Nature and scale of the problem

1. DIVERSITY OF THE DEVICES

DEFINITIONS

According to the International Conventions:
«Shall be considered as a 'mine', booby trap or suchlike device, any apparatus placed on or under or in proximity to any surface and designed or adapted to explode or blow up by **the simple presence**, proximity or contact of an individual» (or of a vehicle);

Or, according to military handbooks:
«A mine (antipersonnel or antitank) is a pyrotechnic device designed to be triggered by an **unintentional action** on the part of the enemy so as to put personnel (or vehicles) out of combat-action.»

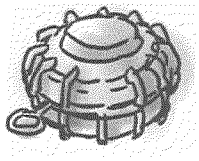
Finally, a third definition defines mines in terms of their parts:

«A **case**, equipped with an **activator**, containing **explosives** or other matter, intended either to destroy or damage vehicles ( ), or else to wound, kill or otherwise incapacitate personnel.»

Like most pyrotechnic devices, a mine is thus composed of three basic parts.

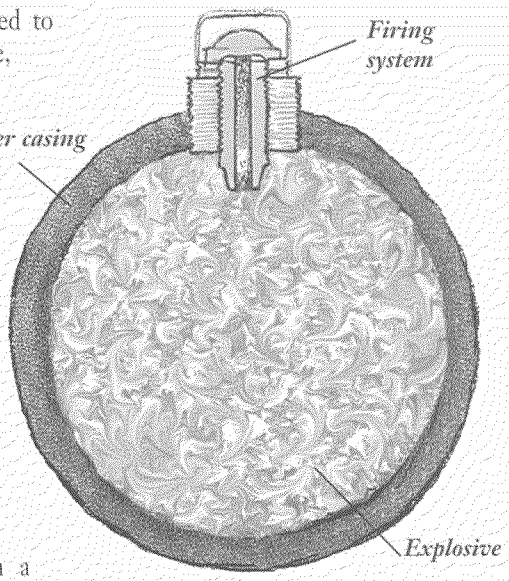
An outer casing: the case holding the charge and protecting it from the immediate environment. In some particular examples, the explosive (e.g., moulded plastic) may be left uncovered. Originally, mine cases were always metal. Nowadays, metals are involved in the composition of only one third of industrially produced mine-cases, being more generally replaced by plastics, bakelite or rubber. Particularly in Soviet mines and their derivatives, wooden, or even concrete, casings are to be found. This possibility of resorting to very basic materials explains the spread of «home-made» manufacture.
The body may contain objects (splinters or balls, or nails and shrapnel) which intensify the destructive capacity of the explosion by means of **projection of fragments**.

A firing system, which may include:



TS 50 (Italy)

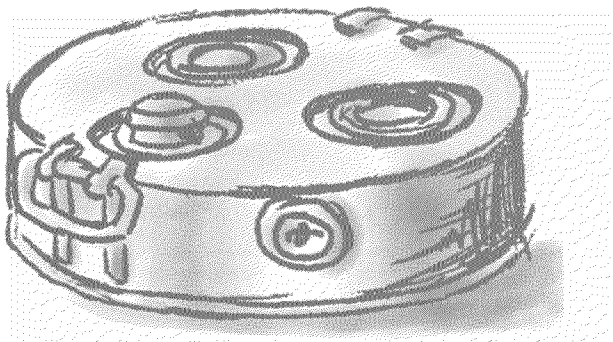
— a **firing device**, charged to react to «the presence, proximity or contact» of the target;
— a **detonator**, being a small amount of highly reactive explosive, set off by the ignition flame and triggering the explosion of the main charge;
— a **booster or relay**, intended, in the case of certain explosives, to reinforce the detonator explosion with a third explosive, or «relay».
Such sets of explosive thus constitute what are known as «pyrotechnic chains» or «explosive trains».



An explosive which «puts personnel (or vehicles) out of combat-action», either by blast-effect or by projected elements.

CLASSIFICATION OF THE DEVICES USED

Devices can be classified, and the concomitant threat defined, in terms of the nature and operating principles of the activator system and main charge employed. Ignition analysis enables the target of the device to be determined, and analysis of the explosive charge defines the danger to which this target is exposed. Thus the various models of mine can be divided, in terms of their intended target and of their destructive force, into



Teller Mine 29 (D 1929)

«**antipersonnel mines**» (AP) and «**antitank mines**» (AT).
Among other types of mine, «**anti-landing**» **land-mines** may be singled out for mention: these are intended to destroy or damage landing-craft when they land on the foreshore (that depth of shore-line which is under water at high tide and exposed at low tide), and are obviously very powerful. This kind of land-mine is not to be confused with the water-mines which threaten landing-craft while these are actually afloat.
To mines as such there must also be added various more or less sophisticated pyrotechnic devices and, in particular, a large amount of unexploded munitions, such as shells, bombs and grenades, etc., which may represent or conceal what are called «booby-traps».
A **booby-trap** may be defined as «an explosive or non-explosive device or any other object so placed as to inflict casualties on personnel when an apparently inoffensive object is moved or an action which would usually be without danger is performed. It may be made using the whole or part of a recuperated explosive device (grenade, mine, shell or various explosives combined with shrapnel and nails).»

