

Barrel Opening Mechanism of Grenade Launcher

Field of Invention

[001] The present invention relates to a barrel opening mechanism for loading and
5 unloading of cartridges into a barrel of a grenade launcher.

Background

[002] A grenade launcher may be a standalone device or detachably mounted below a rifle.
10 For example, the grenade launcher uses a spin-stabilised 40 mm cartridge. A conventional
grenade launcher may employ different methods of opening the barrel: longitudinal sliding
opening; lateral swinging to the left hand, to the right hand side, downward or upward; and
a combination of longitudinal sliding followed by a lateral swing. These methods of
opening the barrel involve many components and often only designed for a right- or left-
15 handed operator; in other words, these conventional grenade launchers are often not
ambidextrous. For example, US 7,487,612, assigned to FN Herstal S.A., discloses two
sliding blocks (13, 14) operable to slide with two longitudinal slides (17) such that the
barrel is advanced in a first longitudinal direction and swiveled laterally in the final phase
of the longitudinal movement.

20 [003] In another example, US 3,641,691, assigned to the US Army, discloses a grenade
launcher in which the barrel is pivotable downwardly to a 15 degree angle and an ejector
rod is used to eject the used cartridge. When the barrel is closed, the firing mechanism is
automatically locked in the firing position.

25 [004] Despite development of known grenade launchers, there exists a need for another type
of barrel opening mechanism that is ambidextrous yet not complex or heavy in design.

Summary

30 [005] The following presents a simplified summary to provide a basic understanding of the
present invention. This summary is not an extensive overview of the invention, and is not

intended to identify key features of the invention. Rather, it is to present some of the inventive concepts of this invention in a generalised form as a prelude to the detailed description that is to follow.

- 5 **[006]** The present invention seeks to provide a barrel opening mechanism for a grenade launcher that is ambidextrous in operation yet designed with a minimum number of components. In addition, the Picatinny rail on the top portion of the barrel is configured to transfer recoil forces from the grenade launcher to a supporting rifle it is connected to.
- 10 **[007]** In one embodiment, the present invention provides a receiver body, which is substantially an inverted L-shaped, with a forward pointing arm and a proximal arm, wherein the proximal arm is configured for housing a trigger mechanism; and a barrel connected below the forward pointing receiver arm by a barrel pivot and a latch mechanism; wherein the latch mechanism comprises a latch disposed in the forward
15 receiver arm and is operable to engage with a catch disposed on a top portion of the barrel so that the latch is engageable with the catch when the barrel is in a closed position and longitudinal X-axes of the barrel and forward receiver arm are substantially parallel, and when the latch is actuated by an appendage of a left or right hand of a user supporting the barrel, the latch becomes released from the catch, thereby allowing the barrel to droop or
20 pivot away from the forward receiver arm about a transverse Y-axis at the barrel pivot so that the same hand is operable to turn a chamber end of the barrel laterally to the left or right hand side about a vertical Z-axis at the barrel pivot for loading or unloading a cartridge into the barrel.
- 25 **[008]** In another embodiment, the present invention provides a method of opening a barrel release and lock mechanism of a grenade launcher. This method comprises: supporting a barrel of a grenade launcher with a left or right hand of a user; using an appendage of said left or right hand to push a lever portion that protrudes on each of two sides of a receiver arm to release a barrel latch, thereby allowing a chamber end of the barrel to droop about a
30 transverse Y-axis of a pivot disposed near a distal end of the receiver arm; turning said barrel with said left or right hand so that the chamber end of the barrel is moved laterally to the left or right side of the receiver arm about a vertical Z-axis of the pivot to allow the user to load or unload a cartridge into/from the chamber of the barrel; and laterally turning

the barrel back to align the barrel with the receiver arm and then pivoting the barrel back to the receiver arm to release a spring-loaded pin so that the barrel latch is engageable with a cooperating catch and the barrel is re-connected to the receiver arm at the latch.

