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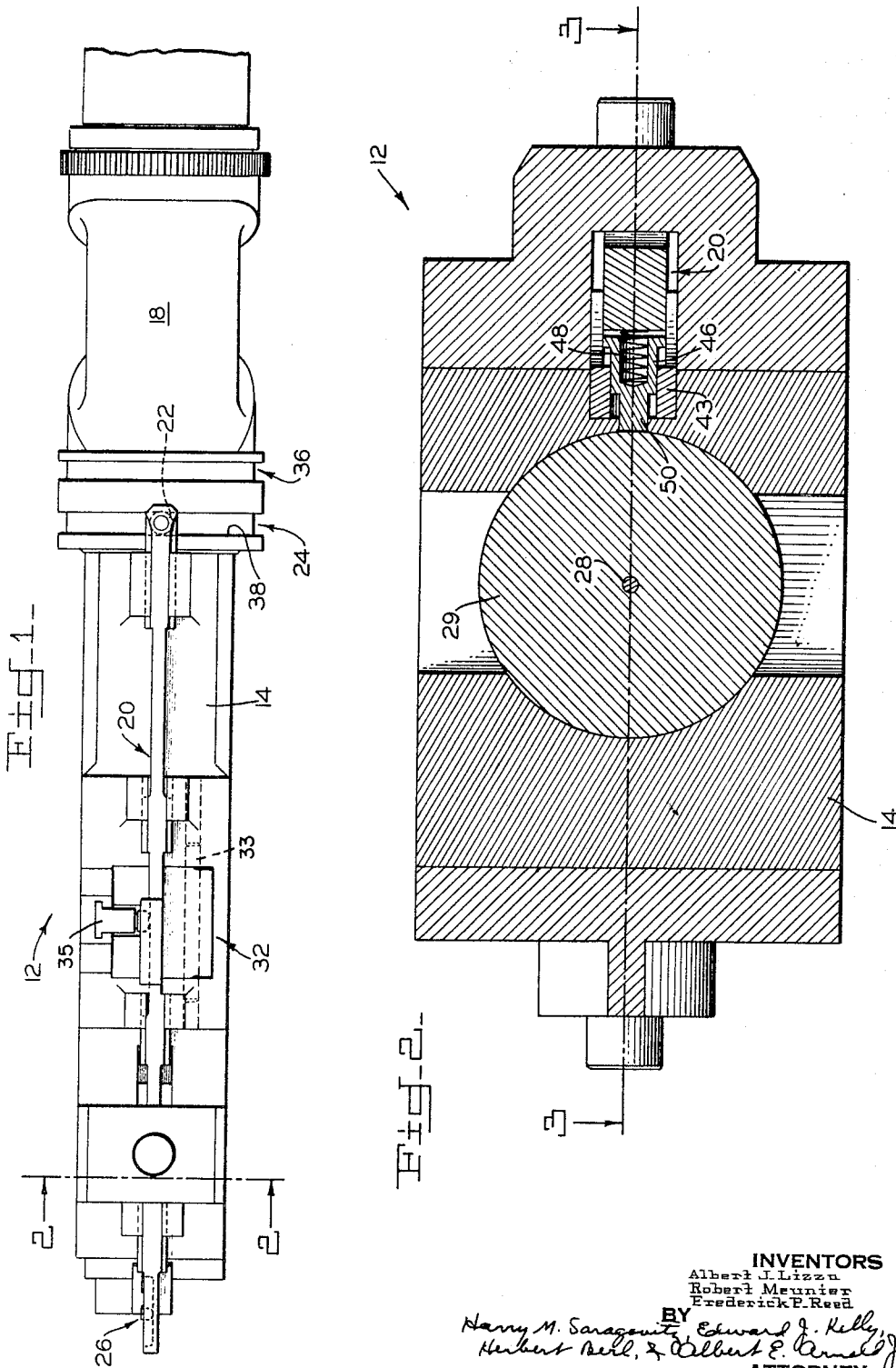
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ROTARY CAM ACTUATED OPERATING ROD MECHANISM

