

(No Model.)

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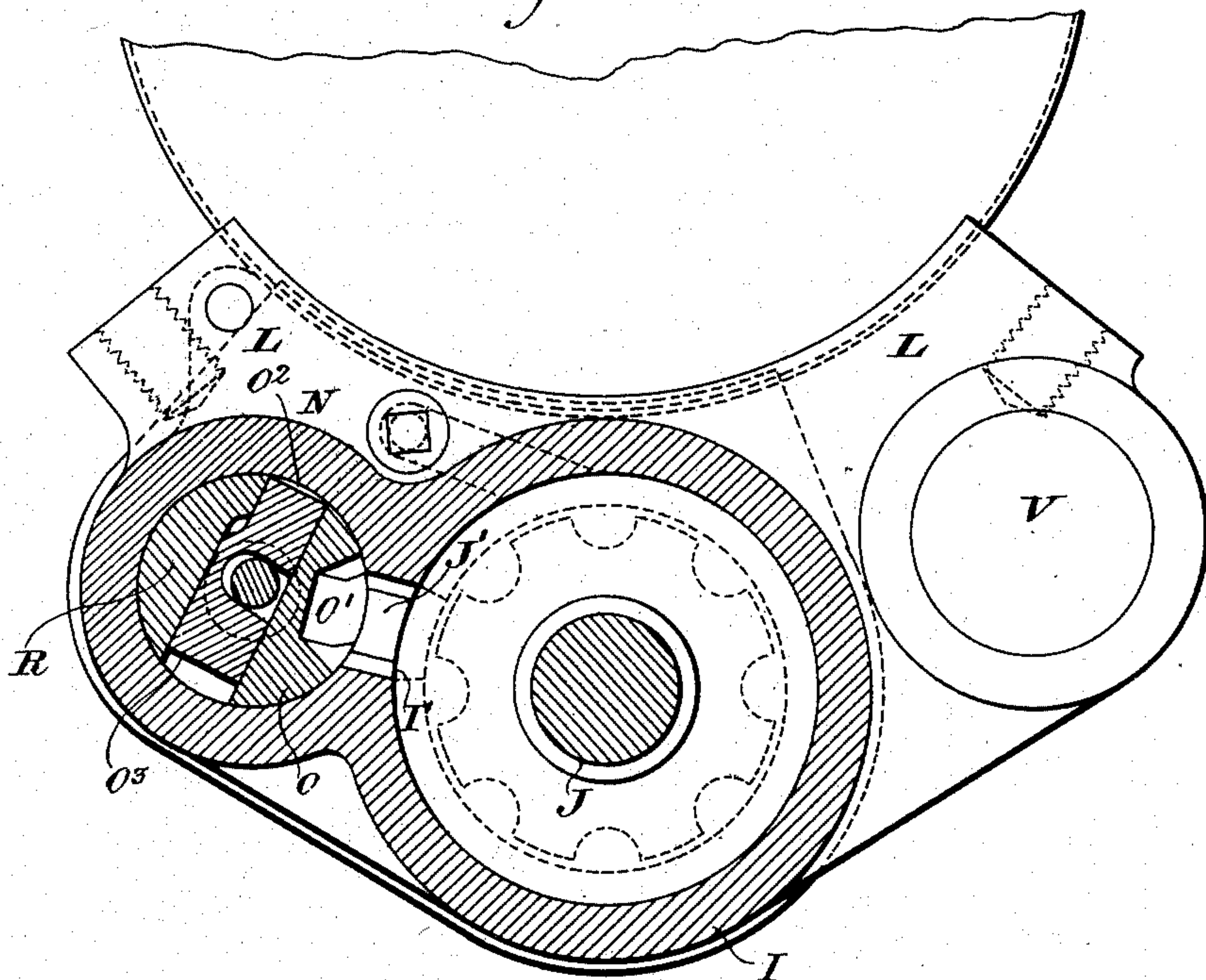
P. NORDENFELT.

APPARATUS FOR CONTROLLING THE RECOIL AND RUNNING OUT OF GUNS.