- 5 **[009]** Preferably, the barrel pivot comprises a substantially cylindrical pivot pin that is journaled in the forward receiver arm to pivot about the Z-axis and a clevis pin pivotable about the Y-axis, with the clevis pin passing through a bore on the pivot pin and the clevis pin being supported by a pair of clevises disposed on a top surface of the barrel.
- 10 **[0010]** Preferably, the clevis pin allows the barrel to pivot substantially 5 degree angle away from the X-axis whilst the pivot pin allows the barrel to be turned laterally to the left or right hand side of the receiver body by substantially 20 degree. Preferably, the barrel opening mechanism comprises a barrel pivot direction lockout pin or selector. The barrel opening mechanism has two notches formed on its cylindrical surface, with the notches
- 15 being angularly oriented with respect to each other and a paw extending from the pivot pin is restricted to move within a length of the selected notch, so that the direction of swivel of the barrel chamber end is selectable depending on whether the user is right-handed or left-handed.
- 20 **[0011]** Preferably, the latch mechanism comprises a spring-loaded release pin, which allows the latch to engage with the catch only when the catch is received in the recess and the spring-loaded release pin is depressed. The latch also comprises a hook configured integrally on a pivoted lever, such that a lever portion projects out on a left hand side of the forward receiver arm and another lever portion projects out on the right hand side of the
- 25 forward receiver arm and the hook is engageable with a slot formed on the catch.
- [0012]** Preferably, a closed end of a Picatinny rail formed along an upper portion of the forward receiver arm is disposed a stopper plate. The stopper plate is located substantially above the barrel pivot and it keeps the pivot pin in position and at the same time transfer
- 30 recoil forces from the grenade launcher to a supporting rifle mounted at the Picatinny rail.

Brief Description of the Drawings

[0013] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

5 [0014] FIG. 1A illustrates a grenade launcher (without a barrel guard) with a barrel latch in the locked position according to an embodiment of the present invention, whilst FIG. 1B illustrates the grenade launcher with the barrel disposed partially in a barrel sleeve; FIG. 1C illustrates the grenade launcher can be connected to a rifle by means of a Picatinny rail;

10 [0015] FIG. 2A illustrates the grenade launcher shown in FIG. 1A with the barrel latch in the released position such that the chamber side of the barrel droops downward; FIGs. 2B and 2C illustrate the chamber side of the barrel being turned to the left hand side of the launcher; whilst FIG. 2D illustrates the chamber side of the barrel being turned to the
15 right hand side;

[0016] FIG. 3A illustrates an exploded view of the barrel from the receiver body showing the pivot and latch mechanism of the present invention;

FIG. 3B illustrates a plan view of the grenade launcher shown in FIG. 1A;

20 FIG. 3C illustrates a cut-out view showing the latch mechanism, whilst FIG. 3D illustrates a sectional view showing the latch mechanism and barrel pivot;

[0017] FIG. 4A illustrates a sectional view of the grenade launcher shown in FIG. 2A, whilst FIGs. 4B and 4C illustrate the barrel being turned respectively to the right hand and
25 left hand sides; and

[0018] FIGs. 5A and 5B illustrate perspective and exploded views of the grenade launcher incorporating a barrel pivot direction lockout pin or selector, whilst FIGs. 5C and 5D illustrate the chamber end of the barrel being restricted selectively to turn respectively to
30 the right hand and left hand sides.

