(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 735 342 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(43) Date of publication:
02.10.1996 Bulletin 1996/40

(21) Application number: **95909570.4**

(22) Date of filing: **15.09.1994**

(51) Int. Cl.[6]: **F42B 12/32**

(86) International application number:
PCT/RU94/00217

(87) International publication number:
WO 96/08690 (21.03.1996 Gazette 1996/13)

(84) Designated Contracting States:
BE CH DE FR GB IT LI NL SE

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(54) ROUND FOR DESTROYING PROJECTILES CLOSE TO A DEFENDED OBJECT

(57) The invention relates to munitions with a warhead having a shell with cuts to provide for its uniform fragmentation or containing multiple individual killing elements and is useful in self-defending a vehicle, preferably a tank.

Munition of the invention comprises a defensive round with its body of preferably box-type shape with an explosive charge configured as a rectangular biconcave lens with its front side covered by a bullet-forming lining increasing in thickness towards the bottom and having intersecting cuts to form pyramid-shaped plates fastened together. The round's body has a groove with a tapered plate. Furthermore, the munition incorporates a case with a propellant charge, a wire communication line and a barrel-container.

The attacking ammunition is defeated in close proximity to the object defended. Commands to eject and detonate the munition are given from the self-defence control system via the communication line.

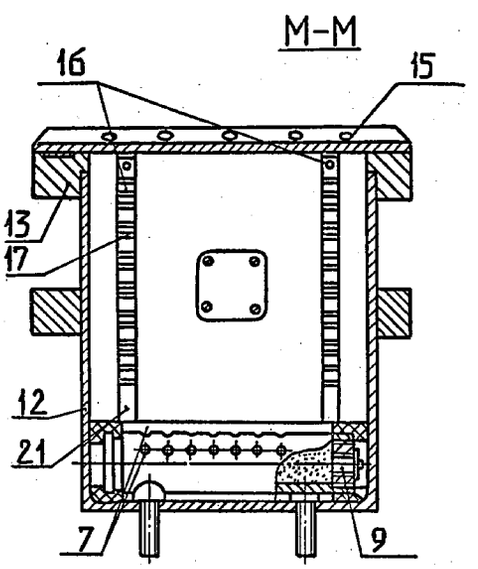

Fig. 1

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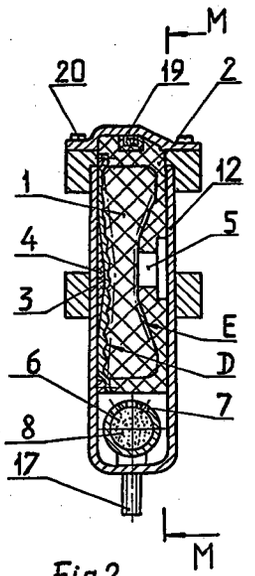

Fig. 2

Description

The invention relates to munitions with a warhead having a shell with cuts to provide for its uniform fragmentation or containing multiple individual killing elements and is useful in self-defending a vehicle, preferably a tank.

It has been provided in Germany's application 3536328 of 31.05.90 a directional defence mine against an external object aimed and detonated by signals from a detection device.

It has been known a directional munition to defeat low-flying objects such as fixed-wing aircraft, rocket projectiles in Germany's application 3432023 with a publication date of 13.03.86. This munition is the prototype and contains an explosive charge with convex spherical lining made up from bullet-forming elements. It is designed to engage major-sized targets only such as fixed- or rotary-wing aircraft, cruising missiles passing above. Target engagement results from physical damage delivered mainly to its body, control units, propulsion sections. After being covered with shower of killing elements, the target is capable of flying a ballistic trajectory path over a significant distance acting as a threat source but this is not acceptable for protection of vehicles.

Density of bullet shower of the prototype is not enough to hit warhead or fuze incorporated in a small-sized munition such as antitank missiles due to a great dispersion sector of bullets associated with a spherical shape of the bullet-forming lining. Additionally, the prototype munition is intended to be activated on the ground or water surface and requires sophisticated development work to mount vehicles mainly due to powerful detonation blast effect on the bearing surface.

It is an object of the invention to provide a munition for defeating ammunition, including small-size one, near to the object defended with effective protection of preferably vehicles, e.g. tanks.

The essence of the invention is that the explosive charge of ejected defensive round is configured as a rectangular biconcave lens with its face side covered by a bullet-forming lining and its rear side housing a fuze connected by a wire communication line to the detonation control system. This configuration of the charge ensures narrowing the dispersion sector of the bullet-forming elements and uniforming their distribution density within the given sector because every lining element ejected by the adjacent explosive charge layer has an inclination to the round's axis determined by slope of the cone walls (shaping) and the recess, opposite the lining, reduces pressure of explosion gases on the bullet-forming lining elements located nearer to the centre of dispersion sector. Velocity decrease of central elements thus obtained results in an ordered (of equal density and flat) array of bullets enhancing probability of target engagement in the predicted space point. The rectangular (in plan) lining ensures practical incorporation to box-shaped munitions of narrow-directed action.

