March 31, 1964 D. P. TASSIE ETAL 3,126,790

FEED BELT BOOSTER WITH DEMAND CONTROL

Filed Nov. 15, 1962 4 Sheets-Sheet 1

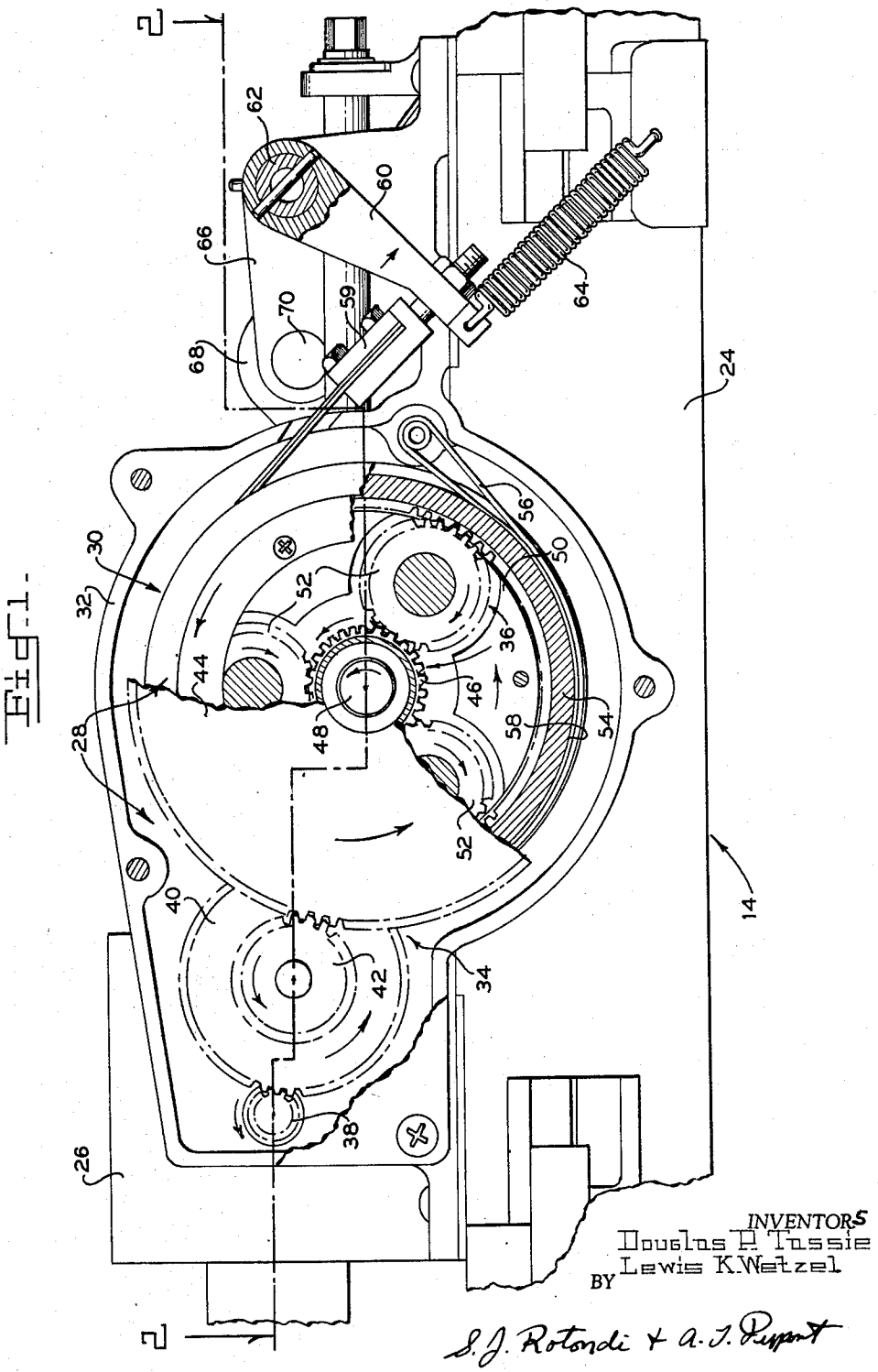

Fig. 1.

