July 17, 1962 H. J. REEPMEYER 3,044,364

SAFETY INTERLOCK FOR THE FIRING MECHANISM OF A CANNON

Filed Sept. 21, 1960 5 Sheets-Sheet 1

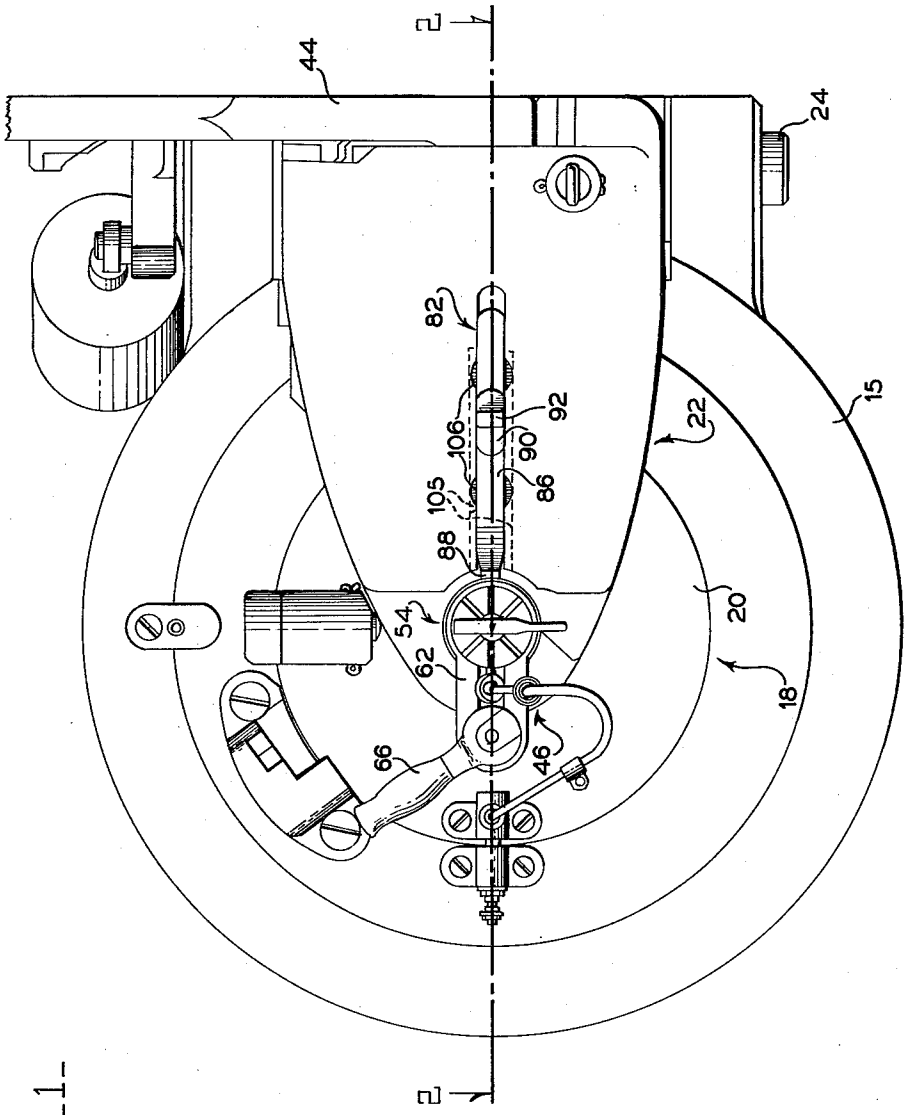


Fig. 1.

