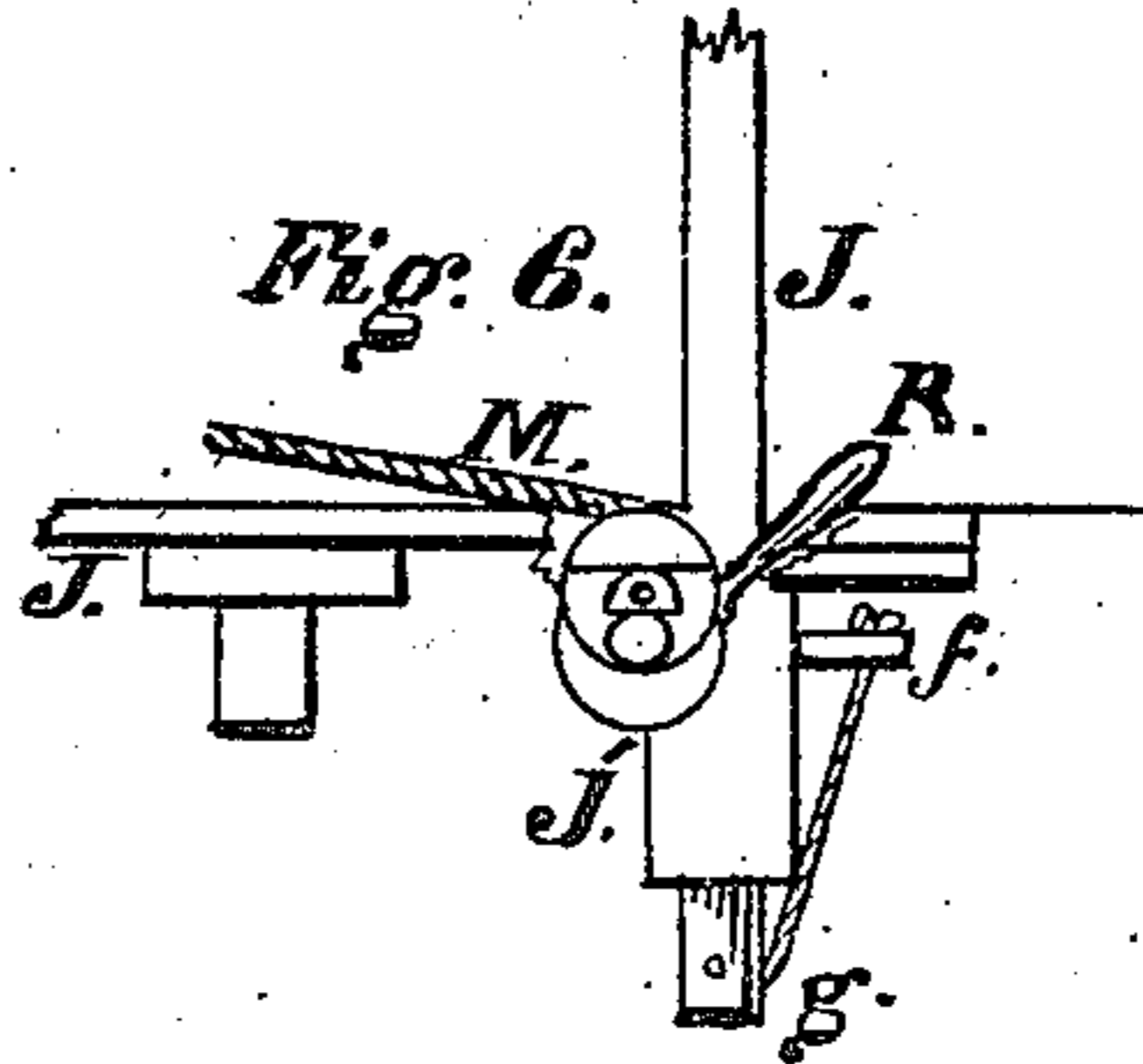
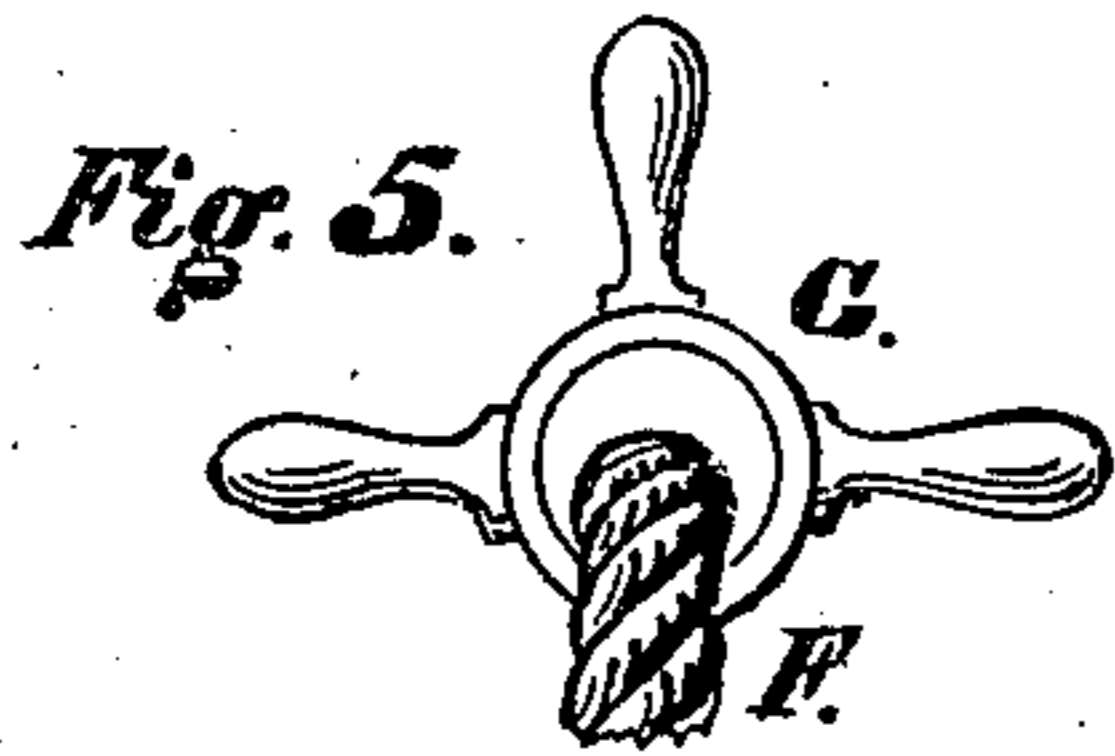
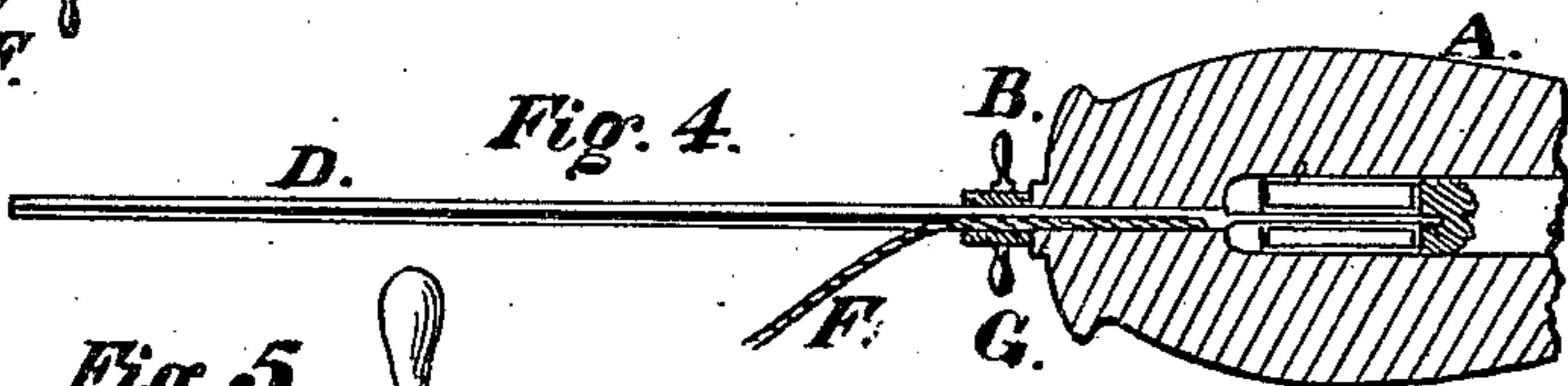
