

March 22, 1966

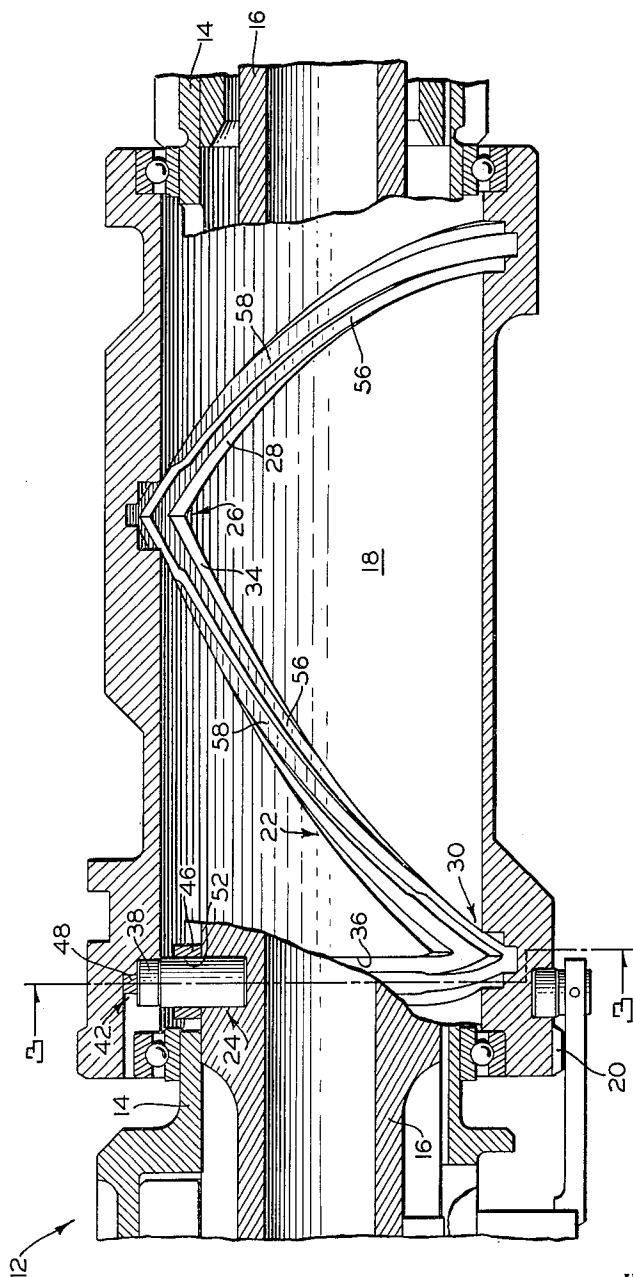
J. G. ROCHA
CIRCUITOUS CAM TRACK WITH CROSSOVERS AND FOLLOWER
DEVICE THEREFOR

3,241,448

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3 Sheets-Sheet 1

Fig. 1



