Oct. 16, 1956 P. H. DIXON 2,766,663

FEED MECHANISM

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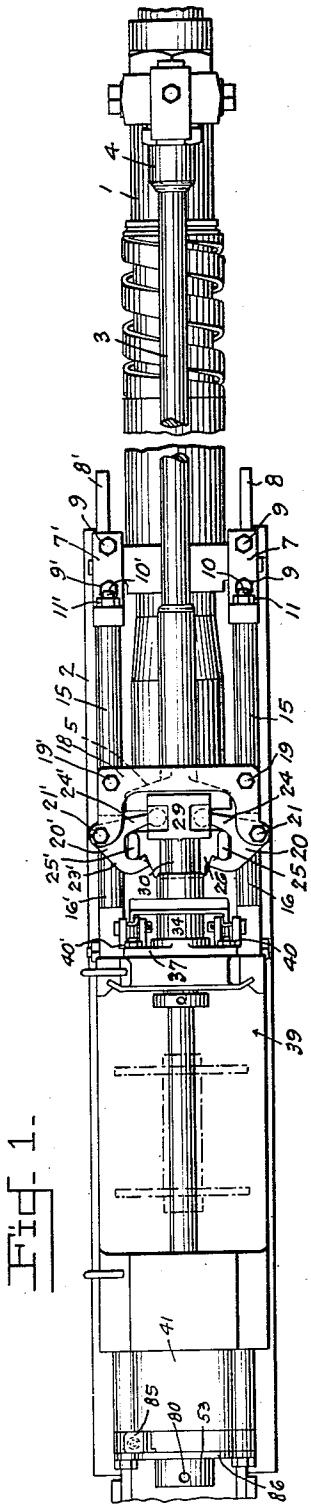

Fig. 1.

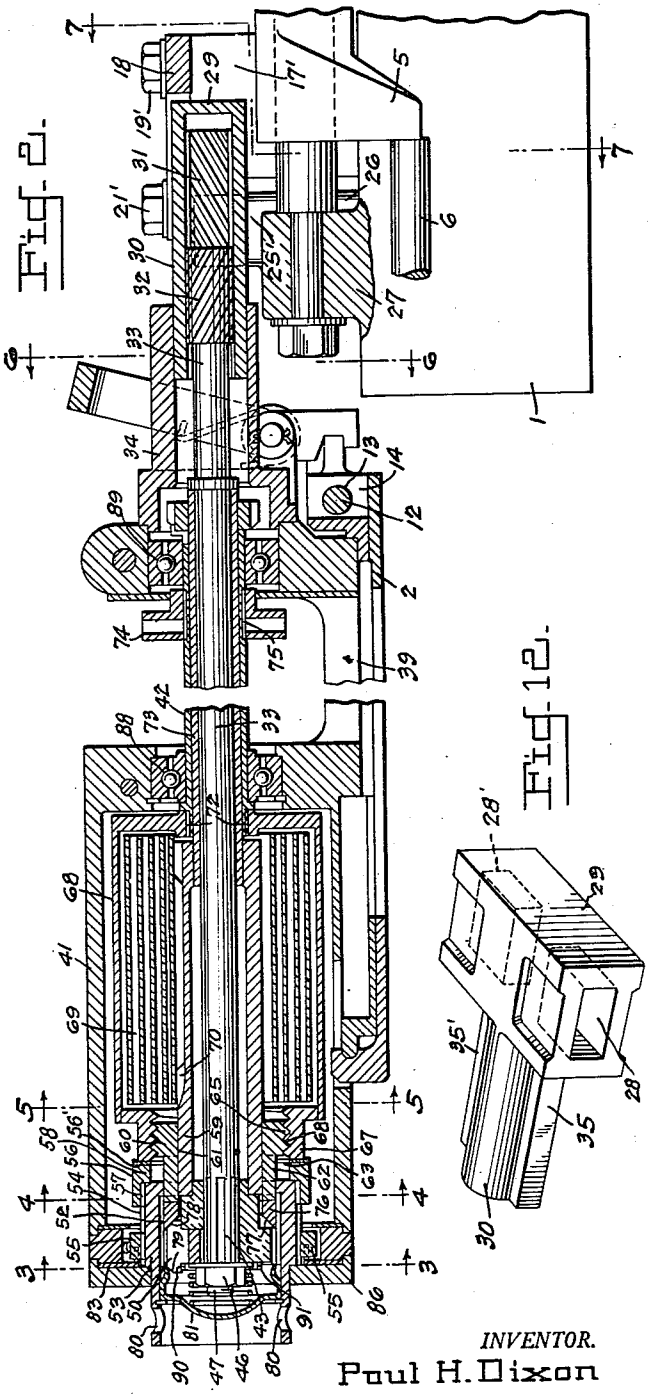

Fig. 2.

Fig. 12.

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Fig. 9.

