Feb. 24, 1953 L. E. JENSSEN ET AL 2,629,288

ANTIROLLBACK BRAKE FOR BOOSTERS

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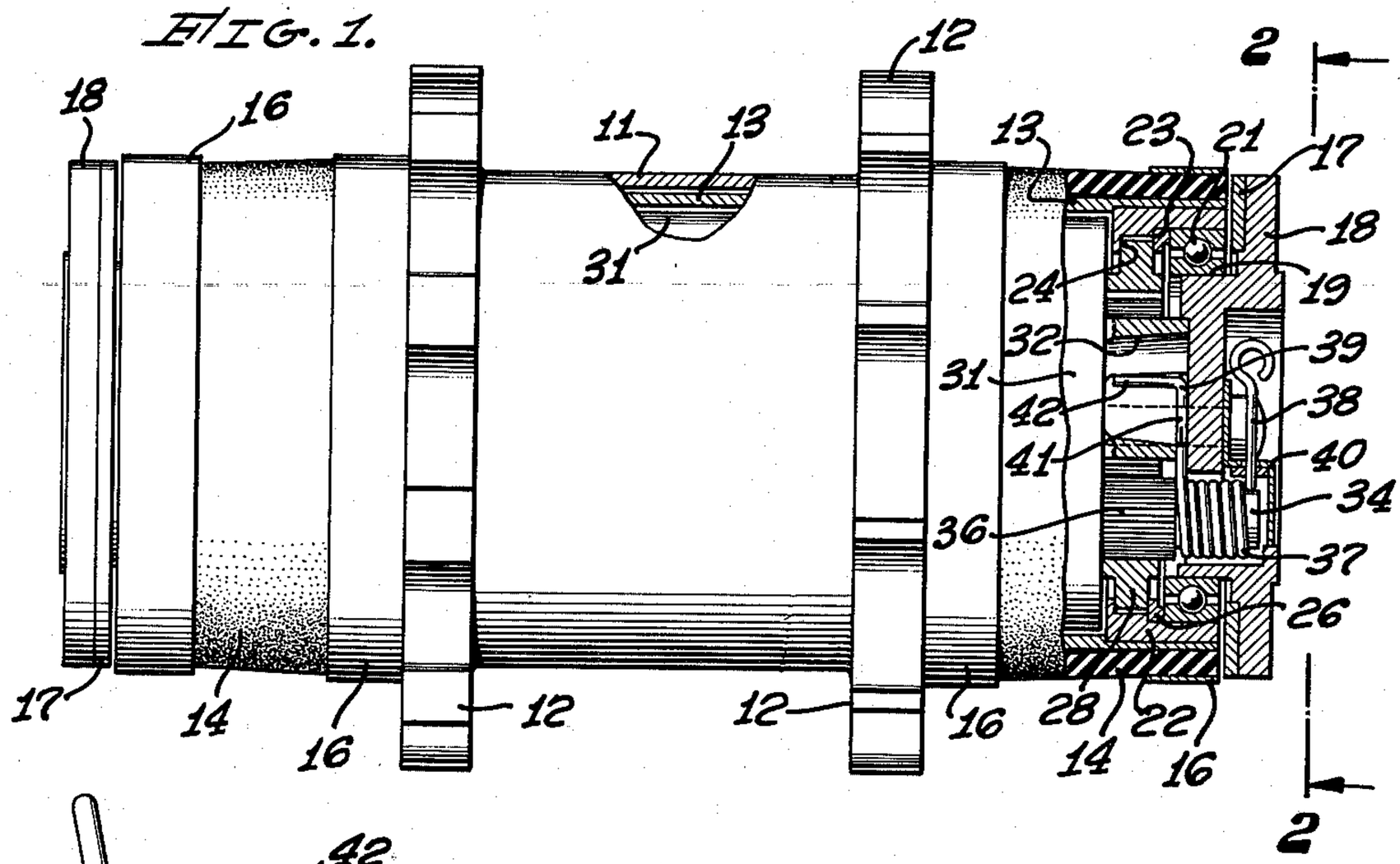
FIG. 1.



