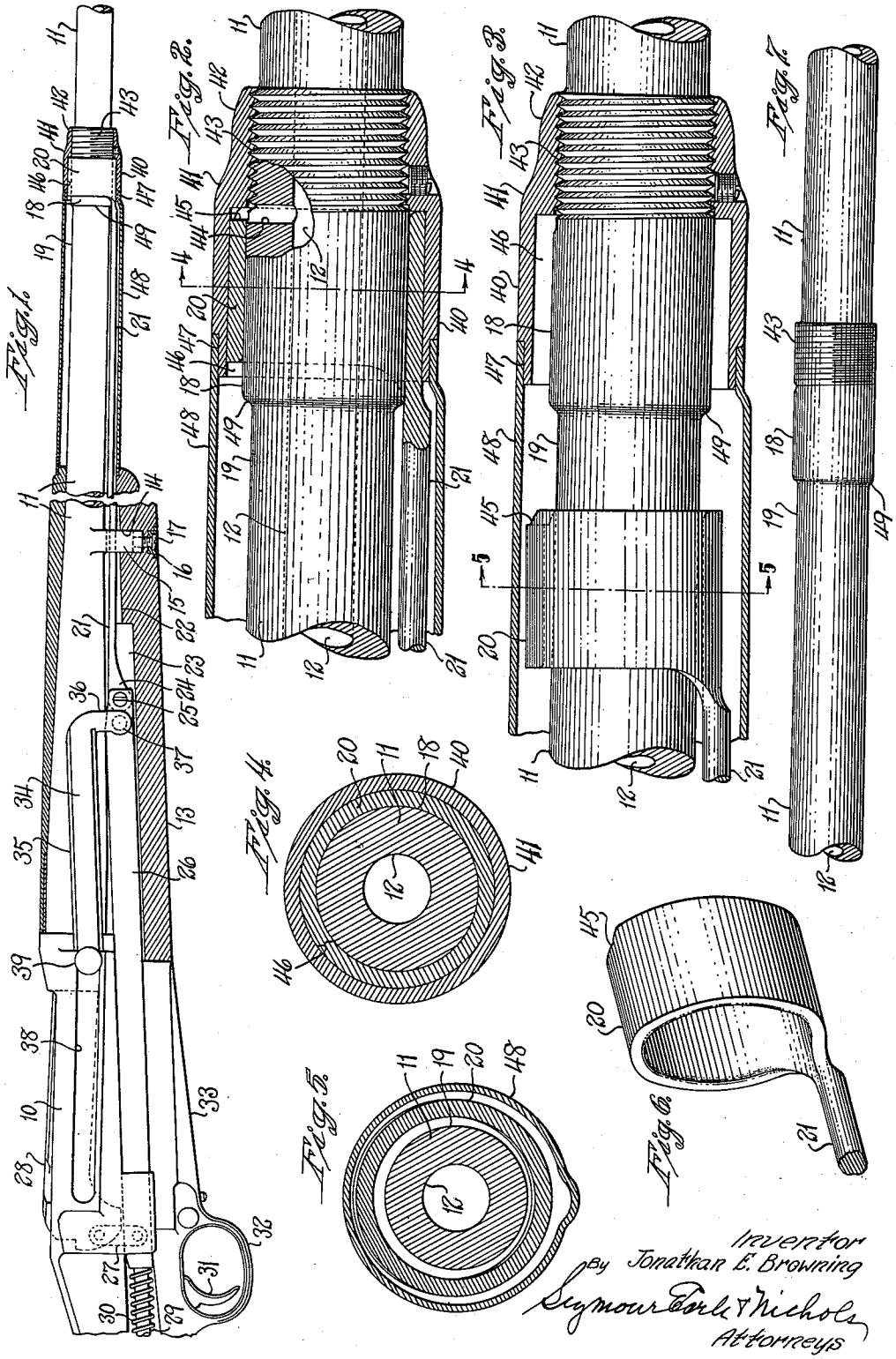
Aug. 13, 1940. J. E. BROWNING 2,211,405

GAS-OPERATED AUTOMATIC FIREARM

Original Filed Aug. 31, 1938



Patented Aug. 13, 1940

2,211,405

UNITED STATES PATENT OFFICE

2,211,405

GAS-OPERATED AUTOMATIC FIREARM

Jonathan E. Browning, Ogden, Utah, assignor, by mesne assignments, to Western Cartridge Company, a corporation of Delaware