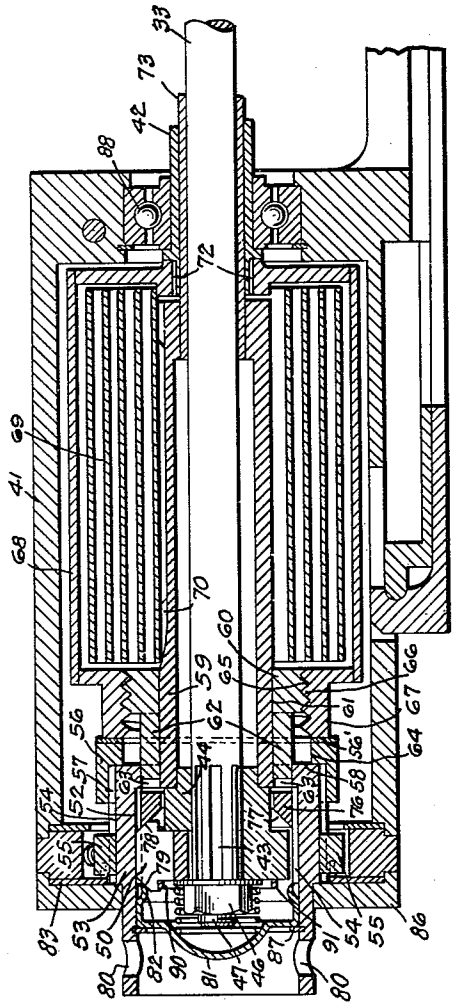
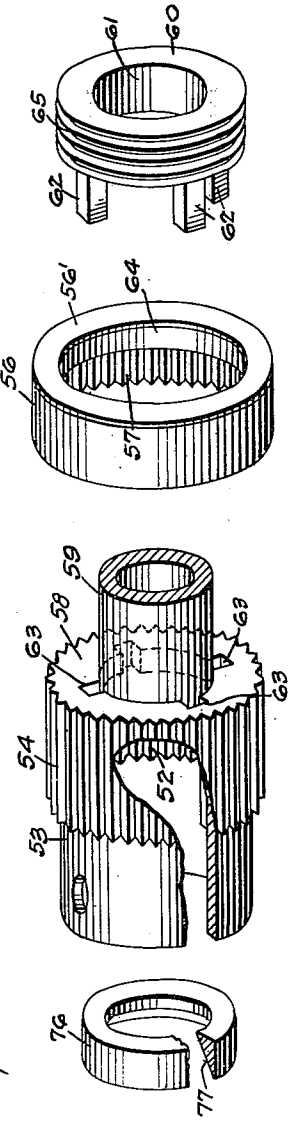


Fig. 10.



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FEED MECHANISM

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Fig. 4.

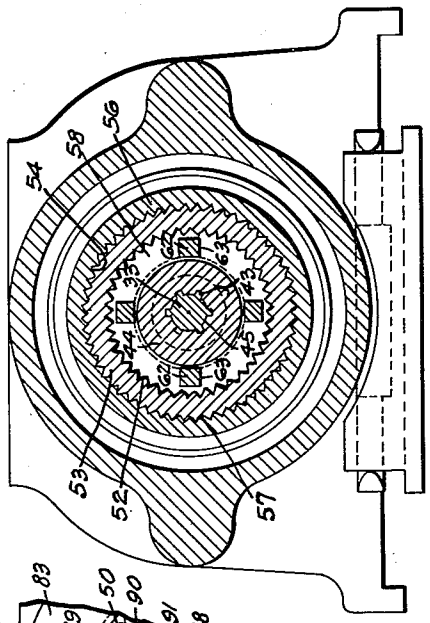


Fig. 6.

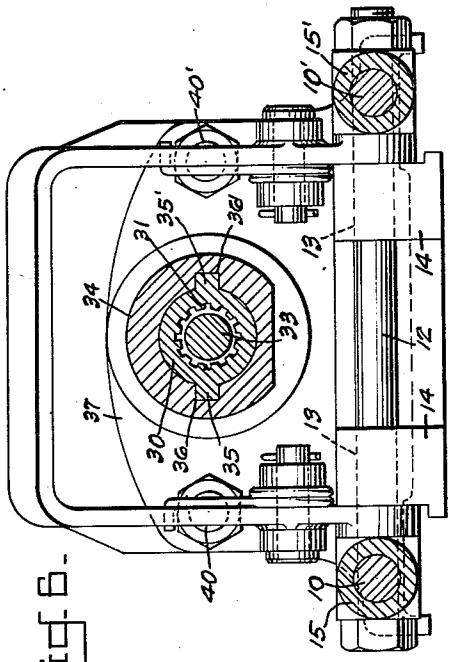


Fig. 8.

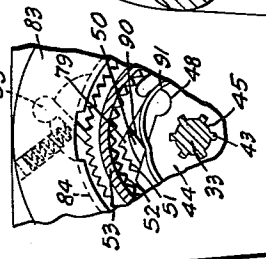


Fig. 7.

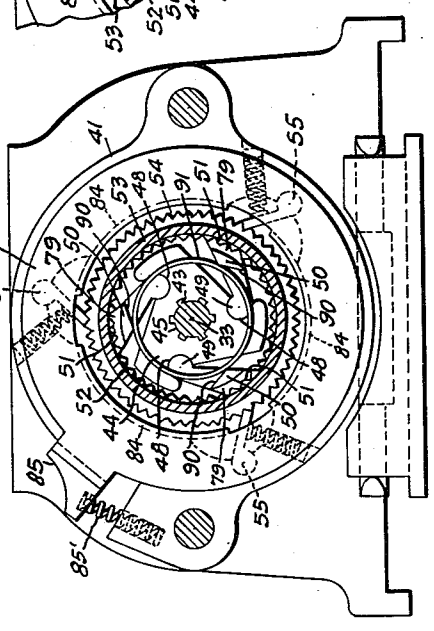
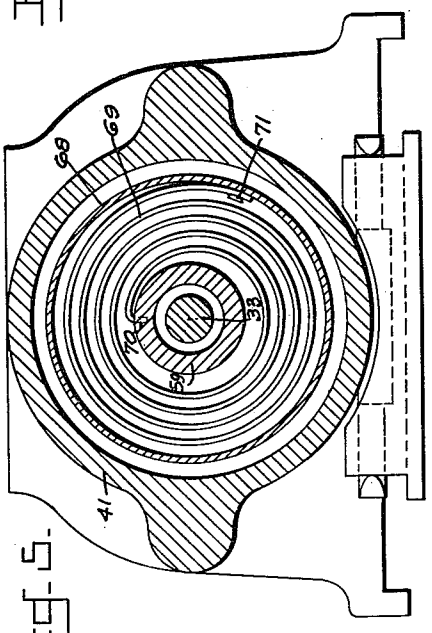


Fig. 5.



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FEED MECHANISM

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Fig. 11.

