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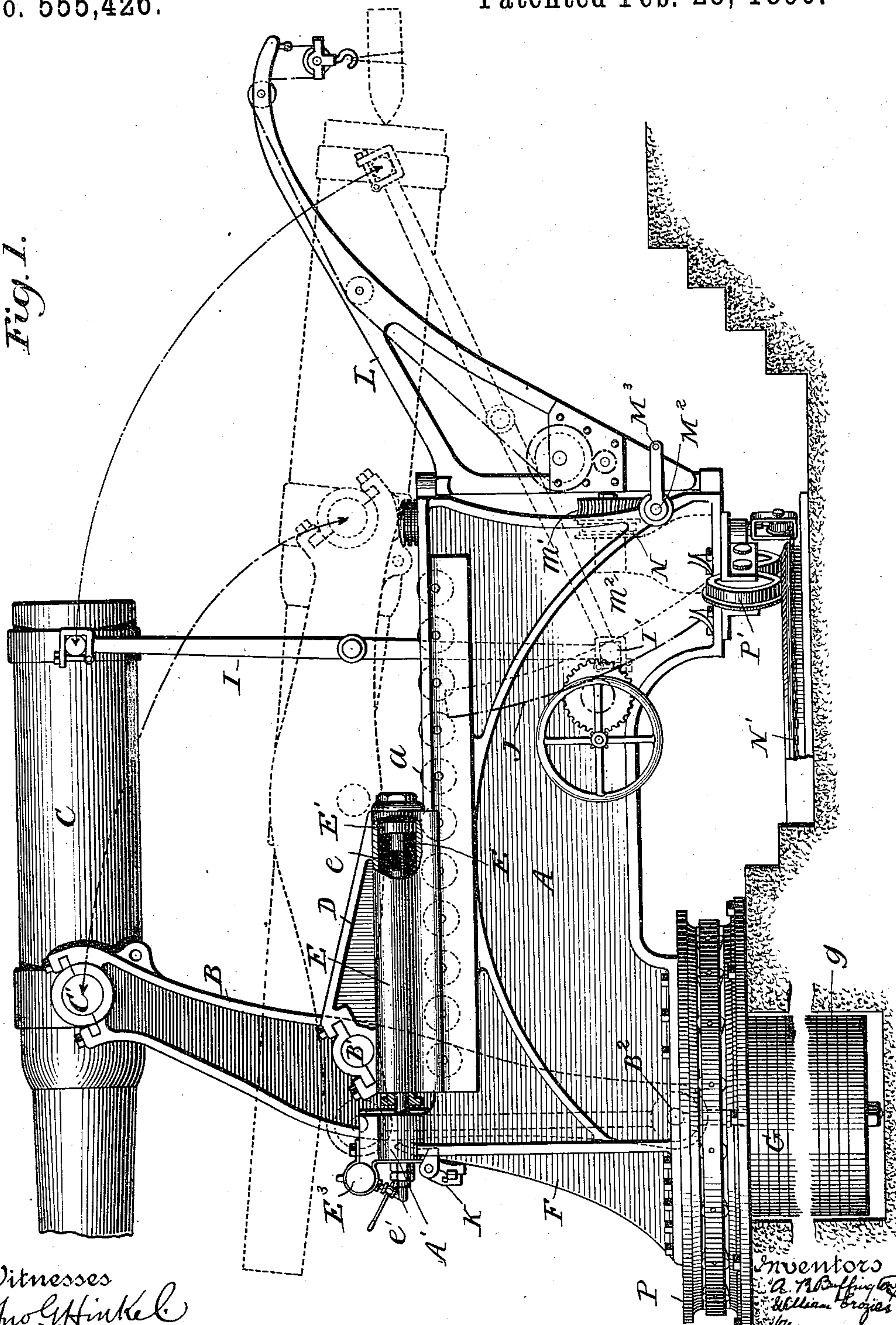
5 Sheets—Sheet 1.

A. R. BUFFINGTON & W. CROZIER.  
GUN MOUNTING.

No. 555,426.

Patented Feb. 25, 1896.

Fig. 1.



