W. E. BOCK.

STARTER FOR EXPLOSIVE ENGINES.

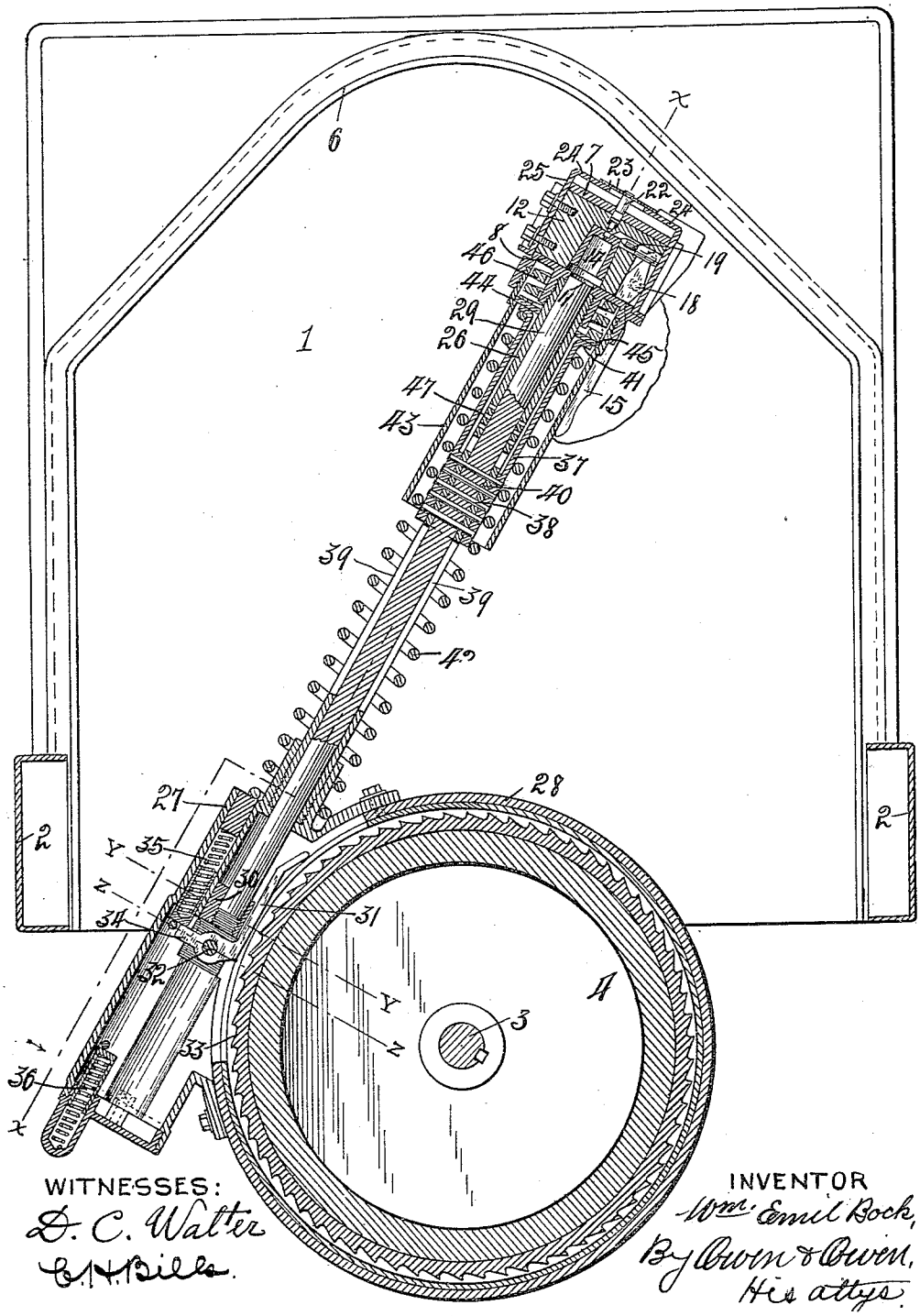
APPLICATION FILED OCT. 30, 1911.

1,043,393.