The bullet-forming lining is an arrangement of intersecting cuts building thin plates fastened together and of pyramidal shape to ensure the bullet-forming effect during fragmentation of the lining elements at munition detonation whereas they change their shape and roll up to bullets because of greater acceleration received by plate material located round the periphery of the pyramid base as compared to its central portion. This is an optimum technical approach to take off explosion power by means of a thin flat plate during ejection and the following flight in a now compact size and with small ballistic coefficient. Furthermore, such a shape of the bullet-forming plate ensures more ordered distribution of bullets in the destructive array due to a better lining fragmentation to bullets during throwing. The process of bullet formation shall also be dependent on the ratio of the maximum plate thickness to an average value within a range of between 2.2 and 3 as well as on that of an average thickness value to the side length of the pyramid base within a range of between 0.1 and 0.3. Material of the bullet-forming plate must be of good ductility at a given strength in order to form non-destructive compact bullets during detonation.

The bullet-forming lining is configured with a thickness enhancing towards the bottom of the defensive round. With a defensive round ejected towards the target, that ensures inclination of the bullet array due to difference in velocity of the bullets propelled whereas bullets facing the approaching target develop the maximum speed. So, the bullets hit, at first, the explosive charge leading to either its non-standard initiation from a warhead side or physical damage and then the "sensible area" of the fuzing system.

When using the prototype installed on a vehicle, bullets hitting the "sensible area" of the fuzing system placed in the warhead of the attacking target can trigger its standard operation, i.e. with detonation of the intact warhead and formation of the shaped-charge jet as the most of the anti-tank weapons systems carry the "sensitive area" in front of the explosive charge.

The body of the defensive round has a longitudinal guiding groove with its depth decreasing towards bottom, said groove takes tapered plate with spikes on its surface which makes contact with the internal surface of the barrel, presses the round to the barrel wall during firing and eliminates round's vibrations in the barrel during the movement because of taking up gaps between barrel wall and round, this being of particular importance for artillery systems with rectangular cross-section of the bore that is difficult to be manufactured to accuracy required. To eliminate destruction of the body of defensive round and specify depression forces, the plate carries spikes which can engage in the less hard lining of the interior barrel space or are able to deform at specific greater pressing forces.

The cartridge case with explosive charge and ignition means has along all of its length gas vents directed towards the defensive round whereas the cartridge case is situated perpendicular to the ejection line. This

design ensures stable powder burning at low pressures in the space behind the round and reduces maximum pressure inside the barrel. The cartridge case and its vents' orientation allows to decrease losses in energy of working propellant powder charge used to turn gas streams towards the barrel exit.

The wire communication line of the munition providing its connection to the detonation control system is built as a microcable and laid as a flat knitted band secured on the body of the defensive round, said wire communication line ensures compact placement and positive operation of the wire under acceleration forces and exhaust actions when travelling inside and outside the barrel because of damping the untwisting wire interlacing (e.g. flat knitting).

The munition is provided with a disposable steel barrel-container with its inner surfaces lined by a plastic to ensure high precision of the bore without machining a high-strength material.

Fig.1, 2 are front and side views (longitudinal axial sections) and Fig.3 shows a top view of the munition provided.

Fig.4 is the munition in its longitudinal section through an installation place of the tapered plate.

Fig. 5 shows a top view (seen from the face) of the section of dispersion sector of bullet-forming lining elements of the flat explosive charge with two recesses.

Fig.6 shows the appearance of the bullet-forming lining seen from the cut side with variable thickness of bullet-forming 30 elements.

Fig.7 is a lateral sectional view of the bullet-forming lining.

Fig.8 illustrates working principle of the round with bullet-forming lining of variable thickness.

Fig.9,10 show the defensive round with wire communication line prior to and after unlaying the cable (ejection).

The munition includes a flat explosive charge 1 in form of rectangular biconcave lens, a plastic body of the round 2, a bullet-forming lining 3 of a rectangular funnel-type shape filled with foamed plastic 4, a fuze 5 , a case 6 with gas vents 7, a propellant powder charge 8, an electric igniter 9 as an initiation means, a wire communication line 10 to conduct electric pulses, an external connector 11 to couple to cables 26 of the ejection and detonation control system, a barrel-container 12 made of sheet high-strength maraging steel with bands 13 and a bore shaped with plastic cover 14, tapered plates 16 fastened with studs 15 and with spikes 17 in grooves 21, set tails 18, and a protective cover 19 with explosive bolts 20.

