Feb. 24, 1953 C. B. PEARSON 2,629,287

ANTIROLLBACK BRAKE FOR AMMUNITION BOOSTERS

Filed Jan. 10, 1948 2 SHEETS—SHEET 1

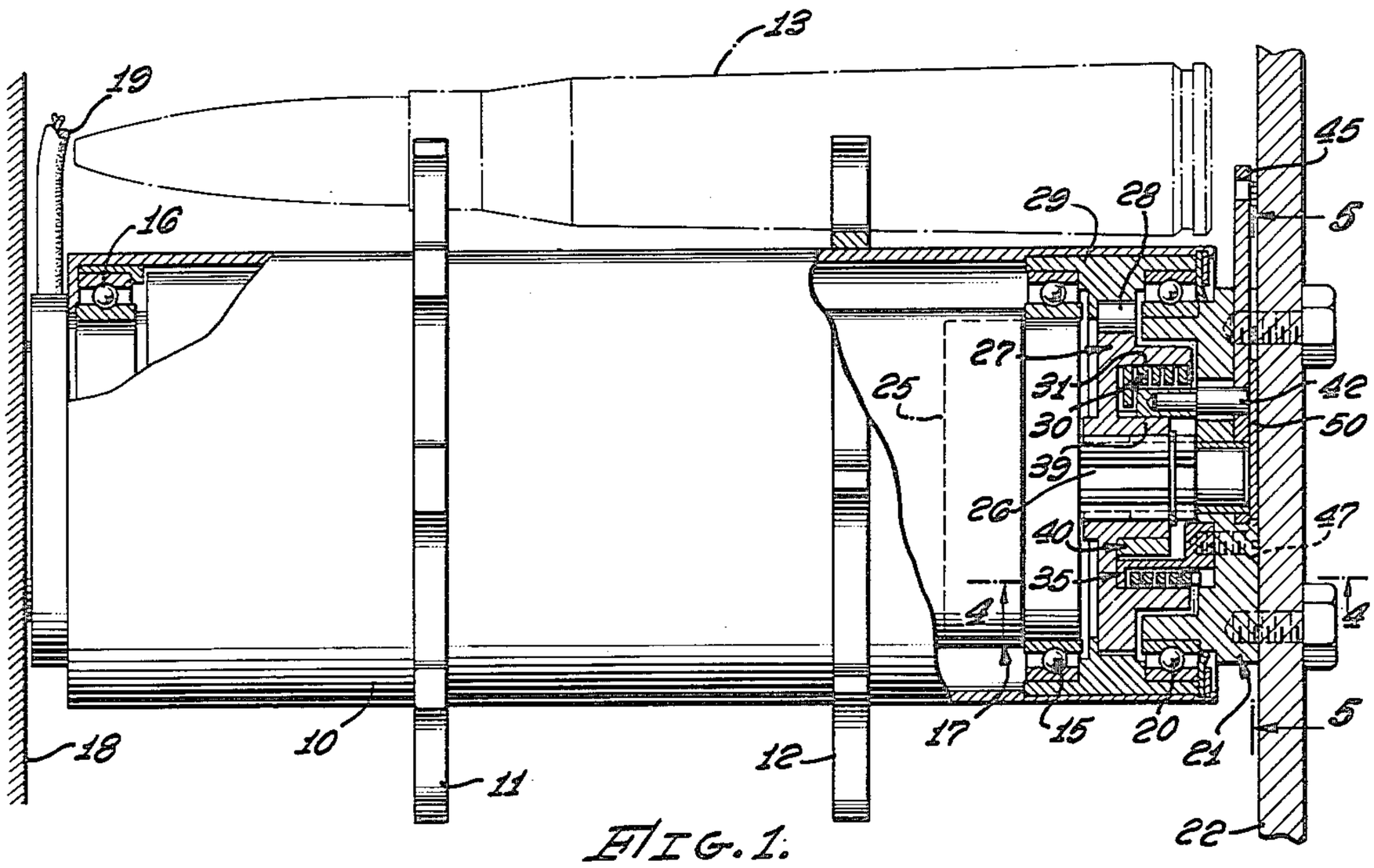


FIG. 1.