Patented Nov. 5, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



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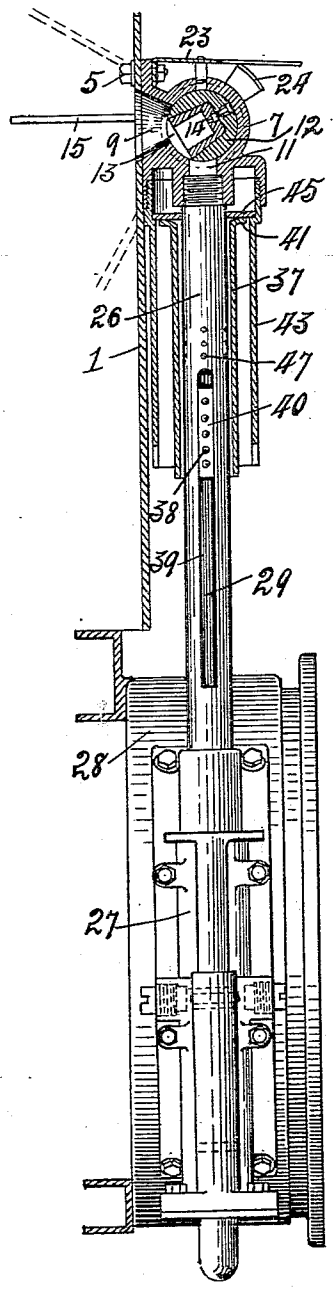
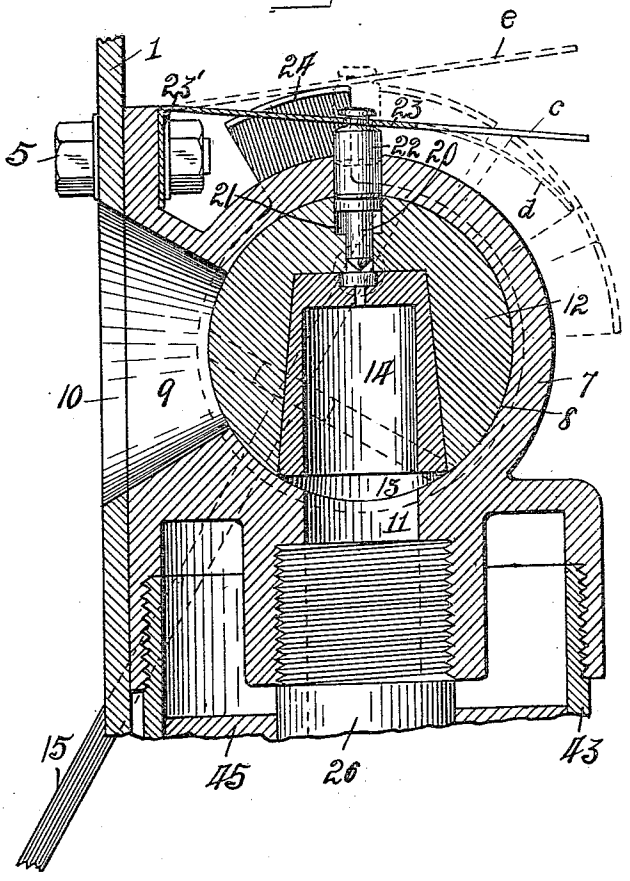


Fig. 2.

Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

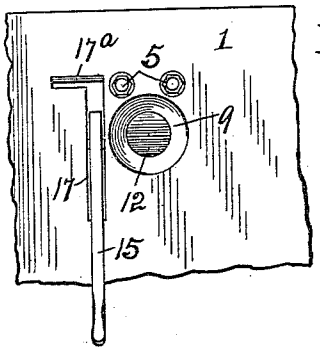


Fig. 5.

