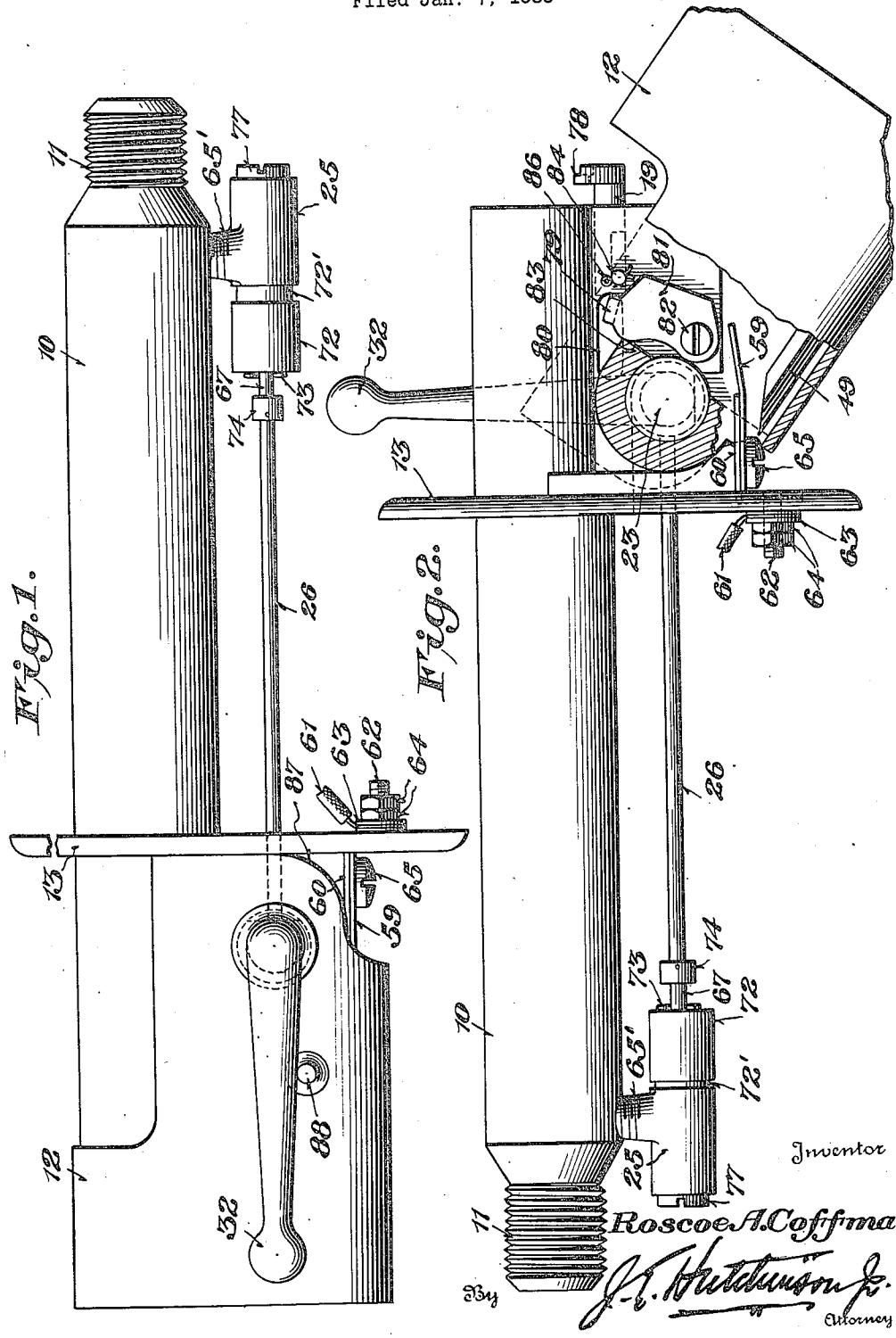
July 4, 1939. R. A. COFFMAN 2,164,700

DEVICE FOR DISCHARGING EXPLOSIVE OR COMBUSTIBLE CHARGES

Filed Jan. 7, 1935 3 Sheets-Sheet 1



July 4, 1939. R. A. COFFMAN 2,164,700

DEVICE FOR DISCHARGING EXPLOSIVE OR COMBUSTIBLE CHARGES

