3 Sheets--Sheet 1.

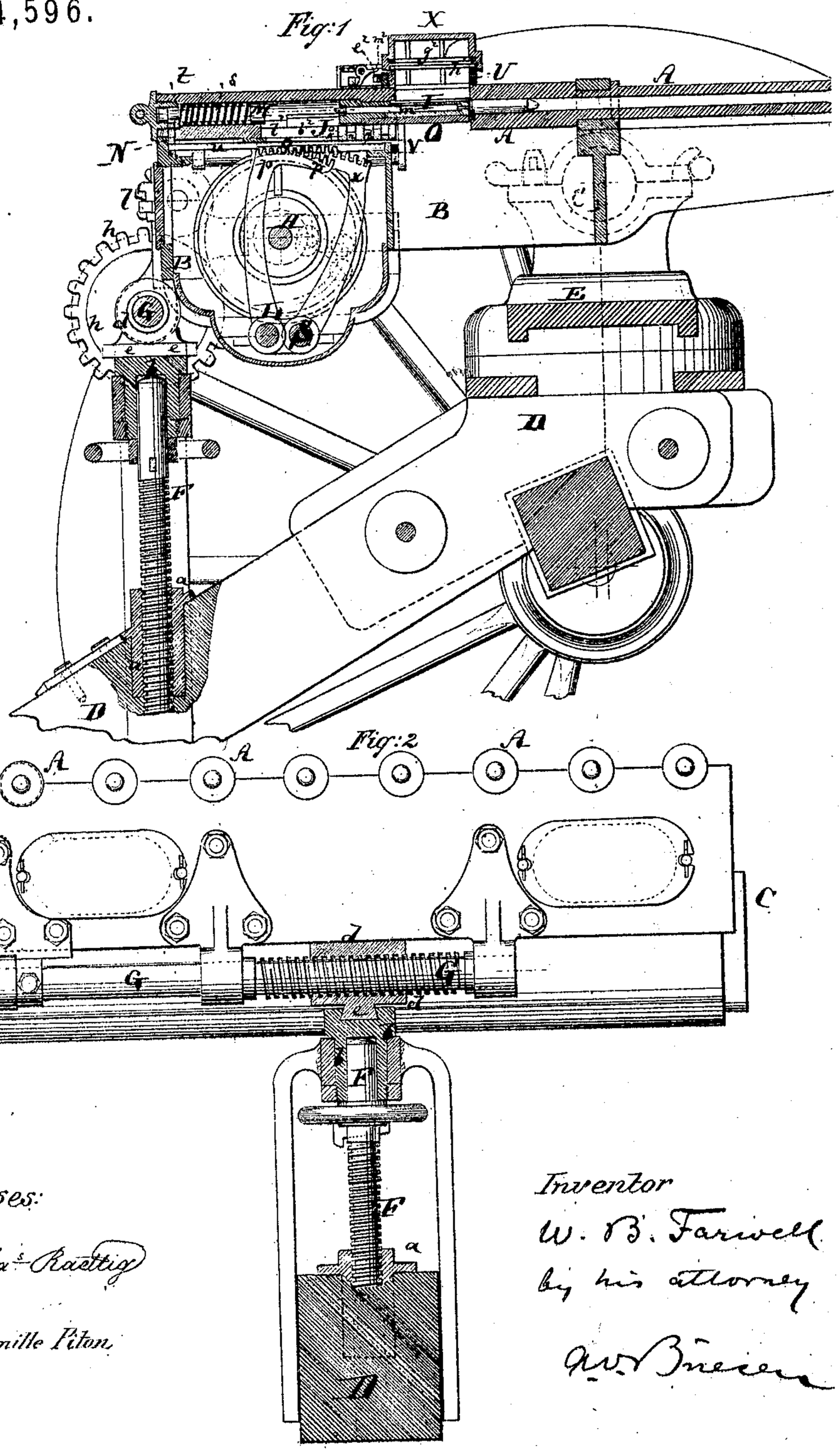
W. B. FARWELL.

Machine-Guns.

No. 154,596.

Patented Sept. 1, 1874.

Fig: 1



Witnesses:

Chas Raettig

Camille Piton

Inventor

W. B. Farwell

by his attorney

A. V. Briesen

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Fig. 3.

