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(54) **MUNITION TO SELF-PROTECT A TANK**

MUNITIONSEINHEIT ZUM SELBSTSCHUTZ FÜR EINEN PANZER

MUNITION POUR L'AUTODEFENSE D'UN CHAR DE COMBAT

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Description

[0001] The invention relates to a munition to self-protect a tank against an attacking round according to the preamble of claim 1.

[0002] It has been known a round with explosive charge having a layer of fragmented elements, where the above layer is concaved to provide a directional flight of the elements. The above elements are situated in the way they are adjacent with their plane surfaces and are shifted at the predefined distance in parallel in the expelling direction. The curvature of the above layer may be different in horizontal and vertical planes in order to provide a predetermined distribution of the above elements field of definite pattern, i.e. their concentration in desired direction through the explosive charge concavity (see Application DE 28 21 723,F 42 B 1/00).

[0003] The employment of the above invention for tank self-defense round does not provide the opportunity to obtain the high velocity of the killing elements (fragments) throwing as the suggested scheme of prefragmented elements is not an optimum in terms of the taking the energy away from the explosive charge and may cause the splitting of the killing elements while throwing at increased velocities. Moreover, the offered design of the killing elements layer may be employed mainly for the stationary mounting of the round and cannot withstand heavy overloads taking place during the defensive round ejection

[0004] It has been known a directional aerodynamic grenade with a time delay intended to provide the directional (mainly downwards) stream of the elements through the explosion above the ground surface. The above grenade is a symmetric body bounded with the aerodynamic surfaces and having a form of a disk. The disk has a convex upper surface and a flat lower surface to provide the lifting force while rotating. The explosive charge is placed inside the above disk. The lower flat surface of the disk is prepared for creation of the killing elements (consists of spherical elements or has intersection cuts etc.). The device is provided with an electrical circuit to delay the explosive initiation within a preset time of its launch moment till the in-flight initition, see USA patent 3646888, F 42 B 13/48.

[0005] The above grenade is intended mainly for the defeating of the manpower and its killing effect is provided by the spreading of the killing elements in large quantities within the predetermined area. The above grenade does not protect against rapidly flying anti-tank projectile and as a defensive means will be ineffective because of the following reasons:

- low speed of the mechanical system for grenade (disks) ejection;
- low accuracy of the disk delivery to the calculated point of detonating and increased angular deviations of the disk at the detonation point;
- large spread of the grenade activation time.

[0006] All these disadvantages result in low accuracy of matching the spray area of flying killing elements with the possible position of the high-speed attacking projectile (target), which further results in the low probability of its hit and destruction.

[0007] The closest prior art to the application is a device for combat tanks self-defending containing a thrower installed on the tank, which has a propelling charge, anti-projectile case covering the explosive charge with the killing elements of the ball form, a means for propelling charge initiation and means for explosive charge detonation. The latter is used to prevent a damage to the tank and provide the detonation of the explosive charge after the anti-projectile is thrown away at a predetermined distance and includes a pull-action fuze connected with the rear part of the thrower by means of a wire. The length of the above wire is equal to the predetermined distance value. Pyrotechnic delayed-action fuze or electric delayed-action fuze initiated through an electric switch (see Patent Application of France 2378254, F 42 B 9/00, issued 18.08.78) may be employed as the means for the explosive charge detonation (instead of the pull-action wire). This document is a basis for the preamble of claim 1.

[0008] The thrower has a form of a cylinder and is mounted on the tank by means of brackets and fastening elements. The cylinder case of the anti-projectile is placed in the thrower bore with a small gap. The bullet-forming lining is the external special-formed face wall of the anti-projectile case with the layer of the pellets to be thrown. The propelling charge is activated by means of the electric igniter initiated by the current pulse from the on-board detonation control system through a two-wire conductor.

[0009] The disadvantage of the known system for the combat tank self- defending is its low efficiency at engaging a high-speed antitank round.

[0010] The anti-projectile is expelled and the killing elements are thrown towards the attacking projectile thus providing the most unfavorable conditions for its defeat:

firstly, in this case, the vulnerable zone of the target is limited by the warhead maximum caliber. Moreover, in case of many missiles and rounds it is shielded by seeker, steering compartments etc. located in their front part;

secondly, in case of this technique of self-defense the killing elements hit first of all the fuse sensors of the hollow-shaped warheads. With high probability, this may cause fuse and warhead activation and regular metal jet stream generation.

[0011] The disclosed scheme and design of the means for anti-projectile in-flight detonating through the use of pull-action wire of the predetermined length or pyrotechnic delay does not provide the necessary accuracy of the attacking projectile position and the time of the explosive charge detonation matching. Specifical-

ly, the employment of the pull-action fuse at speeds of the attacking round exceeding those of the anti-projectile results in great distance errors in the point where the killing elements hit the attacking round because of influence of the internal ballistic characteristics spread on the detonation time moment.

