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(54) **A PROJECTILE ARRESTING DEVICE AND A METHOD FOR PREPARING A PROJECTILE ARRESTING DEVICE**

(57) The present invention relates to a projectile arresting device (1) comprising a foundation (3) constituting a floor (7), a rear wall (5) and partition walls (9) extending in a direction substantially perpendicular to the rear wall (5). The partition walls comprises a rear edge (10a), adjacent the rear wall (5), and a front edge (10b). Projectile stopping material (11) is arranged between the partition walls (9). A projectile stopping material retaining front layer (13) is disposed between the front edges (10b) of the partition walls and arranged adjacent the projectile stopping material (11). The front layer (13) has a convex shape. The invention also relates to a method for preparing a projectile arresting device.

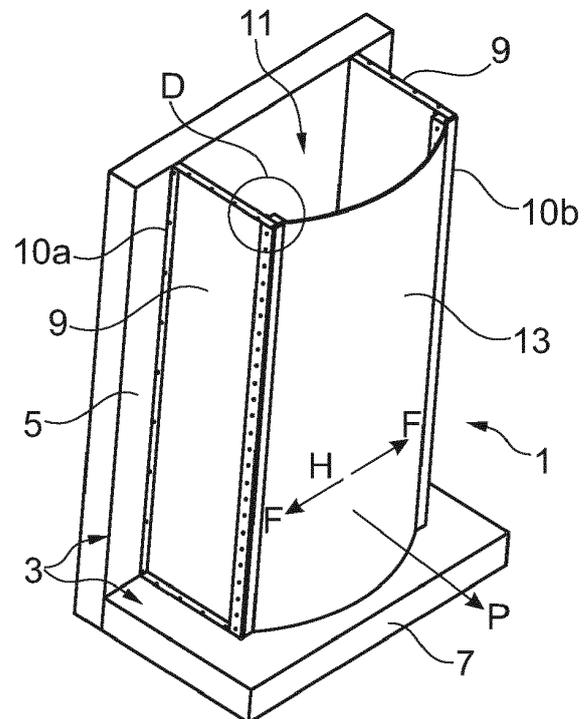


Fig. 1A

Description

TECHNICAL FIELD

[0001] The invention relates to a projectile arresting device. The invention also relates to a method for preparing a projectile arresting device.

BACKGROUND

[0002] The invention is advantageously used for installation on shooting ranges.

[0003] Conventionally, there are various projectile arresting elements known in the art provided for outdoor and indoor shooting ranges. An arresting element for outdoor use can be a natural slope or constitute of masses of earth excavated up to a longitudinal ridge. These outdoor shooting ranges can be supplemented with projectile arresting materials, such as a polymeric or rubber granular material, on the part of the arresting element exposed to gunfire.

[0004] Also known in the art is a projectile arresting device comprising side walls and projectile stopping material arranged between the side walls. Further, the device comprises a resistant wall with a number of closely situated hollow sections. The hollow sections are preferably made of a polymeric material or a reinforced polymeric material, but may in principle be made of any rigid material that withstands the load from stopping material and which can be penetrated by projectile.

[0005] Other advanced projectile arresting elements comprises a frame of walls surrounding a layer of granular material, with a front rubber layer. EP0683375 A1 discloses an absorption projectile arresting element of the type which is insertable within a container. The surface of the projectile arresting element facing shooters is constituted of a rubber cover. Granular material is arranged behind said cover. Means for resisting the pressure of the granular material is arranged between the granular material and the cover. These means include vertical elements of hardened steel or rubber. Alternatively, the resistance means comprises a plurality of blocks which are made of plastic material and have a very high ductility. The blocks may also be manufactured by the use of pressed and glued elastomeric granular material. A layer that allows the passage of the non-deformed projectiles is provided. Said layer does not break or permanently deform after the passage of the projectiles. The projectile arresting element described in EP0683375 is intended for indoor use only. Therefore, the structure is not suitable for outdoor use. The height of the arresting element is too low for shooting outdoors due to the longer firing distances outdoors, in general. A further disadvantage of the projectile arresting element disclosed in EP0683375 is that the means to resist the pressure of the granular material will tear and deform during penetration.

[0006] WO2013184062 A1 discloses an outdoor

shooting range having a covering comprising an elastomer layer. A backing layer is arranged onto an inclined surface of e.g. ground material which has been laid as a bank. The covering layer rests upon an inclined surface of projectile-arresting material filled into a watertight box formed by the backing layer. Since the covering layer is arranged upon the inclined surface of the projectile-arresting material, there is no significant pressure of the projectile-arresting material on the covering layer.

[0007] Other known shooting range devices having an elastomer front layer may break and deform during penetration of the projectiles, because of massive elastomer material that is pushed to the side and backwards by the penetrating projectile. The elastomer front layer may also tend to adopt a bulging shape after penetration.

[0008] However, a problem over time may be that the front walls of elastomer material, polymer material or a reinforced polymeric and/or elastomer material according to the prior art have poor strength, and will be weakened especially due a non-elastic deformation (cold-creeping) of the material when subjected to load for some period of time. As a consequence, the pressure of the granular material will cause the front wall to adopt a bulging shape that continuously bulge out or even break after a number of penetrations during some time.

[0009] Hence, there is a need for an improved projectile arresting device and a method for preparing a projectile arresting device which overcomes the above disclosed disadvantages.

[0010] There is also a desire to improve the durability of the projectile arresting elements, during penetration of the projectiles. Doing this may increase the lifetime of the projectile arresting elements.

[0011] There is also a desire to find an alternative instead of using material for the projectile arresting elements that will be weakened due a non-elastic deformation (cold-creeping) for a front layer subjected to penetration of the projectiles.

