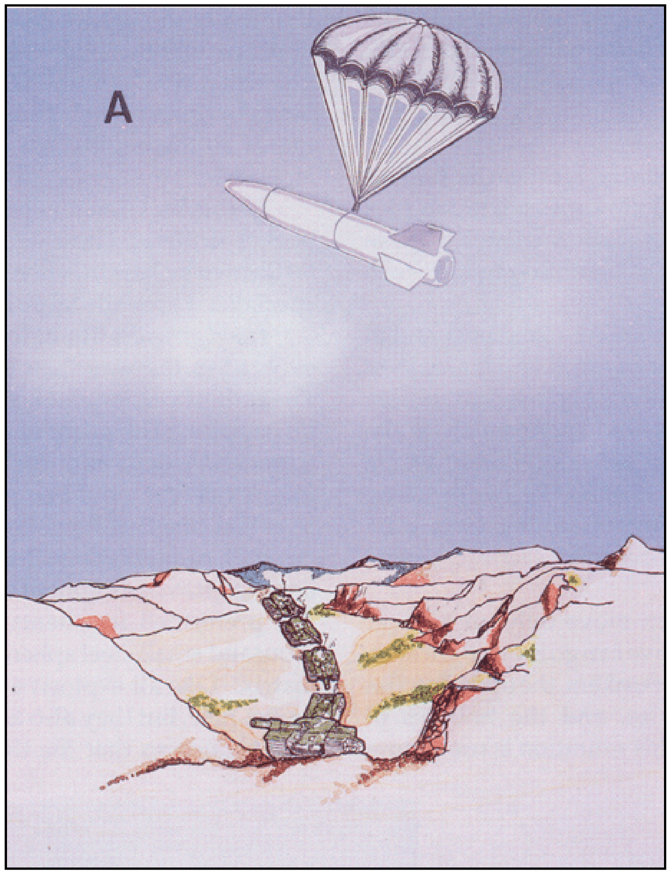

Fig. 1-51. The FAE container is dropped over the target. **A** parachute slows the bomb's descent and carries the charge for the second detonation.

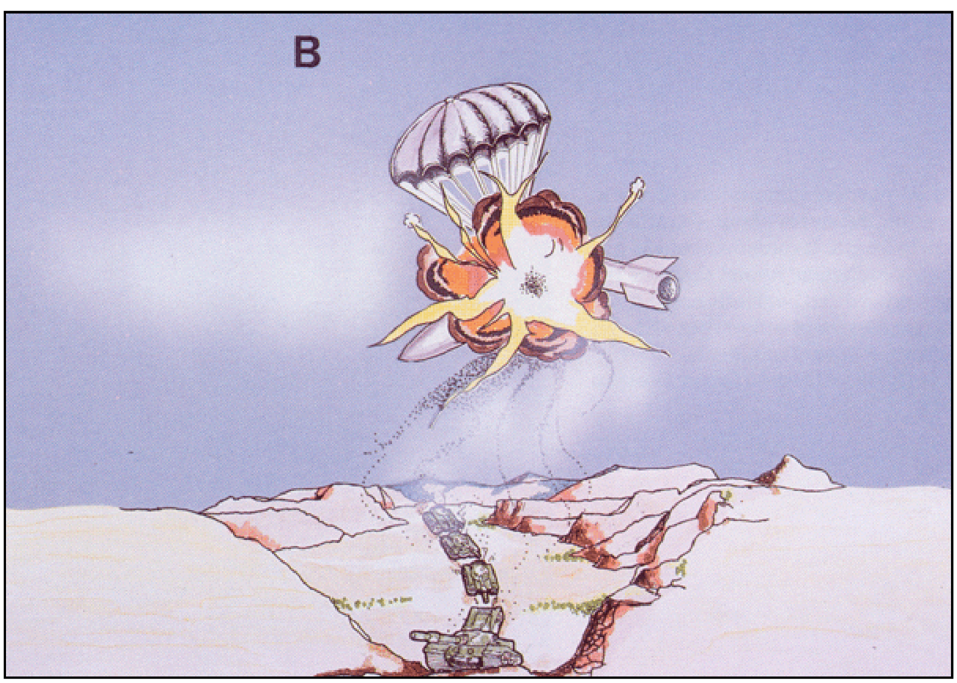

Fig. 1-52. The burster charge detonates, breaking open the **FAE** container and disseminating its fuel, which may be a highly flammable gas or liquid, through the atmosphere.

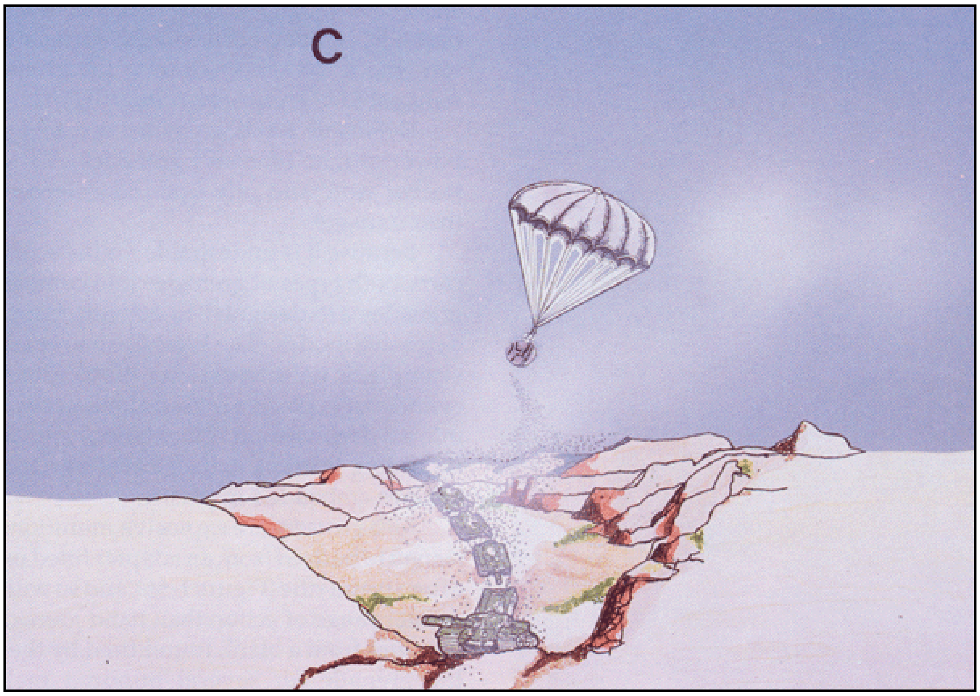

Fig. **1-53.** The fuel mixes with the ambient air, forming an aerosol.

