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DESIGN OF A NEW TYPE OF GAS-DYNAMIC DISRUPTOR USED TO NEUTRALIZE IMPROVISED EXPLOSIVE DEVICES

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ABSTRACT

The paper presents a type of recoilless disruptor developed according to the studies of two disruptors performance and shortcomings currently used DR2 and RICHMOND, respectively. In creating the new disruptor, there were kept some common elements of the two disruptors taken as models of operation (ex. dimensions from RICHMOND were used to design the new system of disruption).

KEYWORDS: disruptor, explosive device, neutralization

1. Introduction

The disruptors are gas-dynamics devices propelling jets using deflagration of colloidal powder.

The disruptors are explosive jet engines means, capable of being used to neutralize improvised explosive devices.

The gas-dynamic principle involves sending a payload (different agents of disruption) at a distance, using a gas pressure force resulting from the burning of a flinging load.

2. THOR - 1 disruptor: constructive considerations

The new disruptor, named THOR - 1 aims to remove certain shortcomings observed in the use of DR-2 and Richmond disruptors during the neutralization operations of some improvised explosive devices, namely:

- relatively heavy handling because of the mass of the entire system (stand-disruptor);
- inability to operate in certain areas and targets;
- the initiation of pyrotechnic elements component of some improvised explosive items by the disruption agent (electric detonating caps, etc.);
- the need to approach the suspect package to obtain a good efficiency;
- dusty remains unburned after the shooting.

This gas-dynamic system, the THOR – 1 disruptor, aims to meet the following demands to be able to use as disruption agents, different materials which cannot initiate pyrotechnic elements from the composition of an improvised explosive device;

- the pipe material can be made of duralumin due to the special physical and mechanical properties, such as resistance to high temperatures and much higher plasticity;
- simple construction and low weight;
- lack of recoil due to the reaction force that arises because of the leak backwards of a quantity of powder gases, through special slits;
- easy to use equipment with remote action means, the special type robots (R.O.V.);
- equipment relatively simple to use and can be quickly put in operation.

The above presented disruptors study revealed that a special importance in the neutralizing activity has the choice of disruption agent, based on the existing target, on the material characteristics (tire) in which the improvised explosive device exists. If d.e.i. exists in a metal tire (e.g. car body, pipe, thin-walled metal crates) it is necessary to use steel projectiles for their punching.

The use of these disruption agents involves taking more risks, which must be taken into account, such as:

- pyrotechnic intervention is usually done in urban areas; therefore, it must be remembered that during the drawing with metal bolts, this is propelled like a bullet in the gun, which can injure bystanders or cause property damage;
- scattering d.e.i debris is much higher. When one pulls on it directly with agents other than water, it

results a certain difficulty in gathering some post-neutralization samples.

To avoid the risks previously presented the new disruptor uses as agent of disruption, water, in various combinations. The THOR-1 disruptor is a modular equipment, recoilless, made of duralumin, specifically designed for the disruption of improvised explosive devices.

Duralumin was chosen because between the metals and non-ferrous alloys currently used in high-tech fields, aluminum and its alloys have the largest share due to their properties and characteristics, and especially because of the traditional techniques for hardening these alloys (based in particular on the alloying and hardening by cold plastic deformation).

3. THOR-1 disruptor design

The same as for the Richmond disruptor, the main feature of THOR-1 is completely recoilless operation using a water body for compensation ejected backwards to neutralize kickback. Due to this characteristic, the pipe together with the compensator and the assembly support do not require to have a great mass of the kickback compensation fact that led to the minimizing weight.

Armed and ready for operating, the disrupter with its support can be carried in one hand and weighs less than 5 kg.

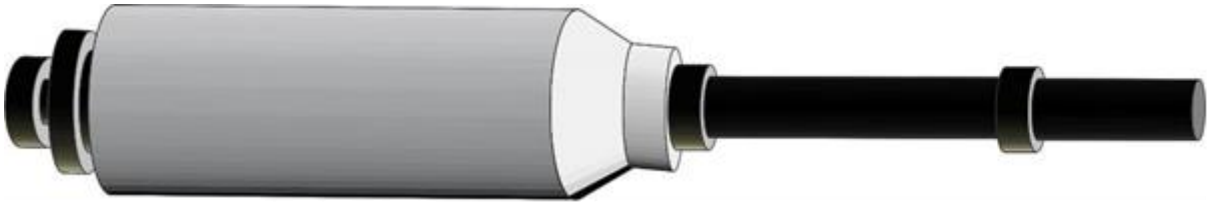

Fig. 1. *THOR -1 disruptor ensemble*

The THOR-1 disruptor is composed of ESA catch; pipe; lock mode, compensation shock; overall striker. The THOR-1 disruptor uses a volume of about 400 ml of water for compensation and is dimensioned to absorb the recoil when firing using the tube of 40 mm with the shock of 25 mm.