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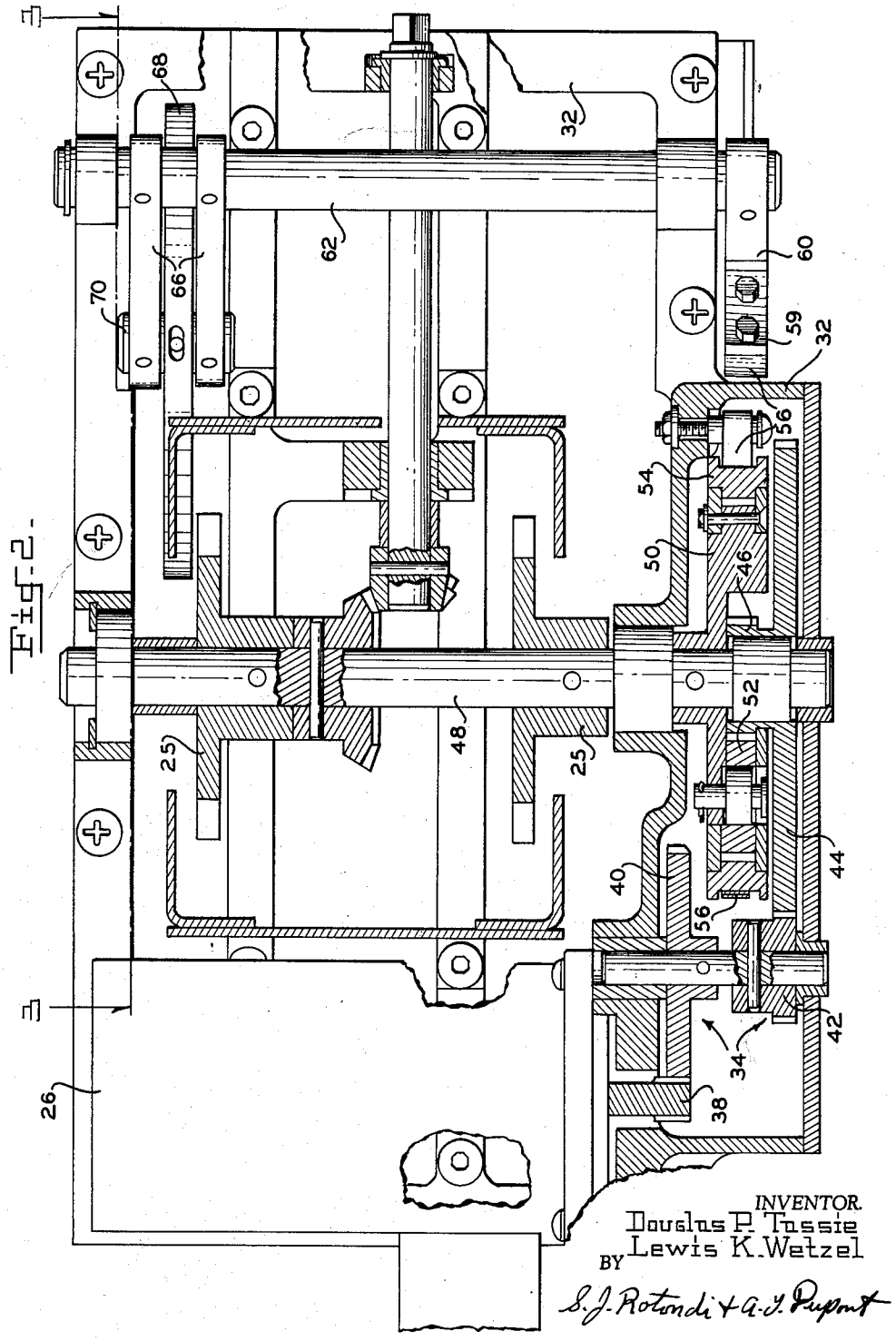