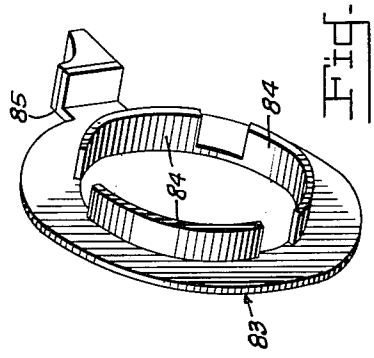
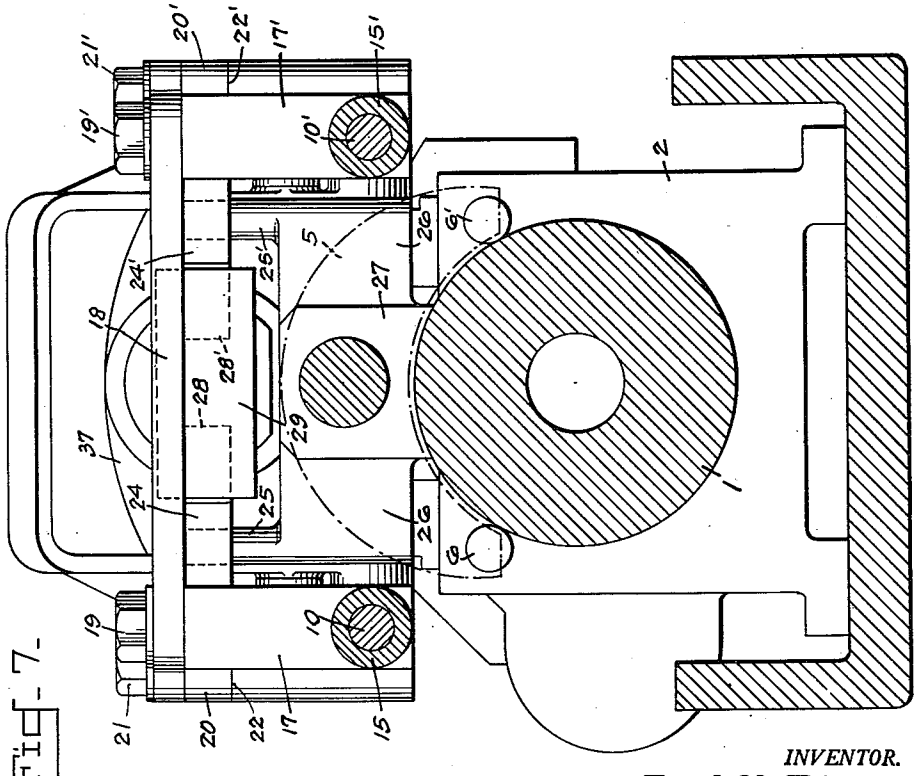


Fig. 7.



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United States Patent Office 2,766,663 Patented Oct. 16, 1956

2,766,663

FEED MECHANISM

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Application August 15, 1952, Serial No. 304,482

19 Claims. (Cl. 89—33)

The present invention relates to an improved feed mechanism for use in automatic guns. More particularly the present invention relates to a feed mechanism of an automatic gun which operates during counterrecoil thereof, and which includes a lever system to compensate for short recoil, an overwinding mechanism to protect the winding spring against excessive counterrecoil, and a friction assist arrangement to assure proper phase relationship between operation of the gun and of the feed mechanism.

It is accordingly an object of the present invention to provide a feed mechanism for an automatic gun which utilizes the energy developed during counterrecoil to feed a new round into the feed mouth.

Another object of the present invention is to provide a feed mechanism for an automatic gun which utilizes the energy developed during counterrecoil but which is substantially independent of the length of the recoil.

It is a further object of the present invention to provide an automatic feed mechanism for a cannon in which the winding operation of the winding spring starts about the same time a new round is being admitted to the feed mouth.

It is a still further object of the present invention to provide an automatic feed mechanism wherein the winding operation occurs when the barrel acceleration is moderate thereby reducing shock loads on the mechanism.

It is another object of the present invention to provide a feed mechanism wherein the winding operation is aided by a friction assist arrangement at the time a new round is admitted to the feed mouth.

A still further object of the present invention resides in the power spring assist mechanism which increases the torque applied to the feed shaft during the winding cycle thereby assuring proper operation for rapid firing of the gun.

It is another object of the present invention to provide a mechanism whereby the displacement of the barrel is magnified by levers which actuate a swivel block.

It is still another object of the present invention to provide an overwind protection mechanism which consists of a ratchet interrupter which is keyed against rotation on the winding arbor but travels longitudinally by means of a coarse thread at its periphery whereby the interrupter travels rearwardly until the interrupter ring disengages the winding ratchets after predetermined longitudinal travel of the interrupter.

The specific nature of the present invention as well as other objects and advantages will become obvious from the following description when taken together with the accompanying drawings which show for purposes of illustration only the preferred embodiments of my invention and wherein:

Figure 1 is a plan view of one preferred embodiment of the automatic feed mechanism in accordance with the present invention;

Figure 2 is a partial, longitudinal cross-sectional view of the feed mechanism of the gun shown in Figure 1;

Figure 3 is a cross-sectional view of the winding mechanism in accordance with the present invention taken along lines 3—3 of Figure 2;

Figure 4 is a cross-sectional view of the winding mechanism in accordance with the present invention taken along lines 4—4 of Figure 2;

Figure 5 is a cross-sectional view of the winding mechanism in accordance with the present invention taken along lines 5—5 of Figure 2;

Figure 6 is a cross-sectional view of the lever arrangement in the feed mechanism of the present invention taken along lines 6—6 of Figure 2;

Figure 7 is a cross-sectional view of the feed mechanism in accordance with the present invention taken along lines 7—7 of Figure 2;

Figure 8 is a partial, cross-sectional view similar to Figure 3 with the inner pawls depressed at end of the counterrecoil stroke as will be explained more fully hereinafter;

Figure 9 is an enlarged cross-sectional view of the winding mechanism shown in Figure 2 at the end of the recoil stroke and beginning of counterrecoil stroke;

Figure 10 is an exploded perspective view including from left to right the arbor ratchet, the interrupter ring, the collar, the ratchet interrupter and the winding arbor;

Figure 11 is a perspective view of the manual ratchet disengagement device;

Figure 12 is a perspective view of the lever swivel block.