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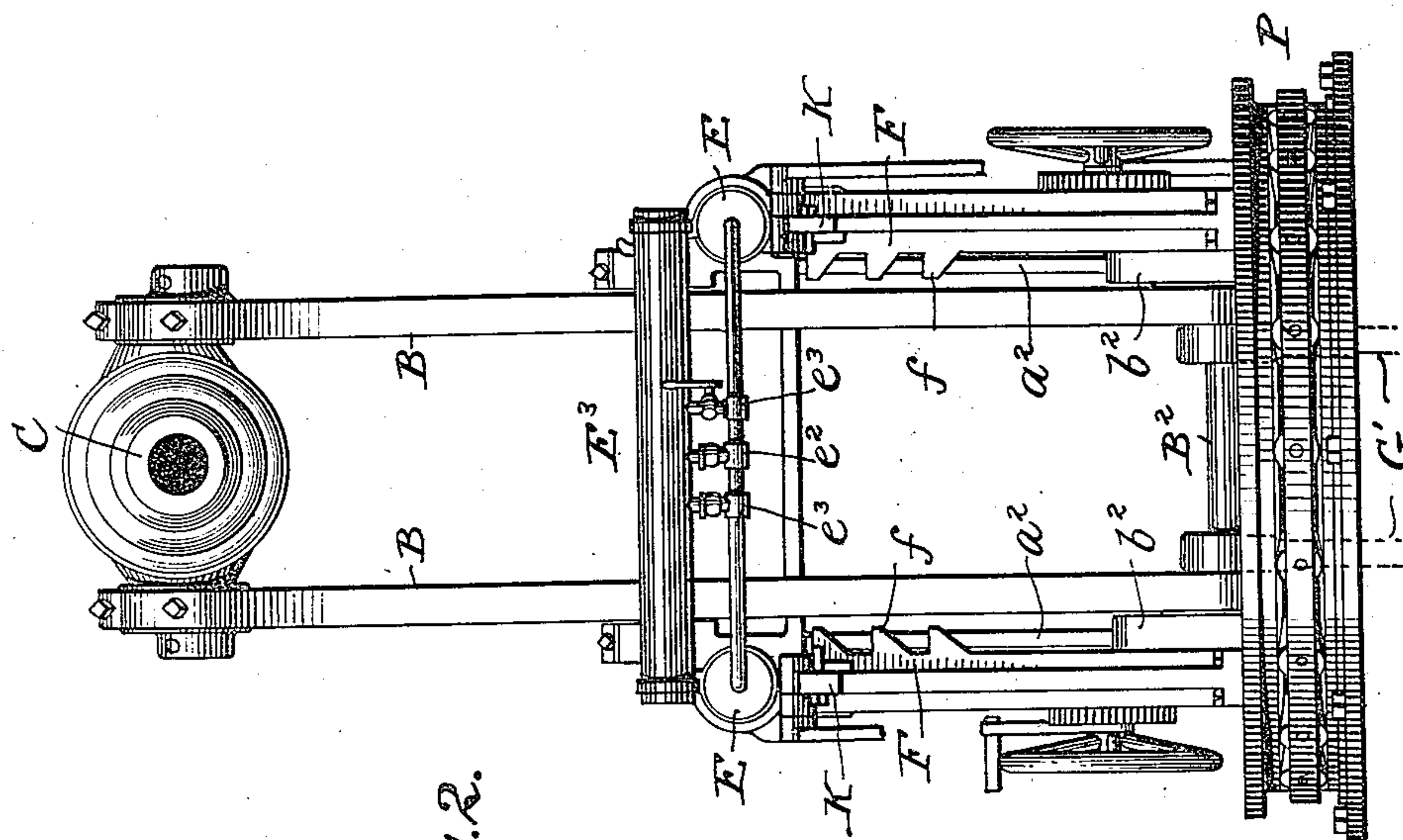
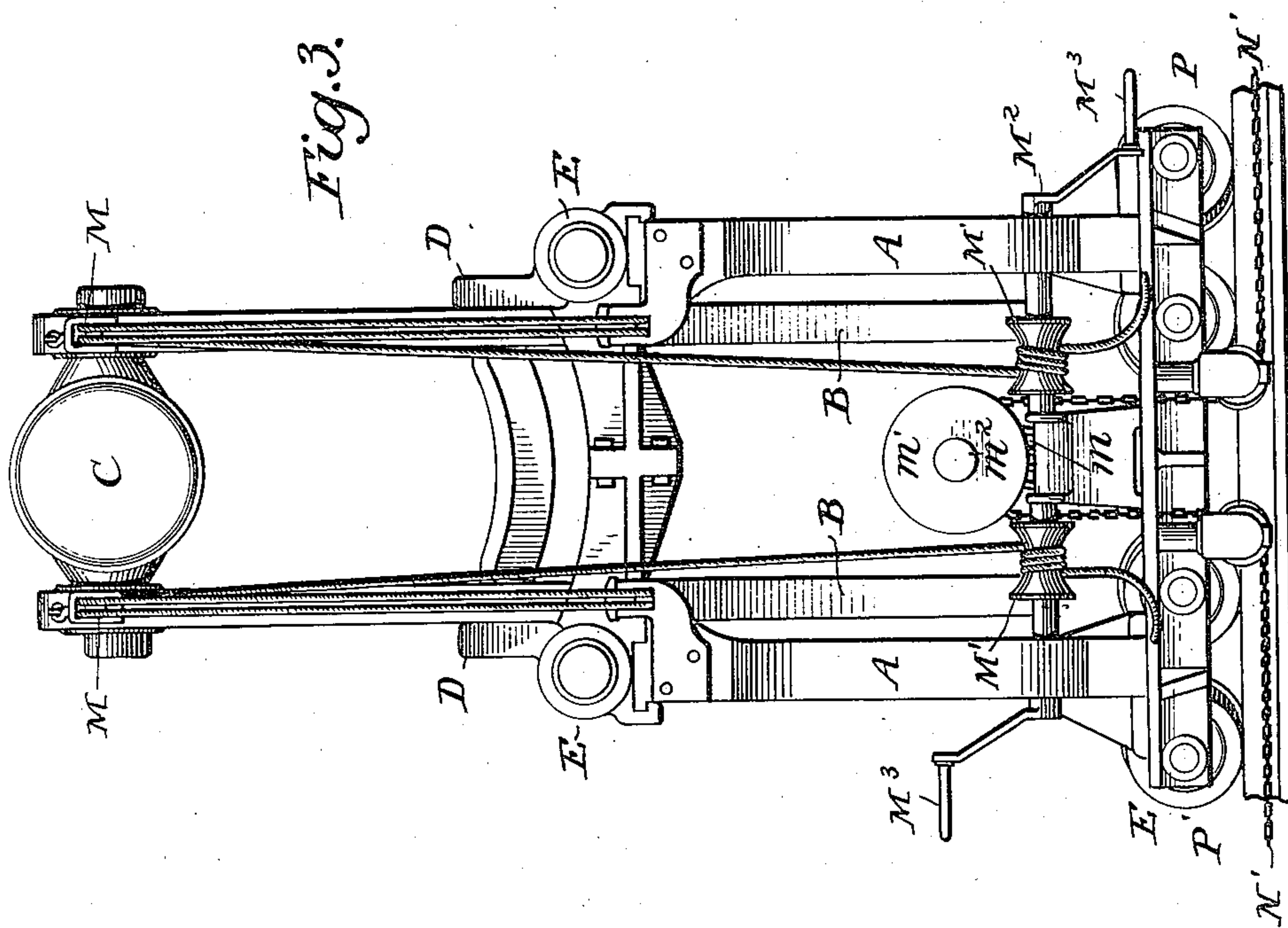
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GUN MOUNTING.

