

(19)



(11)

EP 3 623 742 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.03.2020 Bulletin 2020/12

(51) Int Cl.:
F41H 13/00 (2006.01) **F42B 10/26** (2006.01)
F41A 21/16 (2006.01)

(21) Application number: **18020449.7**

(22) Date of filing: **14.09.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Weiss, Jonas Rudolf Michael**
8942 Oberrieden (CH)

(72) Inventor: **Weiss, Jonas Rudolf Michael**
8942 Oberrieden (CH)

(54) **NET LAUNCHER**

(57) A net launching system comprising a net launcher and multi-component projectile, wherein the net launcher comprises a barrel for accelerating the multi-component projectile and a fire mechanism for firing the multi component projectile in the barrel by causing the pressure at one end of the barrel for accelerating the multi-component projectile, wherein the multi-component projectile comprises a plurality of weights connected by a net, wherein the multi-component projectile is configured to open the net by the radial forces on the weights caused by a rotation of the multi-component projectile,

characterized in that the barrel has a twisted form configured to cause a rotation of the multi-component projectile around the longitudinal axis of the barrel, when the multi-component projectile is accelerated in the barrel, and the multi-component projectile in the barrel before being fired by the fire mechanism has a twisted form corresponding to the twisted form of the barrel such that the acceleration of the multi-component projectile along the longitudinal axis of the barrel causes the rotation of the multi-component projectile around the longitudinal axis of the barrel.

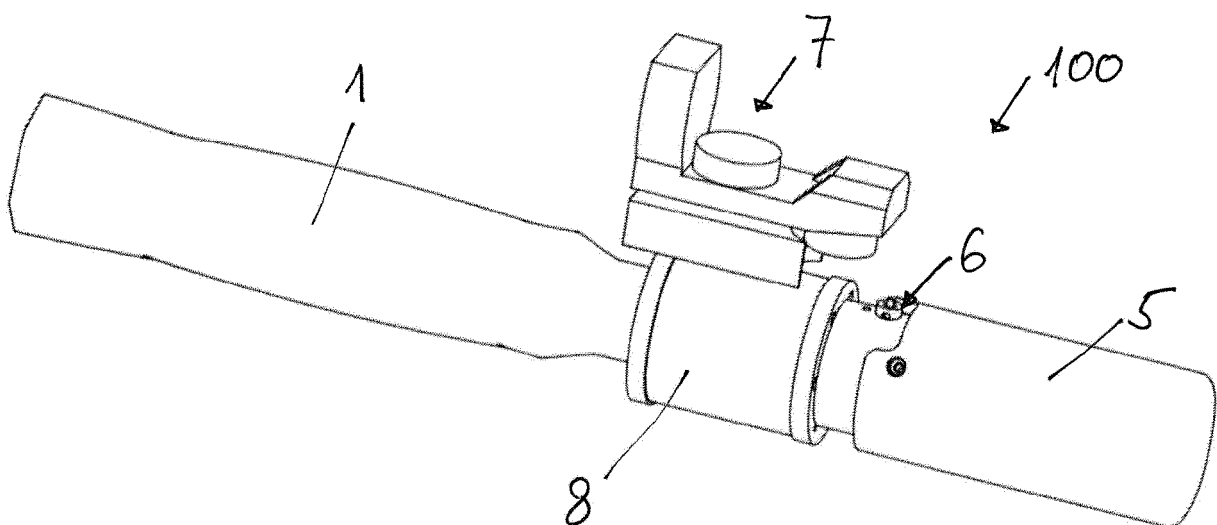


Fig. 1

EP 3 623 742 A1

Description

Field of the invention

[0001] The present invention concerns a net launcher, a multi-component projectile, a net launcher system and a cartridge for a net launcher for launching a net to stop an object, e.g. an intruding drone.

Description of related art

[0002] Drones become more and more popular. They can facilitate many things, but are in certain situations also a security risk. For example, close to airports or heliports, drones are a severe security risk for all aircrafts. Also, for restricted areas like prisons or critical infrastructure, which do not want anybody to invade the area, drones could be a security risk. Therefore, there exist different technologies for drone defence and countering drones.

[0003] US10005556 discloses to mount a net gun on a drone to intercept an intruding drone. The net gun is not described in more detail.

[0004] WO16170367 discloses a net gun with a projectile having multiple weights at the corners of a net. The projectile is fired and then in the vicinity of the intruding drone a net deployment mechanism forces the weights apart to open the net. This mechanism is complex, because each projectile needs electronics or another complex mechanism to trigger the net deployment mechanism.

[0005] DE102016111563 discloses a net gun. The net gun comprises multiple barrels which are not parallel, but extend with an angle from the fire direction. Each barrel fires a weight fixed at a corner of the net. Due to the angled barrels, the weights travel also radially to the fire direction and expand thus the net. However, this net gun is heavy and complex. In addition, the space needed for the net gun is large.

[0006] WO12060822 discloses a multi-component projectile fired by a rifled gun. The multi-component projectile in the barrel has the classical cylindrical form of gun projectiles. The rifled barrel presses the projectile into the rifled recesses such that the projectile starts to rotate around its axis. This rotation causes a radial force on the components of the projectile, when the projectile leaves the barrel. This causes the opening of the net connected with the components of the projectile. This mechanism is very simple. However, rifled barrels with the diameters necessary for multi-component projectiles are normally rather heavy. A further disadvantage is that a mechanical trigger is needed which is less precise than electronic triggers and thus less suitable for automated systems. In addition, the force for pressing the projectile into the rifled recess of the barrel needs to be high enough. This might cause high velocities of the components of the projectile and might cause concerns for damage and injuries in the environment where the net gun is

used and also require a stronger propelling charge and leads to more recoil.

[0007] All solutions of the state of the art are rather complex and/or heavy and/or require a lot of space.

Brief summary of the invention

[0008] It is the object of the present invention to find a net launcher and/or a multi-component projectile which solves the problems of the state of the art.

[0009] It is the object of the present invention to find net launcher system, a net launcher and/or a multi-component projectile which is light and simple, reliable and easy to use.

[0010] This object is solved by a net launcher comprising a barrel for accelerating a multi-component projectile with a net and a fire mechanism for causing the pressure at one end of the barrel to accelerate the multi-component projectile. The net launcher comprises further one or any combination of the embodiments and/or features described subsequently.

[0011] This object solved by a multi-component projectile comprising a plurality of weights connected by a net, wherein the multi-component projectile forms in an unfired state a projectile to be charged in the barrel of a net launcher, wherein the multi-component projectile is configured to open the net after being fired. The multi-component projectile comprises further one or any combination of the embodiment and/ or features described subsequently.

[0012] This object solved by a net launcher system comprising a net launcher and a multi-component projectile. The net launcher and/or the multi-component projectile comprises further one or any combination of the embodiments and/or features described subsequently.

[0013] This object is solved by a cartridge for a net launcher comprises a barrel and a multi-component projectile charged in the barrel, wherein the multi-component projectile comprises a plurality of weights connected by a net, wherein the barrel is configured for accelerating the multi-component projectile, wherein the multi-component projectile is configured to open the net by the radial forces on the weights caused by a rotation of the multi-component projectile. The barrel and/or the multi-component projectile comprises further one or any combination of the embodiments and/or features described subsequently.

[0014] This object is further solved by a method for charging a barrel of a net launcher or of a net launcher cartridge with a multi-component projectile, wherein the barrel comprises a front end and a back end, comprising the later described step of inserting the multi-component projectile from the front end into the barrel.

[0015] In one embodiment, the barrel has a twisted form configured to cause a rotation of the multi-component projectile around the longitudinal axis of the barrel, when the multi-component projectile is accelerated in the barrel. This twisted form of the barrel allows to replace

heavy rifled net launchers by much lighter barrels and to use less powerful pressure gas fire mechanisms. It has further the advantage that the projectile, at least the weights and the net can be reused which is not possible with a projectile used in a rifled gun.

[0016] In one embodiment, the multi-component projectile in the barrel (before being fired by the fire mechanism) has a twisted form corresponding to the twisted form of the barrel such that the acceleration of the multi-component projectile along the longitudinal axis of the barrel causes the rotation of the multi-component projectile around the longitudinal axis of the barrel. This twisted form of the multi-component projectile allows to simplify the projectile, because the projectile does not need to be forced into a rifled form of the barrel. It has further the advantage that the projectile, at least the weights and the net can be reused which is not possible with a projectile used in a rifled gun.

[0017] In one embodiment, the inner cross-sectional form of the barrel with the twisted form and/or the outer cross-sectional form of the multi-component projectile with the twisted form corresponds to a convex regular polygon. The corners of the polygon provide a good guidance for the multi-component projectile in the barrel. Each corner follows thus a spiral due to the twisted form. The equal length of the sides and the equal angle of the corners of the convex regular polygon provides a symmetry which is very stable against pressure and/or provides stable flight. Preferably, the sides between corners of the convex regular polygon are curved versus the outside and/or corners of the convex regular polygon are rounded. Preferably, the sides are curved with a radius unequal, preferably being larger than the distance between the centre point of the polygon and the corners so that the polygon becomes not circular and prevents any rotation of the projectile in the barrel without a displacement along the longitudinal axis. The curved sides improve the stability of the barrel significantly against the pressure caused when firing the multi-component projectile. Preferably, also the corners are rounded. Preferably, the corners are rounded with a radius smaller than the distance between the centre point of the polygon and the corners, preferably smaller than the three quarters of this distance, preferably smaller than the half of this distance, preferably smaller than a third of this distance.

[0018] In one embodiment the cross-sectional inner form of the barrel rotates along the longitudinal axis of the barrel by a constant twist rate, wherein the constant twist rate is defined by twist angle per reference distance.

[0019] In one embodiment, the cross-sectional outer form of the multi-component projectile before being fired corresponds such to said cross-sectional inner form of the barrel that the multi-component projectile cannot rotate around the longitudinal axis of the barrel without being moved along the longitudinal axis of the barrel, and/or the outer cross-sectional outer form of the multi-component projectile rotates along a longitudinal axis of the multi-component projectile by the same constant twist rate.

[0020] In one embodiment, the barrel, preferably with the twisted form, comprises a composite material. The composite material is preferably a fibre reinforced composite material. As fibres, e.g. carbon can be used. This embodiment provides very light (and still robust) barrels. In addition, the composite material is well formable to the final form of the barrel.

[0021] In one embodiment, the multi-component projectile comprises further a sabot and a cover, wherein the weights are arranged between the sabot and the cover.

[0022] In one embodiment, the sabot and the cover have the same outer form, and/or wherein the sabot and the cover are rotated around the longitudinal axis of the multi-component projectile with respect to each other to obtain the twisted form.

