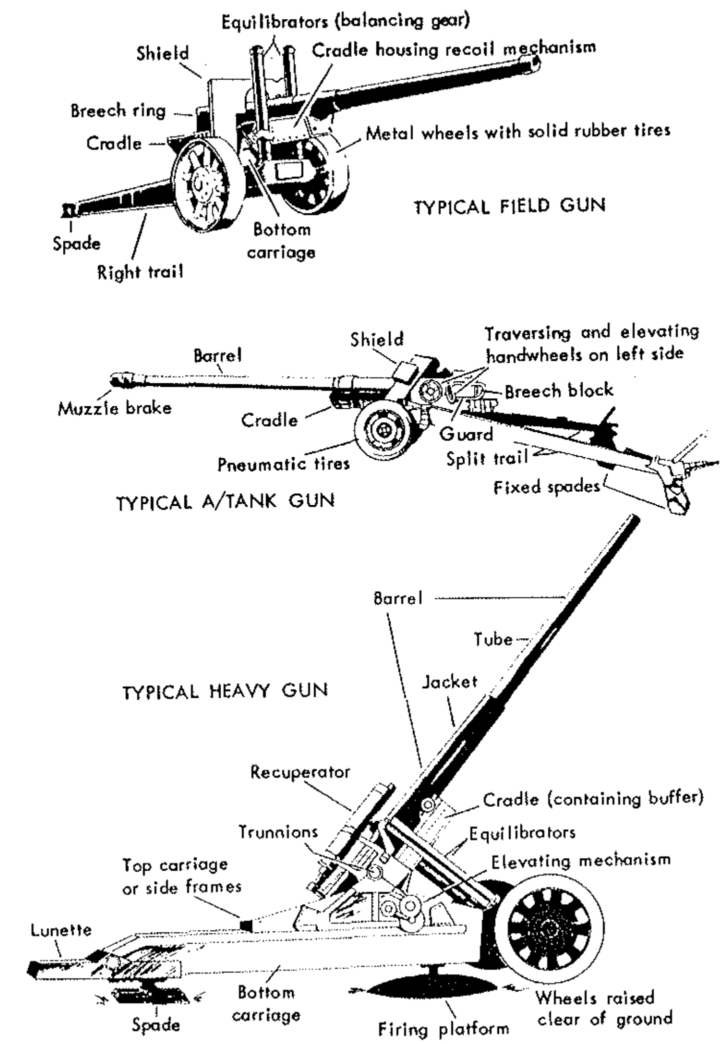

Figure 9.

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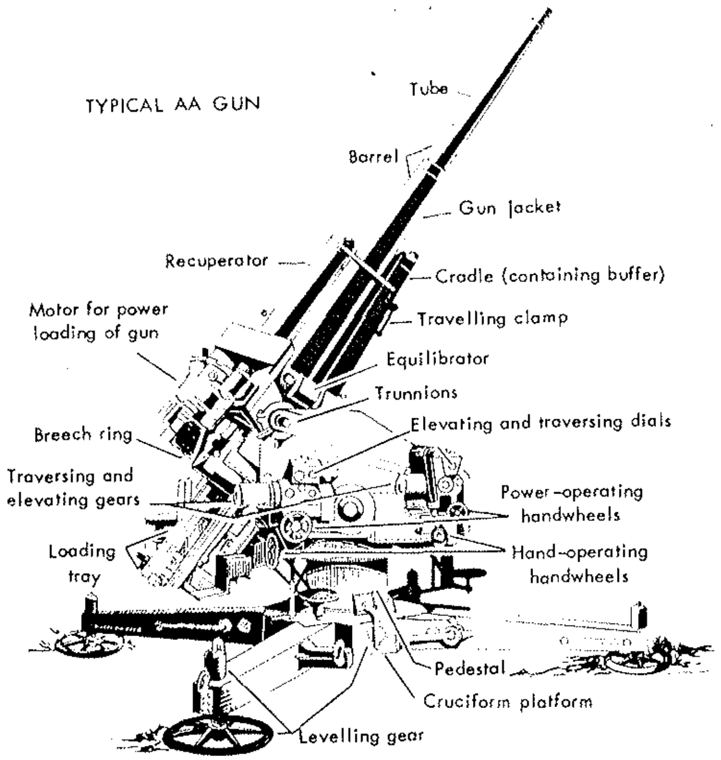

Figure 10.

PERFORMANCE AND TECHNICAL DATA

1. What is the weapon's official name, and what nickname, if any, have the troops given it? Is it a gun, a howitzer, or a gun-howitzer?
2. What role does the weapon perform? Is it dual- or multi-purpose?
3. What is its maximum range when using HE, and what is its penetration performance when armor-piercing ammunition is used and the quality and slope of armor plate are considered? If an antiaircraft gun, what is its maximum vertical range?
4. What types of ammunition are fired? What are the weights of the complete round and the projectile? What is the number of charges? Is the ammunition fixed or unfixed?
5. What is the weapon's rate of fire, and how much time is required to bring it into action?
6. What are the weapon's weights in the traveling and in the firing positions?
7. What is the muzzle velocity (this may vary with different types of ammunition)?
8. How many degrees of traverse and elevation does the piece have?
9. What are the weapon's serial number and factory markings, who was the manufacturer, and what is the plant location?
10. Give a general description of the weapon, including dimensions (length, width, and height) and any recognition features.

BARREL AND BREECH MECHANISM

Barrel

1. What is its caliber (diameter of the bore across the "lands" at the muzzle)? If the bore is tapered, the diameter at the breech should also be given.
2. What is the length of the rifled portion, and what is the length of the chamber? What is the chamber capacity?
3. If the rifling appears to be unorthodox, give a description.
4. Is the barrel fitted with a muzzle brake? If so, of what type, and how long?
5. What is the length of the barrel from the front of the breech mechanism to the front of the muzzle brake?
6. Is the barrel or cannon constructed of one tube or several tubes? What is its general outline? Has it any pronounced differing external diameters? If so, give details.

Breech Mechanism

1. What type of breech mechanism is used (fig. 12)? Is the gun fired by a lever, or electrically, or both?
2. How is the breech mechanism opened and closed? Where is the lever?
3. Are any automatic or semiautomatic breech operating arrangements employed? If so, what type are they and how are they operated?

CARRIAGE OR MOUNT

The terms "carriage" or "mount" are used to denote all components of an artillery piece except the barrel and breech mechanism. The word "carriage" is used in connection with mobile pieces; the word "mount" in referring to fixed or semifixed pieces.

Cradle

This is the part of the weapon through or over which the gun recoils when fired. The cradle and gun are elevated and depressed about pivots known as trunnions, which are supported in a "top carriage." If the trunnions are at the point of balance of the gun and cradle, elevating can be carried out without the aid of "equilibrators;" if not, these must be provided.

1. Is the cradle of welded or riveted construction?
2. Is it cylindrical (permitting the gun to recoil through the cradle), or is it of the trough type (i.e., fitted with slides over which the gun recoils)?
3. What are the positions of the trunnions and the equilibrators? Of what type are the equilibrators, spring, pneumatic with liquid seal, or torsion bar?

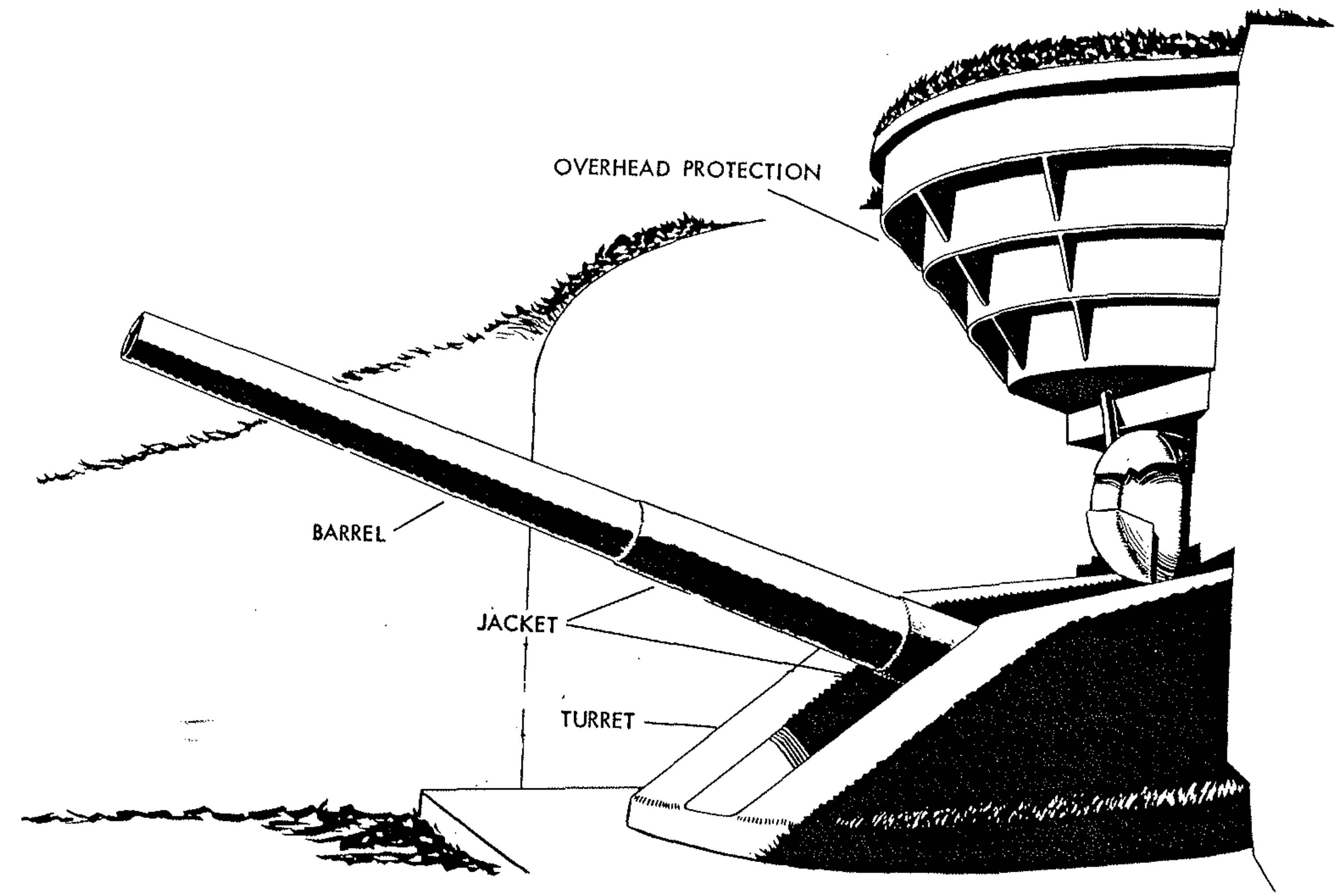

Figure 11.

Recoil and Recuperator Systems

These consist of a "recoil mechanism" (in effect, a shock absorber) and a "recuperator" to return the gun to the firing position.

1. Is the "recoil mechanism" of a normal hydraulic type? Where is it situated?
2. Is the recuperator of spring type or is it hydraulic, using compressed air? Where is it situated?

Top Carriage

This part usually supports the cradle and barrel in trunnion bearings during traverse and elevation onto a target.

1. Is it of welded or riveted construction?
2. What is the position of the trunnion bearings relative to the carriage pivot? What is the horizontal distance from the trunnion bearing to the center line of the pintle?
3. What is the height of the trunnion bearings above the ground when the piece is in the firing position?

Traversing and Elevating Mechanisms

1. What type of gearing is used (for example, nut and screw, or rack and pinion)?
2. Are the mechanisms hand- or power-operated, or both?
3. Where are the handwheels located?

Sighting Mechanism

Invariably, sighting mechanisms are found on the left side of field artillery pieces, and may be found on either or both sides in coast defense and antiaircraft materiel.

1. Is the mechanism an indirect optical sight or a direct laying telescope? The former is normally employed with field pieces, while the latter is used for antitank guns. Frequently, both types are provided.
2. Is the sighting controlled from a remote point? This method usually is employed with coast defense and antiaircraft artillery and is usually indicated by the

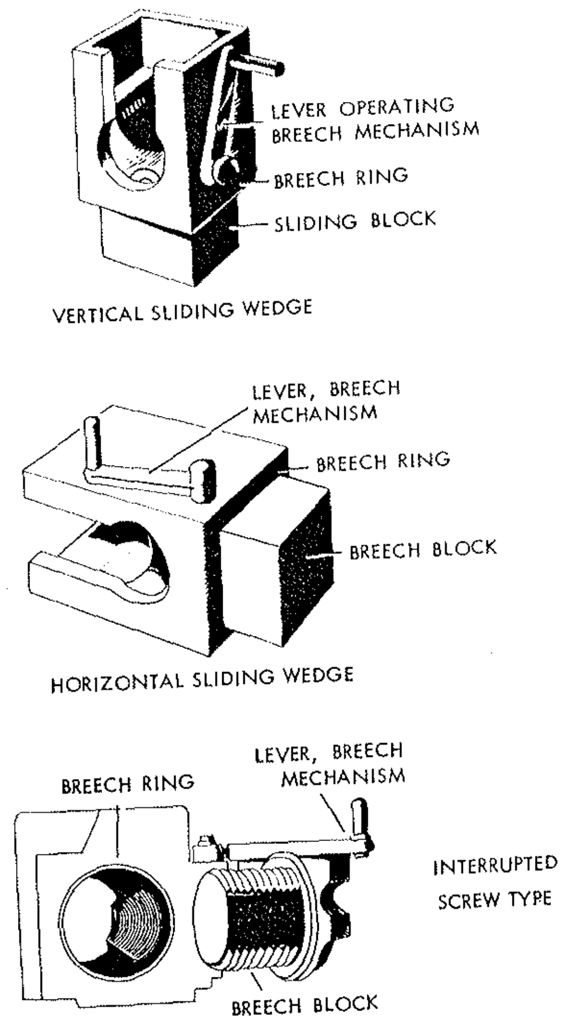

Figure 12.

presence of transmission cables and follow-the-pointer dials on the weapon. In these cases, elevation and traverse are usually power-operated. A description of the system employed is required.

Fuze-Setting Mechanism

With coast defense and antiaircraft artillery, a fuze-setting machine which sets the fuze immediately before it is loaded into the gun usually is employed.

1. Where are the machine or machines located?
2. Are they hand-operated or power-operated, or both?

Loading Devices

Loading and ramming devices are used where a high rate of fire is required—as with antiaircraft artillery—or where the projectiles are heavy.

1. How many loading trays are used?
2. Are they hand- or power-operated?
3. What system is used for ramming the projectiles?

Miscellaneous

Describe the following components if they are applicable: (1) platform; (2) axle assembly; (3) trails (these may be "split," of tubular or rectangular riveted or welded construction, or of the "box" type); (4) pedestal; (5) wheels—are they constructed of light alloy? (6) suspension system.

Pack Load and Airborne Materiel

This materiel is usually so constructed that it can be quickly disassembled, permitting division of the weapon into a number of loads for pack or airborne use.

This type of materiel may be identified by the presence of quick release levers, bolts, or plungers, or by the presence of shaped fittings to which parachutes or pack harness can be quickly attached.

The following additional information is required regarding this materiel: (1) number of loads per weapon; (2) weight of individual loads; (3) time required to disassemble; (4) time required to assemble; (5) light metal components, if any.

Recoilless Guns

With this materiel the stresses of recoil are neutralized by directing a proportion of the propellent gases to the rear. Hence the gun has no trails, recoil mechanism, or recuperator, and is of much lighter construction than a conventional piece.

Additional details required for recoilless materiel are –(1) dimensions and description of the vent or nozzle directing the gases to the rear; (2) the size of the danger area to the rear (caused by the escape of gas); and (3) details of the ammunition having a cartridge case which is large or of unorthodox design.

CHAPTER 3

Infantry Small Arms

INTRODUCTION

Small arms are the basic individual weapons not only of infantrymen, but of all other branches of service as well. They are generally defined as those weapons which can be carried by individuals and which do not exceed 15 millimeters in caliber (equivalent to caliber .60).

Small arms may be classified in three main groups (fig. 13)–(1) pistols and revolvers; (2) rifles and carbines; and (3) submachineguns, machine guns (light and heavy), and automatic rifles. The first two groups are usually single-shot (manual or semiautomatic), while the third group consists of fully automatic weapons, generally with provision for alternative single-shot operation.

Although the efficiency of modern small arms is the outcome of centuries of evolution, efforts to improve their design and performance have by no means ceased. For example, designers are still confronted with the perennial problem of increasing the rate of fire of the machine gun without incurring all the complications which result from overheating. Allied personnel who fought the Germans in 1943 will remember their first experience with the devastatingly high rate of fire of the German M. G. 42. Yet this weapon's 1,500 rounds per minute cyclic rate is very low compared with the 20,000 rpm recently achieved experimentally by one European designer.

The problems of more compact cartridges and of cartridges having combustible cases are also live research subjects. Simplification of design and reduction in weight are being sought by the designers of all small-arms-producing countries.

Another design aspect, which has received considerable practical application, is that of a "hybrid weapon" or one which combines the tactical advantages of the rifle and the submachinegun. Many nations have made considerable independent progress with this multipurpose type of small arm. While weapons of this type cannot be considered decisive in themselves, it would be foolish to underestimate the effect of a large surprise force armed with this type of weapon, equipped with infrared night-aiming devices.

PERFORMANCE AND TACTICAL DATA

Following is a check-list of points to be noted in collecting intelligence information regarding the various types of small arms.

1. What is the official nomenclature, and of what type is the weapon (fig. 13)? What is its role? What is its caliber?
2. What is its length, with and without accessories, such as mount, silencer, grenade-launcher, and special sights?
3. What is its weight with and without full and empty magazine?
4. What are its effective and maximum ranges? (State with what type of round, i.e., ball, AP, etc.)
5. What are the rates of fire—cyclic or theoretical, and practical (including reloading, etc.)?
6. Give the armor penetration, where applicable.
7. What is the weight of bullet, propellant, and complete round? What types of ammunition are fired?
8. What is the muzzle velocity?
9. What are the lengths of the rifled portion and the chamber? What is the weight of the barrel?
10. Give any serial and model numbers which may be inscribed on the weapon, together with the name and location of the manufacturer, as well as his trademark. Furnish tracings if possible.
11. What are the ammunition feeding arrangements? This should include–(*a*) nature and form of the ammunition holder or conveyor (typical magazines are shown in fig. 14); (*b*) position of the ammunition holder in the weapon; (*c*) number of rounds which the magazine or belt holds; and (*d*) method of refilling.

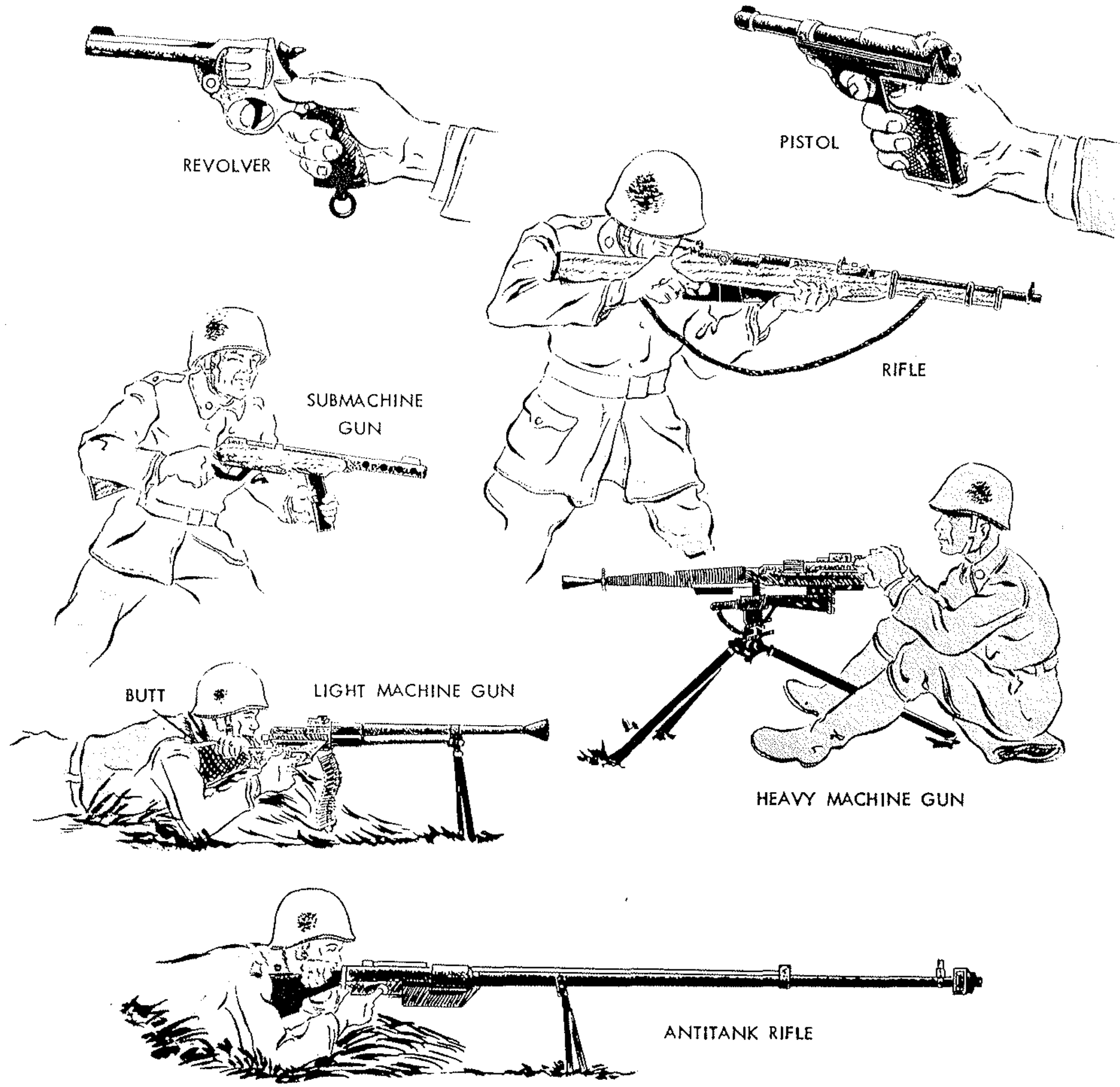

Figure 13.

12. Are any infrared or other night-aiming systems used with this weapon? If so, give a description, including range.

13. Is the weapon provided with: (*a*) a flash hider; (*b*) a muzzle brake; (*c*) a compensator; (*d*) a silencer (fig. 15)?

a. A flash hider is usually trumpet-shaped.

b. The muzzle brake reduces recoil and often takes the form of a symmetrically slotted barrel extension.

c. A compensator uses the escaping gases to counteract the tendency of light weapons to climb during automatic fire. It may take the form of an unsymmetrically slotted barrel extension or a short cylinder with gas-escape holes in its upper surface and attached to the muzzle.

d. A silencer is a device for trapping the gases and therefore the sound, while allowing the bullet to escape. It usually takes the form of a cylindrical barrel extension.

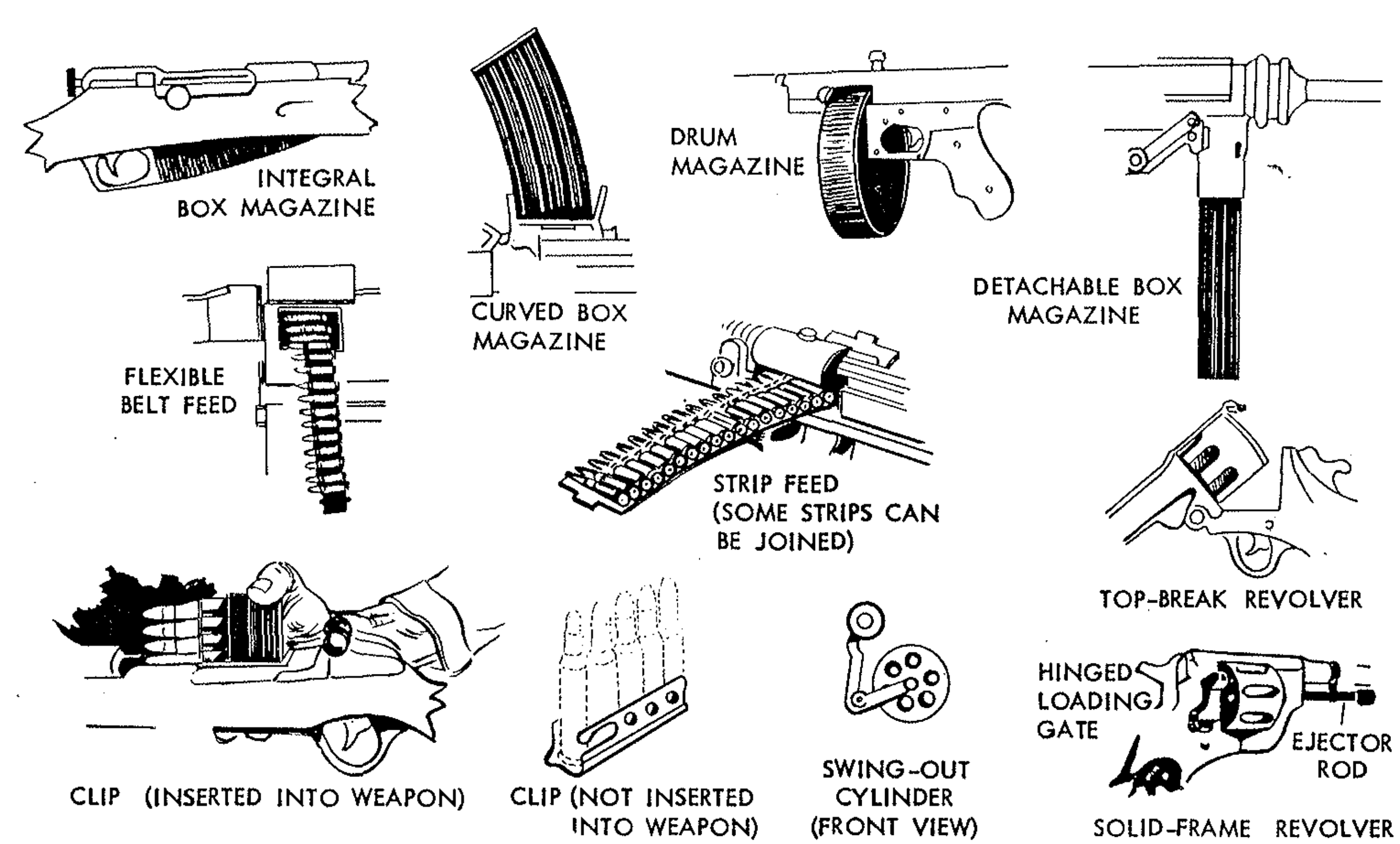

Figure 14.

14. What types of ammunition are fired (armor piercing, incendiary, etc.)? What is the shape of the bullet (round-nosed and short like a pistol bullet or long like a rifle bullet)? What are the dimensions of bullet and cartridge case? Is the cartridge case rimmed, rimless, or belted (fig. 16)? Is the cartridge case tapered or parallel? What material is used in the cartridge case construction? Feed and ejection ports and magazines will usually give an indication of the ammunition size (fig. 17).

15. Should the breech be locked at the moment of firing? How is this accomplished? (Rotation of bolt, bolt movement to locked positions, etc.)

PISTOLS AND REVOLVERS

The basic difference between these well-known weapons is that the revolver ammunition supply is contained in a revolving cylinder while in the pistol the cartridges are carried in a magazine usually contained in the butt and are fed under the influence of a spring. A typical pistol is shown in figure 13.

1. How many rounds can be carried in the magazine or revolving cylinder?
2. If a pistol, has the weapon an external hammer? Can the hammer be made to rise and fall by simply pressing the trigger, or must it be cocked manually? Are provisions made for selective automatic and semiautomatic fire and for attachment of a shoulder stock?
3. In the case of the pistol, what system of action is employed?

RIFLES AND CARBINES

These two types of weapons are generally similar except that the carbine is shorter and lighter and sometimes fires a weaker cartridge than the basic rifle cartridge.

1. Is the weapon manually reloaded, or is it reloaded automatically? Semiautomatic rifles can usually be distinguished from manually operated ones by their inclosed receivers which house the more complicated mechanisms and the driving springs (fig. 18).
2. Is a bayonet provided? What are its dimensions and shape, and what is the method of attachment (fig. 15)?
3. Is the weapon also used as a grenade launcher? In this role, it is fitted with a short detachable cylinder over the muzzle into which the grenade is placed or with a similarly placed spigot. With the latter type, the

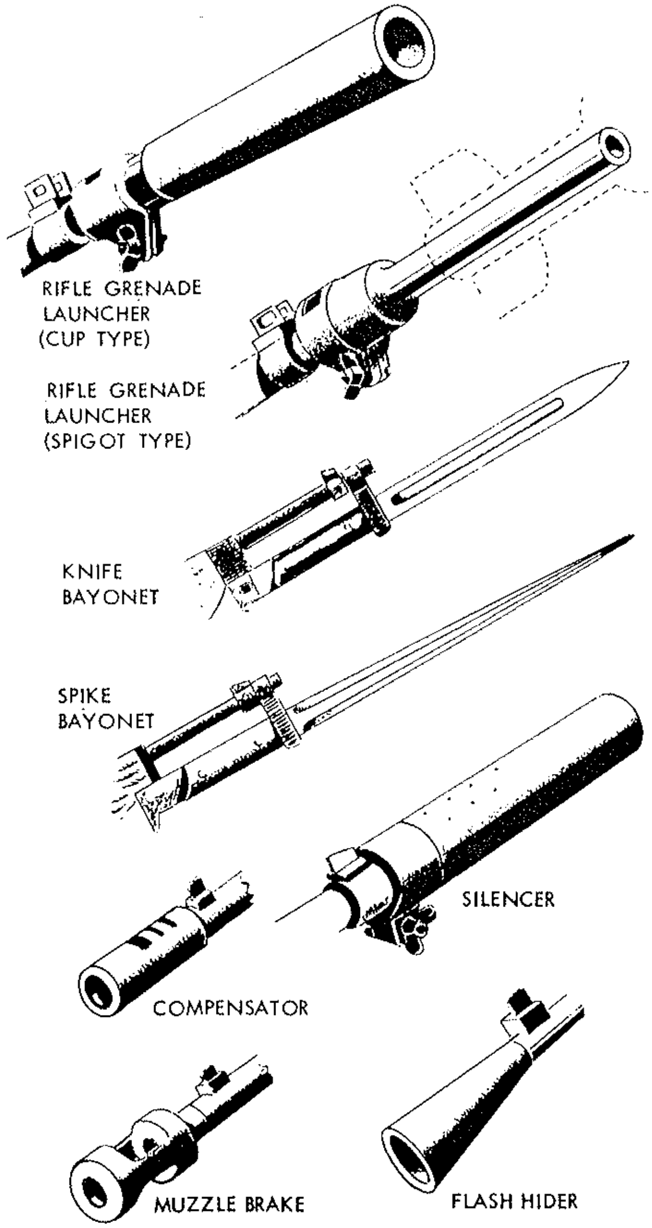

Figure 15.

grenade has a hollow tail which fits over the spigot (fig. 15).

4. Is the stock of plain wood, plywood, or plastic (fig. 19)?

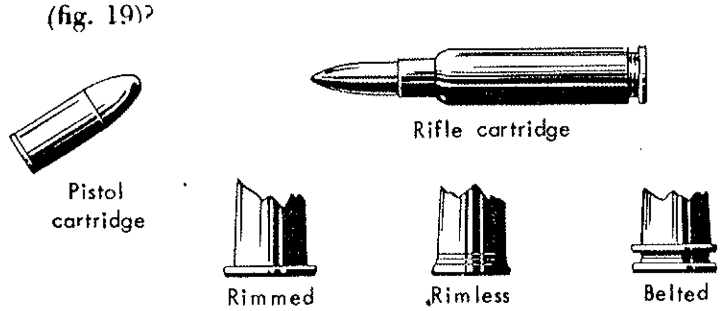

Figure 16.

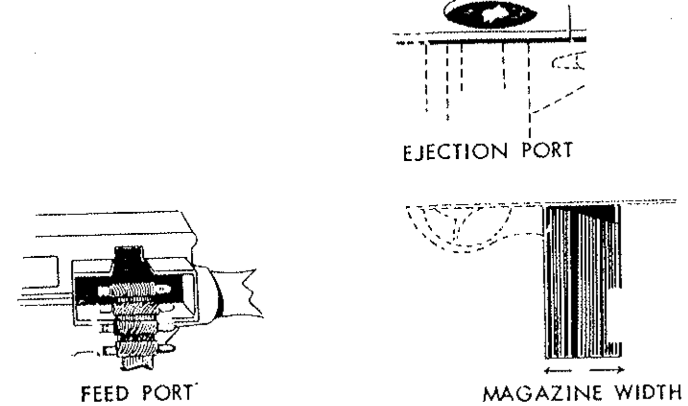

Figure 17.

5. Is a handguard provided? Of what material is it (fig. 19)?

6. What are the sighting arrangements?

a. Is the front sight one of the types shown in figure 20?

b. Is the rear sight one of the types shown in figure 20?

c. If a sniper's telescopic sight is used with the rifle, how is it attached to the weapon? What are its dimensions and degree of magnification? What is the location of the range-setting drum, and what increases do the range-scale graduations represent? A typical sniper's sight is shown in figure 20.

7. Is the weapon an antitank rifle (fig. 13)? (This is obsolete or obsolescent in modern armies.) It may be recognized by the unusually long barrel, the muzzle brake, and some form of support such as a monopod or bipod (fig. 21).

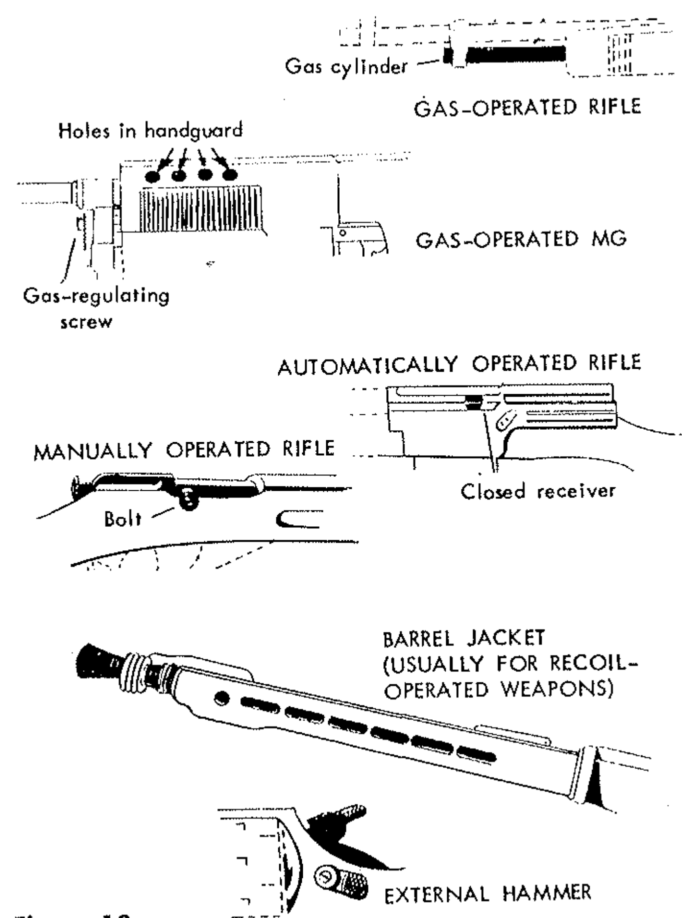

Figure 18.

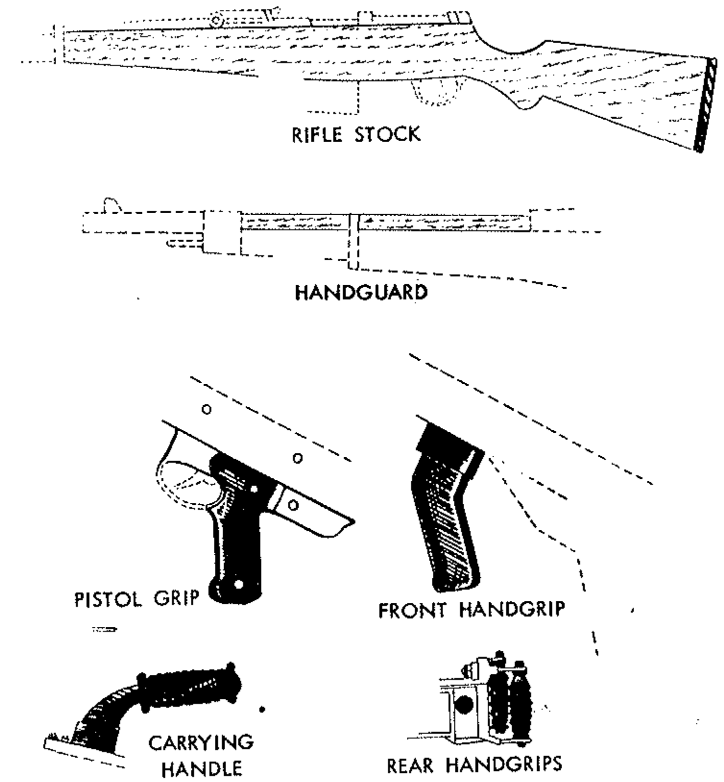

Figure 19.

SUBMACHINE GUNS, MACHINE GUNS, AND AUTOMATIC RIFLES

Machine guns may be light or heavy. Light and heavy machine guns differ chiefly in role and weight. Light machine guns are normally of rifle caliber (cal. .256—cal. .315), belt-fed, and are provided with a bipod. Heavy machine guns are provided with more stable mounts and are sometimes of larger than rifle caliber (cal. .256—cal. .60). A dual-purpose machine gun is one that can be used as either a light or a heavy machine gun by merely changing the type of mount. In United States nomenclature, automatic rifles are similar to the weapon shown in figure 13, but are magazine fed. Submachineguns are hand-held weapons capable of automatic fire. Sometimes they are equipped with a selector to permit either automatic or semiautomatic fire. Submachineguns usually fire pistol cartridges.

1. Is the weapon (*a*) recoil-operated; (*b*) gas-operated; or (*c*) blowback-operated?

a. In the case of the recoil-operated weapon, the barrel must be free to move backward and forward. It is frequently, but not always, housed within a slide or barrel jacket or casing (fig. 18).

b. The gas-operated weapon usually carries a gas cylinder above or below the barrel. It has some sort of gas regulator screw (fig. 18).

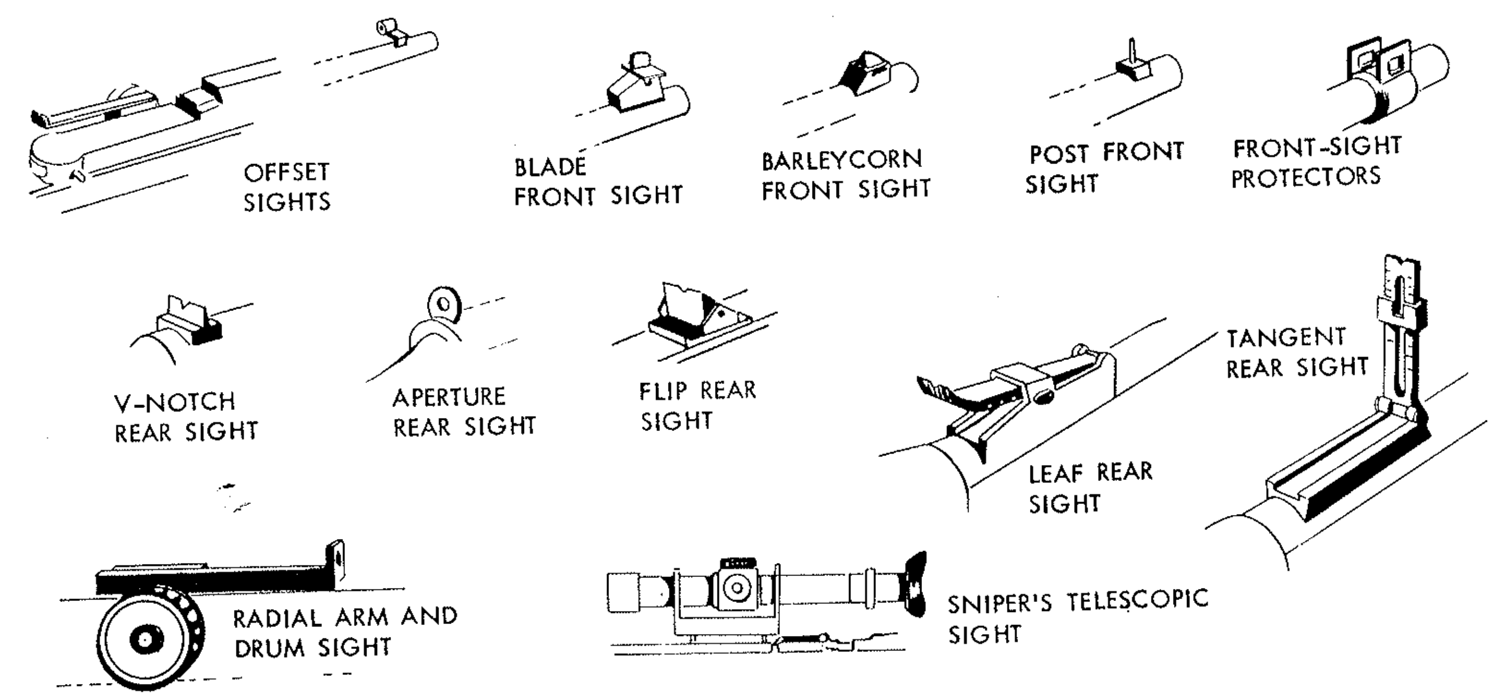

Figure. 20.