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5 Sheets-Sheet 1



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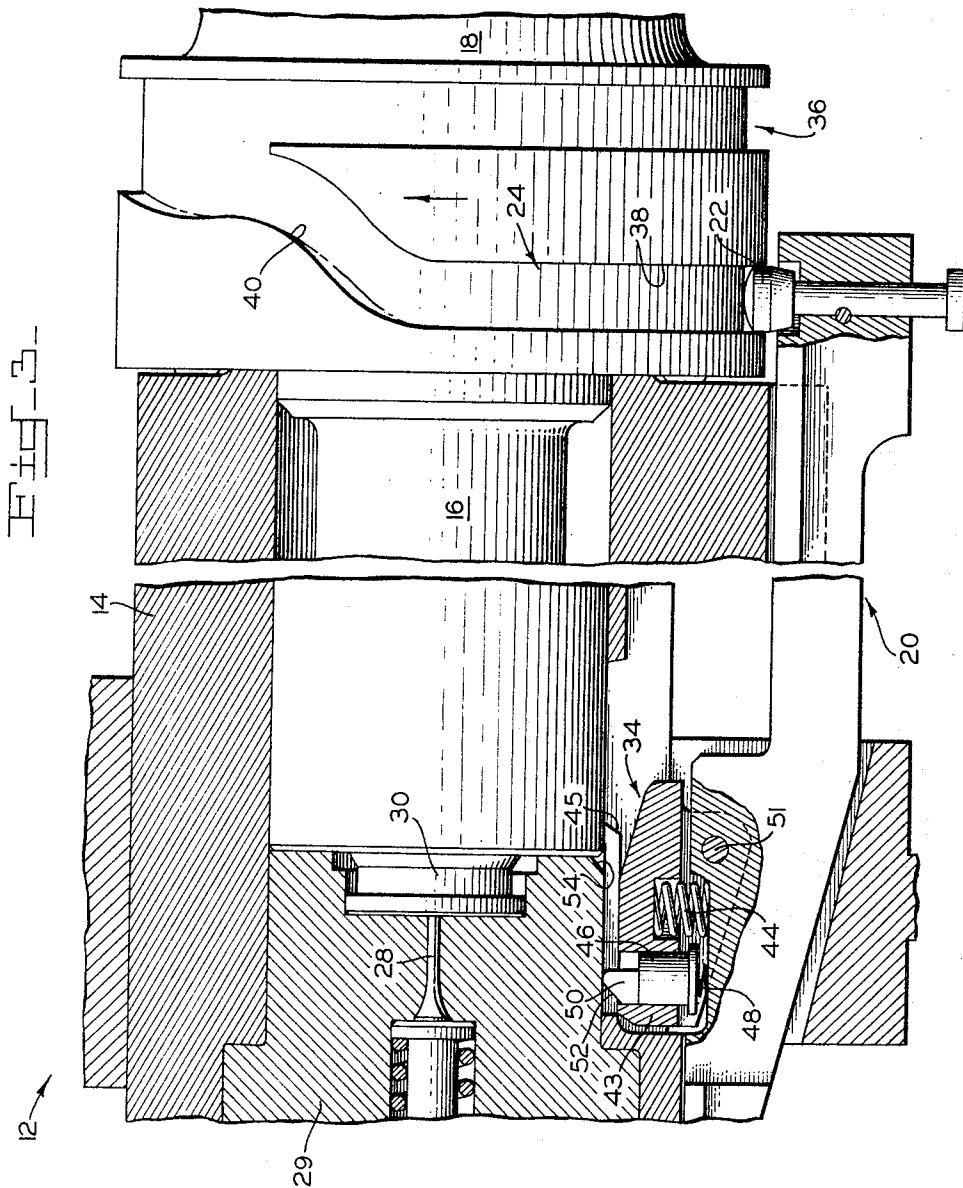
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ROTARY CAM ACTUATED OPERATING ROD MECHANISM