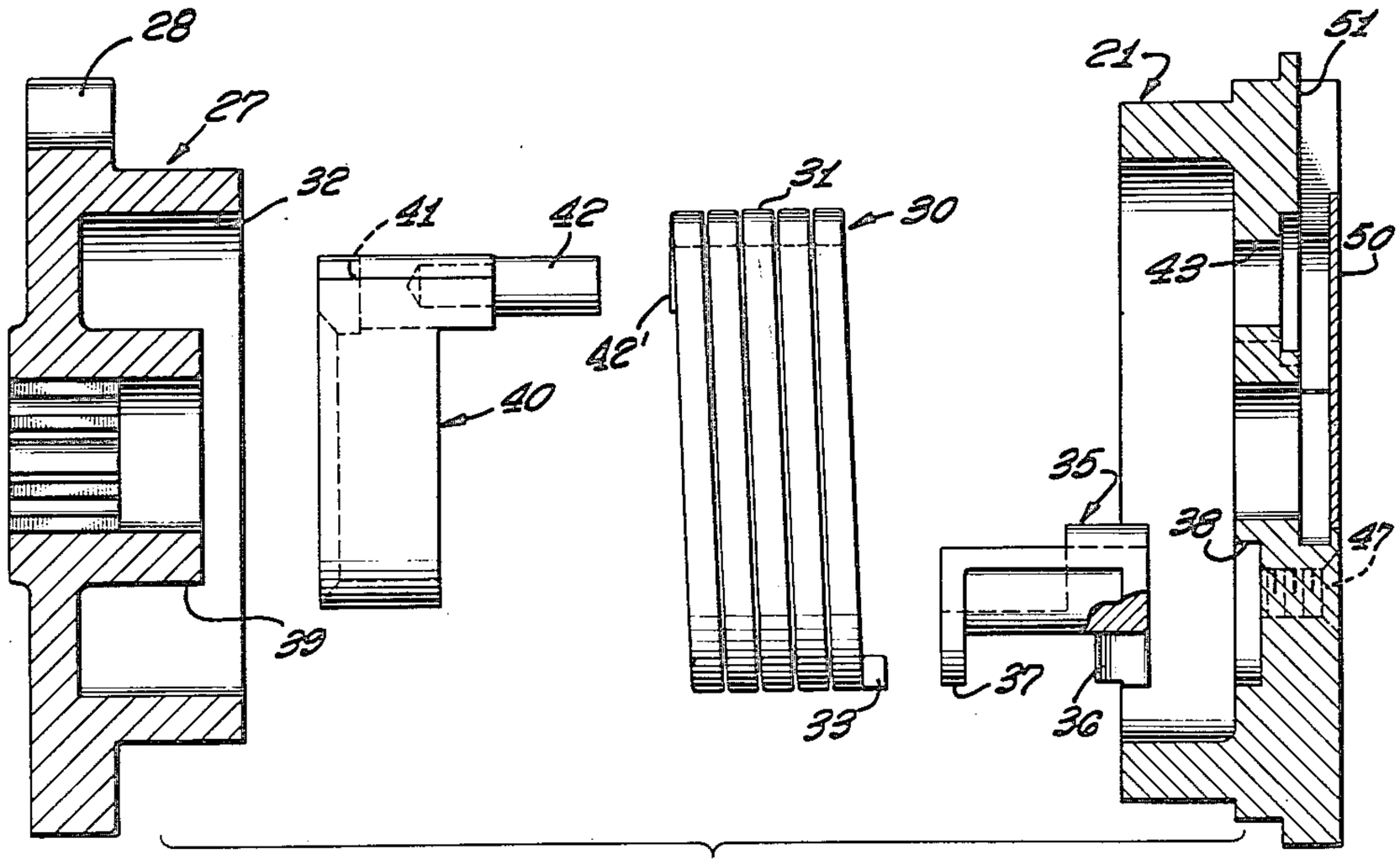


FIG. 2.

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FIG. 5.

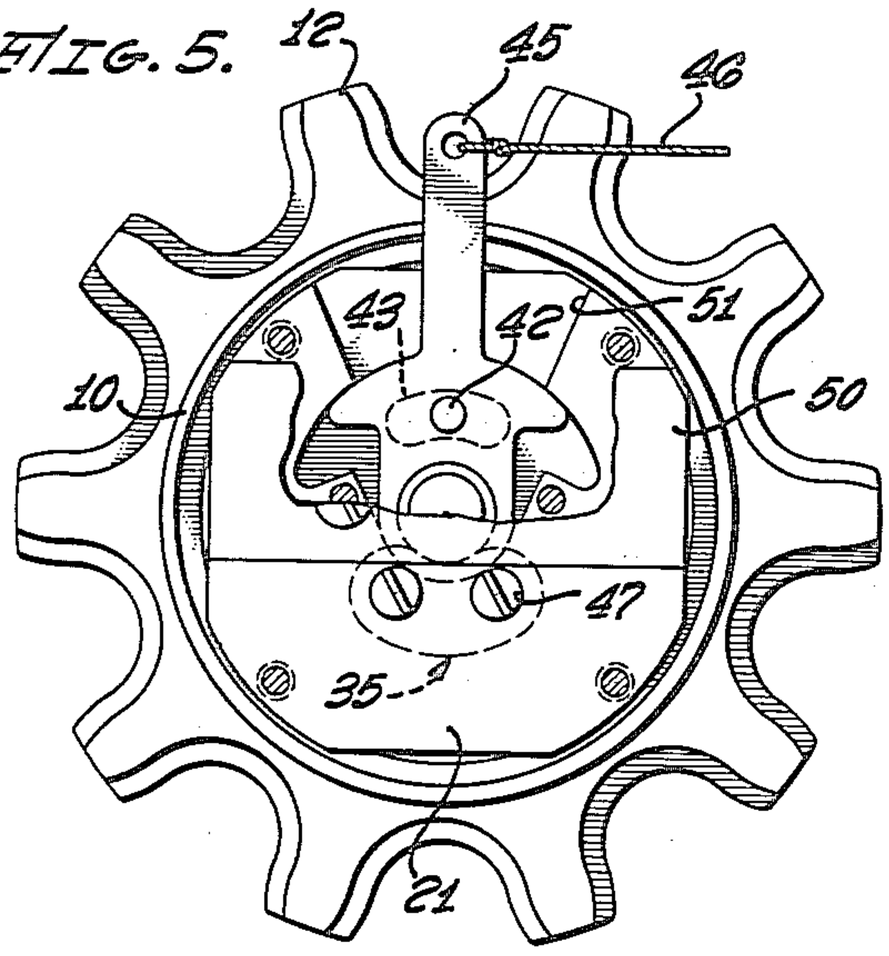



FIG. 7.