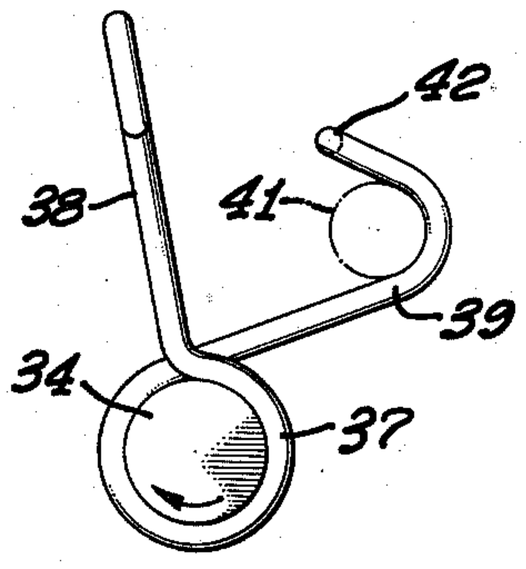


FIG. 4.

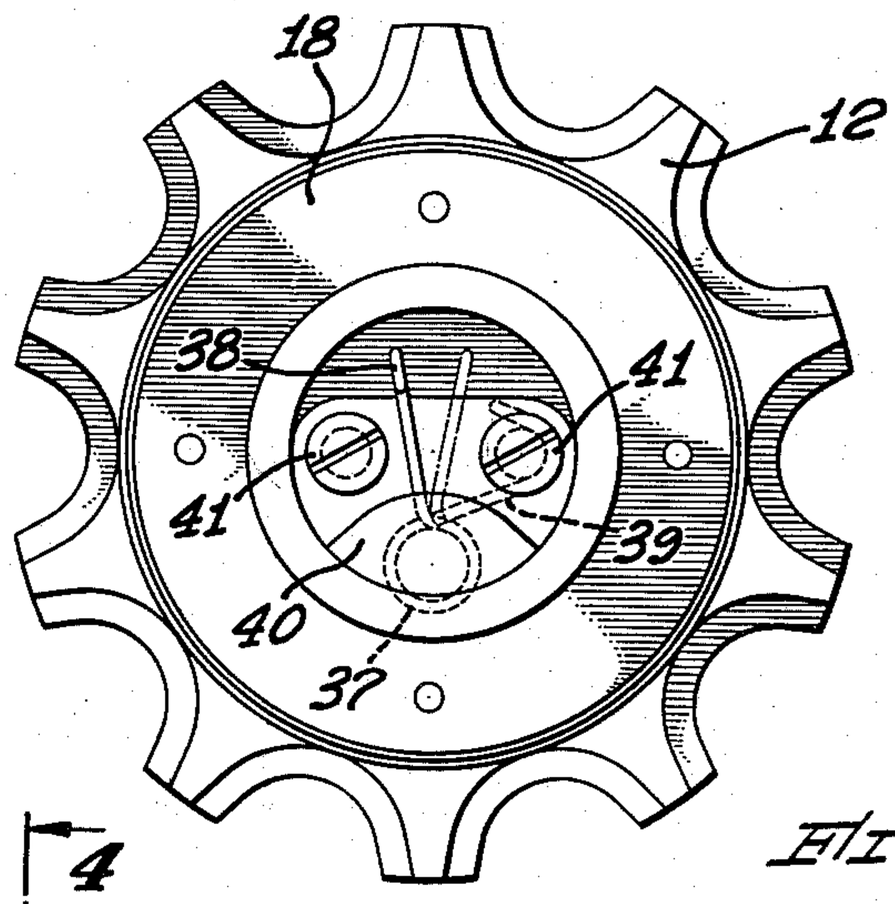


FIG. 2.