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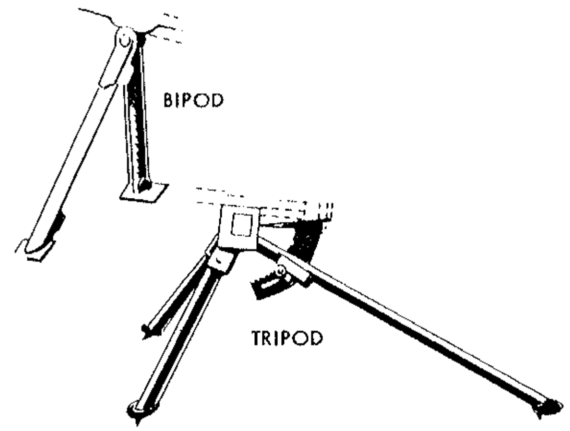


Figure 21.

c. Blowback-type weapons utilize the pressure of the powder gases to force the bolt to the rear independently of the barrel, to which it is not locked at the moment of firing. This system has been practically restricted to submachineguns.

2. Does the weapon give automatic fire only—i.e., does it fire as long as the trigger is pressed—or selective automatic or semiautomatic fire, accomplished by moving a change lever or press button?

3. Is the gun air cooled or liquid cooled? An air-cooled weapon frequently has a slotted barrel casing. Sometimes the barrel has no casing but is provided with fins to assist in the cooling. Air-cooled barrels also may have no casing or fins. A liquid-cooled weapon is provided with a large jacket surrounding the barrel (fig. 22).

4. Is the weapon provided with the following components? If so, are any of them folding or collapsible?

a. A butt, as shown in figure 13.

b. A stock, as shown in figure 19.

c. A pistol grip, as shown in figure 19.

d. A front hand grip, as shown in figure 19.

e. A bipod, as shown in figure 21, or, in the case of heavy machine guns, a tripod as shown in figure 21. How is the bipod or tripod attached to the weapon?

f. A barrel casing as shown in figure 18.

g. A carrying handle as shown in figure 19.

h. Rear grips as shown in figure 19.

5. What are the sighting arrangements?

a. Is the front sight one of the types shown in figure 20?

b. Is the rear sight one of the types shown in figure 20?

c. Is any sighting mechanism provided for indirect fire? If so, where is it mounted? Is it provided with optical or open sights? What is the arrangement of the dials and arcs, and how are they graduated?

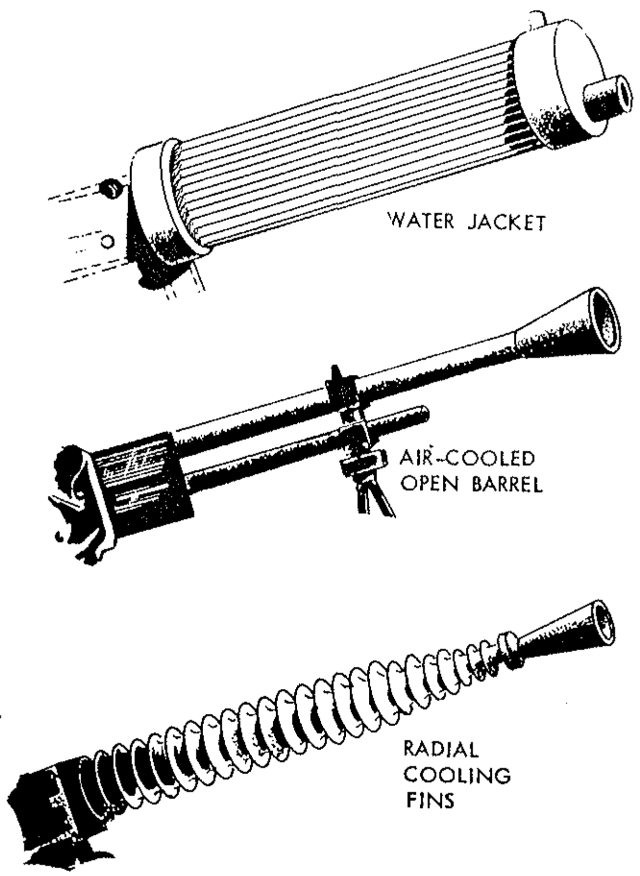


Figure 22.

CHAPTER 4

Mortars, Infantry Antitank Weapons, and Grenades

INTRODUCTION

Mortars and grenades have been used for generations, but the modern infantry rocket and recoilless weapons owe their rapid development to World War II.

Increased thickness of armor has created a need for an infantry, man-carried weapon capable of defeating heavy armor. The present combination of rocket (or recoilless) weapons and a shaped charge enables a single infantryman to carry and fire his weapon and thereby defeat the armor of the heaviest tank. The infantry rocket launcher, however, has severe limitations in range and accuracy. Recoilless weapons, on the other hand, are currently limited in penetrative power, owing to the fact that the HEAT as well as other projectiles fired by recoilless weapons are spin-stabilized, a condition which mitigates against the effectiveness of these projectiles in armor penetration. Designers are now devoting considerable energy to solving these difficulties. The prospect of rendering impotent so cheaply and so easily the most costly and most heavily armored tank is, to say the least, an attractive one.

Infantry weapons, other than small arms, fall into three main categories: (1) mortars; (2) antitank weapons (rocket launchers and recoilless weapons); and (3) grenades.

MORTARS

Mortars may be of the well-known conventional type shown in figure 23, or of the spigot type as shown in figure 24.

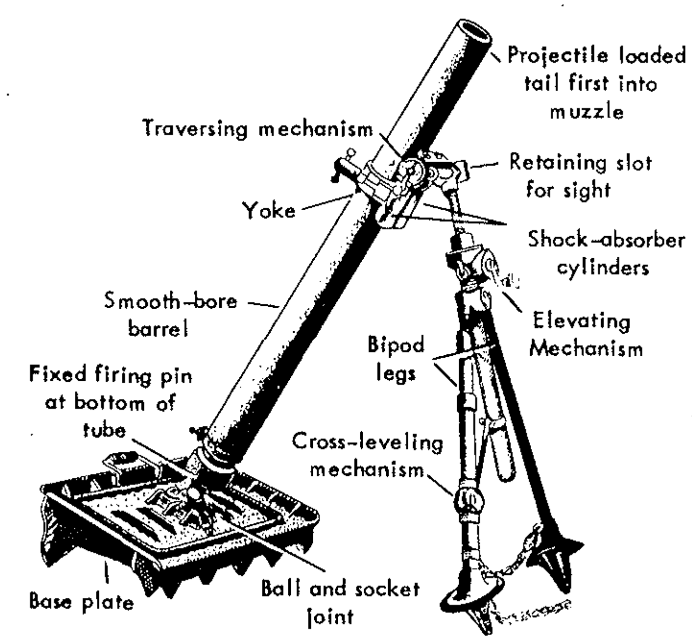
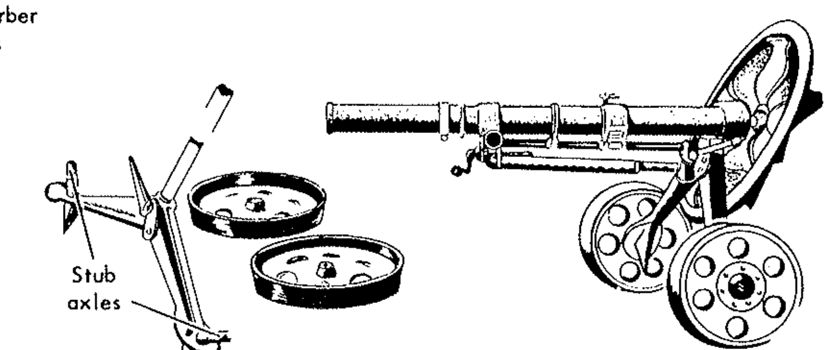


Figure 23.



A spigot mortar is one in which the shell is discharged off a spigot or shaft instead of from a barrel. Spigot mortars have been used principally for projecting heavy demolition charges to a relatively short distance.

In collecting technical data on these weapons, care should be taken to avoid confusion, because foreign nomenclature sometimes uses a word which obviously is related to "mortar" to designate a heavy artillery mortar. The literal translations of many foreign words for the conventional mortar are often "mine thrower," "shell thrower," "grenade launcher," and similar terms.

Figure 23 illustrates a conventional 81-mm. (approximately 3-inch) mortar. The ignition cartridge (fig. 24) is inserted in the tail of the shell. For the longer ranges, additional propellent increments are fixed between the shell's fins. The shell is loaded tail first and, after dropping down the barrel, forces the percussion primer (fig. 24) in the base of the ignition cartridge upon the fixed firing pin in the base cap. Flash from the ignition cartridge passes through the holes in the boom to ignite the increments. The mortar can readily be dismounted into its three main components: barrel and base cap, base plate, and bipod mount.

Following are the most pertinent questions regarding any type of mortar:

1. What is the caliber of the weapon, and what is its official nomenclature? Who is the manufacturer, and where is the plant located? When was the weapon adopted or standardized, or both?

2. What are its performance characteristics? (*a*) maximum and minimum ranges; (*b*) maximum and sustained rates of fire; (*c*) probable errors in deflection and range at maximum and minimum ranges; and (*d*) time required to go into and out of firing position.

3. What are the weights of—(*a*) The complete weapon in the firing position? (*b*) The weapon in the traveling position? (*c*) The bipod or tripod? (*d*) The base plate (if not of the type shown in figure 25)? (*e*) The barrel? (*f*) The transport cart or trailer?

4. What are the dimensions of—(*a*) The base plate? (*b*) The barrel (length from muzzle to end of spherical projection or base cap)? (*c*) The bore (diameter and length from muzzle to tip of firing pin or projectile step)?

5. What are the weapon's total traverse and elevation?

6. What type of cross-leveling mechanism is used? (This is a device to compensate for any unevenness in the ground by canting the sight mount into a true horizontal plane.)

7. What is the method of range adjustment and what is the muzzle velocity? Some mortars, chiefly those of smaller caliber, have been used in which differences of range are obtained not by altering the charge or the elevation of the barrel, but by allowing more or less gas to escape through valves in the breech. Weapons employing this system usually will be recognizable by the existence of an exhaust pipe or baffle plate and a graduated control mechanism, the latter at the breech (fig. 26).

8. What are the transporting arrangements? The components of some large mortars are too heavy to be conveniently man-handled. For such mortars a two-wheeled trailer or cart is often provided. In some cases, the mortar must be completely removed from this carriage before it can be fired (fig. 25). In other cases, however, the carriage may serve as the barrel mount in action in a manner reminiscent of a towed artillery weapon. Sometimes wheels are fitted as shown in figure 23.

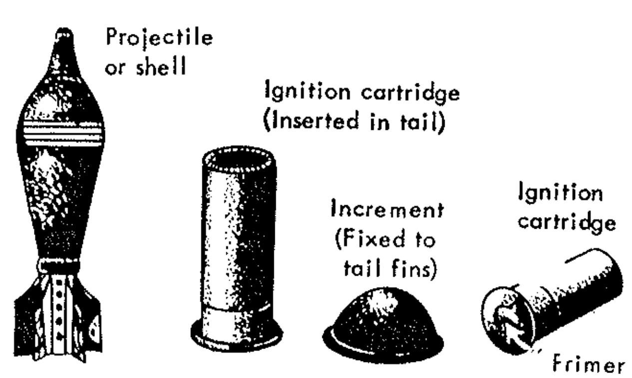
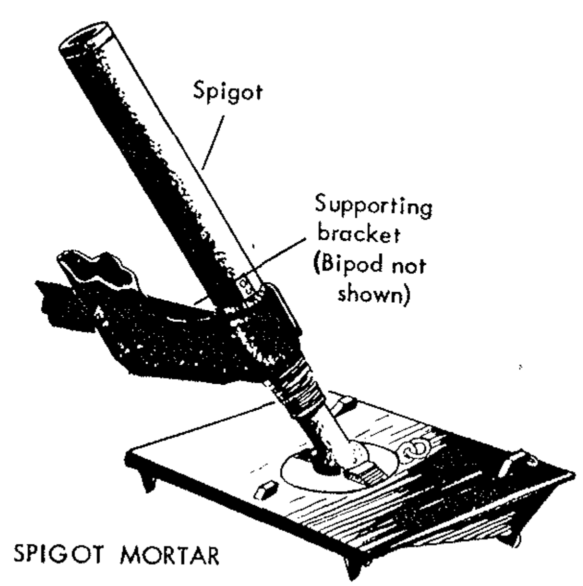


Figure 24.



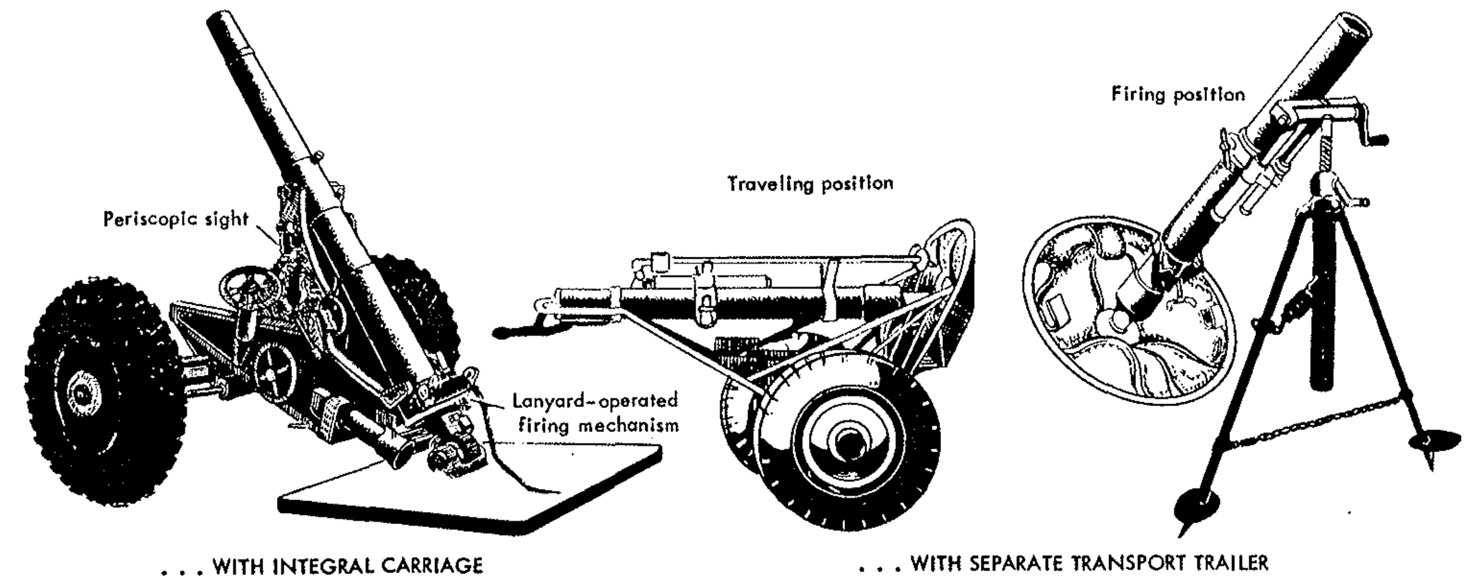


Figure 25.

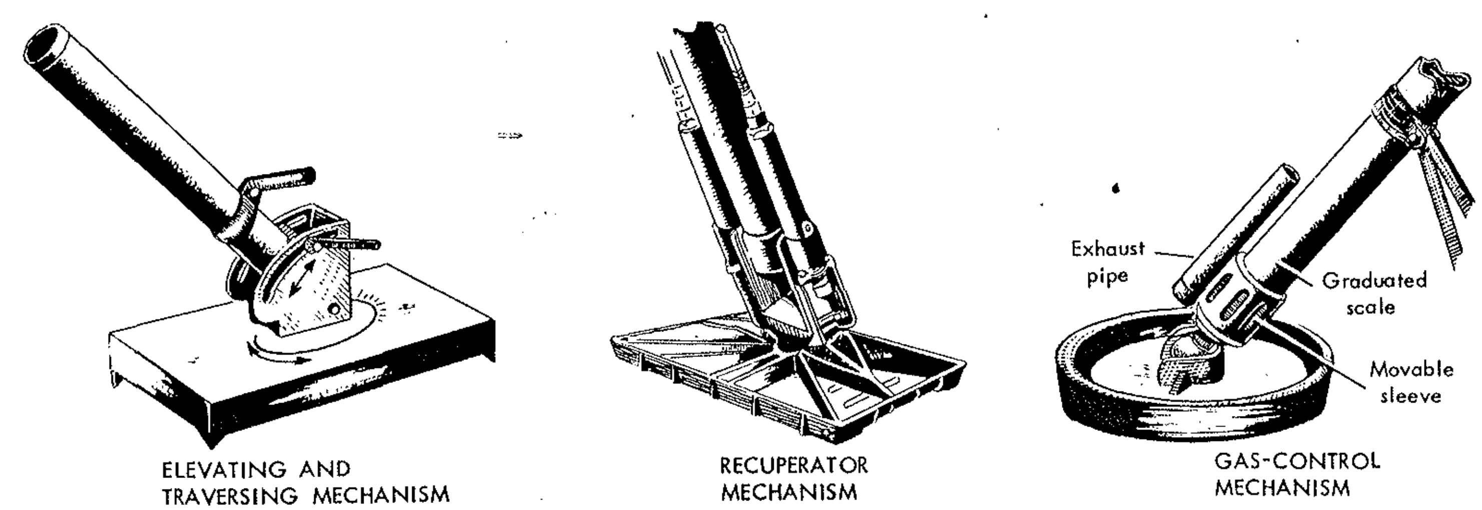


Figure 26.

9. Is the mortar drop- or trigger-fired? If the latter, where is the trigger situated and how is it operated, e.g., by hand or by lanyard? Or can either method of firing be chosen by manipulation of a selective lever?

10. Where is the sight placed? Is it an open or an optical sight (fig. 27)? If the latter, is it of the collimator, straight telescope, or periscopic telescope type (fig. 25)? How many scales has it, and how are they graduated? Does the sight embody a cross-level indicator bubble? If so, where is it located?

11. What is the form of the base cap? Does it mate directly with the base plate by means of a conventional ball joint (fig. 23), or are there intermediate components? Is there any buffer and recuperator mechanism between base cap and base plate (fig. 26)?

12. Is it muzzle-loaded? If not, describe fully the means by which the shell is introduced into the barrel. Is loading by hand or by some other means?

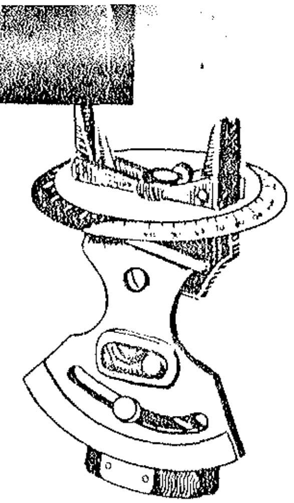
13. Is the barrel smooth-bored or rifled? If the latter, with how many grooves, of what width and depth, and what is the pitch of the rifling, i.e., what is the length in which each groove makes one complete turn? How does the shell engage the rifling?

14. What is the shape of the base plate and spades? What is the depth of the spades?

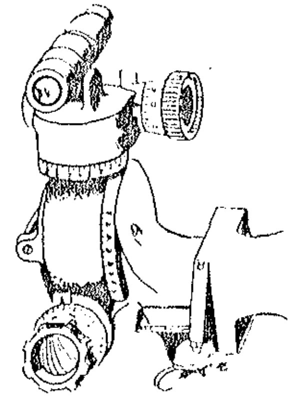
15. What metals are used in the barrel, base plate, and mount?

16. How many men are in the crew, and what are their duties?

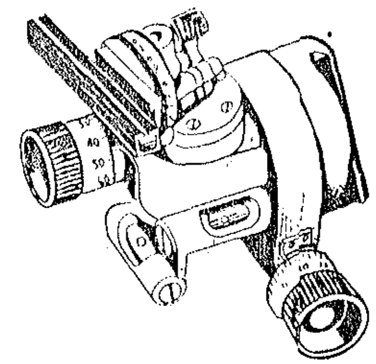
17. What are the weight, the length, and the type of the shell?



OPEN SIGHT AND ELEVATION QUADRANT



STRAIGHT TELESCOPE AND MOUNT



COLLIMATOR SIGHT AND MOUNT

Figure 27.

INFANTRY ANTITANK WEAPONS

The two systems most commonly used in infantry antitank weapons (other than grenades and antitank guns) are rocket propulsion and recoilless.

These two principles, although often confused, are fundamentally different. The propellant of a rocket is part of the projectile, is usually contained within it (fig. 28), and moves with it while burning. In a recoilless weapon the action and location of the propellant in relation to the projectile are similar to those of a conventional firearm. Some of the propellent gases, however, neutralize recoil by escaping either directly backward or in a general rearward direction through a venturi or venturis at the breech, so as to equalize the reaction in both directions (fig. 29).

Rocket Launchers

An antitank rocket launcher is likely to exhibit at least some of the following features (fig. 29):

1. A tube resembling a gun barrel, but thin-walled, smooth-bored, and open-ended; it may terminate in a funnel serving as a loading guide.

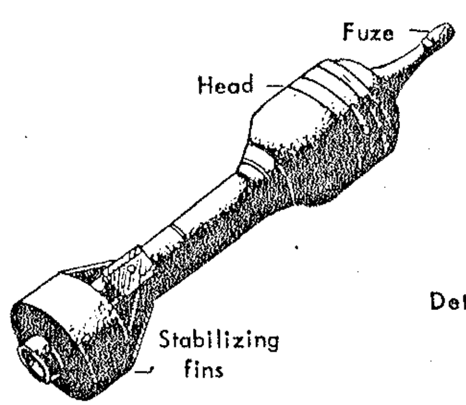
2. A firing lever, button, or trigger well forward of the rear of the launcher.

3. A battery or generator connected with the rear end of the launcher (in cases where firing is initiated electrically).

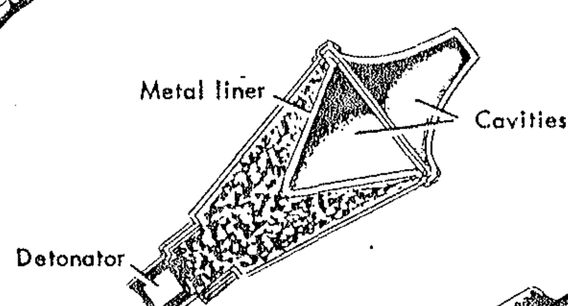
4. A shield with transparent sight windows to protect the firer from back flame as the rocket leaves the launcher. The firer may also wear protective clothing.

5. When the rocket is fired, flame will shoot from the rear of the projectile and continue to stream from the projectile in flight until all the propellant is burned. During this period a continuous roaring noise quite unlike a firearm's report usually will be heard.

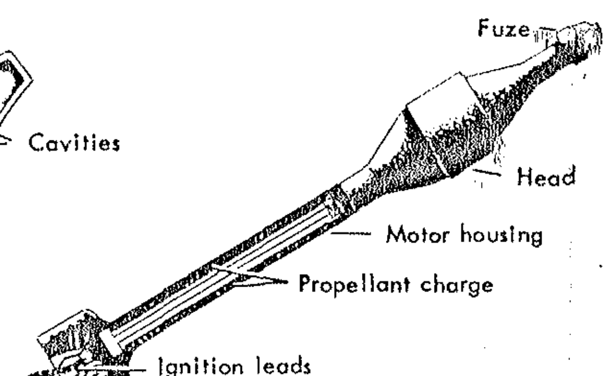
6. The projectile will have no cartridge case, but it will have a venturi or venturis at its base.



TYPICAL HEAT PROJECTILE



PROJECTILE HEAD (CROSS SECTION)



HEAT ROCKET

Figure 28.

Recoilless Weapons

A recoilless weapon may also be an open-ended tube (fig. 29) but is more likely to have a breech mechanism incorporating a venturi or venturis (fig. 29). The barrel may be rifled or smooth-bored. The propellant is often contained in a fixed-round cartridge case (fig. 29), which must be so designed as to allow gases egress to the venturi upon firing—by means, for example, of base or side-sealing discs which rupture under pressure. Figure 29 illustrates the German *Panzerfaust,* one of the outstanding developments in infantry recoilless weapons during World War II.

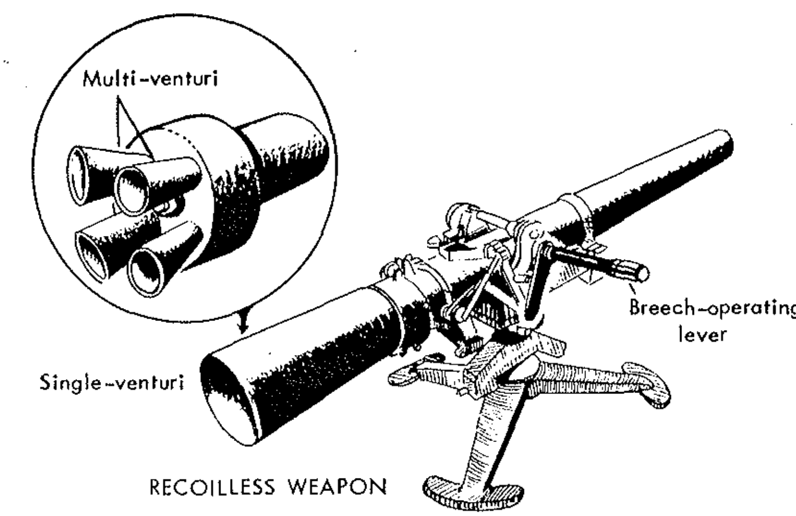
1. *HEAT Projectiles.* Modern infantry antitank weapons fire HEAT projectiles, which have extraordinary lethal effect against armored vehicles. The "shaped" or "hollow" charges used in HEAT projectiles (fig. 28 for typical internal construction) do not themselves pierce armor but, upon detonation under suitable conditions, they produce a forward concentrated jet of high penetrative power. This results from the rush of explosive force and heat into the cone-shaped internal cavity, which is the essential feature of the charge and serves to focus the penetrative effect at the point of contact.

In contrast to projectile penetration, shaped-charge penetration usually makes a hole much smaller than the diameter of the projectile. Figure 28 illustrates the typical external appearance of a shaped-charge projectile for infantry antitank use—it looks much like a mortar shell with an elongated nose. This characteristic shape is dictated by various factors which affect the optimum performance of a shaped charge; but it may, of course, be varied to suit a particular type of weapon. An effective projectile of this type is not likely to be small, and this results in a weapon undesirably heavy for infantry use unless the recoilless principle is employed.

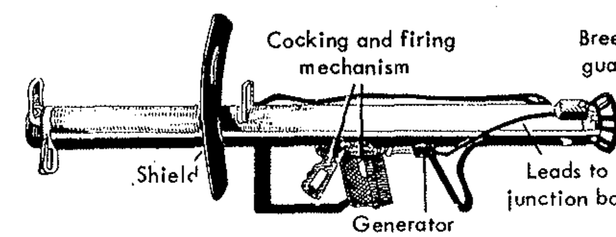
2. *Infantry Antitank Weapons and Ammunition.* The following details are required on infantry antitank weapons and their ammunition:

a. Weapon.

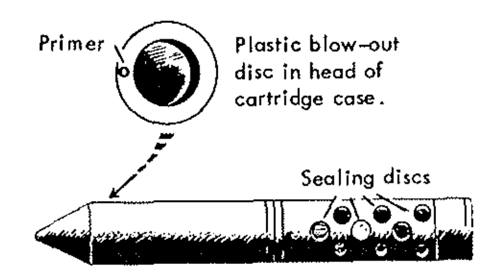
(1) General description—sketch or photograph, if available.
(2) Official nomenclature and troops' nickname, if any; manufacturer and location of plant; date of adoption and/or standardization.
(3) Dimensions and weight.
(4) Does the weapon exhibit any features associated with rocket launchers or recoilless guns?
(5) If it has a barrel or tube, the caliber, length, barrel, thickness, type of bore, and description of breech end.



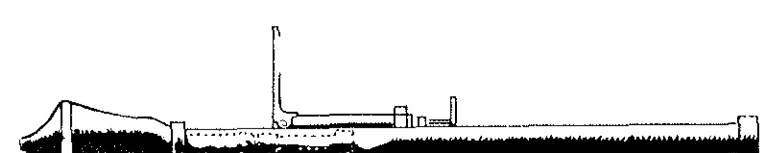
RECOILLESS WEAPON



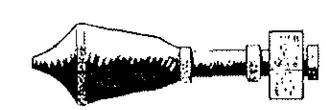
ANTITANK ROCKET LAUNCHER



PROPELLANT IN FIXED CARTRIDGE CASE



PANZERFAUST



PANZERFAUST PROJECTILE IN FLIGHT

Figure 29.

signts.

(7) Has it a mount or wheeled carriage, or is it man-carried? How is it held for firing?

(8) Loading and firing—how are these operations carried out? Position and description of firing mechanism.

(9) Has the weapon any secondary role, other than antitank?

(10) Number and duties of crew.

b. Projectile.

(1) General description, illustrated, if possible.

(2) What are the dimensions and weight?

(3) Has it a cartridge case? Venturi? Fins?

(4) Does the round need to be prepared for firing?

(5) Is ignition by electric or percussion means?

c. Performance.

(1) Maximum accurate range.

(2) Armor penetration figures.

(3) Rate of fire.

GRENADES

The main types of grenades are antipersonnel, antitank, and chemical. The most common methods of delivery are—(1) throwing by hand; and (2) using a launcher. The following details in respect to any grenade are required:

1. *General Description.* Approximate dimensions; general external appearance (send a sketch or photograph if available); color and other markings; material and construction of the grenade; nature of loading.

2. *Use, e.g., antipersonnel, antitank, or smoke.*—If antipersonnel, is the principal effect one of blast or of fragmentation, i.e., must the thrower take cover after throwing? If it is a thin-walled blast grenade, is it designed to be fitted with a steel jacket or sleeve to convert to a fragmentation type?

3. *Weight.* What are the weights complete and weight or volume of loading?

4. *Arming.* What action must be taken to arm the grenade, e.g., removal of the safety pin or pulling the igniter cord or wire? Does this action leave the grenade ready to explode after a given delay, or does it become so only after being thrown? If the grenade has been armed but not thrown, can it be re-set to "Safe"?

5. *Fuze.* Is it time or impact? If the former, give length of delay in seconds. Can the fuze be set for either time or impact action? Describe the fuze action and the components briefly. When fired from a rifle, at what distance from the muzzle does the grenade fuze become armed?

6. *Effectiveness.* Lethal radius, penetration or armor, or duration and area of smoke screen under average conditions.

a. Thrown by hand?

b. Launched from a rifle?

c. Can either method be used?

8. If thrown by hand—

a. Give maximum distance it can be thrown by a[n] average man.

b. Has it any throwing aids, such as a handle or stabilizing vanes of metal or cloth (fig. 30)?

9. If launched from a rifle—

a. Is the rifle modified in any way for the purpose[,] e.g., wire-winding to reinforce stock and handguar[d] (fig. 31)?

b. Method of discharge. Two conventional method[s] are used, a cut-type launcher and a spigot-type launche[r] (fig. 31). In either case the launcher is fitted to th[e] muzzle of a service rifle which is loaded with a bullet[-]less or wooden bullet cartridge containing a specia[l] propellant. Give a brief description of the launchin[g]

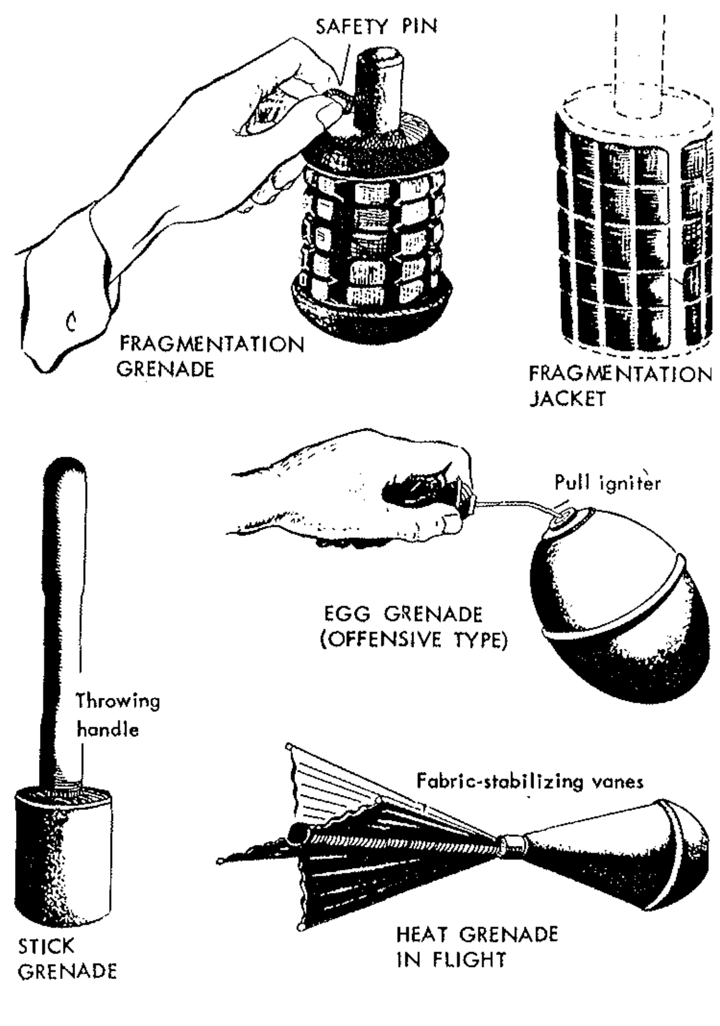


Figure 30.

attachment and note how it is attached. Describe the propelling cartridge.

c. How is the grenade stabilized in flight? Does it have fins? Or does it spin? If it spins, what causes it to do so?

d. Method of aiming. Is a special sight employed (fig. 31)?

e. Is anything attached to the grenade to assist its discharge, such as a gas check or a tail rod for muzzle-loading (fig. 31)?

f. What muzzle velocity is attained?

g. How is the weapon held, e.g., against the firer's shoulder, under his arm, or with the butt of the weapon resting on the ground?

h. What is the maximum range?

10. Within what range limitations can it be effectively employed? Give maximum elevations for such effective ranges.

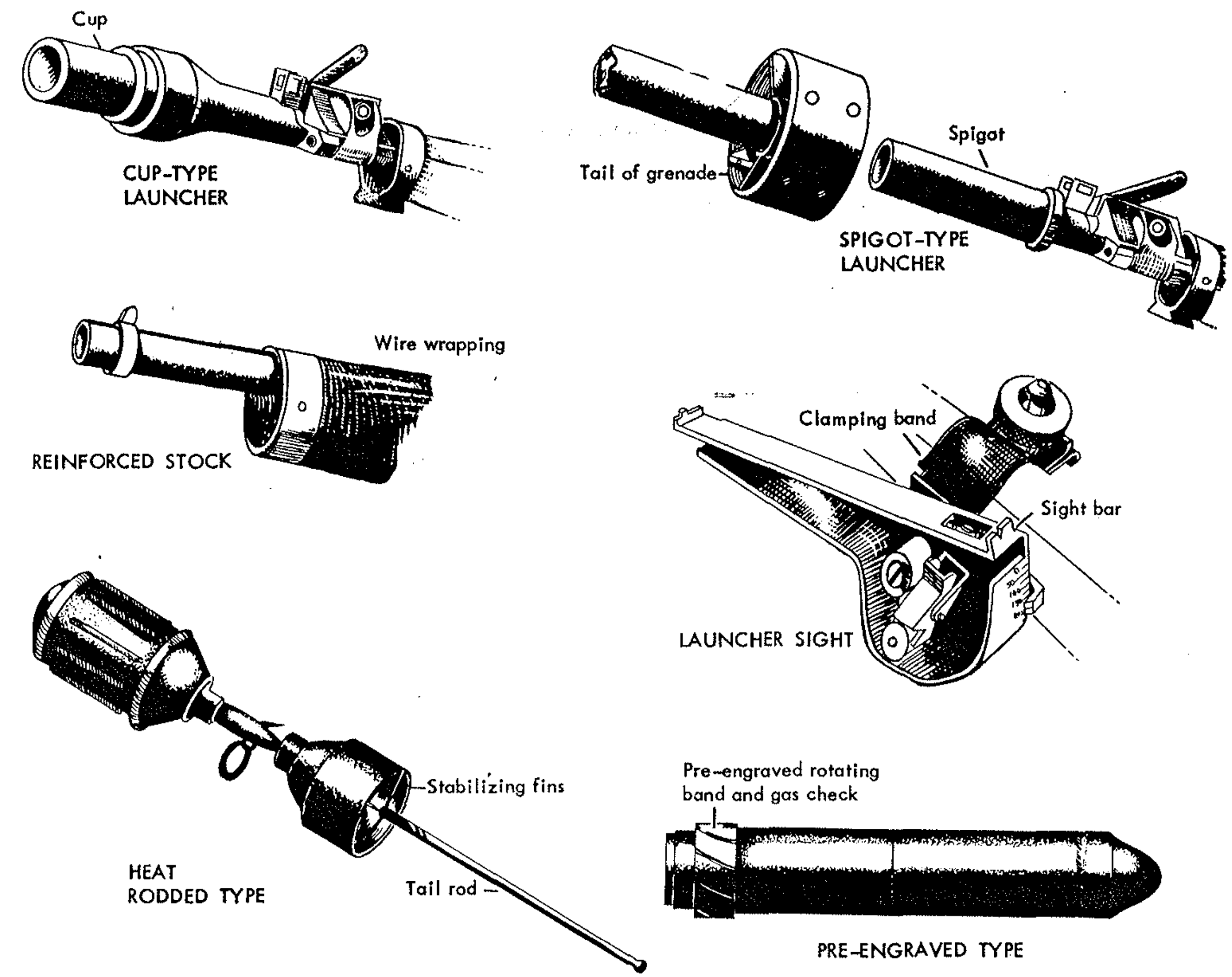


Figure 31.

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CHAPTER 5

Mines, Booby Traps, and Demolitions

INTRODUCTION

The use of mines, booby traps, and demolitions (figs. 32 through 48) has long been an important feature of land warfare for safeguarding defensive positions, channelizing hostile attacks, and demoralizing and destroying enemy troops. They differ from other weapons, such as guns, tanks, mortars, and machine guns, in that they are deliberately placed at selected spots where they can injure the enemy and are activated either by the enemy himself or by some timing or remote-control device.

Most of the world's armies employ specially trained engineer troops for the tactical handling of these dangerous materials. With the increased use of armored and other vehicles in modern armies and with decreased reliance on elaborate, prepared positions, it is expected that in future operations these weapons will assume even greater importance.

MINES

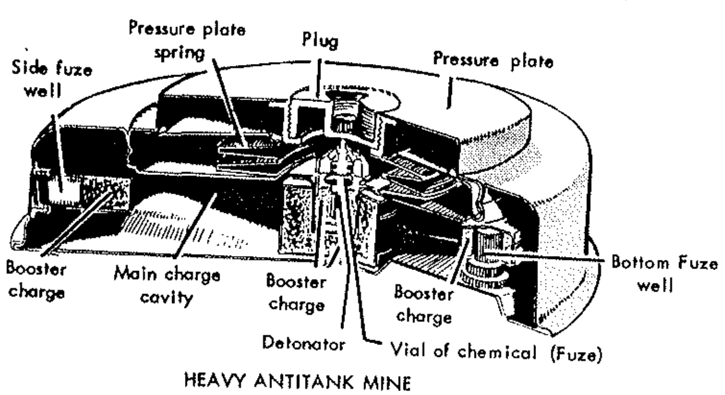
A mine is a charge of explosive, usually encased, fitted with a detonating device or devices designed to be activated by vehicles, boats, or personnel.

Types of Mines

Mines are classified according to the purpose for which they are designed. The six basic types employed in land warfare are: (1) antitank; (2) antipersonnel; (3) antiamphibious; (4) drifting contact; (5) improvised; and (6) dummy.

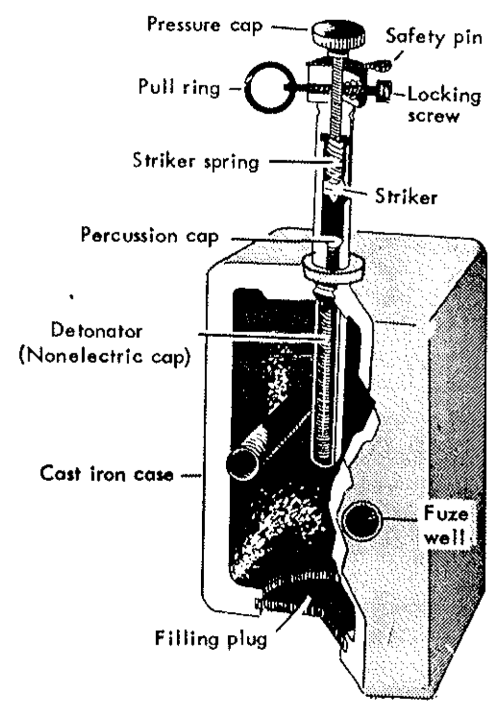
1. Antitank mines (fig. 32) are designed to immobilize tracked or wheeled vehicles. They vary greatly in the amount of explosive they contain, the normal charge being from 4 to 22 pounds. The fuze is usually the pressure type, either percussion or chemical. Ordinarily, a pressure of 200 pounds or more is necessary to detonate them.

2. Antipersonnel mines (figs. 33 and 34) are used primarily to produce casualties among foot troops. The weight of explosive charges usually varies from 1/4 pound to 4 pounds. The force of initiating action normally required varies from 5 to 160 pounds.



HEAVY ANTITANK MINE

Figure 32.



ANTIPERSONNEL MINE

Figure 33.

