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GUN CHARGING MECHANISM

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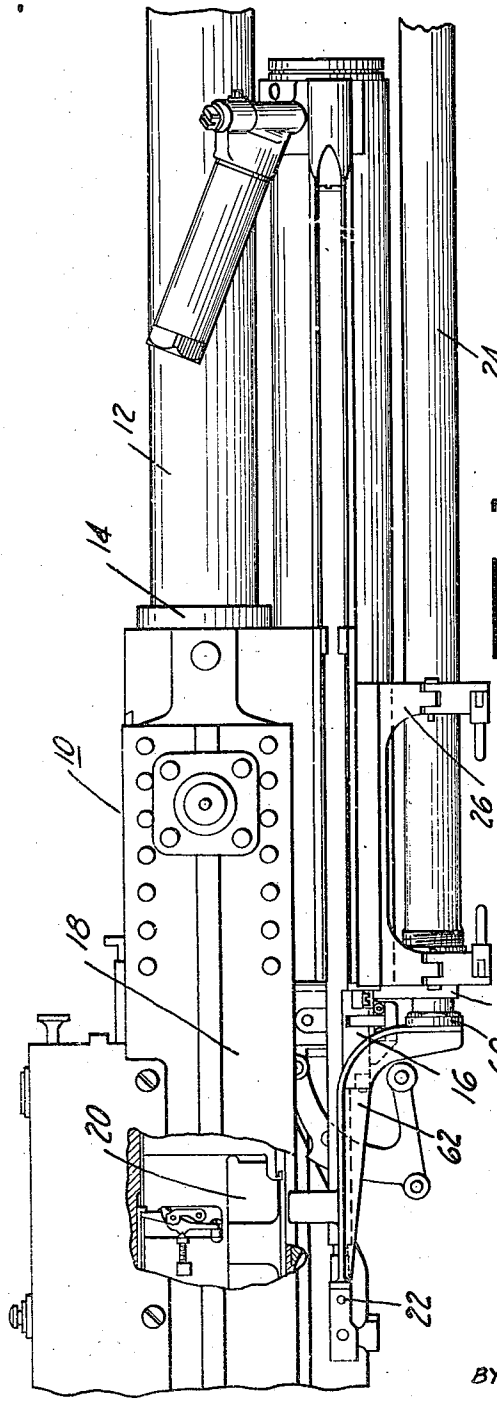


FIG. 1

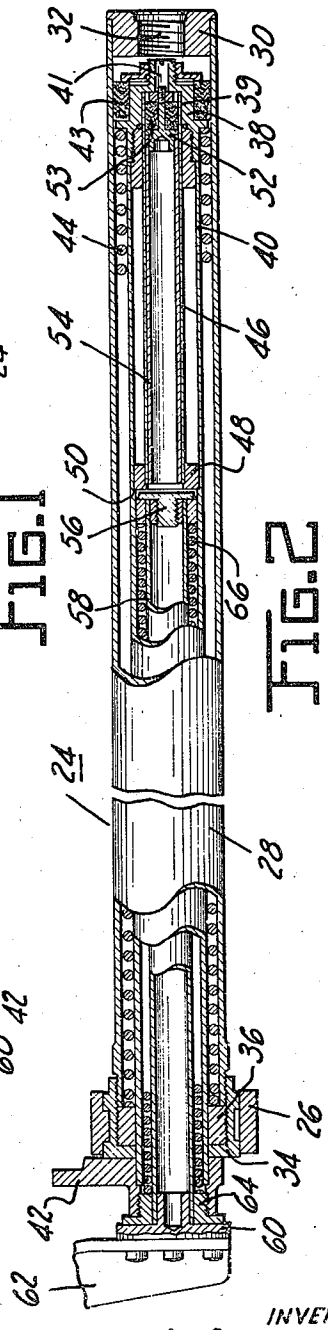


FIG. 2

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GUN CHARGING MECHANISM

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3 Claims. (Cl. 89—1)

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This invention relates to mechanisms for charging a gun and more particularly to mechanisms of the hydraulic type for charging machine guns and small cannon such as the 37 mm. type.