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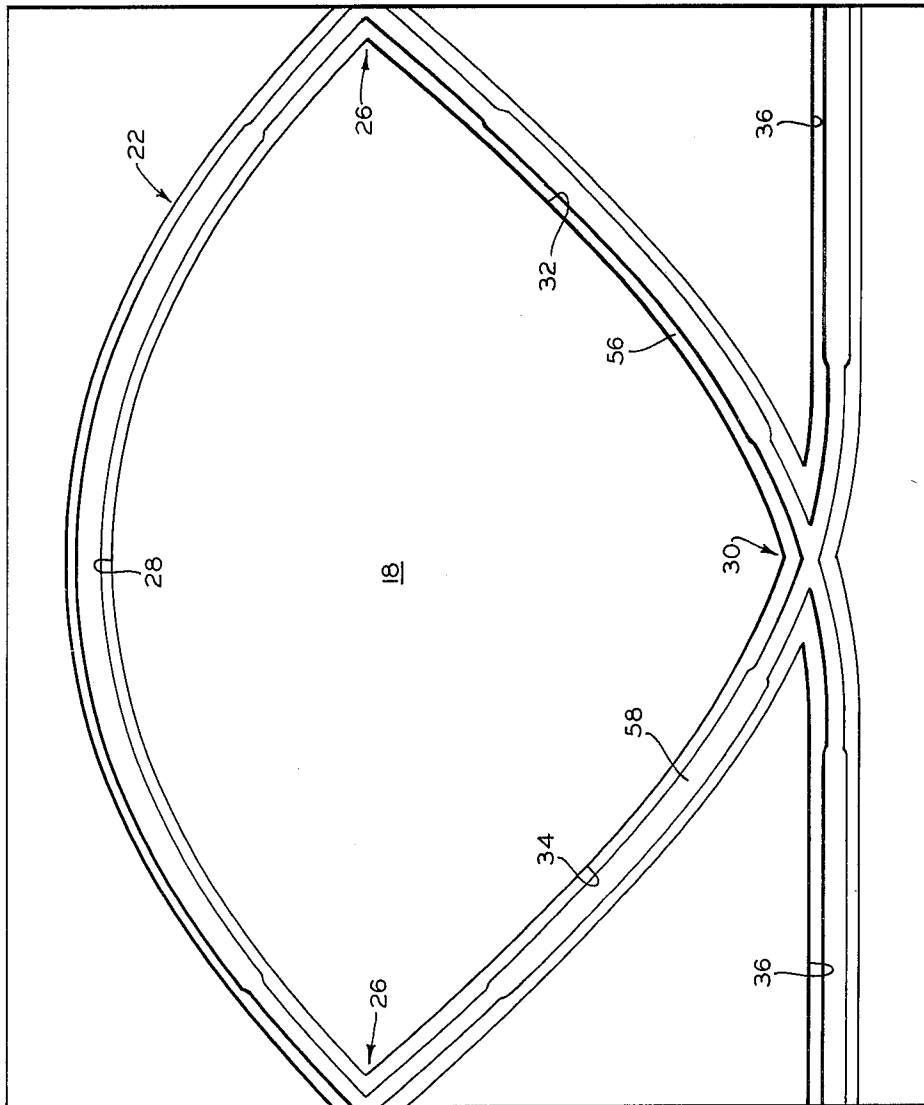


Fig. 2-

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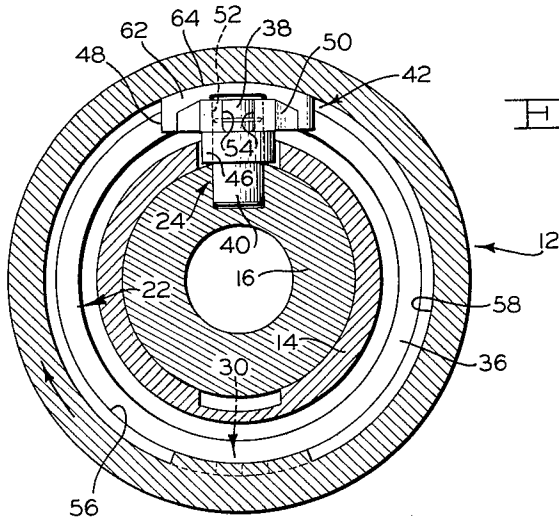


Fig. 3

Fig. 4

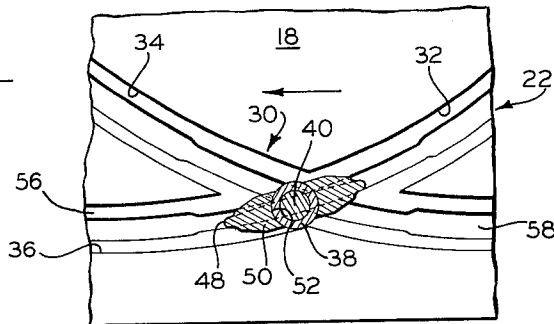
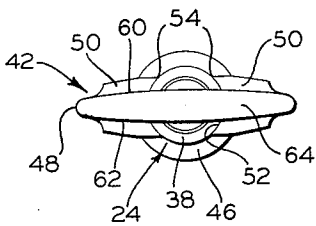


