April 6, 1948. A. E. KRAMER ET AL 2,438,924

MUZZLE CLOSURE DEVICE FOR GUNS

Filed Oct. 30, 1946 4 Sheets-Sheet 1

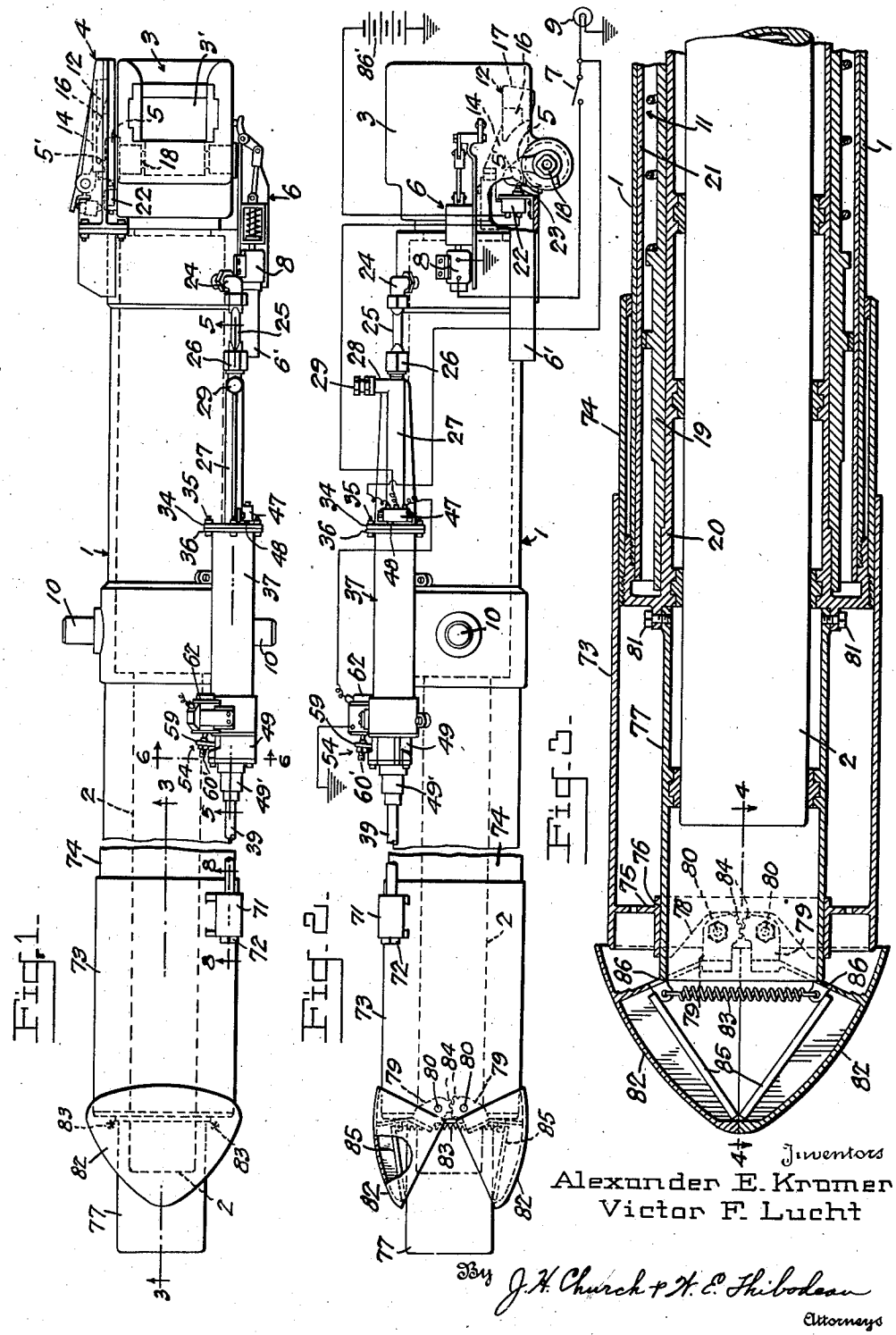


Fig. 1.

Fig. 2.

Fig. 3.

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MUZZLE CLOSURE DEVICE FOR GUNS

Filed Oct. 30, 1946 4 Sheets-Sheet 2

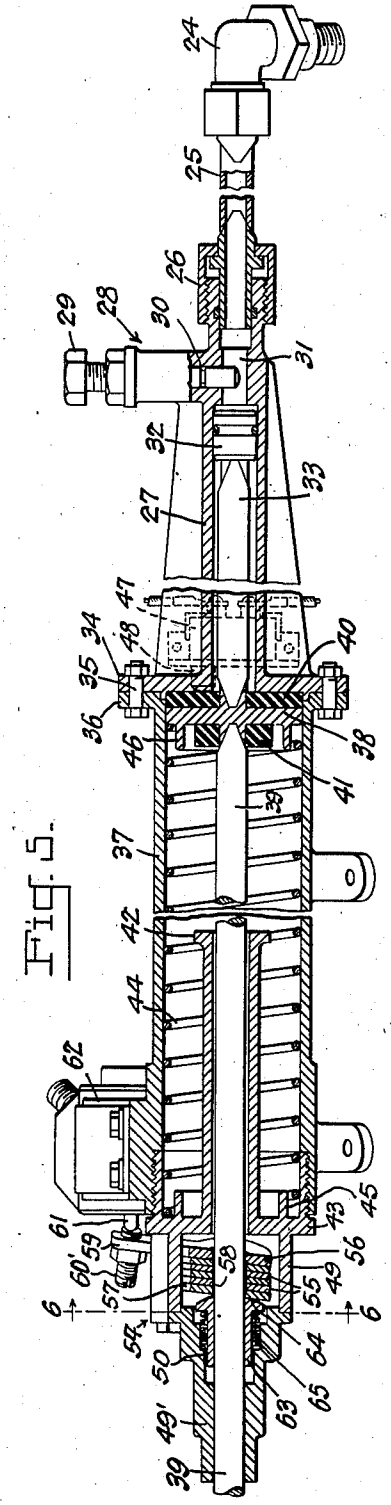


Fig. 5.

