May 10, 1949. C. W. NEWELL 2,469,400

FIRING AND LOADING SAFETY FOR AUTOMATIC GUNS

Filed Sept. 21, 1945 2 Sheets-Sheet 1

Fig. 1

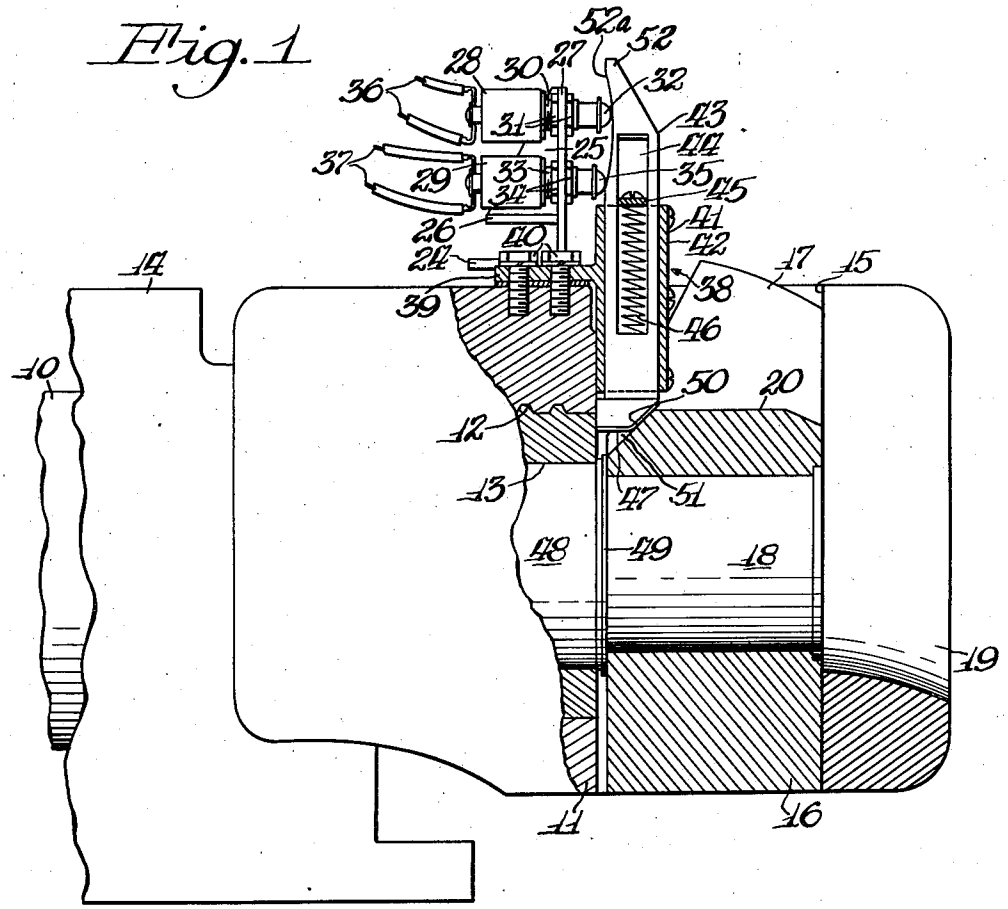
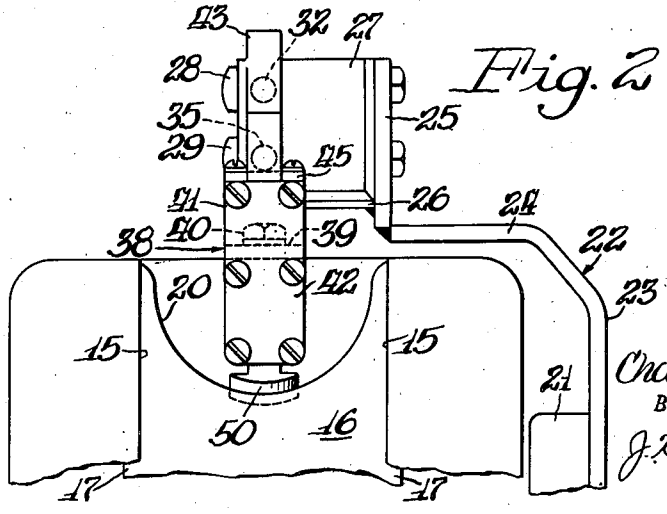


Fig. 2



INVENTOR.
Charles Wayne Newell
BY
J. H. Church & H. E. Thibodeau
ATTYS.