The munition functions as follows:

The electric pulse from the detonation control system, via the external connector 11 and wire communication line 10, enters the electric igniter 9 of the propellant powder charge 8. The propellant charge burns within the constant space of the case 6 and effluent gases flow through the gas vents 7 towards the defensive round ejecting it out of the barrel-container 12. The explosive bolts 20 which fasten the protective cover 19 to the muzzle band 13, break away. At this moment, the munition slides over the tapered plates 16 which press, with their spikes 17 being forced into the plastic barrel cover 14 and moving on the opposite tapered surface A (see Fig.4) in the body grooves 21, the round along the full length of its face side to the opposite surface B of the barrel-container. The round, having taken up gaps, slides on this surface until it leaves the barrel. At the same time, the cable of the wire communication line 10 is being unlaid from the knitted band-type stowage (see Fig.10). The electric pulse is fed from the detonation control system via the external connector and the wire communication line to the fuze 5, initiating the explosive charge 1, the detonation gases change shape of the lining elements 3 at the moment of their propelling and transform them into compact bullets 22 with enhanced lethality. Ratio of the maximum thickness C (see Fig.6) of every bullet-forming plate to an average thickness value G is within a range of 2.2 to 3, and that of the average value G to the pyramid base side H is between 0.1 and 0.3. The bullet array is propelled within a narrow sector W thus ensuring high probability of hitting the warhead of small-size attacking rounds because of forming in this sector a flat destructive front line with evenly distributed array of bullets (plane K in Fig.5). This effect is produced by means of propelling the bullet-forming elements from inclined surfaces of the funnel-shaped bullet-forming lining 3 covering the front recess on the explosive charge (surface D in Fig.2,5) and due to influence of the rear recess on the charge (surface E) slowing the velocity of bullets in the sector centre.

On detonating this munition with a lining of variable thickness, velocity of bullets propelled increases linearly beginning from the bottom portion of the round 23 (see Fig.8) to allow for the latter when launched at an angle towards the round 25 attacking the tank 24 to engage at first sections with vulnerable sides including the warhead (zone L) and then destroy those sections which when hit trigger fuze operation of the attacking round (zone N).

Feasibility of said device is verified by manufacture and tests of trial models incorporated in the tank self-defence systems. The munition allows to effectively engage warheads of small and great diameters in close proximity to the defended object. In addition, the plastic body of the defensive round, its stable flight and directed propelling of bullets within a narrow sector towards the ground ensure possibility for infantry to accompany tanks on the battlefield. An ordered array of "rigidly" arranged distribution of killing elements (bullets) ensures improvements by a factor of 15 to 20 percent in kill probability of a threat weapon. Formation of bullet array with a linear distribution of velocity profile allows to reduce residual armour penetration of the targets engaged.

Claims

1. A munition to defeat projectiles near the defended object comprising a body of the defensive round of preferably box-type shape, an explosive charge with a fuse, a case with a propellant charge and an igniter wherein said explosive charge is configured as a rectangular biconcave lens with the latter's front part covered by a bullet-forming lining and the rear part mounting a fuse connected by a wire communication line to a detonation control system and said bullet-forming lining has an arrangement of intersecting cuts to form thin plates of pyramidal shape fastened together.

2. A munition of claim 1 wherein said bullet-forming lining is made with its thickness increasing towards the bottom side of said defensive round.

3. A munition of claim 1 wherein said body of said defensive round has a longitudinal guiding groove with its depth decreasing to the bottom and carrying a tapered plate with spikes on its surface making contact with inner surface of the barrel.

4. A munition of claim 1 wherein said case with said propellant charge and said igniter has gas vents along its full length directed towards said defensive round whereas said case position is perpendicular to the ejection line.

5. A munition of claim 1 wherein said wire communication line is made of a cable laid as a knitted band fastened to the body of said defensive round.

