J. BLISH.

BREECH CLOSURE FOR FIREARMS.

APPLICATION FILED JUNE 30, 1913.

1,131,319.

Patented Mar. 9, 1915.

2 SHEETS—SHEET 1.

Fig. 3.

Fig. 1.

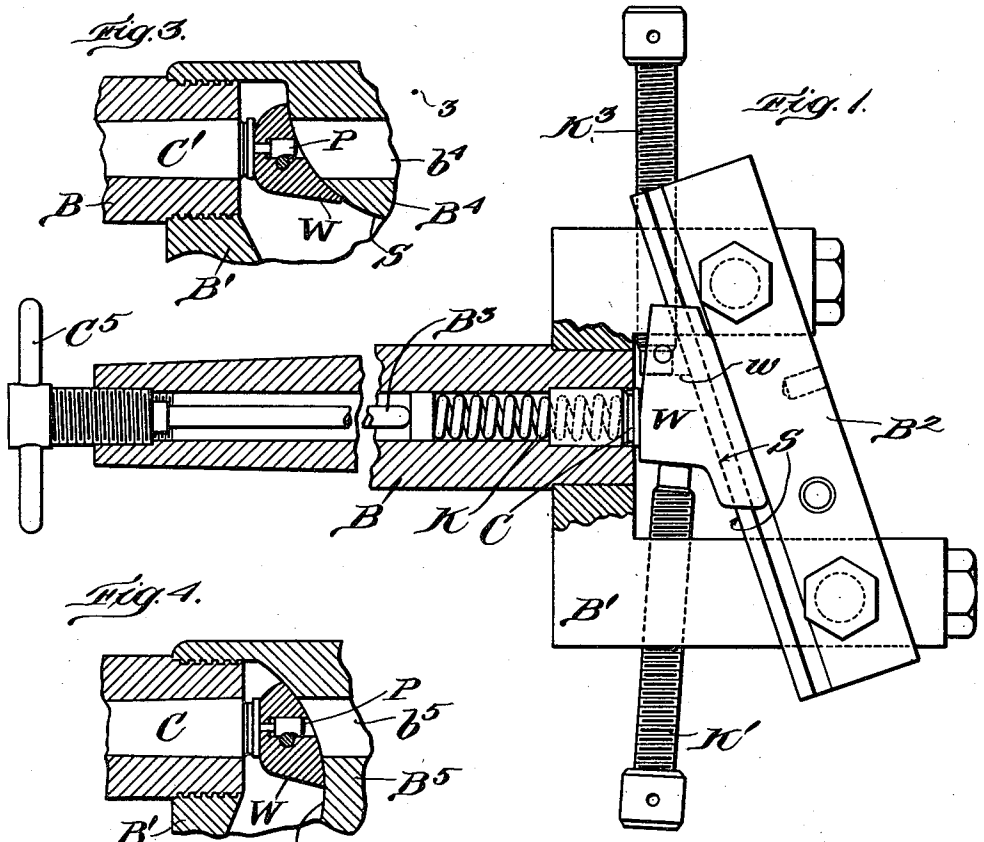


Fig. 4.