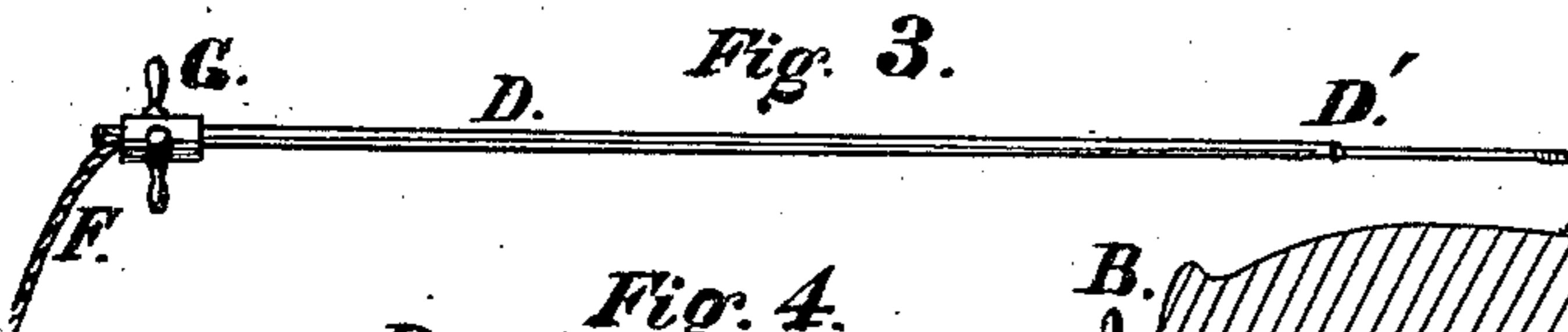
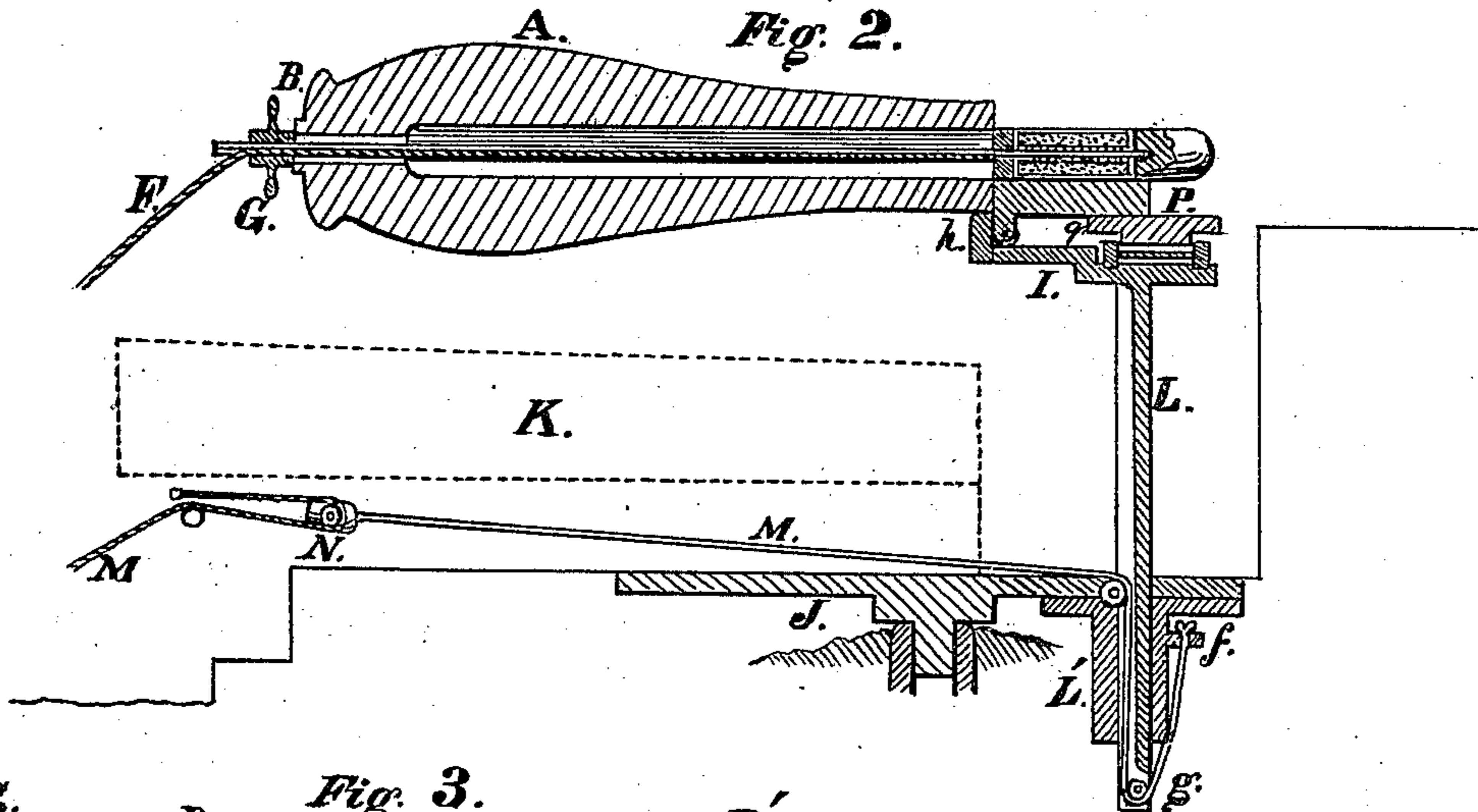
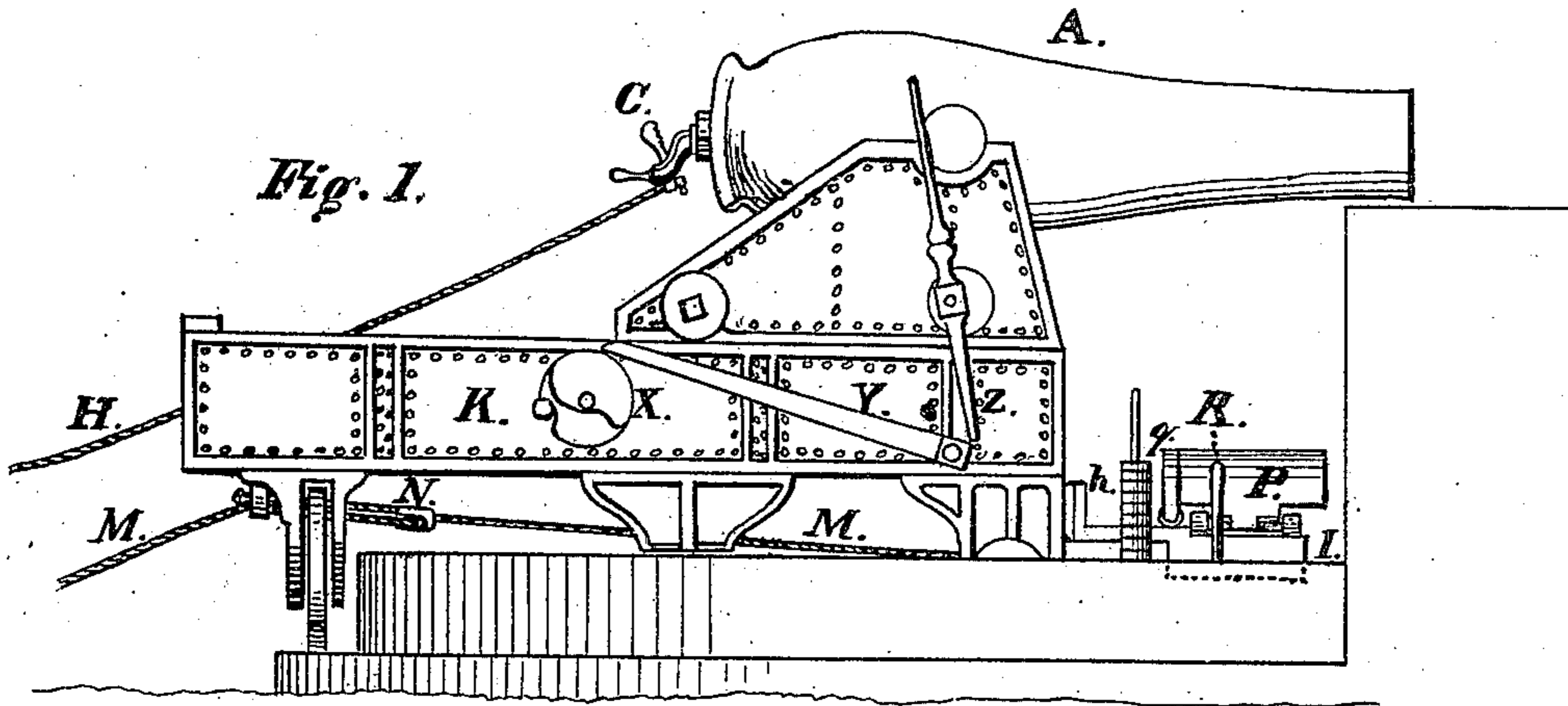


