July 16, 1940. R. A. COFFMAN 2,208,496

ROTARY BREECH MECHANISM FOR POWER GENERATING PROPULSIVE CHARGES

Filed April 16, 1935 4 Sheets-Sheet 1

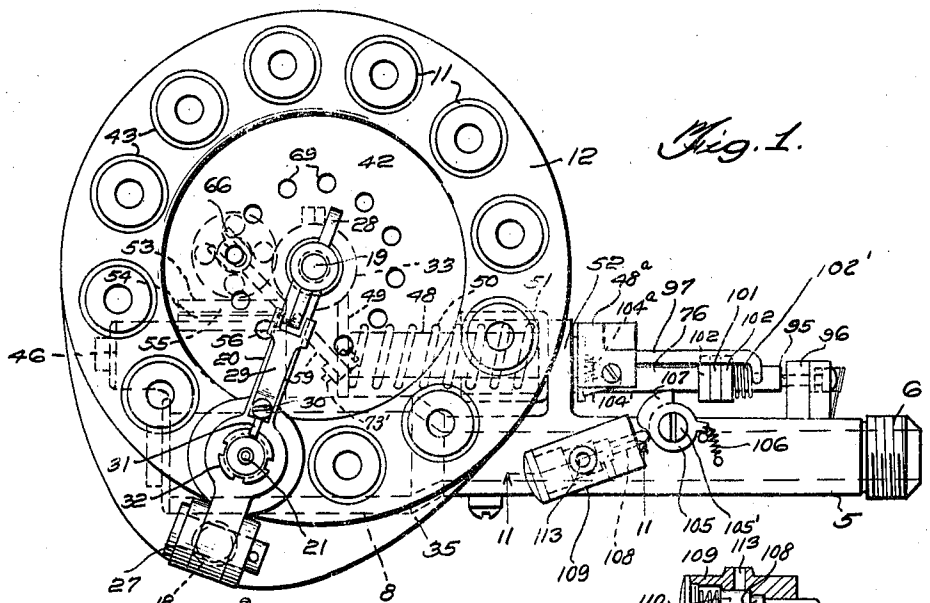


Fig. 1.

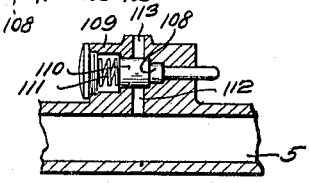


Fig. 11.



Fig. 2.

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ROTARY BREECH MECHANISM FOR POWER GENERATING PROPULSIVE CHARGES

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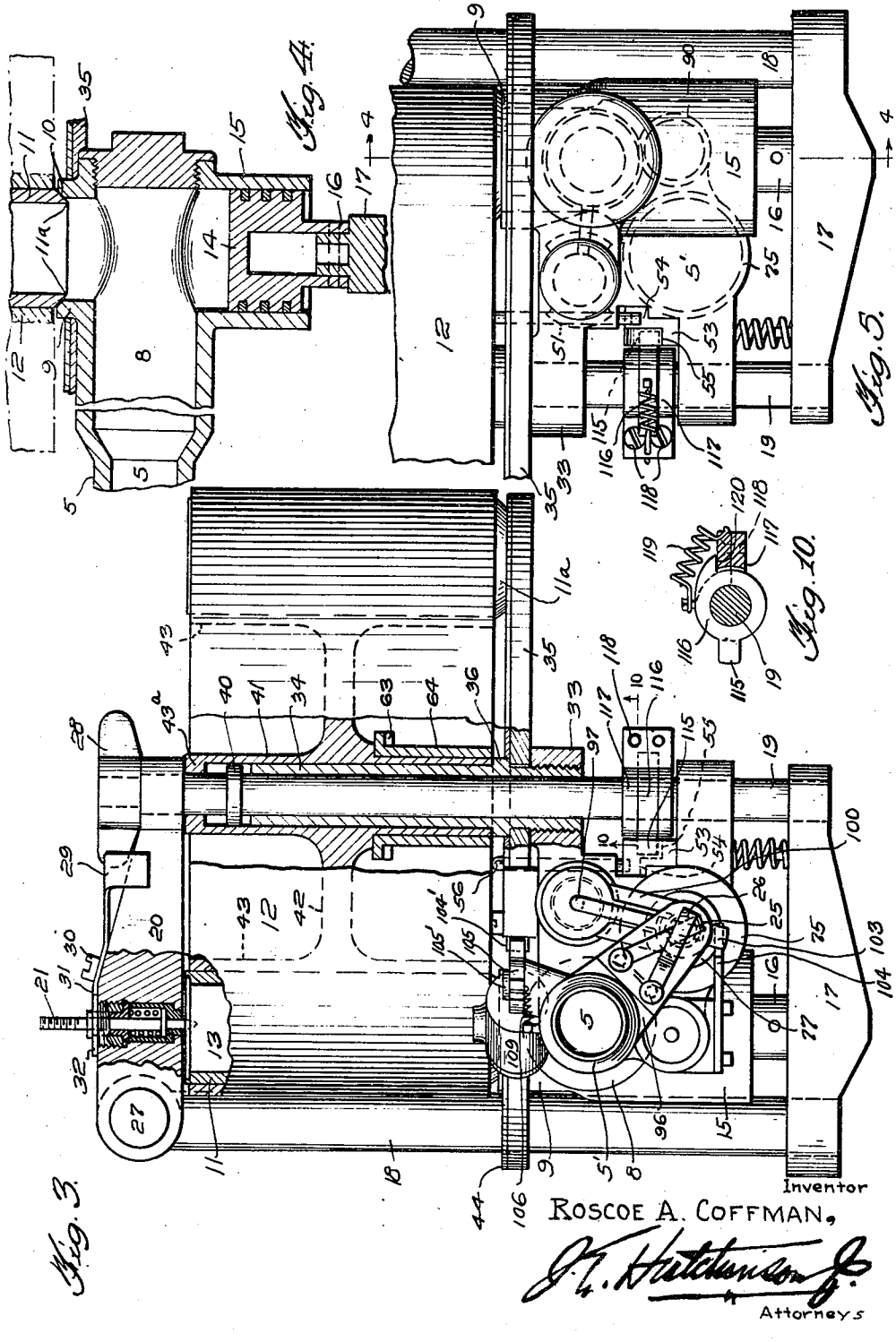


Fig. 4.

