

T. J. MAYALL.
MACHINE GUN.

No. 30,335

Patented Oct. 9, 1860.

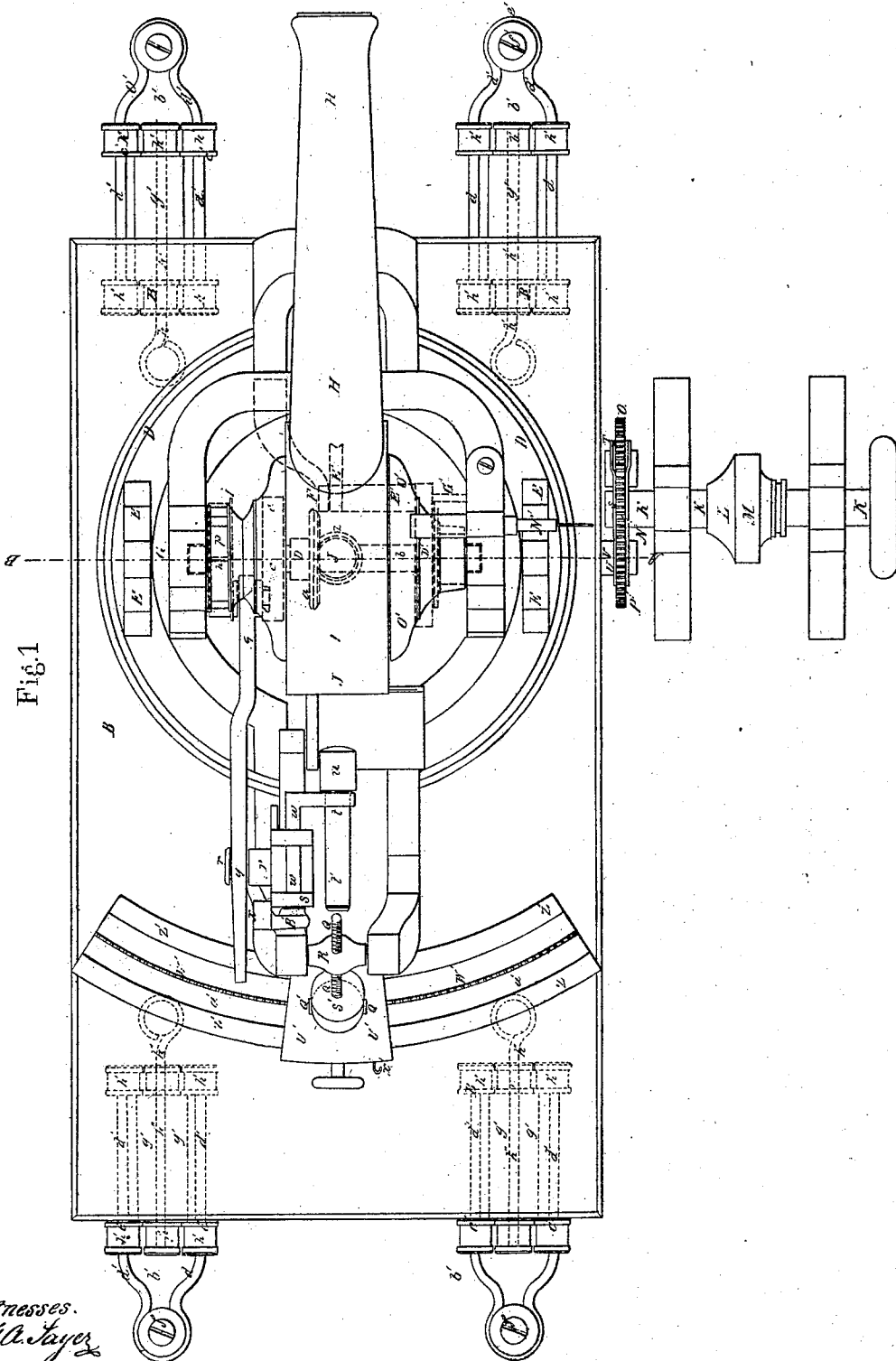


Fig. 1

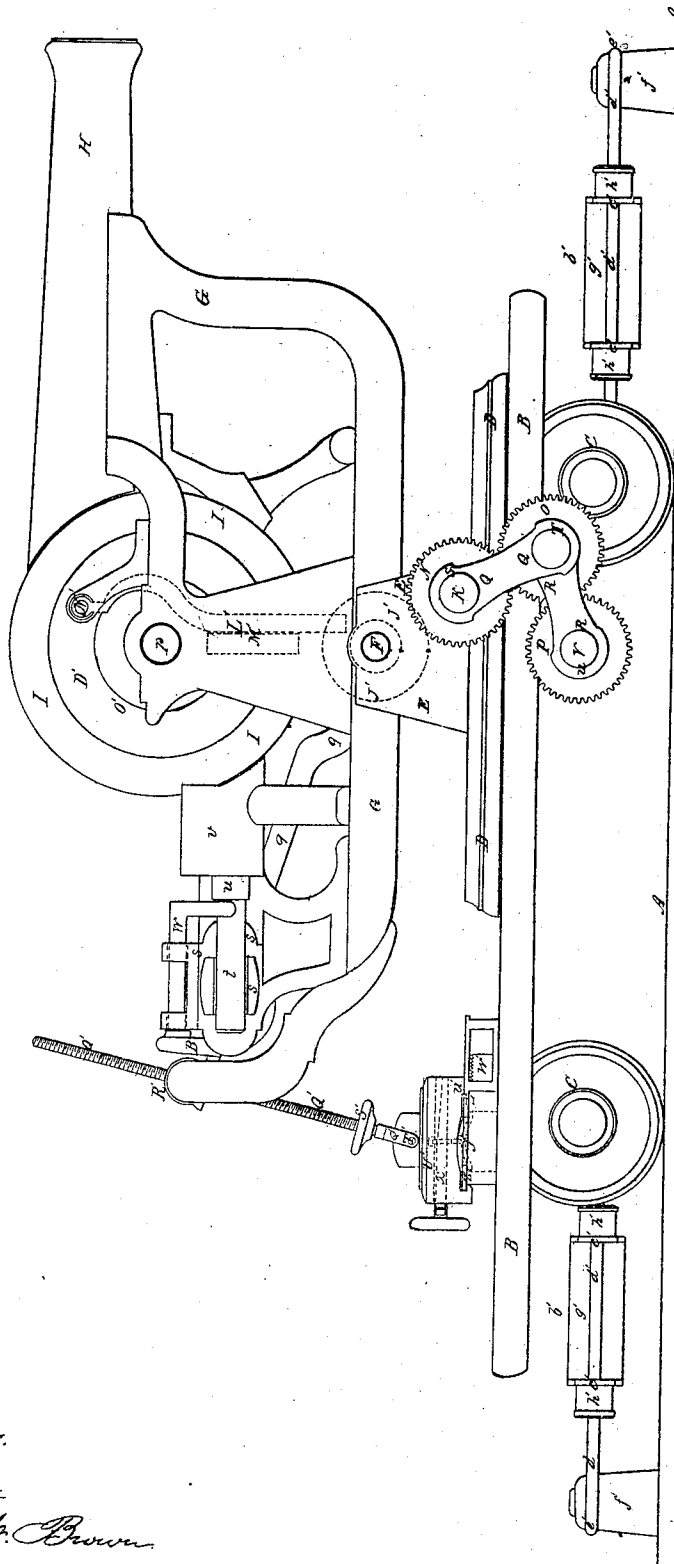
Witnesses.
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Albert H. Brown

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Fig. 2.