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Fig. 4

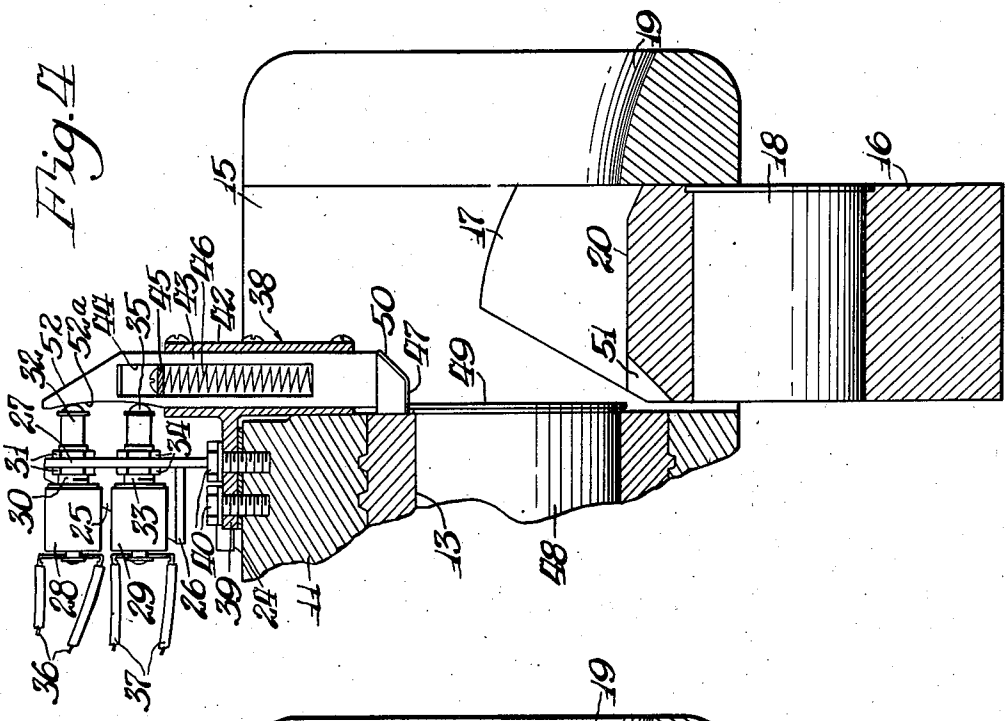
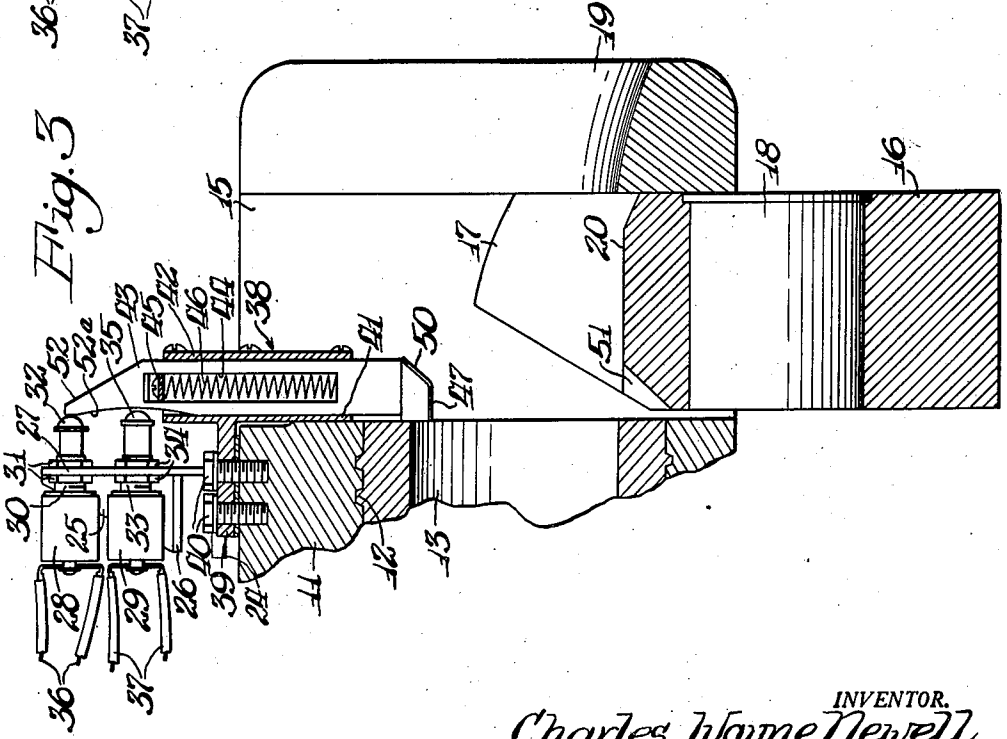


