Dec. 15, 1925. 1,565,895

A. B. BLAUSTEIN

ELECTROMAGNETIC GUN

Filed Oct. 22, 1921

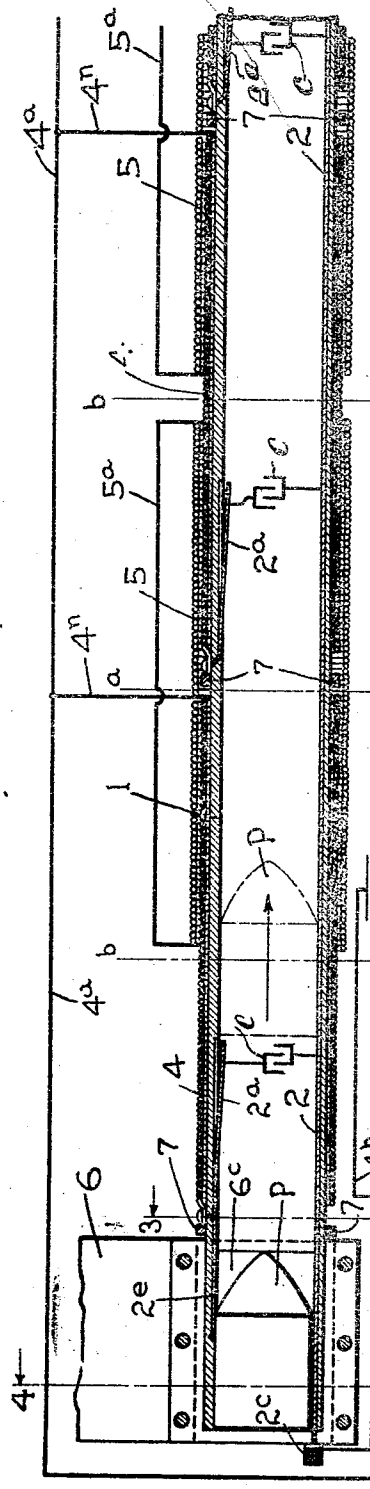


Fig. 1.

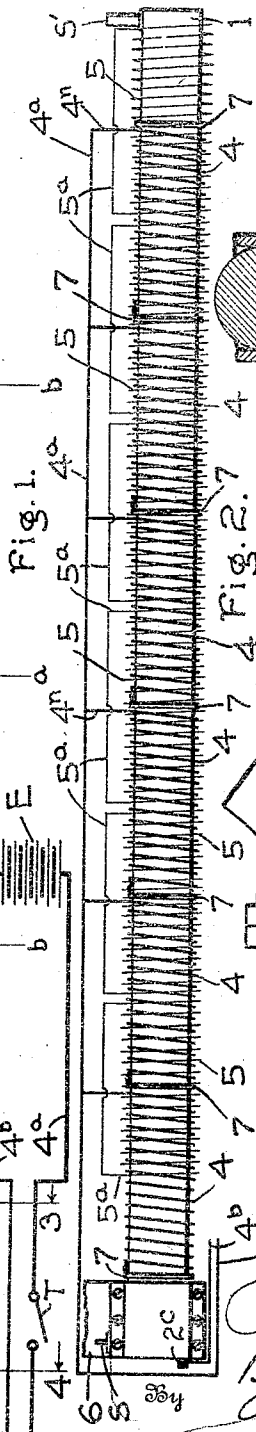


Fig. 2.

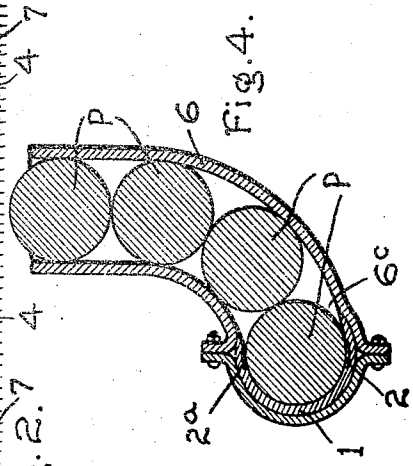


Fig. 4.