H. C. BULL.
Operating Heavy Ordnance.
No. 209,011. Patented Oct. 15, 1878.



WITNESSES.

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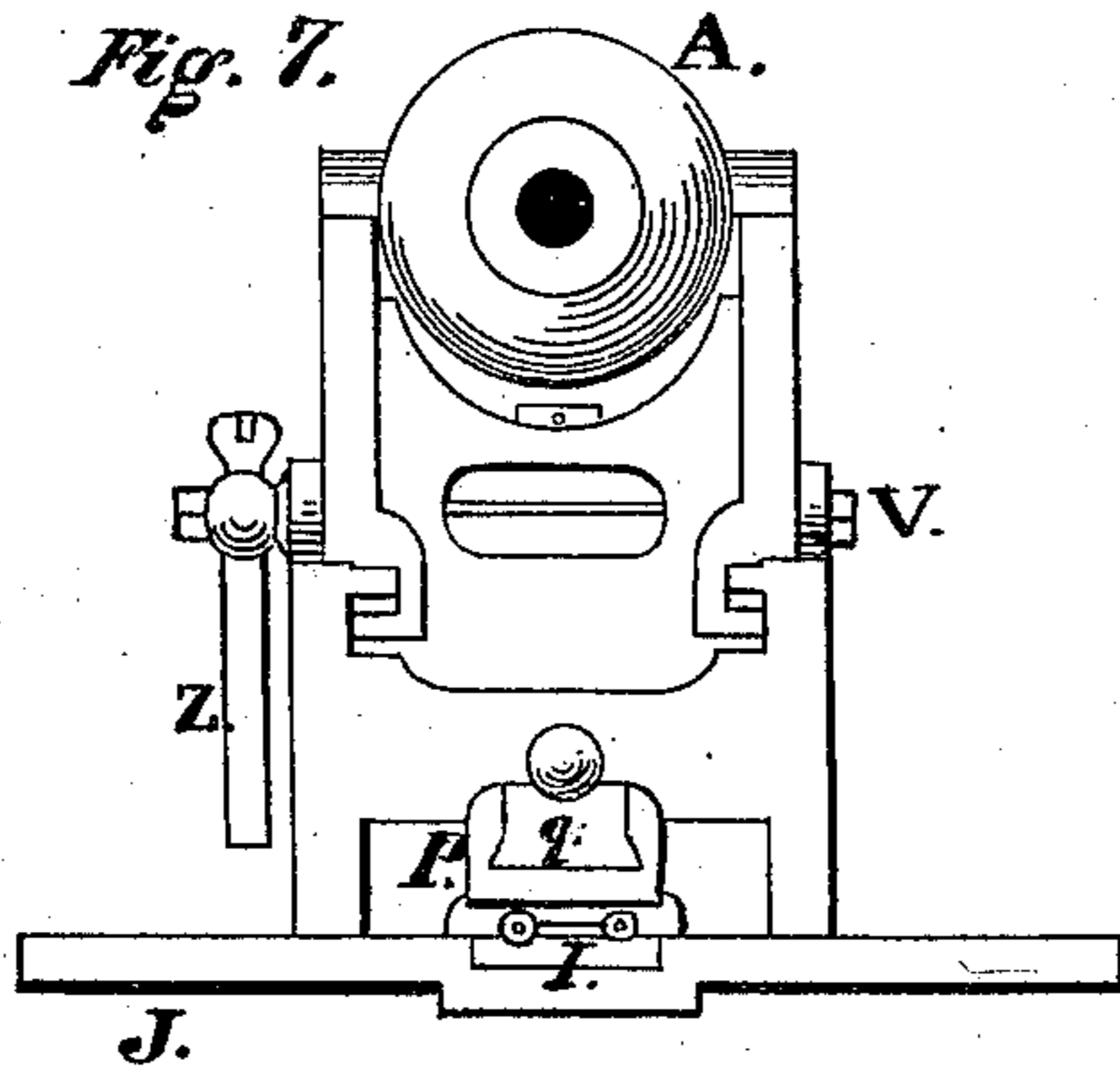


Fig. 10.



Fig. 8.