Fig. 5



INVENTOR.
Charles Wayne Newell
BY
J. H. Church & H. C. Thibodeau
ATTYS.

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FIRING AND LOADING SAFETY FOR AUTOMATIC GUNS

Charles Wayne Newell, Moline, Ill.

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11 Claims. (Cl. 89—1)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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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 a gun. More particularly the invention pertains to a safety control means for an automatic or semiautomatic heavy caliber gun. In its specific aspects the invention relates to safety control devices for an automatic or semiautomatic weapon of the type including a gun, means for loading shells to the gun, and means for firing the gun.

Recent developments in the construction and use of heavy caliber weapons have resulted in the mounting of guns of calibers such as 75 mm. to 105 mm. in aircraft, land vehicles or small vessels, wherein circumstances require that the weapon be completely automatic or semi-automatic because operation of the weapon is under control of the pilot or driver of the aircraft or vehicle, or some other individual who has duties in addition to those involved in firing the weapon. Accordingly, the complete weapon includes as components thereof a gun, means for automatically feeding and ramming shells into the chamber of the gun, means for firing the gun, and control means responsive to completion of the various phases of feeding, loading and ramming to condition the gun for firing only after these phases are complete. The importance of the control means lies in its function as a means for preventing malfunctioning of the weapon, thereby obviating damage to the weapon itself and eliminating potential harm to the operator of the weapon. Malfunctioning and dangers sought to be eliminated are, for example, those incident to loading the weapon while a shell is already in the chamber or while the breechblock is closed; or in firing or attempting to fire the weapon when the breechblock has failed to close completely or the gun has failed to return to battery.

It is accordingly a principal object of the present invention to provide safety or control means operable in response to conditions established by return or nonreturn of the gun to battery, opening or closing of the breechblock of the gun, and presence or absence of a shell in the chamber of the breech.

An important object of the invention is to provide a simple control device combining safeguards against defects incident to any of the aforesaid three conditions.

Other objects of the invention are to provide control or safety means that may be attached to weapons already in use; to provide a control device of relatively simple construction having a minimum number of moving parts; to provide a control device incorporating electrical control switches that may be easily connected into the loading and firing circuits of an automatic gun; and to provide a safety device including a single control member for controlling a plurality of actuators or safety devices.

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Other objects and important features of the invention will become apparent to those skilled in the art as the disclosure is more fully made in the following detailed description of a preferred embodiment of the invention as shown in the accompanying sheets of drawings in which:

Fig. 1 is a fragmentary elevational view, partly in section, of the left-hand rear portion of the barrel-and-breech assembly of a heavy caliber gun, showing a shell in the breech chamber and the breechblock in closed position;

Fig. 2 is a fragmentary rear elevational view showing the supporting means for the actuators of the safety or control means;

Fig. 3 is a view similar to that in Fig. 1 and shows the positions of the parts when the breech chamber is empty and the breechblock is open; and

Fig. 4 is a view similar to that in Fig. 3 and shows the positions of the parts with a shell in the breech chamber and the breechblock still open.