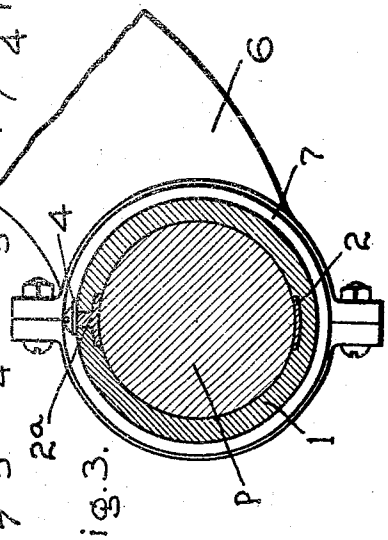


Fig. 3.

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AND PROJECTORS,

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UNITED STATES PATENT OFFICE.

ABE B. BLAUSTEIN, OF BUTTE, MONTANA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ELECTRICAL DEVELOPMENT CORPORATION, OF BUTTE, MONTANA.

ELECTROMAGNETIC GUN.

Application filed October 22, 1921. Serial No. 509,618.

To all whom it may concern:

Be it known that I, ABE B. BLAUSTEIN, a citizen of the United States, residing at Butte, in the county of Silver Bow and State of Montana, have invented certain new and useful Improvements in Electromagnetic Guns; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention relates to electromagnetic guns, and is especially adapted for very rapid fire guns of small calibre, although capable of use for heavier ordnance.

The principal object of the invention is to provide an electromagnetic gun wherein the necessity of the projectile traveling by momentum from one magnetic field to another is reduced to a minimum, if not entirely obviated, and the projectile is practically moved with continuously increasing velocity through the barrel by a series of overlapping solenoids, all acting in the same direction, and one beginning to act upon the projectile as or before the preceding solenoid becomes ineffective thereon, thereby imparting a practically continuously exerted impelling impulse to the projectile, so that it is discharged from the barrel with extreme velocity.

A further object is to provide a gun of the nature described, whereby, if desired, a large number of projectiles can be discharged successively from the barrel in practically a continuous stream and at high velocity.

In the accompanying drawings I have illustrated one practical embodiment of the invention and will describe the same with reference thereto, to enable others skilled in the art to understand and use the invention. Various mechanical features of construction while novel are not of the essence of the invention and I do not consider it restricted to such mechanical features, and therefore have set forth in the claims the essentials of the invention, and the novel combinations of parts, and novel details of construction for all of which protection is desired.

In said drawings:

Fig. 1 is a sectional elevation of a portion of an electro-magnetic gun embodying the invention.

Fig. 2 is a diagrammatic view of such a gun showing the electrical connections.

Fig. 3 is an enlarged transverse section on the line 3—3 Fig. 1. Fig. 4 is a transverse section on the line 4—4 Fig. 1.

The barrel 1 of the gun may be made of any suitable non-magnetic material, or be lined therewith, and so that the projectile will not improperly short circuit the electric circuits or solenoids in passing through the barrel.

Surrounding the barrel are a series of primary solenoids 4 arranged end to end. These are practically constructed alike, but each is separate and distinct from the others. Preferably each primary solenoid is approximately three times the length of the projectile to be discharged from the gun.

The primary solenoids 4 are arranged closely adjacent end to end throughout the length of the barrel but each is adapted to be independently connected to the source of electricity as hereinafter described.

The projectile P may be of any suitable kind and formed of or provided with exterior conducting material so that it will serve both as the core for the solenoid and also preferably as the maker and breaker for the circuit through each primary solenoid as the projectile travels through the barrel.

Any suitable source of electricity may be employed; I preferably employ a high power direct current generator according to the size of the gun and weight of the projectiles to be discharged thereby.

Assuming that a projectile P is placed at the inlet end of the barrel and the primary solenoids 4 then successively energized, the projectile would be first drawn to the center of the solenoid 4 with more or less velocity, (depending upon the strength of the current, size of the solenoid and weight of the projectile). If the current is cut off from the first primary solenoid 4 when the projectile reaches the center thereof, the projectile would move on by momentum until it comes under the influence of the next adjacent primary solenoid; and if such primary solenoid be properly energized the projectile would be drawn on thereinto; and so by successive solenoids impelled through the barrel with increasing velocity and projected therefrom.

Electro-magnetic guns of this kind and so operated have heretofore been proposed, but in such guns so operated the projectile P has to travel by momentum from the center of one primary solenoid until it comes under the influence of the next primary solenoid; and therefore the projectile has a succession of distinct impulses imparted to it, alternating with a distinctly separated succession of linear spaces which it has to traverse by momentum, and in which it is subjected to the retarding action of the residual magnetism created in the projectile and the solenoid when the current is broken, and also the retarding influences of gravity and friction.