EXPLOSIVES

The explosives employed to make the main charge are **secondary explosives**. This kind of relatively stable explosive affords greater safety during transport, storage and deployment. Such explosives do not usually react to a flame, a red-hot wire or to a shock. Secondary explosives are made to explode by fusing (explosion of a charge on contact: i.e., a detonator) or by influence (explosion of a neighbouring charge: i.e., sympathetic explosion). Primary explosives, too reactive for normal military use, are normally employed in the composition of detonators or fuzes.

- The most commonly employed secondary explosive is T.N.T. (**Trinitrotoluene or Tolite**) and its derivatives, which are used as the main charge in most of the mines which are active at the present time. Among other explosive substances used in the manufacture of mines, «Composition B», R.D.X. and Tetryl are more commonly found in Western (N.A.T.O.) devices. Picric acid derivatives and PTN are also used, but more rarely.

- The main charge of the most common antipersonnel mines (blast-mines) is nowadays of between 40 and 250 g, although in fact the quantity of explosive contained in a land-mine can vary from just a few grams (3.7 g, for scatterable antipersonnel mines) up to tens of kilos (30 kg, or indeed even 140 kg, in the case of heavy anti-landing mines).

More-or-less all the explosives used in the production of mines are nitro-compounds.

(See appendix 1, page 67, «The Explosives»).

In a few relatively rare cases, explosives may be replaced by «other matter»: e.g.,

- illuminating powders to light up the battle-field in case of intrusion; or,
- (more rarely) combat gas.
- There also exist exercise mines, where the charge is replaced by a smoke- or noise-producing or marker device; other mines for use in training personnel in mechanical mine-laying and finally inert mines, replicas or real mines having no military charge, for use in training for manual and mechanical laying.

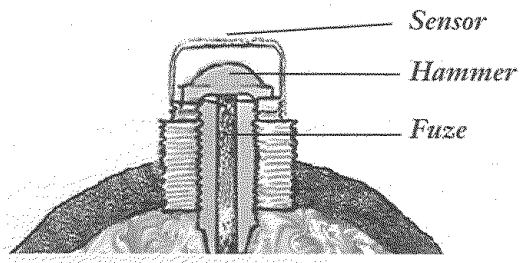
FIRING DEVICES

Whatever the nature of the charge, the firing device is what characterises this type of device and makes it a «mine». The «unintentional action» which sets off the explosion of a land-mine is usually the encounter of the device by the target (individual or vehicle). The firing device itself is composed of the following:

- **A sensor:**
— pressure plate,
— trip-wire,
— pull-activator, or electronic or infra-red command;

- **A fire-ignition system:**
— mechanical (hammer + fuze),
— chemical (striker + inflammable paste), or
— electrical (battery, condenser + inflammator);

- plus, in certain cases:
-A safety system, often installed for arming and, generally, for disarming the mine. It is usually operable from outside. A mine is said to be:
— «**fused**» when the firing system is fitted and the safety device is in place;
— «**armed**» when the firing system is fitted and the safety device is withdrawn.
- A **self-destruct or self-neutralizing system**, sometimes installed in the mine so as, at the end of a certain