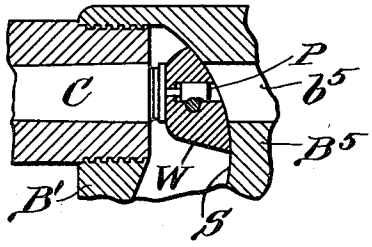
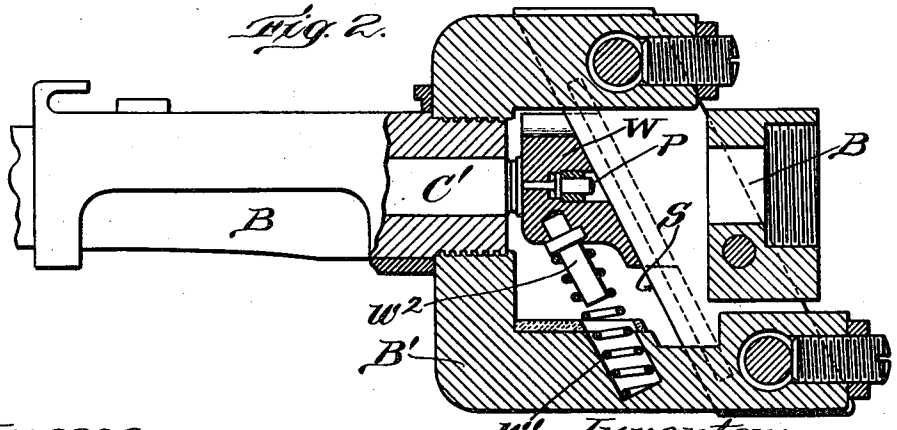


Fig. 2.



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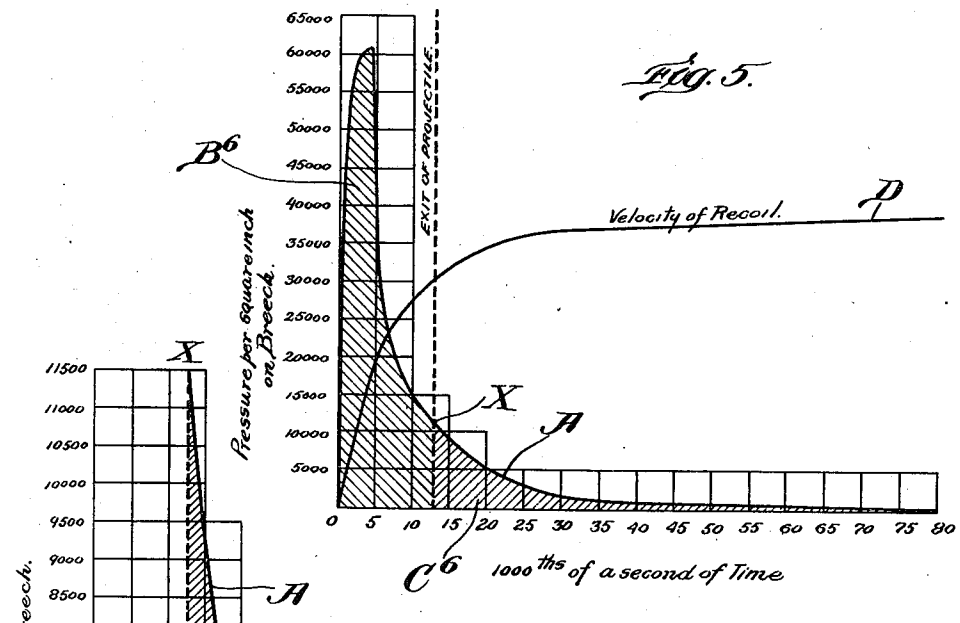

Fig. 5.