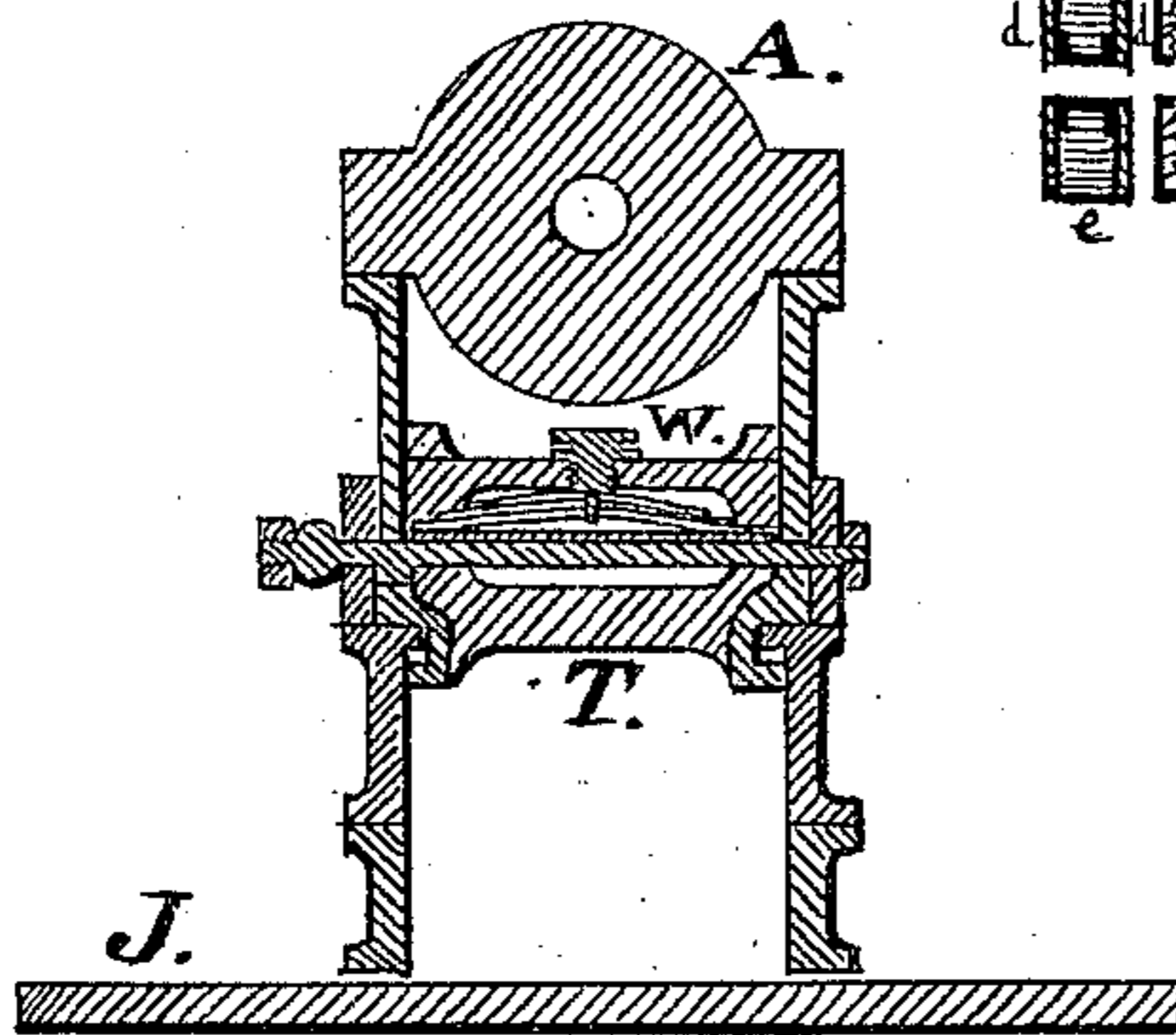


Fig. 9.

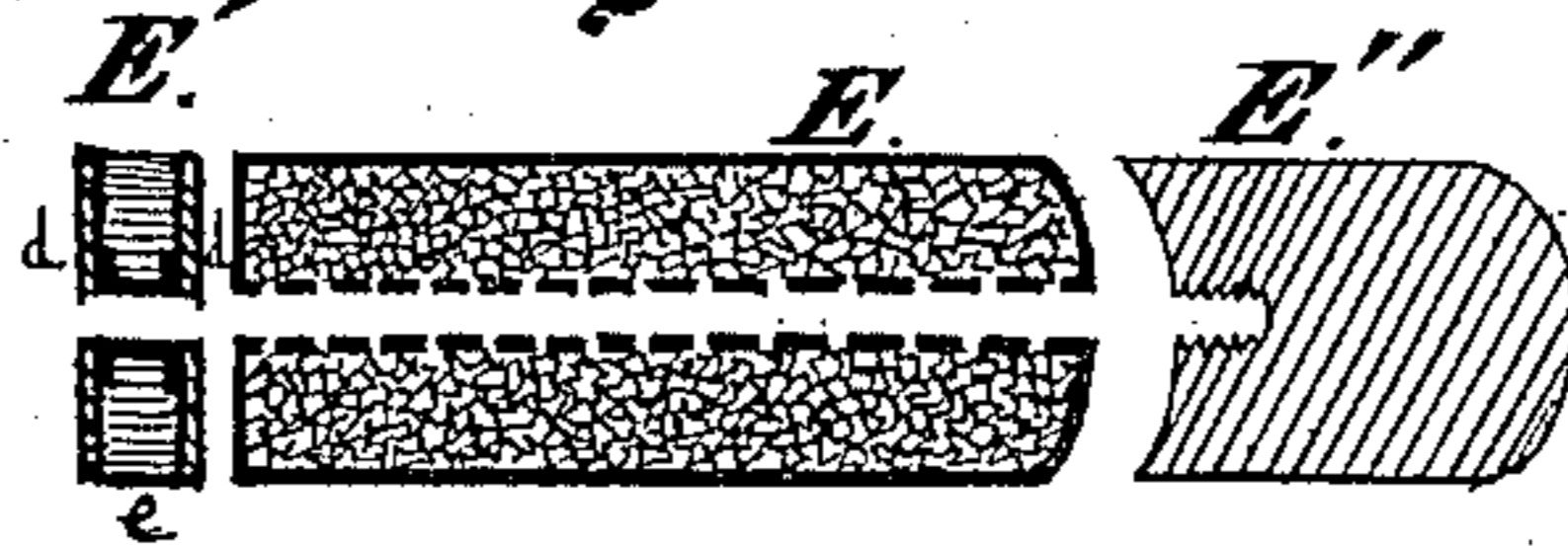


Fig. 13.



Fig. 11.



Fig. 14.

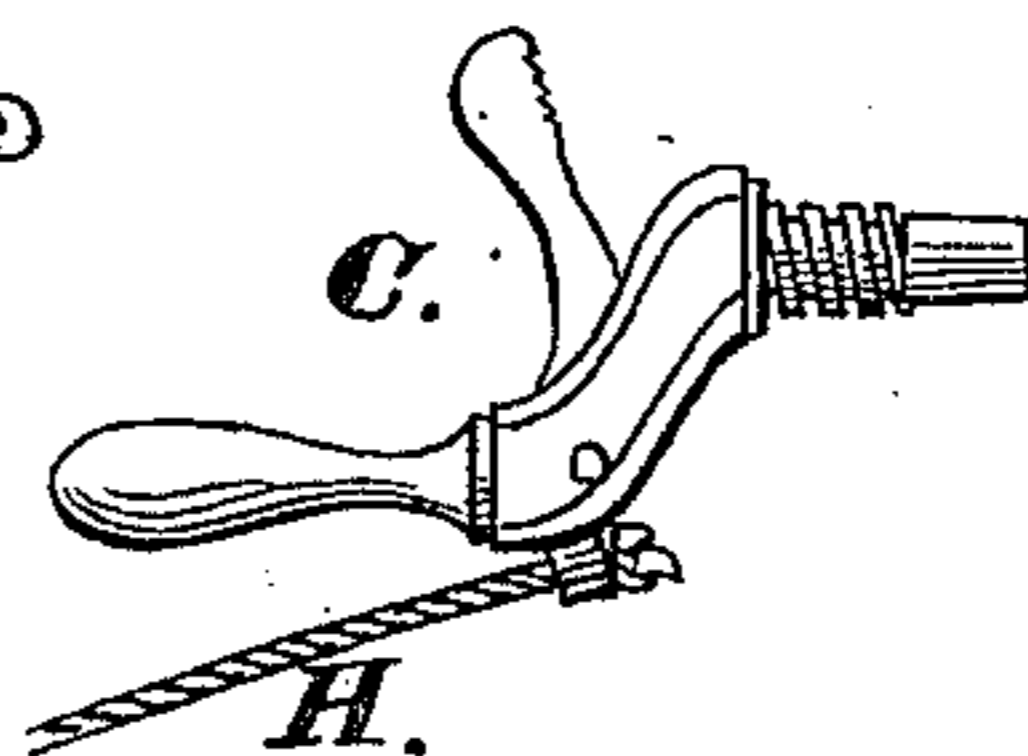
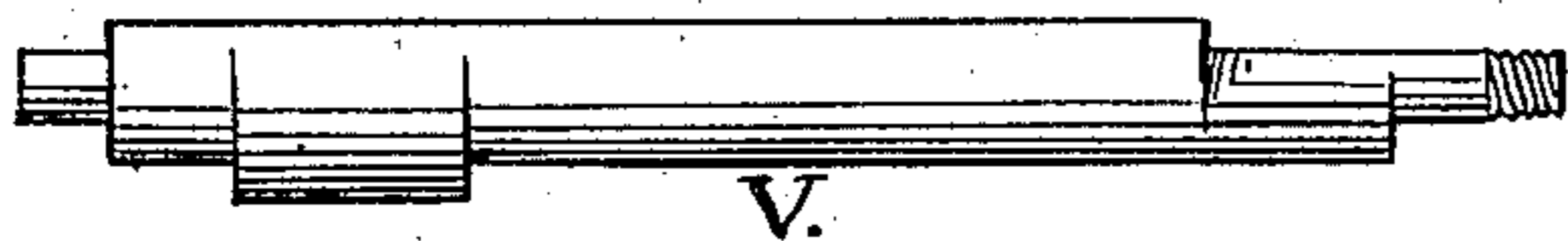
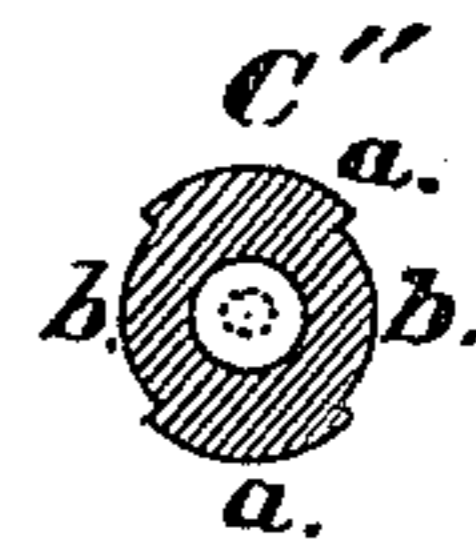