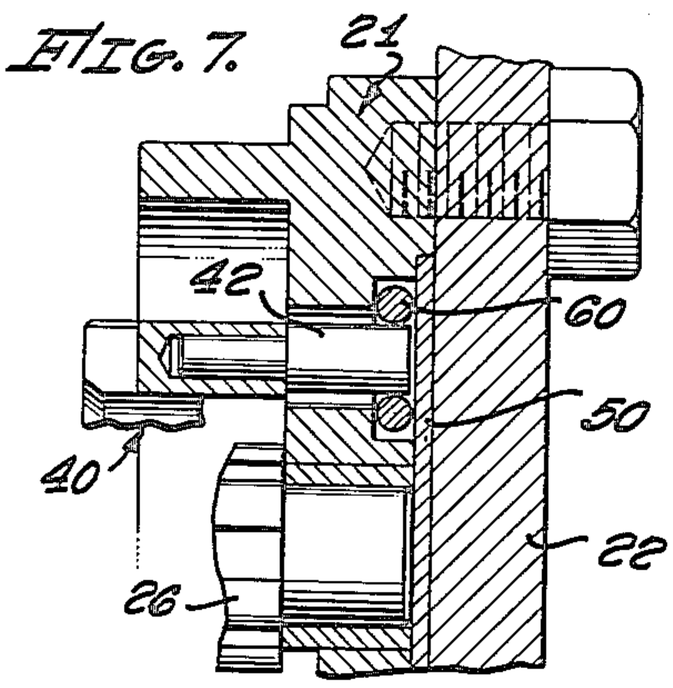



FIG. 6.

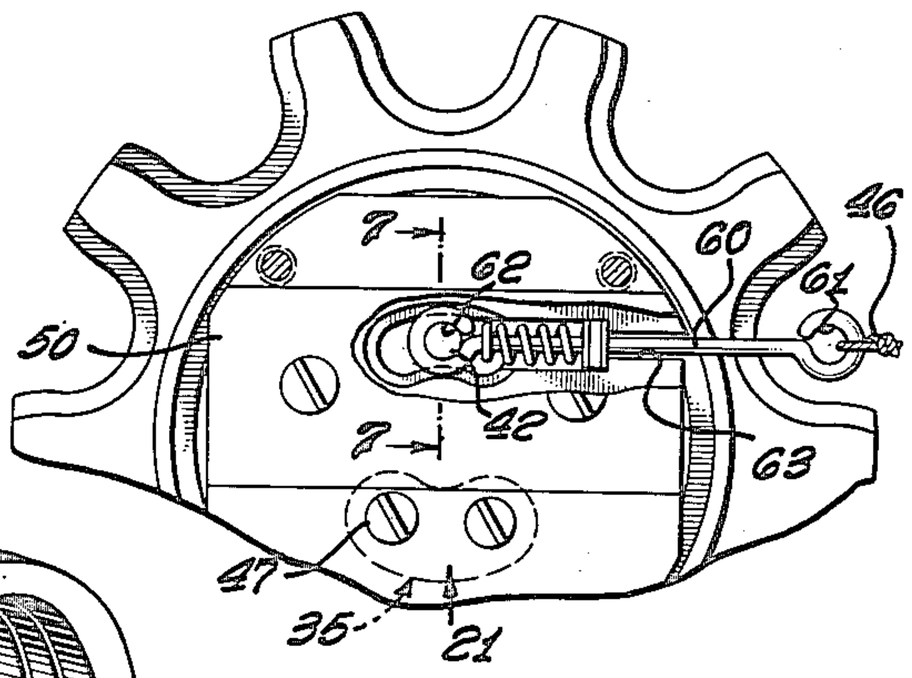
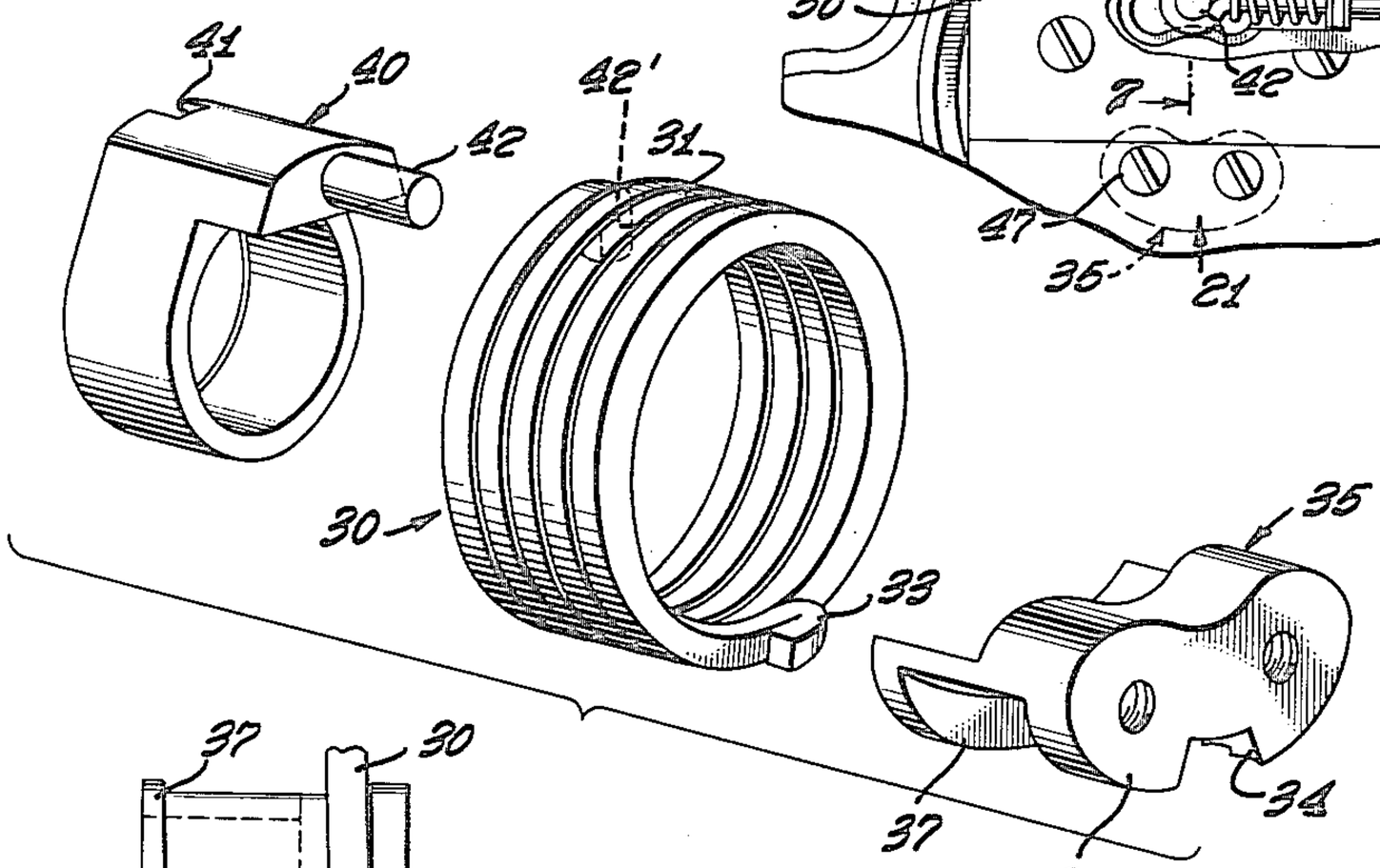