Referring now more particularly to the drawings wherein like reference numerals are used to designate like parts in the various figures thereof, reference numeral 1 indicates the gun barrel which is housed in receiver 2 as is well known in the art. A conventional bolt unlocking mechanism which is gas operated comprises a reciprocating rod 3 (Fig. 1) which is actuated by pressure from gases in the gun barrel 1 which are fed into a cylinder housing 4 at the forward end of rod 3. The rearward end of rod 3 is provided with a yoke 5 which impinges on the bolt unlocking rods 6 and 6' (Fig. 7) as is well known in the art. Two 90° supporting brackets 7 and 7' are rigidly secured to trunnion bearings 8 and 8' by bolts 9. Rods 10 and 10' are fastened at their forward end to brackets 7 and 7' by means of nuts 11 and 11' (Fig. 1) which engage the threaded end portions of rods 10 and 10'. The rearward portions of rods 10 and 10' comprise a tongue portion (not shown) with a bore therethrough to receive a transverse rod 12 (Figs. 2 and 6) which extends through the bores in the tongue portions and through bore 13 in lugs 14 fastened to receiver 2, thereby securing rods 10 and 10' between trunnion bearings 8 and 8' and receiver 2.

Rods 10 and 10' support spacers 15 and 15' and spacers 16 and 16' (Fig. 1). These spacers determine the position of upright brackets 17 and 17'. Brackets 17 and 17' each comprise a bore (not shown) to receive rods 10 and 10' which support brackets 17 and 17'. Brackets 17 and 17' are retained in upright position by plate 18 which is secured to brackets 17 and 17' by bolts 19 and 19'. Winding levers 20 and 20' are pivotally secured to brackets 17 and 17' and to plate 18 by means of bolts 21 and 21'. Brackets 17 and 17' have undercut portions 22 and 22' to accommodate winding levers 20 and 20'. Winding levers 20 and 20' have a rearwardly disposed, bent fingers 23 and 23' and forwardly disposed lever arms 24 and 24'. Fingers 23 and 23' engage upright winding studs 25 and 25' of winding lever drive bracket 26 (Figs. 1 and 7). Winding lever drive bracket 26 is secured to lug 27 (Figs. 2 and 7) which in turn is fastened to barrel 1 in any conventional manner for movement therewith during recoil and counterrecoil.

Lever arms 24 and 24' engage openings 28 and 28' provided in lever swivel block 29 which forms an integral part with winding sleeve 30 (Figs. 1 and 12). Winding sleeve 30 is provided with internal helical splines 31 (Figs. 2 and 6) for engagement with corresponding external

helical splines 32 on winding shaft 33. Winding sleeve 30 moves within winding sleeve bracket 34 and is provided with lateral protrusions 35 and 35' (Figs. 6 and 12) which fit into corresponding grooves 36 and 36' on the inside of winding sleeve bracket 34 to prevent rotation of winding sleeve 30 and restrict its movement along the direction of recoil and counterrecoil of the gun.

Winding sleeve bracket 34 comprises at its rearward end a flange 37 which is fastened to the forward member of the feed mechanism frame 39 by bolts 40 and 40' (Figs. 1, 2 and 6).

Feed mechanism frame 39 forms at its rearward end a housing 41 which contains the winding mechanism. The winding shaft 33 rotates within feed shaft 42 and is splined at its rearward end as indicated by reference numeral 43 (Figs. 2, 4 and 9). Hub 44 is provided with internal splines 45 for engagement with the splines 43 of winding shaft 33. A threaded nut 46 engages the threaded end portion 47 of winding shaft 33 whereby hub 44 is securely splined and fastened to winding shaft 33. Hub 44 is provided with three cutout portions 48 so as to engage the rounded -off ends 49 of ratchets 50 (Fig. 3). Cut-out portions 48 are so arranged as to secure ratchets 50 to hub 44 but to permit free pivotal movement of ratchets 50 in cut-out portions 48 of hub 44. Each ratchet is provided with a shoulder 90 which a ring spring 91 engages so as to urge ratchets 50 to pivot radially to assure engagement of ratchet teeth or splined outer surface 51 thereof with inner ratchet surface 52 of ratchet arbor 53 (Figs. 3, 4, 8 and 10). The outer surface of ratchet arbor 53 is provided with a further ratcheted or splined surface 54 for engagement with spring-loaded ratchets 55 designed to hold the device against unwinding.

A friction ring 56 (see Fig. 10) has internal splines 57 which engage ratchet surface 54 of ratchet arbor 53 thereby locking friction ring 56 for rotation with ratchet arbor 53 to provide the friction assist as will be more fully explained hereinafter. Ratchet arbor 53 through abutment 58 constitutes hollow winding arbor 59 which forms an integral part with ratchet arbor 53. Winding arbor 59 is of such diametric dimension as to permit winding shaft 33 to rotate freely therein. Ratchet interrupter 60 (see Fig. 10) has a sufficiently large bore 61 to fit slidably over winding arbor 59. Ratchet interrupter 60 is further provided with four symmetrically disposed lugs 62 which pass through corresponding grooves 63 cut through abutment 58 thereby securing ratchet interrupter 60 to winding arbor 59 for rotation therewith. Friction ring 56 has a cylindrical bore 64 of such diametric dimension as to permit free rotation of lugs 62: Ratchet interrupter 60 is also provided with a threaded portion 65 which engages the threaded portion 66 of spring housing hub 67. Portions 65 and 66 are of relatively coarse thread for reasons which will become obvious from the description of the operation of the feed mechanism. The friction assist drive utilizes an Ampco bronze face 56' of which friction ring 56 may be made against a hardened steel of which spring housing hub may be made.

