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MACHINE GUN AND SMALL ARM

Filed Sept. 10, 1931

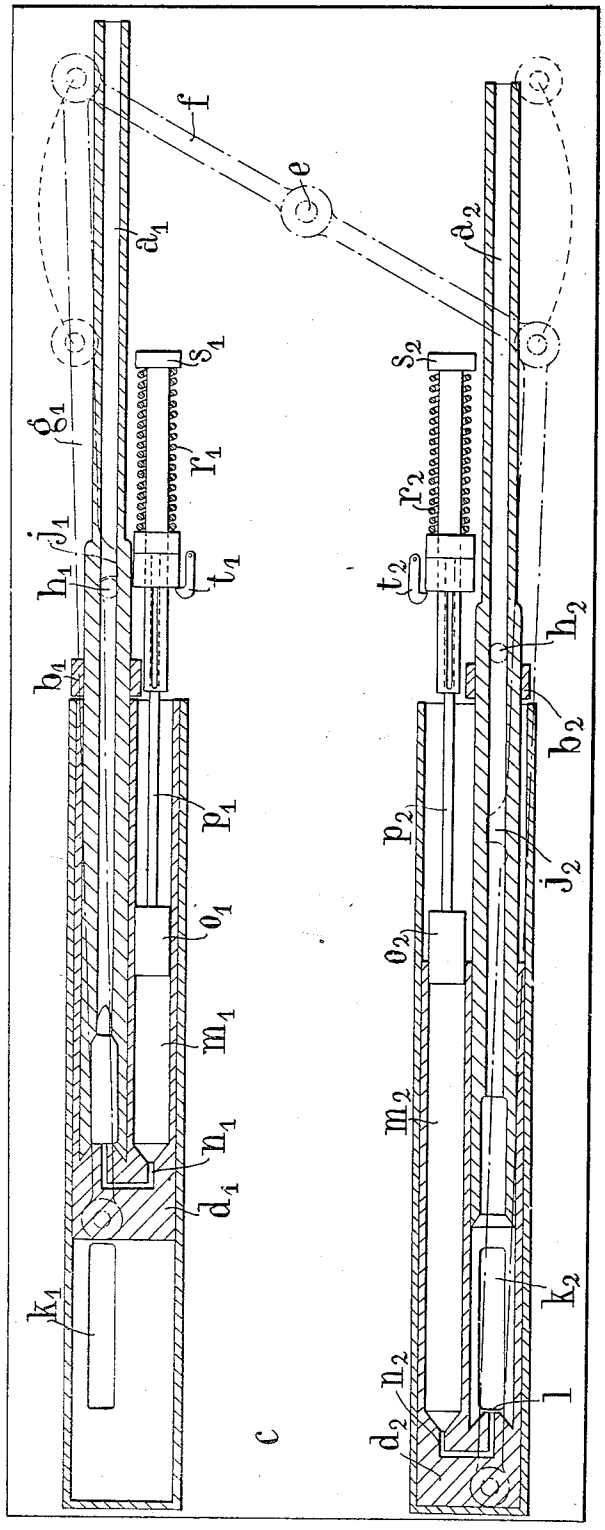

Fig. 1.

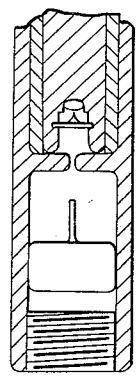

Fig. 3.

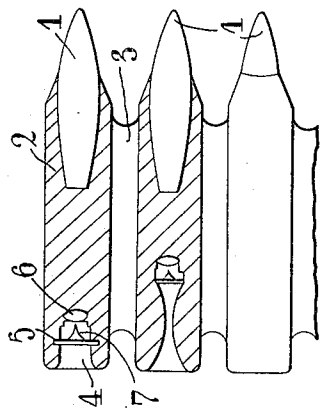

Fig. 2.

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UNITED STATES PATENT OFFICE

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MACHINE GUN AND SMALL ARM

Application filed September 10, 1931, Serial No. 562,181, and in Great Britain June 27, 1930.

This invention relates to machine guns and small arms which may be of the single loading or magazine variety or of the self-loading or semi-automatic or the completely automatic types and has for its object to devise a novel weapon of this character of simple and robust construction and capable of well fulfilling present day tactical requirements.