[0012] The disclosed design of the electric fuse activation impulse transfer via two rods is not acceptable when there is a need to throw the anti-projectile to greater distances.

[0013] Moreover, this design does not provide the necessary protection of the bullet-forming lining of anti-projectile against bullets, splinters etc. and requires, for instance, to install a special protective cover and to remove it before combat employment. This results in the combat readiness reduction.

[0014] The object of this invention is to increase the attacking anti-tank projectile destruction reliability.

[0015] This is achieved by a munition having the features according to claim 1.

[0016] Thus, one aspect of the invention is that the explosive charge of ejected anti-projectile 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 communication cable 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 anti-projectile'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.

[0017] 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.

[0018] The bullet-forming lining is configured with a thickness enhancing towards the bottom of the defensive round. With the anti-projectile 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.

[0019] 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.

[0020] Additionally, the back side of the anti-projectile opposing the bullet-forming lining has longitudinal shaped grooves and tapered plates fitting into said grooves are secured along the bore of said barrel-container.

[0021] The tapered plates are outfitted with cutting-in spikes on the side adjacent to the inner bore surface which is covered with a layer of material less hard than that of the barrel-container.

[0022] Said grooves and tapered plates with spikes on the surface which makes contact with the internal surface of the barrel, presses the anti-projectile to the barrel wall during firing and eliminates anti-projectile's vibrations in the barrel during the movement because of taking up gaps between barrel wall and anti-projectile, 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 anti-projectile and specify depression forces, the plate carries the spikes which can engage in the less hard lining of the interior barrel space or are able to deform at specific greater pressing forces.

[0023] The cartridge case with explosive charge and ignition means has along all of its length gas vents directed towards the anti-projectile 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 anti-projectile 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.

[0024] The communication cable in the following also called wire communication line of the munition providing its connection to the detonation control system is built as a microcable and woven as a flat knitted, i.e. easily

unlayable, band secured on the body of the anti-projectile, in the following also called 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).

[0025] 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.

[0026] Fig.1, 2 are front and side views (longitudinal axial sections) and Fig.3 shows a top view of the munition provided.

[0027] Fig.4 is the munition in its longitudinal section through an installation place of the tapered plate.

[0028] 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.

[0029] Fig.6 shows the appearance of the bullet-forming lining seen from the cut side with variable thickness of bullet-forming 30 elements.

[0030] Fig.7 is a lateral sectional view of the bullet-forming lining.

[0031] Fig.8 illustrates working principle of the round with bullet-forming lining of variable thickness.

[0032] Fig.9.10 show the defensive round with wire communication line prior to and after unlaying the cable (ejection).

[0033] 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.

[0034] The munition functions as follows:

[0035] 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.

[0036] 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).

[0037] 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 self-protect a tank against an attacking round (25) comprising

   - a barrel container (12);
   - an anti-projectile (2) located in said barrel container (12), said anti-projectile (2) comprising

an explosive charge (1), a fuze (5) connected via a communication cable (10) to a detonation control system comprising a fuze (5) for igniting said explosive charge (1) and a bullet-forming lining (3) covering a front side of said explosive charge (1); and

- a propellant charge (8) located under the bottom of the anti-projectile (2) bottom with a squib (9);

characterized in that

- said barrel container (12) has a rectangular box-type shape with a rectangular cross-section;
- said anti-projectile (2) has a rectangular box-type shape;
- said explosive charge (1) has a rectangular bi-concave shape, said bi-concave shape forming a first front recess and a second rear recess in the explosive charge (1), both recesses being opposite to each other;
- the explosive charge side which is covered by said bullet-forming lining is constituted by said first front recess;
- said fuze (5) is located in said second recess; and
- said bullet-forming lining (3) is provided in an arrangement of intersecting cuts to form thin plates of pyramidal shape and has a wall thickness increasing from the top to the bottom of said anti-projectile (2).

2. A munition according to claim 1, wherein the back side of said anti-projectile (2) opposing said bullet-forming lining (3) has longitudinally shaped grooves, and tapered plates (16) fitting into said grooves are secured along the bore of said barrel container (12).

3. A munition according to claim 2, wherein said tapered plates (16) are outfitted with cutting-in spikes (17) on the side adjacent to the inner bore surface which is covered with a layer of material (14) less hard than that of said barrel container (12).

4. A munition according to claim 1, wherein the communication cable (10) is woven as a flat easily unlayable band fastened to the upper face of said anti-projectile (2).