Although the invention is shown and will be described in connection with a particular type of breech structure, it will be understood that the fundamentals of the invention are applicable to other structures; accordingly, the present disclosure should be taken as illustrative and not limiting.

The breech structure shown in the drawings incorporates a barrel-and-breech assembly including a gun barrel 10 and a breech ring 11. The rear end of the barrel 10 is threaded into the breech ring 11, as shown at 12, and is provided with a shell chamber 13. The particular structure herein illustrated is of the type in which the gun barrel, cradle, and recoil mechanism are concentrically mounted. The cradle is designated herein by the numeral 14. One example of the concentric structure of the type referred to is shown in the patent to Lucht, No. 2,358,340. However, the details of the concentric recoil mechanism are not necessary to an understanding of the present invention and are therefore not herein illustrated.

The breech ring 11 is provided at a portion thereof rearwardly of the chamber 13 with a pair

of transversely aligned vertical slides or grooves 15 in which a breechblock 16 is mounted for vertical sliding movement to open and close, the breechblock 16 being provided in the usual manner with opposite vertical guides 17 for this purpose. The breechblock 16 moves downwardly to open and upwardly to close (Figs. 3 and 4). The breechblock 16 is provided in the usual manner with a firing lock 18, which is coaxial with the shell chamber 13 when the breechblock 16 is closed. The breech ring 11 is provided with an opening 19 of the usual form by means of which shells may be loaded axially into the chamber 13 when the breechblock 16 is open. The upper portion of the breechblock 16 is provided with a semicyclindrical cutout 20 which, when the breechblock 16 is open, is axially aligned with the opening 19 in the breech ring 11 and with the shell chamber 13. The mechanism for opening and closing the breechblock 16 may be of any conventional construction but has not been illustrated herein.

The cradle 14 includes supporting structure, a portion of which is shown at 21 in Fig. 2, by means of which the cradle 14 carries the safety or control means for operation in conjunction with the functioning of the breech components. The supporting structure 21 includes a bracket 22 having a depending portion 23 secured to the support 21 and an integral portion 24 extending laterally and over a portion of the breech ring 11 at one side thereof (Fig. 2). The bracket 22 is thus carried by the cradle 14 and is fixed with respect to the breech ring 11 as the latter recoils and returns to battery.

The laterally extending portion 24 of the bracket 22 carries at its free or inner end an upstanding wall or supporting portion 25, welded or otherwise secured at its lower end to the bracket portion 24. The wall 25 is provided with supporting structure including a lower horizontal flange 26 and a vertical transversely extending flange or wall 27, both of which are secured as by welding to the wall portion 25. The supporting structure including the transverse wall portion 27 provides means for carrying a pair of actuators or safety devices, herein shown as an upper actuator 28 and a lower actuator 29. In the presently illustrated embodiment of the invention these actuators are electrical switches. The upper switch 28 is provided with a threaded shank 30 which passes through an opening in the wall 27 and receives a pair of lock nuts 31 for securing the switch to the wall 27, one lock nut being disposed at each side of the wall. The switch 28 further includes a spring-backed plunger 32, the normal position of which is obtained when the plunger is free to extend to its maximum distance outwardly from the switch 28 under pressure of its backing spring.

The lower switch 29 is similar to the upper switch 28 and is similarly mounted in the wall or flange 27, being provided with a threaded shank 33, a pair of lock nuts 34 and a spring-backed plunger 35. As will hereinafter more clearly appear, the upper switch 28 is appropriately connected electrically in series with an electrical control circuit for the loading of the weapon, the connecting leads being designated by the numeral 36. The electrical circuit through the leads 36 is broken when the plunger 32 is in its spring-pressed outer position. The lower switch 29 is similarly connected by leads 37 to an electrical circuit for controlling the firing of the gun, which circuit is broken when the plunger 35 is in its spring-pressed outer position.