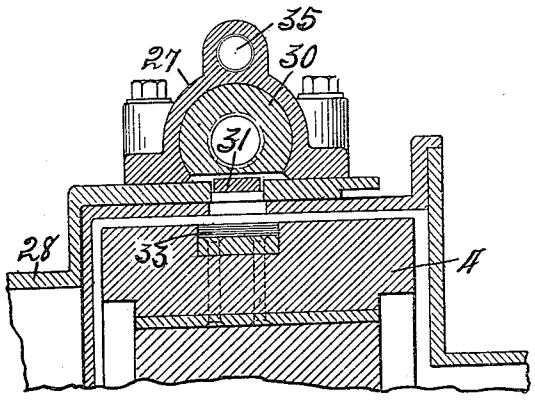


Fig. 6.

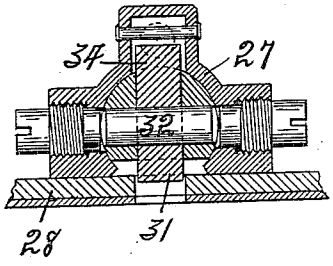


Fig. 7.

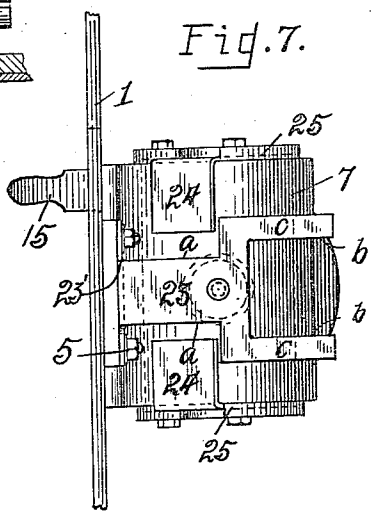
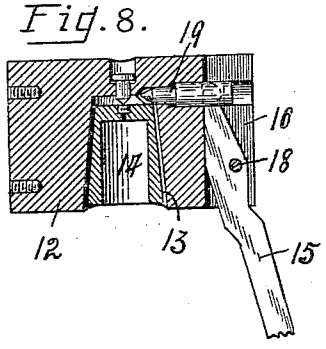


Fig. 8.



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UNITED STATES PATENT OFFICE.

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STARTER FOR EXPLOSIVE-ENGINES.

1,043,393. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed October 30, 1911. Serial No. 657,480.

To all whom it may concern:

Be it known that I, WILLIAM EMIL BOCK, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Starter for Explosive-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to starting means for internal combustion engines, and is particularly intended for use in automobiles, power-boats, or the like, but is not restricted to such use as it may be used in any connection for which it may be adapted or appropriate.

The object of my invention is the provision of a starting means of this character, which is simple and efficient in its construction, easy and inexpensive to operate, and adapted to utilize fluid pressure in coöperation with suitable mechanism to impart the initial or starting movements to an associated engine shaft.

The invention is fully described in the following specification, and while, in its broader aspect, it is capable of embodiment in numerous forms, a preferred embodiment thereof is illustrated in the accompanying drawings, in which,—

Figure 1 is a central longitudinal section of the starter mechanism attached to the dash of an automobile and in connection with the fly-wheel of the engine thereof, with a portion of the dash broken away. Fig. 2 is a central longitudinal section thereof on the line x, x in Fig. 1, with the cartridge carrying part partly turned to cartridge receiving and ejecting position. Fig. 3 is a similar enlarged section of the charge receiving end of the apparatus, with different positions of the firing means shown in dotted lines. Fig. 4 is a rear view of a portion of the dash and associated cartridge receiving and operating parts of the apparatus. Figs. 5 and 6 are enlarged cross-sections respectively on the lines Y, Y and Z, Z in Fig. 1. Fig. 7 is an upper end view of the apparatus, and Fig. 8 is a central section through the cartridge carrying part, with the ejecting parts moved to shell ejecting position.

Referring to the drawings, 1 designates the dash of an automobile, 2, 2 the side-beams of its frame, 3 the engine shaft of the associated propelling motor, and 4 the fly-wheel thereof.

Secured in any suitable manner, as by bolts 5, to the forward side of the dash 1 within the hood-ledge 6 thereon is the head casting or portion 7 of my apparatus, which is provided therethrough in parallelism with the dash with a cylindrical bore or chamber 8 and with a preferably outwardly flaring opening 9, which opens communication between a registering opening 10 in the dash and the bore 8. The head 7 is also provided, in the present instance, at its lower side and in the plane of the opening 9, with an opening or bore 11, which extends radially from the bore 8 and forms a portion of the barrel or combustion chamber of the apparatus, as hereinafter described.

