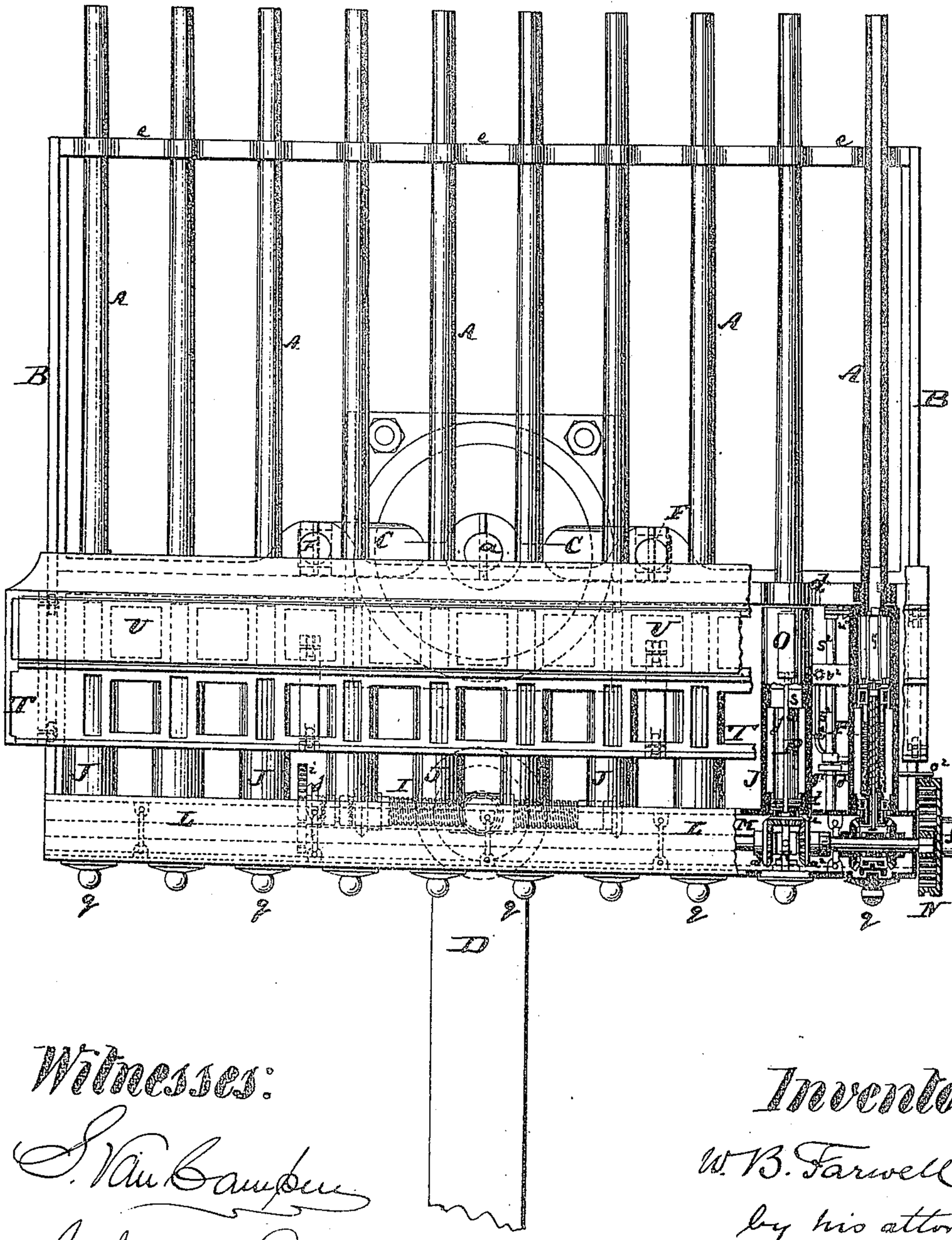
6 Sheets—Sheet 1.

W. B. FARWELL.

MACHINE-GUN.

No. 169,686. Patented Nov. 9, 1875.

Fig: 1



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by his attorney

A. v. Briesen

6 Sheets—Sheet 2.

W. B. FARWELL.

MACHINE GUN.

No. 169,686. Patented Nov. 9, 1875.

Fig. 2.

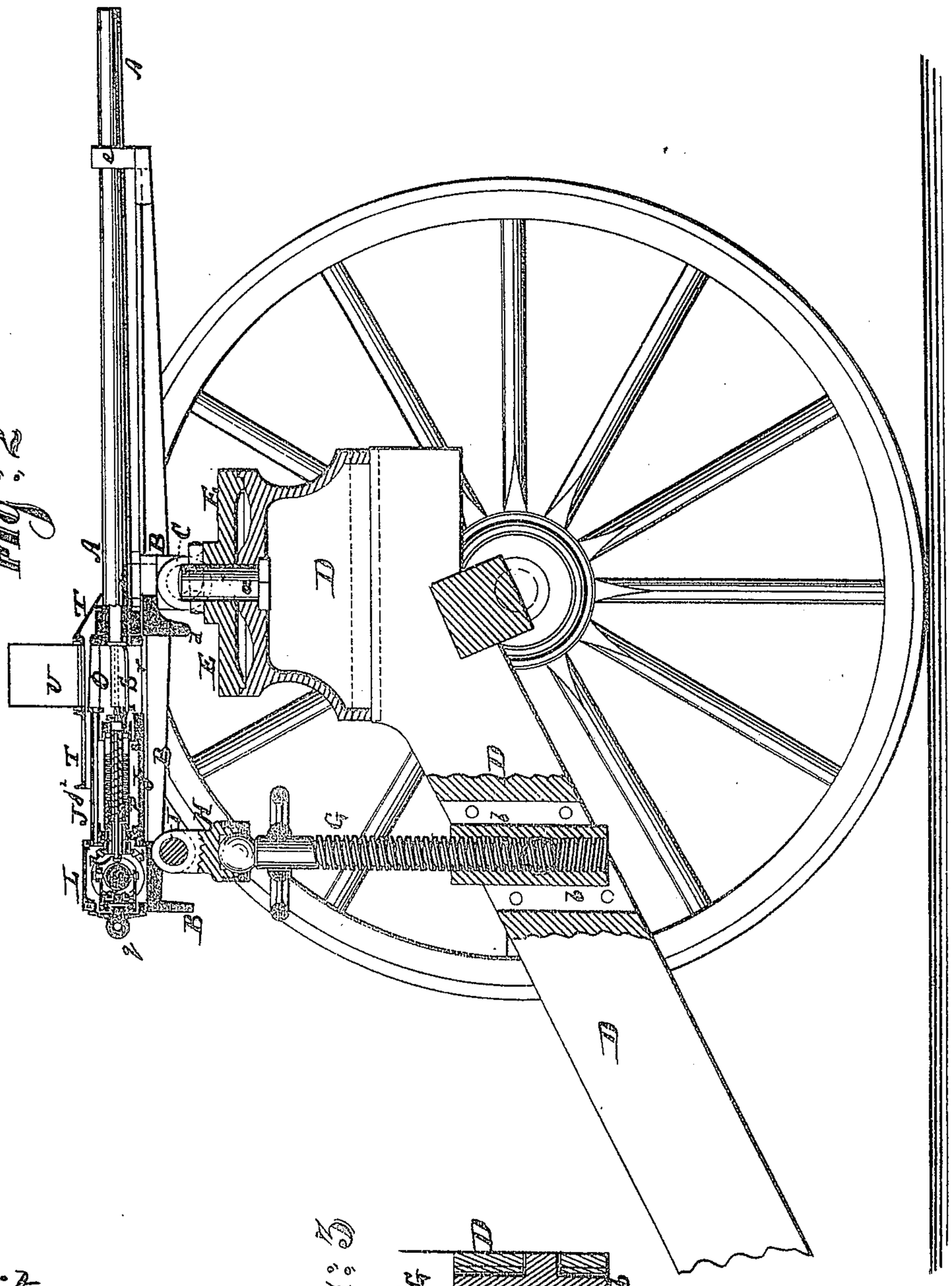
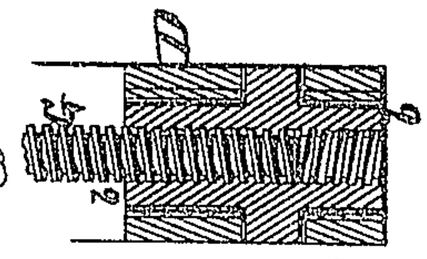


Fig. 3.