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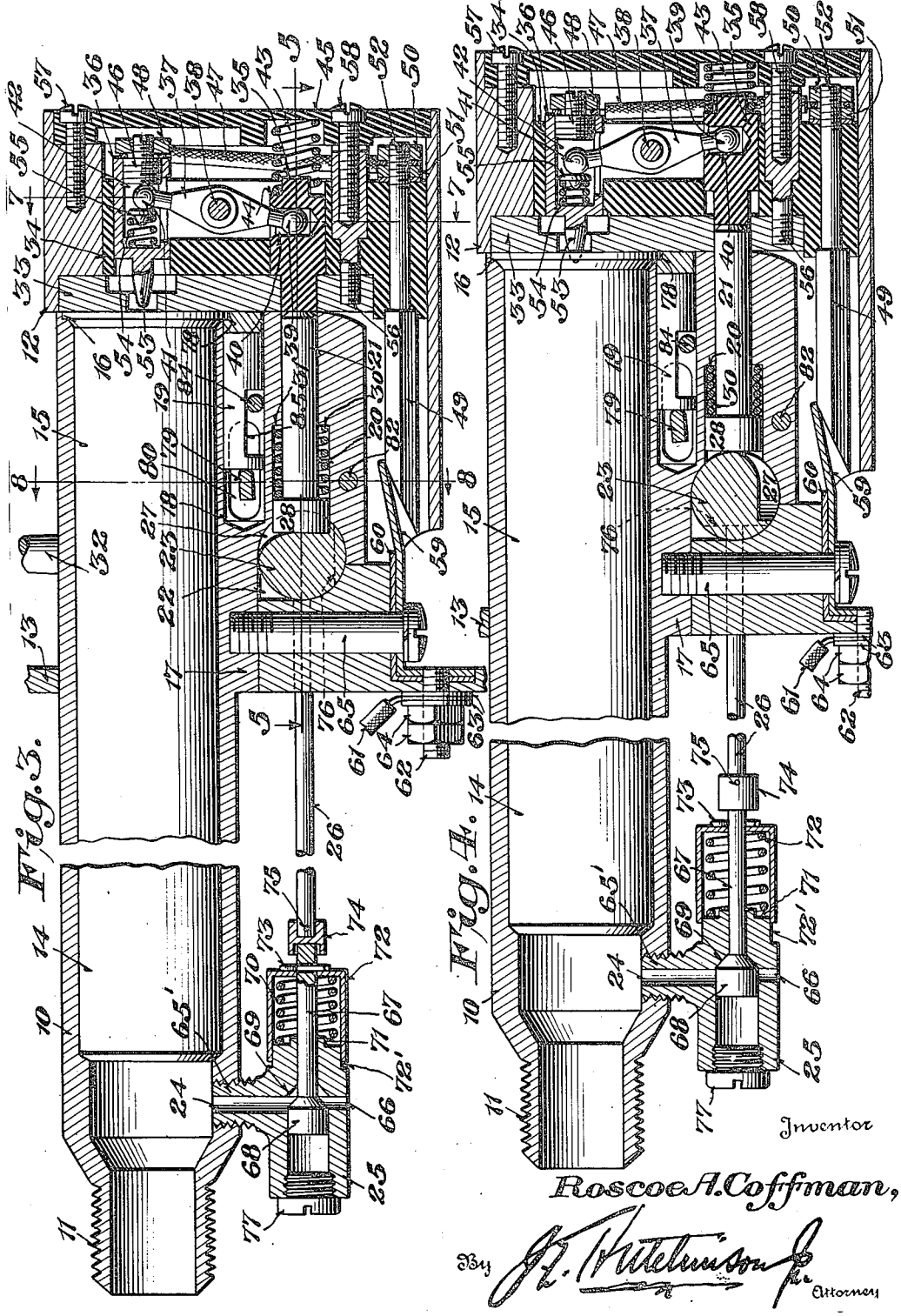


Fig. 3.

Fig. 4.

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July 4, 1939. R. A. COFFMAN 2,164,700

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Filed Jan. 7, 1935 3 Sheets-Sheet 3

Fig. 5.

