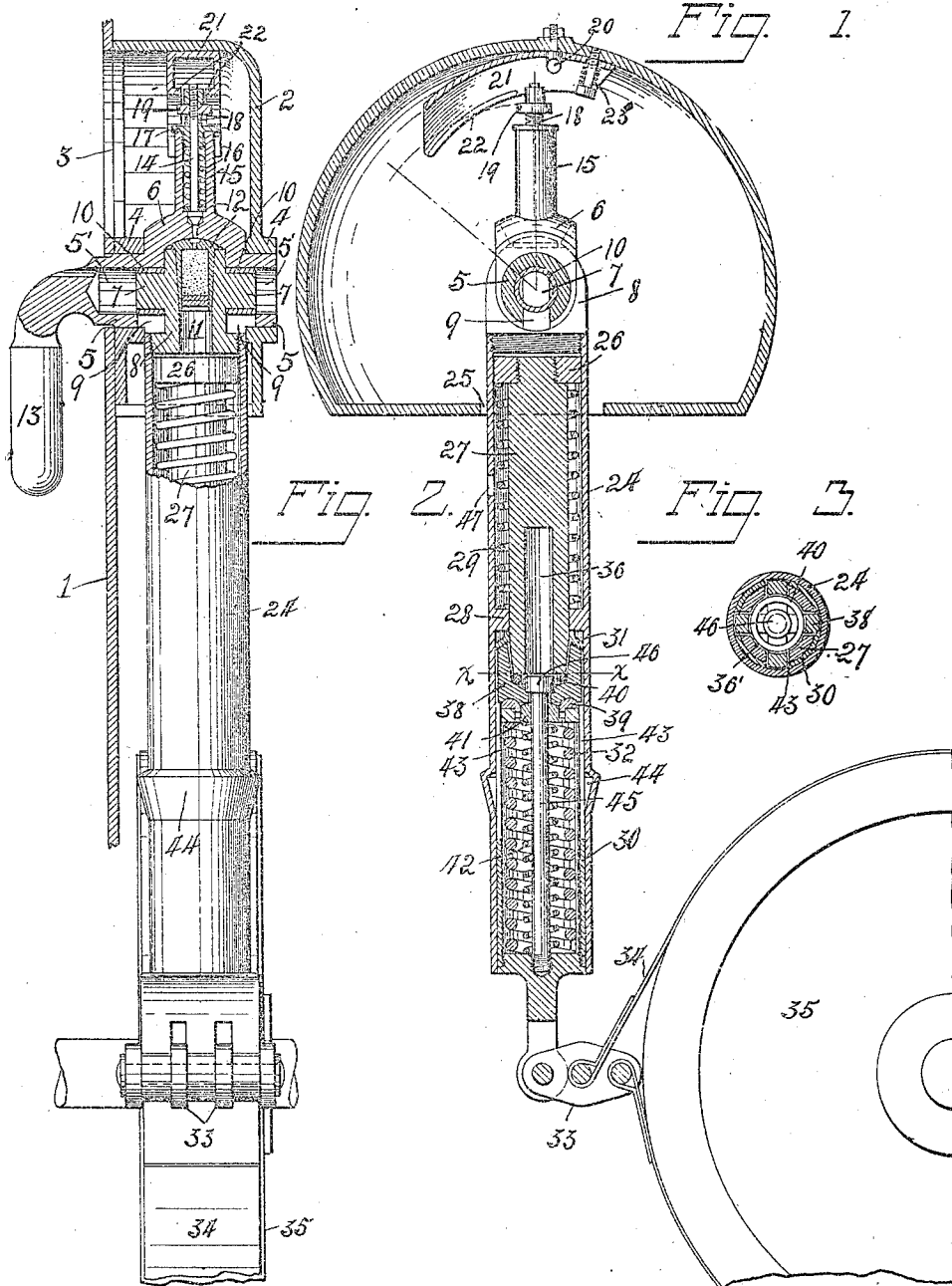


W. E. BOCK.
STARTER FOR EXPLOSIVE ENGINES.
APPLICATION FILED MAR. 17, 1911.

1,043,392.

Patented Nov. 5, 1912.