Fig. 5

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3,241,448

CIRCUITOUS CAM TRACK WITH CROSSOVERS AND FOLLOWER DEVICE THEREFOR

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8 Claims. (Cl. 89—161)

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 those machine guns which are actuated by an external power source and which include a longitudinally reciprocating barrel driven thereby and the invention pertains more particularly to the cam devices for transmitting the energy from the external power source to the barrel for cyclic displacement thereof.

With such externally powered and cam operated guns, the cam devices generally include a rotating drum with a cam path formed therein to cooperate with a follower on the barrel. With some guns, the operating cycle of the barrel is such that in a drum of permissible bulk and weight any cam path generated therein which would actuate the barrel in its cyclic program through one revolution of the drum would create cam angles so steep that energy could not be efficiently transmitted therefrom to the barrel. This problem could be overcome by lengthening the cam path so as to generate it through a circuitous route which would require that the drum be rotated more than one revolution in order for the follower to make its complete circuit of the cam path. Such a circuitous route, however, requires crossovers at some points and in the prior art there has not been provided any means, simple and positive enough for gun use, to control the course of the follower at the crossovers where the intersecting sections of the cam path cross at an acute angle.

Consequently, the length to which the cam path could be extended in the past has been limited. It is, therefore, one of the objects of this invention to provide for cam paths with crossovers a simple and effective crossover device for directing the follower through the crossovers along the prescribed path even though the intersecting sections of the cam path are related at an acute angle.

It is a further object of this invention to provide for automatic guns an operating cam drum in which the cam path is lengthened by a circuitous route so that three revolutions of the drum are necessary for the follower to make a complete circuit of the cam path whereby the angles generated in the cam path are reduced to less than 45° for efficient transmission of energy from the drum to the barrel.

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 fragmentary, longitudinally cross-sectioned view of a machine gun with the barrel shown in battery position and cut away in part to disclose the cam track inside the cam drum;

FIG. 2 is a view of the cam drum opened up by a longitudinal cut and made flat to show the design of the cam track;

FIG. 3 is a view taken along line 3—3 of FIG. 1;

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FIG. 4 is a fragmentary view of the cam track cross-over wherein the helical and annular sections thereof intersect; and

FIG. 5 is a top view of the follower device.

Shown in the figures is an automatic gun 12 having a receiver 14 which supports a barrel 16 for reciprocation between a rearward battery position and a forward loading position. Barrel 16 is actuated in its operating cycle by a drum 18 which encircles receiver 14 and is journaled thereon for rotation. Drum 18 is driven by motor means (not shown) through a ring gear 20 formed on the outside of the drum.

Rotation of drum 18 is converted to longitudinal displacement of barrel 16 through the cooperation of an endless cam track 22 formed inside of the drum with a follower device 24 mounted on the barrel. Cam track 22 forms a circuitous route extending three times around drum 18 to increase the length of the cam track to where the angles of the cam track relative to the longitudinal axis of the barrel are less than 45°. Cam track 22 is also designed to operate barrel 16 through one operating cycle during one complete pass relative to follower device 24.

As is especially well illustrated in FIG. 2, cam track 22 includes a first crossover 26, located approximately midway the front and rear ends of drum 18, in which sections of the cam track intersect at right angles to each other and in a diagonal direction relative to a longitudinal plane of the drum. The two forwardly extending sections of first crossover 26 are connected by an arcuate section 28 which is generated in an arc that extends toward and away from the front end of drum 18. A second crossover 30 is located in drum 18 directly opposite first crossover 26 and includes two diagonal sections disposed at an acute angle relative to each other. A first helical section 32 extends forwardly in a clockwise direction, looking forwardly from the rear end of drum 18, between first crossover 26 and second crossover 30, and a second helical section 34 extends forwardly in a counterclockwise direction between the first and second crossovers. An annular section 36 encircles drum 18 from second crossover 30 parallel to the rear end of drum 18 with one end communicating with first helical section 32 and the opposite end communicating with second helical section 34.