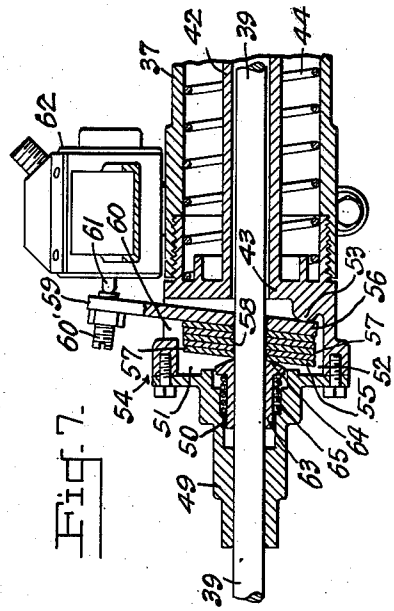


Fig. 7.

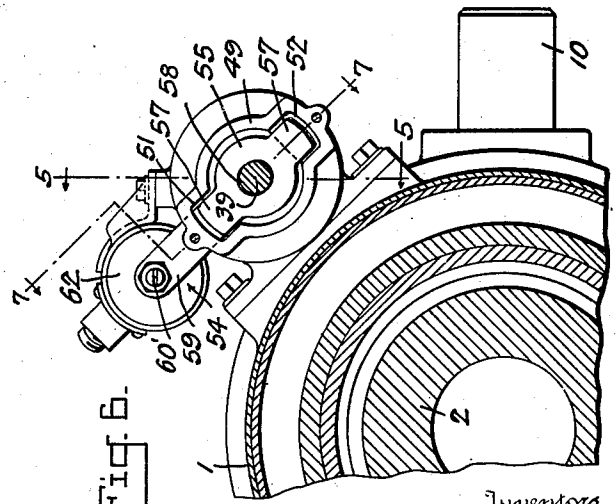


Fig. 6.

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MUZZLE CLOSURE DEVICE FOR GUNS

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Fig. 4.

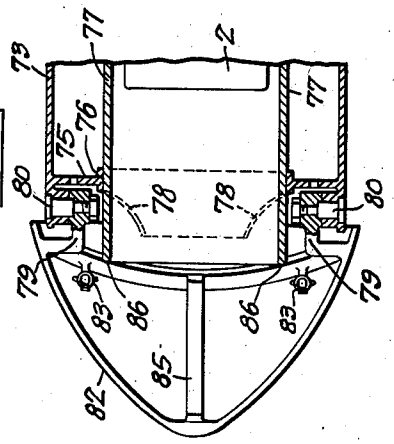


Fig. 8.

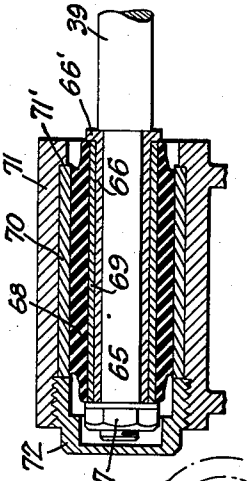


Fig. 13.

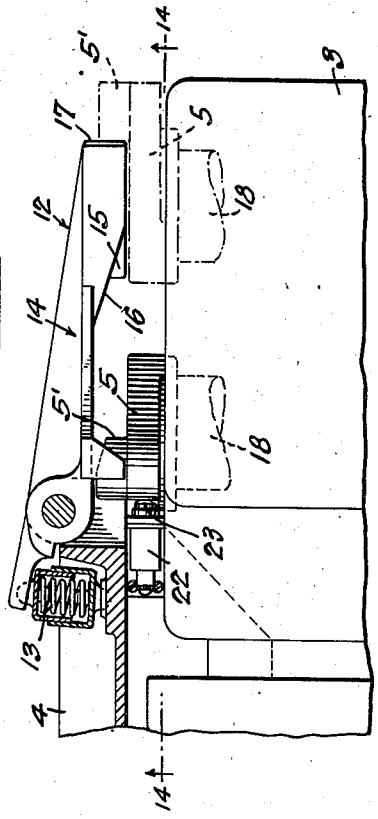
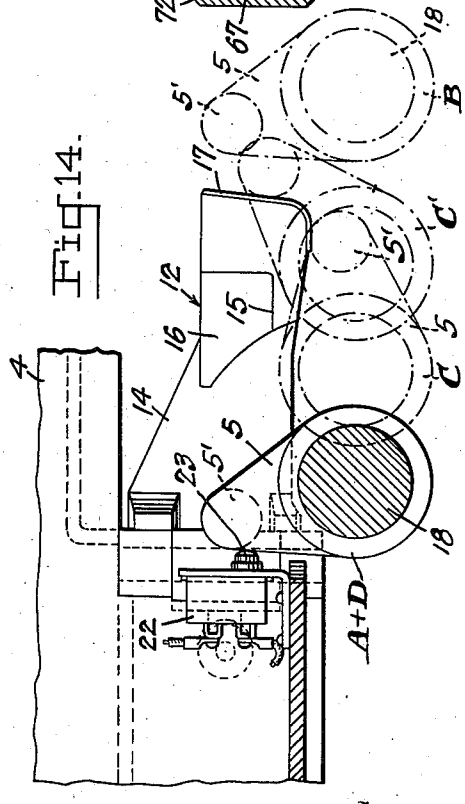


Fig. 14.