Mounted within the bore 8 of the head 7 is what may be termed a rotary breech-block 12, which is of cylindrical form in cross-section and has a transverse radially-disposed cartridge carrying socket 13 therein, the outer or open end of which is adapted to be placed into register with either of the head openings 9 and 11 by a turning of the block.

14 designates a cartridge shell, which is adapted to fit into the socket 13, and to be inserted therein or ejected therefrom through the opening 9—10. The shell and socket are preferably both tapered or slightly enlarged from the inner to the outer ends thereof, as shown, to facilitate an ejection of one from the other.

The rotary movements of the breech-block 12 within the head 7, to place its socket 13 into register with either of the openings 9 or 11, are controlled by a lever 15, which has its inner end mounted within a transverse recess or slot 16 provided in one end of the block 12. The opposite end of this lever is projected through a registering slot 17 in the dash 1, which slot is only of sufficient length to permit the lever to have the requisite movements to place the block socket 13 into register with either opening 9, 11 of the head 7. To adapt the lever 15 to also serve as a shell ejector it is fulcrumed

within the slot 16 of the breech-block, as at 18, Figs. 1 and 8, for oscillatory movements in a plane parallel to the block axis and has its inner end attached to an ejector-pin 19 to impart movements thereto longitudinally of the block when the lever is oscillated on its fulcrum 18. The ejector-pin has its inner end tapered, and is adapted, when moved inwardly, to exert a wedge-like action on the inner end of a shell within the socket 13 to eject the same therefrom, as shown in Fig. 8. The lever 15 cannot be moved upon its fulcrum 18 to effect an ejection of a shell until it has been swung the full limit of its upstroke, when it will stand in register with the lateral branch 17^a of the guide-slot 17 into which it can then be moved to work the ejector-pin 19.

A reciprocally movable firing-pin 20 is carried by the breech-block 12 within a socket 21 at the inner end of and in axial register with the socket 13 in position to strike the cap of a shell 14 disposed therein, as shown in Fig. 3. The firing movements of the pin 20 are actuated by the inward movements of a hammer member 22, which, in the present instance, is of stud form and fits within the outer end portion of the socket 21 for reciprocal movements therein. This hammer is loosely attached at its outer end to a spring-finger 23, which is firmly attached at one end to the dash 1, or a part of the head 7, as at 23', and has its free end projecting forward over the head 7, as best shown in Figs. 2, 3 and 7, and normally tending to hold the hammer at the limit of its instroke. The spring 23 is shown in Fig. 7 as having opposite edges of its inner end portion incut, as at *a*, and its outer end incut, as at *b*, to form the spaced outwardly projecting fingers *c*. Fingers 24, 24 project over the top of the head 7 from respective plates 25, 25 secured to the opposite ends of the breech-block 12 to turn therewith, and coact with the spring 23 to control the hammer retracting and striking movements thereof. When the breech-block is in the firing position shown in Fig. 3, the fingers 24 stand in register with the incuts *a*, *a* of the spring, and the spring holds the hammer 22 substantially in firing contact with the firing pin 20, as shown in Fig. 3. Upon a turning of the breech-block 12 to shell extracting and receiving position, the fingers 24, 24 which turn therewith, work over the spring fingers *c*, *c* and act thereon to effect a downward flexing thereof, as shown by the dotted lines *d* in Fig. 3. When the breech-block has been turned to place its socket 13 into full register with the opening 9 the fingers 24 will have passed over the free ends of the spring fingers *c*, thus releasing the spring fingers and permitting them to spring outwardly to the normal position shown in full lines in Fig. 3. Upon the return movement of the breech-block to firing position the fingers 24 pass under the spring fingers *c*, *c* and effect a raising of the spring to the dotted line position *e* in Fig. 3 prior to the release of the spring by the moving of the fingers 24 into register with the incuts *a* thereof. Upon such release of the spring the hammer is actuated thereby to strike the firing-pin 20 and explode the cartridge. The release of the spring is timed to take place instantly upon a moving of the breech-block socket 13 into full register with the discharge opening 11.