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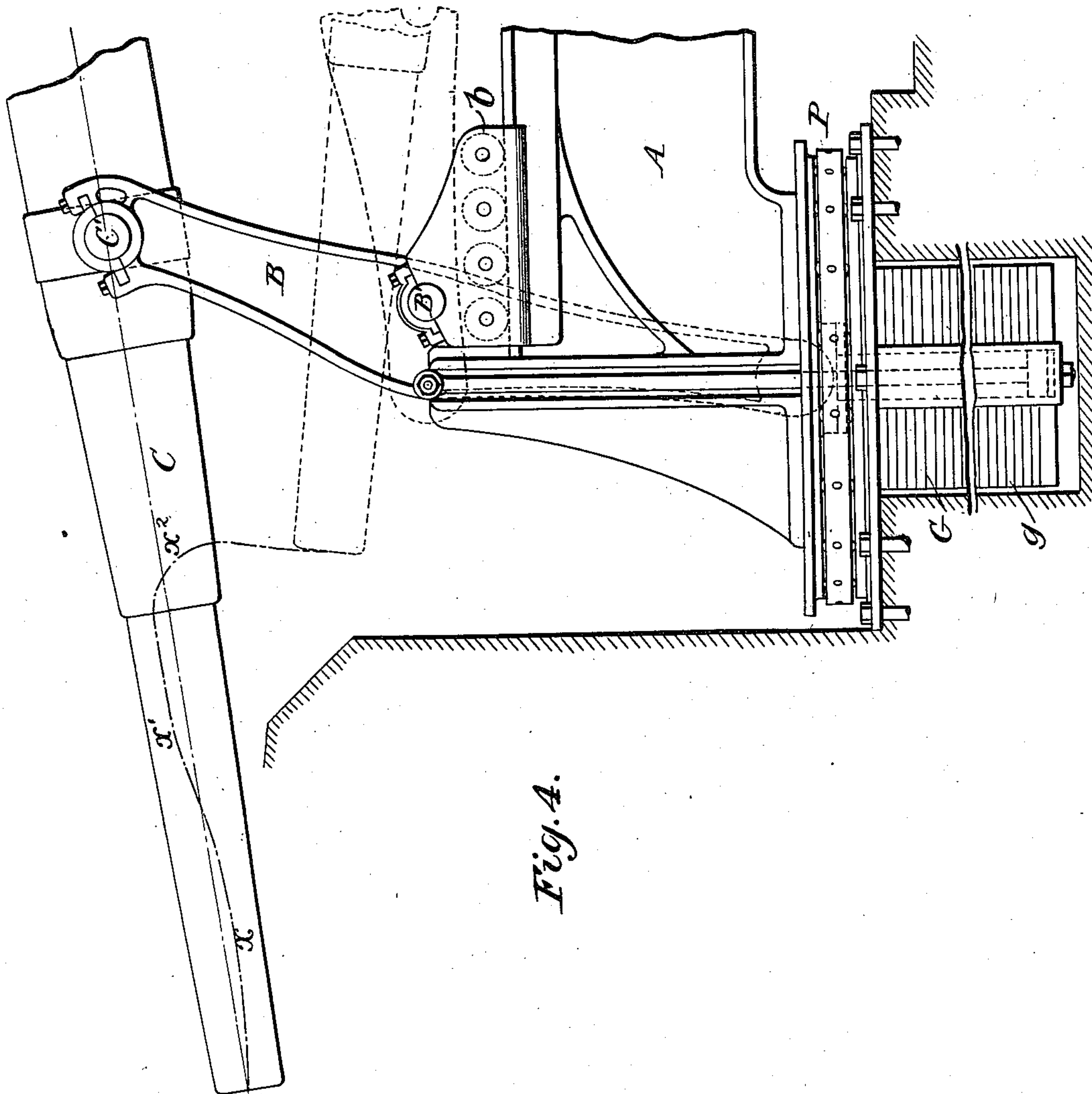
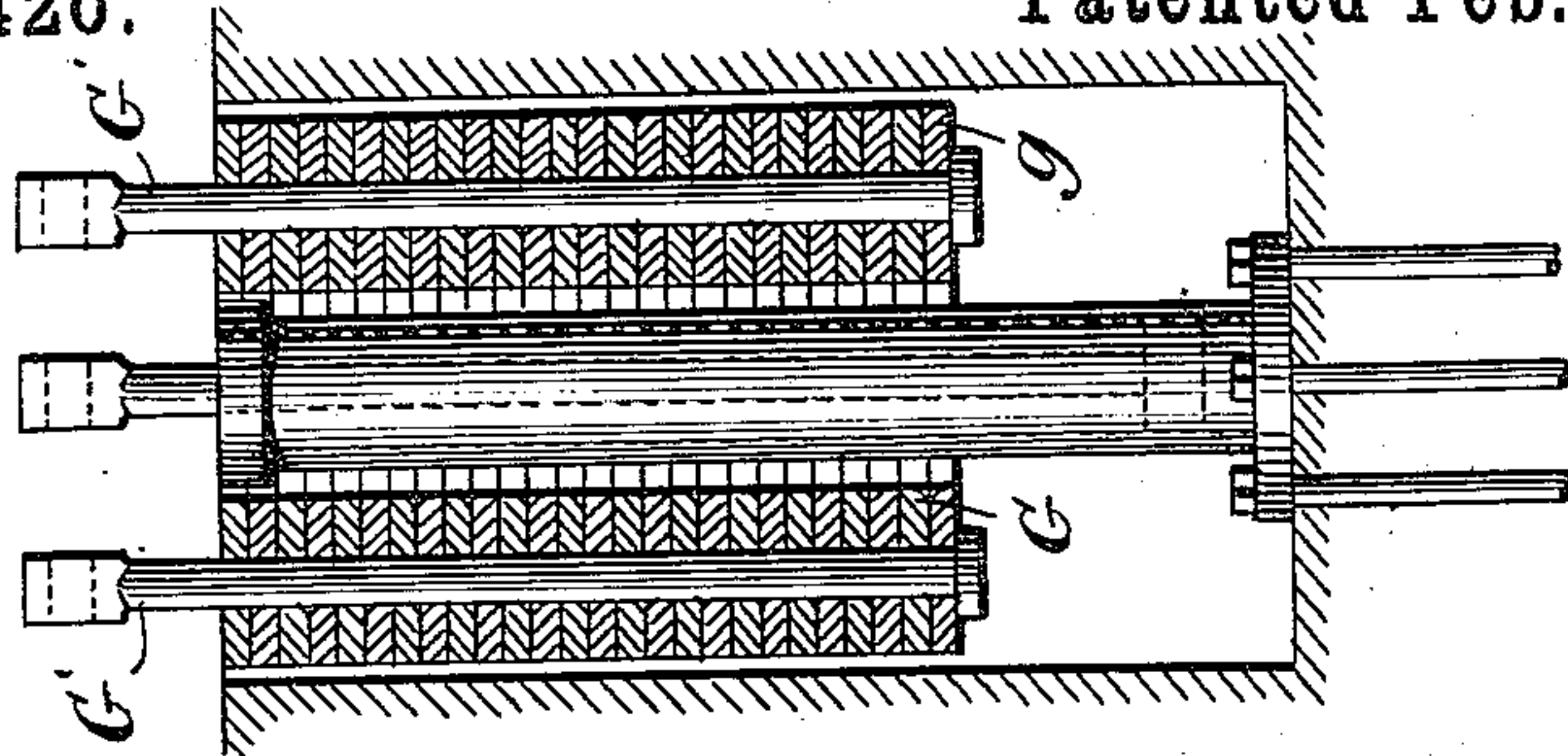
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Fig. 5.