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MUZZLE CLOSURE DEVICE FOR GUNS

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UNITED STATES PATENT OFFICE

2,438,924

MUZZLE CLOSURE DEVICE FOR GUNS

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Application October 30, 1946, Serial No. 706,786

17 Claims. (Cl. 89—31)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to a muzzle closure device for guns, particularly those of the type mounted on a vehicle and equipped with a recoil mechanism having as a part thereof a hydraulic system.

This type is usually mounted in, but not necessarily limited to, a vehicle such as a plane, tank or armored car. The gun may be fired by a remote control device actuated by either the pilot, the vehicle operator or by some other member of the crew and may be loaded manually or by some other method.

A considerable amount of the propellent gases, products of the explosion and toxic in effect, have a tendency to remain in the gun barrel after firing. As a result, when the projectile leaves the gun barrel there is an inrush of air which, accentuated by the motion of the vehicle, will force these gases back through the breech, as it is being opened preparatory to ejecting the fired round and receiving a new one, and enter the gun compartment as well as other portions of the vehicle. In view of the confining nature and the enclosed space of these vehicles, the presence of the toxic gases is objectionable and often injurious to the occupants of the vehicles to the extent that they may become incapacitated to perform their duties.

Furthermore, when the gun is mounted in the nose of a plane or on some other rapidly moving vehicle, the wind pressure in the gun barrel will, at times, be sufficiently great either to prevent the loading of the gun or to force a round of ammunition out of the breech recess. This in turn requires that considerable force be exerted upon the shell in order to shove it home in the gun chamber and trip the extractors to close the breechblock and consequently places an undue strain upon any individual attempting to load the gun or upon any mechanical loading equipment.

The object of the invention is to provide a cover or shield device that will function upon the leaving of a projectile from the gun barrel to close or cover its muzzle end to minimize the effect of wind pressure and thus prevent the gun powder fumes from being blown back through the open breech recess and also facilitate the insertion of a new round of ammunition into firing position with a minimum of effort.

A further object is to provide a muzzle closure device that can be installed upon present guns with a minimum of modification thereof.

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A still additional object is to provide a muzzle closure device that will not materially affect space and weight requirements which are limited in vehicles.

Incidental objects to the above, particularly during storage of the weapon or during inactive periods, is to protect the bore of the gun barrel against injury from moisture, accumulation of dirt, or entry of any foreign matter.

The foregoing and other objects of the invention will become apparent by reference to the specification and attached drawings in which:

Figure 1 is a plan view of the muzzle closure device attached to a gun, the device being shown in open position prior to the firing of the gun;

Figure 2 is a side elevational view of Figure 1 with the addition of a schematic showing of the electrical circuits involved;

Figure 3 is a fragmentary vertical longitudinal sectional view taken through line 3—3 of Figure 1 but showing the muzzle closure device in a closed position to cover the gun muzzle;

Figure 4 is a fragmentary horizontal longitudinal section taken through line 4—4 of Figure 3;

Figure 5 is a vertical longitudinal sectional view of the oil-actuated power cylinder for operating the closure device and is taken through line 5—5 Figures 1 and 6;

Figure 6 is a vertical transverse section through line 6—6 of Figures 1 and 5 showing details of the actuating mechanism for the closure device;

Figure 7 is a fragmentary view taken through line 7—7 of Figure 6 showing details of the one-way friction brake mechanism;

Figure 8 is a vertical longitudinal sectional view through line 8—8 of Figure 1 showing details of the flexible connection between the driving piston rod, actuated by the mechanism of Figure 5, and the driven concentric front tube carrying closure members;

Figures 9, 10, 11 and 12 are schematic wiring diagrams showing the relationship between the various electrical components and the parts of the muzzle closure device during different stages in the cycle of operation involved between the firing of the gun and the functioning of the muzzle closure device;

Figure 13 is an enlarged fragmentary top view of Figure 1 showing the manner of cooperation between the crank cam, the breech-operating crank and the single-pole switch; and

Figure 14 is an elevational view taken through lines 14—14 of Figure 13 showing the breech-operating crank in positions corresponding to those illustrated in Figures 9, 10, 11 and 12.

The invention is applied to a gun which, as shown in Figures 1 and 2, is equipped with a stationary cradle tube 1, a gun barrel 2 slidably mounted therein, a breech mechanism 3 containing a breech block 3', a stationary recoil guide 4, a breech operating crank 5 and an electrically-operated firing device 6 energized by a hand-operated firing switch 7. A signal light 9 is connected in parallel with the switch 7 and a firing solenoid 8. When the light 9 is illuminated, it indicates that the breech block 3' has been closed and the gun is ready for firing.

The stationary cradle tube 1 is pivotally positioned through a pair of diametrically positioned trunnions 10 in a suitable stationary support of the vehicle. The stationary cradle tube 1 houses a combined hydraulic and spring recoil mechanism generally indicated by reference numeral 11, mounted coaxially about the gun barrel 2. This type of hydrospring recoil mechanism may be similar to that described in Patent No. 2,358,340, issued September 19, 1944, for Recoil mechanism.

The stationary recoil guide 4 is fastened to the right rear side of the cradle tube 1 and cooperates with the gun barrel 2 to prevent rotation thereof during firing. The recoil guide 4 as shown more clearly in Figures 13 and 14 has pivoted thereon a cam lever 12 spring pressed towards the breech of the gun by an enclosed spring 13. The cam lever 12 has an arm 14 provided with a horizontal ledge 15 and a tapered surface 16 adjacent to and above the ledge 15. Cooperating with the cam lever 12 is a breech-operating crank 5 having a bevelled crank pin 5'.