Threaded into the opening 11 or otherwise suitably attached to the head 7 in axial register with such opening is one end of a barrel or tubular part 26, the opposite or lower end of which is anchored to a hollow frame-part 27, which is suitably attached in tangential relation to one side of a housing 28 incasing the fly-wheel 4, with the hollow of the frame-part opening into the interior of said housing.

A plunger 29 is mounted for reciprocal movements in the barrel 26 and is of suitable length to extend from adjacent to the breech-block 12 to the interior of the frame-part 27, and, in the present instance, carries a block 30 at its lower end for reciprocal movements in said frame-part. The lower end of the block 30 is longitudinally forked to permit the fulcruming therein of an angled or, in the present instance, substantially L-shaped pawl 31, which is mounted on a pin 32 within said block. This pawl has its long arm extending upwardly for a short distance at the side of the plunger 29 with its free end angled slightly in the direction of the periphery of the fly-wheel 4, to adapt it, when swung slightly outward from the retracted position shown in Fig. 1, to engage a registering one of the annular series of ratchet-teeth 33 on the fly-wheel periphery. The pawl 31 has a tail-piece 34 projecting transversely of the plunger in position to make contact with a suitable yielding bumper means 35, when at the upper end of its stroke with the plunger, to retract the pawl from ratchet engaging position, as shown in Fig. 1, and to make contact with a similar bumper means 36 at the lower end of the frame part 27 when the plunger is at the end of its outstroke to effect a throwing of the pawl into engagement with the ratchet teeth.

Mounted for sliding longitudinal movements upon the upper end portion of the barrel 26 is a sleeve 37 which is rigidly connected to the plunger 29 by rivets or other suitable fastening means 38 which project through oppositely disposed longitudinal slots 39 provided in the barrel 26. These rivets also preferably carry guide strips 40 which work in the slots 39, see Fig. 1. The upper end of the sleeve 37 which is disposed

adjacent to the upper end of the plunger is turned or flanged outwardly, as at 41, to provide a shoulder to receive the upper end-thrust of a coiled compression spring 42, which encircles the sleeve and barrel and has its lower end-thrust, in the present instance, against the stationary frame-part 27. Upon an outstroke of the plunger 29 actuated by fluid pressure, such as, for instance, the expansion of gases occasioned by an explosion within the upper end of the barrel 26 or within the socket 13 in register therewith, the spring 42 is compressed whereby to store energy therein, and when such fluid pressure has spent its force upon the plunger, the spring 42 then acts to impart a powerful in or return stroke thereto, whereby to communicate a starting rotation to the fly-wheel through the medium of the pawl 31 and ratchet teeth 33, which are in engagement during such instroke.

The upper end portion of the spring 42 is incased by a tubular shell part 43 which is threaded or otherwise suitably attached to the bottom of the head 7 and is preferably provided adjacent its upper end with an internal annular shoulder 44 to limit the outward movement of an annulus or ring-like member 45, which loosely encircles the upper end portion of the barrel 26. A buffer-spring 46 encircles the upper end of the barrel 26 and has its opposite ends thrust against the head 7 and annulus 45. The spring 46 forms a spring buffer for receiving the impact of the sleeve 37 against the annulus 45 upon the instroke of the plunger.

When the plunger 29 is at or adjacent the limit of its outstroke the upper end thereof uncovers a series of exhaust ports 47 through which the spent gases within the combustion end of the barrel may find an exit to the atmosphere. Such gases after passing through the ports 47 enter the space between the barrel 26 and shell 43 and pass between the flange 41 and said shell and thence to the atmosphere through the lower end of the shell, it being, of course, understood that at the time the exhaust takes place the upper end of the sleeve 37 is below said ports. The cartridge wads which are driven into the barrel 26 by the discharge of a cartridge, are forced by the return stroke of the plunger back into the socket 13 or the shell 14 and are discharged from the breech-block with the shell.

