THE SYSTEM OF ACTIVE BASES PROTECTION IN THE AREAS OF COMBAT TASKS

Piotr Sprawka

Military University of Technology, Faculty of Mechanical Engineering
Department of Construction Machinery
Gen. S. Kaliskiego Street 2, 00-908 Warsaw, Poland
tel. +48 22 6839791, fax. +48 22 6837211
e-mail: psprawka@wat.edu.pl

Abstract

Due to the ratification of the Ottawa Convention, Poland is obliged to dispose of the arsenal of anti-personnel mines. The work on the modernization of the existing mines, which is underway, focuses on the replacement of their fuses with controlled elements, which will soon make it possible to exclude this type of munitions from being defined as anti-personnel mines. The ongoing degradation of currently possessed stockpiles, a ban on production and purchase of this type of munitions as well as cutbacks in funds for purchasing military equipment for the Polish Armed Forces, all mean the necessity of introducing an alternative with the aim of replacing previously used anti-personnel and anti-tank mines – an alternative which will be characterized by economical production process and, at the same time, by effectiveness sufficient to ensure that the minimum quantity thereof will allow the performance of combat tasks at the same, or even higher, level. This paper describes issues connected to the worldwide tendency to eliminate the arsenal of anti-personnel land mines and to replace them with their alternatives, which are to be applied in the protection system of a designated area. The paper defines requirements to be met by an alternative and presents a concept of such a device, constructed on the basis of the design of a warhead that may have installed in it non-lethal weapons' components.

Keywords: *anti-personnel mine alternatives, remote-controlled minefields, non – lethal weapon*

1. Introduction

The issue of inevitable removal (due to socio-political reasons) of anti-personnel mines from the Armed Forces should be examined on two planes:

- objective necessity to replace the mines with other devices capable of performing tasks conducted by the Armed Forces,
- possibility to obtain a new combat asset, by means of making use of the currently possessed knowledge and technology, which will constitute a qualitatively new type of defensive weapons characterized by incomparably higher advantages in combat as well as in terms of its usefulness for the Armed Forces, in comparison with the current mines (not only anti-personnel ones).

One should also take into account the fact that the world, in the non-military context, will strive to impose a complete ban on the use of mine-like combat assets, i.e. the ones which are self-triggered in reaction to an approaching, or being in a direct contact, technical object, human being or animal, and which act in a way causing damage (injuries) or destruction (death) and, in particular, as regards people, cause pain, suffering and result in permanent disability. Although within the oncoming 10-15 years, it is absolutely impossible to abandon the use of the mines which are currently used, or which are being introduced (except for anti-personnel mines) as a combat asset, it will be necessary to stimulate their development in the following direction:

- capability of the ‘’friend-or-foe” identification;
- ability to be used in the case of barbed engineering barriers;

- capability of self-destruction (loss of combat effectiveness), not by means of detonation, but through the degradation of the combat asset (e.g. that of the explosive) as well as the degradation of control devices;
- improvement in the effectiveness by means of increasing, with the use of various methods, the accuracy and effective range of the device.

In Poland, it particularly concerns the use of the MNxxx-series scatterable mines, mainly in the case of enforced, wider-scale, activities of the Armed Forces. However, both the latter and the classical anti-personnel mines should go through a modernization stage in order to achieve the above-mentioned abilities. The general requirements for the new generation of mines, including alternatives to anti-personnel mines, may be defined in the following way:

- acting only at command, after full identification of the threat,
-limiting (eliminating) people's pain and suffering as well as injuries leading to permanent (visible) disability,
-reducing labour-consumption and logistic potential necessary for storing and planting,
-ability for flexible functioning (dormant, active and passive operation modes) and for changing functions (e.g. anti-transport → anti-personnel → anti-tank),
- ability to self-neutralize through environment-friendly and, in particular, harmless to people and animals, self-degradation; it also includes self-neutralization in response to an unauthorized attempt to "remove" or disassemble the mine.

2.Self-healing minefields

As regards military operations, alternative lethal assets are used. They are used against enemy armed forces, not civilians. The examples of such assets are in [1, 2, 4]:

- mines with short- and long-delay fuses;
- remote-controlled mines;
- sensor-activated machine guns and grenade launchers.