Spring housing hub 67 is secured to spring housing 68 in any conventional manner as, for instance, by a bayonet type joint. A winding spring 69 is secured to winding arbor 59 in groove 70 thereof and to spring housing 68 by means of rivets 71 or the like, as is well-known in the art. Feed shaft 42 is secured to spring housing 68 in any conventional manner as for instance by splines 72 (see Figs. 2 and 9). A sleeve 73 serves as spacer between winding shaft 33 and feed shaft 42. Moreover sleeve 73 also serves as bearing for winding arbor 59. Feed shaft lug 74 is splined to feed shaft 42 as at 75.

Interrupter ring 76 (Figs. 2, 9 and 10) is positioned within ratchet arbor 53 and is provided internally with a camming surface of frusto-conical form. Ratchets 50 are provided with forwardly disposed, complementary cam surfaces 78 whereby rearward movement of ratchet interrupter 60 forces the camming surface 77 of interrupter ring 76 into engagement with cam surfaces 78 of ratchets to disengage splined ratchet surfaces 51 from inner ratchet surface 52 (Fig. 8). Ratchets 50 are further provided with rearwardly disposed cam surfaces 79 which are arranged to disengage ratchet surfaces 51 from inner ratchet surface 52 upon inserting a pin (not shown) into holes 80 of ratchet arbor 53 whereby disc 81 is moved in a forwardly direction. The peripheral part of disc 81 is shaped into an indented portion 82 which engages cam surfaces 79 of ratchets 50 when disc 81 is forced in a forward direction to disengage ratchet teeth 51 from inner ratchet surface 52.

A manual ratchet release ring 93 (Fig. 11) comprises three axially protruding segments 84 and an arm 85; a spring 85' may be used resting against arm 85 to keep ratchet release ring 83 in its normal assembled position (see Fig. 3). Segments 84 are so arranged that the space therebetween is sufficient to accommodate freely ratchets 55. However upon rotation of ratchet release ring 83, ratchets 55 are moved out of engagement with ratchet surface 54. Ratchet release ring 83 is kept within housing 41 by means of retainer ring 86 which is fastened to housing 41 in any conventional manner. Disc 81 is kept in its assembled position by means of a snap ring 87. Bearings 88 and 89 are provided to lessen the friction on feed shaft 42.

Operation

In order to put the feed mechanism into operating condition it is necessary to prewind spring 69. This is accomplished by using a straight pin (not shown) which is inserted into lug 74 on feed shaft 42. The first round is loaded manually by means of a charger and the belt is inserted into the feed mechanism and the spring 69 is then wound a predetermined amount.

The gun is now ready for automatic operation. The winding spring which exerts unwinding forces in a clockwise direction on winding arbor 59 and in a counterclockwise direction on spring housing 68 is prevented from unwinding except as necessary during operation of the feed mechanism by means of ratchets 55 which oppose clockwise rotation of winding arbor 59 and ratchet arbor 53 and by means of the belt and belt stop mechanism (not shown) which permits rotation in a counterclockwise direction of feed shaft 42 together with spring housing 68 only when a new round is fed into the feed mouth as is well-known in the art.

Immediately after firing of the first round the gun is in a position indicated in Figure 2 of the drawing. As barrel 1 recoils, lug 27 together with winding lever drive bracket 26 and winding studs 25 and 25' move rearwardly therewith (Fig. 7). Rearwardly moving winding studs 25 and 25', which engage fingers 23 and 23' of winding levers 20 and 20', rotate winding levers 20 and 20' in opposite directions as viewed in Figure 1. Lever arms 24 and 24' of windings levers 20 and 20', which engage openings 28 and 28' of lever swivel block 29 (Figs. 1 and 12), thus move lever swivel block 29 together with winding sleeve 30 in a rearward direction a greater amount than the rearward movement of winding studs 25 and 25', as determined by the mechanical advantage gained by the lever system of lever arms 24 and 24'. The lever system thus compensates for recoils which might otherwise be too short for satisfactory operation of the feed mechanism. Moreover increased rectilinear motion of winding sleeve 30 permitted reduction in the angle of helical splines 31 and 32 thereby reducing friction and assuring smooth and rapid rotation of the winding shaft 33.

Lateral protrusions 35 and 35' of winding sleeve 30 which engage corresponding grooves 36 and 36' in stationary winding sleeve bracket 34, restrict winding sleeve 30 to rectilinear rearward motion, and prevent any rotation of winding sleeve 30 which might be caused by the presence of helical splines 31. Upon rearward motion of winding sleeve 30, winding shaft 33, which is restricted to circular motion except for normal play, is rotated in a

clockwise direction as viewed in Figures 3–6 by the engagement of splines 31 with splines 32 of winding shaft 33. As a result, hub 44 secured to winding shaft 33, rotates in a clockwise direction. However no motion is transmitted to any other portion of the feed mechanism since the ratchet teeth 51 of ratchets 50 are permitted to ride over inner ratchet surface 52 of ratchet arbor 53.

Upon counterrecoil barrel 1, lug 27, lever drive bracket 26 and winding studs 25 and 25' move in a forwardly direction. Winding levers 20 and 20' are thereby rotated to their first position, and lever swivel block 29 and winding sleeve 30 move in a forwardly direction, thereby rotating winding shaft 33 in a counterclockwise direction.