2 SHEETS—SHEET 1.



WITNESSES:

B. H. Bills.
M. G. Gaskell

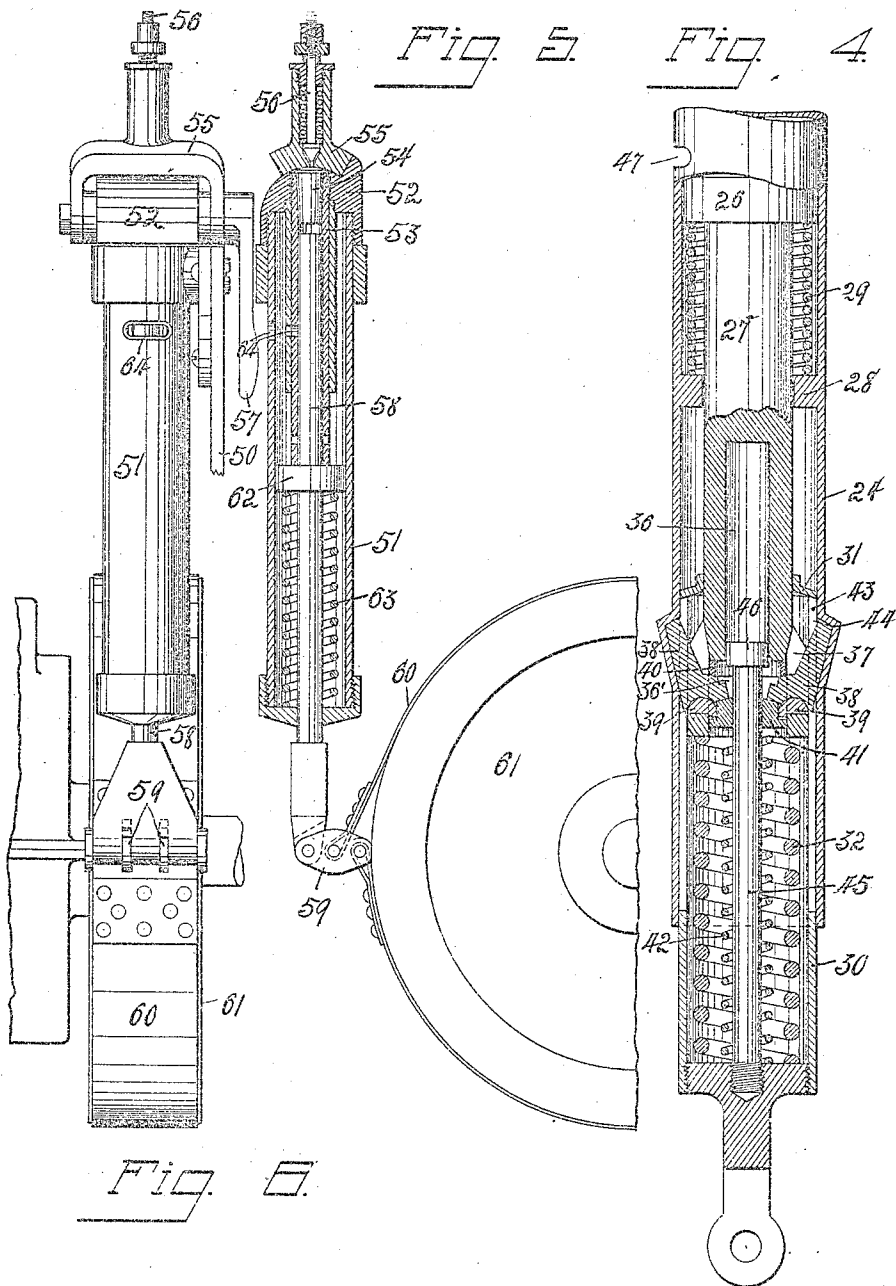
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C. H. Dills.
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INVENTOR:

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UNITED STATES PATENT OFFICE.

WILLIAM EMIL BOCK, OF TOLEDO, OHIO.

STARTER FOR EXPLOSIVE-ENGINES.

1,043,392.

Specification of Letters Patent.

Patented Nov. 5, 1912.

Application filed March 17, 1911. Serial No. 615,088.