Application August 31, 1938, Serial No. 227,712
Renewed December 11, 1939

10 Claims. (Cl. 42—3)

This invention relates to an improvement in automatic firearms, and more particularly to that class of automatic firearms which are operated for effecting the ejection of a fired cartridge and for reloading, by gas pressure acting upon a tubular piston and developed by the firing of a cartridge.

One of the objects of the present invention is to provide a superior firearm of the type referred to, in which provision is made for avoiding the cramping or binding of the tubular piston despite strains placed thereon as the result of its operative connection to the action of the firearm.

Another object is to provide a superior gas-operated automatic firearm having a tubular piston and in which expansion and contraction incident to the development of heat occasioned by the firing of the firearm will not cause the binding of the said tubular piston.

A further object is to provide a superior automatic firearm of the type referred to, in which a tubular piston is operatively connected to the action of the firearm by means of an action-slide or its equivalent which reciprocates obliquely with respect to the normal path of movement of the said tubular piston, and in which simple, reliable and effective means is provided for avoiding the cramping of the parts despite the divergence between the respective paths of movement of the said tubular piston and the said action-slide.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art and which are not claimed in any separate application.

In the accompanying drawing, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a broken view partly in side elevation and partly in vertical central-longitudinal section of one form which a gas-operated automatic firearm embodying the present invention may assume;

Fig. 2 is a fragmentary view partly in side elevation and partly in vertical central-longitudinal section of the portion of the firearm immediately adjacent to the piston and cylinder;

Fig. 3 is a view corresponding to Fig. 2 but showing the tubular-piston moved rearwardly under the urge of gas pressure to effect the actuation of the firearm;

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 3;

Fig. 6 is a perspective view of the tubular-piston together with a portion of the actuating-rod; and

Fig. 7 is a broken view in side elevation of a portion of the barrel.

The particular gas-operated automatic firearm herein chosen for the illustration of the present invention includes a receiver 10 from which forwardly projects a barrel 11 rigid with respect to the said receiver and provided with the usual axial passage or bore 12 through which the projectile and accompanying burning or burnt gases may pass forwardly. Attached to the barrel 11 and to the receiver 10 is a stock 13, the forward portion of which is provided with a recess 14 into which projects the lower portion of a stock-attaching lug 15 depending from the barrel 11. Mounted in the underface of the stock 13 in alignment with the stock-attaching lug 15 is an escutcheon 16 through which extends a vertical screw 17 threaded into the said stock-attaching lug 15.

Adjacent its forward end the barrel 11 is formed with a smooth cylindrically-contoured portion 18 which is larger in diameter than the portion of the barrel immediately to the rear thereof and which for convenience of description may be referred to as a piston-core or piston-guiding portion. Also for purposes of convenience of description, the portion 19 of the barrel 11 which lies immediately to the rear of the piston-guiding portion 18 just referred to, will be termed or referred to as a piston-releasing portion, since it is of a diameter very materially smaller than the diameter of the piston-guiding portion 18 and the internal diameter of a tubular-piston to be presently described.

Sliding axially along the piston-guiding portion 18 around which it is normally located, is a tubular-piston 20 having an internal diameter sufficiently larger than the external diameter of the piston-guiding portion of the barrel 11 so as to freely reciprocate thereon without occasioning harmful binding or cramping or undue gas-leakage. A clearance of approximately ten thousandths of an inch between the piston-guiding portion 18 and the inner surface of the tubular-piston 20 has been found to be satisfactory.