The invention consists in a machine gun, small arm or like weapon comprising a breech-block adaped to fit externally over the barrel.

The invention also consists in a machine gun, small arm or like weapon in which the breech-block comprises a cylindrical case adapted for sliding fit over the rear end of the barrel.

The invention also consists in a machine gun or like weapon comprising twin barrels each provided with a breech-block fitting externally thereto, operating interdependently and alternately.

The invention further consists in a weapon as set forth above in which loading is effected through a slot in the side of the breech-block.

The invention further consists in a weapon as set forth above wherein ignition of the charge is effected by pneumatic means.

The invention further consists in a cartridge for use with a weapon as set forth above comprising a bullet associated with a completely consumable charge (e. g. of cordite).

The invention further consists in cartridges as set forth above connected together in bead-like form by interconnecting webs.

The invention further consists in cartridges connected together as set forth above wherein the interconnecting webs are of the same material as the charge.

Further features of the invention will become apparent from the following description of a few modifications thereof which are given however merely by way of example. These will be more readily understood by reference to the accompanying drawings in which:—

Figure 1 represents one form of a dual barreled automatically operating machine gun in accordance with the invention, and

Figure 2 represents a novel form of cartridge in accordance with the invention which may be used in conjunction with weapons constructed according to the invention such as those of the character illustrated in Figure 1 for example;

Figure 3 shows alternative means which may be employed for firing the charge in its firing position in a barrel.

In carrying the invention into effect in one convenient maner as show in Figure 1 a pair of cylindrical or tubular members a_1, a_2 forming the barrels of the gun are mounted in any suitable way, such as by trunnions or locking lugs b_1, b_2, with their axes parallel, on a common bed or table c which is attached to the mounting. The barrels a_1, a_2 are so associated with respect to their seatings or slides (such as the trunnions) that a small and limited longitudinal movement of the barrel may occur for a reason to be explained below but otherwise held incapable of any other movement relative thereto.

To the rear ends of these barrels are fitted breech-blocks d_1, d_2 of novel form, comprising hollow, cylindrical box-like structures closed at one end, which fit over and external to the rear ends of the barrels in a sleeve-like manner. Such breech-blocks may if desired be mounted on rails, runners, rollers or the like to ensure that in relative movement the barrel and breech-block remain coaxial, and also to facilitate and smooth said relative movement. One advantage of employing breech-blocks of this character is that any gas leaking from the explosion chamber at the rear end of the barrel escapes in a safe, forwardly direction thus safeguarding against inconvenience or danger to the operator.

Upon a suitable pivot, such as a removable pin e standing on the table between the forward ends of the barrels, is mounted a lever f adapted to rock about a means position perpendicular to the barrel axes in a see-saw manner. The extremities of this lever extend slightly over and beyond the barrels, and to each of those extremities, by means of a suitable connecting rod g_1, g_2, pivotally mounted thereon, is attached one of the

breech-blocks d_1, d_2 by a pivot engaging with the other end of the connecting rod g_1, g_2.

The pivot e may be movable as for instance in a longitudinal direction in order to stop the action of the rocking lever f, or it may oscillate in order to amplify the lateral movement of the connecting rods, or for other purposes.

When a barrel and its cylindrical breech-block are telescopically extended the breech-block will hereinafter be referred to as in the open position (lower portion of Figure 1), and it will be clear from the above description that in view of the see-saw action of the rocking lever one breech-block must be closed while the other is open and as one closes the other opens.

At a suitable point on each barrel preferably on the top surface and in front of the trunnion, is a lug or lugs h_1, h_2 rigidly attached to, or integral with, the barrels d_1, d_2. Adjacent to this and rigidly attached to, or integral with, the connecting rod of the breech-block of that barrel is or are one or more inwardly projecting shoulders or fingers or similar devices j_1, j_2 adapted to be moved in front of the said lug or lugs h_1, h_2 so that when the connecting rod g_1 or g_2 has come to rest the engagement of lugs h_1, h_2 and the respective shoulders j_1, j_2 serves to lock the barrel and breech-block together.