Patentansprüche

1. Munitionseinheit zum Selbstschutz für einen Panzer vor einem angreifenden Geschoß (25) umfassend

- einen Schacht-Behälter (12);
- ein im genannten Schacht-Behälter (12) angebrachtes Gegengeschoß (2), das genannte Gegengeschoß (2) umfassend eine Sprengstoffladung (1), einen über ein Verbindungskabel (10) an ein Detonationssteuersystem angeschlossenen Zünder (5) umfassend einen Zünder (5) für Anzündung der genannten Sprengstoffladung und einen eine Frontseite der genannten Sprengstoffladung (1) auskleidenden, geschoßbildenden Belag (3); und
- eine unter dem Boden des Gegengeschosses (2) angebrachte Treibladung (8) mit einem elektrischen Anzünder (9);

dadurch gekennzeichnet, daß

- der genannte Schacht-Behälter (12) eine rechtwinklige Kastenform von einer rechtwinkligen Querschnitt hat;
- das genannte Gegengeschoß (2) eine rechtwinklige Kastenform hat;
- die genannte Sprengstoffladung (1) eine rechtwinklige bikonkave Form hat, die genannte bikonkave Form eine erste vordere Aushöhlung und eine zweite hintere Aushöhlung in der Sprengstoffladung (1) aufweist, wobei beide Aushöhlungen gegenübereinander liegen;
- die Seite der Sprengstoffladung, die mit dem geschoßbildenden Belag ausgekleidet ist, durch die genannte erste vordere Aushöhlung geformt ist;
- der genannte Zünder (5) in der genannten zweiten Aushöhlung angebracht ist; und
- der genannte geschoßbildende Belag (3) eine Anordnung von sich kreuzenden Einschnitten darstellt, um dünne Platten von pyramidalen Form zu bilden, und eine Wanddicke aufweist, die sich vom oberen nach unteren Teil des genannten Gegengeschosses (2) vergrößert.

2. Munitionseinheit nach Anspruch 1 dadurch gekennzeichnet, daß die dem genannten geschoßbildenden Belag gegenüberliegende hintere Seite des genannten Gegengeschosses (2) profilierte Längsnuten aufweist, und in die genannten Nuten eingreifende Keilplatten (16) im genannten Schacht-Behälter (12) seiner Seele entlang festgemacht sind.

3. Munitionseinheit nach Anspruch 2 dadurch gekennzeichnet, daß die genannten eingreifenden Keilplatten (16) mit eingeschnittenen Dornen (17) an der an die innere Seelenoberfläche grenzenden Seite versehen sind, die mit einer Schicht eines weniger als der genannte Schacht-Behälter (12) harten Stoffes (14) ausgekleidet ist.

4. Munitionseinheit nach Anspruch 1 dadurch gekenn-

zeichnet, daß das Verbindungskabel (10) als ein leicht aufziehbares flaches Band gewoben ist, das an die obere Stirnseite des genannten Gegengeschosses (2) festgemacht ist.

Revendications

1. La munition pour l'autodéfense d'un char contre un projectile attaquant (25) comprenant

- un tube-container (12);
- un antiprojectile (2) placé à l'intérieur du tube-container indiqué, l'antiprojectile (2) indiqué comprenant une charge explosive (1), une fusée (5) connectée par un câble de communication (10) à un système de contrôle de la détonation comprenant une fusée (5) pour l'initiation de la charge explosive indiquée et un revêtement à former des balles (3) couvrant un côté de face de la charge explosive (1) indiquée; et une charge de lancement (8) installée sous le fond de l'antiprojectile (2) avec un allumeur électrique (9);

caractérisée par le fait que

- le tube-container (12) indiqué a une forme de boîte rectangulaire avec une section rectangulaire;
- l'antiprojectile (2) indiqué a une forme de boîte rectangulaire;
- la charge explosive (1) indiquée a une forme rectangulaire biconcave, la forme indiquée biconcave forme une première cavité avant et une seconde cavité arrière dans la charge explosive (1), les deux cavités étant opposées l'une à l'autre;
- un côté de la charge explosive qui est couvert de revêtement indiqué à former des balles est formé par la première cavité avant;
- la fusée (5) indiqué est placée dans la seconde cavité indiquée; et
- le revêtement (3) indiqué à former des balles comporte un ensemble d'entailles croisées pour former des plaques minces d'une forme pyramidale et a l'épaisseur du mur augmentant de l'haut au bas de l'antiprojectile indiqué (2).

2. La munition selon la revendication 1, caractérisée par le fait que le côté arrière de l'antiprojectile indiqué (2) opposé au revêtement indiqué (3) à former des balles a des encoches longitudinales profilées, et des plaques cunéiformes (16) entrant dans les encoches indiquées sont fixées dans le tube-container indiqué (12) le long de son canal.

3. La munition selon la revendication 2, caractérisée par le fait que les plaques cunéiformes indiquées ont des tenons encastrables (17) sur le côté adjacent à la surface intérieure du canal qui est couverte d'une couche de matériel (14) moins dur que le matériel du tube-container (12) indiqué.

4. La munition selon la revendication 1, caractérisée par le fait que le câble de communication (10) est tissé comme un ruban plat capable de se dévider facilement et fixé sur la face supérieure de l'antiprojectile indiqué (2).