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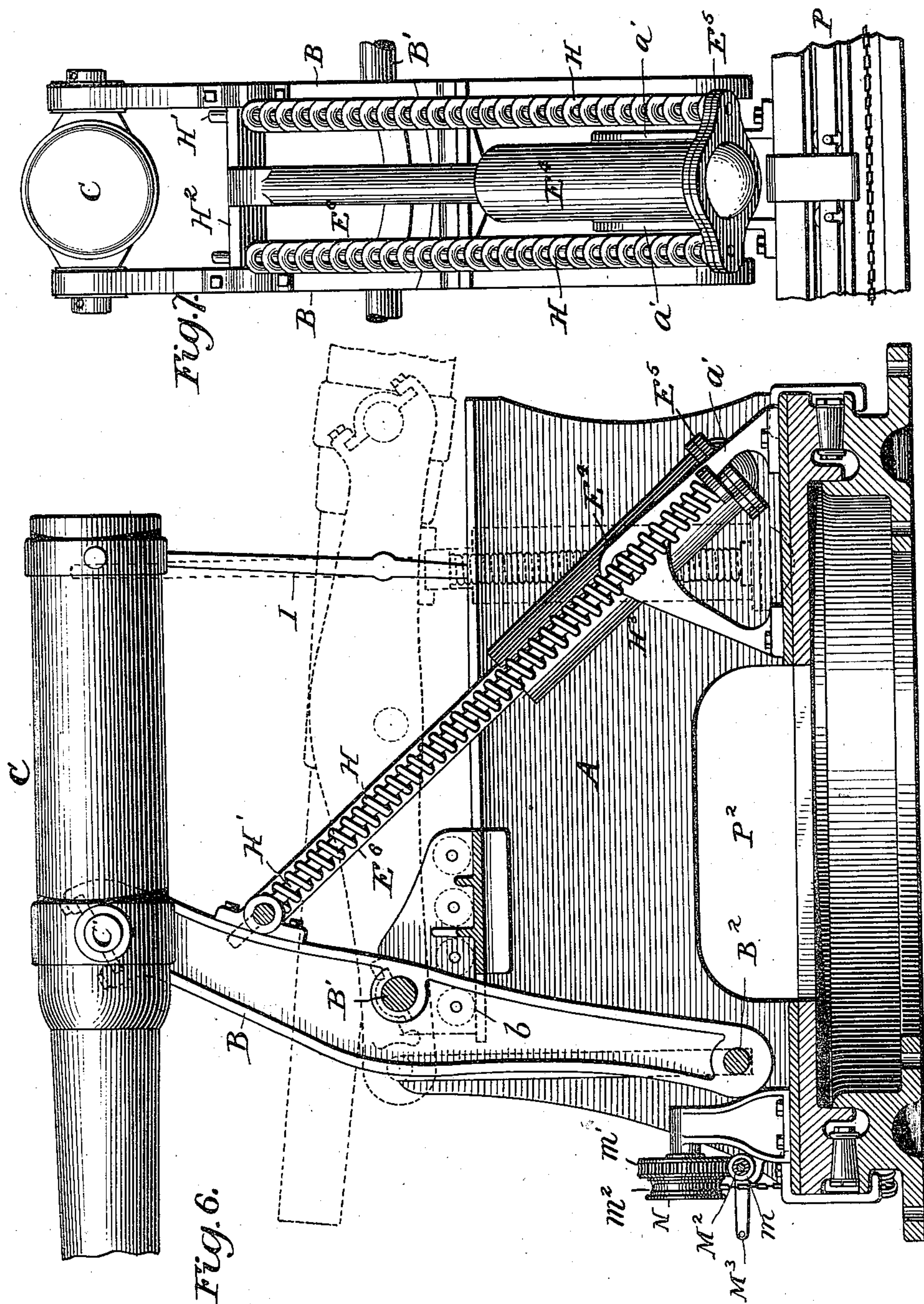
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GUN MOUNTING.