6. A munition of claim 1 wherein it is provided with a steel barrel-container with its inner walls lined by a plastic.

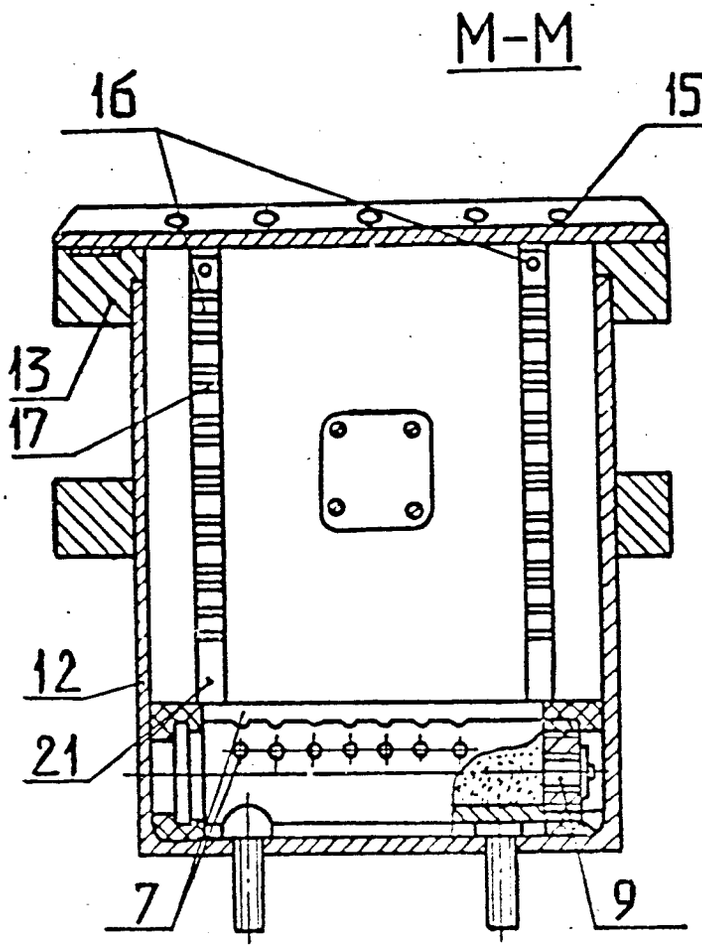

Fig. 1

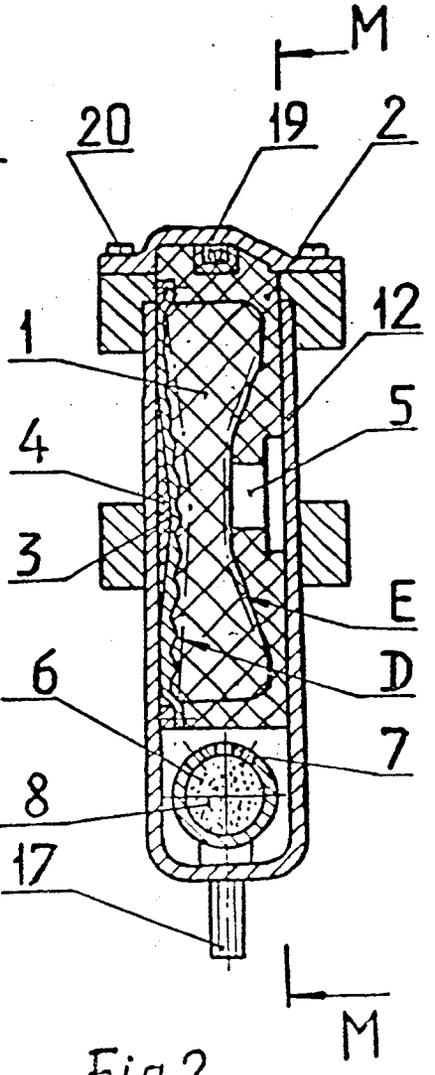

Fig. 2

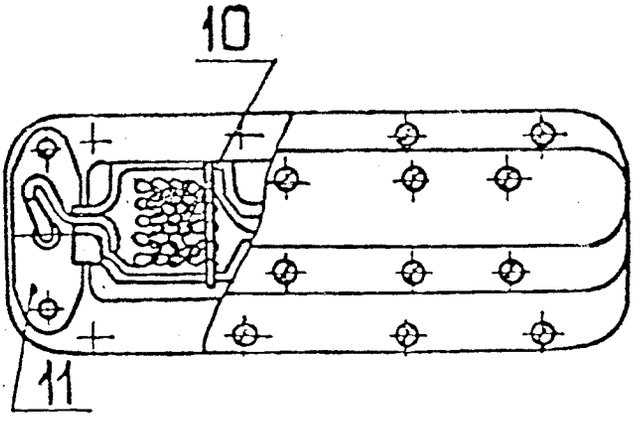

Fig. 3