The breech-operating crank 5 is fastened to the breech-operating shaft 18 which, through a breech-block crank not shown, causes the breech-block 3' to rise (close) or drop (open) in a manner well known to the art and the details thereof form no part of the present invention.

The firing switch 7, which is usually located at a distance from the gun and when closed energizes the firing solenoid 8 of the firing mechanism 6 which in turn actuates a firing pin in the conventional manner.

When the gun is fired, it will recoil to the rear carrying with it the breech mechanism 3, including the breech-operating crank 5 in a substantially vertical position, causing the end of the crank pin 5' thereof to ride along and bear against the tapered surface 16 of the arm 14, pushing it aside against the action of the compression spring 13 until the crank pin 5' rides off the lever end 17, as shown by position "B" in Figures 10 and 14, whereupon the lever 12 will be returned to its original position by the spring 13.

Upon completion of the recoil movement, the gun will be returned forwardly in counterrecoil at battery position by the recoil mechanism 11. With this forward movement, the crank 5 is also carried to the front with the breech mechanism 3, but during this forward movement, the crank pin 5' will strike the lever end 17, as shown by position "C'" in Figure 14, and be revolved thereby in a clockwise direction to the substantially horizontal position shown as position "C" in Figures 11 and 14 and be held in that revolved position against return in the opposite direction by the under surface of the ledge 15 during further forward movement in counterrecoil by the gun. This clockwise rotation of the crank pin 5' will cause the shaft 18 to drop (open) the breechblock 3' which in turn will actuate the extractor devices, not shown, within the breech

mechanism 3 to extract the spent empty case and lock the breechblock 3' in its down (open) position and thus retain the crank pin 5' substantially horizontal, but as the counterrecoil movement is completed, the crank 5' will clear the ledge 15.

When a new round is thrown into the breech, it will rock the extractor devices to unlock the breechblock 3', whereupon a spring assembly, generally indicated by the reference numeral 6', will raise (close) the breechblock 3' and return the crank 5 in a counterclockwise movement to its original substantially vertical position, as shown in Figures 12 and 14, as position "D" preparatory to riding against the tapered surface 16 when the gun again recoils.

As explained in Patent No. 2,358,340 a recoil cylinder 19 is fastened directly to and therefore moves with the barrel 2. The cylinder 19 slides between the inner concentric sleeve 20 and the other tube 1 attached to the trunnions 10. The inner sleeve 20 and tube 1 are rigidly secured together and form an elongated annular chamber containing the hydraulic and spring mechanism of the recoil system. A liner 21 is added to the tube 1 to provide rigidity and strength for the same.

When the gun is fired, recoil action will carry the recoil piston cylinder 19 backwardly forcing oil of the hydraulic mechanism to the rear of the chamber provided between the sleeve 20 and the tube 1 to cushion the shock of recoil in the manner described in the patent mentioned above.

The mechanism and elements thus far described relate to parts usually found on weapons of the type mentioned and form no part of our invention. They therefore have been only generally illustrated and briefly described to indicate the application of the invention. Further description of these parts will henceforth be limited to their manner of cooperation with the various parts of the invention to be now explained in detail.

A single-throw switch 22, having a push button 23, is attached to the stationary recoil guide 4 and in the path of movement of the breech operating crank arm 5. The push button 23 is operated by the crank arm 5 to close the switch 22 when the gun is in battery position, as shown in Figures 9 and 14, and open the switch 22 when the gun is moved rearwardly in recoil carrying with it the crank 5, as shown by Figures 10 and 14, all for a purpose to be described.

A quantity of the oil in the annular chamber between sleeve 20 and tube 1, forced to the rear as the cylinder 19 moves in recoil with the gun barrel 2, will be fed through an elbow fitting 24 to a pipe 25 which is connected by a conventional coupling 26 to a ribbed oil cylinder 27 through a throttle valve 28 containing a screw-threaded member 29 properly sealed at 30 against oil leakage, movement of the member 29 in or out relative to the passage 31 regulating the oil pressure in the oil cylinder 27 against a piston 32 attached to a piston rod 33.

The oil cylinder 27 is flanged at 34 for attachment through bolts 35 to a flange 36 of a spring cylinder 37.

Slidably mounted in the spring cylinder 37 is a piston 38 rigidly secured to the piston rod 33 and to an elongated operating rod 39 which actuates the muzzle closure device in a manner to be described. The piston 38 is provided on each side with shock absorbing material 40 and 41 of rubber or other suitable material.

Rearward movement of the enlarged piston 38 is limited by the oil cylinder flange 34 and forward movement by a longitudinally extending sleeve 42 projecting from a forward cylinder head 43 and surrounding the elongated rod 39, the shock-absorbing material 40 and 41 cooperating with their respective stops 34 and 42 to eliminate shock and jarring of parts.

A compression spring 44 within the spring cylinder 37 opposes movement of the piston 38 and also functions to return the same to its battery position shown in Figure 5. The spring 44 has its ends seated on the annular flange 45 of the cylinder head 43 and the annular flange 46 of the piston 38.

A double-throw switch 47 is mounted on the oil cylinder frame 27, and is provided with an operating rod 48 slidably guided in the cylinder flange 34 for contacting and actuation by the enlarged piston 38.

The forward cylinder head 43 is provided with a friction brake housing 49 having an outboard bearing 49', an annular stepped recess 50, channel-shaped grooves 51 and 52 and a rounded projection 53 in the slot 52.

A one-way brake device 54 is enclosed by the housing 49 and consists of a series of abutting metallic plates 55 and 56. Each plate 55, as shown in end view of Figure 6, is substantially circular and provided with diametrically opposite tongue portions 57 slidably received in the slots 51 and 52, and a central aperture 58 having a diameter slightly larger than that of the rod 39, for loosely receiving the same thus permitting the plates to tilt relative to the rod 39.

