CLAIMS

What is claimed is:

1. A windup swing assembly comprising:

a frame assembly comprising a housing;

a drive spring positioned within the housing and having a drive spring axis (X3) oriented in a non-vertical direction relative to a vertical plane;

a swing arm assembly connected to the frame assembly to receive energy from the drive spring, the swing arm assembly including a swing arm and a swing arm pivot, the swing arm is rotatable about a swing arm axis (X1) that is oriented in a non-horizontal direction relative to a horizontal plane; and

a wind mechanism comprising a wind shaft positioned along the drive spring axis (X3), the wind mechanism having a first end connected to a crank assembly and a second end connected to a spool;

wherein the drive spring includes a first end connected to an attachment plate arranged around the wind shaft and a second end connected to the spool, such that rotation of the wind shaft winds the drive spring via the spool.

2. The windup swing assembly of claim 1, wherein the wind mechanism further includes:

a first winding gear arranged around the wind shaft and attached to the attachment plate; and

a second winding gear meshed with the first winding gear;

wherein a release of stored energy from the drive spring rotationally drives the first winding gear which rotationally drives the second winding gear;

an escapement assembly connected to the frame assembly, the escapement assembly comprising an escapement shaft connected to the second winding gear to rotationally drive the escapement shaft, the escapement shaft being oriented along an escapement axis (X2), the escapement assembly including:

a carriage coupled to the escapement shaft and configured to rotate about the escapement axis (X2); and

a pusher comprising a first end connected to the carriage and a second end connected to the swing arm assembly;

wherein the pusher drives the swing arm assembly to rotate when the escapement gear is driven by the release of stored energy from the drive spring via the connection of the escapement shaft to the second winding gear; and

an escapement gear fixed to the escapement shaft and configured to be driven via the second winding gear, the escapement gear including a plurality of teeth.

3. The windup swing assembly of claim 2, wherein the escapement assembly further includes:

a pawl pivotally attached to the frame assembly, the pawl including a pawl tooth selectively engageable with a tooth of the escapement gear to prevent the escapement gear from rotating in a drive direction when the swing arm is a neutral state;

a dog pivotally attached to the carriage and selectively engageable with a tooth of the escapement gear when the swing arm is rotated and the pawl tooth is disengaged from the escapement gear;

an amplitude control assembly; and

an amplitude control lever;

wherein the amplitude control lever includes a first stop and a second stop that are spaced apart from each other and are each configured to control a swing amplitude.

4. The windup swing assembly of claim 3, wherein the amplitude control assembly includes a drop plate configured to selectively limit a stroke of the dog, and the amplitude control lever is configured to selectively adjust a position of the drop plate, wherein the drop plate includes an engagement portion configured to engage with a portion of the dog and an appendage configured to engage with a portion of the amplitude control lever.

5. The windup swing assembly of claim 4, wherein the amplitude control lever includes an off position.

6. The windup swing assembly of claim 5, wherein a housing supporting the amplitude control assembly includes a downward stop for limiting further movement of the amplitude control lever, the downward stop corresponding to the off position of the amplitude control lever.

7. The windup swing assembly of claim 4, further comprising a gap between the appendage configured to engage with a portion of the amplitude control lever and the housing supporting the amplitude control assembly when the amplitude control lever is in the off position such that the drop plate can float.

8. A windup swing assembly comprising:

a frame assembly comprising a housing;

a drive spring positioned within the housing and having a drive spring axis (X3) oriented in a non-vertical direction relative to a vertical plane;

a swing arm assembly connected to the frame assembly to receive energy from the drive spring, the swing arm assembly including a swing arm and a swing arm pivot, the swing arm is rotatable about a swing arm axis (X1) that is oriented in a non-horizontal direction relative to a horizontal plane;

a wind mechanism comprising a wind shaft positioned along the drive spring axis (X3); and

a torque limiting clutch configured to prevent overwinding of the drive spring.

9. The windup swing assembly of claim 8, wherein the torque limiting clutch is supported radially at a rotation axis thereof.

10. The windup swing assembly of claim 8, wherein an outer lower bearing circumference of the torque limiting clutch is supported axially by the housing.

11. The windup swing assembly of claim 10, further comprising a low friction spacer interposed between the housing and the lower bearing circumference of the torque limiting clutch.

12. The windup swing assembly of claim 8,wherein an outer upper bearing circumference of the torque limiting clutch is supported axially by a crown.

13. The windup swing assembly of claim, 8, wherein the wind mechanism has a first end connected to a crank assembly and a second end connected to a spool.

14. The windup swing assembly of claim 13, wherein the torque limiting clutch comprises a torque clutch spring assembled on the spool and configured to wind when the wind shaft is rotated in a winding direction and to slip when the drive spring is wound over a predetermined torque.

15. The windup swing assembly of claim 14, further comprising a wind mechanism comprising a wind shaft positioned along the drive spring axis (X3), the wind mechanism having a first end connected to a crank assembly and a second end connected to a spool;

wherein the torque limiting clutch comprises:

a first housing operatively connected to the crank assembly, the first housing including clutch driver toothing;

a clutch hub fixed to the crank assembly; and

a clutch pawl pivotally connected to the clutch hub via a biasing element, the clutch pawl biased by the biasing element to selectively engage the clutch driver toothing;

wherein when the drive spring is wound via the crank assembly, the clutch pawl engages the clutch driver toothing up to a predetermined torque limit to transmit torque from the crank assembly to the drive spring, and

when torque transmitted by the crank assembly to the drive spring exceeds the predetermined torque limit, the clutch pawl disengages the clutch driver toothing to prevent further transmission of torque from the crank assembly to the drive spring.

16. The windup swing assembly of claim 8, wherein the torque limiting clutch comprises:

an input shaft connected to the crank assembly;

an output shaft connected to the drive spring;

a cap fixed to the input shaft; and

a clutch spool fixed to the output shaft and clamped to the cap;

wherein the cap and spool are configured to slip relative to one another when a predetermined force is overcome to prevent the drive spring from being overwound.

17. The windup swing assembly of claim 16, wherein the torque limiting clutch comprises:

a shaft connected to the crank assembly;

an input hub comprising at least one catch; and

an output hub connected to the shaft, the output hub comprising at least one protrusion engageable with the catch;

wherein the at least one protrusion is configured to disengage from the at least one catch when a predetermined force from the crank assembly is overcome to prevent the drive spring from being overwound.

18. The windup swing assembly of claim 17, wherein the at least one catch is a resilient member biased toward engagement with the at least one protrusion.

19. The windup swing assembly of claim 17, wherein the at least one catch is pivotally attached to the input hub.

20. The windup swing assembly of claim 17, further comprising a spring connected to the at least one catch and biasing the at least one catch toward engagement with the at least one protrusion.