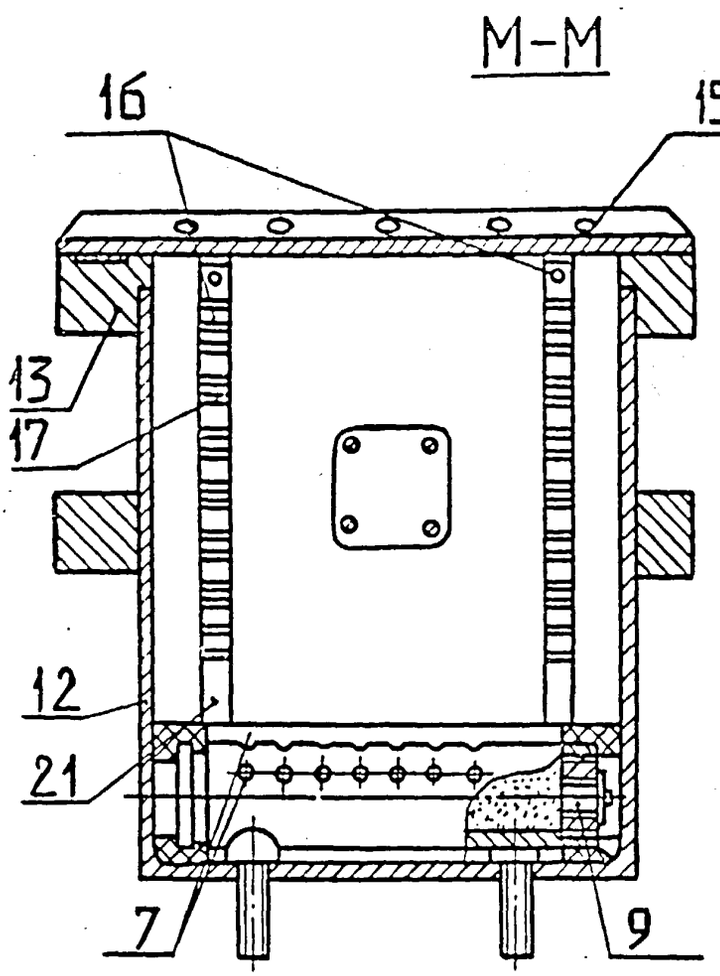

Fig. 1

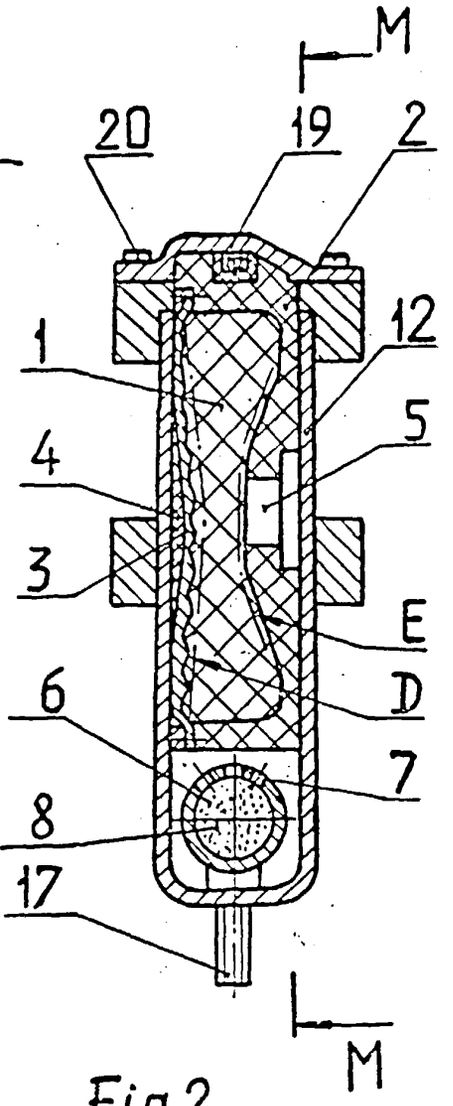

Fig. 2