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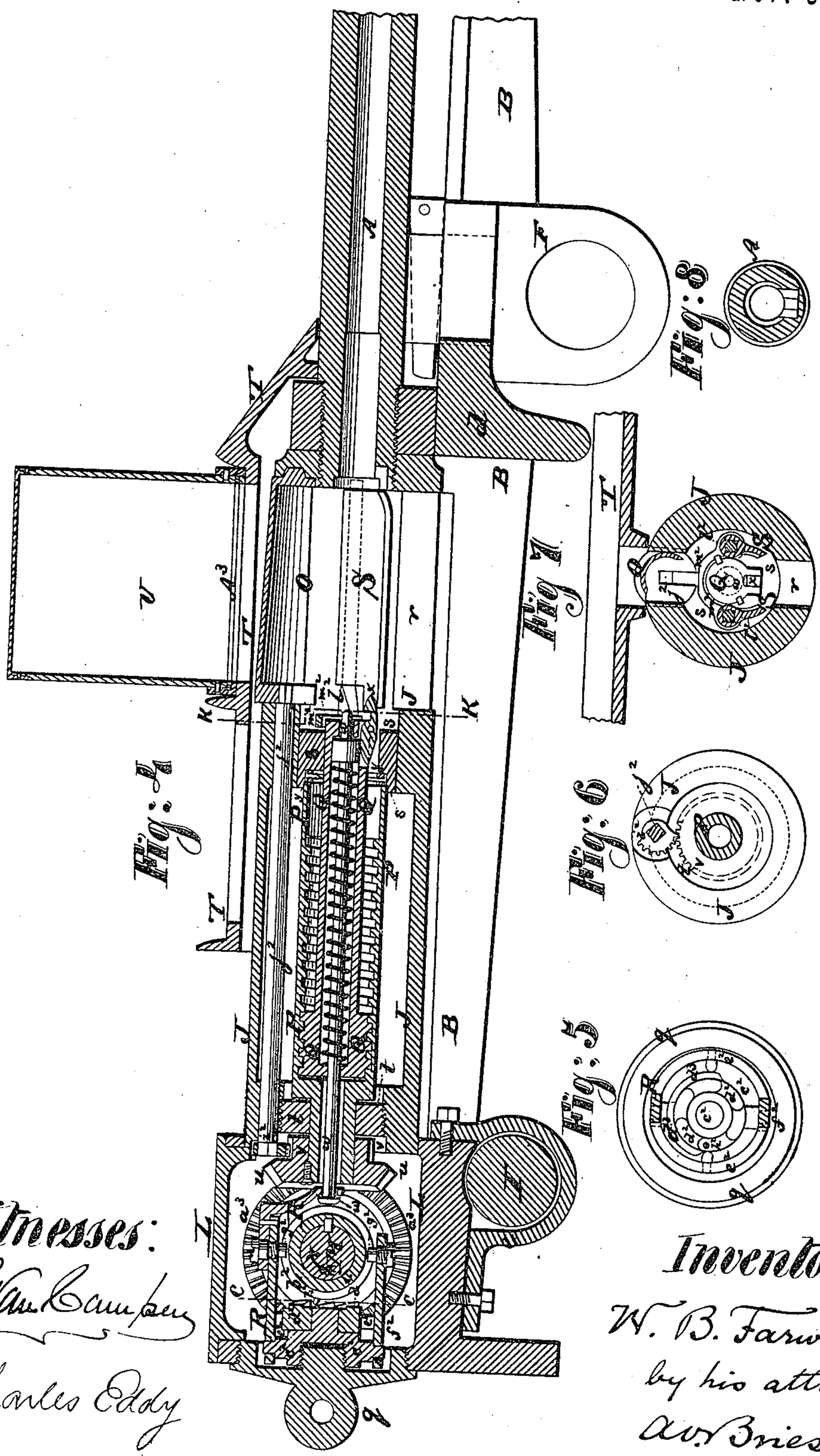
No. 169,686.

6 Sheets—Sheet 3.

W. B. FARWELL.

MACHINE-GUN.

Patented Nov. 9, 1875.



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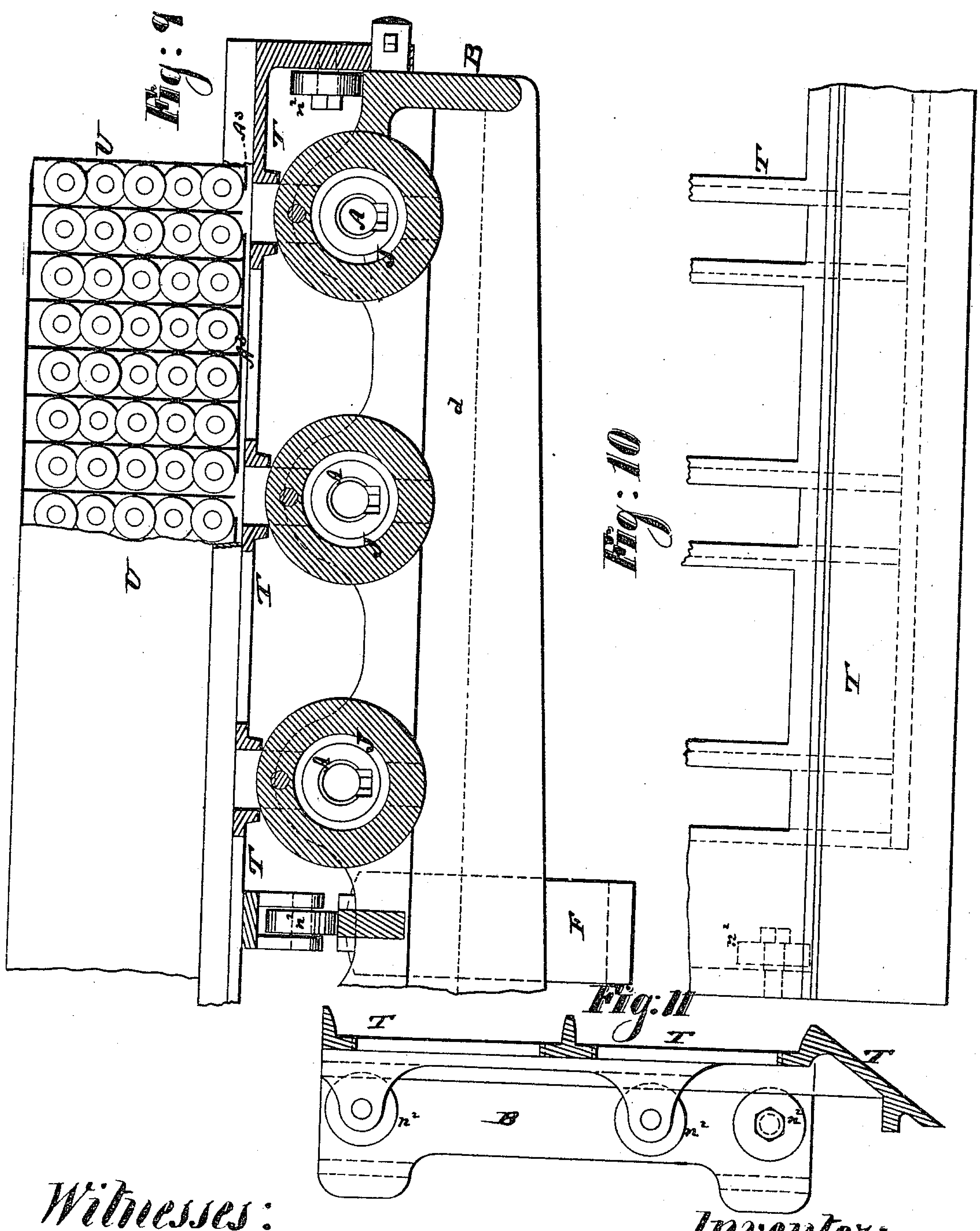
6 Sheets—Sheet 4.

W. B. FARWELL.

MACHINE-GUN.

No. 169,686.

Patented Nov. 9, 1875.



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6 Sheets—Sheet 5.