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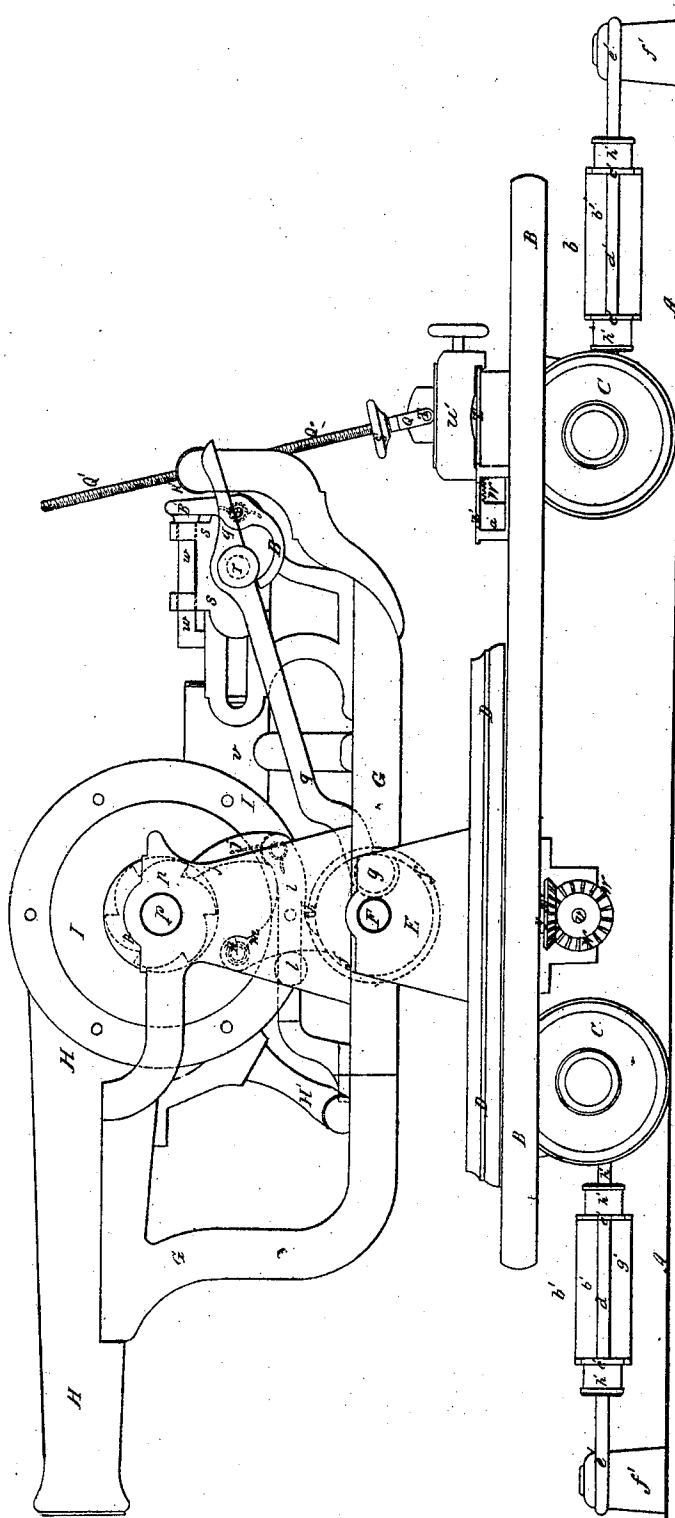
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Fig. 3.



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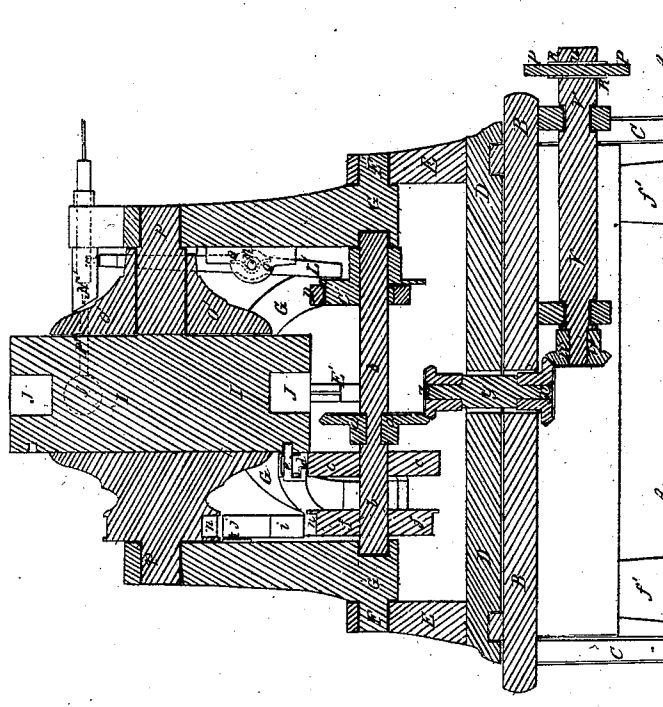
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Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS J. MAYALL, OF ROXBURY, MASSACHUSETTS.

IMPROVEMENT IN BREECH-LOADING ORDNANCE.

Specification forming part of Letters Patent No. 30,335, dated October 9, 1860.

To all whom it may concern:

Be it known that I, THOMAS J. MAYALL, of Roxbury, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Ordnance for Field-Pieces, Vessels, Batteries, Fortifications, &c.; and I do hereby declare that the following description, taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements, by which my invention may be distinguished from all others of a similar class, together with such parts as I claim and desire to have secured to me by Letters Patent.