Extending rearwardly from the tubular-piston 20 above referred to in rigid relationship thereto is an actuating-rod 21 preferably extending rearwardly beneath the barrel 11 through a clearance-groove 22 in the forward portion of

the stock 13, and into a relatively deep longitudinally-extending pocket 23 also formed in the stock 13. At its rear end the actuating-rod is formed with a laterally flattened head 24 which is pivotally connected by means of a stud 25 to the forward end of an action-slide 26 which reciprocates in an oblique path with respect to the axis of the barrel 11, as is clearly indicated in Fig. 1.

The action-slide 26 above referred to, has pivotally connected to its rear end the lower end of a bolt-operating link 27 which in turn has its upper end pivotally coupled to the rear end of a breech-bolt 28 (Fig. 1). Extending rearwardly from the rear end of the action-slide 26 is a spring-plunger 29 encircled by a breech-bolt-closing spring 30 serving to restore the breech-bolt 28 to its forward or closed position as shown in Fig. 1, after the said breech-bolt has been thrown rearwardly by gas pressure impinging upon the forward edge of the tubular-piston 20, in a manner as will hereinafter appear.

As is usual in automatic firearms, the rearward movement of the breech-bolt 28 effects the extraction and ejection of a fired cartridge. Upon its forward travel under the urge of the breech-bolt-closing spring 30, the breech-bolt 28 acts to insert a fresh cartridge into the firing chamber of the arm preparatory to another cycle of operation under the control of a trigger 31. The said trigger 31 is located within a trigger-guard 32 which forms a rigid feature of a trigger-plate 33 secured in any suitable manner to the under side of the receiver 10, all as more fully set forth in detail in my copending application Serial No. 136,523 filed April 13, 1937.

For the purpose of enabling a user of the firearm to manually retract the breech-bolt 28 an L-shaped link 34 (Fig. 1) is employed. The link 34 just referred to, comprises a relatively-long substantially-horizontal arm 35 from the forward end of which downwardly extends a substantially-vertical and relatively-short arm 36. The substantially-vertical arm 36 of the link 34 is operatively coupled to the forward portion of the action-slide 26 by means of a stud 37 and the rear end of its complemental arm 35 is guided for reciprocating movement in a guide-groove 38 formed in the side wall of the receiver 10. The rear end of the horizontal arm 35 of the link 34 is provided with an operating-handle 39, as shown in Fig. 1.

Adjacent its rear end the action-slide 26 has pivotally connected to it the lower end of the breech-bolt-operating link 27 which has its upper end pivotally connected to the lower rear portion of the breech-bolt 28 as before referred to. Through the intermediary of the link 27 the action-slide 26, upon its rearward travel, effects the rearward retraction of the said breech-bolt 28 and conversely on its forward movement the said action-slide effects the advance of the breech-bolt 28 into its breech-closing position and the locking thereof in the latter position.

Extending rearwardly over the piston-guiding portion 18 of the barrel 11 in radially spaced relationship with respect thereto, is the skirt 40 having approximately ten thousandths of an inch clearance with respect to the outer surface of the piston 20 of a cylinder generally designated by the reference character 41. The said cylinder also has an internally-threaded forward portion 42 threaded onto an externally-threaded portion 43 formed on the barrel 11 immediately forwardly of the piston-guiding portion 18 thereof. As thus mounted upon the barrel 11 the cylinder 41 is adapted to be adjusted to positions either slightly rearwardly or slightly forwardly of the position in which it is shown in Figs. 1, 2 and 3, in order to further close off or further open up more of the cross-sectional area of a gas-port 44 extending radially through the wall of the barrel 11 from the interior bore 12 thereof to the exterior surface of the piston-guiding portion 18 of the said barrel. In registry with the outer terminus of the gas-port 44 is a notch 45 formed in the rear edge of the tubular-piston 20.

As the parts above described are constructed and arranged, there is provided a tubular gas-chamber 46 between the periphery of the piston-guiding portion 18 of the barrel 11 and the interior surface of the skirt 40 of the cylinder 41.

Normally located in the tubular gas-chamber 46 just above referred to, is the tubular-piston 20 which is adapted to be forced rearwardly for the operation of the firearm, by means of a gas escaping from the bore 12 radially outwardly through the gas-port 44 into the forward end of the said gas-chamber 46 in registration with the notch 45 in the forward edge of the tubular-piston 20.