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 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 to provide starting means of this class which is simple and efficient in its construction and operation, inexpensive of manufacture and application to an engine, and adapted to be operated by the sudden formation and expansion of gases or by fluid pressure on a part thereof.

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 and one modified form thereof are illustrated in the accompanying drawings, in which,—

Figure 1 is an elevation of the preferred form of my invention in central longitudinal section, with the parts in normal position. Fig. 2 is a side elevation thereof with parts in section. Fig. 3 is a cross section on the line *xx* in Fig. 1. Fig. 4 is an enlarged sectional elevation of the lower portion of the apparatus with the starting parts nearly at the limit of their down strokes. Fig. 5 is an elevation of a modified form of my invention in central longitudinal section, and Fig. 6 is a side elevation thereof.

Referring to Figs. 1 to 4 inclusive of the drawings, 1 designates the dash-board of an automobile or other suitable part to which the apparatus is attached, and 2 a case which, in case of the use of the apparatus in connection with an automobile, is preferably secured to the front side of the dash-board thereof within the hood inclosing the engine. An opening 3 is provided through

the dash-board and rear side of the case to render access to the loading or charge holding parts.

The case 2 has bearings 4 provided in the front and rear portions thereof below the opening 3, and journaled in these are the trunnions 5, which project outward from the legs of an inverted U-shaped part 6, which part in the present case, is the breech-block of the apparatus. The trunnions 5 are axially bored, as at 5', to form bearings for the trunnions 7 of a head 8, which fits up within the breech-block 6, thus permitting the head and breech-block to have relative swinging movements in a common plane. To facilitate an assembling of these parts the trunnions 7 are vertically flattened to adapt them to center the trunnions 5 through correspondingly narrowed openings 9 in the bottoms thereof, and when the trunnions 7 are within the bores 5', bearing sleeves 10, which fit within said bores are slipped thereover to hold said trunnions 7 suspended within the trunnions 5. The construction of the parts 6 and 8 and manner of assembling the same, however, is immaterial so far as the real features of the invention are concerned.

The head 8, has a central bore or charge chamber 11 provided longitudinally there-through into which a charge-carrying cartridge 12, in the present instance, is intended to be inserted from the upper end thereof, as indicated in Fig. 2. To insert a cartridge within the head 8, the part 6 is swung from over the same to uncover the upper end of the charge chamber 11, and when the cartridge has been inserted the part 6 is swung back over said chamber and forms a breech-block for the cartridge or charge. A handle 13 projects from one of the trunnions 5 through a registering opening in the dash-board 1 to facilitate a turning of the part 6.

A firing-pin 14 is shown as being mounted within a hollow stem 15 projecting upward from the top of the part 6 and has its shell coacting end working through a registering opening in said part. A coiled compression spring 16 is disposed within the stem 15 and acts upon a shoulder at the lower or inner end portion of the pin 14 and upon a cap or plug 17 at the outer end of said stem to normally retain the pin depressed or near the limit of its inward or firing movement. The expanding action of the spring 16 is limited at its lower end by a shoulder within

the stem 15, and the firing-pin is normally held elevated in contact with the lower end of the spring and out of contact with the cartridge cap by a spring 18, which has its
 5 opposite end thrust against the stem cap 17 and shoulder or nut 19 at the outer end of said pin.

Pivoted to the case 2 above the firing-pin 14, as at 20, is an elongated pin-retracting
 10 member 21, which has its under side longitudinally channeled with the lower edges of the side walls thereof inwardly flanged to provide opposing ledges 22, which terminate short of the firing plane of the pin 14.
 15 These ledges are longitudinally curved in the plane of swinging movements of the firing pin, and, while they may be moved into a position concentric to the arc of movement of the firing pin are normally held in
 20 eccentric relation thereto by the action of a spring 23 on the short end of the member 21. When the breech-block 6 and attached firing pin 14 are swung to the left, in the present instance, to uncover the charge-
 25 chamber 11 the nut or shoulder 19 of the firing-pin coacts with the under sides of the ledges 22 and moves the member 21 to permit said nut or shoulder to pass beyond the free end thereof, when the member
 30 assumes its normal position. Upon the return movement of the breech-block and pin the nut or shoulder 19 passes over the ledges 22 and the eccentric form thereof causes the pin 14 to be drawn outward or retracted
 35 against the tension of its firing spring 16. When the pin reaches its firing position the nut or shoulder 19 has passed beyond the inner ends of the ledges 22 and the spring 16 imparts a firing movement thereto to explode
 40 a cartridge 12 in the head 8, as is apparent.