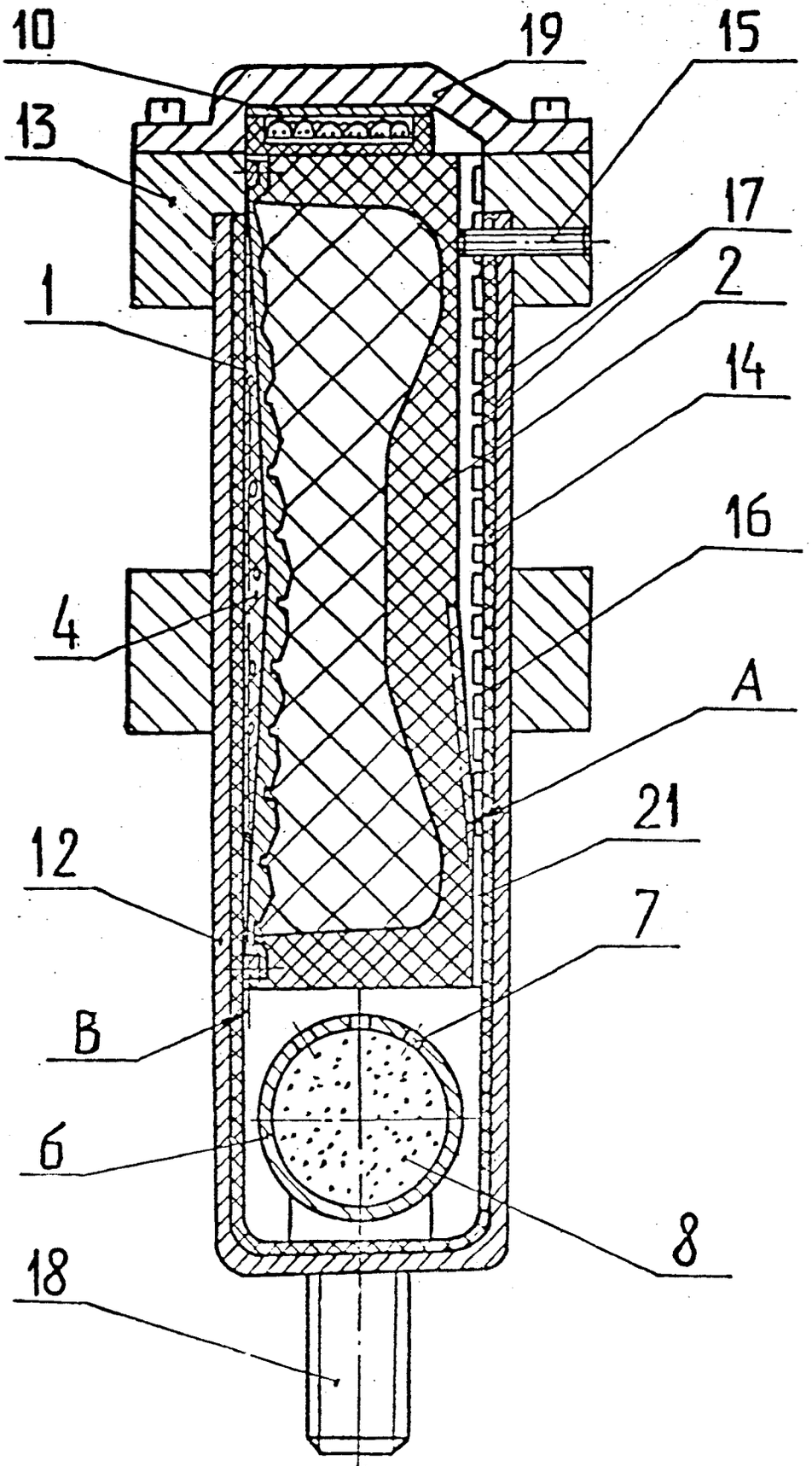

Fig. 4

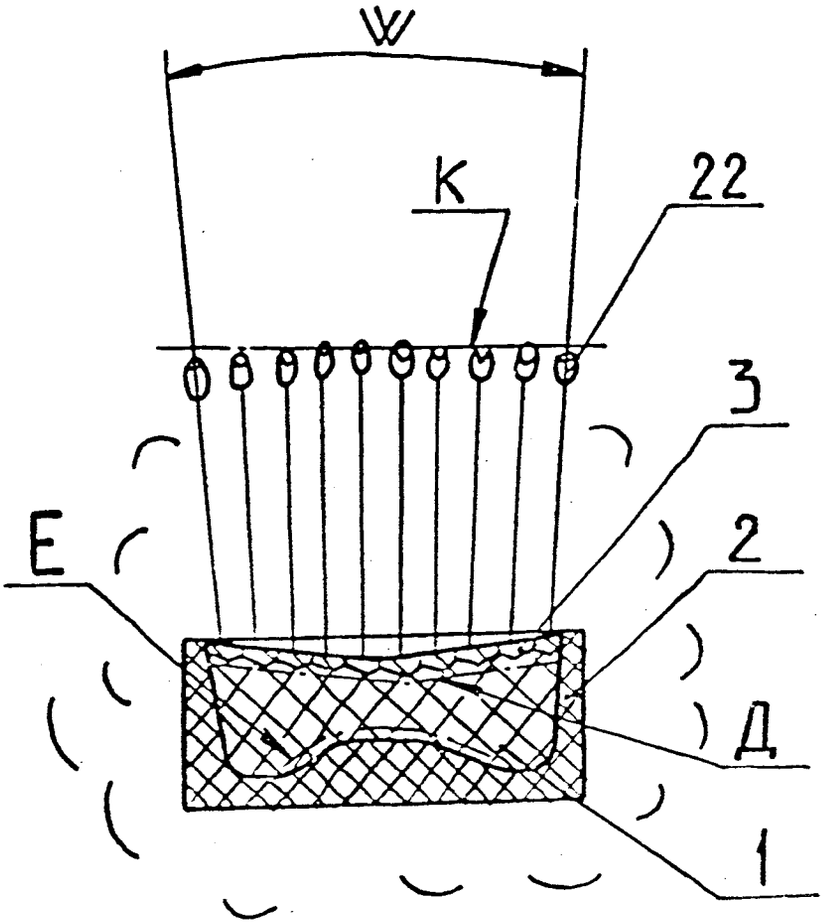

Fig. 5

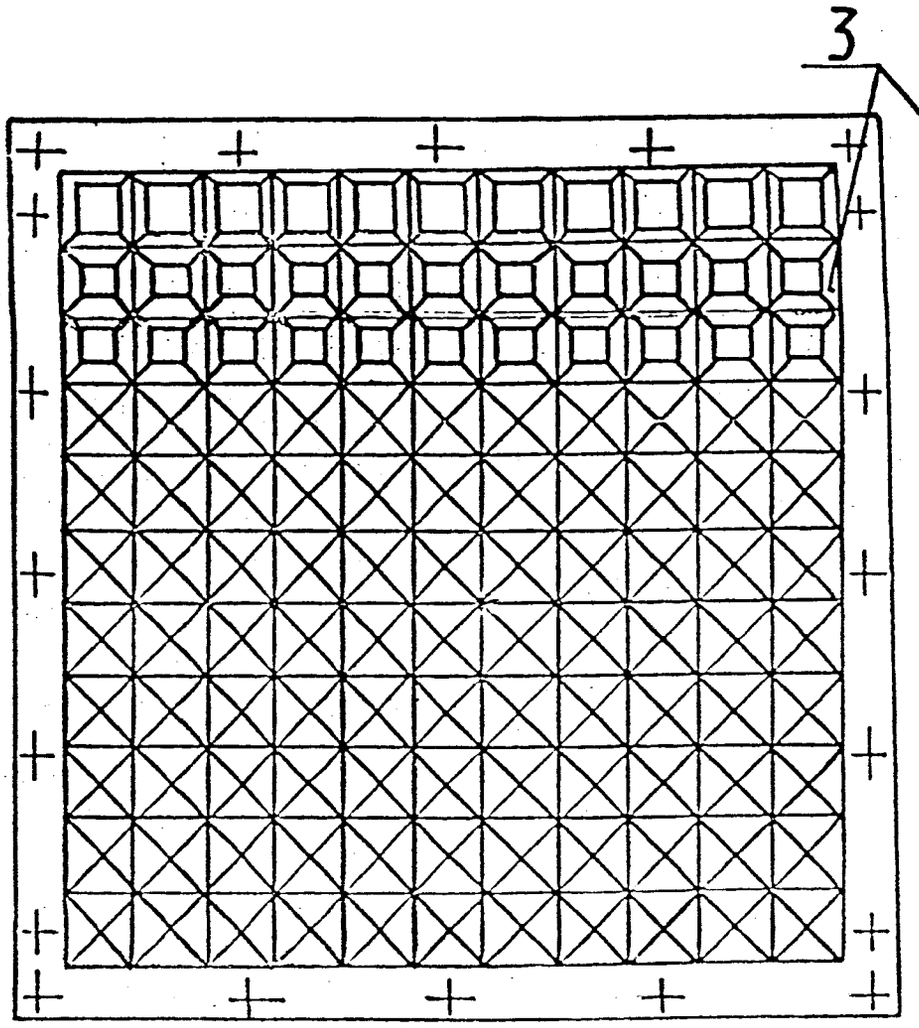

Fig. 6

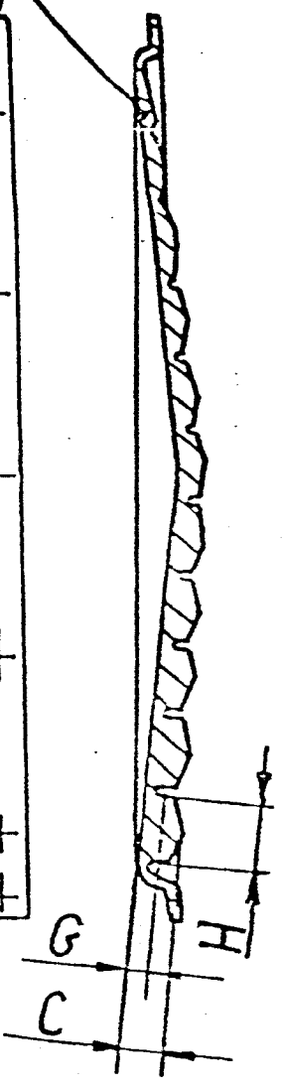

Fig. 7

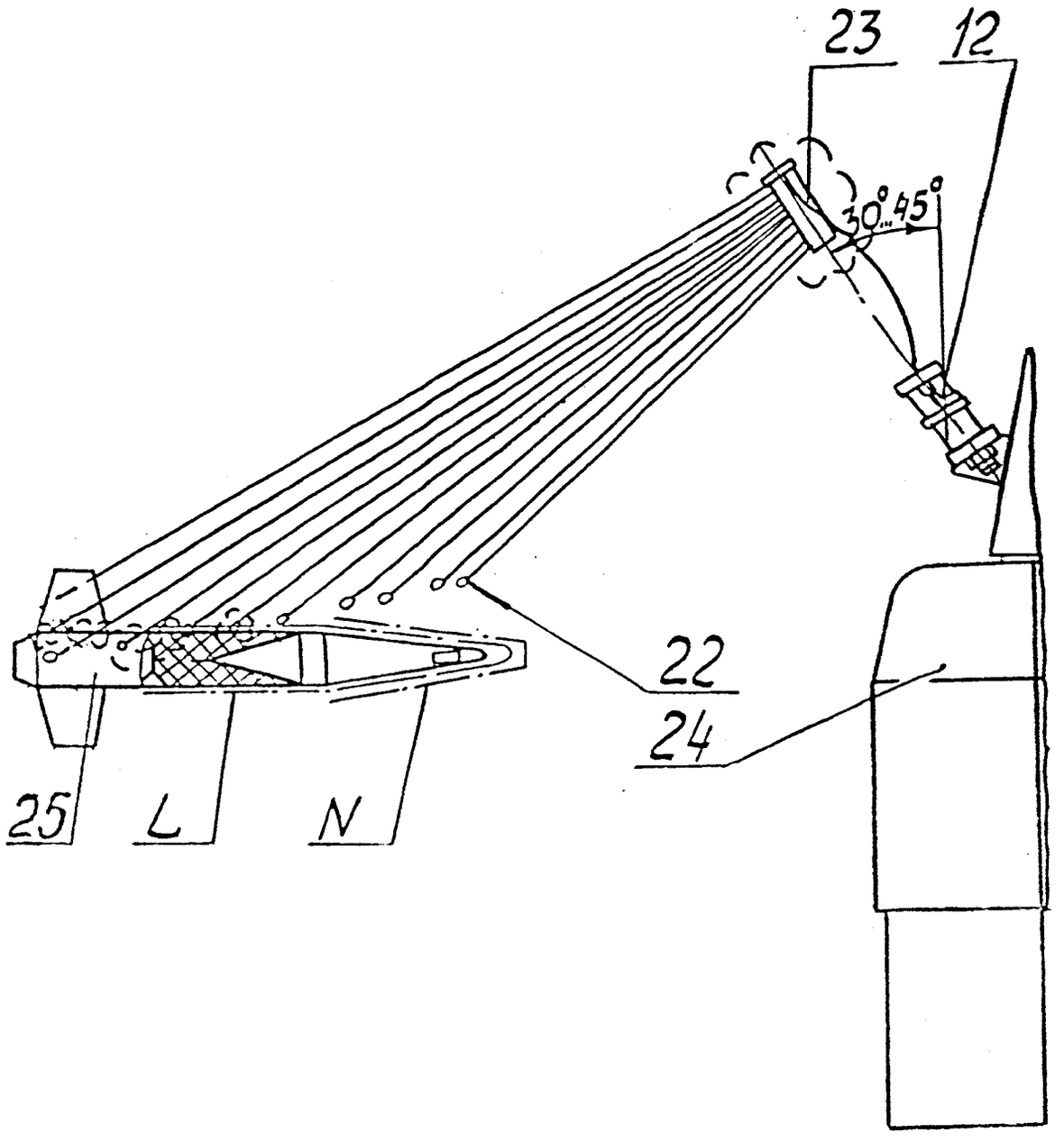

Fig. 8

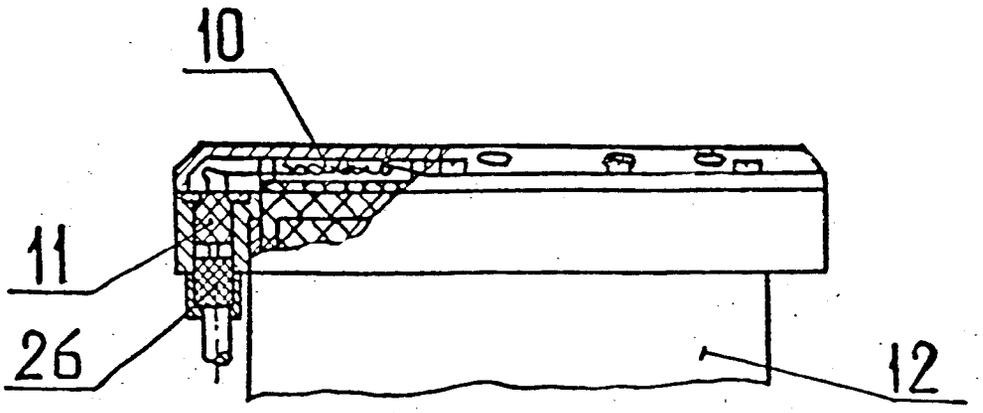

Fig 9