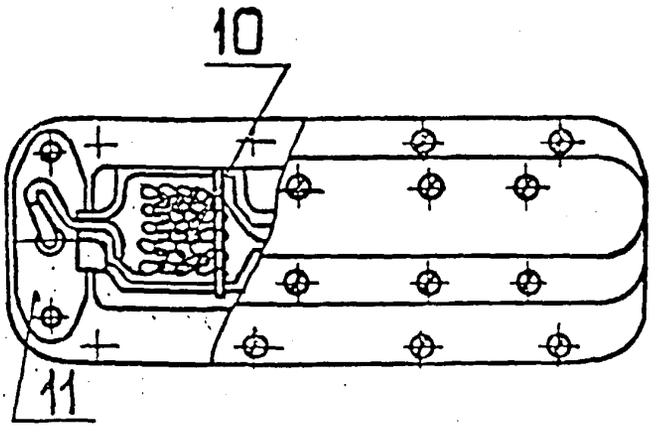

Fig. 3

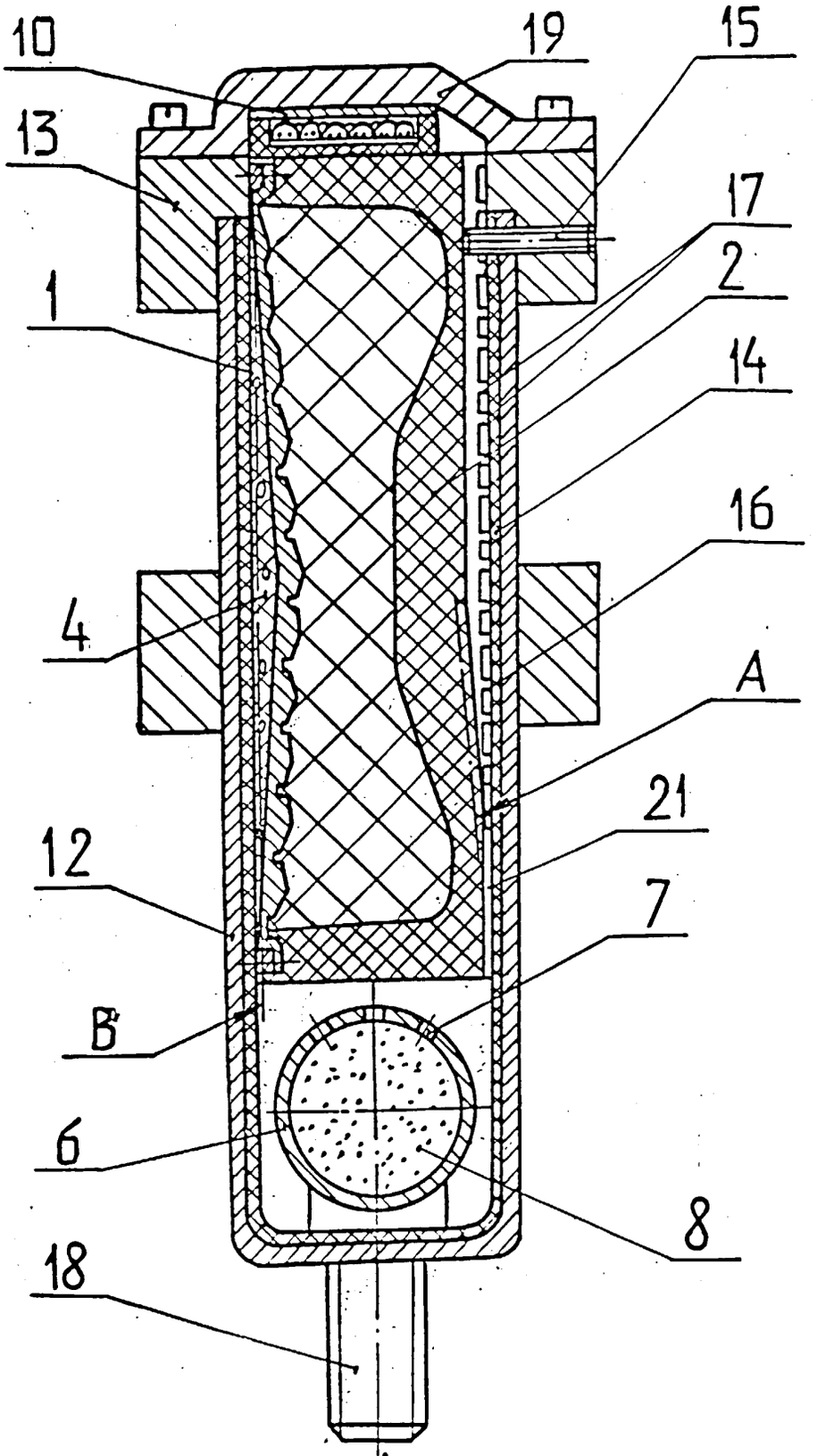

Fig.4