Many of the present day aircraft are provided with guns fixed in the wings and fuselage at points remote from the operator or gunner. During normal gun operation a slide member automatically reciprocates within the gun and is adapted to replenish the gun chamber with another cartridge. Should the gun become jammed, however, due to defective ammunition, some means must be provided for charging the gun from a distant point. Although the reciprocable slide member associated with each gun is an inherent part thereof and may be manually operated for extracting a dud cartridge and inserting a live one, it would be impracticable as well as impossible in some instances to consummate charging the gun in this manner because of the location of the gun at a remote point from the gunner. To overcome this, a charging mechanism is provided which may be controlled by the gunner for simulating normal gun operation of the reciprocable slide member.

Charging of the smaller caliber guns with the conventional single piston charging device which is adapted to engage a single slide member for rearward movement to extract the old cartridge and insert a new one necessitates a cylinder for the piston at least as long as the maximum stroke required for charging the gun. The charging device of the invention employs a telescoping piston arrangement which allows a foreshortening of the overall length of the cylinder with respect to the total stroke of the piston arrangement without sacrificing the length of the piston stroke.

In the larger type guns, such as the 37 mm. cannon, this reciprocable slide member is also automatically operated during normal gun operation by the gun barrel or tube extension which is caused to recoil when a cartridge is detonated; but when charging is desired, because of the increased force required in the larger gun for accomplishing the rearward movement of the barrel and lock frame of the gun simultaneously, since they are latched during initial movement and cannot be moved independently, it has been found expedient to move both the barrel and lock frame by providing a telescoping piston arrangement which engages both of these elements for initially moving them to a predetermined rearward position where the barrel ceases rearward movement and the lock frame only is moved rearwardly by one of the pistons of the charging device.

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It is therefore, an object of the invention to provide a mechanism which may be operated from a distant point for charging a gun.

Another very important object of the invention is to provide a gun-charging mechanism wherein the charging cylinder includes two or more telescoping fluid pressure actuated members.

Another object of the invention resides in the provision of a charging mechanism which will simulate normal gun operation when charging is desired.

A further object of the invention is the provision of a multiple stage telescoping charging cylinder arrangement.

A still further object of the invention resides in the provision of means for charging a gun which has two movable members both of which must be reciprocated for consummating charging.

Another important object of the invention lies in the provision of a gun charging mechanism which is adapted to move the gun barrel or tube extension and lock frame of the gun simultaneously a predetermined distance rearwardly at which time the lock frame is separated from the tube extension and is moved further rearwardly for extracting a shell.

Other objects and advantages of the present invention will be readily apparent by referring to the following specification considered in conjunction with the accompanying drawing, but it is to be understood that any modifications may be made in the specific structural details thereof within the scope of the appended claims without departing from the spirit of the invention.

In the drawing:

Figure 1 is an elevational view partly in section of a portion of a gun with which the device of the invention is associated; and

Figure 2 is a longitudinal sectional view partly in elevation of the device of this invention.

Referring to Figure 1, reference numeral 10 designates generally a gun having a tube or barrel 12 adapted to reciprocate within a bushing 14 upon firing of the gun. Secured to the tube 12 is a tube extension 16 which supports the rear end of the tube in the gun frame 18 and is slidable therein. Also slidable in the gun frame 18 is a lock frame 20 for extracting and ejecting empty shell cases and for feeding live rounds of ammunition into the gun during reciprocation with the tube and tube extension. The lock frame

20 is held in a forward position against tube extension 16 by springs, not shown, which engage the tube extension 16 and driving spring rod connecting pins 22 which are secured to the lock frame 20. The pins 22 are adapted for engagement by external means to the gun when rearward movement of the lock frame for charging the gun is to be accomplished by manual means, for example. During normal gun operation movable members 16 and 20, that is, tube extension 16 and lock frame 20, reciprocate in response to detonation of a shell in the gun for extracting the fired shell and inserting a live one into the gun. Springs which are associated with the gun, but not shown, return the movable members to their forward position for firing at the completion of the charging cycle. However, should the shell which is inserted into the gun be a defective one which will not fire, there will be no detonation to cause reciprocation of the tube extension and lock frame. In such a case other means for extracting the unfired shell and inserting a new one must be provided.