Fig. 5.

Fig. 10.

Fig. 3.

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ROTARY BREECH MECHANISM FOR POWER GENERATING PROPULSIVE CHARGES

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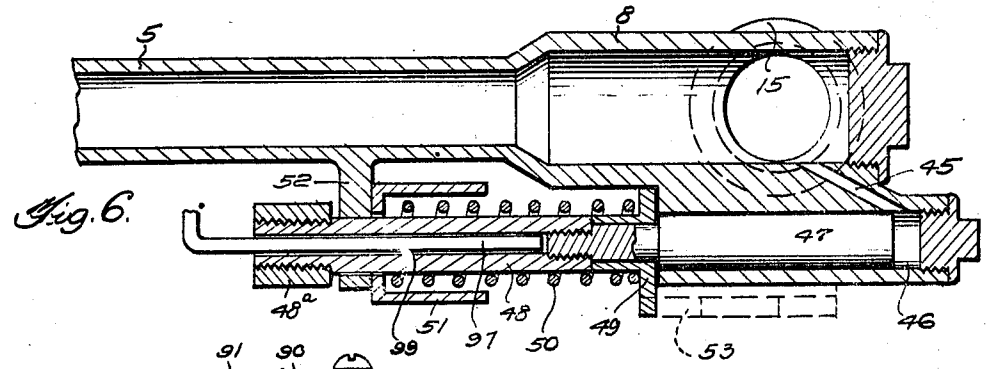



Fig. 6.

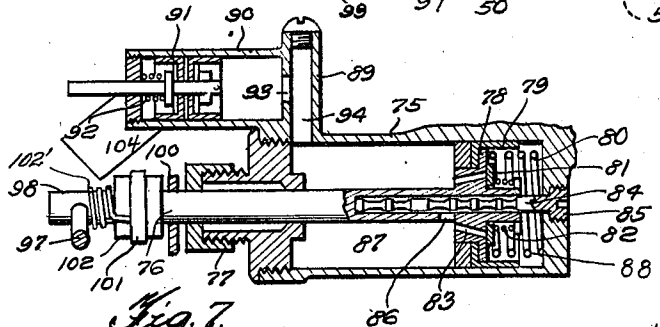



Fig. 7.

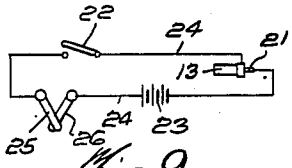



Fig. 9.




Fig. 8.

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ROTARY BREECH MECHANISM FOR POWER GENERATING PROPULSIVE CHARGES

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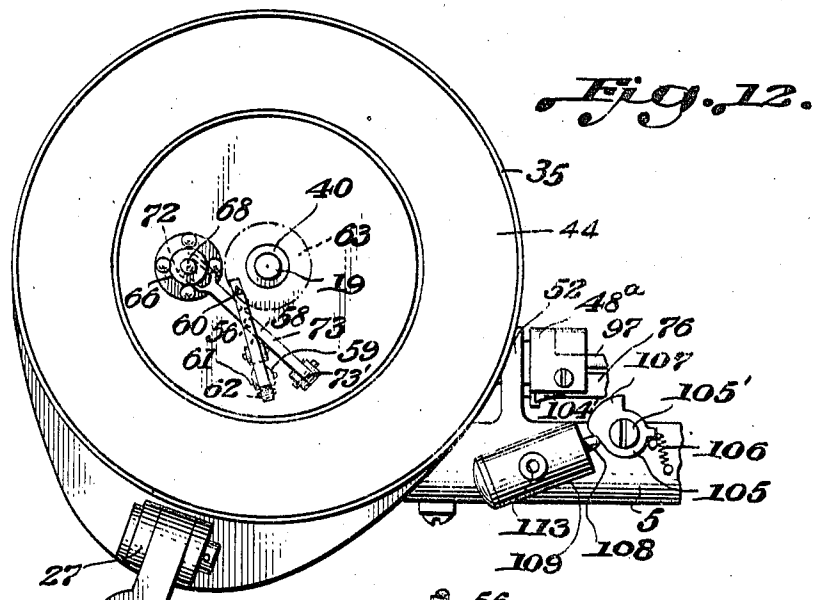



Fig. 12.

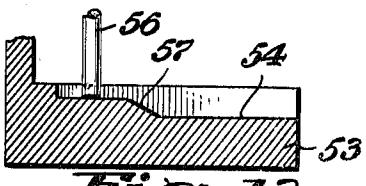



Fig. 13.

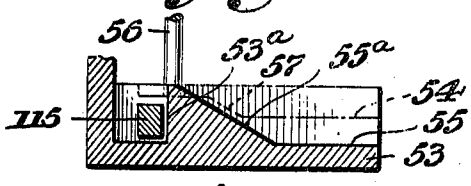



Fig. 14.

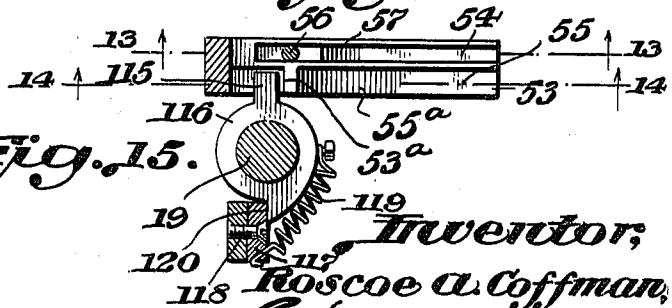



Fig. 15.