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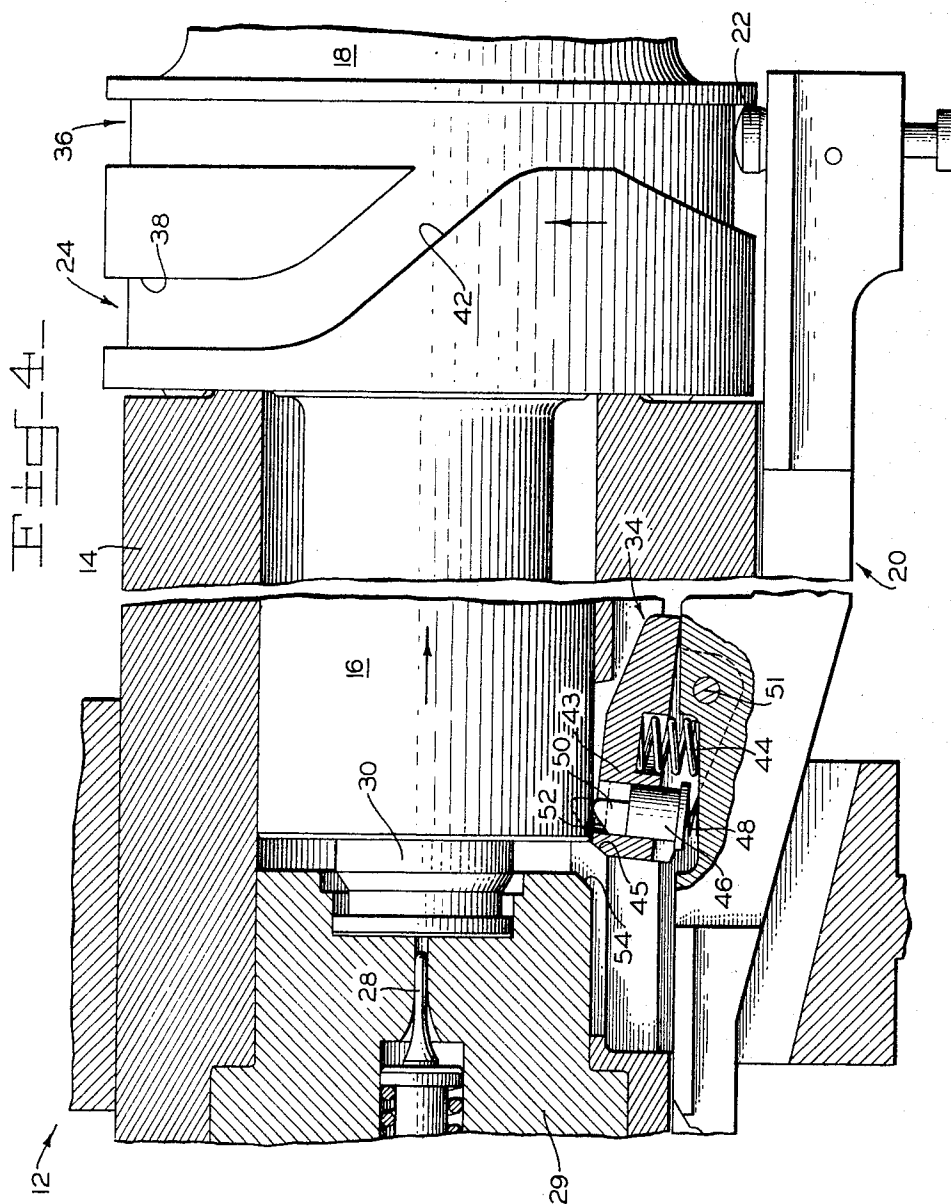
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ROTARY CAM ACTUATED OPERATING ROD MECHANISM

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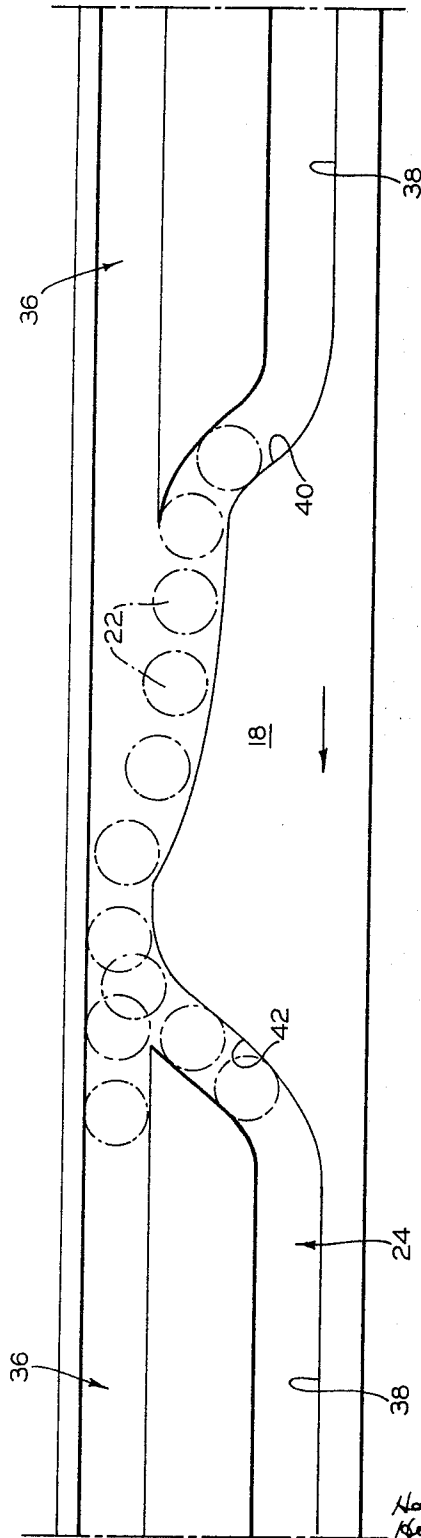
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ROTARY CAM ACTUATED OPERATING ROD MECHANISM