No. 555,426.

Patented Feb. 25, 1896.



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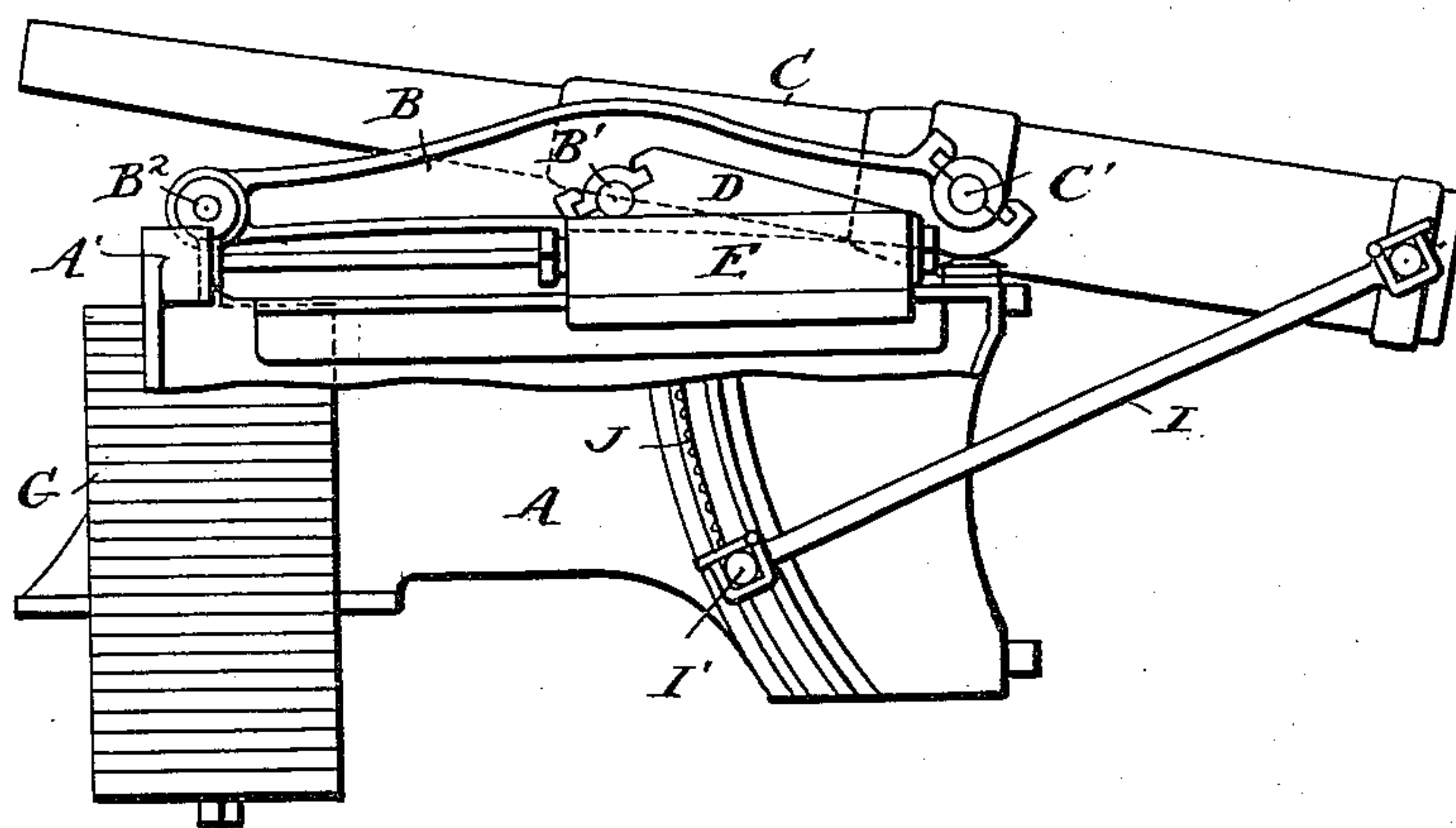
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5 Sheets—Sheet 5

No. 555,426.

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# UNITED STATES PATENT OFFICE.

ADELBERT R. BUFFINGTON AND WILLIAM CROZIER, OF THE UNITED STATES ARMY.

## GUN-MOUNTING.

SPECIFICATION forming part of Letters Patent No. 555,426, dated February 25, 1896.

Application filed October 8, 1894. Serial No. 525,314. (No model.)

*To all whom it may concern:*

Be it known that we, ADELBERT R. BUFFINGTON, an officer of the Army of the United States, stationed at Rock Island Arsenal, Illinois, and WILLIAM CROZIER, an officer of the Army of the United States, stationed at New York city, New York, have invented a new and useful Improvement in Gun-Mountings, of which the following is a specification sufficient to enable those skilled in the art to make and use the same; and we hereby dedicate to the Government of the United States the free right to use, to make, and to have made in the United States for its own use gun-mountings embodying this invention.

Our invention relates more particularly to that class of gun-mountings in which the discharge of the gun or piece causes it to recoil to a position of safety, and which are generally termed "disappearing guns," and its objects are to provide simple and efficient means for controlling and guiding such recoil and for returning the gun or piece at will to the firing position; and our invention consists in the various features of construction, arrangement of parts, and mode of operation substantially as hereinafter more particularly pointed out.

In the accompanying drawings we have illustrated a preferred embodiment of our invention and several modifications thereof sufficient to explain the principles of the invention, and in said drawings—

Figure 1 is a side view of a mounting. Fig. 2 is a front end view. Fig. 3 is a rear end view. Fig. 4 is a partial side view, showing a modification. Fig. 5 is a transverse vertical section of one form of counterweight. Fig. 6 is a side view, partly in section, of another modification. Fig. 7 is a partial end view of the same. Fig. 8 is a side view showing the invention, some of the details being omitted, but clearly illustrating the position of the parts when the gun is in firing position, and in dotted lines illustrating the position of the gun in recoil; and Fig. 9 is a similar view showing the position of the gun and the parts connected therewith at the recoil of the gun.