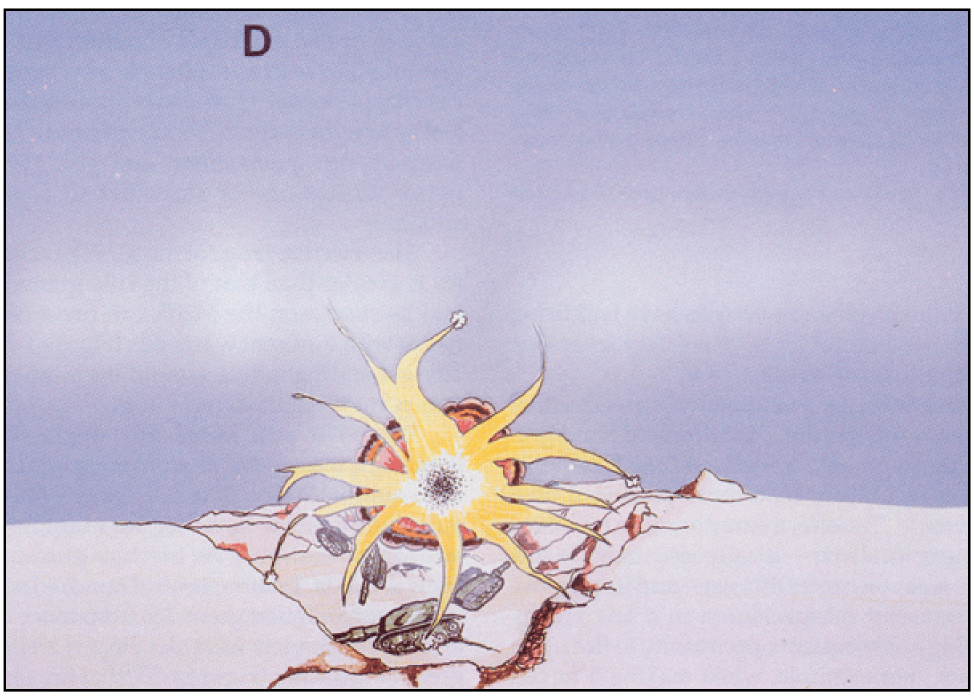

Fig. **1-54.** The fuel-air mixture is detonated by the second explosive charge, which is still attached to the parachute. The delay times between the dispersion of the cloud and its detonation would be about 0.1 second (for an SO-pound FAE) and 2.0 seconds (for a 2,000-pound FAE). Pressures of about 250 psi extend out to the periphery of the cloud, which, for an 80-pound FAE, is about 20–25 feet. At that distance, the pressure from an equivalent weight of TNT would be just over 30 psi.

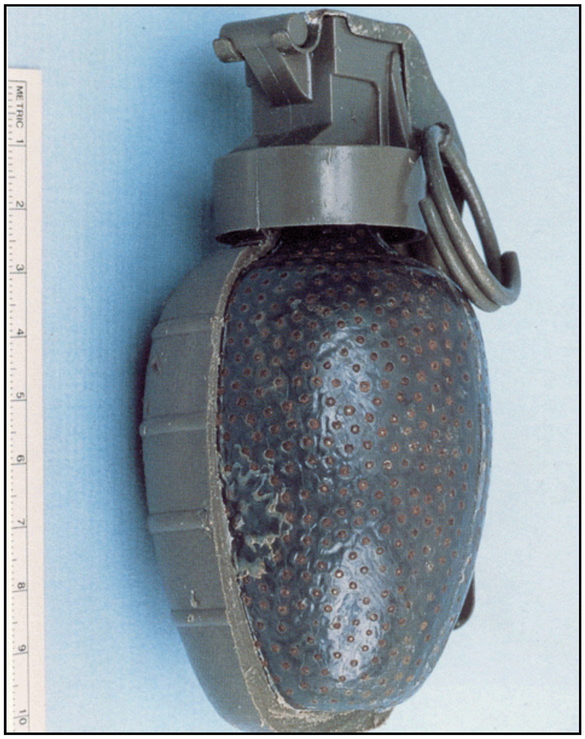

Fig. **1-55.** This modern defensive hand grenade has had its **plastic jacket removed to reveal its contents: 4,000** 50-mg steel balls embedded in an explosive matrix. Compare this improved-fragmentation design with the Soviet-made **POMZ-2** stake mine (Figure 1-66), which resembles an older pineapple-like hand grenade, to see the different thicknesses of the casings.
Source: Explosive Ordnance Disposal Group, Quantico Marine Corps Base

explosion. All hand-grenade designs have had firing pins of some sort, but not all have a safety lever that pops off when the thrower releases it.

Hand grenades have traditionally been classified as either *offensive* or *defensive.* An offensive hand grenade has a thin fragmenting wall, and the fragments tend to be less significant than those produced by a defensive grenade The effective radius of an offensive grenade is quite localized—usually less than the distance that the weapon can be thrown—and its purpose is to create transient incapacitation in a few enemy troops, creating a subsequent opportunity to fire upon the opponents. For example, when making a forced entry in a rescue attempt, an antiterrorist squad may use *concussion grenades* (offensive grenades that produce blast effects without fragments) to disorient and startle hostage-holders. The transient incapacitation produced by the blast is enhanced in an enclosed space. Although the blast of a concussion grenade is normally not powerful enough to cause injury, a person who is extremely close to the grenade might be vulnerable to *primary* blast *injury* (PBI).

Defensive hand grenades are bigger and more powerful than offensive grenades. They also have a thicker wall, and rely upon its fragmentation to do their damage.

Because it is undesirable for the soldier to have to carry both types of grenades into combat, some hand grenades arc designed to convcrt from offcnsivc to defensive modes. The West German-made DM51, for example, is an offensive (or blast) grenade when its cylinder of explosive is used alone. It can be converted into a defensive (or fragmentation) grenade, however, by sliding it into a cylindrical sleeve that is made of spheres embedded in plastic.

Rifle grenades are explosive munitions that are designed to be fired from an adapter fitted onto the barrel of an assault rifle (Figure 1-56), and so will have a much greater range of action than hand grenades will. Gas pressure from a blank round fired by the rifle propels the grenade for several hundred meters. Either antiarmor shaped-charge grenade warheads or antipersonnel fragmentation grenade warheads can be used with this design.

