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New Generation of Pyro-generators

L. Čermák*, P. Götz and L. Šimon

Research Institute of Industrial Chemistry, Explosia Company, Pardubice, Czech Republic

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Abstract:

The aim of this study was the development and the preparation for serial production of a new generation of pyro-generators with a new assembling technology and with new properties, which were requested by force ministries. It means multiple uses of basic components and technology with new lacquers, mastics and glues for product assembling.

Keywords:

Pyro-generator, cartridge, pyro-cartridge, destruction device

1. Introduction

The modernization of propelling systems for the destruction device DZ-89 was requested at beginning of 2008. The requirements were:

- minimum 9-times possibility of reuse,
- marking corresponding to new requests on pyrotechnical products,
- improvement of weapon operability.

Following these requirements, a new project proposal was prepared and submitted for funding at Ministry of industry and trade of Czech Republic under the TIP 2009 call. The project was accepted under number FI-TI1/136.

2. Experimental

2.1. Initial State

Cartridge assembly

Standard cartridges (pyro-generators) are produced as single-use products without possibility of new assembling of the used cartridge cases. The technology includes

* *Corresponding author: Explosia Company, Research Institute of Industrial Chemistry, Department of Research and Development of Explosives, Group of Ballistics, Semtín 107, CZ-530 50 Pardubice, Czech Republic, E-mail: Leos.Cermak@explosia.cz*

non-dismountable joints and enclosures. An example is the cartridge DZ-89e, which is used in the destruction device DZ-89 and allows shooting of water jet or different types of projectiles for creating way or holes in closed areas [1].

The cartridge DZ-89e construction, see Fig. 1, is based on standard technology with closed aluminium cartridge case (Pos. 3). Internal construction is created by plastic element (Pos. 2), distant paper tube (Pos. 4) and felt and paper closing system (Pos. 5-7). Active components are electric activated flame igniter (Pos. 1) and propellant charge (Pos. 9).

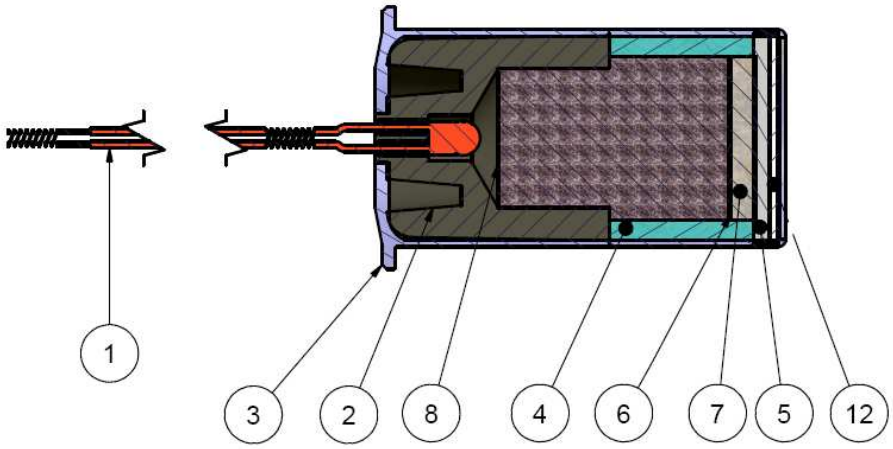


Fig. 1 Cartridge DZ-89e

The cartridge DZ-89e construction, see Fig. 1, is based on standard technology with closed aluminium cartridge case (Pos. 3). Internal construction is created by plastic element (Pos. 2), distant paper tube (Pos. 4) and felt and paper closing system (Pos. 5-7). Active components are electric activated flame igniter (Pos. 1) and propellant charge (Pos. 9).

Tests

Functional tests consisted of 2 operations. First, the product had to fulfil the resistance against water penetration (24 hours in water in depth of 50 cm – increase of weight was not allowed). The second was the ballistic properties test, at which the maximum pressure in the cartridge and the projectile velocity at distance of 20 m from the muzzle were measured. The measurement of the pressure was performed at a chamber through drilled cartridge case, which required adjustment of the case by drilling and milling of a locking groove in the chamber for alignment of the cartridge hole and the pressure transducer. This adjustment was problematic regarding safety, because it was performed on a fully functional cartridge.

Application

The cartridge is designated for the destruction device DZ-89. Differently shaped elements or water column are serving as the projectile. It is necessary to push used cartridge case by force through the muzzle after the shot, which is decreasing the operability.