[0023] In one embodiment, the net comprises a number of cord ends, wherein each cord end is wrapped around one of the weights.

[0024] In one embodiment, weights are arranged equally distributed around the longitudinal axis of the multi-component projectile.

[0025] In one embodiment, weights are aligned with the outer circumference of the sabot and the cover.

[0026] In one embodiment, weights are arranged at the corners of the sabot and the cover.

[0027] In one embodiment, each weight comprises a sabot portion for connecting/aligning the weight with the sabot, a cover portion for connecting/aligning the weight with the cover and a centre portion between the sabot portion and the cover portion.

[0028] In one embodiment, the centre portion has a circular cross-section and/or is configured for wrapping one of the cord ends around it. Preferably, the centre portion has such a distance from the outer form of the projectile and/or from the inner form of the barrel such that the cord end is wrapped around without increasing the outer form of the projectile and/or without touching the inner form of the barrel, when loaded in the barrel.

[0029] In one embodiment, the outer portion of sabot portion is at least partially aligned with the outer form of the sabot and is formed such to follow the twisted form of the multi-component projectile, and/or wherein the outer portion of cover portion is at least partially aligned with the outer form of the cover and is formed such to follow the twisted form of the multi-component projectile.

[0030] In one embodiment, the sabot comprises recesses for hosting the weights and/or the sabot portions of the weights in the right places, and/or wherein the cover comprises recesses for hosting the weights and/or the cover portions of the weights in the right places.

[0031] In one embodiment, the multi-component projectile comprises a net opening mechanism which is configured for holding the multi-component projectile together in a first phase after the multi-component projectile has been fired and left the barrel such that the multi-component projectile held together continues to rotate around its longitudinal axis and which is configured to free

the weights after having received a trigger signal such that the weights move radially away from each other caused by the rotation of the multi-component projectile to open the net. This embodiment, has the advantage that the net opens only before hitting the object. This significantly increases the range of the projectile. The net opening mechanism can be realized very simple by any mechanism which holds together the weights until the trigger signal, because the projectile is rotating/twisting around the flight axis so that the net opens automatically once the mechanism stops holding together the weights. This embodiment is particular advantageous with the barrel and projectile with the twisted form. However, it works with any barrel and projectile which cause a rotation of the projectile around its longitudinal axis, i.e. with a rifled barrel.

[0032] In one embodiment, the multi-component projectile comprises a timer which sends the trigger signal to the net opening mechanism, wherein the time is set by the net launcher, when the multi-component projectile is charged in the barrel.

[0033] In one embodiment, the net launcher comprises a drone detection section for detecting and/or predicting the position and/or flight curve of the drone and a processing section configured to compute the timer based on the detected and/or predicted position and/or flight curve.

[0034] In one embodiment, the multi-component projectile comprises a receiver for wirelessly receiving the trigger signal.

[0035] In one embodiment, the barrel and the multi-component projectile charged in the barrel forms a (replacable) cartridge configured to be connectable to the net launcher for firing the charged multi-component projectile and to be removable from the net launcher after the multi-component projectile has been fired for connecting a new cartridge charged with a new multi-component projectile. This is in particular advantageous in combination with the barrel made out of a (light) composite material and/or with the barrel with the twisted form which is normally difficult to charge. However, it works also with other types of barrels. Preferably, the cartridge comprises at the end of the barrel a fire charge configured to be fired by the fire mechanism. Therefore, all wear parts can be replaced with one cartridge. Preferably, the cartridge comprises a connection ring with a connection interface to be connected to the net launcher, a support for holding the fire charge and a barrel interface to be connected to the barrel.

[0036] In one embodiment, the net launcher comprises at least two of the barrels to be able to shoot at least two projectiles in a short time and/or without recharging.

[0037] In one embodiment, the net launcher comprises a multi barrel cartridge comprising at least two cartridges and/or at least two barrels each charged with a multi-component projectile. This allows to shoot at least two projectiles in a short time and/or without charging and then quickly replacing the multi-barrel cartridge with a

charged one to continue to shoot further projectiles. This embodiment is particular advantageous with the barrel made out of a (light) composite material and/or with the barrel with the twisted form which is normally difficult to charge. However, it works also with other types of barrels.

[0038] In one embodiment, the fire mechanism is a gas pressure mechanism. In one embodiment, the fire charge is a gas pressure cartridge. The gas pressure mechanism can be activated quicker and electrical which allows easier automated or remote activation of the trigger mechanism. In addition, the gas pressure mechanism is lighter than classical mechanical lever fire mechanisms.

[0039] In one embodiment, the net launcher is a human carried gun, for example a hand-held and/or shoulder-worn gun.

[0040] In one embodiment, the net launcher system comprises a drone, wherein the net launcher is mounted on the drone.

[0041] In one embodiment, the net launcher is configured to stop an object, in particular a moving object, in particular a drone.

[0042] In one embodiment, the twisted form of the barrel is such that the multi-component projectile must not be deformed to be rotated in the barrel.

[0043] In one embodiment, the multi-component projectile in the barrel before being charged in the net gun and/or before being fired by the net gun has such a twisted form that the multi-component projectile is rotated along its longitudinal axis, when the multi-component projectile is accelerated in a barrel with a twisted form corresponding to the twisted form of the multi-component projectile.

[0044] In one embodiment, a charging barrel with the same inner cross-section and/ or with the same twisted form as the barrel is used for facilitating the inserting of the multi-component projectile in the barrel. A front end of the charging barrel has a connection interface allowing to place the front end of the barrel on the connection interface such that the charging barrels forms an uninterrupted extension for the barrel. An uninterrupted extension means that the inner walls of the charging barrel are flush with the inner walls of the barrel, or have a minimally smaller cross-section than the barrel and/or that the twisted form of the barrel is continued in the charging barrel such that multi-component projectile can move along the longitudinal axis of the barrel and/or of the charging barrel from the charging barrel to the barrel with the twisted form of the barrel and the charging barrel causing the projectile to be rotated with the movement along the longitudinal axis. Preferably, the sabot comprises a sealing cloth. Preferably, the method comprises the steps of: Inserting the multi-component projectile in the charging barrel from the front end of the barrel such that the sabot points towards the front end of the barrel; connecting the front end of the barrel to the connection interface of the charging interface; and moving the multi-component projectile from the charging barrel backwards into the barrel such that the sabot with the seal cloth points towards the back end of the barrel.

Brief Description of the Drawings

[0045] The invention will be better understood with the aid of the description of an embodiment given by way of example and illustrated by the figures, in which:

Fig. 1 shows a three-dimensional view of a first embodiment of the net launcher.

Fig. 2 shows an exploded view of the cartridge of the net launcher of the first embodiment.

Fig. 3 shows a three-dimensional view of charged cartridge of the first embodiment without the barrel.

Fig. 4 shows three exemplary cross-sectional forms of the barrel.

Fig. 5 shows a three-dimensional view of the net launcher without the handle in a first moment after the multi-component projectile has been fired.

Fig. 6 shows a three-dimensional view of the net launcher without the handle in a second moment after the multi-component projectile has been fired.

Fig. 7 shows a three-dimensional view of the net launcher without the handle in a third moment after the multi-component projectile has been fired.

Fig. 8 shows a three-dimensional view of an embodiment of a charging barrel charged with the multi-component projectile.

Fig. 9 shows an exploded view of the embodiment of the charging barrel.

Fig. 10 shows a front view of the embodiment of the charging barrel.

Fig. 11 shows a first three-dimensional view of a second embodiment of the net launcher.

Fig. 12 shows a second three-dimensional view of the second embodiment of the net launcher.

Fig. 13 shows a side view of the second embodiment of the net launcher.

Fig. 14 shows an embodiment of a multi-barrel cartridge.

Fig. 15 shows a cross-section through the assembled cartridge of Fig. 2.

Detailed Description of possible embodiments of the Invention

[0046] A net launcher system comprises a net launcher and a multi-component projectile.

[0047] Fig. 1 shows a first embodiment of the net launcher 100. The net launcher 100 is preferably a net gun. In this embodiment, it is a hand-held gun, in particular a net gun/launch stick with the handle 5 extending in the same direction as the barrel 1, i.e. the longitudinal axis of the barrel 1 corresponds or is parallel to the longitudinal axis of the handle 5. However, as will be described later, other realizations of the net launcher 100 are possible, e.g. a shoulder supported gun, a station-mounted gun and/or a drone-mounted gun. For drone-mounted gun, the net of the projectile 2 described later in more detail is preferably connected by a tether with the drone. This allows to capture drones in mid-flight and carry them away for safe disposal or investigation.

[0048] Fig. 11 to 13 show a second embodiment of the net launcher 200. Here the net launcher 200 is realized also as hand-held gun, however with the (longitudinal axis of the) handle 5 extending at an angle of substantially 90° with respect to the longitudinal axis of the barrel 1. However, it is also possible that the longitudinal axis of the handle 5 comprises an angle with respect to the longitudinal axis of the barrel 1 between 30° and 90°, preferably between 45° and 90°, preferably between 60° and 90°. The net launcher 200 comprises further a recoil absorber and/or second handle 13. The recoil absorber and/or second handle 13 allows to grab the net launcher 200 with a second hand to improve aiming and holding of the net launcher 200. This is in particular advantageous in combination with multiple barrels 1. Barrels 1 arranged at different positions of the net gun change the recoil for each barrel 1 and thus change the way of aiming for each barrel 1. This second handle 13 stabilizes this effect and equalizes the aiming for different barrels 1. Here the second handle 13 extends in a direction substantially perpendicular to the barrel 1 and to the handle 5. Preferably, the second handle 13 can be folded in or detached to reduce the size of the net launcher 200 for transportation.

[0049] The net launcher 100, 200 comprises a barrel 1 and a fire mechanism.

[0050] The barrel 1 is configured for accelerating the multi-component projectile in the barrel 1 and/or is configured for directing the multi-component projectile in a desired direction. The barrel 1 has a distal end 11 and a proximal end 12. A longitudinal axis of the barrel 1 extends along the barrel 1 and/or along the fire direction and/or from the proximal end 12 to the distal end 11. The distal end 11 is open to launch the fired multi-component projectile 2 out of the barrel 1 and/or in the fire direction. The proximal end 12 is preferably closed and/or has a smaller opening than the distal end 11. Preferably, the (smaller opening of the) proximal end 12 of the barrel 1 is configured to host at least a part of the fire mechanism. Preferably, the proximal end 12 of the barrel 1 is (her-

metically) closed (by the fire mechanism) such that the pressure of the fire mechanism is fully used for the acceleration of the multi-component projectile.