The upper portion of the breech ring 11 carries thereon a bracket 38 provided with a forwardly extending mounting flange 39, secured by a pair of bolts 40 to the top surface of the breech ring 11, and with an integral vertical portion 41 formed as a vertical rectangular sleeve including a removable rear cover plate 42. The sleeve portion 41 carries for vertical sliding movement therein a control member 43 provided intermediate its ends with a vertical slot 44. A transverse bar 45, secured at its opposite ends to opposite sides of the upper portion of the sleeve 41, extends transversely through the slot 44. This bar functions as means for limiting downward movement of the control member 43. The bar serves also as means for receiving the upper end of a compression spring 46, the lower end of which is received by the control member 43 at the lower end of the slot 44 therein. The arrangement of the spring 46 with respect to the control member 43, is such that the control member is normally resiliently urged downwardly or in proximity to the shell chamber 13 when the breechblock 16 is open (Figs. 3 and 4) and when the shell chamber 13 is empty (Fig. 3).

The inner or lower end of the control member 43 is provided with a first contact portion 47 disposed generally horizontally and arranged to be engaged by the rim of a shell in the shell chamber 13. In Figs. 1 and 4, the shell is designnated by the numeral 48 and has a rim 49. The lower or inner end of the control member 43 includes a second contact portion 50 positioned and formed to be engaged by a top portion of the breechblock 16 at the forward end of the semicircular recess 20 therein. In the present instance, this forward upper portion of the breechblock 16 is ground or cut away to provide a well or recess 51 within which the contact portions 47 and 50 of the control member 43 are received.

The upper or outer end of the control member 43 is provided with means for controlling or operating the actuators or switches 28 and 29. This means preferably takes the form of a cam portion, designated by the numeral 52, formed as an integral part of the control member 43. The cam portion 52 is provided with an inwardly curved recess 52a which cooperates with the plungers 32 and 35 of the switches 28 and 29 to depress or release said plungers according to the position of the control member 43 as determined by engagement or nonengagement of the lower or inner contact portions 47 and 50 with a shell 48 in the chamber 13 or with the portion 51 of the breechblock 16.

In the use and operation of a weapon equipped with safety or control devices constructed according to the present invention, loading and firing of the weapon are controlled in a positive manner so that the desirable results set forth above are achieved. The structure of the switch 28 is such that when the plunger 32 is depressed or moved inwardly thereof, an electrical connection is made to complete the circuit through the leads 36. As previously stated, these leads are part of the electrical circuit which controls the mechanism for loading shells into the chamber 13. Such mechanism has not been illustrated herein, since the mechanism itself forms no part of the present invention and the present concern is with only the control for the mechanism. Such mechanism may consist of means of any type, preferably power-operated, and timed with

the other functions of the weapon, to load individual shells successively into the chamber 13 as the weapon is fired and the shell cases of the fired shells are extracted and ejected. A potential danger exists in those instances in which the extracting and ejecting mechanism of the weapon fails to extract and eject the shell case of the previously fired shell from the chamber 13. The degree of this potential danger depends to a great extent upon the type of ammunition being fired; for example, if ammunition fuzed with point-detonating fuzes is being used there is great danger of a premature explosion of a shell being loaded into the barrel against a shell already in the barrel. Even though this type ammunition is not used, there is always the possibility of failure of the weapon to function because of inability of the loading mechanism to load a shell when a shell or case remains in the chamber. For this reason, the control member 43 and its relation to the chamber 13 and switch 28, is such that the control member operates to depress the plunger 32 and close the switch 28 only when the chamber 13 is empty and the breechblock 16 is open. As shown in Fig. 3, the control member 43 may move downwardly so that the deepest portion of the inwardly curved recess 52a on the control portion 52 passes the plunger 32 and so that the upper end of the control portion 52 operates to depress the plunger 32. As shown in Figs. 1 and 4, the deepest portion of the recess 52a serves to permit extension of the plunger 32 when a shell is in the chamber 13 or when the breechblock 16 is closed.