In the USA, a system of barrier minefields called NSD-A (Non Self Destruct Alternative) was designed. Instead of planting mines on the ground, as was the case with previously used devices, miniature, smart NSD-A units, with six, radially spaced munitions launchers, with up to 12-metre effective firing range, are installed. Some of them are explosive mines whereas others are designed to stun or incapacitate with the use of non-lethal munitions. The whole unit is wirelessly controlled from a small terminal with a display, which indicates the movement of enemy forces and inquires what type of munitions should be used against them. The system works in an automatic mode, but it can be switched off, deactivating the minefield and enabling safe dismantlement of the mines [1].

Inventive solutions in this field include the American projects of a "self-healing minefield" and of "intelligent anti-personnel mines."

The American concept of the self-healing minefield (Fig. 1) may be a basis for mine obstacles, e.g. blocking passageways through defiles. It can be installed on crossroads leaving no room for bypassing, thus eliminating the need to use anti-personnel mines. A self-healing minefield detects breaches by means of communication between mines with the use of built-in sensors. Every single mine in the minefield is networked with neighbouring mines, which self-organize into a pre-programmed pattern by means of propellants, such as pyrotechnic pushers. Once a mine disappears from the network, as a result of it being destructed or disabled, the neighbouring mines move on to fill in the gap, which forces the enemy to slow down their operations until the minefield "runs out", or to look for a mine-free terrain. The minefield planted by the intelligent network system, without human involvement [2, 4].

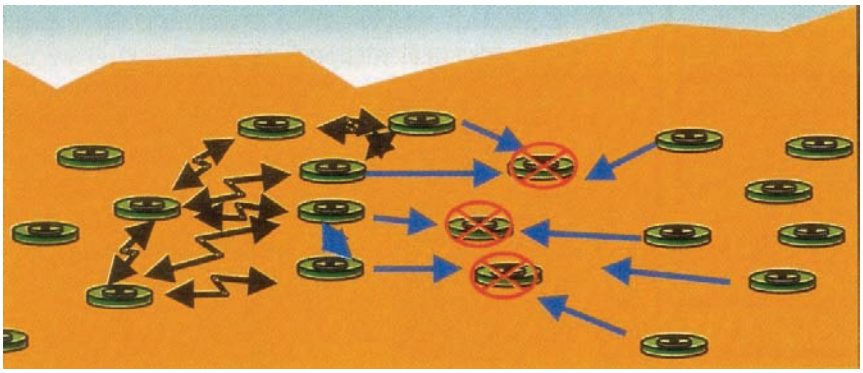

Fig. 1. Self-healing minefield [2, 4]

In the USA, work is underway on intelligent anti-personnel mines (Fig. 1, 2). They act by means of small transmitters, which, irrespective of weather conditions, self-attach to soldiers (moving objects) during the initial phase of the enemy moving through the defended area. Once a soldier (object) is within the effective range of intelligent mines, they are launched. They search for the target, i.e. the transmitters. This allows to achieve high effectiveness in spite of the minimum involvement of the operators and to increase identification of moving targets by the mechanism.

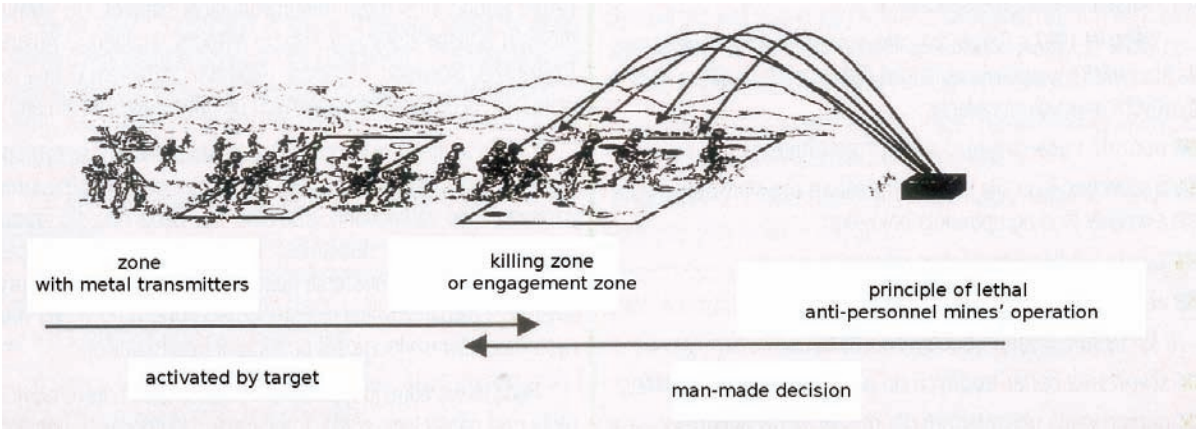

Fig. 2. Intelligent anti-personnel mines [1, 2, 4]

Work is still underway on the systems of the effective use of mines and other combat assets in combat operations. The above-mentioned assets should be used in order to:
- delay and restrain enemy movement,
- decrease enemy combat power, e.g. through temporary neutralization of some of the combat formation elements,
- increase safety of friendly armed forces by means of using appropriate sensors,
- alarm friendly forces.