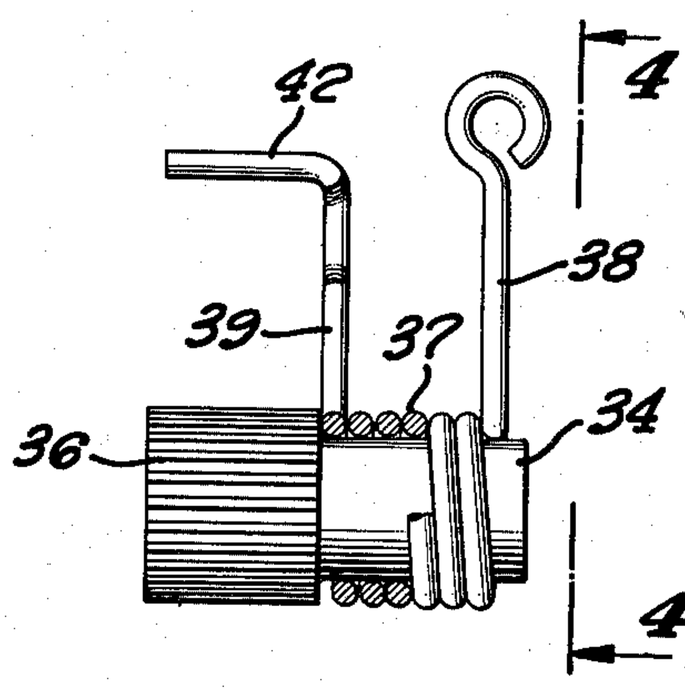


FIG. 3.

LEIF E. JENSSEN,
JOHN A. WARREN,
INVENTORS.

BY

ATTORNEY.

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ANTIROLLBACK BRAKE FOR BOOSTERS

Leif E. Jenssen, Calastoga, and John A. Warren, North Hollywood, Calif., assignors to Hughes Tool Company, Houston, Tex., a corporation of Delaware

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8 Claims. (Cl. 89—33)

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The present invention relates to ammunition boosters in general and more particularly to an ammunition booster incorporating means to prevent roll-back. More specifically, the invention comprises a free-wheeling electric booster for an ammunition belt which is provided with means permitting free rotation in one direction and preventing roll-back in the opposite direction.

In the feeding of ammunition to automatic machine guns the loads placed upon the feeding mechanism are excessive under certain conditions, as for example when diving, due to gravity, centrifugal force, and friction. At times these loads are greater than the gun-feeding mechanism is capable of handling and yet it is desirable, and in fact essential, that the ammunition be fed to the gun at a constant rate which is equal to the normal firing speed of the gun. To assist the gun-feeding mechanism and prevent overload, ammunition boosters are provided which assume the overload to which the normal feeding mechanism is usually subjected and to assist that mechanism in propelling the ammunition to the gun.

In the booster constructed in accordance with the present invention a small diameter motor is mounted within a sprocket over which the cartridge belt and cartridges pass on their way to the gun. When the driving motor is unenergized, the sprocket is permitted to turn freely with the ammunition as it travels along its path. Upon the energization of the motor, however, positive driving torque is transmitted from the motor to the sprocket.

Although this booster has proved satisfactory under ordinary operating conditions, a further feature must be incorporated therein in order to render the booster operable under all conditions. This further feature is an anti-rollback device, the function of which is to prevent retrograde motion of the ammunition belt. Such retrograde motion 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 the gun acting in unison, is applied to the belt in such direction as to produce the retrograde motion. If the belt is allowed to move in such backward or retrograde direction, a gun malfunction is caused by pulling a cartridge out of its proper position in the breech mechanism.

Accordingly, in order to to prevent this retrograde motion of the belt, the present invention discloses an anti-rollback device which is instant-acting, positive, and able to withstand considerable force. The force developed by the anti-rollback device of the invention is applied directly to the driving member of the sprocket, in order to prevent any substantial amount of backward motion of the belt, for even this amount of motion will result in malfunctioning of the gun though the anti-rollback force acts to prevent any further motion. Still further, the invention discloses means for releasing the anti-rollback device so that the belt may move freely in either direction. The releasing means is disclosed as being manually operable, so that an operator may release the anti-rollback device during the operation of loading or unloading the ammunition.

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It is an object of the present invention to provide an ammunition booster incorporating a device permitting rotation in one direction and preventing rotation in the opposite direction.

A further object of the invention is to provide an electrically operated ammunition booster in which the ammunition conveying means is driven positively in one direction while being locked against rotation in the opposite direction in the absence of an operator-applied releasing force.

These and other more specific objects will appear upon reading the specification and claims and upon considering in connection therewith the accompanying drawings to which they relate.