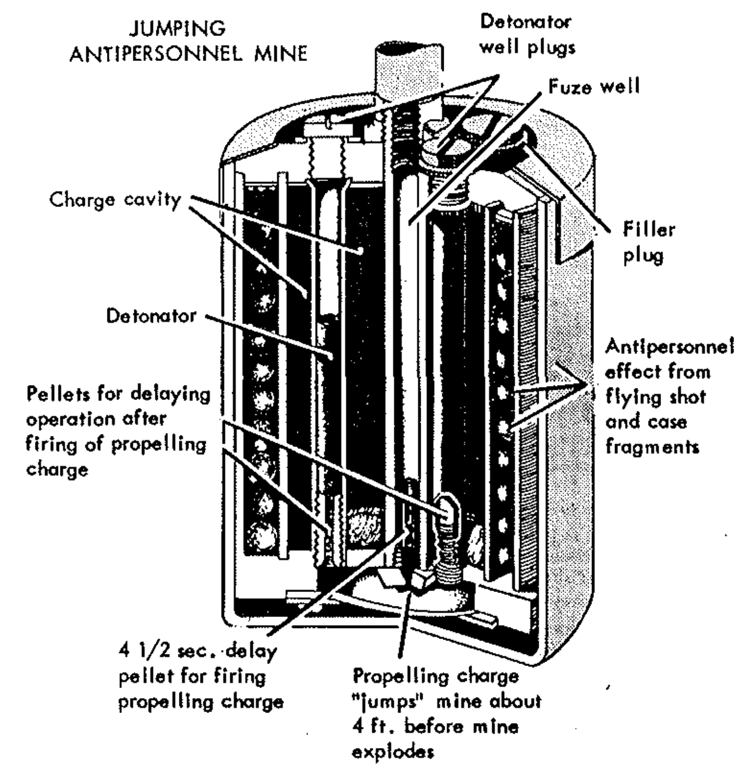
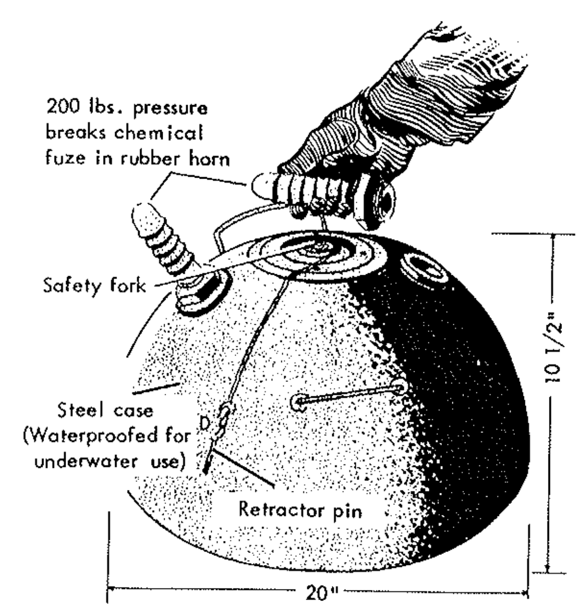
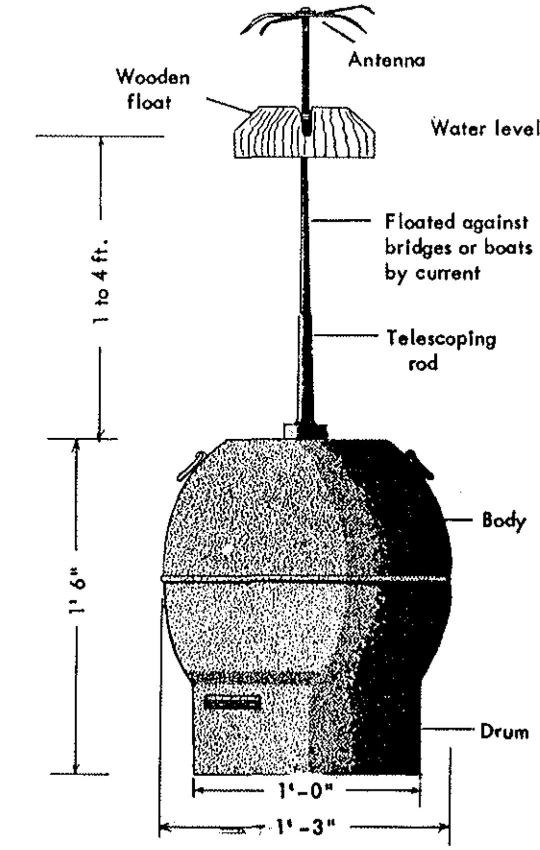


Figure 34.



ANTIVEHICULAR AND ANTIAMPHIBIOUS MINE

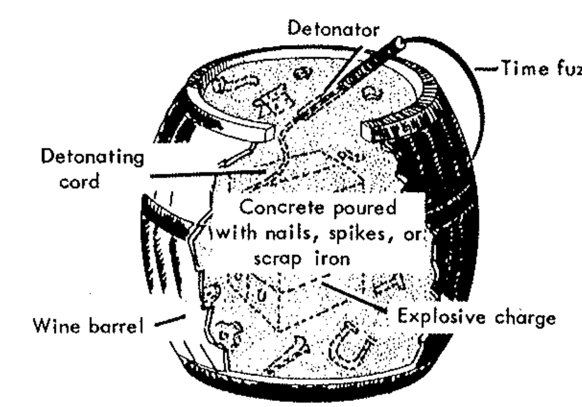
Figure 35.



DRIFTING MINE

Figure 36.

3. Antiamphibious mines (fig. 35) are used principally to hinder the landing of an enemy force by destroying landing craft and disabling landing vehicles. They are placed on the beach or in shallow water. They vary greatly in size and explosive content. The normal charge for this type of mine is from 20 to 70 pounds.



IMPROVISED MINE

Figure 37.

4. Drifting contact mines (fig. 36) are employed to destroy enemy floating bridges and fixed bridge piers. They vary in size and explosive content, the normal charge being from 25 to 100 pounds.

5. Improvised mines (fig. 37) are used when issue mines are unsuitable or unavailable for a particular mission. They may contain any of the standard explosives and can be set off by standard or improvised fuzes.

6. Dummy mines, frequently used in place of real mines because they are cheaper and easier to install, can be made of any material. They can be used in

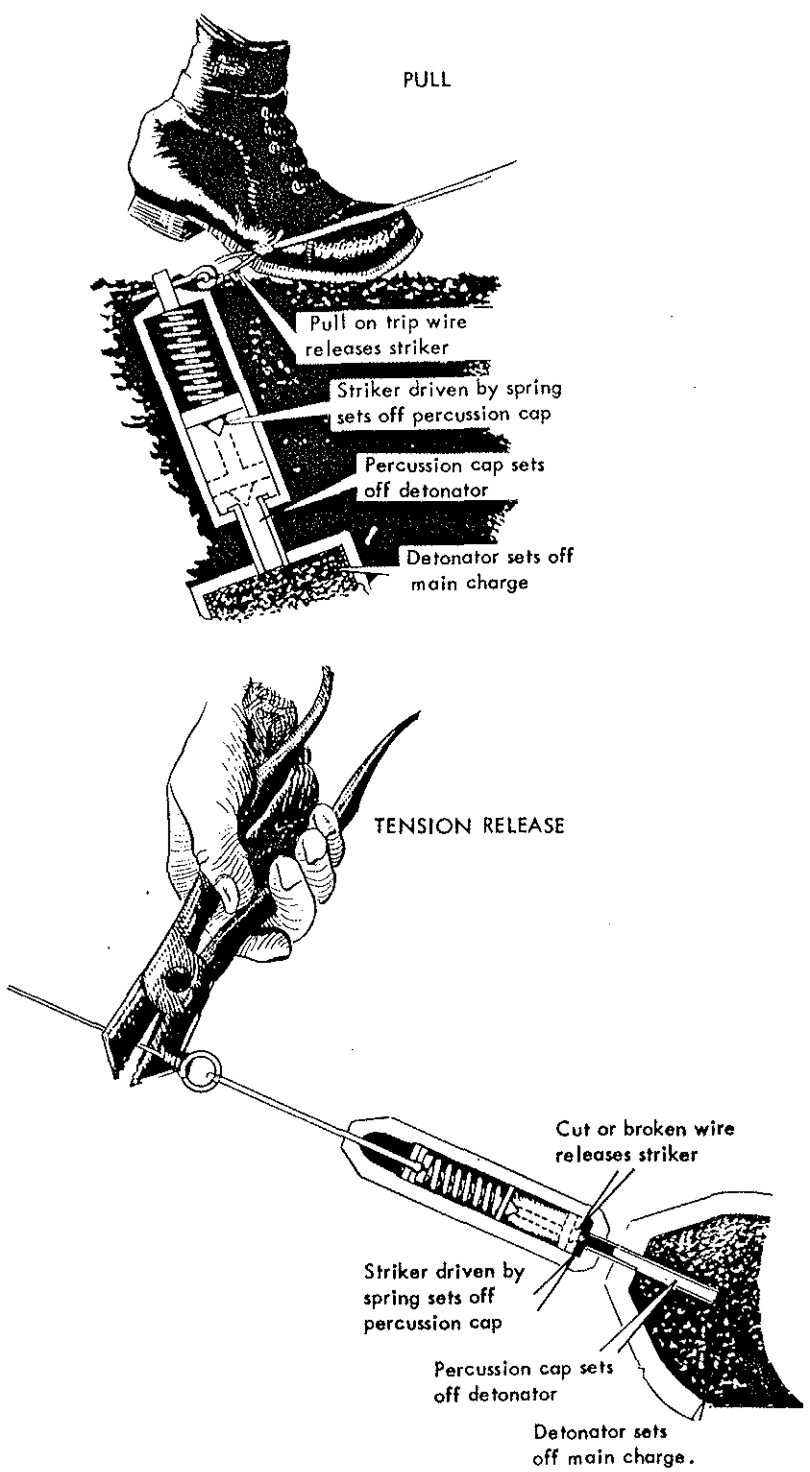


Figure 38.

dummy minefields or to supplement real mines in a live minefield. These mines often contribute materially to delay and confusion of the enemy when properly used.

Mine Components

The five main component parts of a mine are: (1) fuze; (2) detonator; (3) booster charge; (4) main charge; and (5) case.

1. The fuze is the device which initiates the explosive action, either instantaneously or after a set period of delay. The fuze is actuated by personnel, boats, or vehicles by one or a combination of the following: pressure pull, tension release, or pressure release (fig. 38). Fuzes are usually designed for use with a particular mine, for use under special conditions, or for special purposes (i.e., booby traps) (fig. 38). The fuze is usually kept separate from the mine until the mine is to be used. There are four basic types of fuzes.

a. Percussion. A striker fires a percussion cap (figs. 39, 40, and 41).

b. Friction. Friction ignites substances within the fuze (figs. 39 and 42).

c. Chemical. Chemical action, usually accomplished by the breaking of a vial allowing a chemical to come in contact with another chemical or with air, results in flame or explosion (fig. 39).

d. Electrical. The closing of an electric circuit fires an electric cap. The current may be provided either by a battery or by chemical reaction within the fuze (figs. 39 and 42).

2. The detonator (fig. 43) is an explosive of such high sensitivity as to be easily set off by action of the fuze. The detonator's function is to set off the booster charge or the main charge of the mine. The detonator may be an integral part of the fuze, an integral part of the mine, or separate from both.

3. The booster charge, not present in all mines, is an intermediate charge to insure detonation of the main charge. The booster explosive is less sensitive but more powerful than that of the detonator.

4. The main charge is a relatively insensitive explosive set off by the booster or detonator. The main charge provides the striking power of the mine.

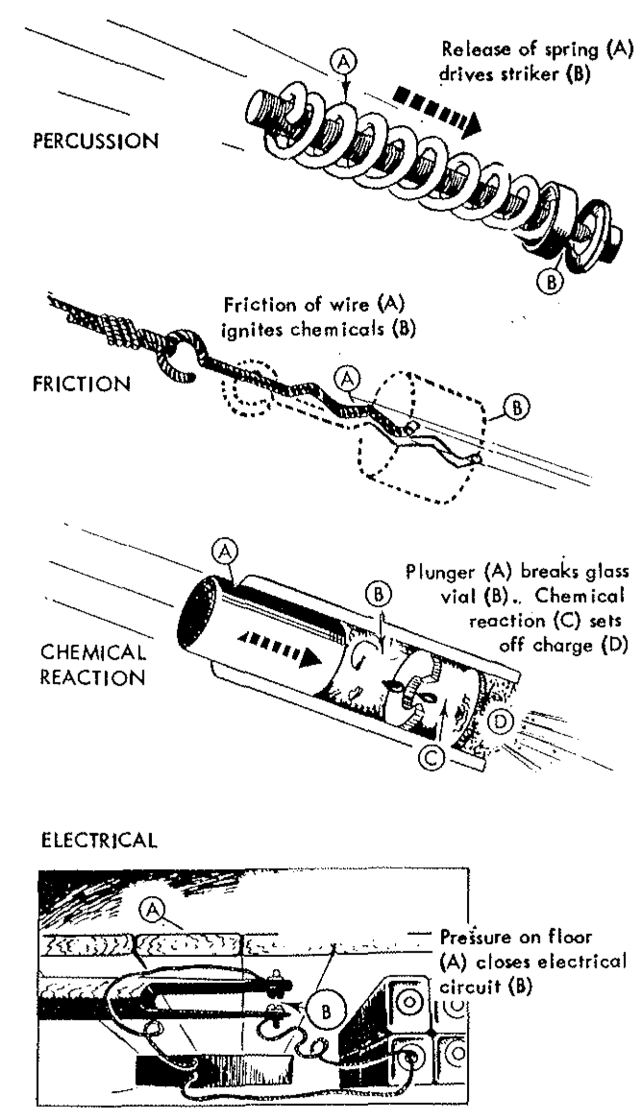


Figure 39.

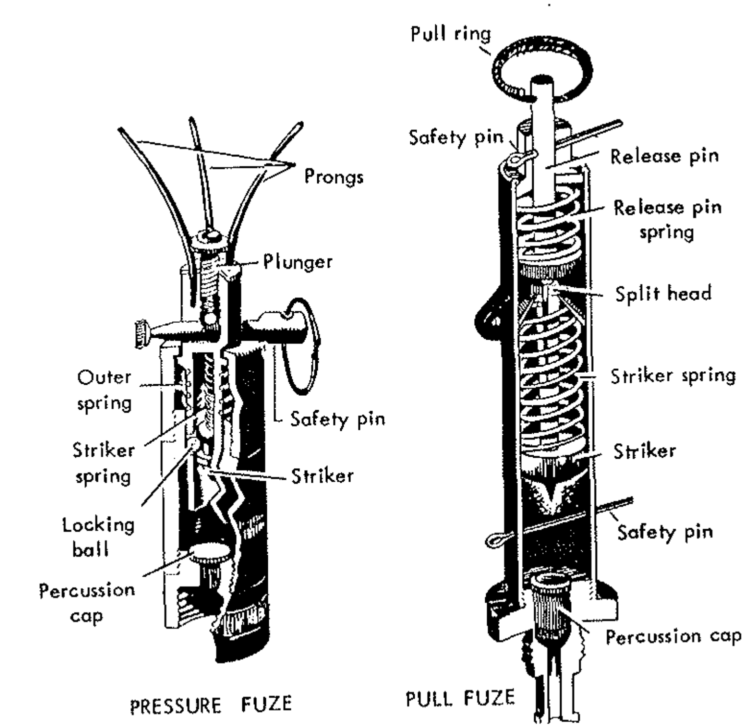


Figure 40.

... The case, which may be made of almost any substance or combination of substances, is the container for the charges and provides wells for the fuze or fuzes.

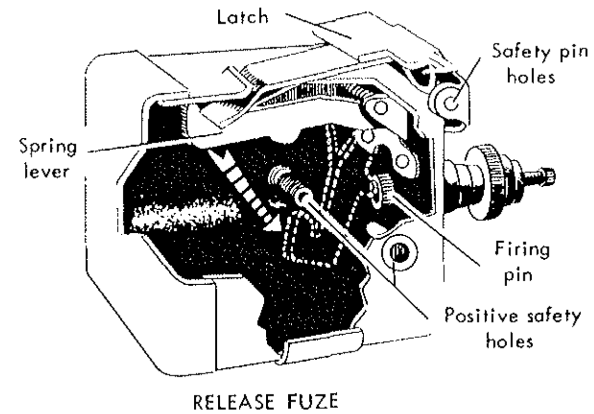


Figure 41.

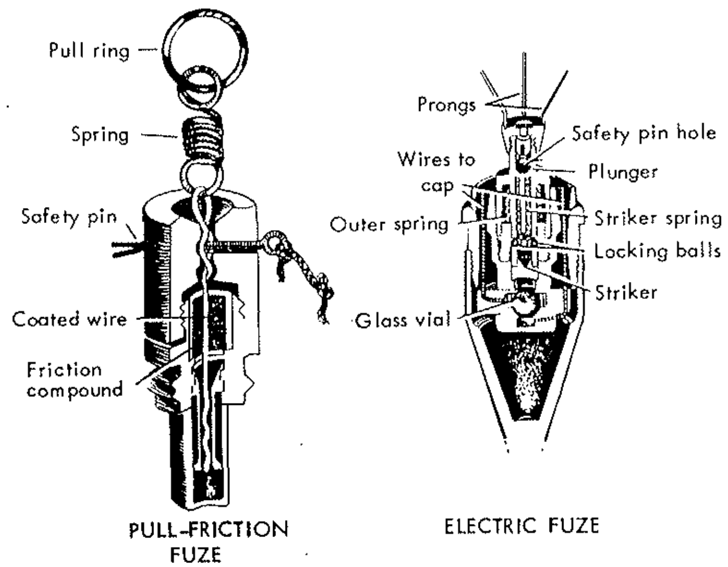


Figure 42.

Elements of Information

In collecting intelligence information, the following check list regarding mines and fuzes will be helpful.

1. Of what type is the mine? (Purpose and use for which designed.)
2. What are the official nomenclature and popular name?
3. What are the identifying marks and colors?
4. What are the shape, dimensions, and weight of the assembled mine?
5. What are the component parts of the mine (figs. 32, 33, and 34)?
6. What are the weight, material, and construction of the case? If an antipersonnel mine, what are the type, number, size, and total weight of pellets or fragments? Is the case equipped with carrying handles?
7. What are the name, composition, and weight of the main charge? What substitute explosives, if any, are used?
8. Is there a booster charge? Where is it located? What are the name, composition, and weight of the booster charge (fig. 32)?
9. What are the shape, size, material, and total weight of the detonator? What are the name, composition, and weight of the explosive in the detonator? Is the detonator an integral part of the mine, a part of the fuze, or separate (fig. 43)?
10. What fuzes are, or can be, used with the mine?
   a. How is the fuze actuated (by pressure, pull, tension-release, pressure-release, or combination thereof)? What force is required to activate the fuze?
   b. What type is the fuze (percussion, friction, chemical, electrical, or a combination of these)?
   c. Is the fuze instantaneous or delay? What is the time of delay?
   d. What are the official nomenclature and popular name?
   e. What are the identifying marks and colors?
   f. With what other mines can this fuze be used? Is it readily adaptable for other use, primarily for booby traps?
   g. What are the shape, dimensions, and weight of the assembled fuze?
   h. What are the name, construction, and material of the component parts (figs. 40, 41, and 42)? What is the sequence of operation? What are the safety devices?
   i. What are the steps in arming and disarming?
   j. What are the effects of moisture, temperature, shock, and passage of time on the operation and reuse of the fuze?
   k. How are the fuzes packed and transported?
11. For the mine, what devices are used for transmitting the force required for detonation (spider, pressure board, extension rod, etc.)?
12. What force is required for detonation?
13. Are there provisions for booby trapping, such as bottom or side wells or hooks? Where are they located and what fuzes are used (figs. 32 and 44)?
14. How effective is the mine against vehicles, boats, structures, or personnel? What is the effective bursting radius? At what height does a jumping-type mine (fig. 34) detonate?
15. What steps, techniques, and precautions are necessary in installing, arming, neutralizing, and removing the mine?
16. Can the mine be laid from the air?
17. What are the effects of moisture, temperature, shock, and passage of time on the operation and reuse of the mine?
18. How are the mines and their component parts packed and transported? Are the fuze, detonator, and mine packaged, or carried together or separately?
19. What is the military issue classification? Is it standard, substitute standard, limited standard (obsolescent), or limited procurement (experimental)?

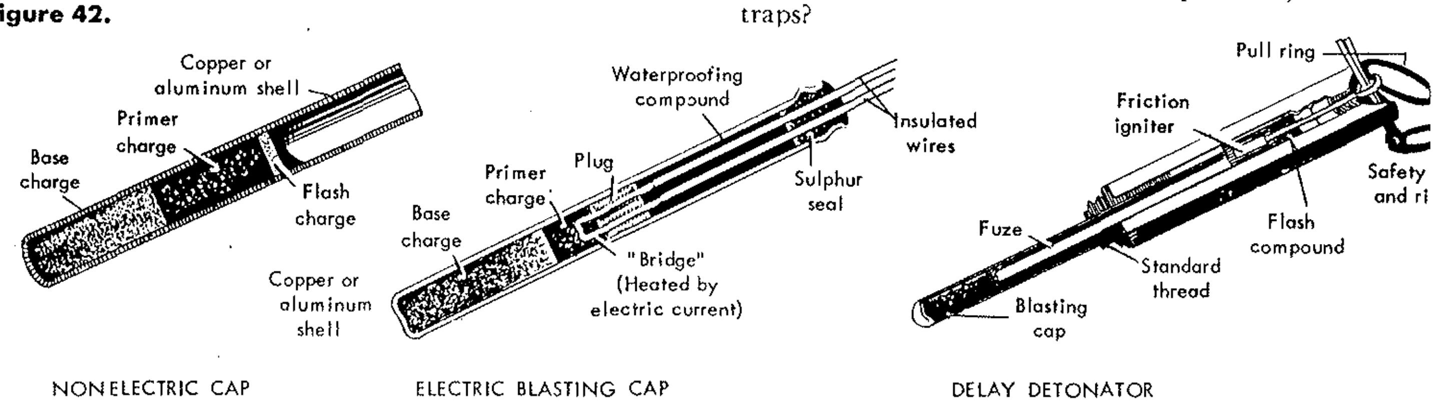


Figure 43.

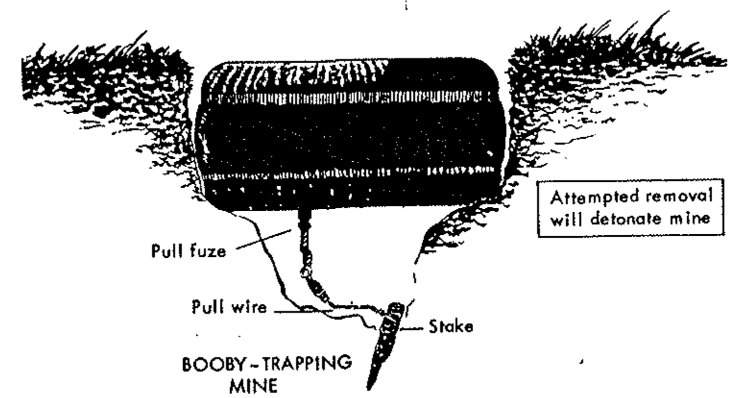


Figure 44.

BOOBY TRAPS

A booby trap is a hidden charge so placed that it is detonated when an apparently harmless object is disturbed. Although often employed in minefields, booby traps are not classed as mines. The booby trap is used primarily to destroy the morale of enemy personnel

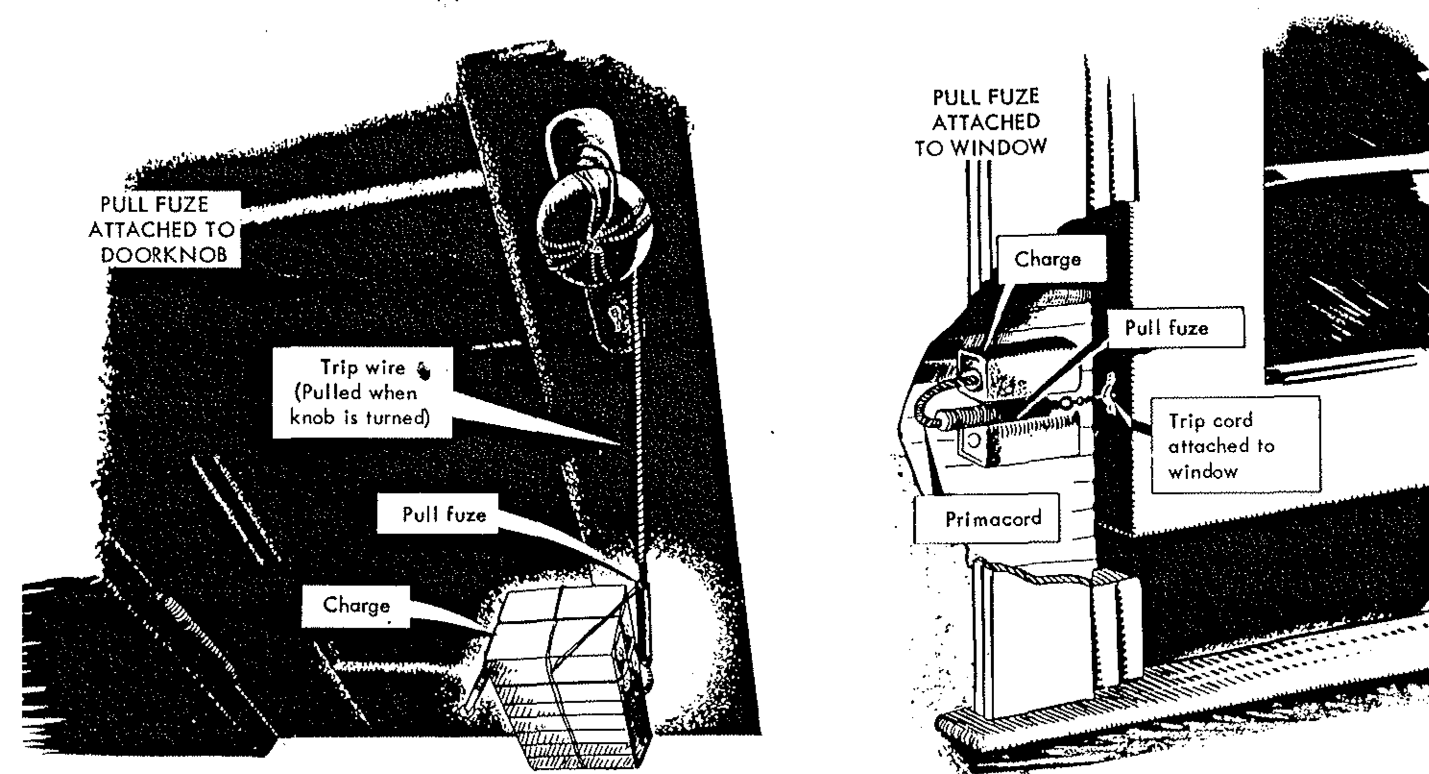


Figure 45.

and to inflict casualties. It may be encountered under almost any circumstances and in almost any form (figs. 44, 45, and 46).

General Description

Booby traps are usually improvised from materials at hand, their form and initiating action being limited only by the materials available and the ingenuity of the makers. A few manufactured booby traps were encountered during World War II, and their large-scale use in the future is possible. Such booby traps might take the form of cigarettes, flashlights (fig. 47), candy bars, billfolds, pipes (fig. 47), articles of clothing, or similar objects.

Any fuze can activate a booby trap. A number of small and very versatile fuzes were developed during World War II, especially for booby trapping work.

Elements of Information

In collecting intelligence information, the following check-list regarding booby traps will be helpful.

1. For fuzes and charges, use the elements of information check-list for the foregoing mines and demolitions. Type of initiating action, details of construction, and methods of installation should be emphasized.
2. What training are troops receiving in the use of booby traps?
3. What are the tactics and techniques for using booby traps?

DEMOLITIONS

Explosive demolitions have always been used to destroy structures, but it was not until the German and Soviet retrograde movements in World War II that there was a wholesale use of demolitions to destroy anything of potential use to an advancing army. Continuous research is striving to develop more dense and more powerful explosives, which greatly enhanced their power, and in the development of the shaped charge (fig. 48) which concentrates the explosive energy in one direction. The effect of the shaping was to give greater

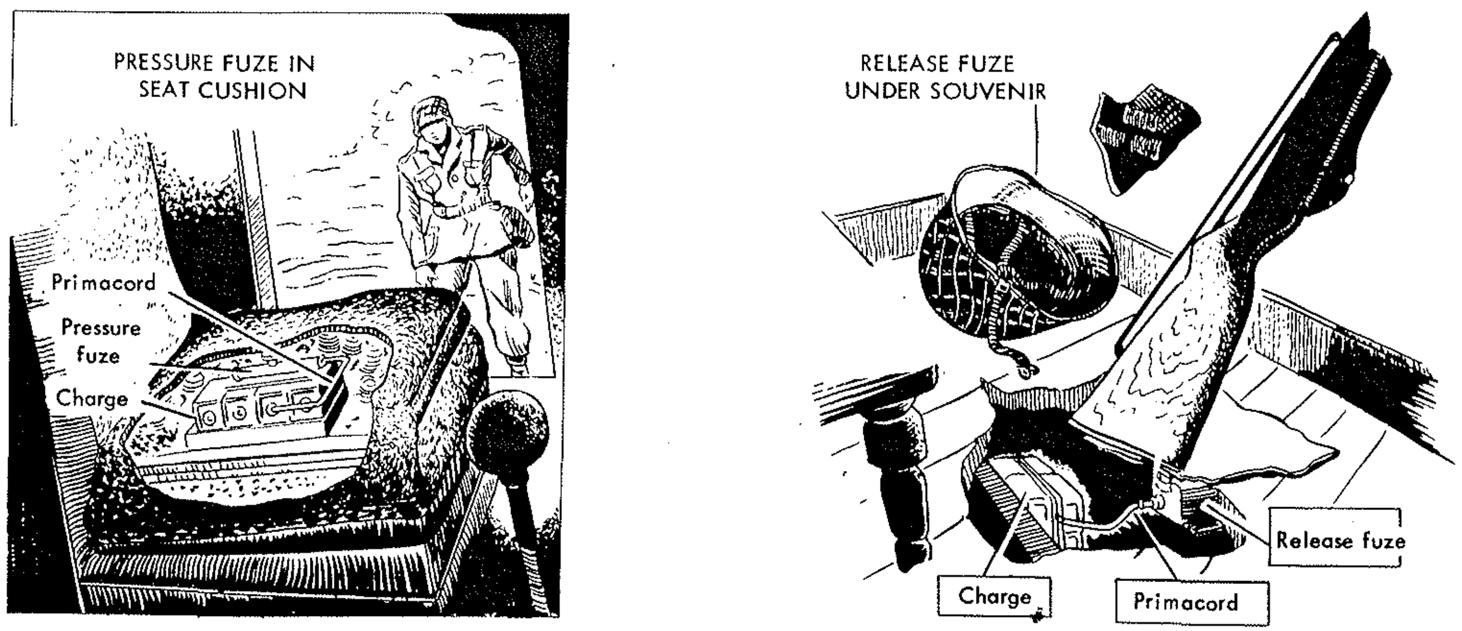


Figure 46.

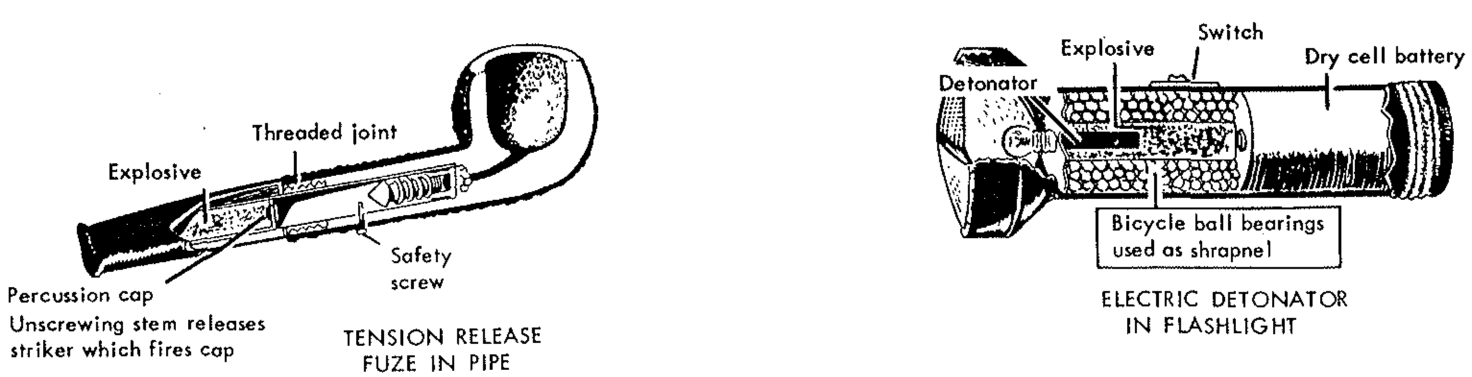


Figure 47.

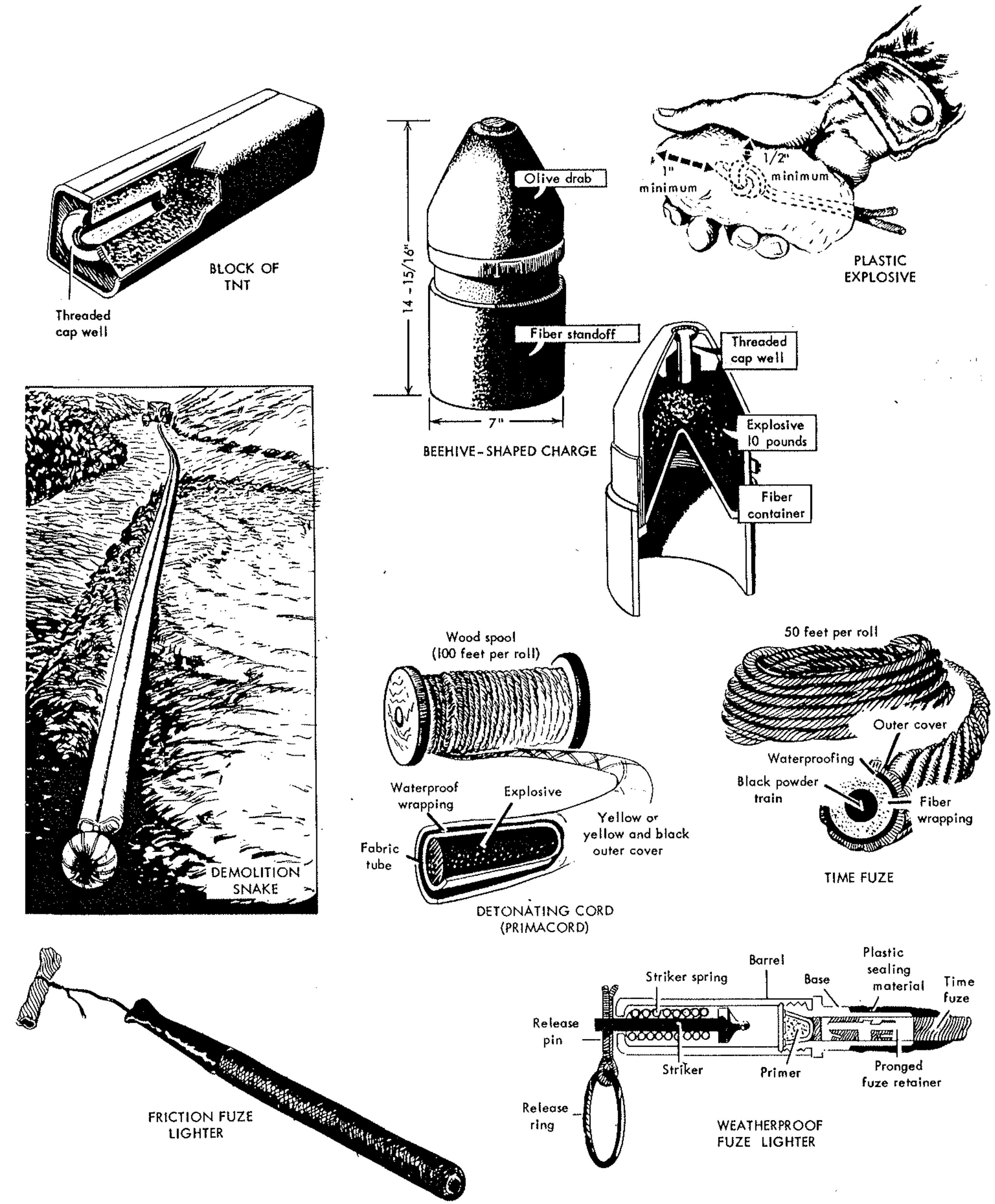


Figure 48.

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than was otherwise possible and also to blast boreholes in steel, concrete, or similar materials. There is an increasing trend toward the use of plastic explosives for demolitions, owing primarily to the ease of molding the explosive to the surface of the element to be destroyed (fig. 48).

Explosives

An explosive is a substance (liquid, plastic, or solid) which, through chemical reaction, violently changes into a gas, creating pressure and heat. This rate of change into a gas is called "velocity of detonation" and is measured in feet per second. The velocity of detonation of TNT, for example, is 21,000 feet per second. Explosives are generally classified as high explosive or low explosive. There is no exact dividing line between the two classes. However, as a general guide, an explosive with a velocity of detonation of less than 15,000 feet per second is considered a low explosive.

To expedite and improve military demolitions, explosives have been cast into many shapes or placed in prefabricated containers (shaped or hollow charges, demolition snakes, Bangalore torpedoes, etc.) (fig. 48).

Blasting Accessories

To use the various explosives effectively and safely, numerous accessories have been devised. The more familiar blasting accessories are detonating cords, time or safety fuzes, fuze lighters, and blasting machines for detonating electrical caps. It is important that the distinction between detonating cord and safety fuze be carefully noted. The detonating cord explodes, whereas the safety fuze burns. Usually the two have distinctive outer color and texture for ready identification by sight or by feel (for night use). The accessories are usually assembled into sets for issue to troops having responsibility for demolition work.

Elements of Information

In collecting intelligence information, the following checklist regarding demolitions (explosives and accessories) will be of value.

1. *Explosives.*

a. What are the official nomenclature and trade name, or other name, by which the explosive is known?

b. What is the classification (high or low)? What is the velocity of detonation (number of feet per second)?

c. What are its principal uses?

d. What is the chemical composition of the explosive?

e. What are the nature (liquid, plastic, crystalline, or cast), density, and color of the explosive?

f. What are the weight, shape, dimensions, color, and markings of the packaged unit? Does it have threaded or unthreaded wells for insertion of blasting caps? What are the dimensions of the wells (fig. 48)?

g. What type of blasting cap is used?

h. What is the stability under varying conditions of temperature, moisture, and time?

i. What is the relative sensitivity to shock and friction?

j. How is it packaged for shipment? What special handling is required?

2. *Prepared Demolition Charges* (fig. 48).

a. What is the official nomenclature?

b. For what special or general purpose has the charge been designed?

c. What are the name, weight, and chemical composition of the explosive used?

d. What are the shape, size, weight, color, and markings of the container, and of what material is it constructed?

e. What type of fuze well is provided? Is it threaded or unthreaded?

f. What type of fuze is used for detonation?

g. What are the techniques of application of the prepared charge?

h. How effective is the charge as applied to the demolition of specific objects?

i. How is it packed and transported?

3. *Blasting Accessories.*

a. Blasting caps and detonators. Electric or non-electric (fig. 43)? Instantaneous or delay (fig. 43)? What is the time of delay? What explosive does it contain? What explosive can it be used with? What type of cap crimper is provided for crimping non-electric caps?

b. Adapters. What type of priming adapters are used to simplify the priming of packaged explosives having threaded cap wells?

c. Detonating cords (fig. 48). What is the official designation? What explosive is used in the core? What are the material, color, and texture of the covering? What is the velocity? What is the length of the normal unit of issue? What is the stability under varying conditions?

d. Detonating cord clips. What methods or devices are used for attaching two strands of detonating cord together?

e. Time or safety fuzes (fig. 48). What is the official designation? At what rate per foot does it burn? What powder is used in the cord? What are the material, color, and texture of the covering? What is the length of the issue unit? What is the stability under varying conditions?

f. Cap sealing compounds. What types of compounds are used to moisture-proof the connection between a non-electric cap and a time fuze?

g. Fuze lighters (fig. 48). What types of fuze lighters are used to facilitate the lighting of the time fuze? What is their dependability under all weather conditions? What are the component parts of the lighter?

h. Firing reels and wire. What are the dimensions, material, and weight of the reel used for dispensing the firing wire? What length of wire is furnished, and what is its thickness?

i. Galvanometers. What are the size and weight? What is the maximum length of circuit that can be tested?

j. Blasting machine or exploder. What is the official nomenclature? What are the size and weight? What number and type of caps over various lengths of circuit will it fire?

k. Kits. Are demolition materials issued in kits? If so, what are the component parts of the kit? What are the shape, dimensions, weight (complete), color, and markings of the case?

CHAPTER

Ammunition

INTRODUCTION

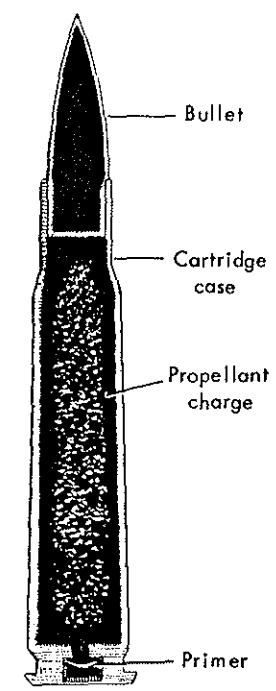
Intelligence on foreign ammunition is valuable for both tactical and technical reasons. The battlefield commander who knows what ammunition, and consequently what artillery, is being used against him is at an obvious advantage. To develop the most effective United States weapons, the designers must have details and the effect of other nations' ammunition on personnel and its performance against armor.

For the field commander, knowledge that guns opposing him are issued with anti-concrete rounds will help him decide whether the protection afforded by the adjacent bunker is adequate or not. Possession of proximity fuzes by the enemy will render the occupation of slit trenches rather hazardous. Employment of tungsten, carbide-cored, high-velocity ammunition will increase materially the penetration performance of an antitank gun, while even the low-muzzle-velocity howitzer, with shaped-charge or other special ammunition, is capable of defeating the most heavily armored tank. The enemy is less capable of inflicting an unpleasant surprise if one knows in advance that he may use canister, illuminating, shrapnel, smoke, or chemical rounds. Another field aspect is that of ammunition fragment identification, a most valuable pointer for counterbattery work.