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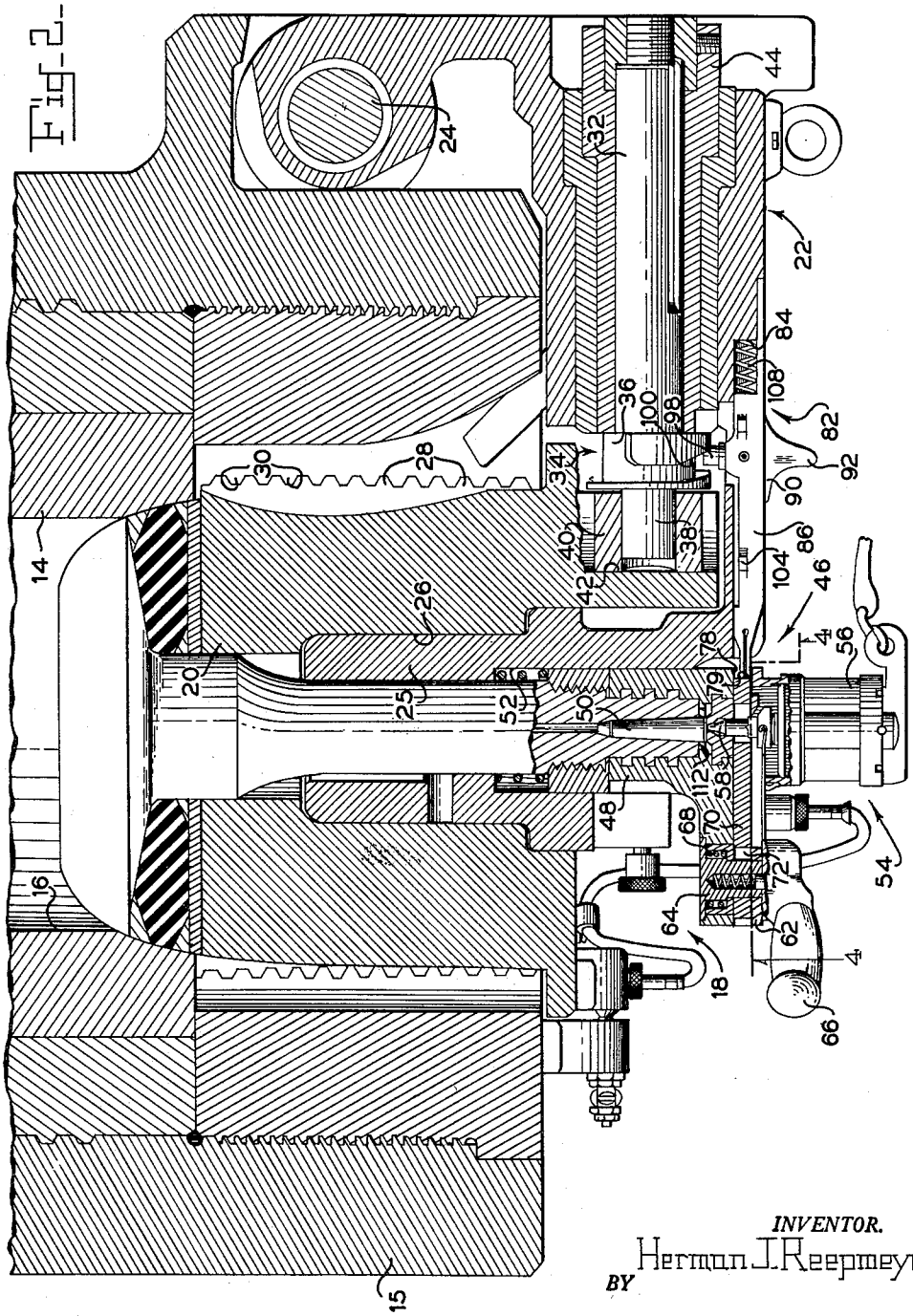
S. J. Rotondi & A. J. Rupert

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SAFETY INTERLOCK FOR THE FIRING MECHANISM OF A CANNON

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Fig. 2.



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Fig. 3.