Referring now to the drawings in which a preferred embodiment of the invention is disclosed:

Figure 1 is a side view of an ammunition booster constructed in accordance with the present invention with certain parts broken away and shown in section;

Figure 2 is an end view looking in the direction of the arrows upon the line 2—2 of Figure 1;

Figure 3 is an enlarged partial section through the anti-rollback device; and

Figure 4 is a view of the device of Figure 3 looking in the direction of the arrows on the line 4—4 of Figure 3.

In the drawings a preferred embodiment of the invention is illustrated and is seen to comprise an outer cylinder or sleeve 11 carrying longitudinally spaced sprockets 12 so contoured circumferentially as to seat the cartridges carried by a continuous cartridge belt. The sprockets 12 are spaced inwardly from the ends of cylinder 11 which encloses a torque tube 13 extended axially at both ends thereof. A flexible sleeve 14 of rubber or similar material is secured to the end of cylinder 11 and has its opposite end clamped to torque tube 13 by an encircling band clamp 16. The relationship is such that a rotary movement imparted to the torque tube is transmitted

through sleeve 14 to sprocket cylinder 11, the driving means being protected by the resilience of the sleeves from shock and vibration caused by external forces acting upon the cartridge belt.

The torque tube 13 is rotatably supported at each of its ends upon an end plate or flange 18 which is adapted to be fixedly secured to any suitable supporting means and which carries a seal 17 and is provided with an inwardly extending circumferential shoulder 19. A bearing 21 has its inner race mounted upon shoulder 19 and its outer race seated in a ring 22 welded or brazed in the end of torque tube 13. Ring 22 is formed with spaced outwardly facing shoulders 23 and 24, the former serving as a seat for a ring spacer element or washer 26 which abuts the edge of the external race of bearing 21. An internal ring gear 28 seats in ring 22 between the shoulder 24 and the spacer 26 and is connectable with the ring 22 by means of an overrunning clutch not shown, but which may take the form shown in the copending application of Claude Slate Serial No. 444,755, filed May 27, 1942, now Patent No. 2,436,404, dated February 24, 1948.

To rotate torque tube 13 and cylinder 11 carried thereby, there is provided an electric driving motor 31 positioned coaxially within cylinder 11. An axially extending cylindrical support 32 extends from motor 31 and is secured upon the recessed inner surface of end plate or flange 18. As both motor 31 and torque tube 13 are mounted upon end plate 18, it follows that the relative axial and longitudinal positions of these two parts are fixed. To transmit its driving power, there extends from the interior of the casing of motor 31 a stub shaft 34 which carries a gear 36 so positioned and arranged as to mesh with the teeth of ring gear 28. Shaft 34 is not the motor shaft but is instead a shaft which is driven at a reduced speed through suitable reduction gearing positioned in motor 31, the specific construction and arrangement of which forms no part of the present invention. Rotation of motor 31 effects the rotation at a reduced speed of gear 36 which, in turn, causes the rotation of ring gear 28, the latter through an unshown overrunning clutch driving ring 22 and torque tube 13 which is fixedly connected thereto. The mounting of torque tube 13 and motor 31 with respect to flange 18 has been described for a single end of the unit but it is understood that the mounting at the opposite end may be a duplicate if desired, or, if preferred, may be a variant, it being further understood, of course, that there is no need to reproduce the driving pinion and ring gear at both ends of the unit.

As pointed out above, it is necessary that the sprockets should be rotatable freely in the direction which causes the ammunition to be fed into the waiting gun. It is also necessary that normally the sprockets should be held against rotation in the opposite direction except when intentionally released as for purposes of unloading ammunition. To provide this functional relationship, a coil spring 37 is wrapped helically around and in frictional engagement with stub shaft 34 adjacent pinion 36, spring 37 having its outer end 38 extended through an external guard 40 and within the centrally recessed external face of end plate 18. The inner end 39 of spring 37 extends upwardly and around one of a pair of screws 41 which secure end plate 18 and motor support 32 together through seating in threaded seats in the latter. The extremity 42 of spring inner end 39 is bent at a right angle

so that it extends axially and lies adjacent the inner surface of support 32, the relationship being such that the contact of end 39 with screw 41 and with support 32 holds it against pivotal movement in either direction about the stub shaft 34.