[0051] The (inner form of the) barrel 1 has a twisted form configured to cause a rotation of the multi-component projectile 2 around the longitudinal axis of the barrel 1 and/or the projectile 2, when the multi-component projectile 2 is accelerated/moved in the barrel 1 in the direction of the longitudinal axis of the barrel 1. The (inner form of the) twisted form of the barrel 1 corresponds to a cylinder with the cylinder axis corresponding to the longitudinal axis of the barrel 1. The terms "cylinder" and "(inner form of the) barrel 1" are used in the following as equivalents. The terms "cylinder axis" and "longitudinal axis of the barrel 1" are used in the following as equivalents. The cylinder 1 has preferably non-circular base surfaces and/or non-circular cylinder cross-sections. The cylinder cross-sections are defined as cross-sections perpendicular to the cylinder axis. The cylinder cross-sections (along the major part of the cylinder axis) have (at least around a part of the circumference of the cross-section) the same form which however rotates along the cylinder axis. The twisted form of the (inner form of the) barrel 1 is preferably such that the form of the cross-section of the cylinder rotates by a constant twist rate, wherein the constant twist rate is defined by twist angle per reference distance. This means that the form of the cross-section of the cylinder rotates with any displacement along the cylinder axis by the same displacement amount by the same rotation amount. The twist rate is preferably smaller than 10 degree per centimeter ($^{\circ}/\text{cm}$), preferably smaller than 8 $^{\circ}/\text{cm}$, preferably smaller than 7 $^{\circ}/\text{cm}$, preferably smaller than 6 $^{\circ}/\text{cm}$. The twist rate is preferably larger than 1 degree per centimeter ($^{\circ}/\text{cm}$), preferably larger than 2 $^{\circ}/\text{cm}$, preferably larger than 3 $^{\circ}/\text{cm}$, preferably larger than 4 $^{\circ}/\text{cm}$. In a preferred embodiment, the twist rate is 5 $^{\circ}/\text{cm}$. The twisted form is preferably such that at least a guidance portion of the circumference of the cross-section of the inner form of the barrel 1 follows the twisted form. The guidance portion comprises in a preferred embodiment the complete circumference of the inner form of the barrel 1. This means that the same point of the guidance portion rotates around the longitudinal axis, when moving the cross-section along the longitudinal axis resulting in a helical path of this point of the guidance portion. This applies preferably for all points of the guidance portion. This allows to create a rotation of the multi-component projectile 2 having (at least partly) the same twisted form of the barrel 1, when the multi-component projectile 2 is accelerated/moved along the longitudinal axis of the barrel 1.

[0052] The cross-sectional form of the barrel 1 (or the cylinder cross-section or the base surface of the cylinder) corresponds preferably to a convex regular polygon, i.e. an n-polygon with n sides of equal length and/or n equal angles of neighboring sides and/or n non-intersecting sides. Preferably, n is larger than 2, preferably larger than 3. Preferably, n is smaller than 12, preferably smaller

than 10, preferably smaller than 8. The convex regular polygon provides a symmetry which is good for the flight characteristics of the projectile, and the corners of the polygon provide a good guidance in the barrel 1. N equal to 4 (regular convex polygon corresponds to a square) and equal to 6 (regular convex polygon corresponds to a regular hexagon) showed to work very well. In a preferred embodiment, the n sides (between the n corners) of the convex regular polygon are curved versus the outside. This reduces the deformability of the barrel 1 under pressure and allows to make the walls of the barrel 1 thinner and/or out of a lighter material. Preferably, the sides are curved with a curvature which is less curved than the curve created by a circle with a corresponding to the distance between the centre point of the polygon and the corner. In addition, it improves the guidance of the multi-component projectile 2 with a corresponding twisted form. Alternatively and/or in addition, the corners of the convex regular polygon are preferably rounded. This has a similar effect as the curved sides. Preferably, the corners are rounded with a rounding radius smaller than the three quarters of distance between the corner and the centre point of the convex regular polygon, preferably smaller than the half of this distance, preferably smaller than a third of this distance. Fig. 4 shows three potential cross-sections of the inner form of three embodiments of a barrel: a square with curved sides of a first embodiment of the barrel 1, a square with rounded corners of a second embodiment of the barrel 1' and a regular hexagon of a third embodiment of the barrel 1". The hexagonal form of the barrel 1" has the advantage that it can accommodate 6 instead of 4 weights and can thus span a tighter « pseudo » net, while the shape approximates a circle, thus giving good « pressure » robustness. This can be further improved by rounding the corners and/or the sides of the hexagon. The square form, in particular the curved square form allows more space in the barrel 1 and 1' which allows to use larger nets.

[0053] The length of the barrel 1 is preferably larger than 10 cm, preferably larger than 12 cm, preferably larger than 14 cm, preferably larger than 15 cm, preferably larger than 16 cm, preferably larger than 17 cm. The length of the barrel 1 is preferably smaller than 40 cm, preferably smaller than 30 cm, preferably smaller than 26 cm, preferably smaller than 24 cm, preferably smaller than 22 cm, preferably smaller than 21 cm, preferably smaller than 20 cm, preferably smaller than 19 cm. In a preferred embodiment, the length of the barrel 1 is 18 cm. However, the invention would work with any other length of the barrel 1.

[0054] The barrel 1 is preferably not a rifled barrel, i.e. is not a barrel with a circular cross-section with helical recesses along the longitudinal axis of the barrel. In a rifled barrel the projectile has a circular cross-section with a larger diameter than the circular cross-section of the barrel 1 such that the projectile is pressed in the helical recesses of the barrel and starts to turn. The twisted form

of the barrel of the present embodiment instead is such that a projectile which has already before the firing of the projectile 2 the same twisted form of the barrel can be rotated along the longitudinal axis, when accelerating the projectile 2 in the barrel. Much less pressure is needed in the barrel 1 to accelerate the projectile and the walls of the barrel 1 must be much less resistant compared to the walls of a rifled barrel.

[0055] The barrel 1 is preferably made by a composite material. The composite material is preferably a fibre reinforced composite material. The fibres of the composite material can be made of carbon. The barrel 1 made out of a composite material is very light. In addition, it allows to form the twisted form of the barrel 1 well.

[0056] In the first embodiment, the net launcher 100 comprises only one barrel 1. In a second embodiment, the net launcher 200 comprises two or more barrels 1, here 3 barrels 1. The net launcher 200 in Fig. 11 to 13 shows three different embodiments of barrels 1, 1' and 1'' with respective different cross-sections. This is just for illustrating different possible forms of the twisted forms of the barrel. Preferably, all barrels 1 of the net launcher 200 have the same twisted form and/or the same cross-sectional form such that the same projectile 2 can be used for each barrel 1.

[0057] The fire mechanism is configured to fire the multi-component projectile 2 in the barrel 1 and/or to create a pressure at the proximal end 12 of the barrel 1 to accelerate the multi-component projectile 2. The fire mechanism is preferably a gas pressure mechanism. The gas pressure mechanism works very well with the barrel 1 made of composite material described below. However, other fire mechanisms are also possible, e.g. a fire mechanism based on gun powder. The gas pressure mechanism comprises preferably a gas pressure reservoir. The gas pressure reservoir is connected by a switch, e.g. a valve, with the proximal end 12 of the barrel 1. Preferably, the fire mechanism comprises a fire cartridge 4 for storing the pressure creating medium. For the gas pressure mechanism, this is a gas pressure cartridge 4. The cartridge 4 can be configured for one single shot or for more than one shot. However, it is also possible to use a gas pressure reservoir which is fixed in the net launcher 100, 200 and which is rechargeable via a gas pressure connector. The fire mechanism comprises preferably an activator 6 which could be a button and/or a lever. The activator 6 allows a user to activate the net launcher 100, 200 causing the fire mechanism to fire the projectile 2 charged in the barrel 1, e.g. to open the pressure of the pressure reservoir into the proximal end 12 of the barrel 1. The activator 6 could be mechanical or electrical. Preferably, the activator 6 is electrical. This allows first a faster release/trigger times than with mechanical activators. Second, it allows an automated, remote and/or high cadence fire mechanism. In one embodiment, it allows a more evolved fire mechanisms incorporating maybe the results of a distance measurement to an object which could infer a certain delay of the activation of the fire

mechanism for obtaining the optimal result. The fire mechanism could be completely automated such that the net launcher does not need any mechanical activator 6 to be activated by a user. The fire mechanism could be activated by an activation signal received from a processing section of the net launcher or from a remote location in communication connection with the net launcher. This is in particular well suited for station mounted and drone mounted net launchers. The fire mechanism could further include a safety switch (not shown in the figures) which must be turned on to activate the fire mechanism to avoid an activation by mistake. A selection switch or automatic selection circuit 10 is used to select one of the barrels 1 which shall be fired, when activating the activator 6.

[0058] The multi-component projectile 2 (abbrev. projectile) comprises a plurality of weights 24 connected by a net (not shown in the figures). The projectile 2 can be in at least two states. In a first state, the projectile 2 with the net and the weights 24 is assembled and has a well-defined outer form to be charged in the barrel 1, to be held in the barrel 1 and/or to be fired from the barrel 1. In a second state, when the projectile 2 is fired with an axial rotation from the barrel 1, the projectile 2 opens the net by the radial forces on the weights 24. The subsequent description of the projectile 2 refers to the first state, if not otherwise mentioned. In contrast to the projectile 2 of a rifled barrel, the present projectile 2 has the same first state, when charged, when hold in the barrel 1 before activating the fire mechanism and/or when accelerated in the barrel 1 after the fire mechanism has been activated and/or shortly before leaving the barrel 1 and/or when the projectile is at the distal end 11 after the fire mechanism has been activated. The multi-component projectile 2 is configured to open the net by the radial forces on the weights caused by a rotation of the multi-component projectile 2. The projectile 2 has a longitudinal axis which corresponds to the longitudinal axis of the barrel 1, when the projectile 2 is charged in the barrel 1. The projectile 2 has a proximal side, a distal side and a lateral side. The longitudinal axis extends from the proximal to the distal side. The proximal and/or distal side is preferably perpendicular on the longitudinal axis of the projectile 2. The lateral side extends around the longitudinal axis of the projectile 2.