The end plate 56 of the one-way brake device 54 has a configuration similar to that of plates 55 with the exception that the plate 56 is substantially thicker than the plates 55 and has one of its tongue portions extended through and guided by a slot 60 in the groove 51 to form a lever arm 59 for actuating the one-way friction brake. The lever arm 59 is provided at one end thereof with an adjustable screw stop 60' contacting a solenoid plunger 61 actuated by a solenoid 62 carried by the air cylinder 37.

The outboard bearing 49 slidably supports the reciprocating rod 39 which in turn slidably carries a collar 63 provided with a concave surface 64 and forced by a compression spring 65 within the recess 50 against the friction plates 55 and 56.

As shown in Figure 7, the projection 53 functions as a pivot for the friction plates and is slightly forward of the solenoid plunger 61 when the solenoid 62 is deenergized, as a result of which the friction plates 55 and 56 are caused to assume a tilted position by the spring-pressed collar 63 and thus grip the rod 39 against movement of the same to the rear of the weapon, or to the right when viewed in Figure 7.

When the elongated rod 39 is moved in a direction toward the muzzle end of the weapon (to the left when viewed in Figure 7) the friction between it and the friction plates 55 and 56 will cause the same to pivot about the projection 53 and away from the solenoid plunger 61 against the action of the spring-pressed collar 63 to a substantially vertical position, shown diagrammatically in Figure 12, to allow the rod 39 to pass freely through the openings 58 in the friction plates 55 and 56.

However, upon slight movement of the rod 39 in a reverse direction to the rear (to the right in Figure 7) the friction between the rod 39 and the plate openings 58, assisted by the spring-pressed collar 63, will cause the plates 55 and 56 to be tilted about the projection 53 against the solenoid plunger 61 to grip the rod 39 against any further rearward motion.

During the proper interval in the operation cycle, to be explained later, when the solenoid 62 is energized, the solenoid plunger 61 is forced outwardly against the lever arm 59 causing the friction plates 55 and 56 to move or tilt counterclockwise, when viewed in Figure 7, about the projection 53 and against the surface 64 of the spring-pressed collar 63 to release the elongated rod 39 for rearward movement to battery position, shown in Figure 5, by the spring 44 acting against the piston 38 rigidly secured to the rod 39.

The forward portion of the piston rod 39, as shown in Figure 8, has a reduced threaded portion 65 for receiving a flanged sleeve 66 locked in place by a nut 67. An elongated rubber sleeve 68 is bonded to concentric metallic bushings 69 and 70. The inner bushing 69 is locked on the sleeve 66 between its flange 66' and the nut 67. The outer bushing is secured in a housing 71 against its shoulder 71' by a threaded cap 72.

The housing 71 is rigidly attached to a reciprocating concentric front tube 73, the rear end of which is slidably mounted on the concentric gun cover tube 74 and the forward end of which is provided with a web 75 carrying an internal concentric bearing surface 76 slidable upon a blast tube 77. The bearing surface 76 is cut away at 78 to provide the necessary clearance for pairs of hinge arms 79 pivoted on pins 80 anchored on the front tube 73. The blast tube 77 is concentric with the gun barrel 2 and is attached by bolts 81 to the stationary tube 20. The blast tube 77 in addition to serving as a support for the surface 76, protects the muzzle closure device and associated parts from injury and possible destruction by the blast of the propellent gases leaving the muzzle end of the barrel, which exert a tremendous pressure for a relative short distance about the muzzle end of the gun until dissipated in the atmosphere.

To close the muzzle end of the gun barrel 2 against the inrush of air a pair of members or petals 82 is employed, each substantially of clamshell bucket shape, as shown, and biased by spaced springs 83 toward each other to a closing position as shown in Figures 3 and 4.

A pair of the hinge arms 79 is attached to each petal 82 and thus the latter are oscillatable on the pivot pins 80 anchored to the reciprocable concentric front tube 73. A gear segment 84 is formed integral with each hinge arm 79 and those gear segments 84 on the same side of the front tube 73 are in mesh with each other thereby causing the petals 82 to rotate to an open or closed position in unison with each other. Also, the weight of one petal 82, is thereby counterbalanced by the weight of the other.

Internally secured to each petal is an inclined pad 85. When the piston rod 39 pulls the front tube 73 to the rear, the petals 82 carried thereby will also be moved back and as they so move, the incline pads 85 will be compelled to ride on and over the surface 86 of the blast tube 77 thereby causing the petals 82 to be spread apart, as shown in Figure 2, against the action of the springs 83 by extending the same, exposing the muzzle opening and providing an unobstructed passage for a projectile to be fired in the customary manner. When the piston rod 39 pushes the tube 73 to the front, the pads 85 will ride

off the surface 86 allowing the springs 83 to bring the petals 82 together and thereby cover the muzzle opening against air rushing in through the gun barrel 2 which in turn would have forced the residual toxic gases back through the gun barrel and out the breech into the vehicle compartment with injurious results to individuals in the compartment.

The electrical circuit is energized by any suitable source of energy 86' which flows through the single-throw switch 22 and lead 87 to the double-throw switch 47 to alternatively activate the circuit 88 through contacts 47' or circuit 89 through contacts 47''.

Operation

The muzzle closure device operates in timed relation with the breechblock 3' so that when the same is down (open), the petals 82 are closed to cover or block the muzzle end of the gun barrel 2 to prevent the residual gases from being forced back through the opened breech by inrushing air. Conversely, when the breech block 3' is up (closed) preparatory to firing, the petals 82 will uncover and clear the muzzle end of the gun to permit free passage of the projectile.