Grenade launchers (such as the M79) can be used alone to fire an explosive munition that consists of a grenade-like warhead plus its own propellant-filled cartridge. The M79 can also be mounted onto an M16, just as a bayonet can be mounted onto a rifle. The two weapons are independent and give the soldier the option to use one or the other in a given tactical situation.

The effective range of the M79 launcher (about 300 m) is greater than that of the rifle grenade. The M79 and its successor, the M203, can fire a variety of grenades with different warheads (Figure 1-57); the casualty-generating radius around the warhead's detonation point is about 30 m.

The **M79** arid **M203** are single-shot **grenade** launchers, but several modern weapons can fire munitions automatically. The U.S. Navy's Mark 19 40-mm automatic grenade launcher, for example, is similar in size to a general-purpose machine gun and can, in just a few seconds, saturate several hundred square meters with fragmentation grenades from more than 1,000 m away. The Soviets have developed a similar 30-mm grenade launcher (Figure 1-58) that fires an improved-fragmentation munition (Figure 1-59). The fragments from this warhead (Figure 1-60), which have an average weight of about 200 mg, have a velocity of 3,200 fps at the point of detonation.[18] In future conventional conflicts, the automatic grenade launcher or the grenade

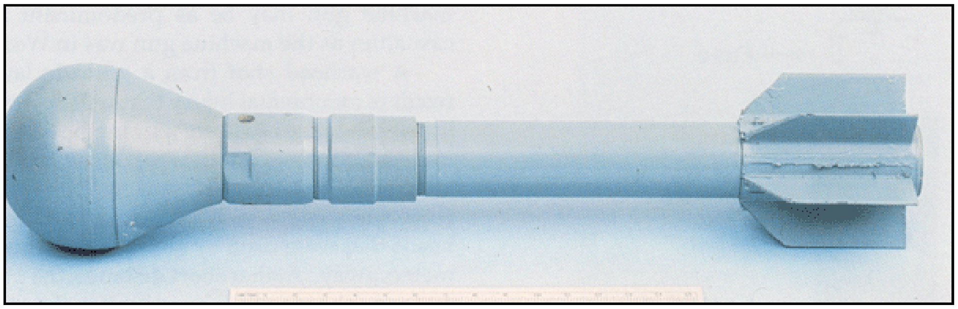

Fig. 1-56. A modern high-explosive rifle grenade
Source: Explosive Ordnance Disposal Group, Quantico Marine Corps Base

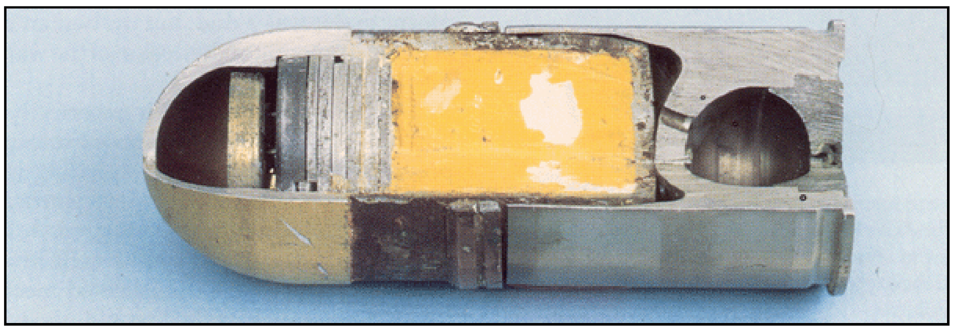

Fig. 1-57. The M79 grenade launcher fires this round, which has been cut open to show the yellow explosive charge, the **fuse** in the warhead's tip, and the cartridge's propellant charge in the lower third of the munition.
Source: U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ

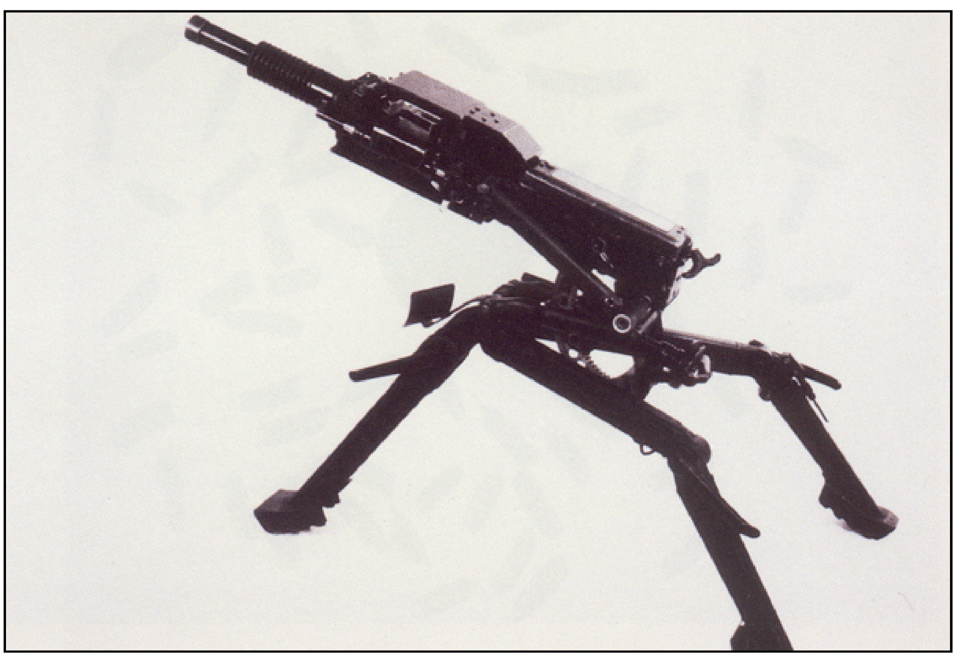

Fig. 1-58. A Soviet-made 30-mm grenade launcher (AGS-17), code-named *Flame* by the NATO forces
Source: Foreign Science and Technology Center, Charlottesville, VA

Fig. 1-59. This roentgenogram shows one of the rounds (the VOG-17) that the AGS-17 can fire, including its coil of notched wire, which is the source of the fragments. Note that the coiled wire and the explosive charge occupy about 75% of the rounds total volume.
Source: Foreign Science and Technology Center

machine gun may be as predominant a source of casualties as the machine gun was in World War I.

A warhead shot from a grenade launcher may result in an unusual injury that will be described here in some detail to illustrate why medical officers need to understand how certain weapons work.