The rear portion of the outer periphery of the skirt 40 of the cylinder 41, is provided with an annular groove 47 in which is seated the forward end of a tubular-guard 48 preferably formed of light sheet metal and having its rear end seated against the forward end of the stock 13. The said tubular-guard 48 is so sized and shaped as to provide clearance for the rearward travel of the tubular-piston 20 and for the movement of the actuating-rod 21.

For brevity of description it may be stated that the breech-bolt 28 and associated parts which are actuated by the action-slide 26 are to be considered as constituting the so-called "action" of the firearm illustrated, in accordance with well understood terminology in the art.

For the purpose of making clear the operation of the firearm herein chosen for illustration, let it be assumed that the tubular-piston 20 is occupying the position in which it is shown in Figs. 1 and 2 of the accompanying drawing, under the urge of the breech-bolt-closing spring 30.

Now when the trigger 31 is operated in the usual manner of firearms, a cartridge will be discharged with the result that the projectile will be propelled forwardly through the bore 12 of the barrel 11 under the force of the burning powder charge. As the projectile passes beyond the inner end of the gas-port 44 the gas under pressure back of the said projectile, will escape radially outwardly through the said gas-port 44 into the tubular gas-chamber 46 to thereby "kick" so to speak, the tubular-piston 20 rearwardly with the result that the actuating-rod 21, the action-slide 26, the breech-bolt 28 and associated parts will all be moved rearwardly against the tension of the spring 30. In this manner the casing of the fired cartridge will be ejected and the firing mechanism will be cocked preparatory to the return movement of the breech-block 28, action-slide 26 and associated parts to their former positions as illustrated in Figs. 1 and 2.

As is usual in automatic firearms, when the breech-bolt 28 moves forwardly after having been retired in the manner above described the said breech-bolt will insert a fresh cartridge into the cartridge chamber in the rear end of the barrel 11, preparatory to again firing the gun by means of the actuation of the trigger 31.

As the tubular-piston 20 moves rearwardly when the firearm is discharged, the said piston will pass rearwardly off from the piston-guiding portion 18 of the barrel 11 and beyond the rear edge of the skirt 40 of the cylinder 41. During its rearward movement as just above described, the tubular-piston 20 will assume substantially the position in which it is shown in Fig. 3 in which it will be noted that the axis of the said tubular-piston and the barrel 11 now have an angular relationship due to the downward travel of the rear end of the actuating-rod 21 caused by its attachment to the forward end of the action-slide 26. Since the actuating-rod 21 is rigid with the tubular-piston 20 it follows that the piston 20 will be canted as it travels rearwardly. Owing however to the fact that the piston 20 rides off from the piston-guiding portion 18 of the barrel 11 shortly after its rearward movement is initiated the cramping of the said piston upon the piston-guiding portion 18 is avoided.

When the tubular piston 20 moves forwardly from the position in which it is shown in Fig. 3 to the position in which it is shown in Figs. 1 and 2, the tapering-junction 49 between the piston-releasing portion 19 and the rear end of the piston-guiding portion 18 will serve to insure that the said piston is guided concentrically into the tubular gas-chamber 46 preparatory to another cycle of operation.

In the general manner above described the tubular-piston 20 or its equivalent is prevented from harmfully binding upon the barrel by permitting the said piston to move rearwardly over a portion of the barrel having very materially smaller diameter than the interior diameter of the said piston, thus enabling a very simple, reliable and effective construction and arrangement of parts to be employed.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston operatively-connected to the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a relatively-large-diameter piston-guiding portion relatively-snugly fitting the interior of the said tubular-piston, and the said barrel also having a relatively-small-diameter piston-releasing portion adjacent to the said piston-guiding portion and fitting the interior of the said tubular-piston to a degree freely permitting the appreciable tilting or canting thereof with respect to the axis of the said barrel; and means for applying gas pressure from the interior of the said barrel to the said tubular-piston for moving the same off from the piston-guiding portion of the said barrel and onto the piston-releasing portion thereof and in a direction required to operate the said firearm-action; whereby the said tubular-piston upon being moved over the piston-releasing portion of the said barrel is freed for tilting movement with respect to the axis of the said barrel to thus guard against the cramping of the said tubular-piston upon the said barrel.

2. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston operatively-connected to the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a relatively-large-diameter piston-guiding portion relatively-snugly fitting the interior of the said tubular-piston, and the said barrel also having a relatively-small-diameter piston-releasing portion located immediately to the rear of the said piston-guiding portion and freely fitting the interior of the said tubular-piston to a degree freely permitting the appreciable tilting or canting thereof with respect to the axis of the said barrel; and means for applying gas pressure from the interior of the said barrel to the forward edge of the said tubular-piston for moving the same rearwardly off from the piston-guiding portion of the said barrel and onto the piston-releasing portion thereof to effect the operation of the said firearm-action; whereby the said tubular-piston upon being moved rearwardly over the piston-releasing portion of the said barrel is freed for tilting movement with respect to the axis of the said barrel to thus guard against the cramping of the said tubular-piston upon the said barrel.

3. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; a barrel extending through the hollow interior of the said tubular-piston and having a relatively-large-diameter piston-guiding portion relatively-snugly fitting the interior of the said tubular-piston, and the said barrel also having a relatively-small-diameter piston-releasing portion adjacent to the said piston-guiding portion and fitting the interior of the said tubular-piston to a degree freely permitting the appreciable tilting or canting thereof with respect to the axis of the said barrel; an actuating-rod operatively connected to the said tubular-piston for being moved thereby and also operatively connected to the said firearm-action; and means for applying gas-pressure from the interior of the said barrel to the said tubular-piston for moving the same off from the piston-guiding portion of the said barrel and onto the piston-releasing portion thereof and in a direction required to cause the said actuating-rod to operate the said firearm-action.

4. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; a barrel extending through the hollow interior of the said tubular-piston and having a relatively-large-diameter piston-guiding portion relatively-snugly fitting the interior of the said tubular-piston, and the said barrel also having a relatively-small-diameter piston-releasing portion located immediately to the rear of the said piston-guiding portion and fitting the interior of the said tubular-piston to a degree freely permitting the appreciable tilting or canting thereof with respect to the axis of the said barrel; an actuating-rod operatively connected to the said tubular-piston and extending rearwardly therefrom and operatively connected to the said firearm-action; and means for applying gas-pressure from the interior of the said barrel to the forward edge of the said tubular-piston for moving the same rearwardly off from the piston-guiding portion of the said barrel and onto the piston-releasing portion thereof.

5. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; a barrel extending through the hollow interior of the said tubular-piston and having a relatively-large-diameter piston-guiding portion

relatively-snugly fitting the interior of the said tubular-piston, and the said barrel also having a relatively-small-diameter piston-releasing portion adjacent to the said piston-guiding portion and fitting the interior of the said tubular-piston to a degree freely permitting the appreciable tilting of canting thereof with respect to the axis of the said barrel; an actuating-rod rigidly connected to the said tubular-piston and operatively connected to the said firearm-action; and means for applying gas pressure from the interior of the said barrel to the said tubular-piston for moving the same off on the piston-guiding portion of the said barrel and onto the piston-releasing portion thereof and in a direction required to cause the said actuating-rod to operate the said firearm-action

6. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; a barrel extending through the hollow interior of the said tubular-piston and having a relatively-large-diameter piston-guiding portion relatively-snugly fitting the interior of the said tubular-piston, and the said barrel also having a relatively-small-diameter piston-releasing portion located immediately to the rear of the said piston-guiding portion and fitting the interior of the said tubular-piston to a degree freely permitting the appreciable tilting or canting thereof with respect to the axis of the said barrel; an actuating-rod rigidly connected to the said tubular-piston and extending rearwardly therefrom into operative connection with the said firearm-action; and means for applying gas pressure from the interior of the said barrel to the forward edge of the said tubular-piston for moving the same rearwardly off from the piston-guiding portion of the said barrel and onto the piston-releasing portion thereon to effect the operation on the said firearm-action.