Among the most useful ammunition intelligence is that concerning interchangeability. This means knowing which enemy ammunition can be fired from Allied guns and which Allied ammunition can be fired from enemy weapons. During World War II the scope of this interchangeability was surprisingly great. It is particularly useful when airborne and irregular forces are employed and supply lines are precarious.

Although it cannot be recommended except in emergency, the use of enemy ammunition during World War II on many occasions saved the day. A considerable quantity of enemy mortar ammunition was used by the 101st and 82d U. S. Airborne Divisions in their various operations. In the autumn of 1944 an acute ammunition shortage existed on many fronts in the European Theater. During one 2-week period, 85 per cent of the ammunition expenditure of the U. S. XX Corps came from captured stocks. When this is expressed in tonnage and shipping requirements, its importance is obvious.

Ammunition (excluding rockets) falls into three main categories (figs. 49 through 63): (1) small-arms ammunition; (2) mortar ammunition; and (3) artillery ammunition.



SMALL - ARM ROUND

Figure 49.

SMALL-ARMS AMMUNITION

Small-arms ammunition consists of four major component parts: the bullet, the cartridge case, the propellent charge, and the primer. These are shown in figure 49.

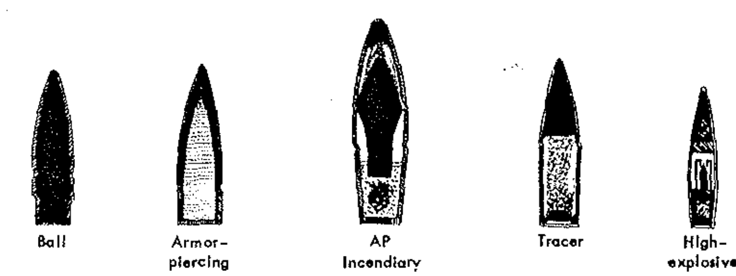
Bullets, which are of numerous types and combinations and may or may not include a tracer element, are usually fixed to the cartridge case by one of five common methods. Bullet attachment methods and five common types of bullets are shown in figures 50 and 51.

Cartridge cases may be of brass, steel, or light alloy, and the cartridge case usually has one of the shapes shown in figure 52. The walls may be either tapered, parallel, or necked, as shown in figure 53.

Propellants are usually formed with one of eight common shapes, as shown in figure 54.

METHODS OF ATTACHING BULLETS TO CARTRIDGE CASES

Figure 50.



COMMON SMALL - ARM BULLET TYPES

Figure 51.

Primers are generally one of two classes: rim-fire or center-fire. Center-fire primers are divided into two types: (1) the "Boxer" type, the anvil of which is a component of the primer assembly; and (2) the "Berdan" type, the anvil of which is an integral part of the cartridge case. Examples of these are shown in figure 55.

Following is a checklist of the main details required on small-arms ammunition.

1. *Complete Round* (fig. 49).

a. What is the nomenclature of the complete round, and from what weapon or weapons is it fired? What is its basis of issue? What mission is it designed to perform?

b. What is its overall length?

c. What is its weight?

d. What are the method and type of joint waterproofing employed?

e. What is the muzzle velocity of the round and, if it is armor-piercing, what is its performance?

f. What markings are present, and what do they signify?

2. *Bullet* (figs. 50 and 51).

a. What type is the bullet, and what is its weight?

b. What are the component parts of the bullet?

c. What is its overall length, and what is the bullet length protruding from the cartridge case?

3. *Cartridge Case* (figs. 52 and 53).

a. Of what type is the case, and of what material is it constructed?

b. What are its dimensions: length, neck diameter, and base diameter?

c. What method is used to fix the bullet to the case (fig. 50)?

d. What are the markings and their meanings?

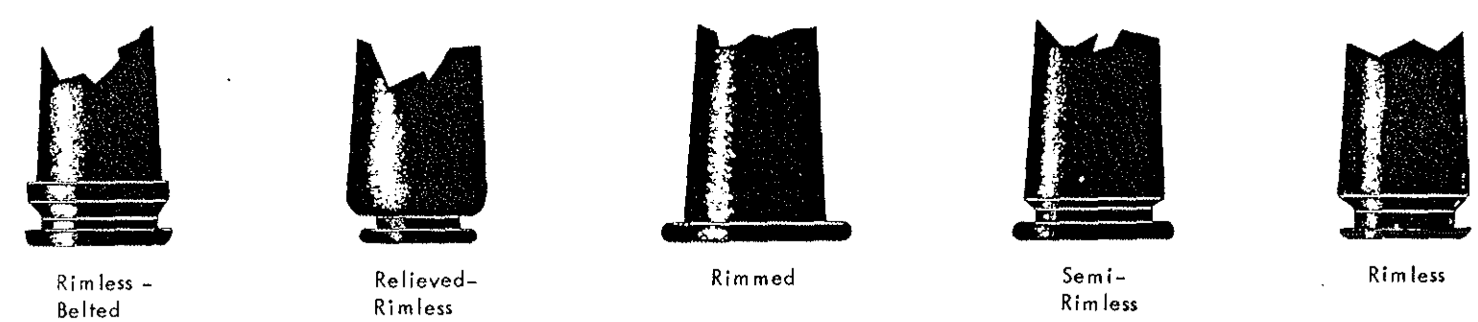
4. *Propellent Charge* (fig. 54).

a. What are the weight and type of propellant?

b. What is its chemical composition?

5. *Primer* (fig. 55).

a. What type of primer is used and what is the method of fixing it to the cartridge case?



CARTRIDGE CASE BASES

Figure 52.

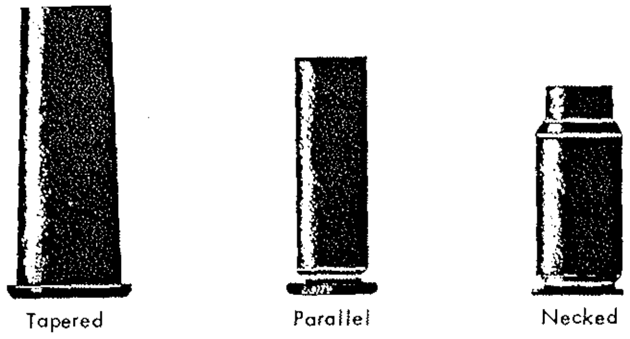


Figure 53.

b. What is the chemical composition of the primer material?

6. *Packing.*

a. What are the size and composition of the container?

b. What are the container markings, and what do they mean? (Do labels or stencil markings restrict the use of the ammunition in any way? Is a class or grade indicated by the markings)?

c. What are the weights of empty and full container?

d. What are the total contents of the container and the method of packing (applicable to small-arms rounds, which are usually in belts, cartons, magazines, clips, or bandoliers)? What is the manufacturing firm, and where is the plant located?

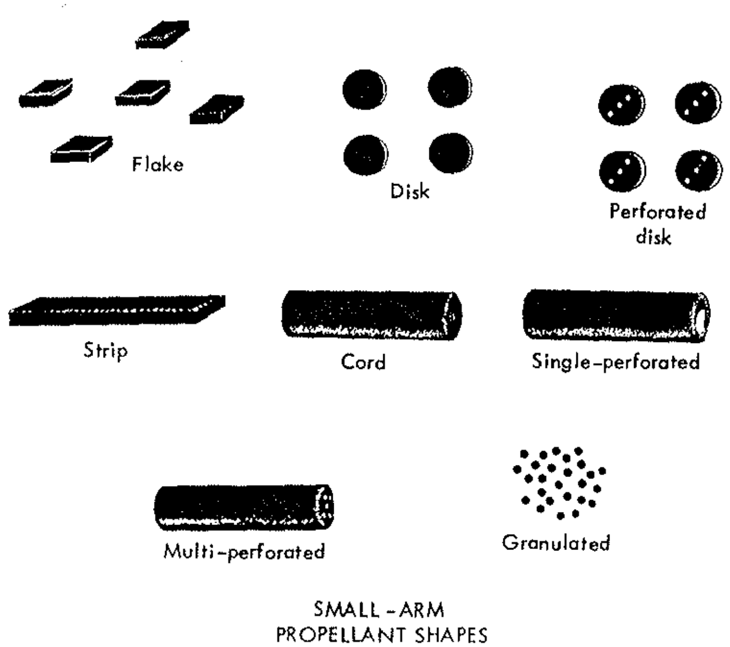


Figure 54.

... ammunition usually consists of three ma component parts, as shown in figure 56. These are: the fuze; (2) the body and tail fin assembly; and the propellent charge. The propellent charge consi of the ignition cartridge and possibly one or more i crement charges.

The ignition cartridge (fig. 56) is inserted into t tail of the shell, which is loaded into the mortar, t first, from the muzzle. The striker at the base of t mortar tube meets the primer in the base of the igniti cartridge. Flash from the ignition cartridge pass through holes in the tail to ignite the increment charg which are attached to the tail fins to give addition range.

The placing of a special small charge at the head of shell, so that on impact it is thrown up into the air ar there explodes, is a device which has often been tried though with unsatisfactory results—with the obje of obtaining an airburst. The use of proximity fuzes obtain the same result is a possibility for the future.

Following is a checklist of the main details requir on mortar ammunition.

1. *Fuze.*

Some foreign mortar fuzes are interchangeable wi those used for artillery ammunition, and all are at lea similar to certain artillery fuzes. Details required o mortar fuzes are, therefore, covered in the discussion artillery fuzes below.

2. *Shell Body* (fig. 56).

The body may be streamlined or cylindrical in shap and has an important tolerance known as "windage, i.e., the clearance between the shell and the morta tube.

a. What is the nomenclature (including caliber) o the round and what is its type (high-explosive, smoke illuminating, etc.)? What is its basis of issue? Wha mission is it designed to perform?

b. From what weapon or weapons is the shell fired Are they smooth bored or rifled?

c. What is the length of the round with and withou fuze?

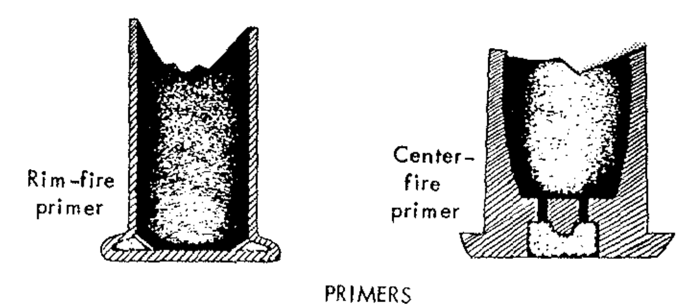


Figure 55.

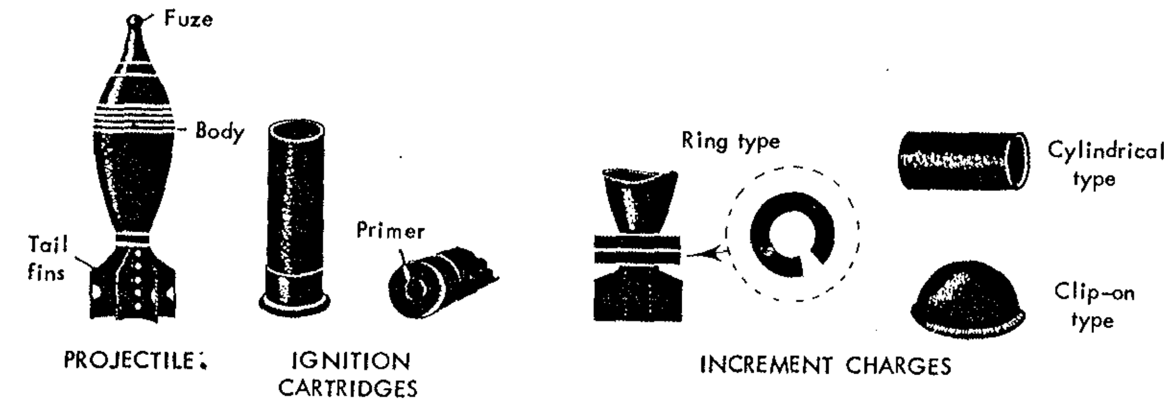


Figure 56.

d. What is the length of the fins, and how many are there?

e. What is the weight of the shell fuzed, and what is the weight of the filling?

f. What is the type of filling?

g. What are the markings or colorings (stamped or stenciled) and what do they signify?

h. What are the packing arrangements? (See discussion of packing under small arms above.)

i. What is the manufacturing firm, and what is the plant location?

3. *Propellent Charge* (fig. 56).

This usually consists of an ignition cartridge and increment charges. The range may be varied by increasing or decreasing the number of increment charges. These charges are usually one of two shapes—cylindrical or in the form of a ring.

a. What type of ignition cartridge is used, and what is the weight of its charge?

b. What types of increment charges are used, and what is the maximum number that can be used?

c. What type of propellant is used in both ignition cartridge and increments, and what is its shape?

d. What are the weight and shape of the increments?

e. What is the method of assembly of the increments for various charges?

f. What are the markings, and what do they mean?

ARTILLERY AMMUNITION

Artillery ammunition usually consists of five major component parts: (1) the fuze; (2) the projectile; (3) the cartridge case; (4) the propellent charge; and (5) the primer. A typical complete round is shown in figure 57. These components are assembled into three basic types of ammunition: fixed, semi-fixed, and separate-loading. (Drawings of these will be found in fig. 58.)

Following are descriptions and checklists of the main details required on artillery ammunition:

1. *Fuze* (figs. 59 and 60).

Fuzes are devices used with projectiles to cause them to explode at the time and under the circumstances desired. They generally contain some of the most sensitive explosives. Unauthorized personnel should never attempt to disassemble these devices and investigate their internal mechanism, as such action is extremely hazardous. However, a considerable amount of technical data may be obtained from an analysis of visible fuze characteristics.

Artillery fuzes are of two basic types, according to

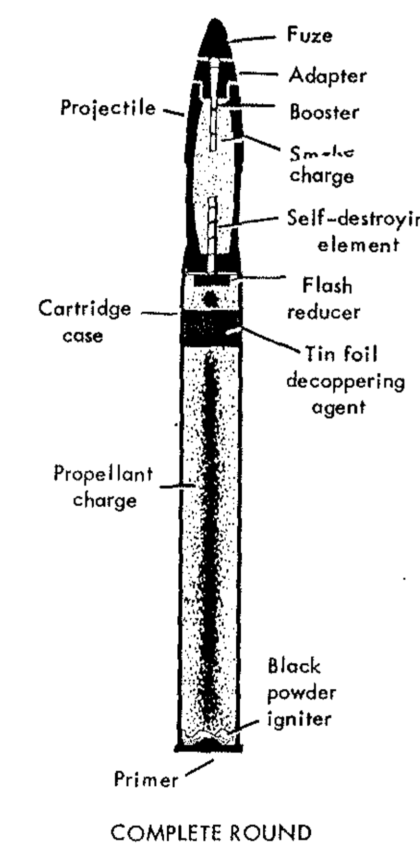


Figure 57.

may also be classified according to their system of operation as: (1) impact; (2) time; or (3) proximity.

Impact fuzes are set off by impact against a target, either with or without a time delay. Time fuzes function after a predetermined time of flight. Combinations of these types include: superquick and delay, time and superquick (powder-train time with a superquick or point detonating element in the nose), and mechanical time and superquick.

Base fuzes are normally of the impact type and may function as delay or nondelay.

Proximity fuzes are designed to operate either automatically on reaching proximity to a target, or as a result of influence from an external source. They are actuated by radio, radar, electrostatic, acoustic, photoelectric, infrared, or other methods. No fuze setting is

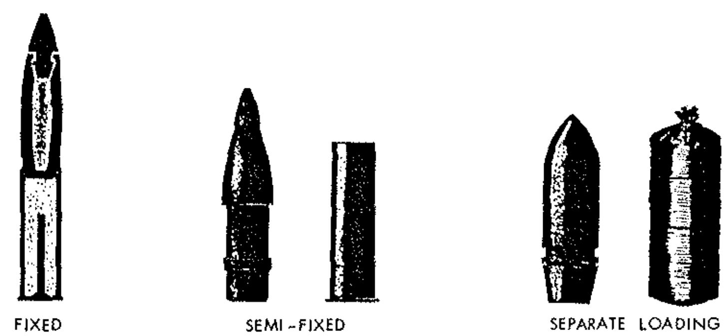


Figure 58.

required. Proximity fuzes are very similar to other types in external appearance.

Fuzes normally incorporate safety devices to prevent their premature operation during handling, firing, or early stages of flight. They are armed (i.e., the safety device is released) by various methods during flight, such as centrifugal force resulting from the spinning of the projectile or "set-back" of fuze components as a result of changes in speed of flight.

Following is a checklist of the information required on fuzes. It is again emphasized that unqualified personnel should never attempt to investigate the working mechanism of any fuze; data should be obtained by other means.

a. What are the nomenclature and markings (stamped or stenciled) on the exterior of the fuze, and what do they signify?

b. What are the type and position (mechanical, time, impact, etc., and point or base location)?

c. What are the external safety devices (cap or pull ring, safety wire, etc.)?

d. What are the overall length and shape?

e. What is the exposed length?

f. What are the depth and diameter of fuze intrusion into the projectile?

g. What is the weight of the fuze?

h. What is the body material: steel, aluminum, magnesium, plastic, etc.?

i. Provide, if possible, sketches and photos (preferably cross-sectional), with dimensions and pertinent information including diameter pitch and contour of threads.

j. In combination types of fuzes, is there a device for selecting which type of functioning is to be obtained and can such a device be changed to another setting at the gun?

k. In time fuzes, what is the number of time rings (if a powder-train fuze), and what are the maximum functioning times? Is the fuze set by means of hand setter or weapon setter? What are the graduation units on the time ring?

l. What are the details of arming and safety devices in terms of revolutions per minute or forces to actuate on set-back?

m. What are the details of operation or setting before and during firing?

n. Are detonator and sensitive explosive train interrupted by use of out-of-line elements until the fuze emerges from the weapon? Does the fuze incorporate a "delay-arming" device, i.e., provided with additional safety devices to prevent functioning on striking obstructions within a given distance of the gun? If so, to what distance, and what types of safety devices are employed? Does the fuze incorporate a "bore-safe" device, i.e., an additional safety device to prevent the fuze functioning within the bore of the weapon? If so, how does the device accomplish this end?

o. Will the fuze function on graze or ricochet impact when its nose does not strike the target? How is this effect obtained?

p. What is the method of fixing the fuze to the shell?

q. What is the composition of all explosive charges?

r. What are the method and type of waterproofing?

s. With which projectiles is the fuze used?

t. Against what types of targets is the fuze used? What is its sensitivity in terms of thinnest target, such as aluminum sheet, that will actuate it at various ranges? What is the ruggedness in terms of thickest targets on which the fuze will function properly? What is the maximum obliquity at which the fuze will function?

u. What are the details of delayed arming, and what is the range at which the fuze is armed by this device?

v. What self-destruction devices are employed, and how do they operate (retardation of spin, tracer action, etc.)?

w. What is the muzzle velocity or the range at which the fuze is armed?

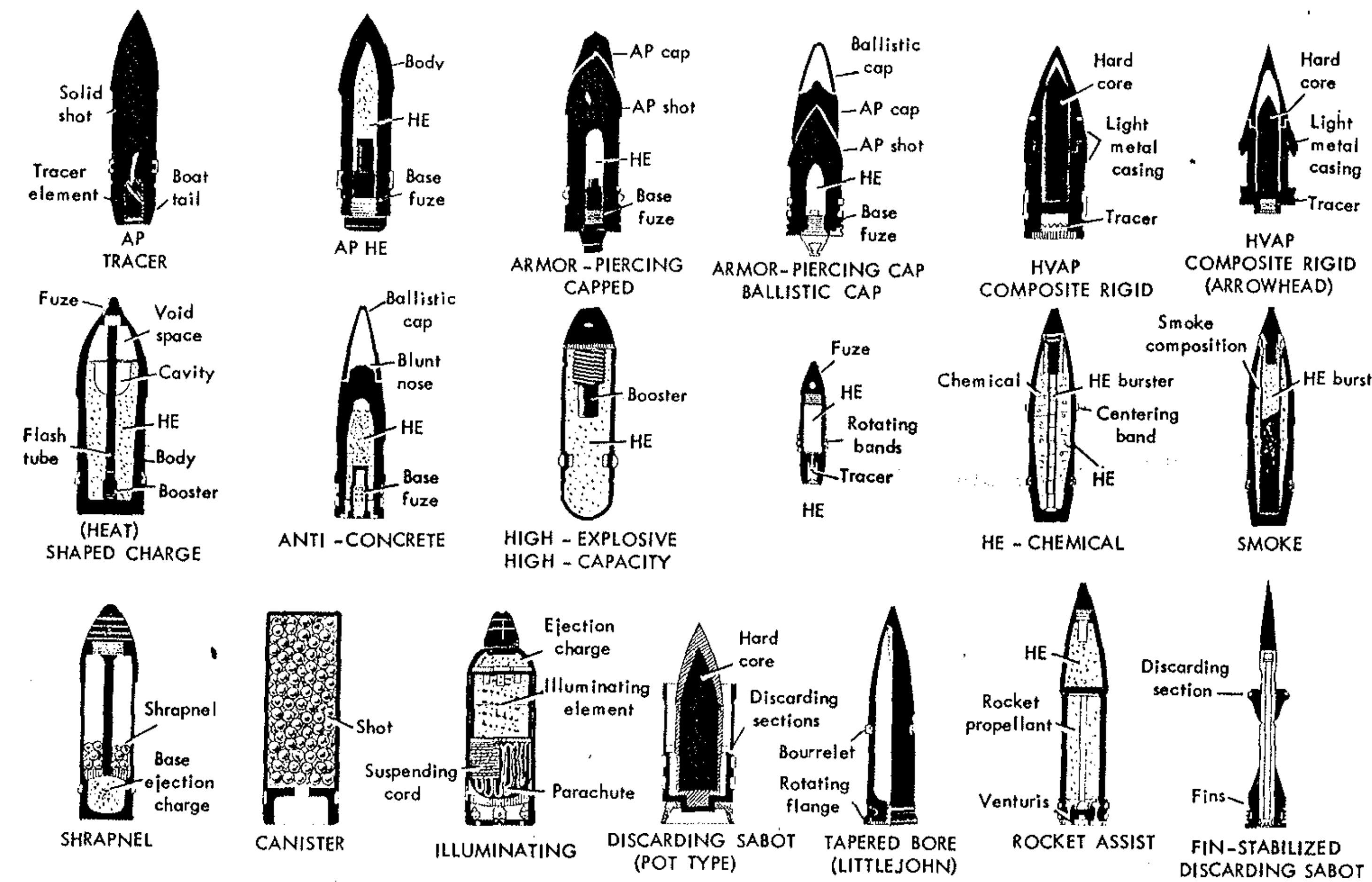


Figure 59.

2. *Projectile* (fig. 59).

Projectiles may be either fin-stabilized or spin-stabilized. In the former case, they make use of tail fins and either do not rotate or rotate comparatively slowly, while those of the latter type have spin imparted to them during their passage through the bore of the gun by means of the gun rifling and a rotating band on the shell, or by pre-engraved spines on the shell. The types of projectiles in common use are shown in figure 59. A drawing, showing a rotating band and also giving examples of the minute dimensions required for projectile identification, is shown in figure 61. Shapes and positions of other types of rotating bands will be found in figure 59.

a. What is the nomenclature of the projectile, and from what gun or guns is it fired?

b. What type of projectile is it (HE, AP, smoke, etc.)? Describe fully and include cross-sectional drawings. What is the maximum muzzle velocity? What is its basis of issue?

c. What is the weight of the projectile (fuzed, unfuzed, filled, or empty)?

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d. What is its length (fuzed or unfuzed)? What are the angle and length of the boat tail (tapered rear portion)?

e. Of what material or combination of materials is the projectile constructed, and what method is used for fixing any ballistic caps to it?

f. What is the radius of ogive (curve of nose portion)?

g. Give details of any fuze adapters and plugs used. Is a fuze cavity liner used? If so, give material and thickness of liner.

h. What is the fuze hole diameter?

i. In the case of AP projectiles, give the hardness pattern of the projectile and cap. What is the method of attachment of cap to projectile?

j. What are the number, width, and material of the rotating and centering bands, and what is the distance from the projectile base to the lower edge of the rotating band (or bands, if more than one)?

k. What is the number of grooves in the rotating band and what are the minute dimensions of the key-

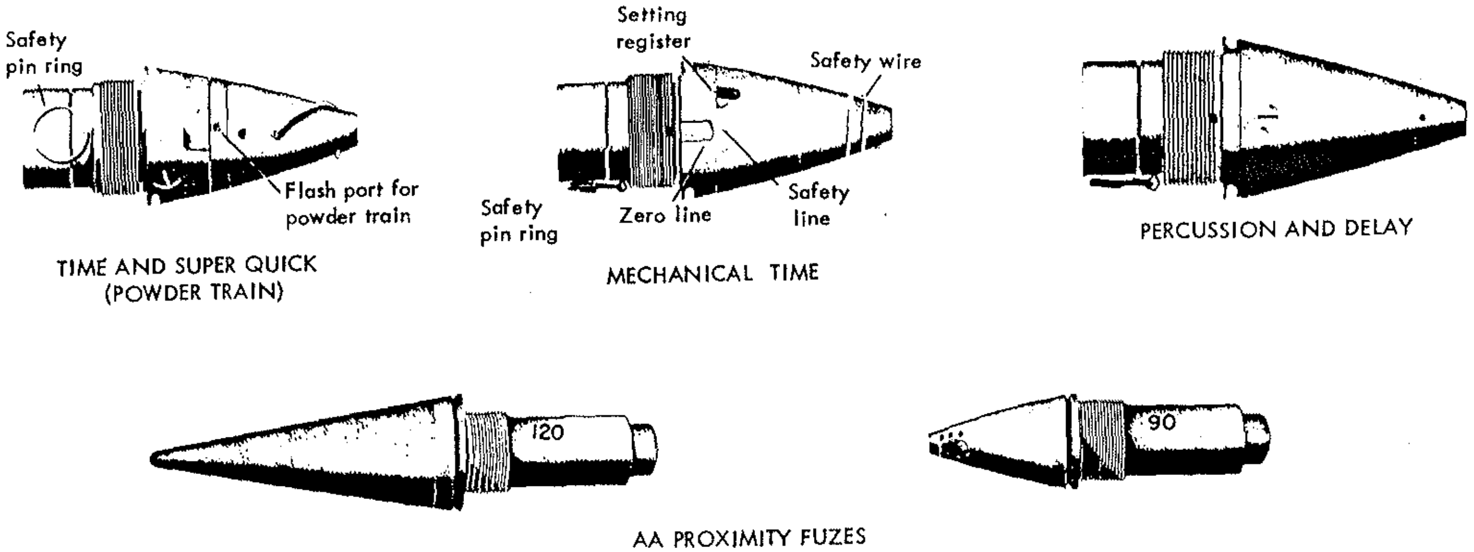


Figure 60.

ing of rotating and centering bands? What are the width and material of the centering band?

l. What is the weight of the projectile filling? If HE, what type of explosive is it?

m. Give details of the explosive train, including booster composition and weight. Is there a smoke charge in the booster? If so, give composition, weight, and color of smoke produced.

n. What are the weight, composition, and duration of burning of the tracer? Does it have bright or dark ignition, i.e., does the tracer "light up" at the muzzle or after a short delay? How long is the delay?

o. What are the markings and colors, and what are their meanings?

3. *Cartridge Case* (fig. 61).

Cartridge cases may be constructed of brass, steel, plated steel, light alloys, plastics, etc., by one of three methods: drawn, wrapped, or composite. Examples of cartridge cases for conventional guns are shown in figure 61.

Recoilless gun cartridge cases are constructed in such a manner as to allow a portion of the propellent gases to escape through the venturi or nozzle to the rear of the gun. Two common designs of this type of cartridge cases are shown in figure 62.

Information required on cartridge cases includes the following:

a. What is the nomenclature, and with what weapons is the cartridge case used? What purpose is it designed to perform? What is its basis of issue?

b. What are its length, volume, base diameter, neck length, neck diameter, rim diameter, and weight empty?

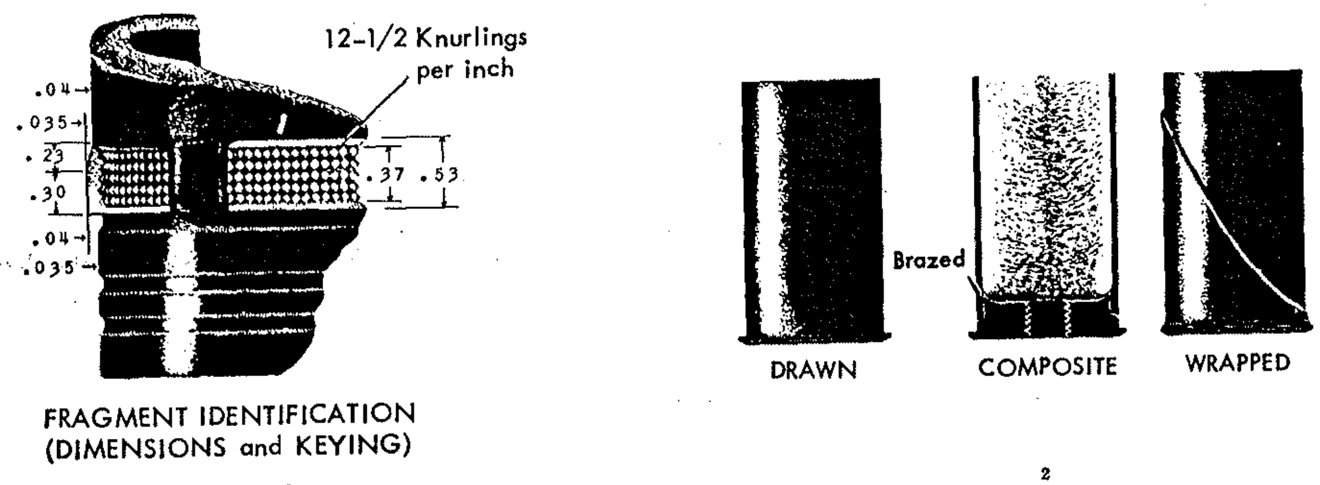


Figure 61.

c. Of what material is the case constructed, and what is the method of fixing the case to the projectile? What type of primer is used, and how is it assembled in the cartridge case (press fit or threaded)?

d. What markings (and colors) are used, and what are their meanings?

4. *Propellent Charge.*

Propellent charges may be loaded loose into the cartridge case, contained in bags within the cartridge case, or loaded in bags for use with separate-loading ammunition. The propellant may be any one of the shapes described under small-arms ammunition propellant (fig. 54). Some semi-fixed ammunition propellent charges are composed of varying types and sizes of increments which, when combined in specified ways, give varying ranges and muzzle velocities.

a. What is the propellant's nomenclature, and of what type is it (gunpowder, nitro-cellulose; cordite, etc.)? What is the official nomenclature of the charge, and with what weapon or weapons is it used?

b. Is the propellant flashless and/or smokeless?

c. What are the total weight, shape, size, and color?

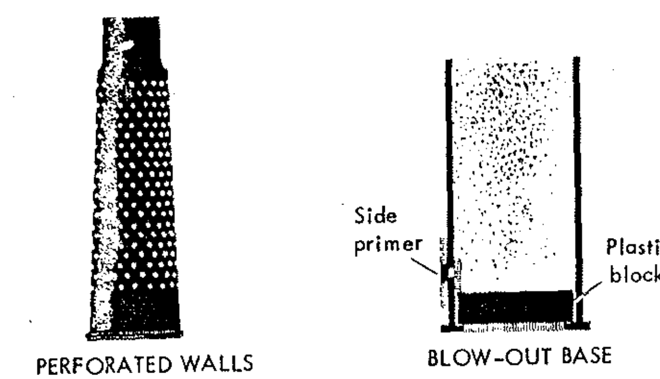


Figure 62.

d. What are the numbers of specified charges and increments?

e. What is the method of assembling increments to form charges, and what is the weight of each increment? What are the weights of the various resulting charges?

f. What decoppering agent is used (if any)? What are its composition, weight, and location?

g. What is the charge bag material (cotton, silk, etc.)?

h. What is the composition of the flash reducer, and what are its weight and location?

i. What is the igniter composition, what are its location and weight?

j. What are the markings on the charge bags, and what are their meanings?

5. *Primers* (fig. 63).

The propellent charge is ignited by a primer, which may be one of three types—percussion, electric, or friction. Drawings of several variations of these types are shown in figure 63. Primers are located in the base of the cartridge cases used in fixed and semi-fixed ammunition, whereas those used with separate-loading ammunition are inserted into the breech mechanism of the weapon. Primers used with fixed and semi-fixed ammunition may be assembled with long perforated tubular igniters which project into the propellant charge to improve its ignition.

a. What is the nomenclature of the primer, and what type is it? With what weapons and ammunition is it used?

b. What are its base diameter, overall length, weight, and body composition (brass, steel, etc.)?

c. What is the method of fixing to the cartridge case or firing mechanism (press fit or threaded)?

d. What are the markings and their meaning?

e. What are the amount and composition of the prim-

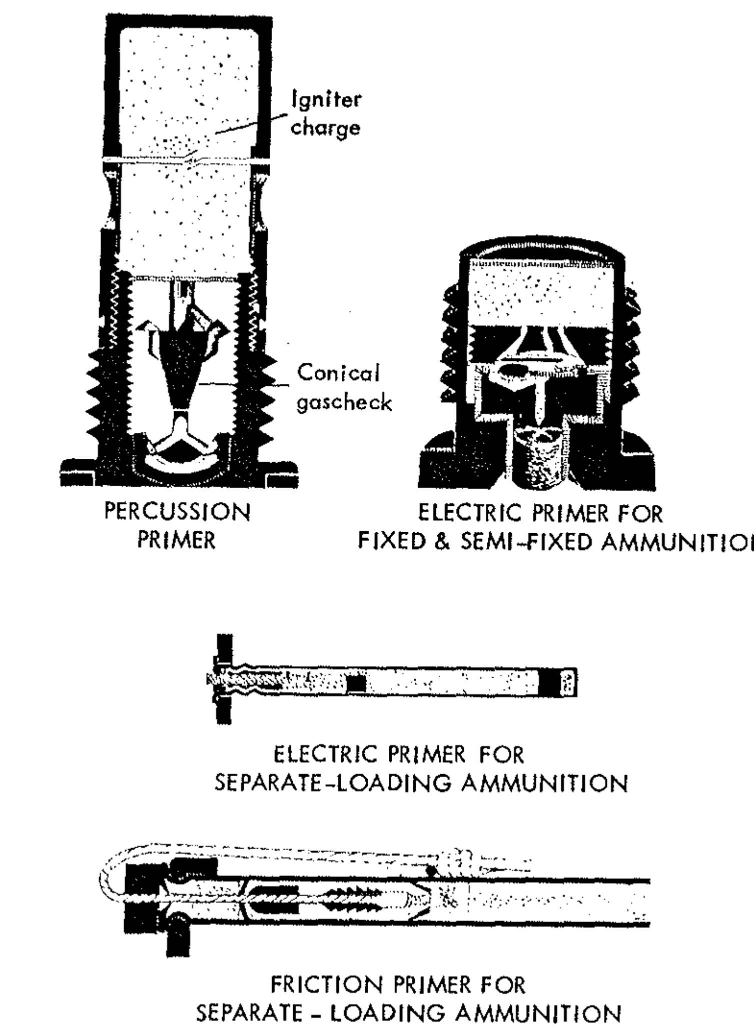


Figure 63.

f. For electric primers, give the firing voltage, energy required, and type of firing circuit used (batteries, condenser, magneto, etc.).

6. *Miscellaneous.*

a. What are the length and weight of the assembled complete round?

b. What are the method and type of joint waterproofing?

c. What is the manufacturing firm, and where is the plant located?

In addition to the data on packing listed in the foregoing discussion of small arms, the following details are required:

a. Type of components carried (fuzes, projectiles, etc.).

b. Number of components.

c. Is the complete round shipped assembled with fuze or with nose plug? If nose plug is used, describe method of sealing fuze cavity.

CHAPTER 7

Artillery Rockets and Rocket Launchers

INTRODUCTION

This chapter is confined to rocket launchers of the field artillery type. These weapons, usually multibarrelled, are often used in place of artillery when it is desired to saturate an area with high explosive or other projectiles. Frequently these weapons are dual-purpose, being capable of launching antiaircraft barrage fire as well as fulfilling ground-to-ground roles. The many advantages of light, mobile equipment capable of projecting a heavyweight shell at a high rate of fire insures a place for the rocket-launcher in any modern army.

The artillery rocket is not normally controlled in flight. The use of homing devices, with or without proximity fuzes, would, however, in certain circumstances, greatly improve the weapon's efficiency, and such developments should be watched for.

The rocket's accuracy, although not comparable with that of rifled weapons or mortars, is sufficient to saturate target areas, or for AA barrage fire. The fairly large 50-percent zone of these weapons, coupled with the salvo fire and large charge-weight ratio of shell, makes them particularly suitable for chemical warfare purposes, where area contamination and the development and maintenance of high concentrations of lethal gases are desired.

From the production point of view, the elimination of rifled barrels and of carriages adequate for heavy recoil loads presents decided advantages, although an increased expenditure of propellant and the more costly manufacture of ammunition must be accepted.

While the effects of rockets are no greater than is to be expected from their HE content and thickness of casing, the cumulative effect of large salvos arriving in quick succession, heralded by their characteristic and alarming noise, can be most devastating even for experienced troops, unless they have been previously and adequately forewarned.

The antitank application of the rocket is no less important than its roles as field and antiaircraft artillery. Light, man-carried, rocket-propelled, shaped charges have played havoc with heavy armor, and improvements in this type of rocket may be expected.

Artillery rocket-launchers fall into three main categories: (1) self-propelled equipment carried on wheeled or tracked vehicles (figs. 64 through 66); (2) towed carriages (fig. 64); and (3) static launching racks or frames (figs. 64 and 65).

Any of these categories may use rocket guides (those portions of the weapon which support the rocket before and during its first moments of flight) of the following types:

a. Smooth-bore metal tubes resembling barrels. These usually are thin-walled, parallel-sided, and open at both ends (fig. 64).

b. Metal frames which provide guiding surfaces for the rocket (figs. 64 and 65).

c. Wooden or metal packing cases which serve as launching frames (fig. 64). Rockets fired from their packing cases are usually employed in static defenses and may be launched in quantity from simple frames or earth ramps.

d. Longitudinally slotted rails. With this type, the rockets are provided with studs to engage in the slots and either rest above or are suspended from beneath the rails (fig. 66).

LAUNCHERS

Artillery rocket-launchers are usually designed to fire salvos and are therefore provided with multi-guide rails (figs. 64 and 65). These guide-rail groupings may be of any form or shape, but most often are in rectangular banks.

The following is a checklist of information required on rocket launchers:

a. If self-propelled, what basic chassis is used, and what modifications have been made?

b. What are the official nomenclature and the nickname, if any? What is the caliber of rocket fired, and ground-to-air? Has the weapon any dual- or multi-purpose?

c. What types of ammunition are fired, and what are their maximum ranges? How accurate is the weapon?

d. What is the rate of fire of a salvo, and how long does it take to reload? How much time is required to bring the launcher into action?

e. What are the limits of traverse and elevation?

f. What form of guide rail is used? What is the number of guide rails, and how are they arranged? What is the length of each guide rail? Are the guide rails or tubes provided with any adaptors to permit the firing of ammunition of a different caliber?

g. Are the rockets loaded from the front or the rear? Are any mechanical loading devices used?

h. What are the dimensions of the launcher?

i. Where is the firer's position, and by what means is he protected from the backblast of the rockets?

j. What types of mechanism are used for elevating and traversing?

k. What are the sighting arrangements, and what do the graduations represent?

l. How many men are there in the crew and what are their duties?

m. Is firing by percussion or electric? If the former, describe the mechanism. If electric, what is the source of current supply? (Fig. 64 shows a typical hand generator.)

n. Give a general description of the launcher, including the platform, if static, and the carriage, if towed.

o. What is the name of the manufacturer or manufacturers, and what is the location of the plant or plants?

