Chapter 1
Military Explosives

Section I. Demolition Materials

1-1. Characteristics. To be suitable for use in military operations, explosives must have certain properties. Military explosives—

- Should be inexpensive to manufacture and capable of being produced from readily available raw materials.
- Must be relatively insensitive to shock or friction, yet be able to positively detonate by easily prepared initiators.
- Must be capable of shattering and must have the potential energy (high energy output per unit volume) adequate for the purpose of demolitions.
- Must be stable enough to retain usefulness for a reasonable time when stored in temperatures between -80 and +165 degrees Fahrenheit.
- Should be composed of high-density materials (weight per unit volume).
- Should be suitable for use underwater or in damp climates.
- Should be minimally toxic when stored, handled, and detonated.

1-2. Selection of Explosives. Select explosives that fit the particular purpose, based on their relative power. Consider all characteristics when selecting an explosive for a particular demolition project. See Technical Manual (TM) 9-1300-214 for detailed information on military explosives. Table 1-1 (page 1-2) contains significant information regarding many of the explosives described below.

1-3. Domestic Explosives.

a. *Ammonium Nitrate.* Ammonium nitrate is the least sensitive of the military explosives. It requires a booster charge to successfully initiate detonation. Because of its low sensitivity, ammonium nitrate is a component of many composite explosives (combined with a more sensitive explosive). Ammonium nitrate is not suitable for cutting or breaching charges because it has a low detonating velocity. However, because of its excellent cratering affects and low cost, ammonium nitrate is a component of most cratering and ditching charges. Commercial quarrying operations use ammonium nitrate demolitions extensively. Pack ammonium nitrate in an airtight container because it is extremely hydroscopic (absorbs humidity). Ammonium nitrate or composite explosives containing ammonium nitrate are not suitable for underwater use unless packed in waterproof containers or detonated immediately after placement.

b. *Pentaerythrite Tetranitrate (PETN).* PETN is a highly sensitive and very powerful military explosive. Its explosive potential is comparable to cyclonite (RDX) and nitroglycerin. Boosters, detonating cord, and some blasting caps contain PETN. It is also used in composite explosives with trinitrotoluene (TNT) or with nitrocellulose. A PETN-nitrocellulose composite (Ml 18 sheet explosive) is a demolition charge. The PETN explosive is a good underwater-demolition because it is almost insoluble in water.

Table 1-1. Characteristics of US demolitions explosives

Name	Applications	Detonation Velocity		RE Factor*	Fume Toxicity	Water Resistance
		M/Sec	Ft/Sec			
Black Powder	Time Fuse	400	1,300	0.55	Dangerous	Poor
Ammonium Nitrate	Cratering Charge	2,700	8,900	0.42	Dangerous	Poor
Amatol 80/20	Bursting Charge	4,900	16,000	1.17	Dangerous	Poor
M1 Dynamite	Demolition Charge	6,100	20,000	0.92	Dangerous	Fair
Detonating Cord	Priming	6,100 to 7,300	20,000 to 24,000	—	Slight	Excellent
TNT	Demolition Charge Composition Explosive	6,900	22,600	1.00	Dangerous	Excellent
Tetrytol 75/25	Demolition Charge	7,000	23,000	1.20	Dangerous	Excellent
Tetryl	Booster Charge Composition Explosive	7,100	23,300	1.25	Dangerous	Excellent
Sheet Explosive M118 and M186	Cutting Charge	7,300	24,000	1.14	Dangerous	Excellent
Pentolite 50/50	Booster Charge Bursting Charge	7,450	24,400	—	Dangerous	Excellent
Nitroglycerin	Commercial Dynamite	7,700	25,200	1.50	Dangerous	Good
Bangalore Torpedo, M1A2	Demolition Charge	7,800	25,600	1.17	Dangerous	Excellent
Shaped Charges M2A3, M2A4, and M3A1	Cutting Charge	7,800	25,600	1.17	Dangerous	Excellent
Composition B	Bursting Charge	7,800	25,600	1.35	Dangerous	Excellent
Composition C4 and M112	Cutting Charge Breaching Charge	8,040	26,400	1.34	Slight	Excellent
Composition A3	Booster Charge Bursting Charge	8,100	26,500	—	Dangerous	Good
PETN	Detonating Cord Blasting Caps Demolition Charges	8,300	27,200	1.66	Slight	Excellent
RDX	Blasting Caps Composition Explosives	8,350	27,400	1.60	Dangerous	Excellent
*TNT equals 1.00						

c. *Cyclotrimethlenetrinitramine (RDX). RDX* is also a highly sensitive and very powerful military explosive. It forms the base charge in the M6 electric and M7 nonelectric blasting caps. When RDX is desensitized, it serves as a subbooster, booster, bursting charge, or demolition charge. The principal use for RDX is in composite explosives, such as Composition A, B, and C explosives. RDX is available commercially under the name cyclonite.

d. *Trinitrotoluene.* TNT is the most common military explosive. It maybe in composite form, such as a booster, a bursting, or a demolition charge, or in a noncomposite form. Since TNT is a standard explosive, it is used to rate other military explosives.

e. *Tetryl.* Tetryl is an effective booster charge in its noncomposite form and a bursting or a demolition charge in composite forms. Tetryl is more sensitive and powerful than TNT. However, RDX- and PETN-based explosives, which have increased power and shattering effects, are replacing tetryl and composite explosives containing tetryl.

f. *Nitroglycerin.* Nitroglycerin is one of the most powerful high explosives. Its explosive potential is comparable to RDX and PETN. Nitroglycerin is the explosive base for commercial dynamites. Nitroglycerine is highly sensitive and extremely temperature-sensitive. Military explosives do not use nitroglycerin because of its sensitivity. Do not use commercial dynamites in combat areas.

g. *Black Powder.* Black powder is the oldest-known explosive and propellant. It is a composite of potassium or sodium nitrate, charcoal, and sulfur. Time fuses, some igniters, and some detonators contain black powder.

h. *Amatol.* Amatol is a mixture of ammonium nitrate and TNT. It is a substitute for TNT in bursting charges. Some older bangalore torpedoes use 80-20 amatol (80 percent ammonium nitrate and 20 percent TNT). Because amatol contains ammonium nitrate, it is a hydroscopic compound. Keep any explosives containing amatol in airtight containers. If properly packaged, amatol remains viable for long periods of time, with no change in sensitivity, power, or stability.

i. *Composition A3.* Composition A3 is a composite explosive containing 91 percent RDX and 9 percent wax. The purpose of the wax is to coat, desensitize, and bind the RDX particles. Composition A3 is the booster charge in some newer shaped charges and bangalore torpedoes. High-explosive plastic (HEP) projectiles may also contain Composition A3 as a main charge.

j. *Composition B.* Composition B is a composite explosive containing approximately 60 percent RDX, 39 percent TNT, and 1 percent wax. It is more sensitive than TNT. Because of its shattering power and high rate of detonation, Composition B is the main charge in shaped charges.

k. *Composition B4.* Composition B4 contains 60 percent RDX, 39.5 percent TNT, and 0.5 percent calcium silicate. Composition B4 is the main charge in newer models of bangalore torpedoes and shaped charges.

l. *Composition C4 (C4). C4* is a composite explosive containing 91 percent RDX and 9 percent nonexplosive plasticizers. Burster charges are composed of C4. C4 is effective in temperatures between -70 to+ 170 degrees Fahrenheit; however, C4 loses its plasticity in the colder temperatures.

m. *Tetrytol.* Tetrytol is a composite explosive containing 75 percent tetryl and 25 percent TNT. It is the explosive component in demolition charges. Booster charges require different mixtures of tetryl and TNT. Tetrytol is more powerful than its individual components, is better at shattering than TNT, and is less sensitive than tetryl.

n. *Pentolite.* Pentolite is a mixture of PETN and TNT. Because of its high power and detonating rate, a mixture of 50-50 pentolite (50 percent PETN and 50 percent TNT) makes an effective booster charge in certain models of shaped charges.

o. Dynamites.

(1) Standard Dynamite. Most dynamites, with the notable exception of military dynamite, contain nitroglycerin plus varying combinations of absorbents, oxidizers, antacids, and freezing-point depressants. Dynamites vary greatly in strength and sensitivity depending on, among other factors, the percentage of nitroglycerin they contain. Dynamites are for general blasting and demolitions, including land clearing, cratering and ditching, and quarrying.

(2) Military Dynamite. Military dynamite is a composite explosive that contains 75 percent RDX, 15 percent TNT, and 10 percent desensitizers and plasticizers. Military dynamite is not as powerful as commercial dynamite. Military dynamite's equivalent strength is 60 percent of commercial dynamiters. Because military dynamite contains no nitroglycerin, it is more stable and safer to store and handle than commercial dynamite.

1-4. Foreign Explosives.

a. *Composition.* Foreign countries use a variety of explosives, including TNT, picric acid, amatol, and guncotton. Picric acid is similar to TNT, but it also corrodes metals and thus forms extremely sensitive compounds.

WARNING
Do not use picric acid in rusted or corroded metal containers.
Do not handle picric acid. Notify explosive ordnance disposal (EOD) personnel for disposition.

b. *Use.* You may use the explosives of allied nations and those captured from the enemy to supplement standard supplies. Only expert demolitionists should use such explosives and then only according to instructions and directives of theater commanders. Captured bombs, propellants, and other devices may be used with US military explosives for larger demolition projects, such as pier, bridge, tunnel, and airfield destruction. Most foreign explosive blocks have cap wells large enough to receive US military blasting caps. Since foreign explosives may differ from US explosives in sensitivity and force, test shots should be made to determine their adequacy before extensive use or mixing with US-type explosives.

Section II. Service Demolition Charges

1-5. Block Demolition Charges. Block demolition charges are prepackaged, high-explosive charges for general demolition operations, such as cutting, breaching, and cratering. They are composed of the high-explosive TNT, tetrytol, Composition-C series, and ammonium nitrate. Block charges are rectangular inform except for the 40-pound, ammonium-nitrate block demolition charge, military dynamite, and the ¼-pound-TNT block demolition charge, which are all cylindrical in form. The various block charges available are described in the text that follows, as well as Table 1-2. See TM 43-0001-38 for detailed information about demolition charges and accessories.