Heretofore many attempts have been made to produce a practically-working disappearing gun adapted for heavy ordnance, and

without attempting to recite the many and various constructions which have been suggested and the objections thereto, or the requirements necessary to the successful and practical working of such a mounting, we may say that it is the object of our present invention to improve upon such gun-mountings, and to provide a mounting which is simple in construction, not liable to get out of order, which is rapid and efficient in operation, and which meets all the requirements of a thoroughly practical disappearing-gun mounting.

One of the main features of our invention consists in so arranging the parts of the mounting that the pivotal point or trunnions of the gun shall move in the arc of an ellipse during its recoil and return to firing position.

Another feature of our invention consists in so arranging and constructing the parts that while the pivotal point of the gun or piece moves in the arc of an ellipse the breech of the gun will move in the arc of a circle.

Another distinguishing feature of our invention consists in so constructing and arranging the mounting that the muzzle of the gun in its recoil shall have a motion which is best adapted for retiring the gun from above a parapet or similar device, such motion being of a unique character, comprising a movement in a sinuous or ogee line, ending in a quick downward curve at about right angles to said sinuous line.

These general features of our invention, as well as those hereinafter set forth, may be used together or in connection with other constructions embodying other features of our invention or equivalents thereof.

While our invention comprehends broadly any construction and arrangement of parts whereby the general features thereof may be carried out or utilized, it also comprises certain general features of construction and arrangement of parts, as well as certain specific features hereinafter more particularly pointed out, and while we will now proceed to describe, with reference to the accompanying drawings, the means which we prefer to employ in accomplishing the objects of our invention, it will be understood that the in-



vention is not limited to the use of these various features of construction, and the various features of construction are not limited to the specific arrangement set forth, as they may all be varied by those skilled in the art without departing from the spirit of the invention.

We provide a carriage A, which may be of any suitable construction and arrangement, according to the particular requirements of any particular case, and support upon the carriage what we have termed a "rotating" lever or levers B, which lever or levers support at their upper ends the gun or piece C, the gun being pivotally mounted in said levers by trunnions C', or any other equivalent construction or arrangement, so that the pivotal point of the gun shall be at the end of the levers.

It may be remarked at this point that while a single lever might be arranged, with forked arms or otherwise, or the parts united so as to constitute what would ordinarily be termed a "single" lever, we have shown the lever made of two complementary parts and shall refer to these hereinafter as "levers," with the understanding that this term includes any equivalent construction which will operate in substantially the same way, as will be hereinafter pointed out with reference to the levers. These levers are provided near their middle points with an axle or trunnions B', or equivalent means for supporting the levers, and this axle is a moving axle, the movements of which are constrained substantially in the manner hereinafter set forth. The lower ends of the rotating levers are also preferably connected to a cross-bar B<sup>2</sup> or equivalent construction, and the movements of this end of the lever are also constrained, as hereinafter set forth. It will thus be seen that the gun is mounted upon rotating levers having two of their points constrained to move in respect to each other, while another point at the free ends of the levers supports the gun, and the arrangement is such that this latter point of the levers moves in the arc of an ellipse. Thus the levers may be said to have three axes and no fixed points, the levers moving as a whole, the movement being constrained at two points on lines at an angle to each other.

Various means for restraining the two points of the rotating levers may be used in carrying out the broad principles of our invention, it being sufficient that the levers shall be so restrained that these points shall move upon lines making an angle with each other which will result in causing the other or free point of the levers to move in the arc of an ellipse, or substantially so.

Thus, referring to Fig. 1, the axle or trunnions B' near the central portion of the levers is supported in a top carriage D, which is mounted upon the chassis-pieces of the main carriage A, and is adapted to move horizontally thereon, either the chassis, as shown in Fig. 1, or the carriage, as shown in Fig. 4, being provided with friction-rolls *a b* or equivalent devices.

This carriage is connected to some sort of a restraining device—such, for instance, as springs, hydraulic cylinders, and the like—and we have shown in Fig. 1 a hydraulic cylinder E arranged on each side of the carriage, which cylinders are provided with pistons E', connected by piston-rods E<sup>2</sup> to projections A' on the main carriage A. In the present instance the rods E<sup>2</sup> are provided throughout their length with holes *e* which are connected at their front ends by pipes *e'* with the reservoir E<sup>3</sup>, these pipes being provided with a non-return valve *e<sup>2</sup>* and by-pass valves *e<sup>3</sup>*.

It will be understood that instead of the specific arrangement of cylinders just described any other equivalent and well-known construction and arrangement may be used, and instead of the cylinders being attached to the top carriage the pistons may be attached to the carriage and the cylinders to the main carriage. The rods may be attached to projections at the rear ends of the chassis-pieces instead of at the forward ends, so that during the recoil they will push into the hydraulic cylinders instead of pulling out. The cylinders may also be fixed at the rear of the chassis and the rods attached to the trunnions or axle of the rotating lever. The hydraulic cylinders may be bolted vertically to the under side of the racer of the turn-table, as described hereinafter, or there may be a single hydraulic cylinder connected to the bottom of the counterweight, as also described hereinafter, or any other equivalent and well-known restraining device, which may also act as a recuperator, may be used in place of the specific construction and arrangement of cylinders above set forth.

It will thus be seen that the top carriage D is arranged to move in a substantially horizontal plane on the chassis of the main platform and its movements are controlled by some sort of a restraining device, and it may be said to constitute a moving fulcrum for the rotating levers.