The 40 mm caliber barrel is screwed directly into the lock module and is used with the device attached to the muzzle - attenuator or shock. It is used in the configurations of disruption in proximity (Figure 2). The lock module is designed to accept 12.7 mm caliber cartridges (Figure 3).

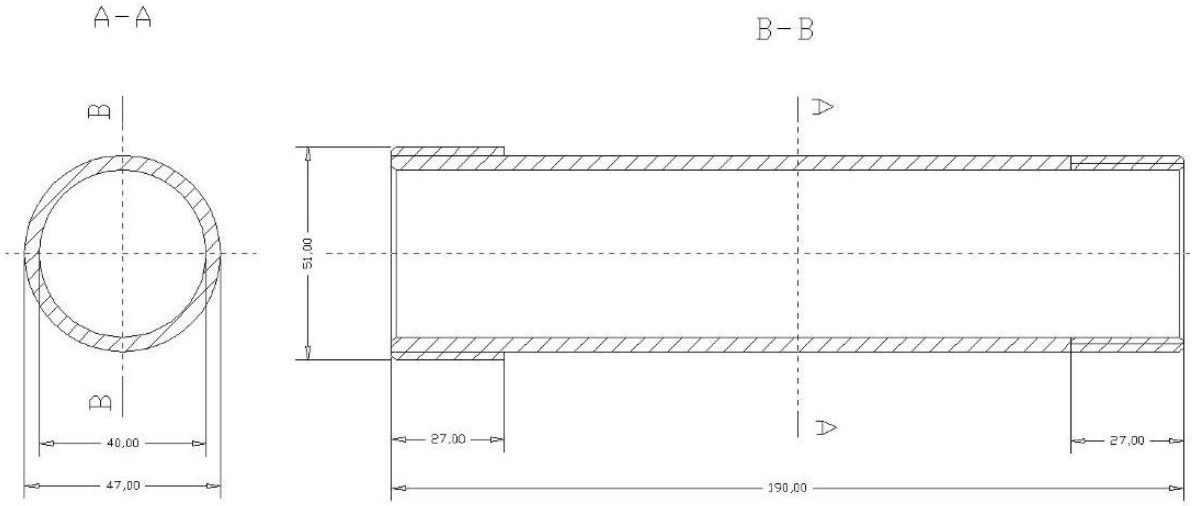

Fig. 2. *The barrel - calibre 40 mm*

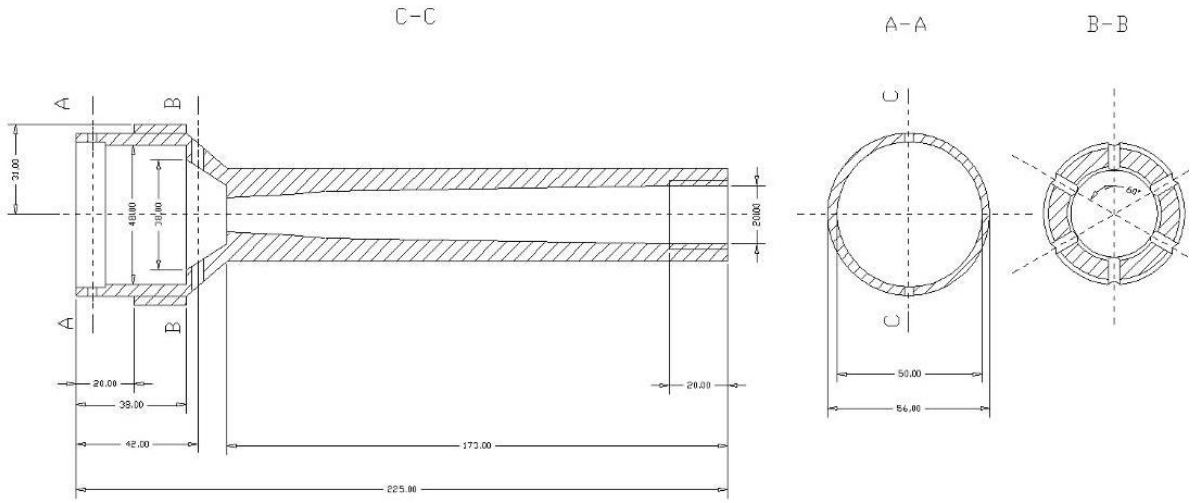

Fig. 3. *Disruptor module lock*

The THOR-1 disruptor uniqueness consists in particular, in the use of a shock with the diameter of 25 mm. Its use formats and speeds