As winding shaft 33 rotates in a counterclockwise direction, ratchet teeth 51 of inner ratchets 50 engage the inner ratchet surface 52 of ratchet arbor 53, thereby rotating ratchet arbor 53 in a counterclockwise direction. Since winding arbor 59 forms an integral part with ratchet arbor 53, winding arbor 59 will rotate in a counterclockwise direction and begin to wind spring 69. Simultaneously with counterclockwise rotation of ratchet arbor 53 and winding arbor 59, ratchet interrupter 60, which is locked for rotation therewith by means of lugs 62 which engage grooves 63 in abutment 58, will also rotate counterclockwise as viewed in Figure 4. Since ratchet interrupter 60 is provided with a right-hand threaded portion 65 on its periphery, it will move in a rearward direction (i. e. toward the left in Figs. 2 and 9) as long as spring housing hub 67 does not also rotate counterclockwise at a rate equal or in excess to that of ratchet interrupter 60. As ratchet interrupter 60 moves rearwardly its lugs 62 engage ring 76 and force it rearwardly whereby, camming edge 77 of interrupter ring 76 will engage cam surfaces 78 of ratchets 50 thereby disengaging ratchet teeth 51 of ratchet 50 from inner ratchet surface 52 of winding arbor 53 as shown in Figure 8. Since threads 65 and 66 on ratchet interrupter 60 and spring housing hub 67 are relatively coarse, only a few counterclockwise rotations of ratchet interrupter 60 relative to spring housing hub 67 are required to disengage the unidirectional coupling formed by inner ratchets 50.

Since friction ring 56 is splined to ratchet arbor 53, it will rotate therewith during counterrecoil in a counterclockwise direction. Moreover since the winding operation starts at about the same time a new round is being admitted to the feed mouth which releases feed shaft 42 for limited predetermined counterclockwise rotation, ring 56 which comprises a friction face 56', such as Ampco bronze, engaging the rear of housing hub 67, will provide as much as 15% more torque direct to the feed shaft 42 through spring housing hub 67 and spring housing 68 which are all secured to one another for simultaneous rotation. This friction assist torque, which is provided at the beginning of feeding operation, is caused by the forward thrust of counterrecoiling winding sleeve 30 which transmits the forward thrust to ring 56 through winding shaft 33 and hub 44 which in turn exerts the same forward thrust on abutment 58 as at 92, which thereupon transmits such thrust to collar 56.

Although feed shaft 42, spring housing 68 and spring housing hub 67 rotate counterclockwise at the same time as counterclockwise rotation of winding arbor 59, the former will rotate at lesser speed due to slippage in the friction assist and the load on the feed shaft 42, so that relative counterclockwise rotation of winding arbor 59 and ratchet interrupter 60 relative to spring housing 68 exists which will eventually disable the unidirectional coupling formed by ratchets 50, thereby preventing overwinding of spring 69 as shown in Figure 9.

After completion of the counterrecoil, feed shaft 42 will continue its feeding operation so that spring housing hub 67 will now rotate counterclockwise relative to stationary ratchet interrupter, which is effectively the same as a clockwise rotation of ratchet interrupter 60 relative to spring housing hub 67, thereby moving ratchet interrupter 60 in a forward direction to reenable the unidirectional coupling for the next cycle of operation which will occur during the next counterrecoil. It is obvious that threads 65 and 66 are designed to provide the proper amount of winding necessary to continue automatic operation of the gun without endangering overwinding of spring 69.

In order to unwind the spring 69 during unloading, a pin (not shown) is inserted in holes 80 which will exert pressure against disc 81 and hold the same forwardly. Pressure on disc 81 will bring indented or camming portion 82 thereof into engagement with rearward cam surfaces 79 of ratchets 50 which are thereby disengaged from inner ratchet surface 52 of ratchet arbor 53. Spring 69 is then safely unwound by cranking this pin as segments 84 of ratchet release ring 83 holds outer ratchets 55 out of engagement with outer ratchet surface 54 of winding arbor 53 by small manual, rotational displacement of ratchet release ring 83 from its normal position.

While I have shown and described only one preferred embodiment of my invention, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

I claim:

1. A feed mechanism for automatic cannons including a barrel, comprising a feed shaft, a spring housing secured to said feed shaft, a winding arbor, a clock type spring fastened at its ends to said spring housing and to said winding arbor respectively, a ratchet arbor forming an integral part with said winding arbor through an abutment, internal and external ratchet surfaces on said ratchet arbor, a winding shaft, first ratchet means interposed between said winding shaft and said internal ratchet surface for unidirectionally coupling said arbor to said winding shaft, second ratchet means in operative engagement with said external ratchet means for preventing unwinding of said spring, a hollow spring housing hub having an internally threaded portion secured to said spring housing, a friction ring having internal splines for engagement with said external ratchet surface said ring abutting the rear face of said housing hub for rotation therewith to assist feeding rotation of said housing and feed shaft, a ratchet interrupter having an externally threaded portion for engagement with the internally threaded portion of said spring housing hub, said ratchet interrupter including a plurality of lugs, means for limiting said ratchet interrupter to axial motion relative to said winding arbor, further means for disengaging said first ratchet means from said internal ratchet surface upon predetermined rearward movement of said ratchet interrupter, and means for converting the rectilinear recoil and counterrecoil motion of said barrel into circular motion of said winding shaft, said last-named means including a mechanical lever system to increase said rectilinear motion prior to its conversion into circular motion.

2. In a feed mechanism for an automatic gun having a receiver and a barrel mounted therein for reciprocation in recoil and counterrecoil, a winding shaft journaled in said receiver, a spring housing coaxially surrounding said shaft and including a threaded hub, a coil driving spring within said housing and having one end secured thereto, a ratchet arbor coaxial of said shaft and having a tubular extension within said housing, the other end of said spring being attached to said extension, driving ratchet means between said arbor and said shaft, holding ratchet means between said arbor and said receiver, a ratchet interrupter threadedly engaging said hub whereby said interrupter is moved axially of said hub in response to relative rotation of said hub and interrupter, means operated by axial movement of said interrupter to render said driving ratchet means inoperable, means rotating

said winding shaft by and in response to reciprocation of said barrel in opposite directions, and means operated by said spring housing to feed cartridges to the gun.