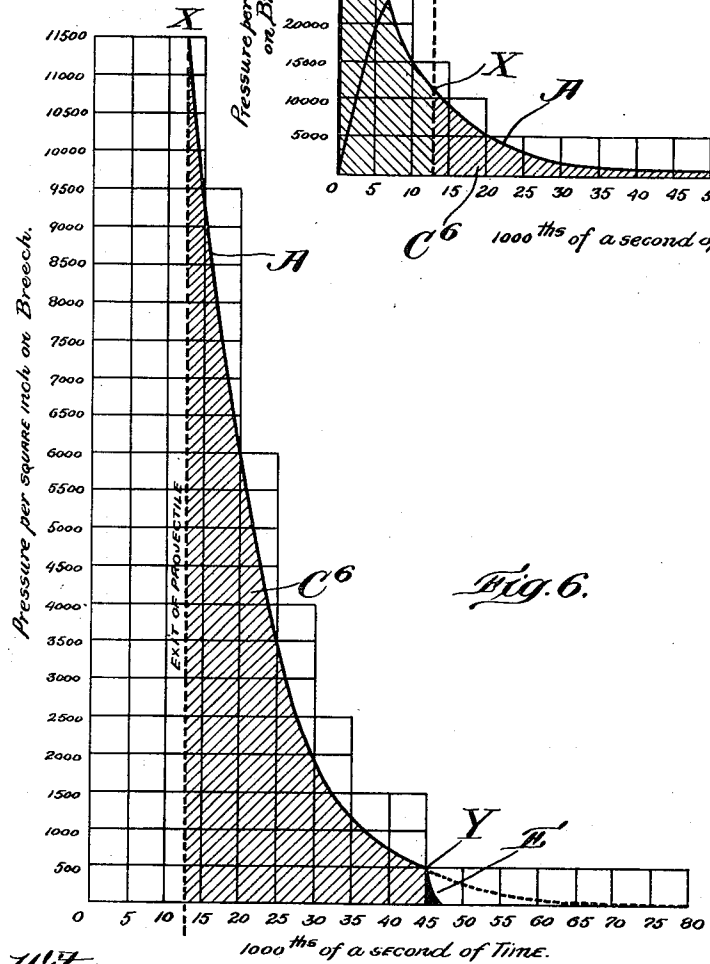

Fig. 6.

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UNITED STATES PATENT OFFICE.

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BREECH-CLOSURE FOR FIREARMS.

1,131,319. Specification of Letters Patent. Patented Mar. 9, 1915.

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To all whom it may concern:

Be it known that I, JOHN BLISH, commander in the United States Navy, retired, and a citizen of the United States, and resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Breech-Closures for Firearms, of which the following is a specification.

My invention consists in a new and improved explosion chamber closure, exemplified by a breech closure for firearms, and is adaptable to breech-loading arms of all calibers, which may employ any variety of breech-loading ammunition.

The chief characteristic of my invention is exemplified by the employment of pressure generated by the discharge of the breech-loading piece, as the sole factor for locking the breech closer, for actuating the breech closer to open the breech, and for ejecting the cartridge case, obturator, or other ammunition adjunct remaining in the piece after firing; and also, if desired, for reloading and refiring the piece, in case the firearm is of the automatic class. Moreover, according to my invention, the pressure generated by discharge operates directly and without requiring intermediate mechanical translators of force and motion, in the chief and elementary functions of locking the breech closer and opening the same at the proper predetermined time. Ejection of the cartridge case accompanies the opening movement of the breech closer, since the cartridge case or its analogue is the means through which the pressure generated by discharge of the explosive is communicated to the breech closer. The addition of mechanical adjuncts which confer automatism in reloading the piece is ancillary or supplementary to the main elements of my invention.

Heretofore, so far as I am aware, automatic breech closers have operated through the agency of friction, inertia of parts, or resistance of springs, or several of these factors which have been relied on to control the opening of the breech closure; or have been operated by gas pressure working through mechanical trains. In my invention no resort is had to any of these agencies, as will herein appear.

My invention is illustrated in the drawings hereto annexed, in which—

Figure 1 shows in longitudinal elevation and section a model, explanatory of the principles of my invention; Fig. 2 shows in elevation and section a simple form of breech closer; Fig. 3 shows in section an alternative form of breech closure; Fig. 4 shows another alternative form; Fig. 5 shows a curve of pressures generated in a firearm; and Fig. 6 shows a curve of pressures on a scale different from that of Fig. 5.