The essentially novel feature of my invention resides in the employment of auxiliary or secondary solenoids whereby the instant that the current is cut off of one primary solenoid and during the time the projectile would ordinarily have to travel by momentum across a dead linear space (subject to retarding influences as above described), it is subjected to the pull of a supplemental or secondary solenoid which draws the projectile across such dead space under magnetic attraction and enters it into the next succeeding primary solenoid.

Surrounding the series of primary solenoids 4 are a series of secondary solenoids 5; the secondary solenoids approximately correspond in length with the primary solenoids, but are so arranged as to alternate or break joints therewith; that is each secondary solenoid 5 is arranged to overlap the adjacent ends of two primary solenoids 4; the center of such secondary solenoid 5 being opposite the space between the adjacent ends of the adjacent pair of solenoids 4; and the ends of such secondary solenoid 5 terminate approximately adjacent the respective centers of the two primary solenoids which such secondary solenoid overlaps. Thus as shown in Fig. 1 the center (indicated by the dotted line *a*—*a*) of the secondary solenoid 5 is intermediate the ends of the two adjacent primary solenoids 4; while the centers (indicated by dotted line *b*—*b*) of the two primary solenoids are practically alined with the ends of the said secondary solenoid.

Each secondary solenoid 5 has its terminals connected by a conductor 5^a forming a closed circuit. Each secondary solenoid 5 is energized by induction in the well known manner when the current through the related primary solenoid is broken.

An induced current passes through the secondary solenoid the instant that the current is broken in the related primary solenoid, and the more abruptly the current is broken in the related primary solenoid the greater will be the current induced in such secondary solenoid.

The direction of the induced electromotive force in the secondary solenoids should be such that the pull exerted by the secondary solenoid will be in the same direction as the primary solenoid, the windings of the primary solenoids being indicated in Fig. 1 shown in heavy lines.

In my invention instead of the projectile having to jump by momentum from one primary solenoid to the next the instant that one primary solenoid ceases to act effectively on the projectile, the latter is subjected to the influence of a powerful secondary solenoid and drawn forward across the heretofore dead linear space on into the influence of the next succeeding primary solenoid; so that at no time during the travel of the projectile through the barrel does it have to move any appreciable distance by momentum, and its velocity is practically continuously increased from the instant that it starts forward in the barrel until it leaves the muzzle thereof or until the projectile speed is equal to the speed of travel of the lines of force.

In my invention the projectile is always subjected to the use of the speed of travel of the magnetic lines of force electro-magnetic attraction drawing it forward, with increasing velocity, as it receives an additional forward impulse from each successive primary solenoid and each successive secondary solenoid. The secondary solenoids alternate in their drawing action with the primary solenoids, and the primary and secondary solenoids thus exert a practically continuous magnetic pull upon the projectile while the same is passing through the barrel.

Any suitable means may be employed for energizing the primary solenoids successively. Preferably the projectile P is used to control the circuits through the successive primary solenoids. For this purpose in the barrel 1 is arranged a longitudinally disposed contact bar 2 which may be made of any suitable material and as shown extends through the barrel of the gun and into the feed hopper 6^c at the breech end of the gun and is electrically connected by a conductor 4^b to the source of electricity.

One terminal of each primary solenoid 4 is connected by a conductor 4^n to lead 4^a which connects with the source of electricity conventionally indicated at E. The other terminal of each primary solenoid is electrically connected with a contact 2^a, which extends into the barrel 1, adjacent but spaced from the bar 2. Each contact 2^a is preferably formed of a spring metal strip having one end fastened to the barrel and its other end projecting into the barrel through an opening therein and extending lengthwise thereof toward the center of the related primary solenoid as shown. When a projectile enters the barrel it contacts with the bar 2 and spring 2^a and closes the elec-

trical circuit between the contact spring 2^a and the contact bar 2.