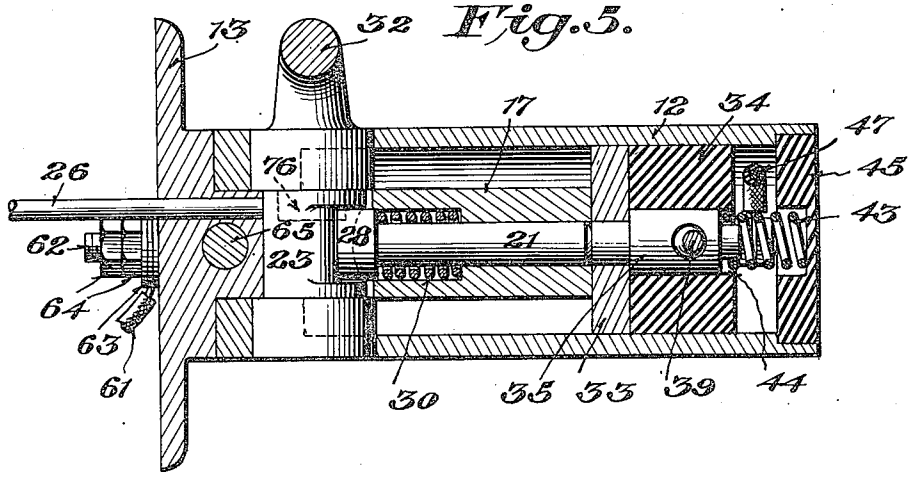


Fig. 6.

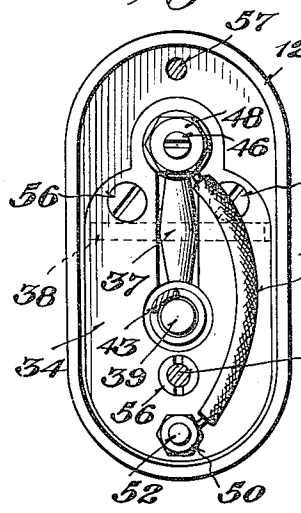


Fig. 7.

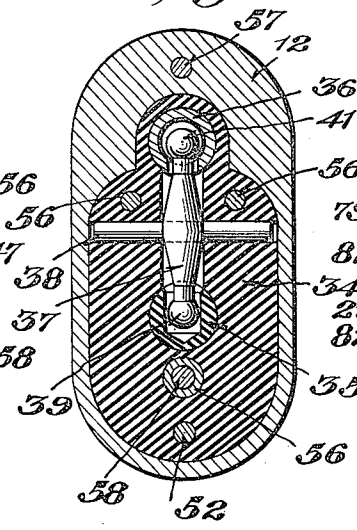
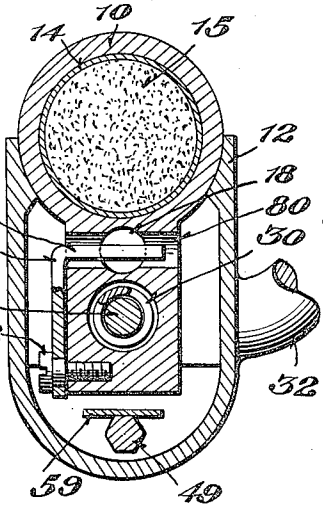


Fig. 8.



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UNITED STATES PATENT OFFICE

2,164,700

DEVICE FOR DISCHARGING EXPLOSIVE OR COMBUSTIBLE CHARGES

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Application January 7, 1935, Serial No. 751

16 Claims. (Cl. 123—183)

This invention relates broadly to a device for discharging explosive or combustible charges. More particularly the invention relates to a device for discharging explosive or combustible cartridges by electricity.

It is an object of this invention to provide a device which will be certain in its operation, reliable in use, and possessing characteristics of safety under all conditions.

Another object of the invention is to provide a device consisting of a barrel for holding a cartridge and a movable breech block for closing one end of the barrel and in which the cartridge cannot be discharged until the breech block is firmly locked in position against the open end of the barrel.