In order to explain the conditions under which my invention operates, and which are fundamental to its principle of operation, I refer to Figs. 5 and 6. Fig. 5 is a reproduction of the curve shown in a diagram printed in the *Encyclopedia Americana*, and shows graphically the firing pressure recorded during an authoritative test of a United States Army eight inch rifle. The ordinates represent pressures, the abscissæ times, in thousandths of a second. About thirteen thousandths of a second after initial ignition of the charge, the projectile left the muzzle of the rifle. The dotted ordinate line is drawn at this point, X, in Figs. 5 and 6. For purposes of definition, I will term the pressure represented by the curve from zero, or origin, to the dotted ordinate line, the ballistic pressure, and the pressure represented by the remainder of the curve, to the right of the dotted line, as the vanishing pressure. It will be observed that the maximum ballistic pressure is very quickly generated, the ascending curve A (Fig. 5) arriving at the maximum of 61000 pounds in about four thousandths of a second. The expansion, or descending curve which defines the course of ballistic pressure (area B^6) arrives at about 12,000 pounds to the square inch when the projectile leaves the piece, and thereafter the curve of vanishing pressure (area C^6) descends, reaching zero approximately in 80 thousands of a second after the initial firing. It will be noted that the velocity of free recoil, represented by curve D, (Fig. 5) does not reach its maximum and substantially constant value, until after the projectile has left the gun and ceased to be a factor. In Fig. 6 the curve of vanishing pressure is drawn to a scale in which the pressure ordinates are ten times as large as in Fig. 5. This diagram will be referred to again.

I now refer to Fig. 1 which shows a model illustrating the principle of my invention. B represents a rifle barrel and B′ a U-shaped receiver secured to the chamber end

of the barrel B. Parallel abutment bars B^2 are firmly bolted to the receiver B′ in such manner that their front surfaces, which form guides or ways on which the breech closer W slides, or is fixed, as the case may be, are oblique to the axis of the barrel B, and therefore to the direction of rearward thrust generated within the barrel. The breech block, or breech closer W is, generally speaking, wedge-shaped, and is provided with rear surfaces which engage with the guides or ways S on the abutment bars B^2. The front face of the breech closer W bears against the disk C, which corresponds to the base of a cartridge case. The upper part of the breech closer W may be recessed, as indicated by dotted line *w*. Screws K′ and K^3 are inserted through threaded holes in the receiver B′, and may be made to bear on the lower and upper parts, respectively, of the breech closer W. A powerful spring K is inserted in the breech chamber of the barrel B, and a stiff rod B^3, carried on a screw threaded head C^5 (for which the bore of the barrel B is threaded at the muzzle) bears against the spring K.

To demonstrate the principle on which my breech closure operates, raise the breech closer W and set it against the disk C by means of the screw K′. Then advance the screw head C^5 into the barrel B, until the spring K is compressed to the utmost. Then retract the screw K′. Under the heavy pressure exerted upon it, the breech closer W is rigidly immovable. It may be moved downward by exerting great force on it by means of screw K^3, but the pressure of screw K^3 must be continued in order to produce continued downward movement of the breech closer W. While the spring pressure is at high value, the breech closer W is held, as in a clamp, of which the bars B^2 on one side and the disk C on the other, constitute the opposed jaws. When the critical point is reached in progressive diminution of the spring pressure, the clamp, or vise—characteristic of these two opposed members, B^2 and C, vanishes entirely and ceases to function; the disk C then acts as a pusher to retire the breech closer W, which slides freely and easily on the bars B^2 and disk C. The point of demarcation between these two successive characteristics of the members B^2 and C appears to be a very sharp one, at all events, no progressive or gradual disappearance of the rigid clamping function is discernible. Instead of forcing the breech closer downward by means of screw K^3, slowly unscrew the muzzle screw C^5, thus relaxing spring K gradually. When the pressure exerted on the breech closer W has descended to a low value, the breech closer W suddenly responds to this residual spring pressure, and slides downward along the ways S on the abutment bars B^2, opening the breech and allowing the disk C (representing a cartridge case) to be ejected from the breech chamber, and to fly out over the upper surface *w* and between the abutment bars B^2. Repeated trials of this demonstration will show that the release of the breech closer W always occurs at almost exactly the same pressure value. According to the laws of friction, if the angle of support, relatively to direction of pressure thrust, be such that sliding movement between the two engaging members will result at any pressure, it should result at all pressures. Since the demonstrated behavior of the model illustrated in Fig. 1 is contrary to this law, friction is ruled out of the case, being a factor of no substantial consequence. It is obvious also that the inertia of the breech closer W plays no part in the operation of the closure device, and that the only agent relied on to lock the breech closer is the pressure developed in the firearm, acting to cause locking or clamping engagement between the breech closer and its abutment until the pressure falls to such a value that the laws of friction supervene, when the breech closer slides on its abutment and opens the breech.