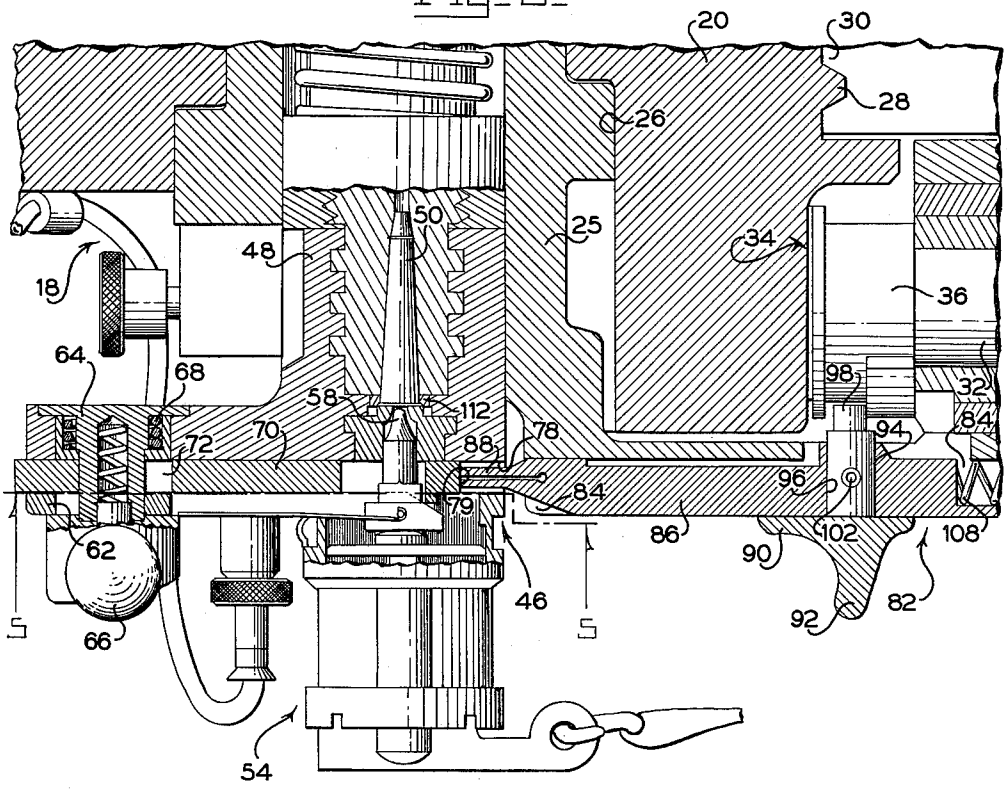
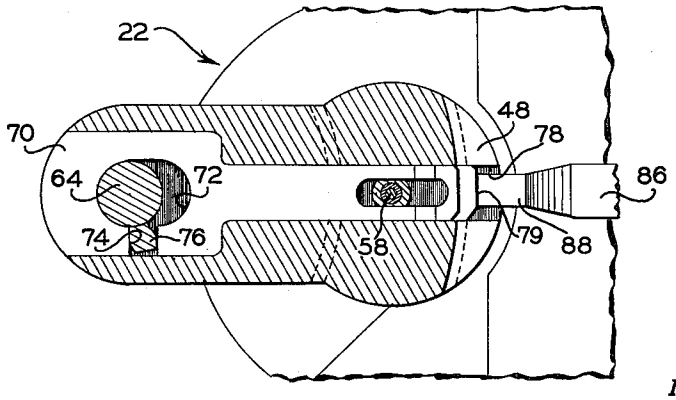


Fig. 4.



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Fig. 5.

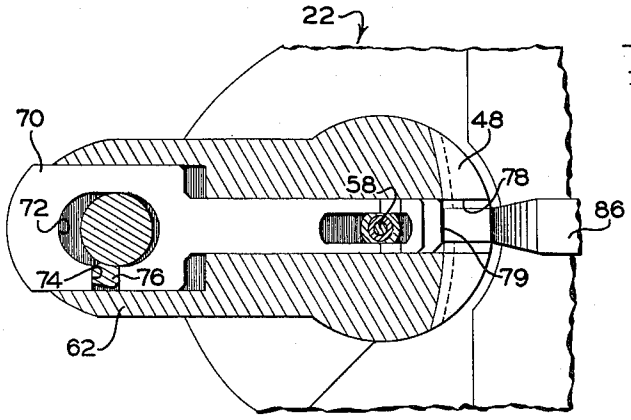


Fig. 6.