When the members are in this position the charge is inserted and fired by means to be described below. It will be appreciated that by recoil from the explosion, the barrel and breech-block will tend to move together rearwardly and will be able to do this to a limited extent which is fixed by the small amount of longitudinal movement of the barrel allowed relative to the trunnion. When however this rearward movement of barrel and breech-block accurs the breech-block connecting rod not only moves rearwardly but also outwardly, since its end, which is pivoted to the rocking lever f, describes an arc of a circle. The shoulders or fingers j_1, j_2 on the connecting rods are so positioned and dimensioned with respect to the locking lug or lugs h_1, h_2 of the barrels that the amount of outward movement of the connecting rod due to the small combined movement rearwardly of both barrel and breech-block is sufficient to separate each shoulder from its lugs so that thereafter the breech-block is unlocked from the barrel and proceeds to move alone while the barrel remains stationary against the trunnion or against a suitable stop which may be provided. Meanwhile the other breech-block moves under the influence of the other arm of the rocking lever to its closed position, the final part of the movement serving to lock it to its barrel, whereupon the charge is fired and the same series of operations follows, as described above. From this description it should be clear that the operation of one barrel and breech-block is entirely dependent upon the firing of a charge in the other barrel, but the action is otherwise entirely automatic apart from the provision of a spring or other means for initiating the cycle of loading and firing operations.

A preferred form of cartridge for use with the type of gun referred to above is shown in Figure 2 and comprises a bullet 1, preferably of streamline form, associated with an explosive charge 2 of cordite held in a case made of a similar combustible material, e. g. cordite or of combustible or explosive cellulose or similar material.

It will be appreciated that since cordite is adapted to be formed in this manner not only is the cost and difficulty of manufacture reduced, but there is also eliminated the metal cartridge case which is responsible for a very large percentage of gun failure due to jamming. Further the cartridges may be connected together by thin webs 3, also of cordite or similar material, which are integral with the cordite or similar casing of the charge, so that the cartridges may be issued in bead-like strings (as shown) containing any desired number of rounds such as 25, 50, 100 or 200 etc. Fibrous materials may if desired be introduced in order to strengthen the cartridge envelope and/or web. In this way another cause of jamming in guns at present in use—the feed belt—is eliminated. It is to be understood that any explosive or combustible other than cordite, which is adapted to be formed as a casing for the charge and as a connecting web, may be employed without departing from the scope of the invention.

It will be clear from the above description that the whole cartridge is explosive and consumable. The charge and its casing is totally inflammable, the bullet is fired out and, at once, without ejection of a casing or residue, the barrel is ready to receive a new charge. Alternatively, if preferred, the gun may be adapted for use with metallic cartridge cases.

Feeding of the cartridges is carried out, either from above the gun through a hopper device feeding a slot in the breech, or, preferably, from below the bed c upon which the barrels are mounted, through a slot k_1, k_2 in said bed, with which a second slot in the breech-block comes into alignment when the breech-block reaches its open position. When these two slots come into register the band of cartridges is moved upwardly, from, say, a coiled position in the feeding box below, by means of a sprocket drive or a pawl and ratchet device or otherwise suitably, to bring the next cartridge within the breech-block and held upwardly therein by the connecting web 3 joining it to the band. The wall l of the breech-block at the rear end of the slot is formed with two transverse knife edges, one coincident with the top or inner surface

and the other coincident with the outer or lower surface which rides over the base or bed of the barrels. The inner or upper of these knife edges is arranged to be somewhat in advance of the lower, and the adjacent slot surfaces are so arranged that as the breech-block moves to its closed position the knives act as cutting edges to shear off the cordite web connecting neighbouring cartridges. By advancing the upper knife edge the web is prevented from entering the barrel, and it may be ejected through any suitable enlargement of the lower slot or through any other aperture or in any other suitable way out of the vicinity of the operating members, for subsequent disposal. Having sheared the cartridge from the cartridge band, the breech-block continues to advance carrying the cartridge with it and lodging the same in its firing position at the rear end of the barrel. When this position is reached the locking means j_1, h_1 or j_2, h_2 between the barrel and breech-block are operative as described above, and the device is ready for firing.