The figures of the accompanying plate of drawings represent my improvements.

In Plate 1, Figure 1 is a plan or top view of my improved ordnance for field-pieces, batteries, &c. Plate 1, Fig. 2 is a side elevation of the same. Plate 2, Fig. 3 is a side elevation of the same. Fig. 4, Plate 2, is a central longitudinal vertical section. Fig. 5, Plate 3, is a transverse vertical section taken in the plane of the line A B, Fig. 1, Plate 1.

The present invention consists in a new mode of constructing and operating ordnance for field-pieces, vessels, batteries, fortifications, &c., constituting an entirely new system of gunnery, and having for its objects the performing of all the various functions and operations of loading, firing, thumbing, sponging, &c., of cannons and other fire-arms by machinery in lieu of the usual methods, and so as to produce a rapid and nearly continuous discharge of projectiles, the apparatus, moreover, besides possessing the necessary automatic motions for effecting the above-named offices, being self-regulating, so as to provide for the accidental non-discharge of any one charge without interrupting or interfering with the general operation of the whole.

To obtain accuracy of aim, combined with rapidity of loading and firing, is evidently impossible by any of the methods heretofore practised, as has been found in the use of breech-loading artillery where facility of loading has been effected at the expense of accuracy of aim, it being necessary on account of the recoil to reset the gun after each discharge, thereby consuming as much time as was gained by the rapidity of loading. In my invention I have provided for this contingency by the use of devices which almost instantaneously replace

the gun after the recoil in the precise position which it occupied before its discharge, so that the desired direction once being given to the barrel each and every discharge will throw the projectiles in that direction until the gun is raised or lowered or slewed to the right or left, as the case may be. My new apparatus is also so arranged and operated that the guiding and setting of the aim of the gun can be effected while the loading, firing, sponging, and all the necessary operations are taking place, without interrupting or interfering with the same, whereby the rapidity of the discharge will suffer no diminution, as would otherwise be the case.

The main features of the apparatus represented in the drawings, the details of which I shall next proceed to describe, consist of a revolving many-chambered cylinder or magazine to which such an intermittent rotary motion is given as to bring its chambers successively in apposition with a gun barrel, a rammer so operating as to force the charges, one at a time, from a hopper or receiver into the chambers of the cylinder as fast as one is discharged; a sponger which has a reciprocating rectilinear motion, so as to cleanse the gun each time a charge is fired, and an arrangement of devices for thumbing the touch-holes at the proper moment.

The operations of igniting the charges, of resetting the gun after each recoil, and of providing for the guiding and aiming of the same at the same time that the loading, firing, &c., are going on, so as to prevent any diminution of rapidity in firing, are also distinctive features of the apparatus, as will be hereinafter fully explained.

A A A in the drawings represent a base, such as the deck of a vessel, &c.; B B, a platform or carriage supported by four wheels, C C C, having elastic tires, of rubber, gutta-percha, or other suitable material.

Upon the carriage B B is placed, so as to swing around upon the same, upon suitable friction-rollers, a circular plate, D D, the standards E E of which serve as bearings to the stationary axles F F of a frame, G G, which serves to support the gun-barrel H H, &c., and is susceptible of being raised and depressed and set at any desired angle with the horizon (turning loosely on the axles F F) by means of devices the operation of which will be hereinafter described.

The cylinder I I has formed in it a series of

chambers, J J, &c., and has an intermittent rotary motion in a vertical plane imparted to it, so as to bring each of the chambers J J, &c., in apposition with the gun-barrel H H, as follows:

K K in the drawings represent a driving-shaft having a conical-shaped pulley, L, and laterally-sliding friction-clutch M operating together, so as to produce any desired amount of speed. A band or belt moving by steam or horse power can be applied to the clutch M; or the main shaft may be driven by hand-power.