[0012] A further desire is to eliminate the risk for damage and deformation of a front layer during penetration of the projectiles.

SUMMARY

[0013] An object of the invention is to improve an inventive projectile arresting device and a method for preparing a projectile arresting device where the previously mentioned problems are avoided. Another object of the invention is to improve the overall quality of projectile arresting elements provided for construction of outdoor and indoor shooting ranges. A further object is to improve that the front layer will not break and deform during penetration of the projectiles. Yet a further object is to improve lifetime of a front layer of projectile arresting elements that will not be weakened due a non-elastic deformation (cold-creeping) when subjected to penetration of the projectiles.

[0014] The objects are achieved by a projectile arrest-

ing device according to claim 1. Thus, the invention also provides a projectile arresting device for comprising: A foundation constituting a floor, a rear wall, and partition walls extending in a direction substantially perpendicular to the rear wall. The partition walls comprises a rear edge, adjacent the rear wall, and a front edge. A projectile stopping material is arranged between the partition walls. A projectile stopping material retaining front layer is disposed between the front edges of the partition walls and arranged adjacent the projectile stopping material. The front layer has a convex shape. The front layer is stiff, provided with limited elasticity, having a convex shape in an unloaded and a loaded condition of the projectile stopping material. The partition walls are made in one single piece with the front layer.

[0015] Since the front layer is provided with a curved convex shape when projectile stopping material is loaded between the partition walls in the projectile arresting device, the front layer is subjected to more tensile strength than pressure force. The risk that the front layer may bulge, break and deform during penetration of the projectiles is decreased significantly. The advantage is that the lifetime of the front layer and the projectile arresting device is increased. By providing a substantially permanent convex shape of the front layer, the influence of pressure force on the front layer can be decreased. The risk that the front layer may bulge, break and deform during penetration of the projectiles is decreased significantly. The advantage is that the lifetime of the front layer and the projectile arresting device is increased. Further, the manufacturing of the projectile arresting device can be cost efficient.

[0016] According to yet another aspect of the invention the front layer is made of an elastomer with reinforced material adapted to resist tensile forces. By providing a front layer made of elastomer with reinforced material, the risk that the front layer may bulge, break and deform during penetration of the projectiles is decreased significantly. The advantage is that the lifetime of the front layer and the projectile arresting device is increased.

[0017] According to a further aspect of the invention, the front layer is fixed to the partition walls by fastening means. The risk that the front layer get loose, due to the pressure on the front layer from the loaded projectile stopping material, is decreased significantly.

[0018] According to yet a further aspect of the invention the partition walls are made of steel plate stiffened by providing a corrugated shape of the walls. As a result, the partition walls is provided with a reinforcement in order to withstand the pressure from the stopping material against the partition walls, if one or more adjacent sections is/are completely emptied during service, repair and/or maintenance.

[0019] According to another aspect of the invention, the front layer may be attached in the upper end of the projectile arresting device at the upper edges of the partition walls. In this way, it can be ensured that the front layer may keep the stopping material in position during

service, repair and maintenance of the projectile arresting device, when stopping material is removed and replaced with new stopping material.

[0020] The objects are also reached with a method according to any one of claims. Thus, the objects are achieved by a method for preparing a projectile arresting device, comprising the following steps: providing partition walls to a foundation, constituting a floor, and to a rear wall; arranging the partition walls to extend in a direction substantially perpendicular to the rear wall, the partition walls comprises a rear edge, adjacent the rear wall, and a front edge; arranging projectile stopping material between the partition walls; disposing a projectile stopping material retaining front layer between the front edges of the partition walls and arranged adjacent the projectile stopping material; providing the front layer with a convex shape; and wherein the front layer is stiff, provided with limited elasticity, having a convex shape in an unloaded and a loaded condition of the projectile stopping material, and wherein the partition walls are made in one single piece with the front layer.

[0021] Further advantages and advantageous features of the invention are disclosed in the following description and in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Below, embodiments of the invention will be described with reference to the drawings, in which:

- fig. 1A shows a perspective front view of a projectile arresting device according to an embodiment of the invention,
- fig. 1B shows an enlarged detail D of the projectile arresting device according to the embodiment in fig. 1A,
- fig. 2A shows a perspective front view of a projectile arresting device according to another embodiment of the invention,
- fig. 2B shows an enlarged detail D of the projectile arresting device according to the embodiment in fig. 2A,
- fig. 3 shows a perspective front view of a projectile arresting device according to yet another embodiment of the invention,
- fig. 4 shows a perspective front side view of projectile arresting device according to a further embodiment of the invention,
- fig. 5A shows a perspective rear view of a projectile arresting device according to yet a further embodiment of the invention,
- fig. 5B shows another perspective front view of the projectile arresting device according to the embodiment in fig. 5A,
- fig. 6A shows a perspective front view of a projectile arresting device according to another embodiment of the invention,
- fig. 6B shows a perspective rear view of the projectile

arresting device according to the embodiment in fig. 6A,

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0023] The front side of the projectile arresting device is defined as the side which is facing towards the shooter and the rear side of the projectile arresting device is defined as the side opposite the front side.