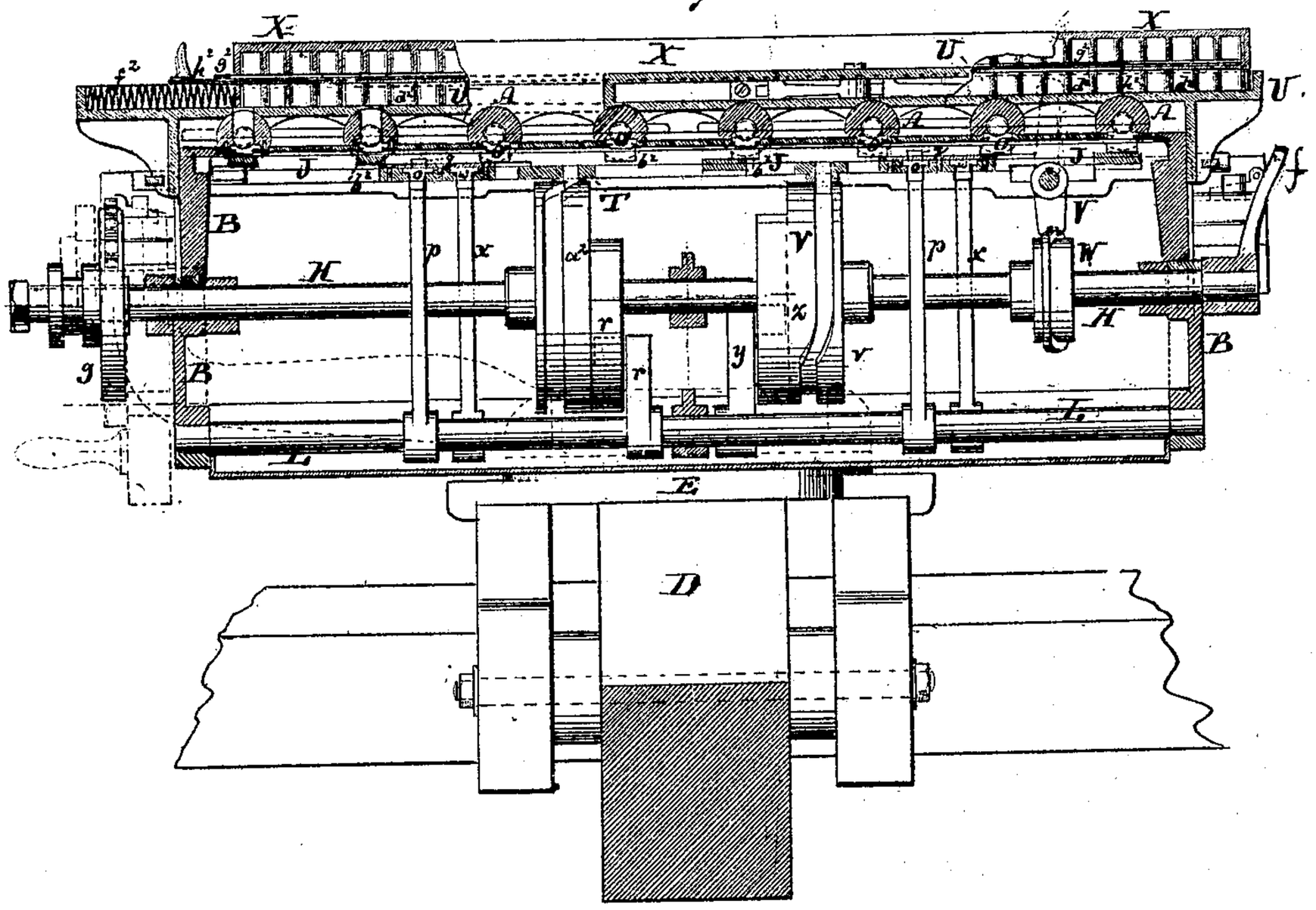

Fig 4

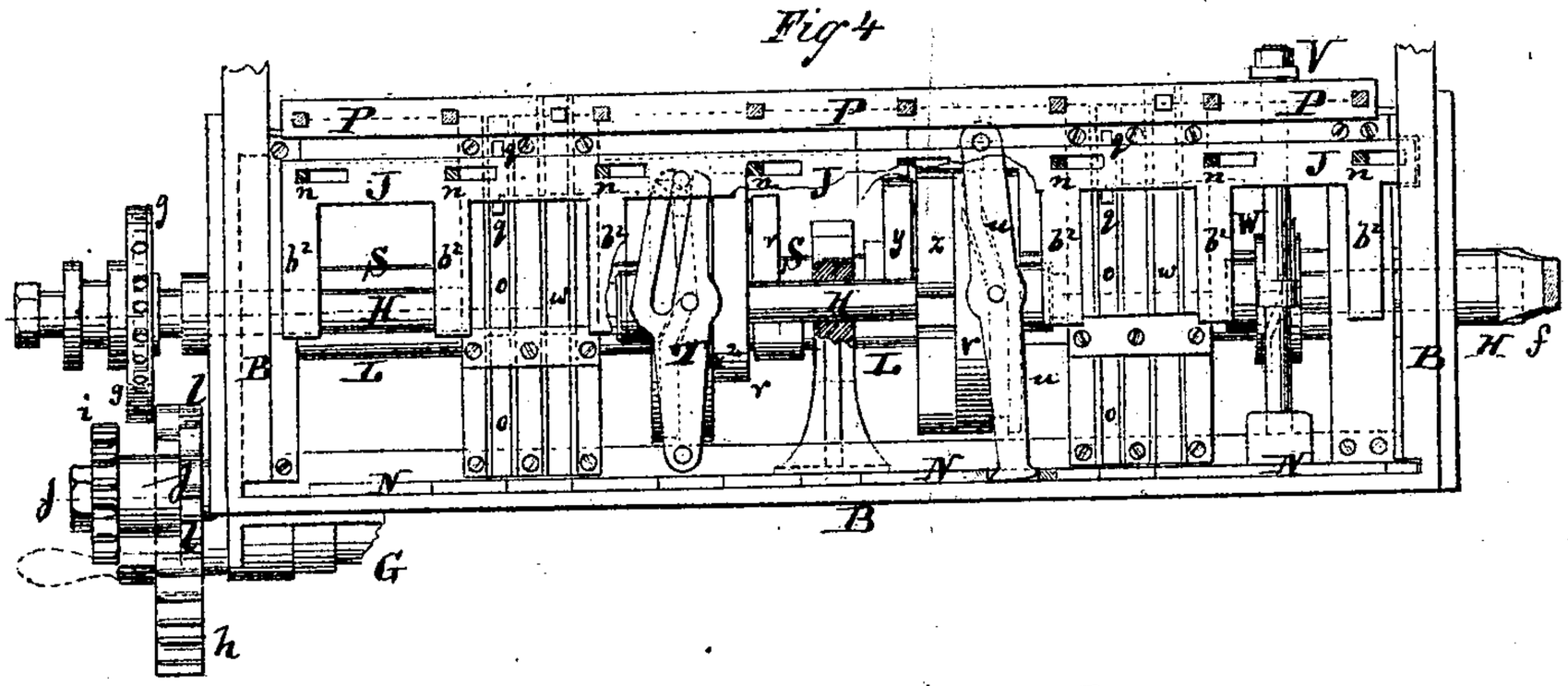

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Fig: 5.

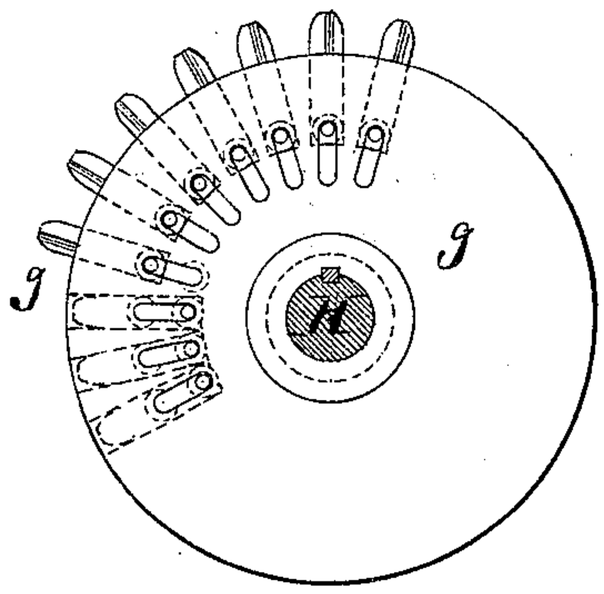


Fig: 6.