Table 1-2. Characteristics of block demolition charges

Explosive	Unit (Pounds)	Size (Inches)	Detonation Velocity		RE Factor	Packaging/ Weight[2]
			M/Sec	Ft/Sec		
TNT	0.25	1½ D x 3½ L	6,900	22,600	1.00	200 per Box/55 Lb
	0.50	1¾ x 1¾ x 3¾	6,900	22,600	1.00	96 per Box/53 Lb
	1.00	1¾ x 1¾ x 7	6,900	22,600	1.00	48 per Box/53 Lb
M112 Block[1]	1.25	1 x 2 x 10	8,040	26,400	1.34	30 per Box/40 Lb
M118 Block	2.00	1 x 3 x 12	7,300	24,000	1.14	4 Sheets per Block; 20 per Box/ 42 Lb
M118 Sheet[1]	0.50	¼ x 3 x 12	7,300	24,000	1.14	
M186 Roll	25.00	¼ x 3 x 50 ft	7,300	24,000	1.14	3 per Box/80 Lb
Ammonium Nitrate	43.00	7 x 24	3,400	11,000	0.42	1 per Box/52 Lb
M1 Dynamite	0.50	1¼ D x 8 L	6,100	20,000	0.92	100 per Box/62 Lb

[1]The volume of M112 is 20 cubic inches. The volume of one sheet of M118 is 9 cubic inches.
[2]Packaging weights include packaging material and weight of container.

1-6. TNT Block Demolition Charge.

a. *Characteristics.* TNT block demolitions, shown in Figure 1-1, are available in three sizes (Table 1-2). The ¼-pound block is issued in a cylindrical, waterproof, olive-drab cardboard container. The ½-pound and l-pound blocks are available in similar rectangular containers. All of the three charges have metal ends with a threaded cap well in one end.

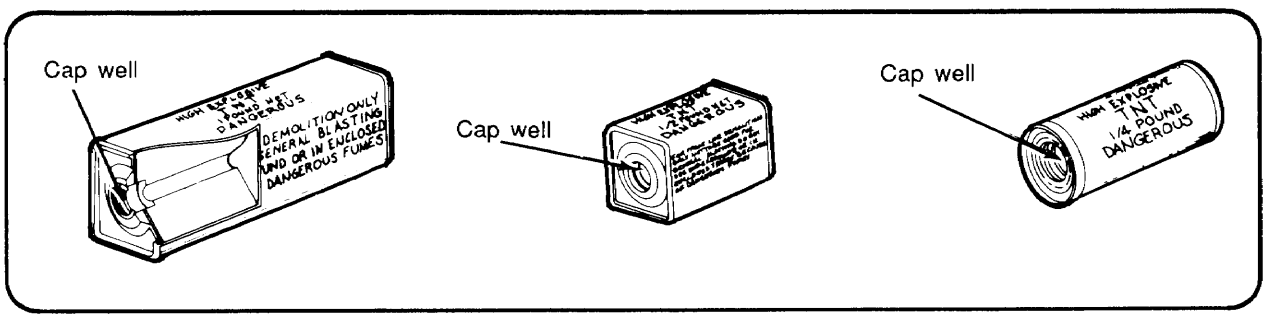

Figure 1-1. TNT block demolition charges

b. *Use.* TNT block demolition charges are effective for all types of demolition work. However, the ¼-pound charge is primarily for training purposes.

c. *Advantages.* TNT demolition charges have a high detonating velocity. They are stable, relatively insensitive to shock or friction, and water resistant. They also are conveniently sized, shaped, and packaged.

d. *Limitations.* TNT block demolition charges cannot be molded and are difficult to use on irregularly shaped targets. TNT is not recommended for use in closed spaces because one of the products of explosion is poisonous gases.

1-7. M112 Block Demolition Charge.

a. *Characteristics.* The M112 block demolition charge consists of 1.25 pounds of C4 packed in an olive-drab, Mylar-film container with a pressure-sensitive adhesive tape on one surface (Figure 1-2). The tape is protected by a peelable paper cover. Table 1-2 (page 1-5) lists additional characteristics of the Ml12 block.

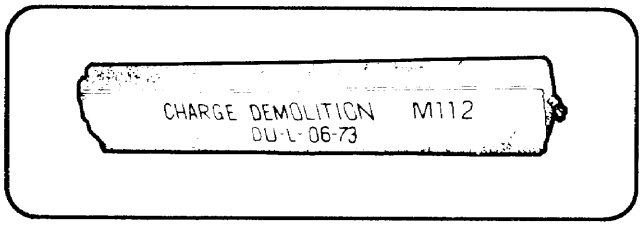

Figure 1-2. M112 block demolition charge

b. *Use.* The M112 block demolition charge is used primarily for cutting and breaching. Because of its high cutting effect and its ability to be cut and shaped, the M1l2 charge is ideally suited for cutting irregularly shaped targets such as steel. The adhesive backing allows you to place the charge on any relatively flat, clean, dry surface with a temperature that is above the freezing point. The Ml12 charge is the primary block demolition charge presently in use.

WARNING

Composition C4 explosive is poisonous and dangerous if chewed or ingested; its detonation or burning produces poisonous fumes. Cut all plastic explosives with a sharp steel knife on a nonsparking surface. Do not use shears.

c. Advantages. You can cut to shape the M112 block demolition charge to fit irregularly shaped targets. The color of the wrapper helps camouflage the charge. Molding the charge will decrease its cutting effect.

d. *Limitations.* The adhesive tape will not adhere to wet, dirty, rusty, or frozen surfaces.

1-8. M118 Block Demolition Charge.

a. *Characteristics.* The M118 block demolition charge, or sheet explosive, is a block of four ½-pound sheets of flexible explosive packed in a plastic envelope (Figure 1-3). Twenty Ml18 charges and a package of 80 M8 blasting-cap holders are packed in a wooden box. Each sheet of the explosive has a pressure-sensitive adhesive tape attached to one surface. Table 1-2 (page 1 -5) lists additional characteristics for the M118 charge.

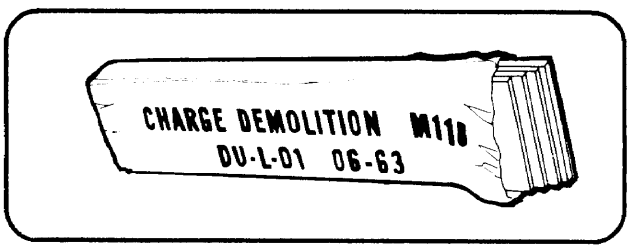

Figure 1-3. M118 block demolition charge

b. *Use.* The Ml18 charges are designed for cutting, especially against steel targets. The sheets of explosive are easily and quickly applied to irregular and curved surfaces and are easily cut to any desired dimension. The Ml18 charge is effective as a small breaching charge but, because of its high cost, it is not suitable as a bulk explosive charge.

c. Advantages. The flexibility and adhesive backing of the sheets allow application to a large variety of targets. You can cut the ½-pound sheets to any desired dimension and apply them in layers to achieve the desired thickness. The Ml18 charge is not affected by water, making it acceptable for underwater demolitions.

d. *Limitations.* The adhesive tape will not adhere to wet, dirty, rusty, or frozen surfaces.

1-9. M186 Roll Demolition Charge.

a. *Characteristics.* The Ml86 roll demolition charge, shown in Figure 1-4, is identical to the Ml18 block demolition charge except that the sheet explosive is in roll form on a 50-foot, plastic spool. Each foot of the roll provides approximately a half pound of explosive. Included with each roll are 15 M8 blasting cap holders and a canvas bag with carrying strap. Table 1-2 (page 1-5) lists additional characteristics for the M186 charge.

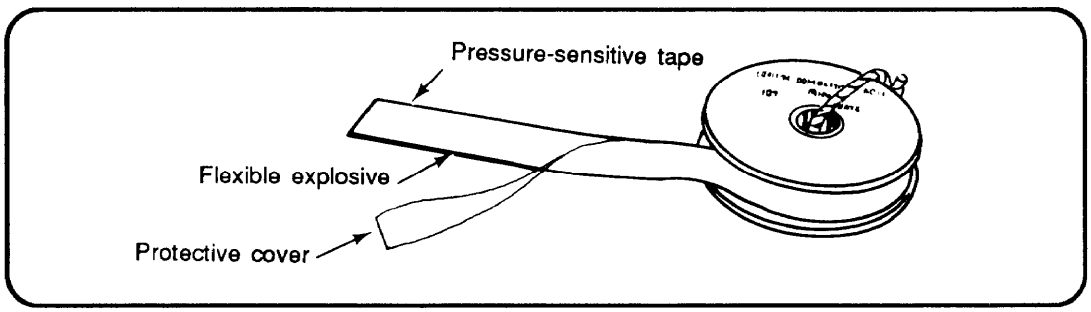

Figure 1-4. M186 roll demolition charge

b. *Use.* Use the M186 roll demolition charge in the same manner as the Ml18 block demolition charge. The Ml86 charge is adaptable for demolishing targets that require the use of flexible explosives in lengths longer than 12 inches.

c. *Advantages.* The Ml86 roll demolition charge has all the advantages of the Ml18 block demolition charge. You can cut the M186 charge to the exact lengths desired.

d. *Limitations.* The adhesive backing will not adhere to wet, dirty, rusty, or frozen surfaces.

1-10. Forty-Pound, Ammonium-Nitrate Block Demolition Charge

a. *Characteristics.* Figure 1-5 (page 1-8) shows the 40-pound, ammonium-nitrate block demolition charge or cratering charge. It is a watertight, cylindrical metal container with approximately 30 pounds of an ammonium-nitrate-based explosive and 10 pounds of TNT-based explosive booster in the center, next to the priming tunnels. The two priming tunnels are located to the outside of the container, midway between the ends. One tunnel serves as a cap well for priming the charge with an M6 electric or M7 nonelectric military blasting cap. The other tunnel series as a priming path, with the detonating cord passing through the tunnel and knotted at the end. There is a cleat between the tunnels to secure the time blasting fuse, electrical firing wire, or detonating cord. There is a metal ring on the top of the container for lowering the charge into its hole. Table 1-2 (page 1-5) lists additional characteristics for the 40-pound, ammonium-nitrate block demolition charge.