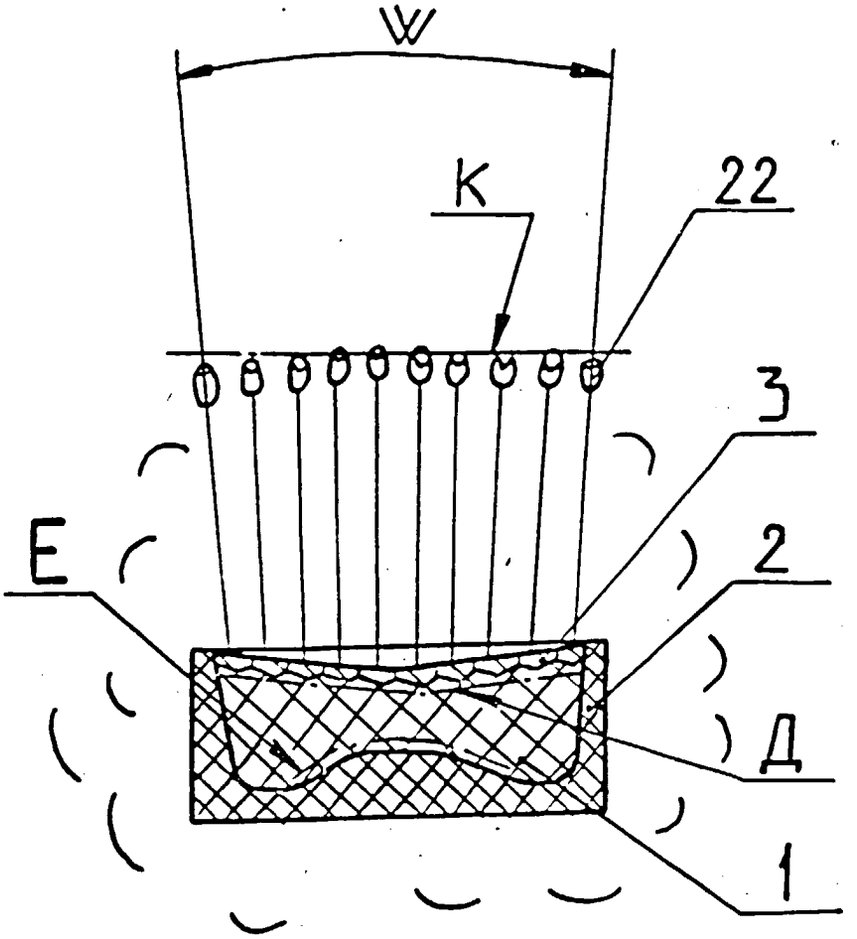

Fig. 5

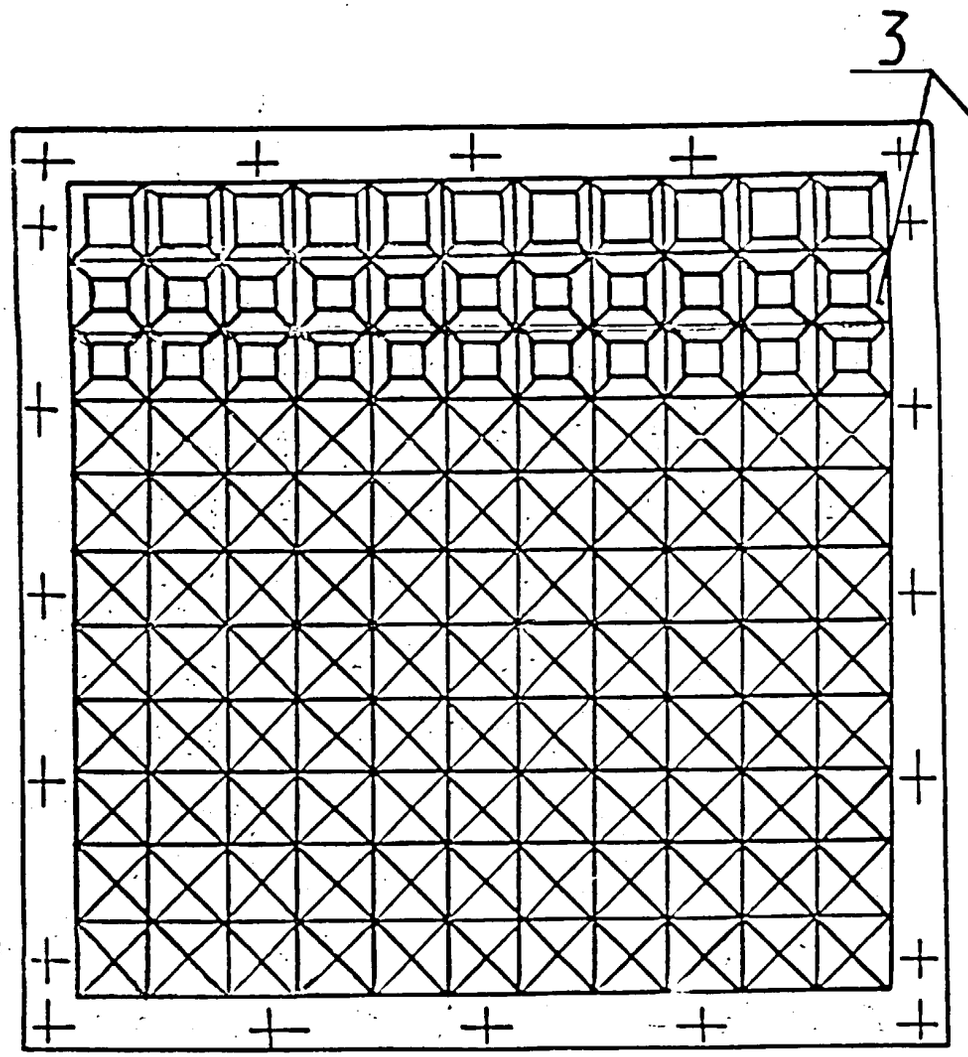

Fig. 6