The lower end of the levers is also constrained to move in a plane at an angle to the plane of the movement of the top carriage, and this plane is shown as practically at right angles thereto, being a vertical plane, and the end of the levers is connected by a cross-bar, as before stated, which is arranged to move in the vertical cross-head guides F', formed or arranged at the front end of the carriage A. In the present instance the cross bar or head B<sup>2</sup> is provided with clips *b<sup>2</sup>*, which embrace the guide-pieces *a<sup>2</sup>* on the main carriage, so that the end of the levers is constrained to move in a vertical direction. This cross-head guide may in one sense be said to be a secondary fulcrum for the rotating levers, this secondary fulcrum being stationary, and the pivotal point or cross bar or head of the lever operating therewith moving in relation thereto.

The counterweight which is to aid in taking up the recoil and act in returning the gun



to firing position is connected to this moving end of the levers in any suitable way, so that the force exerted on the counterweight will be in a vertical direction, and of course the counterweight will exert its force in the same direction. Thus we have shown the counterweight G as connected to the cross-head B<sup>2</sup> by I-rods G'. The counterweight may be of any suitable construction, preferably being made up of a certain number of plates or weights g, which are supported on the I-bolts G', and may be arranged in a pit under the turn-table or in any other convenient position.

It is sometimes desirable to arrange the hydraulic cylinder or cylinders on the under side of the racer of the turn-table, as shown in Fig. 4, so that it is inclosed by the counterweight and extends into the same pit, the piston-rods passing through slots in the chassis-pieces and being connected to the top carriage by any suitable means, or the cylinder may be secured to the bottom of the pit or well, as shown in Fig. 5, and connected to the cross-bar of the levers and be used in conjunction with the counterweight. In some instances the counterweight may be omitted and replaced by recuperator-springs or other equivalent devices, as indicated in Figs. 6 and 7, where the springs H are arranged upon rods H', which pass through a bar H<sup>2</sup> connecting the levers, the rods being supported at the lower ends in a pivoted support H<sup>3</sup>, mounted on brackets a' on the main carriage. These springs assume the position shown in dotted lines in Fig. 6 upon the recoil of the gun. With this arrangement there may be used a single hydraulic cylinder, as E<sup>4</sup>, Fig. 7, supported in the brackets, and the rods on which the springs H are mounted may be attached to a cross-head E<sup>5</sup> of the cylinder, while the piston-rod E<sup>6</sup> of the cylinder is attached to the cross-bar H<sup>2</sup> of the levers. We have thus described and illustrated several typical constructions of the restraining devices, and it will be understood that these may be used in any desired combination, or other equivalent and well-known devices may be used in connection with the rotating levers to perform the functions stated, our invention not involving the use of any specific construction and arrangement of cylinders or springs or the like.

So far, we have referred but slightly to the connections with the breech of the gun by which the motions of the breech and muzzle of the gun are controlled. We have shown two elevating-rods I attached to journals near the breech of the gun, and their lower ends are mounted in blocks I' moving in and supported by the curved rails J, which are attached to the chassis. The curve of these rails corresponds to a radius equal to the length of the lever, with the center at the center of the breech-trunnion when the gun is in its depressed or loading position. (Shown in dotted lines in Fig. 1.) The gun is, therefore, down on its bed and there is no strain

whatever on these levers, and the blocks can be raised or lowered by any suitable mechanism of gears and worm, or otherwise, without any great effort, and it will be understood that the raising of the blocks decreases the elevation of the muzzle of the gun and the lowering of the blocks increases the same, so that the gun can be aimed for altitude while in its depressed position by adjusting the blocks on the curved rails.

It will be seen that the breech of the gun, being connected and controlled by the elevating-rods, will move in the arc of a circle, as indicated by dotted lines in Fig. 1, notwithstanding the fact that the pivotal point or trunnions of the gun moves in the arc of an ellipse. This arrangement of devices—that is, moving the pivotal point of the gun in the arc of an ellipse and the breech in the arc of a circle—produces a peculiar and unique motion of the muzzle of the gun, so that it is well adapted to quickly retire from above the parapet or other defense and be projected into firing position. Thus it will be seen on reference to Fig. 4 that as the gun commences to recoil the muzzle is depressed slightly, following the curve x, (indicated in dotted lines,) and then rises again above its central line, as at x', and moves practically in a straight line for a short distance, when it is curved quickly downward, as at x<sup>2</sup>, to its final position below the opening in the parapet. This enables the gun to be used in close quarters and to be exposed to the opening the shortest possible time, and the advantages of this arrangement whereby this motion is produced will be readily appreciated by those skilled in the art.

In order that the gun may be held in its recoil position, we provide pawls K or some other locking means, which insure the gun remaining stationary during the process of loading and sighting or otherwise, and these pawls engage in the present instance with ratchets formed on the clips b<sup>2</sup>. The inner front edges of the cross-head guide F may be provided with projections or teeth f, by means of which, by the use of a bar or otherwise, the gun can be forced to the complete recoil position, if perchance the discharge does not produce this effect.

A crane L may be attached to the carriage for supporting the projectile, or any other arrangement for loading the gun may be used.

Sometimes it is desirable to lower the gun into loading position for the purpose of cleaning or for drill, and we provide an arrangement by which this may be readily accomplished by attaching pulley-blocks M to the breech-trunnions and mounting a windlass M' in the carriage on a transverse shaft M<sup>2</sup>, which may be operated by a handle M<sup>3</sup>, and this shaft may be provided with a worm m, which gears with a worm-wheel m', mounted on a short shaft m<sup>2</sup>, supported on the carriage, and having also mounted on the shaft



a sprocket-wheel N, and over this sprocket-wheel may pass a chain N', the ends of which are fixed so that the gun may be pointed in azimuth.