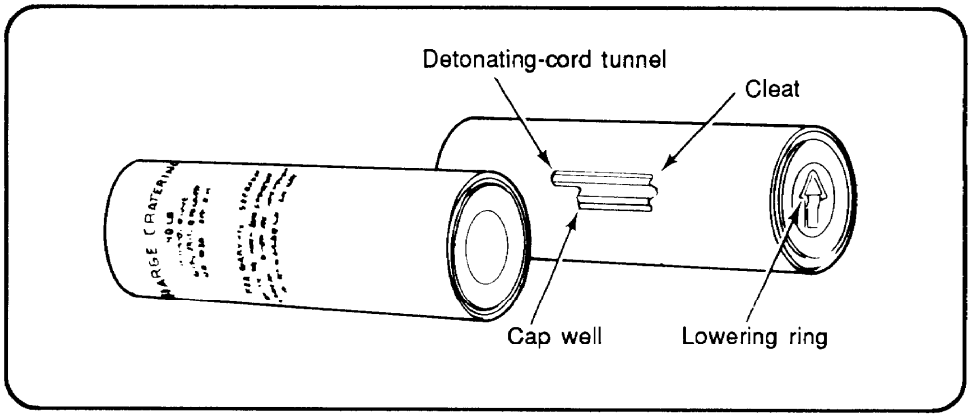

Figure 1-5. Forty-pound, ammonium-nitrate cratering charge

b. *Use.* This charge is suitable for cratering and ditching operations. Its primary use is as a cratering charge, but it also is effective for destroying buildings, fortifications, and bridge abutments.

c. *Advantages.* The size and shape of this charge make it ideal for cratering operations. It is inexpensive to produce compared to other explosives.

d. *Limitations.* Ammonium nitrate is hydroscopic. When wet, it will not detonate. To ensure detonation, use metal containers showing no evidence of water damage. Detonate all charges placed in wet or damp boreholes as soon as possible.

1-11. Ml Military Dynamite.

a. *Characteristics.* M1 military dynamite is an RDX-based composite explosive containing no nitroglycerin (Figure 1-6). M 1 dynamite is packaged in ½-pound, paraffin-coated, cylindrical paper cartridges, which have a nominal diameter of 1.25 inches and a nominal length of 8 inches. Table 1-2 (page 1-5) lists additional characteristics for Ml military dynamite.

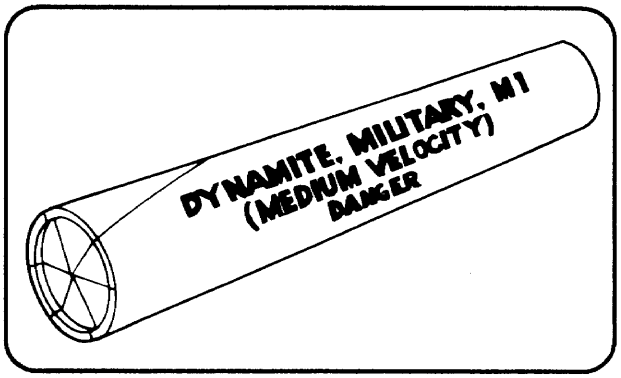

Figure 1-6. M1 military dynamite

b. *Use.* Ml dynamite's primary uses are military construction, quarrying, ditching, and service demolition work. It is suitable for underwater demolitions.

c. *Advantages.* Ml dynamite will not freeze or perspire in storage. The Ml dynamite's composition is not hydroscopic. Shipping containers do not require turning during storage. Ml dynamite is safer to store, handle, and transport than 60-percent commercial dynamite. Unless essential, do not use civilian dynamite in combat areas.

d. *Limitations.* Ml dynamite is reliable underwater only for 24 hours. Because of its low sensitivity, pack sticks of military dynamite well to ensure complete detonation of the charge. Ml dynamite is not efficient as a cutting or breaching charge.

Section III. Special Demolition Charges and Assemblies

1-12. Shaped Demolition Charge. The shaped demolition charge used in military operations is a cylindrical block of high explosive. It has a conical cavity in one end that directs the cone-lining material into a narrow jet to penetrate materials (Figure 1-7). This charge is not effective underwater, since any water in the conical cavity will prevent the high-velocity jet from forming. To obtain maximum effectiveness, place the cavity at the specified standoff distance from the target, and detonate the charge from the exact rear center, using only the priming well provided. Never dual prime a shaped charge.

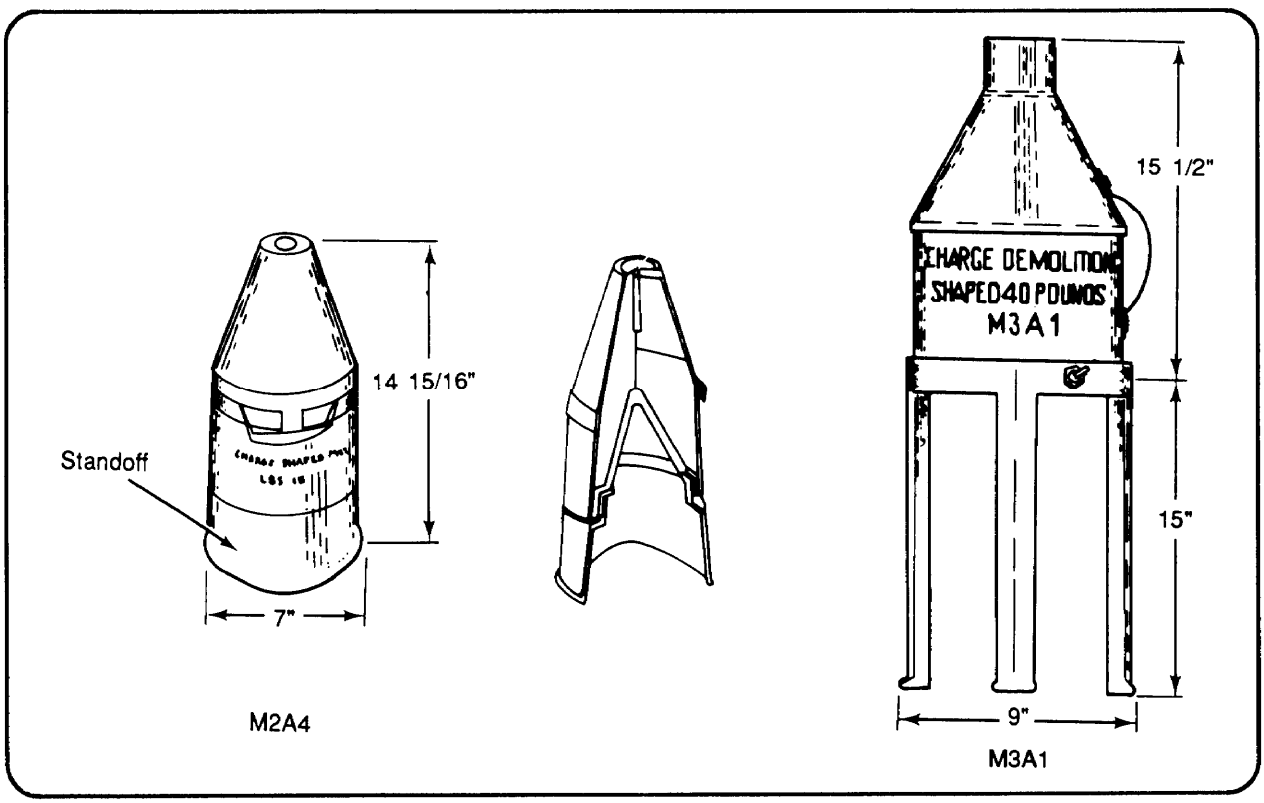

Figure 1-7. Shaped charges

a. *Characteristics.*

(1) Fifteen-Pound, M2A4 Shaped Demolition Charge. The M2A4 charge contains a 0.1 l-pound (50 gram) booster of Composition A3 and a 11.5-pound main charge of Composition B. It is packaged three charges per wooden box (total weight is 65 pounds). This charge has a moisture-resisting, molded-fiber container. A cylindrical fiber base slips onto the end of the charge to provide a 6-inch standoff distance. The cavity liner is a cone of glass. The charge is 14 $^{15}/_{16}$ inches high and 7 inches in diameter, including the standoff.

(2) Forty-Pound, M3A1 Shaped Demolition Charge. The M3A1 charge contains a 0.1 l-pound (50 gram) booster of Composition A3 and a 29.5-pound main charge of Composition B. It is packaged one charge per box (total weight is 65 pounds). The charge is in a metal container. The cone liner also is made of metal. A metal tripod provides a 15-inch standoff distance. The charge is 15 ½ inches high and 9 inches in diameter, not including standoff.

b. *Use.* A shaped demolition charge's primary use is for boring holes in earth, metal, masonry, concrete, and paved and unpaved roads. Its effectiveness depends largely on its shape, composition, and placement. Table 1-3, lists the penetrating capabilities of various materials and the proper standoff distances for these charges.

Table 1-3. Characteristics of boreholes made by shaped charges

Material	Specifications	M2A4 Shaped Charge (15-Pound)*	M3A1 Shaped Charge (40-Pound)**
Armor plate	Penetration	12.00 in	At least 20.00 in
	Average hole diameter	1.50 in	2.50 in
Reinforced concrete	Maximum wall thickness	36.00 in	60.00 in
	Penetration depth in thick walls	30.00 in	60.00 in
	Average hole diameter	2.75 in	3.50 in
	Minimum hole diameter	2.00 in	2.00 in
Concrete pavement (10-inch with 21-inch rock base course)	Optimum standoff	42.00 in	60.00 in
	Minimum penetration depth	44.00 in	71.00 in
	Maximum penetration depth	91.00 in	109.00 in
	Minimum hole diameter	1.75 in	6.75 in
Concrete pavement (3-inch with 24-inch rock base course)	Optimum standoff	42.00 in	—
	Minimum penetration depth	38.00 in	—
	Maximum penetration depth	90.00 in	—
	Minimum hole diameter	3.75 in	—
Permafrost	Hole depth (30-inch standoff)	72.00 in	—
	Hole depth (42-inch standoff)	60.00 in	—
	Hole depth (50-inch standoff)	—	72.00 in
	Hole diameter (42-inch standoff)	1.50 to 6.00 in	—
	Hole diameter (50-inch standoff)	—	5.00 to 8.00 in
	Hole diameter (normal standoff)	4.00 to 30.00 in	7.00 to 30.00 in
Ice	Hole depth (42-inch standoff)	7.00 ft	12.00 ft
	Hole diameter (42-inch standoff)	3.50 in	6.00 in
Soil	Hole depth (30-inch standoff)	7.00 ft	—
	Hole depth (48-inch standoff)	—	7.00 ft
	Hole diameter (30-inch standoff)	7.00 in	—
	Hole diameter (48-inch standoff)	—	14.50 in
Graveled roads	Hole depth (30-inch standoff)	7.00 ft	—
	Hole depth (48-inch standoff)	—	9.00 ft
	Hole diameter (30-inch standoff)	7.00 in	—
	Hole diameter (48-inch standoff)	—	7.00 in

*A dash in the M2A4 Shaped Charge column indicates that a M3A1 shaped charge is required.
**A dash in the M3A1 Shaped Charge column indicates that a M2A4 shaped charge is sufficient.

c. *Special Precautions.* To achieve the maximum effectiveness of shaped charges—

- Center the charge over the target point.
- Align the axis of the charge with the direction of the desired hole.
- Use the pedestal to obtain the proper standoff distance.