On the end of the driving-shaft K K is a gear-wheel, N, which, by means of an intermediate gear, O, communicates motion to a gear-wheel, P, the cluster of gears N, O, and P being connected by toggle or swinging arms Q Q R R, turning loosely on bearings at S, T, and U. By thus connecting and supporting the gears N, O, and P it will be seen that the two gears O and P can be brought nearer to the gear N or travel away from the same, as the case may be, without disengaging any one of them with the others. The importance of this arrangement of gearing will be evident, as it permits the main carriage B B to travel freely in a longitudinal direction when the recoil and resetting takes place without disconnecting the devices which communicate motion from the driving-shaft. The gear P is on one end of a horizontal shaft, V V, extending under the carriage B B, on the other end of which is a bevel-gear, W, that engages with a similar gear, X, on the lower end of a short vertical shaft, Y, that passes upward loosely through the carriage B B and circular plate D D, and has on its upper end a bevel-gear, Z, that engages with a similar gear, a, placed on a horizontal shaft, b, turning loosely in proper bearings formed in the swinging frame G G.

Fixed to one end of the shaft b is a circular plate, c, having on its periphery a projection, d, Figs. 1 and 5, the office of which is to disengage at proper intervals of time a spring-clutch, e, from a series of holes in the chambered cylinder or magazine I I, the said spring-clutch, when not thus disengaged by the action of the projection d, serving to firmly hold the cylinder in position while being loaded, &c.

A circular plate, f, connected to the plate c by a short crank-shaft, g, has on its circumference a stud, h, which, as the said plates c and f revolve, abuts against and lifts a jointed lever-pawl, i j, swinging upon a fulcrum at k, having its length of motion regulated by a stop, l, and kept down to its bearing upon the plate f by a spring, m. The spring-pawl i j is thus made to engage at intervals with a ratchet-wheel, n, placed on the same shaft, p, with the magazine I I, which will thus receive an intermittent rotary motion.

I will next proceed to describe the manner in which the several sections or chambers J J, &c., of the cylinder I I are loaded or charged with suitable cartridges, it being premised that the same movements which cause the several

chambers or sections J J, &c., to be brought in apposition with the gun-barrel also cause the several sections or chambers J J, &c., to be brought in succession in proper position for the insertion of cartridges.

To the crank-shaft g of the two plates c and f, so as to swing loosely thereon, is attached a connecting-rod, q. The connecting-rod q engages at or near one end with a short shaft, r, of the traveling carriage s, which thereby receives a reciprocating rectilinear motion. Attached to the traveling carriage s, or forming a part thereof, is a hollow tube or shaft, t, within which plays the rammer u, that receives the same motion as the traveling carriage s, so that the charges or cartridges, being fed into a suitable hopper, v, will at proper intervals of time be driven into the several chambers of the magazine.

In case from any accident the contents of any one chamber of the magazine should fail to be discharged, the rammer u is prevented from driving in another cartridge by its rear end abutting against a sliding bent lever, w, which so actuates an arm, B', turning upon a center at x as to disengage the connecting-rod q from the short shaft r of the sliding carriage s, above referred to, the rammer u and bent lever w being retracted by means of springs y and z, one of which is coiled around the shaft A' inside of the tube or hollow shaft t, and the other around the center or shaft x of the arm B'.

Simultaneously with the loading or charging of one of the chambers J J, &c., one or more of the said chambers are being sponged or swabbed out by means of devices which I will now proceed to describe.

To the horizontal shaft b, before referred to, is secured a cam, C', which, upon the revolution of the shaft b, bears and travels upon the inside surface of a strap, D', attached to a right-angular lever, E, turning upon centers F' and G', to which is connected by a pivot-joint a rod, H', on one end of which is a suitable sponger or swabber, I', so as to cause it to travel in and out of and thereby cleanse each chamber or section of the magazine in succession.

It will be evident that in case of the non-discharge of any of the chambers or sections J J, &c., the devices which operate the sponger I' can be thrown out of gear by any means which will disconnect the cam C' from its strap D'.

The discharge of each chamber successively is provided for by means of a plate, J', attached to the horizontal shaft b, before referred to, upon one side of which is a projection, K', which abuts against an arm, L', turning upon a center at M', and thereby causes at proper intervals of time a rod, N', to enter through a thumbing-plate, O', the touch-holes P' P', &c., of each chamber or section brought in apposition with the said rod by the previously-described revolution of the magazine or cylinder. The rod N' is retracted after entering each touch-hole by means of a spring, Q',

coiled upon the center M' of the arm L' . At the moment that the rod N' enters the touch-hole P' of each chamber of the magazine a spark of electricity is sent through the said rod by means of a suitable battery attached to one end of the same. The thumbing of each touch-hole after every discharge is effected by a stationary plate, O' , against which the cylinder or magazine, by means of a ground or other tight joint, has a close bearing during its revolution, so as to stop all vent of the said touch-holes and prevent a premature discharge. The thumbing-plate O' can also be furnished with rubber or other elastic projections or packings, which upon the revolution of the cylinder or magazine will closely fit over the several touch-holes.