7. A gas-operated automatic firearm, including in combination: a firearm-action; a barrel provided upon its exterior with a piston-guiding portion adapted to relatively-snugly fit the interior of a tubular-piston, the said barrel also being provided with a piston-releasing portion located adjacent the said piston-guiding portion and of appreciably-lesser diameter than the same; a tubular-piston normally surrounding the piston-guiding portion of the said barrel and movable axially toward the said piston-releasing portion thereof; and means for applying gas pressure from the said barrel to one end of the said tubular-piston for moving the same axially of the said barrel from the piston-guiding portion thereof to the piston-releasing portion thereof to thereby permit the said tubular-piston to tilt with respect to the axis of the piston-guiding portion of the said barrel as the said tubular-piston moves axially under the impulse of gas pressure from the said barrel to effect the operation of the said firearm-action.

8. A gas-operated automatic firearm, including in combination: a barrel provided upon its exterior with a piston-guiding portion adapted to relatively-snugly fit the interior of a tubular-piston, the said barrel also being provided with a piston-releasing portion located immediately adjacent the said piston-guiding portion and of appreciably-lesser diameter than the same; a breech-bolt; an action-slide mounted for reciprocation in an oblique path with respect to the axis of the said barrel and operatively connected to the said breech-bolt; a tubular-piston normally surrounding the piston-guiding portion of the said barrel and movable axially toward the said piston-releasing portion thereof and operatively connected to the said action-slide; and means for applying gas-pressure from the said barrel to one end of the said tubular-piston for moving the same axially with respect to the said barrel from the said piston-guiding portion thereof onto the piston-releasing portion thereof, to thereby permit the said tubular-piston to tilt with respect to the axis of the piston-guiding portion of the said barrel as the said tubular-piston moves axially under the impulse of gas-pressure from the said barrel to effect the operation of the said action-slide and breech-bolt.

9. A gas-operated automatic firearm, including in combination: a barrel provided upon its exterior with a piston-guiding portion adapted to relatively-snugly fit the interior of a tubular-piston, the said barrel also being provided with a piston-releasing portion located immediately adjacent the said piston-guiding portion and of appreciably-lesser diameter than the same; a breech-bolt; an action-slide mounted for reciprocation in an oblique path with respect to the axis of the said barrel and operatively-connected to the said breech-bolt; a tubular-piston normally surrounding the piston-guiding portion of the said barrel and movable axially onto the said piston-releasing portions thereof; an actuating-rod operatively-interposed between the said tubular-piston and the said action-slide; and means for applying gas-pressure from the said barrel to one end of the said tubular piston for moving the same axially with respect to the said barrel from the said piston-guiding portion thereof onto the piston-releasing portion thereof as the said tubular piston moves axially under the impulse of gas-pressure from the said barrel to effect the operation of the said actuating-rod, action-slide and breech-bolt.

10. A gas-operated automatic firearm, including in combination: a barrel provided upon its exterior with a piston-guiding portion adapted to relatively-snugly fit the interior of a tubular-piston, the said barrel also being provided with a piston-releasing portion located immediately to the rear of the said piston-guiding portion and of appreciably-lesser diameter than the same; a breech-bolt; an action-slide mounted for reciprocation in an oblique path with respect to the axis of the said barrel and operatively-connected to the said breech-bolt; a tubular-piston normally surrounding the piston-guiding portion of the said barrel and movable axially onto the said piston-releasing portions thereof; an actuating-rod rigidly connected at its forward end to the said tubular-piston and operatively connected adjacent its rear end to the said action-slide; and means for applying gas-pressure from the said barrel to the forward end of the said tubular-piston for moving the same axially with respect to the said barrel from the said piston-guiding portion thereof onto the piston-releasing portion thereof as the said tubular-piston moves axially under the impulse of gas-pressure from the said barrel to effect the operation of the said actuating-rod, action-slide and breech-bolt.

JONATHAN E. BROWNING.