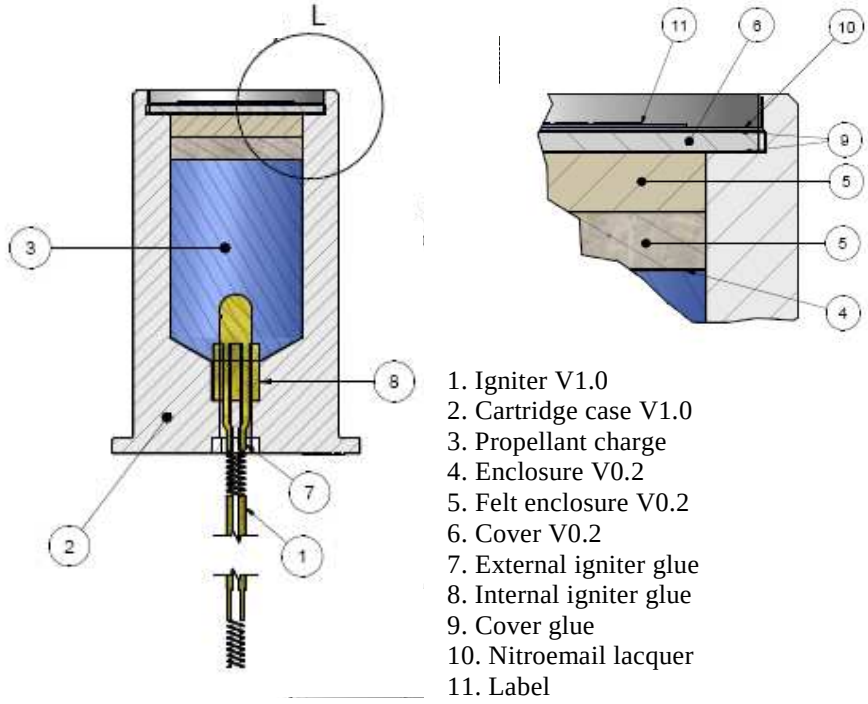
2.2. Development and Tests

Multiple usage

From beginning it was clear, that the original construction would not fulfil the requirements. Because of corrosive combustion products, stainless steel was chosen as the new construction material. Construction had to fulfil the resistivity to possible short circuit of igniter cables and the possibility of removing internal parts for simplification of assembling.

Four versions of the device were successively developed, which were marked as PP-PRE V0.1-V0.4. During the development not only requested performance and properties, but also technological workability were evaluated.

The final solution was verified at a high stress - by 10 rounds from one cartridge case and by tests of water resistibility. By these tests the first part of the requirements was fulfilled.



1. Igniter V1.0
2. Cartridge case V1.0
3. Propellant charge
4. Enclosure V0.2
5. Felt enclosure V0.2
6. Cover V0.2
7. External igniter glue
8. Internal igniter glue
9. Cover glue
10. Nitroemail lacquer
11. Label

Fig. 2 Cartridge PP-PRE V0.4

New marking

The original marking was performed as printing on the cartridge surface. New marking had to outlast 10 rounds and its content had to be compatible with submitter requests. Basic marking was performed on the bottom of the cartridge by a laser and consisted of:

- product name – in this case PP-PRE,
- last 2 digits of the year of cartridge case production,
- serial number (sequence in the year mentioned above),

- sign of possible readjustment by stamping,
- the area determined for readjustment by stamping.

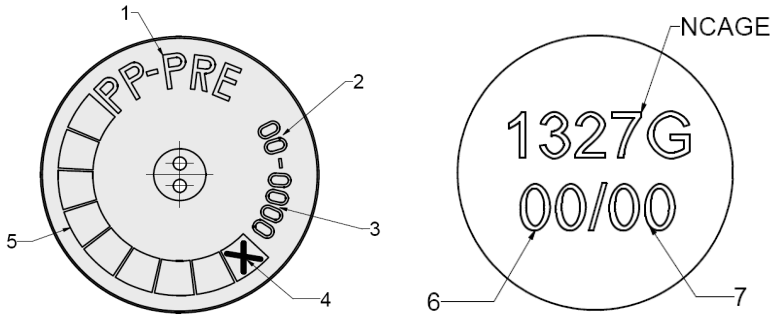


Fig. 3 Marking scheme of PP-PRE cartridge

The actual marking was performed by the label adjusted to the cartridge cover by lacquer and consisted of:

- production lot of assembling,
- last 2 digits of the year of assembling,
- NCAGE - identification code of producer.

Weapon operability Improvement

At the tests and also at verification in weapon was verified stability of dimensions of cartridge case and multiple loading was without problems.

3. Conclusion

New methods of assembling based on new types of glues and lacquers were developed. Also the solution of securing igniter cables insulating resistance was successful. Practical use confirmed the rightness of problem solution. The construction itself has reserves related to possible increase of destruction device DZ-89 performance.

References

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[2] ČERMÁK, L. *Průběžná výzkumná zpráva za rok 2010: Výzkum nové generace pyrogenerátorů* (*2010 annual research report: Research of new generation of pyro-generators*). Pardubice-Semtín: Explosia – VÚPCH, 2010. 23 p.

Acknowledgement

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