Detailed Description

[0019] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0020] FIGs. 1A and 1B show a grenade launcher 100 employing a barrel opening mechanism 105 according to the present invention. The barrel opening mechanism 105 includes a barrel pivot 150 and a barrel latch mechanism 170. The barrel opening mechanism 105 can be used in any single-shot gun, as exemplified by a grenade launcher. As shown in FIGs. 1A and 1B, the grenade launcher 100 includes a receiver body 110, a barrel 130 being connected to the receiver body 110 by the barrel pivot 150 and latch mechanism 170, a barrel sleeve 140 and a lock sleeve 132 to lock the barrel sleeve 140 to the barrel 130. The receiver body 110 is substantially inverted L-shaped, with a forward pointing arm 110a provided to support the barrel 130, and the other proximal arm 110b for housing a trigger mechanism, with a portion being shaped for handgrip or as a butt stock. The barrel pivot 150 is pivotable about two orthogonal axes, that is, a Y-axis transverse to the receiver arm 110a and a Z-axis perpendicular to the receiver arm 110a, with a longitudinal X-axis along a length of the receiver arm. The latch mechanism 170 includes a pivoted lever 172 mounted inside the receiver arm 110a and a catch 180 disposed on a top surface of the barrel. In the normal barrel closed position, the lever 172 engages with the catch 180. The lever 172 extends on both sides of the receiver arm 110a (as seen more clearly in FIG. 3B) so that it can be actuated with a thumb or finger of one's hand supporting the barrel 130. When the latch mechanism 170 is released by momentarily pressing on the lever 172 on either side of the receiver arm 110a, a chamber end 134 of the barrel (into which a projectile is inserted) is allowed to droop substantially 5 degree from the longitudinal X-axis about the Y-axis at the barrel pivot 150. In this drooped-down or open pivoted position, the barrel 130 is supported only at the barrel pivot 150, as seen more clearly in FIG. 2A. As the pivot 150 is close to the top surface of the barrel 130 and with a relief angle provided at a front tip 114 of the receiver arm 110a, the drooped barrel is no longer in contact with any part of the receiver body 110 and is free to be turned laterally to the left or right hand side of the receiver body 110 about the Z-axis at the pivot 150. In one

embodiment, the barrel 130 is operable to be turned laterally to the left or right side of the receiver body 110 by substantially 20 degree about the pivot 150 such that the projectile can be loaded or unloaded at the chamber end 134 of the barrel 130 without obstruction by the receiver arm 110b, as seen more clearly in FIGs. 2B, 2C, 2D, 4B and 4C.

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[0021] FIG. 3A shows an exploded view of the barrel opening mechanism 105. As shown in FIG. 3A, the pivot 150 is made up of a pivot pin 152, a pair of clevises 156 and a clevis pin 157. The pivot pin 152 is substantially cylindrical in shape along the Z-axis but has two parallel flat surfaces 153 to cooperate with the pair of clevises 156. A top part of the pivot pin 152 has a lateral projection 154 so that the lateral projection 154 is received in the receiver arm 110a for pivotal movement about the Z-axis. A stopper plate 122, mounted at the end of a Picatinny rail 120 formed on an upper surface of the receiver arm 110a, keeps the pivot pin 152 pivotable in the receiver arm 110a. The clevis pin 157 goes through a bore on the clevises 156 and another bore through the pivot pin 152 to allow the barrel to pivot about the Y-axis. With this pivot design, the pivot 150 allows the barrel 130 to tilt or droop substantially 5 degree from the X-axis and at the same time be pivotable laterally to the left- or right-hand side of the receiver body 110 by substantially 20 degree. An advantage of the present invention is that when the barrel 130 is in the open position, the chamber end 134 is unobstructed for loading and unloading of a projectile; this means that the barrel chamber is suitable to receive projectiles of a predetermined design but of varied lengths, thus ensuring the grenade launcher 100 incorporating the barrel opening mechanism 105 is usable with future projectiles that may be longer in lengths. The other advantage of the present invention is that the barrel 130 is pivotable to the left- or right-hand side of the receiver body 110, thus making the grenade launcher ambidextrous.