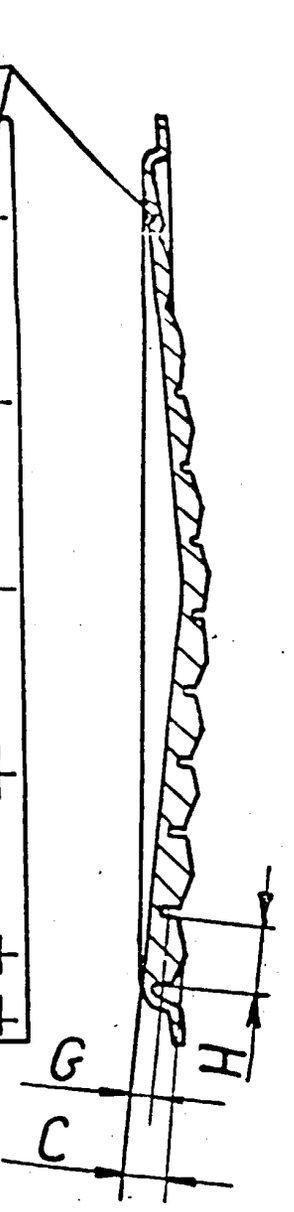

Fig. 7

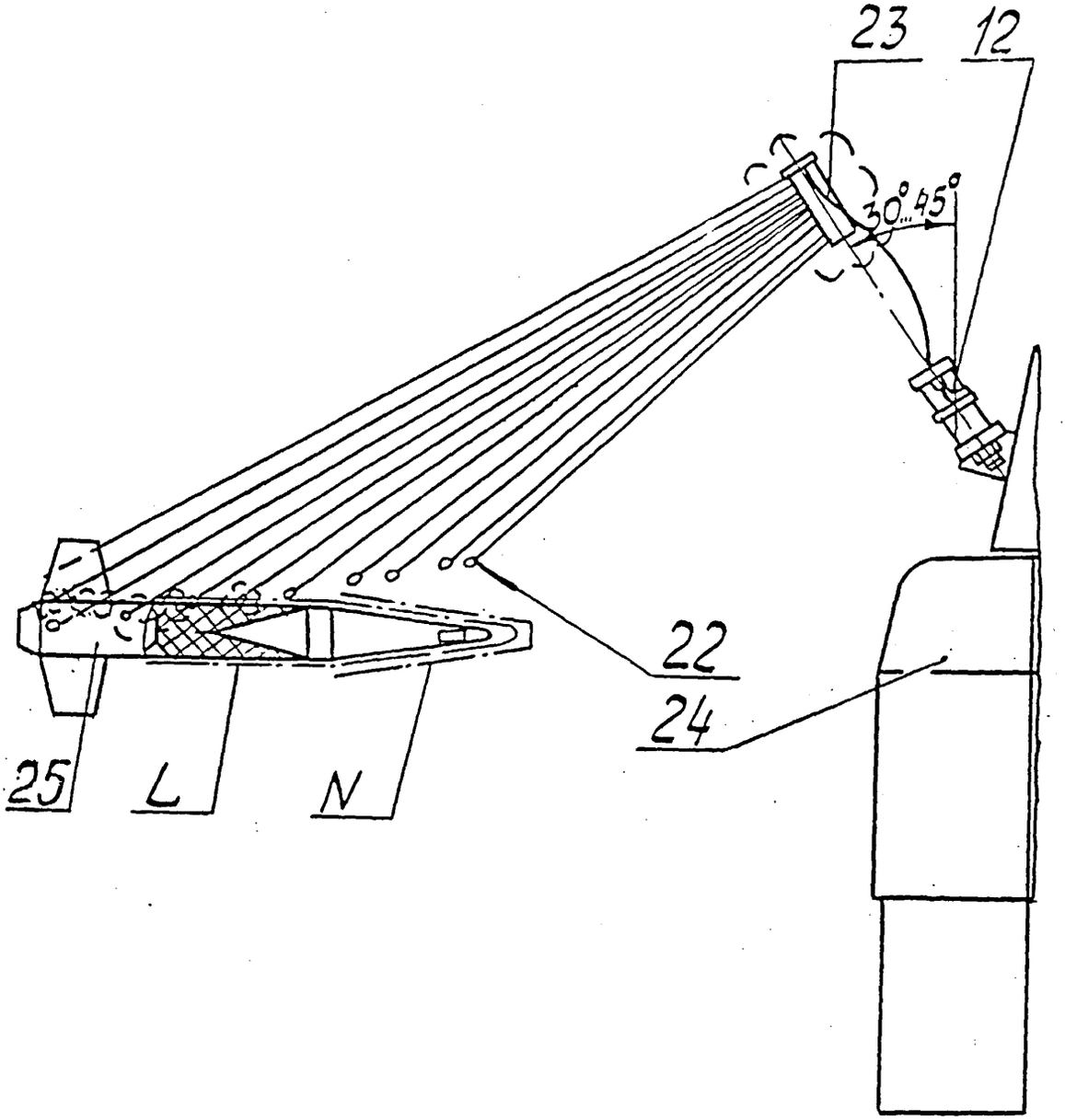

Fig. 8