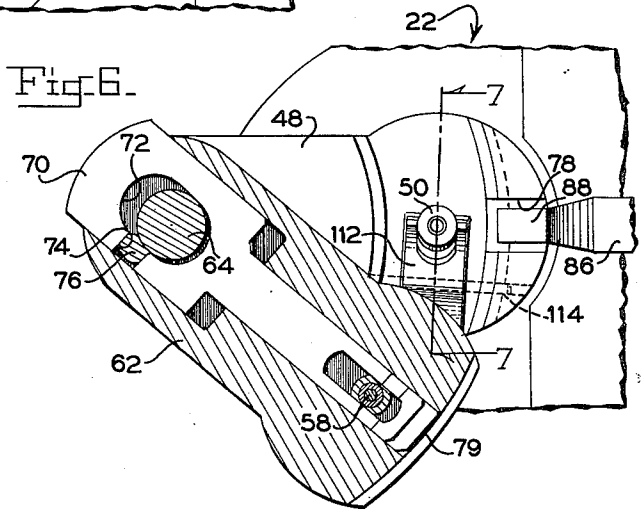


Fig. 7.

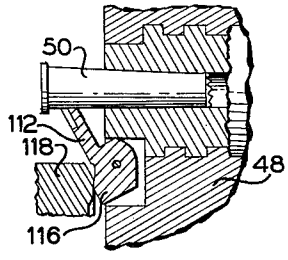
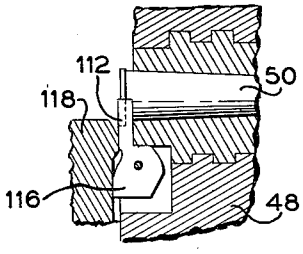


Fig. 8.



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Fig. 9.

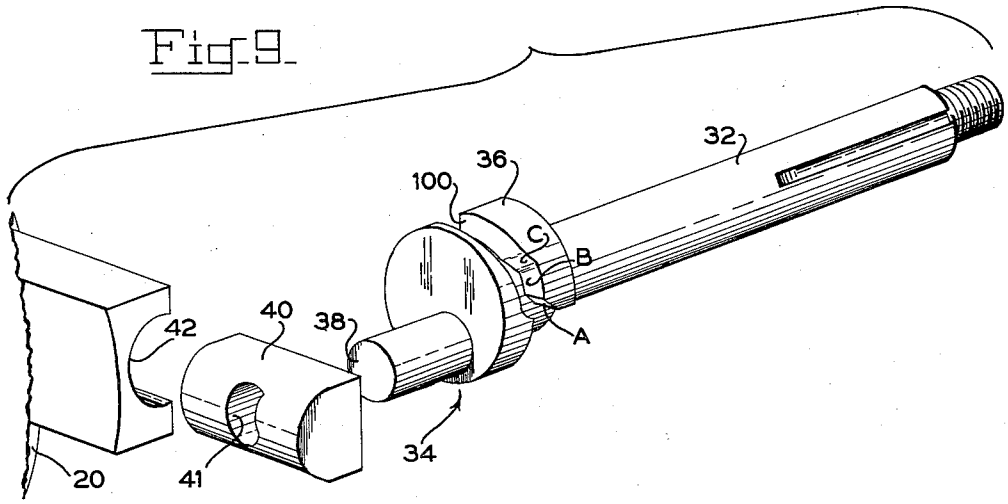
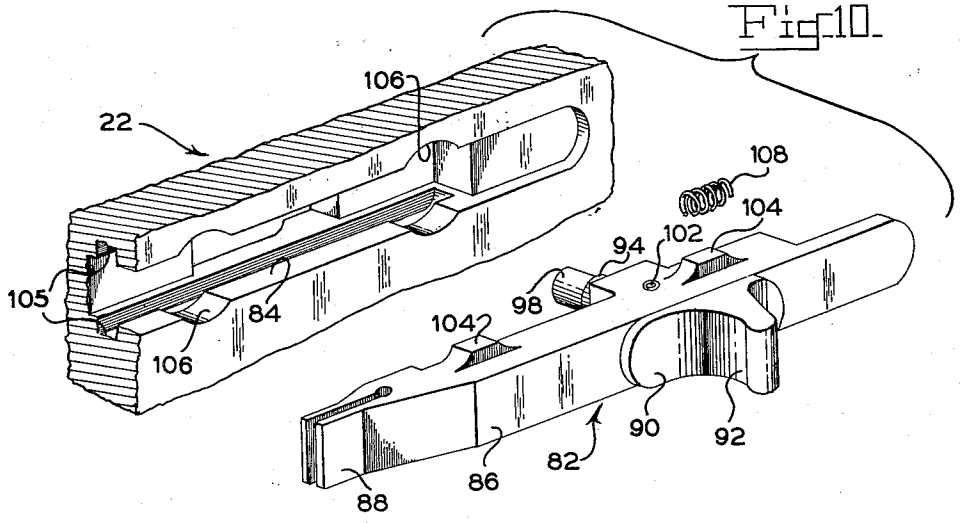


Fig. 10.