In the Vietnam War and in subsequent training accidents, soldiers were occasionally hit by M406 warheads that were fired by grenade launchers only 5–10 meters away. At that short distance, the projectile had just enough velocity to bury itself in the casualty's soft tissue, but the warhead did not detonate (Figure 1-61). Medical personnel may have believed that the warhead's failure to explode when it hit the casualty meant that it was a dud, but the benign behavior was actually a function of the design of the warhead's M551 fuse.

All fuses must do two things perfectly: *(a)* detonate the munition when it is supposed to explode and *(b)* prevent the munition from exploding when it is not supposed to M406 warheads were designed to explode only after the grenade launcher had propelled them farther than their effective fragmentation fuses ensured not only that they would not explode before they passed that point, but also that they would be

Fig. 1-60. Some of the fragments that are formed from the notched wire in the VOG-17 round after it *has* been detonated are compared in size to a dime.
Source: Foreign Science and Technology Center

certain to explode after.

Because both the firing pin and the fuse detonator in this warhead must interact precisely, the machinery **must fnllnw a sequence nf events in** order to detonate:

(a) The fuse detonator (which contains a small amount of very sensitive explosive) is located in a rotor that is held in place by both a set-back pin and the firing pin. The set-back pin must retract so that the fuse **detonator can rotate 180° from its original** position to align with the firing pin (Figure 1-62). At the precise moment that the warhead is fired, the set-hack pin is **dis-**lodged from the rotor.

(b) As the warhead travels through the rifled launcher barrel, it gains centrifugal force. If the centrifugal force can continue over the time that it takes to travel about 14 m, the will **be** dislodged, **thus com-**pletely freeing the rotor. (If the warhead does not cover this minimum distance **before** it **hits a target, it will nnt have** rotated enough to allow centrifugal force to dislodge the firing pin, and the warhead will remain unarmed.)

(c) The rotor rotates so that the fuse detonator on it lines up with the firing pin (Figure 1-63).

(d) If there is any sudden deceleration of the **warhead, the will strike the fuse** detonator, which ignites the explosive.

(e) This small explosion ignites a larger amount of explosive in the lead charge, which, **in** turn,

(f) detonates a booster charge.

(g) Finally, the main high-explosive bursting charge explodes, fragmenting the warhead casing.

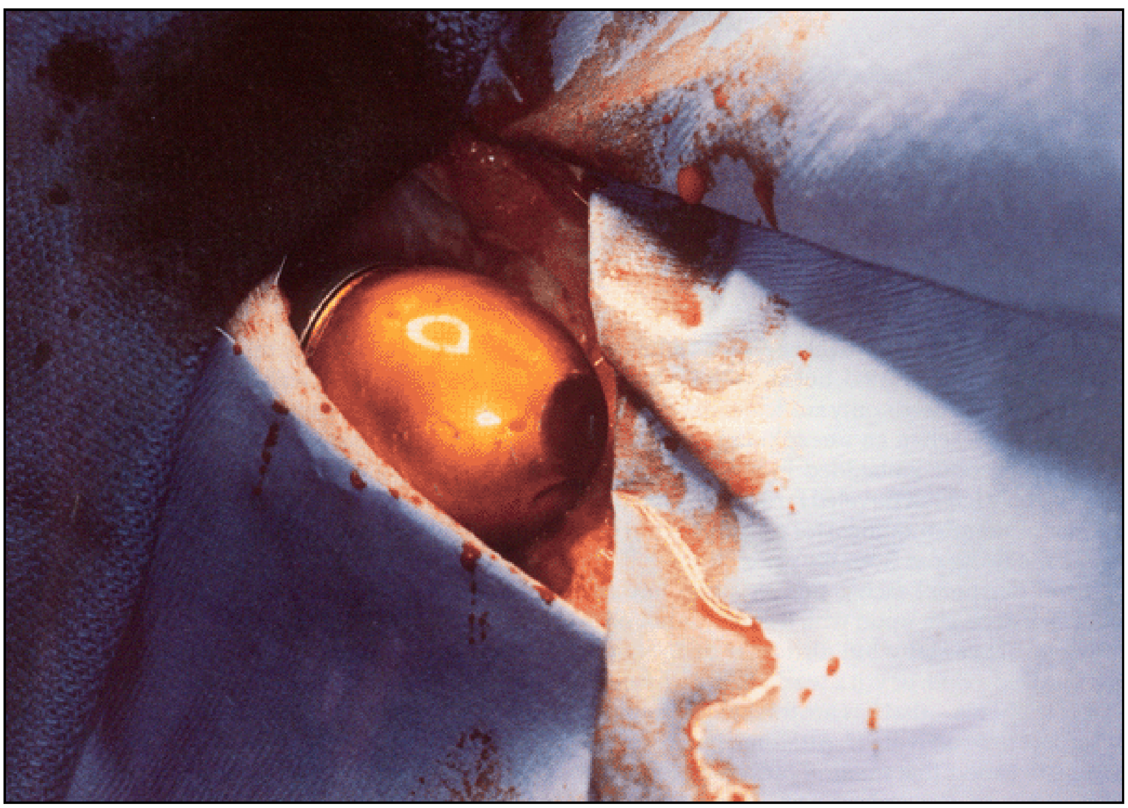

Fig. 1-61. This gaping soft-tissue wound contains an **M406** grenade. Of all the munitions used in Vietnam, this was the type most likely to be found embedded and unexploded in tissue. The fuse is located at the **tip** of the warhead, and **is** activated and will detonate on contact only after the warhead has rotated 10–12 times, the equivalent of traveling a distance of about 45 feet. This characteristic of the fuse made the removal of the unexploded munition relatively safe for medical personnel.
Source: U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal

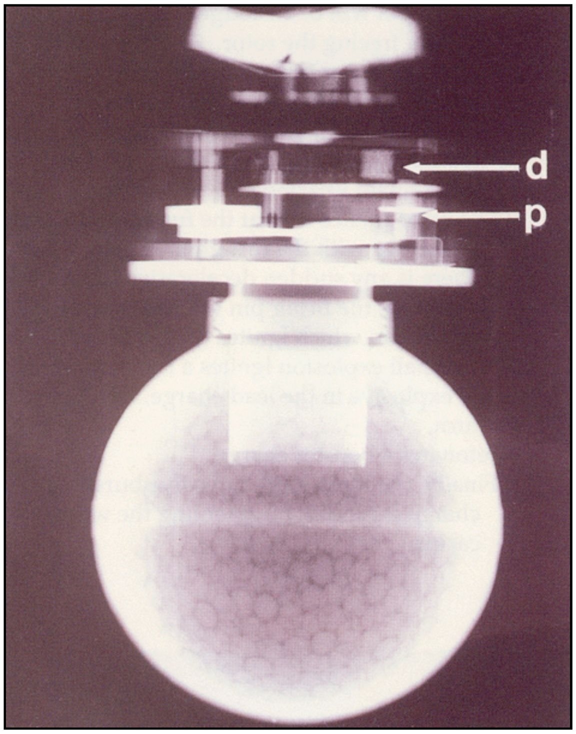

Fig. 1-62. The M551 fuse before the set-back pin (p) has withdrawn from the rotor upon which is mounted the fuse detonator (d). The warhead is in the unarmed position.
Source: U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal

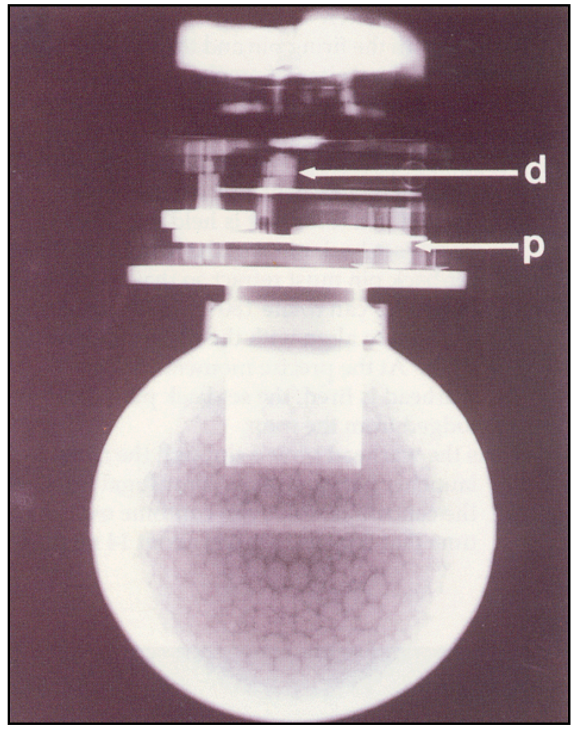

Fig. 1-63. The M551 fuse after the set-back pin and the firing pin (p) have moved and the fuse detonator (d) on the rotor is in line with the firing pin. The warhead is now armed and can explode.
Source: U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal

The critical point in the sequence is *(c)*; before this step, the warhead is unarmed, but as soon as this step occurs, the warhead needs only sufficient deceleration to explode. Thus, when an unexploded warhead of this type has become embedded in a casualty's soft tissues, it usually has not traveled far enough (and thus has not made enough rotations) for centrifugal force to disengage the firing pin from the rotor.

Medical personnel facing this situation have to make a quick decision, upon which depends not only the safety of the casualty but also their own. Is the warhead indeed a dud, or is it a warhead with a fuse—like that of the M406—that has not traveled far enough before impact to be activated? Although it may not be reasonable to expect that medical officers become experts on fuses, an elementary understanding of the weapon's design would reassure the medical team that they probably could, in the absence of other evidence, safely remove the warhead.

Mines. In a narrow sense, a *mine* is defined as an explosive ordnance designed to be buried in the ground. In the broader sense, a mine is any hidden explosive ordnance that lies in wait for its target. As such, it may be equally dangerous to friendly or enemy forces. Depending on the size and design of their fuses, mines can be used against materiel or personnel.

Antimatériel mines are designed to damage armored fighting vehicles, especially tanks. Conventional antitank mines contain 10–20 pounds of explosive and have a fuse that is activated when it is compressed by 300–500 pounds of weight (Figure **1-64)**. Thus, the weight of one person who happened to step on a buried antitank mine would probably not be enough to detonate it. Antitank mines usually damage the tank's track or suspension, although lighter vehicles (such as armored personnel carriers) may sustain more severe structural damage. Personnel inside the vehicle, however, would be susceptible to the same kinds of rapid acceleration-deceleration injuries and other blunt trauma that they might receive in a car wreck. Newer antitank mines use shaped-charge warheads to penetrate the tank's belly armor; more frag-

Fig. 1-64. This cutaway shows a portion of the 11-pound explosive charge (painted yellow) of an M21 antitank mine. The function of the thick concave melt plate that forms the upper margin of the explosive charge is similar in some respects to the melt sheet of a shaped-charge warhead. When the charge explodes, the metal plate breaks up into many high-velocity fragments that penetrate the tank and create far more damage than the blast alone would have done. The mine can be detonated either by a conventional pressure fuse that is activated by weight or a sophisticated tilt-rod extension fuse that is activated when the target vehicle's underside brushes it.
Source Explosive Ordnance Disposal Group, Quantico Marine Corps Base

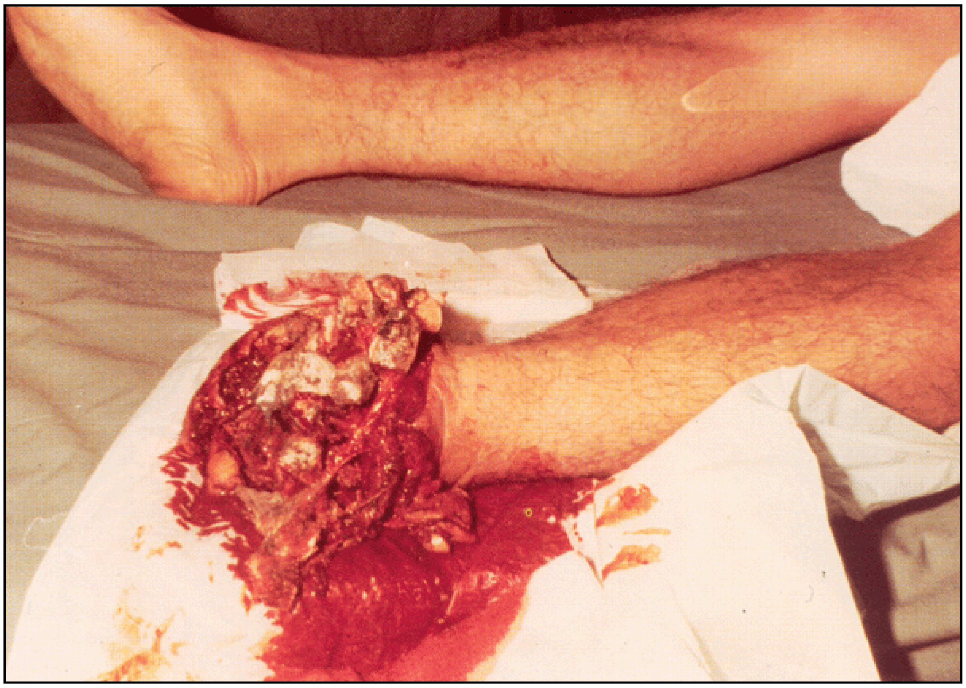

Fig. 1-65. The casualty has suffered a traumatic amputation of the distal portion of his foot, typical of the injuries caused by a buried antipersonnel mine.
Source: Wound Data and Munitions Effectiveness Team

mentation and thermal injuries may result.