3. In a feed mechanism for an automatic gun having a receiver, a winding shaft journaled in said receiver, a spring housing journaled in said receiver coaxially about said shaft and including a threaded hub, a ratchet arbor journaled in said receiver coaxially of said shaft and having an extension into said housing, a driving coil spring within said housing and having its ends secured to said housing and extension, respectively, driving ratchet means carried by said shaft and engaging ratchet teeth formed internally on said arbor whereby rotation of said shaft in one direction normally rotates said arbor, holding ratchet means carried by said receiver and engaging ratchet teeth formed externally on said arbor to prevent retrograde rotation thereof, a ratchet interrupter threadedly engaging said hub and having splined engagement with said arbor whereby said interrupter is moved axially in response to relative rotation between said arbor and housing, means operated by axial movement of said interrupter to a predetermined position axially of said arbor to render said driving ratchet means inoperable, and means driven by rotation of said housing to feed cartridges to the gun.

4. In a feed mechanism component for an automatic gun having a receiver, a winding shaft journaled in said receiver, a ratchet arbor coaxially of said shaft and comprising tubular rearward and forward portions of greater and lesser diameters respectively, and a shoulder integrally connecting said portions, there being a plurality of circumferentially-spaced holes through said shoulder, and first and second sets of ratchet teeth interiorly and exteriorly respectively, on said rearward portion, a coaxial spring housing carried by said receiver rotatable about said shaft and forward portion during feeding motion thereof and including a hub rotatable therewith and having a rearward face spaced from and adjacent said shoulder, first ratchet means carried by said shaft interiorly of said rearward portion and normally engaging said first set of ratchet teeth, a coiled spring coaxial of said forward portion and having its respective ends secured to said spring housing and forward portion, an interrupter journaled on said forward portion and threadedly engaging said hub and slidable rearwardly when its rotational speed exceeds that of said hub, there being lugs on said interrupter extending slidably through respective holes in said shoulder, second ratchet means carried by said receiver and engaging said second set of ratchet teeth, an interrupter ring in said rearward portion to render said first ratchet means inoperable in response to rearward movement of said interrupter lugs, and a friction ring interposed between and contacting the confronting faces of said shoulder portion and hub, said friction ring being splined to said rearward portion for rotation and axial movement therewith and axial movement with respect to said hub.

5. In a component for the feed mechanism of an automatic gun, a winding shaft, a tubular ratchet arbor coaxial of and about said shaft and having an integral extension of reduced dimeter defining a shoulder with said arbor, said arbor having a set of ratchet teeth on its interior surface, a spring housing journaled coaxially about said extension and having a threaded hub adjacent said arbor, a coil spring in said housing having its ends secured to said housing and extension, respectively, ratchet means between said shaft and ratchet teeth to drive said arbor in one direction only in response to a corresponding rotation of said shaft, an interrupter member mounted on said extension for axial sliding only with respect thereto and in threaded engagement with said hub, and means operated by axial movement of said interrupter to a predetermined position axially of said arbor to effect disengagement of said ratchet means from said ratchet teeth.

6. In a component as recited in claim 5, and a friction ring between said arbor and hub and in frictional contact with both.

7. In a feeding mechanism for an automatic gun having a receiver and a barrel mounted in said receiver for reciprocation in recoil and counterrecoil, a winding shaft journaled in said receiver, driving means operated by and in response to reciprocation of said barrel for effecting proportional rotation of said shaft in respective directions, a tubular arbor journaled in said receiver coaxially about said shaft and having first and second sets of ratchet teeth on its inner and outer surfaces, respectively, first ratchet means carried by said shaft and engaging said first set of teeth to rotate said arbor in response to counterrecoil rotation only of said shaft, second ratchet means carried by said receiver and engaging said second set of teeth to hold said arbor in the position to which rotated by said shaft, a spring housing rotatably mounted coaxially of said shaft, a coil driving spring in said housing and having its ends connected respectively to said housing and said arbor, and means responsive to a predetermined excess of rotation of said shaft respectively to said housing to render said first ratchet means inoperable.

8. A feeding mechanism as recited in claim 7, said last named means comprising a threaded hub integral with said housing, an interrupter threadedly engaging said hub and mounted for axial sliding only on and with respect to said arbor, and means freeing said first ratchet means from its teeth by and in response to a predetermined axial position of said interrupter relatively to said arbor.

9. A feeding mechanism as in claim 8, said arbor and hub having axially spaced confronting faces normal to said shaft, and a friction ring interposed between and contacting both said faces.

10. A feeding mechanism as in claim 9, said driving means effecting an axial pull on said shaft in response to counterrecoil of said barrel, means fixing said housing against axial shift with respect to said shaft, and means whereby axial pull on said shaft tends to move said arbor toward said hub to thereby increase the pressure on said friction ring.

11. In a feed mechanism for an automatic gun, a receiver housing, a winding shaft journaled in said housing, a tubular winding arbor coaxial about said shaft and having internal and external ratchet teeth, driving ratchets carried by said shaft and engaging said internal teeth to rotate said arbor in one direction of rotation only of said shaft, a spring housing journaled coaxially about said shaft and arbor, a driving coil spring having its ends attached with said arbor and spring housing respectively, holding ratchets carried by said receiver housing and engaging the external teeth on said arbor, the rearward end of said arbor having aligned diametral holes in a portion projecting from said receiver housing, a ratchet release cup slidably fitting said arbor and having a cam portion normally obstructing said holes whereby a winding rod inserted through said holes cams said cup axially, said cup and driving ratchets having coacting cam surfaces whereby the latter are cammed to inoperable position by axial movement of said cup, as aforesaid.

12. A feed mechanism as recited in claim 11, and a manual release ring mounted on said receiver housing for rotation coaxially about said shaft and arbor, said ring having axially protruding segments engageable with and releasing said holding ratchets from the external teeth on said arbor in response to a predetermined rotation of said ring, and means external of said housing to rotate said ring.

13. In a feed mechanism for an automatic gun having a receiver and a barrel mounted for reciprocation in said receiver in recoil and counterrecoil, first and second bellcranks, means pivotally mounting said bellcranks on laterally spaced parallel axes fixed with respect to said receiver, each said bellcrank having arms of shorter and longer effective lengths, a winding sleeve mounted for reciprocation parallel with the bore axis of said barrel

and connected with the longer of said bellcrank arms for reciprocation in response to pivoting of said bellcranks, means associated with the shorter of said bellcrank arms to pivot the same by and in response to recoil of said barrel, a driving spring, a winding shaft, means tensioning said spring in response to rotation of said shaft in one direction, and means rotating said shaft in opposite directions by and in response to corresponding directions of reciprocation of said sleeve.