Another object of the invention is to provide a device of this character with means to vent back pressures and gases from the cartridge barrel so that the breech block may be opened without danger of a forcible ejection of the empty cartridge.

Another object of the invention is to provide a device for electrically igniting a charge in which the electrical circuit is always broken when the device is open for the insertion of a charge.

Another object of the invention is to provide a device of the character to be described in which the firing pin cannot be brought into contact with a cartridge with sufficient force to mutilate the same.

Other and important objects of this invention will become apparent as the following description is read in connection with the drawings herein:

Fig. 1 is a side elevation of the device with the breech block closed and in locked position and with its associated vent closed,

Fig. 2 is a view similar to Fig. 1 in which the breech block is shown in its open position with its associated vent open and in which a portion of the breech block is broken away to show certain of the underlying details,

Fig. 3 is a vertical section of Fig. 1 showing the breech block closed preparatory to being locked in closed position and with the associated vent open,

Fig. 4 is a vertical sectional view similar to Fig. 3 but different therefrom in that the locking lever has been moved to closed position and the breech block is therefore shown locked to the barrel with the associated vent closed and the other elements are shown in the position assumed during the firing of the cartridge,

Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 3 and shows some parts in elevation,

Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 3,

Fig. 7 is a vertical sectional view taken on line 7—7 of Fig. 3 and showing some parts in elevation, and

Fig. 8 is a vertical sectional view taken on line 8—8 of Fig. 3.

While this invention may be applied to a wide variety of uses, nevertheless for convenience of description and illustration it will be described as being used in connection with the aeroplane starting motor of my application, Serial No. 536,389 wherein I have shown a motor which is operated by propulsive gases produced by an electrically discharged cartridge, as shown in my application, Serial No. 581,032.

Referring more in detail to the drawings in which like parts are indicated by like reference numerals throughout the several figures, my invention comprises a barrel 10 or other convenient means for holding a cartridge or other explosive or combustible charge, provided at one end with screw threads 11 for attaching the same to my aeroplane starting system or other device (not shown). The other or rear end of the barrel 10 is closed by means of the breech block 12, and the barrel 10 and breech block 12 are supported by a plate 13 by means of which the device may conveniently be attached to a control board of an aeroplane or to some other support at its point of use by means of screws or other suitable means.

The barrel 10 is provided with a bore 14 adapted to hold a cartridge 15 or other suitable explosive or combustible charge. At the rear end of the bore 14 is provided a recess 16 against which the shoulder of a cartridge 15 may rest. On the under side of the barrel 10 and formed integrally therewith, is a lug 17 in which is formed a bore 18 for accommodating a shell extractor 19. A second bore 20 is formed directly under bore 18 and accommodates a breech locking pin 21. The front end of lug 17 is formed with a circular recess 22 which is adapted to accommodate a locking post 23 with which is formed extending at right angle thereto an operating lever 32 by means of which the locking post 23 may be rotated.

Pivoted on and moving angularly about locking post 23 is the breech block 12.

At the fore end of barrel 10 is a vent 24, closed by means of a valve mechanism 25. The valve mechanism 25 is operated through an operating

rod 26, which lies in contact with locking post 23.

The locking post 23 is provided with a cam recess 27 against which the head 28 of the locking pin 21 is pressed by means of a coil spring 30, which spring is held under tension between the head 28 of locking pin 21 and a shoulder 31 in bore 20. When the operating lever 32 is in its raised or vertical position the cam surface 27 of the locking post 23 faces rearwardly, and the coil spring 30 therefore urges locking pin 21 into the cam recess. In this position the locking pin 21 is located entirely within the lug 17 and the breech block 12 may therefore be raised and lowered at will.

The breech block 12 which moves angularly about the locking post 23 to close or open the barrel 10, carries interiorly the mechanism for firing the shell 15. This mechanism will now be described. Within the breech block 12, which is suitably recessed, and resting against the face plate 33, which is attached to the breech block 12 in a suitable manner as by screws (not shown) is a block of insulating material 34 in which is guided for horizontal reciprocatory motion an operating plug 35 and a firing pin 36. The operating plug 35 and the firing pin 36 are connected by means of a fulcrum lever 37 which is movable around a pivot pin 38, supported in the sides of the insulating block 34, and located centrally of the length of the fulcrum lever 37. One end 39 of the fulcrum lever 37 operates in a recess 40 in the operating plug 35, while the other end 41 operates in a recess 42 in the firing pin 36.