Figure 9 schematically illustrates the parts at the beginning of the operation cycle. As shown in this figure, the gun is in battery position, loaded, the muzzle cover is opened and the breechblock 3' is up (closed) placing the breech-operating crank 5 in a substantially vertical position (position "A") resting against the push button 23 closing the switch 22. Also the piston 38 attached to the rod 39, is in its rearmost position in the air cylinder 37, as shown also in Figure 5, contacting the push rod 48 of the double-throw switch 47 to close one set of contacts, 47', illuminating the signal light 9 and energizing the circuit having the firing switch 7. With piston 38 as shown in Figure 5, the petals 82 are opened, as in Figures 1 and 2, the clutch-release solenoid 62 is deenergized and the friction plates 55 and 56 tilted by the spring-pressed collar 63 as shown in Figure 7.

Referring to Figure 10 for the next stage in the operation cycle, when the firing switch 7 is closed, the firing solenoid 8 actuates the firing mechanism 6 tripping the necessary mechanism for releasing the firing pin against the primer of a round of ammunition to fire the same. The gun will recoil to the rear carrying with it the breech-operating crank 5 from its position "A" to position "B," away from the push button 23 of the switch 22 to open the same, thus breaking the flow of current from the source 86' rendering the electrical circuits 87, 88 and 89 inoperative, and also extinguishing the signal light 9.

Movement of the gun to the rear in recoil will result in the recoil mechanism forcing a quantity of its oil through the tube 25 against the small piston 32, which in turn will cause the enlarged piston 38 and its piston rod 39 muzzle-wards, releasing the push rod 46 of the switch 47 permitting the same to close at contacts 47'', preparatory for the next stage in the operation cycle schematically shown in Figure 11, and also shifting the outer front tube 73 to cause the petal pads 85 to ride off the blast tube surfaces 86 thereby permitting the petals 82 to close off the muzzle from the inrushing air. Also, the breech operating crank 5 will be moved to the rear with the weapon causing its crank pin 5' to slide against the tapered surface 16, pushing aside the lever arm 14 and riding off its end 17.

When movement of the gun rearwardly in recoil has been completed and forward movement in counterrecoil is about to begin, the breech-operating crank arm 5 will strike the end 17 and be rotated clockwise, as shown by position "C'" in Figure 14, to a substantially horizontal position, position "C," to drop (open) the breechblock 3' and eject the fired round, and at the same time the oil pressure in the tube 25 will subside. However, due to the holding action of the friction plates 55 and 56, the rod 39 will be held in its forward position and retain the petals 82 closed.

The placing of a new round of ammunition into the gun chamber will activate the extractor devices to permit the breech closing device 6' to lift (close) the breechblock 3' rotating the breech operating crank 5 to a substantially vertical position, position "D" closing the switch 22 as schematically shown in Figure 12 and also in Figure 14.

Closing of the switch 22 will cause current to flow from the source 86, through 87, contacts 47'' to energize the clutch-brake solenoid 62 forcing the solenoid plunger 61 against the lever arm 59, tilting the friction plates 55 and 56 in a counterclockwise direction to release the rod 39 and piston 38 for return movement to battery position by the spring 44. When the piston 38 reaches battery position, it will operate push rod 48 to open switch 47 at 47' and close it at 47'' completing the cycle.

Under normal circumstances, when the gun is loaded and ready to fire, the petals 82 are opened and remain so until the gun is fired. Conversely, after the gun has been fired, the petals 82 are closed and the breech opened, the parts remaining in these relative positions until a new round has been rammed into place.

However, there may be times when it is desirable to have both the petals 82 and the breechblock 3' closed to block both ends of the gun barrel, as for example, during periods of inactivity or storage, to protect the gun barrel against damage from moisture, dirt or other foreign matter.

This may be accomplished by the operator disconnecting the source of energy 86' and manually forcing the front tube 73 muzzle-wards after the empty breech has been closed. The one-way clutch 54 will retain the front tube 73 in its forward position through holding the rod 39. The switch 22 will be closed by the crank 5 and the switch 47 will be closed at 47'' by the movement of rod 39 away from the push rod 48, all as shown in Figure 12.

When it is desired to place the gun back into normal operation, the source of energy 86' will be reconnected, which will automatically energize the clutch release solenoid 62 placing the petals 82 in open position as already explained.

It will be obvious that various modifications might be made in the device herein without departing from the spirit of the invention.

We claim:

1. In combination, a gun barrel, a breech mechanism therefor, a fluid-controlled recoil apparatus concentric with said barrel for absorbing the recoil thereof, a sleeve extension attached to said recoil apparatus, an outer concentric sleeve slidably supported on said sleeve extension and said recoil apparatus for reciprocatory movement, a pair of closure members, hinge means pivotally supporting said closure members on said outer concentric sleeve, spring means in said closure members biasing the same towards a closing position, inclined cam plates

in said closure members adapted to ride on and off said sleeve extension, segmental gears on said hinge means meshing with each other, said spring-biasing means, inclined cam plates and meshing segmental gears being constructed and arranged to open and close said closure members upon reciprocatory motion of the outer concentric sleeve to uncover and to cover, respectively, the muzzle end of said gun barrel, an elongated piston rod, a shock-absorbing device connecting said rod to said outer concentric sleeve, hydraulic means connected to said fluid-controlled recoil apparatus for moving said piston rod forwardly when said gun barrel recoils, a one-way friction-brake means encircling said piston rod to permit motion of the same forwardly and to hold the same against motion rearwardly of the gun barrel, electrical means actuated by said mechanism to render said one-way friction brake means inoperative to hold said rod against rearward movement and spring means for moving said piston rod rearwardly.