FIG. 3.



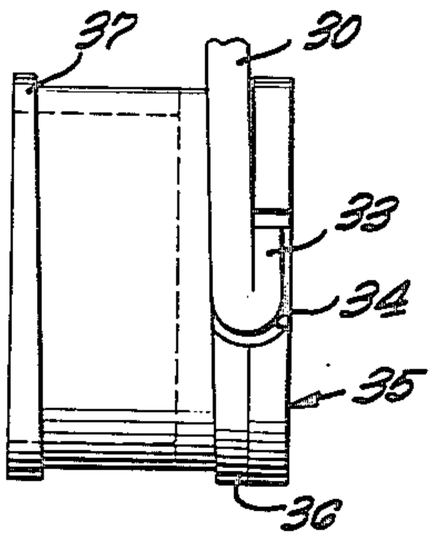




FIG. 4

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# UNITED STATES PATENT OFFICE

2,629,287

## ANTIROLLBACK BRAKE FOR AMMUNITION BOOSTERS

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Application January 10, 1948, Serial No. 1,573

15 Claims. (Cl. 89—33)

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This invention relates generally to ammunition boosters for use in feeding ammunition to an automatic gun. More particularly this invention relates to a brake assembly associated with the drive of such a booster, the purpose of which is to prevent retrograde motion of the ammunition belt except when desired and upon voluntary operation of a suitable brake releasing means.

The booster mechanism embodying the present invention is comprised of a relatively small electric motor surrounded by a hollow tubular sprocket, rotatably mounted with respect to the motor and adapted by suitably positioned sprocket teeth, to feed a belt of machine gun ammunition over it in the manner of a sprocket chain. A free wheeling connection is provided between the motor and the sprocket so that when the motor is energized, rotary power is delivered from the motor to the sprocket, but when the motor is unenergized, the belt may be pulled freely over the sprocket by the firing action of the gun. Thus if the electrical system is disabled, making it impossible to energize the motor, the gun may still be fired in a normal manner. A booster mechanism embodying the foregoing features is disclosed in the co-pending application of Claude C. Slate, Serial No. 444,755 filed May 27, 1942, now Letters Patent No. 2,436,404 issued February 24, 1948.