- Suspend the charge at the proper height on pickets or tripods, if the pedestal does not provide the proper standoff distance.
- Remove any obstruction in the cavity liner or between the charge and the target.

1-13. M183 Demolition Charge Assembly.

a. *Characteristics.* The Ml83 demolition charge assembly or *satchel charge* consists of 16 M112 (C4) demolition blocks and 4 priming assemblies. It has a total explosive weight of 20 pounds. The demolition blocks come in two bags, eight blocks per bag. The two bags come in an M85 canvas carrying case. Two M85 cases come in a wooden box 17 1/8 by 11½ by 12½ inches. Each priming assembly consists of a 5-foot length of detonating cord with an RDX booster crimped to each end and a pair of Ml detonating-cord clips for attaching the priming assembly to a detonating cord ring or line main.

b. *Use.* The M183 assembly is used primarily forereaching obstacles or demolishing structures when large demolition charges are required (Figure 1-8). The M183 charge also is effective against smaller obstacles, such as small dragon's teeth.

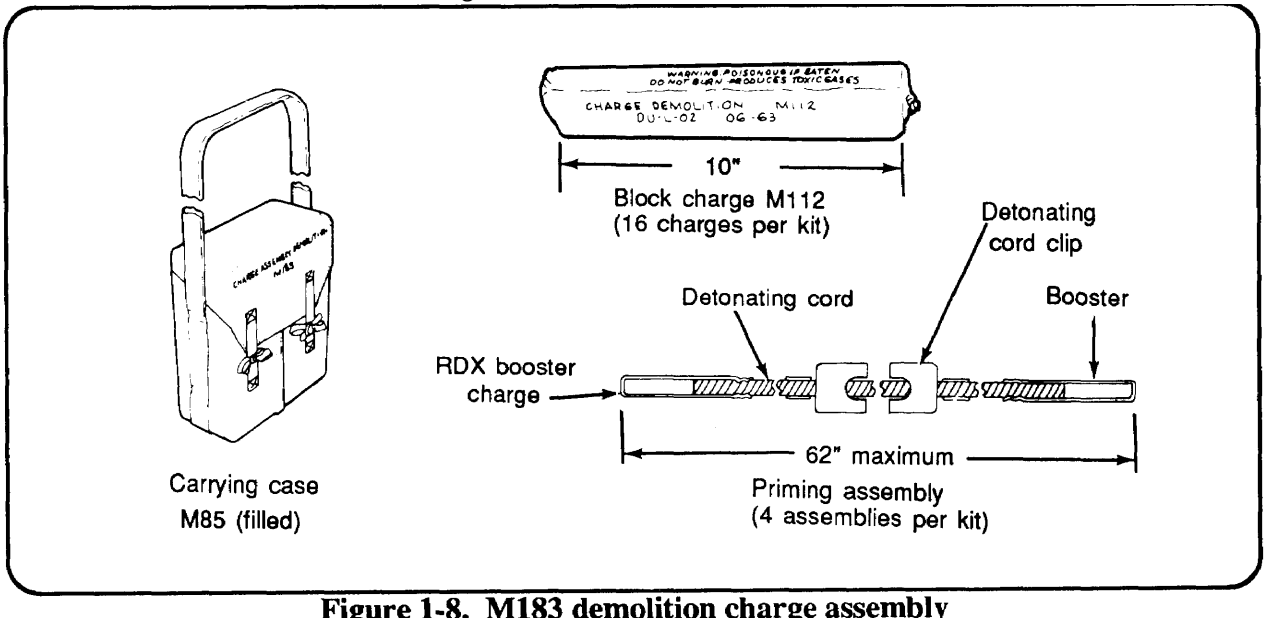

Figure 1-8. M183 demolition charge assembly

c. *Detonation.* Detonate the Ml83 demolition charge assembly with a priming assembly and an electric or a nonelectric blasting cap or by using a detonating-cord ring main attached by detonating cord clips.

1-14. M1A2 Bangtlore-Torpedo Demolition Kit.

a. *Characteristics.* Each kit consists of 10 loading assemblies, 10 connecting sleeves, and 1 nose sleeve. The loading assemblies, or torpedoes, are steel tubes 5 feet long and 2 1/8 inches in diameter, grooved, and capped at each end (Figure 1-9, page 1-12). The torpedoes have a 4-inch, Composition A3 booster (½ pound each) at both ends of each 5-foot section. The main explosive charge is 10½ pounds of Composition B4. The kit is packaged in a 60¾- by 13¾- by 4 9/16-inch wooden box and weighs 198 pounds.

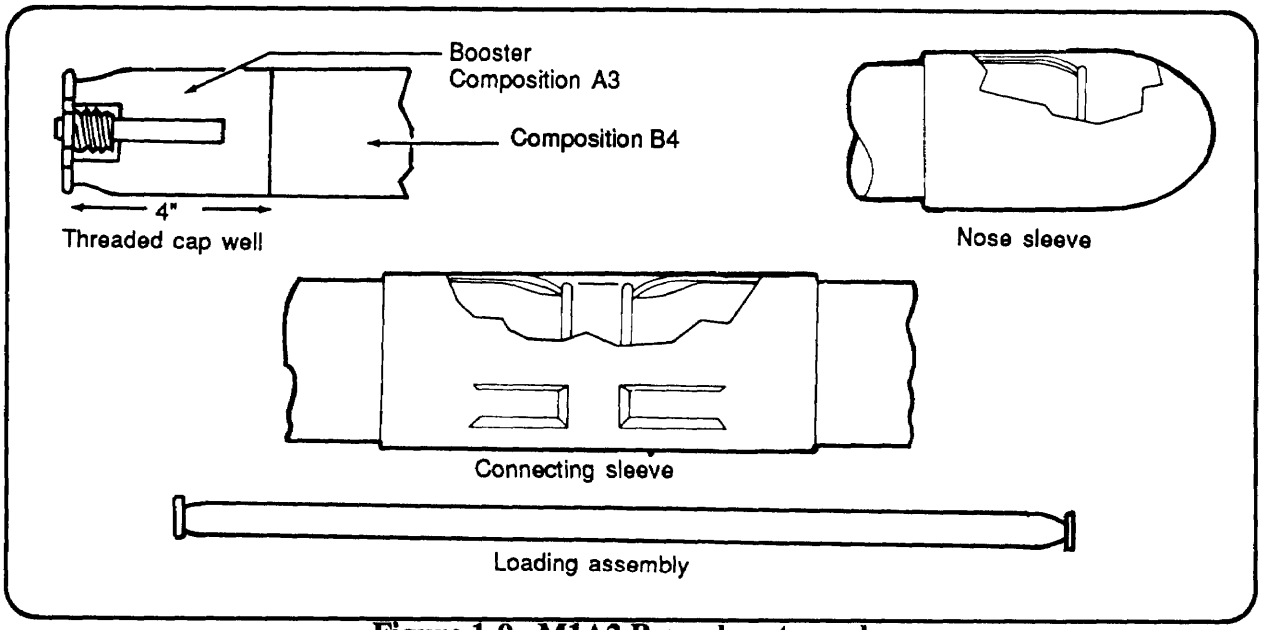

Figure 1-9. M1A2 Bangalore torpedo

b. *Use.* The primary use of the torpedo is clearing paths through wire obstacles and heavy undergrowth. It will clear a 3- to 4-meter-wide path through wire obstacles.

WARNING
The Bangalore torpedo may detonate a live mine when being placed. To prevent detonation of the torpedo during placement, attach the nose sleeve to a fabricated dummy section (approximately the same dimensions as a single Bangalore section) and place the dummy section onto the front end of the torpedo.

c. *Assembly.* All sections of the torpedo have threaded cap wells at each end. To assemble two or more sections, press a nose sleeve onto one end of one tube, and then connect successive tubes, using the connecting sleeves provided until you have the desired length. The connecting sleeves make rigid joints. The nose sleeve allows the user to push the torpedo through entanglements and across the ground.

d. *Detonation.* The recommended method to detonate the torpedo is to prime the torpedo with eight wraps of detonating cord and attach two initiation systems for detonation. Another method for priming the Bangalore torpedo is by inserting an electric or a nonelectric blasting cap directly into the cap well. Do not move the torpedo after it has been prepared for detonation. You may wrap the end with detonating cord prior to placing it, but do not attach the blasting caps until the torpedo is in place.

1-15. M180 Demolition Kit (Cratering).

a. *Characteristics.* This kit consists of an M2A4 shaped charge, a modified M57 electrical firing device, a warhead, a rocket motor, a tripod, and a demolition circuit (Figure 1- 10). The shaped charge, firing device, and warhead are permanently attached to the launch leg of the tripod. The rocket motor and the demolition circuit (packed in a wooden subpack) are shipped separately. The

kit weighs approximately 165 pounds (74.25 kilograms). TM 9-1375-213-12-1 provides the assembly procedures, operational description, and maintenance instructions for the Ml80 kit.