Spring 37 is wound helically about stub shaft 34 in such a manner, as is clearly shown in Figures 1, 3 and 4, that shaft 34 is free to rotate clockwise, as viewed in Figure 4, for the friction of the rotating shaft against the spring tends to unwind it, the end 38 being free. More particularly, spring 37 is wound away from end 39 in a counter-clockwise direction, so that rotation of shaft 34 in the opposite direction, that is the clockwise direction, the frictional contact between spring 37 and shaft 34 tends to unwind spring 37 to reduce the frictional engagement. Actually the unwinding action is limited and only of such an extent as to permit substantially free rotation of the shaft. Should the shaft 34 tend to rotate in the opposite direction, however, that is counter-clockwise and in the opposite direction from that indicated by the arrow in Figure 4, spring 37 immediately wraps tightly around the shaft to prevent its rotation. Such action occurs whenever ring gear 28 tends to rotate in the direction opposite to its normal motor driven direction, a movement which occurs when a counter-rotational force is exerted upon sprockets 12. The construction provides, therefore, for the free rotation of the sprockets in one direction, which would be clockwise as viewed in Figure 4 and under the actuation of driving motor 31, while providing positive means to prevent rotation in the opposite direction, that is counter-clockwise as viewed in Figure 4. In other words, spring 37 and shaft 34, which constitute the anti-rollback device of the present invention, function as a continuously engaged one-way friction brake to permit motor 31 and sprockets 12 to rotate freely in one direction, and to prevent rotation of these elements in the opposite direction.

It is at times required to rotate sprockets 12 in a reverse to normal direction, as in removing ammunition. In such a case the exertion by the operator of a pivoting pressure in a clockwise direction, that is in the direction opposite to the direction in which spring 37 is wound around end 39, upon the end 38 of spring 37, viewing that element as shown in Figure 4, sufficiently releases the spring from shaft 34 as to enable the latter to rotate freely in either direction. The operator needs only retain this releasing force while he pulls the cartridge belt in the reverse direction around the sprockets. Upon the force being removed, spring end 38 returns to its normal position and the spring is in position to function effectively as previously described.

In the operation of the ammunition booster constructed in accordance with the present invention, a cartridge belt filled with cartridges is supported by the sprockets 12 and, in one use, passes up one side thereof and across the top onto a waiting mounting or carrier. The normal propelling force for the cartridge belt is provided by the automatic gun mechanism into which the cartridges are being fed. However to insure operation when the force required to propel the belt becomes excessive, for any one of a number of reasons such as may exist during the dive of an airplane, booster motor 31, which is controlled by a circuit forming no part of the present invention, carries a part of the load and exerts a driving torque to rotate sprockets 12 at their

normal speed at all times. The motor being connected to the sprockets through flexible sleeves 14 provides limited flexibility and resilience to take up undesirable shocks which would otherwise be transmitted from the ammunition belt to the working parts of the mechanism.

Upon deenergization of the unit and upon the ammunition belt coming to rest, its movement in a reverse direction is prevented by the locking action of spiral spring 37 which is so wound that it does not interfere with the rotation of shaft 34 in a direction to move the ammunition into the gun but positively prevents its reverse rotation. To remove the ammunition from the gun, as by pulling the ammunition belt and which requires the reverse rotation of sprockets 12, the operator need only pivot extended lever arm 38 of the spring 37 to the right as viewed in Figure 4, thereby releasing the clutch. The continued exertion of this releasing force enables the sprockets to be rotated in a reverse direction as long as desired.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention and that no limitation is intended to the details of construction or design herein shown other than as defined in the appended claims.

We claim:

1. A machine comprising a rotary element, a non-rotating wire coiled around said element and normally in frictional contact therewith in one direction of advance and having one fixed end and one free end, said free end being exposed at the end of said rotary element and radially displaced from said element to leave an end portion out of contact with said element to form a control lever, characterized in that said wire prevents rotation of said element in one direction by being drawn tightly therearound and in that the unwrapping movement of said lever loosens said wire and permits said element to rotate freely in either direction.