Fig. 12.



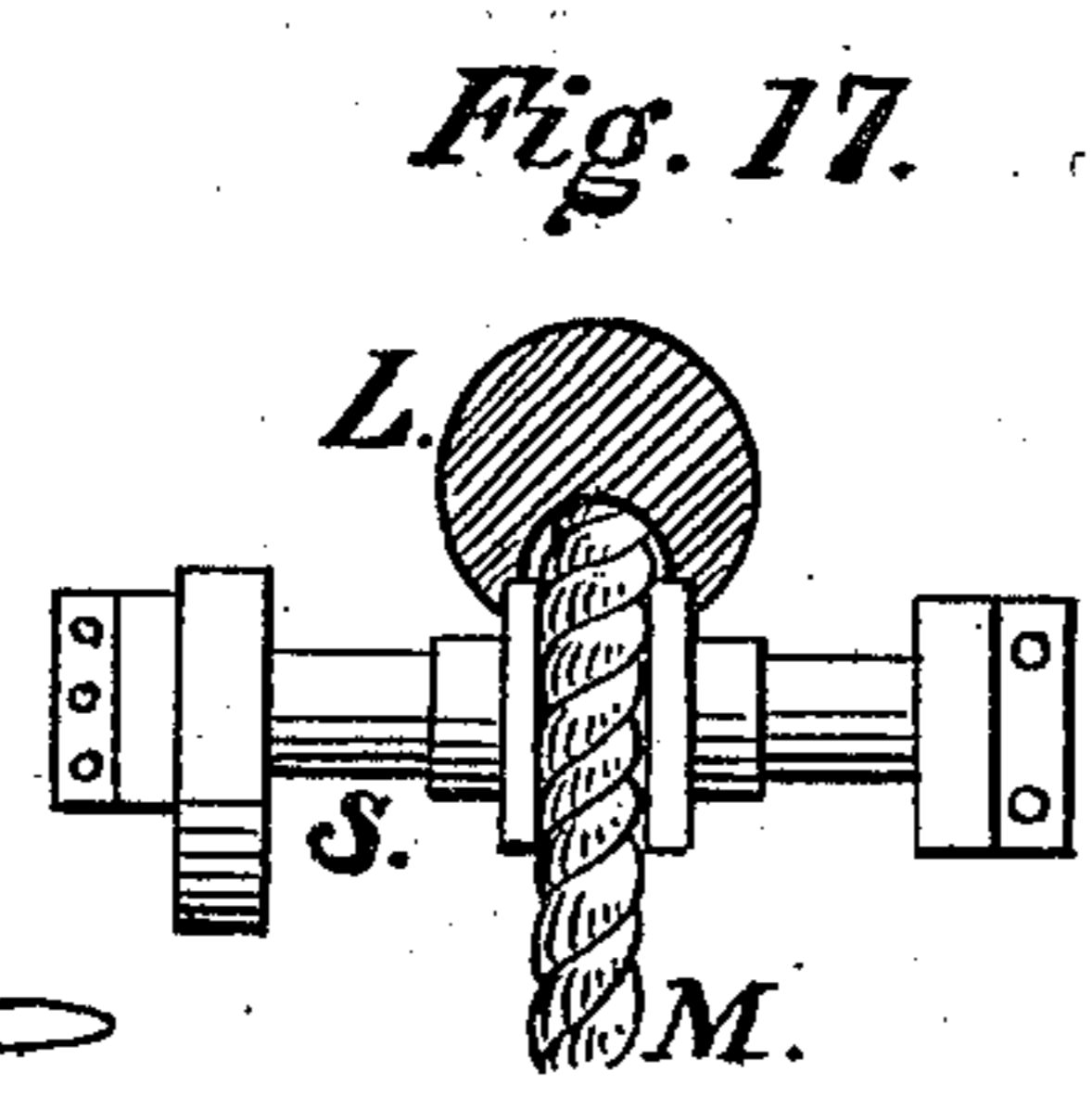
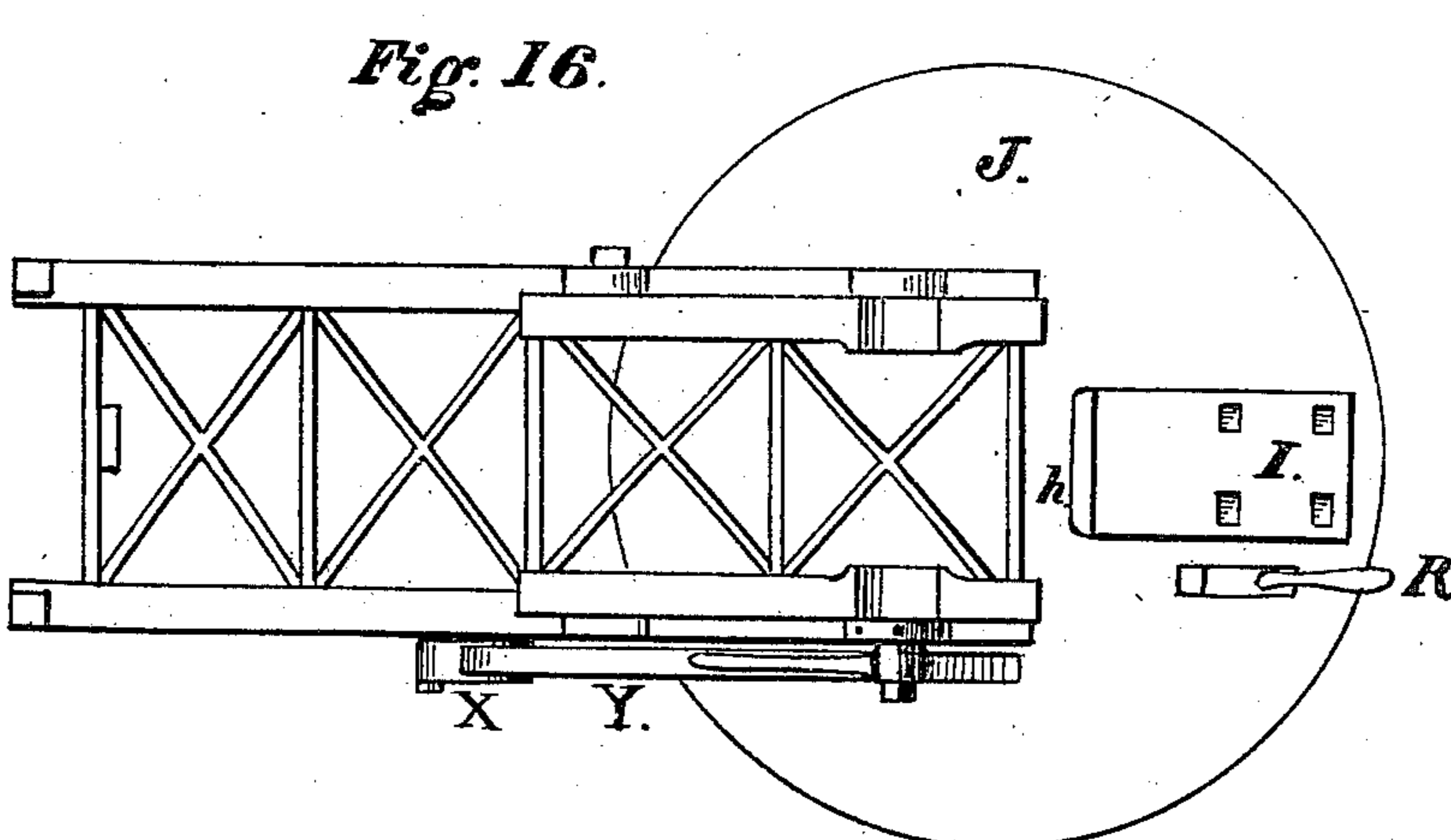
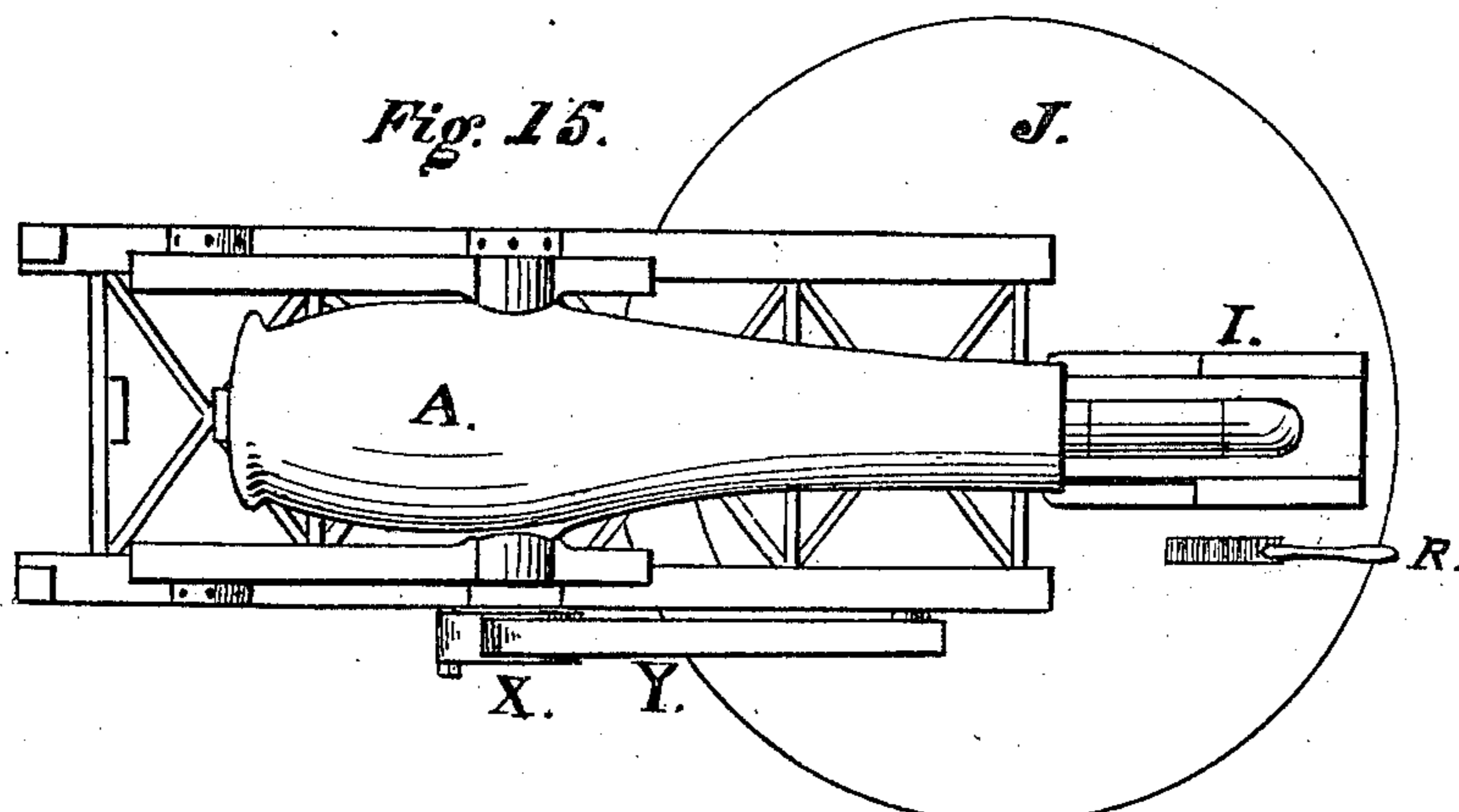
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UNITED STATES PATENT OFFICE.

HENRY C. BULL, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN OPERATING HEAVY ORDNANCE.

Specification forming part of Letters Patent No. **209,011**, dated October 15, 1878; application filed January 5, 1876.

To all whom it may concern:

Be it known that I, HENRY C. BULL, of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful improvements in the mode of loading and firing heavy cannon and in apparatus for that purpose, also in the construction of the cartridge, in the arrangement of the load, and in the mode of elevating it to the muzzle of the piece, and also in the mode and mechanism for controlling the recoil of the gun; and I do hereby declare that the following is a full, clear, and exact description of my said inventions and improvements, reference being had to the accompanying drawings, making part of this specification, and in which—

Figure 1 is a side elevation of the cannon, mounted on its carriage and chassis; and the remaining figures are sections and details of the several parts and improvements.

The same letters of reference are used to designate the same parts in all the figures in which they occur.

The object of my invention and improvements is to facilitate the charging of muzzle-loading cannon by means of mechanism operating in the rear of the gun; to elevate the charge or load to the muzzle of the cannon by mechanism operating from the rear; to a new and improved mode of firing the gun, and to automatically control or limit the recoil of the gun.

To enable others skilled in the art to make and use my said inventions and improvements, I shall now describe the construction and operation of the same, referring, as I proceed, to the said drawings by the figures and letters marked on them.