[0024] FIGS. 1A show a perspective view of a projectile arresting device 1 according to an embodiment of the present invention. The projectile arresting device 1 may comprise a foundation 3 made of a floor of any material that holds the pressure from the arresting device, such as e.g. soil, wood, steel or concrete. The foundation 3 may also be a standard ground support element such as premade steel or concrete support wall unit in L- or T-shape for greater heights. The foundation 3 forms a rear wall 5 and a floor 7 of the projectile arresting device 1. The height of the projectile arresting device 1 may be between 0.3m - 10 m, and preferably between 1.2 m - 5 m. Partition walls 9 are arranged to the foundation 3 and extends in the direction towards the shooter. The partition walls 9 are preferably made of steel which is bent in profile to increase the strength when loaded or unloaded from granules. Sort of sheet metal is chosen depending on the intended ammunition strength and may also be of ballistic steel. The partition walls 9 comprise a rear edge 10a, which is connected to the foundation 3, and a front edge 10b. The partition walls 9 may have a width of about 150 mm - 2500 mm, preferably 400 mm - 1200 mm, the projectile arresting device 1 is also provided with a stopping material 11, wherein the function of the stopping material is to capture and absorb the projectiles. The stopping material 11 is preferably a polymeric or rubber granular material, but other materials capable of capturing and retaining the projectiles can also be used. The stopping material 11 is arranged between the partition walls 9.

[0025] The projectile arresting device 1 further comprises a front layer 13. The front layer 13 serves to resist the pressure of the stopping material 11 for keeping the stopping material 11 in place, and to prevent projectiles penetrating the projectile arresting device 1 from escaping. The front layer 13 is provided between the partition walls 9. The projectile arresting device 1 may further comprises attachment means provided at the partition walls 9 for fixation of the front layer 13 to the partition walls 9. The front layer 13 is arranged to the front edges 10b of the partition walls. The rear wall 5, the partition walls 9 and the front layer 13 serves to keep the stopping material 11 in place during service, repair and maintenance of the projectile arresting device 1, when stopping material 11 is removed and replaced with new stopping material 11.

[0026] The front layer 13 has a convex shape as illustrated in fig. 1A. The convex shape of the front layer 13 may be provided during two alternative conditions. Ac-

ording to one condition, the front layer 13 is provided with a significant elasticity and the front layer 13 is capable to be curved to the convex shape by the pressure against the front layer 13 when the stopping material 11 is loaded in the projectile arresting device 1. Stretching of the front layer 13 may be limited by a woven fibre reinforcement which is suitably selected from a sparsely woven fibre layer of nature or synthetic fibre. Fibre direction should primarily be chosen so that traction forces between the attachments in the partition walls are taken up. According to one embodiment, the fibres are only arranged in the pulling direction and vertical fibres exist only in order to keep the fibres in their position when manufacturing the layer.

[0027] According to another condition, the front layer 13 is provided with a limited elasticity and keep a constant convex shape with little or none variation of its convex shape, when the projectile arresting device 1 is loaded or unloaded with stopping material 11. A reinforced cloth can be attached to the front surface of the front layer 13. By providing the front layer 13 with a limited elasticity and keep a constant convex shape, the front layer 13 will not hang down due to gravity and the pressure from the stopping material 11. The front layer 13 may be made of a stiff elastomer or reinforced material while it still can be made thin with a convex shape keeping the stopping material in position and having the advantage that only tensile strength occurs in the front layer. The partition walls 9 can suitably be made in one single piece with the front layer, with essentially the same or corresponding limited elasticity and material as the front layer 13.

[0028] In fig. 1A, the projectile arresting device 1 is illustrated filled with the stopping material 11 providing a pressure P against the front layer 13. The load by the pressure P of the stopping material 11 against the front layer 13 will in general provide tensile forces F in the front layer 13. The tensile forces F in the front layer 13 will mainly be spread horizontally H in the front layer 13. With reference to the above described two alternative conditions to provide the convex shape of the front layer 13, the front layer 13 may in both conditions be made of an elastic material having a high tensile strength. The front layer 13 may be made of an elastomer, such as polyuretan (PUR), with reinforced material adapted to resist tensile forces. Suitably, the front layer 13 may be reinforced with synthetic fibres, carbon fibres and/or aramid fibres. Preferably, the front layer 13 may be reinforced by a synthetic fibre cloth. More preferably, the front layer 13 is made of PUR that may be provided with reinforced material.

[0029] Fig. 1B shows an enlarged detail D of the projectile arresting device 1 according to the embodiment in fig. 1A. Fastening means for attaching of front layer 13 to partition walls 9 can be made of steel or elastomeric material. The curved front layer may be mounted with fasteners at such a distance that the bent layer is retained by friction and clamping force and does not slide out between the attachments. More particularly, the elastic front

layer 13 may be fixed to the partition walls by fastening means such as a mechanical attachment, preferably at the front edge 10b of the partition walls 9. The front layer 13 may be attached mechanically at each side of the partition walls 9 at several positions along the height of the projectile arresting device 1. The front layer may be arranged towards the surface of the partition wall 9 and fastening devices 4, made of steel or elastomer support elements, and can be arranged on both sides of the partition wall and pulled together by screw connections, with the front layers 13 between them. Behind the attachment, on the inside of the partition walls 9, the end edge 13e of the front layer 13 may be further secured. If the front layer 13 is made of an elastomer, for instance made of an elastomer, a piece of the elastomer can be attached by gluing at the end edge of the front layer 13 in order to ensure that the end edge of the front layer 13 is prevented due to tensile forces in the layer from sliding out of the attachment at any position along the height of the projectile arresting device 1.

[0030] The projectile arresting device 1 may comprise of a second convex layer with preferably the same elasticity, dimension and curvature as the convex front layer 13 described above. Alternatively, the second convex layer may be made of a material that is less durable but more elastic than the front layer 13. The second convex layer have no load carrying capacity. The second convex layer can preferably be arranged on the front side of the first convex front layer 13. The advantage with arranging the less durable second convex layer at the front side of the front layer 13 is that damages and holes from penetrated projectiles can easily be repaired from the front side. The partition walls may comprise of at least two sheets that are attached by fastening means. The first and second convex layers can be attached in the partition walls between said at least two sheets.