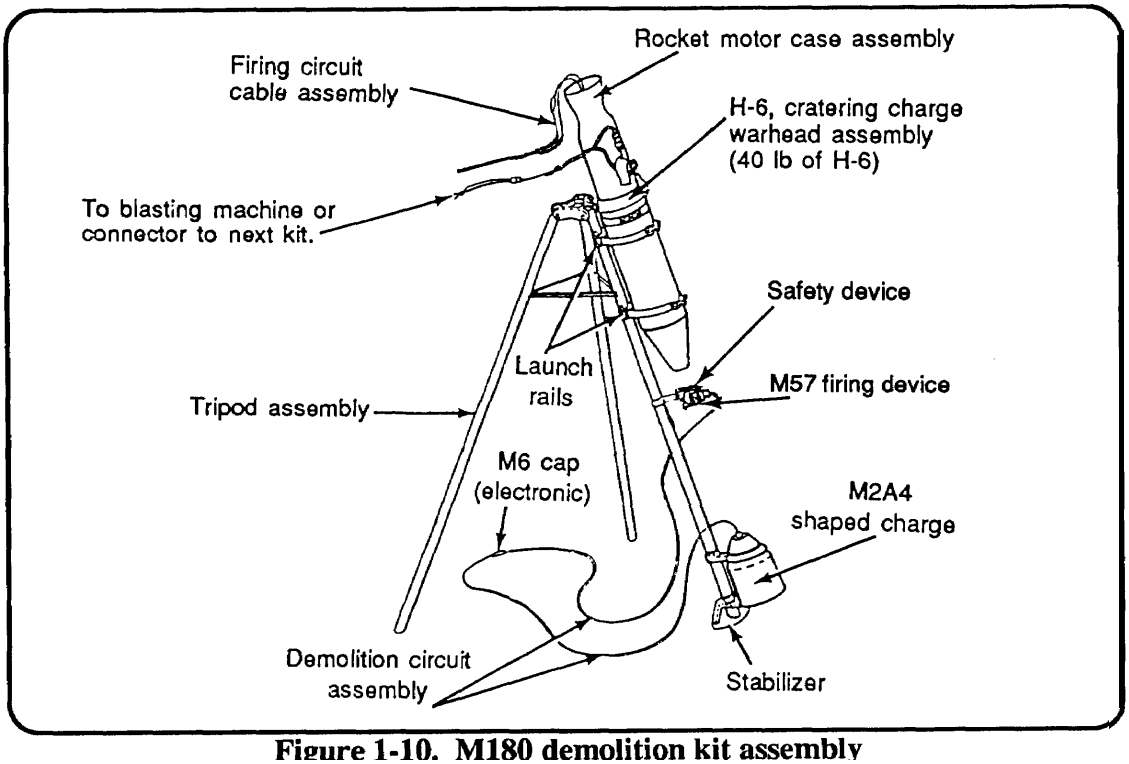

Figure 1-10. M180 demolition kit assembly

b. *Use.* The M180 is designed to produce a large crater in compacted soil or road surfaces, but not in reinforced concrete, arctic tundra, bedrock, or sandy soil. The charge produces a crater in two stages. The shaped charge blows a pilot hole in the surface. Then, the rocket-propelled warhead enters the hole and detonates, enlarging the pilot hole. Up to five kits can be set up close together and fired simultaneously to produce an exceptionally large crater. Up to 15 kits can be widely spaced and freed simultaneously for airfield pocketing.

WARNING
Regardless of the number of kits used, the minimum safe distances for the M180 cratering kit are 1,200 meters for unprotected personnel and 150 meters for personnel under overhead cover.

c. *Detonation.* When firing the M180, use the M34 50-cap blasting machine.

Section IV. Demolition Accessories

1-16. Time Blasting Fuse. The time blasting fuse transmits a delayed spit of flame to a nonelectric blasting cap. The delay allows the soldier to initiate a charge and get to a safe distance before the explosion. There are two types of fuses: the M700 time fuse and safety fuse. Although safety fuse is not often employed, it is still available.

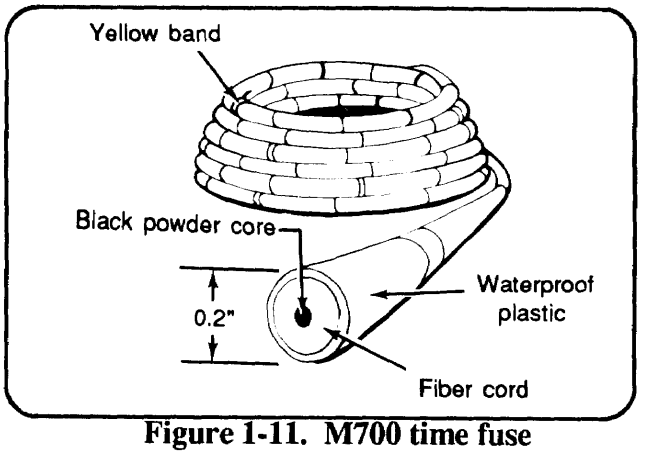

Figure 1-11. M700 time fuse

a. *M700 Time Fuse.* The M700 fuse is a dark green cord, 0.2 inches in diameter, with a plastic cover (Figure 1-1 1). The M700 bums at an approximate rate of 40 seconds per foot. However, test the burning rate as outlined in Chapter 2 (paragraph 2-lb(l), page 2-2). Depending on the date of manufacture, the cover may be smooth or have single yellow bands around the outside at 12- or 18-inch intervals and double yellow bands at 60- or 90-inch intervals. These bands accommodate hasty measuring. The outside covering becomes brittle and cracks easily in arctic temperatures. The M700 time fuse is packaged in 50-foot coils, two coils per package, five packages per sealed container, and eight containers (4,000 feet) per wooden box (30 1/8 by 15 1/8 by 14 7/8 inches). The total package weighs 94 pounds.

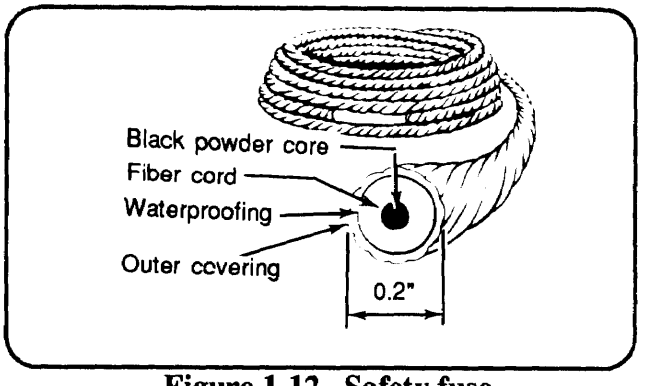

Figure 1-12. Safety fuse

b. *Safety Fuse.* Safety fuse consists of black powder tightly wrapped with several layers of fiber and waterproofing material. The outside covering becomes brittle and cracks easily in arctic temperatures. The burning rate may vary for the same or different rolls (30 to 45 seconds per foot) under different atmospheric and climatic conditions. This fuse may be any color, but orange is the most common (Figure 1-12). Test each roll in the area where the charge will be placed (paragraph 2-lb(l), page 2-2). Since safety fuse burns significantly faster underwater, test it underwater before preparing an underwater charge. Safety fuse is packaged in 50-foot coils, two coils per package, and 30 packages (3,000 feet) per wooden box (24¾ by 15¾ by 12 ½ inches). The total package weighs 93.6 pounds.

1-17. Detonating Cord.

a. *Characteristics. The* American, British, Canadian, and Australian (ABCA) Standardization Program recognizes this Type 1 detonating cord as the standard detonating cord. Detonating cord (Figure 1-13) consists of a core of high explosive (6.4 pounds of PETN per 1,000 feet) wrapped in a reinforced and waterproof olive-drab plastic coating. This detonating cord is approximately 0.2 inches in diameter, weighs approximately 18 pounds per 1,000 feet, and has a breaking strength of 175 pounds. Detonating cord is functional in the same temperature range as plastic explosive, although the cover becomes brittle at lower temperatures. Moisture can penetrate the explosive filling to a maximum distance of 6 inches from any cut or break in the coating. Water-soaked detonating cord will detonate if there is a dry end to allow initiation. For this reason, cut off and discard the first 6 inches of any new or used detonating cord that nonelectric blasting caps are crimped to. Also, leave a 6-inch overhang when making connections or when priming charges.

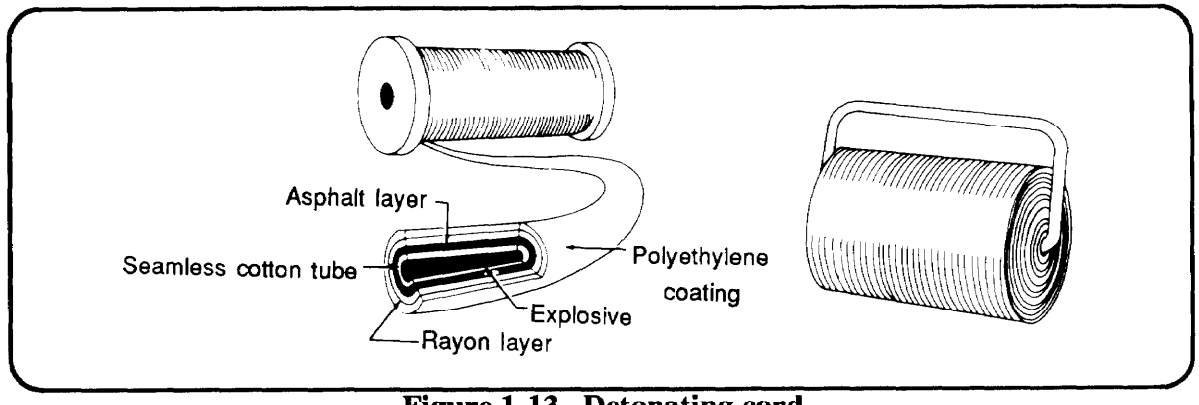

Figure 1-13. Detonating cord

b. *Use.* Use detonating cord to prime and detonate other explosive charges. When the detonating cord's explosive core is initiated by a blasting cap, the core will transmit the detonation wave to an unlimited number of explosive charges. Chapter 2 explains the use of detonating cord for these purposes.

c. Precautions. Seal the ends of detonating cord with a waterproof sealant when used to fire underwater charges or when charges are left in place several hours before firing. If left for no longer than 24 hours, a 6-inch overlap will protect the remainder of a line from moisture. Avoid kinks or sharp bends in priming, as they may interrupt or change the direction of detonation and cause misfires. Avoid unintended cross-overs of the detonating cord where no explosive connection is intended. To avoid internal cracking do not step on the detonating cord.