The lower switch 29 is associated with the electrical firing circuit for the gun in such a manner that the weapon can be fired only when the breechblock 16 is completely closed. The several dangers and malfunctions incident to firing or an attempt to fire the gun when the breechblock is not completely closed are well known to those versed in the art and need not be enumerated here. It will suffice to state that the probability of occurrence of these dangers and malfunctions is of sufficient importance to warrant the use of a control device such as that set forth herein, particularly in a weapon in which the shell-feeding, shell-loading and gun-firing operations are phases of automatic cycles of operation. Accordingly, the switch 29 is so arranged with respect to the control member 43 that the circuit through the leads 37 to the firing control means can be closed only when the breechblock 16 is completely closed. In other words, the upper control portion 52 of the control member 43 is so arranged with respect to the plunger 35 that the plunger will be depressed to complete the electrical connection through the leads 37 only when the control member 43 is moved to its farthest upper or outward position by complete closing of the breechblock 16.

The relationship of the parts as shown in Fig. 1 is such that the weapon is in condition for firing; that is, the shell 48 is in the chamber 13 and the breechblock 16 is completely closed. The relationship of the cam recess 52a to the plungers 32 and 35 is such that the former is released and the latter is depressed; hence, the circuit through the leads 36 of the switch 28 is incomplete and another shell cannot be inadvertently loaded against either the closed breechblock 16 or the shell 48 in the chamber 13. In this connection it is to be noted that the same result will be obtained when the breechblock 16 closes, even though for some reason or other the loading mechanism has failed to load a shell into the chamber 13; that it to say, closing of the breechblock 16 alone will serve to establish the conditions shown in Fig. 1, wherein the circuit through the upper switch 28 is open and that through the lower switch 29, is closed. Although it is possible to attempt to fire the weapon without a shell in the chamber 13, it may not be loaded again until the breechblock 16 is opened.

As shown in Fig. 4, the presence of the shell in the chamber 13 will not of itself depress the plunger 35 of the lower or firing switch 29, since the cam recess 52a at the outer portion 52 of the control member 43 is so shaped and disposed as to permit the plunger 35 to extend so that no connection is made through the leads 37. It will be seen, therefore, that when the shell 48 is loaded into the chamber 13, the rim 49 of the shell 48 engages the contact portion 47 of the control member 43 and moves the control member 43 upwardly or outwardly, or away from the chamber 13, to a position in which the circuits through both switches 28 and 29 are incomplete; consequently, another shell cannot be inadvertently loaded into the chamber 13; nor can the weapon be fired. However, assuming that the weapon is functioning normally, the breechblock 16 will close immediately after the shell 48 is chambered, in which case the breechblock 16 will engage the contact portion 50 on the control member 43 and will move the control member 43 still further outwardly. This additional movement does not affect the plunger 32 of the switch 28 but does depress the plunger 35 of the switch 29 to complete the circuit through the leads 37, with the result that the weapon may be fired but an additional shell cannot be inadvertently loaded.

It will be seen from the foregoing description that a simple and safe control means has been provided for the purposes set forth. Although the invention has been described in connection with a particular type of weapon and in connection with a control system of the electrical type, it will be understood that the invention may be similarly employed in weapons and with control systems of other types. Likewise, numerous other modifications and alterations may be made in the preferred form of the invention herein described and illustrated without departing from the spirit and scope thereof as defined in the appended claims.

I claim:

1. In a gun including breech mechanism mounted for recoil and return to battery and having a chamber and a sliding breechblock mounted for movement downwardly to open and upwardly to close, the combination with said breech mechanism of upper and lower actuators, means for mounting said actuators above said breech mechanism and fixed against recoil, a single control member carried by said breech mechanism for movement with said breech mechanism in recoil and return to battery and for vertical sliding movement with respect to said chamber breechblock and actuators and having a lower end projecting toward said chamber and breechblock, and an upper end projecting toward said actuators, means tending normally to move said control member downwardly over the rear end of said chamber when said chamber is empty and when said breechblock is open, a first contact portion on said control member at its lower end positioned to be engaged by a shell in said chamber to hold said control members upwardly, a

second contact portion at said lower end of said control member positioned to be independently engaged by said breechblock moving upwardly in closing to move said control member further upwardly, and cam means on said upper end of said control member for engaging and releasing said actuators according to the positions of said control member, said cam means being so constructed and arranged as to release said upper actuator and engage said lower actuator when said breechblock is closed and to engage said upper actuator and release said lower actuator when said breechblock is open and said chamber is empty and to release both actuators when said chamber contains a shell and said breechblock is open.

