

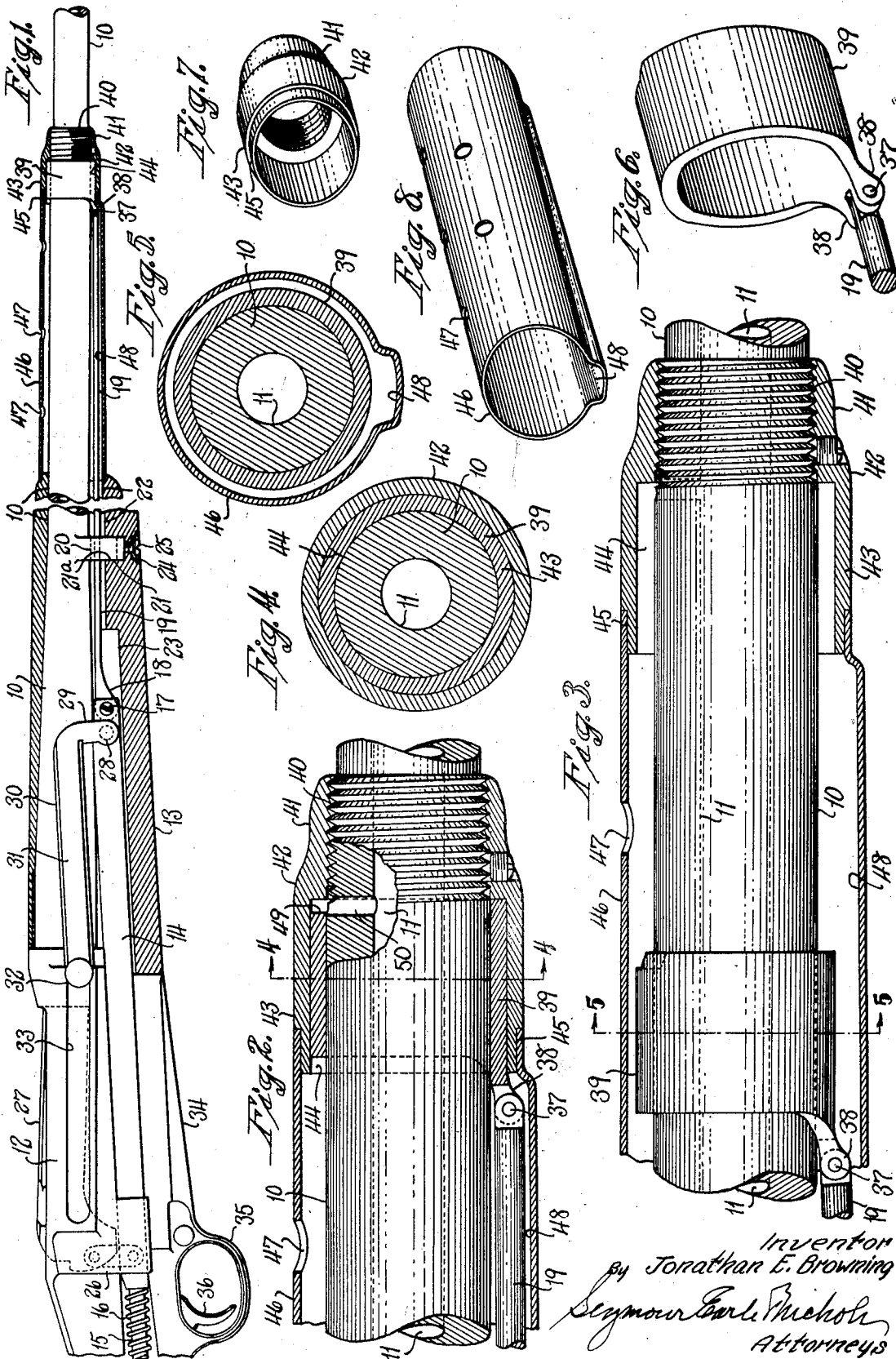
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GAS-OPERATED AUTOMATIC FIREARM

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## GAS-OPERATED AUTOMATIC FIREARM

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The present invention relates to improvements in automatic firearms wherein gas-pressure developed by the firing of a cartridge is utilized to effect the ejection of the fired cartridge and re-loading of the firearm with a fresh cartridge preparatory to again firing the firearm.