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Patented July 16, 1940

2,208,496

# UNITED STATES PATENT OFFICE

2,208,496

## ROTARY BREECH MECHANISM FOR POWER GENERATING PROPULSIVE CHARGES

Roscoe Alexander Coffman, Pittsburgh, Pa.

Application April 16, 1935, Serial No. 16,726
In Great Britain January 18, 1935

20 Claims. (Cl. 60—44)

This invention relates to a method of and means for generating and delivering propulsive charges, and it has for its object to provide highly efficient means for generating a plurality of propulsive charges in controllable and ordered succession; for effecting the thorough scavenging of the apparatus after the delivery of one charge and prior to the generation of another charge, and for rendering it possible to utilize in a highly facile manner the unit charge shells constituting the subject matter of my copending application, Serial No. 581,032, filed December 14, 1931, and particularly when used in connection with a starter device of the type shown in my United States Patent No. 1,776,228.

Further detailed objects and advantages of the invention will be set forth in the following specification.

In the accompanying drawings.

Figure 1 is a plan view of an apparatus constructed in accordance with the invention.

Figure 2 is a side elevation thereof.

Figure 3 is a view partly in front end elevation and partly in vertical section.

Figure 4 is a detailed sectional view upon line 4—4 of Fig. 5.

Figure 5 is a fragmentary rear elevation.

Figure 6 is a fragmentary longitudinal sectional view through the main barrel, upon line 6—6 of Fig. 8.

Figure 7 is a sectional view through a dashpot hereinafter described.

Figure 8 is a view partly in side elevation and partly in section looking from the opposite side than that illustrated in Fig. 2 and with certain of the parts omitted.

Figure 9 is a diagrammatic view of the electrical connections hereinafter described.

Figure 10 is a section on line 10—10 of Fig. 3.

Figure 11 is a detailed sectional view through the scavenging cylinder through the line 11—11 of Fig. 1.

Figure 12 is a plan view of the apparatus with the magazine removed and the breech block thrown to an inoperative position.

Figure 13 is a detailed sectional view of the cam slide taken on the line 13—13 of Figure 15.

Figure 14 is a detailed sectional view of the cam slide taken on the line 14—14 of Figure 15; and

Figure 15 is a top plan view, partly in section, of the cam slide and its cooperating parts.

Like numerals designate corresponding parts in all the figures of the drawings.

The purpose of the present invention is to provide a mechanism comprising a barrel, a magazine adapted to contain shells of the character of that shown in my copending application aforesaid, means for automatically operating the magazine to bring the shells successively into firing relation to the barrel, means for insuring against the closing of the firing circuit until the shell has been properly positioned with respect to the barrel, means for insuring the thorough scavenging of the barrel prior to the bringing of another cartridge into operative relation of the same, and means for controlling the speed of operation of the various parts to bring about a variable rate of speed where desired, all of the foregoing operations being carried out under the influence of power derived from the charge itself.

The shells used are described as containing a combustible fuel in contradistinction to a quick flash high power detonating explosive. The fuel used is described as consisting of a combination nitrocellulose and nitroglycerine grains which may be of varying sizes or degrees of aeration to bring about desired variations in the rate of burning so that where desired some of the charge may be bodily blown over to another point to be there consumed. Unit charge shells of this character have a wide range of applicability and usefulness in that they constitute what is in effect packages of stored up power which may be used to operate other mechanisms without the shock and jar which would be inherent in the use of truly explosive charges.

In providing a mechanism adapted to develop and deliver the power from unit charge cartridges of this character, I may utilize a structure such as that shown in the accompanying drawings and comprising a barrel 5 that is threaded at its forward end 6 for connection to a delivery tube (not shown) by which the generated gases or a part of the fuel itself, may be conducted to a mechanism to be operated, such as, for example, the engine starter referred to above.

At the rear end of the barrel there is preferably provided as indicated at 8, a combustion chamber. The barrel is provided at one side with a neck extension 9 having a seat 10 adapted to receive the tapered end of the shell receiving liners 11 of a shell carrying magazine 12, one of the shells being indicated at 13. When a shell is discharged its burnable contents pass into combustion chamber 8 and are there burned and continuing to burn within the closed system until completely consumed, the generated gases passing out of the barrel 5 to perform whatever work

is required of them. Some of these gases act upon a piston 14 that is mounted in a cylinder 15 which extends downwardly from combustion chamber 8. This piston is in turn connected, at 16, to a head 17.

In the accompanying drawings, the barrel 5 is illustrated as extending horizontally, and the magazine is illustrated as being mounted to rotate in a horizontal plane parallel to and above the barrel. However, since one of the most important uses of the apparatus is in conjunction with airplane engine starters, it follows that the entire mechanism must be operable in any and all attitudes of the airplane.

The head 17 is connected at its outer end to two rods 18 and 19, see Figure 3 and Fig. 5, and these rods are in turn connected at their other ends to a breech block 20, Fig. 3, which carries an electrical firing pin 21. In my application Serial No. 581,032 I have described the shell as being capable of being electrically fired, and in Fig. 9 of the present application I have diagrammatically illustrated an electric circuit comprising a manually operable control switch 22, battery 23, conductors 24, and contact blades 25 and 26 which operate automatically in a manner hereinafter described.

It will be noted that the circuit includes the metallic ferrule of the shell 13 and the firing pin 21, and when a circuit is completed by the contact of 25 with 26, and by the closing of switch 22, the shell is fired either by the creation of a jump spark within the shell or by the heating of a bridge wire in the manner shown in my aforesaid application and well known in the electric detonator art.