Threaded or otherwise suitably secured to the lower or outer end of the head 8 in longitudinal register with its bore is a barrel 24, which extends through an opening
 45 25 in the bottom of the case 2 and has its lower end open. A piston 26 is located within the upper portion of the barrel 24 and has a stem 27 projecting downwardly therefrom and working through an internal
 50 annular shoulder or reduced portion 28 in the barrel 24. A coiled compression spring 29 normally acts to retain the piston 26 elevated in close proximity to the head 8 and encircles the stem 27 with its opposite ends
 55 thrust against the piston 26 and shoulder 28.

Reciprocally mounted within the barrel 24 below the shoulder 28 therein is a hollow
 60 plunger 30, which has its upper end open and receiving the lower end of the stem 27 which is enlarged within the upper end of the plunger 30, and the upper end of the latter is drawn inward or shouldered over said enlargement as shown at 31. A coiled compression spring 32 is disposed within the
 65 plunger 30 and has its opposite ends thrust

against the outer closed end of the plunger and the enlarged end of the stem 27 to yieldingly hold said plunger and stem in longitudinally, extended position, as shown in Fig. 1. The stem and plunger are both normally held retracted within the barrel 24
 70 by the action of the spring 29. The outer end of the plunger 30 is shown in the present instance as pivotally connected to an end or ends of one or more laterally projecting
 75 links 33, each of which has spaced connection longitudinally thereof with the opposite ends of a brake band 34, which encircles the fly-wheel or other rotary part 35 of the associated engine. The connection
 80 of each link with the plunger and brake-band ends is such that a quick outward thrust of the plunger on the link will effect a tightening of the brake-band upon the encircled part and impart rotation to such
 85 part, as is apparent.

Upon a sudden expansion of gases within the barrel 24 above the piston 26, such, for instance, as would be occasioned by the explosion of a cartridge charge, for which the
 90 construction shown is adapted, the impact thereof upon said piston will impart a sudden powerful outward movement thereto against the tension of the spring 29. This movement of the piston and its stem is im-
 95 parted to the plunger 30 through the medium of the spring 32, which tends to cushion the sudden impact of the plunger upon the links 33 and brake-band 34, and to lessen the liability of breaking such parts.
 100 It is thus apparent that the piston 26, stem 27 and plunger 30 in reality form a single two part plunger, with one of the parts serving as a cushion for the other.

As the outward movement of the plunger
 105 part 30 is resisted by the parts to which its outer end is attached it is found quite necessary in practice to provide some means for locking the plunger part 26—27 at the limit
 110 of its out-stroke so that the spring 32, which was compressed by the sudden impact thereon of the part 26—27, will exert its full expanding force upon the plunger part 30 to move it outward the full limit of its stroke
 115 instead of causing a kicking back action of the part 26—27. One means for accomplishing this locking action consists in providing the lower end of the piston-stem 27 with an axial bore 36 having the enlarged
 120 outer end portion 36', and providing the enlarged lower end portion of said stem with longitudinally-extending radial sockets or incuts 37, which are shown in the present
 125 instance as being four in number, and as having their lower end portions terminating short of the lower end of the stem and opening into the enlarged portion 36' of the stem bore. Mounted for oscillatory movements within each socket 37 is an angled or substantially L-shaped pawl 38, which has its
 130

short arm projecting within the bore 36', and its long arm normally standing upright, as shown in Fig. 1. To facilitate an assembling of the pawls 38 within their sockets each rests upon a fulcrum block 39, which is removably mounted in the lower end of its socket 37 with its inner end hooked downwardly within the bore 36' to prevent an outward sliding of the block. These blocks have their upper sides rounded and seat within corresponding depressions in the lower ends of the pawls. A ring 40 is disposed within the inner end of the bore 36' and rests upon the upper longitudinally curved sides of the short arms of the pawls 38 to cooperate with the blocks 39 to hold the pawls against vertical movements within the sockets 37, as is apparent. A thrust block 41 is mounted for free reciprocal movements within the socket 36' below the short arms of the pawls 38, and is adapted to bear at its inner side against the lower inner end portions of said arms, whereby an inward movement of the block will act on the pawls to tend to throw the free ends of the long arms thereof outward, as indicated in Fig. 4. The block 41 is influenced to normally move inward by the action thereon of a light tensioned coiled compression spring 42, which is disposed within the spring 32 and has one end thrust against said block and its other against the outer end of the plunger part 30.