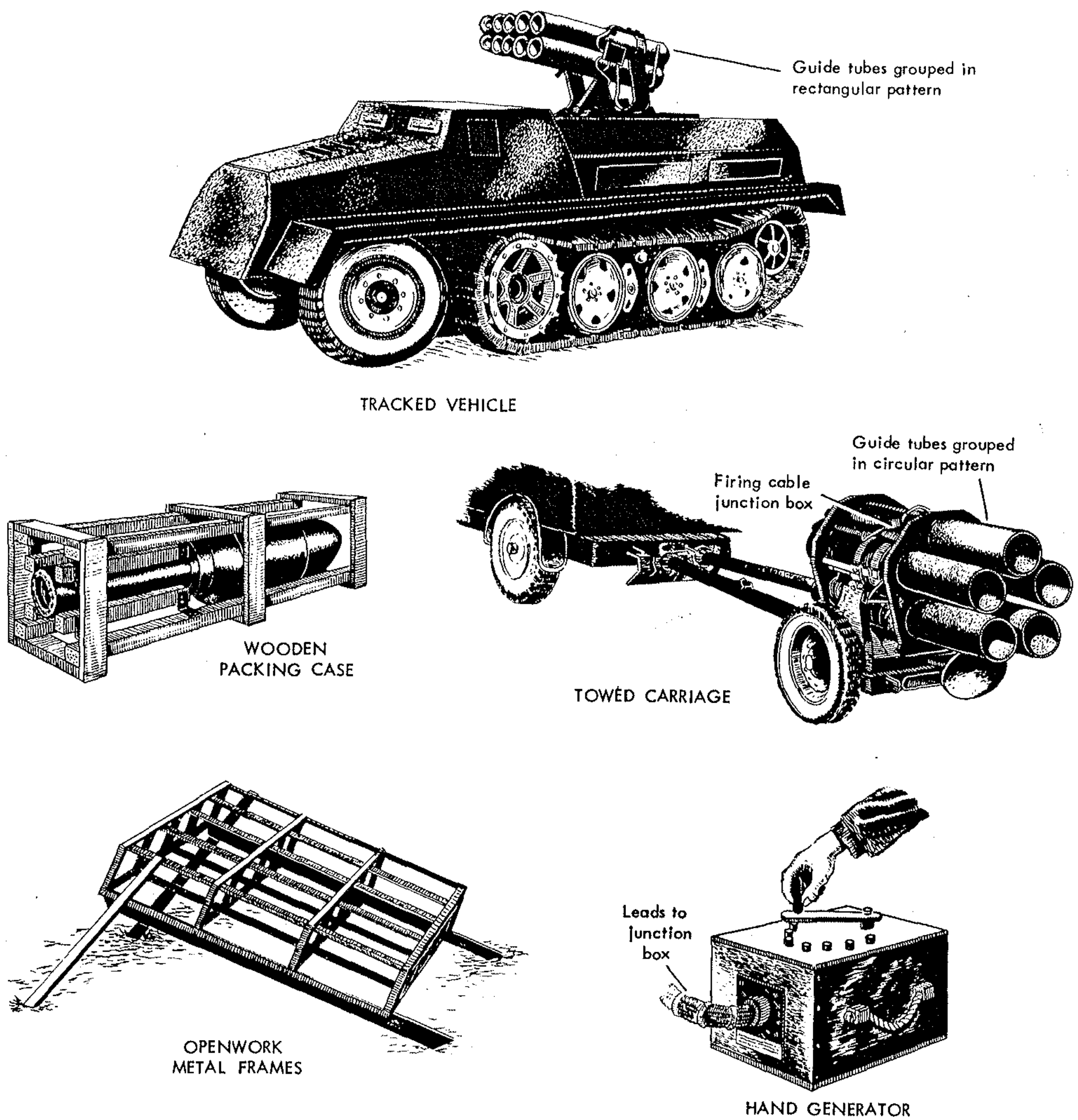


Figure 64.

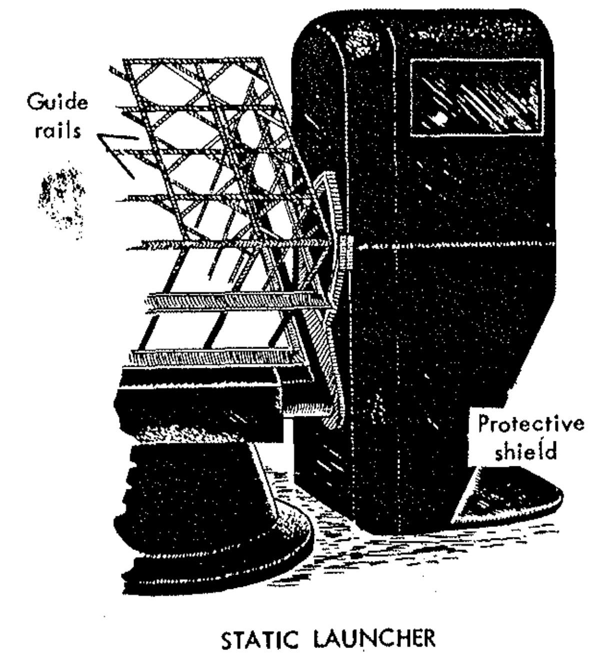


Figure 65.

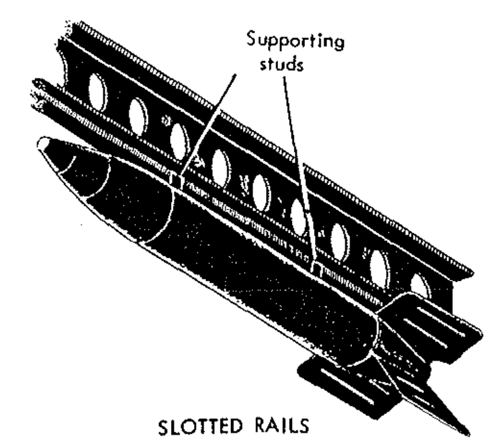


Figure 66.

ROCKETS

An artillery rocket normally consists of two major

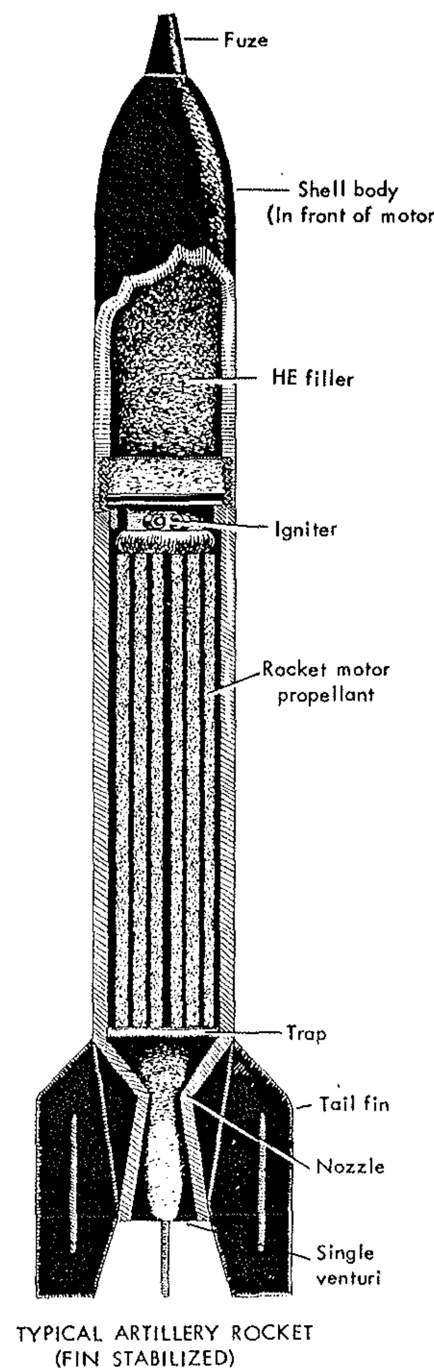


Figure 67.

components—(1) the shell, which contains HE or some other filling, together with a fuze (fig. 67); and (2) the motor, consisting mainly of the solid fuel or other propellant, and the venturi or venturis[1]) (fig. 68).

Figure 67 illustrates a conventional rocket projectile having a single-axial venturi and tailfin stabilization. Some of the more important variations from this general design which may be encountered are—

a. Spin stabilization, effected by multiple small venturis around the circumference of the base of the motor (fig. 68). These venturis are inclined at an angle to the axis so that the issuing gases impart rotation to the rocket.

b. A rocket in which the shell is of markedly larger diameter than the motor (fig. 64).

c. A rocket, in which the shell is behind the motor instead of in front of it (fig. 68).

d. A rocket in which the shell surrounds the motor or vice versa. This design achieves a better ballistic shape owing to the improved distribution of weight during burning of the propellant.

The efficiency of a field rocket projectile is partly determined by the amount of assembly which must be carried out immediately before firing. Where rockets are transported in sections in order to avoid risk of damage or accident in transit, the time necessary to achieve a ready-to-fire condition should be noted.

Following is a checklist of the main information required on field rockets:

a. What is the caliber of the rocket? What are its official nomenclature and its nickname?

b. What are the minimum and maximum ranges of the rocket?

c. From what launchers is the rocket fired, and what is its role? Is it dual- or multi-purpose, i.e., AA, ground-to-ground, or AT?

d. What type of filling is contained in the shell, i.e., HE, smoke, chemical?

e. What are the dimensions of the various components and stabilizing fins, if any?

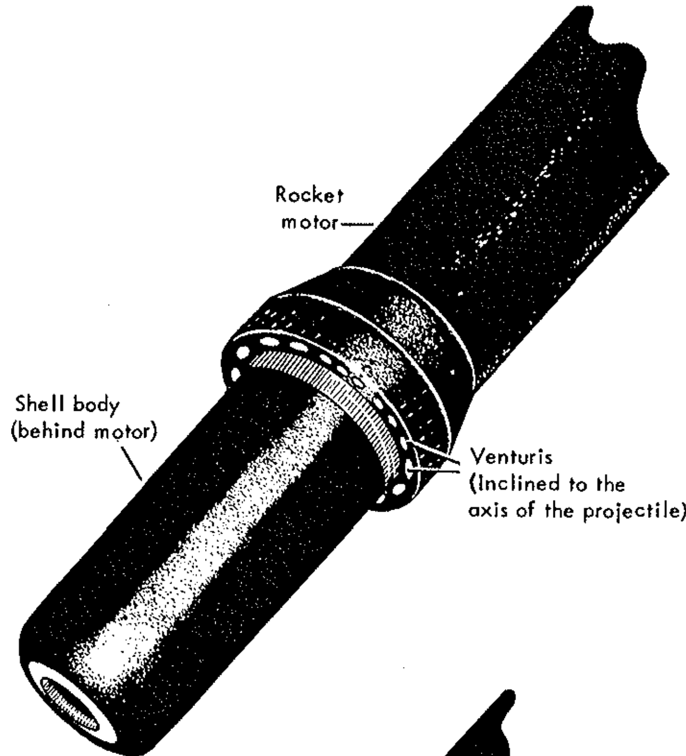
f. What are the weights of the various components and fillings?

g. Is firing by electrical means or percussion? (Fig. 64 shows a typical hand generator.) Describe the firing arrangements.

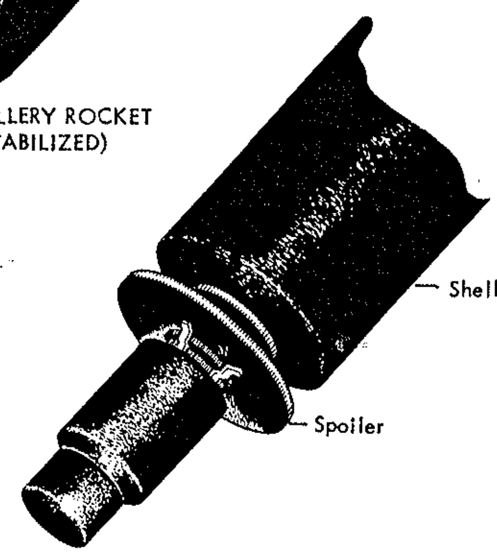
h. Does it have spoilers? Spoilers are devices fitted to a projectile to be fired at less than the normal minimum range (fig. 68). They reduce range without lowering the angle of projection. Give a description of any which may be used.

i. Complete ballistic details are required, including time of burning of propellent charge and temperatures. What are the length and breadth of the 50-percent zone?

[1]A restricted or shaped orifice designed to increase the velocity of passing liquids or gases.



TYPICAL ARTILLERY ROCKET (SPIN STABILIZED)



SPOILER

Figure 68.

j. What are the details of the shell and its fuze? Field rocket shells and fuzes are basically similar to those of artillery projectiles.

k. What type and composition of propellant are used? Are any special precautions taken during storage?

l. What are the safe firing temperature limits? Are different rounds used for cold and hot climates?

m. What materials of construction are used? If steel, what composition and what heat treatment, if any, are used?

n. What is the name of the manufacturer (s), and what is the location of the plant (s)?

CHAPTER 8

Radio and Radar Antennas

INTRODUCTION

Intelligence on foreign antennas is valuable for strategic and tactical reasons, since, through this means, frequencies being used, or contemplated for use, in potential enemy communications often can be determined.

Such intelligence provides guidance for the design and use of countermeasures equipment on those frequencies required for jamming enemy radio as well as radar signals. Also, such intelligence supplies a key to the enemy's use of communication facilities and hence, in a general way, to his level of electronic development.

In the case of radio jamming, the most effective countermeasures equipment can be designed only when all of the frequencies to be employed by the enemy are known with reasonable exactness.

ANTENNA THEORY

After a radio or radar signal has been generated by the transmitter it must be converted to the form of electro-magnetic waves in space. At the receiving point, this energy must be removed from space and delivered to the translating apparatus. The device which fills both requirements is the antenna.

The energy radiated by the antenna is in the form of electromagnetic waves which, upon reaching a receiving antenna, induce a voltage in it. When the receiver is tuned to the same frequency and under conditions of proper antenna length and orientation, the signal will be translated by the detecting device and made either audible or visible.

The receiving antenna does not require extreme care in design for satisfactory operation. The transmitting antenna system, however, is sensitive in many constructional details. Most transmitting antennas are either of the Hertz or Marconi type.

The Hertz antenna operates on the principle that maximum radiation of power occurs when the antenna is one-half wavelength long. This antenna, which may be either a vertical or a horizontal wire or rod, is not electrically connected to the earth.

If one half of the radiator of a Hertz system is replaced by a ground, it becomes a Marconi-type antenna. This conversion usually is accomplished through grounding either the output circuit of the transmitter or the coupling coil at the end of the feed line. Either method causes no change in the waves propagated from the remaining half of the antenna.

In any antenna circuit, resistance reduces its efficiency; and, since the Marconi antenna is grounded, it is desirable to obtain a low resistance in the ground circuit. This cannot always be accomplished, as the earth is dry and sandy in many localities. When this is the case, a counterpoise[1] is used. When a horizontal antenna is used, the counterpoise is placed underneath the antenna, above the ground and insulated from it. With a vertical-type antenna, a spoke-like arrangement of wires is used, extending outward from the antenna. This arrangement also is above ground and insulated from the earth. A vertical-type Marconi antenna installed in a vehicle usually uses the vehicle chassis as the counterpoise.

Hertz antennas generally are used at higher frequencies (above two megacycles), while Marconi antennas usually are used at lower frequencies. The latter, however, also may be used at high frequencies in certain applications, such as airplane or vehicular antennas, where the airplane or vehicle itself becomes the effective ground. The main advantage of the Marconi antenna lies in the fact that, for any given frequency, it is shorter than the Hertz antenna.

There is a direct relationship between the length of antenna and its operating frequency. This is attributable to the fact that, when an electrical charge is de-

[1]A counterpoise is either a wire or a system of wires or metal which is used as a substitute for ground.

... travel at approximately the speed of light, roughly 300,000,000 meters per second. If these impulses are generated at a given rate per second (f), then the impulses will be separated a distance or wavelength equal to the velocity of propagation, divided by the impulse rate or frequency, as shown in this simple relationship—

$$\text{Wavelength} = \frac{300{,}000{,}000}{f}$$

Since most efficient radiation from the antenna takes place when it is one-half wavelength long, it follows that all antenna lengths are a function of the operating frequency (*f*).

CLASSIFICATION OF ANTENNAS

Antennas assume various shapes and orientations according to the specific purpose they serve. Some of the factors which determine the construction of an antenna are: (1) the operating frequency; (2) the direction of transmission; and (3) to some extent, the amount of power it radiates.

In most instances, low- and medium-frequency antennas use wires as radiators, the length of the radiators indicating the frequency of the transmitter. The position of the wires, either vertical or horizontal, determines the antenna's radiation pattern.

High-frequency equipment generally uses metallic rods as radiators. Where the rods are short, as in the case of radar antennas, they are called "dipoles." In this case, they usually are placed end-to-end on a frame and are connected to a "feeder."

The feeder, which may consist of two wires or a single cable, serves to transfer the energy from the transmitter to the radiators. Dipoles almost always are accompanied by a reflector placed behind them, which may be a similar rod, wire mesh, or metal "dish," used to concentrate the radiated energy in the forward direction.

According to the service they perform, antennas may be grouped as follows: (1) broadcast antennas; (2) communications antennas; (3) direction-finding and radio-range antennas; (4) FM and TV antennas; and (5) radar antennas.

Next to configuration, the dimensions of an antenna system are the most important criteria in the determination of its use. Points on which information is important are mentioned in the discussion of the individual types. In all cases, however, a photograph or sketch usually reveals more than the most thorough written account based on visual observation, particularly if the pictorial material is properly oriented and some indication of dimensions is given.

Representative types of antennas for the classificatio mentioned are discussed briefly below. In each case, th dimensions and configuration of the antenna used ar a function of the operating frequency and the dire tivity requirements. Generally, as the operating fr quency increases, the antenna becomes shorter; an as directivity is emphasized, the number of elements i the antenna system becomes larger.

Broadcast Antennas

In modern installations the broadcast antenna usu ally consists of a tower, which itself is the radiator. C metal construction and varied shapes, it may reach height of 1,000 feet or more, depending upon the a signed wavelength of the transmitting stations. Th towers may be either self-supporting or guyed.

Frequently, it is desired to radiate more energy in on direction than in another, to increase the signal strengt over a selected area. This is accomplished by addin one or more towers to the antenna system to act as director or a reflector of the waves radiated by the an tenna.

In some broadcast installations, the antenna may b a single wire suspended between two towers or mast with the feeder-wire connecting at the end or at th center. In all cases, the antenna length, whether towe or wire, is directly proportional to the wavelength c the transmitting station.

Communications Antennas

Communications antennas comprise a great numbe of sizes, shapes, and patterns, depending upon thei operating wavelength and directional properties. It i important, therefore, to know their dimensions accu rately to obtain a clue to their operating frequency an use.

Direction-Finding and Radio-Range Antenna

Direction-finding equipment may use either fixed o rotatable antennas. Adcock and loop-type antennas, o variations of these types, are commonly used with equip ment which is mechanically rotatable.

The second type of direction-finding (D/F) equip ment uses a system of fixed antennas and depends upo electrically selecting the receiving elements by a switch ing arrangement to determine signal bearings. For ex ample, four masts, arranged in a square with a fifth mast in its center, may compose a D/F installation.

Radio-range antennas which are used for air-naviga tion purposes are, in some respects, similar to the fixe type of D/F antennas. The chief differences are that (1 the masts or towers of a radio-range station are con siderably higher than are D/F antennas; and (2) ther is no center tower.

FM and TV Antennas

The operating frequencies of television and FM antennas lie in the same range; this means that the length of the radiators or of the "dipoles" is approximately the same. For this reason, the characteristics of the two antennas are similar. Frequently, these antennas will be found on top of a broadcast antenna tower, since, in operating at frequencies which give line-of-sight transmission, high elevation is an important factor in obtaining maximum coverage.

Radar Antennas

Radar antennas have a considerably more complicated structure than radio antennas. Radars operate at high frequencies and therefore use "dipoles," the length of which is determined by the operating frequency. There may be one dipole, or many dipoles massed on one or more frames.

One characteristic of radar antennas which gives them a distinctive appearance is the use of reflectors. These may consist of a single rod, a parabolic or semicylindrical screen, or a flat wire mesh. Frequently, a slightly shorter rod, called a "director," is found ahead of the dipole antenna.

ELEMENTS OF INFORMATION

Detailed and technical information on antennas may be available in photographs in technical documents. Much valuable information also may be obtained by visual inspection and by interrogation.

In collecting information, the following checklist may serve as a useful guide. The list is divided into sections, each section listing the type of data desired for each classification of antennas.

Applicable to Broadcast Antennas

1. Height of tower or mast.
2. Type of loading, if any, at top or base of mast.
3. Layout and orientation, where two or more towers are present.
4. Length of antenna between towers, if any.

Applicable to Communications Antennas

1. Height of masts.
2. Exact layout and orientation of masts.
3. Length and number of wires between masts.
4. Length and position of feeder.
5. If dipoles are used, their dimensions, number, and configuration and whether they are stationary or rotatable.

Applicable to FM and TV Antennas

1. Height of tower.
2. Length of antenna mast at top of tower.
3. Number, length, orientation (horizontal or vertical), and spacing of dipoles at top of tower.

Applicable to D/F and Range Antennas

1. Height of masts.
2. Exact lay-out and orientation of masts.
3. Dimension of loop or loops.
4. Length of dipoles.
5. Distance between masts or dipoles.

Applicable to Radar Antennas

1. Length of dipole or dipoles.
2. Position of dipoles (horizontal, vertical).
3. Type of reflectors (rod, wire mesh, or "dish").
4. Type of feeder.
5. Method of rotation and sweep of antenna in azimuth and elevation.
6. Elevation of antenna above ground.
7. Fixed or mobile installation.

CHAPTER 9

Radio Transmitters and Receivers

INTRODUCTION

Electronic equipment to the nontechnical observer appears to consist of a hopeless maze of tubes, knobs, and meters and a hodgepodge of strange-appearing gadgets which are connected by miles of multicolored wires to produce music, voice, Morse code, location of distant airplanes, and even motion pictures. Radio equipment may be reduced to a group of common denominators, however, that make identification and cataloging a simple task even for the nontechnical observer.

METHODS OF COLLECTING INFORMATION

Electronics information in a foreign country may be collected by one or more of three methods—(1) receipt of data from the foreign government on a *quid pro quo* basis; (2) exploitation of a source who has, or has access to, the desired information; and (3) observation or examination of the equipment by the intelligence agent himself.

The first two of these methods are not within the scope of this pamphlet, although proper questioning of a knowledgeable source may be aided by reference to the checklist appearing at the end of this chapter.

The following simulated situation will demonstrate the techniques of the third method of collection:

A technician experienced in both radio and in the intelligence field sees some distance away, and behind a "manproof" fence, what appears to be radio equipment. His interest is first attracted by the antenna, an item which nearly always accompanies a radio transmitter and quite often a receiver as well.

At first glance, it is apparent to him that the antenna has no reflecting screen or decimeter or microwave types of equipment. He identifies it as a half-wave doublet such as is often used for military communications. After this identification, the observer carefully estimates the length, height, and direction of orientation of the antenna, using for comparison common objects of standard dimensions which are nearby. These data would later serve to determine the wave-length and, to some extent, the area coverage of this station.

Next the observer notes that, of the various persons near the equipment, two appear to be operating it. Their exact movements are carefully followed as they will give some clue as to the functioning of the equipment: The dials that are adjusted—how often the operators adjust them—their use of headphones, microphone, or Morse key, whether they write messages or take notes, and even whether they merely sit and watch the equipment. Since the observer is experienced in many types of electronic equipment, he concludes that this equipment is a field radio station for sending and receiving Morse code messages.

The equipment cabinet appears to be about 3 feet long, 2 feet high, and 1 foot thick. From the activities of the operators, the observer concludes that a receiver and a transmitter must be contained in that space. This deduction is useful for general descriptive purposes and for providing some supporting evidence for a later estimate of power and range. One of the crew frequently operates a hand generator (fig. 64) while his crewmate uses the Morse key. At other times the former rests, while his crewmate copies messages. This tells the observer that the transmitter is powered in the field by a hand generator.

The maximum wattage that one man is able to produce from a hand-driven generator is about 50 watts, consequently the maximum power output of the transmitter is somewhat less than this. Since the operator receives messages without the generator being cranked, the observer concludes that the receiver operates from batteries.

The observer while watching the foregoing characteristics makes an approximate count of the number of messages received and sent, and notes the number of

runners or messengers visiting the site and other activities of the personnel that would provide a clue as to the station's importance and operating schedule.

On a subsequent visit the observer seizes an unexpected opportunity to get past the wire fence and approach the radio equipment. He can get close enough to it to read the name plates, which are always a most fruitful source of information. Since the observer is presumably trained in intelligence, the foreign words on the name plates present no problem. A knowledge of the alphabet used often will make it possible to ascertain the three critical items desired which are stamped on virtually every nameplate—(1) nomenclature or name of equipment; (2) serial number, from which can be deduced production figures; and (3) date of manufacture. Also desirable to procure, and occasionally found on name plates, instruction tags, or elsewhere are: (1) the name of the manufacturer; (2) the power; (3) frequency or wavelength; and (4) organizational markings.

The observer's closer view now permits detailed observation of smaller items, such as panel meters and controls, with special reference to their markings and the position of pointers.

For a nontechnical observer to differentiate readily between the transmitter and receiver, or if haste prevents close observation, a good rule-of-thumb to remember is that a transmitter generally will have more knobs, dials, and, particularly, meters than its companion receiver. Also, the leads to the transmitting antenna normally will be insulated against high voltage, often with porcelain insulators, whereas the receiving antenna lead-in will have plastic or rubber insulation.

In rare instances, an intelligence observer may find the equipment unguarded. This is the case in this simulated situation. Since time is an important factor, the observer could note only essentials. One thought is uppermost in the mind of a trained observer: What tube does the transmitter use in its "Final"? To find the answer to this all-important question—and it is of prime importance to Intelligence—he immediately looks for the largest tube in the equipment. To make sure that it is the "Final" tube he notes that it is the one connected to the antenna and then gives it close scrutiny. Its size, the method by which it is cooled (air or water), its internal construction, its number or other markings, and any other peculiarities are all noted, for this is the heart of the whole equipment. It determines the power which can be fed into the antenna and often indicates whether the equipment is of a new or an old type.

A quick but searching scrutiny of the remainder of the transmitter covers the following items:

Final Tank Coil

This vital component of any transmitter normally is a single layer coil of wire or tubing that connects to the "Final" tube and the antenna. This coil and associated capacitors affect the operating frequency of the transmitter and its approximate power output.

The observer in this simulated situation notes the size, number, and spacing of the capacitor plates and measures the coil's diameter, length, number of turns, and size of wire for later computation of the operating frequency and power output. In some very-high-frequency transmitters, the coil may take the form of two parallel metal tubes or rods. (Fig. 69 shows final tank coils.) If such is the case, their diameter, length, spacing from each other, and the possible presence and location of any "shorting bars" or rods connecting them are significant.

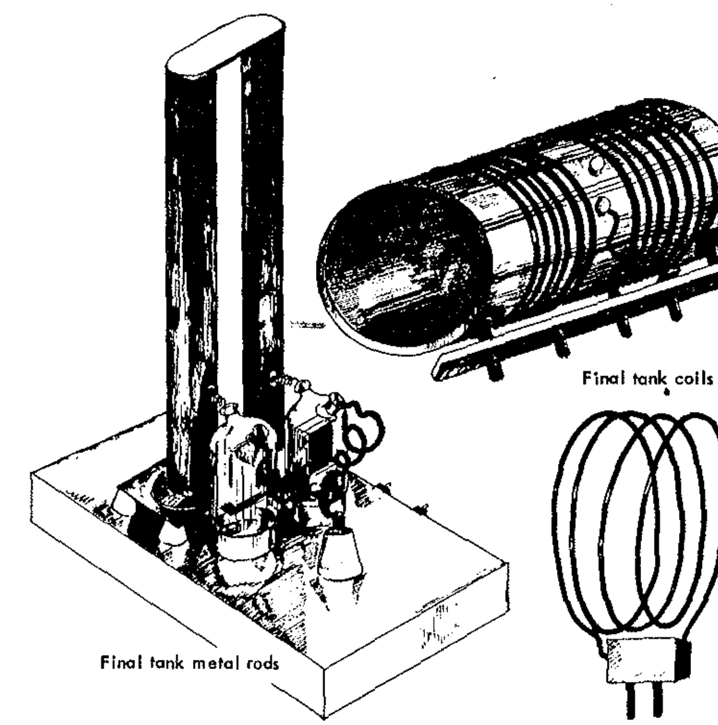


Figure 69.

Tubes

The observer will inspect the rest of the tubes in the transmitter and note their make, number, or identifying marks (fig. 70). From this information can be determined the general circuit of the transmitter, as each tube type is best utilized for one particular function. There must be one tube for the generation of radio frequency oscillations and others to amplify this signal to a point where it will "drive" the final tube. If voice modulation is utilized in the transmitter, there will be special types of tubes for the amplification of the voice signals.

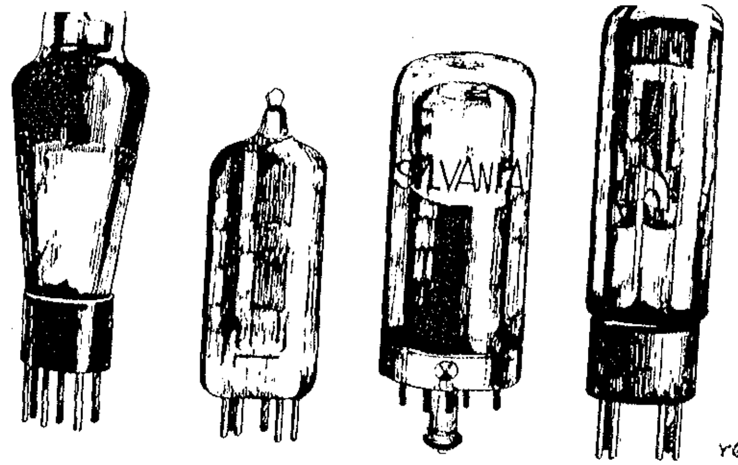


Figure 70.

Frequency Control

Finally, the observer will determine the method used in controlling the frequency of the transmitter. Quartz crystals normally fill this function in a transmitter. They may be contained in many different types of holders (fig. 71). The frequency of the crystal usually is stamped on the holder. However, this frequency may or may not be the operating frequency of the transmitter since the initial frequency may be multiplied several times to obtain the desired output frequency. If no crystals are found in the transmitter, the frequency is probably controlled by a "Master Oscillator." While each quartz crystal provides only one stable frequency, a master oscillator may provide any desired frequency in a band of frequencies at the will of the operator. Since this simulated situation appears to leave a few minutes more for the observer's inspection, he next directs his attention to the receiver. Receiver designs are fairly universal, so the most important items are the number and type of tubes used and the frequency coverage. The frequency coverage may be obtained from the scale of the tuning dial or calibration chart.

The operating controls also are carefully noted, as they may give a clue to the use or non-use of "Noise Limiter," "Variable Selectivity" or other devices which may determine its vulnerability to jamming signals.

Finally, before the observer leaves the still unguarded area, he will note the size and type of power supply, means of transporting the equipment, and its approximate weight. Upon his return, he will write his complete report which will consolidate all incomplete data already reported as a result of earlier observations of the target.

Experience probably will not provide all the excellent opportunities for observation enjoyed by the observer in this simulated situation. However, this is an

example of information-collection which can be accomplished through enlightened attention to details and alert exploitation of opportunities.

As a further aid, the following checklist should be consulted:

OBSERVATION OF EQUIPMENT FROM A DISTANCE

Antenna

Length, height, direction, and type.

Personnel

Number of operators required and method of operating equipment. (Operating methods should be reported in detail.)

Equipment Size

Dimensions of all equipment; its size and weight.

Power Equipment

The type of power used: hand generator, power generator, commercial power, or battery.

Activity

The amount of activity in connection with the radi station or equipment and the hours of operation.

OBSERVATION OF EQUIPMENT AT CLOSE RANGE

Name Plates

All information from all name plates on the radi equipment and the power supply.

Components

The number of individual components or boxes and the connecting cordage. All knobs, dials, meters, and terminals on the equipment should be noted and their positions and readings taken when the equipment is in operation, out of operation, and in the stand-by condition.

INSPECTION OF INTERNAL PARTS

Transmitter Final Amplifier Tube

This tube is usually the largest one in the transmitter and should receive the closest attention. Its size, shape, number or make, method of cooling (water or air), and other peculiarities should be noted.

Transmitter Final Tank Coil

This coil is a vital part of any transmitter and normally is a single layer of wire or tubing which connects with the final tube and the antenna. Its diameter, length, number of turns, and size of wire should be noted. Absence of this coil indicates that some other type of final tank is employed, such as parallel bars, which should receive the same attention as to size, length, diameter, and spacing.

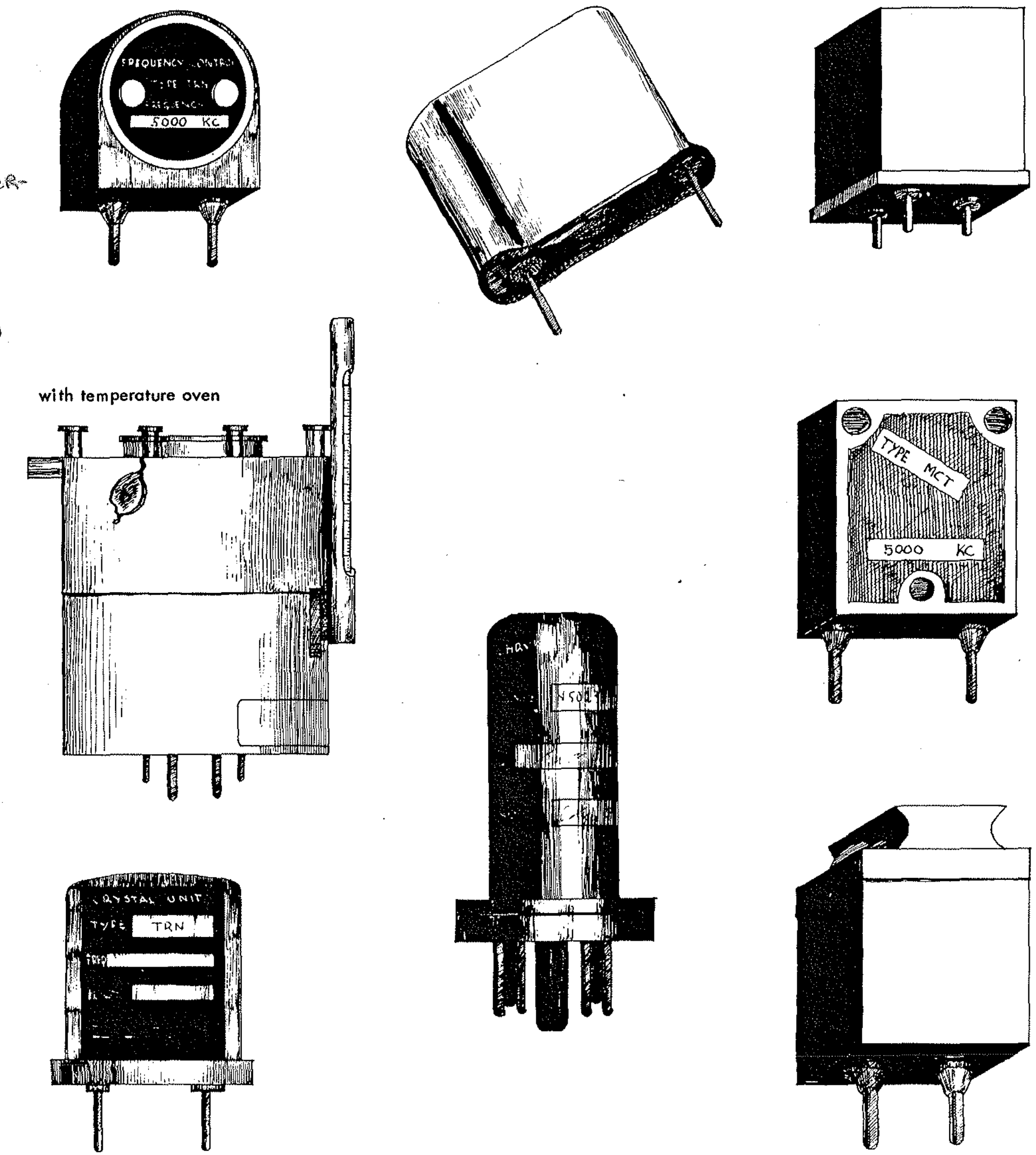


Figure 71.

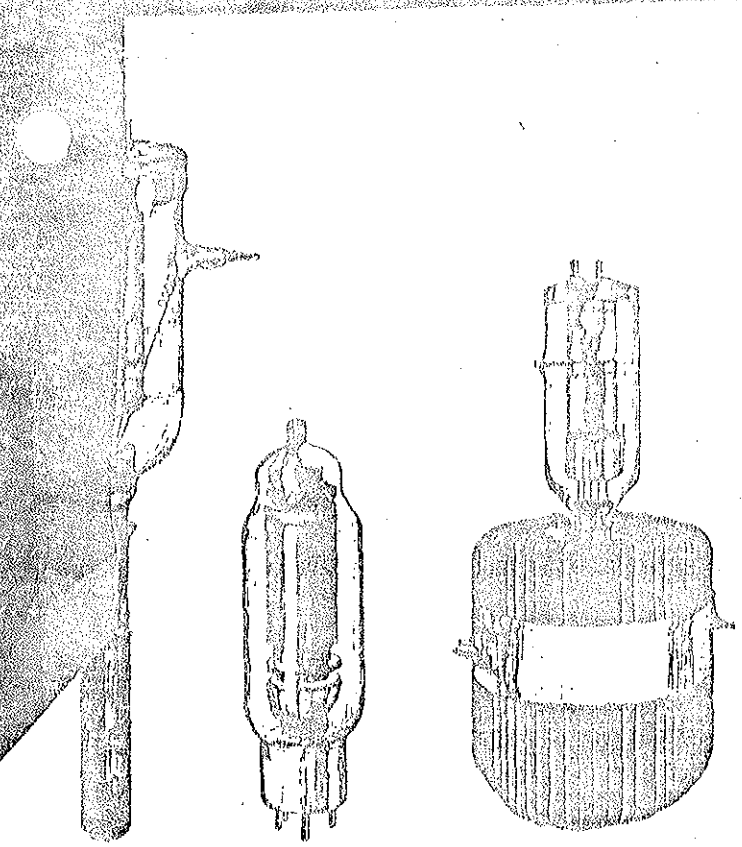


Figure 72.

Transmitter Tubes

The number of tubes in the transmitter should be noted, with their nomenclature (fig. 72).

Transmitter Frequency Control

The number and frequencies of all quartz crystals in the transmitter should be recorded. If no crystals are located in the transmitter, that fact also should be noted.

Receiver

The nomenclature of tubes used in the receiver should be recorded. All knob and dial markings should be noted, especially the frequency coverage of the receiver as obtained from the tuning dial or frequency calibration chart.

Power Supply

All information should be obtained from the labels on the power equipment. Battery voltages should be determined from their labels.

Portability

The method of transporting the equipment should be determined—portable, man-pack, air transportable, airborne, ground fixed, or other.

INTERROGATION TECHNIQUES

For the observer in the field who knows of the existence of radio equipment in his area but is unable to make a personal inspection, owing to security restrictions, the following checklist may be used in the interrogation of technical personnel:

1. What is the exact location of equipment?
2. For what purpose was the equipment designed?
3. What is the power output of the transmitter?
4. On what frequency does the transmitter normally operate?
5. What is the technical nomenclature of equipment?
6. How many operators are required?
7. What are the size and weight of the equipment?
8. How often and when is the equipment used, and with whom does it communicate?
9. What source of power does the equipment use, and is there an emergency power source available?

CHAPTER 10

Bridges and Stream-Crossing Equipment

INTRODUCTION

The crossing of streams and defiles has always been an important consideration in warfare. Mechanization of armies and extremely mobile warfare have given the problem increased importance.

In the development of modern stream-crossing equipment, research is concerned with the following problems: (1) increase in load-carrying capacity; (2) reduction of weights; (3) simplification of design; (4) greater ease of erection; and (5) greater transportability.

Although detailed and technical information on bridges and stream-crossing equipment may be drawn from photographs, technical documents, and reports of actual tests, much valuable information also can be obtained by visual inspection and interrogation.

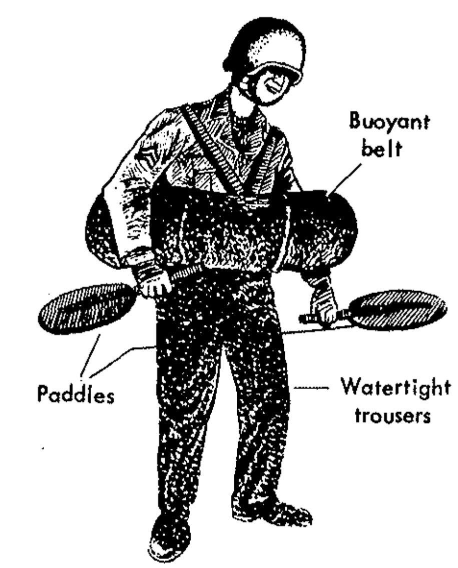
Stream-crossing equipment is of two principal types—floating and fixed. Both types may vary in size and capacity, ranging from types designed for the crossing of individual soldiers to types of bridges capable of carrying the heaviest military loads.

FLOATING EQUIPMENT

1. Individual equipment (fig. 73) is that worn or used by soldiers to give them buoyancy while crossing deep-water obstacles, primarily when on reconnaissance missions. The equipment consists usually of watertight trousers and a pneumatic or stuffed buoyant belt. Propulsion is by paddles or the paddling action of arms and hands.

2. Reconnaissance boats (fig. 74), which are easily carried by one or two men, are of small capacity (up to six men). The boats are usually of the pneumatic type. Propulsion is by oars, paddles, or mechanical means.

3. Assault boats (fig. 75) usually are designed to carry a squad (12) of riflemen, plus a boat crew (3), in infantry assault crossings, where secrecy rather than speed is the prime consideration. The boats are propelled by oars, paddles, or mechanical means. These boats also



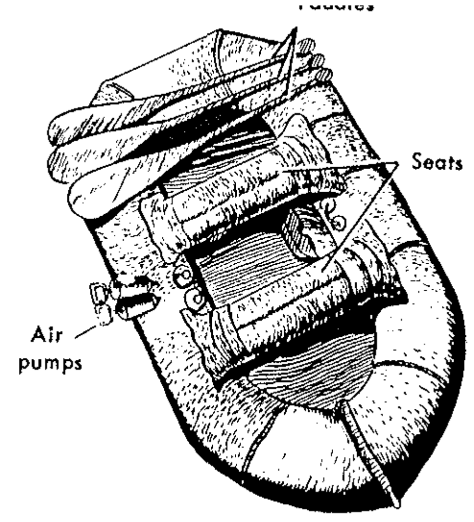
INDIVIDUAL EQUIPMENT

Figure 73.

may be designed for further use as pontons in the construction of rafts and floating bridges.

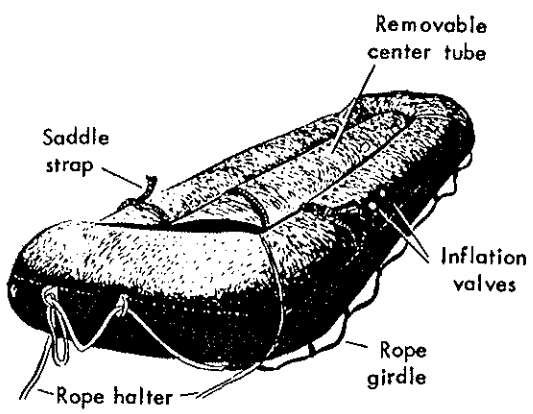
4. Storm boats (fig. 76) are high-speed craft used in infantry assault crossings where secrecy is sacrificed for speed. These boats usually are designed to carry 8 to 12 riflemen and the boat crew of 2. Propulsion is by motor, usually outboard.