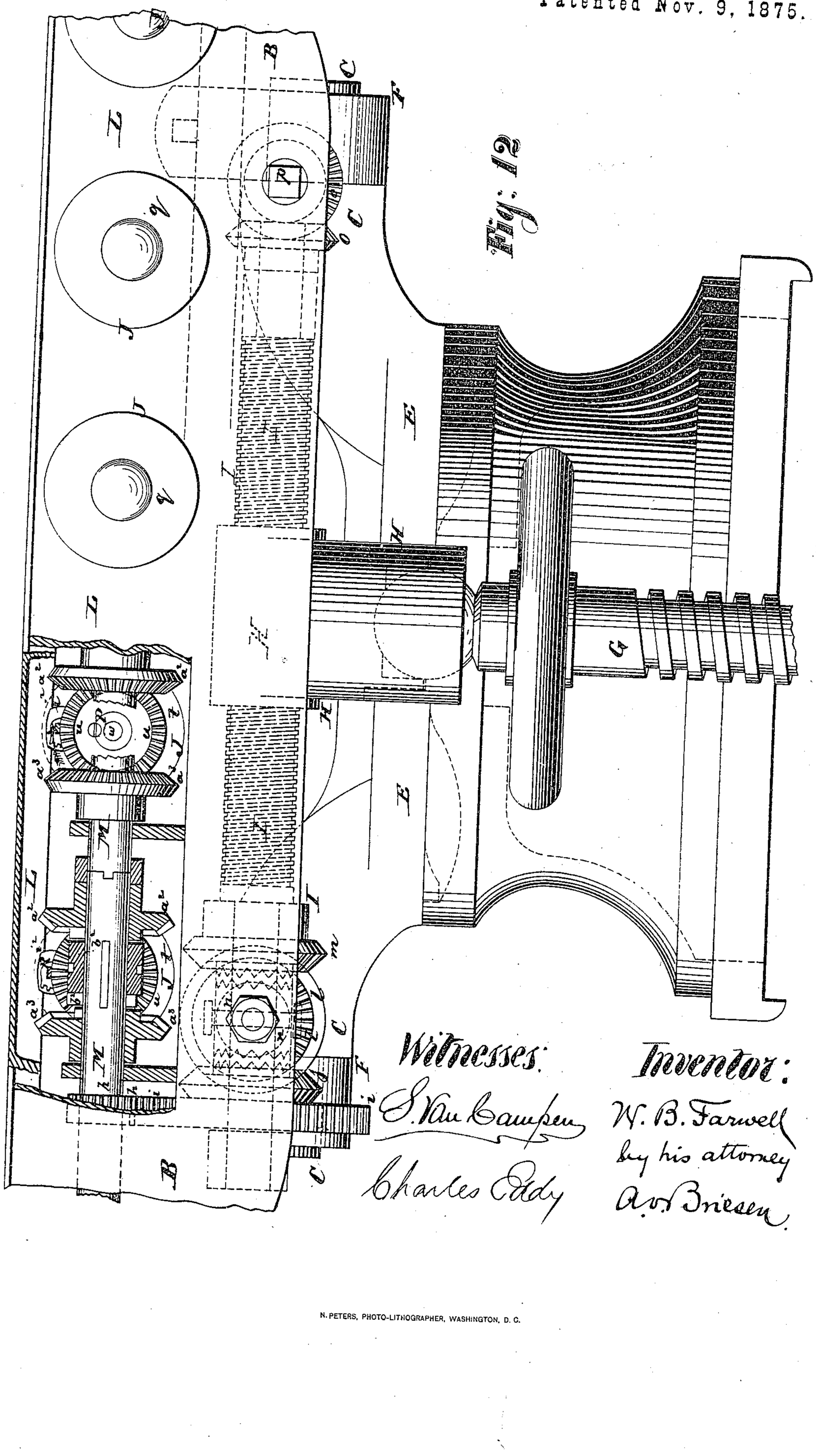
W. B. FARWELL.

MACHINE-GUN.

No. 169,686.

Patented Nov. 9, 1875.

Fig. 12.



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6 Sheets—Sheet 6.

W. B. FARWELL.

MACHINE-GUN.

No. 169,686.

Patented Nov. 9, 1875.

Fig: 13.

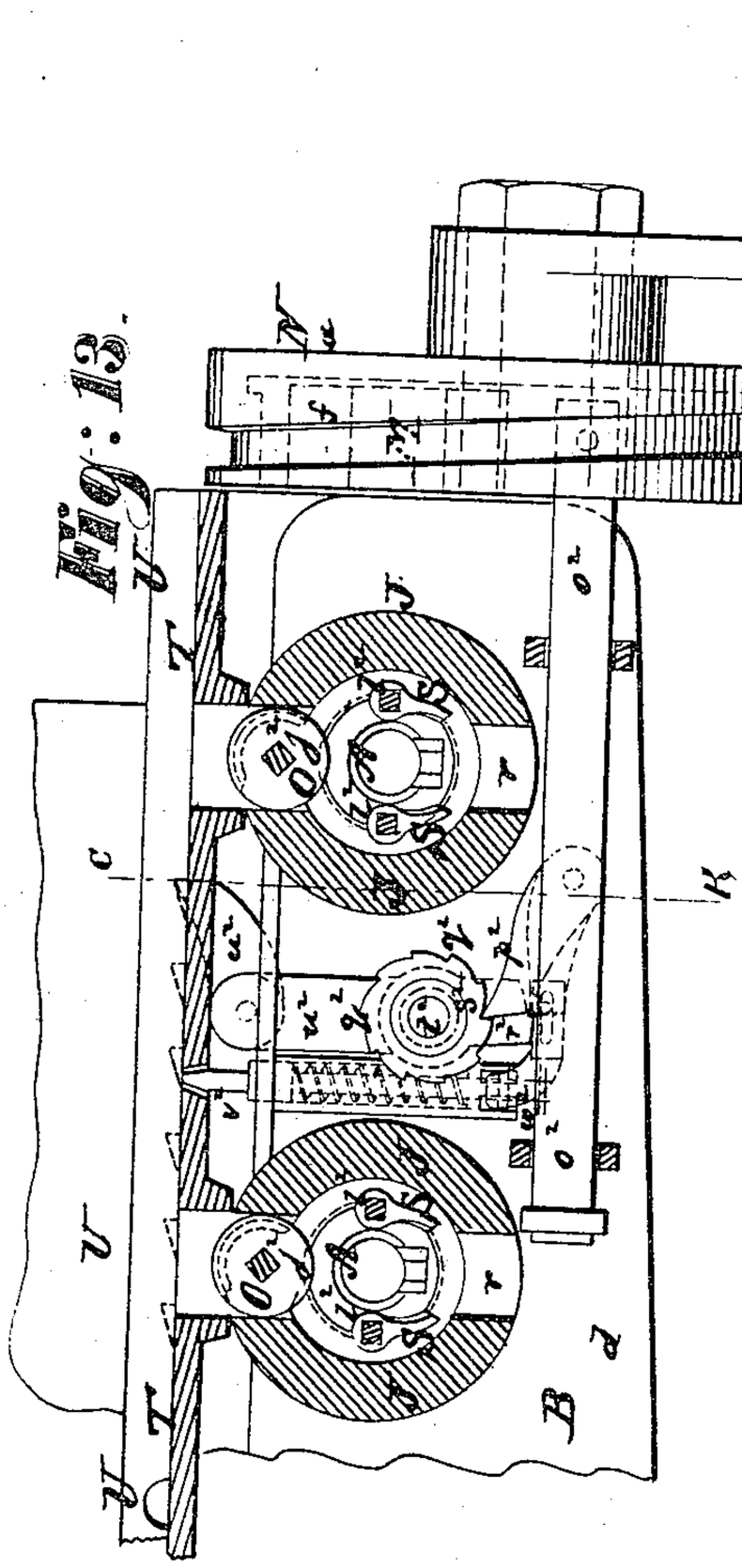


Fig: 14.