1-18. Blasting Caps. Blasting caps are for detonating high explosives. There are two types of blasting caps: electric and nonelectric. They are designed for insertion into cap wells and are also the detonating element in certain firing systems and devices. Blasting caps are rated in power, according to the size of their main charge. Commercial blasting caps are normally Number 6 or 8 and are for detonating the more sensitive explosives, such as commercial dynamite and tetryl. Special military blasting caps (M6 electric and M7 nonelectric) ensure positive detonation of the generally less sensitive military explosives. Their main charge is approximately double that of commercial Number 8 blasting caps. Never carry blasting caps loose or in uniform pockets where they are subject to shock. Separate blasting caps properly. Never store blasting caps with other explosives. Do not carry blasting caps and other explosives in the same truck except in an emergency (paragraph 6-11, page 6-10).

WARNING

Handle military and commercial blasting caps carefully, as both are extremely sensitive and may explode if handled improperly. Do not tamper with blasting caps. Protect them from shock and extreme heat.

a. *Electric Blasting Caps.* Use electric blasting caps when a source of electricity, such as a blasting machine or a battery, is available. Both military and commercial caps may be used. Military caps (Figure 1-14, page 1-6) operate instantaneously. Commercial caps may operate instantaneously or have a delay feature. The delay time of commercial caps for military applications ranges from 1 to 1.53 seconds. Electric caps have lead wires of various lengths. The most common lead length is 12 feet. Electric caps require 1.5 amperes of power to initiate. The standard-issue cap

is the M6 special electric blasting cap. TM 43-0001-38 gives additional information on blasting caps.

WARNING
Do not remove the short-circuiting shunt until ready to test the cap. Doing this prevents accidental initiation by static electricity. If the cap has no shunt, twist the lead's bare ends together with at least three 180-degree turns to provide a shunting action.

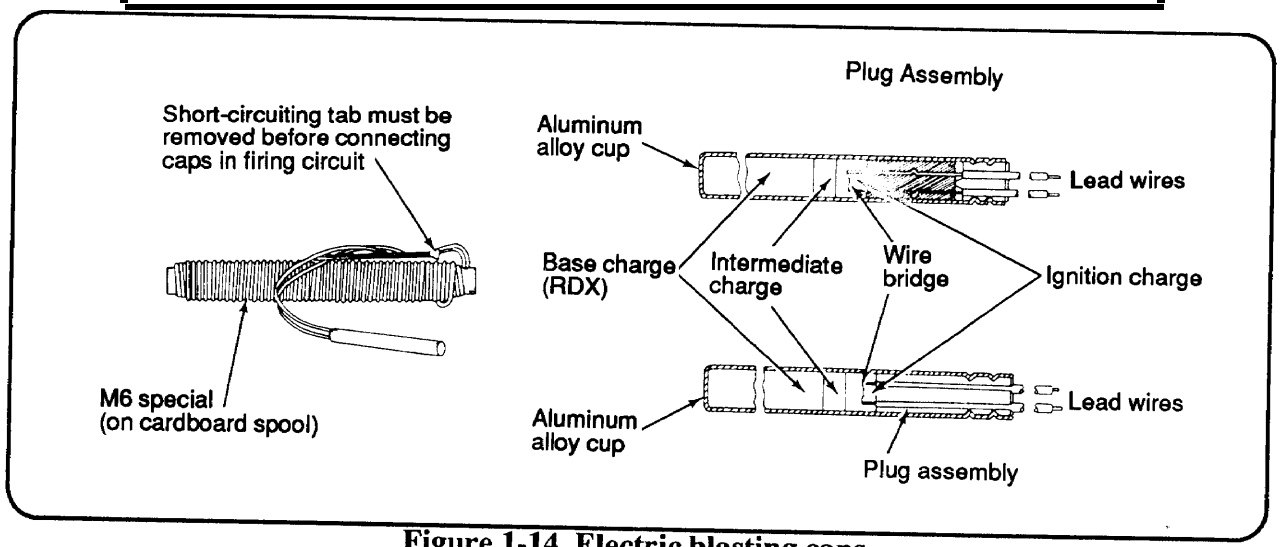

Figure 1-14. Electric blasting caps

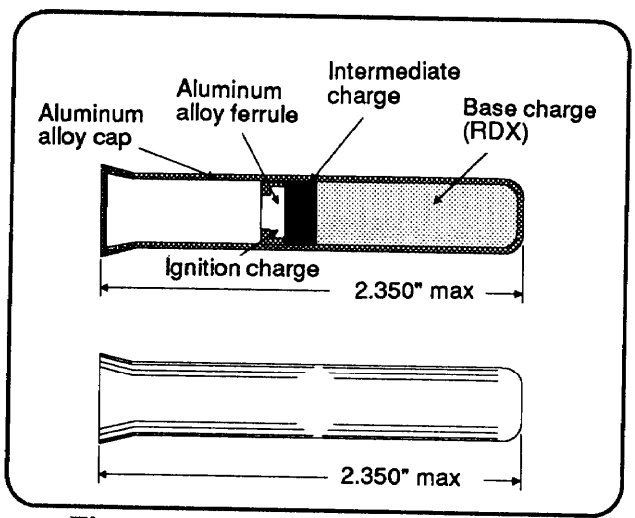

Figure 1-15. Nonelectric blasting cap

b. *Nonelectric Blasting Caps.* Initiate these caps with time-blasting fuse, a firing device, or detonating cord (Figure 1-15). Avoid using nonelectric blasting caps to prime underwater charges because the caps are hard to waterproof. If necessary, waterproof nonelectric blasting caps with a sealing compound. The M7 special nonelectric blasting cap is the standard issue. The open end of the M7 special nonelectric blasting cap is flared to allow easy insertion of the time fuse. TM 43-0001-38 gives additional information on blasting caps.

1-19. MlA4 Priming Adapter. The MIA4 priming adapter is a plastic, hexagonal-shaped device, threaded to fit threaded cap wells. The shoulder inside the threaded end will allow time blasting fuse and detonating cord to pass, but the shoulder is too small to pass a military blasting cap. To accommodate electric blasting caps, the adapter has a lengthwise slot that permits blasting cap lead wires to be quickly and easily installed in the adapter (Figure 1-16).

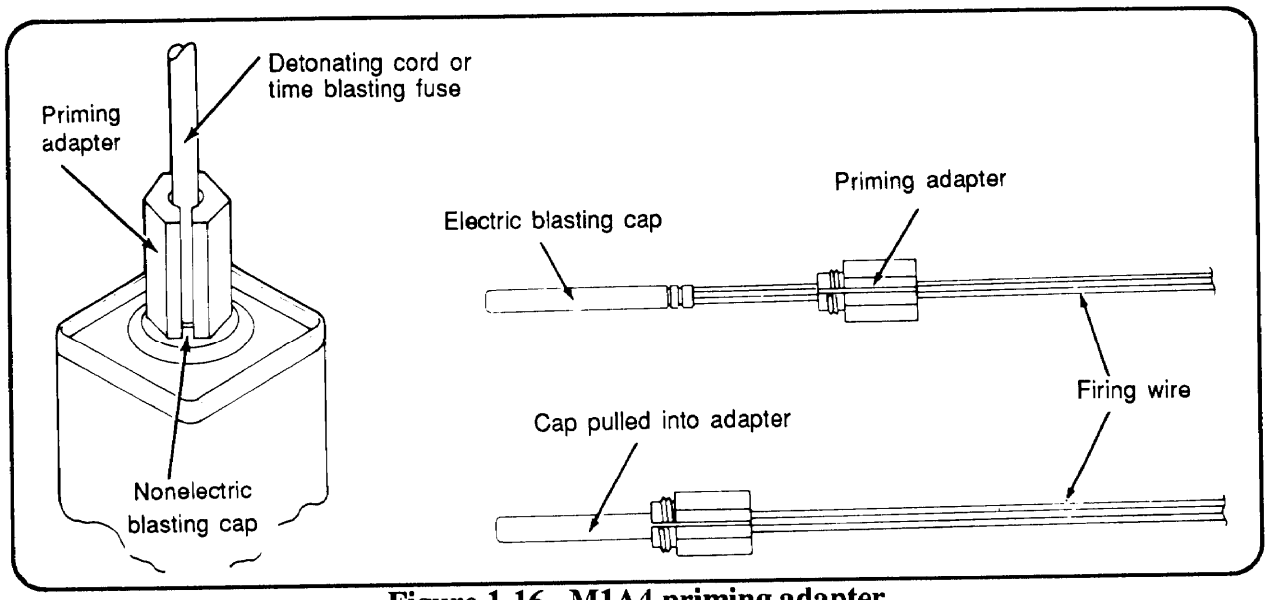

Figure 1-16. M1A4 priming adapter

1-20. M8 Blasting Cap Holder. The M8 blasting cap holder is a metal clip designed to attach a blasting cap to a sheet explosive (Figure 1-17). These clips are supplied with Ml18 sheet demolition charges and Ml86 roll demolition charges. The M8 blasting cap holder is also available as a separate-issue item in quantities of 4,000.

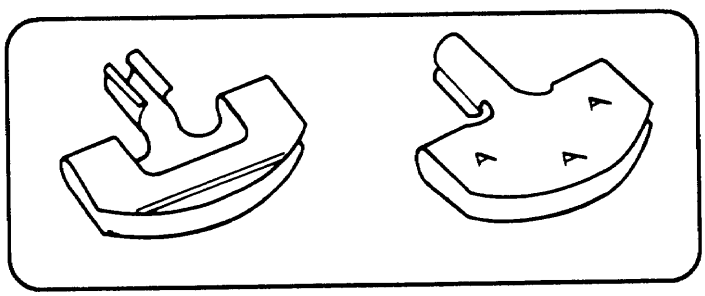

Figure 1-17. M8 blasting cap holder

1-21. Ml Detonating-Cord Clip. The Ml detonating-cord clip is a device for holding two strands of detonating cord together, either parallel or at right angles (Figure 1-18, diagram 1). Using these clips is faster and more efficient than using knots. Knots, if left for extended periods, may loosen and fail to function properly.