The breech block 20 of Fig. 3 is pivotally connected, at 27, to the rod 18 and is held in place upon rod 19 by a winged thumb nut 28. Normally, this thumb nut is prevented from turning by a detent 29 which straddles its wings, but when it is desired to remove the magazine from its operative position and reload, the detent 29 can be depressed enough to free the wings of the nut 28 and permit the same to be turned so that the breech block can be thrown back and the magazine removed as a whole from the rod 19. The detent 29 is preferably continued beyond its securing screw 30 to form a tongue 31 adapted to engage in the notches of and lock a nut 32 by which the firing pin is locked in operative position.

The barrel 5 and the combustion chamber 8 are preferably cast integrally in a block generally outlined at 5' of Fig. 5 which block carries a transversely screw threaded lug 33, Fig. 3, and by referring to that figure, it will be seen that a sleeve 34 is threaded into the lug 33 and binds a plate 35 between said lug and a shoulder 36 of said sleeve. The rod 19 passes through the sleeve and carries a collar 40 which lies within the hub 41 of the magazine. The magazine consists of the hub 41, its radial rib 42, the group of cylinders (in this case twelve, 43) and the liners 11 for said cylinders. These liners are provided with the forward beveled ends 11a adapted to engage the seat 10 of the neck extension 9 of the cylinder.

Referring to Fig. 8, it will be seen that the plate 35 is channelled, at 35a, for the reception of an annular band or layer 44 of asbestos or other fire proof material against which the inner or open ends of the liners 11 normally bear and over which said liners travel; this asbestos band guarding against the possibility of spark or flame entering the open mouths of the liners and reaching the mouths of the adjacent shells 13.

When a shell is fired, some of the pressure from chamber 8 by-passes through a port 45, Fig. 6, to an auxiliary cylinder 46 and acts upon a piston 47 in said cylinder to thrust said piston and a tubular rod 48 connected thereto forwardly, said piston carrying with it a plate 49 which, in such forward movement of the piston compresses a spring 50 into a cup-like element 51 that is carried by a lateral extension 52 of the barrel 5. The plate 49 carries a slide 53 shown in phantom in Fig. 6 and which, as may be seen from an inspection of Figures 3, 5, 8, 13, 14 and 15 is provided with two cam surfaces 54 and 55. The cam surface 54 acts, upon the return movement of rod 48 under the influence of spring 50, to thrust a locking pin 56 upwardly when the lower end of said locking pin rides up the incline 57.

In the normal position of the parts, i. e., the position in which they are shown in Fig. 8 and which is the position in which they lie when the parts are at rest, the pin 56 is elevated and at this time the short end 58 of a bell crank lever 59 has been thrust upwardly to throw the pawl 60 toward the right, said pawl being pivoted to the bell crank lever 59, at 61, and being actuated by a spring 62 to cause its nose to engage the teeth 63 of a sleeve 64 carried by the hub 41 of the magazine, the function of the pawl and bell crank lever being to impart the necessary step by step turning movement of the magazine.

However, when the slide 53 moves forwardly and the pin rides onto the lower level of the cam 54, the bell crank lever is moved toward the left to cause the nose of its pawl to engage the next operating tooth. This action takes place under the co-acting influence of a spring 65 that is housed in a casing 66 and which bears between the top of said casing and a collar 67 on a lock rod 68. The upper end of this lock rod is adapted at the proper time to disengage and re-engage in the corresponding one of the opening 69 of the web 42 of the magazine. This rod is also provided with a finger piece 70 upon its lower end by which it may be manually operated when it is desired to free the magazine and permit its rotation by hand, if desired for any reason. The thrust of the spring 65 is in opposition to the thrust of a spring 71 which bears between the collar 67 and the forked end 72 of an arm 73 pivoted at 73'. The arm 73 lies in the path of movement of the bell crank lever 59.

Thus, when slide 53 moves toward the left and pin 56 descends, the arm 73 is lowered, tension is released upon spring 71, and spring 65 acts to thrust the lock rod 68 out of its opening 69 and this same action causes the bell crank lever 59 to move toward the left to take hold of the succeeding one of the teeth 63. Then, when the slide 53 moves toward the right under the influence of spring 50, initial upward movement of the pin 56, through the bell crank lever, turns the magazine enough to move the opening 69 out of engagement with the lock rod; this action taking place before the tension imposed upon spring 71 by the movement of arm 73 is sufficient to overcome the action of spring 65. However, continued upward movement of the pin 56 and arm 73 result in placing such tension upon spring 71 as to overcome spring 65 and the lock rod is moved into contact with the face of the web 42 so that when the next opening 69 comes

into alignment with said rod (and at which time one of the shells will be properly aligned with cylinder extension 9) said lock rod will snap into said opening and lock the magazine against turning movement.

A dashpot 75 is disposed in parallel relationship with the barrel 5 and may be formed as a part of the barrel casting. The construction of this dashpot is illustrated in Fig. 7 from which it will be seen that a piston rod 76 passes through a stuffing box 77 and carries a piston 78 upon its inner end. This piston, provided with a suitable packing ring 79 which may be of leather, is moved from its normal position by the action of spring 80 of Fig. 7.

A valve plate 81 that is normally closed by the action of a spring 82 controls ports 83 formed through the said piston. A transversely grooved control pin 84 is carried by the cylinder head 75 and the piston rod 76 is made of tubular formation for the reception of this pin. It will be observed that this pin has a threaded head 85 that is screwed into the cylinder 75 so that this pin may be removed and another substituted therefor, of a different configuration. A port 86 is formed through the wall of the piston rod 78 and establishes communication between the interior of the cylinder, at 87, and the interior of the cylinder, at 88, the flow being through the port 86 and along the pin 84 which is made to fit so loosely in the bore of the piston rod that flow of the cylinder content, which may be oil, glycerine, or other suitable lubricant, may take place past said pin. The purposes and advantage of this arrangement will be presently described.