[0059] The projectile 2 in the first state has a twisted (outer lateral) form. The outer lateral form refers to the form of the lateral side of the projectile. The twisted form of the projectile 2 corresponds at least so much to the twisted form of the barrel 1 that the acceleration or displacement of the projectile 2 along the longitudinal axis of the barrel 1 causes a rotation of the projectile 2 around the longitudinal axis of the barrel 1 or the projectile 2. Preferably, the cross-sectional outer form of the projectile 2 corresponds such to said cross-sectional inner form of the barrel 1 that the multi-component projectile cannot rotate around the longitudinal axis of the barrel 1 without being moved along the longitudinal axis of the barrel, and/or such that the outer cross-sectional outer form of

the projectile 2 rotates along a longitudinal axis of the projectile 2 by the same constant twist rate of the barrel 1. It is sufficient that at least one portion (along the longitudinal axis of the projectile 2) preferably two portions have this twisted form. In one embodiment (see e.g. Fig. 3), the two end portions of the projectile 2 (a distal portion and a proximal portion) have the twisted form, while a centre portion between these two end portions does not have the twisted form and does thus not contribute to the guidance of the projectile 2 in the barrel 1. In the following, the twisted form is described in general. It is clear to a person skilled in the art that the twisted form does not necessarily need to extend along the complete longitudinal axis and/or around the complete circumference of the projectile 2.

[0060] The twisted form of the projectile 2 corresponds preferably to a cylinder with the cylinder axis corresponding to the longitudinal axis of the barrel 1. The terms "cylinder" and "(outer form of the) projectile 2" are used in the following as equivalents. The terms "cylinder axis" and "longitudinal axis of the projectile 2" are used in the following as equivalents. The cylinder 1 has preferably non-circular base surfaces and/or non-circular cylinder cross-sections. The cylinder cross-sections are defined as cross-sections perpendicular to the cylinder axis. The cylinder cross-sections (along the major part of the cylinder axis) have (at least around a part of the circumference of the cross-section) the same form which however rotates along the cylinder axis. The twisted form of the (outer form of the) projectile 2 is preferably such that the form of the cross-section of the cylinder rotates by a constant twist rate, wherein the constant twist rate is defined by twist angle per reference distance. This means that the form of the cross-section of the cylinder rotates with any displacement along the cylinder axis by the same displacement amount by the same rotation amount. The twist rate corresponds to the twist rate of the twisted form of the barrel 1. The twisted form is preferably such that at least a guidance portion of the circumference of the cross-section of the outer form of the projectile 2 follows the twisted form. The guidance portion comprises in a preferred embodiment the complete circumference of the inner form of the barrel 1 at at least one, preferably two portions of the projectile 2 along the longitudinal axis of the projectile 2. This means that the same point of the guidance portion rotates around the longitudinal axis, when moving the cross-section along the longitudinal axis of the projectile 2 resulting in a helical path of this point of the guidance portion. This applies preferably for all points of the guidance portion. This allows to create a rotation of the projectile 2 when accelerated/moved along the longitudinal axis of the barrel 1.

[0061] The cross-sectional form of the projectile 2 (or the cylinder cross-section or the base surface of the cylinder) corresponds preferably to a convex regular polygon, i.e. an n -polygon with n sides of equal length and/or n equal angles of neighboring sides and/or n non-intersecting sides. Preferably, n is larger than 2, preferably

larger than 3. Preferably, n is smaller than 12, preferably smaller than 10, preferably smaller than 8. N equal to 4 (regular convex polygon corresponds to a square) and equal to 6 (regular convex polygon corresponds to a regular hexagon) showed to work very well. In a preferred embodiment, the n sides (between the n corners) of the convex regular polygon are curved versus the outside. Preferably, the sides are curved with a curvature which is less curved than the curve created by a circle with a corresponding to the distance between the centre point of the polygon and the corner. Alternatively and/or in addition, the corners of the convex regular polygon are preferably rounded. Preferably, the corners are rounded with a rounding radius smaller than the three quarters of distance between the corner and the centre point of the convex regular polygon, preferably smaller than the half of this distance, preferably smaller than a third of this distance.

[0062] Each weight 24 is connected with the net. Preferably, each weight 24 is connected with a circumferential border of the net and/or is connected equally distributed around the net. The net can be a meshed net with the weights 24. The weights 24 could be connected directly in the meshed net or at its circumference. However, preferably the weights 24 would be connected via cords to the meshed net or its circumference. The net can however also be a simplified net constituted by a cord or cords connecting the weights 24, for example also in a common centerpoint. In case of only two weights 24, the net can be made of one single cord whose ends are connected with a respective weight. The net is arranged in the projectile 2 such that the net opens, when the weights 24 are forced apart from the radial force on the rotating projectile 2. In one embodiment, cord ends of the net are wrapped around the weights 24. Additionally and/or alternatively, the net is folded or rolled between the weights 24 in the projectile 2. The net and/or the cord can be made out of any flexible material which allows to store the net and/or the cords within the projectile 2. The cord can be a string, a thread, a filament, a strand, a fibre, a wire, a yarn, a twine, a rope, a cable, a wire or anything else suitable to form a net and/or fix the net to the weights 24.

[0063] The weights 24 have preferably all the same weight and/or form. The weights 24 are arranged preferably with the same distance from the longitudinal axis of the projectile 2 and/or equally distributed around the longitudinal axis of the projectile 2. When the cross-section of the projectile 2 is a convex regular polygon, the number n of corners corresponds preferably to the number of weights 24. Preferably, one weight 24 is arranged in each corner to maximize the rotational momentum transferred to the multi-component projectile during the firing. The projectile 2 is made such that the weights 24 can maintain their relative positions in the first state and such that the weights 24 in the second state and/or when been fired out of the barrel 1 can move radially away from the fire direction and/or the longitudinal axis of the projectile 2

forced by the rotation of the projectile 2. Preferably, the projectile 2 comprises further a sabot 22. The sabot 22 is arranged at the proximal end of the projectile 2 which points towards the proximal end 12 of the barrel 1, when the projectile 2 is charged in the barrel 1. The sabot 22 has preferably the same cross-sectional form as the barrel 1 to cause a maximum acceleration on the projectile 2. The sabot 22 has preferably holding means for holding the weights 24 in place. Here, the holding means is realized by a shape of the sabot 22 (on the distal end of the sabot 22) causing a form fit with the weights 24. The form fit is such that the weights cannot move except substantially in the radial direction of the projectile 2. Thus, in the barrel 1 the weights 24 could not move radially apart and stay in place. Once the projectile 2 leaves the barrel 1, the weights 24 are not anymore held by the walls of the barrel 1 and the weights 24 leave their positions in the form fit radially from the flight direction. In one embodiment, the form fit can further block a radial movement of the weights 24 as long as the sabot 22 and the cover 23 are held together. This could be advantageous for an embodiment with a net opening mechanism as described below. The sabot 22 comprises preferably a sealing cloth (not shown) extending around the circumferential sides of the sabot 22 to improve the sealing between the barrel 1 and the projectile 2. The sealing cloth should be bend from the sabot 22 towards the proximal end 12 of the barrel 1, when charged in the barrel 1. Preferably, the projectile 2 comprises further a cover 23. The cover 23 is arranged at the distal end of the projectile 2 which points towards the distal end 11 of the barrel 1, when the projectile 2 is charged in the barrel 1. The cover 23 has preferably the same cross-sectional form as the barrel 1 to cause a maximum acceleration on the projectile 2. The cross-sectional form of the sabot 22 and the cover 23 are preferably rotated to each other (around the longitudinal axis of the projectile 2) to obtain a twisted form of the projectile 2 described in more detail below. The cover 23 has preferably holding means for holding the weights 24 in place. Here, the holding means is realized by a shape of the cover 23 (on the proximal end of the cover 23) causing a form fit with the weights 24. The form fit is such that the weights cannot move except substantially in the radial direction of the projectile 2. Preferably, the weights 24 are held between the sabot 22 and the cover 23. However, it is also possible to form a projectile 2 (without the sabot 22 and/or the cover 23) such that the weights 24 fit such together that they cannot move except in the radial direction with respect to the longitudinal axis. In this embodiment, the weights 24 have a first portion 24.1, a second portion 24.3 and a centre portion 24.2 between the first portion 24.1 and the second portion 24.3. The first portion 24.1 is arranged on the side of the proximal end of the weights 24 and/or on the side of the sabot 22. The second portion 24.3 is arranged on the side of the distal end of the weights 24 and/or on the side of the cover 23. The first and/or second portion 24.1, 24.3 of the weights 24 has preferably a surface contributing to

the guidance portion and/or to the twisted form. This means that the outer surface of the projectile 2 in said portion(s) corresponds to the twisted form and/or to the inner form of the barrel 1. This holds the weights 24 radially in their positions as long as the projectile 2 is within the barrel 1. The centre portion 24.2 has preferably a reduced diameter such that a space remains between the inner surface of the barrel 1 and the centre portion 24.1 of the weights 24. This space is preferably used for wrapping or winding the net or the cord ends of the net around the centre portion 24.1 of the weights. The centre portion 24.1 has preferably a round, preferably a circular cross-section which provides a force-less unwrapping or unwinding when the net is opened by the forces caused by the rotation or the spin of the projectile 2.

[0064] In one embodiment, the projectile 2 comprises a net opening (delay) mechanism which is configured for holding the projectile 2 together in a first phase after the projectile 2 has been fired and left the barrel 1 such that the projectile 2 held together continues to rotate or spin around its longitudinal axis. The net opening mechanism is further configured to free the weights 24 after having received a trigger event such that the weights 24 move radially away from each other caused by the rotation of the projectile 2 to open the net. This can increase the range of the projectile 2. The trigger event is preferably an electronic trigger signal received at the net opening mechanism. This electronic trigger signal can be sent from a timer of the projectile 2 set by the net launcher 100, 200 shortly before firing the projectile 2, typically based on a distance measurement or a sequence thereof. The electronic signal could also be received wirelessly in the projectile 2 during the flight towards the object to be intercepted. This allows to react even after firing on the behavior of the object to be intercepted. The net opening mechanism can be realized for example by a string circumferential means extending around the circumference of the projectile 2 around the longitudinal axis of the projectile 2 and holding the weights 24 radially together. Once the trigger signal is received, the circumferential means is opened to release the weights 24 such that they can move radially away forced by the rotational forces of the projectile 2. The circumferential means can be a simple string with a separation or opening mechanism. In another embodiment, the net opening mechanism could be realized by a holding means configured to hold the sabot 22 and the cover 23 together. Preferably, the holding means is configured to create a holding force between the sabot 22 and the cover 23 in the direction of the longitudinal axis of the projectile 2. The holding means could be a string connecting the sabot 22 and the cover 23. The projectile 2 is preferably designed such that the sabot 22 and the cover 23 and the weight 24 are arranged in a form fit or press fit such that they can not move relative to each other until the holding means is released or opened. The holding means is configured to open meaning that the sabot 22 and the cover 23 are not held together any more. The holdings means opens,

when it receives the above-mentioned trigger signal.