the water flow in order to maximize the power of penetration and thus generating a pressure of 1000 daN/cm^2.

It also eliminates the use of other elements, for example the slightly polyethylene plunger that Richmond uses. It is screwed directly into the 40 mm barrel horse (Figure 4).

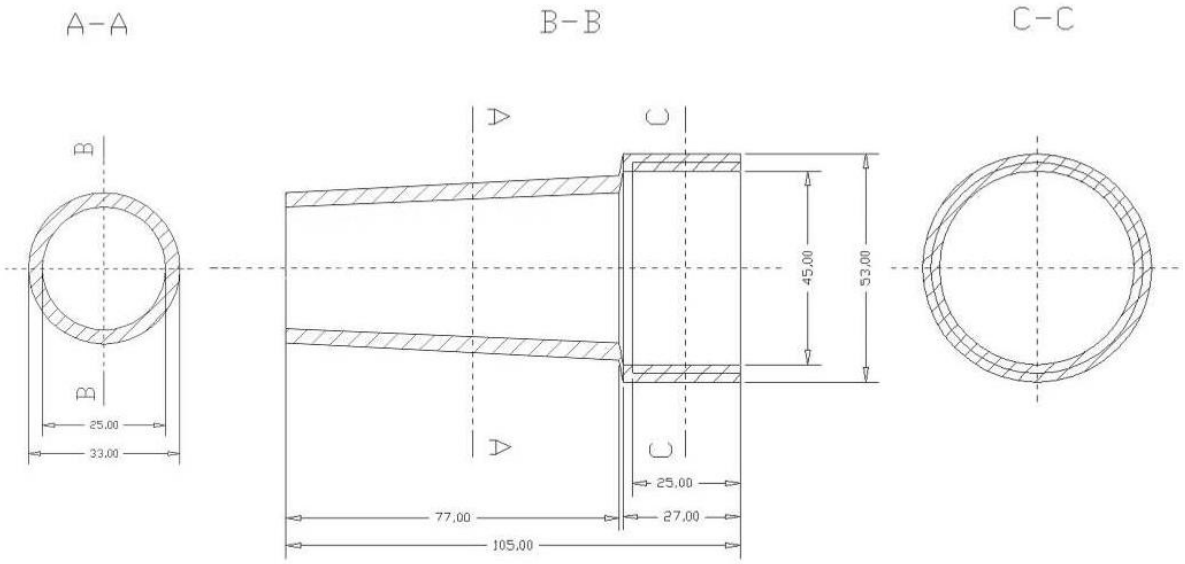

Fig. 4. *Disruptor shock*

The compensator functions to form a ring around the switch, the resulting cavity is used for filling with water (antifreeze solution) which forms the compensatory ballast necessary to recoil cancellation (Figure 5).