For simulating normal gun operation for charging the gun when a defective shell is in the gun or when it is necessary to reload after a round has been exhausted, a charging mechanism 24 is attached to the gun 10 in any suitable manner such as by a bracket 26. The mechanism comprises a cylinder 28 having an end portion 30 drilled and tapped at 32 for connecting a hydraulic pressure source, not shown. An end member 34 threadedly engages the other end of cylinder 28 and holds it securely to the bracket 26. A bushing 36 is secured to the same end of the cylinder by end member 34. A piston 38, which has a counterbored portion 39 and an aperture 41 therein, reciprocates in the cylinder and has fastened thereto a piston rod 40 which extends beyond the cylinder and has a lug 42 attached thereto which engages the tube extension 16 when the tube is to be moved rearwardly for charging the gun. Packing 43 encircles piston 38 and provides a seal between the piston and the cylinder 28 to prevent escape of fluid from between these parts. A spring 44 disposed within cylinder 28 has one end abutting the bushing 36 and the other end engaging piston 38 for returning the piston and piston rod 40 to the right end of the cylinder as viewed in Figure 2 when hydraulic pressure is exhausted from cylinder 28. A sleeve 46 is held securely within the piston rod 40 by a ring-like member 48 which abuts one end of the sleeve 46 and engages a shoulder 50 of the piston rod to prevent axial movement of the sleeve with respect to the piston 38 and piston rod 40. The other end of the sleeve fits into the counterbored portion 39 of the piston 38. A second piston 52 is disposed within piston 38 and sleeve member 46. A packing 53 encircles piston 52 and provides a seal between the piston 52 and sleeve 46 to preclude the escape of hydraulic fluid between these parts. A piston rod 54 slidable in the sleeve 46 is connected to the piston 52 at one end and is adapted to move in response to a predetermined pressure acting on piston 52 for moving the lock frame only of the gun after the tube extension has traveled its maximum rearward direction.

The piston 52 and piston rod 54 are operatively connected to a member 56 which is attached to a rod member 58 which carries a flange element 60 to which a yoke 62 is fastened for engaging the spring rod connecting pins 22, to thereby force the lock frame 20 rearwardly at times. Rod member 58 passes through a bushing 64 threadedly

engaging flange 42. A spring 66 has one of its ends abutting the bushing 64 and its other end riding against piston member 56 so as to act on the piston rod 54 to cause the piston 52 with which it is connected to assume a normal position to the right end of the cylinder 28 as shown in Figure 2. The springs 44 and 66 are so designed with respect to the pistons 38 and 52 respectively that when fluid pressure is admitted to cylinder 28 piston 38 moves to the left a predetermined distance carrying piston 52 along with it before piston 52 begins its movement to the left with respect to piston 38. That is, the spring loadings on the two pistons 38 and 52 are such that the pistons travel together during most of their rearward movement before piston 52 is moved to the left with respect to piston 38.