The carriage may be mounted in any suitable way, it being shown in Fig. 1 as mounted on a turn-table P, of the usual construction, with the counterweight underneath, and the rear portion being mounted on traverse-wheels P', and it will thus be seen that the carriage can be readily adjusted by operating the worm-gear through the medium of the sprocket-chain.

In Fig. 6 the whole carriage is mounted on a central pivoted turn-table P<sup>2</sup>, and the worm-gear is arranged in front, as indicated, the operation of which will be readily understood.

From the above description the general principles of our invention will be clearly understood, so that they may be applied in the construction and arrangement of a gun for any particular or desired purpose, and the operation will be apparent from what we have before set forth, and need not be stated in detail. It will be understood that when the gun is in the elevated position (shown in full lines in Fig. 1) and the piece is discharged the rotating lever moves in the manner before stated, its axis B moving rearward in a horizontal line on the chassis, and its end or cross-bar B<sup>2</sup> moving upward in the guides, and these two points being constrained in this manner the result is that the upper ends of the levers to which the gun is pivoted move to the rear and downward in the arc of an ellipse, while the breech-piece, being guided by the elevating-rods, moves rearward and downward in the arc of a circle. The muzzle of the gun, from this combination of mechanism, describes a proper curve for clearing the parapet, as heretofore described, and it will be seen that the breech is always brought to the same position for loading, being controlled by the elevating-rods. When in its depressed condition, the pawls will engage the ratchets to secure it and hold the gun until it is desired to discharge it, or otherwise elevate it, and it can be sighted both for altitude and azimuth while in its depressed position. The energy of the recoil of the falling gun is absorbed partly in raising the counterweight and partly by the resistance of the liquid in the hydraulic cylinders, and the flow of the liquid in these cylinders can, of course, be controlled and regulated in any of the well-known ways by adjusting the parts or valves so as to produce an approximately constant force. It will also be understood that even if the piece does not recoil to its full depressed position the check-valves connected with the hydraulic cylinders will prevent the piece rising and will retain it in any position which it may have reached, and it can be forced downward by bars or otherwise, if necessary. Upon opening the by-pass valves and tripping the pawls when they engage the ratchets

the preponderance of the counterweight will raise the gun to the firing position.

What we claim, and desire to secure by Letters Patent, is—

1. The combination with a gun-carriage, of a gun, and means substantially as described connecting the gun to the carriage, said means being constrained to move with the gun in the arc of an ellipse at the point where they are attached to the gun, substantially as described. 75

2. The combination with the gun-carriage, of a gun, means substantially as described connecting the pivotal point of the gun to the carriage, said means being constrained to move with the gun in the arc of an ellipse at the point where they are attached to the gun, and means connecting the breech of the gun to the carriage, said means being constrained to move with the gun in the arc of a circle at the point where they are attached to the gun, substantially as described. 80 85

3. The combination with a gun-carriage, of a gun, means connecting the pivotal point of the gun to the carriage, and means connecting the breech of the gun to the carriage, the said means being constrained substantially as described so that the pivotal point of the gun will move in the arc of an ellipse, the breech of the gun will move in the arc of a circle and the muzzle of the gun will move in a sinuous line and then in a downward curve during the recoil of the gun from firing position, substantially as described. 90 95 100

4. The combination with a gun-carriage, of a gun, means substantially as described connecting the gun to the carriage, said means being constrained to move with the gun in the arc of an ellipse at the point where they are attached to the gun, and a counterweight connected to said means and moving in a vertical direction on the recoil and return of the gun to its firing position, substantially as described. 105 110

5. The combination with a gun-carriage, of a gun, and rotating levers connecting the gun and carriage, the said levers having two of their points constrained to move respectively upon two lines making an angle with each other, whereby the point of connection between the levers and gun will move in the arc of an ellipse, substantially as described. 115

6. The combination with a gun-carriage, of a gun, and rotating levers connecting the gun to the carriage, said rotating levers having three axes and no fixed points, the levers moving as a whole and being constrained at two points to move with the gun in the arc of an ellipse at the point where the levers are attached to the gun, substantially as described. 120 125

7. The combination with a gun-carriage, of a gun, and rotating levers connecting the gun to the carriage, the said levers having two of their points constrained, one to move in a horizontal direction, and the other to move in a vertical direction, while their ends connected 130



with the gun move in the arc of an ellipse, substantially as described.

8. The combination with a gun-carriage, of a gun, and rotating levers connecting the gun with the carriage, the levers being provided with a moving pivotal point near their central portion mounted on the top of the carriage and being constrained to move in a substantially horizontal direction, and the lower ends of the levers being guided in vertical guides in the carriage, whereby the levers are constrained to move upon two lines making an angle with each other, while their points of connection with the gun move in the arc of an ellipse, substantially as described.

9. In a gun-mounting, the combination with the carriage and gun, of rotating levers pivotally mounted on a moving fulcrum on the carriage and having one end mounted to slide in guides on the carriage, the other end being free and supporting the gun, substantially as described.

10. In a gun-mounting, the combination with the carriage and gun, of rotating levers connecting the gun and carriage and having two of their points constrained to move respectively upon two lines making an angle with each other, hydraulic cylinders connected to one of the points for constraining its

movement, and a counterweight connected at the other point to constrain its movement, substantially as described.

11. In a gun-mounting, the combination with the carriage and gun, of rotating levers connected to the pivotal point of the gun and constrained at two points to move respectively upon two lines making an angle with each other, and elevating rods connecting the breech of the gun with the carriage, the arrangement being such that the pivotal point of the gun moves in the arc of an ellipse and the breech of the gun moves in the arc of a circle, and the muzzle moves in a sinuous curve on recoil, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of the subscribing witnesses.

ADELBERT R. BUFFINGTON.  
WILLIAM CROZIER.

Witnesses as to the signature of Adelbert R. Buffington:

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GEO. D. DARWIN.

Witnesses as to the signature of William Crozier:

CHARLES B. WHEELER,  
M. F. HARMON.