

June 2, 1942.

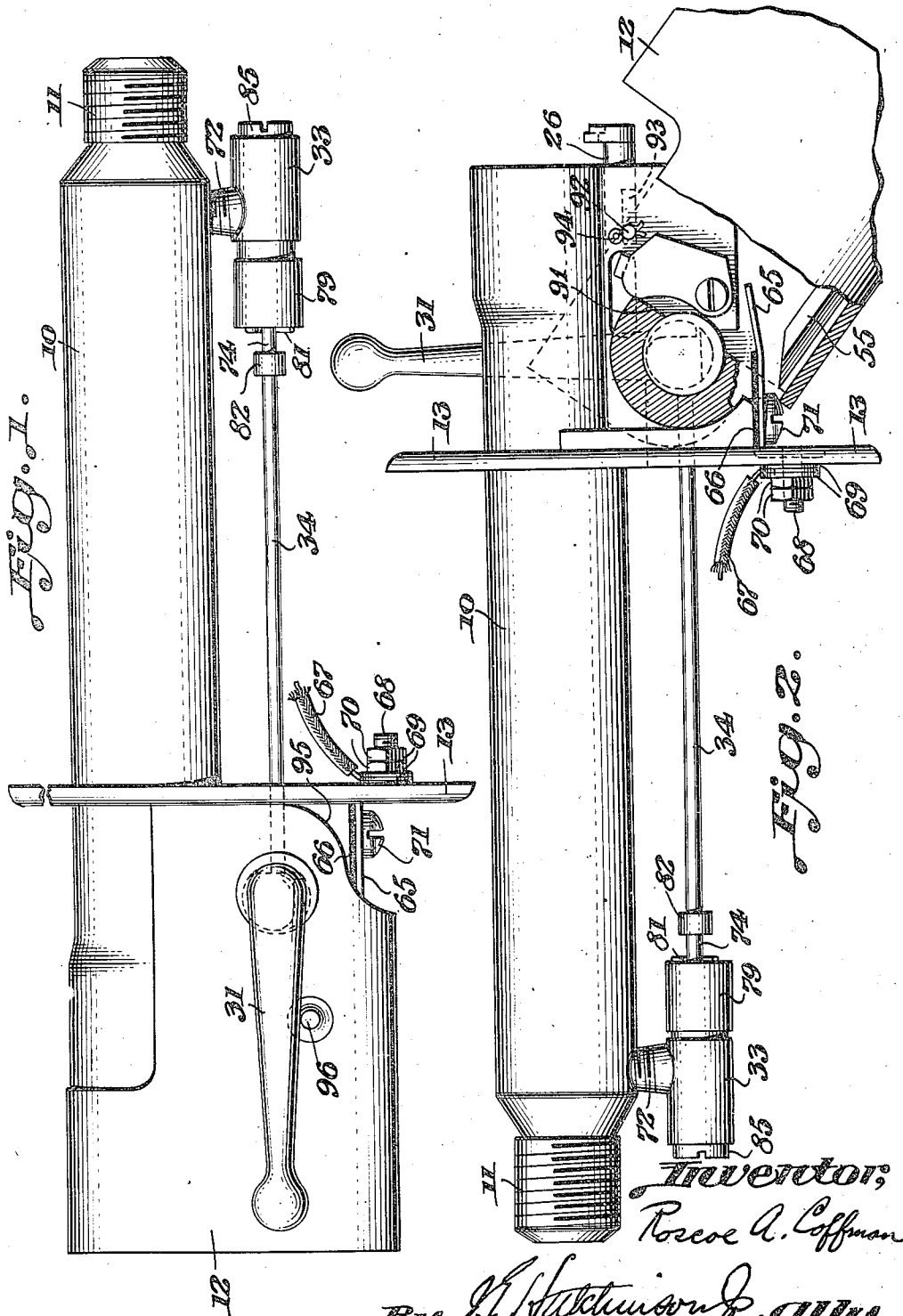
R. A. COFFMAN

2,284,640

BREECH MECHANISM FOR POWER GENERATING UNITS

Filed Nov. 24, 1937

4 Sheets-Sheet 1



June 2, 1942.

