CLAIMS

What is claimed is:

1. A weapon system for firing a round, comprising:

a receiver;

an operating group configured to operate the weapon system through a charged condition, a firing condition, and a recoil condition, the operating group comprising

a barrel extension at least partially housed within the receiver and arranged to axially translate relative to the receiver;

an operating rod (op-rod) assembly at least partially housed and arranged to axially translate within the barrel extension in the charge condition, the firing condition, and the recoil condition; and

a bolt assembly coupled to the op-rod assembly and at least partially housed and arranged to axially translate within the barrel extension;

a barrel coupled to the barrel extension and defining a chamber;

a gas accelerator with a first end coupled to the barrel and a second end coupled to the op-rod assembly; and

a buffer assembly comprising a drive spring having a first end coupled to the receiver and a second end coupled to the op-rod assembly,

wherein, in the charged condition, the op-rod assembly and the bolt assembly are retracted against the drive spring;

wherein, in the firing condition, the op-rod assembly and bolt assembly are driven by the drive spring such that the round is guided into the chamber and the op-rod assembly and bolt assembly are locked to the barrel extension and a forward momentum of the op-rod assembly is imparted to the operating group and

the round is fired, wherein a portion of an impulse of the fired round stops the forward momentum of the operating group; and

wherein, in the recoil condition,

the operating group is driven rearward by the remaining portion of the impulse of the fired round,

the gas accelerator imparts additional rearward momentum to the op-rod assembly and bolt assembly and stops rearward momentum of the barrel and barrel extension, and

the op-rod assembly and the bolt assembly are stopped by the drive spring.

2. The weapon system of claim 1, wherein the buffer further includes a hydraulic piston configured to resist forward and rearward movement of the barrel extension.

3. The weapon system of claim 2, wherein the buffer further includes a self-centering spring configured to resist forward and rearward movement of the barrel extension.

4. The weapon system of claim 3, wherein the hydraulic piston and the self-centering spring are configured such that any force transfer between the barrel extension and the receiver occurs through the hydraulic piston and the self-centering spring.

5. The weapon system of claim 1, further comprising a lock assembly configured to secure the bolt assembly to the op-rod assembly in the charged condition through chambering the round.

6. The weapon system of claim 5, wherein the lock assembly is configured to release the bolt assembly from the op-rod assembly in the firing condition.

7. The weapon system of claim 6, wherein the lock assembly is further configured to secure the bolt assembly to the barrel extension in the firing condition.

8. The weapon system of claim 7, wherein the lock assembly includes a lock pin, a first cam defined in the op-rod assembly, and a second cam in the barrel extension, wherein the lock pin engages the first cam and the second cam to secure and release the bolt assembly relative to the barrel extension and the op-rod group.

9. The weapon system of claim 8, wherein in a first portion of the firing condition, the lock pin is engaged by the first cam and the second cam to secure the bolt assembly to the op-rod assembly such that the op-rod assembly forces the bolt assembly forward, and

wherein, in a second portion of the firing condition upon contact of the bolt assembly and the barrel extension, the lock pin disengages from the second cam and the first cam guides the lock pin such that the bolt assembly forms a locking engagement with the barrel extension.

10. The weapon system of claim 9, wherein, in the recoil condition, the rearward movement of the op-rod assembly guides the lock pin within the second cam such that the bolt assembly is released relative to the barrel extension.

11. The weapon system of claim 1, wherein in an ejection condition, a case of the round is coupled to the bolt assembly.

12. The weapon system of claim 11, wherein the barrel extension includes an extractor such that, in the ejection condition, the extractor engages the case during the rearward movement of the bolt assembly to remove round from chamber and eject the case from the weapon system.

13. A method for firing a weapon, comprising:

retracting a bolt assembly and an operating rod (op-rod) assembly relative to a barrel extension against a drive spring;

driving the bolt assembly and the op-rod assembly with a forward momentum within the barrel extension such that the bolt assembly chambers a round and contacts the barrel extension, imparting forward momentum to the op-rod assembly, the bolt assembly and the barrel extension such that the round is fired, whereby the firing of the round stops the forward momentum and imparts an impulse of rearward momentum on the op-rod assembly, the bolt assembly, and the barrel extension;

guiding gases from the round with a gas accelerator to drive the op-rod assembly rearward and to stop the rearward momentum of the barrel extension; and

absorbing the rearward momentum of the op-rod assembly with the drive spring.

14. The method of claim 13, wherein the driving step includes driving the bolt assembly and the op-rod assembly with the forward momentum that is approximately one-third to one-half of the impulse of the round.

15. The method of claim 13, further comprising the step of restraining movement of the op-rod assembly in forward and aft directions with a buffer assembly.

16. The method of claim 15, wherein the restraining step includes restraining movement of the barrel extension assembly in forward and aft directions with a soft spring and a hydraulic piston valve of the buffer assembly

17. The method of claim 13, wherein the driving step includes securing the bolt assembly to the op-rod assembly in the charged condition until the bolt assembly engages the barrel extension.

18. The method of claim 17, wherein the driving step includes releasing the bolt assembly from the op-rod assembly when the bolt assembly engages the barrel extension.

19. The method of claim 18, wherein the driving step includes securing the bolt assembly to the barrel extension during the contact with the barrel extension.

20. The method of claim 19, wherein the step of securing the bolt assembly to the barrel extension includes guiding a cam on the bolt assembly into a cam relief of a hold-up cam on the barrel extension and down an op-rod cam on the op-rod assembly such that a first lock surface of bolt assembly pivots to engage a second lock surface of the bolt assembly.