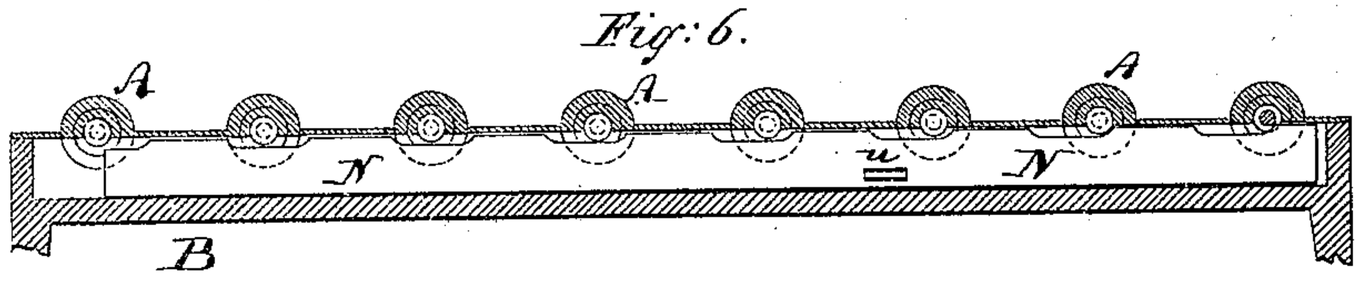
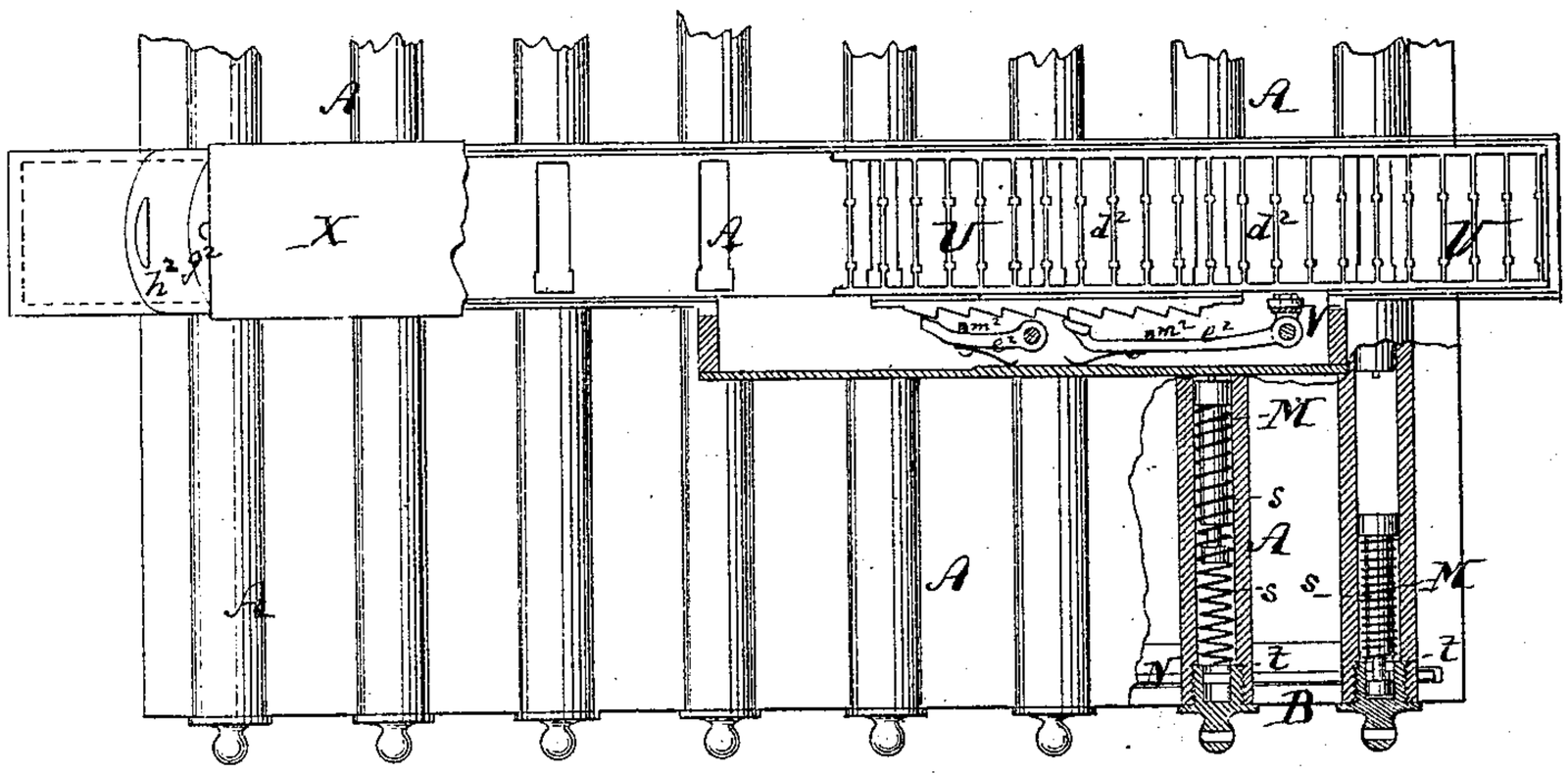


Fig: 7.