[0031] Fig. 2A shows a perspective front view of a projectile arresting device according to another embodiment of the invention. Fig. 2B shows an enlarged detail D of the projectile arresting device according to the embodiment in fig. 2A. The same reference numerals are used for the corresponding features as shown and described with reference to figs. 1A-B. As shown in figs. 2A-B, the front layer 13 may be attached in the upper end of the projectile arresting device at the upper edges of the partition walls 9. In this way, it can be ensured that the front layer 13 is not hanging down during refilling the projectile arresting device 1 with the stopping material 11 in place during service, repair and maintenance of the projectile arresting device 1, when stopping material 11 is removed and replaced with new stopping material 11. A rigid sheet 15, such as a steel plate for instance, may be arranged on top of the projectile arresting device arranged adjacent the front layer. The sheet may be arranged between the partition walls 9 and attached to the partition walls by attachment means 17. The sheet also ensures that the partition walls 9 are hold in place without the risk of collapsing, from the pressure of the stopping material 11.

[0032] Fig. 3 shows a perspective front view of a projectile arresting device according to yet another embodiment of the invention. The same reference numerals are used for the corresponding features as shown and described with reference to figs. 1A-B and 2A-B. As shown in the embodiment in Fig. 3, and described above with reference to Fig. 1A-B, the partition walls 9 are preferably made of steel which is bent in profile to increase the strength when loaded from stopping material 11, such as granules. The partition walls 9 may be made of steel plate stiffened by bent in profile, providing e.g. a corrugated shape of the walls. A bent profile, such as corrugated shaped walls, have the advantage to have a high durability for the partition wall 9.

[0033] Fig. 4 shows a perspective front side view of projectile arresting device according to a further embodiment of the invention. The same reference numerals are used for the corresponding features as shown and described with reference to figs. 1A-B, 2A-B and 3. According to the embodiment, a surface layer 19 may be arranged in front of the front layer 13 for target projections. The partition walls 9 have been extended with an extension wall 9a in front of the front layer 13 and a surface layer can be arranged to the outermost edges 10b of the partition walls 9. The surface layer may for instance be a thin sheet made of PUR used as surface for target projections. In the space S between the front layer 13 and the surface layer 19 for target projections, stopping material 11 that may come out via projectile penetration holes in the front layer 13, can be collected in the space S.

[0034] Another embodiment (not shown) is to arrange a surface layer such as a sheet of elastomer cloth, paper or paperboard in front of the front layer 13, preferably hanging from a rail at a ceiling above, if indoors, or preferably arranged to hang from a framework or the similar, if outdoors, in front of the front layer 13. An arrangement for mechanically changing the surface layer that has been subjected to projectile holes can be provided, by transporting away the used layer and bringing another new surface layer forwarded by a rail, rolls, framework, or the similar.

[0035] Fig. 5A shows a perspective rear view of a projectile arresting device 1 according to yet a further embodiment of the invention. Fig. 5B shows another perspective rear view of the projectile arresting device according to the embodiment in fig. 5A. The same reference numerals are used for the corresponding features as shown and described with reference to figs. 1A-B, 2A-B, 3 and 4. The front layer 13 of the projectile arresting device may be provided with at least one opening 22. A sleeve 24, having flanges 24a, 24b and open at each end, is attached to the back side 13b of the front layer 13 at the flanges around the at least one opening 22. One purpose of the at least one opening 22 in the front layer 13, provided with a sleeve 24, is to provide a specific designated area of the front layer 13 that is subjected for the most concentrated firing, a so called "hot-spot". The sleeve 24 can be provided with a detachable wall portion

25 such as an expanded elastomeric material to hold back the stopping material at service, repair and maintenance. A major amount of the fired projectiles can be shot without changing the front layer 13 and instead change a very small part of the front layer 13. The front side of the sleeve at the flange 24b, facing the front layer 13, can be covered with an easy interchangeable part of an elastomeric material.

[0036] This construction allows the highly concentrated firing that causes great wear can be easily repaired by replacing the elastomer material in the sleeve 24, such as a round plate 26 made of elastomer, preferably made of polyurethane.

[0037] An opening 22 in the front layer with a sleeve 24 can also be designed with a hatch 27, in order to get easy access into the sleeve 24 for empty the projectiles collected inside the sleeve 24 or for filling the sleeve or filling and/or emptying of projectile stopping material 11 the space inside the projectile arresting device 1. The hatches 27 can be made of elastomeric and penetrable. The hatches 27 may have a front of elastomer that follows the curvature of the front layer 13 to not be detected.

[0038] The sleeve 24 is preferably arranged behind the front layer 13 and between the rear wall and the partition walls 9. The sleeve 24 is suitable attached by gluing on the back side of the front layer 13. The front layer 13 may be provided with a reinforced portion 28 at the back side of the front layer 13 around the area where the sleeve 24 is attached. The reinforced portion 28 is attached to the back side of the front layer 13 such that the sleeve 24 follows the elastic movement of the front layer. The reinforced portion 28 is suitably a sheet of elastomer that is penetrable. The sheet of elastomer can be attached to the front layer 13 by gluing and suitably to the partition walls with fastening means without restricting the movement of the sheet together with the front layer 13. If attachment of the sheet to the partition walls is not suitable, the sheet can be attached to the front layer 13 with fastening means and/or by gluing.