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United States Patent Office 3,044,364 Patented July 17, 1962

3,044,364

SAFETY INTERLOCK FOR THE FIRING MECHANISM OF A CANNON

Herman J. Reepmeyer, Cohoes, N.Y., assignor to the United States of America as represented by the Secretary of the Army

Filed Sept. 21, 1960, Ser. No. 57,589
5 Claims. (Cl. 89—27)
(Granted under Title 35, U.S. Code (1952), sec. 266)

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

This invention relates to the firing mechanisms of cannons and more particularly to safety devices for preventing the accidental discharge of a chambered round when the breechblock is out of a closed-locked position relative to the firing chamber in the tube.

It is important with all types of guns that chambered rounds be prevented from accidental discharge when they are not supported by the breech blocking member and these safety devices differ, of course, according to the operating mechanisms, and particularly the firing mechanisms, of the guns.

In the large caliber guns of cannon types wherein the projectile and bagged propellant are loaded separately into the firing chamber by hand and the primer is loaded in the firing mechanism located in the breechblock, the conventional means for preventing accidental discharge of the chambered round before the breech is closed and locked is to have the primer retained by a firing lock which is installed by manual threading into the breechblock only after the breechblock is closed and locked. When the firing lock is installed in the breechblock, a safety plunger is forced laterally into engagement with a locking slot in the crankshaft employed to actuate the breechblock and thereby prevents displacement thereof from the closed position.

With this device, each time the cannon is fired the lock must be manually removed before the breech can be opened and the firing lock with a live primer must be reinstalled before the cannon can be fired again. This, while providing positive safety, is a two-stage, time consuming operation and should the firing lock jam considerably time is lost in the disassembly of the safety plunger and firing lock before the breech can be opened.

Therefore, to increase the rate of fire of such cannons, there has been devised a firing mechanism which includes a percussion device which is hingedly mounted on the breech mechanism and which is biased to an open position by a cooperating spring. The percussion device is releasably held in the closed position, ready for firing by a latch which, when actuated, permits the percussion device to be swung to the open position by the cooperating spring. With the opening of the percussion device, an extractor is triggered to eject the case of the spent primer from the breech mechanism.

It is the principal object of this invention to provide for cannons using such hinged percussion devices a safety plunger which is operationally disposed in the breech mechanism between the latch of the percussion device and the breechblock actuating crankshaft and is energized therewith so that, when the crankshaft is rotated for displacement of the breechblock from the closed position, the safety plunger is actuated against the latch for release of the percussion device. Whereby, the percussion device is swung clear of the primer, so as not to be actuatable thereagainst, or clear of the spent primer case, as the case may be, and the primer or spent case is, therefore, automatically ejected from the breechblock.

It is another object of this invention to provide such a safety device wherein the plunger is actuated by a cam slot formed in the crankshaft and such cam slot is generated so that the plunger is actuated against the latch during the initial rotation of the crankshaft. Whereby, a live primer may be automatically ejected from the percussion device by rotation of the crankshaft while the chambered cartridge is sufficiently supported by the breechblock to prevent any damage if the chambered cartridge should be accidentally discharged before ejection of the primer.

It is still another object of this invention to provide for cannons of stated type a safety device which is simple and rugged in construction, easy to manufacture and positive in operation.

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 view of the rear end of a cannon with the safety interlock of this invention installed therein;

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

FIG. 3 is a fragmentary view similar to FIG. 2 but showing the percussion device unlatched and free to be swung to the open position;

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. 3;

FIG. 6 is a view similar to FIGS. 4 and 5 but showing the percussion device swung to the open position;

FIG. 7 is a view taken along line 7—7 of FIG. 6;

FIG. 8 is a view similar to FIG. 7 but showing the relationship of the percussion device and extractor for chambering a primer in the receiver of the firing mechanism;

FIG. 9 is a perspective exploded view of the crank mechanism for rotating the breechblock; and

FIG. 10 is a perspective exploded view of the carrier and plunger.