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Fig. 5-



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ROTARY CAM ACTUATED OPERATING ROD MECHANISM

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ABSTRACT OF THE DISCLOSURE

This invention provides for machine guns having a cam-drum arranged to reciprocate a barrel through one cycle responsive to a multiple number of turns of the cam-drum, an operating rod mechanism which is translationally actuated through its operating cycle by a cam path in the cam-drum during one revolution thereof and is circuited into releasable engagement with another cam path arranged to hold the operating rod mechanism against displacement during the remaining number of rotations of the cam-drum required for cycle reciprocation of the barrel.

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

This invention relates to those machine guns in which the operating mechanisms are actuated by a rotary cam-drum and it pertains more particularly to the operating rod mechanism for actuating the barrel lock and firing mechanism and the means for correlating the operation of the barrel lock and firing mechanism to the firing cycle of the machine gun where more than one rotation of the cam-drum is required for actuating the machine gun through one firing cycle.

In a known machine gun, the operating mechanisms are actuated by a cam-drum which is energized by an outside source of power. In this weapon, the barrel is reciprocated by the cam-drum and because of the length of its stroke the barrel is actuated by a circuitous cam path in the cam-drum, whereby the cam-drum rotates three revolutions for one reciprocal cycle of the barrel to reduce the diameter of the cam-drum and/or the cam angle.

This presents a problem respective to the synchronization of the barrel lock and firing mechanism operating rod to the cyclic displacement of the barrel. The reason for this problem is that the stroke of the operating rod is much shorter than that of the barrel and consequently a separate cam path has to be used. This raises another problem as the displacement of the operating rod is not sufficient for a circuitous routing of the cam path.

It is, therefore, the object of this invention to provide an operating rod mechanism which is translationally actuated by a cam path in the cam-drum during one revolution thereof and is locked out of engagement with the cam path during the remaining number of cycles which are required of the cam-drum for one cyclic operation of the machine gun, to reduce the length of the cam path to a minimum.

The specific nature of the invention as well as other

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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 reduced side view of a machine gun with the operating rod for actuating the firing mechanism and barrel lock shown in the rearward firing position;

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;

FIG. 4 is a view similar to FIG. 3, but shows the operating rod in its forward position and the barrel moved slightly forward of its battery position;

FIG. 5 is a view similar to FIG. 4, but shows the latch on the operating rod engaged by the barrel for rearward displacement thereby and the operating rod actuated by the barrel to engage the follower on the operating rod with the cam path in the cam-drum; and

FIG. 6 is a laid out plan of the cam path.

Shown in the figures is a machine gun 12 having a receiver 14 and a barrel 16 mounted therein for sliding reciprocation between a forward loading and a rearward, battery position. Barrel 16 is reciprocated by a cam-drum 18 through the cooperation of a cam groove therein with a follower on the barrel. The cam groove and cooperating follower (not shown) are designed as disclosed in the application by John G. Rocha for Circuitous Cam Track With Crossover and Follower Device Therefor, Ser. No. 415,834 filed Dec. 3, 1964, and which has matured into Patent No. 3,241,448 issued Mar. 22, 1966. In such patent means are disclosed for converting three revolutions of cam-drum 18 to one reciprocation of barrel 16 to reduce the cam angle of the cam groove and/or the diameter of the cam-drum.