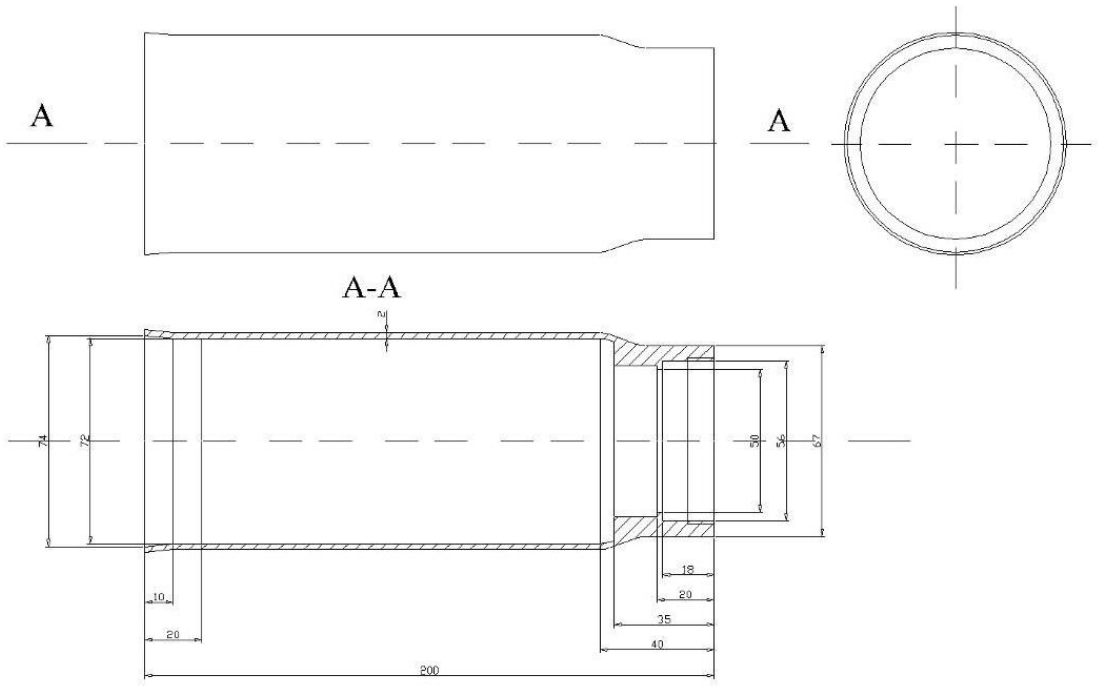

Fig. 5. *The compensator of the THOR-1 disruptor*

The striker assembly is designed to be used with 12.7 cartridges electrically initiated, provided with electric wires. The assembly is provided with a lip of extraction and a back oring which retains the catch sub-assembly in position when the hammer is removed (Figure 6).

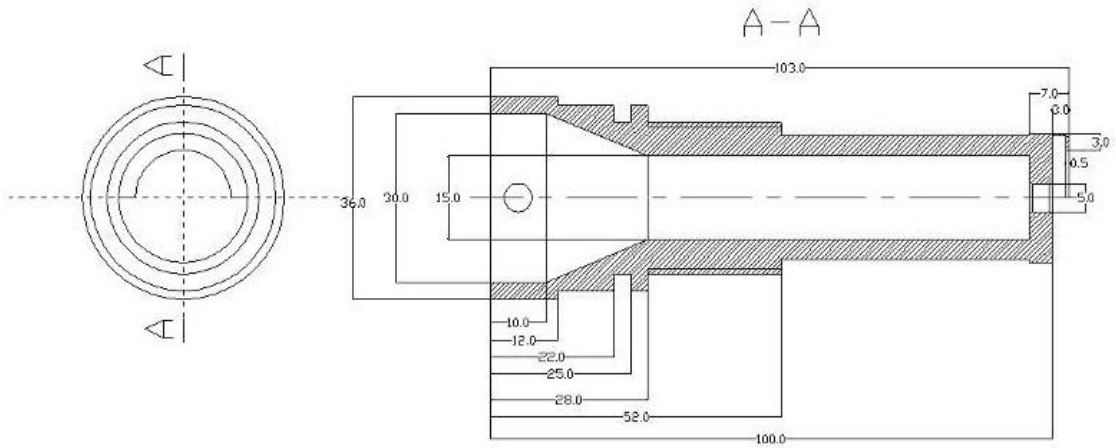

Fig. 6. *Thor-1 striker assembly*

The striker assembly is mounted behind the catching bolt that retains the ring piston, leaving out only the mass of the compensating water and the ring cover. It also has the role to minimize any damage caused by mass compensation which is discarded (Figure 7).