[0039] The sheet of elastomer may be provided with a wedge shape and attached into the front layer 13 and to fit the sleeve 24 which is provided with the corresponding wedge shape. Thanks to the wedge form, the sheet and the stopping material, such as an expanded elastomeric material in the sleeve 24, can be easily exchanged from the front layer 13 at the front side of the projectile arresting device 1. This is advantageous since the part of the front layer 13 that is subjected to wear due to concentrated firing, can be easily exchanged from the front layer 13, while the other parts of the front layer 13 that have been subjected to minor or insignificant amount of firing is less influenced to wear and thus need not to be exchanged.

[0040] If it is not possible to fill stopping material from the top of the projectile arresting device 1 due to the roof or ceiling height, for instance if the projectile arresting device 1 is arranged indoors, the filling can be done at the front layer 13 through an upper sleeve 24. The sleeve 24 may be attached and arranged to the front layer 13

as described above. However, it may still not be possible to fully fill the entire space at the top of the projectile arresting device 1. Therefore, a steel plate can be arranged in an inclined position in the top of the projectile arresting device 1 in the space at the top, behind the front layer 13. The steel plate may further be provided with a flange of steel at the lower end to steer the projectile downwards into the stopping material 11, extended at an angle to the steel plate and in vertical direction inside the projectile arresting device 1. The steel plate and the flange can be attached by welding. The steel plate and the flange may be provided as one sheet of steel where the flange is bent to the desired angle relative the upper part of the sheet. The steel plate with the angled flange are cooperating to guide projectiles, entering at the top, into the stopping material 11 below the flange at the top. The dimension of the steel plate and the angled flange can be chosen depending on the ammunition used at the shooting range. The steel plate and the flange are not penetrable and are preferably made of a ballistic steel plate.

[0041] With reference to the embodiments shown and described above with reference to figs. 1A-B, 2A-B, 3, 4 and 5A-B, it is suitable to provide a bottom plate which holds the layer and which is extended past the layer so that a collecting channel is formed. The collecting channel can be formed with a straight edge so that the front layer 13 of elastomeric material can be attached hanging behind this edge so that the stopping material 11 can be collected between the straight edge and the edge following the attachment of the curved front layer 13. The distance between the layers may vary depending on the selected attachment of the front layer 13.

[0042] Furthermore, an inclined non-penetrable steel plate may also be arranged at the bottom portion of the projectile arresting device 1, in such a way that it guides the stopping material 11 to an opening for discharge of stopping material 11 and reduce the amount of stopping material 11.

[0043] The upper part and the lower part of the projectile arresting device 1 can be provided in substantially elastomer material. A possible discharge availability at the bottom lower part of the projectile arresting device may facilitate supply of a fire inhibiting agent, protected from rain, snow and the arresting device may also be sealed from air that may feed a fire.

[0044] Fig. 6A shows a perspective front view of a projectile arresting device 1 according to another embodiment of the invention. Fig. 6B shows a perspective rear view of the projectile arresting device according to the embodiment in fig. 6A. The same reference numerals are used for the corresponding features as shown and described with reference to figs. 1A-B, 2A-B, 3, 4 and 5. The projectile arresting device 1 shown in fig. 6A-B can be provided with a stiff self-supporting front layer 13, attached at the back side edges with a L-shaped steel profile 30 that can be secured by fastening means to a wall or a backing of metal or wood. A stabilizing partition wall

9 made of e.g. elastomer metal or wood between the sections has the task of keeping the shape of the part that should be straight. The partition walls 9 can suitably be made in one single piece with the front layer 13, with essentially the same or corresponding limited elasticity and material as the front layer. 13 In the roof at the top and at the bottom, the front layer 13 can be secured in a plate of polymer with a clamping joint. Opening for filling stopping material 11 can be done in the top part. If this is possible due to the roof height, the openings can be made with cloth of elastomer as front. For this projectile arresting device 1, a stiffer elastomer or two layers can be used, where the exterior is highly elastic layer and the inner can be a rigid layer, but not so rigid that it bursts when passing through projectiles.

[0045] The projectile arresting device may comprise a roof provided by a rigid sheet 15 projecting from the rear wall 5 and which covers an area in front of the projectile arresting device 1. The roof may be a one piece integral part of the foundation 3, as a unit constituting the floor 7, rear wall 5 and the roof, for instance all made of concrete. A projecting roof protects targets from rain and snow. Attachments for mechanical targets can be arranged below said projecting roof.

[0046] As described above, existing walls, floors and ceilings may be used for mounting the projectile arresting device 1 or projectile arresting arrangement indoors. Existing walls and floors then acts like the foundation for the projectile arresting device 1 or projectile arresting arrangement. In another embodiment, however, the projectile arresting device 1 may be a movable modular unit comprising a foundation constituting a floor 7, a rear wall 5 and a roof. In doing so, it is possible to provide a projectile arresting arrangement comprising at least two projectile arresting devices 1, where at least two projectile arresting devices are grouped together, thereby forming inter alia an I-shape, L-shape, U-shape, C-shape, F-shape, T-shape or E-shape.

[0047] The projectile arresting device 1 may be provided with a moisture barrier layer of polymeric material. This layer prevents water from the soil to be absorbed by the stopping material 11. The moisture barrier layer also prevents rainwater that has entered the projectile arresting module 1 from leaking into the ground. This prevents unwanted lead and other contaminants from projectiles or stopping material from being leached by water and spread in an uncontrolled manner in the surrounding environment. The layer is applied on the foundation 3, and can also cover a lower part of an inner side of the rear wall 5. The foundation 3 can also be from soil and also use concrete slabs in different heights to get a slope of the layer to the perforated drainage pipe. Rain water may be collected in a perforated drainage pipe disposed in the lower part of the projectile arresting device 1. The drainage pipe may be provided with a coupling coupled to the next module or with a sleeve coupling (not shown) arranged in the layer. Another solid pipe, leading to a collection vessel or filter, may be coupled to sleeve

coupling (not shown).