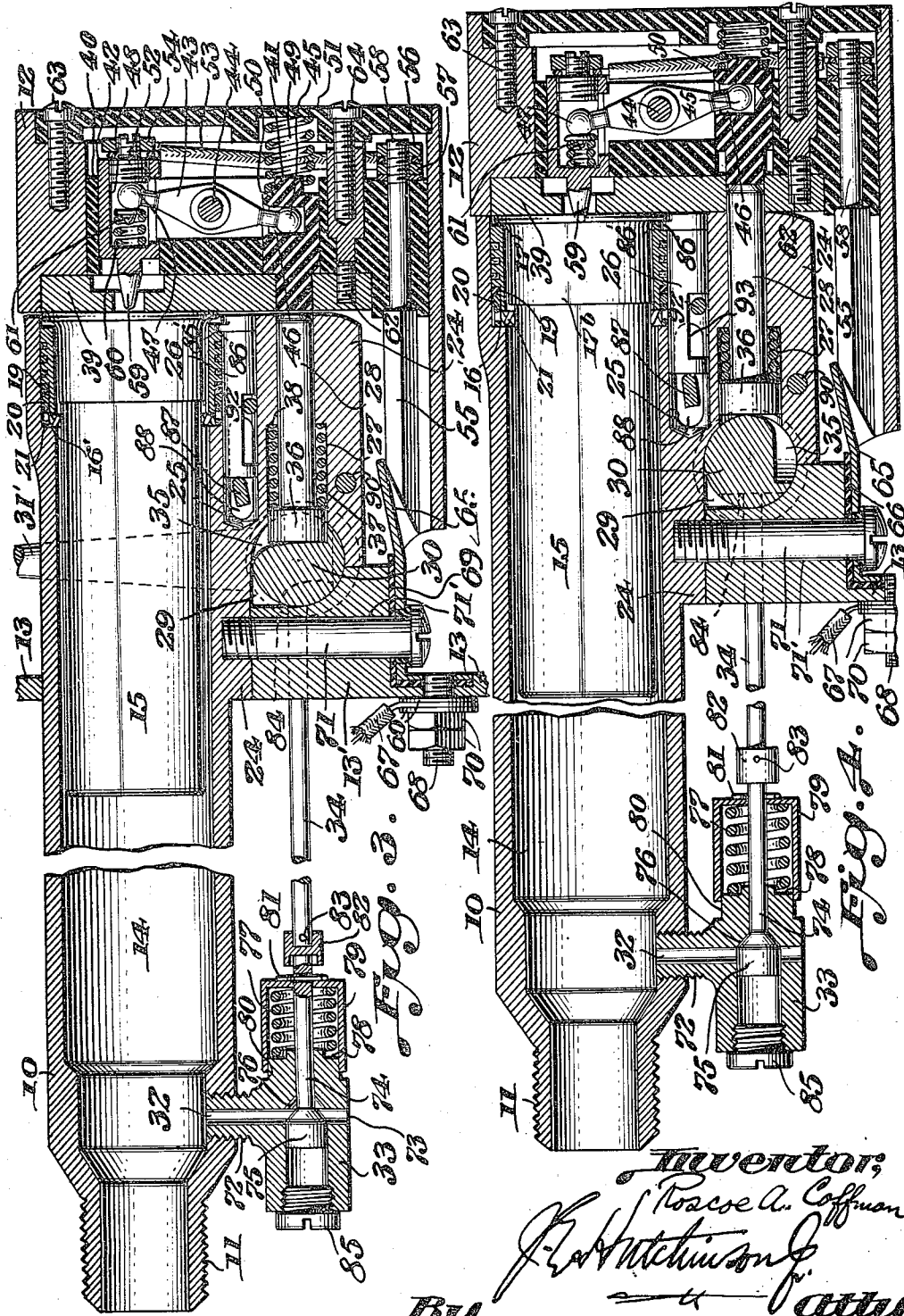
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2,284,640

BREACH MECHANISM FOR POWER GENERATING UNITS

Filed Nov. 24, 1937

4 Sheets-Sheet 2



June 2, 1942.

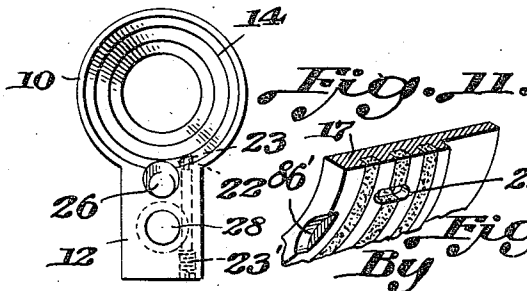
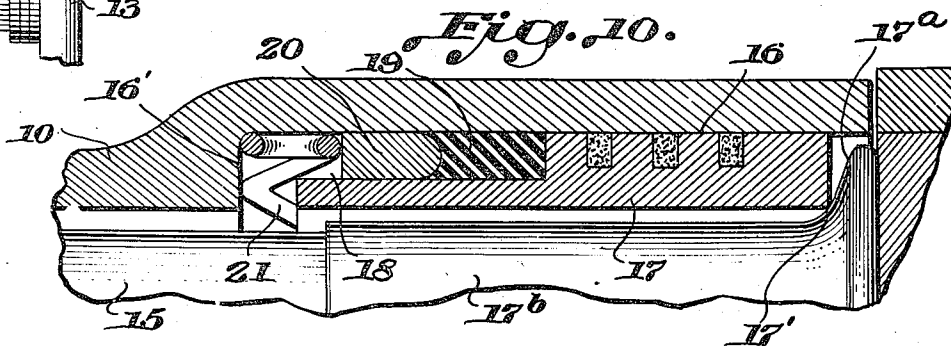
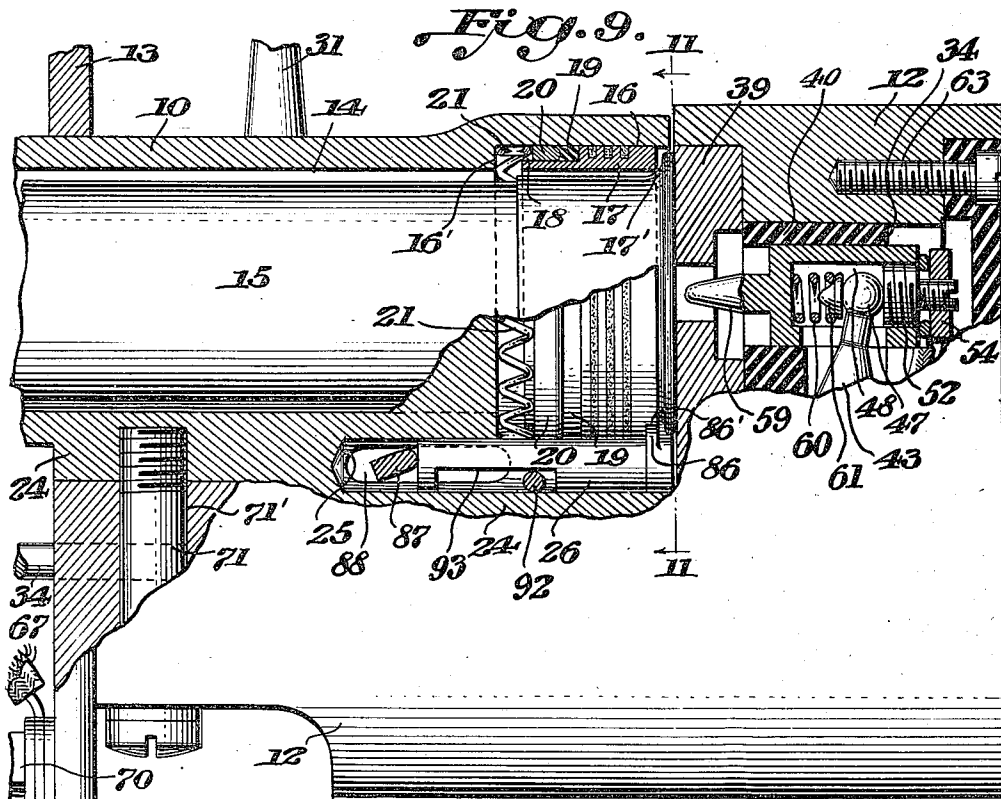
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2,284,640