Shown in the figures is a cannon, such as the 155-MM Gun M2, having a tube 14 with a breech ring 15 fixed to the rear end thereof and a chamber 16 which is closed by a breech mechanism 18. Breech mechanism 18 includes a breechblock 20 rotatingly supported by a carrier 22 which is pivotally mounted on breech ring 15 by means of a vertically disposed hinge pin 24 so that the breech mechanism may be swung in a horizontal plane between an open and a closed position.

Breechblock 20 is mounted on carrier 22 by means of a cylindrical spindle 25 which extends from the carrier at right angles thereto so as to be received by a mating bore 26 extending axially through the breechblock. Provided around the periphery of breechblock 20 are interrupted threads 28 which are arranged to pass through cooperating interrupted threads 30 inside of breech ring 15 when the breechblock is actuated to the closed position, so as to be disposed in back of such breech ring threads when the breechblock is rotated to the lock position. Complete locking is achieved when breechblock 20 is rotated 35° from the unlocked to the locked position.

Rotation of breechblock 20 is achieved by a crankshaft 32 which is mounted in carrier 22 for 135° rotation. Crankshaft 32 is provided at one end with a crank 34 which includes a cylindrical riser portion 36 formed integrally on the crankshaft and a rod 38 which extends from the riser portion so as to be spaced radially from the longitudinal axis of the crankshaft and disposed parallel thereto. A cylindrical crosshead 40 is provided with a diametrical hole 41 therethrough for receiving rod 38 and such crosshead is slidingly received by a mating semicylindrical recess 42 in breechblock 20 so that, as rod 38 is displaced eccentrically by rotation of crankshaft 32, the breechblock is rotatingly displaced on spindle 25. Crank 34 is designed so as to convert the 135° rotation of crankshaft 32 to the 35° rotation of breechblock 20

required for actuation thereof between the lock and unlock positions.

Crankshaft 32 is manually actuated by a handle 44 which is fixed to the crankshaft at the outer end thereof. Whereby, when handle 44 is swung downwardly from a vertical to a horizontal position, breechblock 20 is rotated to the unlock position and then, when the handle is pushed forwardly relative to the direction of cannon 12, for angular displacement in a horizontal plane, breech mechanism 18 is swung to the open position. Breechblock 20 is closed and locked through a reversal of the above-mentioned movements.

Brech mechanism 18 carries a firing mechanism 46 which includes a receiver 48 for chambering a primer 50 and such receiver is received by an axial bore 52 which extends axially through spindle 25 so that discharge of the primer in the receiver will in turn cause discharge of the round chambered in tube 14 when the breechblock is closed to register the primer with the propellant in the tube. Primer 50 is discharged by a percussion device 54 which includes a cylindrical housing 56 in which there is contained a spring-loaded firing pin 58 disposed for discharge of the primer. Housing 56 includes a flange 62 which projects from the forward edge thereof and by means of which the housing is mounted on a shaft 64 extending outwardly from the rear face of carrier 22. Housing 56 is disposed on shaft 64 for pivotal displacement between a closed position wherein the rear end of receiver 48 is blocked to support the discharge of primer 50 and firing pin 58 is in alignment therewith, and an open position wherein the rear end of the receiver is cleared for the installation of the primer and ejection of the fired case thereof. Shaft 64 is arranged to be rotatable in receiver 48 and to extend outwardly beyond flange 62 so that a lever 66 may be mounted on the extending end for turning the shaft.

Percussion device 54 is biased to the open position by a helical torsion spring 68 which is operationally interposed between flange 62 and receiver 48 and is releasably secured in the closed position by a slide 70 which is mounted laterally through the housing, respective to the longitudinal axis thereof, and flange 62. One end of slide 70 is provided with an aperture 72 to permit extension of shaft 64 therethrough and such aperture is notched, as noted at 74, for receiving a mating tang 76 extending radially from the shaft. Whereby, rotation of shaft 64 by lever 66 is converted to translational movement of slide 70. The opposite end of slide 70 is receivable by a suitable recess 78 in receiver 48 so that rotation of lever 66 in one direction will move such opposite end, noted at 79, into the recess for securing percussion device 54 in the closed position. When lever 66 is rotated in the opposite direction, end 79 is retracted from the recess for release of the percussion device. Recess 78 extends through receiver 48 to the perimeter thereof to permit the end of slide 70 to be contacted for alternate displacement of the slide to release percussion device 54.