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[0022] Referring back to FIGs. 1B and 3A, the barrel sleeve 140 has an open channel 142 formed on the top, longitudinal portion as seen in the figures. The open channel 142 is as wide as the distance between the outside faces of the clevises 156 or length of the clevis pin 157. Preferably, the width of the open channel 142 is substantially wider than the distance between the clevises or length of the clevis pin 157 but the edges of the open channel 142 are provided with a pair of projections 144, which are spaced apart to accommodate the distance between the clevises 156 or length of the clevis pin 157. In the later embodiment, tolerance of the width between the pair of projections 144 need only to

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be controlled instead of along the entire length of the open channel 142. In use, when the barrel sleeve 140 is in place around the barrel 130, the pair of projections 144 locate the clevis pin 157 in the clevises 156; with this arrangement, there is no need to provide any locking mechanism for the clevis pin 157, thus allowing the number of components of the barrel opening mechanism 105 to be reduced and further simplifying this mechanism.

[0023] As can also be seen in FIG. 3A, the latch mechanism 170 includes the lever 172 and the cooperating catch 180 disposed on the top surface of the barrel 130 along the longitudinal X-axis. FIG. 3C shows a cut-out portion of the latch mechanism 170 and shows the lever 172 has a portion being formed with a hook 174 to engage with a slot 182 formed on the catch 180. The lever 172 is biased in the normal, engaged position by a spring 176. As seen in FIGs. 2A, 2B or 3A, the catch 180 extends out of the top surface of the barrel 130 but when the barrel is in the closed position, the catch 180 is received into the receiver arm 110a within a cavity located below the lever 172, as seen more clearly in FIG. 3C, so that the longitudinal axes of the barrel 130 and receiver arm 110a are substantially parallel. In order to ensure that the latch mechanism 170 is operable only when the catch 180 is received in the cavity located below the lever 172, a spring-loaded pin 178 (not shown in the figures) is extended to prevent the lever 172 from returning to its original position after the latch mechanism 170 is activated and the barrel 130 is released from its connection at the catch 180 with the receiver arm 110a; in other words, the spring-loaded pin 178 is provided to prevent the hook 174 from re-engaging with the slot 182 until the barrel 130 is returned to its closed position, the catch 180 is fully received into its cavity below the receiver arm 110a and the spring loaded pin 178 is depressed. In this way, the spring-loaded pin 178 serves as a very important safety lock to ensure that the barrel 130 is connected to the receiver arm 110a by the latch mechanism 170 before the grenade launcher 100 is deployed.

[0024] In the above barrel opening mechanism 105, the latch mechanism 170 is spaced apart from the pivot 150. Preferably, the latch mechanism 170, such as the parts of the lever 172 that projects out of the receiver arm 110a are located substantially forward with respect to the trigger guard 136. This allows a user to support the grenade launcher 100 with one hand at a position forward of the trigger guard 136 yet allowing a finger or thumb of the

same hand to actuate the latch lever 172, with the other hand on the handgrip and its finger to activate the trigger.

[0025] In a further embodiment, a transverse lock pin 210 is disposed across the Picatinny rail 120 to lock a matching male component of the Picatinny rail disposed on a rifle 200 (as seen in FIG. 1C) to which the grenade launcher 100 is to be mounted to. In use, the free end of the male component of the rifle's Picatinny rail is in butt contact with a thickness edge of the stopper plate 122 such that locking of the two Picatinny rail components at the lock pin 210 has a clearance fit. With clearance fit between the lock pin 210 and the rifle's Picatinny rail component, recoil forces on the receiver body 100 are transferred to the rifle 200 through the stopper plate 122 and Picatinny rail without the lock pin 210 taking up the recoil forces. In other words, in the present invention, the lock pin 210 is used to lock together the two components of the Picatinny rail when the grenade launcher 100 is mounted below the rifle 200 but does not take up any recoil forces during deployment. For this reason, the lock pin 210 is relatively small in size of substantially 2 to 3 mm square in cross-section. By providing the lock pin 210, the grenade launcher 100 according to the present invention can be deployed as a stand-alone equipment or detachably mounted to a rifle.