A lateral extension 89 of the cylinder carries a compensating cylinder 90 in which a piston 91 is disposed. A spring 92 urges this piston inwardly and the interior of the cylinder 90 is in communication with the cylinder 75 through ports 93 and 94. The function of the piston 91 and the spring 92 is to compensate for the variation of cubic capacity in the left hand end of cylinder 75 due to the movement of the piston rod 76 out of said cylinder. As this takes place, the piston 91 moves inwardly enough to force an equivalent quantity of liquid from cylinder 90 into the portion 87 of cylinder 75. At the completion of the firing of one charge, the spring 80 will have moved the piston rod 76 outwardly to its limit of movement and the outer end of said piston rod will have impinged upon and thrust forwardly upon rod 95, Fig. 8, that is movable through a lug 96 of the barrel 5 and the function of which is to press contact strip 25 into engagement with the contact strip 26, these strips corresponding to the like parts illustrated in the diagrammatic Fig. 9, and constituting a part of the electric circuit. When, in the firing of a succeeding charge, rod 48 moves forwardly, it carries with it a block 48a which is mounted upon the forward end of said rod. In order to suitably guide the piston rod 76 of the dashpot, and the rod 48, in their extended positions, and to hold these parts in proper parallelism with each other, I provide a rod or heavy wire 97, a lateral extension of which fixedly engages piston rod 76, at 98, and the longitudinal run of which has sliding engagement, as indicated at 99, in the rod 48. In addition, the block 48a is provided with a lateral web 100 which embraces and slides along rod 76.

When the block 48a moves outward, a flanged surface 49a of said block, which is suitably beveled for the purpose, at 49b, rides past an oscillatory latch plate 101 which is mounted for limited turning movement between collars 102 on the rod 76, and after the flanged surface passes the latch plate, said latch plate is moved by a spring 102' to cause it to engage behind the flanged surface 49a of block 48a, thus coupling the power storing means to said piston rod 76 and for the purpose herein described.

The result is that when the block starts to move rearwardly again under the influence of spring 50, it carries the latch plate 101 and the piston rod 76 with it. Therefore, the return movement of the parts is resisted and cushioned by the action of the dashpot and this return movement can take place only as fast as liquid can be displaced from 88 by flowing past grooved control pin 84 and out of port 86 into the chamber 87, and this movement can in turn be made a variable one by suitably shaping the pin 84, it being readily understood that this pin 84 is removable and may be replaced by a pin differently grooved to suit the conditions desired for controlling the flow of liquid. It may be found to be desirable to have some portions of this movement more rapid than others, and by suitably shaping pin 84 throughout its length and with liquid control passages or grooves of varying size and capacity, any desired variation may be had. Rearward movement of rod 48 and piston rod 76 together, continues, until a tail 103 of the latch plate 101 engages an inclined plate 104 which projects from compensating cylinder 90, see Figures 3 and 8.

This plate is so disposed as to constitute a cam surface over which the tail 103 rides to turn latch plate 101 against the tension of its spring and move it out of engagement from beneath the flanged surface 49a of the block 48a. This takes place near the rearward limit of movement of the parts and when it takes place the piston rod of the dashpot is released from rod 48, and the spring 80 begins to thrust the piston 79 of the dashpot forward as fast as liquid can be displaced from 87 to 88 through ports 83. However, it will be seen that the electric circuit is broken and that no cartridges can be fired until the dashpot piston completes its forward movement and moves contact member 25 into engagement with contact member 26.

Consequently, the possibility of a premature firing of a shell before the parts have been completely returned to aligning and locked position is absolutely eliminated. During the return movement of rod 48 and associated parts, as above described, a latch 104' that is carried by block 48a, Fig. 1, engages a cam disk 105 that is pivoted, at 105' upon the barrel and moves said cam disk against the action of a spring 106 to cause a cam extension 107 of said disk to thrust a piston rod 108 inwardly in a small cylinder 109 that is mounted upon the top of the barrel 5. The latch 104' is spring actuated outwardly, as indicated at 104a. This cylinder is a scavenging one and the piston rod carries a piston 110 which is normally thrust outwardly by spring 111 and which when thrust inwardly against the tension of said spring uncovers a port 112 so that the barrel may be fully scavenged by the escape of any unburned gases through port 112 and a port 113 in the top of said cylinder.

In order to free the shells of engagement by the firing pin 21 and to relieve the pressure of the breech block 20 upon said shells and thereafter also to impart bodily lifting movement to

the magazine away from the plate 35 and its asbestos covering or layer 44, prior to rotation of the magazine, the cam 55 of slide 53 (Fig. 8) is provided. This cam acts upon the tail 115 of a rocking dog 116 that is mounted within a U-shaped block or collar 117, said block in turn embracing and being secured to rod 19 by screws 118, see Figs. 3, 5 and 10.

When the cam 55 is in the position to the right as shown in Figure 8, the tail 115 of the rocking dog 116 which has previously passed from the high point of the surface 55a of said cam 55, then assumes the position shown adjacent the vertical surface 53a of said cam 55, in which position the magazine and the breech block have been lowered or returned to normal position for the firing of another cartridge if and when all other parts of the mechanism are in proper operative relation. As the cam 55 moves to the left of the position shown in Figure 8, as will be hereinafter set forth, the vertical surface 53a of said cam will contact the tail 115 of the rocking dog 116 and move the same out of the path of said cam member 55 and against the tension of the spring 119, hereinafter referred to more in detail, thereby rocking said spring actuated dog 116 and permitting the cam member 55 to continue its movement to the left and finally permitting the tail 115 to assume a position over the flat horizontal surface of the cam 55 ready to be acted upon by the inclined surface 55a of said cam for lifting the tail 115 and the spring dog, and along with it rod 19, the magazine and the breech block as herein set forth, and this as the cam 55 returns to its normal position at the right, as shown in Figure 8.