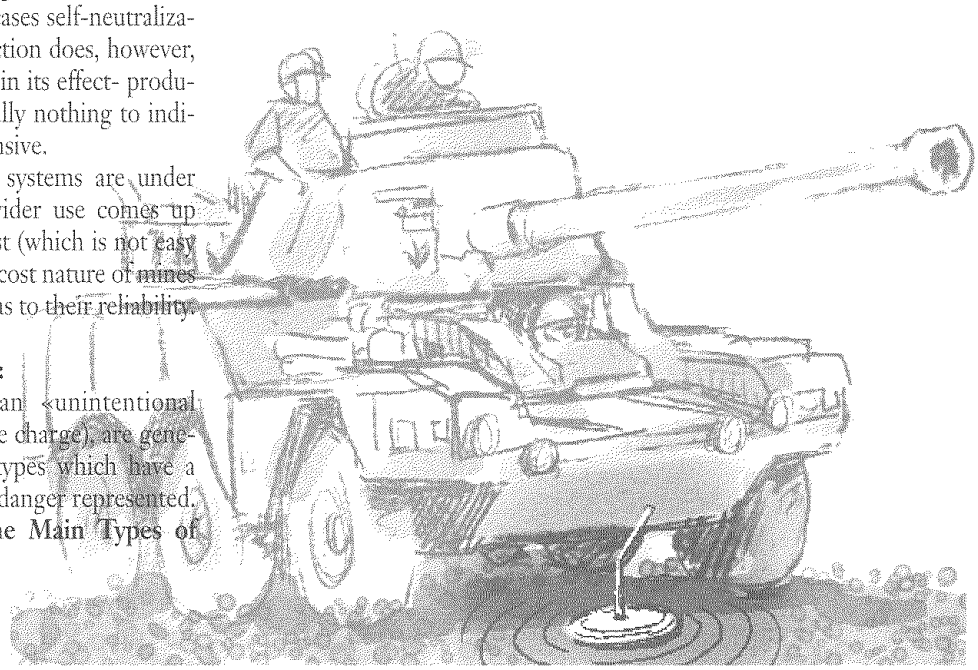


time, going from a few hours to a few months, to result in either:
— self destruction by explosion of the main charge, or
— self neutralization by inhibition of the firing device, captor or fire-ignition system.

For obvious safety reasons, self-destruction is hardly possible for mines having wide-scale effect (with powerful charge or with long-range fragmentation) or for large antitank mines, and in these cases self-neutralization is the only option. Self-destruction does, however, have the advantage of being visible in its effect- producing a crater- whereas there is usually nothing to indicate that a mine has become inoffensive.
Self-destruct and self-neutralizing systems are under international negotiation. Their wider use comes up against the barrier of their high cost (which is not easy to reconcile with the generally low-cost nature of mines as such) and of a certain scepticism as to their reliability.

The main types of firing devices:
The devices which transform an «unintentional action» into an explosion (firing the charge), are generally classified into several main types which have a direct bearing on the nature of the danger represented. **(See appendix 2, page 69, «The Main Types of Firing Devices»).**

- **Pressure-activated systems.**
- **«Trip-wire» systems.**
- **Electronic firing devices.**
- **Remote control activators.**



Tiltrod mine

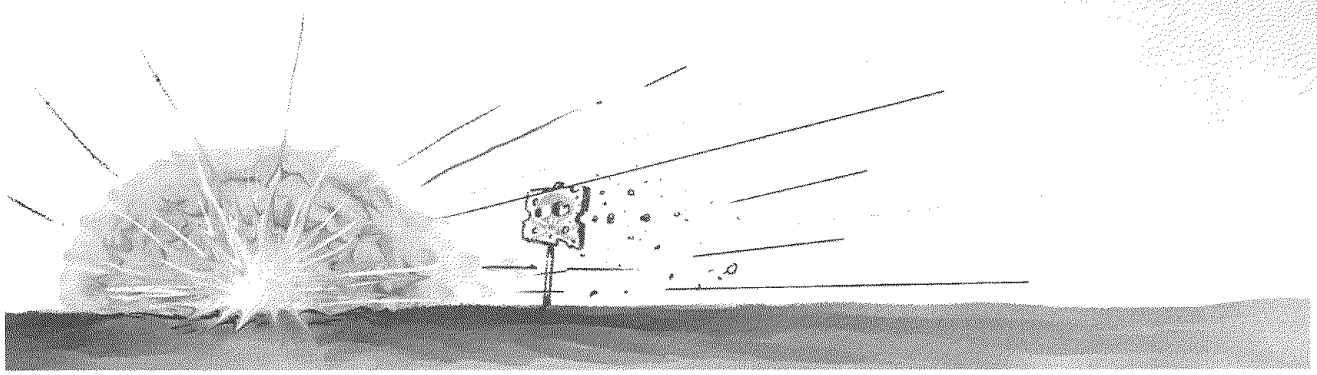
ANTIPERSONNEL MINES

The characteristics of the known models of antipersonnel mine mean that, whatever their country of origin, they are relatively small devices, of a few centimetres, relatively light (between 1 and 2 kg), and containing an explosive charge of up to 300 g. Antipersonnel mines make up **75% of all mines laid.**

According to the complexity of their casing, antipersonnel mines may be divided into 2 categories:

- **blast effect** (with or without a light, often non-metallic, casing); and
- **fragmentation effect** (with a heavy, often composite, and normally metallic, casing).

Blast effect



Fragmentation effect