[0048] According to a further embodiment, the projectile arresting device 1 may be provided as semi-circular units. The front layer 13 is provided with a limited elasticity and keep a constant convex semi-circular shape with little or none variation of its convex shape, when the projectile arresting device 1 is loaded or unloaded with stopping material 11. Two semi-circular units can be arranged with their rear back sides against each other in order to form a complete circular projectile arresting device. As a result, a circular projectile arresting device can be provided that can be subjected to shooting at any position around the projectile arresting device 1.

[0049] Further, a method for preparing a projectile arresting device as shown and described above with reference to figs. 1A-B, 2A-B, 3, 4, 5A-B and 6A-B, may comprise the following steps: providing partition walls 9 to a foundation, 3 constituting a floor 7, and to a rear wall 5; arranging the partition walls 9 to extend in a direction substantially perpendicular to the rear wall 5, the partition walls comprises a rear edge 10a, adjacent the rear wall 5, and a front edge 10b; arranging projectile stopping material 11 between the partition walls 9; disposing a projectile stopping material 11 retaining front layer 13 between the front edges 10b of the partition walls and arranged adjacent the projectile stopping material 11, and providing the front layer 13 with a convex shape.

[0050] It is to be understood that the present invention is not limited to the embodiments described above and illustrated in the drawings; rather, the skilled person will recognize that many changes and modifications may be made within the scope of the appended claims.

35 Claims

1. Projectile arresting device (1) comprising:

- a foundation (3) constituting a floor (7),
- a rear wall (5),
- partition walls (9) extending in a direction substantially perpendicular to the rear wall (5), the partition walls comprises a rear edge (10a), adjacent the rear wall (5), and a front edge (10b),
- projectile stopping material (11) arranged between the partition walls (9),
- projectile stopping material retaining front layer (13) disposed between the front edges (10b) of the partition walls and arranged adjacent the projectile stopping material (11),
- **characterized in that** the front layer (13) has a convex shape, wherein the front layer (13) is stiff, provided with limited elasticity, having a convex shape in an unloaded and a loaded condition of the projectile stopping material (11) and wherein the partition walls (9) are made in one single piece with the front layer (13).

2. Projectile arresting device (1) according to claim 1, wherein the front layer (13) is made of an elastomer with reinforced material adapted to resist tensile forces. 5
3. Projectile arresting device (1) according to any of the preceding claims, wherein the front layer (13) is connected to the partition walls by fastening means.
4. Projectile arresting device (1) according to any of the preceding claims, wherein the partition walls (9) are made of steel plate stiffened by providing a corrugated shape of the walls. 10
5. Projectile arresting device (1) according to any of the preceding claims, wherein the front layer (13) is attached in the upper end of the projectile arresting device at the upper edges of the partition walls (9). 15
6. A method for preparing a projectile arresting device, comprising the following steps: 20
- providing partition walls (9) to a foundation, (3) constituting a floor (7), and to a rear wall (5),
 - arranging the partition walls (9) to extend in a direction substantially perpendicular to the rear wall (5), the partition walls comprises a rear edge (10a), adjacent the rear wall (5), and a front edge (10b), 25
 - arranging projectile stopping material (11) between the partition walls (9), 30
 - disposing a projectile stopping material retaining front layer (13) between the front edges (10b) of the partition walls and arranged adjacent the projectile stopping material (11), 35
 - providing the front layer (13) with a convex shape, and
 - wherein the front layer (13) is stiff, provided with limited elasticity, having a convex shape in an unloaded and a loaded condition of the projectile stopping material (11) and wherein the partition walls (9) are made in one single piece with the front layer (13). 40

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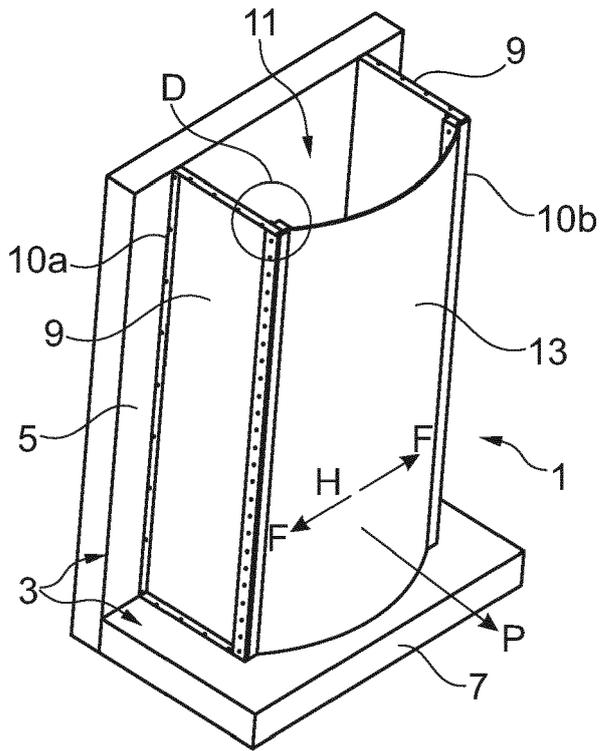