The buried antipersonnel mine is designed to maim rather than to kill. It can be made in a variety of sizes and shapes, but commonly resembles a shoe-polish can. About one-half pound of explosive in a buried mine can blow off a victim's foot (Figure 1-65). In addition, when the mine explodes, the particles of dirt in which it was buried become secondary missiles that grossly contaminate any resulting wounds. Although a traumatic amputation certainly incapacitates the individual soldier, the fact that only the soldier who actually steps on the mine is likely to be injured limits the mine's usefulness.

To increase the casualty-generation radius, buried mines with

developed. The M16A2 *bounding* or ***pop-up*** *mine* (commonly called a *Bouncing Betty*) is an example. When activated by being stepped on, a small explosive charge blows a 4-inch wide steel case about 2-4 feet into the air. This steel case is packed with about one pound of explosive. It immediately detonates and sprays fragments as far as 35 m from the site.

Until recently, surface or fixed antipersonnel mines have been somewhat primitive. The Soviet-made POMZ-2 (Figure **1-66)** was used

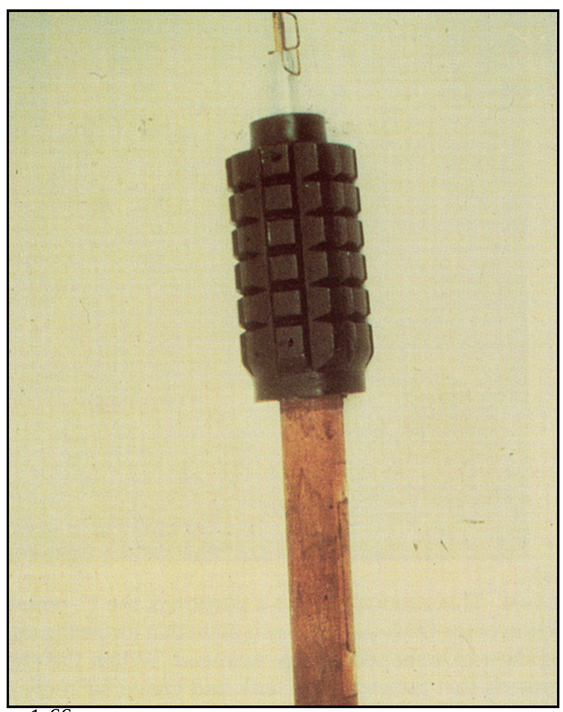

Fig. 1-66. A POMZ-2 stake mine
Source: Letterman Army Institute of Research

War II and resembled older hand grenades. Its explosive charge splintered its thick cast-iron or steel jacket into fragments, the size of which were supposedly determined by deep external grooves. However, the jacket tended to break apart into much larger chunks, similar to those formed by a random-fragmentation shell. Four or five of these 2-kg munitions were connected by a trip wire that, when yanked, detonated the entire line. Fragmentation injuries would occur up to 25 m from each mine.

Modern designs are both more destructive and more easily deployed. Whereas older designs fragmented in all directions upon detonation, newer designs—such as the M18 antipersonnel mine and the M21 antitank mine (Figure 1-64)—focus their fragmentation effects in one direction. The metal plate of the M21 breaks up into fragments when it is blown against the tank's underside. In the M18 (called the Claymore, after the sword used by the Scottish highlanders), this metal sheet has been replaced by a layer of 700 ballbearing-like steel spheres, each weighing 0.75 gram. A 670-gram explosive charge blows the spheres outward over a 60" arc for distances up to 250 meters. Lethal injuries occur within 50 meters, and gross mutilation is common. The Claymore mine is primarily used to defend an area's perimeter, and may be detonated (a) electrically, *(b)* by a timed fuse, or *(c)* by a trip wire. Its effects were devastating in Vietnam.

Booby *Traps.* A booby *trap* is a concealed device that explodes when a nearby harmless-looking object is touched. Although the explosive device may be any commercially available grenade, mine, or shell, booby traps will often be improvised, especially when they are used in terrorist and counterinsurgency operations. A pipe bomb, for example, is a length of steel pipe filled with TNT and fused with a length of detonating cord. Improvised booby traps often contain preformed fragments such as nails, small pieces of wire, or chunks of metal or glass. Such weapons can cause devastating injuries (Figure 1-67).