Fig-2-

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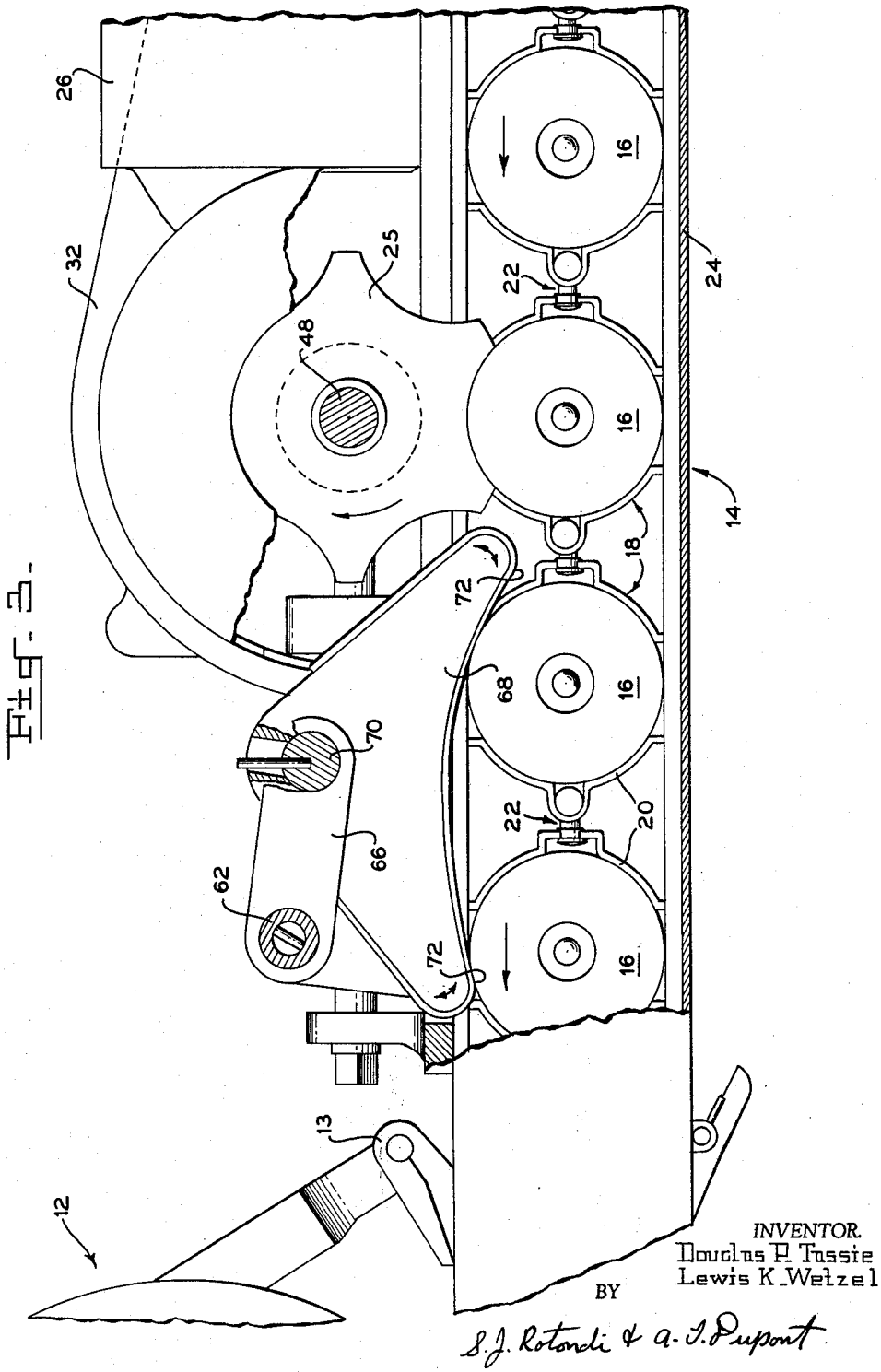

Fig. 3.