Witnesses:

Chas. Raettig.

Camille Titon

Inventor:

W. B. Farwell
by his attorney
A. V. Briesen

UNITED STATES PATENT OFFICE.

WILLARD B. FARWELL, OF NEW YORK, N. Y., ASSIGNOR TO THE FARWELL GUN COMPANY.

IMPROVEMENT IN MACHINE-GUNS.

Specification forming part of Letters Patent No. **154,596**, dated September 1, 1874; application filed April 13, 1874.

To all whom it may concern:

Be it known that I, WILLARD BRIGHAM FARWELL, of New York, in the county of New York and State of New York, have invented a new Improvement in Machine-Guns, of which the following is a specification:

This invention relates to improvements on the machine-gun for which Letters Patent No. 137,428 were granted to me on the 1st day of April, 1873; the present invention consisting more particularly in a new arrangement of mechanism for feeding the cartridges into the barrels, in a new mechanism for confining the cartridges in their places within the barrels when firing, in a new apparatus for locking the breech-closers, new means for exploding the charges, and a novel arrangement of mechanism for pointing the gun and traversing it.

By the present invention the mechanism described in my aforesaid Letters Patent is greatly simplified, and greater efficiency of operation obtained; the most important feature of the invention being in the new feeding apparatus, and in the traversing mechanism, by which the range or sweep of the gun is, with mechanical absolute certainty, adjusted after each firing in a new direction, to thus secure the most powerful effect possible with a given number of charges. My invention derives its chief value from this fact, that by its means the proportion of cartridges actually utilized in firing upon an enemy is greatly increased, that therefore a smaller amount of ammunition need be carried with a gun, and that consequently the cost of transporting ammunition is immensely reduced. In connection with a series of barrels, which are arranged horizontally side by side, this traversing-mechanism is eminently valuable, because thereby the range of each barrel is changed at each new adjustment of the gun sidewise; whereas, in the Gatling gun, for example, by each adjustment the range of one of the barrels only is actually varied, because all the barrels are only fired when they vertically have the axis of the longitudinal pivot around which they turn.

In the accompanying drawing, Figure 1 represents a longitudinal vertical section of my improved machine-gun, the section being taken through one of the barrels. Fig. 2 is a rear view of the same, partly in section, the plane of section being in line with the axis of the tail-screw. Fig. 3 is a vertical transverse section on the line of the operating-shaft H; Fig. 4, a top view of the mechanism below the barrels. Fig. 5 is a detail face view of the toothed traversing-wheel on the working-shaft; Fig. 6, a detail side view of the notched bar for locking and disengaging the hammer; and Fig. 7 a top view, partly in section, of the gun.

Similar letters of reference indicate corresponding parts in all the figures.

A A A in the drawing are the barrels of the gun, which are arranged side by side, and mounted on a frame, B, which has trunnions C C, that are supported in the gun-carriage D, a suitable turn-table, E, being interposed between the gun-carriage and the frame that receives the trunnions, to allow for adjusting the gun laterally by the traversing mechanism, hereinafter more fully described. F is the elevating and depressing screw, working in a nut, *a*, that is sunk into the carriage D, the upper end of said screw entering a cylindrical cap, *b*, that supports the rear or breech end of the frame B, so that by turning the tail-screw F the frame B will be vibrated on the trunnions C and the barrels A A thereby set at a suitable inclination according to the range which it is desired to obtain. The traversing mechanism consists principally of a worm or screw, G, which has its bearings in the back portion of the frame B and passes through a nut, *d*, which is, by a longitudinal dovetail-shaped projection, *e*, connected with the cap *b*, hereinbefore mentioned—that is to say, the dovetail *e* enters a corresponding groove in the upper part of the cap *b*. The dovetail connection *e* allows the nut *d* to slide longitudinally on the cap *b*, so that thus when the tail-screw F is worked the change of inclination is transmitted to the back part of the frame B through the longitudinal spontaneous motion of the nut *d* on the cap *b*—that is to say, provided that the axis of the worm G is brought vertically above and in line with the axle of the tail-screw F when the barrels A are

all in a horizontal position. Then it is evident that if the muzzle ends of the barrels are to be pointed downward by the elevation of the cap *b* the axis of the worm G will be displaced farther backward, whereas the said worm will be displaced farther forward when the muzzles of the barrels are pointed upwardly, and the aforementioned sliding mechanism between the nut *d* and cap *b* is to enable the screw G to be thus displaced forwardly or backwardly in accordance with the direction in which the barrels may be pointed.