The pawls 38 have their vertical edges projecting within registering slots 43 provided longitudinally in the plunger casing 30, said slots being of sufficient length to permit the pawls to work therein throughout the maximum stroke of the stem 27 relative to the plunger part 30. When the plunger part or stem 27 has reached the limit of its out-stroke the long arms of the pawls 38 move into register with an internal socket or an annular enlargement 44 in the barrel 24 into which the ends of the long arms of the pawls are forced by the action of the thrust block 41 and spring 42 thereon, as is apparent by reference to Fig. 4. In order to effect an automatic release of the pawls 38 from locking engagement with the barrel socket 44 when the plunger part 30 has substantially reached the limit of its out-stroke, I secure a pin or stem 45 axially within the plunger part 30 to the outer end thereof and project its inner or free end through the thrust block 40 and provide an enlarged head 46 thereon for working within the bore 36 of the plunger part 27. The head 46 is of suitable size for the lower edge thereof to register with the inner ends of the pawls 38 and is adapted to engage therewith and to move said pawls to retracted position as shown in Fig. 1, said retracting movement of the pawls being completed when the plunger parts 27 and 30 have reached, or

substantially reached, the limit of their relative outward movements. It is thus apparent that the plunger part 27, when at the limit of its out-stroke, is firmly anchored against an inward or kicking movement until the plunger part 30 has reached the limit of its out-stroke under the action of the spring 32, when the locking means is automatically released to permit a return of the plunger parts to normal position within the barrel. In the present instance the relative outward movement of the plunger parts 27 and 30 are limited by the coaction of the outer parts of the pawls 38 with the inwardly drawn portion 31 at the inner end of the plunger part 30.

In the operation of this form of invention the operator swings the breech-block 6 to the left by a movement of the handle 13 to uncover the outer end of the charge chamber 11 of the head 8, places a loaded cartridge 12 therein, and then swings the breech-block back to its normal position. As the breech-block is swung to open position the nut or shoulder 19 on the firing-pin passes under the ledges 22 of the member 21, said member being moved against the tension of its spring 23 thereon, and, upon a closing movement of the breech-block, said nut or shoulder 19 moves over the ledges 22 which act thereon to retract the firing pin. When the breech-block reaches the limit of its closing movement the nut or shoulder 19 has passed from engagement with the inner ends of the ledges 22 and the firing-pin spring 16 moves the pin inwardly with sufficient force for it to strike and explode the cap in the cartridge carried by the head 8. The sudden expansion of the gases within the firing chamber occasioned by the explosion of the cartridge therein exerts itself upon the plunger 26 and imparts a sudden powerful outward movement thereto. The sudden movement of the plunger part 26 is cushioned by the spring 32 so that the full force of the same is not immediately exerted on the attached link or links 33 and brake-band 34, thus reducing to a minimum the liability of breaking such parts at a starting operation. When the plunger part 26—27 has reached the limit of its out-stroke the pawls 38 are automatically moved into engagement with the barrel recess or recesses 44 by the thrust action of the block 41 and spring 42 thereon. The plunger part 26—27 is now firmly anchored against an inward movement so that the full force of the compressed spring 32 is exerted upon the plunger part 30 to move it to the limit of its out-stroke. The force of movement of the plunger and its length of stroke are such as to exert a sufficient turning force upon the fly-wheel or other rotary part to which it is attached to impart several rotations thereto. When the plunger part 30

is at substantially the limit of its outward movement the head 46 of the pin 45 moves into engagement with the inner ends of the pawl 38 and effects a retraction of their outer ends from within the recesses 44 of the barrel, thus releasing the plunger part 26—27 to permit it to return to its normal position under the influence of the spring 29. The barrel 24 and associated parts are adapted to swing with the trunnions 7 as their axis as the lower end of the plunger follows the arc of the fly wheel in its out and in strokes. When the plunger part 26 is near the limit of its outward stroke or uncovers an opening 47 in the barrel casing it permits the expulsion of the cartridge wads and burnt gases from the firing chamber.