The operating plug 35 is urged forwardly as shown in Fig. 3 by means of a coil spring 43, which is retained at its one end by a shoulder 44 on the operating plug 35, and at its other end in a suitable recess in the back plate 45. When in this position the fulcrum lever 37 is turned about its pivot 38 and the firing pin 36 is drawn rearwardly, as shown in Fig. 3 by virtue of contact between the end 41 of the fulcrum lever 37 with a bolt 46 at the rear end of the firing pin. Forming an electrical contact with the firing pin 36 is a conductor 47, one end of which is securely clamped to the bolt 46 by means of a nut 48. The other end of the conductor 47 is in electrical contact with a contact 49 in the bottom of the insulating block through clamping nuts 50 and 51 on the screw threaded end 52 of the contact 49 which extends through the insulating block 34.

The firing pin 36 is provided with a recess as shown at 42, and is provided with a contact point 53 adapted to make electrical contact with the shell 15. Within the recess 42 of the firing pin 36 is a coil spring 54, one end of which is in contact with the forward end of the firing pin and the other end of which is closed by a pressure button 55, against which the end 41 of the fulcrum lever 37 rests.

The insulating block 36 is securely held within the breech block 12 and against the face plate 33 by means of screws 56 (Fig. 6). The open rear end of the breech block 12 is closed by means of a closure plate 45 which is preferably formed of insulating material and which is held securely in place by means of a plurality of screws such as shown at 57 and preferably by at least one additional screw 58 which cooperates with a stud head of the screw 56.

Electrical contact 49 which is carried by the insulating block 34 and which is adapted to move with the breech block 12 contacts, in its closed position, with a fixed contact 59 carried by the plate 13 and insulated therefrom by an insulating strip 60. This contact is connected with a source of electric current by means of a connector 61 attached to the contact 59 by means of a terminal 62 passing through the plate 13. For this purpose insulating washers 63 are provided and between which the conductor 61 is clamped by means of nuts 64 screwed to the end of the terminal 62.

It may now be noted that the plate 13 is firmly attached to the lug 17 of the barrel 10 by means of a screw threaded bolt 65.

The vent 24 of the barrel 10 has heretofore been mentioned and the valve mechanism for opening and closing this vent will now be more particularly described. The valve mechanism 25 is screw threaded as at 65' to engage screw threads in the barrel vent, or otherwise suitably attached to the barrel 10. This valve mechanism is provided with an exhaust bore 66 through which gases may pass when the bore 66 is uncovered. In order to close the exhaust bore 66 the valve mechanism is provided with a valve stem 67 on the end of which is formed a head 68, a portion of which is conically shaped to fit snugly into a seat 69. The valve stem 67 is urged rearwardly by means of a coil spring 70 and consequently the head 68 is urged into the seat 69 to close the exhaust port 66. This spring rests against a shoulder 71 on the exterior of the valve body and is enclosed by a sleeve 72 which slides upon a suitably formed face 72' of the valve body and against which the rear end of the coil spring 70 rests. The sleeve 72 may be restrained in its rearward movement by means of a cotter pin 73 or by other suitable means. The valve stem 67 rests loosely in a sleeve 74 which is carried by the operating rod 26 and which may be attached thereto by means of a pin 75 passing therethrough. The sleeve 74 may, however, rest loosely between the valve stem 67 and the operating rod 26 to maintain the two in alignment, but to provide at the same time means for quickly disconnecting the two. The operating rod 26 passes through the plate 13 and lies in contact with the locking post 23 which post is provided with a slot 76. This slot assumes a vertical position when the locking lever 32 is in closed or locking position, thus permitting the end of the operating rod 26, urged by the coil spring 70, to enter the recess 76 and permit the valve head 68 to close the exhaust port 66. The valve mechanism 25 may be provided with a screw threaded closure plug 77 for the purpose of cleaning, lubricating, or inspecting the interior of the valve.