BREECH MECHANISM FOR POWER GENERATING UNITS

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,284,640

BREECH MECHANISM FOR POWER
GENERATING UNITS

Roscoe A. Coffman, Hollywood, Calif.

Application November 24, 1937, Serial No. 176,371

13 Claims. (Cl. 89—1)

This invention relates to what is known in practice as a "single shot breech" mechanism for discharging combustible or burnable charges used in the art of fluid pressure starting systems of the general type disclosed in my U. S. Patent No. 2,005,913, issued June 25, 1935. More particularly the invention relates to certain important and essential improvements incident to the type of "single shot breech" mechanism or device disclosed in my co-pending application Serial No. 751, filed January 7, 1935.

It is the main object of this invention to provide a breech mechanism or device of the character set forth which is so constructed and arranged that the pressure or barrel chamber of said breech is maintained in leak-proof condition during the firing of the cartridge and the building up or generation of a predetermined amount of pressure gases within said chamber and the starting system for performing a useful power operation.

In this connection, and with this main object in view, it is desired to call attention to the fact that in former practice, it has been necessary to provide a cartridge shell of such dimensions as to tightly fit within the barrel chamber, and this for the purpose of avoiding as effectively as possible, and under the conditions existing prior to the present invention, the leakage of pressure gases past the cartridge shell and through the rear end of the breech barrel during the firing of the cartridge and the building up of such pressure gases within the system. However, due to this tight-fitting relation between the cartridge shell and the interior surface of the barrel bore, serious difficulty has been experienced in ejecting the cartridge shell from the barrel after the cartridge has been fired. Furthermore, it has been found that the paper or other fibre part of the tubular shells made to this dimension for the purpose specified, is subject to swelling, due to climatic conditions—moisture—and in view of this inherent fact or condition, further serious difficulty has been brought about in placing or loading a cartridge within the barrel, and in some instances, found impossible to so load said cartridge, the cartridge shell having swelled to such an extent as to be too large under any conditions to be received within the breech barrel. In this connection also, it may be noted that even though a swelled cartridge is finally forced within the barrel, then, after firing of the same, considerable difficulty is also experienced in ejecting said cartridge shell from the breech barrel, and in certain instances the cartridge shells are held

so tightly within the barrel that the metal ferrel of said shells has been disconnected from the paper or fibre part of the shells and the paper part left within the barrel when endeavoring to eject the cartridge shell under considerable force applied to the ferrel through the ejecting means.

With the present invention all necessity for a properly dimensioned and tight-fitting cartridge shell is obviated and not required, and furthermore, the cartridge shell is made of such dimensions as to loosely and easily fit within the breech barrel under all of the conditions above referred to, means having been provided to rely upon the pressure gases surrounding the shell as positioned within the barrel, to bring about a sealing of the cartridge receiving end of said barrel for preventing leakage of gas pressure at this end of the barrel.

It is well to note at this point that the problems involved in the firing of a power generating unit or cartridge of the type here disclosed are entirely different and wholly unrelated to the firing of the ordinary shot-gun cartridge, in that a shot-gun cartridge builds up considerable pressure within the cartridge shell and thereby serves to increase the diameter of the shell for properly sealing the cartridge against the interior surface of the barrel bore, whereas in applicant's type of system no material pressure is generated within the cartridge shell, but on the other hand the fuel is immediately discharged from the cartridge and the gas pressure generated by the burning of said fuel within the expansion chamber of the barrel and the system leading therefrom, so that there is a tendency for some of the gases to pass between the exterior surface of the cartridge shell and the interior of the barrel bore, and hence the necessity for providing means to take care of said leakage tendency and which will adequately seal the rear or base end of said cartridge to the barrel structure.