In the form of the invention disclosed in Figs. 5 and 6, 50 designates a dash-board or other part to which the apparatus is attached; 51 the barrel which is pivoted to the part 50 for swinging movements and is provided with a head 52 from which a tube 53 projects within the barrel to form the charge-chamber, and into the upper end of which a cartridge 54 may be inserted. A breech-block 55 is swingingly carried by the head 52 and carries the firing pin 56 which may be retracted by hand or in any other suitable manner. The breech block 55 is provided with a handle 57 without the part 50 to facilitate a swinging of the same. A plunger 58 works within the tube or firing chamber 53 and has its lower end projecting without the lower closed end of the barrel 51 and attached to links 59 to which the ends of a brake-band 60, which encircles a fly-wheel or other rotary part 61 are secured, as described for the preferred form. A collar or enlargement 62 is provided on the plunger 58 for working in the lower end portion of the barrel 51 below the charge-chamber 53 and receives the upper end-thrust of a coiled compression spring 63, which is located within the lower end of the barrel 51 and has its lower end thrust against the lower closed end of the barrel. The expulsion of the cartridge wads and gases from the charge chamber is through registering openings 64 in the casing of said chamber and the barrel 51.

It is apparent that the cushion feature of the plunger is absent from this form of the invention. It is found in practice that while this form of the invention will operate to start an engine, it is preferable to use a device employing a plunger having the cushion feature, as the brake-band is thereby relieved of the direct force of the explosion.

While I have particularly referred to the firing of a loaded cartridge to obtain an expansion of gases within the charge-chamber, I do not restrict the invention in such respect as any suitable means for creating a sudden fluid pressure or expansion of gases

within the apparatus for acting on the starting means may be employed.

I wish it understood that my invention is not limited to any specific construction or arrangement of the parts except insofar 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 rotatable member, of a part having a charge chamber therein, a breech-block swingingly mounted on said part and movable to close or uncover said chamber, a firing pin carried by said breech block, means for operating on the firing pin during a movement of the breech-block to chamber closing position to retract said pin and then release it at a predetermined point in its swinging movement to fire a charge, and a plunger guided by said part and having connection with said member, said plunger being movable by an expansion of gases in said chamber to impart rotation in one direction to said member and having means for cushioning the impact of such gases thereon.

2. In an apparatus of the class described, the combination with a rotatable member, of a plunger having connection with said member, said plunger having a plurality of parts which are capable of limited relative longitudinal movements and having a spring interposed between said parts to cushion the impact of one part on the other, said plunger being movable by fluid pressure thereon to store energy in said spring, and the spring then acting to impart the member turning movements to the plunger, and means for preventing a back movement of the plunger while the spring is acting to turn the member.

3. In an apparatus of the class described, the combination with a rotatable member, of means having connection with said member and being movable by fluid pressure to impart rotation in one direction to said member, said means comprising a plurality of parts capable of relative yielding movements, and means for preventing a kicking back of one of said parts when at the limit of its said movement until the other part has completed its member starting movement.

4. In an apparatus of the class described, the combination with a rotatable member, of means having connection with said member and movable by fluid pressure to impart rotation in one direction to said member, said means having a plurality of parts capable of relative yielding movements, means for automatically locking one of said parts at the limit of its member turning movement, and means for automatically releasing said locking means when the other part is at sub-

stantially the limit of its member turning movement.

5. In an apparatus of the class described, the combination with a rotatable member, of a charge chamber, means having connection with said member and movable by fluid pressure within said chamber to impart rotation in one direction to said member, said means comprising a plurality of parts capable of relative yielding movements, and means which automatically locks one of said parts at the limit of its member turning movement and releases it when another part has reached substantially the limit of its member turning movement.