2. In a gun including breech mechanism having a chamber and a sliding breechblock mounted for movement downwardly to open and upwardly to close, the combination with said breech mechanism of upper and lower actuators, means for mounting said actuators above said breech mechanism, a single control member carried by said breech mechanism for vertical sliding movement with respect to said breechblock and actuators and having an upper end projecting toward said actuators and a lower end positioned in proximity to said chamber and breechblock, means tending normally to move said control member downwardly over the rear end of said chamber when said chamber is empty and when said breechblock is open, a first contact portion on said control member at its lower end positioned to be engaged by a shell in said chamber to hold said control member upwardly, a second contact portion at said lower end of said control member positioned to be independently engaged by said breechblock moving upwardly in closing to move said control member further upwardly, and cam means on said upper end of said control member for engaging and releasing said actuators according to the positions of said control member, said cam means being so constructed and arranged as to release said upper actuator and engage said lower actuator when said breechblock is closed and to engage said upper actuator and release said lower actuator when said breechblock is open and said chamber is empty and to release both actuators when said chamber contains a shell and said breechblock is open.

3. In a gun including breech mechanism having a chamber and a breechblock mounted for movement to open and to close, the combination with said breech mechanism of first and second actuators, means for mounting said actuators fixedly adjacent said breech mechanism, a control member carried by said breech mechanism for movement inwardly toward and outwardly away from said breechblock and chamber and having an outer end projecting in proximity to said actuators and an inner end positioned in proximity to said chamber and breechblock, means tending normally to move said control member inwardly over the rear end of said chamber when said chamber is empty and when said breechblock is open, a first contact portion on said control member at its inner end positioned to be engaged by a shell in said chamber to hold said control member outwardly, a second contact portion at said inner end of said control member positioned to be independently engaged by said breechblock in closing to move said control member further outwardly, and cam means on said outer end of said control member for engaging and releasing said actuators according to the positions of said control member, said cam means being so constructed and arranged as to release said first actuator and engage said second actuator when said breechblock is closed and to engage said first actuator and release said second actuator when said breechblock is open and said chamber is empty and to release both actuators when said chamber contains a shell and said breechblock is open.

4. In a gun including breech mechanism mounted for recoil and return to battery and having a chamber and a sliding breechblock mounted for movement to open and close, the combination with said breech mechanism of first and second actuators, means mounting said actuators adjacent said breech mechanism and fixed against recoil, a control member carried by said breech mechanism for movement with said breech mechanism in recoil and return to battery and for movement inwardly toward and outwardly away from said breechblock and chamber and having an outer end projecting in proximity to said actuators and an inner end projecting in proximity to said chamber and breechblock, means tending normally to move said control member inwardly over the rear end of said chamber when said chamber is empty and when said breechblock is open, a first contact portion on said control member at its inner end positioned to be engaged by a shell in said chamber to hold said control member outwardly, a second contact portion at said inner end of said control member positioned to be independently engaged by said breechblock in closing to move said control member further outwardly, and cam means on said outer end of said control member for engaging and releasing said actuators according to the positions of said control member, said cam means being so constructed and arranged as to release said first actuator and engage said second actuator when said breechblock is closed and to engage said first actuator and release said second actuator when said breechblock is open and said chamber is empty and to release both actuators when said chamber contains a shell and said breechblock is open.

5. In a gun including breech mechanism having a chamber and a vertically sliding breechblock, the combination with said breech mechanism of a pair of actuators, means for mounting said actuators adjacent said breech mechanism, a single control member carried by said breech mechanism for vertical sliding movement with respect to said chamber, breechblock and actuators and having an upper end projecting toward said actuators and a lower end positioned in proximity to said chamber and breechblock, means tending normally to move said control member downwardly over the rear end of said chamber when said chamber is empty and when said breechblock is open, a first contact portion on said control member at its lower end positioned to be engaged by a shell in said chamber to hold said control member upwardly, a second contact portion at said lower end of said control member positioned to be independently engaged by said breechblock sliding upwardly in closing to move said control member further upwardly, and means on said upper end of said control member for operating said actuators according to the positions of said control member as determined by engagement or nonengagement of said contact portions by said breechblock and/or a shell in said chamber.