The cannon, which may be of the usual form, is shown at A in Fig. 1, and in vertical section in the line of its axis in Fig. 2. In my improved arrangement I dispense with the ordinary touch-hole and primers, loading and firing the gun by means of a hole or aperture drilled in the axis of the gun through the breech into the chamber, as shown at B in Figs. 2 and 4. For large cannon I make this hole two inches (more or less) in diameter; and sometimes I counterbore this hole for about one-third of its distance, and screw into this enlarged portion a steel bushing having

the same bore as the remaining portion of the aperture. A screw-thread is formed in this bushing, for the purpose of attaching the firing-piece C, Fig. 1, to the cannon. This firing-piece is shown on a larger scale in Fig. 12, in which C is a side view, and C' a top view; and that this firing-piece may be expeditiously attached to or detached from the gun, I remove a segment of one-fourth the periphery from the opposite sides of its screwed shank, as shown at C and C', Fig. 12; and an end view on a still larger scale is shown at C'' in the same figure, in which *b* and *b* are the denuded portions, and *a* and *a* the threaded portions of the shank, by which arrangement or construction of the screwed portion of the shank of the firing-piece and the steel bushing the firing-piece may be instantly set home to the full depth of the threaded portion, and then be thoroughly secured by a quarter-turn of the shank, and be as quickly removed after firing by a reversed motion. This mode of interlocking the screw-threads is known in mechanics as the "sectional screw and nut fastening."

In loading the cannon, I pass the loading-rod D through the opening B in the breech until its forward end projects at the muzzle, as shown at Fig. 2. This loading-rod is shown separately at Fig. 3. The forward portion is made of smaller diameter, so as to form a shoulder, as shown at D', and the outer end of this reduced portion has a screw formed upon it, for the purpose of taking into a hole, tapped with a corresponding screw-thread, made in the shot or shell which is to be fired from the cannon.

The cartridge of this cannon is of cylindrical form, and has a central tube of proper size for the small part of the loading-rod D to pass freely through it, as shown at E in Fig. 9, in which figure a longitudinal section is given of the several parts of the charge or load. This central tube may be made of thin metal, paste-board, or other suitable material, and may be perforated with numerous small holes, as shown in Fig. 11, which is a side view of a detached tube. These small holes permit the simultaneous ignition of the whole charge by the central fire, which is forced into the tube from the firing-piece C, Fig. 1. This cartridge

forms the subject of a separate patent which has been duly allowed to me.

I also use, as a part of my system, a swab of peculiar construction for wiping out the chamber of the gun after each discharge. I make this swab of felting or other suitable material, and confine it between two metallic disks and a central metallic bush, as shown at *E'*, Fig. 9, in which *e* is the felting and *d* and *d'* the metallic disks. Both disks have a circular hole in the center for the small part of the loading-rod to pass through. An end view of this swab is shown at Fig. 10.

The load is prepared by placing the several parts upon a carrier in front of the gun and in line with its chamber—first, the swab *E'*, then the cartridge *E*, and lastly the projectile *E''*, as shown in Fig. 9. The small part of the loading-rod is passed through these several parts, and then secured to the projectile by the screw on its end, as shown in Fig. 2, when the whole charge or load is drawn home into the chamber of the gun, as shown in Fig. 4, by hauling on the lanyard *F*, Figs. 2 and 3, which is attached to the loading-rod *D* behind the shoulder *D'*, and occupies a groove made for its reception in the loading-rod, as shown in the longitudinal section of the rod at *D*, Fig. 4, and in cross-section in the hand-wheel *G*, Fig. 5, which hand-wheel should be held firmly in place against the breech of the gun while the load is being drawn home in the chamber; and to relieve the friction on the lanyard a small sheave may be attached to the hub or boss of the hand-wheel to support the lanyard, which is drawn out with a downward pull, the center of the gun being considerably above the reach of the men; but by this arrangement the pull of the lanyard upon the loading-rod is direct and central with the chamber of the gun.

The confined air within the chamber of the gun is a serious obstruction when the charge is forced in from the muzzle, as in the ordinary muzzle-loaders; but in my system it finds a ready exit by the space or clearance around the loading-rod in the aperture *B* while the load or charge is being drawn into the chamber.

When the charge is brought home to its place in the chamber of the cannon the loading-rod *D* is unscrewed from the projectile by the hand-wheel *G* and removed, and the firing-piece *C* immediately secured to the gun, as shown in Fig. 1, to which firing-piece the lanyard *H* is attached for tripping the trigger and firing the percussion-cap; and the small chamber in the shank being loaded with an ordinary blank musket-cartridge, a greatly-increased fire is forced into the main charge of powder within the chamber of the gun.

The firing or discharge of the gun leaves the swab *E'* in the bottom of the chamber; but on removing the firing-piece *C* and introducing the loading-rod *D* through the rear aperture *B*, the small part of the rod passes centrally through the swab till its shoulder *D'*

strikes or takes against the metallic disk, which is then pushed along the chamber of the gun until it emerges at the muzzle, wiping out the chamber in its passage, thus cleaning the gun and preparing it for reloading.

The load or charge is arranged on a platform, *I*, Figs. 1, 2, and 7, attached to the turn-table *J*, upon which the chassis *K* is mounted, as shown in section in Fig. 2 and in top view in Figs. 15 and 16.

Fig. 15 is a top view of the cannon complete, with its carriage, chassis, and turn-table, and Fig. 16 is the same with the cannon removed; and as the platform moves around with the chassis and turn-table it is always in proper position under and in front of the muzzle of the gun.

The platform *I* is mounted on a vertical column, *L*, which moves or slides in a deep socket, *L'*, attached to the under side of the turn-table *J*, as shown in Fig. 2, and is elevated by means of the lanyard *M*, which is secured to the socket at *f* above. Its bottom edge then passes under a small sheave, *g*, in the foot of the column; then upward and over a sheave in the turn-table, as shown in Fig. 2; then to the rear, where the applied force is increased by a block and tackle, *N*, as shown beneath the chassis *K* in Figs. 1 and 2.

The column *L* has a hollow or groove formed in it for the elevating-rope *M* to work in, as shown in cross-section at *L*, Fig. 17.

The platform *I*, on top of the column *L*, carries a small truck, *P*, Figs. 1, 2, and 15, mounted on four small wheels, as shown in Figs. 1 and 7, which rest in four cavities formed in the face of the platform for that purpose, as shown in Fig. 16, thus keeping the truck exactly in proper position to deliver the load or charge into the chamber of the gun. This has a sliding piece or cross-truck, *q*, Fig. 2, working at right angles with it, and has a hollow in its bed or upper face for the charge or load to lie in, as shown in Figs. 2, 7, and 15. The inner end of this cross-slider is mounted on wheels bearing on the platform *I*, as shown in Figs. 1 and 2, and so arranged as to carry the load or charge to the muzzle of the cannon when left by the recoil at or near the limit of the rear of the chassis. A front view of this truck and cross-slider is shown at *P* and *q* in Fig. 7.

The platform *I* has a vertical lip or stop, *h*, on its rear edge, to take under and against the muzzle of the cannon when the charge or load has been raised to the exact height to enter the chamber of the gun, as shown in Figs. 1 and 2.

When it is necessary or desirable to retain the platform *I* in an elevated position, this is instantly accomplished by impinging or wedging the sheave between the sides of the groove made in the column *L*, as shown in Fig. 17, (which gives a cross-section of the column,) and is accomplished by a partial rotation of the eccentric-spindle *S*, upon which the sheave is mounted, by the hand-lever *R*, Figs. 1, 6, 15, and 16; and when the charge or load is drawn into the

chamber of the gun the platform I may be allowed to descend by its own gravity by easing the pressure on the lever R.