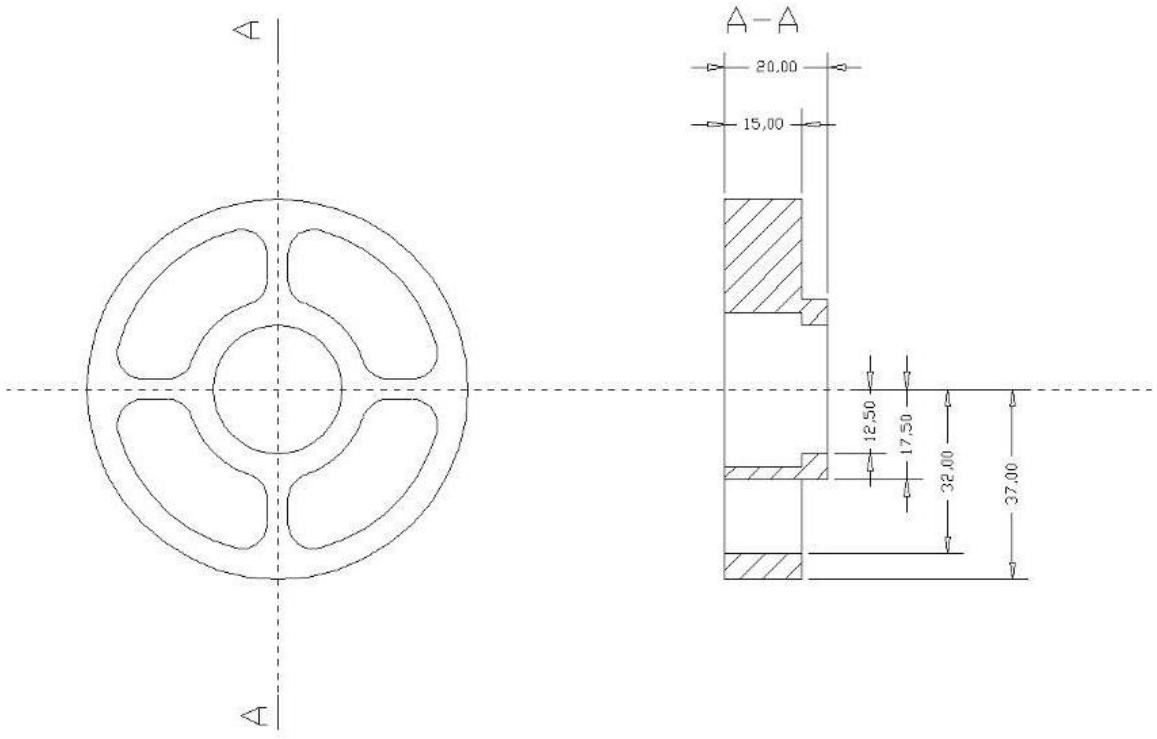

Fig. 7. *The catch subassembly*

Auxiliary elements:

Compensator cover - it aims to close in the compensator the quantity of water necessary to compensate the recoil (Figure 8).

The polyethylene piston role is to close the water in the compensator (Figure 9).

The closing cap serves to close the amount of water in the pipe of 40 mm at both ends (Figure 10).