The present invention relates to an improvement of the booster mechanism disclosed in the Slate application, said improvement comprising an anti-rollback device to prevent retrograde motion of the ammunition belt. Retrograde motion of the ammunition belt may take place when the guns are not firing, when the motor is de-energized, or when a momentary force, greater than that exerted by the motor and gun acting in unison, is applied in a backward direction to the belt. One type of anti-rollback device is disclosed in the copending application of Leif E. Jenssen and John A. Warren, Serial No. 779,046, filed October 10, 1947, in which the device is interposed in the train of reduction gearing and on a shaft extending from the output pinion which engages the final driven gear.

According to the present invention the anti-rollback device is incorporated into the free wheeling connection of the booster transmission in such a manner that the least possible movement of the ammunition belt will cause the device to energize and stop the backward rotation of the belt. The device comprises a coil spring in continuous frictional engagement with an internal cylindrical surface of the driving member of the free wheeling connection. In addition, the anti-rollback device includes selectively operable means for overcoming the action of the spring in order to permit backward rotation of the belt whenever desired.

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Therefore, it is an object of the present invention to provide an ammunition booster having an anti-rollback device incorporated into the free wheeling connection of the booster.

It is a further object of this invention to provide an anti-rollback device concentrically located within the driving member of the free-wheeling clutch, and to thus provide a powerful, self-energizing one-way brake in the power train close to the belt moving sprockets.

It is an additional object to locate such a brake in the power train where the least possible retrograde movement of the ammunition belt will cause the brake to energize and stop the backward rotation of the sprockets and the belt, and where the brake will not restrain the forward and independent movement of the belt.

It is another object of the invention to provide a single member which operates as part of the free-wheeling clutch, and which also operates as part of the anti-rollback brake.

It is a still further object to provide an anti-rollback brake of the coil spring type which is self-energized by its own spring tension, and which is in constant frictional engagement with an internal cylindrical surface existing within the driving member of the free-wheeling clutch.

Still another object is to provide means to overcome the self-energizing effect of the brake so as to permit backward movement of the belt when required; for example, when unloading the ammunition from the belt.

For a more detailed description of a booster mechanism incorporating the present invention, reference should now be had to the attached drawings in which:

Figure 1 is a partially sectioned elevational view of an electrically powered booster embodying the present invention;

Figure 2 is an enlarged exploded view of portions of the device shown in Figure 1, these parts being separated to illustrate their individual shapes;

Figure 3 is a perspective view showing certain of the parts shown in Figure 2;

Figure 4 is a bottom view of some of the parts of the device shown in Figure 1, the view being taken on the line 4—4 in Figure 1;

Figure 5 is an elevational section taken on the line 5—5 in Figure 1;

Figure 6 is a view taken similarly to Figure 5 of a modified form of the invention; and,

Figure 7 is an enlarged elevational section taken on the line 7—7 in Figure 6.

Referring now to the drawings, and particularly to Figure 1 thereof, it will be seen that the booster embodying this invention comprises an outer rotatable shell 10 on which are welded or otherwise secured a pair of aligned tooth members 11 and 12 adapted to engage ammunition of the type shown in phantom line in Figure 1 and identified by the reference character 13.

The shell 10 is rotatably supported on ball bearings 15 and 16, the inner races of which are carried on the housing of an electric motor 17 which is secured to a vertical supporting surface 18 and supplied with power by a two conductor lead 19.

The forward ends (to the right in Figure 1) of shell 10 is additionally supported by a ball bearing 20, the inner race of which is supported on a fixed drum-shaped member 21 secured to a support plate 22. The ball bearing 20 additionally serves to align motor 17 coaxially with drum-shaped member 21.

The motor 17 includes within the forward end of its housing, a gear reduction 25 indicated in dotted lines in Figure 1 which delivers rotary power to a forwardly projecting splined shaft 26 which carries affixed thereto, the inner member 27 of a roller-jam overrunning clutch. This clutch is of the type shown in the above mentioned co-pending application, Serial No. 444,755.

The inner clutch member 27 is provided with a number of peripheral wedge shaped openings carrying rollers 28 adapted to engage by jamming action, an outer clutch member 29 which is attached to, and drives shell 10 and also carries the outer races of ball bearings 15 and 20. Thus when motor 17 is energized to drive shaft 26 in a clockwise direction (Figure 5) the jamming action of rollers 28 directly couples inner member 27 and the outer member 29 of the overrunning clutch whereby to drive shell 10 in a clockwise direction.

As previously mentioned, the purpose of the present invention is to provide an anti-rollback brake so shell 10 may run freely in a forward, i. e., clockwise direction, but will be normally prevented from rotating in a counterclockwise direction. This purpose is accomplished by an assembly of parts best seen in Figure 2. The anti-rollback brake of this invention comprises a close wound coil spring 30, the outer peripheral surface 31 of which is placed in light frictional contact with an inner cylindrical surface 32 of clutch member 27 when these parts are assembled. One end of spring 30 is held fixed by a terminal lug 33 positioned in a socket 34 of a stationary kidney shaped member 35 to be described more fully hereinafter.

