

# Robotized Combine for cleaning mine fields

Author : Marin Grudev Midilev, Translator: Georgi Slavov Slavov

**Summary** — This presentation gives concise information about the options for cleaning mine fields through the Robotized Combines. The expose contains the organizational structure and the principle of operation of the Robotized Combines. The initial details are given for design and construction, as well as other applications of technologies.

## I. INTRODUCTION

**T**HIS expose is based on the acquired personal knowledge in engineering activity – about land mines and anti-tank mines and setting land fields, as well as the practical training, held by me from 1979 to 1992. The expose is a version of a project element (logical solution of organizational structure and principle of operation) Robotized Complex for ecological production of fruits and vegetables for fresh consumption on open areas.

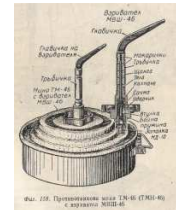
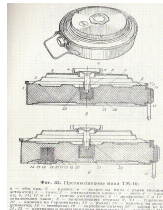
*The depth (width) of the mine field is up to 120 m, the length of the mine field depends on the participants to create it, the shape is always rectangular, the type of land field depends on the types of mines, disposed there. Creating the mine field is accompanied by drawing up a scheme. The scheme of the mine field gives the basic characteristics of the field, the diagram of mine location and the type of mines. Most of the mine fields are created with mines, which were in arms with the Bulgarian National Army up to 1989 and in the Warsaw Treaty. The manuals, methodology and handbooks used in Bulgarian National Army have relations with the forthcoming clearing of mine fields.*

Review of initial data

Types of mines, armed in Bulgarian National Army:

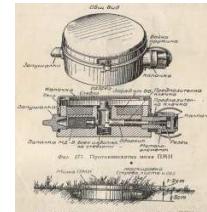
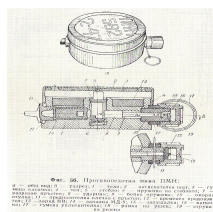
1. Anti-tank mines:

TM- 46

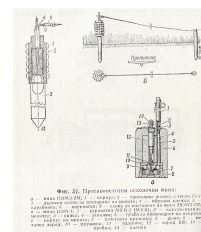


2. Land mines :

A. / PMH



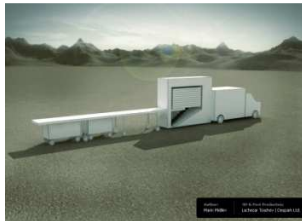
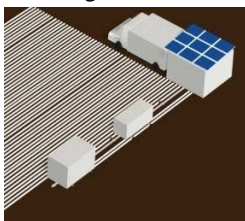
B. / POM 2M (POMZ- 2) and POMZ-2M



Technological offer OB 0106:  
<http://www.bit.or.at/ik/ec-bbsshow8.php?ref1=OB-0106&vQuelle=ecaustria.at&cc>

Analogue are the Robotized Combines of complex types are combines as principle of operation and organizational structure for: production of prick-in plants, gathering crops of melons and watermelons etc, with certain construction modifications, limitations and additions, relevant to the specific use.

Analogue of:

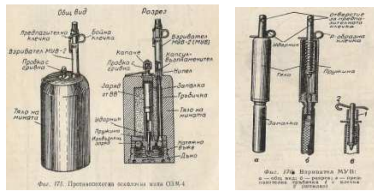


## II. PROCEDURE

### A. Review Stage

*The mine fields are created basically before battle activities in the past. They have been set for the purpose of destruction of the living force of the enemy, as disposed from the site point of view on accessible areas – mainly plane and fertile areas. To create the mine fields motorized or infantry units have been used, by means of step method.*

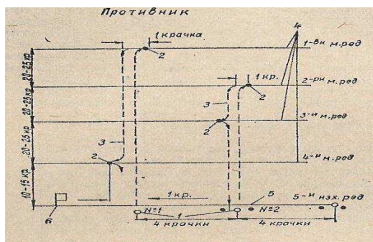
A. C./ OMZ – 4 and detonator MUV



4. Mine-seeker device MT 66-1



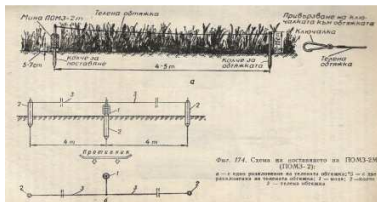
3. Sample scheme of mine field setting:



The types of mine, armed in the member- state of NATO, have the same applications in the review of initial data for creating a Robotized Combine for clearing mine fields, but due to the requirement for conciseness of the expose, they will be omitted.

Sample scheme of mine depletion:

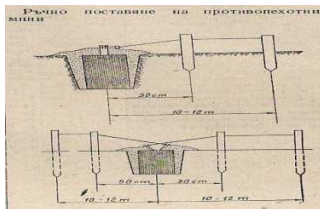
A. / POM-2M



B. Final Stage

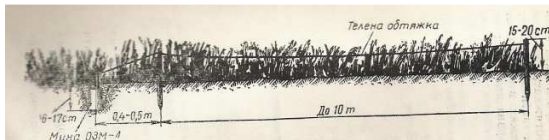
The existence of mine fields causes not one or two innocent human casualties; the same refers to the standard methods of mine-sweeping by manual method. Their disposition on fertile soils causes the non- usage of the areas. The mine-sweeping of mine fields by the method of explosion causes excessive waste of energy, and pollution of environment.