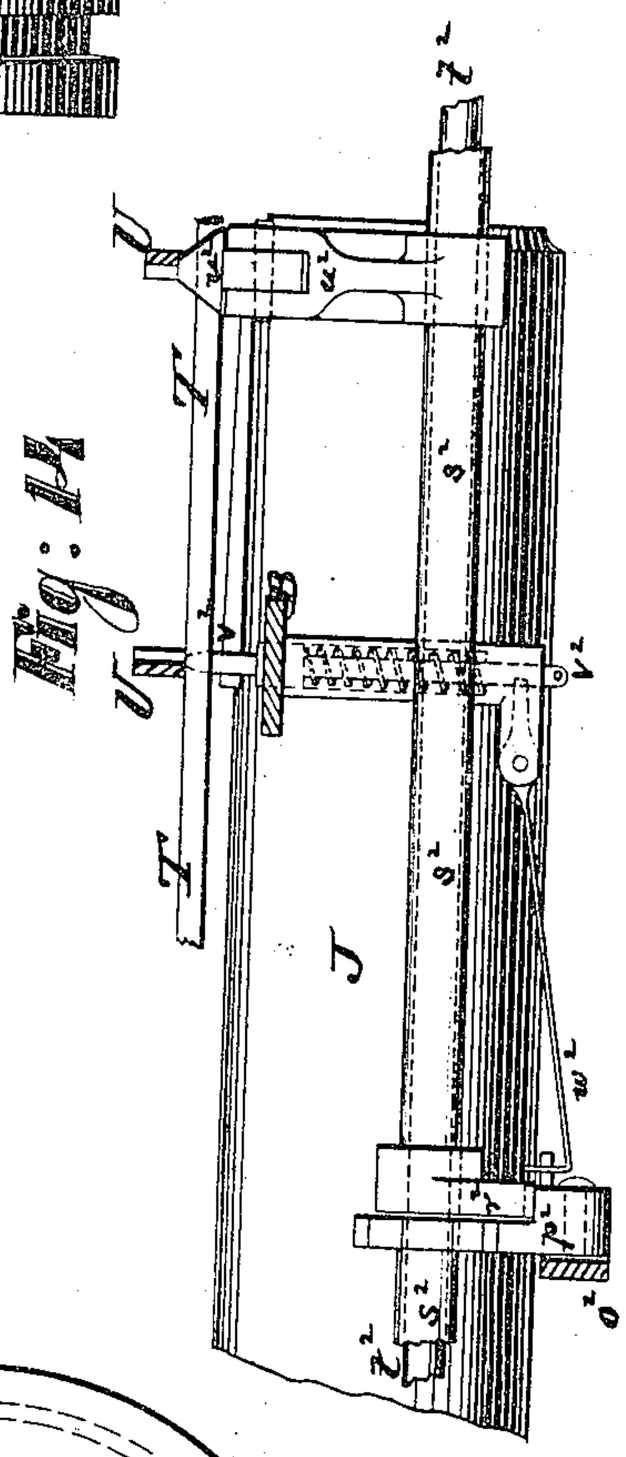
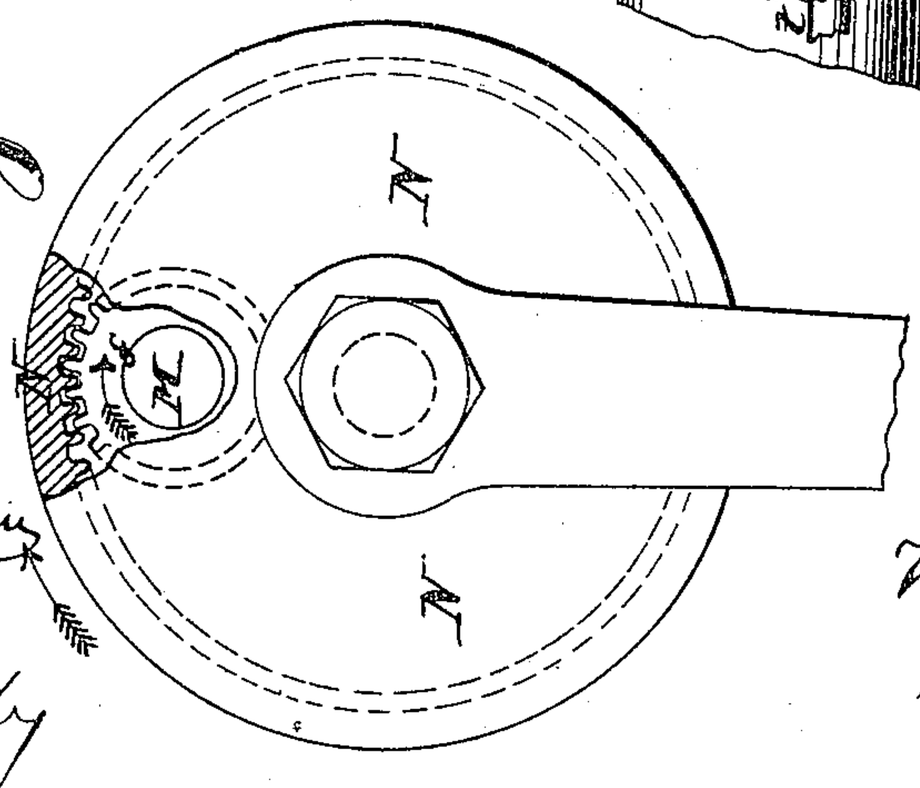


Fig: 15



Witnesses:

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Charles Eddy

Inventor:

W. B. Farwell

by his attorney

A. V. Briesen

UNITED STATES PATENT OFFICE.

WILLARD B. FARWELL, OF NEW YORK, N. Y.

IMPROVEMENT IN MACHINE-GUNS.

Specification forming part of Letters Patent No. **169,686**, dated November 9, 1875; application filed May 7, 1875.

To all whom it may concern:

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

This invention relates to a new machine-gun, which has resulted from experiments with the machine-gun described in former patents granted to me and numbered 137,428 and 154,596.

The present invention, though retaining the general arrangement of barrels and discharge-magazine which is shown in my former patents, departs from the inventions described therein by the employment of an entirely different mechanism for loading, firing, and discharging the cartridges by an entirely novel disposition of the firing and loading parts, whereby the same are brought entirely within the cylindrical breech-chambers that constitute rearward extensions of the barrels by an entirely new method of supporting and adjusting the frame which carries the barrels, and also by a new traversing mechanism for vibrating the gun during the firing process.

The chief point of novelty in the present invention is in the use of telescopic tubing applied within the breech-chambers of the barrel, the innermost tube in each chamber carrying and embracing the firing-pin, and serving in itself as the breech-closer of the barrel proper. The tube next surrounding the innermost tube has no longitudinal, but a rotary, movement, and is provided with an internal screw-thread, whereby, when it is revolved, it serves to impart longitudinal motion to the innermost tube, and to move the same forward to close the breech end of the barrel, and subsequently backward for opening the breech end and allowing a new cartridge to be brought into position.

By this arrangement of telescopic tubing I am enabled to dispense with all the complex mechanism for firing and loading the gun which is described in my former patents, and to confine the whole mechanism within the breech continuation of the barrel. This allows ready access to all the interior parts, ready and convenient repair, and particularly a cheaper construction, since the parts which enter into each barrel are exact duplicates of one another, while heretofore more of a general transverse operating mechanism, common to all the parts, had to be employed.

I have nothing but a simple transverse shaft with gears and clutches thereon for operating the external tubing aforementioned, and none of the locking and unlocking bars, which were chief features in my former inventions.

By my new invention I can readily throw any one or more of the barrels out of action.

Another great feature involved in my present invention is the application beneath the charging-magazine and behind the barrels of receiving-jaws, upon which the cartridge is dropped from the discharging-magazine, and by which it is sustained in line with the bore of the barrel, to be subsequently pushed home by the breech-closer. These jaws are automatically operated as soon as the cartridge has been pushed far enough into the barrel, remaining open as the breech-closer moves backward, to allow the empty cartridge-shell to be dropped through, but are closed as soon as the breech-closer reaches its most backward position, so that they will receive the new cartridge. The various special features of the mode of hanging the frame, operating the traverse, and adjusting the frame, working the magazine, and the magazine-support, will all be hereinafter more fully described.

In the accompanying six sheets of drawings, Figure 1 is a plan or top view, partly in section, of my improved machine-gun. Fig. 2 is a side elevation, partly in section, of the same. Fig. 3 is a detail vertical section through the center of the nut which receives the lower end of the tail-screw. Fig. 4 is a longitudinal vertical section through the breech-chamber of one of the barrels. This figure and all succeeding figures are drawn on a larger scale than Figs. 1, 2, and 3. Fig. 5 is a detail vertical transverse section on the line *c c*, Fig. 4. Fig. 6 is a detail back view, partly in section, of what I term the breech-chamber. Fig. 7 is a detail vertical transverse section through the cartridge-receiving chamber, which is between the breech end of the barrel and the breech-chamber. Fig. 8 is a detail end view

of the breech end of the barrel. Fig. 9 is a vertical transverse section through a series of barrels and part of the cartridge-holding magazine, the line K K in Fig. 4 indicating the plane of section. Fig. 10 is a detail plan view of part of the magazine-supporting slide, and Fig. 11 is a vertical longitudinal section of such slide. By the word longitudinal section I mean a section taken on the line of the bore of the barrel, and by the word transverse section a section taken at right angles to the line of the barrel. Fig. 12 is a back view, partly in section of the gun, showing the traversing mechanism, and also the arrangement of clutches and gear-wheels of the operating-shaft. Fig. 13 is a vertical transverse section through two of the barrels, showing the mechanism for adjusting and moving the cartridge-magazine. Fig. 14 is a vertical longitudinal section on the line *c k*, Fig. 13. Fig. 15 is a detail end view of the operating-shaft, showing the means for transmitting motion to the same.

