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J. G. ROCHA
CLUTCH-LOCK FOR EXTERNALLY POWERED
FIREARM FEEDING MECHANISM

3,296,930

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3 Sheets-Sheet 1

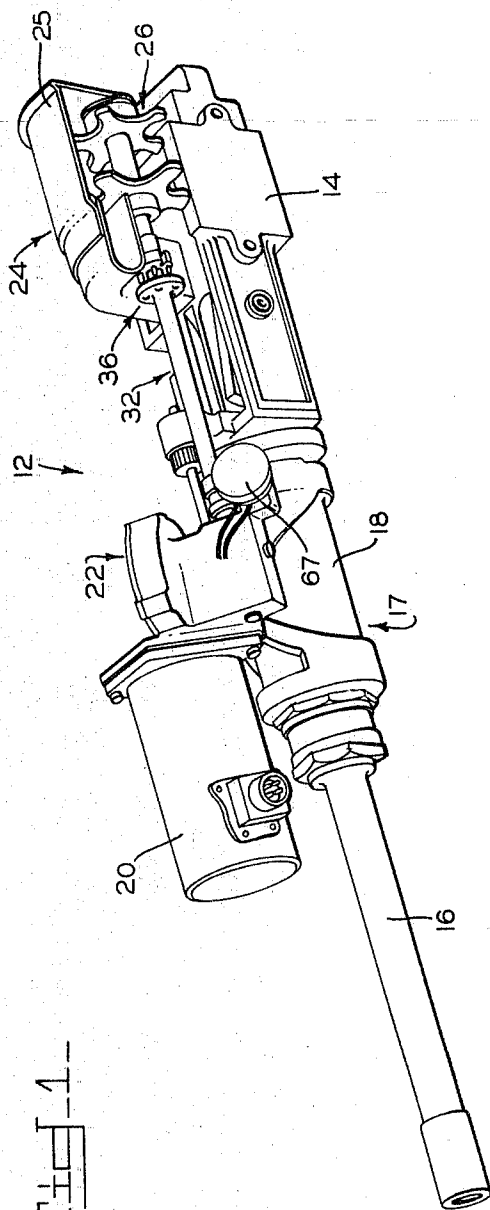


FIG. 1

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Fig. 2

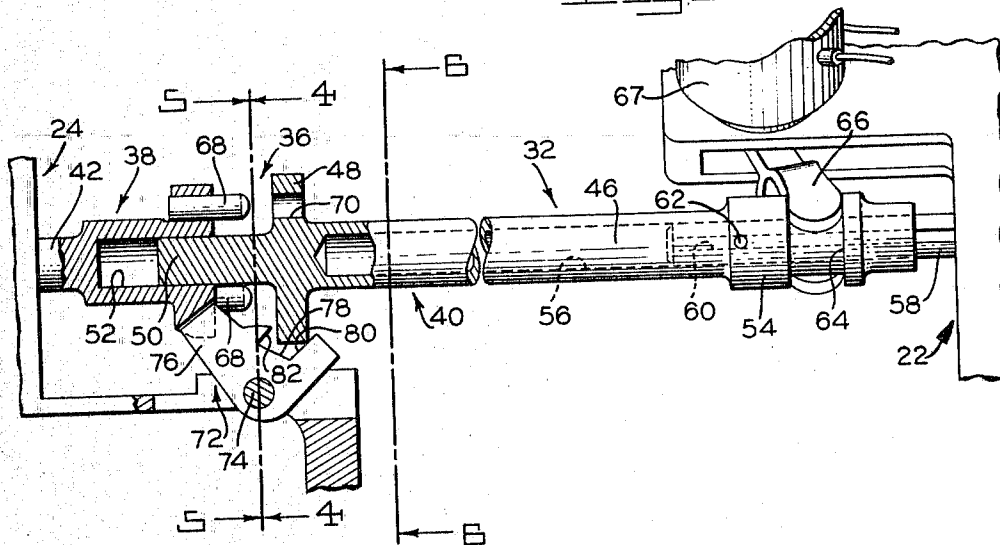


Fig. 3

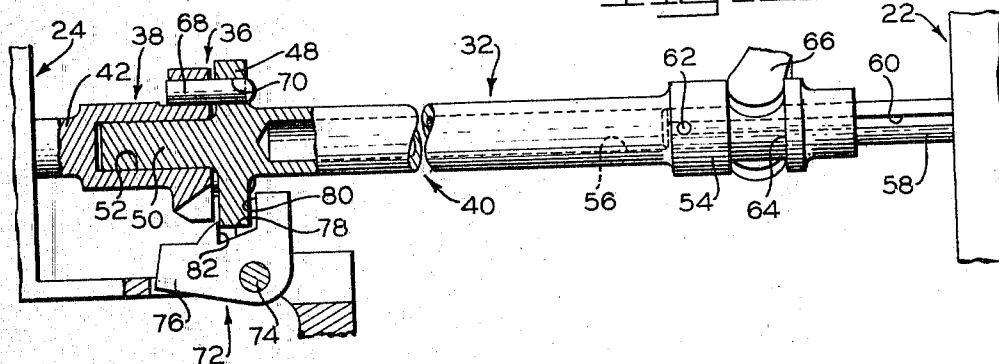


Fig. 4

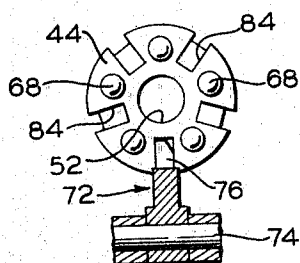
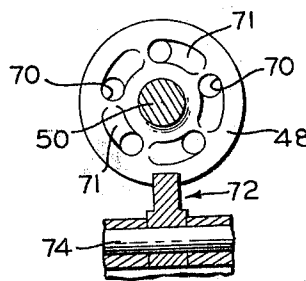


Fig. 5