Therefore, it is one of the principal objects of this invention to provide a sealing sleeve or member which is so arranged within the pressure chamber of the breech barrel and so related to the loosely fitting cartridge received within said barrel, that the gases generated within the barrel chamber, after the cartridge is fired, serve to move and maintain said sleeve in sealing contact with the cartridge shell to prevent leakage of gases from the cartridge receiving end of the breech barrel.

Another object of the invention is to provide a device consisting of a barrel for holding a cartridge or power generating unit and with a breech

block for closing the cartridge receiving end of said barrel, and whereby said breech block may be moved into sealing or tight fitting relation with the end of said barrel by what may be broadly ascribed a wedging action.

Another object of the invention is to provide a device of this character which will be certain in its operation, reliable in use, and effective in delivering predetermined pressure gases with full force and effect to the part to be moved in a system of the character in question.

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

In these drawings like reference numerals indicate like parts throughout, and:

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

Figure 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.

Figure 3 is a vertical section of Fig. 1 showing the breech block closed preparatory to being locked and moved longitudinally into tight-fitting closed position and with the associated vent open;

Figure 4 is a vertical sectional view similar to Fig. 3 but differing therefrom in that the locking lever has been moved to closed position and the breech block is therefore shown in tight-fitting relation with the cartridge receiving end of the barrel and locked to the barrel, the associated vent being closed and the other elements shown in the position they assume during the firing of the cartridge;

Figure 5 is a horizontal sectional view taken on line 5-5 of Fig. 3 and shows some parts in elevation;

Figure 6 is a vertical sectional view taken on line 6-6 of Fig. 3;

Figure 7 is a vertical sectional view taken on line 7-7 of Fig. 3 and showing some parts in elevation;

Figure 8 is a vertical sectional view taken on line 8-8 of Fig. 3;

Figure 9 is an enlarged view, partly in section, of the rear end of the breech barrel and the breech block, showing particularly the sealing sleeve construction and its relation to the cooperating parts, and further showing the breech block in closed but unlocked position and before said breech block is moved to tight fitting relation with the rear end of the barrel;

Figure 10 is a fragmentary sectional view of the sealing sleeve on an enlarged scale showing the relation of this sleeve with the cartridge, the dimension of the cartridge with respect to the internal diameter of the sleeve and barrel being somewhat exaggerated to show the loose fit of the cartridge within the barrel;

Figure 11 is a view in elevation of the rear end of the breech barrel with the breech block and cartridge removed, and showing particularly the pin and slot connection between the sealing sleeve and the barrel structure; and

Figure 12 is a perspective view of a portion of the sealing sleeve in which the relation of the longitudinal slot and the ejector recess are shown.

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 and system disclosed in my Patent No. 2,005,913 referred to above, wherein I have shown a starting motor which is operated by propulsive gases produced by an electrically discharged cartridge, as shown in my U. S. application, Serial No. 581,032.

At the outset, it may be stated that there are many detailed features of this "single shot breech" mechanism as shown and described herein, which form the basis of and are covered by applicant's co-pending application Serial No. 751 to which reference has been made above, the present application being principally directed to the features of the eccentric wedging action of the breech block and the sealing sleeve or member for sealing the rear end of the breech barrel.

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 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 combustible or burnable charge. At the rear end of the barrel bore 14 is provided an elongated annular recess 16 within which is fitted a sealing sleeve 17 in leak-proof relation with said barrel, said sleeve having a series of annular recesses upon its outer surface which are filled with graphite or other suitable material effective for the purposes intended. The internal bore of the sleeve 17 may be of the same diameter as the main internal diameter of the barrel bore 14, or in other words, the thickness of the sleeve is approximately the depth of the elongated recess 16 above referred to, and in this connection, this barrel and sleeve arrangement constitutes the new type of cartridge receiving chamber to be more fully described hereinafter and covered by this application. The sleeve 17 has a reduced diameter at its forward end forming an annular recess 18 for receiving suitable packing means between the barrel and said sleeve, leather or rubber packing being indicated at 19 and an annular packing gland shown at 20. Spring means as at 21 is provided for urging the sleeve structure and its packing means in a rearward direction, said spring means being shown interposed between the end wall 16' of the annular recess 16 and the gland 20. It is also to be noted that the sleeve 17 is provided with a longitudinal slot 22 within which a stop pin or retaining member 23 is adapted to fit, and this for the purpose of not only retaining the sleeve within the barrel bore recess 16 and preventing it from being accidentally displaced, but also for preventing rotative movement of said sleeve and limiting its longitudinal movement within said recess, said stop pin or retaining member passing through a transverse bore within the barrel structure and having screw-threaded engagement therewith, as indicated at 23'. Further than the above, it is desired to point out that the forward end of the sleeve 17 is at all times spaced a suitable

distance from the end wall 16' of the recess 16, and this for the purpose of permitting pressure gases generated within the barrel chamber to exert pressure upon the forward end of the sleeve structure to urge said sleeve in a rearward direction and with its rearward internal circumferential edge 17' in sealing or tight-fitting relation with the base rim 17^a of the cartridge ferrel 17^b contained within the barrel chamber.