Thus, cam track 22 forms an endless path which extends around drum 18 in annular section 36, forwardly through second crossover 30 into first helical section 32 through first crossover 26 into arcuate section 28, therealong back to the first crossover, through the first crossover into the second helical section 34 and therealong through the second crossover back into the annular section.

When follower device 24 is located in annular section 34, barrel 16 is held in battery position for firing and, when first helical section 32 and arcuate section 28, up to the peak of the arc thereof, are moved over the follower device, the barrel is moved forwardly to the loading position. During continued rotation of cam drum 18, whereby the remaining portion of arcuate section 28 and second helical section 34 are moved over follower device 24, barrel 16 is actuated rearwardly to the battery position.

It is evident that, if follower device 24 consisted solely of a roller, there would be a period of travel through the intersections of crossovers 26 and 30 when the roller would be without the guiding control of the side walls

of cam track 22. This, obviously, would cause trouble especially at second crossover 30 where the acute angle of the intersecting sections increases the period of travel where the roller would be out of control and it would be easy for the roller to take either one of the two available paths. Applicant has successfully overcome this problem through the cooperative structures of follower device 24 and crossovers 26 and 30 as described herein-after.

Follower device 24, as is especially well shown in FIGS. 4 and 5, includes a roller 38 which is rotatably mounted on a pin 40 extending upwardly from barrel 16 and a crossover device 42 which is journaled on the roller. Crossover device 42 includes a cylindrical hub 46, a blade 48 of boat-shaped configuration with a leading and a trailing end respective to rotation of drum 18, and a buttress section 50 which aids the support of the blade on the hub. Hub 46 includes a coaxial bore 52 having a diameter similar to the outside diameter of roller 38 so that the roller is received by the bore. Bore 52 extends into buttress section 50 to interrupt the sides thereof and form openings 54 therein through which segments of roller 40 project for contact with the sides of cam track 22.

Cam track 22 is of rectangular configuration in cross-section and includes an inner surface 56. Formed in inner surface 56 is a raceway 58 which receives blade 50. Except at crossovers 26 and 30, raceway 58 has a width greater than the greatest width of blade 50 to prevent interference between the blade and the sides of the raceway as the angular sections of cam track 22 move over follower device 24. At crossovers 26 and 30, the sides of raceway 58 are narrowed to approximately the same width as the greatest width of blade 58 so that guidance of follower device 24 past the intersections of crossover 26 and 30 is taken over by the blade and the cooperating sections of the raceway.

Blade 50 is of sufficient length so that, when second crossover 30 moves thereover, the leading end of the blade is securely received by raceway 58 in the incoming section of cam track 22 before the trailing end of the blade is disengaged from the section of the raceway on the opposite side of the intersection. It is noted in FIG. 4 that the section of cam track 22 and, therefore, raceway 58, which intersect in second crossover 30, are arcuately formed according to the similar radius of the respective helical sections 32 and 34, therefore, the sides of blade 50, noted at 60 and 62, are arcuately formed according to the radius of the intersecting sections to provide contact of the full length of blade 50 with sides of raceway 58 when second crossover 30 is moved thereover. It is also shown in FIG. 3 that the top edge of blade 50, noted at 64, is arcuately formed according to the radius of the inside wall of raceway 58 to provide close engagement of the blade therewith.