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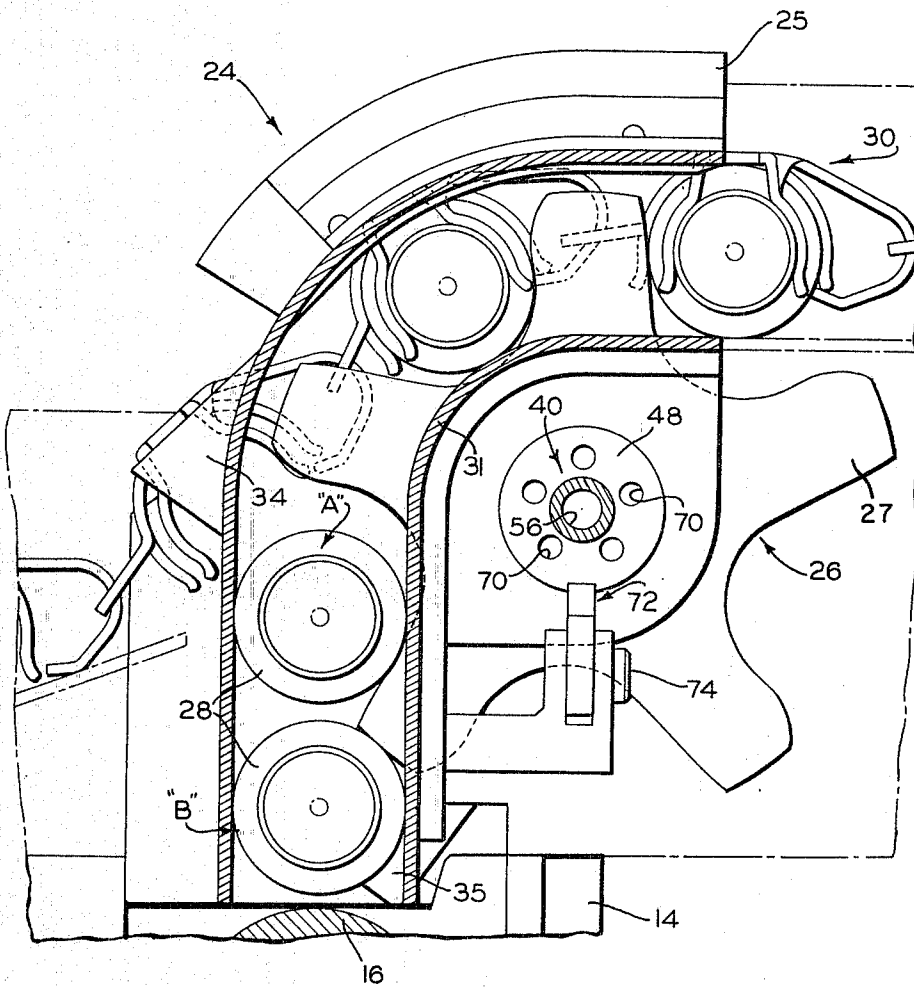
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Fig. 6



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CLUTCH-LOCK FOR EXTERNALLY POWERED FIREARM FEEDING MECHANISM

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3 Claims. (Cl. 89—33)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to automatic guns which are operated by an external source of power and pertains more particularly to the controls of the feeding mechanisms thereof.