14. A feed mechanism as in claim 13, said last-named means comprising helical splines on the interior of said sleeve and in mesh with helical splines on said shaft.

15. In a feed mechanism for an automatic gun having a receiver and a barrel mounted by said receiver for reciprocation in recoil and counterrecoil, first and second bellcranks each having first and second arms of greater and lesser length, respectively, means mounting said bellcranks on said receiver for pivotal movement about respective transversely-spaced parallel axes normal to the bore of said barrel, a drive bracket fixed with said barrel for reciprocation therewith and having upstanding lugs each drivingly engaging a respective second arm of said bellcranks, a winding sleeve, a swivel block integral with said sleeve, a swivel connection between said block and the first arms of said bellcranks, a winding shaft journaled in said receiver, a splined connection between said sleeve and shaft, a driving coil spring, ratchet means winding said spring by and in response to counterrecoil rotation of said shaft, means operated by said spring to feed ammunition to said gun, and means responsive to a predetermined winding of said spring to render said ratchet means inoperable.

16. A feed mechanism for automatic cannons including a barrel, comprising a hollow feed shaft, a spring housing secured to said hollow feed shaft, a winding arbor journaled within said spring housing coaxially thereof, a flat spiral spring secured at its ends to said spring housing and said winding arbor respectively, a ratchet arbor formed integral with said winding arbor and having a slotted abutment formed at the junction between said arbors, internal and external ratchet surfaces on said ratchet arbor, a winding shaft axially disposed within said feed shaft and said arbors, a first ratchet means having cam faces thereon interposed between said winding shaft and said internal ratchet surface for coupling said arbor to said winding shaft on counterrecoil movement of said barrel to wind said spiral spring, a second ratchet means in operative engagement with said external ratchet surface to prevent unwinding of said spring, a hollow internally screw threaded hub secured to said spring housing surrounding said winding arbor adjacent said winding arbor abutment, a ratchet interrupter having an externally threaded portion for engagement with the internally threaded portion of said spring housing hub said screw threaded portions of said spring housing hub and said ratchet interrupter having a predetermined pitch, said interrupter having a plurality of lugs axially movable through said slotted abutment whereby said interrupter rotates as a unit with said arbors, a camming ring axially movable within said winding arbor for engagement by said lugs and operable to disengage said first ratchet means in response to a predetermined relative rotation between said hub and interrupter, a friction ring forming a winding assist and having internal teeth engageable with said external ratchet surface of said ratchet arbor for rotation therewith, said friction ring having a forward portion in frictional engagement with the rear end of said spring housing hub, and means for multiplying and converting rectilinear recoil and counterrecoil motion of said barrel into circular motion of said winding shaft.

17. In a feed mechanism for automatic guns, the combination comprising a feed means comprising a spring housing having an internally threaded hollow hub on its rear end, a spring winding arbor coaxial of said housing, a spiral winding spring in said housing connected at respective ends to said housing and winding arbor, a winding shaft coaxially rotatable in said arbor and having helical splines formed on its forward end, unidirectional coupling means connecting said winding arbor and winding shaft for rotation in response to counterrecoil movement of the gun, said coupling means comprising a series of spring pressed ratchet members pivotally mounted on said winding shaft each said ratchet member having a cam surface on its forward face, a diametrically enlarged hollow cylindrical ratchet arbor coaxial of said winding arbor and having serrations on its inner surface to receive the thrust of said ratchets during counterrecoil movement of the gun, said ratchet arbor being formed integrally with said winding arbor to provide a shoulder at their junction, there being a series of annularly spaced grooves in said shoulder, overwind protection means comprising a coaxial annular ratchet interrupter externally threaded to engage said internally threaded hub on said spring housing and a series of rearwardly extending lugs integral with said ratchet interrupter and slidable through the grooves in said shoulder, an interrupter ring positioned between the rearward ends of said lugs and the forward faces of said ratchets, there being a rearwardly facing cam surface on said ring opposite the cam surfaces on said ratchets, whereby when rotation of said winding shaft exceeds predetermined feeding energy stored in said spring, said ratchet interrupter is displaced rearwardly by the threaded connection with said housing hub, said lugs slide rearwardly, forcing the cam surface of said interrupter ring against the cam surfaces on said ratchets, retracting said ratchets from the serrations in said ratchet interrupter and releasing said ratchet arbor, a winding sleeve having internal helical splines in mesh with the helical splines on said winding shaft, and a lever system connecting said winding sleeve and a recoiling part of the gun in magnifying relation to increase rotation of said winding shaft.

18. In a feed mechanism for an automatic gun having a receiver, a winding shaft journaled in said receiver, a spring housing journaled in said receiver coaxially about said shaft, a ratchet arbor journaled in said receiver comprising a generally tubular main portion and a tubular extension of reduced diameter integral with said main portion, said reduced extension entering said housing and defining a shoulder between said main portion and said reduced extension, there also being a plurality of axial openings in and through said shoulder, a driving coil spring within said housing, ratchet means carried by said shaft cooperating with said arbor rotating said shaft in one direction only, means carried by said receiver preventing reverse rotation of said arbor, means preventing overwinding of said coil spring comprising a tubular ratchet interrupter rotatably fitting said reduced extension and having axial lugs, each slidably fitting a corresponding opening in said shoulder, and means actuated by axial movement of said interrupter rendering said ratchet means inoperable.

19. In a feed mechanism for an automatic gun as claimed in claim 18 wherein said spring housing is disposed coaxially of and surrounds said reduced extension and includes a hub adjacent said main portion, said hub and said interrupter being threadably engaged, and said driving coil spring is secured at one end to and surrounds said extension in an annular space between said housing and extension and is secured at its other end to said housing.

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