Thus, when drum 18 is rotated by motor means (not shown), follower device 24 is located in annular section 28, when gun 12 is fired, and then second crossover 30 moves over the follower device past the intersection into first helical section 32 causing barrel 16 to be moved forwardly from the battery position. As drum 18 continues to rotate, first crossover 26 moves over follower device 24 with blade 50 and raceway 58 therein cooperating to guide the follower device into arcuate section 28 to complete the actuation of barrel 16 into battery position. When the reverse portion of arcuate section 28 moves over follower device 24, barrel 16 is moved rearwardly to its battery position with blade 50 and raceway 58 cooperating to guide the follower device through first crossover 26 from the arcuate section into second helical section 34, which causes the barrel to be actuated to the battery position. As drum 18 continues to rotate, second crossover 30 moves over follower device 24 with blade 50 and the related section of raceway 58 cooperating to guide the follower device into annular section 36 and

thereby complete the actuation of barrel 16 to battery position and hold the barrel therein for firing while the annular section moves over the follower device.

From the foregoing it is clearly apparent that the cam angles of cam track 22 have been reduced to slopes which efficiently transmit the energy from drum 18 to barrel 16 by lengthening the cam track through a circuitous path around the inside of the cam drum and that the circuitous route is made possible by the successful solution of the problem of guiding the follower device over the crossovers required by the circuitous route.

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. In a firearm having a receiver, a barrel slidably supported by the receiver for longitudinal reciprocation, a follower device mounted on said barrel, a cylindrical drum rotatably journaled on said receiver, an endless cam track formed inside said drum for cooperation with said follower device for converting rotation of said drum to translational displacement of said barrel according to the requirements of the operating cycle of said firearm, said cam track including a plurality of sections, a plurality of crossovers connecting said sections to form an endless path designed to circuit said drum in a plurality of turns therearound, and said crossovers including sections of said cam track crossing each other at an intersection.

2. The firearm as defined in claim 1 wherein at least one of said crossovers includes intersecting sections of said cam track which cross at an acute angle, and including cooperating means in said crossovers and in said follower device for positively engaging said cam track therewith when rotated over said follower device and positively guiding said follower device past said crossovers and along the designed path of said cam track.

3. The firearm as defined in claim 2 wherein at least one of said sections is annularly formed around said drum parallel to the ends thereof.

4. The firearm as defined in claim 2 wherein said follower device includes a roller journaled on a pin extending from said barrel and a crossover device journaled on said roller, said cam track in said sections is formed to engage said roller to convert rotation of said drum to translation of said barrel, and a raceway formed in said cam track at said crossovers to engage with said crossover device for maintaining said follower device in the designed path of said cam track and converting rotation of said drum to translation of said barrel.

5. The firearm as defined in claim 4 wherein said cam track is of rectangular configuration in cross-section and includes a pair of opposite sides and an inner surface therebetween and said raceway is formed in said inner surface with a rectangular configuration in cross-section, and said crossover device includes a cylindrical hub, a blade of boatlike configuration with a leading and a trailing end integrally formed on one end of said hub and a buttress section formed on opposite sides of said blade integral therewith and with the adjacent end of said hub, a coaxial bore having a diameter similar to that of said roller extending through said hub into said buttress section to receive said roller, and a pair of openings formed in opposite sides of said buttress section by said bore to permit contact of said roller with said sides of said cam track, and wherein said raceway has a width similar to the greatest width of said blade at said crossovers so as to slidably engage said blade thereat.

6. The firearm as defined in claim 5 wherein said blade has a sufficient length to bridge the intersection of said raceway at each of said crossovers with the leading end of said edge being securely engaged with the incoming section of said raceway before the trailing end is disen-

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gaged from the section of said raceway on the opposite side of the intersection.

7. The firearm as defined in claim 6 and including in those of said crossovers having intersecting sections of said cam track which cross at an acute angle, intersecting sections of said raceway arcuately formed according to the same radius, and including offset sides of said blade convexly formed according to the radius of said intersecting sections of said raceway.

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8. The firearm as defined in claim 6 and including a top edge of said blade arcuately formed according to the radius of the inside wall of said raceway to slidingly mate therewith.

No references cited.

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