Firing of the charge is preferably effected by pneumatic means and to this end a cylinder m_1, m_2 is rigidly attached to, or integral with, the side of each breech-block. The axis of this pneumatic cylinder is parallel to the axis of the breech-block and the pneumatic cylinder is closed at the rear end except for a narrow tubular channel or tunnel n_1, n_2 leading into the gun through the rear end of the breech-block. In each pneumatic cylinder is housed a plunger-piston o_1, o_2, from which a rod p_1, p_2 passes out of the forward and open end of the cylinder. On the piston rod is fitted a spring r_1, r_2, preferably of the coiled helical type, adapted to bear against a stop s_1, s_2 mounted on the barrel bed, so that any forward movement of the piston puts the said spring under compression through the medium of the piston rod. Alternatively with the spring under compression it tends to drive the piston inwardly of the pneumatic cylinder, compressing the air or gas contained therein, and forcing it through the abovementioned tunnel n_1 or n_2 through the breech-block into the barrel. In order that this may operate at the desired time a pawl or detent t_1, t_2 pivoted on the table is adapted to catch and hold the spring under compression until the critical moment, when it may be suitably released, as by gearing or trip mechanism attached to the rocking lever or to any other suitable working part.

In operation the piston works as follows:—

With the breech-block suitably locked relative to the barrel, the pawl or detent t_1 or t_2 is withdrawn (by the means referred to above) to release the spring r_1, r_2 which thereupon forces forward the piston o_1, o_2 to compress the enclosed gas which streams into the barrel and fires the charge, as described more fully below. A proportion of the gaseous pressure due to the explosion is then transmitted back to the pneumatic cylinder and serves to return the piston and compress the spring which is then caught by the pawl or detent t_1 or t_2 and held under compression in readiness for the next charge. The breech-block meanwhile recedes to the open position, takes up the next charge and, moving forwardly to the closed position, causes an initial compression of gas or air in the pneumatic cylinder as it moves forward relative to the stationary piston. When the breech-block reaches, and is locked in, its closed position the pawl or detent is again released, the piston o_1 or o_2 completes the initial compression of the gas, which reaches such pressure as to fire the new charge, and the cycle of operations is repeated indefinitely.

The compressed gas operates to fire the cartridges as follows:—

Longitudinally of each cartridge and from the rear end is formed a tunnel 4 terminating in a pressure plate 5 of rigid material embedded in the cartridge and perpendicular to the axis of the tunnel. From the forward side of this plate, projecting into the cordite and adjacent to an ignition cap 6 which is also embedded in the charge, is a pin 7. When now the pawl or detent t_1 or t_2 is released and the piston forces gas or air at high pressure through the tunnel n_1 or n_2 in the breech-block, the pressure plate 5 is pushed forward and the pin 7 punctures the ignition cap 6 whereby the charge is fired. If desired the tunnel 4 at the rear end of the cartridge may for safety be in the shape of a Venturi tube or bottle-neck (as shown) so that accidental firing can only take place under exceptional circumstances involving the insertion of a nail or pin into the cartridge tunnel.

It may be desirable in firing to allow of sudden release of the compressed gas from the pneumatic cylinder into the barrel, instead of a comparatively steady increase of pressure while the piston advances, and to this end any suitable port or valve devices may be introduced into the air tunnel of the breech-block to be operated in a suitable way, such as from any of the working parts, in order to delay the passage of compressed gas until a critical moment.

As an alternative means for ignition, if desired, the pneumatic cylinder and piston may be dispensed with and the pressure plate or primer of the cartridge struck by a pin projecting inwardly from the inner rear face of the breech-block. This pin may be surrounded by a helical guard spring which serves to push the cartridge from the serving position, i. e. at the inlet slot, to the firing position. At this point the spring may meet greater resistance and may be compressed with the result that the pin of the breech-

block would be forced forward relative to the guarding spring, into the ignition hole of the cartridge, to depress the pressure plate and puncture the ignition cap.

As a further alternative shown in Figure 3 a loose firing pin may be contained in a longitudinal recess in the breech-block, having no aperture except towards the primer. On recoil this firing pin sets back, while on run out it flies forward and detonates the primer by virtue of its momentum which may be increased by weighting, if desired.

In order to start the gun it will be clear that power must in the first place be supplied either to compress the air in the pneumatic cylinder in the case of pneumatic firing, or to throw one of the breech-blocks forward at sufficient speed to depress or rupture the cartridge pressure plate, in the case of pin-percussion firing. To this end, in the case of pneumatic firing an upwardly or outwardly projecting lever may be fitted to facilitate the compression of the piston spring to engagement by the pawl t_1 or t_2 which may then be released initially by a suitable trigger device, while in the case of pin-percussion firing a similar lever may be fitted to operate a spring placed behind one of the breech-blocks, so that the said spring may be compressed to be held back by a similar pawl or detent. When this pawl is released by a suitable trigger, the spring functions to throw the breech-block forward thus firing the charge, and it is adapted, when the breech-block opens again under the pressure of that initial explosion, to be compressed and permanently retained thereafter by the pawl in order not to hinder the further operation of the breech-block.