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Fig. 4.

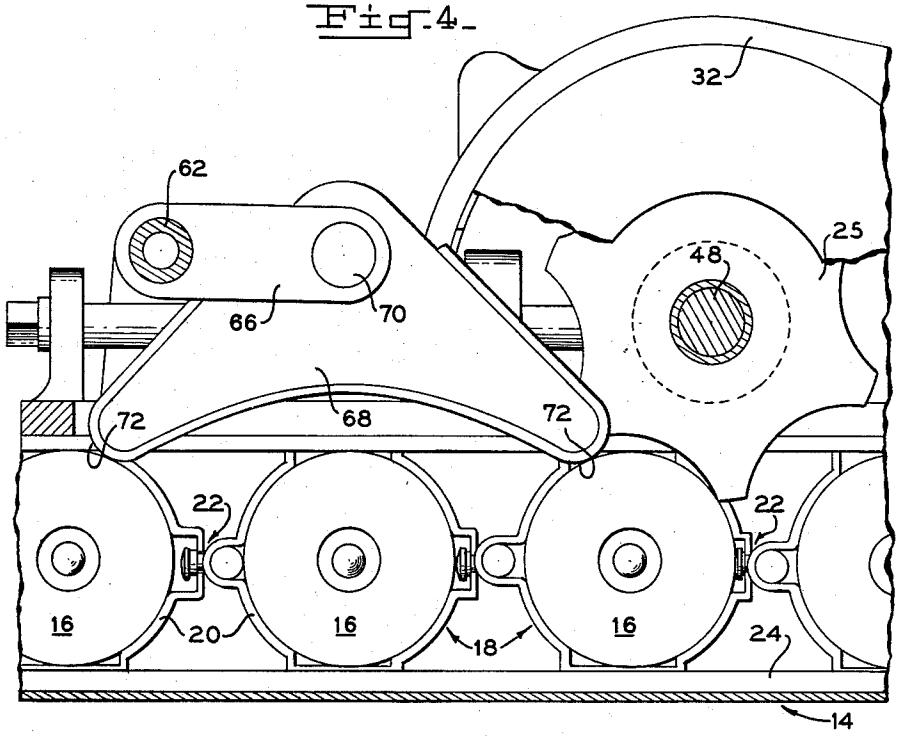
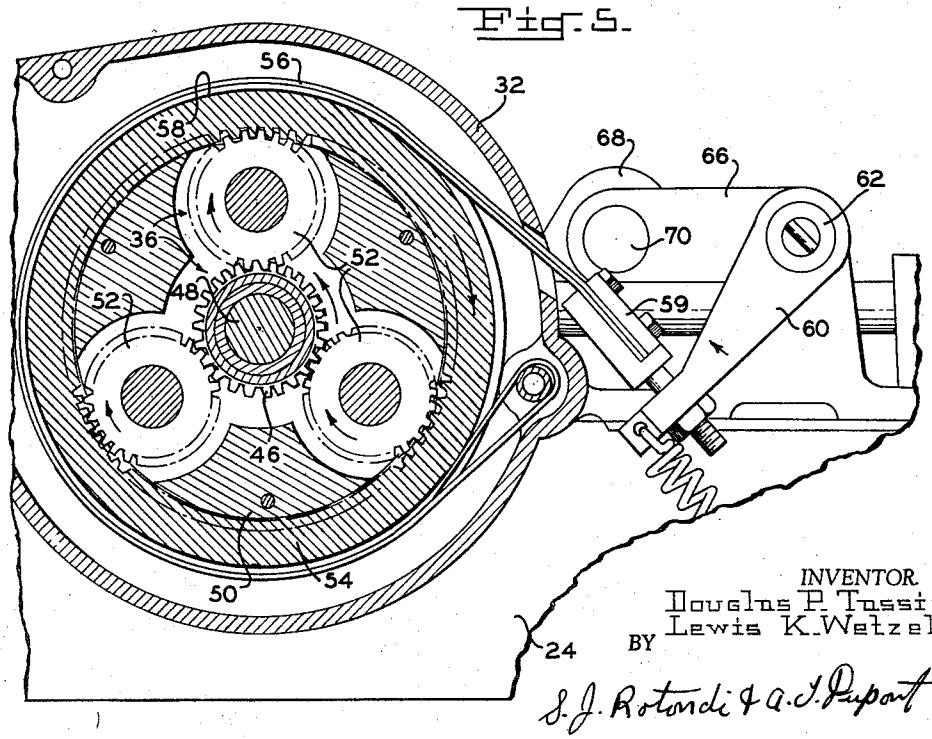