It will be observed that by the dovetail connection with the cap *b* the nut *d* is also prevented from being laterally displaced.

In the back part of the frame B is hung transversely a horizontal shaft, H, which has its crank *f* at one end, so that by means of said crank, it may be revolved for operating the gun. At one end of the shaft H is fitted upon the same a toothed wheel, *g*, which, by a suitable clutch-lever, can be moved lengthwise on said shaft, to be thrown in gear, either with a toothed wheel, *h*, or with a pinion, *i*. When, by sliding it on the shaft H, the wheel *g* is thrown in gear with the toothed wheel *h*, said toothed wheel being mounted upon the shaft of the worm G, then the said worm will be revolved in a direction opposite to that in which the shaft H is being revolved by means of the crank *f*. But when the wheel G is thrown into gear with the pinion *i*, said pinion turning loose on a suitable arbor, *j*, then another pinion, *l*, which is connected with *i* will mesh into the teeth of the wheel *h* and cause the worm G to revolve in the same direction in which the shaft H is being turned by means of the crank *f*. Thus, by merely shifting the wheel *g* on the shaft H, the rotation of the worm G may be reversed at pleasure. By rotating the worm G, the nut *d* will affect the worm-thread thereof, so as to displace the worm, as it is being turned, laterally, and thus traverse the entire frame B, with all its appendages, and consequently also the barrels. After the gun has been traversed in one direction, it can, by shifting the wheel *g*, be readily traversed in the opposite direction, and thus the field in front of the gun can be swept at pleasure. The wheel *g* is to be provided with a limited number of teeth only, so that an intermittent rotary motion will only be applied to the worm G, it being necessary to perform the traversing operation previous to the firing of the barrels, and therefore it would be injurious to the mechanism and to the proper operation of the gun to impart a continuous rotary motion to the worm G, as in that case the barrels would be in the traversing motion, even while being fired, the firing operation being also controlled by the rotation of the shaft H; but it is also desirable to regulate the degree of turning to which the worm G is subjected during each rotation of the shaft H, because, when the gun is set to take the range of the enemy—say, two hundred yards distant from the gun—the traversing motion must be larger than when an enemy who is, say, a thousand yards from the gun is to be reached, as the divergency of the angle of adjustment will be greatly increased with the increased distances. It is consequently desirable to give the gun more traversing motion when the enemy is nearer, and less when farther away from the gun; and for this purpose I make the few teeth which I provide on the wheel *g* adjustable therein, so that I can push any suitable number of teeth inwardly and out of effect, and leave any desired number projecting outwardly and in effective position. The teeth of the wheel *g* have, therefore, slotted shanks, that are connected by bolts to the body of the wheel *g*; or they have projecting bolts that pass through radial slots of the wheel *g*; and in either case the said teeth can be pushed inward, so that they will not affect the pinion *i* or the wheel *h*; or they can be brought outward in gear with the said pinion *i* or wheel *h*. Thus when, for instance, for obtaining a short range, it is desirable to use eight teeth on the wheel *g*, the surplus number of teeth is pushed inward for a longer range. This part of the invention is fully shown in Fig. 5 of the drawing.