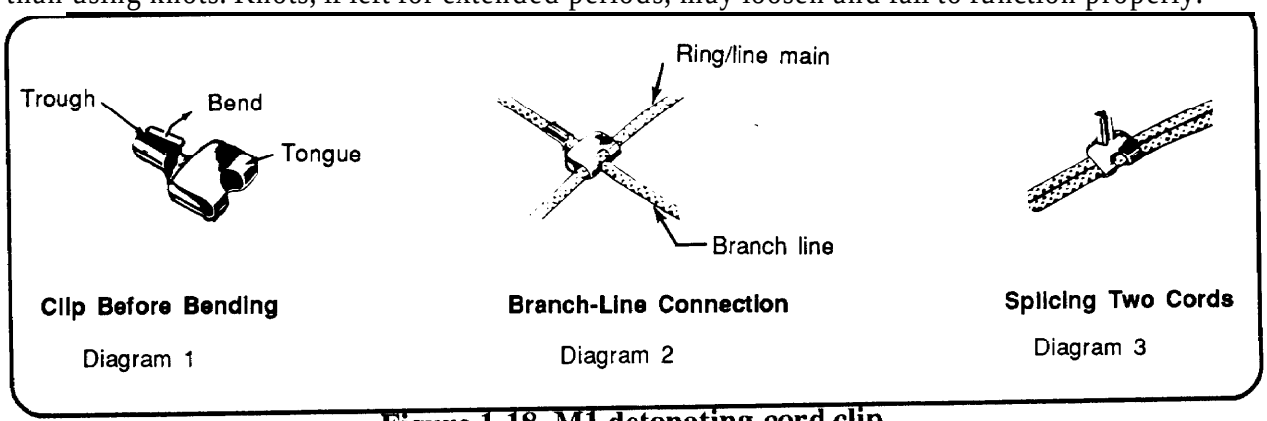

Figure 1-18. M1 detonating-cord clip

a. *Branch Lines.* Connect a detonating cord branch line by passing it through the trough of the Ml detonating cord clip and through the hole in the tongue of the clip. Next, place the line/ring main into the tongue of the clip so that it crosses over the branch line at a 90-degree angle and ensure

the crossover is held secure by the tongue; it may be necessary to bend or form the tongue while doing this. (Figure 1-18, diagram 2, page 1-17).

b. *Splices.* Splice the ends of detonating cords by first overlapping them approximately 12 inches. Then secure each loose end to the other cord by using a clip. Finally, bend the tongues of the clips firmly over both strands. Make the connection stronger by bending the trough end of the clip back over the tongue (Figure 1-18, diagram 3, page 1-17).

1-22. Ml Adhesive Paste. Ml adhesive paste is a sticky, putty-like substance that is used to attach charges to flat, overhead or vertical surfaces. Adhesive paste is useful for holding charges while tying them in place or, under some conditions, for holding without ties. This paste does not adhere satisfactorily to dirty, dusty, wet, or oily surfaces. Ml adhesive paste becomes useless when softened by water.

1-23. Pressure-Sensitive Adhesive Tape.

a. *Characteristics.* Pressure-sensitive tape is replacing Ml adhesive paste. Pressure-sensitive tape has better holding properties and is more easily and quickly applied. This tape is coated on both sides with pressure-sensitive adhesive and requires no solvent or heat to apply. It is available in 2-inch-wide rolls , 72 yards long.

b. *Use.* This tape is effective for holding charges to dry, clean wood, steel, or concrete.

c. *Limitations.* This tape does not adhere to dirty, wet, oily, or frozen surfaces.

1-24. Supplementary Adhesive for Demolition Charges.

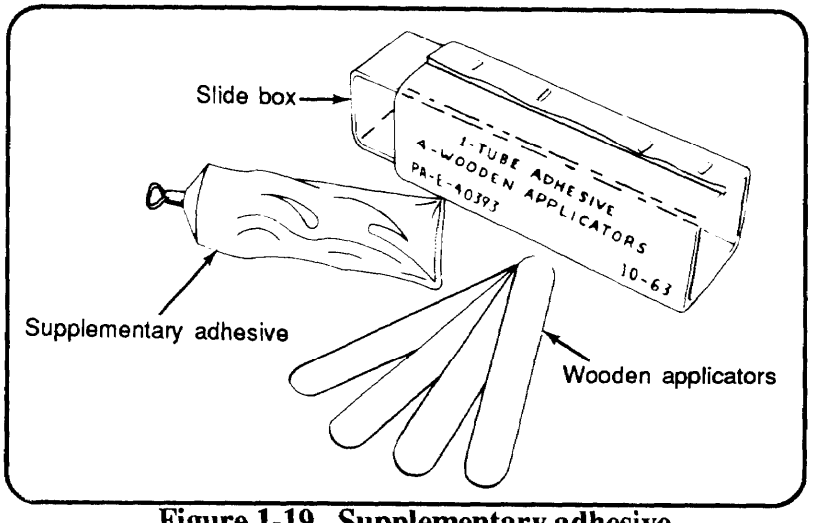

Figure 1-19. Supplementary adhesive

a. *Characteristics.* This adhesive is used to hold demolition charges when the target surface is below freezing, wet, or underwater. The adhesive comes in tubes packed in water-resistant, cardboard slide boxes, with wooden applicators (Figure 1-19).

b. *Use.* Apply the adhesive to the target surface and the demolition block with a wooden applicator and press the two together.

1-25. Waterproof Sealing Compound. This sealant is for waterproofing connections between time blasting fuses or detonating cords and nonelectric blasting caps. The sealing compound will not make a permanent waterproof seal. Since this sealant is not permanent, fire underwater demolitions as soon as possible after placing them.

1-26. M2 Cap Crimper. Use the M2 cap crimper (Figure 1-20) for squeezing the shell of a nonelectric blasting cap around a time blasting fuse, standard coupling base, or detonating cord.

Crimp the shell securely enough to keep the fuse, base, or cord from being pulled off, but not so tightly that it interferes with the operation of the initiating device. A stop on the handle helps to limit the amount of crimp applied. The M2 crimper forms a water-resistant groove completely around the blasting cap. Apply a sealing compound to the crimped end of the blasting cap to waterproof it. The rear portion of each jaw is shaped and sharpened for cutting fuses and detonating cords. One leg of the handle is pointed for punching cap wells in explosive materials. The other leg has a screwdriver end. Cap crimpers are made of a soft, nonsparking metal that conducts electricity. Do not use them as pliers because such use damages the crimping surface. Ensure crimp hole is round (not elongated) and the cutting jaws are not jagged. Keep the cutting jaws clean, and use them only for cutting fuses and detonating cords.

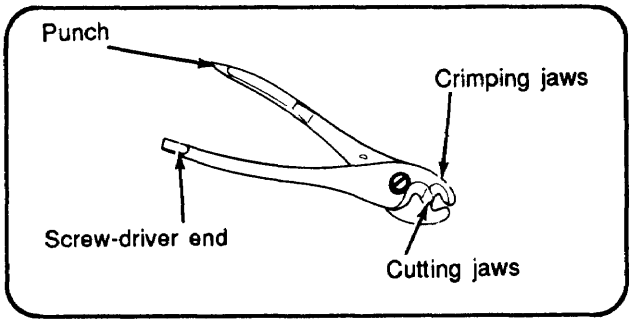

Figure 1-20. M2 cap crimper

1-27. M51 Blasting-Cap Test Set.

a. *Characteristics.* The test set is a self-contained unit with a magneto-type impulse generator, an indicator lamp, a handle to activate the generator, and two binding posts for attaching firing leads. The test set is waterproof and capable of operation at temperatures as low as -40 degrees Fahrenheit (Figure 1-21).

b. *Use.* Check the continuity of firing wire, blasting caps, and firing circuits by connecting the leads to the test-set binding posts and then depressing the handle sharply. If there is a continuous (intact) circuit, even one created by a short circuit, the indicator lamp will flash. When the circuit is open, the indicator lamp will not flash.

c. *Maintenance.* Handle the test set carefully and keep it dry to assure optimum use. Before using, ensure the test set is operating properly by using the following procedure:

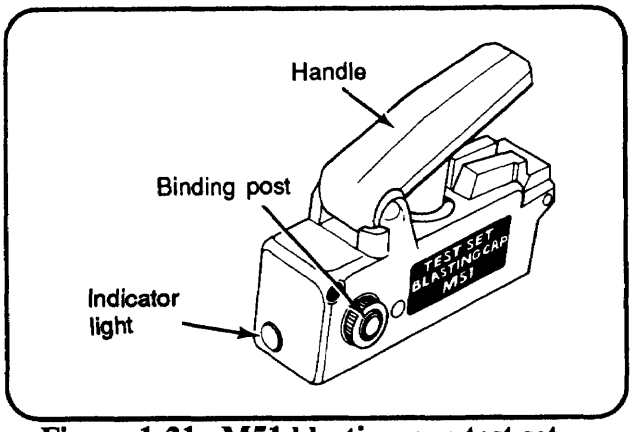

Figure 1-21. M51 blasting-cap test set

(1) Hold apiece of bare wire or the legs of the M2 crimpers between the binding posts.

(2) Depress the handle sharply while observing the indicator lamp. The indicator lamp should flash.

(3) Remove the bare wire or crimper legs from the binding posts.

(4) Depress the handle sharply while observing the indicator lamp. This time the indicator lamp should not flash.

(5) Perform both tests to ensure the test set is operating properly.

1-28. Blasting Machines. Blasting machines provide the electric impulse needed to initiate electric blasting-cap operations. When operated, the M32 and M34 models use an alternator and a capacitor to energize the circuit.

a. *M32 10-Cap Blasting Machine.* This small, lightweight blasting machine (Figure 1-22) produces adequate current to initiate 10 electrical caps connected in series using 500 feet of WD-l cable. To operate the machine, use the following procedure:

(1) Check the machine for proper operation. Release the blasting machine handle by rotating the retaining ring downward while pushing in on the handle. The handle will automatically spring outward from the body of the machine.

(2) Activate the machine by depressing the handle rapidly three or four times until the neon indicator lamp flashes. The lamp is located between the wire terminal posts and cannot be seen until it flashes, since it is covered by green plastic.