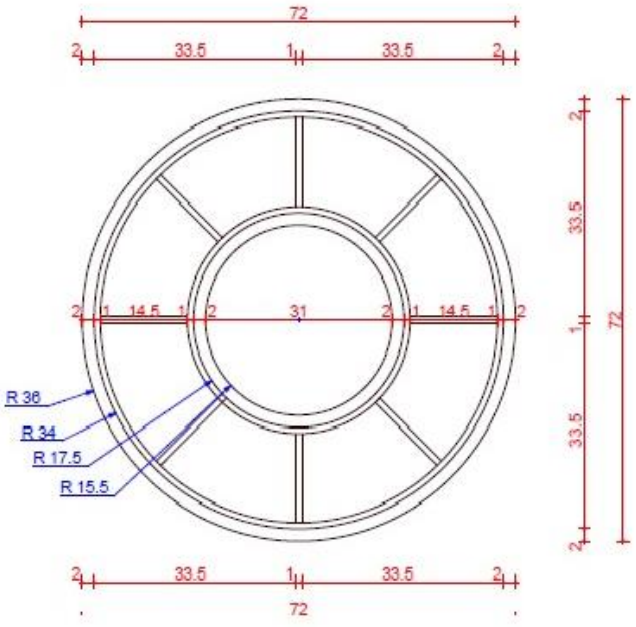

Fig. 8. *The compensator cover*

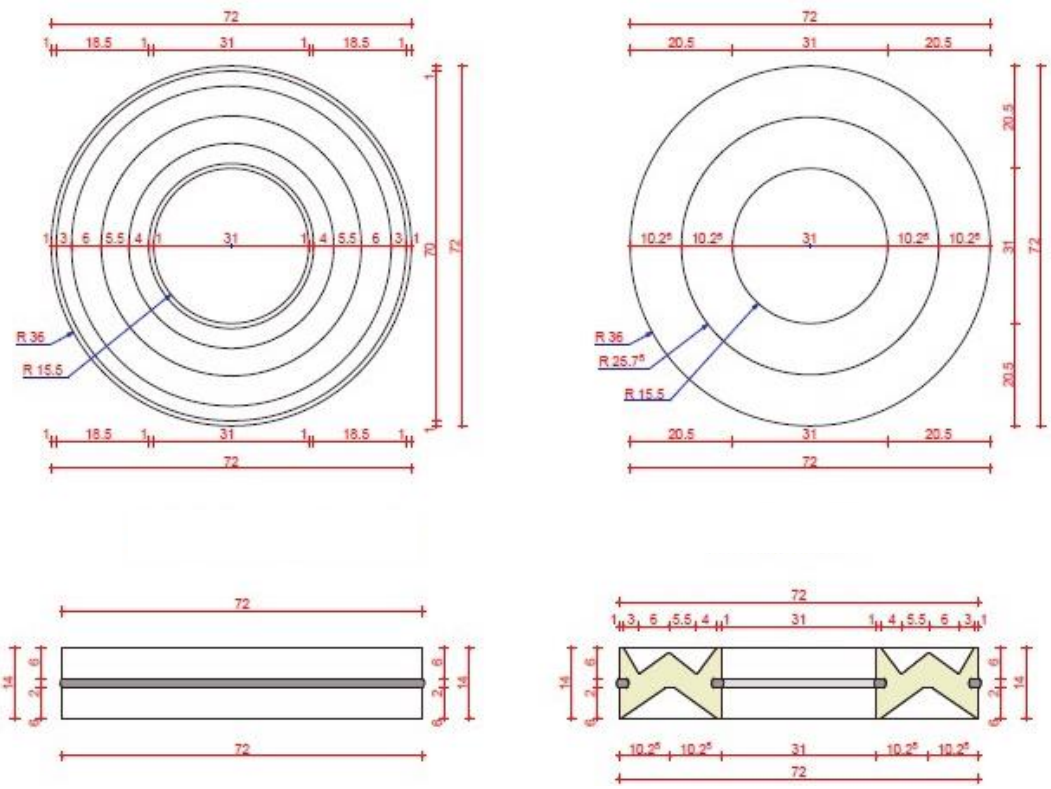

Fig. 9. *The polyethylene piston*

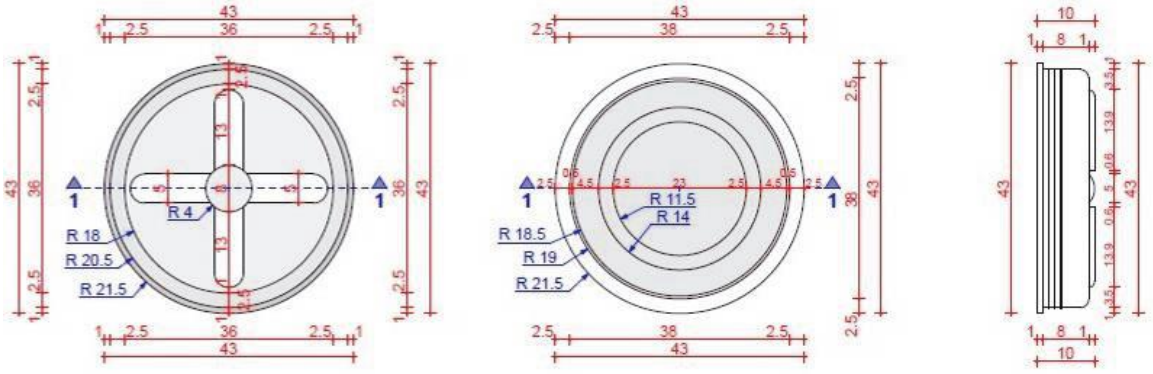

Fig. 10. *The closure cap*

4. Conclusions

- The THOR- disruptor 1 is a potent neutralization equipment, both for the values of the disruption speed agent and the energy of hitting the target;

- The duralumin construction facilitates the transport and handling, due to the very low weight;

- The simplicity of design facilitates rapid entry into operation and a minimal training for the pyrotechnics operators.

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