Provision is made for the elevation and depression of the gun, and also for the setting of the gun at any desired horizontal angle with regard to the carriage B , whereby projectiles can be discharged in every desired direction, either parallel with or inclined to the horizon, as follows: Q' is a vertical screw passing through a rocker-shaft, R' , of the rear portion of the swinging frame $G' G'$, so that upon turning a nut, S' , to the right or left the swinging frame G' , and consequently the gun-barrel, magazine, &c., will be elevated or depressed. The screw-shaft terminates in a forked strap, Q'' , attached by swinging joints $T' T'$ to a carriage, U' , made to travel on the arc of a circle by means of a gear-wheel, V' , that engages with the teeth of a toothed arc, W' , thereby slewing the gun to the right or left, as may be desired. The traveling carriage is set and held at any desired position upon the toothed arc by means of a wedge-shaped sliding rod, X' , which, upon a forward motion being imparted to it, causes a strap, Y' , to bear upward against the shoulders $Z' Z'$ of a grooved way, a' , upon which the carriage U' bears. The strap Y' is disengaged from the shoulders $Z' Z'$ by the pulling out of the wedge-shaped rod.

In the accompanying drawings the gun is represented as being susceptible of traveling horizontally upon a portion only of the arc of a circle; but it will be obvious that by continuing the toothed arc W' , so as to form a complete circle, the gun can be made to travel around the entire circumference thereof.

From the foregoing description it will be seen that the guiding or steering of the gun, so as to discharge projectiles in every possible direction, can be readily effected during the time of and without interrupting the various operations of loading, swabbing out, discharging, &c.

To provide for the recoil of the gun, so as to reset it in the exact position which it occupied previous to a discharge, I attach to each end of the gun-carriage $B B$ powerful rubber or other springs $b' b'$, &c., so arranged and operating that both their tension and compression will act equally upon the gun-carriage $B B$. These springs I prefer to construct as follows:

$c' c' c'$, &c., are cross-heads, which slide freely upon side bars, $d' d' d' d'$. These bars are connected to an eye, e' , which is fitted over a suitable standard, f' . The heads $c' c'$, &c., bear upon the ends of a hollow elastic cylinder of india-rubber, g' , or other suitable spring. Through the center of the spring g' and through the cross-heads passes a rod, h'' , terminating in a loop that is fastened to the gun-carriage $B B$. $h' h'$, &c., are washers of india-rubber. It will be seen by this arrangement that the gun in recoiling will be acted upon so as to reset it by a double force—viz., that of the expansive force of the compressed springs at each end of the gun-carriage.

From the foregoing description it will be evident that the firing of the gun need not necessarily be accomplished by means of a galvanic battery, as it might easily be done by hand or by means of a band or tape carrying percussion-caps caused to explode by a hammer worked automatically. An endless band carrying cartridges may also be used to feed the charges to the hopper.

It will also be obvious that my new apparatus may be so mounted upon a carriage as to be used as a field-piece, and that its working parts may be protected from injury by shots by the use of a ball-proof cover.

Having thus described my improvements, what I claim as my invention, and desire to have secured to me by Letters Patent, is—

1. Thumbing the touch-holes of the chambers automatically by means of the plate O' , operating as described, or any other equivalent arrangement of mechanical devices for accomplishing the desired result.

2. Preventing the accidental non-discharge of any one chamber from disorganizing the apparatus by means of devices, operating as described, to throw the rammer out of gear and preventing its inserting another cartridge, and then throwing it into gear again, to be in readiness to perform its functions for the next succeeding chamber.

3. In combination with the rotating magazine, the needle-rod N' , operated automatically, as described, and connected with a galvanic battery, so as to ignite the charges at the proper times, as set forth.

4. The arrangement of the gears N , O , and P and their swinging arms, operating together, as described, so as to permit the gun-carriage to travel back and forth without disconnecting the devices which communicate motion to the machinery from the driving-shaft.

5. The sponging or swabbing of the chambers of the magazine by means of the devices operating as described, the same consisting of the rod H' , carrying a suitable sponge, jointed to a right-angular lever, actuated by a suitable cam, as set forth.

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