Fig. 2 illustrates the application to firearm practice of the principles demonstrated by the model shown in Fig. 1. Here the breech closer W is provided with a pin w^2 and a relatively light holding spring *w*′, of which the function is simply to lift the breech closer W into place and hold it against the cartridge case C preparatory to firing. This spring *w*′ is not called on to perform any function in respect to holding the breech closer W against firing pressure. If the piece be laid on its side and the breech closer W moved by hand into place against the cartridge case, no spring *w*′ being used, the operation of the breech closure will be precisely the same as when the spring *w*′ is employed for the purpose stated. The breech closer W is also provided with a firing pin P, which may be actuated by any suitable mechanism. None is here shown, since I desire to disclose and describe my invention in the simplest possible terms, without importing descriptions of auxiliary contrivances which any skilled maker of firearms may supply. With the piece charged and the breech closer in position as shown in Fig. 2, when the piece is fired, the pressures in the barrel develop in the manner illustrated in Figs. 5 and 6. While the pressures are high, namely, during the entire duration of ballistic pressure and part of the succeeding vanishing pressure, the breech closer W is locked fast to the abutment bars B^2. When the critical pressure, which corresponds to the supervention of the laws of friction over the related parts W and B^2, is reached, the breech closer W

is abruptly moved outward and downward and the cartridge case ejected between the abutment bars B^2. Here, as in the case of the model apparatus shown in Fig. 1, the cartridge case C and bars B^2, during the period of ballistic pressure, and up to the instant when the critical pressure of release is arrived at during the decline of vanishing pressure, act as the two opposed jaws or members of a clamp, holding the breech closer W immovably between them. And when the critical pressure of release is reached, these members B^2 and C undergo a sudden functional transformation, cease to act as a clamp, and operate to slide the breech closer open.

Referring to Fig. 6: If the inclination, or obliquity of the guiding surfaces S, to the axis of the barrel, B is so determined that the critical pressure shall be 500 pounds to the square inch, the point of breech opening is indicated at Y (Fig. 6) and the effect of release due to breech opening and ejection of the cartridge case is indicated by the curve-area E. Relatively speaking, a long time elapses between the departure of the projectile from the barrel and the breech opening. The construction of the breech closure may be determined so that at any stage in the vanishing pressure period the breech closer will be released. Preferably, of course, the point of critical pressure will be so determined that enough energy will be available to perform all the operations of breech opening, cartridge case ejection, reloading, etc., which may be involved in the complete cycle of the firearm. The main point to be empnasized is, that until the critical pressure is reached in the descent of pressure value, the breech closer is firmly clamped to its abutment, and that when this critical pressure is reached, the breech closer is perfectly free to move on its abutment. Some features of operation which are derivative from this main point deserve mention. No movement of the breech closer over its abutment guides takes place until the pressure of contact is reduced to a low value; therefore, abrasion and wear of the engaging surfaces is avoided, and the breech opening movement, though abrupt, is not unduly violent. No mechanical extractor is required, the cartridge case blowing out of the breech under the vanishing pressure. The ejection of the cartridge case occurs at the earliest possible instant, so that the heat momentarily stored in the cartridge case is in large part radiated after the case leaves the breech chamber, and not into the metal surrounding the chamber. The locking of the breech closure is positive, without requiring any bolt or latch; the opening of the breech closure is free and unrestrained, and not retarded or complicated by any bolt or latch.