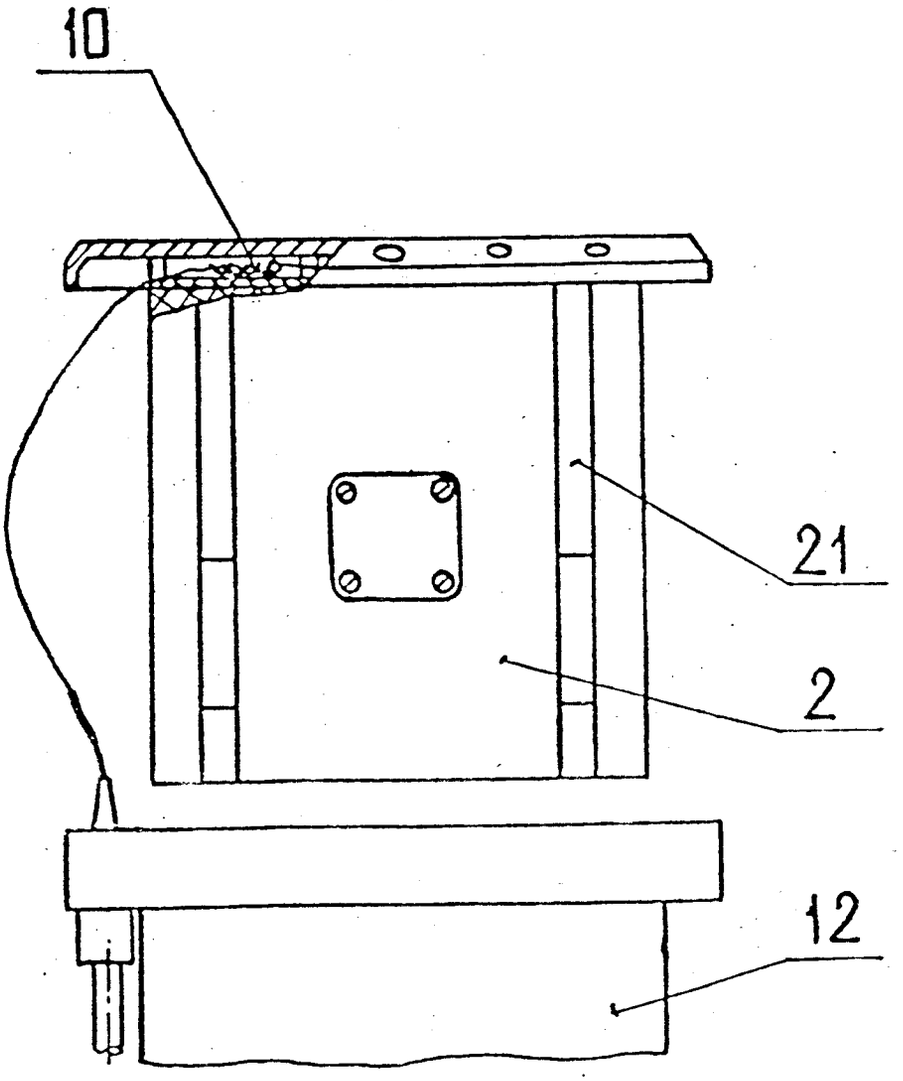

Fig 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 94/00217

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. 6 F42B 12/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. 6 F42B 12/00-12/02, 12/10, 12/20-12/22, 12/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR, A1, 2378254 (SOCIETE D'ARMEMENT ET D'ETUDES ALSETEX), 18 August 1978 (18.08.78) -.-	1-6
A	US, A, 3646888, (EXPLOSIVE TECHNOLOGY, INC.),7 March 1972 (07.03.72) -.-	1-6
A	DE, A, 2340653 (FMC CORP.), 4 April 1974 (04.04.74) -.-	1-6

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☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 June 1995 (09.06.95)	15 June 1995 (15.06.95)
Name and mailing address of the ISA/RU	**Authorized officer**
Facsimile No.	**Telephone No.**

Form PCT/ISA/210(second sheet)(July 1992)