Assuming now that a shell has been fired, the gases generated by the combustible charge will be delivered through the barrel and the remainder of the system for use in performing a work operation (such for instance, as the starting of an internal combustion engine), and at the same time the pressure of such gases is exerted upon the forward end of the sealing sleeve and its gland to urge said sleeve in a rearward direction with respect to the barrel, and this for the purpose of effectively maintaining the rear end or said rearward internal circumferential edge of the sleeve in sealing contact relation with the base rim of the cartridge just fired, so that all leakage of any pressure gases through the rear or cartridge receiving end of the barrel is prevented as will be obvious. This is one of the important and essential features of the present invention.

On the under side of the barrel 10 and formed integrally therewith, is a lug 24 in which is formed a bore 25 for accommodating a shell extractor 26. A second bore 27 is formed directly under bore 25 and accommodates a breech locking pin 28. The front end of lug 24 is formed with a circular recess 29 which is adapted to accommodate a locking post 30 with which is formed, extending at right angles thereto, an operating lever 31 by means of which the locking post 30 may be rotated.

Pivoted on and moving angularly about locking post 30 is the breech block 12.

At the fore end of barrel 10 is a vent 32, closed by means of a valve mechanism 33. The valve mechanism 33 is operated through an operating rod 34, which lies in contact with locking post 30.

The locking post 30 is provided with a cam recess 35 against which the head 36 of the locking pin 28 is pressed by means of a coil spring 37, which spring is held under tension between the head 36 of the locking pin 28 and a shoulder 38 in bore 27. When the operating lever 31 is in its raised or vertical position, the cam surface 35 of the locking post 30 faces rearwardly, and the coil spring 37 therefore urges locking pin 28 into the cam recess. In this position the locking pin 28 is located entirely within the lug 24 and the breech block 12 may therefore be raised and lowered at will.

At this point, it is to be noted that the locking post 30 is also provided with two eccentric cam or wedging members 30^a and 30^b, one arranged on each side of the cam recess 35 and journaled in the forward side members 12^a of the breech block structure, thus constituting the pivotal connection for the breech block heretofore referred to. These eccentric cam members are so arranged with respect to the pivotal journals of the breech block, that when the breech block is in its raised position and closing the cartridge receiving end of the barrel and prior to locking the breech, movement of the operating lever 31 in a downward direction to rotate the locking post 30 for locking the breech block, will also rotate the eccentric cams 30^a and 30^b to move the breech block longitudinally toward the rear

end of the barrel and into sealing or tight-fitting relation therewith as will be readily understood, and this when considering that the locking post is journaled in the stationary barrel structure and the eccentric members serve to create a camming or wedging action upon the movable breech block to move the closing face of said breech block a sufficient distance in a forward direction and into firm contact with the barrel end and the cartridge contained within said barrel, and this to bring about the sealing or tight-fitting relation between these parts. This is also another important and essential feature of the present invention.

The breech block 12 which moves angularly about the locking post 30 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 39 which is attached to the breech block 12 in a suitable manner as by screws (not shown) is a block of insulating material 40 in which is guided for horizontal reciprocatory motion an operating plug 41 made of insulating material and a firing pin 42. The operating plug 41 and the firing pin 42 are connected by means of a fulcrum lever 43 which is movable around a pivot pin 44, supported in the sides of the insulating block 40, and located centrally of the length of the fulcrum lever 43. One end 45 of the fulcrum lever 43 operates in a recess 46 in the operating plug 41, while the other end 47 operates in a recess 48 in the firing pin 42.

The operating plug 41 is urged forwardly as shown in Fig. 3 by means of a coil spring 49, which is retained at its one end by a shoulder 50 on the operating plug 41, and at its other end in a suitable recess in the back plate 51. When in this position, the fulcrum lever 43 is turned about its pivot 44 and the firing pin 42 is drawn rearwardly as shown in Fig. 3 by virtue of contact between the end 47 of the fulcrum lever 43 with a bolt 52 at the rear end of the firing pin. Forming an electrical contact with the firing pin 42 is a conductor 53, one end of which is securely clamped to the bolt 52 by means of a nut 54. The other end of the conductor 53 is in electrical contact with a contact 55 in the bottom of the insulating block through clamping nuts 56 and 57 on the screw threaded end 58 of the contact 55 which extends through the insulating block 40.

The firing pin 42 is provided with a recess as shown at 48, and is provided with a contact point 59 adapted to make electrical contact with the shell 15. Within the recess 48 of the firing pin 42 is a coil spring 60, 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 61, against which the end 47 of the fulcrum lever 43 rests.

The insulating block 40 is securely held within the breech block 12 and against the face plate 39 by means of screws 62 (Fig. 6). The open rear end of the breech block 12 is closed by means of a closure plate 51 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 63 and preferably by at least one additional screw 64 which cooperates with a stud head of the screw 62.

Electrical contact 55 which is carried by the insulating block 40 and which is adapted to move with the breech block 12 contacts, in its closed

position, with a fixed contact 65 carried by the plate 13 and insulated therefrom by an insulating strip 66. This contact is connected with a source of electric current by means of a connector 67 attached to the contact 65 by means of a terminal 68 passing through the plate 13. For this purpose, insulating washers 69 are provided and between which the conductor 67 is clamped by means of nuts 70 screwed to the end of the terminal 68.