The rod 19 when lifted by the cam 55 as described, also carries with it the head 17 and the rod 18, as will be readily understood, and this movement of these parts first imparts lifting movement to the firing pin and breech block mechanism away from the magazine, and further due to the engagement of the collar 40 with the shoulder 43a of the magazine, lifting movement is also imparted to said magazine for the purpose intended and as heretofore set forth. It is to be noted that the rocking dog 116 is held in normal position with its nose or projection 120 resting against the block or collar 117 which acts as a stop in one direction for the dog 116, said dog being urged in said direction by means of a spring 119 as clearly shown in Figures 10 and 15 of the drawings.

It will be readily understood from the above description that when the various parts are in normal position as shown in Figure 8, the magazine is in locked relation with the plate 35 (lock rod 68 engaging within one of the openings 69 in the web 42 of the magazine), and the unit charge shell to be fired is in proper alignment with the side outlet of the barrel into which said unit charge is discharged; also that locking pin 56 is in its uppermost position urging the bell crank lever to the right, the position it assumed after its previous operation of moving the magazine one step to bring the unit charge, now to be fired, in the relative position just mentioned.

Furthermore, it is to be understood that at this time the block 48a is disconnected from the piston rod 76 of the dashpot 75 and that said piston rod 76 is being urged to its distended position to the left by the spring 80 in the dashpot cylinder, and this for the purpose of holding contacts 25 and 26 of the ignition circuit in closed position, so that when the manual switch 22 is closed, the ignition circuit will be completed for the purpose of firing the unit charge shell which is now properly positioned as just described.

Upon ignition of this unit charge shell and the discharging of the unit charge into the barrel, pressure is built up for the purposes intended here, and some of this pressure is used for moving a piston 47 to store up power in a spring 50 which afterwards serves to return the piston 47 to its normal position as shown in Figures 6 and 8. This piston 47 while storing up power in the spring 50, also moves the tubular rod 48 and its block 48a to the left where the block 48a makes temporary connection with the dashpot piston rod 76 through the operation of the parts 49a, 49b, 101, and 102', so that when the fluid pressure in the barrel has accomplished its work and is exhausting, the storage spring 50 then comes into action to return the piston 47, rod 48 and block 48a to their normal position, and moving with them at this time and in the same direction to the right, is the dashpot piston rod 76 due to the connection 49a, 49b, 101 and 102' just referred to, all these parts just described being moved to the right under the influence of the dashpot structure described herein, and for the purpose of allowing for the proper amount of time for exhausting the barrel and for the operation of the various mechanisms to be operated prior to the firing of another charge. It is well to note here that immediately upon the initial movement of the dashpot piston rod 76 to the right, the ignition circuit at contacts 25—26 is open, and these contacts are not closed again until the piston rod 76 is released from its connection with block 48a and returned again to the position shown in Figure 8, said release being accomplished by means of the engagement of the tail 103 on the latch 101 with the stationary cam or inclined plate 104, and this at the end of the return movement of parts 48a, 48 and 47.

During the return movement of these parts under the influence of the power storage spring 50, the cams 54 and 55 come into play due to the movement of these cams in the same direction to the right (said cams being carried by a plate 49 moving with the piston 47), whereupon cam 55 operates as herein described to first move the breech block and firing pin away from the magazine and thereafter move the magazine away from the barrel, so as to permit easy rotation of the magazine one step to bring another unit charge shell in proper position to be fired as just described. As to the cam 54, this cam contacts pin 56 and lifts the same into engagement with the bell crank lever 59 for moving the same to the right so that the pawl and ratchet 60—63 may operate to move the magazine one step as just set forth, said bell crank lever and its pawl 60 having previously been moved to the left to engage the pawl with another tooth of the ratchet wheel 63 at the time pin 56 was lowered out of contact with the short arm of the bell crank lever and when the cam 54 had been moved to the left to permit of such lowering.

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

1. A structure of the character described comprising a barrel provided with a seating portion, a rotatably mounted magazine provided with a plurality of liner cylinders each containing a unit charge shell of the pressure generating type, said cylinders being adapted to each successively engage the said seating portion, means

to ignite the said unit charge shell when each cylinder is in such seating relation, pressure operated means utilizing at least a portion of the pressure generated by the unit charge so ignited to effectively seal the said engaged cylinder and the said seating portion in leak proof operative position, a plate over which the said liner cylinders rotate, and an annular web carried by said plate and cooperating with the sealing ends of said liner cylinders whereby the inoperative cylinders are effectively sealed to the atmosphere simultaneously with the sealing of said engaged cylinder in its leak proof operative position.

2. A device of the character described comprising a main barrel, the rear end of which constitutes a combustion chamber, a cylinder arranged in parallelism with said barrel, a direct communicating port between said cylinder and the combustion chamber, a piston in said cylinder operated by the pressure fluid passing through said port, a rod to which the piston is connected, a spring for resisting movement of said rod and piston in which power is stored by the movement of said piston during its fluid pressure stroke, an automatic switch, a dashpot cylinder in parallelism with the first-named cylinder, a piston in the dashpot cylinder, a piston rod for the dashpot piston adapted to close the automatic switch when in its normal projected or released position, latch mechanism between the first-named rod and the piston rod of the dashpot cylinder adapted to lock the two to travel together for opening said automatic switch during initial reverse movement of the first-named piston under the influence of said spring, means for releasing the latch mechanism after such reverse movement has continued for a predetermined period, and means for projecting the piston rod of the dashpot cylinder after such release for moving said automatic switch to its normal closed position.