With automatic guns having a feeding mechanism which is operated by an external source of power, problems arise because the feeding mechanisms are connected directly with the gun operating mechanism and therefore, when the trigger is released, the feeding mechanism continues to feed as the gun coasts to a stop, and heretofore there has not been provided any simple and automatic means for clearing the gun to leave it in a safe condition between bursts.

It is, therefore, the object of this invention to provide between the operating mechanism and a sprocket type feeding mechanism of such an automatic gun a combination clutch and locking device which provides for automatic clearing of the gun at the end of each burst and which assures that;

(1) The feeding mechanism will be driven at a continuous motion without backlash relative to the operating mechanism when engaged therewith;

(2) The feeding mechanism will be releasably engageable to the operating mechanism at a definite position relative thereto to assure synchronized relationship between the gun and feeder;

(3) The feeding mechanism will be locked in a selected position when the trigger is released and the clutch is actuated to disengage the feeding mechanism from the operating mechanism;

(4) The gun will continue operating for at least two more cycles after the feeding mechanism is locked to clear the gun of all uncontrolled cartridges which have been stripped from the cartridge belt; and

(5) When firing is resumed, the feeding mechanism will be engaged with the operating mechanism and unlocked for rotation thereby without an uncontrolled period which would permit reverse free wheeling of the feeding mechanism by weight of the cartridge belt.

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 perspective view of a machine gun with the clutch-lock device of this invention installed therein;

FIG. 2 is an enlarged partially cross-sectioned side view of the clutch-lock device showing the clutch disengaged and the lock engaged;

FIG. 3 is a view similar to FIG. 2 but showing the clutch engaged and the lock disengaged;

FIG. 4 is a view taken along line 4—4 of FIG. 2;

FIG. 5 is a view taken along line 5—5 of FIG. 2; and

FIG. 6 is a view taken along line 6—6 of FIG. 2.

Shown in the figures is an automatic gun 12 which includes a receiver 14 and a barrel 16 mounted therein for reciprocation between a forward loading position and a rearward battery position. Barrel 16 is reciprocated by an operating mechanism 17 such as is disclosed in U.S. Patent 3,241,448 to J. G. Rocha and patent application

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by Reed et al. for "Rotary Cam Actuated Operating Rod Mechanism," Serial Number 485,657, filed September 7, 1965 and includes a cam drum 18 which is rotated by an electric motor 20 through a transmission 22. Motor 20 is arranged to be energized when a trigger (not shown) is pulled.

Mounted on the top of receiver 14 is a feeding mechanism 24 which includes a housing 25 and a sprocket device 26 with five teeth 27 which successively engage cartridges 28 in a cartridge belt 30 to drive the belt through the housing along a feed tray 31. Sprocket device 26 is connected by a drive shaft 32 to transmission 22 for rotation thereby in a clockwise direction and cam drum 18 is so designed that for each operating cycle of gun 12 the sprocket device is advanced one pitch. Feeding mechanism 24 also includes a stripper 34 which removes cartridges 28 sideways from cartridge belt 30 during movement thereof through housing 25. The stripped cartridges 28 are delivered to feed tray 31 for further advancement by a feed pawl 35 to a firing position in axial alignment with barrel 16. Feed pawl 35 is actuated by barrel 16 for synchronization therewith as disclosed in the patent application by Frederick P. Reed for "Feed Mechanism," Serial Number 452,412, filed April 30, 1965. Stripper 34 and feed pawl 35 are so spaced relative to the firing position that two stripped cartridges 28 are located in feeder 24 between sprocket device 26 and barrel 16, during operation of gun 12.

Drive shaft 32 is interrupted by a clutch 36 which provides for releasable engagement of sprocket device 26 with transmission 22. Clutch 36 includes a driven member 38 and a drive member 40. Driven member 38 includes a shaft 42, which is a forward extension of the axle of sprocket device 26, and a cylindrical pin plate 44 integrally formed on the front end of the shaft. Drive member 40 includes a shaft 46 and a clutch plate 48 integrally formed thereon between a rear section 50 and a front section 54 of such shaft. Rear section 50 is journaled in a mating hole 52 that extends rearwardly into shaft 42 along the axis thereof from the front end and front section 54 is axially bored at 56 to receive a spindle 58 which is directly connected to transmission 22.