Since spring 30 is wound away from lug 33 in a clockwise direction, when the motor 17 is energized to drive the shell 10 in a clockwise direction, the frictional contact of the rotating clutch member 27 with spring 30 tends to wrap the spring 30 in a direction to reduce its diameter. Therefore when shell 10 rotates in a clockwise direction the frictional contact pressure of spring 30 with clutch member 27 is reduced and clutch member 27 and shell 10 permitted to rotate freely. If, however, it is attempted to rotate clutch member 27 in a counterclockwise direction, the frictional engagement with spring 30 tends to unwrap



the same whereby to increase its external diameter and jam it against internal cylindrical surface 32 of clutch member 27 and effectively stop counter rotation.

In order to take maximum advantage of this wrapping and unwrapping action of spring 30, it is desirable that the turns of spring 30 be held in close contact with each other and spring 30 be prevented from elongating axially to separate the turns. The coils of spring 30 are held in this closed position by a pair of downwardly extending flanges 36 and 37 formed in kidney shaped member 35. As can be seen in Figure 4, the inner surfaces of flanges 36 and 37 are helically shaped so as to conform to the end surfaces of spring 30.

The kidney shaped member 35 is fixed with respect to the rotating parts of the assembly being received in a suitably shaped recess 38 formed in the inner surface of drum-shaped member 21, and held in place by a pair of screws 47.

As previously mentioned, another of the important features of an assembly of the class under discussion, is that the anti-rollback brake be releasable upon occasion, to permit counter rotation of the booster drive members. It will be realized that an independent force operating on coil spring 30 tending to wrap spring 30 and reduce its external diameter will effectively disengage the spring from inner clutch member 27 and permit free rotation of member 27 in either direction.

This independent wrapping action of spring 30 is accomplished by a core member 40 rotatably supported on a hub 39 in inner clutch member 27 and positioned within spring 30. The core member 40 is provided with a radial recess 41 into which an inwardly extending terminal lug 42' of spring 30 projects. The result of this is that if core member 41 is rotated in a clockwise direction, spring 30 is wrapped in a direction to reduce its diameter whereby to release the anti-rollback brake. On the other hand, if core member 40 is rotated in a counterclockwise direction, spring 30 is unwrapped with the result that the brake is engaged. The rotary bias of spring 30 is such as to normally move core member 40 to the latter position, i. e., with the anti-rollback brake engaged or engageable.

The core member 40 is provided with a crank pin 42 which projects forwardly through an arcuately slotted opening 43 to the back of fixed drum-shaped member 21. An operating lever 45 is pivotally carried by a smooth stub end of shaft 26 to permit rocking motion of lever 45 about the axial center of the booster assembly. The pin 42 is received in a suitable hole in lever 45 so that motion of the lever in a clockwise direction tends to wrap spring 30, and vice versa. An operating cable 46 is provided in order that lever 45 may be operated from a remote point.

A cover plate 50 is secured to the forward end of the assembly to seal the interior against foreign matter, and additionally to hold lever 45 in place. As can be seen best in Figure 2, drum-shaped member 21 is milled away on its forward surface, as indicated by the numeral 51 whereby to receive lever 45.

In a modified form of the invention illustrated in Figures 6 and 7, lever 45 is dispensed with and a link 60 and the eyes 61 and 62 formed in the ends thereof, is engaged directly with pin 42 and brought out through a suitable slot 63 to be directly connected to operating cable 46. As in the previous embodiment, cover plate 50 serves to hold link 60 in place. A small coil com-

pression spring 65 is provided surrounding the shank of link 60 and anchored in stationary member 21 whereby to exert a thrusting action on link 60 to aid counterclockwise rotation of core member 40 in moving spring 30 to its normally expanded position.

The invention operates as follows. When loading ammunition over the booster assembly, during which operation free rotation in either direction is desired, tension is applied to operating cable 46. The result of such tension is to rotate core member 40 in a clockwise direction, thus radially contracting spring 30 and reducing its diameter whereby to disengage spring 30 from interior cylindrical surface 32 of inner clutch member 27. With the anti-rollback brake disengaged in this manner, shell 10 may be rotated in either direction. When shell 10 is rotated counterclockwise the result is to engage the roller jammed clutch whereby to rotate inner clutch member 27 and eventually motor 17 through gear transmission 25.

When the ammunition magazines have been loaded in the manner just described, tension in the cable 46 is then released, permitting spring 30 to expand to its normal position in light frictional engagement with surface 32. Such frictional engagement does not prevent the free forward motion of the booster under the power of the motor, but the instant that backward urging torque is applied to tooth member 12, spring 30 is caused to expand radially somewhat, bringing it into secure engagement with surface 32 and preventing backward motion.

It is thus seen that this invention discloses an anti-rollback brake, opposing any backward urging torque in the booster and self-energized by its own tension, to prevent any counter rotation of the sprocket or the motor. Furthermore, means are disclosed to selectively overcome the self-energizing action of the brake so as to permit free movement of the booster in either direction, whenever such movement is desired.

While the anti-rollback brake systems shown and described herein are fully capable of achieving the objects and providing the advantages hereinbefore stated, it is realized that they are capable of considerable modification by those skilled in the art without departing from the spirit of the invention. Therefore the protection sought is not meant to be limited to the scope of the forms shown and described, but rather to the scope of the appended claims.