[0065] The projectile 2 preferably loaded or charged from the distal end 11 of the barrel 1 (front-end loader). Preferably, the projectile 2 is assembled (in the first state) before being inserted into the distal end 11 of the barrel 1. However, it would also be possible to assemble the projectile 2 directly within the barrel 1. In a preferred embodiment, the projectile 2 is first inserted in a charging barrel 14 as shown in Fig. 8, 9 and 10. The projectile 2 can for example be mounted / assembled within the charging barrel 14. The charging barrel 14 has the same inner cross-section and/or the same twisted form as the barrel 1, wherein a front end of the charging barrel has a connection interface 141 allowing to place the front end 11 of the barrel 1 on the connection interface 141 such that the charging barrel 14 forms an uninterrupted extension for the barrel. The connection interface 141 is preferably a step increasing the inner dimension by the roughly the thickness of the wall of the barrel 1. Thus, when the front end 11 of the barrel 1 is placed on the step, the inner form of the barrel 1 is automatically aligned with the inner form of the charging barrel 14. The projectile 2 is preferably inserted in the charging barrel 1 such that the proximal end of the projectile 2 or the sabot 22 points towards the connection interface 141. This allows in particular to insert the sabot 22 with the sealing cloth in the right orientation. When the barrel 1 is connected to the connection interface 141 of the charging barrel 1, the projectile 2 can be moved from the charging tube 14 into the barrel 1. This can be realized by a stick inserted through the end of the charging tube 14 being opposed to the end with the connection interface 141. However, the projectile 2 can also be moved by the gravity or other means. The sealing cloth remains in the correct position, when moving the projectile 2 into the barrel 1. This procedure allows to charge the projectile 2 with the sealing cloth in the right orientation. The charging tube 14 shown in Fig. 8 to 10 is configured to fit on the barrel 1" shown in Fig. 11 to 13. Obviously, the same principle applies for barrels 1, 1' with other twisted forms and cross-sections.

[0066] Fig. 5 to 7 shows now the projectile 2 after being fired and after having left the distal end 11 of the barrel 1. In Fig. 5, the projectile 2 has just left the barrel 1 and is still in the first state, i.e. still in the assembled state. Due to the twisted form of the barrel 1 and the projectile 2, the projectile 2 rotates around its longitudinal axis while being accelerated in the barrel 1 (spin). This spin continues after having left the barrel 1 and creates a radial force on the weights 24 of the projectile 2. Thus, as shown in Fig. 6 and 7, the weights 24 move radially apart and open thus the net connected therebetween. The sabot 22 and the cover 23 will simply fall down. With the above-described net opening mechanism of the projectile 2, the opening of the net and/or the disassembling of the projectile 2 can be delayed such that larger projectile ranges can be achieved.

[0067] In order to accelerate the charging process of the barrel 1 with the projectile 2, a cartridge comprising

at least the barrel 1 and the projectile 2 is suggested. Each cartridge comprises already the barrel 1 charged with the projectile 2 such that after having fired the net launcher 100, 200, the user can simply replace the empty barrel 1 or cartridge with a new charged cartridge, i.e. the barrel 1 charged with projectile 2. This accelerates the recharging process significantly. Fig. 2 shows an exploded view of such a cartridge. Therefore, the net launcher 100, 200 comprises preferably a connector 8 for receiving a corresponding connector 3 of the cartridge. The connector 3 comprises preferably a cartridge interface 31 for connecting the connector 3 with the (connector 8 of the) net launcher 100, 200. The cartridge interface 31 is here a thread for fastening the cartridge to a corresponding thread of the connector 8 of the net launcher 100, 200. Preferably, the cartridge comprises a connector ring or circle 25 conductively connected with the electrical terminal(s) of the fire charge 4. The connector ring or circle 25 is arranged at end of the interface 31 or the thread 31 and is connected with a corresponding connector terminal of the net launcher 100, 200. The electrical signal from the activator 6 or from any other control means can be received thus in the fire cartridge, when the cartridge is charged in the net launcher 100, 200 for firing the projectile 2 charged in the cartridge. The described launcher interface 31 is just one embodiment for this interface. Other interface realizations are possible. The connector 3 comprises preferably a barrel interface for connecting the connector 3 or the cartridge to (the proximal end 12 of) the barrel 1. This barrel interface can for example be a thread to be connected to a corresponding thread of (the proximal end of) the barrel 1. When the barrel 1 is made out of a composite material, the interface in the barrel 1 connected to the barrel interface of the connector 3 can be realized by a (metal) thread ring fixed in the barrel 1. The barrel interface provides one way to recharge the fire cartridge of the cartridge by inserting the fire cartridge 4 between the connector 3 and the barrel 1 and connecting them again. However, it is also possible that the connector 3 is realized integral with the proximal end 12 of the barrel 1 and/or that the fire cartridge 4 is recharged differently. The connector 3 comprises preferably a thread 31 for fastening the cartridge to a corresponding thread of the connector 8 of the net launcher 100, 200. However, other connector mechanisms are possible. The connector 3 is fixed preferably on the proximal end 12 of the barrel 1. However, it is also possible that the connector 3 is realized integral with the proximal end 12 of the barrel 1.

[0068] The cartridge comprises preferably also the fire cartridge 4. The connector 3 comprises a sleeve housing at its centre opening the fire cartridge 4. The fire cartridge is preferably inserted between the proximal end 12 of the barrel 1 and the connector 3. The fire cartridge 4 is arranged such that the fire cartridge 4 enters in the barrel 1 from the proximal end 12 and/or such that the fire cartridge 4 hermetically closes the opening of the barrel 1 at the proximal end 12. Therefore, the pressure caused

by the fire cartridge 4 when activating the fire mechanism is released (exclusively) in the barrel 1.

[0069] The embodiment of the net launcher 200 with multiple barrels 1 can also comprise multiple cartridges each with a single barrel 1. It is however also possible to provide a multi-barrel cartridge 201 comprising at least two barrels 1, each barrel 1 charged with a projectile 2. The multiple barrel cartridge 201 comprises preferably a fire cartridge (not shown) in each barrel 1. The multiple barrel cartridge 201 comprises preferably a common support 15 supporting the multiple barrels 1. The support 15 comprises preferably openings in connection with the inside of each barrel 1 via the proximal end 12 of the barrel 1. The opening 151 is configured for example to host the fire cartridge 4 of the cartridge 201 or the fire mechanism of the net launcher 200. The support 15 comprises preferably connection means 152 for quickly attaching the multiple barrel cartridge 201 on the net launcher 200. This allows to launch multiple nets in a short time and to charge the multiple barrels 1 very quickly with a single manipulation.

[0070] The net launcher 100, 200 comprises preferably a distance and/or position measurement system 9 for measuring a distance from the net launcher 100, 200 to the object to be intercepted and/or a position of the object to be intercepted. The distance measurement can be further configured to predict a future position or a future distance based on the actual position and/or distance.

[0071] The net launcher 100, 200 comprises preferably an aiming system 7. This could be a simple cross-hair. This could be a more sophisticated aiming system with a display adding aiming support information, e.g. where to point best the net launcher, when to shoot best, etc.. This aiming support information could be calculated based on the measured actual and/or future distance and/or position of the object. The aiming system 7 could be also fully automated such that the aiming system sends the trigger signal to the fire mechanism, when it processed to get the object to be intercepted. Such an automated aiming system 7 could further control the direction of the barrel 1. The barrel 1, in particular in a station-mounted or a drone mounted net launcher, could have a direction apparatus which changes the direction of the barrel 1, preferably azimuth and/or altitude. This could be for example a gimbal. In a drone-mounted net launcher, the aiming system 7 could alternatively and/or additionally control the direction of barrel 1 by changing the orientation of the drone itself. It is further possible to establish a fully automated drone control which flies automatically in the vicinity of the object to be intercepted and controls the position and/or orientation of the drone and/or the direction of the barrel 1 in order to bring the net launcher in a potentially good launch position and activates then automatically the fire mechanism of at least one of the barrels 1. The aiming system described could be fully arranged in the drone and/or fully or partly in a remote location. If the aiming system is fully or partly in a remote location, the drone and/or the net launcher

are controlled by control signals sent wirelessly to the drone from the remote location, e.g. by radio control.

[0072] The presented net launcher 100, 200 is particularly well-suited for intercepting drones.

[0073] The presented net launcher 100, 200 is particularly well-suited to be mounted on a drone, because the net launcher is very light, the barrel 1 has a small cross-section such that multiple barrels can be mounted on the drone. Such a drone-mounted net launcher 100, 200 is particular well suited for a drone-based drone defense. A further advantage of the present net launcher 100, 200 for drones is that the fire mechanism can be activated electronically which allows an automatic and/or remote triggering of the fire mechanism.

Claims

1. A net launching system comprising a net launcher and multi-component projectile, wherein the net launcher comprises a barrel for accelerating the multi-component projectile and a fire mechanism for firing the multi component projectile in the barrel by causing the pressure at one end of the barrel for accelerating the multi-component projectile, wherein the multi-component projectile comprises a plurality of weights connected by a net, wherein the multi-component projectile is configured to open the net by the radial forces on the weights caused by a rotation of the multi-component projectile,
characterized in that
the barrel has a twisted form configured to cause a rotation of the multi-component projectile around the longitudinal axis of the barrel, when the multi-component projectile is accelerated in the barrel, and the multi-component projectile in the barrel before being fired by the fire mechanism has a twisted form corresponding to the twisted form of the barrel such that the acceleration of the multi-component projectile along the longitudinal axis of the barrel causes the rotation of the multi-component projectile around the longitudinal axis of the barrel.
2. Net launcher system according to the previous claim, wherein the barrel with the twisted form is made by a fibre reinforced composite material.
3. Net launcher system according to one of the previous claims, wherein the cross-sectional form of the barrel corresponds to a convex regular polygon, wherein sides between corners of the convex regular polygon are curved versus the outside and/or corners of the convex regular polygon are rounded.
4. Net launcher system according to the previous claim, wherein cross-sectional outer form of the multi-component projectile before being fired corresponds

such to said cross-sectional inner form of the barrel that the multi-component projectile cannot rotate around the longitudinal axis of the barrel without being moved along the longitudinal axis of the barrel, and/or the outer cross-sectional outer form of the multi-component projectile rotates along a longitudinal axis of the multi-component projectile by the same constant twist rate.