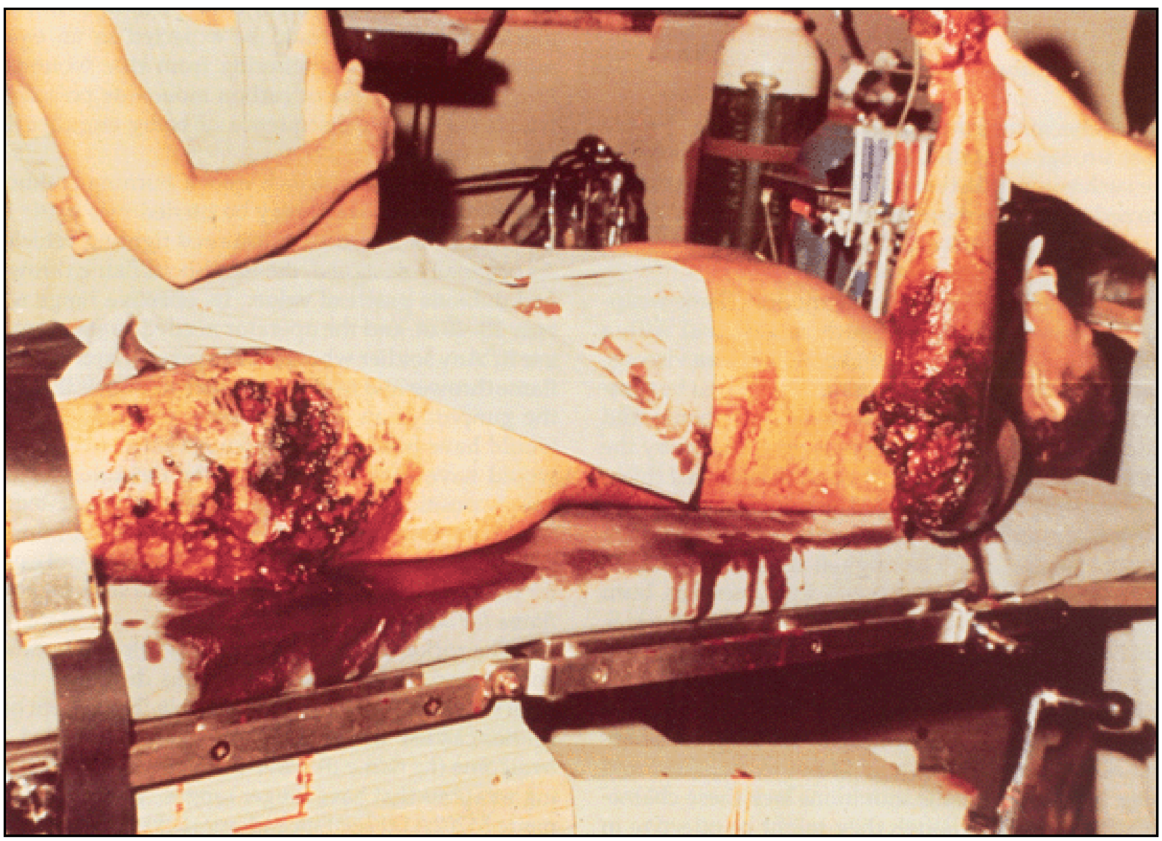

Fig. 1-67. This casualty has a massive soft-tissue injury that was caused by a booby trap made from several hand grenades and assorted pieces of scrap metal.
Source: Wound Data and Munitions Effectiveness Team

FLAME AND INCENDIARY MUNITIONS

Although *flame* and *incendiary munitions* theoretically constitute separate classes of weapons, they both use fire to expel the enemy from fortified or concealed positions. Flame weapons deliver the combustible materials to the target, and it is this combustible ma**terial—not the target itself—that initially burns.** Incendiary weapons also contain a combustible material but use it to set a combustible target on fire, the way a match would ignite a pile of papers. The care of combat casualties who have been injured by flame and incendiary weapons does not differ from the care of burn casualties in general. However, because phosphorus-containing munitions may have the effects of both flame and incendiary munitions (that is, the phosphorus itself can cause a chemical burn as well as ignite the victim's clothes), the injuries that result do raise special treatment concerns.

Flame Munitions

Flame munitions are designed to expel people from strongholds or hidden positions. Because burns are such painful, disfiguring injuries, the fear of being burned—perhaps more than the actual burns themselves—may be the crucial incapacitating factor in the effectiveness of these weapons.

The combustible used in all modern flame weapons is a hydrocarbon fuel (such as gasoline) with a thickening agent added to make the mixture viscous. The thickening agent was originally prepared by combining aluminum hydroxide with naphthenic and palmic acids. The combustible is **now** known by the generic name *napalm*, even though the original thickener has long been superseded by substances based on **soaps of aluminum and** a **more** suitahle **fatty acid,** such **as** isooctanoic acid. The original napalm formula of 91%–98% gasoline and 2%–9% thickener has been replaced by more sophisticated preparations; the U.S. Air Force's Napalm B, for example, consists of 25% gasoline, 25% benzene, and 50% polystyrene. This adhesive, slow-burning, jelly-like liquid will cling to the victim long enough for deep burns to occur. Gasoline-filled bottles (known as Molotov cocktails) and other improvised flame munitions lack these characteristics, and *so*, although they might be effective in starting localized fires, they are relatively ineffective against personnel.

Flame munitions can be delivered by *(a)* air-dropped bombs, *(b)* flame throwers, or *(c)* warheads fired from rocket launchers.

Air-dropped bombs, such as the MK79 (Model 1) 1,000-pound fire bomb, are by far the most common flame munitions. The extensive use of these napalm **bombs during the Vietnam War generated consider**able notoriety. Compared with many other weapons, however, they were able to hit targets more precisely, leaving surrounding structures untouched and thus producing relatively little collateral damage. Nor was the workload of medical personnel burdened by napalm injuries; an equivalent weight of high-explosive or cluster munitions would have been likely to create many more casualties. About 100 casualties in the Wound Data and Munitions Effectiveness Team (WDMET) study, for example, were known to have been inadvertently engulfed by napalm fireballs in Vietnam. Six of them died, which was one-fifth the mortality rate that would be expected in an equal number of casualties suffering from rifle wounds.[19] Death from asphyxia or carbon monoxide poisoning was not a likely consequence of being engulfed by napalm fire.

Flame throwers, which eject a burning combustible through a nozzle, may be carried into battle by individuals or mounted in armored fighting vehicles. As originally designed, the hand-held flame thrower had dubious practical value: Its effective range was only 2040 m, and the operator needed to stand up to use it. Any soldier who carried a pressurized air-tank flame thrower and managed to stick its nozzle through the gunport of an enemy bunker, Hollywood-style, **would** have been **such** dttdcks would have succeeded only if the defenders of the enemy position had been previously incapacitated.

Flame **throwers mounted nn tanks and armored** personnel carriers are much less vulnerable, can carry far more combustible material, and can squirt a jet of flame for 300400 m.

The rocket launcher has been developed because both American and Soviet weapons designers have been reluctant to abandon completely the concept of a soldier-carried flame thrower. They have tried to overcome the flame thrower's deficiencies by designing weapons that have longer ranges. The American-made M202A1 *(Flask)* incendiary rocket launcher and the Soviet-made RPO-A recoilless flame thrower are shoulder-borne weapons that fire incendiary warheads, each one of which holds several liters of napalm. The

Soviet-made weapon can fire two napalm warheads per minute with a range of 400 m. The new warheads burst on contact with the target, unlike an earlier version in which combustion began as soon as the warhead left the launcher, its trail of fire extending from the weapon to the target.

Incendiary Weapons

Unlike weapons that use napalm, incendiary bombs and grenades are used almost exclusively to set matériel on fire. The casualty-generating potential of these weapons is not unique, and is incidental to their use as antimatériel weapons. Incendiary bombs were used extensively in World War II (for example, to create the firestorms over Tokyo), but since then, they have become curiosities.