Slidably mounted in one side of receiver 14 is an operating rod 20 provided at the front end with a follower 22 which is engageable with a cam path 24 formed around the outside of cam-drum 18 so that rotation thereof is converted to translational displacement of the operating rod. Operating rod 20 functions to operate a firing mechanism 26 having a firing pin 28 which is arranged to be cocked during forward displacement of the operating rod and released at the end of the rearward stroke thereof and which is mounted in a cylindrical breech block 29 which extends forwardly into receiver 14.

When barrel 16 is in battery position, a cartridge 30 is enveloped thereby for discharge by firing pin 28 and the barrel is secured in battery position by a lock 32. Lock 32 is mounted on a longitudinal shaft 33 for pivotal displacement between an inner barrel locking position and an outer barrel unlocking position. Lock 32 is actuable to the barrel locking position by operating rod 20 during rearward displacement thereof and to the barrel unlocking position during forward displacement by means of a laterally moving slide 35 which has cooperation with a cam slot in the operating rod.

Operating rod 20 needs to be cycled to lock and unlock barrel 16 in battery position and to cock and release firing pin 28 only during a short portion of the operating cycle of the barrel, when it moves into and out of battery position. Therefore, to reduce the length of cam path 24, so that it extends only in one turn around the outside of cam-drum 18, operating rod 20 is arranged, as hereinafter described, to be locked out of engagement with the cam path during two revolutions of the cam-drum and engaged with the cam path for one revolution thereof. This is accomplished through the cooperation of a latch 34 mounted

on the rear end of operating rod 20 with barrel 16, cam path 24 and a related channel 36 which is formed around the outside of cam-drum 18. Channel 36 is located adjacent the front end of cam-drum 18 so as to receive follower 22 when the operating rod is in its forward position and is formed parallel to a cross sectional plane right angular to the rotary axis of cam-drum 18 so that when follower 22 is located in the channel, rotation of cam-drum 18 does not impart movement to operating rod 20.

Cam path 24 includes a dwell section 38, which is formed around the outside of cam-drum 18 parallel to channel 36 and is spaced forwardly thereof a distance equal to the length of the stroke of operating rod 20, an ingress section 40 which leads from the channel to the dwell section, and an egress section 42 which leads from the dwell section to the channel joining the channel at the junction of the ingress section therewith, as is particularly well shown in FIG. 6. Thus, when follower 22 is located in ingress section 40 the rotation of cam-drum 18 actuates operating rod 20 from its forward to its rearward position and when the follower is in egress section 42 the operating rod is actuated from its rearward to its forward position. Also, when follower 22 is located in dwell section 38, operating rod 20 is held in its rearward position and when in channel 36 the operating rod is secured in its forward position.

Latch 34 is pivotally mounted on operating rod 20 so that the rear end, noted at 43, is displaceable towards and away from the path of movement of barrel 16 and the latch is biased towards the path of movement, from an unlatched to a latching position, by a spring 44. When latch 34 is in the latching position, rear end 43 contacts a cooperating inclined surface 45 in receiver 14, as best shown in FIG. 4, to block rearward displacement of operating rod 20 from its forward position into cam path 24.

Latch 34 carries a plunger 46 which is transversely mounted through rear end 43 for sliding displacement between an engaging and a release position. A spring 48 biases plunger 46 to the engaging position. When latch 34 is in its latching position and plunger is in the engaging position, an inwardly extending end 50 of the plunger is contactable by the rear end of barrel 16 when approaching battery position and is adjacent thereto. Latch 34 is pivotally mounted on operating rod 20 by means of a pin 51 which extends through the latch forwardly of plunger 46 and outwardly therefrom, respective to the path of movement of barrel 16, so that when the plunger is contacted by the barrel the continued rearward displacement thereof causes rear end 43 of the latch to be swung outwardly to the unlatched position. When barrel 16 reaches battery position, operating rod is displaced sufficiently rearward thereby for follower 22 to be receivable by ingress section 40 as shown in FIG. 5.

Provided on end 50 of plunger 46 is a forwardly and inwardly extending cam surface 52 which, when latch 34 is in the unlatched position, is positioned for contact with a mating surface 54 formed on breech block 29, as shown in FIG. 5. The sliding contact of cam surface 52 with surface 54 during rearward displacement of operating rod 20, by the engagement of ingress section 40 with follower 22, actuates plunger 46 to the release position and, as shown in FIG. 3, into contact with the outside surface of breech block 29 for sliding displacement therealong, freeing the operating rod for continued rearward displacement by the engagement of follower 22 with ingress section 40.