Spindle 58 is slotted at 60 to receive a pin 62 which extends transversely through front section 54 so that drive member 40 is rotatable by the spindle without loss of movement but is freely displaceable for translational movement relative thereto between a rearward engaging and a forward disengaging position. Provided in drive member 40 is an annular channel 64 which is engaged by a yoke 66 arranged to be pivoted by a solenoid 67 for actuating such drive member between the engaging and disengaging positions. Solenoid 67 is electrically connected to the trigger (not shown) so that, when the trigger is pulled, the solenoid is energized with motor 20 and drive member 40 is thereby actuated to the engaged position. When the trigger is released, solenoid 67 is de-energized with motor 20 and drive member 40 is thereby actuated to the disengaged position.

Mounted in pin plate 44 for forward extension therefrom are five pins 68 which are symmetrically disposed around the center of such pin plate as shown in FIG. 4 and the length of such pins is such that they are free of clutch plate 48 when drive member 40 is in the disengaged position as shown in FIG. 2. When drive member 40 is actuated to the engaging position, as shown in FIG. 3, pins 68 are received by mating apertures 70 in clutch plate 48 so that feeding mechanism 24 is engaged with operating mechanism 17 without relative movement therebetween. An arcuately formed ramp 71 leads in a counterclockwise direction into each of the apertures 70 from the rear face of clutch plate 48, as shown in FIG. 5, for facilitating the engagement of drive member

40 and driven member 38. As pins 68 and apertures 70 are symmetrically arranged, they are engageable at any one of five positions, spaced 72° apart, whereby operating mechanism 17 is synchronized with the five toothed sprocket device 26 in anyone of five positions. When drive member 40 is in the disengaged position, as shown in FIG. 2, sprocket device 26 is locked against displacement by a lock 72 which is pivotally mounted on feed tray 31 by a laterally disposed pin 74 for cooperation with clutch plate 48 and pin plate 44 as hereinafter described. Lock 72 includes an integral tongue 76 which extends rearwardly from pin 74 and a recess 78 which is located above such pin so as to receive the outside perimeter of clutch plate 48 as shown in FIGS. 2 and 3. Recess 78 forms a front wall 80 which is contactable by the front face of clutch plate 48 to pivot lock 72, so as to raise tongue 76 to a locking position, when drive member 40 is actuated to the disengaged position. Recess 78 also forms a rear wall 82 which is contactable by the rear face of clutch plate 48 to lower tongue 76 to an unlocked position when drive member 40 is actuated to the engaging position as shown in FIG. 3.

When lock 72 is in the locked position, the end of tongue 76 is received by one of five notches 84 formed in the periphery of pin plate 44 so that sprocket device 26 is blocked against rotation. Notches 84 are symmetrically located around pin plate 44 and are positioned so that, when one thereof is engaged by lock 72, teeth 27 of sprocket device 26 are positioned, as noted in FIG. 6, so that the last one of the two stripped cartridges on feed tray 31, noted at "A," is blocked from passage therealong and so that the sprocket device is synchronized with feed pawl 35 for continuous feeding of the cartridges from the sprocket device to the firing position.

OPERATION

When gun 12 is idle, clutch 36 is disengaged and feeding mechanism 24 is blocked against rotation by lock 72 so that the weight of cartridge belt 30 against sprocket device 26 cannot cause a reverse free wheeling thereof.

When gun 12 is fired, the trigger (not shown) is pulled which simultaneously energizes motor 20 and solenoid 67. Thus, drive member 40 is energized by motor 20 and solenoid 67, through yoke 66, presses the drive member rearwardly so that the front ends of pins 68 bear against the aligned ones of the ramps 71 and then, as the drive member is rotated, the drive member creeps rearwardly according to the slope of the ramps until the pins are in registry with the respective apertures 70. Final displacement of solenoid 67 presses pins 68 into apertures 70 for full engagement of clutch 36. At the same time, as drive member 40 creeps rearwardly, clutch plate 48 contacts rear wall 82 of lock 72 causing pivotal displacement thereof and disengagement of tongue 76 from the engaged ones of notches 84 so that, when clutch 36 is fully engaged, lock 72 has unlocked sprocket device 26 for rotation by the drive member.