2. In combination, a gun barrel, a breech mechanism therefor, a fluid-controlled recoil apparatus for absorbing the recoil of said barrel, a sleeve extension attached to said recoil apparatus, an outer concentric sleeve slidably supported on said sleeve extension and said recoil apparatus for reciprocatory movement, a pair of closure members, hinge means pivotally supporting said closure members on said outer concentric sleeve, spring means in said closure members biasing the same towards a closing position, inclined cam plates in said closure members adapted to ride on and off said sleeve extension, said spring-biasing means and inclined cam plates being constructed and arranged to open and close said closure members upon reciprocatory motion of the outer concentric sleeve to uncover and to cover, respectively, the muzzle end of said gun barrel, a rod, a device connecting said rod to said outer concentric sleeve, hydraulic means connected to said fluid-controlled recoil apparatus for moving said rod forwardly when said gun barrel recoils, brake means cooperating with said rod to permit motion of the same forwardly and to hold the same against motion rearwardly of the gun barrel, means actuated by said breech mechanism to render said brake means inoperative to hold said rod against rearward movement and means for moving said rod rearwardly.

3. In a muzzle closure device for a gun barrel, the combination of a sleeve fixed relative to said gun barrel, an outer concentric sleeve slidably supported on said sleeve for reciprocatory movement, a pair of closure members, hinge means pivotally supporting said closure members on said outer concentric sleeve, spring means in said closure members biasing the same towards a closing position, inclined cam plates in said closure members adapted to ride on and off said sleeve, segmental gears on said hinge means meshing with each other, said spring-biasing means, inclined cam plates and meshing segmental gears being constructed and arranged to open and close said closure members upon reciprocatory motion of the outer concentric sleeve to uncover and to cover, respectively, the muzzle end of said gun barrel, an elongated piston rod, a shock-absorbing device connecting said rod to said outer concentric sleeve, hydraulic means including a cylinder for said piston rod to move the same when said gun barrel recoils, a one-way friction-brake means encircling said piston rod to permit motion of the same forwardly and to hold the same against motion rearwardly of the gun barrel, electrical means for actuating said one-way friction brake, means to render the same inoperative to hold said rod against rearward movement and spring means for moving said piston rod rearwardly.

4. In a muzzle closure device for a gun barrel, the combination of a support fixed relative to the gun barrel, a member reciprocably mounted on said support, closure means for the bore of said barrel and mounted on said member, means on said closure means biasing the same toward a closed position, cam means on said closure means adapted to ride on and off said support as said member reciprocates to open said closure means and to permit said biasing means to close said closure means respectively, said closure means in the open position uncovers said bore and in the closed position covers the same, a rod, means connecting said rod to said member, means connected to said rod for moving the same forwardly of the gun barrel, means adjacent said rod for holding the same against motion rearwardly of said gun barrel, means cooperating with said holding means for holding the same inoperative whereby said rod can be moved rearwardly and means abutting said rod for moving the same rearwardly.

5. In a muzzle closure device for a gun barrel, the combination of a support fixed relative to the gun barrel, a member reciprocally mounted on said support, closure means for the bore of said barrel and mounted on said member, spring means on said closure means biasing the same toward a closed position, cam means on said means adapted to ride on and off said support as said member reciprocates to open said closure means and to permit said biasing means to close said closure means, respectively, said closure means in the open position uncovers said bore and in a closed position covers the same, a rod, means connecting said rod to said member, hydraulic means for moving said rod forwardly relative to the gun barrel, means for holding said rod against motion rearwardly of said gun barrel, means for rendering said holding means inoperative whereby said rod can be moved rearwardly and means for moving said rod rearwardly.

6. In a muzzle closure device for a gun barrel, the combination of a support fixed relative to the gun barrel, a member reciprocably mounted on said support, closure means for the bore of said barrel and mounted on said member, means biasing said closure means toward a closed position, means on said closure means adapted to ride on and off said support as said member reciprocates to open said closure means and to permit said biasing means to close said closure means, respectively, said closure means in the open position uncovers said bore and in the closed position covers the same, a rod, means connecting said rod to said member, means for moving said rod in one direction, means for holding said rod against motion in an opposite direction, means for rendering said holding means inoperative whereby said rod can be moved in said opposite direction and means for moving said rod in said opposite direction.

7. In combination, a gun barrel, a breech mechanism therefor, a fluid-controlled recoil apparatus attached to said gun barrel for absorbing the recoil thereof, a support fixed to said recoil apparatus, a member reciprocably mounted in said support, closure means for the bore of said barrel

and mounted on said member, means on said closure means biasing the same towards a closed position, cam means on said closure means adapted to ride on and off said support as said member reciprocates to open said closure means and to permit said biasing-means to close said closure means, respectively, said closure means in the open position uncovers said bore and in the closed position covers the same, a rod, means connecting said rod to said member, hydraulic means connecting said recoil apparatus to said rod whereby on recoil of the gun barrel said apparatus will move said rod forwardly, means holding said rod against motion rearwardly of said gun barrel, means actuated by the breech mechanism to render said holding means inoperative whereby said rod can be moved rearwardly and means for moving said rod rearwardly.

8. A muzzle closure device for a gun having a gun barrel, comprising the combination of a closure means, a member reciprocably mounted for muzzle-ward and rearward movement relative to the gun barrel, means attaching said closure means to said reciprocable member, means in the path of said closure means for opening the same, means cooperating with said closure means for closing the same when moved away from said opening means, means connected to said reciprocable member for moving the same in a direction whereby said closure means are closed, means urging said connecting means rearwardly, means holding said connecting means in its muzzle-ward position against the force of said urging means, means for rendering said holding means inoperative to hold said connecting means whereby the same is returned rearwardly by said urging means and means to actuate said means for rendering said holding means inoperative.