Thus, when barrel 16 is actuated by cam-drum 18 to and from the forward loading position, follower 22 is located in channel 36 and is held therein to prevent accidental entry into ingress section 40 by latch 34, whereby operating rod 20 is blocked in its forward position. When barrel 16 is adjacent battery position, the rear end thereof contacts end 50 of plunger 46, causing latch 34 to be rocked to its unlatching position, as best shown in FIG.

5. With latch 34 in its unlatched position, operating rod 20 is free to be moved by barrel 16, through the contact thereof with plunger 46, so that when the barrel reaches battery position, follower 22 is displaced into registry with the mouth of ingress section 40. Thus, the continued rotation of cam-drum 18 moves ingress section 40 over follower 22 and thereby the rearward displacement of operating rod 20 is continued to the rearward position. When barrel 16 reaches battery position, and latch 34 is consequently displaced to the unlatched position, cam surface 52 on plunger 46 is positioned for contact with surface 54 on breech block 29 so that the rearward displacement of operating rod 20, continued by the passage of ingress section 40 over follower 22, causes plunger 46 to be depressed outwardly and end 50 delivered onto the outside surface of breech block 29, thereby clearing operating rod 20 for continued, uninterrupted rearward travel. When operating rod 20 is moved rearwardly, lock 32 is actuated thereby to the barrel locking position and when the operating rod is adjacent its rearward position, firing pin is released to fire cartridge 30 inclosed by barrel 16.

As dwell section 38 moves over follower 22, lock 32 is held in the barrel locking position to provide time for the gas pressure in barrel 16 to be reduced to a safe level. Continued rotation of cam-drum 18 moves egress section 42 over follower 22 and thereby operating rod 20 is actuated forwardly, causing lock 32 to be displaced to the barrel unlocking position and firing pin 28 to be cocked. Further rotation of cam-drum 18 moves channel 36 into engagement with follower 22 and latch 34 snaps into contact with surface 45 to block operating rod 20 in its forward position disengaged from cam path 24.

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 a machine gun, the combination including a receiver, a barrel slidably mounted in said receiver for cyclic reciprocation between a forward loading position and a rearward battery position, a rotary cam-drum arranged to displace said barrel one cycle responsive to a multiple number of rotations of said cam-drum, an operating rod slidably mounted in said receiver for translational reciprocation therein, a cam path formed in said drum so as to be releasably engageable by said operating rod and so as to convert one rotation of said cam-drum to one cyclic displacement of said operating rod, a latch mounted on said operating rod for releasably locking said operating rod out of engagement with said cam path, and means cooperating with said latch for engaging said operating rod with said cam path for one rotation of said cam-drum and for locking said operating rod out of engagement with said cam path during the remaining number of the multiple rotations of said cam-drum required to displace said barrel one cycle.

2. The combination as defined in claim 1 and including a follower positioned on said operating rod for engagement with said cam path to convert rotation to said cam-drum to translational displacement of said operating rod, and a channel formed in said cam-drum parallel to a cross-sectional plane disposed at right angles to the rotating axis thereof and arranged to receive said follower when said operating rod is locked by said latch out of engagement with said cam path.

3. The combination as defined in claim 2 wherein said cam path includes a dwell section disposed parallel to said channel, an ingress section leading from said channel to said dwell section, and an egress section leading from said dwell section to said channel.

4. The combination as defined in claim 3 wherein said latch includes a rear end and is pivotally mounted on said operating rod for displacement of said rear end to-

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wards and away from the path of movement of said barrel to respective latching and unlatched positions, a surface on said receiver contactable by said rear end when said latch is in the latching position to releasably hold said operating rod out of engagement with said cam path, and wherein said latch includes a spring biased plunger disposed for engagement by said barrel when adjacent battery position during displacement thereto for actuating said latch to the unlatched position and said operating rod to a position wherein said follower is in registry with said ingress section, and means for depressing said plunger to clear said operating rod for continued displacement by engagement of said follower with said ingress section.

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5. The combination as defined in claim 4 and including a barrel lock and a firing mechanism operable by said operating rod.

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