5. Rafts (fig. 77) generally are used to transport weapons, vehicles, and supplies in support of an assault crossing, pending the construction of bridges. Rafts may be constructed of any available material, but usually are made of components of other floating equipment, ranging from the assault boat to the heaviest floating bridge. Rafts may be issued in sets, or be made from floating bridge sets and the addition of such auxiliary



PNEUMATIC RECONNAISSANCE BOAT

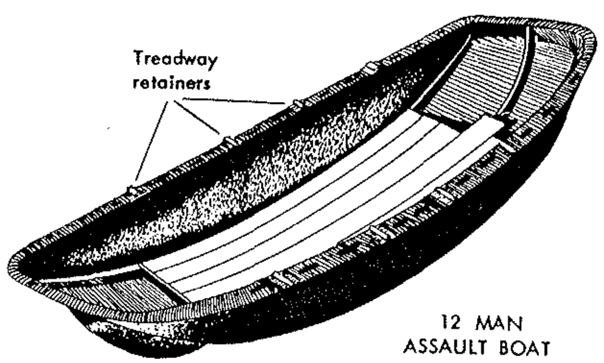
1



PNEUMATIC FLOAT

2

Figure 74.



12 MAN ASSAULT BOAT

Figure 75.

equipment as cables, blocks, and similar articles.

6. Floating bridges (figs. 78, 79, and 80) have floating elements for intermediate supports. They are used because of the speed and ease with which they can be erected; however, they are usually replaced by semipermanent, fixed bridges as soon as the tactical situation permits. Floating bridges are of two general types—foot and vehicular. Both are made up of two kinds of spans—floating and shore-connecting.

a. The floating spans consist of floating supports (substructure) and a roadway (superstructure).

(1) The floating support, called a ponton, is normally one of the following types:

(*a*) Pneumatic floats (fig. 74), which are collapsible containers that can be inflated by air, are usually shaped like a boat or a sausage and divided into numerous air-tight compartments.

(*b*) Boats (figs. 75, 81, and 82), which normally are made of wood or metal, are either rigid or folding. They usually have compartmented hulls, or are filled with a foamlike or other light material to insure maximum flotation even when the hull is punctured. The joints in the folding boats are covered with canvas or rubber-impregnated material to prevent leakage. In some cases rigid boats are made in two sections—bow sections and center sections.

(2) The superstructure of a floating bridge consists of—

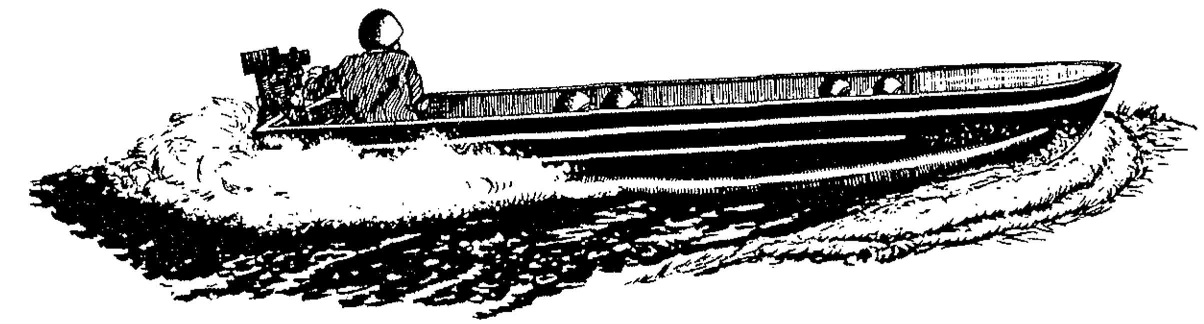
(*a*) *Balk.* These are the timber or metal beams used to join the floating supports (pontons) to form a floating bay and to carry the decking. In some cases the balk are laid side by side to form a solid covering, thereby eliminating the use of wooden plank, called chess, for decking (fig. 82).

(*b*) *Decking.* This usually consists of chess. (The term is usually applied to the decking of floating bridges consisting of planks laid side by side transversely across the balk.)

(*c*) *Siderail.* These are the pieces of wood or metal which hold the chess in position, stiffen the balk, and serve as curbs.

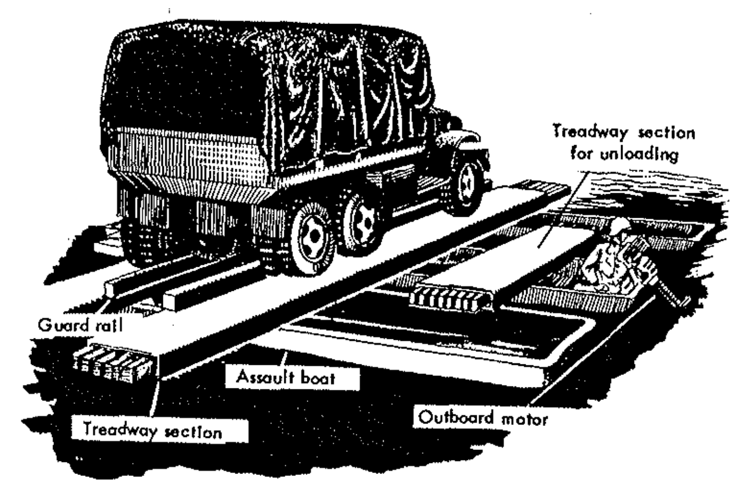
(*d*) *Treadways.* This is a roadway consisting of two parallel tracks for the wheels of vehicles to run upon. A treadway is a unit designed to serve as balk, chess, and siderail combined (fig. 88).

(*e*) *Duckboards.* This is the name generally given prefabricated panels which serve as both balk and chess to form the walkway of a footbridge.



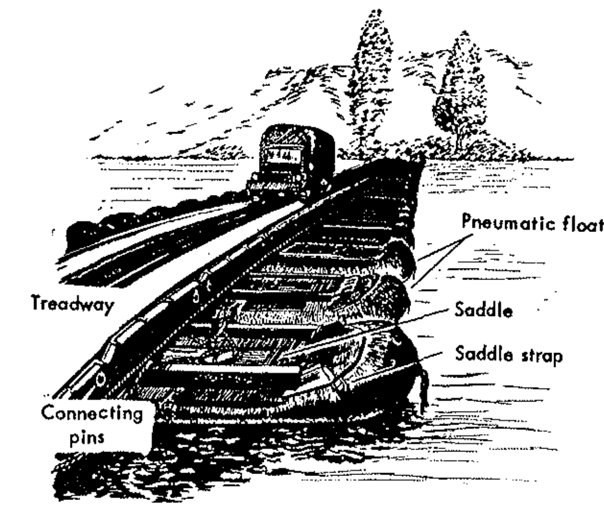
STORM BOAT WITH MOTOR

Figure 76.



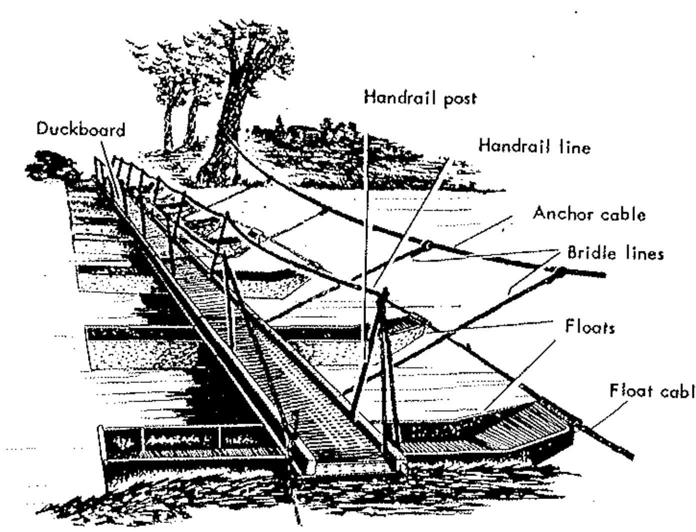
RAFT

Figure 77.



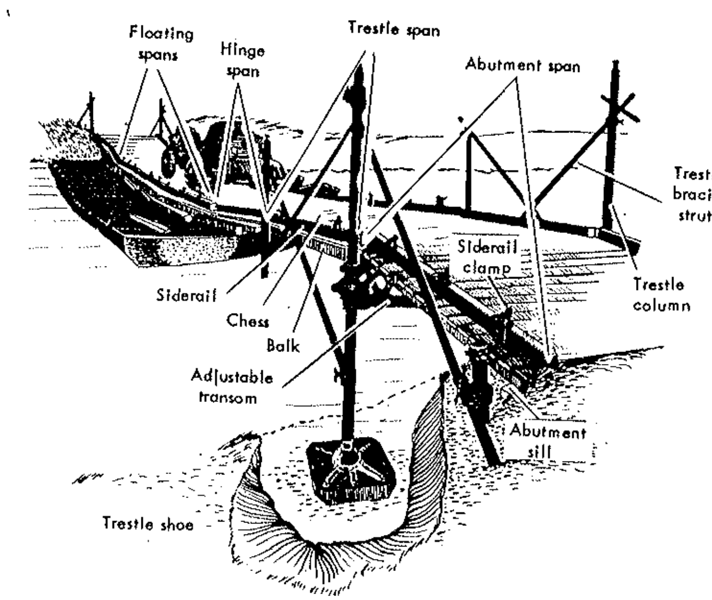
TREADWAY TYPE VEHICULAR BRIDGE

Figure 79.



FOOTBRIDGE

Figure 78.



BALK AND CHESS TYPE VEHICULAR BRIDGE

Figure 80.

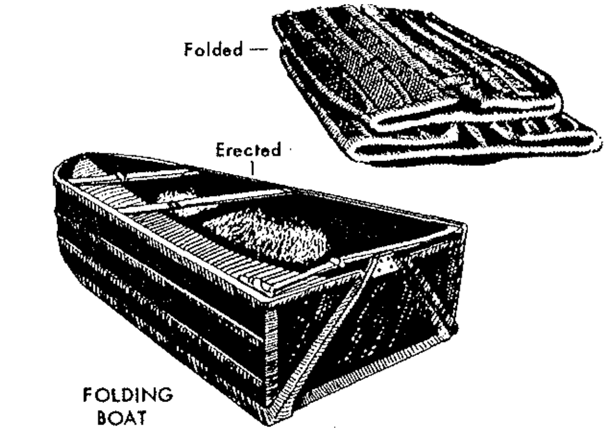
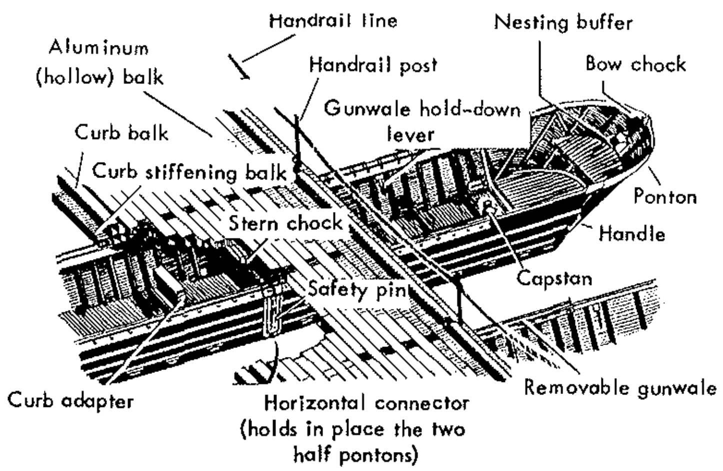
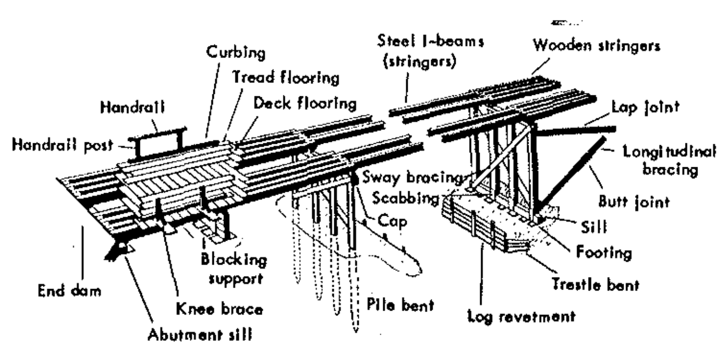


Figure 81.



BALK TYPE VEHICULAR BRIDGE

Figure 82.



STRINGER BRIDGE

Figure 83.

b. Shore-connecting spans provide for the transition from floating spans to the shores. Three types of shore spans may be encountered (fig. 80) — (1) The hinge span, which connects the shoreward ponton with the abutment or a trestle; (2) the trestle span (not present in all bridges), which connects the trestle of one span to the trestle of another span; and (3) the abutment span, which connects the shoreward trestle with the abutment.

FIXED BRIDGES AND CABLEWAYS

In military operations, fixed bridges and cableways may be constructed by using sets of prefabricated components, precut structural elements drawn from depots, or local materials.

Principal Types of Military Bridges

1. *Stringer Bridge* (fig. 83). This simplest type of fixed bridge can be divided into two main parts—substructure and superstructure.

a. The substructure consists of end supports, called abutments, and intermediate supports, called bents or piers. The abutment may consist of a masonary support, pile bent, or crib-type support, with the necessary footings, sill, and backwall, or end dam. The sill is normally the only prefabricated part of the abutment. Intermediate supports may be pile bents, trestle bents, or piers. Trestle bents and piers are often prefabricated so that field erection only is required.

b. The superstructure includes the stringers and the flooring. Stringers are longitudinal members spanning the distance between intermediate supports or abutments. For military bridging, standardized lengths of stringers, timber, and steel are usually maintained in depots. They are seldom maintained in sets, but are available for requisition for specific tasks. Flooring is made up of planks laid across the stringers to form a roadway. Generally, flooring consists of two layers, the deck or transverse planking and the tread planking. The tread planking is usually laid diagonally over the deck planking to distribute the load longitudinally and to provide a wearing surface. Flooring also may be prefabricated in sections made of metal or other materials. The superstructure also may include a curb and a handrail.

2. *Girder Bridge.* A girder bridge is one in which the roadway loads are transmitted from the floor system to the abutments or piers by steel or iron girders. This type of bridge is used when it is impractical to bridge a span with wood, iron, or steel stringers. Its components are essentially the same as those of the stringer bridge except that the stringers are supported by floor beams rather than by an intermediate substructure. The floor beams are transverse members transmitting the load from the stringers to the girders. Girder bridges are classified as through girder bridges when the roadway is supported on beams framed between the girders, and as deck girder bridges when the roadway is supported on beams secured to the top of the girders. Girders are of two basic types:

a. The plate girder (fig. 84)—usually referred to simply as girder—has a solid web and may consist of an I-beam, or it may be built up of plants, angles, and channels.

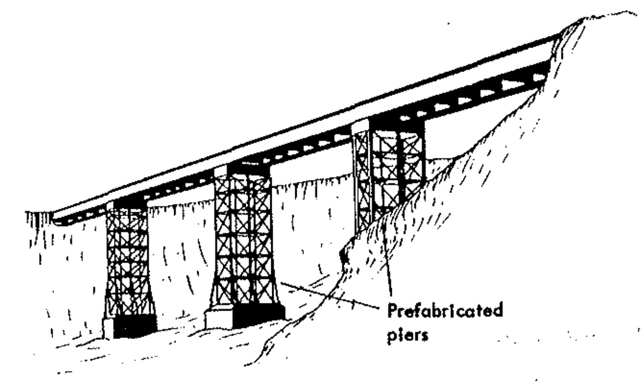
b. The truss girder (figs. 85 and 86)—normally called a truss—is similar to the plate girder except that instead of a solid web there is an open structural framework composed of angles, bars, channels, and the like. The truss-type girder bridge probably is the only type of girder used in prefabricated bridging sets. The panels of the bridge set are connected, usually by pinning, to form a truss girder span of the required length. In the Bailey Panel Bridge, a commonly known example, the panels may be double- and triple-connected in parallel, and double- and triple-decked in height, to provide combination trusses of the required strength for the span covered.

3. *Suspension Bridge* (fig. 87). This bridge has its roadway suspended from two cables which pass over the tops of two towers and are secured to anchorages on each bank. The floor beams are supported by vertical cables, called slings, suspended from the main cables. The stringers rest on the floor beams. The military employment of this bridge is normally confined to mountain operations, and the bridge usually is designed to carry only light loads.

4. *Special Types.* An example of a special type is the vehicular mounted bridge (fig. 88) used in assault operations. It usually consists of a tank chassis, with a bridge structure mounted on its hull in a folder position. The bridge may be put into position either mechanically or by hand. One type of vehicular mounted bridge utilizes the vehicle as a center support. In another type, the bridge may be lowered over the gap to be bridged and be separated from the vehicle.

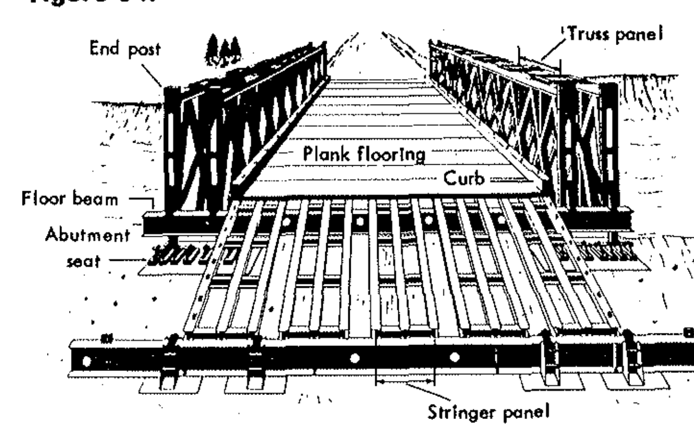
Cableways

A cableway (fig. 87) is a device used for crossing obstacles when other methods are impractical because of high banks or swiftness of current, conditions which may be encountered in mountainous terrain. A cableway consists of a track suspended between two towers



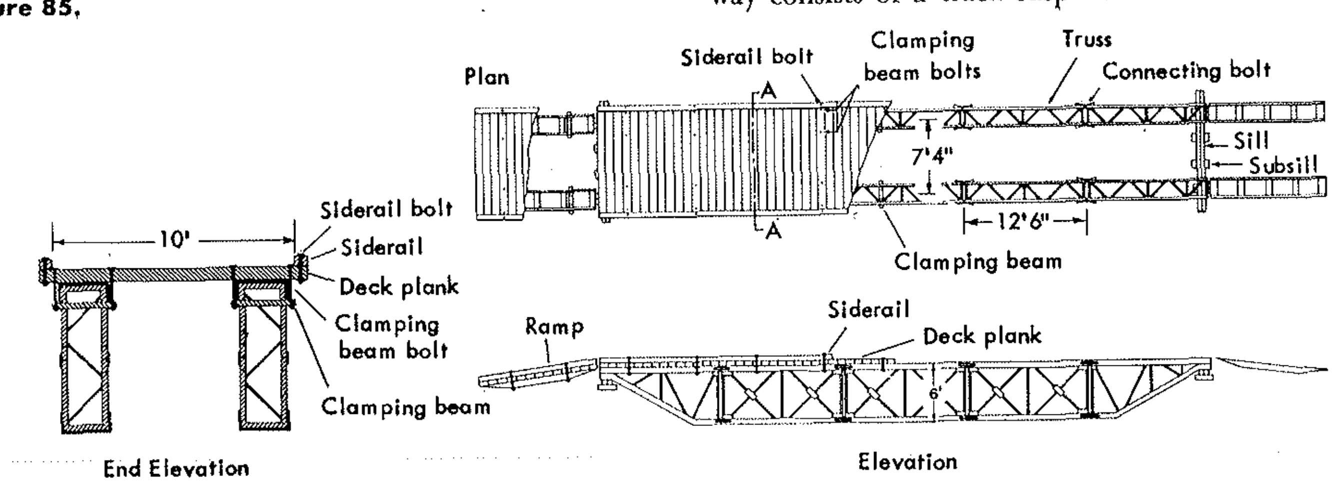
DECK PLATE GIRDER RAILROAD BRIDGE

Figure 84.



THROUGH TRUSS BRIDGE (BAILEY TYPE)

Figure 85.



GIRDER TYPE FIXED BRIDGE

Figure 86.

and anchored behind each tower. The traveling carriage, which is the load carrier, is suspended from the track cable and is usually drawn back and forth across the span by a cable attached to a power unit.

ELEMENTS OF INFORMATION

In collecting intelligence information, the following checklist regarding bridges and stream-crossing equipment will be helpful:

All Equipment

1. What is the official nomenclature (name and model)?
2. What is the purpose of the equipment?
3. What does the item look like? (Describe the equipment or send a picture of it.)
4. What is the maximum allowable stream velocity (in feet per second) for the safe use of floating equipment?
5. How long does it take to assemble this equipment or place it in operation? Number of men required? Are special devices used?
6. To what troops is the equipment issued and in what quantities?
7. How is it transported? Is special transportation equipment provided? What are the type and quantity?
8. What is the evaluation given this equipment by the military forces using it?
9. What tactical doctrine covers the use of this equipment?
10. What is the military issue classification: standard, substitute standard, limited standard (obsolescent), or limited procurement (experimental)?
11. What are the components of a complete set? How many are there of each?

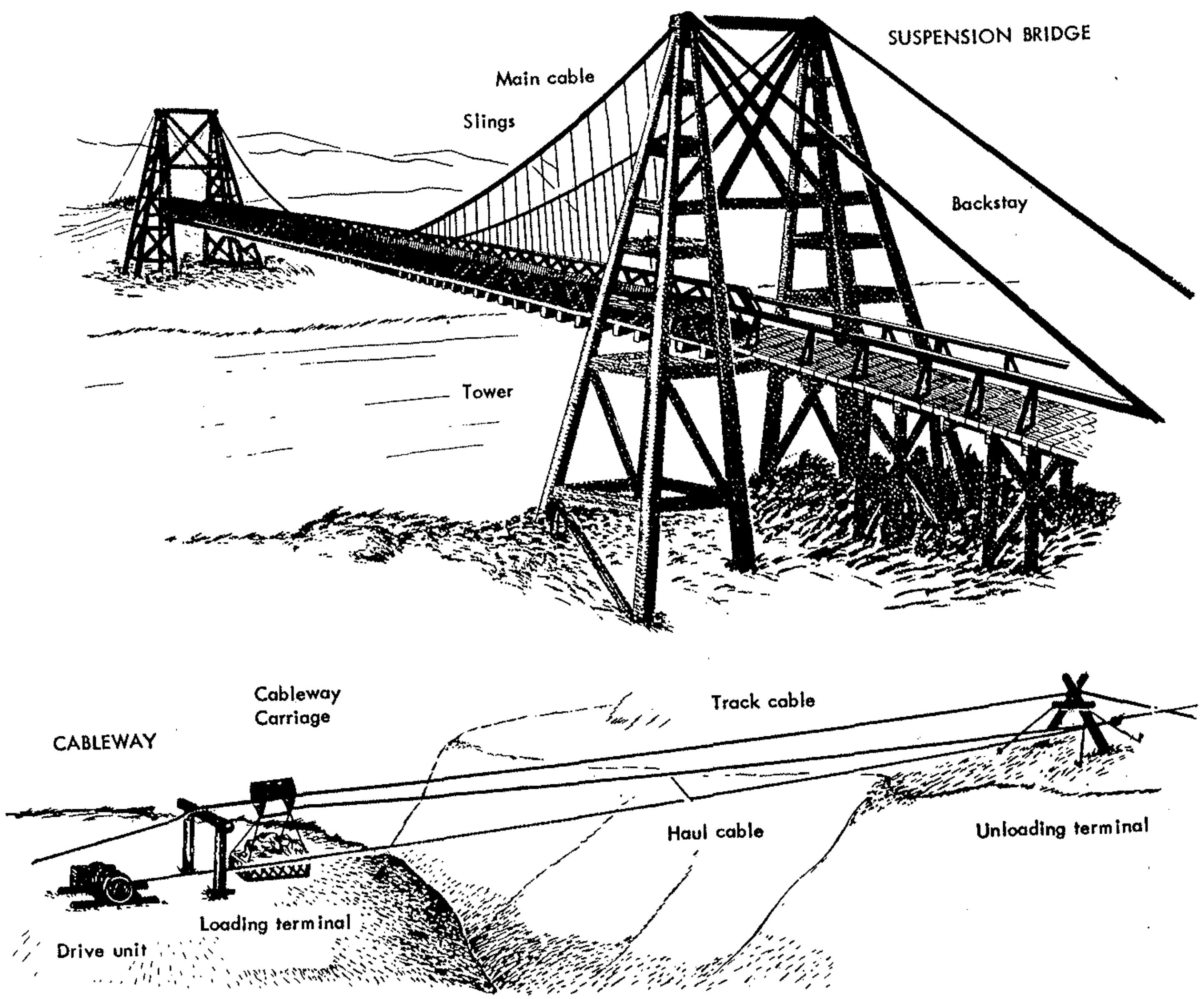


Figure 87.

Specific Equipment

1. *Individual Equipment.*

a. What are the physical characteristics (shape, material, weight, and dimensions)?

b. Are oars (fig. 89) or paddles (fig. 73) provided for propulsion?

c. What means are provided to prevent the suit from filling with water?

2. *Boats* (fig. 90).

a. What is the boat's primary use? Its secondary uses, if any?

b. What is its shape? Weight (without propulsion unit)? Overall dimensions? Draft? Material?

c. What provisions (such as compartments or the use of a foamlike material) exist for maintaining buoyancy when the hull is punctured?

d. What is the load-carrying capacity (men, pounds)? What is the freeboard (in inches) when loaded?

e. What are the methods of populsion? If by motor, what is the type? Weight? Fuel and rate of consumption? Horsepower? How mounted on the craft? What is the boat's maximum speed under various loadings?

f. If the equipment is of the pneumatic type, what provisions are provided for inflating it?

g. Are oar locks, life lines, and saddle straps organic parts of the equipment?

h. Are they nestable? How are they transported?

3. *Floating Bridges.*

a. What is the type of floating element (pneumatic

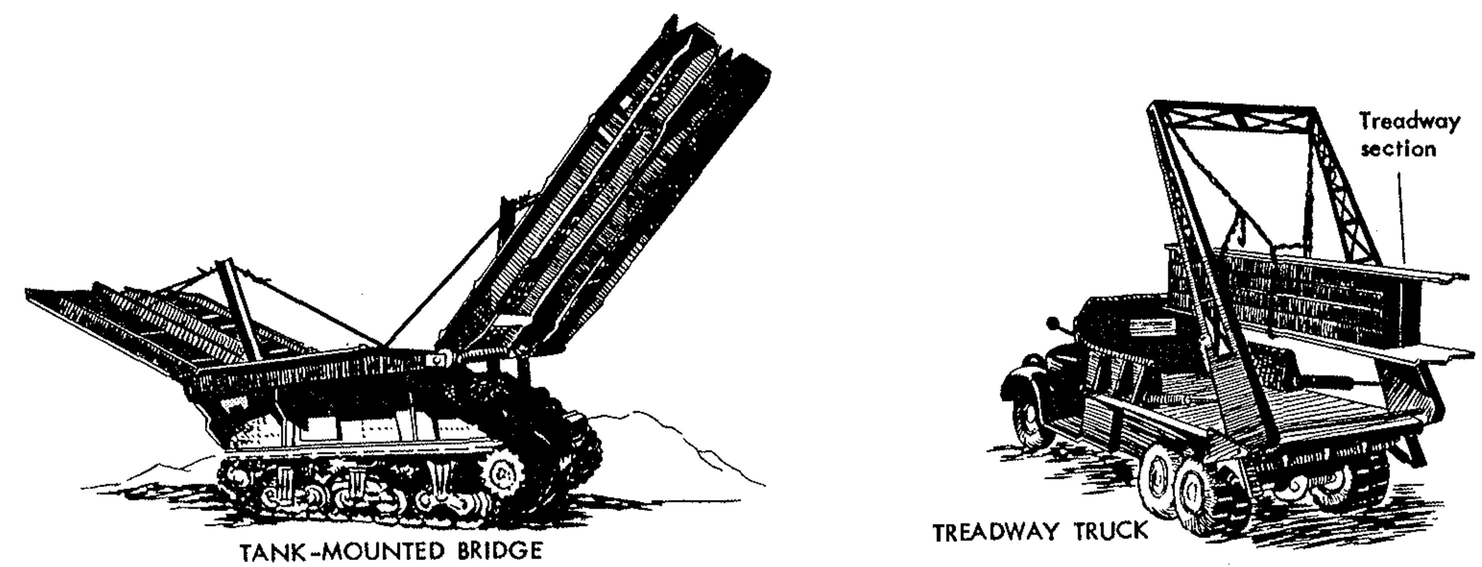


Figure 88.

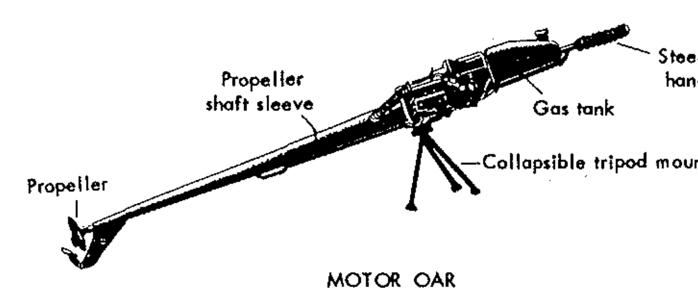


Figure 89.

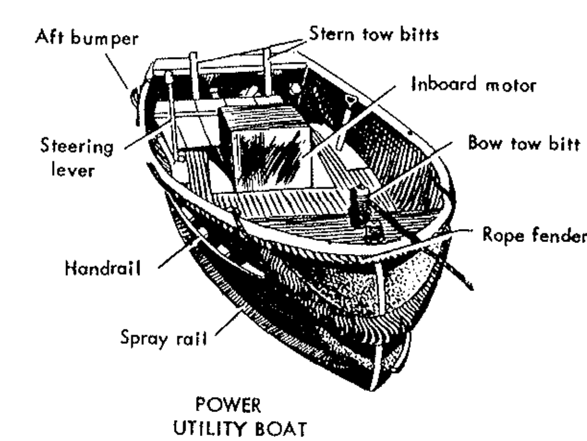


Figure 90.

float or boat)? (Use boat checklist for reporting this item.)

b. What is the spacing between the floating elements (center to center)?

c. What means are provided for fastening the superstructure? Is there a prefabricated saddle issued with the pneumatic float? Of what material is the pneumatic float or boat made? What are its dimensions and weight? If the boat type, does it have removable gunwales?

d. What is the type of superstructure? Balk? Balk and chess? Treadway? Duckboards (for personnel)? What are the physical characteristics of these elements (shape, material, and dimensions)? What are the spacing and the means of fastening the elements of the superstructure together? Are curbs and handrails provided? How are they held in place? What is the roadway's width?

e. What are the component elements of the spans connecting the floating portion of the bridge to the shore? If a trestle is provided, what are the shape, material, and dimensions of the shoe, column, transom, and bracing? Are the connecting spans adjustable?

f. What equipment is provided, and by what means is the bridge anchored?

g. What is the maximum length of bridge that can be built from this equipment? What is its load capacity (in tons)? Is it axle-loading?

h. May the normal bridge be reinforced to increase its capacity? How? To what capacity?

i. What special equipment (e.g., cranes, power boats, outboard motors) is issued to facilitate assemblage?

j. At what maximum speed may vehicles cross? Wha is the spacing required for various vehicle weights?

k. Can rafts and ferries be assembled from thi equipment? What component elements are used? Wha is its load-carrying capacity? What is the means of prc pulsion? Speed of raft and ferry, loaded and unloaded What shore provisions are needed for loading an unloading?

4. *Fixed Bridges.*

a. What are the material, shape, weight, and overal dimensions of the component parts?

b. What is the shape (cross-section) of the indi vidual members of those elements which are built-u sections—truss panels, trestles, towers, and similar com ponents? Are the joints welded, riveted, or bolted?

c. How are the connections between the separate ele ments made? Are special tools required?

d. What is the method of launching? Is special equip ment (rollers, launching nose, other) required?

e. What is the maximum length of bridge that car be erected from this equipment? What is its capacit (for railroad bridges indicate E loadings)? What is th bridge's roadway clearance? Is a separate walkwa provided?

f. What equipment is provided for anchoring th main cables of the suspension bridge and the cableway

g. For the cableway, what is the capacity of the car riage (load carrier), and at what speed can maximur loads be moved? What types of drive and hoist unit are provided?

CHAPTER 11

Construction Equipment

INTRODUCTION

World War II showed that success in modern warfare depends partly upon the ability of armies to construct rapidly the facilities required to move mechanized weapons and equipment.

The magnitude of the wartime construction effort led to acceptance of numerous pieces of construction equipment as essential items of war materiel. The best known of these is the bulldozer, generally regarded as the "miracle tool" of the war. There were a great many other construction tools, however, which also played a vital role in military activities in every theater of operations. Among them were the power shovel, the road grader, the scraper, and the air compressor—to name only a few.

This chapter is intended to provide a guide for obtaining desired information on construction equipment of foreign armies. To facilitate the treatment, all construction equipment has been placed arbitrarily within the following six categories: (1) earthworking; (2) concrete, bituminous, and soil-aggregate; (3) powered hand tools; (4) pit and quarrying; (5) loading and transporting; and (6) miscellaneous.

EARTHWORKING EQUIPMENT

Earthworking equipment (figs. 91 through 96) is that used for excavating, moving, grading, or compacting earth. The principal items of such equipment, with a brief description of the primary purposes which each serves, are as follows:

Earth Augers

Earth augers (fig. 91) are designed for boring holes in the earth for such construction purposes as setting posts and placing explosives.

Bulldozers And Angledozers

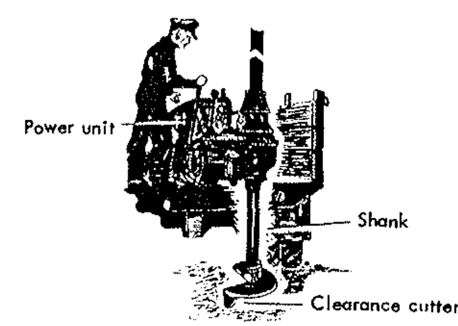
Bulldozers and angledozers (fig. 92) are used as tractor attachments for excavating, moving, and rough-grading earth.

Ditchers

Ditchers (fig. 93) are used for general-purpose ditching and trenching.

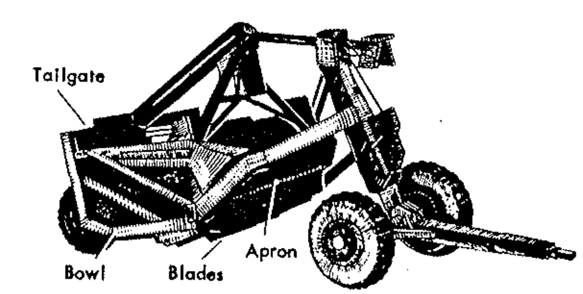
Graders

Graders (fig. 94) are used for construction and maintenance work, such as shaping roadways, trimming shoulders, road ditching, and bank cutting.



EARTH AUGER

1

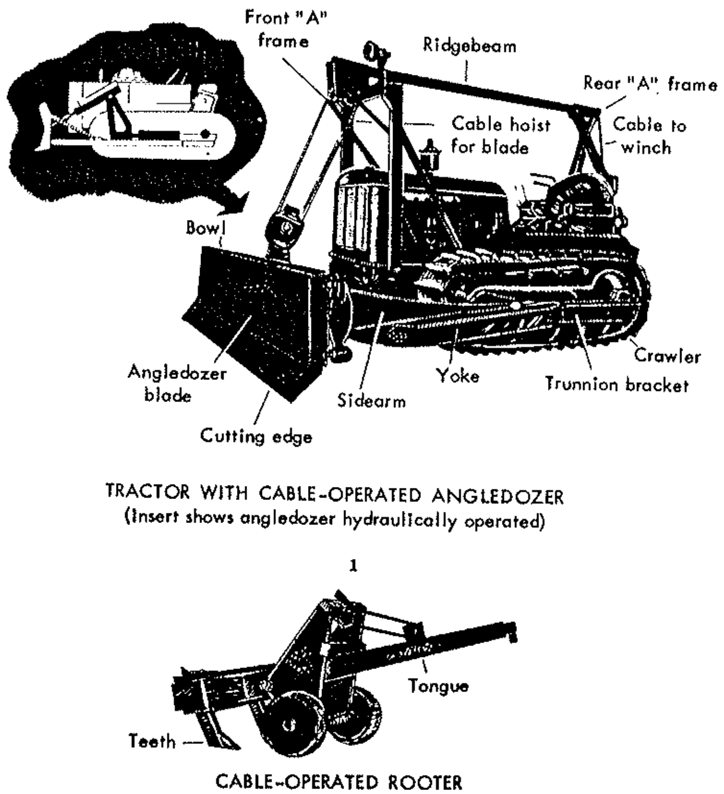


CABLE-OPERATED SCRAPER (CARRYALL)

2

Figure 91.

Sheeps foot rollers (fig. 95) are used for compacting earth subgrades and fills; smooth-drum (smooth-wheeled) rollers (fig. 95) are used principally for compacting stone subgrades and finished surfaces. Rubber-tired rollers are used for compacting soils; they may be used in conjunction with sheeps foot rollers. The roller shown in figure 95 generally has the same number of tires in the rear as in the front, but the former are on a fixed axle.



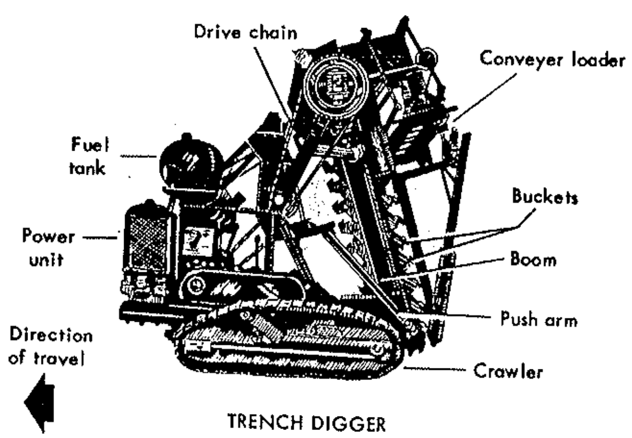
TRACTOR WITH CABLE-OPERATED ANGLEDOZER
(Insert shows angledozer hydraulically operated)

1

CABLE-OPERATED ROOTER

2

Figure 92.



TRENCH DIGGER

Figure 93.

Rooters

Rooters (fig. 92) are used for breaking up hard eart surfaces in advance of the use of scrapers and grader: and for further separating hard surfaces previousl broken up by blasting or by pneumatic hammers.

Scrapers (Carryalls)

Scrapers (fig. 91) are used as a self-loading unit fo excavating, hauling (short distance), and spreading.

Shovels And Cranes

Shovels and cranes (fig. 96) are used primarily fo excavating or loading. There are no rigorous definition distinguishing between earth-moving shovels and cranes Both terms are applied to crawler- and truck-mountec power equipment which may be converted into a shovel dragline, clam shell, orange peel, or trench hoe, de pending upon character of boom, rigging, and bucke used.

Tractors

Tractors (fig. 92) are used as prime movers for towec construction equipment and as separate operating unit: when equipped with one or more attachments, such a: angledozers and bulldozers, bucket loaders, cranes, pilе drivers, pipe layers, or winches. The tractor is the mosi important single item of earthworking equipment.

CONCRETE, BITUMINOUS, AND SOIL-AGGREGATE EQUIPMENT

Various types of concrete, bituminous, and soil-aggregate equipment (figs. 97 through 102) are used for the preparation, placement, and finishing of suitable mixes of cement, bitumens, and clay, respectively, with selected aggregates (such as sand and gravel). The principal items of equipment in this category are listed below, with indications of their primary functions:

Concrete Mixer

A rotating drum unit (fig. 97), used for mixing cement with water and aggregate.

Batching Plant

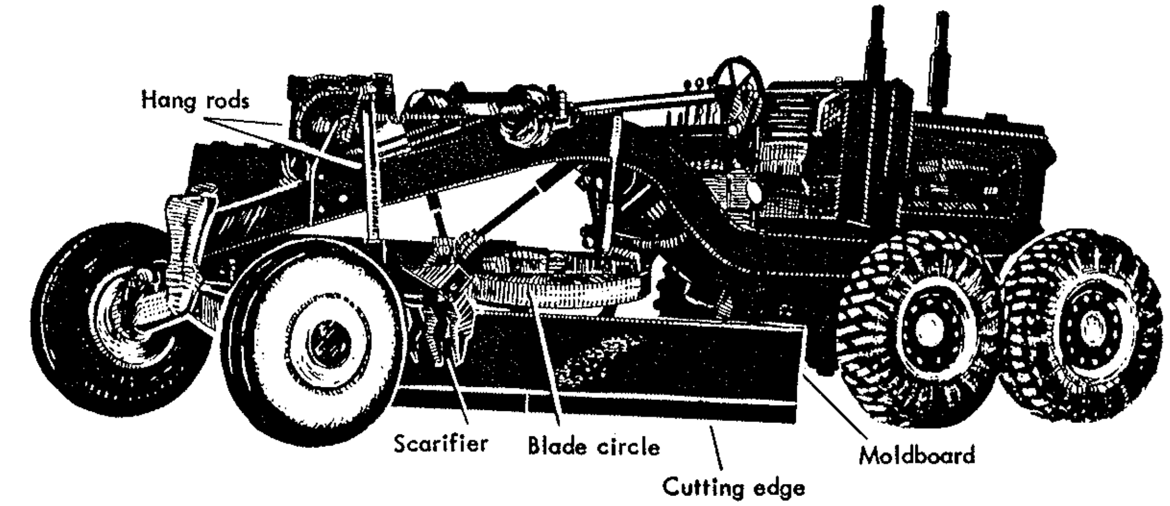
An elevated structure (fig. 98) with compartments for storing separately and measuring out fine (sand) and coarse (gravel, rock, or other) aggregate. It may feed into the loading hopper of a concrete mixer. More elaborate plants may be equipped to handle bulk cement as well as aggregate.