Each contact spring 2^a preferably extends into the related primary solenoid so that just as or before the shell reaches the center of such solenoid 4 the shell will clear the contact 2^a, thus breaking the circuit through such primary solenoid; and when this circuit is broken a current is induced in the related secondary solenoid 5, which draws the projectile onward toward the center of such secondary solenoid 5, and also destroys or lessens the lag or residual magnetism in the primary solenoid and projectile which would ordinarily retard the projectile. Just as or before the projectile reaches the center of the secondary solenoid it engages the contact spring 2^a of the next succeeding primary solenoid and the latter is energized and takes hold of the shell and moves it forward.

The primary solenoids and secondary solenoids thus act in alternation as described to continuously impel the shell through the barrel with continuously increasing pressure and velocity.

In order to enhance the current in each secondary solenoid 5 from the preceeding energized related primary solenoid 4, and reduce sparking between the contact springs 2^a and bar 2, a condenser C is shunted between each contact spring 2^a and the bar 2, as shown in Fig. 1.

The projectiles P may be fed to the barrel in any suitable way and by any suitable means. If desired they can be fed by gravity through a feed chute 6, the lower portion of which is preferably curbed and fitted to an opening in one side of the breech end of the barrel, as indicated in Figs. 1 and 4, so that the lowermost projectile enters the barrel by gravity. When a projectile enters the chamber 6^c (as in Figs. 1 and 4) it closes the circuit between the contact spring 2^a and contact bar 2, and the projectile is discharged, as above described.

The inlet opening in the barrel is close to the inlet end of the first primary solenoid 4 (see Fig. 1) and the contact spring 2^a of the first primary solenoid may have an extension 2^e projecting from it into the chamber 6^c at the feed end of the barrel, as shown in Fig. 1 so that when the projectile enters the barrel it contacts with said part 2^e and with the bus bar 2, thereby closing an electrical circuit through the first primary solenoid, and the projectile is immediately discharged through the barrel—as described, provided, of course, that the primary solenoids are energized.

Any suitable means may be provided for controlling the electric current through the primary solenoids, for instance a switch or circuit closer T, of any suitable kind, may be placed in the main line 4^a (see Fig. 1) and when this switch is closed the primary solenoids will be energized, as described on the entry of a projectile; and as fast as the projectiles roll into the barrel they will be discharged, so long as the switch T remains closed. In practice any suitable trigger switch (not shown) may be provided so that the projectile may be discharged singly or successively at the will of the operator.

The adjacent solenoids may be separated or spaced apart on the barrel by means of annular rings or collars 7 of any suitable material placed on the barrel and interposed between the adjacent ends of the primary solenoid. The barrel may also be provided with proper sights indicated at S and S′, at its breech and muzzle; and in actual practice a suitable mount (not shown) should be provided for supporting the gun so that it can be readily trained and operated like an ordinary machine gun where the invention is employed for light guns or like heavy pieces of ordnance, if the invention is employed for large projectiles. The particular mount of the gun forms no feature of the present invention and therefore needs no explanation herein. The barrel is shown as plain, but if desired it and the projectile might be rifled.

The details of construction and dimensions of parts will vary according to the size of the gun, and the preference of the constructor and are not essentials of the present invention.

The power of the gun, and the velocity with which the projectiles are discharged therefrom, will depend upon the length of the barrel, the size and number of the primary and the secondary solenoids, the length and weight of the projectile, and the strength of the electrical current; and the mechanical perfection of the details of construction.

What I claim is:

1. In an electro-magnetic gun, a series of primary solenoids arranged end to end along the barrel, means for successively electrically energizing the primary coils as the projectile traverses the barrel, and a series of short circuited secondary solenoids alternating with the primary solenoids and adapted to be energized by induction from the primary solenoids when the circuits in the primary solenoids are broken.

2. An electro-magnetic gun comprising a barrel adapted to receive a magnetizable projectile; a plurality of primary solenoids surrounding the barrel and arranged end to end, each primary solenoid being approximately three times the length of said projectile; electrical connections between each primary solenoid and a source of electricity; means whereby the projectile will make and break the primary solenoid circuits as the projectile traverses the barrel; and a plural-

ity of short-circuited secondary solenoids surrounding the barrel and primary solenoids, and alternating with said primary solenoids; said secondary solenoids being energized by induction from the adjacent primary solenoids as the circuits in the latter are broken; whereby the secondary solenoids will be energized in alternation with the adjacent primary solenoids, and the projectile impelled through the barrel with continuing increasing pressure and velocity.

In testimony that I claim the foregoing as my own, I affix my signature.

ABE B. BLAUSTEIN.