To illustrate alternative modes of carrying into effect the same principle of operation as above explained in connection with Figs. 1 and 2, I refer to Figs. 3 and 4. In these figures, the abutment is formed as part of the receiver B′, and the supporting and guiding surfaces are cylindrical. In Fig. 3 the cylindrical surface S has its axis at the rear of the breech closer W, and at one side of the axis of the barrel B, while in Fig. 4, the cylindrical surface S has its axis forward of the breech closer W, and likewise at one side of the axis of the barrel. In both forms, the abutment B^4 or B^5 is bored, at b^4 or b^5, to afford passage for the ejected cartridge case. The breech closer W is formed with a cylindrical surface in both these instances, which conform to the abutment surface S, and will be provided with suitable means (not shown) for guiding it in its movement over the abutment surface. Whatever the variation in form or detail of breech closure, the characteristic of my invention resides in an arrangement of a closer and an abutment presenting a surface at an angle of obliquity or inclination to the direction of pressure thrust (*e. g.* axis of the barrel) such that, at low values of pressure thrust the closer will slide on the abutment, whereas at higher values, (over and above a critical pressure which is the maximum under which the closer will slide) the closer is rigidly locked or clamped between the abutment and the medium through which pressure is exerted on the closer, such as a cartridge case, by the pressure alone. The angle at which the abutment surfaces are inclined to the direction of pressure which in a firearm coincides substantially with the axis of the barrel should therefore be sufficiently great, *i. e.* should approach nearly enough to ninety degrees, to insure the locking or clamping by discharge pressure during the ballistic stage, and yet not so near to ninety degrees as to prevent sliding movement under the normal frictional conditions at some value in the vanishing pressure stage. Should the inclination of the abutment surfaces to the axis of the barrel be decreased, the value in the vanishing pressure stage at which the breech closer will unlock, will rise higher, and an angle will finally be reached at which the locking or clamping effect will no longer be obtained. On the other hand, should the inclination of the abutment surfaces to the axis of the barrel be increased, approaching a right angle, the value in the vanishing pressure stage at which the breech closer unlocks will be diminished, and an angle will finally be reached at which the unlocking effect will no longer be obtained. The practical angle to be selected will lie between these two theoretical limits.

I have ascertained by experiment that

with a United States Army service rifle, a proper angle for the slideway formed by plane-surfaced abutment bars, such as shown in Fig. 2, is about 71° to the axis of the barrel. The characteristic action of the breech closure herein described lies in clamping the breech closer immovably against the inclined slideway by pressure alone during the relatively high pressure exerted on the breech closer by the cartridge case throughout the ballistic stage, and for as long thereafter during the vanishing stage as may be expedient, and, when a predetermined value of pressure is reached during the vanishing stage, sliding the breech closure upon the slideway, by the pressure alone. Except for the clamping effect of the higher pressures, the breech closer requires no obstruction, the slideway itself being entirely unobstructed.

It might at first impression be supposed that the breech closer must begin its sliding movement at the initiation of pressure in the firearm, but the demonstration by means of the model shown in Fig. 1 dispels this impression. The assumption of full pressure is instantaneous, so that there is practically no point in the line of rising pressure which corresponds to the critical point of breech closure release in the line of vanishing pressure, which is gradual. Furthermore, it is quite obvious that if the breech closer were to begin sliding on the abutment slideway when under the extremely high pressure of the ballistic stage of discharge, the engaged surfaces of the closer and slideway would suffer abrasion and wear. In fact, even though these engaged surfaces be not hardened, they show no sign of wear after many rounds have been fired in the piece. If any sliding movement of the breech closer were to take place under high pressures, the softer metal of which the cartridge case is composed would inevitably be abraded and portions of it would cling to the harder metal of which the breech closer is composed. No trace of such action appears. This, again, proves conclusively that no sliding begins until the pressure between the engaged surfaces has fallen to a low value. Again, since with the breech closure above described the breech closer opens always at substantially the same predetermined low pressure value, it is quite immaterial to the operation of the breech closure, whether a full service charge, an excessive charge, a reduced charge, or a blank cartridge, be used; a circumstance which serves practically to distinguish the above described breech closure system from the heretofore known types.