Paver, Concrete

A type of concrete mixer (fig. 99) provided with a boom and bucket for distributing the concrete after mixing.

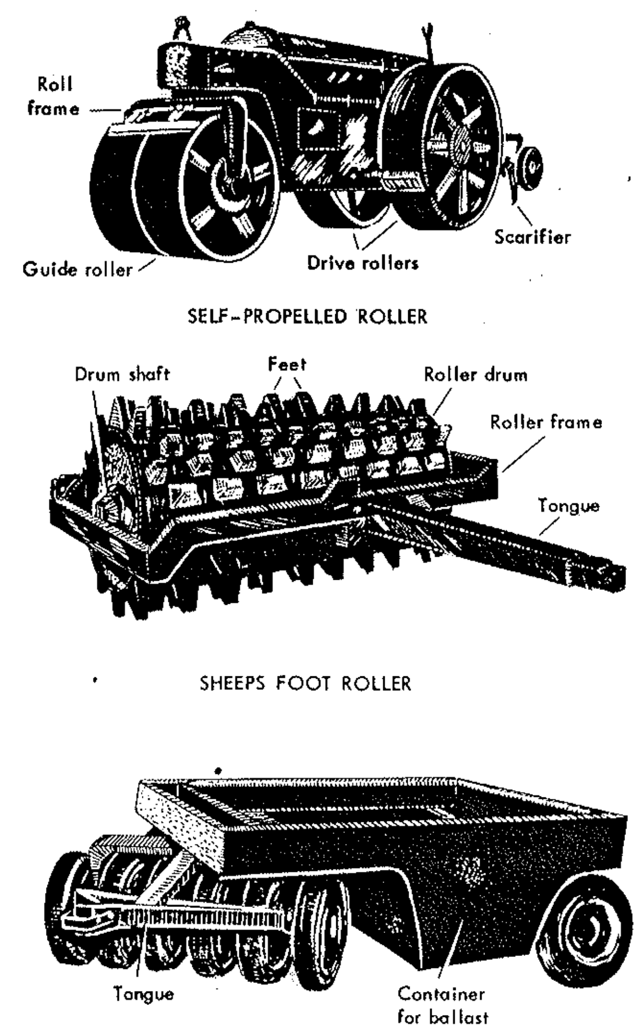
Spreader, Concrete

A machine (fig. 98) which bridges the area being surfaced and, by means of a moving blade, uniformly spreads the fresh concrete.



MOTORIZED GRADER

Figure 94.



SELF-PROPELLED ROLLER

SHEEPS FOOT ROLLER

RUBBER-TIRED ROLLER

Figure 95.

Finisher, Concrete

A machine (fig. 97) which bridges the area being surfaced and, by the sidewise movement of a surface template (screed), finishes the surface of the fresh concrete.

Bituminous Plant

A unit for mixing bitumen and aggregate and, in some cases, for spreading and finishing the mix also.

1. *Central Plant* (fig. 100). A unit operated in place and used only in the mixing process. Components include the mixer, loader, dryer, heater, pumps, and bitumen storage tank. Mix is distributed by truck.
2. *Traveling Plant* (fig. 100). A unit which travels over the area being surfaced. This unit consists of a loader (which picks up aggregate deposited on the area to be surfaced) and a mixer, and generally includes a spreader and finisher. If the unit includes a spreader and finisher, it performs the entire mixing, spreading, and finishing process as it travels.

Bituminous Distributor

The bituminous distributor (fig. 101) is a truck- or trailer-mounted tank, equipped with an apparatus for spraying liquid bitumen under pressure onto the surface of a roadway.

Soil-Aggregate Stabilizer

The soil-aggregate stabilizer (fig. 102) is a plant which prepares and proportions clay for mixing with selected aggregate (such as sand and gravel) to provide a stable mixture for roadway surfacing.

POWERED HAND TOOLS

Powered hand tools (fig. 103) are manually supported and guided in their operation. Power for driving

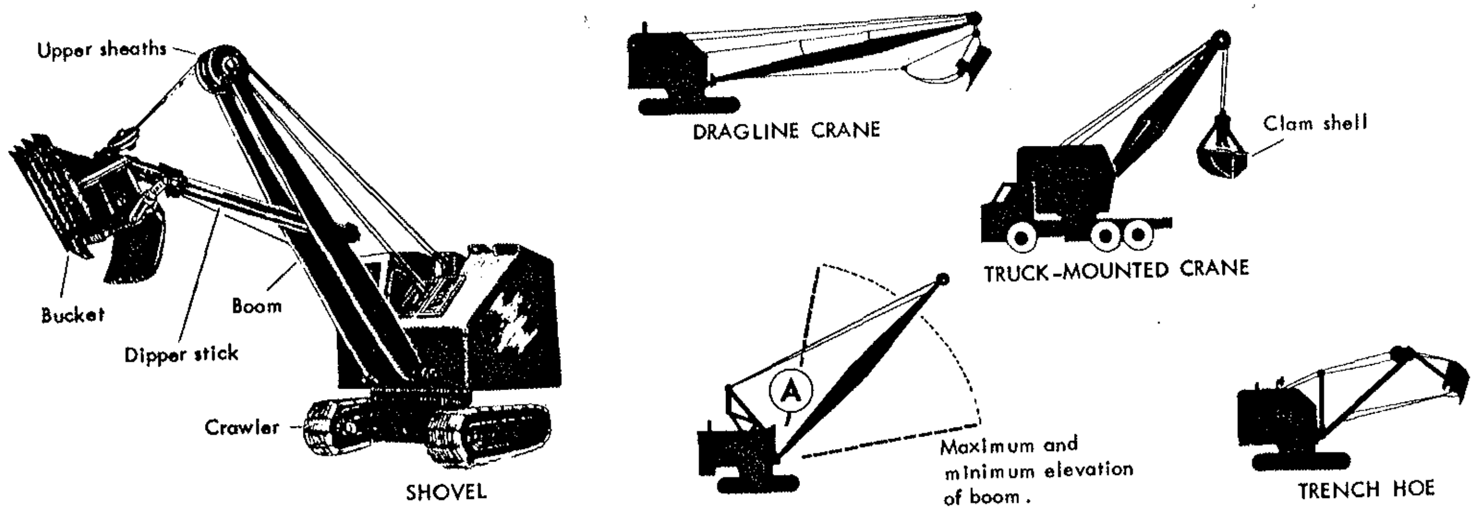


Figure 96.

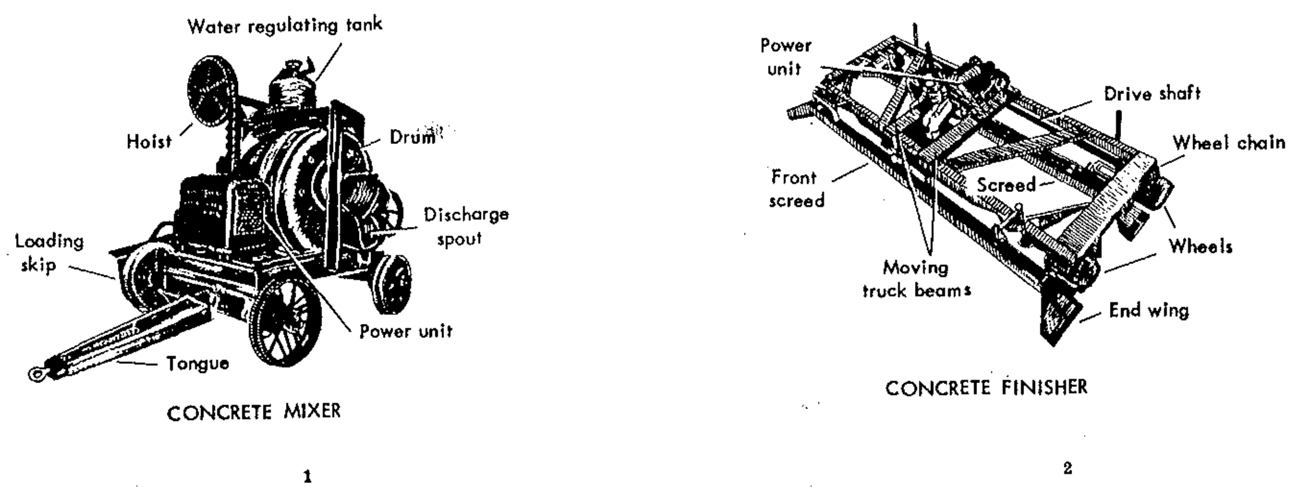


Figure 97.

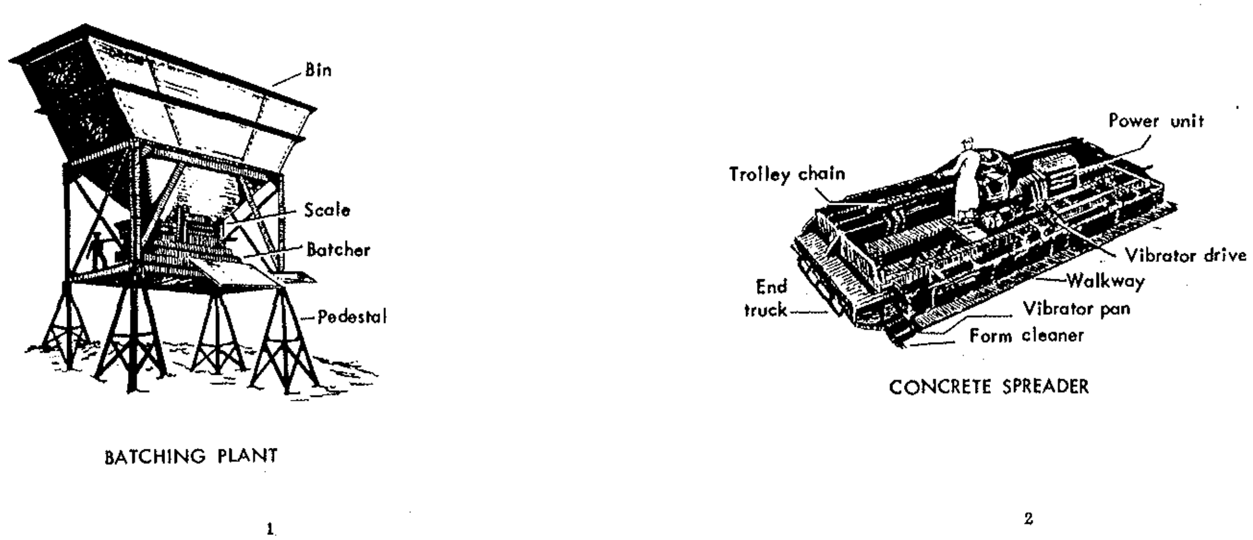


Figure 98.

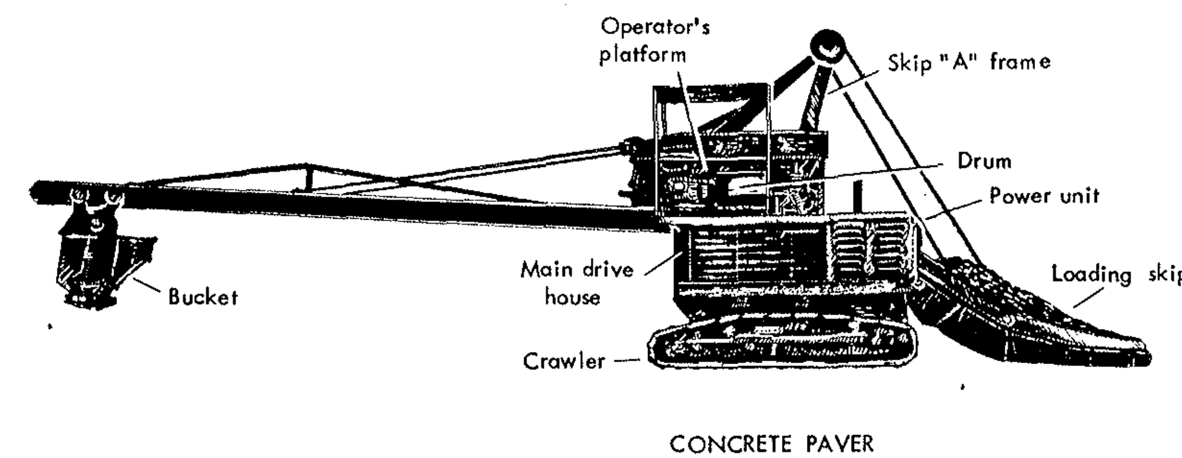
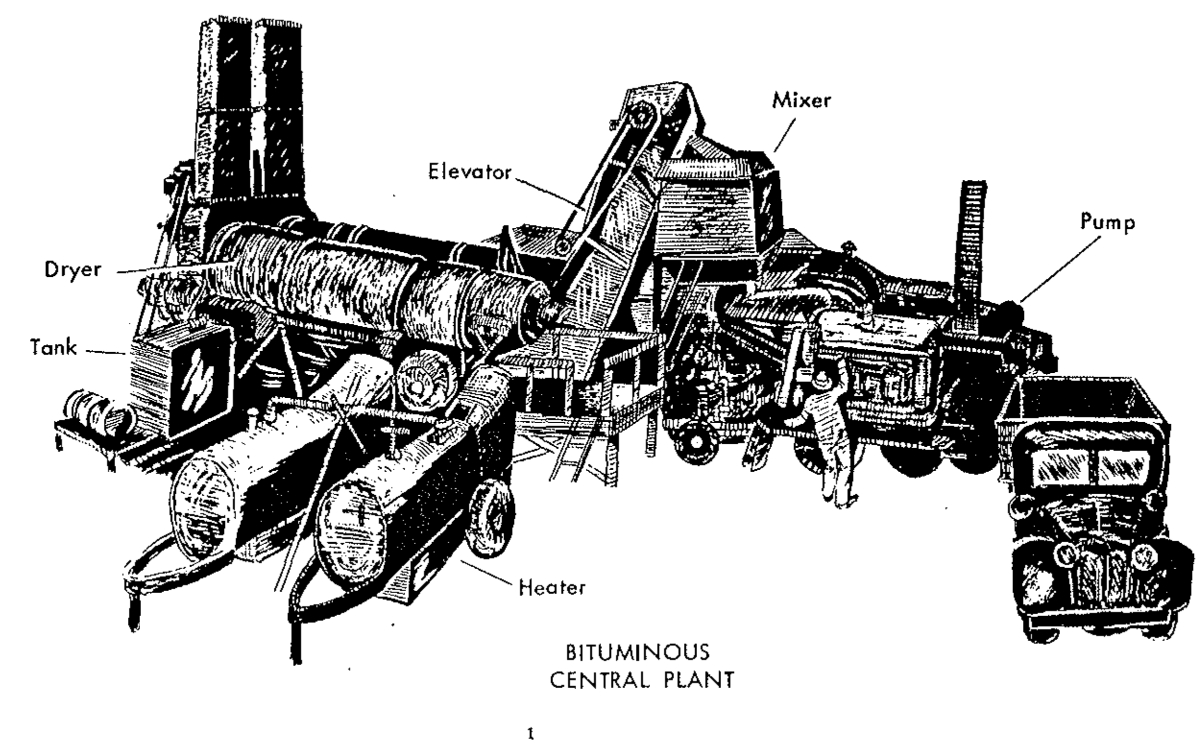


Figure 99.



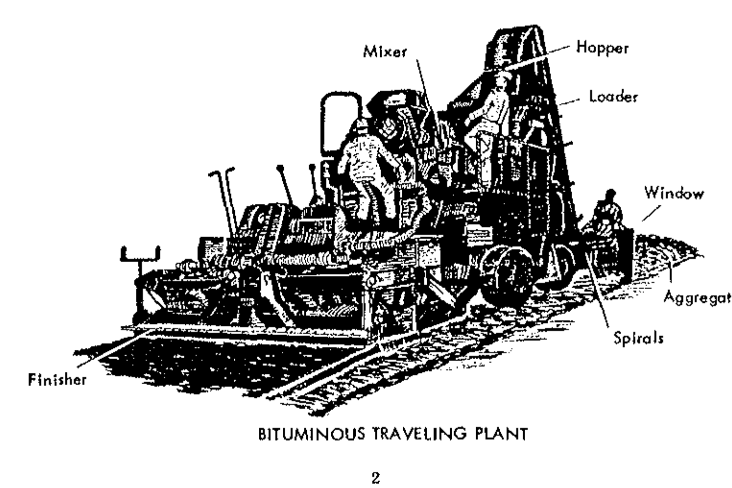


Figure 100.

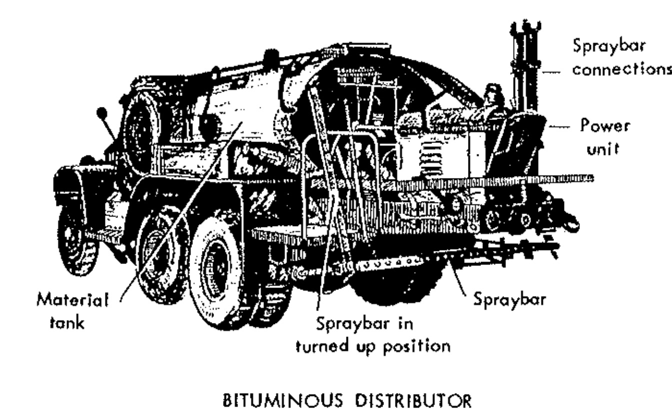
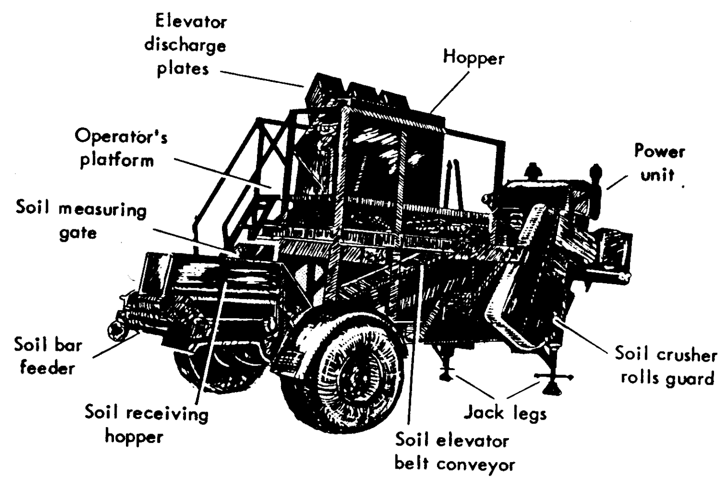


Figure 101.



SOIL-AGGREGATE STABILIZER

Figure 102.

such tools may be supplied by electricity, compressed air, or internal combustion engines. The more important powered hand tools are listed below, with a statement of their primary use.

Pneumatic Driving Tools

There is a variety of such tools. The most common is the jackhammer (pavement breaker) (fig. 103), with a number of special-purpose attachments (spaders, tampers, picks, points, and drills) for breaking up and drilling through paving and rock, cutting into earth and bituminous paving, tamping earth and rock fill, and other similar uses.

Saws

The chain-type saw is used for felling trees and for cutting logs and lumber; the circular-type saw, for general carpentry (fig. 103).

Wood And Steel Drills

Wood and steel drills are used for carpentry and metal work.

Spray Units, Points

Paint spray units are used for applying paint to surfaces.

Riveting Hammer

Riveting hammers (fig. 103) are used for driving hot or cold rivets in steel construction. The basic unit also may be equipped with a small chisel for chipping hard surfaces.

Nail Drivers

Nail drivers (fig. 103) are used to drive heavy nails and spikes.

LOADING AND TRANSPORTING EQUIPMENT

Loading and transporting equipment is used for loading material into storage bins or transport vehicles, and for conveying and transporting material. The principal items in this category are listed below, with a description of the primary purpose.

Loaders, Bucket Type

Loaders, bucket type (fig. 104) are used for elevating loose materials and for loading into transport equipment.

Loading Skips (Buckets)

Loading skips (buckets) (fig. 105) are employed as attachments to self-propelled vehicles for the removal and loading of loose or packed materials.

Conveyors

Conveyors (fig. 106) are used in loading material on an inclined plane or in conveying material horizontally to a desired location.

Cableways

Cableways are used in transporting material or personnel over difficult terrain.

Wagons, Truck, Tractor, and Animal-Drawn

In some countries, wagons mounted on railroad wheels and operated over portable track are widely used for the transport of material over short distances. (A wagon is shown in fig. 104).

Dump Trucks

Dump trucks (fig. 107) are used in transporting bulk materials, and usually they are unloaded by hydraulic means.

GRAVEL-PIT AND QUARRY EQUIPMENT

Gravel-pit and quarry equipment is used in drilling, crushing, grading, and washing sand and rock aggregate. The principal items of such equipment are listed below, with a brief description of their use.

Drill-Wagon

This equipment (fig. 108) is used for deep-drilling (to a depth of as much as 30 ft.) of holes in rock for the placing of explosives. The unit may be adjusted for vertical or horizontal drilling.

Crusher

The crusher (fig. 109) is used to crush stone to proper size for use in concrete, bituminous, or stabilized earth mixes, or for the construction of subgrades. Crushers are of the jaw or roll type.

Screens

Screens (fig. 110) are used in grading stone and sand according to size. Screens may be of the rotary or vibrating type.

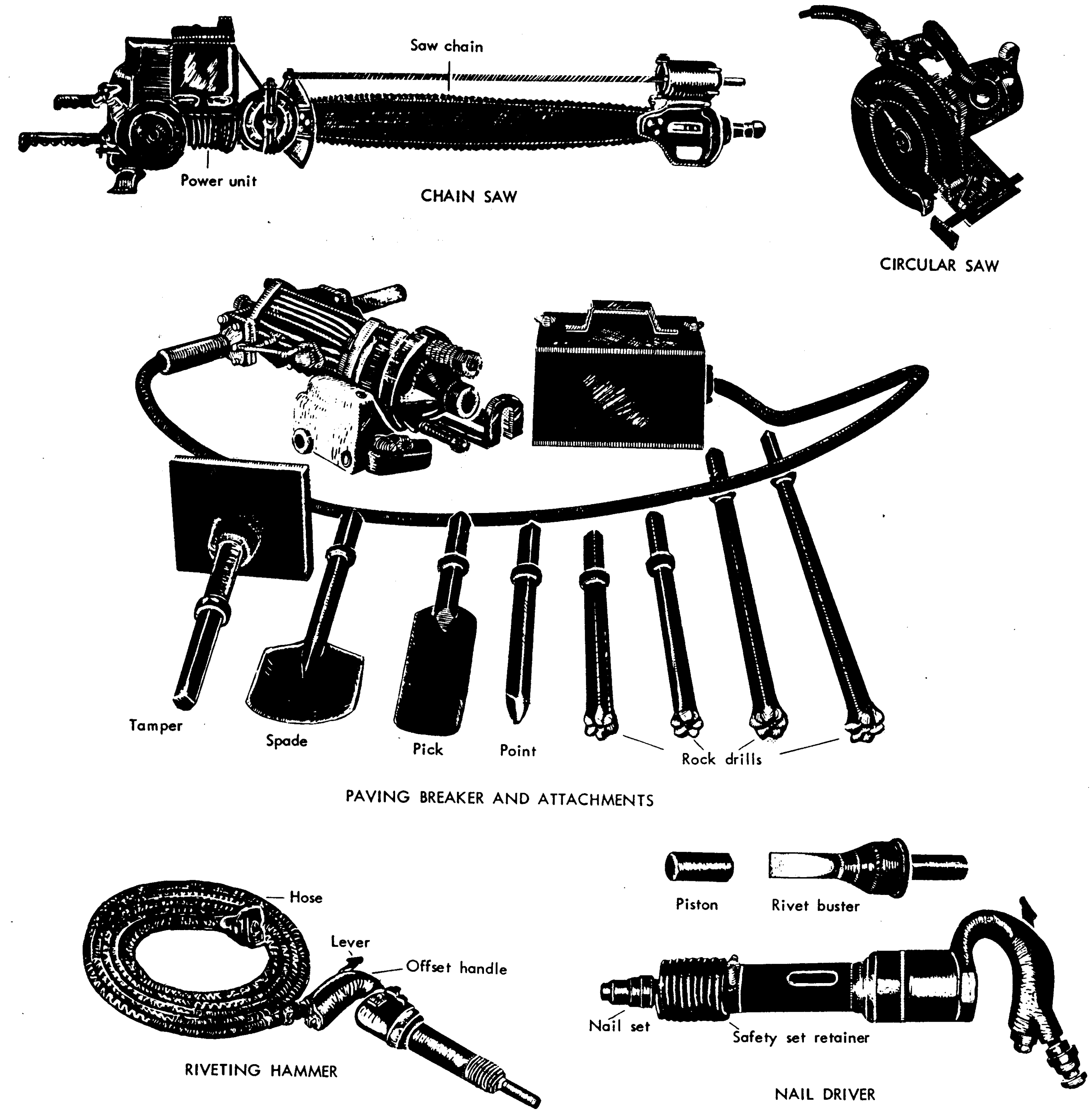
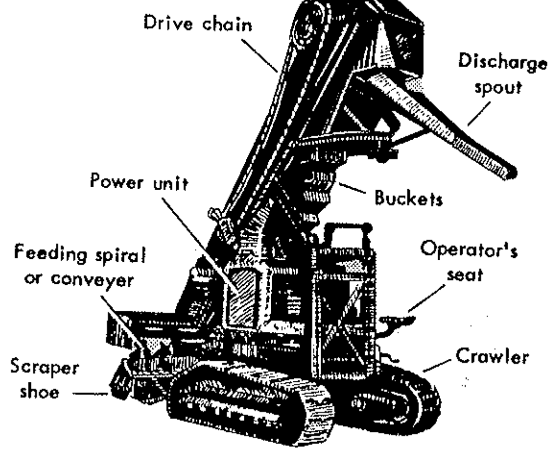
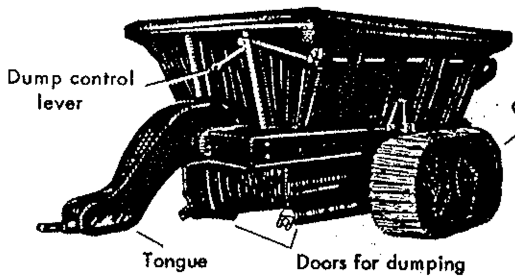


Figure 103.



MULTI-BUCKET LOADER

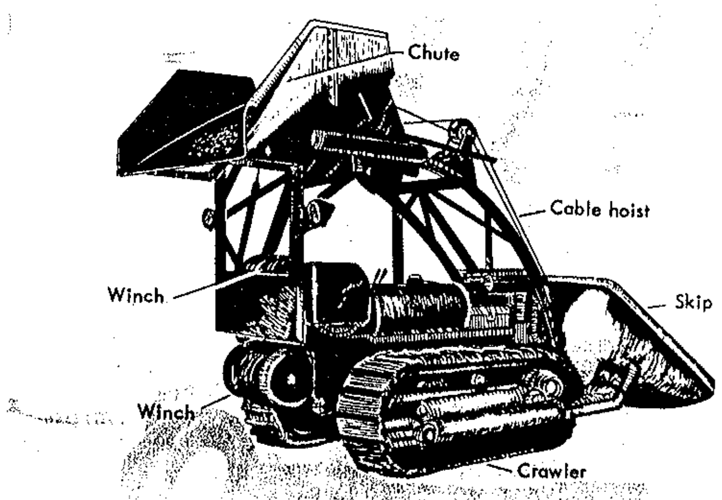
1



WAGON

2

Figure 104.



LOADING SKIP

Figure 105.

Washers

Washers are used for washing out foreign matter from stone and sand.

MISCELLANEOUS EQUIPMENT

Snow Plow, Blade Type

Snow plow, blade type (fig. 111) is used in scraping snow and then pushing the loosened snow to the side of runways, roads, etc.

Snow Plow, Rotary Type

Snow plow, rotary type is used for picking up snow and blowing snow into vehicles or from the area to be cleared.

Pile Drivers

Pile drivers (fig. 112) are used in driving or jetting round or square piles, or for driving sheet piling. Pile drivers, designed as attachments to mobile cranes, are rapidly replacing other types of pile drivers on military construction. A complete pile driver consists of hammer, leads, or guides; tower; and a power-lifting unit. The hammer may operate by gravity or be operated by steam, air, or an internal-combustion engine.

Air Compressors

Air compressors (fig. 111) are used to supply air under pressure for operation of powered hand tools, and for driving operations.

Electric Generators

Electric generators are used to provide electric current of required characteristics for operation of powered hand tools or for lighting purposes.

Saw, Circular

The circular saw (fig. 113) is designed as a tractor attachment for felling trees.

Sawmill, Portable

Portable sawmills (fig. 114) are used for converting logs into lumber.

Planer

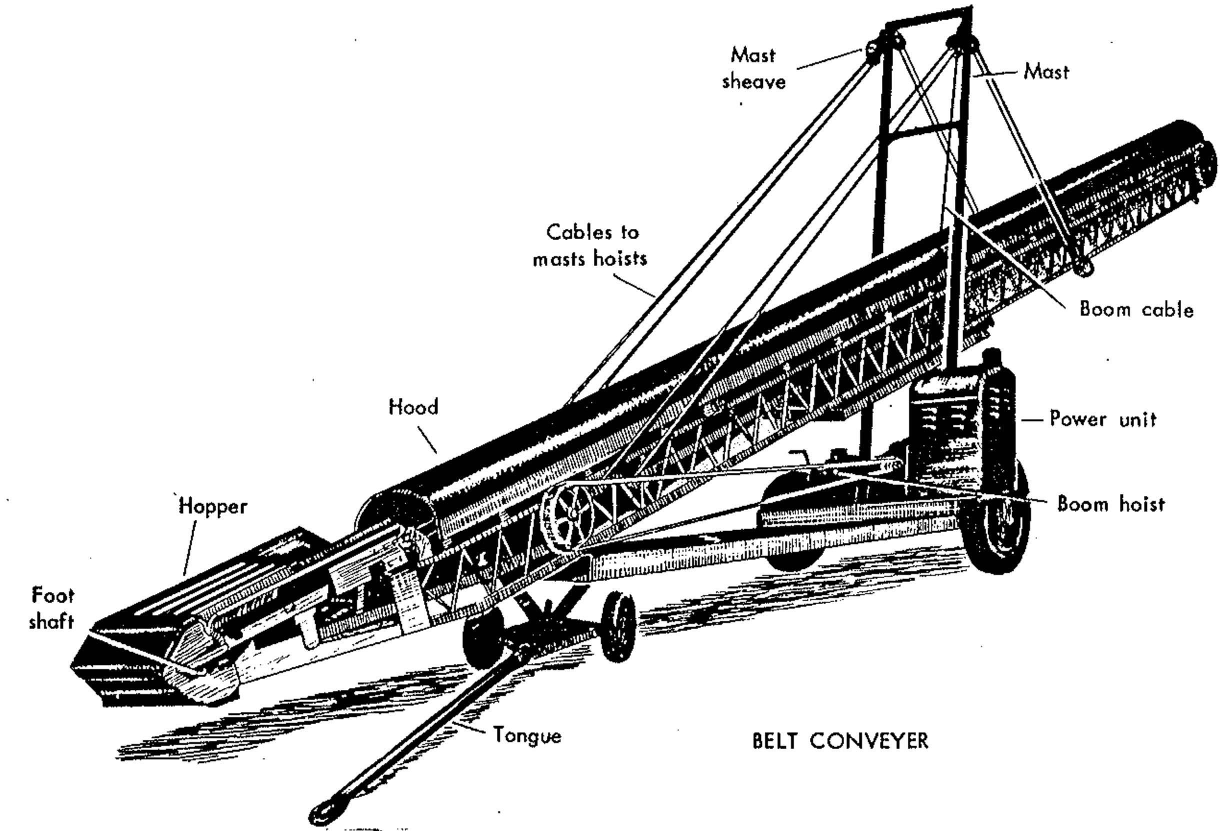
A planer is used for dressing rough lumber.

Welder, Electric-Arc

The electric-arc welder consists of a direct current generator, a power unit for operation of the generator, lead cables, and a torch. The electric generator is used for generation of high-amperage direct current. The torch is used for holding the electrode, which is fuzed with the metallic parts to be united.

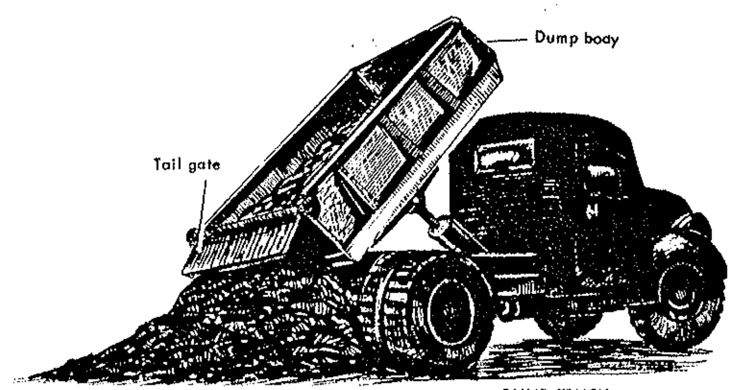
Welder, Oxygen-Acetylene

This equipment (fig. 115) consists of separate containers for oxygen and acetylene, regulating gages and valves on each container, a hose connected to each container, and a torch to which the two hoses are connected. The gases are burned at the end of tips of various types depending on the kind of work to be performed. Welding rods, longer than those used in electric arc-welding, are held in the hand during the fusion process.



BELT CONVEYER

Figure 106.

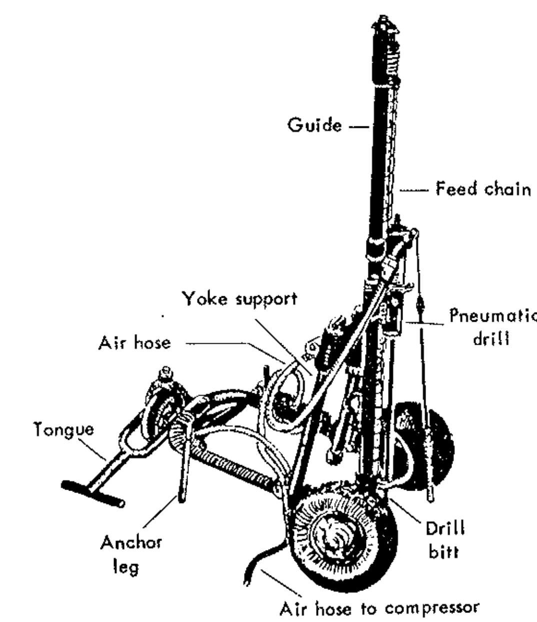


DUMP TRUCK

Figure 107.

Shallow-Water Diving Equipment

This equipment (fig. 112) consists of a hand pump or air compressor, rubber sneakers, diver's underwear, an expansion tank when used with a hand pump, a face mask, and a weighted belt. The hand pump is not used for diving operations where water exceeds 30 feet in depth. Diving operations with this equipment are limited to 60 feet.

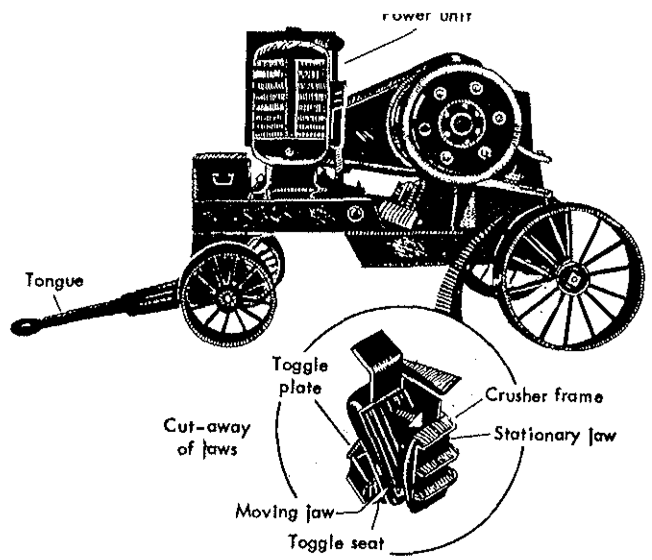


WAGON DRILL

Figure 108.

Deep-Water Diving Equipment

This equipment consists of a specially designed air compressor, a diver's suit, a metal helmet and breastplate, and weights. A stage may be used in lowering



ROCK CRUSHER (JAW TYPE)

Figure 109.

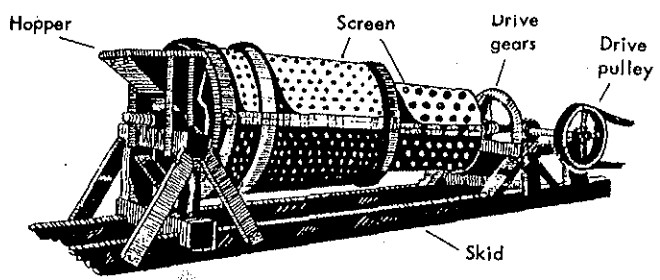
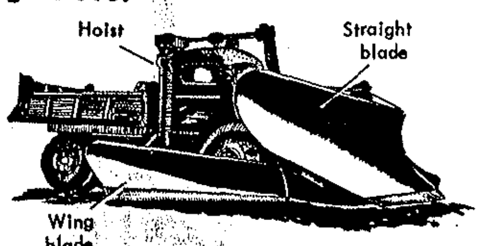
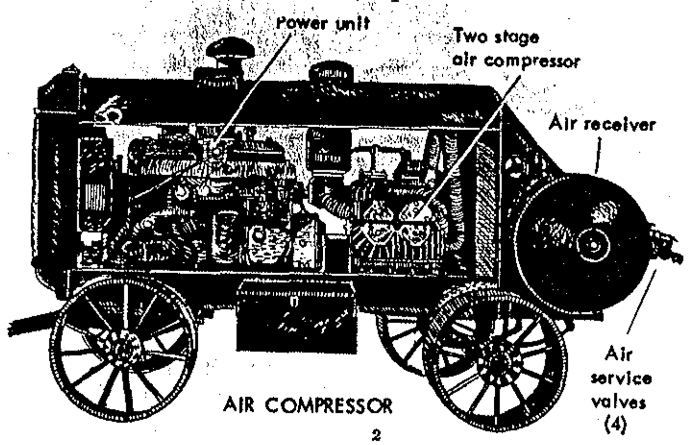


Figure 110. ROTARY SCREEN

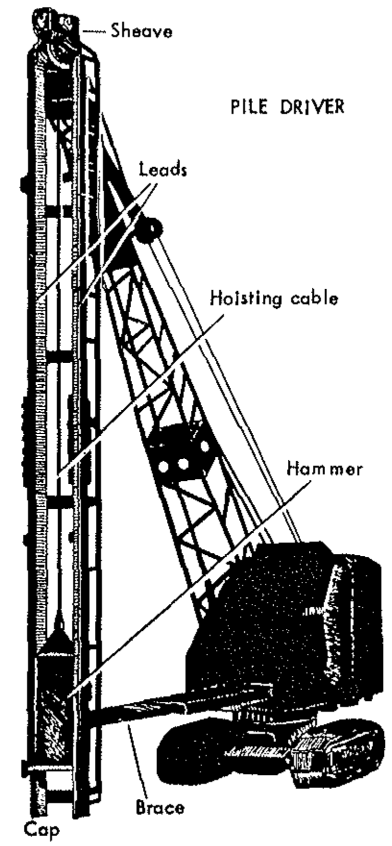


SNOW PLOW (BLADE TYPE) 1

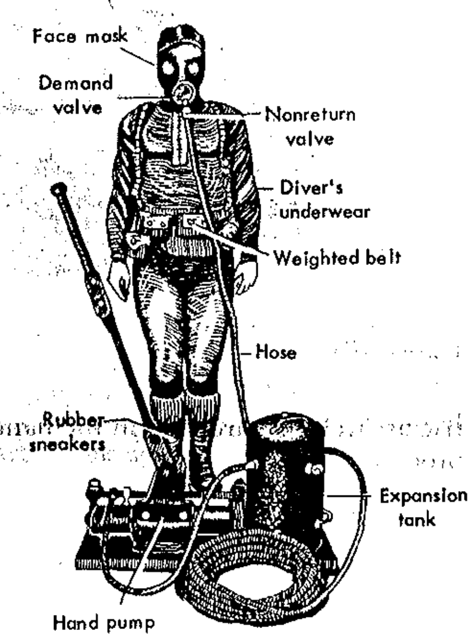


AIR COMPRESSOR 2

Figure 111.