Various features of the invention described above may readily be applied to weapons, e. g. small arms of the pistol or rifle type having only one barrel, and such a modification in accordance with the invention will now be described.

Single barrelled small arms in accordance with the invention may comprise a breech-block in the form of a cylindrical case closed at its rear end adapted for sliding fit externally upon the rear end of the barrel, as in the above-described dual barrelled modification. For the purpose of loading a slot in the wall of the breech member is adapted, when that member is in an extreme outermost or open position, to register with a similar slot in the magazine or cartridge storing compartment, thus forming a passage through which a cartridge may be fed into the breech-block and thereby moved into its firing position in the barrel.

Preferably the cartridges are formed of a bullet and an explosive charge held in a casing of the same or similar explosive material so that the whole is consumable; and preferably loading is effected in the manner previously described and for that purpose the cartridges are initially formed on a web of the same or similar material to the explosive, from which they may be each cut off prior to firing, by one or more knife edges on the edge of the feeding slot in the breech, in the manner previously described.

With weapons whose breech mechanism is hand operated (whether of single loading, magazine or semi-automatic self-loading type) the pistol grip or other handling device may advantageously be attached to the bolt or breech-block and may carry a trigger and other parts of the firing mechanism, thus enabling the weapon to be loaded (if the weapon is not automatic or semi-automatic) and to be fired without the necessity of removing one's hand from the trigger.

When the invention is applied to automatic or semi-automatic weapons having only one barrel a return-spring, if necessary in combination with breech locking devices, of normal design, may be employed; or alternatively a pneumatic or hydro-pneumatic "run-out" may be introduced.

For single loading or magazine arms the breech locking mechanism, i. e. lugs and resisting shoulders, for example, may be of normal design, either locking by a partial turn or by a "straight-pull" operation.

In any of the arms mentioned above firing of the cartridge may be carried out by pneumatic means. These may comprise, for example, a cylinder attached to, or used in conjunction with, the weapon, or a part or parts thereof, fitted with a piston reciprocated by suitable means, such as by recoil from the bullet or by pressure from the explosive gases to compress air, whereby a detonating cap of a future charge may subsequently be actuated, in a manner similar to that described above. Alternatively for firing the charge air may be compressed into a suitable reservoir by the explosion gases themselves acting directly through suitably arranged ports or valves; or a "floating" piston, i. e. a heavy piston freely mounted and adapted to move into action without direct mechanical control (e. g. under its own momentum), may be employed (as shown in Figure 3). In order to compress air initially to enable firing to commence a hand lever or similar device adapted to compress the air initially in the reservoir, by moving the piston, for example, or by any other suitable means, may be provided. The column or jet of compressed air projected against the cartridge may be used to impel a pellet of high specific gravity carrying a needle, against a cap in the cartridge, or vice versa. These devices, and air compressed thereby, as well as a portion of the compressed air contained, throughout the firing, in the reservoir, may be used, if desired or necessary, to assist in cooling the weapon and thus to maintain the various parts at a suit-

ably low operative temperature during firing.

In order to make best use of the explosive pressure generated various devices for improving obturation may be introduced in any modifications of the invention. Thus piston rings may be introduced inside the bolt to block any clearance between its inner surface and the barrel. Similarly advantage may be made of the elastic properties of the steel or other material of which the barrel is made, to cause the rear end to expand slightly, under impulse from the propellant and thus temporarily to fit tightly within the inner surface thereof. Further the explosive or combustible material forming the envelope of the cartridge may be so chosen or arranged, in position, quality or quantity, that a suitable rate of burning is obtained whereby the bullet leaves the muzzle before the envelope is wholly consumed, thus assisting obturation and contributing to the lowering of the pressure in the barrel before the breech is opened.