It may now be noted that the plate 13 is firmly attached to the lug 24 of the barrel 10 by means of a screw threaded bolt 71, which is insulated from the fixed contact 65 by means of an insulating washer 66', said bolt passing through a vertical bore 71' formed in a lug 13' integral with the plate 13 and extending between the side members 12^a of the breech block. This lug 13' is so formed on its rearward surface as to conform to the circular shape of the locking post 30, and in this connection closes the circular recess 22 thus providing the complete bearing for the locking post.

The vent 32 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 33 is screw threaded as at 72 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 73 through which gases may pass when the bore 73 is uncovered. In order to close the exhaust bore 73 the valve mechanism is provided with a valve stem 74 on the end of which is formed a head 75, a portion of which is conically shaped to fit snugly into a seat 76. The valve stem 74 is urged rearwardly by means of a coil spring 77 and consequently the head 75 is urged into the seat 76 to close the exhaust port 73. This spring rests against a shoulder 78 on the exterior of the valve body and is enclosed by a sleeve 79 which slides upon a suitably formed face 80 of the valve body and against which the rear end of the coil spring 77 rests. The sleeve 79 may be restrained in its rearward movement by means of a cotter pin 81 or by other suitable means. The valve stem 74 rests loosely in a sleeve 82 which is carried by the operating rod 34 and which may be attached thereto by means of a pin 83 passing therethrough. The sleeve 82 may, however, rest loosely between the valve stem 74 and the operating rod 34 to maintain the two in alignment, but to provide at the same time means for quickly disconnecting the two. The operating rod 34 passes through the plate 13 and lies in contact with the locking post 30 which post is provided with a slot 84. This slot assumes a vertical position when the locking lever 31 is in closed or horizontal position, thus permitting the end of the operating rod 34, urged by the coil spring 77, to enter the slot or recess 84 and permit the valve head 75 to close the exhaust port 73. The valve mechanism 33 may be provided with a screw threaded closure plug 85 for the purpose of cleaning, lubricating, or inspecting the interior of the valve.

The shell extractor 26 is formed with a lip 86 against which the base rim of the shell 15 may rest, and which is adapted to engage behind the shell rim to extract the same when the extractor 26 is moved rearwardly by means of the finger 87 operating against the forward end of the extractor 26 and through a transverse slot 88 in the lug 24. The lip 86 of the shell extractor 26

when in normal position with the breech block closed, lies in a recess 86' formed at the rear end of the sleeve 17 in the outer circumferential surface of said sleeve and at the lower part thereof, said recess being so shaped to receive said lip 86. The finger 87 is a horizontal extension of a plate 89, which is pivoted to the lug 24 by means of a screw 90. This plate is thrown forward into engagement with the extractor 26 through engagement with a snail 91 formed on the interior of the breech block 12. The extractor 26 is held within its bore by means of a transverse member 92 which lies in a slot 93 formed in the extractor 26, and which is held in position preferably by means of a cotter pin 94.

It will be noted that the breech block 12 is formed on an arc 95 at its lower corner which contacts the plate 13, thus permitting free movement about the locking post 30. The breech block is also provided with a stop pin 96 for the purpose of limiting the downward movement of operating the lever 31.

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 31 is thrown to its vertical position and the locking post 30 is rotated through a part of a revolution, causing during the initial rotation of the locking post an immediate movement of the rod 34 in a forward direction to operate the exhaust valve for relieving the pressure within the barrel and this before the locking bolt has been fully thrown to unlock the breech block. In this rotative movement of the locking post the end of the rod 34 is moved forwardly by the flat bottom surface of the recess 84 with which it engages and is caused to finally ride upon the cylindrical surface of the locking post, thus moving the valve stem 74 forward against the tension of the spring 77, moving the valve head 75 away from its seat 76 and opening the exhaust port 73 while the breech block itself is still in closed position and furthermore, during the initial movement of said parts, with the exhaust valve open and the breech block still locked. This operation permits gases within the barrel 10 to vent to the atmosphere and release any back pressures within the barrel prior to the final unlocking of the breech block so that when the breech block 12 is unlocked and lowered, the shell 15 within the barrel 10 will not be forcibly ejected. At the same time, the head 36 of the locking pin will have entered the cam recess 35 of the locking post 30 under pressure of the spring 37 and the locking pin 28 will be completely withdrawn from the face plate 39 and will now lie entirely within the lug 24. The withdrawal of the locking pin 28 will permit the operating plug 41 to move forward under the action of the coil spring 49, thus turning the fulcrum lever 43 about its pivot 44 and thereby withdrawing the firing pin 42 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 55 and 65. At the same time the snail 91 will contact the plate 89 and move it around its pivot 90, thus moving the horizontal extension or finger 87 against the front of the extractor 26 and moving the same rearwardly. Since the lip 86 of the extractor 26 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 26 of the extractor 26, thus moving the extractor 26 forward when the breech block 12 is raised sufficiently to bring the snail 91 out of contact with the plate 39. It will be noted that at this time the contacts 55 and 65 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 55 and 65 to the contact point 59 of the firing pin 42, but the firing pin 42 is held withdrawn into the insulating block 40 by force of the coil spring 49, and can therefore not contact the cartridge 15 until further operation of the operating lever 31. In this position of the breech block as shown in Fig. 3, the face plate 39 of the breech block has engaged the base end of the cartridge shell forcing the inserted shell in a forward direction against the rear end of the sealing sleeve 17 and compressing the spring 21 sufficiently to exert pressure upon said sealing sleeve in a forward direction, thus holding the rear internal circumferential edge 17' of said sleeve under spring tension against the rim 17^a of the cartridge shell ferrel 17^b, as clearly shown in the drawings.