I claim:

1. In an ammunition booster having an ammunition carrying sprocket and a rotary power source, a power transmission for driving the sprocket from the power source, said transmission comprising: overrunning clutch means connected between said independent power source and said sprocket, to drive said sprocket in a given direction and to permit said sprocket to run freely in said given direction at a speed greater than the speed of said power source, said clutch means including a rotating member having an inner cylindrical surface, stationary supporting means positioned adjacent said member; an anti-rollback member supported on said supporting means and normally frictionally engaged with said surface to permit rotation of said rotating member in said given direction but to prevent counter rotation of said rotating member; and means operatively connected to said anti-rollback member for selectively disengaging said anti-rollback member from said rotating member to permit free rotation of said rotating member in either direction.



2. In an ammunition booster having an ammunition carrying sprocket and a rotary power source, a power transmission for driving the sprocket from the power source, said transmission comprising: overrunning clutch means connected between said power source and said sprocket to drive said sprocket in one direction and to permit said sprocket to run freely in said one direction at a speed greater than the speed of said power source, said clutch means including a rotating member having a cylindrical friction surface; and anti-rollback means frictionally engaged with said friction surface to permit rotation of said member in said one direction but to prevent counter rotation of said member.

3. In an ammunition booster having an ammunition carrying sprocket and a rotary power source, a power transmission for driving the sprocket from the power source, said transmission comprising: overrunning clutch means connected between said power source and said sprocket to drive said sprocket in a given direction and to permit said sprocket to run freely in said given direction at a speed greater than the speed of said power source, said clutch means including a rotating member; anti-rollback means including an expansible member in frictional contact with said rotating member, said expansible member being expansible upon rotation of said rotating member in a direction counter to said given direction whereby to increase the pressure of said frictional contact and prevent further counter rotation; and control means engaged with said expansible member to contract said expansible member thereby to selectively permit free rotation of said rotating member in either direction.

4. In an ammunition booster having an ammunition carrying sprocket and a rotary power source, a power transmission for rotating the sprocket from the power source in one direction, said transmission comprising: a rotatable member coupled between said sprocket and said power source for rotating said sprocket in said one direction said member having an interior cylindrical surface; stationary supporting means adjacent said member; and a close wound coil spring having one end fixed to said supporting means and having its exterior surface in frictional contact with said cylindrical surface, said spring being wound away from said one end in said one direction whereby rotation of said member in said one direction contracts said spring to reduce the pressure of said frictional contact while rotation of said member in a direction counter to said one direction expands said spring to increase said pressure and stop said counter rotation.

5. In an ammunition booster having an ammunition carrying sprocket and a power source, a power transmission for driving the sprocket from the power source, said transmission comprising: a rotatable member coupled between the power source and the sprocket for rotating the sprocket in one direction, said member having an interior cylindrical surface; a radially expansible coil spring having a fixed end, the peripheral surface of said spring being in frictional contact with said interior surface of said member, said spring being expansible by partial rotation of said member in a direction counter to said one direction to increase the pressure of further frictional contact and prevent said counter rotation; and manual control means for disengag-

ing said spring from said interior surface of said member, said control means including rotatable means coupled with the unsecured end of said spring and rotatable in said one direction to confrom said member and permit free rotation of tract said spring thereby to disengage said spring said member in either direction.

6. In an ammunition booster having an ammunition carrying sprocket and a rotary power source, a power transmission for driving the sprocket from the power source, said transmission comprising a rotatable member coupled between the power source and the sprocket for rotating the sprocket in one direction, said member having an interior cylindrical surface; stationary supporting means adjacent said member and including a bearing rotatably supporting said sprocket; a close wound coil spring fixed at one end to said supporting means and having its peripheral surface in frictional contact with said cylindrical surface, said spring being wound away from said one end in said one direction whereby rotation of said member in said one direction contracts said spring to reduce the pressure of said frictional contact while rotation of said member in a direction counter to said one direction expands said spring to increase said pressure and stop said counter rotation; and manual control means for disengaging said spring from said cylindrical surface, said control means including a core member coupled with the unsecured end of said spring and rotatable in said one direction to contract said spring to disengage said spring from said rotatable member and permit free rotation of said rotatable member in either direction, a crank pin on said core member, and control cable means operatively connected to said pin for rotating said core member.

7. In an ammunition booster having an ammunition carrying sprocket and a power source, a power transmission for rotating the sprocket from the power source in one direction, said transmission including: a rotatable member coupled between the power source and the sprocket for rotating the sprocket in said one direction, said member having an interior cylindrical surface; a radially expansible coil spring having its peripheral surface in frictional contact with said cylindrical surface of said rotatable member, said spring being expansible by rotation of said rotatable member in a direction counter to said one direction to increase the pressure of said frictional contact and prevent further counter rotation; manual control means for disengaging said spring from said cylindrical surface of said rotatable member, said control means including a core member coupled with the unsecured end of said spring and rotatable in said one direction to contract said spring to disengage said spring from said rotatable member and permit free rotation of said rotatable member in either direction; and an auxiliary spring operatively connected to said control means to resist the disengaging action of said control means.