Except for traditional anti-tank and scatterable mines, self-healing minefields should be made up of directional mines in the first place. They can remotely hit operational equipment and human targets with projectiles fired from anti-tank grenade launchers, explosively formed projectiles (EFP) and by means of a stream of shrapnel scatter fired at a certain direction relative to the mine placement site. Both the projectiles and shrapnel scatter are directed by means of a properly shaped liner of the mine's (projectile's) charge or by the fragmentation plate shape as well as due to the proper marking of the mine's striking point. This specific group of mines includes horizontal-action, anti-tank mines, some anti-personnel fragmentation mines and their modified versions – anti-helicopter mines.

In the NATO armed forces, the mines are designed with the aim of meeting the following requirements [3]:
- reliability of hitting, from a distance of up to 75m, a tank moving at a velocity of up to 60km/h, irrespective of its travel direction relative to the mine,
- total weight not exceeding 20kg (preferably up to 15kg),
- protection system against being utilized or reset by the enemy,
- possibility of programming the mine's combat readiness within the range of 3 – 96 hours (with a break every 3h) and up to 40 days,
- not reacting to a walking person or to a vehicle of up to 31 tons in weight and up to 4 m in length,
- being equipped with a microprocessor for programming target selection (e.g. the first, the second or the third one), with a sensor for target detection with a narrow field of vision (not exceeding 25°) and with equipment for remote-controlling mine's combat configuration, that is, for resetting it to the safe mode and the other way round
- possibility of being deactivated by friendly forces in case the mine is in the combat configuration (up to 5 times within 40-60 days),
- design enabling one person to plant the mine within 5 minutes (10 minutes at night-time) in any terrain, including hard surfaces ,
- ensuring that the mine includes at least three elements: a warhead, a control unit and a safety-executive mechanism.

3. Concept of remote-controlled mine for designated area protection

On the basis of the above-presented requirements, work is underway at the Chair of Engineering Equipment of the Military University of Technology (MUT) on the development of an alternative to anti-personnel mines. The design of an alternative is based on a plastic structure equipped with electric control elements (Fig. 3).

The presented alternative is equipped with slewing and detonating mechanisms (1 and 2 respectively). The effective range of the alternative is 100m. The intended principle of its operation consists in tracing an object moving in the proximity of the device in a protected area and, at the command of the operator, in getting armed and performing an action with an incapacitating effect. A minefield (protected area - inaccessible) laid with the use of such elements is to be remotely controlled by a single operator by means of wired and/or wireless connection. The operator should be capable of arming selected alternatives in the minefield as well as modifying their operation mode (incapacitating, paralysing, immobilizing military technology). An exemplary diagram of a minefield established with the use of such elements is shown in Fig. 4.

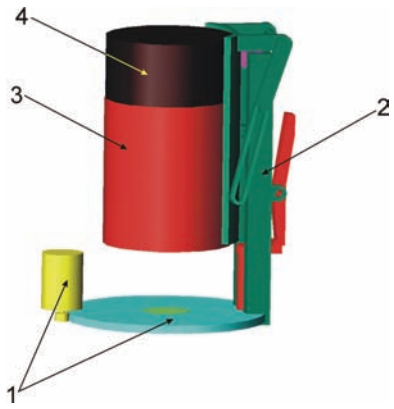

Fig. 3. Alternative device: 1-slewing mechanism, 2-detonator mechanism, 3-propellant-fill head, 4-insert