Fig. 1A

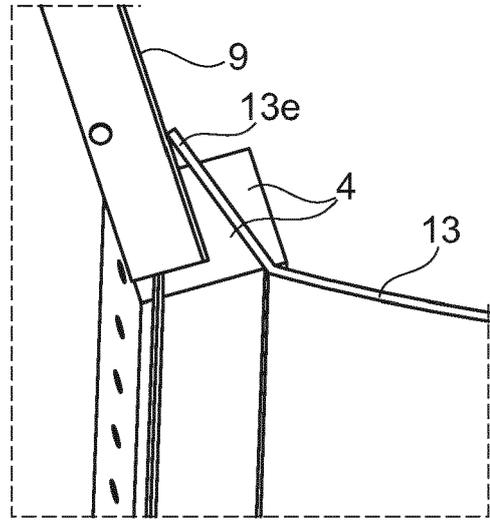


Fig. 1B

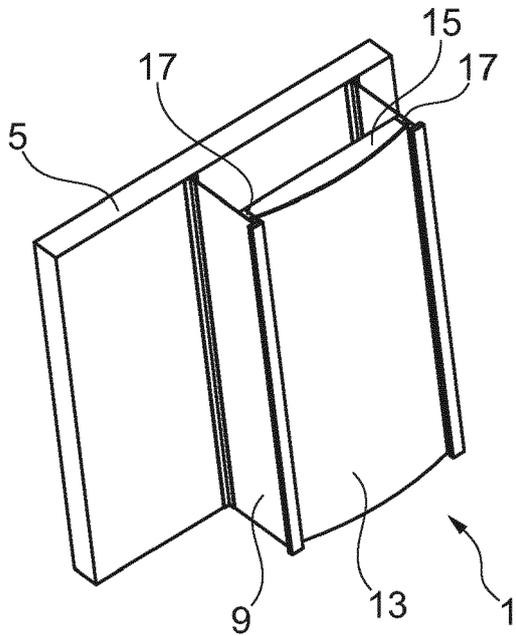


Fig. 2A

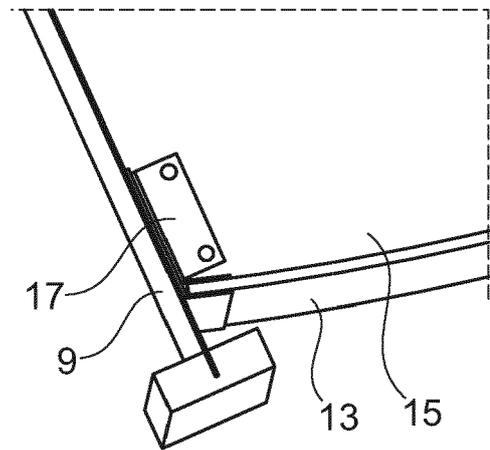


Fig. 2B

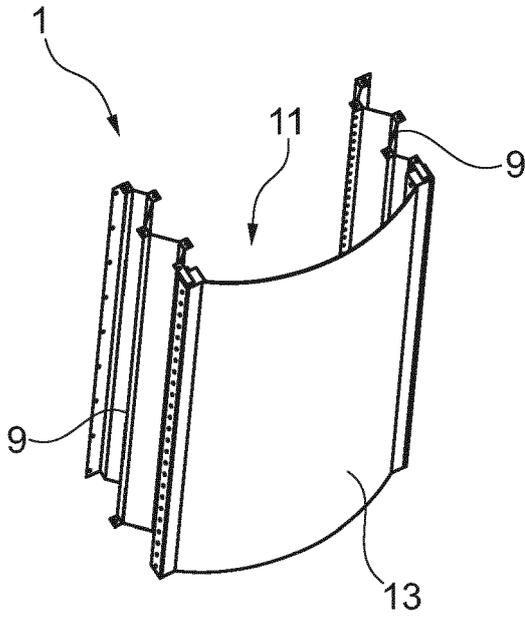


Fig. 3

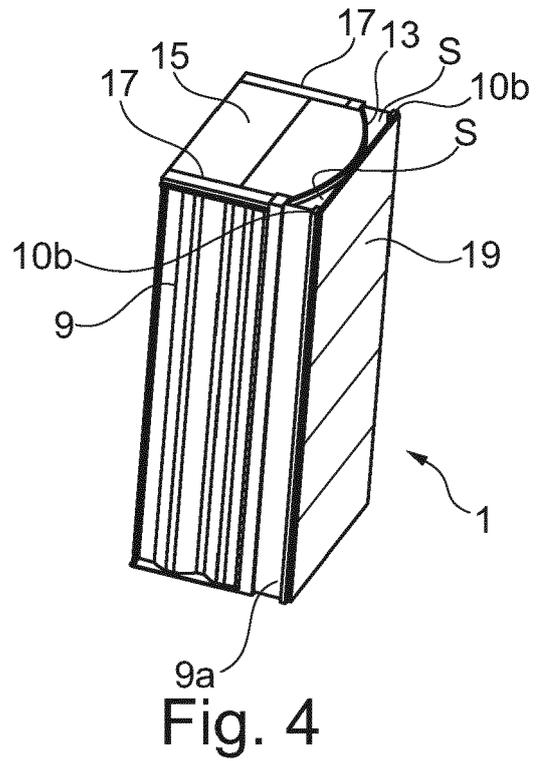


Fig. 4

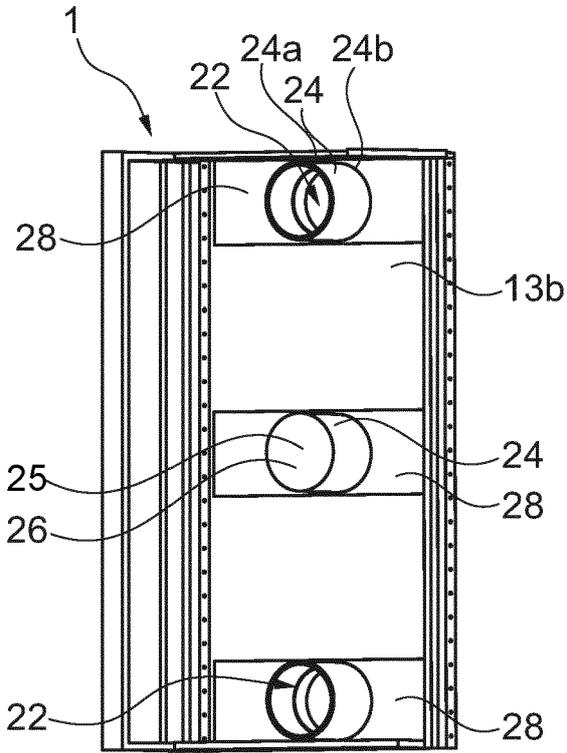


Fig. 5A

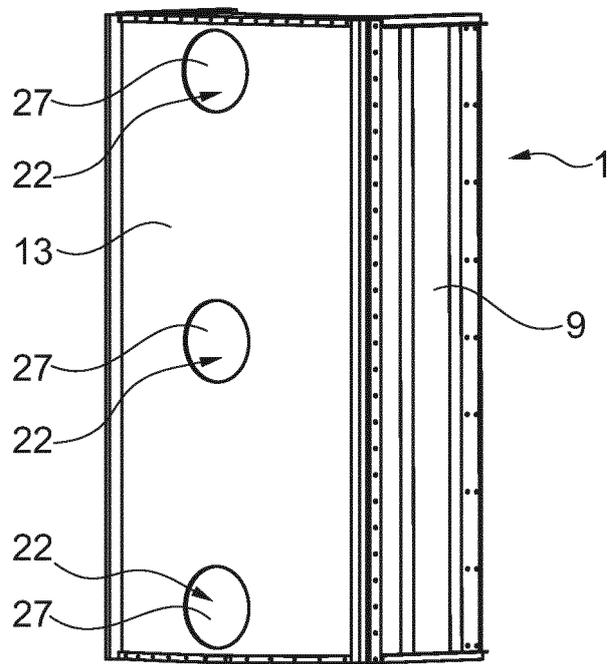