The recoil movement of the cannon upon the chassis is controlled and limited by an automatic differential mechanism, which presents a resistance to the movement that increases rapidly with the space passed over. This effect I accomplish by means of the binder T, Figs. 8 and 13. The lower gibs, *m m*, of this binder take under the inner projecting ledges of the chassis, as shown in Fig. 8, (which is a cross-section in the axial line of the trunnions through the cannon, carriage, and chassis.) Within this binder there is a strong spring of plates or leaves of steel, or a strong spring of any suitable material, which rests on the eccentric-shaft V, and the tension or force of this spring is regulated by the screw W, which bears upon it, as shown in Figs. 8 and 13.

When the gun is in position for firing, the bearing-wheels of the gun-carriage are lifted clear of the top surface of the chassis, and the eccentric X, Fig. 1, is made to elevate the rear end of the inclined plane Y, Fig. 1, upon which the end of the lever Z, Figs. 1 and 7, has a bearing.

During the recoil of the gun the inclined plane Y causes the lever Z to partially rotate on its axis as it moves up the incline, thus causing the eccentric or large side of the shaft V, Figs. 13 and 14, to impinge against the ends of the spring, thereby causing the holding-gibs of the binder to bear with increasing force against the under side of the ledges of the chassis until, by the time the gun-carriage has reached nearly the end of the chassis, the friction or bite of the holding-gibs has completely neutralized the force of the recoil.

In order to release the gun-carriage so as to advance the gun into battery, the eccentric X is dropped to its lower center, thereby lowering the inclined plane Y. The lever Z is then moved forward sufficiently to release the binder and raise the gun and carriage on the wheels.

The new mode of loading and firing heavy ordnance and the means for that purpose herein described not only enable these operations to be executed with great rapidity and accuracy, but the men who are engaged in the work are protected while so employed, as the operations are conducted and performed below the level and under the protection of the parapets, except the sighting of the piece.

I do not, however, confine myself to the exact details of arrangement and construction which I have herein described, but claim the right to vary the same as circumstances or convenience may require, so long as I confine myself within the purview of my invention.

I shall now describe the manner of manipulating or handling a heavy cannon arranged according to this system, which may be accomplished by a force of less than thirty men, divided into squads, with special duties assigned to each, as follows:

Squad No. 1, consisting of two men, shall put the load on the shot-carriage and run it upon the elevator. Their position is near the front of the gun.

Squad No. 2, consisting of ten men, stationed at the rear of the gun, shall elevate the load to the muzzle of the gun by hauling on the elevator-lanyard; and, secondly, they shall draw the load or charge into the chamber of the gun by hauling on the loading-lanyard.

Squad No. 3 (one man) stands in front, to the right of the muzzle of the gun. His first duty is to remove the swab from the loading-rod when it has been pushed out of the gun. His second duty is to place a new swab on the loading-rod. His third duty is to guide the loading-rod through the central tube of the cartridge into the threaded aperture in the shot or shell; and, lastly, when the load or charge has been drawn into the gun, he will release the elevator-platform, so that it may descend by its own gravity to its recess in the turntable to receive another load or charge.

Squad No. 4 (one man) will take charge of the firing-piece, and will immediately remove the same from the gun after its discharge. He will then prepare it for firing, and will insert it in the breech of the gun when the loading-rod is removed.

Squad No. 5 (one man) has charge of the loading-rod. His first duty, on the removal of the firing-piece after the discharge of the gun, is to introduce the loading-rod through the rear aperture, encountering the swab with the shoulder of the rod, and pushing it forward till it emerges from the muzzle, thereby cleaning out the chamber of the gun. His second duty is, when the small part of the loading-rod has passed through the load or charge, to rotate the rod by the hand-wheel till it is screwed home into the shot or shell. His third duty is to hold the hand-wheel close to the breech of the gun, while squad No. 2 draws the charge home in the chamber by hauling on the loading-lanyard. His fourth duty is to disconnect the loading-rod from the projectile by a reverse movement of the hand-wheel, and then withdraw the loading-rod from the gun, when immediately squad No. 4 will insert the firing-piece.

Squad No. 6, consisting of eight men, manages the levers of the wheels of the gun-carriage and chassis. Their first duty, immediately after the firing of the gun, is to drop the inclined plane and disengage the gripping device that controls the recoil. Their second duty is, as soon as the charge or load has been drawn into the chamber, to advance the gun into battery; and their third duty is to readjust the recoil-controlling apparatus.

The training of the gun to right or left, the elevating of the charge, and the disengaging of the recoil-controlling apparatus may be all performed in the time occupied in sighting the gun.

It is thus manifest that the interval of time between the discharges of the gun may be

limited to the time required for removing, preparing, and reattaching the firing-piece, which is performed in less time than is usually consumed in swabbing out the gun; and all the operations being performed under the protection of parapets, the men and officers in charge of the gun are comparatively safe from the enemy.

Having thus described my improvements in the mode of loading and firing muzzle-loading cannon, and in the mechanism and arrangements designed and employed for these purposes, what I claim therein as new, and desire to secure by Letters Patent of the United States, is—

1. A muzzle-loading cannon constructed with an opening or small passage through the breech in the axial line of the chamber, in combination with a perforated swab, which remains in the gun when fired, and a removable loading-rod adapted to enter and operate through the said rear opening or passage in the gun, for the purpose of working the swab and of drawing the charge or load home into the gun, substantially as herein described.

2. A loading-rod adapted to enter the chamber of a gun through an aperture in the breech, having a shoulder near its front end to engage with or take against the swab, and a reduced forward portion to pass through the swab and the cartridge, and provided with a screw-thread to screw into the cartridge or projectile, all substantially as set forth.

3. A loading-rod, in combination with a lanyard or rope operating in a longitudinal groove in said rod from the point of attachment at or near its forward shoulder, so as to draw the charge or load home into the chamber of the gun by the central and direct pull of the lanyard, substantially as described.

4. A loading-rod, in combination with a hand-wheel adapted to slide upon the rod, but not to turn thereon, for rotating the same and for supporting the lanyard at its exit from the rear aperture of the breech, constructed and operated substantially as described.

5. A detachable percussion-firing piece or lock constructed with a shank adapted to enter and securely close the orifice in the breech of the gun, in which shank is a small powder-chamber opening into the chamber of the gun, to contain a small charge of powder for igniting the main charge by filling its central cavity with flame, all substantially as described.

6. A swab constructed to fit the bore of the gun, with a central perforation to allow the passage of the reduced part of the loading-rod, but not the shoulder on said rod, substantially as described.

7. The ammunition-truck, in combination with the elevator for conveying and raising the load or charge into range with the chamber of the gun, substantially as described.

8. The ammunition-truck and elevator, for bringing the load or charge into range with the chamber of the gun, in combination with the cross-slide, for moving the load or charge horizontally close up to the muzzle of the gun, substantially as described.

9. The column of the elevator, in combination with the top and bottom sheaves and the lanyard or tackle for raising or lowering the elevator-platform, substantially as described.

10. The column of the elevator, in combination with the top sheave and its eccentric-spindle, for the purpose of holding the elevator at any desired height, substantially as described.

11. The combination of the gun-carriage with the chassis by means of interlocking grippers, constructed substantially as described.

12. The gun-carriage and chassis, in combination with the controlling-spring for checking the recoil, and means, substantially as described, for increasing or diminishing the retarding effect of such spring, substantially as described.

13. The eccentric-shaft which bears upon the controlling-spring, in combination with its lever for increasing the tension of said spring when said lever is operated by the recoil movement of the gun, substantially as described.

14. The automatic differential apparatus for arresting the recoil movement of the gun within a limited space, consisting of the eccentric-shaft and its lever, in combination with the inclined plane and its controlling-spring, whereby the force of the retarding friction increases with the space passed over by the recoil, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY C. BULL.

Witnesses:

F. A. FULLER, Jr.,
OCTAVE WHITTAKER.