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

A A A in the drawings are the barrels of the gun, of which a suitable number may be employed, and which are arranged side by side and parallel with each other, and firmly secured in a frame, B, which is supported on a gun-carriage, D, of suitable construction, a turn-table, E, being interposed between the gun-carriage and the frame that receives the trunnions C to allow of adjusting the gun laterally by the traversing mechanism, to be hereinafter more fully described.

The mode of hanging the frame on the trunnions C is more fully shown in Figs. 4 and 12, and also indicated in Fig. 2. I form the trunnions C directly on the turn-table E, and pass them through pendent eyebolts F, which are secured by suitable keys, or otherwise, to the frame B, as indicated more clearly on the right-hand side of Fig. 12. By this arrangement I not only shorten the distance between the two trunnions and facilitate the adjustment of the gun on the trunnions, but I also obtain ready means for separating the frame from the carriage, which can be done by merely unfastening the eyebolts F.

In my last previous patent, and in all guns of similar form heretofore used, the trunnions were formed directly on the frame, and at the sides of the frame, their distance from each other being the full width of the frame, and they were hung in eyes or journals fastened to the gun-carriage or turn-table. It will be seen from Fig. 12 that by my present arrangement the distance between the two trunnions need not exceed the distance between five of the barrels, and where ten barrels are used, as indicated in Fig. 1, the saving of metal is quite considerable, aside from the greater ease of adjustment.

G is the tail-screw, interposed between the rear of the frame B and the carriage D for supporting the rear ends of the barrels, and adjusting them jointly on the trunnions C. The upper end of the tail-screw G is formed into a ball, which is inserted within a spherical socket formed in the lower part of the traversing-nut H of the gun. I is the traversing-worm, hung in the rear part of the frame B, and rotated in the manner hereinafter described, for traversing the gun—that is to say, for turning the barrels jointly on the axis *a* of the turn-table. As this worm I is revolved it turns within the nut H, and as this nut is connected with the tail-screw, and thereby with the carriage D in such a way that it cannot be laterally displaced, it follows that the displacement effected by the turning of the worm will be transmitted to the frame B of the gun, whereby said frame will be caused to turn in one direction or the other on the axis *a* of the turn-table.

In my last former patent I have described a peculiar dovetail attachment and slide for connecting the cap of the tail-screw with the traversing-nut; but I have found that by forming the cap of the tail-screw directly on the traversing-nut, in the manner clearly shown in Figs. 2 and 12, and by using the ball-and-socket joint in the manner indicated, the same result will be obtained as that described in my last former patent, with less friction, however, and by simpler mechanism. This result is still more readily obtained by the use of the pivoted nut *b*, in which the lower end of the tail-screw has its support, and which is clearly shown in Figs. 2 and 3. This nut is sunk in a cavity or opening of the gun-carriage, and has laterally-projecting trunnions, by which it is hung in the carriage, so it can vibrate backward and forward, and adjust itself, and with it the tail-screw, to the inclination produced by the turning of said tail-screw.

In my former machine-gun, and in the majority of other guns employing tail-screws, it is customary to firmly secure the nut *b* in the carriage, and in my last-named patent I have provided a connection between the upper end of the tail-screw and the traversing-nut, which would allow the two parts to remain connected during the operation of the tail-screw, but which did not allow the tail-screw to change its inclination or direction. It was consequently necessary to interpose a third article—a connecting-link, so to say—between the traversing-nut and the tail-screw. But in my present gun, where the upper end of the tail-screw is directly inserted in the traversing-nut, the operation of parts can only be obtained by allowing an inclination of the tail-screw, and therefore the pivoting of the lower nut had to be resorted to. The cap of the tail-screw is, of course, made separate from the body of the traversing-nut, in the manner indicated in Fig. 2 and by dotted lines in Fig. 12, the two parts being screwed or otherwise rigidly connected together.

The rear ends or breech ends of all the bar-

rels are screwed into a cross-bar, *d*, of the frame B, and near their forward ends they are confined in another cross-bar, *e*, of the frame B. Behind, and in line with the breech-end of each barrel, is a cylindrical chamber, J, which I term the breech-chamber, and which contains within it the mechanism for loading and firing the cartridges, and for extracting the empty cartridge-shells, as hereinafter more fully specified.

The front end of the breech-chamber J is screwed around the rear end of the barrel A, to which it appertains, substantially as indicated in Fig. 4, so that thus the breech-chamber actually constitutes the continuation of the barrel, though virtually not part of the barrel proper. The rearmost end of the breech-chamber J connects with a transverse box, L, within which the operating-shaft M, with all its several attachments, is contained. This operating-shaft by preference is turned by hand, and I prefer to use the means illustrated in Figs. 1 and 15 for this purpose—that is to say, I rigidly-attach a pinion, *f*, to the end of the shaft M, and let this pinion gear into the teeth of an internal gear-wheel, N, which is connected with an operating-crank, *g*. By revolving the crank *g* on the wheel N the pinion *f*, and with it the shaft M, is also turned, the preferable arrangement being such that one rotation of the crank will produce three revolutions of the shaft M. A pinion, *h*, which is mounted upon the shaft M, (see Fig. 12,) meshes into the teeth of a gear-wheel, *i*, that is loosely hung upon the traversing worm or shaft I. This gear-wheel *i* connects rigidly with a bevel-gear wheel, *j*, that meshes into another bevel-gear wheel, *l*, which is hung in the frame B, as indicated in Fig. 12. A third bevel-gear wheel, *m*, is loose on the traversing-worm I, and in gear with the wheel *l*, and set to face the wheel *j*. A clutch, *n*, is applied to the shaft I, between the wheels *j* and *m*, and is connected with a suitable lever, by which it can be thrown into connection with either one of these two wheels.

When the clutch is thrown into connection with the wheel *j* the traversing-worm will be rotated slowly in a direction opposite to that in which it will be rotated if the clutch is thrown into gear with the wheel *m*, and if it is desired to have no automatic traverse, it is only necessary to set the clutch midway between the two wheels *j* and *m*, and thereby bring the traversing-worm entirely out of operative connection with the shaft M.

The opposite end of the traversing-worm is, by bevel-gear wheels *o*, connected with an arbor, *p*, to which a crank-handle can be secured for operating the traversing-worm by hand, so that if the clutch *n* throws the wheels *j m* out of action the traverse can be obtained, if desired, by turning the arbor *p*.

It will be observed that this arrangement of operating the traverse either automatically or by hand renders the gun much more useful than one having only an automatic traverse, as it is often necessary to quickly set the gun at a much greater angle than that at which it could be set by the ordinary automatic apparatus; and yet the automatic apparatus is such that if in action it would cause all the barrels to change their position slightly after each firing, and thus under rapid fire a large angle in front of the gun will be entirely swept.

As already stated, the rear end of each breech-chamber J connects with the traverse-box L that contains the shaft M; but a cascabel-plate, *q*, is screwed into an opening in the rear of the box L in line with each one of the barrels and breech-chambers, so that by the unscrewing of the cascabel-plate the mechanism in front of the same will be disclosed, and easy of access. Directly behind the end of each barrel proper is formed a slot, *r*, through the bottom of the breech-chamber, as clearly shown in Fig. 4, and a similar slot is cut vertically above *r* through the top of the breech-chamber, for the reception of the cartridge-dipper O, hereinafter more fully referred to. That part of the breech-chamber which is occupied lengthwise by the slots and the dipper I call the cartridge-receiving chamber. Directly behind the cartridge-receiving chamber a fixed bearing, *s*, is secured in the breech-chamber; and at the rear end of said breech-chamber another fixed bearing, *t*, is screwed or otherwise secured therein. These two bearings serve to support a horizontal tube, P, which tube is concentric with the breech-chamber, and in line with the barrel A, to which it pertains, and is capable of revolving in its bearings. Upon the rear end of this tube is firmly secured a beveled gear-wheel, *u*, whose hub *v* is toothed for operating the dipper, as clearly indicated in Fig. 4. The tube P has an internal screw-thread cut into it, which engages the external screw-thread formed on an interior tube, Q, which tube Q extends through the front bearing *s*, as clearly shown in Fig. 4. The drawing also clearly shows that the tube Q is concentric with P and J, and in line with the axis of the barrel A. The tube Q serves as a breech-closer.