Fig. 5.



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FEED BELT BOOSTER WITH DEMAND CONTROL

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4 Claims. (Cl. 89—33)

This invention relates to those auxiliary booster devices which are used to feed an ammunition belt to an automatic gun so as to reduce the power requirements thereof for the feeding function.

It is one object of this invention to provide such a booster which feeds the ammunition belt to the gun only according to its needs and so does not jam the ammunition belt into the gun during deceleration.

It is another object of this invention to provide such a booster with a clutch control which is actuated by changes in the pitch distance between the belted rounds as the tension on the belt is increased or relieved by the feeding demands of the gun.

It is a further object of this invention to provide a demand-control booster which occupies little space and is of simple construction while being positive in its function.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

FIG. 1 is a partially cross-sectioned side view of the booster showing the clutch engaged;

FIG. 2 is a view taken along line 2—2 of FIG. 1;

FIG. 3 is a view taken along line 3—3 of FIG. 2 showing the rounds between the booster and the gun at the maximum pitch so that the pitch sensor rocks about its axis to ride over the rounds passing under it;

FIG. 4 is a view similar to FIG. 3 but showing the belted rounds at their minimum pitch distance and the pitch sensor pushed upwardly by the high points of the two contacted rounds; and

FIG. 5 is a partially cross-sectioned side view of the clutch disengaged action of the pitch sensor when pushed upwardly by the contacted round when at their minimum pitch distance.

Shown in the figures is a gun 12 with a conventional feeding device 13 for drawing rounds 16 in an ammunition belt 18 thereinto and a booster 14 which cooperates with the feeding device in the feeding function. Belt 18 includes a plurality of round retaining links 20 which are joined by connectors 22. Connectors 22 are designed to permit limited relative movement between connected rounds 16 and therefore a change of pitch between minimum and maximum limits. It is this variable pitch of rounds 16 in belt 18 which is the governing factor in controlling the feeding rate of booster 14, as hereinafter described.

Booster 14 includes a feedway 24 through which belt 18 is moved, a pair of sprockets 25 arranged for engaging rounds 16 to move the belt through the feedway, a drive motor 26, a gear system 28 for transferring the torque of the motor to the sprockets, and a clutch 30 arranged in cooperation with the gear system and rounds 16 in belt 18 for interrupting the transfer of torque.

Gear system 28 is contained within a housing 32 and includes a gear train 34 for reducing the normal speed of drive motor 26, so that the feeding rate of sprocket 25 is slightly less than the maximum firing rate of gun 12 and for transferring the torque of the drive motor to a planetary gear system 36. Gear train 34 includes a first gear 38 which is formed integral on the drive shaft of motor 26 and has meshing engagement with a second gear 40

of larger diameter. Integral with second gear 40 is a gear 42 of reduced diameter which is engaged with a gear 44. A sun gear 46 is integral with gear 44 and the unit is journaled on a shaft 48. Fixed to shaft 48 is a cage 50 which carries three planetary gears 52 having meshing engagement with sun gear 46 and also with teeth formed on the inside of a ring gear 54. Sprockets 25 are also fixedly mounted on shaft 48 so that rotation of cage 50 causes rotation of the sprockets.