In line with the bore of each barrel A is arranged a cylindrical breech-closer, I, within which the firing-needle *m* is contained. All the several breech-closers I are, by downwardly-projecting pins *n*, respectively, connected with a longitudinally-movable frame, J, which slides in the frame B, and rests between unwardly-projecting pins *q q* of toothed racks *o o*, that mesh into toothed segments *p*, which project from a rock-shaft, L. The rock-shaft L is vibrated by cam and crank connection *r* with the shaft H, in the requisite manner, and when vibrated it imparts its motion to the toothed segments *p*, and moves the racks *o*, and by their means the frame J forward or backward, as may be required, and with that frame the breech-closers I. The breech-closers move in the rear parts of the barrels, and behind them are arranged in said barrels the firing-hammers M M, which are all made in the form of double-headed pins, that are embraced between their heads by spiral springs *s*. The rear end of each spring *s* abuts against a shoulder, *t*, formed in the rear part of the barrel, so that the spring may be contracted by pushing the hammer M as far back in the barrel as it is possible to push the same, as in Fig. 1, in which case the spring will be contracted between the front head of the hammer M and the said shoulder *t*. In this position the hammer M is locked by means of a transversely-sliding plate, N, that enters, through a slot, the rear parts of the barrels from beneath, and stands in front of the rear head of the hammer. The plate N is notched at proper intervals, so that when it is laterally moved, after having locked the hammer, the notches will successively come in line with the rear heads of the hammers M, and thus release said rear heads and allow the springs *s* to expand.

and propel the hammers successively forward against the firing-pins *m* in the barrels. I prefer to fire the barrels of the gun successively—that is to say, to first fire one barrel and then another, and so on until they have all been discharged, and then to reload and again fire the barrels successively. In order to do this the aforementioned notches in the plate N are so placed that when the notch pertaining to the first barrel arrives in line with the hammer of the first barrel, so as to release the same, all the other barrels will still retain their hammers in the cocked position. A slight additional motion of the bar N will release the hammer of the second barrel, but still lock the remaining hammers. A still further slight side motion of N will release the third barrel, &c., so that thus successive firings of the several barrels will be attained.

The bar N receives its motion transversely in the frame B by a lever, *u*, which is vibrated by a cam, *v*, that is mounted upon the shaft H, the lever *u* having a pin projecting into a cam-groove of the cam *v* to receive the requisite vibrating motion from the same.

It will be observed that, by firing the barrels successively instead of firing them simultaneously, the recoil, which would be very material in a simultaneous discharge, is greatly reduced—in fact, diminished to such an extent as to be hardly perceptible; and that, nevertheless, by one rotation of the shaft H, all the barrels will be discharged, which is fully as much in the matter of speed as could be attained were the barrels all discharged simultaneously during one rotation of the working-shaft.

The cartridges, after they have been exploded, leave their shells within the breech parts of the barrels—that is to say, directly in front of the breech-closers I. These shells are, after firing, withdrawn by means of the cartridge-extractors O. The extractors are plates, that are fitted, when the breech-closers I bear against the cartridges under said breech-closers, into slots formed in the lower portions of the barrels or cartridge-chambers, and they are all connected to a plate or bar, P, that extends transversely under the barrels parallel with and in front of the plate or frame *g*, hereinbefore referred to. The plate P has toothed racks *w* projecting backwardly, and meshing into toothed segments *x*, that are mounted upon a rock-shaft, S, hung in the frame B. The rock-shaft S is vibrated by a crank-connection, *y*, with a cam, *z*, that is mounted upon the shaft H, so that, during each rotation of the shaft H, the shaft S will be rocked first backward and then forward. When the shaft S is rocked backward its toothed segments *x* carry the bar P also backward, and thereby take the cartridge-extractors O backward, and cause them with their prongs at the front ends to withdraw the cartridge-shells, and to drop them through the openings that are formed by the backward movement of the extractors in front of them. Before a new cartridge is placed in the barrel, the extractors are again moved forward to form supports for the new cartridge, and to prevent the latter from falling through. After the cartridge-extractors have been moved forward, and the cartridges dropped in from above upon them, as hereinafter described, the breech-closers I are moved forward, and carry the cartridges ahead into the breech ends of the barrels, and hold them there until fired. But in order to prevent the breech-closers I from yielding backwardly during the explosion of the cartridges under the influence of the expanding gases, the said breech-closers are especially locked by means of the aforementioned bar J, which, besides its longitudinal motion, is also capable of receiving transverse reciprocating motion from a lever, T, which is pivoted to the frame B, and which has a pin projecting into a groove of a cam, a^2, that is mounted upon the shaft H. When the frame or plate J, and with it each of the breech-closers, is in its forward position, the said plate J is moved sidewise by the lever T, so as to carry its projecting arms b^2, shown in Fig. 4, directly behind the back edge l^2 of the openings in the barrels, in which the extractors O move when liberated. The arms b^2 then lock the breech-closers I in their forward position, and prevent them from being pushed backward by the force of the explosion of the cartridges. After firing, the first motion is a transverse motion of the bar J, whereby its arms b^2 are carried clear away from and out of line of the barrels, allowing the breech-closers thereupon to be moved backward, and the cartridge-extractors to follow in the manner already shown. The motion imparted to the frame J and breech-closers is greater than that of the cartridge-extractors, so that by the backward motion of the breech-closers the hammers may also be crowded back, and their springs contracted, and the hammers then locked in the cocked position hereinbefore mentioned. The pins *n* of the breech-closers enter transverse slots of the plates J, to allow the latter to move laterally, as described. Directly above the openings which are formed in the lower parts of the barrels for the reception of the cartridge-extractors are formed in the upper parts of said barrels openings for the reception of cartridges from the charging-magazine. This charging-magazine U consists principally of a transversely-sliding frame which is, by longitudinal partitions d^2 d^2, divided into a series of compartments or chambers, each compartment having the size necessary for the reception of one cartridge. Intermittent transverse rectilinear motion is imparted to this charging-magazine U by means of a pawl, e^2, which is actuated by a rocking lever, V, that receives its motion from a cam, W, on the shaft H. After each discharge of the cartridges in the barrels, the charging-magazine U is moved by means of said pawl, which enters a toothed rack formed at the side of the charging-magazine, suf-