During the rotation of the tube P in one direction the inner tube Q will be caused to move forward toward the barrel until its front end reaches within the breech end of the barrel. When the tube P is revolved in the opposite direction the innermost tube Q will be drawn backward.

A cartridge-extractor, *x*, is pivoted to the front end of the breech-closer Q between downwardly-projecting lugs thereon, and is capable of entering beneath the flange of the cartridge in the barrel, and remaining in contact therewith during the firing process, so that it may withdraw the empty cartridge-shell upon the return motion of the breech-closer Q.

w is the firing-pin, having within the breech-closer a shoulder near its front end, which front end extends through an aperture in the

front end of the breech-closer. This firing-pin is placed lengthwise through the tube Q, and extends through the hollow rearward extension of the tube P, as shown. A suitable spring embraces this firing-pin between its shoulder and the rear end of the breech-closer. The rear end of the firing-pin which extends beyond the bevel-wheel *u*, has a button or head formed upon it, which serves, in connection with a vibrating claw, R, to hold the firing-pin back during the loading operation—that is to say, when the breech-closer is screwed forward the firing-pin remains in the position shown in Fig. 4, being held back by the claw R, and after the breech-closer has pushed the cartridge home into the barrel, and all the parts have been arranged ready for firing, the claw R is moved aside and releases the firing-pin, which is thereupon violently thrown forward by the spring, said spring having been contracted between the rear end of the tube Q and the shoulder of the pin *w* during the forward motion of said tube. In order to prevent the shock which is produced by the explosion of the cartridge from tending to start the breech-closer Q in its backward motion—that is to say, from giving it a short turn in the screw-thread of P, which would not be impossible were the breech-closer to retain its connection with the screw-thread of the surrounding tube P—I cause the thread of the tube Q to entirely leave that of P in the position of the parts ready for firing, and utilize therefore the ends of the two screw-threads of P and Q as shoulders, and as a rear support for the breech-closer, the front edge of the thread on Q bearing in this position against a spring-washer, Y, which is interposed between the front bearing *s* and the front end of the tube P, as clearly shown in Fig. 4. This spring-washer not only allows the screw-thread of the tube Q to leave that of P, but it also serves, as the tube P commences to be turned back, to crowd the tube Q backward, and reinsert its thread into that of P, thus facilitating the operation of parts. It must be observed that in order to allow the above-mentioned backward and forward motion of the breech-closer Q the number of its screw-threads must be much less than that of the threads in the tube P, as indicated in Fig. 4. The mechanism for imparting rotary motion to the tube P, and reversing it automatically, also that for operating the vibrating claw R, I will now proceed to describe.

The main shaft M carries two loose beveled gear-wheels, a^2 a^3, on opposite sides of, and in gear with, each beveled wheel *u*, substantially as indicated in Fig. 12, and also in Fig. 1. Between these two wheels a^2 a^3 is fitted, upon the shaft M, a sliding clutch, d^2, which clutch, when moved against one of said two wheels, a^2 or a^3, throws the same into connection with the shaft M, so it will be revolved by said shaft. The other of the two wheels a^2 a^3 being loose meanwhile it follows that that wheel, a^2 or a^3, which is locked by the clutch, will impart motion to the wheel *u* and to the tube P. It also follows that the clutch, which locks said wheel, revolves with the shaft. Upon the inner face of the cascabel-plate *q* is screwed or otherwise fastened a plate, c^2, to which the back end of the claw R is pivoted, as indicated in Fig. 4. A central stem, projecting from said plate c^2, constitutes the pivot or axis for a small wheel, d^2, which has its front face formed into six, more or less, teeth, and which, on its edge, carries a cam, d^3. The shank of the claw R connects, by a ring, e^2, rigidly with a rod, f^2, which is pivoted to the lower edge of the plate c^2 directly in line with the pivot of the claw. It follows that when the claw is vibrated on this pivot the lower rod f^2 will also vibrate on its own pivot. g^2 g^2 are pins that project from the shank of the claw R and from the rod f^2 into a circumferential groove of the clutch b^2, as indicated in Fig. 4. h^2 is a short pin projecting radially from the clutch b^2, for the purpose of engaging into the teeth of the little wheel d^2, and imparting intermittent rotary motion to the said wheel. Now, if the shaft M is rotated in the direction of the arrow, shown in Figs. 4 and 15, and the clutches b^2 should all be in gear with the wheels a^2, then each tube P is rotated in the direction of the arrow indicated in Fig. 12, by which rotation it will cause the breech-closer Q to be moved forward. I prefer to so arrange the diameters of the wheels a^2 and *u* that three revolutions of the former will produce four of the latter; but these proportions may be varied according to the length and variation of pitch of the screw-thread of the tube P.

At each revolution of the shaft M the clutch b^2 causes its pin h^2 to engage into the face of the toothed wheel d^2, and to impart a partial rotation to the said wheel; and at the end of the third revolution of the shaft M, when the breech-closer Q will have been as far forward as possible, the motion imparted to the wheel d^2 will cause its cam d^3 to come in contact with one of two inwardly-projecting pins of the ring e^2, as indicated in Fig. 5, and thereby to push said ring to one side, as in Fig. 5, and vibrate the claw and lower rod f^2 on their pivots. This motion of the claw will cause the same to release the firing-pin, and the latter will be propelled forward by its spring, causing the cartridge to be exploded. The vibration imparted to the claw, above mentioned, and to the rod f^2, will not only cause a disengagement of the firing-pin, but will, by the pins g^2, which extend from the claw and rod f^2 into the clutch, also cause said clutch to be moved from the wheel a^2 into contact with the wheel a^3, so that now the rotation of the tube P will be reversed and the breech-closer automatically drawn back. During this reversed motion of the tube P the clutch will not reverse its motion, but will revolve, as before, with the shaft, and impart intermittent rotary motion

to the little wheel d^2 by engaging once during each revolution with one of the teeth thereof; and when the tube P has finished its next third rotation, which has brought the breech-closer as far back as possible, the cam of the wheel d^2 will come in contact with the opposite pin of the ring e^2, and thereby vibrate said ring, and with it the claw, so as to cause the latter to engage with the firing-pin again, and also cause the said claw and its rod f^2 to move the clutch in contact again with the wheel a^2.

Thus it is seen that by the continuous rotation imparted to the shaft M in one direction the clutch will automatically ship and unship the two gear-wheels a^2 a^3 alternately; the tube P will be continuously rotated, once in one direction, and then in the other direction; the breech-closer will be moved backward and forward; the firing-pin engaged and disengaged; and, in fact, the whole firing and loading process automatically carried on.

In this connection I will yet have to describe the movement of the dipper, which is also derived from the rotation of the wheel u. The hub of the wheel u constitutes, as already described, a toothed wheel, v, which meshes into the teeth of a toothed segment, i^2, that is mounted upon a shaft, j^2, whose bearings are within the breech-chamber J, above the tube P, as shown in Fig. 4.

This shaft j^2 connects its squared front end with the rear end of the dipper O by entering a slotted recess in the rear-end plate of said dipper. The front of said dipper is formed into a beveled or tapering pin, which enters a socket provided for its reception in the front part of the breech-chamber J. This mode of hanging the dipper allows the ready removal thereof, for, by merely drawing the shaft j^2 backward it will be detached from the dipper, and the latter may be readily withdrawn from the breech-chamber by lifting its rear end and drawing the front beveled pin out of the socket.

The dipper operates as follows: It is turned up in the position indicated in Figs. 4 and 7 during the forward motion of the breech-closer, and remains in that position until the cartridge last put in has been loaded and fired. When the breech-closer begins to be drawn back, the wheel V, gearing into the segment i^2, will turn the shaft j^2 on the dipper so as to bring the concave side of said dipper to the top. The dipper will then, in its concave part, receive from the magazine above a cartridge, and will retain that cartridge until the breech-closer begins to move forward. At the very commencement of the forward motion the dipper is reversed by the reversal of the motion of the wheel v and segment i^2, and is thereby caused to throw its cartridge into the cartridge-receiving chamber, upon the receiving-jaws, that will be hereinafter more fully described.