The shell extractor 19 is formed with a lip 78 against which the head of the shell 15 may rest, and which is adapted to engage behind the shell head to extract the same when the extractor 19 is moved rearwardly by means of the finger 79 operating against the rear of the extractor 19 and through a transverse slot 80 in the lug 17. The finger 79 is a horizontal extension of a plate 81, Figs. 2 and 8, which is pivoted to the lug 17 by means of a screw 82. This plate is thrown forward into engagement with the extractor 19 through engagement with a snail 83 formed on the interior of the breech block 12. The extractor 19 is held within its bore by means of a transverse member 84 which lies in a slot 85 formed in the extractor 19, and which is held in position preferably by means of a cotter pin 86, Fig. 2.

It will be noted that the breech block 12 is formed on an arc 87 at its lower corner which contacts the plate 13, thus permitting free move-

ment about the locking post 23. The breech block is also provided with a stop pin 88 for the purpose of limiting the downward movement of operating lever 32.

Assuming now that a shell has been fired and it is desired to eject the empty cartridge, insert another, and fire the same, after a discharge the operating lever 32 is thrown to its vertical position and the locking post 23 is rotated through a part of a revolution, causing the end of the rod 26 to ride upon the cylindrical surface of the locking post, thus moving the valve stem 67 forward against the tension of the spring 70, moving the valve head 68 away from its seat 69 and opening the exhaust port 66 while the breech block itself is still in closed position. This operation permits gases within the barrel 10 to vent to the atmosphere and release any back pressures within the barrel so that when the breech block 12 is lowered, the shell 15 within the barrel 10 will be not forcibly ejected. At the same time the head 28 of the locking pin will have entered the cam recess 27 of the locking post 23 under pressure of the spring 30 and the locking pin 21 will be completely withdrawn from the face plate 33 and will now lie entirely within the lug 17. The withdrawal of the locking pin 21 will permit the operating plug 35 to move forward under the action of the coil spring 43, thus turning the fulcrum lever 37 about its pivot 38 and thereby withdrawing the firing pin 36 out of contact with the shell in the barrel 10.

Now the breech block 12 may be permitted to fall to its open position as shown in Fig. 2, thus breaking contact between the contact members 49 and 59. At the same time the snail 83 will contact the plate 81 and move it around its pivot 82, thus moving the horizontal extension 79 against the front of the extractor 19 and moving the same rearwardly. Since the lip 78 of the extractor 19 is in engagement with the rim of the shell 15 the shell will be moved rearwardly out of the barrel 10, to an extent sufficient to clasp the same with the fingers to completely withdraw it from the barrel.

A new shell may now be inserted into the barrel 10 and moved forward into engagement with the lip 78 of the extractor 19, thus moving the extractor 19 forward when the breech block 12 is raised sufficiently to bring the snail 83 out of contact with the plate 81. It will be noted that at this time the contacts 49 and 59 are still apart, thus avoiding possibility of short circuiting through the breech block 12. When the breech block 12 is raised to the position shown in Fig. 3, electrical circuit is made through the contacts 49 and 59 to the contact point 53 of the firing pin 36, but the firing pin 36 is held withdrawn into the insulating block 34 by force of the coil spring 43, and can therefore not contact the cartridge 15 until further operation of the operating lever 32. When the operating lever 32 is now brought down into its horizontal position, the locking post 23 will again be rotated to permit the end of the valve operating rod 26 to ride in its slot 76 of the locking post 23, thus permitting the valve stem 67 to move rearwardly under tension of the coil spring 70 and permit the valve head 68 to seat in its valve seat 69 and close the exhaust port 66. At the same time, or preferably slightly thereafter, the cam recess 27 of the locking post 23 will have been moved away from the head 28 of the locking pin 21, and the head 28 of the locking pin 21 will then be in engagement with a higher cylindrical portion of the locking post 23. Under this action the locking pin 21 will be moved rearwardly against the tension of the coil spring 30, and will move into the recess in the face plate 33. It may be specifically noted that rearward movement of the locking pin 21 will carry with it the fulcrum operating button 35 by virtue of contact between these two members, and further, that the locking pin 21 will have moved into the face plate 33 to securely lock the breech block 12 to the barrel 10 before the firing pin 36 has moved forward any appreciable distance. This assures a firm lock between the breech block 12 and the barrel 10 prior to contact between the firing point 53 and the shell 15.