5. Net launcher system according to one of the previous claims, wherein the multi-component projectile comprises further a sabot with a seal cloth. 5
6. Net launcher system according one of the previous claims, wherein the net comprises a number of cord ends, wherein each cord end is wrapped around one of the weights. 10
7. Net launcher system according to one of the previous claims, wherein the multi-component projectile comprises a net opening mechanism which is configured for holding the multi-component projectile together in a first phase after the multi-component projectile has been fired and left the barrel such that the multi-component projectile hold together continues to rotate around its longitudinal axis and which is configured to free the weights after having received a trigger signal such that the weights move radially away from each other caused by the rotation of the multi-component projectile to open the net. 15
8. Net launcher system according to one of the previous claims comprising at least two barrels, each barrel configured to charge a multi-component projectile. 20
9. Net launcher system according to one of the previous claims, wherein the barrel and the multi-component projectile charged in the barrel forms a replaceable cartridge configured to be connectable to the net launcher for firing the charged multi-component projectile and to be removable from the net launcher after the multi-component projectile has been fired for connecting a new cartridge charged with a new multi-component projectile. 25
10. Net launcher system according to the previous claim, wherein the cartridge comprises at the end of the barrel a fire charge configured to be fired by the fire mechanism. 30
11. Net launcher system according to one of the previous claims, comprising a multi barrel cartridge comprising at least two cartridges and/or at least two barrels each charged with a multi-component projectile. 35
12. Net launcher system according to one of the previous claims, wherein the fire mechanism is a gas pressure mechanism and/or wherein the fire charge is a gas 40

pressure cartridge.

13. Net launcher system according to one of the previous claims, comprising a drone, wherein the net launcher is mounted on the drone. 45
14. Multi-component projectile for a net launcher comprising a plurality of weights connected by a net, wherein the multi-component projectile is configured to open the net by the radial forces on the weights caused by a rotation of the multi-component projectile along its longitudinal axis, **characterized in that** the multi-component projectile in the barrel before being charged in the net gun and/ or before being fired by the net gun has such a twisted form that the multi-component projectile is rotated along its longitudinal axis, when the multi-component projectile is accelerated in a barrel with a twisted form corresponding to the twisted form of the multi-component projectile. 50
15. A cartridge for charging a net launcher, wherein the cartridge comprises a barrel and a multi-component projectile charged in the barrel, wherein the multi-component projectile comprises a plurality of weights connected by a net, wherein the barrel is configured for accelerating the multi-component projectile, wherein the multi-component projectile is configured to open the net by the radial forces on the weights caused by a rotation of the multi-component projectile, **characterized in that** the barrel has a twisted form configured to cause a rotation of the multi-component projectile around the longitudinal axis of the barrel, when the multi-component projectile is accelerated in the barrel, and the multi-component projectile in the barrel has a twisted form corresponding to the twisted form of the barrel such that the acceleration of the multi-component projectile along the longitudinal axis of the barrel causes the rotation of the multi-component projectile around the longitudinal axis of the barrel. 55

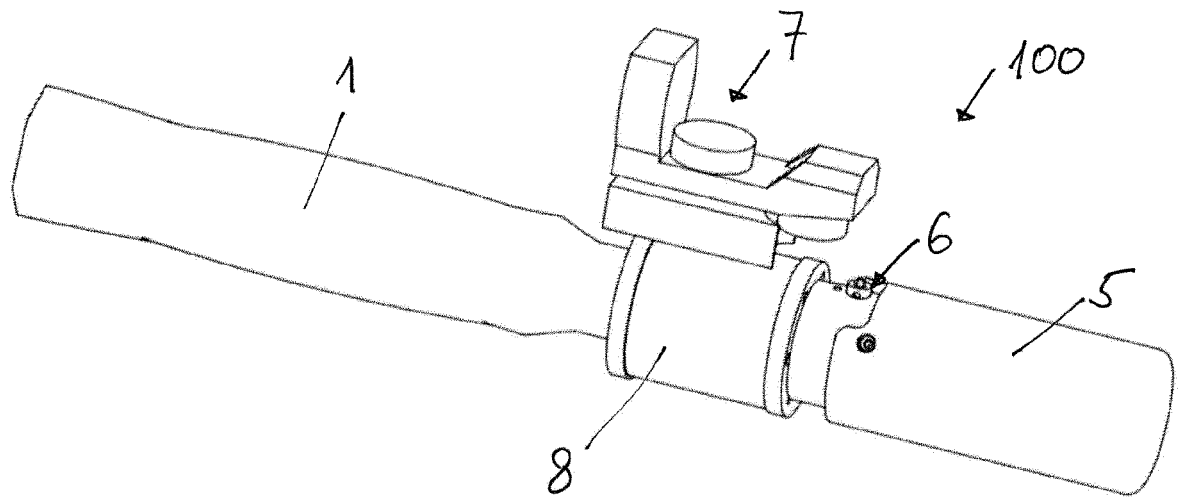


Fig. 1

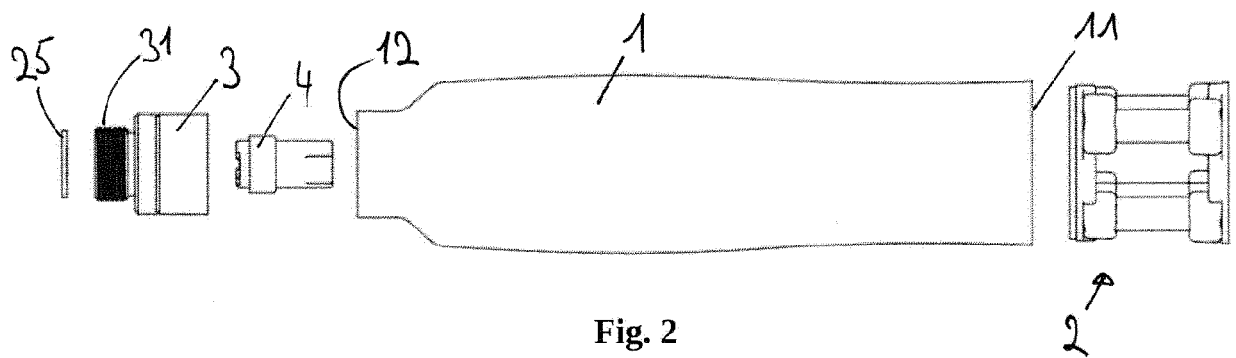


Fig. 2

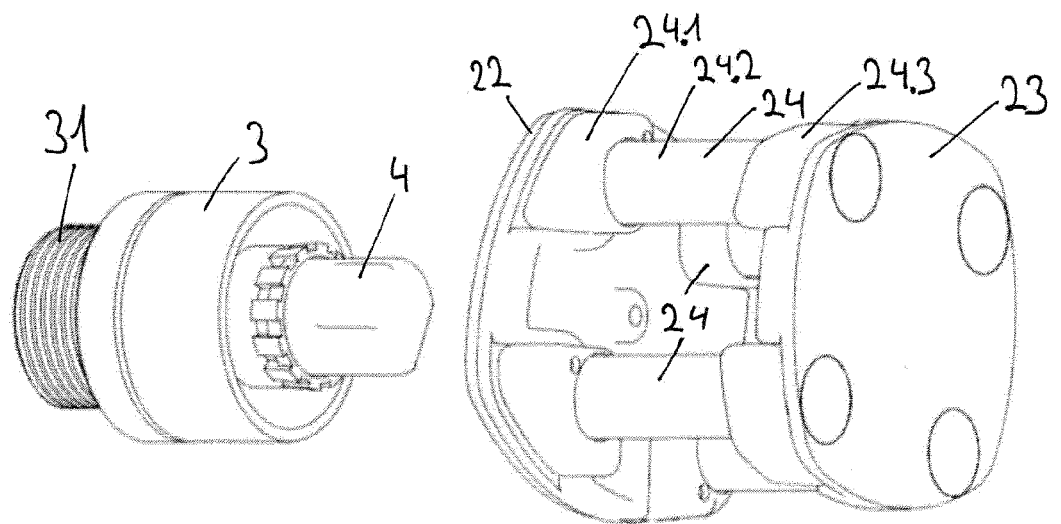


Fig. 3

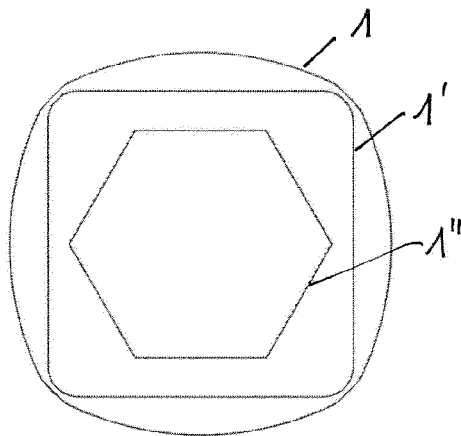


Fig. 4

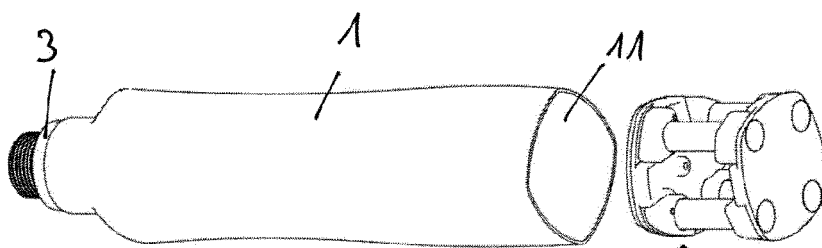


Fig. 5

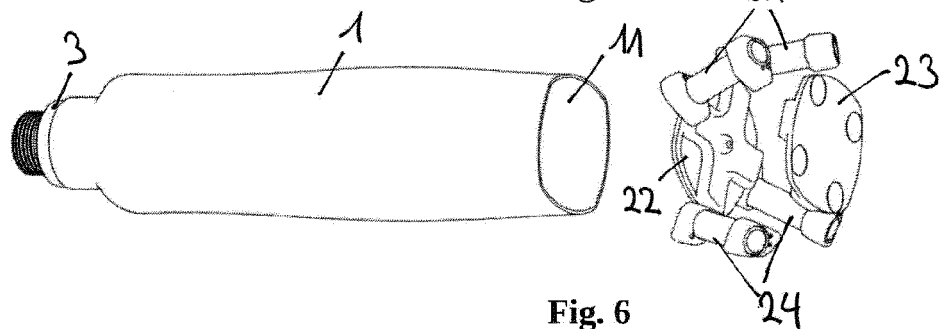


Fig. 6

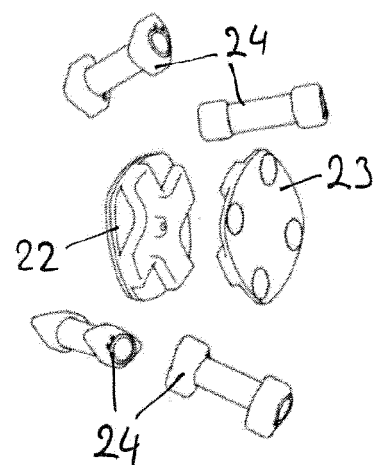
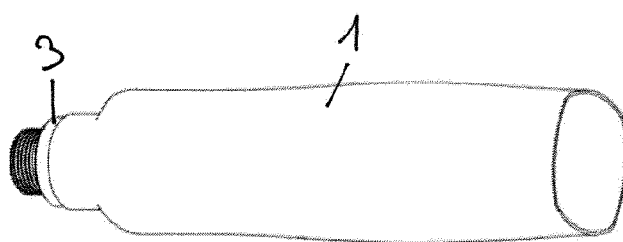