Slide 70 is contactable by a plunger 82 which is slidingly mounted in carrier 22 by means of a mating channel 84 formed in the rear face thereof so that the plunger is displaceable along the extended longitudinal axis of the slide. Plunger 82 includes a shank 86 which is of square cross-section and is terminated at one end by a probe 88 of reduced cross-section so as to be insertable into recess 78 for contact with end 79 of slide 70. Plunger 82 is actuated manually by a handle 90 which includes a fingerpiece 92, an integral cylindrical portion 94 which is receivable as by press fit in a hole 96 through shank 86, and a cylindrical cam follower 98 which extends axially from the cylindrical portion. Handle 90 is secured to shank 86 by a pin 102. Thus, when plunger 82 is installed in channel 84, fingerpiece 92 extends outwardly therefrom, cam follower 98 extends inwardly for cooperation with a cam path 100 formed in crankshaft 32, as hereinafter described, and probe 88 is positioned for movement against end 79 of slide 70.

Plunger 82 is slidingly retained in channel 84 through the engagement of two pairs of lugs 104, which extend vertically from shank 86 in spaced relationship therealong, with cooperating slots 105 in the channel. Clearances 106 are provided for the insertion of the lugs 104 into slots 105. A compressible coil spring 108 is disposed between plunger 82 and the right-hand end of channel 84 for biasing the plunger to the left towards slide 70 and position the lugs 104 away from the clearances 106 so that the plunger is retained within the channel.

Cam path 100 is formed around riser portion 36 of crank 34 and is generated so that when crankshaft 32 is rotated to rotate breechblock 20 from the lock to the unlock position, plunger 82 is actuated by the cam path against slide 70 to push end 79 thereof from recess 78 for release of percussion device 54. Cam path 100 is generated, as shown at "A" in FIG. 9, so that slide 70 is actuated out of recess 78 during the first 8° of rotation of breechblock 20 whereby the breechblock is fully supported in event a round in chamber 16 is accidentally discharged by percussion device 54 before it is swung open to move primer 50 clear of the propellant in the chamber. Cam path 100 is also generated to dwell for approximately 72°, as noted at "B," and then is generated, as noted at "C," to approximately 102° to move plunger 82 further to the left (facing the breech end of tube 14) to where probe 88 will be positioned to block any accidental displacement of percussion device 54 to the closed position thereof wherein primer 50 might be accidentally discharged as the propellant is passed thereby into chamber 16.

An extractor 112 is pivotally mounted in receiver 48 by means of a pin 114 so as to extend upwardly in a mating clearance in the rear face of housing 56 to engage the front of the rim of primer 50. Provided on the rear side of extractor 112 below pin 114 is an arcuate protuberance 116 which is contactable by a cam 118 on the front face of housing 56, when percussion device 54 swings from the closed position, to pivot the upper end of the extractor outwardly for ejection of the fired case of primer 50 or the live primer when the cannon is to be cleared.

Thus, when the cannon has been fired or is to be cleared, handle 44 is pulled downwardly causing rotation of crankshaft 32 and, consequently, crank 34 whereby breechblock 20 is rotated from the lock position. At the same time, cam path 100 is rotated along cam follower 98 of plunger 82 so that the plunger is actuated against slide 70 during the initial rotation of crankshaft 32 and while threads 28 on breechblock 20 are still engaged with threads 30 in breech ring 15. Whereupon, when end 79 of slide 70 is pushed clear of recess 78, percussion device 54 is free to be swung open under the bias of spring 68. As percussion device 54 swings to the open position, cam 118 thereon contacts arcuate protuberance 116 on extractor 112 to eject the fired case of primer 50 or the live primer if the cannon is to be cleared after being readied for fire. Consequently, cannon 12 is made safe when breechblock 20 is unlocked as primer 50 is removed from firing mechanism 46.