The breech closer of a firearm is in its essence a valve, the function of which, as with all valves, is to control an opening in a chamber, or channel, within which pressure is developed. The principle of my invention, herein explained, is therefore applicable to valves in divers situations, wherever it may be found useful to hold a valve immovably closed by means of the pressure which it confines and, by diminution of that pressure to cause the valve to relax its closure-hold and open in response to diminished pressure. Therefore, I wish it to be understood, that while my invention is peculiarly applicable to firearms and is specifically illustrated in such an application, it is susceptible of wider application; and that in using the terms, "breech closure", "breech closer", "explosion chamber", "barrel", and the like, I employ them illustratively and not by way of limitation.

I claim:

1. A breech closure system for firearms, characterized by a mechanically unobstructed abutment slideway inclined to the axis of the firearm barrel and a breech closure on said slideway; the breech closer and slideway adapted to be immovably clamped together by relatively high discharge pressures exerted on the breech closer, and relieved from said clamped condition by reduction of discharge pressure to allow the breech closer to slide on the slideway under discharge pressures of relatively low value.

2. A breech closure system for firearms, characterized by a mechanically unobstructed abutment slideway fixed with relation to and inclined to the axis of the firearm barrel and a breech closer on said slideway; the breech closer and slideway adapted to be immovably clamped together by relatively high discharge pressures exerted on the breech closer, and relieved from said clamped condition by reduction of discharge pressure to allow the breech closer to slide on the slideway under discharge pressures of relatively low value.

3. In a firearm, the combination of a breech closer having a rearward surface inclined to the axis of the barrel and a forward surface normal to the axis of the barrel, an abutment having an inclined surface against which the rearward surface of the breech closer rests, said abutment adapted in coöperation with the cartridge case or its analogue, to clamp the breech closer immovably under higher values of discharge pressure, and to relax said clamping effect under a lower value of discharge pressure.

4. In a firearm, the combination of a slideway inclined to the axis of the barrel and a breech closer between the slideway and the cartridge chamber, adapted to be clamped immovably between the slideway and a cartridge case by discharge pressure alone, under higher values of the same, and to slide freely in the slideway under impulse from the cartridge case in response to lower values of discharge pressure.

5. In a firearm, the combination of a slide-

way fixed with relation to the barrel and inclined to the axis of the barrel and a breech closer between the slideway and the cartridge chamber, adapted to be clamped immovably between the slideway and a cartridge case by discharge pressure alone, under higher values of the same, and to slide freely in the slideway under impulse from the cartridge case in response to lower values of discharge pressure.

6. The method of breech closure control, which consists in immovably clamping a breech closure to a surface obliquely disposed to the direction of the pressure, by adhesion produced by relatively high discharge pressure, and subsequently eliminating said adhesion by reduction in the pressure, and thereupon moving the breech closure over the inclined surface by relatively low vanishing pressure.

7. In a firearm, the combination of a breech closure having a rearward surface inclined to the axis of the barrel and a forward surface normal to the axis of the barrel, an abutment fixed with relation to the barrel and having an inclined surface against which the rearward surface of the breech closure rests, said abutment adapted in coöperation with the cartridge case or its analogue, to clamp the breech closure immovably under higher values of discharge pressure, and to relax said clamping effect and thereby move the breech closure under a lower value of discharge pressure.

Signed by me at Boston, Massachusetts, this 23d day of June, 1913.

JOHN BLISH.

Witnesses:
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FLORENCE A. COLLINS.