It will be appreciated that in any form of the invention the rear ends of the barrel, and particularly the outer edges thereof may be severely subjected to bad effects from the explosive gases and erosion may take place. In order to facilitate the quick repair of such deterioration an annulus at the rear end of each barrel may be removably fitted thereto in such a way that when eroded it may easily be withdrawn and replaced by a new one. Such annuli may, for example, be in the form of short cylinders adapted to be forcibly slipped or shrunk or screwed on to the barrel over a short portion at its rear end having a reduced external diameter, in such a manner that the annulus fills the "step" in the barrel and completes its external cylindrical form.

In order further to ensure substantially gas tight jointing in the barrel and the breech-block one or more asbestos washers or pads may be introduced at suitable points. Such washers or pads may, for example, take the form of the well known de Bange pad at present in use.

If desired suitable cooling devices may be introduced to maintain the barrels and other working parts at suitable temperatures, but in view of the fact that the barrels are well exposed, that the moving parts generate air currents and eddies having substantial cooling effects and that, since in dual barrelled modifications the barrels are used alternately, the time allowed for each barrel to fire one round is doubled, such cooling is probably, in general, unnecessary. If necessary it may, for example, take the form of water jackets surrounding the parts to be cooled, or any other suitable form adapted to meet local requirements and conditions to be fulfilled.

In the case of breakdown or stoppage of the weapon due, for example, to misfiring, jamming or overheating, the gun is adapted for rapid reconditioning by quickly replacing the troublesome barrel, and it will be appreciated that since the barrels are identical, it will be sufficient to carry only one extra barrel in the gun equipment even of dual barrelled forms of the invention. On this account also it will be appreciated that accurate mass production of the barrels can be easily and cheaply effected, this being a not insignificant advantage introduced by the invention.

It is considered that machine guns and like weapons according to the invention are better adapted to use charges giving relatively low or medium pressures and velocities and on this account the trajectories and angles of descent of the bullets will be of considerable amplitude. On the other hand the calibre of the gun may be considerably larger than present general practice, thus allowing the use of tracer bullets and strike-indicating bullets considerably more efficient and of greater range over which the path is indicated than can at present be employed. In view of this a considerable percentage of rounds fired (say even 30%) may consist of tracers, and by this means the accuracy now necessary in range-finding can be reduced, since errors therein, or errors due to the high curvature of, and comparatively slow movement of the bullet along its trajectory can quickly be noted and compensated.

The reduced weight of ammunition relatively to weight and energy of projectile is an important contributory factor peculiar to the present invention when considered in connection with range finding and control of fire.

It is to be borne in mind however that the invention is not limited to any particular form of ammunition but that, while the special form of totally inflammable charge described above may be employed, the ordinary form of small arms ammunition (comprising a charge in a brass or like casing in which the bullet is mounted) or any other suitable form of cartridge may be used. The feeding of such ammunition may be operated in substantially the same way as described above, i. e. through registering slots at the top, bottom or sides of the breech-block through which injection may be effected by means of levers, cams, springs or the like, or (if feeding is from above) by means of gravitational forces whereby the cartridges drop, one by one, say from a hopper above.

It is to be understood that the invention is not to be limited to any details of the modification thereof described above which is given purely by way of example. Furthermore we may make any alterations in parts of the invention which are necessary under

the conditions to be fulfilled to carry the invention into effect without departing from the ambit thereof in any way.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A weapon comprising a barrel, a breech-block for the barrel having a sleeve confining the barrel and slidably guided its entire length thereon.

2. A weapon comprising a barrel having an unobstructed exterior, a breech-block for the barrel including a sleeve adapted to enclose the barrel and having intimate sliding engagement with the barrel.

3. A weapon comprising a barrel, a breech-block for the barrel including a sleeve adapted to slide on the barrel, leakage of gas from the breech of the barrel between the sleeve and barrel being in a direction toward the discharge end of the barrel.

4. The combination with a gun barrel, of a breech-block therefor including a sleeve slidably guided on the barrel, fluid controlled means for igniting a cartridge in the breech of the barrel, and means for discharging gases in a direction away from the breech-block.

5. A weapon as claimed in claim 1, wherein the breech block is provided with a cutting edge.

6. A weapon comprising a barrel, a breech-block slidably guided thereon, a cartridge box, the breech-block and box having slots therein adapted to register for the passage of a cartridge therethrough to the breech of the barrel.

In testimony whereof I have signed my name to this specification.

LATHAM VALENTINE STEWART BLACKER.