ficient to bring one new chamber and cartridge over each barrel, so that the cartridge in said chamber may be dropped into the barrel upon the cartridge-extractor to be pushed into place by the breech-closer. During the motion which is imparted to the charging-magazine U by means of the pawl, said charging-magazine is carried against a spring, f^2, contracting said spring, so that, finally, when all the chambers of the charging-magazine have been emptied, it will only be necessary to disengage the pawl e^2 from off the rack on the charging magazine to enable the said spring f^2 to carry the charging-magazine back into its first position. This disengaging of the pawl from the rack may be made to take place automatically by means of a pin, m^2, projecting from the side of the upper charging-magazine, and actuating the pawl at the proper time to release it from the racks, or by any other means. For supplying the magazine I use the inverted charging-magazine X, of the same size and construction substantially as the charging-magazine U, but with inverted supply, as shown. This supply-magazine X is filled with cartridges, one in each chamber, and has its lower openings closed by means of two slides, g^2 and h^2. The slide g^2 closes, say, every five alternate chambers, and the slide h^2 every remaining set of five chambers, both said plates being open, in line with the solid parts of each other. When the supply-magazine X has been placed over the charging-magazine U in the manner shown it is only necessary first to draw the slide g^2 so as to bring its solid portions under the solid portions of the slide h^2; thereby the chambers that were closed by the slide g^2 are all opened and their cartridges discharged into the corresponding chambers of the charging-magazine U. The slides g^2 and h^2 are then moved simultaneously to bring their solid portions under the chambers that were last emptied, and the chambers that had been closed by h^2 are thereby emptied into the remaining corresponding chambers of the charging-magazine. The supply-magazine X is then entirely emptied, and can be removed from the charging-magazine U, leaving the same in condition to charge the barrels five times or more, if a larger number of chambers is provided in said charging-magazine for each barrel.

I claim as my invention—

1. The combination of the tail-screw F with the swivel-cap *b*, and with the dovetail attachment *e* of the nut *d* of the traversing apparatus, substantially as specified.

2. The working-shaft H, carrying the adjustable wheel *g*, and combined with the pinion *i*, toothed wheel *h*, and traversing worm G, for operation substantially as described.

3. The wheel *g* for transmitting the traversing motion, made with sliding teeth that can be drawn inward out of effect or pushed outward, as and for the purpose described.

4. The laterally-movable bar N, arranged in a machine-gun so that it enters the barrels to lock the firing-hammers M in the manner described, and notched at intervals to cause the barrels to be fired successively and not simultaneously, as set forth.

5. The bar J, combined with the breech-closers I and with mechanism whereby it is moved backward and forward, and also laterally, to carry the breech-closers into the proper positions and to lock the same during the firing operation, as specified.

6. The combination of the supply-magazine X, subdivided as described, and provided with the slides g^2 and h^2, with the charging-magazine U, which is also subdivided and has an intermittent rectilinear motion, substantially as and for the purpose hereinbefore described and set forth.

7. The combination of the cartridge-magazine U, which is subdivided into chambers, with a series of barrels, A A, having openings beneath a number of said chambers, and with a pawl, e^2, and actuating-lever V, all arranged so that the magazine will be above the barrels and drop the cartridges into the same, substantially as described.

WILLARD B. FARWELL.

Witnesses:

A. V. BRIESEN,

E. C. WEBB.