Clutch 30 comprises a flexible strap 56 which is received by a channel 58 formed around the perimeter of ring gear 54. One end of strap 56 is anchored to housing 32 and the opposite end is connected by a bolt and nut arrangement 59 to an arm 60 fixedly mounted on an axle 62 journaled in housing 32 on the outlet side of feedway 24 so that a pivotal displacement of the arm will cause strap 56 to tighten against ring gear 54 to act as a brake therefor and engage clutch 30, as hereinafter described. A spring 64 is connected between the free end of arm 60 and housing 32 for biasing the arm so as to tighten strap 56 against ring gear 54.

Also fixedly mounted on axle 62 is a lever 66 which extends therefrom essentially parallel to feedway 24. A sensor 68, which is substantially of triangular configuration, is rockingly mounted on the free end of lever 66 by means of a transverse pin 70 which extends through the upper apex of the sensor. The bottom side of sensor 68 is concavely formed and the bottom angles are rounded to form a pair of semicircular contact points 72. Contact points 72 are arranged so as to be contactable with rounds 16 on opposite sides of each round as shown in FIGS. 3 and 4 so that the differences between the minimum and maximum pitch distance, respective to the rounds related to the contact points is twice the limited displacement permitted by each connector 22 and they are spaced so that when one rides over the high point of one of the rounds the other is free to move downwardly clear of its related round. Thus, as belt 18 moves along feedway 24 sensor 68 rocks about the axis of pin 70.

The spacing of contact points 72 and the variable pitch relationship of rounds 16 are so related that when the rounds are at their minimum pitch relationship the contact points are both in contact with the high points of the related rounds and thereby sensor 68 is pushed upwardly to pivotally displace lever 66. The pivotal displacement of lever 66 causes a similar displacement of arm 60 to loosen strap 56 and thereby unlock ring gear 54 to disengage clutch 30.

Operation

When clutch 30 is engaged, by the pressure of strap 56 against ring gear 54, the torque of drive motor 26 is transferred through gear train 34 to sun gear 46 which causes rotation of planetary gears 52. As ring gear 54 is locked by strap 56 the rotation of planetary gears 52 causes rotation of cage 50 and therefore of sprockets 25 which pull belt 18 through feedway 24 to gun 12. As long as gun 12 demands rounds 16 at a slightly greater rate than that at which they are fed by booster 14 rounds 16 between booster 14 and the gun are maintained at their maximum pitch relationship and sensor 68 rocks about the axis of pin 70 as the rounds pass under it.

When gun 12 slows down or stops so that feeding device 13 no longer pulls on belt 18 the distance of rounds 16 between booster 14 and the gun is decreased to the minimum pitch relationship. This causes contact points 72 to ride up on the high points of the related rounds 16 pivoting lever 66 and consequently arm 60 so that the bias of spring 64 is overcome and the tension of strap 56 against ring gear 54 is released. With ring gear 54 released, the torque of drive motor 26 is transferred through planetary gears 52 to the ring gear, and rotation of cage

50 is stopped, because of the greater resistance of the cage to rotation by the drag of belt 18.

As soon as gun 12 demands ammunition and feeding device 13 pulls on belt 18 the pitch distance of rounds 16 between the gun and booster 14 is increased to the maximum. This permits downward displacement of sensor 68 by the bias of spring 64 and the tightening of strap 56 against ring gear 54, whereby the torque of drive motor 26 is directed to sprockets 25 to resume feeding belt 18 to the gun. The normal position of sensor 68 respective to round 16 is adjustable by bolt and nut arrangement 59.