9. A muzzle closure device for a gun having a gun barrel, a recoil mechanism therefor and a breech mechanism on said barrel, comprising the combination of a closure means, a member reciprocably mounted for muzzle-ward and rearward movement relative to the gun barrel, means pivotally mounting said closure means upon said reciprocable member, means in the path of said closure means for opening the same, means cooperating with said closure means for closing the same when moved away from said opening means, hydraulically-operated means connected to the gun recoil mechanism and said reciprocable member for moving the same in a muzzle-ward direction whereby said closure means are closed, resilient means urging said hydraulically-operated means rearwardly, friction means associated with said hydraulically-operated means for holding the same in its muzzle-ward position against the urging force of said resilient means, means for rendering said friction means inoperative to hold said hydraulically-operated means whereby the same is returned rearwardly by said resilient means and means operated in timed relation with the breech mechanism to actuate said means for rendering said friction means inoperative.

10. In combination, a gun barrel, a breech mechanism therefor, a fluid-controlled recoil apparatus for absorbing the recoil of the gun barrel, closure members for the barrel bore, a member reciprocably mounted for muzzle-ward and rearward movement relative to the gun barrel, means pivotally mounting said closure members upon said reciprocable member, means in the path of said closure members for opening the same, means cooperating with said closure members for closing the same when moved away from said opening means, hydraulically-operated means connected to said gun recoil mechanism and said reciprocable member for moving the same in a muzzle-ward direction whereby said closure members are closed, resilient means urging said hydraulically-operated means rearwardly, friction means associated with said hydraulically-operated means for holding the same in its muzzle-ward position against the urging force of said resilient means, means for rendering said friction means inoperative to hold said hydraulically-operated means whereby the same is returned rearwardly by said resilient means and means operated in timed relationship by the breech mechanism to actuate said means for rendering said friction means inoperative.

11. A muzzle closure device for a gun barrel comprising the combination of a means adapted to cover and uncover the muzzle of the gun barrel, means associated with said first-named means for supporting the same in cooperative relationship with the gun barrel, means for actuating said first-named means to a position to cover the gun muzzle, means opposing the movement of said actuating means, means adjacent said actuating means for holding the same in a covering position for the gun barrel muzzle, and means abutting said holding means for rendering the same inoperative whereby said opposing means will return said actuating means to a position to uncover said gun muzzle.

12. A muzzle closure device for a gun barrel comprising the combination of a means adapted to cover and uncover the muzzle of the gun barrel, means associated with said first-named means for supporting the same in cooperative relationship with the gun barrel, hydraulically-operated means for actuating said first-named means to a position to cover the gun muzzle, resilient means opposing the movement of said actuating means, friction brake means adjacent said actuating means for holding the same in a covering position for the gun barrel muzzle, means abutting said friction brake means for rendering the same inoperative whereby said resilient means will return said actuating means to a position to uncover said gun muzzle.

13. In combination, a gun barrel, a breech mechanism therefor, a hydraulic recoil system attached to said gun barrel for absorbing the shock of recoil thereof, means adapted to cover and uncover the muzzle of the gun barrel, means associated with said first named means for slidably supporting the same in cooperative relationship with the gun barrel, hydraulically-operated means connected to said recoil system for actuating said first-named means to a position to cover the gun muzzle, resilient means opposing the movement of said actuating means, friction-brake means adjacent said actuating means for holding the same in a covering position for the gun barrel muzzle, means abutting said friction brake means for rendering the same inoperative whereby said resilient means will return said actuating means to a position to uncover said gun muzzle and means activated by said breech mechanism for energizing said abutting means.

14. In combination, a gun barrel, a hydraulic recoil system for absorbing recoil of said gun barrel, a closure means for said gun barrel bore, operating means connected to said recoil system to open and close said closure means, means connected with said operating means to cause the same to hold said closure means in an open position, means associated with said holding means

to render the same ineffective and means after said last mentioned means has become ineffective for returning said operating means to a position to cause said closure means to close.

15. In combination, a gun barrel, a breech mechanism therefor, a hydraulic recoil system for absorbing recoil of said gun barrel, a closure means for the gun barrel bore, hydraulically-operated means actuated by said recoil system when the gun barrel moves in recoil to open and close said closure means, means connected with said hydraulically-operated means whereby the same is adapted to hold said closure means in an open position, electromagnetic means associated with said holding means adapted upon being energized to render the same ineffective, means after said last-mentioned means has become ineffective to return said hydraulically-operated means to a position to cause said closure means to close and means operated by said breech mechanism to energize said electromagnetic means.

16. In combination, a gun barrel, a breech mechanism therefor, a hydraulic recoil system for absorbing recoil of said gun barrel, a closure means for the gun barrel bore, hydraulically-operated means actuated by said recoil system when the gun barrel moves rearwardly in recoil to open and close said closure means, a one-way

friction brake means connected with said hydraulically-operated means to cause the same to hold said closure means in an open position, electromagnetic means associated with said holding means adapted upon being energized to render the same ineffective, and means after said last-mentioned means has become ineffective to return said operating means to a position to cause said closure means to close and means operated by said breech mechanism when in a closed position to energize said electromagnetic means.

17. In combination, a gun barrel, a breech mechanism therefor and adapted to open and close to receive a round of ammunition, closure means for the bore of the gun barrel, means actuated with the firing of the round of ammunition in said gun barrel to cause said closure means to close said bore after a predetermined time interval has elapsed after the firing of the round of ammunition, means associated with said actuating means for locking the same in a bore closing position, and means actuated by the breech mechanism when in a closed position to render said locking means ineffective and whereby said closure means opens said gun barrel bore.

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