After discharging its cartridge the dipper resumes its former position, the same as shown in Fig. 7, and enters with its sharpened edge beneath the upper cartridges, which would, but for the presence of the dipper, drop into the cartridge loading-chamber, but are, by the dipper, prevented from so doing.

I have, in my first patent, hereinabove mentioned, already described a dipper for discharging the cartridges into the barrel, but said dipper was arranged above the cartridge-chamber and in combination only with the inclined bottom of a peculiar magazine. By arranging it as I now do, in line with and strictly within the breech-chamber of the gun, I economize space, and permit the use of a flat-bottomed magazine, which may stand close above the dipper, in the manner indicated in Fig. 4, and also make it possible to load the several barrels successively, in contradistinction to the simultaneous loading formerly required.

For gaining access to the interior mechanism of the gun-barrel, it will only be necessary to unscrew the cascabel-plate pertaining to said barrel, taking with it the plate c^2, claw R, and rod f^2. A small screw, clearly shown in Fig. 4, which fastens the wheel u to the tube P, can then be unscrewed, allowing the withdrawal of the wheel u. On the further withdrawal of the shaft j^2, and removal of the dipper, the rear bearing t of the tube P can be unscrewed, whereupon the entire tube P, with all its contents, can be withdrawn.

S S are two jaws, which are hung between the breech end of the barrel and the front bearing s of the tube P, and which are intended to receive the cartridge that is dropped by the dipper, and to hold it in line with the bore of the barrel until the breech-closer has pushed it into the latter. Each of these jaws is firmly and rigidly attached near its upper edge to its pivot l^2, and these stems or pivots are both hung with their front ends in the rear of the barrel, and with their rear ends in the bearing s, as indicated in Fig. 4. The rear portion of each stem l^2 is not covered by or in contact with the jaw S, as shown in Fig. 4, and such uncovered portion of each stem l^2 is twisted spirally. m^2 is a yoke which straddles the front end of the breech-closer and embraces the twisted parts of the stems l^2, and which, when the breech-closer has nearly reached its most forward position, is, by a projecting pin on said breech-closer (such pin not being shown in the drawing) pushed forward the distance, which intervenes between the bearing s and the rear edge of the jaw S. The ends of the yoke m^2 embracing the twisted ends of the stems l^2, it follows that, as the yoke is pushed forward by the projecting pin of the breech-closer, the same causes the twisted stems to turn, and thereby also causes the jaws S S to be swung apart into the position shown in Fig. 7. When the breech-closer, upon being drawn backward, has nearly reached its rearmost position it draws the yoke back with it by another projecting pin,

and thereby turns the twisted stems l^2, and closes the jaws S S again sufficiently to cause them to form a support for the cartridge that is subsequently dropped by the dipper. T is the magazine-support, and U the magazine, of my improved gun. The magazine-support is a platform, which is placed over the barrels, extending laterally across the whole width of the gun, as shown in Fig. 1, and which, by three transverse ribs, has its surface formed into two shallow receivers for two magazines, U. This magazine-support T is supported by rollers n^2 on the frame of the gun, in the manner clearly indicated in Figs. 9, 10, and 11, in such a way that it can be moved backward and forward along the frame. The front edge of the magazine-support T is made slanting, as shown in Fig. 4, so that a ball striking the same will not be able to reach and injure the mechanism used in and near the cartridge-receiving chamber. The magazine U is made sufficiently long to extend across all the barrels of the gun, and is, by vertical longitudinal partitions, divided into chambers, each sufficiently wide to receive one cartridge on a horizontal plane, and sufficiently high to receive five, more or less, cartridges on a vertical plane. When this magazine is placed upon the support T, while the same is in the position shown in Fig. 4, the magazine is moved laterally on its slotted bottom A^3 to bring one row of cartridges above the dippers O, to drop them upon said dippers. The loading and firing process can then be continued, and after each firing a new cartridge, from the same chamber or compartment of the magazine, drops upon the dipper, &c., until all the cartridges of the one chamber, above the dipper, have been consumed.

The magazine must then be moved laterally to bring a new row of cartridges over the dippers, and after that has been exhausted the magazine can be moved to bring the next row of cartridges over the dippers, &c. When the magazine is nearly empty, a new magazine, filled with cartridges, is placed upon the empty space of the support T, in rear of the first magazine; and as soon as the first magazine is entirely empty, the support T is slid forward on the rollers n^2, and the new magazine brought over the dippers and acted upon, as above described. The entry-magazine can then be removed and refilled, or other disposition made, as required; and when the second magazine is nearly empty, a new-filled magazine is placed on the support T in front of it, and brought above the dippers, by sliding the support backward after the second magazine has been entirely emptied. Thus, the firing process can be entirely continuous by providing the magazine-support with a sliding motion, and with a double support for two magazines.

For imparting the necessary intermittent rectilinear motion to the magazine, a pawl mechanism is used, which operates it at requisite intervals. This mechanism is more clearly shown in Figs. 13, 14, and 15, and its position will be further understood by reference to Fig. 1.

I utilize a cam-groove in the edge of the internal gear-wheel N, which gives motion to the driving-shaft M, in the manner hereinabove already described, for also imparting reciprocating motion to a horizontal rod, o^2. This rod carries a pawl, p^2, which is, by a suitable spring action, held against the edge of a toothed wheel, q^2. The pawl p^2 is double, one part of it entering, as already stated, into the toothed wheel q^2, while the other part has the tendency to reach the notched end of a crank, r^2, that projects from a sleeve, s^2, which loosely embraces the shaft t^2 of the wheel q^2, said shaft being hung in the frame of the gun.

From the same sleeve s^2, which is shown clearly in Fig. 14, and which hangs longitudinally between two of the barrels of the gun, projects a jointed pawl, u^2, in contact with the notched lower edge of the magazine U, said notched edge being, preferably, the front edge of the magazine. The spaces between the notches in the lower edge of the magazine must correspond with the widths of the chambers formed in the magazine. Now, it must further be observed that the wheel q^2 has one tooth or notch about twice the depth of all the other teeth, as seen in Fig. 13. When the pawl p^2 enters into this deep tooth, its other part is carried into the notch of the crank r^2, and the next succeeding motion, by which the rod O^2 is pushed toward the toothed wheel, will cause the pawl p^2 to vibrate the crank r^2, thereby turning the sleeve s^2, and operating the pawl u^2, which moves the magazine. After this motion of the pawl u^2, the same will remain at rest again until the wheel q^2 has completed a further revolution under the influence of the pawl p^2. Thus I am enabled to retain the magazine at rest while the cartridges that are superposed in the same chamber of the magazine are being utilized; but when the chamber above each dipper has been entirely emptied, the magazine will be fed laterally by the pawl u^2 to bring a new chamber over the dipper, until all the chambers have been exhausted.

In order to keep the mechanism just described constantly in the proper position to properly affect the magazine whenever placed upon it, I have devised means for throwing the pawl p^2 entirely out of contact with the wheel q^2 during the time that no magazine stands on the support T. This means consists of a spring-rod, v^2, which bears against the non-toothed lower edge of the magazine, as shown in Fig. 14, and which, when there is a magazine placed upon the support T, is depressed. The lower end of this spring-rod v^2 connects by another rod, w^2, with the pawl p^2, and throws said pawl into contact with the wheel q^2 whenever the rod v^2 is depressed by the magazine, but when the magazine is re-

moved, said rod is immediately raised by its spring, and thereby causes the rod w^2 to swing the pawl p^2 out of contact with the wheel q^2. There is also a notch cut into the edge of the magazine, that bears on the spring-rod v^2 to allow the elevation of said spring-rod as soon as the last vertical row of cartridges has been brought over the dippers. This rounded notch is indicated in Fig. 13.