6. In an apparatus of the class described, the combination with a rotatable part, of a guide part, a plunger having connection with said member and movable in said guide part by fluid pressure thereon to impart rotation in one direction to said member, said plunger having a plurality of relatively movable parts, and means cooperating with said parts for locking one at substantially the limit of its member turning movement until the other part has reached substantially the limit of its member turning movement.

7. In an apparatus of the class described, the combination with a rotatable member, of a guide having a charge chamber, a multiple part plunger having connection with said member and movable in said guide by fluid pressure created in said chamber to impart rotation in one direction to said member, a plurality of the parts of said plunger being capable of relative longitudinal yielding movements, and means for locking the part first to complete its member turning stroke at the limit of its stroke and to automatically release such part when the part of the plunger which is last to complete its member turning stroke has completed such stroke.

8. In an apparatus of the class described, the combination with a rotatable member, of a guide having a charge chamber, a plunger having connection with said member and movable in said guide by fluid pressure in said chamber to impart rotation in one direction to said member, said member having a plurality of parts capable of relative longitudinal yielding movements, means movable with the plunger and cooperating with the guide to lock one of the plunger parts at the limit of its outstroke until the other part has reached the limit of its outstroke.

9. In an apparatus of the class described, the combination with a movable member, of a guide having a charge chamber, a plunger having connection with said member and movable in said guide by an expansion of gases in said chamber to impart movement in one direction to said member, said plunger comprising a plurality of yieldingly ex-

tended telescoping parts, means carried by the part upon which the gas impact is first exerted to lock it at the limit of its outstroke, said means being operative to automatically release said locked part when the other plunger part has completed its outstroke.

10. In an apparatus of the class described, the combination with a movable member, of a charge chamber, means having connection with said member and movable by an expansion of gases in said chamber to impart rotation in one direction to said member, said means comprising a plurality of relatively movable parts, and mechanism for automatically locking the part of said means which first receives the gas impact at the limit of its member moving stroke and being automatically operable to release said part when another part of said means has reached the limit of its member moving stroke.

11. In an apparatus of the class described, the combination with a movable member, of a guide having a fluid pressure chamber, a multiple-part telescopic plunger having connection with said member and movable in said guide by fluid pressure in said chamber to impart movement to said member in one direction, means yieldingly holding the plunger at the limit of its instroke, a compression spring normally retaining the parts of the plunger longitudinally extended, and mechanism carried by one plunger part for automatically cooperating with the guide to hold such plunger part at the limit of its outstroke until the other plunger part has reached the limit of its outstroke.

12. In combination, a guide, a plunger having a plurality of yieldingly movable parts, a member movable by such plunger, and means for locking one of the plunger parts at the limit of its member moving stroke until another plunger part has reached the limit of its member moving stroke.

13. In an apparatus of the class described, a plunger guide, a fluid pressure actuated plunger working in said guide and having a plurality of relatively movable parts which are normally relatively extended, means carried by one of said parts for locking with the guide to hold the plunger part upon which an impact is first exerted at the limit of its outstroke until the other plunger part has reached the limit of its outstroke.

14. In an apparatus of the class described, a guide, a plunger movable in said guide and having a plurality of telescoping parts, a compression spring interposed between said plunger parts to normally hold them relatively extended, pawls carried by one plunger part within the other plunger part and adapted to work through said latter plunger part and to cooperate with the casing to hold the part by which they are carried in one position of its movement, means

yieldingly acting on said pawls to influence their outward movements, and means movable with one of the plunger parts for acting on said pawls to draw them inwardly to releasing position when the part to which said means is attached has reached a predetermined point in its movement.

15. In an apparatus of the class described, the combination with a movable member, of
10 a plunger attached to said member and having a plurality of relatively movable parts, a spring normally holding the plunger parts in extended relation and permitting a relative movement of said parts for substantially

the full stroke of the plunger for the purpose of storing up energy in said spring to impart the full stroke to said member, and means for preventing a back movement of the plunger parts until the member has been turned a predetermined distance. 15

In witness whereof I have hereunto signed
my name to this specification in the presence
of two subscribing witnesses. 20

WILLIAM EMIL BOCK.

Witnesses:

C. W. OWEN,
GLEE GASKELL.