When the operating lever 31 is now brought down into its horizontal position, the locking post 30 will again be rotated to permit the end of the valve operating rod 34 to ride in its slot 34 of the locking post 30, thus permitting the valve stem 74 to move rearwardly under tension of the coil spring 77 and permit the valve head 75 to seat in its valve seat 76 and close the exhaust port 73. At the same time, or preferably slightly thereafter, the cam recess 35 of the locking post 30 will have been moved away from the head 36 of the locking pin 28, and the head 36 of the locking pin 28 will then be in engagement with a higher cylindrical portion of the locking post 30. Under this action the locking pin 28 will be moved rearwardly against the tension of the coil spring 37, and will move into the recess in the face plate 39. As the locking post 30 is rotated to operate the locking pin for locking the breech block, the eccentric members 30^a and 30^b are also rotated to move the breech block in a forward longitudinal direction and by a wedging or camming action against the rear end of the breech barrel and necessarily in tight-fitting relation therewith, as heretofore pointed out. It may be specifically noted that rearward movement of the locking pin 28 will carry with it the fulcrum operating button or plug 41 by virtue of contact between these two members, and further, that the locking pin 28 will have moved into the face plate 39 to securely lock the breech block 12 to the barrel 10 before the firing pin 42 has moved forward any appreciable distance. What has been said above assures a firm lock and tight fitting relation between the breech block 12 and the barrel 10 prior to contact between the firing point 59 and the shell 15.

As the locking pin 28 continues to move rearwardly, the operating button or plug 41 will be moved with it, against compression of the coil spring 49, thus moving the fulcrum lever 43 around its pivot 44 and end 47 of fulcrum lever 43 forward against compression of the coil spring 60. The firing pin 42 will now move forward bringing the firing point 59 into contact with the

shell 15, and when this contact is made the shell 15 will be in proper relation to be discharged, the electrical circuit having been completed through the conductor 67, contacts 65 and 55, conductor 53, and the firing pin 42. It will be noted that the movement of the firing pin 42 is greater than the movement necessary for contacting an electrical contact in the shell 15. When the firing point 59 is in contact with the shell 15, the spring 60 serves as a lost motion or take up device which compensates for the balance of the movement of the fulcrum lever 43. If an ordinary shot-gun shell with a percussion cap or primer were to be placed in the barrel 10, the firing point 59 upon contact with the percussion cap of the shell would stop moving forward and the spring 60 would absorb the balance of movement of the fulcrum 43 to prevent the firing point 59 from sinking into the percussion cap, thus making it impossible to fire the percussion cap shell in the barrel.

Further than the above, it will be noted that upon the locking of the breech block in a structure such as herein set forth, the cartridge shell contained within the barrel chamber is then firmly held in sealing relation with the internal bore of the barrel and under spring tension, and this during the operation of effecting electrical connection within the breech prior to completing the electrical circuit for firing the cartridge. Also upon the firing of the cartridge within the barrel or system, sealing of the cartridge within the barrel becomes at once more effective and certain in that with the building up of increasing pressure within the system necessary for performing the desired work operation, a progressively increasing pressure is applied to the sealing sleeve for holding the rear internal circumferential edge of said sealing sleeve in firm and tight-fitting relation with the rim of the cartridge ferrel. In other words, the sealing sleeve is in leak-proof relation with the internal bore of the barrel at the cartridge receiving end of said barrel, said sleeve surrounding the cartridge shell, and with its rearward internal circumferential edge coacting with the cartridge (preferably with the ferrel rim of said cartridge) is therefore maintained in this relation under spring tension and also by reason of the pressure of gases generated within the system, and this being so notwithstanding the recoil of the breech block due to application of pressure within the shell and barrel chamber upon the firing of the charge.

It is also quite apparent when considering that part of the invention relating to the eccentric wedging member for clamping the face of the breech block in tight-fitting contact against the rear or cartridge receiving end of the breech barrel, that due to this eccentric arrangement and the fact that the breech block is bodily moved in a rearward direction during the unlocking operation of the breech block, all strain on the locking mechanism is relieved and the locking bolt permitted to move to unlocked position or allowed to function as intended when desiring to open the breech block for the loading of another charge. In this connection, it is desired to state that when firing a charge within the breech barrel the breech block is subjected to recoil and the gases within the barrel chamber are exerting pressure against the interior face of said breech block tending to move said breech block in a rearward direction around its pivotal connection with the barrel structure, all of which

tends to create a binding of the parts of the locking mechanism (including the spring operated locking bolt and its locking recess) one against the other, which at times may prevent the throwing of the spring locking bolt at the proper time to unlocked position, even though the operating handle for locking and unlocking the breech block has been moved to unlocked position, and this due to this binding relation of the said parts. The initial rearward movement of the breech block as herein described therefore properly positions the breech block upon its pivotal connection and thereby relieves all strain on the various locking mechanism parts so as to permit them to function as intended and at all times.