Fig. 7

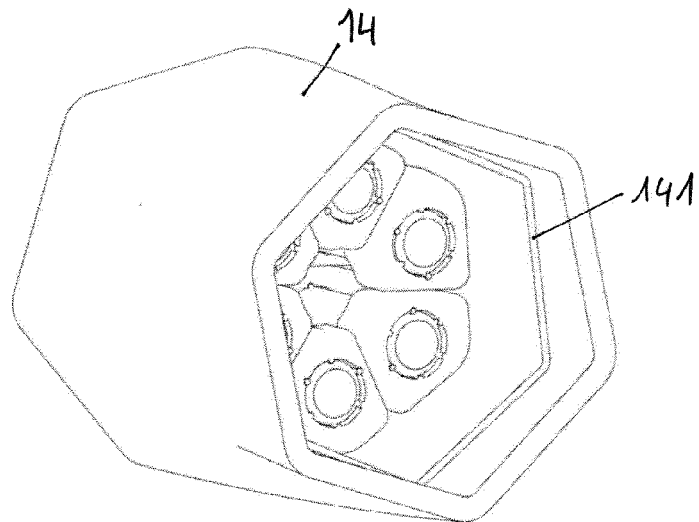


Fig. 8

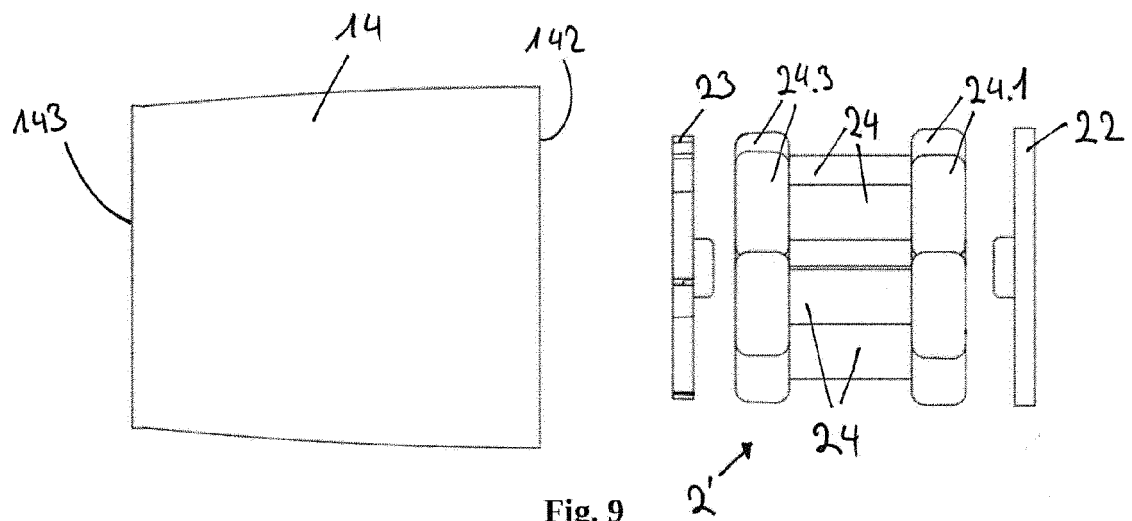


Fig. 9

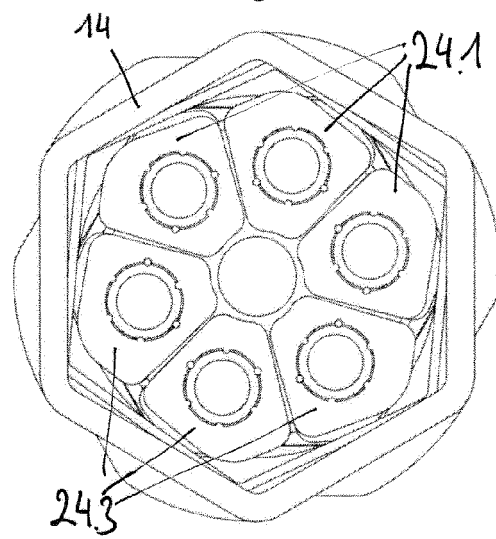
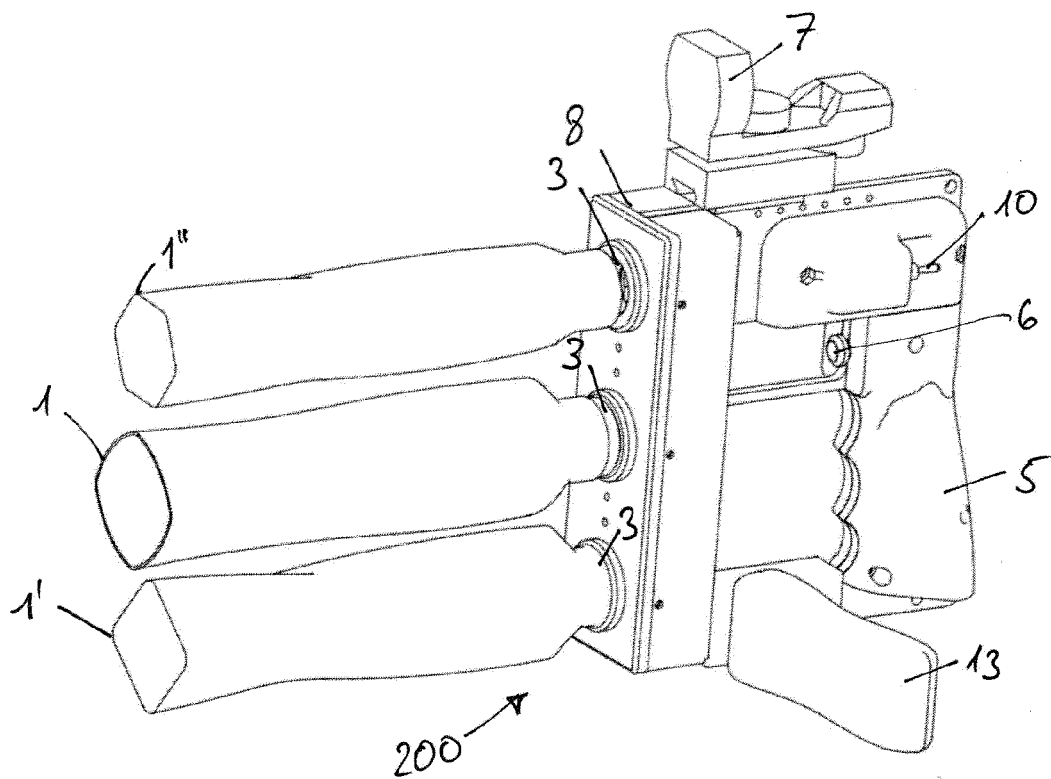
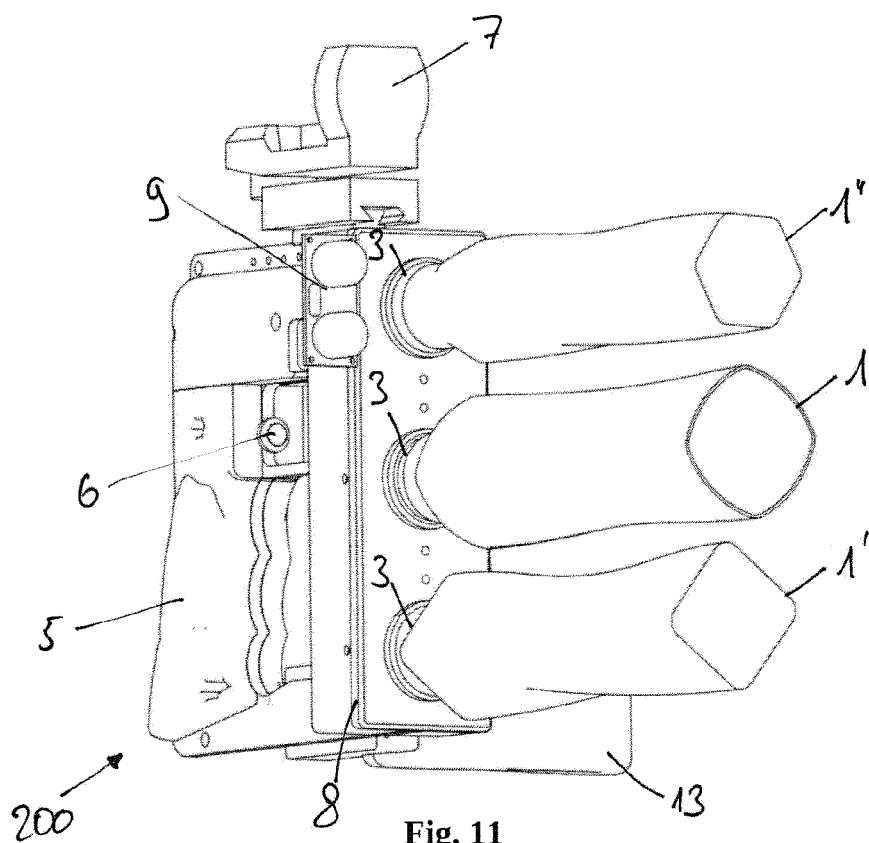
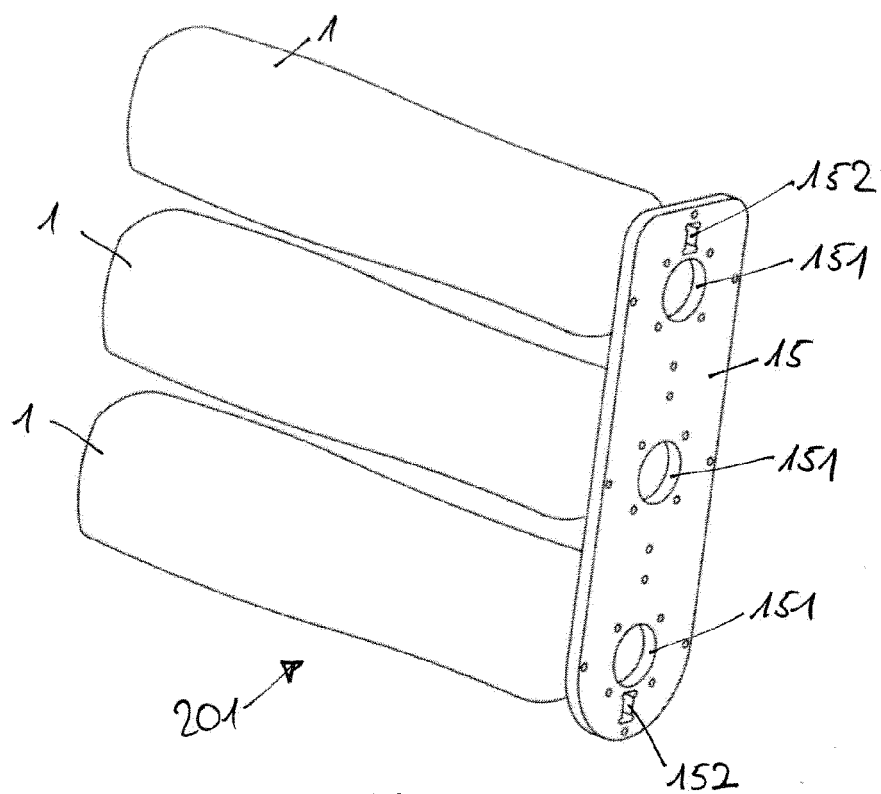
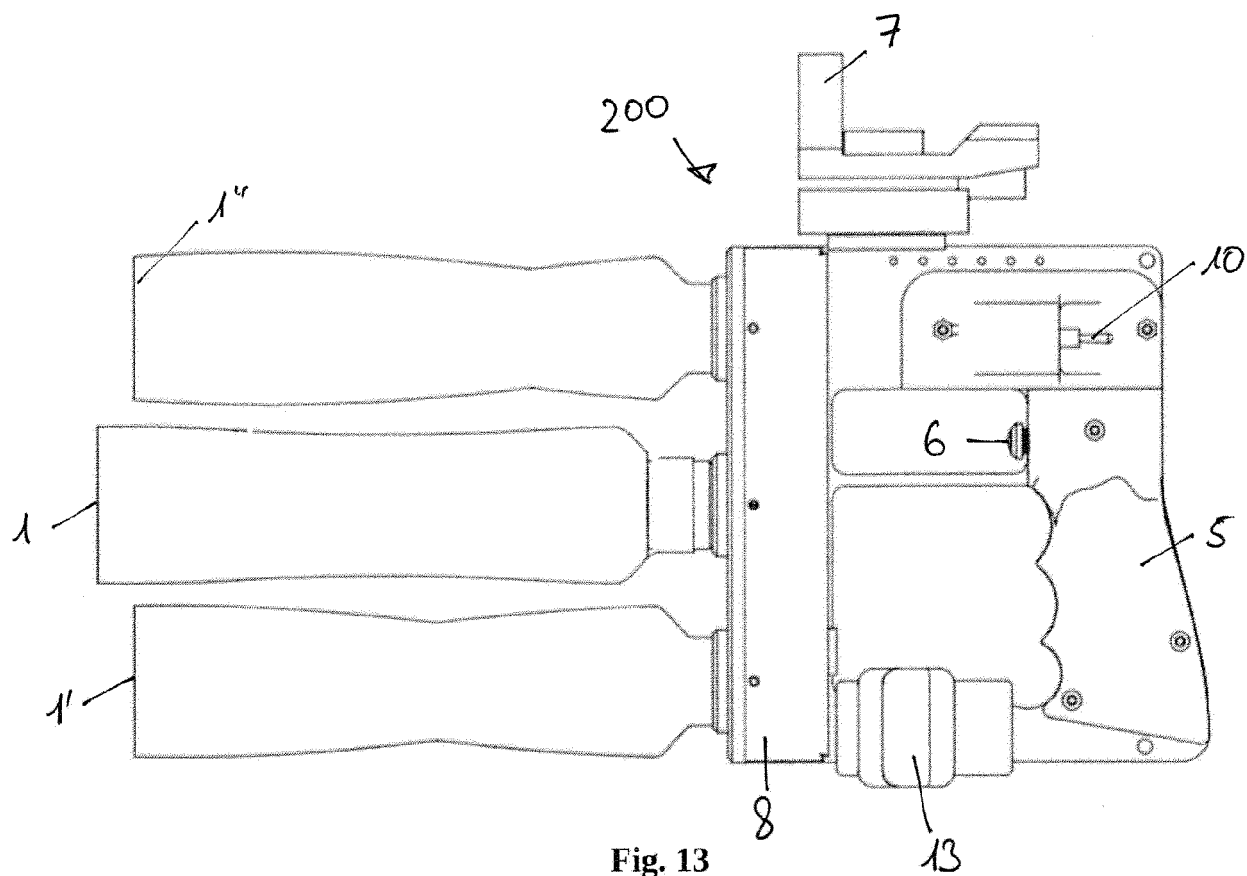
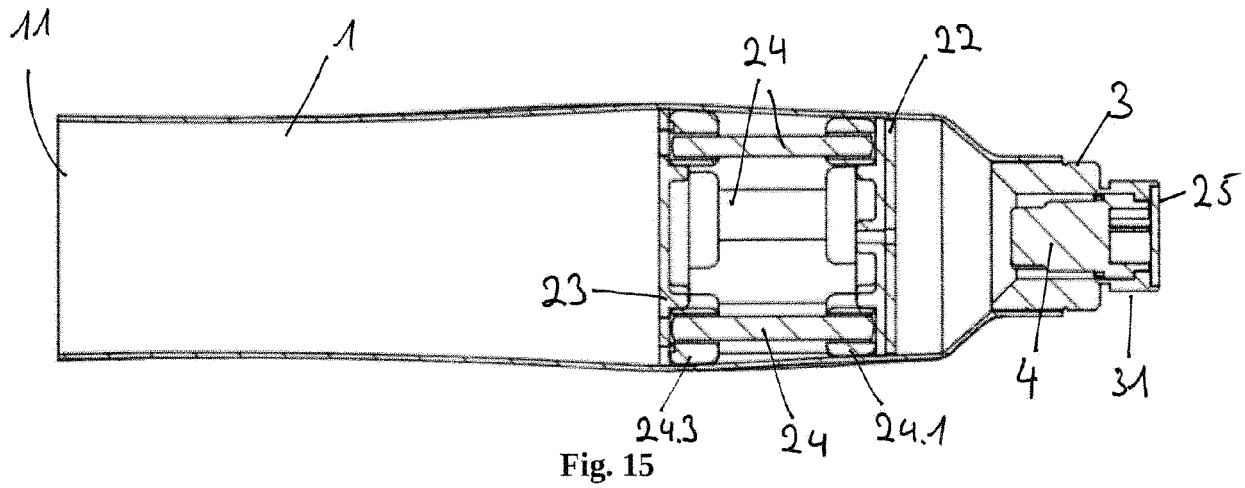


Fig. 10









EUROPEAN SEARCH REPORT

 Application Number
 EP 18 02 0449

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	CN 204 678 977 U (UNIV SOUTH CHINA AGRICULT) 30 September 2015 (2015-09-30) * paragraph [0022] - paragraph [0026]; figures 1-4 *	1-5,8, 11-14 6,7,9, 10,15	INV. F41H13/00 F42B10/26 F41A21/16
Y A	----- CN 101 191 712 A (CHENG CHENG [CN]) 4 June 2008 (2008-06-04) * page 3; figures 1-4 *	1-5,8, 11-14 6,7,9, 10,15	
Y A	----- GB 1 591 226 A (MINNESOTA MINING & MFG) 17 June 1981 (1981-06-17) * page 2, line 82 - line 97 * * page 4, line 43 - page 5, line 114 * * figures 4-8 *	1-5,8, 11-14 6,7,9, 10,15	
Y A	----- EP 0 049 068 A1 (MINNESOTA MINING & MFG [US]) 7 April 1982 (1982-04-07) * page 12, line 1 - line 19 * * figure 3 *	1-5,8, 11-14 6,7,9, 10,15	
A	----- EP 0 479 746 A1 (STATOIL EUROPARTS AB [SE]) 8 April 1992 (1992-04-08) * column 2, line 7 - column 3, line 48; figures 1,2 *	2	TECHNICAL FIELDS SEARCHED (IPC) F41H F42B F41A