To load the cannon with breech mechanism 18 swung open, a projectile and bagged propellant are pushed into chamber 16 of tube 14 and then handle 44 is pulled rearwardly to close the breech mechanism. When breech mechanism 18 is closed, handle 44 is pushed from a horizontal to a vertical position which causes rotation of breechblock 20 to the lock position. Primer 50 is then chambered in receiver 48 and lever 66 rotated to swing percussion device 54 upwardly to the closed position. As lever 66 is rotated, shaft 64 is rotated therewith to actuate slide 70 laterally through the cooperation of tang 76 with notch 74 to move end 79 of the slide into recess 78 for securing percussion device 54 in the closed position. As slide 70 is actuated to the latch position by lever 66, end

79 of the slide pushes plunger 82 to the right to move cam follower 98 thereon into contact with cam path 100 and ready to unlatch the percussion device 54 for automatic ejection of primer 50 or the spent case thereof when handle 44 is pulled downwardly.

From the foregoing it is clearly evident that there is provided herein for cannons a safety device which is easy to manufacture, simple and rugged in construction and positive in operation.

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 cannon having a tube, a breech ring mounted thereon, and a breechblock mounted for rotation on a spindle of a carrier mounted on the breech ring for pivotal displacement between an open and a closed position, a crankshaft rotatingly mounted in the carrier, a crank disposed on one end of said crankshaft for operational cooperation with the breechblock for converting eccentric displacement of said crank by rotation of said crankshaft to rotation of said breechblock for alternate displacement between a lock and an unlock position, a firing mechanism including a receiver disposed in the spindle for chambering a primer and a percussion device mounted on said receiver for pivotal movement between a closed position in back of the primer chambered in said receiver and an open position, a spring operationally disposed between said receiver and said percussion device for biasing said percussion device to the open position, a slide disposed in said percussion device for releasably securing said percussion device to the carrier in the closed position, and a plunger operationally disposed between said crankshaft and said slide for transferring rotation of said crankshaft to displacement of said slide for actuation thereof to release said percussion device from the closed position.

2. The cannon as defined in claim 1 wherein said crank is provided with a cylindrical riser portion and said slide is disposed for translational displacement in said percussion device, and including a cam path formed in said riser portion, and a cam follower extending from said plunger to engage said cam path, said cam follower being disposed for converting rotation of said crankshaft to translational displacement of said plunger.

3. The cannon as defined in claim 1 wherein said slide and said plunger are disposed in longitudinal alignment and said plunger is disposed for actuation against one

end of said slide for actuation thereof to unlock said percussion device from said receiver, and including cooperating cam means on said crank and said plunger for converting rotation of said crankshaft in a direction for moving the breechblock to an unlock position to translational movement of said plunger against said slide for actuation thereof to unlock said percussion device.

4. The cannon as defined in claim 1 wherein the breech ring is provided with internal threads of interrupted type and the breechblock is provided with external threads of similar type arranged for displacement in back of the internal threads of the breech ring for securing the breechblock against displacement relative thereto, and including a cam follower extending from said plunger to said crank, and a cam path formed on said crank for cooperation with said cam follower for converting rotation of said crank to translational displacement of said plunger, said cam path being generated so as to actuate said plunger for release of said percussion device when said crank is rotated to rotate the breechblock to the unlock position and to completely release said percussion device before the threads of the breechblock are clear of the threads in the breench ring.

5. The cannon as defined in claim 1 wherein said plunger is of square cross-section and includes a probe extending longitudinally from one end, a handle including a cylindrical portion with a finger portion and a cam follower disposed on the opposite end thereof, said handle being mounted through said plunger so that said cam follower and said finger portion extend from opposite sides thereof, a channel formed in the rear face of the carrier for slidingly receiving said plunger, said channel being disposed for positioning said plunger so that said probe is actuatable against one end of said slide for actuation thereof to release said percussion device, said fingerpiece extending outwardly from the carrier and said cam follower extending to said crank, and a cam path formed on said crank so as to cooperate with said cam follower for converting rotation of said crankshaft in a direction to actuate the breechblock to the unlock position to translational displacement of said plunger to actuate said probe against said slide for actuation thereof to release said percussion device.

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