The general operation of the gun will be understood without special description, but for greater clearness I will proceed to denote the succession of the processes carried on by the revolution of the shaft M. After the gun has been properly pointed by the adjustment of the tail-screw, and, if necessary, also by operating the traversing-worm I by hand, the traverse-clutch n is thrown into gear with one of the beveled wheels on the traverse-worm, so that, by a subsequent revolution of the shaft M, the traverse may be properly operated. A magazine filled with cartridges is next placed upon the front of the support T in such position that the pawl u^2 will enter the first tooth on the under side of the magazine, as indicated in Fig. 13, that being the first working position of the magazine. In this position the first row of cartridges intended for each barrel will be brought above the dipper of such barrel. Rotary motion is now imparted to the shaft M in the direction of the arrow shown in Fig. 4, the wheels a^2 being, meanwhile, in gear with their respective clutches b^2, and consequently also actuating the beveled wheels u and tubes P. At the first start of this motion the dipper is turned to throw the first cartridge of the row above it upon the closed jaws S S. The continued motion imparted to the tube P, as stated, causes the breech-closer Q, which, by the way, receives projecting feathers from the surrounding bearing S, so it will be prevented from turning on its axis, to be screwed forward, so it will push the cartridge home into the barrel. Just before the cartridge is entirely pushed into the barrel the yoke m^2 will be moved forward, and the jaws S S spread apart. The cartridge-extractor thereupon enters during the continued forward motion of the breech-closer under the flange of the cartridge. After a cartridge has thus been pushed home the claw R is swung aside by the action of the cam d^3 of the wheel d^2, which comes in contact with the pin of the ring e^2, and the firing-pin is thrown forward, exploding the cartridge.

The firing action may of course be simultaneous in all the barrels, as also the loading action, or may be successive by properly adjusting the clutches b^2 with reference to the position of their projecting pins h^2. By causing the claw to release the firing-pin the clutch b^2 has, as already hereinbefore specified, also caused, by its own longitudinal motion, the release of the wheel a^2 and the throwing in gear of the wheel a^3, and the consequent reversal of the rotation of the tube P, and a backward motion of the breech-closer. As this backward motion takes place the cartridge-extractor removes the empty shell from the barrel, and allows it to drop out through the open space formed between the open jaws S S, and as the breech-closer nearly reaches its most backward position it moves the yoke m^2 back with it, and thereby turns the twisted stems l^2 and causes the jaws S S to close beneath the dipper, the said dipper having been turned up, with its concave side to the top, just as the breech-closer commenced its backward motion. Immediately on the breech-closer reaching its most backward position the claw R is again brought over the firing-pin to lock it, and the clutch b^2 is again moved into contact with the wheel a^2, and the operation continued as before described. After all the cartridges of a vertical row over each barrel have been discharged the pawl p^2 drops into the deep tooth of the wheel q^2, and thereby causes the crank r^2 to be affected and the magazine to be fed laterally to bring a new row of cartridges over the dippers.

It is evident that the magazine-bottom A^3 must remain immovable on the support T, while the magazine is moved laterally, as described.

It will be observed that the cartridge-extractor x is pivoted in a slot formed in the breech-closer Q beneath the firing-pin w, and that when the breech-closer Q is drawn back, as in Fig. 4, the head or shoulder of the firing-pin will bear against the rear end of the extractor to hold its front-end elevated and to prevent the extractor from playing on its pivot; but as soon as the breech-closer is moved forward toward the barrel A from the position shown in Fig. 4, the rear end of the extractor ceases to be under the head or enlargement of the firing-pin, and receives thereby liberty to play to a slight extent on its pivot, and this slight degree of play will allow it to pass its hooked end under the flange of the cartridge in the barrel. The flange of the cartridge will then remain in the notch of the extractor in the requisite manner. When, afterward, the firing-pin is propelled forward to explode the cartridge the head or enlargement on said pin will at once arrive over the rear end of the extractor x, and prevent such extractor from vibrating during the subsequent backward motion of the breech-closer, and therefore the extractor will be forced to retain its hold on the cartridge-shell until the same has been entirely withdrawn from within the barrel. Thus as the extractor is pivoted beneath the firing-pin, and the head on the firing-pin, which is used to limit its degree of forward motion, locks the extractor, the extractor must operate automatically in the desired manner.

I claim as my invention—

1. The tail-screw G, combined with the pivoted nut b and by ball-and-socket joint with the traversing-nut H, substantially as herein shown and described.

2. The traversing-worm I, combined with the beveled wheels *j m* and, by gearing, with the transverse operating-shaft M, and provided with a clutch, *n*, by which its motion can be reversed, substantially as herein shown and described.

3. In combination with the transverse operating shaft M, that gears into the traversing-worm I, the beveled wheels *j m*, clutch *n*, and gearing *o*, by which the traverse can be changed from an automatic to a hand traverse, substantially as herein shown and described.

4. The reciprocating breech-closer Q, provided with an external screw-thread to receive its motion from the rotating embracing-tube P having an internal screw-thread, substantially as specified.

5. The combination of the barrel A with the rearwardly-extending breech-chamber J, transverse box L, and with the cascabel *q*, which is applied to said box, substantially as specified.

6. The combination of the firing-pin *w*, tubular breech-closer Q, embracing tube P, and cylindrical breech-chamber J, all of said parts being concentric and operating substantially as specified.

7. The tubular screw P, connected rigidly with the beveled wheel *u* and gear-wheel *v*, and combined with the breech-closer Q and cartridge dipper-shaft j^2, substantially as specified.

8. In combination with two or more barrels, A A, which are placed on the same plane, in a machine-gun, the operating-shaft M, carrying two or more sliding clutches, b^2, and two or more loose wheels, a^2 a^3, all arranged so that each of the barrels A will have its interior mechanism actuated by the same shaft M, but independently from the other barrels through the intervention of the clutches and wheels a^2 a^3, substantially as specified.

9. The sliding clutch b^2, made with a projecting pin, h^2, for the purpose of imparting intermittent rotary motion to the toothed wheel d^2, substantially as described.

10. The rotating-wheel d^2, provided with a cam, d^3, and combined with the claw and lever R, for operating the clutch and affecting the firing-pin of the machine-gun, substantially as specified.

11. The clutch b^2, combined with the lever R, which carries the pin g^2 into a groove of the clutch and with intermediate mechanism, whereby the rotation of the clutch serves to vibrate the lever R and to move the clutch lengthwise, as specified.

12. The cascabel-plate *q*, carrying on its inner face the plate c^2, which serves as a pivot for the lever R, and as support for the wheel d^2, substantially as specified.

13. The firing-pin *w*, combined with the vibrating claw R, by which it is locked and released, substantially as herein shown and described.

14. In combination with the shank of the claw R, the ring e^2 and rod f^2, said ring carrying two pins on opposite sides of the actuating-wheel d^2 to be affected by the cam d^3, substantially as herein shown and described.

15. The vibrating cartridge-extractor *x*, pivoted in a slot of the tubular reciprocating breech-closer Q beneath the firing-pin *w*, and combined with said firing-pin to be locked by the head or enlargement thereof, substantially as herein shown and described.

16. In combination with the front bearing *s* of the rotating tube P, the spring *y*, which is interposed between the end of the tube P and the bearings, to operate in conjunction with the reciprocating breech-closer Q, substantially as specified.

17. The vibrating cartridge-dipper O, fitted within a recess of the breech-chamber J, and attached removably to the operating-shaft j^2, substantially as herein shown and described.

18. The gear-wheel *v*, mounted on the rotary tube P and combined with the toothed segment i^2 on the shaft j^2 of the vibrating dipper, substantially as herein specified.

19. The vibrating jaws S S, arranged in the cartridge-receiving chamber beneath the vibrating dipper O, substantially as and for the purpose specified.

20. In combination with the vibrating jaws S S, the twisted stems l^2 and the sliding yoke m^2 for the purpose of operating said jaws, as specified.

21. The double pawl p^2, combined with the toothed wheel q^2 and with the operating-crank r^2 on the sleeve s^2, substantially as specified.

22. In combination with the cam-wheel N and reciprocating rod O^2, the pawl p^2, wheel q^2, crank r^2, and operating-pawl u^2, all arranged substantially as specified.

23. The wheel q^2, made with one tooth deeper than the remaining teeth, and combined with the actuating-pawl p^2 and notched crank r^2 to throw said pawl in connection with said crank once only during the rotation of said wheel, as specified.

24. The combination of the spring-rod v^2 and connecting-rod w^2 with the pawl p^2, for the purpose of being acted upon by the magazine, in the manner specified.

25. The sliding magazine-support T, made with three transverse ribs, which form its surface into two shallow receivers for two magazines, substantially as and for the purpose specified.

26. In combination with a machine-gun having a series of parallel barrels, the laterally-movable magazine *u* and the longitudinally-movable magazine-support T, substantially as described.

27. The combination of the dipper O with the breech-chambers J and their relative arrangement, whereby the dipper will be enabled to support a cartridge, which will be clear of the charging-magazine, substantially as and for the purpose specified.

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