[0026] FIGs. 5A and 5B show exploded views of the above grenade launcher 100 incorporating a barrel pivot direction lockout pin or selector 160. The pivot direction lockout pin or selector 160 is disposed on the receiver arm 110a parallel to and at a distance aft of the clevis pin 157. As shown in FIGs. 5A and 5B, the direction lockout pin 160 has two notches 162a, 162b formed on the cylindrical surface, with the notches 162a, 162b being angularly oriented with each other; preferably, the notches 162a, 162b are substantially 90 degrees oriented to each other. When assembled, one of the notch 162a or 162b engages with a paw 158 extending laterally from a pivot pin 152a (which is a variation of the above pivot pin 152). The direction lockout pin 160 extends out of the width of the receiver arm 110 and each end terminates with a knurled knob 164. Each knurled knob 164 may be located on the direction lockout pin 160 by means of a locking pin 166. By turning the knurled knob 164, a user sets the rotational orientation of the direction lockout pin or selector 160 so that the paw 158 engages with the notch 162a or 162b; in effect, the direction of barrel swivel to the left- or right-hand side of the receiver

arm 110a is restricted by the paw 158 moving within a length of the notch 162a or 162b. In this manner, the user selectively determines the direction of swivel of the barrel 130 to the left- or right-hand side of the receiver arm 110a by setting the direction lockout pin or selector 160 in a clockwise or anti-clockwise position depending on whether the user is right-handed or left-handed. For illustration, FIG. 5C shows a left-handed user (ie. left hand on the hand-grip or butt 110b) and the position lockout pin 160 being set so that the paw 158 engages with the notch 162a and the chamber end 134 of the barrel 130 is to the right side of the receiver arm 110a. On the other hand, FIG. 5D shows a right-handed user having set the position lockout pin 160 so that the paw 158 engages with the notch 162b and the chamber end 134 of the barrel 130 is swiveled to the left side of the receiver arm 110a.

[0027] From the above description, a reader will appreciate that the barrel opening mechanism of the present invention is advantageously ambidextrous. In addition, the grenade launcher incorporating the barrel mechanism has relatively few additional parts, so making the grenade launcher still relatively light. Another advantage of the present invention is that no tools are required to dismantle the barrel opening mechanism 105 or the entire barrel 130, for example, for cleaning. For example, by unscrewing the lock sleeve 132 from the barrel 130, the barrel sleeve 140 can be removed from the barrel 130, thereby allowing the clevis pin 157 to be removed and the entire barrel 130 to be dismantled from the receiver body 110. In the same manner, no tools are required to re-assemble the barrel opening mechanism or barrel onto the receiver body.

[0028] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the invention. For example, the above barrel opening mechanism 105 can be used on any single-shot gun, such as, a shotgun, irrespective of it being single- or double-barrel and its barrel size. In a further example, the spring-loaded pin 178 may be configured as a detent ball.

CLAIMS:

1. A grenade launcher comprising:

a receiver body, which is substantially an inverted L-shaped, with a forward pointing arm and a proximal arm, wherein the proximal arm is configured for housing a trigger mechanism; and

a barrel connected below the forward pointing receiver arm by a barrel pivot and a latch mechanism;

wherein the latch mechanism comprises a latch disposed in the forward receiver arm and is operable to engage with a catch disposed on a top portion of the barrel so that the latch is engageable with the catch when the barrel is in a closed position and longitudinal X-axes of the barrel and forward receiver arm are substantially parallel, and when the latch is actuated by an appendage of a left or right hand of a user supporting the barrel, the latch becomes released from the catch, thereby allowing the barrel to droop or pivot away from the forward receiver arm about a transverse Y-axis at the barrel pivot so that the same hand is operable to turn a chamber end of the barrel laterally to the left or right hand side about a vertical Z-axis at the barrel pivot for loading or unloading a cartridge into the barrel.