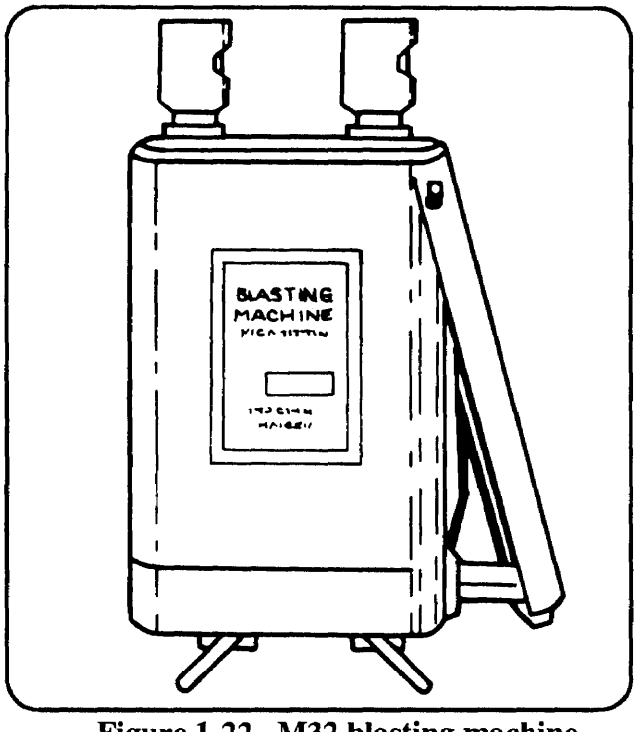

Figure 1-22. M32 blasting machine

(3) Insert the firing wire leads into the terminals by pushing down on each terminal post and inserting the leads into the metal jaws.

(4) Hold the machine upright (terminals up) in either hand, so the plunger end of the handle rests in the base of the palm and the fingers grasp the machine's body. Be sure to hold the machine correctly, as the handles are easily broken.

(5) Squeeze the handgrip sharply several times until the charge fires. Normally, no more than three or four strokes are required.

b. *M34 50-Cap Blasting Machine.* This small, lightweight machine produces adequate current to initiate 50 electrical caps connected in a series. It looks like the M32 blasting machine (Figure 1-22) except for a black band around the base and a steel-reinforced actuating handle. Test and operate the M34 in the same manner as the M32.

1-29. Firing Wire and Reels.

a. *Types of Firing Wire.* Wire for firing electric charges is available in 200- and 500-foot coils. The two-conductor AWG Number 18 is a plastic-covered or rubber-covered wire available in 500-foot rolls. This wire is wound on an RL39A reel unit. The single-conductor. AWG Number 20 annunciator wire is available in 200-foot coils and is used to make connections between blasting caps and firing wire. The WD- l/TT communication wire will also work, but it requires a greater power source if more than 500 feet are used (blasting machines will not initiate the full-rated number

of caps connected with more than 500 feet of WD-l/TT wire). As a rule of thumb, use 10 less caps than the machine's rating for each additional 1,000 feet of WD-1/TT wire employed.

b. *Reel.* The RL39A reel, with spool, accommodates 500 feet of wire. The reel has a handle assembly, a crank, an axle, and two carrying straps (Figure 1-23). The fixed end of the wire extends from the spool through a hole in the side of the drum and fastens to two brass thumb-out terminals. The carrying handles are two U-shaped steel rods. A loop at each end encircles a bearing assembly to accommodate the axle. The crank is riveted to one end of the axle, and a cotter pin holds the axle in place on the opposite end.

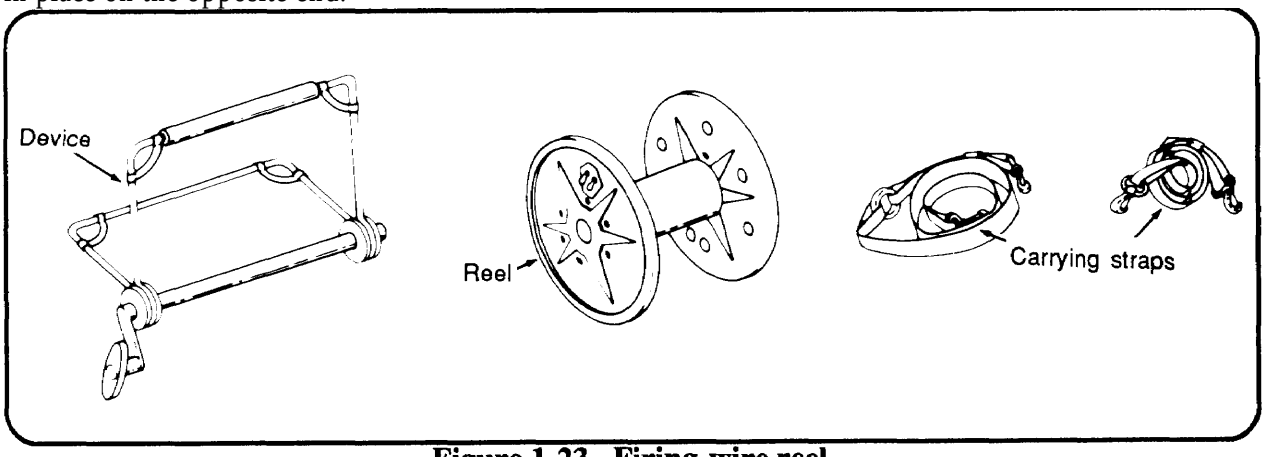

Figure 1-23. Firing-wire reel

1-30. Firing Devices and Other Accessory Equipment

a. *M60 Weatherproof Fuze Igniter.* This device is for igniting timed blasting fuse in all weather conditions, even underwater, if properly waterproofed. Insert the fuse through a rubber sealing grommet and into a split collet. This procedure secures the fuse when the end capon the igniter is tightened (Figure 1-24, page 1-22). Pulling the pull ring releases the striker assembly, allowing the firing pin to initiate the primer, igniting the fuse. Chapter 2 (page 2-4) gives detailed operating instructions for the M60 igniter.

b. *Demolition Equipment Set.* This set (Electric and Nonelectric Explosive Initiating Demolition Equipment Set) is an assembly of tools necessary for performing demolition operations (Table 1-4, page 1-22).

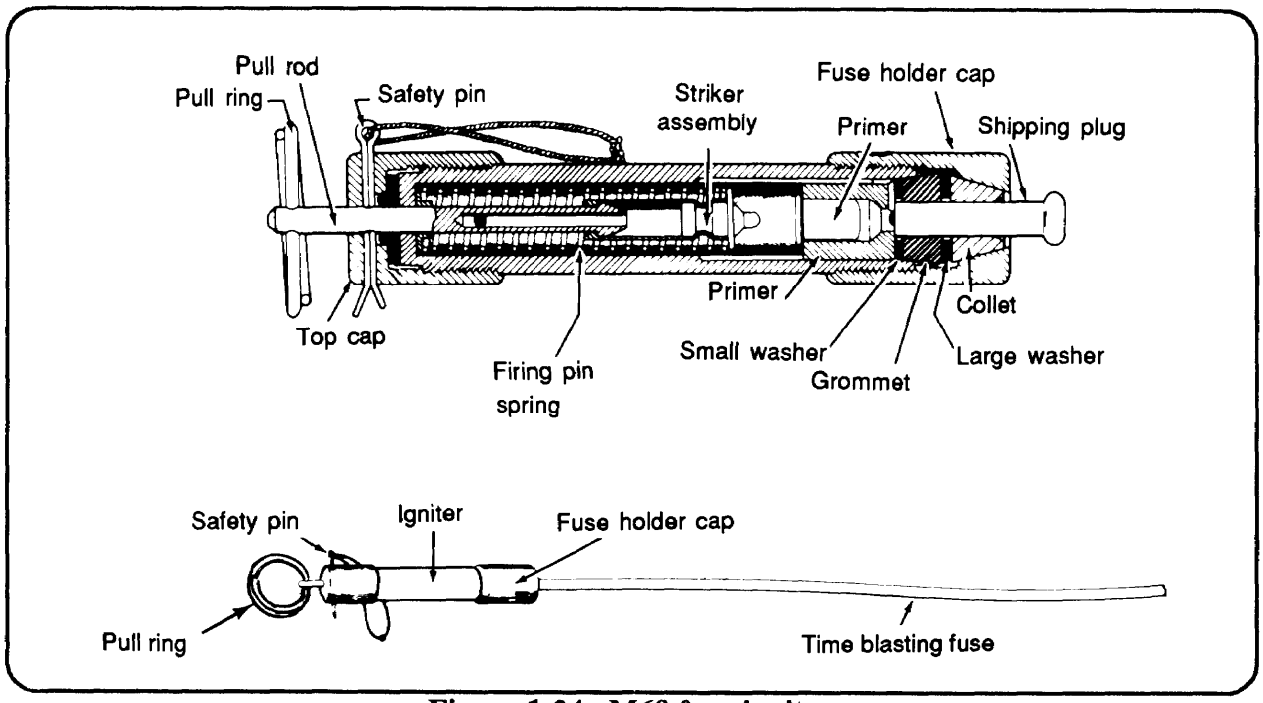

Figure 1-24. M60 fuze igniter

Table 1-4. Demolition equipment set

Quantity	Nomenclature	Quantity	Nomenclature
3	Bag, Demolition Equipment	1	Machine, Blasting, M34
5	Box, Blasting Cap, Plastic, 10-Cap	2	Pliers, Lineman's, w/ Side Cutter, 8-Inch
1	Chest, Demo, Engr Plt, M1931	1	Pliers, Diagonal-Cutting, 6-Inch
4	Crimper, Blasting Cap, M2	4	Reel, Cable
2	Knife, Pocket, w/ Can Opener and Punch	1	Machine, Cable-Reeling, Manual
2	Knife, Pocket, w/ Screwdriver and Wire Scraper	1	Set, Blasting-Cap Test, M51
1	Shears, Metal-Cutting, Manual, 8-Inch	**NOTE:** The individual items listed in this set are available separately.	
2	Tape, Measuring, Steel, Millimeters and Inches		
1	Tape, Measuring, Plastic-Coated, 100-Foot		