A	----- US 9 080 832 B2 (GAITHER TOOL COMPANY INC [US]) 14 July 2015 (2015-07-14) * column 3, line 6 - line 40 * * column 4, line 3 - line 39 * * figures 1A, 2A *	5	
A	----- US 2017/144756 A1 (RASTGAAR AAGAAH MOHAMMAD [US] ET AL) 25 May 2017 (2017-05-25) * paragraph [0015] - paragraph [0017]; figures 1,4 *	8,11,13	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 February 2019	Examiner Seide, Stephan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 02 0449

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-02-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 204678977 U	30-09-2015	NONE	
CN 101191712 A	04-06-2008	NONE	
GB 1591226 A	17-06-1981	CH 636695 A5 DE 2747570 A1 FR 2370949 A1 GB 1591226 A NL 7712208 A NL 9100544 A SU 1227104 A3	15-06-1983 18-05-1978 09-06-1978 17-06-1981 12-05-1978 01-07-1991 23-04-1986
EP 0049068 A1	07-04-1982	AR 229104 A1 AU 539016 B2 CA 1138333 A DE 3173140 D1 EP 0049068 A1 MX 6223 E NZ 198494 A US 4326524 A	15-06-1983 06-09-1984 28-12-1982 16-01-1986 07-04-1982 21-12-1984 30-08-1985 27-04-1982
EP 0479746 A1	08-04-1992	AT 133782 T DE 69116787 D1 DE 69116787 T2 EP 0479746 A1 SE 467301 B US 5191165 A	15-02-1996 14-03-1996 30-05-1996 08-04-1992 29-06-1992 02-03-1993
US 9080832 B2	14-07-2015	NONE	
US 2017144756 A1	25-05-2017	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 10005556 B [0003]
- WO 16170367 A [0004]
- DE 102016111563 [0005]
- WO 12060822 A [0006]