CLAIMS

What is claimed is:

1. A weapon system for firing a round, comprising:

a receiver;

an operating group configured to operate the weapon system through a charged condition, a firing condition, and a recoil condition, the operating group comprising

a barrel extension at least partially housed within the receiver and arranged to axially translate relative to the receiver;

an operating rod (op-rod) assembly at least partially housed and arranged to axially translate within the barrel extension in the charge condition, the firing condition, and the recoil condition; and

a bolt assembly coupled to the op-rod assembly and at least partially housed and arranged to axially translate within the barrel extension;

a barrel coupled to the barrel extension and defining a chamber;

a gas accelerator with a first end coupled to the barrel and a second end coupled to the op-rod assembly; and

a buffer assembly comprising a drive spring having a first end coupled to the receiver and a second end coupled to the op-rod assembly,

wherein, in the charged condition, the op-rod assembly and the bolt assembly are retracted against the drive spring;

wherein, in the firing condition, the op-rod assembly and bolt assembly are driven by the drive spring such that the round is guided into the chamber and the op-rod assembly and bolt assembly are locked to the barrel extension and a forward momentum of the op-rod assembly is imparted to the operating group and the round is fired, wherein a portion of an impulse of the fired round stops the forward momentum of the operating group; and

wherein, in the recoil condition, the operating group is driven rearward by the remaining portion of the impulse of the fired round, the gas accelerator imparts additional

rearward momentum to the op-rod assembly and bolt assembly and stops rearward momentum of the barrel and barrel extension, and the op-rod assembly and the bolt assembly are stopped by the drive spring.

2. The weapon system of claim 1, wherein the buffer further includes a hydraulic piston configured to resist forward and rearward movement of the barrel extension.

3. The weapon system of claim 2, wherein the buffer further includes a buffer spring configured to resist forward and rearward movement of the barrel extension.

4. The weapon system of claim 3, wherein the hydraulic piston and the buffer spring are configured such that any force transfer between the barrel extension and the receiver occurs through the hydraulic piston and the buffer spring.

5. The weapon system of claim 1, further comprising a lock assembly configured to secure the bolt assembly to the op-rod assembly in the charged condition through chambering the round.

6. The weapon system of claim 5, wherein the lock assembly is configured to release the bolt assembly from the op-rod assembly in the firing condition.

7. The weapon system of claim 6, wherein the lock assembly is further configured to secure the bolt assembly to the barrel extension in the firing condition.

8. The weapon system of claim 7, wherein the lock assembly includes a lock pin, a first cam defined in the op-rod assembly, and a second cam in the barrel extension, wherein the lock pin engages the first cam and the second cam to secure and release the bolt assembly relative to the barrel extension and the op-rod group.

9. The weapon system of claim 8, wherein in a first portion of the firing condition, the lock pin is engaged by the first cam and the second cam to secure the bolt assembly to the op-rod assembly such that the op-rod assembly forces the bolt assembly forward, and wherein, in a second portion of the firing condition upon contact of the bolt assembly and the barrel extension, the lock pin disengages from the second cam and the first cam guides the lock pin such that the bolt assembly forms a locking engagement with the barrel extension.

10. The weapon system of claim 9, wherein, in the recoil condition, the rearward movement of the op-rod assembly guides the lock pin within the second cam such that the bolt assembly is released relative to the barrel extension.

11. The weapon system of claim 1, wherein in an ejection condition, a case of the round is coupled to the bolt assembly.

12. The weapon system of claim 11, wherein the barrel extension includes an extractor such that, in the ejection condition, the extractor engages the case during the rearward movement of the bolt assembly to remove round from chamber and eject the case from the weapon system.

13. A method for firing a weapon, comprising:

retracting a bolt assembly and an operating rod (op-rod) assembly relative to a barrel extension against a drive spring;

driving the bolt assembly and the op-rod assembly with a forward momentum within the barrel extension such that the bolt assembly chambers a round and contacts the barrel extension, imparting forward momentum to the op-rod assembly, the bolt assembly and the barrel extension such that the round is fired, whereby the firing of the round stops the forward momentum and imparts an impulse of rearward momentum on the op-rod assembly, the bolt assembly, and the barrel extension,

the forward momentum and imparts an impulse of rearward momentum on the op-rod assembly, the bolt assembly, and the barrel extension,

wherein the driving step includes securing the bolt assembly to the op-rod assembly in the charged condition until the bolt assembly engages the barrel extension, wherein the driving step includes releasing the bolt assembly from the op-rod assembly when the bolt assembly engages the barrel extension, wherein the driving step includes securing the bolt assembly to the barrel extension during the contact with the barrel extension;

guiding gases from the round with a gas accelerator to drive the op-rod assembly rearward and to stop the rearward momentum of the barrel extension; and

absorbing the rearward momentum of the op-rod assembly with the drive spring.

14. The method of claim 13, wherein the driving step includes driving the bolt assembly and the op-rod assembly with the forward momentum that is approximately one-third to one-half of the impulse of the round.

15. The method of claim 13, further comprising the step of restraining movement of the op-rod assembly in forward and aft directions with a buffer assembly.

16. The method of claim 15, wherein the restraining step includes restraining movement of the barrel extension assembly in forward and aft directions with a soft spring and a hydraulic piston valve of the buffer assembly

17. The method of claim 13, wherein the step of securing the bolt assembly to the barrel extension includes guiding a cam on the bolt assembly into a cam relief of a hold-up cam on the barrel extension and down an op-rod cam on the op-rod assembly such that a first lock surface of bolt assembly pivots to engage a second lock surface of the bolt assembly.