2. A grenade launcher according to claim 1, wherein said barrel pivot comprises a substantially cylindrical pivot pin that is journaled in the forward receiver arm to pivot about the Z-axis and a clevis pin pivotable about the Y-axis, with the clevis pin passing through a bore on the pivot pin and the clevis pin being supported by a pair of clevises disposed on a top surface of the barrel.

3. A grenade launcher according to claim 2, wherein the clevis pin allows the barrel to pivot substantially 5 degree angle away from the X-axis whilst the pivot pin allows the barrel to be turned laterally to the left or right hand side of the receiver body by substantially 20 degree.

4. A grenade launcher according to any one of claims 1-3, wherein the catch is a projected element mounted on the top surface portion of the barrel.

5. A grenade launcher according to claim 4, wherein the catch is received in a recess formed in the forward receiver at the position below the latch.

6. A grenade launcher according to claim 5, wherein said latch mechanism further comprises a spring-loaded release pin, which allows the latch to engage with the catch only when the catch is received in the recess and the spring-loaded release pin is depressed.

7. A grenade launcher according to any one of claims 1-6, wherein the latch comprises a hook configured integrally on a pivoted lever, such that a lever portion projects out on a left hand side of the forward receiver arm and another lever portion projects out on the right hand side of the forward receiver arm and the hook is engageable with a slot formed on the catch.

8. A grenade launcher according to any one of claims 2-7, further comprising a pivot direction lockout pin disposed on the forward receiver arm in a position parallel to the clevis pin and at a distance to engage with a paw projecting laterally from the pivot pin.

9. A grenade launcher according to claim 8, wherein the pivot direction lockout pin has two notches formed on a cylindrical surface of the direction lockout pin, with the notches being angularly oriented with respect to each other and the paw is restricted to move within a length of the selected notch depending on whether the user is right-handed or left-handed.

10. A grenade launcher according to any one of claims 1-9, further comprising a barrel sleeve to receive the barrel.

11. A grenade launcher according to claim 10, wherein the barrel sleeve comprises an open channel, with the width of the open channel being configured to locate the clevis pin.

12. A grenade launcher according to claim 11, wherein the width of the open channel is controlled only at a pair of projections projecting into the open channel.

13. A grenade launcher according to any one of claims 10-12, wherein the barrel sleeve is locked in position on the barrel by a lock sleeve, and locking and unlocking of the barrel sleeve does not require any tool.

5 14. A grenade launcher according to any one of claims 1-13, wherein an upper portion of the forward receiver arm comprises a female half of a Picatinny rail.

15. A grenade launcher according to claim 14, wherein a closed end of the Picatinny rail is disposed a stopper plate, which is located substantially above the barrel pivot.

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16. A grenade launcher according to claim 15, further comprising a lock pin disposed transversely through the female half of the Picatinny rail to prevent an external device mounted in the Picatinny rail from dislodgment, wherein the lock pin is disposed a predetermined distance from a contiguous face of the stopper plate so that impulse forces
15 of the grenade launcher are transitted to the external device directly through the contiguous face of the stopper plate.

17. A method of operating a barrel release and lock mechanism, said method comprising:

20 supporting a barrel of a grenade launcher with a left or right hand of a user;
using an appendage of said left or right hand to push a lever portion that protrudes on each of two sides of a receiver arm to release a barrel latch, thereby allowing a chamber end of the barrel to droop about a transverse Y-axis of a pivot disposed near a distal end of the receiver arm;

25 turning said barrel with said left or right hand so that the chamber end of the barrel is moved laterally to the left or right side of the receiver arm about a vertical Z-axis of the pivot to allow the user to load or unload a cartridge into/from the chamber of the barrel;
and

laterally turning the barrel back to align the barrel with the receiver arm and then
30 pivoting the barrel back to the receiver arm to release a spring-loaded pin so that the barrel latch is engageable with a cooperating catch and the barrel is re-connected to the receiver arm at the latch.