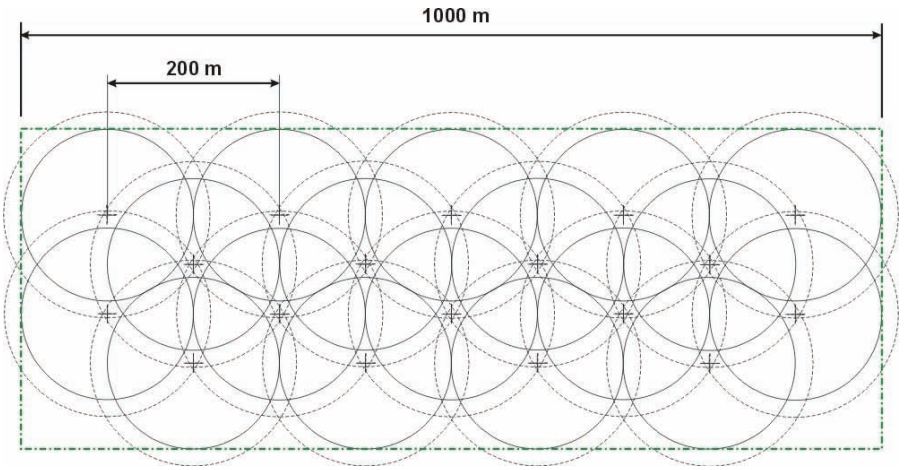

Fig. 4. Diagram of a protective minefield set with the use of alternatives

The addition of this type of devices to the military equipment will significantly decrease the number of combat assets necessary to secure and protect areas in combat operation zones and limited-access areas and facilities all over the country.
A 1000-meter wide protective minefield may include between 9 and 18 mines, ensuring maximum effectiveness.

Figure 5 shows the correlation between the length of the minefield, the field density (n), and the number of possessed mines.

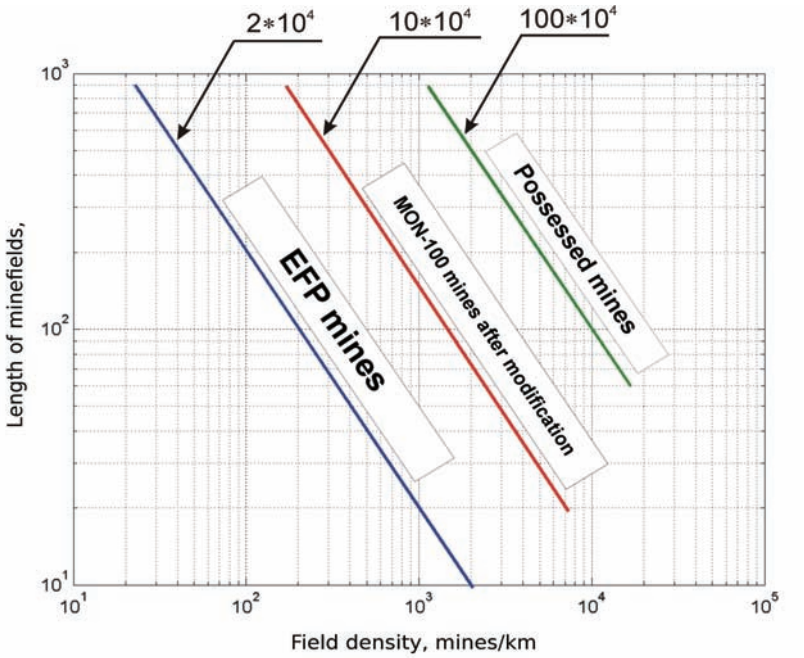

Fig. 5. Correlation between minefield length, field density (n) and number of mines

4. Conclusions

Due to the ratification of the Ottawa Convention, Poland is obliged to dispose of the arsenal of anti-personnel mines. The work on the modernization of the existing mines, which is underway, focuses on the replacement of their fuses with controlled elements, which will soon make it possible to exclude this type of munitions from being defined as anti-personnel mines. The

ongoing degradation of currently possessed stockpiles, a ban on production and purchase of this type of munitions as well as cutbacks in funds for purchasing military equipment for the Polish Armed Forces, all mean the necessity of introducing an alternative with the aim of replacing previously used anti-personnel and anti-tank mines – an alternative which will be characterized by economical production process and, at the same time, by effectiveness sufficient to ensure that the minimum quantity thereof will allow the performance of combat tasks at the same, or even higher, level. It is also desired that non-lethal combat assets should be introduced, which will allow the use of this type of devices for protecting important military and civilian facilities located in Poland.

The work, which is underway at the MUT Chair of Engineering Equipment, on the development of an alternative is aimed at designing a device meeting the requirements of the contemporary battlefield's "network centricity" and complying with the policy guidelines on the purchase of "low cost" arms.

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