The operation of my improved engine starter is as follows: The operator having turned the lever 15 to move the breech-block 12 to place the shell-receiving socket 13 thereof into register with the opening 9—10 through the dash and head 7, inserts a cartridge into the socket 13 and then moves the lever 15 to its normal position to return the breech-block into position for the socket 13 to register with the barrel opening or combustion chamber 11. As the breech-block is returned to this position, the fingers 24—24 which project from the end thereof under the spring fingers e, e work rearwardly in contact with the under sides of such spring fingers and effect a raising of the spring to the abnormal dotted position e, (Fig. 3). When the breech-block has been turned a sufficient distance to place its socket 13 into full register with the combustion end of the barrel, the fingers 24 will have moved into register with the incuts a, a of the spring 23 to release the spring and permit it to actuate the hammer 22 to strike the firing-pin 20 to explode the cartridge carried by the breech-block. The impact upon the upper end of the plunger 29 occasioned by the expansion of gases within the combustion end of the barrel imparts a rapid and forceful outstroke to the plunger against the pressure of the spring 42. When the plunger has reached the limit of its outstroke the pawl 31 will have moved into engagement with a registering tooth in the ratchet 33 due to the tail-piece 34 of the pawl striking the bumper means 36. The explosion or fluid pressure within the combustion end of the barrel having spent its force upon the plunger and exhausted through the ports 47 to the atmosphere, the spring 42, which was compressed upon the outstroke of the plunger, acts thereon to impart a powerful and rapid instroke thereto and a consequent quick turning of the fly-wheel by reason of the pawl 31 being in engagement with one of the ratchet teeth thereof. The turning force thus communicated to the fly-wheel is adapted to impart a sufficient number of revolutions thereto to start the associated engine. When the plunger has reached the limit of its instroke, the pawl 31 is moved from engagement with the ratchet teeth 33 by reason of its tail-piece 34 engaging the bumper means 35. The force of the instroke of the plunger when at the limit of such movement is received by the buffer means 45, 46 thus preventing an abrupt stopping of the plunger and lessening to a minimum the jar communicated to the apparatus by such stopping. When it is desired to again use the starter the operator raises the handle 15 to the upper end of the dash slot 17, thereby turning the breech-block socket 13 into register with the opening 9, 10, and to effect an ejection of the contained shell from such socket the lever 15 is thrown into the registering transversely extending portion 17^a of its guide slot to cause an oscillation of the lever upon its fulcrum 18 to impart an inward shell ejecting movement to the ejector-pin 19. The lever is then moved into register with the major portion 17 of the guide slot and a loaded cartridge is inserted within the breech-block before returning the same to firing position.

In starters of this character heretofore used, so far as I am aware, it has been the practice to utilize the explosion actuated stroke of the plunger to communicate the starting movements to the engine. It has been found, however, that the sudden and powerful impact thus communicated to the fly-wheel or crank-shaft is very injurious to the engine and frequently twists or breaks parts thereof which are not of sufficient strength to withstand the sudden starting action thus imparted thereto. It will be apparent, however, with the present form of starter that the impact of the explosion is only utilized to compress or store up a starting energy in the spring 42 whereby an even yielding starting pressure is exerted upon the fly-wheel or other coacting part of the engine to start the same. This form of starter also exerts a gradually increasing starting pressure upon the coacting rotary part of the engine due to the plunger not being moved as rapidly at the initial or starting portion of its instroke as it is moving during the remainder of such stroke.

I wish it understood that my invention is not limited to any specific construction or arrangement of the parts except in so far as such limitations are specified in the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is,—

1. In an apparatus of the class described, the combination with a movable member having a series of ratchet teeth, of reciprocal means influenced to normally stand in one position of its movement and movable from such position by fluid pressure, a pawl carried by said means for engaging the ratchet teeth and moving said member upon a movement of the means to normal position, and means for automatically moving the pawl into and out of ratchet engaging position at predetermined points in the movements of said first means.

2. In an apparatus of the class described, the combination with a movable member having a series of ratchet teeth, of a plunger influenced to normally stand in one position of its movement and movable from such position by fluid pressure, a pawl carried by said plunger for engagement with said ratchet teeth, and yielding bumper means with which a part of the pawl coacts at predetermined points in a movement of the plunger to move the pawl into and out of engagement with the ratchet teeth.