As the locking pin 21 continues to move rearwardly the operating button 35 will be moved with it against tension of the coil spring 43, thus moving the fulcrum lever 37 around its pivot 38 and end 41 of fulcrum lever 37 forward against tension of the coil spring 54. The firing pin 36 will now move forward bringing the firing point 53 into contact with the shell 15, and when this contact is made the shell 15 will be discharged, the electrical circuit having been completed through the conductor 61, contacts 59 and 49, conductor 47, and the firing pin 36. It will be noted that the movement of the firing pin 36 is greater than the movement necessary for contacting an electrical contact in the shell 15. When the firing point 53 is in contact with the shell 15, the spring 54 serves as a lost motion or take up device which compensates for the balance of the movement of the fulcrum lever 37. If an ordinary shot gun shell with a percussion cap or primer were to be placed in the barrel 10, the firing point 53 upon contact with the percussion cap of the shell would stop moving forward and the spring 54 would absorb the balance of movement of the fulcrum 37 to prevent the firing point 53 from sinking into the percussion cap, thus making it impossible to fire the percussion cap shell in the barrel.

This describes a complete cycle of operation and it is of course to be understood that each subsequent operation of the device will be similar. It has been the object to describe this invention in general terms to avoid limitations which are not intended to be implied into the claims hereinafter appended. Particularly with reference to the term "explosive charge" or "cartridge", it is to be noted that any combustible charge is intended and the particular form of the charge is immaterial in so far as this invention is concerned. The drawings, in view of which this description has been written, are used for convenience in illustrating one form of the invention only, and it is expressly to be understood that various modifications and changes may be made within the scope of the following claims, and what I claim is:

1. In a device of the class described, a barrel adapted to hold an explosive cartridge, a pivoted breech block for closing one end of said barrel, a firing pin in said breech block, an electrical contact fixed to said barrel structure exteriorly of said breech block, an electrical connector for said pin in said breech block and movable therewith to engage said contact in only the closed position of said pivoted breech block, a single means operable upon initial movement thereof to lock said breech block to said barrel in closed position, and upon further movement thereof move said firing pin into operative relation with a cartridge in said barrel.

2. In a device of the class described, a barrel provided with a vent independent of the muzzle of said barrel and adapted to hold an explosive cartridge, a pivoted breech block for closing one end of said barrel, a firing pin in said breech block, means operable upon initial movement thereof to close said vent in said barrel and to lock said breech block to said barrel in closed position, and upon further movement thereof move said firing pin into operative relation with a cartridge in said barrel.

3. In a device of the class described, a barrel provided with a vent and adapted to hold an explosive cartridge, a pivoted breech block for closing one end of said barrel, a firing pin in said breech block, an electrical contact fixed to said device exteriorly of said breech block, an electrical connector for said pin in said breech block and movable therewith to engage said contact in only the closed position of said breech block, means operable upon initial movement thereof to close said vent in said barrel and to lock said breech block to said barrel in closed position, and upon further movement thereof move said firing pin into operative relation with a cartridge in said barrel.

4. A device of the class described comprising an open ended barrel adapted to hold an explosive cartridge, a breech block for closing one end of said barrel, a locking post about which said breech block is pivoted, a locking pin movable by said post for engaging said breech block in closed position, a firing pin carried by said breech block adapted to be moved into firing position by said locking pin, an electrical contact fixed to said barrel, an electrical connector for said pin fixed to said breech block adapted to engage said contact in only the closed position of said breech block, a vent for said barrel operable by said locking post, and a shell extractor operable upon the movement of said breech block.

5. A device of the class described comprising an open ended barrel provided with a vent and adapted to hold an explosive cartridge, a breech block for closing one end of said barrel, a locking post about which said breech block is pivoted, a locking pin in contact with said post adapted to engage said breech block in closed position, a vent closure in contact with said post, a firing pin operable by said locking pin carried by said breech block, a fixed electrical contact exterior to said breech block, an electrical connector fixed to said breech block and movable therewith to engage said contact in only the closed position of said breech block, means to rotate said locking post to lock said breech block to said barrel in closed position and move said vent closure to closed position upon initial rotation, and upon further rotation move said firing pin into operative relation with a cartridge in said barrel.