Fig. 5B

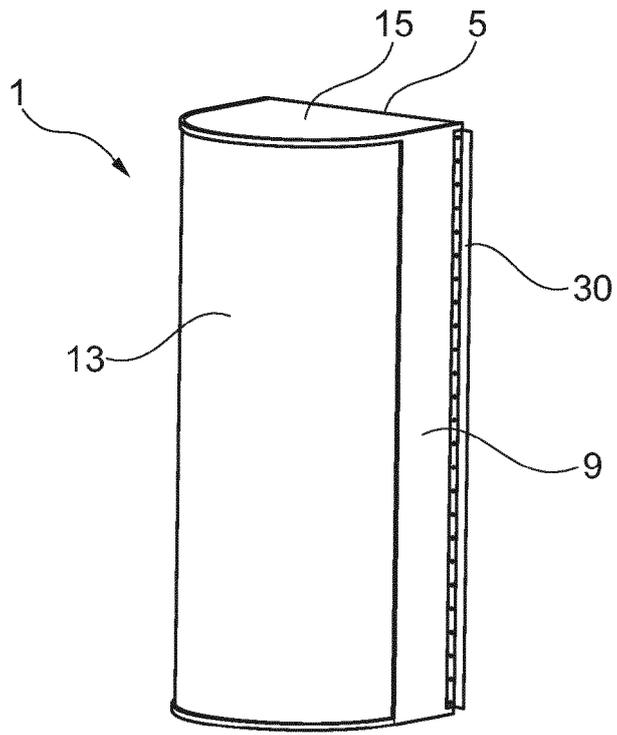


Fig. 6A

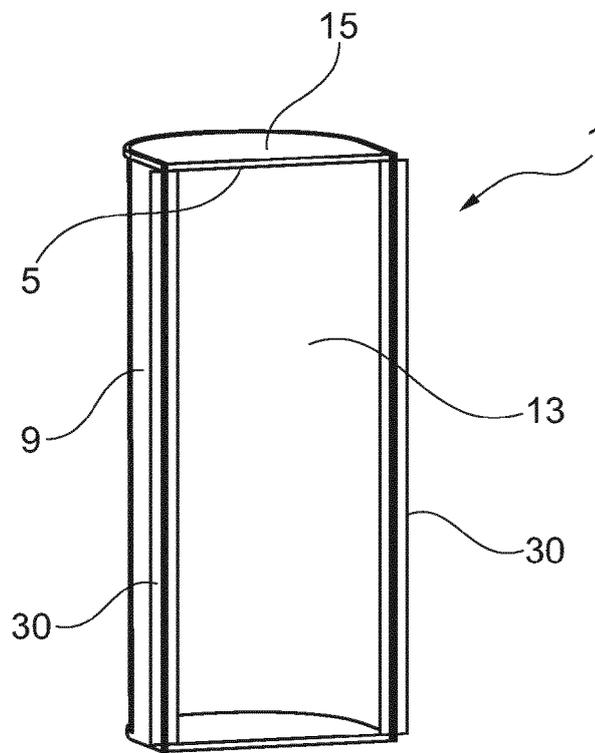


Fig. 6B



EUROPEAN SEARCH REPORT

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Place of search The Hague		Date of completion of the search 4 September 2020	Examiner Menier, Renan
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