3. In an apparatus of the class described, the combination with a rotatable member, of a barrel, a plunger movable in said barrel and having its movements in one direction actuated by fluid pressure, a part movable with the plunger without the barrel, a coiled spring acting on said part to oppose the fluid pressure influenced movements of the plunger and adapted to cause a return of the plunger to normal position, and means for imparting rotation to said member from a movement of the plunger to normal position.

4. In an apparatus of the class described, the combination with a rotatable member, of a barrel having longitudinally extending slots therein and provided with exhaust ports, a plunger movable in said barrel by an expansion of gases therein, a sleeve freely encircling said barrel and rigidly attached to the plunger through said slots, said sleeve being shouldered at the outer end thereof, means yieldingly acting on the shouldered end of the sleeve to return the plunger and sleeve to normal position after being moved by fluid pressure, and means carried by the plunger and automatically operable to engage and move said member when the plunger returns to normal position.

5. In an apparatus of the class described, a part having a combustion chamber, a charge carrying member which is rotatable into positions to receive a charge or to place a charge carried thereby into register with said combustion chamber, and yielding mechanical means controlled by a rotation of said member for firing a charge therein.

6. In an apparatus of the class described, a part having a combustion chamber, a member having a charge carrying socket and rotatable to place such socket into charge receiving or charge firing positions, and spring means for firing a charge carried by said member.

7. In an apparatus of the class described, a part having a combustion chamber therein, a charge carrying member having a socket and rotatable to place such socket into charge receiving or charge firing positions, and a firing-pin automatically operable to fire a charge carried by said member when its socket is moved into register with the combustion chamber.

8. In an apparatus of the class described, a part having a combustion chamber therein, a member having a charge carrying socket and rotatable to place such socket into or out of register with said chamber, and spring actuated firing means automatically controlled by the movements of said member to fire the charge carried thereby when in register with said chamber.

9. In an apparatus of the class described, a movable charge carrying part, and a firing-pin automatically operable to fire a charge carried by said part when the part is moved to a predetermined position.

10. In an apparatus of the class described, a rotatable charge carrying part, and a firing-pin automatically operable to fire a charge carried by said part when the part is moved to a predetermined position.

11. In an apparatus of the class described, a charge carrying part movable to and from

charge receiving and firing positions, and spring firing means automatically controlled by the movements of said part to fire a charge when the part is moved to firing position.

12. In an apparatus of the class described, a rotatable charge carrying part, a firing pin, a spring actuated hammer for striking said pin, and means movable by said part to retract the hammer and then release it to strike the firing pin at a predetermined point in a movement of said part.

13. In an apparatus of the class described, a rotatable charge carrying part, a firing pin associated with such part, a hammer for striking said pin, a spring finger attached to said hammer, and means movable with said part for moving the spring finger to retract the hammer and to release the finger to permit it to move the hammer to strike the pin at a predetermined point in the movement of said part.

14. In an apparatus of the class described, a member having a cartridge receiving socket and movable to place such socket into cartridge ejecting or firing positions, and means operable to move said member and to eject a cartridge from its socket when moved to cartridge ejecting position.

15. In an apparatus of the class described, a member having a cartridge receiving socket and being rotatable to place such socket in cartridge ejecting or firing positions, and means movable in one direction to rotate said member and when said member has been moved to cartridge ejecting position being then movable in another direction to eject a cartridge from the member.

16. In an apparatus of the class described, a cartridge carrying member rotatable to cartridge ejecting or firing positions, a lever fulcrumed to said member for oscillatory movements in a plane substantially parallel to its axis and being movable with the member about its axis, a cartridge ejecting pin movable by said lever when oscillated upon its first mentioned fulcrum, and means guiding said lever to prevent it from turning on its first mentioned fulcrum except when the member is in cartridge ejecting position.

In testimony whereof, I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM EMIL BOCK.

Witnesses:
C. W. OWEN,
M. Q. OPPENHEIM.