Magnesium metal or *fhermife* (that is, ferric oxide and aluminum in a 3:1 ratio) are the common constituents of incendiary weapons. Thermite is a stable, inert powder that must be purposely ignited. Whereas napalm burns at about 1,000° C, thermite burns at 2,000°–3,000° C, and therefore it can be used to damage metal. For example, thermite grenades can destroy gun barrels.

Casualties who have been burned by these materials should receive standard burn care.

Phosphorus-Containing Munitions

Phosphorus-containing grenades, shells, or bombs can cause severe thermal and chemical burns. Phosphorus ignites spontaneously in air at 44" C and produces a temperature of about 800" C. In hot climates, the storage of phosphorus-containing munitions is difficult; phosphorus tends to liquefy in warm weather and may leak, causing fires.

Liquefied phosphorus is particularly dangerous to personnel; its continued presence on the skin results in dermal penetration and tissue necrosis. Phosphorus-containing munitions (such as the M34 hand grenade) are designed to fragment, and tissues deep under the skin may be impregnated by both metal and phosphorus fragments. Whereas metal fragments from most other weapons do not need to be surgically removed, any metal fragments that are covered with liquid phosphorus — as well as any embedded pieces of white phosphorus — must be excised (Figure 1-68).

Fig. 1-68. This casualty suffered a mutilating injury of the lower leg that was caused by an M34 white phosphorus grenade. Most of the tissue damage was caused by the grenade's fragmentation, but treatment was complicated by the white phosphorus (which appears as the yellowish-white material in the illustration) that impregnated the wound.
Source: Wound Data and Munitions Effectiveness Team

The usefulness of flame and incendiary munitions on the battlefield is limited, despite their hellish effects. Compared to the number of American casualties burned by fires in armored fighting vehicles and aircraft, very few were wounded by flame, incendiary, or phosphorus-containing munitions. Data from the Korean War indicate that there were only **312** American casualties with burns from white phosphorus during the entire war.[20] In the Vietnam War, only eight out of almost 8,000 casualties had white phosphorus burns, and seven of those were accidental wounds caused by M34 white phosphorus grenades.[21]

MEDICAL IMPLICATIONS

The weapons of conventional land warfare are designed to inflict physical harm on opponents by wounding them with bullets or fragments, damaging their internal organs with blast effects, or burning them. Even though some of the weapons that cause such injuries have become extremely sophisticated in modern times, most armed aggression through the centuries has been based on these three injuring mechanisms. The military physician must be prepared to treat the effects of them all.

Most casualties in modern conventional wars are injured by weapons that cause ballistic wounds. These weapons either fire projectiles at a target or explode into fragments. Although the severity of the wound depends to some extent upon the nature of the projectile or fragment, the most important factor in ballistic injury is the anatomical site that is hit: A small, jagged fragment from a primitive booby trap can be lethal if it hits whcrcas a high from a sophisticated assault rifle might be only mildly incapacitating if it hits a finger.

Blast injuries may not at first be obvious to medical personnel. As weapons increasingly take advantage of the physical properties of blast waves (particularly in enclosed spaces, such as tanks, or in conjunction with body armor), medical officers should be aware that a blast injury may also be present in a casualty whose only overt injuries are the more immediately threatening blunt, penetrating, *or* thermal trauma.

Burns cause relatively few casualties in conventional warfare. Because they can be so disfiguring and painful, however, these injuries have serious psychological implications for both combat and medical personnel, as well as intensive medical-resource allocation requirements.

The following sections of this textbook are devoted to detailed discussions of ballistic, blast, and burn injuries.

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21. Wound Data and Munitions Effectiveness Team. 1970. In reference 11, Table 4, p. C-7.

RECOMMENDED READING AND RESOURCES

The definitive sources for weapons data are the technical manuals and field manuals that are published by the armed forces. The primary source of official documents on weapons effectiveness, both classified and unclassified, is available from:

Joint Technological Coordinating Group for Munitions Effectiveness
Ballistics Research Laboratory
Aberdeen Proving Ground, MD 21005

The single most useful database describing weapons effects is the Wound Data and Munitions Effectiveness Team (WDMET) study prepared by the Army Materiel Command. These data are stored at the National Naval Medical Center, Bethesda, MD, and access is controlled by:

Uniformed Services University of the Health Sciences
Bethesda, MD 20814-4799
Telephone: (301) 295-6262

Three summary volumes contain extensive abstracts of the statistical data, and can be obtained from:

Defense Documentation Center
Cameron Station
Alexandria, **VA** 22304-6145
Telephone: (703) 545-6700 and (703) 274-7633

Association of the U.S. **Army.** *The Army green book.* Published annually a3 the October issue of *Army*

Beebe, G. W., and De Bakey, M. E. 1952. *Battle casualties: Incidence, mortality, and logistic considerations* Springfield, IL: Charles Thomas.

Chant, C. 1960. *How weapons work.* Secaucus, NJ: Chartwell Books, Inc.

Farrar, C. L., and Leeming, D. W. 1983. *Military ballistics.* Vol. 10, *Battlefield weapons systems & technology,* edited by R. G. Lee. Oxford: Brassey's Publishers.

Foss, C., and Hogg, I. V. 1986. *Battlefield — The weapons of modern land warfare.* London: Orbis Publishing Corporation.

Heaton, L. D.; Coates, J. B.; and Beyer, J. C., eds. 1962. *Wound ballistics.* Washington, D.C.: Office of the Surgeon General, Department of the Army. This is the standard text in the open literature describing the wounding effects of weapons.

Hogg, I. V., and Weeks, J. 1985. *Military small arms.* 5th edition. Northfield, IL: DBI Books.

Hogg, I. V. 1985. *Illustrated encyclopedia of ammunition.* Secaucus, NJ: Chartwell Books, Inc.

Jane's Infantry Weapons. New York: Jane's Publishing, Inc. Jane's publications deal with the entire spectrum of weapons systems and are published annually.

Lee, R. G. 1981. *Introduction to battlefield weapons systems.* Vol. 1, *Battlefield weapons systems & technology.* Oxford: Brassey's Publishers.

Reister, F. A. 1973. *Americnn experience in Korea.* Washington, DC: Office of the Surgeon General, Department of the Army.

The military medical officer can readily obtain information on weapons systems from the ordnance personnel assigned to many military installations.