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 "combustible 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.

What I claim and desire to secure by Letters Patent is:

1. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge containing a combustible charge, a sealing sleeve positioned within said barrel and surrounding the base end of said cartridge where it contacts therewith, a breech block adapted to close one end of said barrel and bear against the base of the cartridge contained within the barrel, and means for firing said cartridge within the barrel to produce pressure gases operative within the closed system for performing a useful work operation, the pressure contained within said barrel and system serving to move said sleeve rearwardly in sealing relation with the cartridge to prevent leakage of the generated gases around the cartridge through the closed end of said barrel.

2. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge containing a combustible charge for performing a work operation, a sealing sleeve positioned within an annular recess formed within the barrel at the cartridge receiving end of said barrel and having leak-proof contact therewith, said sleeve surrounding the cartridge when the cartridge is in firing position and also engaging with its rearward end the base of said cartridge to form a sealing contact therewith, means for urging said sleeve into said sealing relationship with the cartridge, and means for firing the cartridge when the barrel is closed, some of the pressure gases generated by the firing of said cartridge entering the barrel recess and acting upon the sleeve to maintain said sleeve in its sealing position with respect to the cartridge to prevent loss of pressure through the rear end of said barrel.

3. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, means for sealing the shell to the barrel and pressure operated means within the barrel and surrounding the cartridge shell for maintaining said first mentioned means in sealing engagement with the cartridge shell during firing of the cartridge and until the work operation has been performed.

4. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, means in leak-proof relation with said barrel and surrounding the cartridge shell within said barrel, spring means for urging said first-named means in sealing relation with the base rim of the cartridge ferrel, and means for firing the cartridge when the parts are in this relation, some of the gases generated by the combustible charge serving to effectively maintain said parts under such sustained pressure in said sealing relation to thereby prevent leakage of the predetermined pressure gases for use in the system and until after the work operation has been performed.

5. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system adapted to hold a cartridge shell containing a combustible charge for use in a power generating starting system and including a closed expansion chamber extending from said barrel, and means for effectively sealing the cartridge receiving end of said barrel and maintaining the same in such sealing relation by the force of the pressure gases generated within the barrel and said expansion chamber and throughout the period of time the pressure gases are performing work in the starting system.

6. A device for igniting a combustible charge comprising a barrel adapted to hold a cartridge containing a combustible charge, a sealing sleeve positioned within an annular recess formed within the barrel bore at the cartridge receiving end of said barrel, said sleeve surrounding the cartridge when received within said barrel, packing means interposed between the forward reduced end of said sleeve and the elongated wall of said recess for maintaining the sleeve in leak-proof relation with the barrel, spring means interposed between an end wall of the recess and the packing means for exerting pressure against the packing means and also urging the sleeve rearwardly in contact with the ferrel rim of said cartridge when in firing position, a breech block for closing said barrel, said breech block when closed forcing the cartridge in a forward direction to its firing position within the barrel and against the rear end of said sleeve for placing the spring means under tension and establishing a sealing contact between the sleeve and said cartridge, and means for firing the cartridge when the breech block is in closed position, the pressure gases generated within the barrel by the firing of the cartridge contacting the forward end of said sleeve structure to maintain the sealing relation between the rear end of said sleeve and the cartridge and effectively prevent leakage of pressure gases through the cartridge receiving end of said barrel.

7. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a car-

tridge shell containing a combustible charge for performing a work operation, a breech block for closing the cartridge receiving end of said barrel, and means for maintaining a sealing relation between the barrel and said shell notwithstanding the recoil of the breech block due to application of pressure within the shell and barrel chamber and until after the work operation has been performed.

8. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, and means for sealing the shell to the barrel, said means increasing the effectiveness of the sealing operation with increase of working pressure within the barrel and until after the work operation has been performed.

9. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, and automatic means for utilizing a portion of the power generated by the charge within the barrel for effectively sealing the cartridge shell to the barrel and until after the work operation has been performed.

10. A device for igniting a projectile free combustible charge comprising a barrel forming a part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, a breech block for closing the cartridge receiving end of said barrel, means for locking said breech block, means for preventing the unlocking of the breech block un-

til the gases have been released from the system, and means for sealing the shell to the barrel during the locking of the breech block and until the release of gases from said system.

11. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, and resilient mechanical means for sealing the shell to the barrel prior to firing the cartridge.

12. A device for igniting a projectile free combustible charge comprising a barrel forming part of a closed system and adapted to hold a cartridge shell containing a combustible charge for performing a work operation, a breech block for closing the barrel; and means for sealing the shell to the barrel notwithstanding rearward movement of the shell within the barrel and against the breech block.

13. In a closed system in which fluid pressure is generated from solid fuel for use while in said closed system for performing a work operation and including a cartridge receiving barrel chamber, an expansion chamber beyond said barrel chamber, means for firing a solid fuel containing cartridge within said barrel and system, and means coacting against the ferrel rim of the cartridge for sealing said cartridge to the barrel with progressively increasing pressure in accordance with the building up of pressure within the barrel chamber and system, said pressure being maintained after the cartridge shell and the cartridge barrel chamber have been emptied of solid fuel and until the pressure gases in said system have performed the work operation.

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