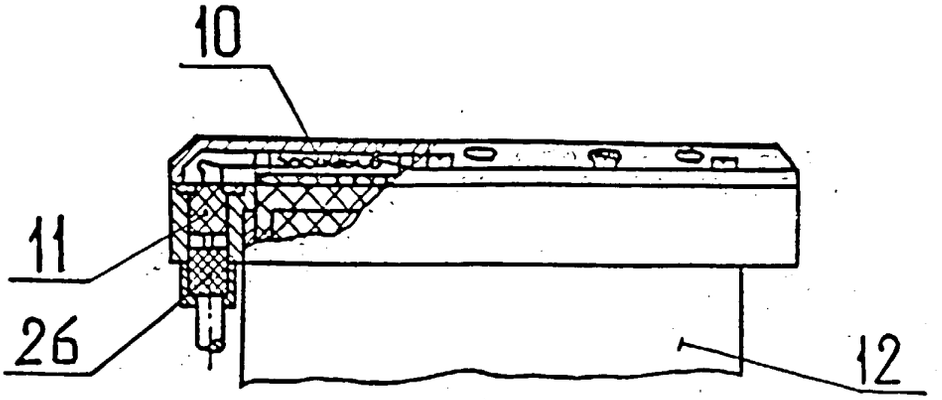

Fig 9

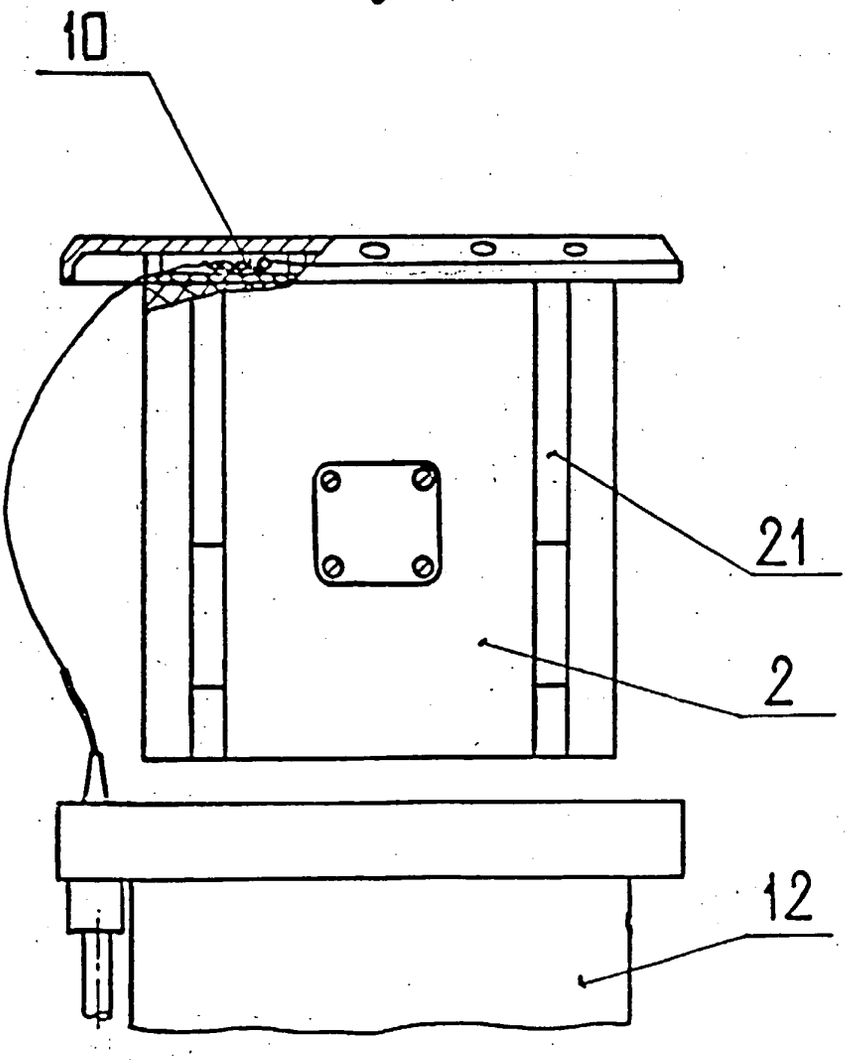

Fig 10