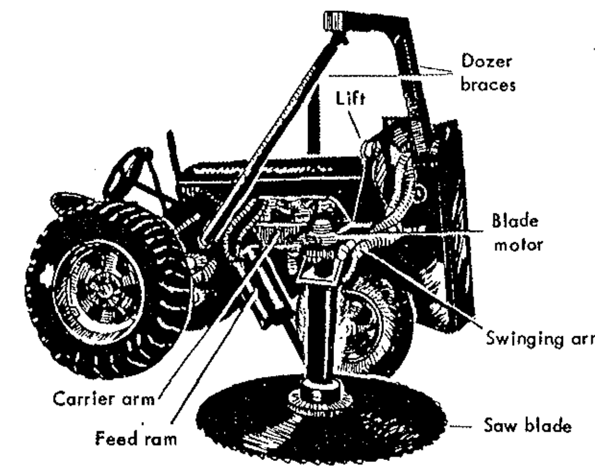


PILE DRIVER 1



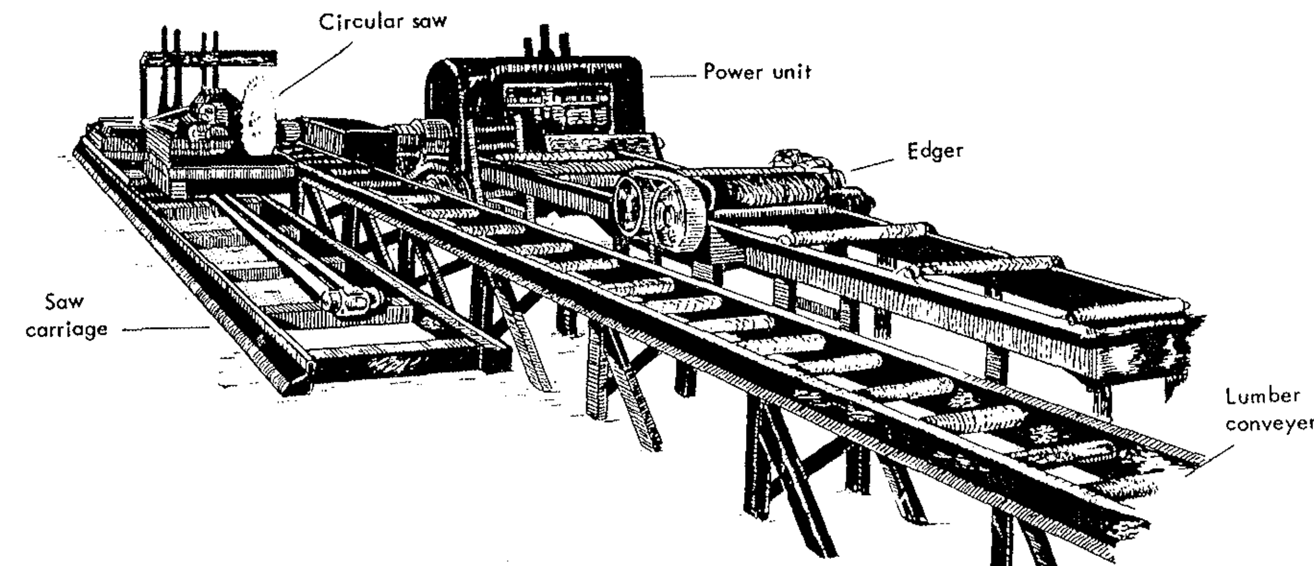
SHALLOW-WATER DIVING OUTFIT 2

Figure 112.



TRACTOR-MOUNTED SAW

Figure 113.



SAW MILL

Figure 114.

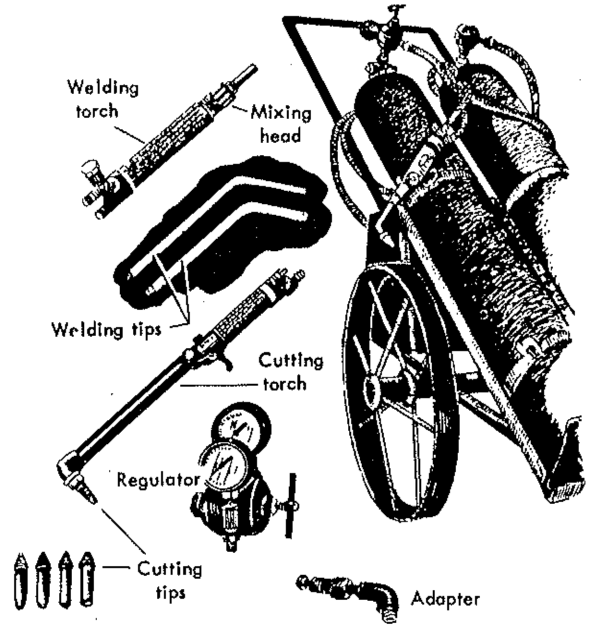
the diver to the required depths. A compression chamber may be provided to treat divers injured by sudden changes in pressure. This equipment is used for depths up to 300 feet.

ELEMENTS OF INFORMATION

Detailed and technical information on construction equipment may be available in photographs, technical documents, and reports of actual tests. Much valuable information may also be obtained by visual inspection and by interrogation. In collecting information, the following checklist may serve as a useful guide. The checklist is divided into sections, the first section listing the type of data desired on practically all types of construction equipment, followed by a section for each category of equipment listing the additional data desired on equipment in that category.

Applicable to All Construction Equipment

1. *Designation.* Name, make, and model. Replica of name plate, if any.
2. *Description.* A statement of the principal components which comprise the complete item of equipment.
3. *Purpose and Method of Use.*
4. *Issue.* Is the unit a standard military or civilian item?
5. *Dimensions.* Length, width, or diameter and height.
6. *Weight.* Net weight of unit without attachments, and gross weight of unit equipped for operation. Total load-bearing area in contact with the ground.
7. *Mounting.* Crawler, skid, wheel, or other. If wheel-mounted, the number of axles, spacing, and weight on each axle. If crawler-mounted, width and length of crawler tread.
8. *Mobility.* Towed or self-propelled. If towed, by what type of unit and at what speed? If self-propelled, maximum speed for each gear, and economical speed. Ease or difficulty of movement.
9. *Power Unit.* Designation (name, make, model), type (gasoline, Diesel, electric), rated horsepower (HP), brake horsepower (BHP), and draw bar horsepower (DBHP). If internal combustion engine, number of cylinders, capacity of fuel tank, and rate of fuel consumption. If electric, current characteristics (ac or dc, amperage, voltage, phase, cycles, and power factor).
10. *Rate of Performing Work.* This is defined as the



OXYGEN-ACETYLENE WELDER

Figure 115.

output in a specific time, such as cubic yards per hour or feet per minute.

11. *Operation.* Ease or difficulty of operation, personnel required for operation.

12. *Maintenance.* Ease or difficulty of maintenance. Type and frequency of maintenance required. An estimate of the general serviceability and ruggedness of the equipment under field conditions. Standardization and interchangeability of parts.

13. *Comparison With Similar Types of Foreign Equipment.*

14. *Availability.* Number on hand and condition, current production, potential production, names and locations of manufacturing and assembly plants, degree of dependence on foreign sources of supply.

15. *Attachments.* Types, characteristics, and use.

16. *Research and Development.* Where and to what extent are research and development being conducted on a particular type of equipment?

Applicable to Earthworking Equipment (figs. 91 through 96)

1. *Augers.* Range in diameter and maximum depth of hole bored.

2. *Bulldozers and Angledozers.* Maximum depth, width, and angle of cut. Is the cutting blade adjustable and, if so, to what extent? Is the blade operated by cables or hydraulically?

3. *Ditchers.* Range of widths and maximum depth of cut.

4. *Grader.* Maximum depth, width, and angle of cut. Is the cutting blade mechanically or hydraulically operated? Can the blade be adjusted for side-slope cutting?

5. *Rollers.* Effective ground pressure per square unit of measure.

6. *Rooter.* Number of teeth. Depth of penetration.

7. *Scrapers.* Width and depth of cut, capacity of bowl, and whether cable-operated or hydraulically operated.

8. *Shovels and Cranes.* Capacity of buckets, maximum lift at maximum and minimum angles, maximum and minimum radii of cut, maximum depth of cut, maximum height of discharge of bucket, and maximum degree of swing.

Applicable to Concrete, Bituminous, and Soil-Aggregate Equipment (figs. 97 through 102)

1. *Mixers, all types.* Cubic capacity of drum or pug mill; time required for mixing.

2. *Paver, Concrete.* Length of boom and capacity of bucket.

3. *Spreaders and finishers.* Range of adjustment for width of roadway, and production capacity in square yards of surface finished per hour.

Applicable to Powered Hand Tools (fig. 103)

General. Applicable to all types.

1. *Type of Power.* If air, what volume (CFM) and pressure are required? If electric, what are the electrical characteristics and kilowatts required? If internal combustion, what type of power unit is used and where is it attached?

2. *Saws, Chain.* Effective length.

3. *Pneumatic Drivers (Paving Breaker and Attachments).* List and describe all attachments.

4. *Saws, Circular.* Maximum depth of cut.

5. *Drill.* Type, maximum diameter, and depth of hole drilled.

6. *Spray Units, Paint.* Capacity of paint container.

7. *Riveting Hammer.* Maximum diameter of hot and cold rivets driven.

8. *Nail Driver.* Maximum size of nail or spikes driven.

Applicable To Loading And Transporting Equipment (figs. 104 through 107)

1. *Loader, Bucket Type.* Height of discharge, and is it equipped with spirals, paddles, or similar devices which act similarly to screw conveyers?

2. *Wagon.* Capacity of body. Direction of dump: rear, side, or bottom. Draw bar horsepower required for towing.

3. *Conveyers.* Effective length, and is it equipped with hopper or spirals at the lower end.

4. *Loading Skip (Bucket) Type.* Height of discharge. Cubic capacity of skip (bucket).

5. *Cableways.* Capacity and type of buckets. Total length and distances between cable supports. Vehicles required for moving unit.

6. *Dump Trucks.* Capacity of body. Direction of dump: side, or rear. Size and number of tires.

Applicable To Pit And Quarry Equipment (figs. 108 through 110)

1. *Screen.* Is it vibrating or rotary? What type of material does it handle? What are the size and cubic quantity of material produced in a specific time?

2. *Crusher.* Whether primary or secondary crusher. Type of crusher; jaw or roll. Maximum size of stone handled, sizes and cubic quantity of stone produced in a specific time.

3. *Drill, Wagon.* Maximum depth and diameter of hole drilled; volume (CFM) and pressure of air required.

4. *Washer.* Quantity and pressure of water required.

Applicable To Miscellaneous Equipment (figs. 111 through 115)

1. *Saw, Circular, Tractor Attachment.* Maximum diameter of tree cut.

2. *Sawmill, Portable.* Maximum dimensions of timber handled; capacity in board feet of sawed lumber produced; number of men required for operations.

3. *Diving Outfit.* Type, shallow-water or deep-water; describe components.

4. *Pile Driver.* Type and maximum dimensions of pile handled.

5. *Snow Plow, Blade-Type.* Width of clearance; number and dimensions of blades; where attached and how operated.

6. *Snow Plow, Rotary-Type.* Width of clearance, and whether operated by own power unit or by motor of vehicle. If the snow plow is an attachment, describe its power connection to the vehicle.

7. *Compressor, Air.* Cubic quantity of air compressed and at what pressure. Size of air receiver.

8. *Generator, Electric.* Electrical characteristics and rated kw. of the current produced.

9. *Welder, Oxygen-Acetylene.* Tabulate and fully describe all components. Describe threaded connections, type of thread, threads per inch, diameters (minor, major, pitch), length of threaded portion, left or right hand, male or female, etc.

10. *Planer.* Maximum size of lumber handled.

11. *Welder, Electric-Arc.* Electrical characteristics and whether unit can be used for lighting.

CHAPTER 12

Engineer Equipment Used in Arctic Warfare

INTRODUCTION

This chapter is designed to assist observers in obtaining information on the special engineer equipment used by foreign military forces in operations under Arctic conditions where temperatures of minus 40° F. are frequent, and temperature-drops of as much as 36° F. may occur in a few hours.

In World War II, combat experience under conditions of extreme cold was limited mainly to the armies of Germany and the USSR. The Soviets claim that their unusual tactics and superior combat techniques under Arctic conditions enabled them on many occasions to accomplish combat missions which the Germans had declared impossible. However, both the Soviets and the Germans encountered many problems and faced difficulties with all types of clothing, weapons, and equipment.

Engineer equipment used in Arctic warfare may be grouped under these headings—(1) camouflage; (2) demolitions and obstacles; (3) mines and fuzes; (4) electrical equipment; (5) bridging and stream-crossing equipment; (6) water supply and purification; (7) land navigation; (8) mapping and surveying; (9) prefabricated materials; (10) fortifications and military construction; (11) construction equipment; and (12) general. Under these categories are checklists which will serve as useful guides in the collection of intelligence.

CAMOUFLAGE

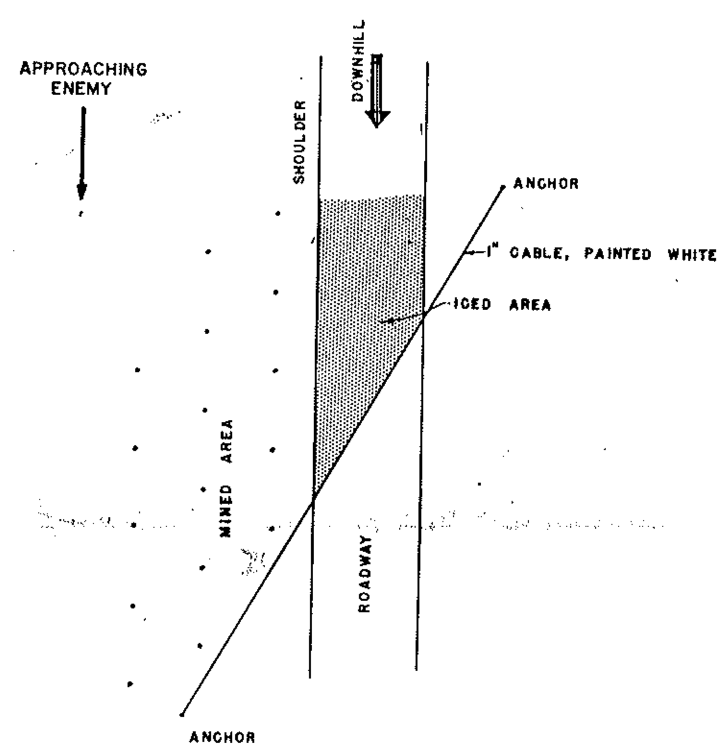
Arctic conditions present peculiar camouflage problems. White must be used in winter. However, it is difficult to employ when rapid switches in coloration are necessary to meet the quick weather changes during spring and autumn. Smoke from fires is difficult to conceal, and tracks made in snow by vehicles and personnel are not easy to hide.

1. What are the fabrics and materials used in Arctic regions for decoy equipment, camouflage nets, garnishing, and suits?

2. What are the types of paints used in camouflage work on nets, cloth, vehicles, and structures in the Arctic?

3. What are the camouflage techniques used in Arctic regions for—(*a*) individual camouflage; (*b*) small-unit camouflage; (*c*) small-installation camouflage (gun positions, command posts, etc.); and (*d*) bivouacs and motor parks?

4. What is the type of equipment used to counteract detection by infrared photography or night-viewing devices?



ARCTIC-TYPE OBSTACLE

Figure 116.

5. What are the types of simulators used (rifle-fire, machine gun fire, artillery fire, signal flares, and other pyrotechnics) ? Where possible, describe them.

DEMOLITIONS AND OBSTACLES

The frozen terrain, freezing temperatures, ice, and snow complicate demolition work.

1. What is the type of explosive used in extreme cold for demolition work in —(*a*) cratering; (*b*) rock blasting; (*c*) felling trees; and (*d*) destroying bridges and other structures?

2. What is the type of detonating equipment used with explosives, electrical or non-electrical?

3. What are the types, models, and characteristics of exploders, fuze lighters, safety fuzes, detonating cords, and detonators used in Arctic demolition work?

4. How are explosives and demolition equipment stored in Arctic areas?

5. Describe the portable obstacles used against landing craft, wheeled and tracked vehicles, airborne operations, and personnel in the Arctic.

6. What are the special techniques employed in using, siting, and placing obstacles in the Arctic (fig. 116)?

MINES AND FUZES

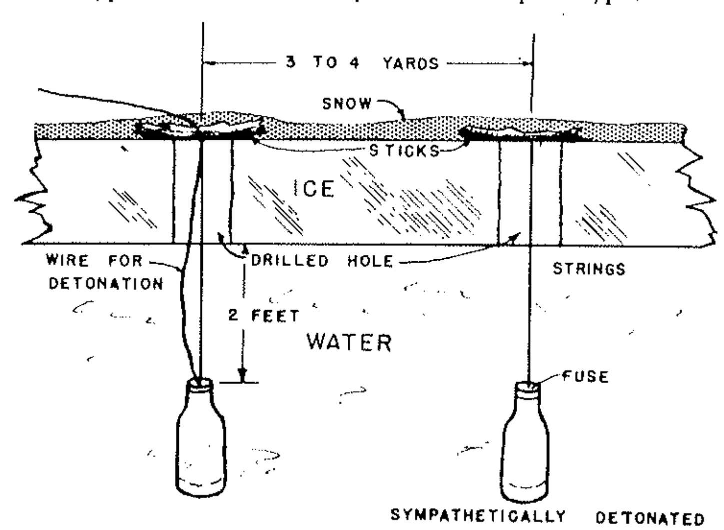
Tilt-rod fuzes for land mines were found very effective in World War II under conditions of deep snow.

1. What are the types and models of land mines used in the Arctic?

2. What are the special methods employed in laying mines in Arctic regions to insure their effective functioning?

3. Describe the special techniques employed in locating and removing mines laid in Arctic regions.

4. How are mines detonated in the Arctic? What is the type of fuze? Is it a pressure—or pull type, rod or tilt-fuze, electrical, chemical, or remote-controlled (fig. 117) ?



ICE MINES

Figure 117.

ELECTRICAL EQUIPMENT

Electrical equipment is a constant source of trouble where condensation is prevalent. Batteries, too, are considerably reduced in efficiency under conditions of extreme cold.

1. What are the means employed to start vehicle engines, generator sets, and other motorized equipment in extreme cold?

2. What models of generators and engines are especially designed for cold-weather operations, and what fuel do they use?

3. What kind of batteries are used in cold weather?

4. What are the power sources used to operate infrared-detecting equipment under Arctic conditions?

5. What are the sources of power used to operate electronic mine-detecting equipment under Arctic conditions?

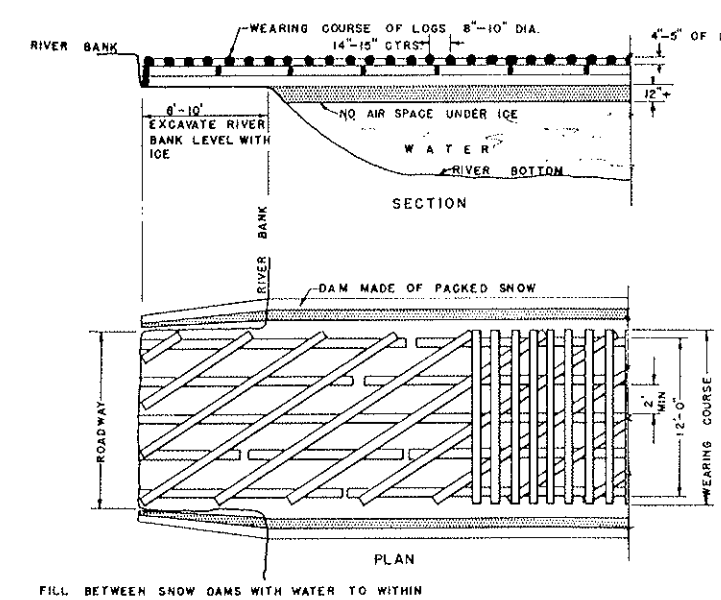
BRIDGING AND STREAM-CROSSING EQUIPMENT

1. Is standard bridging equipment used, or is it modified? Describe the modifications in detail.

2. Is specially designed bridging equipment used? If so, describe it.

3. Are any special types of assault boats or storm boats used? If so, describe them.

4. How are ice-crossings made? How is the crossing reinforced to carry heavy loads? How many crossings would be used in a single tactical crossing (fig. 118) ?



ICE BRIDGE

Figure 118.

WATER SUPPLY AND PURIFICATION

1. What are the types of equipment used for Arctic operations?
2. Is special equipment employed? If so, describe it in detail.
3. How is water freezing prevented?
4. Is any special equipment used to melt ice and snow for water supply?

LAND NAVIGATION

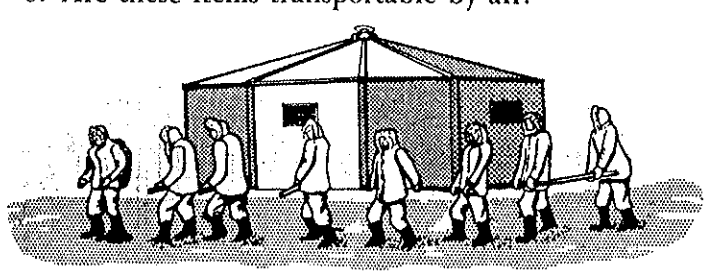
1. Describe the instruments employed in Arctic operations for land navigation. To whom are they issued?
2. Is the odometer or any similar instrument employed?
3. Is the compass employed? If so, is it a special compass?
4. Is the sextant or the octant employed? If so, to whom is it issued?

MAPPING AND SURVEYING

1. What mapping and surveying methods are used?
2. Describe the types of surveying instruments used.
3. What lighting devices are used on instruments, enabling them to be used during the long Arctic nights?
4. Has Shoran been used in Arctic surveys? If so, has it been effective?
5. What are the types of lubricating oils used on surveying instruments?
6. How are horizontal and/or vertical control stations located on the terrain?
7. What are the night-surveying techniques and equipment employed?

PREFABRICATING MATERIALS

1. What are the types of prefabricated construction materials in use for—(*a*) landing mats; (*b*) pipelines; (*c*) hangars; (*d*) barracks; (*e*) shops; and (*f*) shelters (fig. 119)?
2. Where possible, give plans and description of the foregoing.
3. Are these items transportable by air?

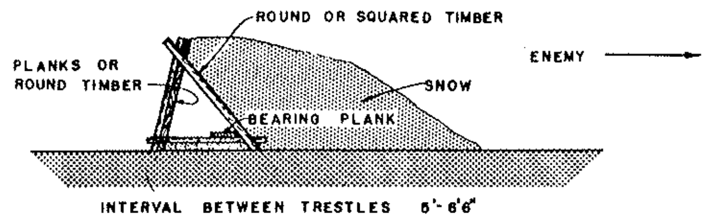


TRANSPORTING PREFABRICATED HUT

Figure 119.

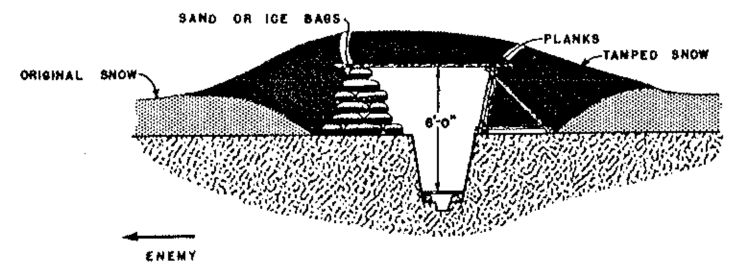
FORTIFICATION AND MILITARY CONSTRUCTION

Operations in the Arctic do not vary in principle



TIMBER & SNOW BREASTWORK

Figure 120.



TRENCH CONSTRUCTION

Figure 121.

from those in other regions. There are, however, certain differences in the application of standard engineering techniques. The manner in which these methods must be applied depends on the physical character of the Arctic regions.

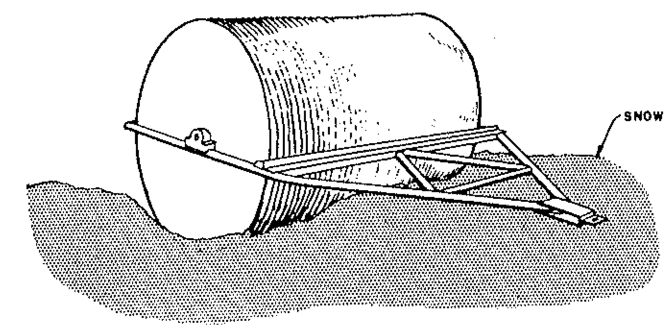
The construction of fortifications must be adapted to conditions of snow and ice and the scarcity of materials normally used in temperate climates.

Military construction methods and practices must be modified to meet conditions in the Arctic. The destructive action of the elements cannot be ignored and must be accounted for in the original design of roads, railways, and buildings constructed in the Arctic.

1. What are the types of permanent and field fortifications in use (figs. 120 and 121)?
2. What are the trends in the construction and use of fortifications?
3. What are the design and maintenance standards, specifications, techniques, and trends in military construction of cantonments, airfields, ports, roads, railroads, and underground structures? Are any new or unusual techniques being developed or used? Have any special materials been developed for construction in Arctic (permafrost) areas?
4. What are the methods used to compact snow on airfields and roads? What equipment is used (fig. 122)?
5. What are the methods for constructing and maintaining airfields on ice caps and ice masses?

CONSTRUCTION EQUIPMENT

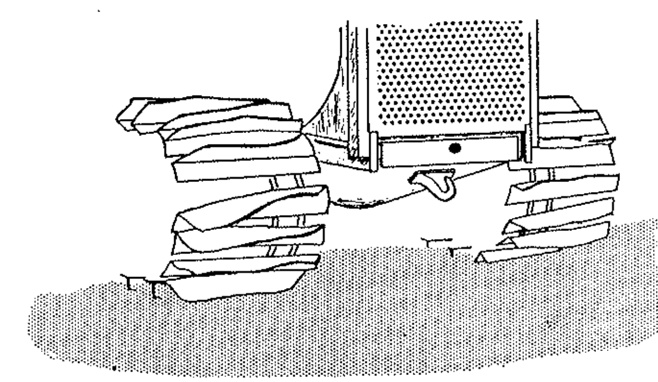
1. How are operators' cabs heated, insulated, and ventilated? What type of insulating materials? If auxiliary heating units are used, what are the types and how are the units operated?



LOW-PRESSURE SNOW ROLLER

Figure 122.

2. What are the attachments or methods used for obtaining adequate flotation for crawler and wheel-mounted units (fig. 123)? If by redesign of crawlers, what are the widths and lengths of crawlers coming in contact with the ground? What is the ground pressure (pounds per square inch)? If grousers are used, what is their design? Of what material are they made and how are they attached? What is the size and construction of the pneumatic tires?
3. What are the changes made in design of the chassis for preventing the accumulation of mud?



TRACTOR WITH LOW GROUND-PRESSURE GROUSERS

Figure 123.

4. How are fog and ice eliminated from windshields? If by heaters or defrosters, what are the types and how are the units operated?
5. What are the names and characteristics of special fuels and lubricating oils?
6. Are fuel lines insulated? If so, by what materials?
7. What methods are employed to prevent moisture condensation in fuel tanks and fuel lines? If by fuel antifreezes, how are they identified and what are their characteristics?
8. How are engine-starting problems overcome?
9. Is the lubricating oil diluted? If so, by what means?
10. What type of hose connections is used on the cooling systems?
11. What are the types and characteristics of radiator antifreeze solutions used?
12. Is the unit equipped with low-temperature batteries? If not, what are the methods used for heating batteries?
13. How are electrical leads insulated? What material is used?
14. What are the types of heaters used for heating transmissions, and how are these units operated?

GENERAL

1. Are there any research and development laboratories for Arctic operations?
2. What are the gasket materials used on petroleum tanks and pipelines in extremely low temperatures (down to minus 70°F.)?
3. Have improved engine starters (which do not require a battery as a source of power) been developed?
4. Is the engineer equipment designed for all-purpose use, or is specially designed equipment employed for Arctic winter use only?
5. What is the equipment (model, description, and characteristics) used to minimize or eliminate "ice fog" from engine exhausts, fired weapons, and other signs of human activity?

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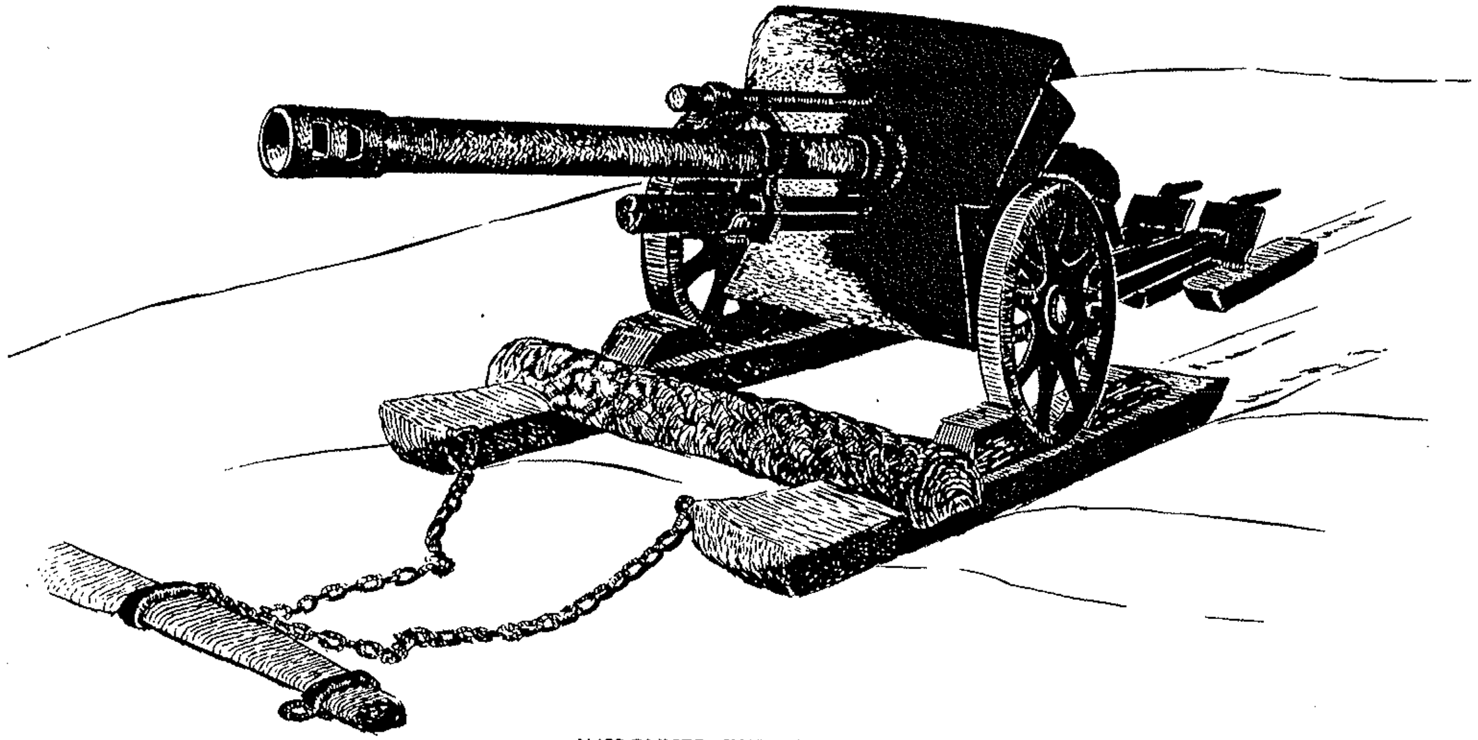


IMPROVISED SKID MOUNT

Figure 126.

AMMUNITION

1. What is the effectiveness of the following types of fuzes in Arctic environment: (*a*) point detonating; (*b*) proximity (VT); (*c*) mechanical; (*d*) time; and (*e*) barometric?

a. How is the operation of these fuzes affected when fired in a snowstorm?

b. Is ammunition's performance changed after being stored in Arctic environment?

c. Are any special measures or precautions taken for storage and/or packing owing to Arctic environment?

d. Is ammunition packed so that rounds are easily removable even though gloves are worn?

2. What, if any, modifications of these types of fuzes are required to make them operable in the Arctic?

3. What types of propellants (their constituents and methods of manufacture) are used?

4. In operations under Arctic conditions, how are the following characteristics altered: (*a*) caliber used; (*b*) type of fuzing; (*c*) armor penetration obtained; (*d*) armor obliquity defeatable; (*e*) material for cone and physical shape of shaped charges; and (*f*) explosive loading?

5. Is the arrow-type projectile used in the Arctic? If so, give the caliber and type of loading (i.e., HE, AP, or incendiary). What thickness of armor can be penetrated?

6. What is the effectiveness of various types of armor-piercing projectiles in the Arctic?

7. What types of incendiary projectiles are used in the Arctic, and what fillers are used?

8. What types of colored smoke are used in the Arctic, and what compositions are used?

9. Are the intensity, visibility, duration of visibility, and color of colored smoke shell affected by Arctic temperatures?

10. Are there any noticeable variations in the fragmentation of HE shell owing primarily to the effect of cold on the physical properties of shell steel? If so, to what degree is it affected by changes in steel chemistry?

11. What are the penetration characteristics of HVAP, AP, and APC projectiles under Arctic conditions as affected by changes in angle of impact in comparison with results obtained at temperatures above zero?

12. How much do Arctic temperatures affect the armor-defeating performance of HEP type shell using plastic explosives? If the performance is changed, what part is attributable to low temperature in the plate?

13. Are the length of trace, the visibility of trace, and the ignition of trace affected by Arctic temperatures and snow?

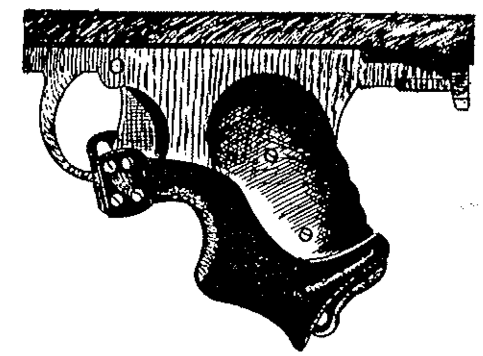
14. How much is muzzle velocity affected by low temperatures, and what propellant is best for maintaining uniform velocity at all temperatures?

15. Is the propellent ignition affected by extreme subzero conditions, resulting in erratic pressures and excessive flash and smoke? If so, what corrective means are available?

16. Have any means been found to maintain a constant initial-burning temperature of propellants under extreme cold, as well as in hot climates?

17. Is a close-proximity fuze used in lieu of the point detonating fuze to compensate for the muffling and dampening effect of snow or soft earth?

18. What types of artillery rocket propellants are used in the Arctic?



TYPICAL TRIGGER FOR USE
WITH HEAVY GLOVES

Figure 127.

19. To what extent is rocket accuracy affected by low temperatures and by changes in temperature?

SMALL ARMS

1. Have any special small arms or ammunition been developed for use in the Arctic? If so, give details?

2. What modifications have been made to the standard small arms to make them adaptable to Arctic use (e.g., winter triggers (fig. 127) and sights for use with heavy gloves)?

3. What caliber and types of side arms have been developed for Arctic use?

GENERAL

1. What are the physical and chemical properties of all lubricants for weapons and vehicles of all types in temperatures down to –65°F.?

2. Are metal surfaces which are likely to be used by operators (i.e., control knobs, handwheels, and tools) coated with any material to prevent cold burn?

3. What are the physical and chemical properties of fuels used for transport, fighting vehicles, generators, and cookers under Arctic conditions?

4. What special compounds have been developed for low-temperature rubber for use in such items as tires, fan belts, hoses, and insulators?

5. What special effects have been noted on various materials, oils, and instruments? What general behavior of metals has been noted and what types of fracture have occurred?

CHAPTER 14

Quartermaster Equipment Used in Arctic Warfare

INTRODUCTION

This chapter is designed to assist in the collection of information on specialized quartermaster equipment used by foreign military forces in operations under Arctic conditions.

It is estimated that troops in the Arctic must devote as much as 75 percent of their effort to survival. The major factors for survival in the Arctic are proper food, clothing, shelter, and equipment. These items must be supplied regularly and must be adequate or casualties will result. Consequently, any improvement in these items and their supply will directly extend the military usefulness of troops in the Arctic.

RATIONS

1. What kinds of Arctic rations are used, and under what conditions of service are the various kinds issued?
2. Describe the components of each ration in detail, including caloric content; weight; form or process used; any added substances and their purposes (e.g., to preserve, to make more palatable or more digestible, or to restore or enrich vitamin content).
3. What is the basis of issue of the various types of rations, and what are the methods of requisition?
4. What is the source of any unusual or scarce components? Where and how are they manufactured? What are now on hand?
5. What are the normal stocks of rations at various organizational levels? Give any available information on deterioration of rations, with rates and causes.
6. Give any available information of the palatability and acceptability of rations.
7. What type of packaging is used for rations? Are packages capable of being opened easily by troops wearing hand protection? Is any special process used on the packaging material such as waterproofing or rustproofing? At what temperatures will the package afford protection?
8. What methods of storage for rations are used? For how long a period will rations remain stable at Arctic temperatures?
9. Are any special devices, individual stoves, or compounds used for heating individual rations? Give details.
10. Are any devices used to prevent freezing of water in canteens?
11. Describe the method of feeding and the steps taken to keep food hot. Are thermos containers used?

BASIC ARCTIC CLOTHING

1. Describe each item, giving details of—(*a*) materials (components, weights, etc., including any special processes such as waterproofing, materials used for insulation, or filling of padded items); (*b*) construction (what layers, methods of assembly, stitching, insulation principles); (*c*) closures; (*d*) size tolerances (close or loose fit); and (*e*) performance characteristics, including warmth and ventilation; effect on freedom of movement; conditions for which particularly suited or unsuited; durability; ease of donning and removing; any tendency to deteriorate in storage or under special conditions such as wet, cold weather.
2. What are the sources of raw materials, places of manufacture, and quantities on hand and on order?
3. What are the bases of issue, methods of requisition, and normal stock levels?
4. To what troops, and under what conditions, are special uniforms issued? Is there a special white camouflage uniform for use in snow-covered terrain? How are parachutists employed in Arctic operations clothed and equipped? Describe each item of any special uniform as in paragraph 1.
5. What footwear types are used? What are the materials and construction methods? Describe insoles, socks, insulation principles, and closures. Under what conditions is each type of footwear used? How effective is traction on ice and snow?
6. Give details of hand protection; special performance requirements; types and materials; liners and inserts.
7. Are special heating devices used with hand and footwear for warming hands and feet under conditions of extreme cold? What is the method of operation of any heating devices, and how effective are they?

INDIVIDUAL EQUIPMENT

1. Describe all types of packs, packboards, and rucksacks in use, including suspension principles, materials, weights, and waterproofing. By what kinds of troops or for what purposes are the various types used?
2. Describe all types of snowshoes used, particularly any all-purpose type, as to design, type of webbing used, weight, durability, method of use.
3. What types of skis are used? Give details as to material, design, flexibility, durability, coatings. Give information in regard to ski waxes, including kinds used and under what conditions the various ones are suitable. Describe ski bindings in detail; can they be attached easily with a gloved hand? What types of ski poles are used? Describe details such as snow rings and hand grips. What are the methods of long-term storage of skis and ski equipment; describe any methods for preventing warpage of skis during storage.
4. What types of sleeping bags are used and what are their materials and construction? What insulating materials are used? Are there various sizes? Are special casualty-evacuation sleeping bags used? Give details of construction including waterproof cover, special waterproof and bloodproof liner, quick release devices, etc. Are heating devices used in sleeping bags? If so, describe design, method of operation, type of fuel, effectiveness.
5. Are any forms of ballistic protection offered except the helmet?
6. Are there any special devices for face and head protection in Arctic temperatures? If so, describe materials, details of construction, and method of use.
7. Is there a small individual tent or shelter? Give details of construction, weight, materials, where used.
8. Describe special equipment issued to the individual or to groups of individuals, for example, snow knives.

ORGANIZATIONAL EQUIPMENT

1. What type of tent or other temporary shelter (including improvised) is used in extreme cold? Describe materials and construction, including particularly any multiple-layer construction and any insulating materials used. Give dimensions. Are tents fire- and weather-proofed? How many men will each type shelter? Are tents easily erected in Arctic weather? How are tents transported? What type of tent or other shelter is used to protect mobile field equipment such as bakeries and laundries and for storage?
2. What type of stove is used to heat shelters, and what type of fuel is used in the stove?
3. What type of sled is used? (Give size, shape, construction material, weight, capacity, method of operation including loading and unloading, and means of propulsion.) For what purposes is the sled used? What are its characteristics as to mobility, effectiveness and durability, and limitations? Are small tractors used to tow sleds? If so, describe them in detail. Where is the equipment made, and in what quantities? What type of harness is used for towing man-hauled sleds (i.e., shoulder, waist, other types). What is the normal distribution of the various types of sleds, especially man-hauled, to infantry units?
4. What type of water heater is used, and how is it fueled and transported?
5. What arrangement is there for bathing in very cold weather? If showers are used, how are they inclosed? Is fumigation carried on in conjunction with bathing? If so, describe the process and equipment.

CHEMICALS AND PLASTICS

1. What protective creams and lotions are used, such as anti-chap lipstick and special insect-repellent lotions?
2. Have any elastomeric materials such as rubber been developed that will retain their desirable characteristics under extremely low temperatures? What are their specific properties such as freeze point, brittleness, and resistance to fuels and chemicals? What reinforcements are used? What items are made from them?

FUELS AND LUBRICANTS

1. What are the Arctic specifications of fuels and lubricants?
2. Give all information available on gasoline, oil, and lubricants in Arctic operations, such as performance data, consumption rates, and special Arctic equipment or procedures for handling, storing, or transporting.

QUARTERMASTER EQUIPMENT FOR AIRBORNE SUPPLY

1. What types of personnel and cargo parachutes are used? What materials are used in their construction? Include weight of materials and sizes of parachutes.

2. What is rate of descent with parachutes described above under Arctic conditions?

3. What provisions are made for packing and maintenance of parachutes and drop equipment in the Arctic?

4. Heavy drop.

a. What heavy drop equipment is used?

b. What kind of aircraft is used for heavy drop?

c. How is heavy drop rigged? Load-bearing platform? Direct rigging to equipment?

d. What is the heaviest load dropped?

e. Do personnel drop from the same plane with heavy drop?

f. What is the procedure for locating and marking the drop area?

g. What kind of ground-release device is used?

h. What are the mechanics of unloading in the air?

i. What kinds of parachutes (size, type, material) are used?

j. What equipment is used to load aircraft?

INSIGNIA AND DECORATIONS

Describe and explain the significance of any insignia or decorations indicating Arctic function or experience.

ANIMALS

1. What types of animals are used for pack or draft, and under what conditions are they used? What is their daily load and range? Are they handled by military or civilian personnel?

2. Describe animal harness and similar equipment, including materials, weights, adjustability, and durability.

3. Where and how are the animals procured, and in what numbers? What numbers are available?

4. What are the policies and practices for keeping, replacing, conditioning, and training the animals?

5. Describe their feed and the feeding practices connected therewith.

6. What are the breeding programs for the various types of animals?

[AG 400 (15 Apr 53)]

BY ORDER OF THE SECRETARY OF THE ARMY:

OFFICIAL:
WM. E. BERGIN
Major General, USA
The Adjutant General

J. LAWTON COLLINS
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