One of the main objects of the present invention is to provide a superior gas-operated automatic firearm of the type referred to in which the "kick" incident to the discharge thereof is appreciably lessened in its effect upon the marksman.

Another object of the present invention is to provide a simple, reliable and effective organization of parts in a gas-operated automatic firearm, whereby compactness and low cost of manufacture are achieved.

A further object is to provide a superior gas-operated automatic firearm in which a piston is employed for operating the action of the firearm and in which the impulse imparted to the said piston by the burning or burnt gases is automatically diminished to a very marked degree as the piston approaches the limit of its travel under the impulse of the said gases.

Still another object of the present invention is to provide a superior gas-operated automatic firearm wherein provision is made to enable the gases which actuate the piston to set up counter-recoil forces to measurably offset the recoil initiated by the discharge of a cartridge.

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 may assume in accordance with the present invention;

Fig. 2 is a fragmentary view on a larger scale than Fig. 1 and partly in side elevation and partly in vertical central-longitudinal section of the portion of the firearm immediately adjacent the piston and cylinder thereof;

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

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

Fig. 5 is a similar 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 connected thereto;

Fig. 7 is a perspective view of the cylinder detached; and

Fig. 8 is a perspective view of the guard-tube detached.

For the purpose of illustration, a gas-operated automatic rifle has been chosen for illustration in the accompanying drawing and will be hereinafter described in detail.

The automatic rifle illustrated in the accompanying drawing includes a barrel 10 having the usual axial bore 11 and rigidly attached at its rear end to a receiver 12. Attached to the barrel 10 and the receiver 12 is a stock 13 preferably formed of wood or other heat-insulating and shock-absorbing material.

Reciprocating in an oblique path with respect to the axis of the barrel 10 and along the side of the receiver 12, is an action-slide 14 having a rearwardly-extending spring-plunger 15 encircled by a helical breech-bolt-closing spring 16 acting to yieldingly urge the said action-slide 14 and connected parts forwardly. The forward end of the action-slide 14 is pivotally connected by means of a screw-stud 17 to the rear head 18 of an actuating-rod 19. The said actuating-rod 19 reciprocates beneath the barrel 10 and extends through a clearance-passage 20 formed in a barrel-lug 21 and through an adjacent clearance-groove 22 formed in the stock 13. The rear portion of the actuating-rod 19 together with its rear head 18 and the forward portion of the action-slide 14 reciprocates in an upwardly-opening pocket 23 also formed in the stock 13 and communicating at its forward end by the clearance-groove 22 already referred to.

The stock-attaching lug 21 above referred to extends downwardly into a socket 21a extending downwardly from the bottom of the clearance-groove 22. Extending upwardly through an escutcheon 24 mounted in the under-face of the stock 13 is a screw 25 threaded into the lower portion of the stock-attaching lug 21.

As will be seen by reference to Fig. 1 the rear end of the action-slide 14 has pivotally connected to it the lower end of a breech-bolt-operating link 26. The said link 26 has its upper end pivotally connected to the lower rear portion of a breech-bolt 27 movable within the receiver 12.

For the purpose of enabling the action-slide 14 and associated parts to be manually operated the said action-slide has pivotally connected to it by means of a stud 28, the relatively-short vertical arm 29 of an L-shaped link 30. The said L-shaped link also includes a relatively-long substantially-horizontal arm 31 which is provided at its rear end with an operating handle 32 and which reciprocates in a guide-way 33 formed in the side wall of the receiver 12.

Secured in any suitable manner to the under portion of the receiver 12 is a trigger plate 34 formed with a loop-like trigger guard 35 in which is located a trigger 36 controlling the firing of the automatic rifle in any suitable manner not herein requiring detailed description as for instance, is more fully set forth in my copending application Ser. No. 136,523 filed April 13, 1937.