When firing is to be stopped, the trigger (not shown) is released whereupon solenoid 67 and motor 20 are de-energized. De-energizing solenoid 67 causes drive member 40 to be actuated forwardly to the disengaged position, where clutch plate 48 is free of pins 68, and simultaneously lock 72 is pivoted so that tongue 76 thereof engages the aligned one of the notches 84 to lock feeding mechanism 24 against further rotation at a position wherein cartridge "A" of the two stripped cartridges 28 is controllably held by sprocket device 26 from engagement by feed pawl 35. However, motor 20 and operating mechanism 17 are free to coast to a stop. If the normal coasting period is not sufficient to operate gun 12 for at least two additional cycles, a time delay device may be included in the electrical circuit controlling motor 20. The two additional cycles are important because it is during this period that the chambered cartridge 28 is fired and the free one of the stripped cartridges (noted at "B" in FIG. 75

6) is fed by feed pawl 35 to battery position and fired to leave gun 12 in a safe condition.

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.

I claim:

1. A machine gun for firing cartridges delivered thereto in a cartridge belt, said machine gun including a receiver; an operating mechanism; an electric motor; a transmission for transmitting the torque of said motor to said operating mechanism; a feeding mechanism including a sprocket device with a plurality of teeth engageable with the cartridges in the cartridge belt for movement thereof, a stripper for removing the cartridges from the cartridge belt onto a feed tray while being moved by said sprocket device and a feed pawl for successively moving the stripped cartridges along the feed tray to a firing position; a drive shaft disposed between said transmission and said sprocket device for transmitting the torque of said motor thereto; a clutch arranged in said drive shaft to provide releasable engagement of said sprocket device with said transmission; means for actuating said clutch to a disengaged position for releasing said sprocket device from said transmission when said motor is de-energized and to an engaged position for connecting said sprocket device to said transmission when said motor is energized; a lock cooperating with said clutch for locking said sprocket device against rotation when said clutch is actuated to the disengaged position and for unlocking said sprocket device when said clutch is actuated to the engaged position; said clutch including a drive member connected to said transmission for rotation thereby without angular displacement relative thereto and for longitudinal displacement relative thereto between an engaged and a disengaged position, a driven member integral with said sprocket device and means for engaging said lock with said drive member for actuation thereby to locked and unlocked positions relative to said sprocket device; said sprocket device, said feed pawl, said stripper and the firing position being so located relative to each other that two stripped cartridges are disposed between said sprocket device and said firing position during operation of said machine gun; said driven member being provided with a plurality of notches equal to the number of said teeth in said sprocket device, said sprocket device being disposed in a locked position in response to said lock engaging one of said driven member notches and wherein one of said teeth blocks displacement of one of the two stripped cartridges into position for engagement by said feed pawl and the other one of the two stripped cartridges is free to be delivered to the firing position by said feed pawl and fired during continued operation of said operating mechanism after said feeding mechanism is locked against displacement; said driven member including a shaft extending integrally from said sprocket device, a pin plate coaxially formed on the free end of said shaft and a plurality of pins equal to the number of teeth in said sprocket symmetrically mounted in said pin plate for extension therefrom; and said drive member including a clutch plate in coaxial relationship with said driven member, a plurality of apertures in said clutch plate equal to the number of said pins, said apertures being arranged to receive said pins when said drive member is actuated to the engaged position; said pins having such a length that said pins are free of said apertures when said drive member is in the disengaged position; and a plurality of arcuate ramps respectively leading into a related one of said apertures from a face of said clutch plate facing said pin plate, said ramps being arranged for respective contact by said pins when said drive member is actuated to the engaged position to ease said pins into said apertures and said drive member into the engaged position.

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2. The machine gun as defined in claim 1 wherein said means for actuating said clutch includes an electric solenoid, and a pivotal yoke interposed between said solenoid and said drive member.

3. The machine gun as defined in claim 1 wherein said notches are formed in said pin plate and including means for mounting said lock for pivotal displacement between the locked and unlocked positions, a tongue formed on said lock for insertion into one of said notches when said lock is in the locked position and for withdrawal free of said notches when said lock is in the unlocked position, and a recess formed in said lock to receive the periphery of said clutch plate for converting displacement of said drive member to the disengaged position to pivotal displacement of said lock to the locked

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position and displacement of said drive member to the engaged position for pivotal displacement of said lock to the unlocked position.

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