B. / Land mine – scheme



The sequence and principle of operation in mine-sweeping by manual method is reciprocal to the creation of mine fields after discovering the mine by means of auxiliary devices, metal detectors, mine detectors, explosion detectors and other auxiliary means and localization of mine, as well as the type of mine.

C. / OMZ – 4

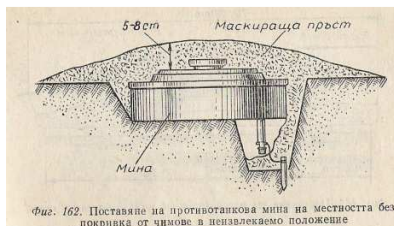


The sequence of actions is:

1. For land mines and anti-tank mines, with activating the detonator on pull:

- A. Remove the cover (camouflage) soil layer, if any;
- B. Disconnect the strained wire;
- C. Deactivate the detonator by setting a safety lock-pin;
- D. Dismount the detonator from the mine body;
- E. Dig out the mine;
- F. Bring out the mine body from the field.

D. / Anti-tank mine with non-extraction element



2. For anti-tank and land mines, with activating the detonator mainly on pressure and with or without non-extraction element:

- A. Remove the cover (camouflage) soil layer,
- B. Deactivate the detonator by setting a safety lock-pin;
- C. Dismount the detonator from the mine body;
- D. Dig out the mine;
- E. In case of a non-extraction element – second detonator, activated on pull, then the steps on pull are executed before bringing out the mine body of the mine field.

The final possible option for mine-sweeping of mine fields and separate mines, by duplicating the activities by manual methods is the use of androids – e. g. ASIMO of Honda. The known to me existing robots for mine- sweeping of mine fields and separate mines can perform only part of

*the activities in mine- sweeping. It is obligatory to have a robot control operator.*

**For Robotized cleaning of mine- fields I suggest to design a Robotized Combine:**

The organizational structure and principle of operation of the Robotized Combines are analogue to a production line with the following main features:

1. The manipulated elements are immovable, only the manipulating units are moved.
2. The power and control units are out of the manipulation area and are temporary immovable.
3. The principle of movement in a new zone for manipulation is by waking (step broken movement) in a straight line or by determined axis.
4. Others

On the grounds of construction activity by using ready made elements, the variety of Robotized Combines is wide.

### C. Appearance/ Figures

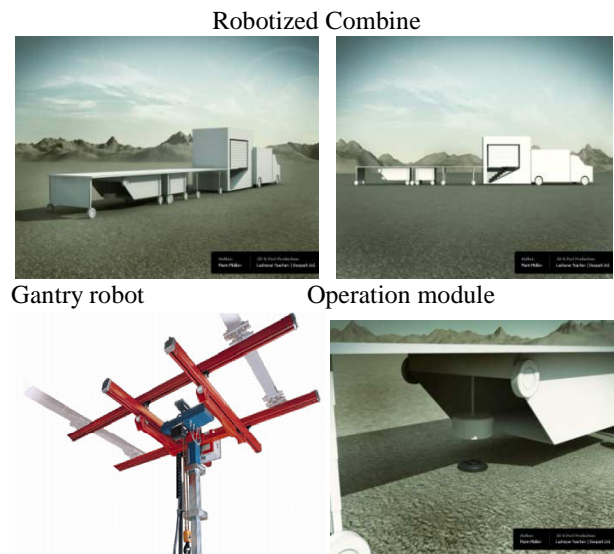
Prototype by description of the site – plane with small uneven zones and null slope angle, depth of mine field 120 m.:

1. A rail, comprising of equal modules, as the first module contains the metal detectors and explosive detectors. The rail in unfold appearance (all modules assembled) is 120 m or 60 m long.
2. Major (main) Module of the Robotized Combine. The power elements are located in it, the control of the Robotized Combine, the operator, observing the process etc.
3. Operational (executive) module. It comprises mounted gantry robot , performing the above described activities of deactivation of the mine types,
4. And performing the actions in storage of deactivated mines in armoured containers for transportation to the next purpose.

The elements for execution of actions in mine sweeping, united in a common module – called operative (minesweeper) body.

5. Storage robot – transfers the armored containers. The module moves by ‘walking’.
6. Transport module – transports the armored containers from the Main module to the Operation module and vice versa and moves the containers from and to the Main module and to and from the Operation module.
7. Transport automobile with robotized loading and unloading activity of the armored containers.

### D. Electronic Image Files (Optional)



### E. Copyright Form

Know How

<http://projects.despark.com/043-MarinMidilev/>

### III. VERSION WITH ADDITIONAL OPTIONS

The versions for creating the Robotized Combines for cleaning mine- fields are based mainly on the characteristic features of the terrain – slope angle and can be designed for movement on plane land site with slope angle of about 30 degrees. The existing real possibility that the Operation (mine-sweeping) body executes activities on mine-sweeping out of board is about 50% of the length of the horizontal crossed module of the gantry robot.

### IV. UNITS

All the required elements/ units/ - pneumatic pincers, vacuum-driven handlers, pneumatic modules for linear movement and electro-mechanic modules of linear movement are real and are manufactured by not one or two multinational companies.

### V. TASK FOR FURTHER OPERATION. CONCLUSION

**The stages of the future work in creating the working prototypes of a Robotized Combine for cleaning land-mines are:**

1. **Finding or creating the necessary normal working conditions – financial funds, place and time.**
2. **Forming the engineering team.**
3. **Clearing up the tasks.**

4. *Providing necessary technologies and technical products for creating the experimental prototype.*
5. *Experiments with the prototype.*
6. *Alterations and supplements to the prototype on the base of achieved results in the tests during experiments.*

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