6. In a gun including breech mechanism mounted for recoil and return to battery and hav-

ing a chamber and a vertically sliding breechblock, the combination with said breech mechanism of a pair of actuators, means for mounting said actuators adjacent said breech mechanism and fixed against recoil, a single control member carried by said breech mechanism for movement with said breech mechanism in recoil and return to battery and for vertical sliding movement with respect to said chamber, breechblock and actuators and having an upper end projecting toward said actuators and a lower end positioned in proximity to said chamber and breechblock, means tending normally to move said control member downwardly over the rear end of said chamber when said chamber is empty and when said breechblock is open, a first contact portion on said control member at its lower end positioned to be engaged by a shell in said chamber to hold said control member upwardly, a second contact portion at said inner end of said control member positioned to be independently engaged by said breechblock sliding upwardly in closing to move said control member further upwardly, and means on said outer end of said control member for operating said actuators according to the positions of said control member as determined by engagement or nonengagement of said contact portions by said breechblock and/or a shell in said chamber.

7. In a gun including breech mechanism having a chamber and a breechblock mounted for opening and closing, the combination with said breech mechanism of a pair of actuators, means for mounting said actuators adjacent said breech mechanism, a single control member carried by said breech mechanism for movement with respect to said breechblock and actuators and having first and second portions projecting respectively toward said actuators and toward said chamber and breechblock, means tending normally to move said control-member second portion over the rear end of said chamber and said control-member first portion away from said actuators when said chamber is empty and when said breechblock is open, said second portion being positioned to be engaged by a shell in said chamber, to move said first portion toward said actuators, and to be independently engaged by said breechblock in closing, to move said first portion further toward said actuators, and means on said first portion of said control member for operating said actuators according to the positions of said control member.

8. In a gun including breech mechanism having a chamber and a breechblock mounted for opening and closing, the combination with said breech mechanism of a safety device, means for mounting said device adjacent said breech mechanism, a control member carried by said breech mechanism for movement with respect to said breechblock and device and having portions projecting respectively in proximity to said device and to said chamber and breechblock, means tending normally to move said control member toward said chamber and away from said device when said chamber is empty and when said breechblock is open, said chamber-proximate

portion of said control member being positioned to be engaged by a shell in said chamber, to move said control member toward said device, and to be independently engaged by said breechblock in closing to move said control member further toward said device, and means at said outer device-proximate portion of said control member for operating said device according to the positions of said control member.

9. In a gun having breech mechanism, mounted for recoil and counter-recoil including a chamber and a breechblock mounted for opening and closing, the combination with said breech mechanism of a pair of safety devices mounted adjacent said mechanism and fixed against recoil, means on said mechanism operatively associated with one of said devices and operable in response to presence or absence of a shell in said chamber for controlling said one device, and means on said mechanism operatively associated with said other device and operable in response to opening and closing of said breechblock for controlling said other device.

10. In a gun having breech mechanism, mounted for recoil and counter-recoil including a chamber and a breechblock mounted for opening and closing, the combination with said breech mechanism of a pair of safety devices mounted adjacent said mechanism and fixed against recoil, and a single control member mounted on said mechanism, operatively associated with said devices and operable in response to presence or absence of a shell in said chamber for controlling one device and operable in response to opening and closing of said breechblock for controlling said other device.

11. In a gun having breech mechanism arranged for recoil and return to battery and having a shell chamber and a breechblock mounted for opening and closing said chamber, the combination with said breech mechanism of a support mounted adjacent said mechanism and fixed against recoil, first and second electric switches mounted on said support, a control element mounted on said breech mechanism for movement away from and toward said switches as said breech mechanism recoils and returns to battery and having first and second portions, said first portion being so constructed and arranged as to cooperate with said first switch to close and open said first switch according to whether said chamber is empty or contains a shell, and said second portion being so constructed and arranged as to cooperate with both of said switches to close and open said first switch and to open and close said second switch according to whether said breechblock is open or closed.

CHARLES WAYNE NEWELL.

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The following references are of record in the file of this patent:

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