Returning now to the actuating-rod 19 before referred to, it will be noted that the forward end thereof is pivotally connected by means of a rivet 37 or the like to a bifurcated ear 38 projecting rearwardly from the lower portion of a tubular-piston 39. The tubular-piston 39 just referred to, encircles the barrel 10 adjacent the forward end thereof. The internal diameter of the tubular-piston 39 and the external diameter of the adjacent portion of the barrel 10 are so related as to provide for the smooth and relatively free sliding fit required to permit the said tubular-piston to reciprocate freely on the said barrel.

Immediately forwardly of the foremost position of the piston 39, the barrel 10 is provided with an externally-threaded portion 40 onto which is threaded the internally-threaded forward portion 41 of a cylinder 42. The said cylinder 42 is provided with a rearwardly-extending annular skirt 43 having an internal diameter proportioned to receive with a free sliding fit, the tubular-piston 39 before referred to. As thus constructed and arranged the interior surface of the skirt 43 of the cylinder 42 is uniformly spaced outwardly from the periphery of the adjacent portion of the barrel 10 so as to provide a gas-chamber 44 of tubular form and in which the tubular-piston 39 is normally located.

The outer rear portion of the skirt 43 of the cylinder 42 is cut away to provide an annular groove 45 in which fits the forward portion of a guard-tube 46 which is preferably formed of sheet metal and provided with a plurality of vent-openings 47. The rear end of the guard-tube 46 is in seated engagement with the forward portion of the stock 13 as is shown in Fig. 1. The said guard-tube 46 is provided in its lower portion with a depressed or outwardly-projected portion resulting in the formation of a trough 48 provided for the clearance of the forward portion of the actuating-rod 19 and the bifurcated ear 38 of the tubular-piston 39.

Leading radially outwardly from the bore 11 of the barrel 10 to the periphery of the said barrel at a point intersecting the forward end of the gas-chamber 44 and in registry with a notch 49 in the tubular-piston 39 is a gas-port 50. The effective cross-sectional area of the outer end of the gas-port 50 just referred to, may be varied as desired by threading the cylinder 42 rearwardly or forwardly to cover or uncover a greater or lesser extent of the said gas-port.

For convenience of description the breech-bolt 27 and its associated parts which are actuated or motivated by the action-slide 14, may be considered as constituting the so-called "action" 75

of the firearm herein chosen for illustration, in accordance with well understood terminology in the art.

In order that the operation of the automatic fire-arm above described and illustrated in the accompanying drawing may be understood, let it be assumed that the fire-arm is loaded preparatory to being fired and that the tubular-piston 39 is in its forward position as illustrated in Figs. 1 and 2 of the accompanying drawing.

If now the trigger 36 is operated, the cartridge in the cartridge-chamber of the firearm will be discharged with the result that the projectile will be propelled forwardly through the bore 11 of the barrel 10 under the force of the burning powder charge. As the projectile passes beyond the inner end of the gas-port 50, the gas under pressure back of the said projectile will escape radially outwardly through the said gas-port 50 into the tubular gas-chamber 44. The entry of gas into the forward portion of the tubular gas-chamber 44 will result in the tubular-piston 39 being "kicked" so to speak, rearwardly thus causing the actuating-rod 19, action-slide 14, breech-bolt 27 and associated parts to be moved rearwardly against the counter-urge of the breech-bolt-closing spring 16. By this operation of the firearm the casing of the cartridge which has just been fired will be ejected and the firing mechanism will be cocked preparatory to the return movement of the breech-bolt 27, action-slide 14 and associated parts to their former positions in which they are illustrated Figs. 1 and 2.

In its rearward movement the tubular-piston 39 will ride completely out of the gas-chamber 44 and out of engagement with the skirt 43 of the cylinder 42 with the result that there will be a sudden release of gas pressure from the said gas-chamber 44. The gas escaping from the gas-chamber 44 when the tubular-piston 39 moves rearwardly as just described, will travel rearwardly in the space between the barrel 10 and the inner surface of the guard-tube 46 and thence outwardly through the vent openings 47 therein with the effect of producing a counter-recoil effect measurably offsetting or softening the total effect of the recoil occasioned by the initial firing of the firearm.