6. In a device of the class described, a barrel provided with a vent and adapted to hold a combustible charge, a breech block adapted to close one end of said barrel, a locking post associated with said barrel and adapted for locking said breech block to said barrel, and a valve operable by said post to close said vent upon the initial movement of said locking post.

7. In a device for igniting a combustible charge, a barrel provided with a vent, a movable locking post associated with said barrel, a breech block adapted to close one end of said barrel, a locking pin operable by said post for locking said breech block in closed position, a valve operable by the initial movement of said post to close said vent, said post upon further movement operative to move said pin to a position to lock said breech to said barrel.

8. In a device of the class described, a barrel provided with a vent and adapted to hold an explosive cartridge, a breech block for closing one end of said barrel, a firing pin in said breech block, means operable upon initial movement thereof to lock said breech block to said barrel in closed position, and upon further movement thereof move said firing pin into operative relation with a cartridge in said barrel, the said means operable to lock said breech block simultaneously permitting automatic spring actuated closing of the vent in said barrel.

9. In a closed system for igniting a combustible charge, a barrel adapted to hold a combustible charge, a breech block adapted to close one end of said barrel, a firing pin for said combustible charge, means operable to lock said breech block to said barrel in closed position, and means for preventing the unlocking of the breech block prior to the releasing of the pressure within the system.

10. In a closed system for igniting a combustible charge, a barrel adapted to hold a combustible charge, a breech block adapted to close one end of said barrel, means operable to lock said breech block to said barrel in closed position, an electric firing pin carried by said breech block and adapted to contact said combustible charge for igniting the same when the breech block is locked, and means for releasing the pressure within the system after firing of the cartridge within the system and prior to the unlocking of the breech block.

11. In a closed system in which fluid pressure is generated for use in performing a work operation, a barrel adapted to hold an explosive cartridge, a breech block adapted to close one end of said barrel, a firing pin in said breech block, a single means operable upon initial movement thereof to lock said breech block to said barrel in closed position, and upon further movement thereof move said firing pin into operative relation with a cartridge in said barrel, means for firing said cartridge, and auxiliary means for releasing the pressure within the system after firing of the cartridge and prior to the unlocking of the breech block.

12. In a closed system in which fluid pressure is generated for use in performing a work operation and including a cartridge receiving barrel chamber, a breech block adapted to close one end of said barrel chamber, means for locking said breech block in operative relation with the barrel chamber, means for firing a cartridge within said barrel chamber, and means controlled by the locking means for releasing the pressure within the closed system prior to the unlocking of the breech block.

13. In a closed system in which fluid pressure is generated for use in performing a work operation and including a cartridge receiving barrel chamber, a breech block adapted to close one end of said barrel chamber, means for locking said breech block in operative relation with the barrel chamber, means for firing a cartridge within said barrel chamber, and means for maintaining the breech block in locked relation with the barrel chamber until pressure within the closed system is relieved.

14. In a closed system in which fluid pressure is generated for use in performing a work operation and including a cartridge receiving barrel

chamber, a breech block adapted to close one end of said barrel chamber, means for locking said breech block in closed position, venting means for said closed system, and means requiring the operation of the venting means for the purpose of releasing the pressure within the system prior to the unlocking of the breech block.

15. In a closed system in which fluid pressure is generated for use in performing a work operation and including a cartridge receiving barrel chamber, a breech block adapted to close one end of said barrel chamber, mechanism for locking said breech block in closed position, venting mechanism for said closed system, and a single manually operated means cooperating with both the locking mechanism and the venting mechanism requiring the operation of the venting mechanism for the purpose of relieving pressure within the closed system prior to the unlocking of the breech block.

16. In a closed system in which fluid pressure is generated for use in performing a work operation, an open ended barrel provided with a vent independent of the muzzle of said barrel and adapted to hold an explosive cartridge, a breech block for closing one end of said barrel, means for locking said breech block in closed position, a vent closure, and means operable to open said vent for releasing the pressure within the closed system prior to the unlocking of the breech block.

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