2. In an ammunition booster, a rotary element to propel ammunition, rotary driving means positively and directly connected to actuate said element without lost motion and including a rotary shaft, and a wire having one fixed end, said wire being coiled around said shaft to permit said shaft to rotate freely in one direction and to prevent any substantial rotation of said element and said driving means in the opposite direction.

3. In an ammunition booster, a rotary element to propel ammunition, rotary driving means positively and directly connected to actuate said element without lost motion and including a rotary shaft, a wire coiled around said shaft and having one fixed end and one free end projecting away from said shaft, characterized in that said free end forms an operating lever by which said wire tends to wrap around said shaft when rotated in one direction to prevent such rotation and in that said shaft may be released for free rotation in either direction by an unwrapping force applied to said free end of said wire tangentially to said shaft.

4. In an ammunition booster: a cylinder; spaced ammunition-contacting sprockets on said cylinder; a torque tube coaxially positioned within and drivingly connected to said cylinder; power drive means including a rotary member, an overrunning clutch directly connected between said tube and said power drive means for rotating said tube from said power drive means in one direction and for permitting said tube to overrun said power drive means in said one direction; and anti-rollback means for preventing rotation of said rotary member in a direction counter to said one direction, said anti-rollback means including a coil spring wrapped around and in frictional engagement with said rotary member, said spring having a fixed end and being normally adapted to tighten upon attempted counter-rotation of said rotary member whereby to prevent said counter-rotation said spring having an extended free end portion forming a lever adapted to receive pressure in a direction tangential to said rotary member to unwrap said spring from said rotary member whereby to permit free rotation of said torque tube and said rotary member in either direction.

5. In an ammunition booster, the combination comprising: a cylinder; spaced ammunition-contacting sprockets on said cylinder; a torque tube positioned coaxially with and extending axially of said cylinder; means connected between said tube and said cylinder for rotating said cylinder with said tube; an end flange; means for rotatably supporting said tube on said flange; rotary power means; and means coupled between said tube and said power means for rotating said tube from said power means in one direction, the last-named means including a rotatable element coupled to said power means and having a friction surface, and a member having one end fixed to said flange, said member being frictionally engaged with said surface to prevent any substantial rotation of said rotatable element in a direction opposite to said one direction.

6. In an ammunition booster, the combination comprising: a cylinder; spaced ammunition-contacting sprockets on said cylinder; a torque tube positioned coaxially within and extending axially of said cylinder; means connected between said tube and said cylinder for rotating said cylinder with said tube; an end flange; means for rotatably supporting said tube on said flange; rotary power means; means coupled between said tube and said power means for rotating said tube from said power means in one direction, the last-named means including a rotatable element coupled to said power means and having a friction surface, and a member having one end fixed to said flange, said member being frictionally engaged with said surface to prevent any substantial rotation of said rotatable element in a direction opposite to said one direction; and means for selectively releasing said member from frictional engagement with said element to permit said element to rotate in either direction.

7. In an ammunition booster, the combination comprising: a cylinder; spaced ammunition-contacting sprockets on said cylinder; a torque tube positioned coaxially within and extending axially of said cylinder; means connected between said tube and said cylinder for rotating said cylinder with said tube; an end flange; means for rotatably supporting said tube on said flange; rotary power means; and means coupled between said tube and said power means for rotating said tube from said power means in one direction, the last-named means including a rotatable element coupled to said power means, and a coiled wire wrapped around and in frictional contact with said element, said wire hav-

ing one end fixed with respect to said flange and having its opposite end extending free of contact with said element, said wire being wound away from said one end in a direction opposite to said one direction to prevent rotation of said element in said opposite direction, said wire being adapted to be unwrapped and released from said element to permit said element to rotate in either direction upon application of a force to said opposite end in said opposite direction.

8. In an ammunition booster, rotary means for contacting and moving ammunition, power means coupled to said rotary means for rotating said rotary means in one direction, means coupled to said power means for preventing rotation of said power means and said rotary means in a direction opposite to said one direction, the last-named means comprising a continuously engaged one-way friction brake including a first member coupled to said power means for rotation by said power means and a second member having one fixed end, said second member being

in frictional engagement with said first member, and manually operable means for releasing said first and second members from frictional engagement.

LEIF E. JENSSEN.
JOHN A. WARREN.

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