3. A device of the character described comprising a main barrel constituting a combustion chamber, a magazine adapted to hold a plurality of unit charges adapted to generate fluid pressure when ignited and burned, means for automatically bringing each unit charge successively into operative relation with said combustion chamber, means for discharging a unit charge into said chamber when in operative position, an electrical circuit for igniting said unit charge, a manual control switch in said circuit and a normally closed automatically controlled switch therein, a cylinder arranged in parallelism with said barrel, a direct communicating port between said cylinder and the combustion chamber, a piston in said cylinder operated by the pressure fluid passing through said port, a rod to which the piston is connected, a spring for resisting movement of said rod and piston in which power is stored by the movement of said piston during its fluid pressure stroke, a dashpot cylinder in parallelism with the first-named cylinder, a piston in the dashpot cylinder, a piston rod for the dashpot piston adapted to close the automatic switch when in its normal projected or released position, latch mechanism between the first-named rod and the piston rod of the dashpot cylinder adapted to lock the two to travel together for opening said automatic switch during initial reverse movement of the first-named piston under the influence of said spring, means for releasing the latch mechanism after such reverse movement has continued for a predetermined period, and means for projecting the piston rod of the dashpot cylinder after such release for moving said automatic switch to its normal closed position.

4. A structure as recited in claim 3 in combination with a feeding mechanism for the magazine, and a lock mechanism for the magazine, and means for actuating both of said mechanims under the return movement of the first-named piston and its rod.

5. A structure as recited in claim 3 in combination with a locking mechanism for the magazine, and a feed mechanism for the magazine, a slide movable with said piston actuated rod, cams carried by said slide, and means actuated by said cams for operating the locking and feeding mechanisms of the magazine.

6. A structure as recited in claim 3 in combination with a compensating means for the dashpot for automatically supplying to the dashpot cylinder an amount of liquid equal to that displaced by that portion of the piston rod which has been projected from the dashpot.

7. A structure as recited in claim 3 in combination with a variable flow mechanism for the dashpot piston by which the inward movement of the dashpot piston is rendered variable in speed.

8. A device of the character described comprising a barrel, a cylinder in parallelism therewith, a piston in said cylinder, a port between the barrel and cylinder, a rod actuated by said piston, a spring resisting movement of said rod, a slide carried by said rod, a pair of cams carried by said slide, a rotative magazine containing a plurality of unit charge shells, a firing pin and breech block mechanism positioned above said magazine and adapted to cooperate with each of said unit charge shells in succession for igniting the same, an endwise movable rod axially disposed with respect to the magazine, a ratchet mechanism for imparting turning movement to the magazine about said axially disposed rod, a locking mechanism for the magazine, means for actuating the ratchet mechanism under the influence of one of said cams, means for imparting bodily lifting movement to said rod by the other of said cams, and means for imparting bodily lifting movement to the firing pin and breech block mechanism under the movement of said rod, for moving said firing pin and breech mechanism away from the magazine prior to the turning movement of said magazine.

9. A structure as recited in claim 8 in combination with a breech block connected to said rod, said rod acting to move the breech block away from the magazine and while maintaining said relationship to thereafter move the magazine away from the barrel and prior to the turning movement of said magazine for the purposes intended.

10. A device of the character described comprising a barrel the rear end of which constitutes a combustion chamber, a magazine mounted for rotation about an axis perpendicular to the axis of the barrel, said magazine comprising a plurality of chambers adapted to receive propulsive charge shells, said barrel having a side outlet with which said chambers are brought successively into alignment, a breech block extending across the rear of said magazine, a pair of rods to the end of one of which said breech block is pivotally connected and to the end of the other of which said breech block is releasably connected, a head to which the opposite ends of

said rods are connected, a piston for imparting movement to said head and to the breech block to move the breech block toward the magazine, a cylinder in which said piston is mounted, said cylinder being in communication with the barrel, a second cylinder in parallelism with the barrel and disposed to one side thereof, a power storing means comprising a piston movable in said cylinder and a spring compressed by the movement of said piston, to permit said piston to return to its normal position, a member carried by one of said rods, and cam means actuated by the power storing means for moving said member to move the rod in such manner as to initially move the breech block away from the magazine and thereafter move the magazine away from the barrel to permit easy and effective rotation of said magazine for positioning a shell in proper firing relation with said barrel.

11. A structure as recited in claim 10 in combination with a feed mechanism for the magazine, and a cam mechanism actuated by the power storing means upon its return stroke for actuating said feed mechanism.

12. A structure as recited in claim 10 in combination with a feed mechanism for the magazine and a locking mechanism for the magazine, and cam means actuated by the power storing means upon the return stroke of the latter for actuating the feed mechanism and said locking means.

13. A structure as recited in claim 10 in combination with a retarding means comprising a piston and rod adapted to be coupled to the power storing means to permit proper operation of the several mechanisms, and interengaging guides between the power storing means and said rod of the retarding means to insure proper coupling of said parts for the purposes intended.

14. A structure as recited in claim 10 in combination with a scavenging vent upon the barrel to permit escape of any unburned gases, a controlling means for the same, and means actuated under the return movement of the power storing means and actuating said controlling means.