Operation of the charging mechanism is as follows:

Hydraulic fluid is admitted to the cylinder 28 at the connection 32. As the fluid pressure rises in the cylinder, piston 38 is forced to the left to thereby cause the lug 42 and yoke 62 to engage the tube extension 16 and spring rod connecting pin 22 of the lock frame 20 and move these members rearwardly a predetermined distance with respect to the gun. At the time the two movable members, namely, the tube extension and lock frame have reached their maximum rearward stroke by action of piston 38 only, the pressure in the cylinder acting on pistons 38 and 52 has risen to a value where the latter piston is moved to the left with respect to the former to thereby urge yoke member 62 further to the rear carrying with it lock frame 20. When the two members have reached their respective maximum rearward positions by the action of both pistons 38 and 52, the defective cartridge is ejected and the hydraulic pressure in cylinder 28 is connected to exhaust, not shown, whereby the springs 44 and 66 return the pistons 38 and 52 unimpeded to the position shown for another charging cycle. The springs, not shown, associated with the gun, return the movable members to their forward position shown in Figure 1 for firing the gun after hydraulic pressure is exhausted from cylinder 28 as previously stated. During the return stroke of the tube extension the feeding mechanism of the gun, not shown, inserts a live shell into the path of the lock frame which forces the shell into the gun chamber. It is readily seen that such reciprocable action of the two movable members extracts the shell and inserts another one.

What I claim is:

1. In combination, a gun of the type having means which must be moved to the rear of said gun and then released for counter-movement when charging is desired, said means including two reciprocable members constructed and arranged so that when one of said members is moved a predetermined distance toward the rear of said gun the other member is moved simultaneously therewith until said predetermined distance is reached whereupon movement of said one member is arrested while movement of said other member toward the rear of the gun is continued until a second predetermined distance is reached, a hydraulic mechanism mounted on the gun for moving the members toward the rear thereof and comprising a cylinder, a piston reciprocable in the cylinder and normally urged toward one end thereof and constructed and arranged to be in engagement with said one member to move said two members simultaneously said first predetermined distance toward the rear of said gun

when said piston is moved to the other end of said cylinder, and piston means reciprocable within said first-named piston and normally urged toward one end thereof and constructed and arranged to be in engagement with the other member, said piston means constituted to move the other member said second predetermined distance toward the rear of the gun so that said two members are now positioned for counter-movement to thereby cause the gun to be charged upon their return.

2. In combination, a gun of the type having means which must be moved to the rear of said gun and then released for counter-movement when charging is desired, said means including two reciprocable members constructed and arranged so that when one of said members is moved a predetermined distance toward the rear of said gun the other member is moved simultaneously therewith until said predetermined distance is reached whereupon movement of said one member is arrested while movement of said other member toward the rear of the gun is continued until a second predetermined distance is reached, a hydraulic mechanism mounted on the gun for moving the members toward the rear thereof and comprising a cylinder, a piston reciprocable in the cylinder and normally spring urged toward one end thereof and constructed and arranged to be in engagement with said one member to move said two members simultaneously said first predetermined distance toward the rear of said gun when said piston is moved to the other end of said cylinder, and piston means reciprocable within said first-named piston and spring urged toward one end thereof and constructed and arranged to be in engagement with said other member, said piston means constituted to move the other member said second predetermined distance toward the rear of the gun so that said two members are now positioned for counter-movement to thereby cause the gun to be charged upon their return.

3. In combination, a gun of the type having means which must be moved to the rear of said gun and then released for counter-movement when charging is desired, said means including two reciprocable members constructed and arranged so that when one of said members is moved a predetermined distance toward the rear of said gun the other member is moved simultaneously therewith until said predetermined distance is reached whereupon movement of said one member is arrested while movement of said other member toward the rear of the gun is continued until a second predetermined distance is reached, a cylinder mounted on the gun, a pair of pistons disposed within said cylinder for reciprocation, a spring in the cylinder urging one of said pistons toward one end of the cylinder, a spring in said one piston urging said other piston into telescoped position with respect to said one piston, said one piston constructed and arranged to be in engagement with said one member to move said two members simultaneously said first predetermined distance toward the rear of said gun when said one piston is moved to the other end of said cylinder, said other piston constructed and arranged to be in engagement with the other member to move the same said second predetermined distance toward the rear of the gun when said other piston is moved with respect to said one piston and also moved toward the rear of the gun, whereby said two members are positioned for counter-movement to thereby cause the gun to be charged upon their return.

GEORGE A. GOEPFRICH.