In addition the counter-recoil effect above referred to the rearward movement of the tubular-piston 39 completely out of the gas-chamber 44 in the cylinder 42 will cause a marked diminution in the force applied to the said tubular-piston during the latter part of its rearward movement, thus enabling the said piston to slow down at a much greater rate than would be the case were the gas pressure applied to the front end of the piston to be permitted to continue the active propulsion of the said tubular-piston throughout the entire rearward travel thereof. The effect just described serves to provide maximum power to initiate the rearward travel of the breech-bolt 27 to effect the extraction of the cartridge case of the just-fired cartridge. After the initial impulse imparted to the breech-bolt 27 and associated parts, the rearward urge upon the tubular-piston 39 for a major portion of its rearward travel is so markedly lessened as to automatically avoid without the use of complex mechanisms, the injury to the firearm-action and associated parts incident to their stoppage at the limit of their rearward travel prior to their forward travel back into the position in which they

are shown in Figs. 1 and 2 preparatory to another cycle of operation of the firearm.

In a manner common in automatic firearms the breech-bolt 27, after having reached a limit of its rearward travel under the impulse imparted to it by the initial movement of the tubular-piston 39, moves forwardly under the urge of the breech-bolt-closing spring 16 to effect the insertion of a fresh cartridge into the cartridge chamber of the firearm, preparatory to the firing thereof.

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; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; and a cylinder mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing a tubular gas-chamber therebetween in communication with the said gas-port in the said barrel; the said operating-connections being operable to move the tubular-piston into the said tubular gas-chamber to position the same therein; the said tubular-piston positioned in the gas-chamber being subject to the pressure of the gas to move outwardly with respect to the gas-chamber, and the said tubular gas-chamber formed between the said cylinder and barrel being materially shorter in a direction along the axis of the said barrel than is the stroke of the said tubular-piston, whereby the said tubular-piston in its travel moves out of the said gas-chamber and thereby permits the gas to freely escape from the said gas-chamber.

2. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; and a cylinder mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing a rearwardly-opening tubular gas-chamber therebetween in communication with the said gas-port in the said barrel; the said operating-connections being operable to move the tubular-piston into the said tubular gas-chamber to position the same therein; the said tubular-piston positioned in the gas-chamber being subject to the pressure of the gas to move outwardly with respect to the gas-chamber, and the said rearwardly-opening gas-chamber formed between the said cylinder and barrel being materially shorter in a direction along the axis of the said barrel than is the stroke of the said tubular-piston, whereby the said tubular-piston in its rearward travel moves out of the said rearwardly-opening tubular gas-chamber and thereby permits the gas to freely escape from the said gas-chamber.

3. A gas-operated automatic firearm, including

in combination: a firearm-action; a tubular-piston; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston; a cylinder mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing therebetween a rearwardly-opening tubular gas-chamber closed at the forward end thereof; gas-admitting means communicating with the forward portion of the said gas-chamber for supplying gas under pressure thereto from the interior of the said barrel; and a guard-tube surrounding the said barrel and extending rearwardly from the said cylinder thereof and providing a channel around the said barrel for the accommodation of the said tubular-piston and having a cross-sectional area materially greater than the cross-sectional area of the said tubular-piston; the said tubular-piston being movable to pass from the said guard-tube into the said gas-chamber and into the said forward portion thereof adjacent the said gas-admitting means, the said tubular-piston being subject to the gas admitted to the gas-chamber to move rearwardly from the forward portion thereof, and the said gas-chamber formed between the said cylinder and barrel being materially shorter in a direction along the axis of the said barrel than is the stroke of the said tubular-piston, whereby the said tubular-piston in its travel rearwardly moves out of the said rearwardly-opening gas-chamber and into the said rearwardly-extending guard-tube and thereby permits the gas to freely escape from the said gas-chamber.

4. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; a cylinder mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing a tubular gas-chamber therebetween in communication with the said gas-port in the said barrel; the said operating-connections being operable to move the tubular-piston into the said tubular gas-chamber to position the same therein; and a guard-tube surrounding the said barrel adjacent to said cylinder thereon and providing a channel around the said barrel for the accommodation of the said tubular-piston and having a cross-sectional area materially greater than the cross-sectional area of the said tubular-piston; the said tubular-piston positioned in the gas-chamber being subject to the pressure of the gas to move outwardly with respect to the gas-chamber, and the said gas-chamber formed between the said cylinder and barrel being materially shorter in a direction along the axis of the said barrel than is the stroke of the said tubular-piston, whereby the said tubular-piston in its travel moves out of the said gas-chamber and into the said guard-tube and thereby permits the gas to freely escape from the said gas-chamber.

5. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; a cylin-

der mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing a rearwardly-opening tubular gas-chamber therebetween in communication with the said gas-port in the said barrel; the said operating-connections being operable to move the tubular-piston into the said tubular gas-chamber to position the same therein; and a guard-tube surrounding the said barrel and extending rearwardly from the said cylinder thereof and providing a chamber around the said barrel for the accommodation of the said tubular-piston and having a cross-sectional area materially greater than the cross-sectional area of the said tubular-piston; the said tubular-piston positioned in the gas-chamber being subject to the pressure of the gas to move outwardly with respect to the gas-chamber, and the said gas-chamber formed between the said cylinder and barrel being materially shorter in a direction along the axis of the said barrel than is the stroke of the said tubular-piston, whereby the said tubular-piston in its travel rearwardly moves out of the said rearwardly-opening gas-chamber and into the said rearwardly-extending guard-tube and thereby permits the gas to freely escape from the said gas-chamber.

6. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston provided in one edge with a notch; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; and a cylinder mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing a tubular gas-chamber therebetween; the said tubular-piston being movable to enter into the said gas-chamber and to be positioned therein with its said notch communicating with the said gas-port; the said tubular-piston being subject to the pressure of gas admitted to the said gas-chamber, and the latter being materially shorter in the direction of the barrel than the stroke of the piston, whereby the piston may be moved out of the said gas-chamber and permit the escape of gas therefrom.

7. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston provided in one edge with a notch; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; and a cylinder mounted upon the said barrel and having a cylindrical portion extending along a relatively-short portion of and surrounding the said barrel in radially-spaced relationship thereto and providing a tubular gas-chamber therebetween having its forward portion communicating with the said gas-port; the said tubular-piston being movable to enter into the said gas-chamber and to be

positioned in the forward portion thereof with its said notch communicating with the said gas-port; the tubular-piston being subject to the pressure of gas admitted to the said gas-chamber, and the said relatively-short portion of the cylinder providing a tubular gas-chamber which is materially shorter in axial direction than is the stroke of the said tubular-piston, whereby the said tubular-piston in its travel moves out of the said gas-chamber and thereby permits the gas to freely escape from the said gas-chamber.

8. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston having a notch in its forward edge; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; and a cylinder mounted upon the said barrel and having a cylindrical portion surrounding the said barrel in radially-spaced relationship thereto and providing therebetween a rearwardly-opening tubular gas-chamber closed at the forward end thereof; the said tubular-piston being movable to enter into the said gas-chamber and to be positioned with the notch in the forward edge thereof communicating with the said gas-port; the said tubular-piston being subject to the pressure of gas admitted to said gas-chamber, and the latter being materially shorter in the axial direction of the barrel than is the stroke of the tubular-piston, whereby the tubular-piston may move out of said gas-chamber and permit the escape of gas therefrom.

9. A gas-operated automatic firearm, including in combination: a firearm-action; a tubular-piston having a notch in its forward edge; operating-connections between the tubular-piston and the said firearm-action; a barrel extending through the hollow interior of the said tubular-piston and having a gas-port leading laterally from its interior to its exterior; and a cylinder mounted upon the said barrel and having a cylindrical portion extending along a relatively-short portion of and surrounding the said barrel in radially-spaced relationship thereto and providing therebetween a rearwardly-opening tubular gas-chamber closed at the forward end thereof; the said tubular-piston being movable into the said gas-chamber to bring the notch in the forward edge of the tubular-piston into communication with the said gas-port; the said tubular-piston being subject to the pressure of gas admitted to said gas-chamber and the said relatively-short portion of the cylinder providing a rearwardly-opening gas-chamber which is materially shorter in a direction along the axis of the said barrel than is the stroke of the said tubular-piston, whereby the said tubular-piston in its rearward travel moves out of the said rearwardly-opening tubular gas-chamber and thereby permits the gas to freely escape from the said gas-chamber.

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