15. A device of the character described comprising a barrel the rear end of which constitutes a combustion chamber, a magazine mounted for rotation about an axis perpendicular to the axis of the barrel, said magazine comprising a plurality of chambers adapted to receive propulsive charge shells, said barrel having a side outlet with which said chambers are brought successively into alignment, a breech block extending across the rear of said magazine, a pair of rods to the end of one of which said breech block is pivotally connected and to the end of the other of which said breech block is releasably connected, a head to which the opposite ends of said rods are connected, a piston for imparting movement to said head and to the breech block to move the breech block toward the magazine, a cylinder in which said piston is mounted, said cylinder being in communication with the barrel, a second cylinder in parallelism with the barrel and disposed to one side thereof, a power storing means comprising a piston movable in said cylinder and a spring compressed by the movement of said piston, a member carried by one of said rods, cam means actuated by the power storing means for moving said member to move the rod in such manner as to initially move the breech block away from the magazine and thereafter move the magazine away from the barrel, a dashpot cylinder having a piston therein and a piston rod, a firing pin carried by the breech block, an electric circuit in which said firing pin is included, circuit making and breaking means in said electric circuit, means for actuating the piston and piston rod, and means actuated by the piston rod of the dashpot for closing the circuit of said last named circuit making and breaking means.

16. A device of the character described comprising a barrel the rear end of which constitutes a combustion chamber, a magazine mounted for rotation about an axis perpendicular to the axis of the barrel, said magazine comprising a plurality of chambers adapted to receive propulsive charge shells, said barrel having a side outlet with which said chambers are brought successively into alignment, a breech block extending across the rear of said magazine, a pair of rods to the end of one of which said breech block is pivotally connected and to the end of the other of which said breech block is releasably connected, a head to which the opposite ends of said rods are connected, a piston for imparting movement to said head and to the breech block to move the breech block toward the magazine to hold said breech block in proper firing relation to said magazine, a cylinder in which said piston is mounted, said cylinder being in communication with the barrel, a second cylinder in parallelism with the barrel and disposed to one side thereof, a power storing means ecomprising a piston movable in said cylinder and a spring compressed by the movement of said piston to permit said piston to return to its normal position, a member carried by one of said rods, cam means actuated by the power storing means for moving said member to move the rod in such manner as to initially move the breech block away from the magazine and thereafter move the magazine away from the barrel to permit rotation of said magazine, a dashpot comprising a cylinder, a piston therein, a piston rod carried by said piston, a spring tending to thrust said piston rod outwardly, a circuit closing means in the path of movement of said piston rod adapted to be closed at the completion of the outward movement of said piston rod and means for locking the piston rod and the power storing means together in such manner as to open the switch during the initial reverse movement of the piston rod and to cause the dashpot to retard the return movement of the power storing means and thus allow time for proper operation of the various mechanisms.

17. A device of the character described comprising a barrel the rear end of which constitutes a combustion chamber, a magazine mounted for rotation about an axis perpendicular to the axis of the barrel, said magazine comprising a plurality of chambers adapted to receive propulsive charge shells, said barrel having a side outlet with which said chambers are brought successively into alignment, a breech block extending across the rear of said magazine, a pair of rods to the end of one on which said breech block is pivotally connected and to the end of the other of which said breech block is releasably connected, a head to which the opposite ends of said rods are connected, a piston for imparting movement to said head and to the breech block to move the breech block toward the magazine, a cylinder in which said piston is mounted, said cylinder being in communication with the barrel, a second cylinder in parallelism with the barrel and disposed to one side thereof, a power storing means comprising a piston movable in said cylin-

der and a spring compressed by the movement of said piston, a member carried by one of said rods, cam means actuated by the power storing means for moving said member to move the rod in such manner as to initially move the breech block away from the magazine and thereafter move the magazine away from the barrel, a dashpot comprising a cylinder, a piston therein, a piston rod carried by said piston, a spring tending to thrust said piston rod outwardly, a circuit closing means in the path of movement of said piston rod adapted to be closed at the completion of the outward movement of said piston rod, and means for locking the piston rod and the power storing means together in such manner as to open the circuit during the initial reverse movement of the piston rod and to cause the dashpot to retard the return movement of the power storing means, a scavenging element upon the barrel, and means carried by the power storing means for actuating the scavenging element during the return movement of the power storing means.

18. A device of the character described comprising a main barrel constituting a combustion chamber, a magazine adapted to hold a plurality of unit charges adapted to generate fluid pressure when ignited and burned, means for automatically bringing each unit charge successively into operative relation with said combustion chamber, means for discharging a unit charge into said chamber when in operative position, means operated in one direction by pressure from within said combustion chamber for storing up power for the return stroke of said means to normal position, cam means operated during the return stroke of said power storing means for partially rotating the magazine to bring the next unit charge in proper position for firing, and a dashpot mechanism operated to control the return stroke of said power storing means.

19. A device of the character described comprising a main barrel constituting a combustion chamber, a magazine adapted to hold a plurality of unit charges adapted to generate fluid pressure when ignited and burned, means for automatically bringing each unit charge successively into operative relation with said combustion chamber, an electrical circuit for igniting said unit charge when in operative position with respect to the combustion chamber, means operated in one direction by pressure within said combustion chamber for storing up power for the return stroke of said means to normal position, an automatic switch in the electrical circuit and adapted to be thrown to a position to open the circuit at the beginning of the return stroke of said power storing means, cam means operated during the return stroke of said power storing means for partially rotating the magazine to bring the next unit charge in proper position for firing, and a dashpot mechanism operative to control the return stroke of said power storing means and also effective to maintain the automatic switch in open position during the return stroke of the power storing means to thereby prevent premature firing of a unit charge.

20. A device of the character described comprising a main barrel constituting a combustion chamber, a magazine adapted to hold a plurality of unit charges adapted to generate fluid pressure when ignited and burned, a firing pin and breech block mechanism associated with said magazine and adapted to cooperate with each of said unit charges in succession for igniting the same, mechanism for intermittently rotating said magazine step by step to automatically position each unit charge successively into operative relation with said combustion chamber, means for discharging a unit charge into said chamber when in operative position, and a power operated cam slide, cooperating with parts of the magazine structure to move the breech block mechanism away from the magazine and while maintaining said relationship to thereafter move the magazine away from the barrel and prior to the turning movement of said magazine for the purposes intended.

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