8. An ammunition booster comprising: a sprocket for engaging and moving a belt of ammunition, said sprocket having a hollow cylindrical body; power means positioned within said hollow body, said power means including a motor, a shaft coaxial with said body and reduction gearing for delivering rotary power from said motor to said shaft; an overrunning clutch having a drive member secured to said



shaft, a driven member secured to said body, and means positioned between said drive and driven members for driving said driven member from said drive member in one direction and to permit said driven member to overrun said drive member, said drive member having an interior cylindrical friction surface; supporting means, positioned adjacent said clutch, for rotatably mounting said sprocket; anti-rollback means including a close wound coil spring having first and second ends and having its exterior peripheral surface in frictional contact with said cylindrical surface and, a holding member secured to said drum shaped member and secured to said first end of said spring, said holding member including flanges to prevent axial expansion of said spring, said spring being wound away from said first end in said one direction to permit rotation of said drive member in said one direction but to prevent rotation of said drive member in a direction opposite to said one direction; and manual control means for said spring, said control means including a core member coupled with said second end of said spring and rotatable in said one direction to contract said spring to disengage said spring from said cylindrical surface and permit free rotation of said drive member in either direction.

9. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the sprocket from the source, said transmission comprising: over-running clutch means connected between said power source and said sprocket to drive said sprocket in a given direction and to permit said sprocket to run freely in said given direction at a speed greater than the speed of said power source, said clutch means including a rotating member having a smooth friction surface; stationary supporting means positioned adjacent said member; and a yieldable anti-rollback member supported on said supporting means, said anti-rollback member being in frictional engagement with said surface to permit rotation of said rotating member in said given direction but to prevent counter rotation thereof.

10. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the sprocket from said source, said transmission comprising: over-running clutch means connected between said source and said sprocket to drive said sprocket in one direction and to permit said sprocket to run freely in said one direction at a speed greater than the speed of said source, said clutch means including a rotating member; and anti-rollback means coupled to said rotating member for preventing rotation of said rotating member in a direction counter to said one direction, said anti-rollback means including a coil spring having its exterior peripheral surface in frictional contact with said rotating member, and fixed supporting means coupled to said spring to prevent axial expansion of said spring, said spring having one end secured to said supporting means, said spring being wound in such direction as to expand radially upon attempted counter rotation of said rotating member to prevent said counter rotation.

11. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the

sprocket from said source, said transmission comprising: over-running clutch means connected between said source and said sprocket to drive said sprocket in one direction and to permit said sprocket to run freely in said one direction at a speed greater than the speed of said source, said clutch means including a rotating member; anti-rollback means coupled to said rotating member for preventing rotation of said rotating member in a direction counter to said one direction, said anti-rollback means including a coil spring having its exterior peripheral surface in frictional contact with said rotating member, and fixed supporting means coupled to said spring to prevent axial expansion of said spring, said spring having one end secured to said supporting means, said spring being wound in such direction as to expand radially upon attempted counter rotation of said rotating member to prevent said counter rotation; and means operatively engaged with an end of said spring opposite said one end for selectively releasing said spring from frictional contact with said rotating member to permit said rotating member to rotate freely in either direction.

12. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the sprocket from the source, said transmission comprising: overrunning clutch means connected between said power source and said sprocket to drive said sprocket in a given direction and to permit said sprocket to run freely in said given direction at a speed greater than the speed of said power source, said clutch means including a rotating member having a smooth friction surface; stationary supporting means positioned adjacent said member; a yieldable anti-rollback member supported on said supporting means, said anti-rollback member being in frictional engagement with said surface to permit rotation of said rotating member in said given direction but to prevent counter rotation thereof; and control means operatively connected to said anti-rollback member for selectively releasing said anti-rollback member from said frictional engagement whereby selectively to permit said counter rotation.

13. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the sprocket from said source, said transmission comprising: an overrunning clutch coupled between said source and said sprocket for rotating said sprocket from said source in one direction, said clutch including a rotatable member; anti-rollback means frictionally engaged with said



rotatable member for preventing rotation of said rotatable member in a direction counter to said one direction; and means coupled to said anti-rollback means for releasing said anti-rollback means from frictional engagement with said rotatable member to permit said rotatable member to rotate freely in either direction.

14. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the sprocket from said source, said transmission comprising: an overruning clutch coupled between said source and said sprocket for rotating said sprocket from said source in one direction, said clutch including a driving member coupled to said source and a driven member coupled to said sprocket; anti-rollback means frictionally engaged with said driving member for preventing rotation of said driving member in a direction counter to said one direction; and means coupled to said anti-rollback means for releasing said anti-rollback means from frictional engagement with said driving member to permit said driving member to rotate freely in either direction.

15. In an ammunition booster having an ammunition-carrying sprocket and a rotary power source, a power transmission for driving the sprocket from said source, said transmission comprising: an overruning clutch coupled between said source and said sprocket for rotating said sprocket from said source in one direction, said clutch including a rotatable member; self-energized means frictionally engaged with said rotatable member for preventing rotation of said rotatable member in a direction counter to said one direction; and means coupled to said self-energized means for selectively de-energizing said self-energized means to permit said rotatable member to rotate freely in either direction.

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