From the foregoing it is clearly apparent that while booster 14 is compact in size and is of simple construction it provides positive feeding of rounds 16 according to the demands of gun 12 and will not jam the rounds thereinto during deceleration. It is also apparent that booster 14 can be similarly applied to feed systems in any other one of the arts where demand control is important and the objects being fed can be linked together to form a belt.

Although a particular embodiment of the invention has been described in detail herein, it is evident that many variations may be devised within the spirit and scope thereof and the following claims are intended to include such variations.

We claim:

1. In combination, a gun, an ammunition belt including a plurality of links each retaining a cartridge and connectors for joining pairs of said links so as to permit relative displacement thereof between a minimum and a maximum pitch relationship, a feeding device in said gun for drawing said ammunition belt thereinto, and in a booster for assisting said feeding device in moving said ammunition belt to said gun, a drive motor, a pair of sprockets engageable with said belt, and means for transferring the torque of said drive motor to said sprockets when the pitch distances between not more than three adjoining ones of said cartridges between said feeding device and said sprockets are at their maximum pitch relationship and for interrupting the transfer of torque when the pitch distances between not more than three of said cartridges between said feeding device and said sprockets are at their minimum pitch relationship.

2. The combination as defined in claim 1 wherein said means include a gear system operationally disposed between said drive motor and said sprockets, a clutch displaceable between an engaged and a disengaged condition for controlling the torque transfer, a pitch sensor arranged for contact with pairs of said cartridges separated by one thereof in said belt between said feeding device and said sprockets and for displacement by change in the pitch relationship of the contacted ones of said cartridges, and means for transferring the displacement of said sensor to said clutch for displacement thereof between the engaged and disengaged conditions.

3. In combination, a gun, an ammunition belt including

a plurality of links each retaining a cartridge and connectors for joining pairs of said links so as to permit relative displacement thereof between a minimum and a maximum pitch relationship, a feeding device in said gun for drawing said ammunition belt thereinto, and a booster for assisting said feeding device in moving said ammunition belt to said gun, said booster including a drive motor, a pair of sprockets engageable with said belt, a gear system operationally disposed between said drive motor and said sprockets and including a planetary gear system having a sun gear connected by a gear train to said motor, a cage connected to said sprockets, planetary gears mounted in said cage for meshing engagement with said sun gear and a ring gear inclosing said cage for meshing engagement by said planetary gears, a clutch including a strap received by a channel around the perimeter of said ring gear, and anchored at one end to a housing of said booster, lever means connected to the opposite end of said strap, and a spring disposed between said lever means and said housing for tightening said strap against said ring gear whereby the torque of said sun gear is transferred to said sprockets through said cage, said lever means including an axle mounted transversally to the path of said movement of said belt, an arm fixedly mounted on said axle for engagement with the opposite end of said strap, a lever fixedly mounted on said axle so as to extend over said belt between said feeding device and said sprockets approximately parallel to the path of movement of said belt and a pin fixedly mounted to the free end of said lever, and a sensor journaled on said pin so as to be rocked thereon by said belt during passage thereof under said sensor when the relationship of the cartridges having contact with said sensor are at their maximum pitch relationship and so as to be lifted by pivotal displacement of said arm to loosen said strap when said cartridges having contact with said sensor are in minimum pitch relationship.

4. The combination as defined in claim 3 wherein said sensor includes a pair of contact points which are contactable with a related pair of said cartridges which are separated by one thereof, said contact points being spaced so that said sensor is rocked by contact of alternate ones of said contact points with the related ones of said cartridges during passage of said belt under said sensor and said cartridges are in maximum pitch relationship, and so that when said cartridges between said gun and said booster are in minimum pitch relationship said contact points are in contact with the high points of the related ones of said cartridges to raise the sensor for pivotal displacement of said arm to loosen said strap around said ring gear.

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