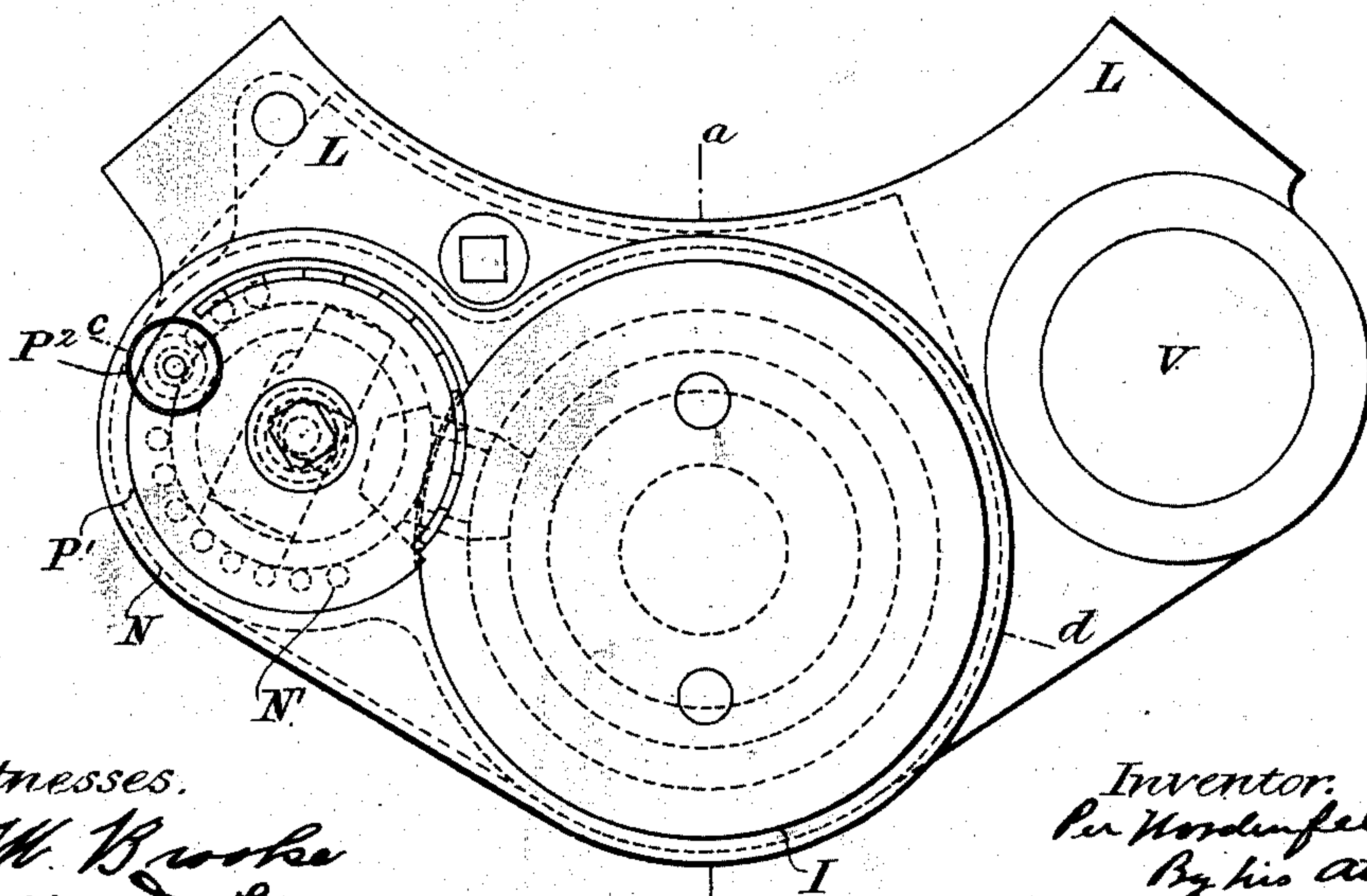
No. 436,376.

Patented Sept. 16, 1890.

*Fig. 2.*



*Fig. 1.*



Witnesses.

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Inventor.  
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By his atty.

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(No Model.)

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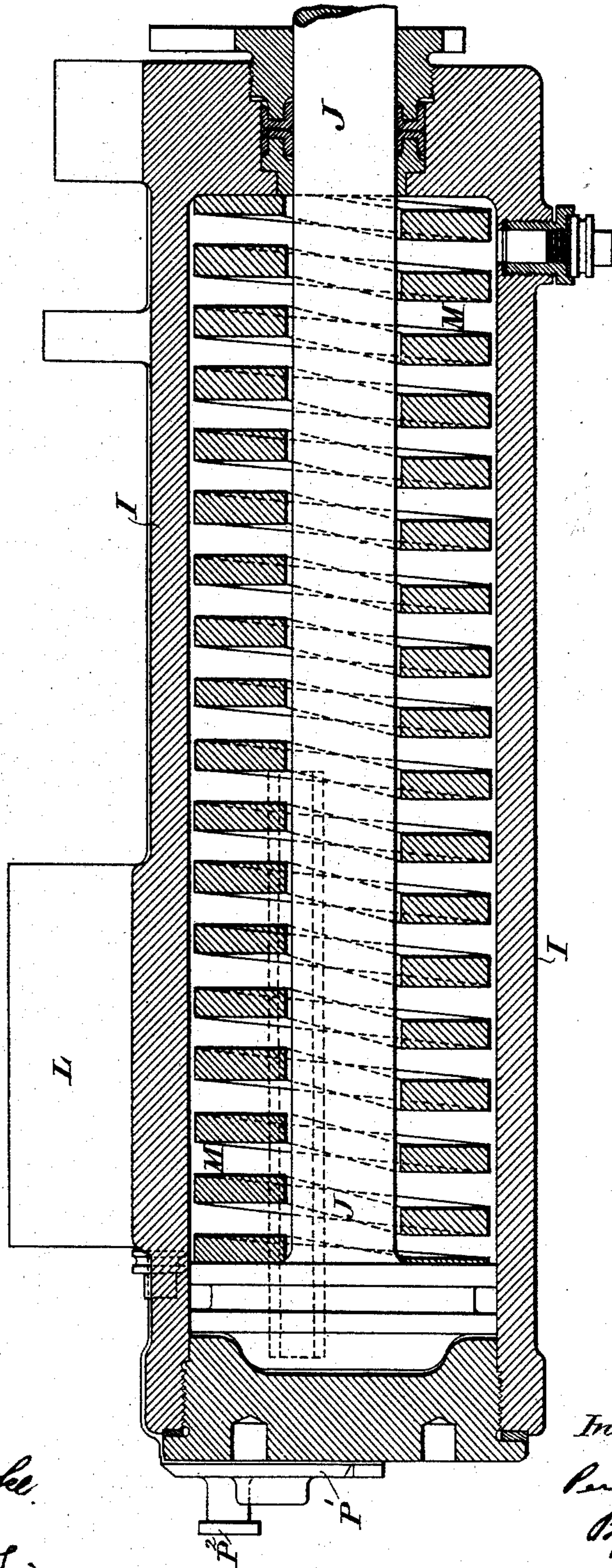
P. NORDENFELT.

APPARATUS FOR CONTROLLING THE RECOIL AND RUNNING OUT OF GUNS.

No. 436,376.

Patented Sept. 16, 1890.

Fig. 3.



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(No Model.)

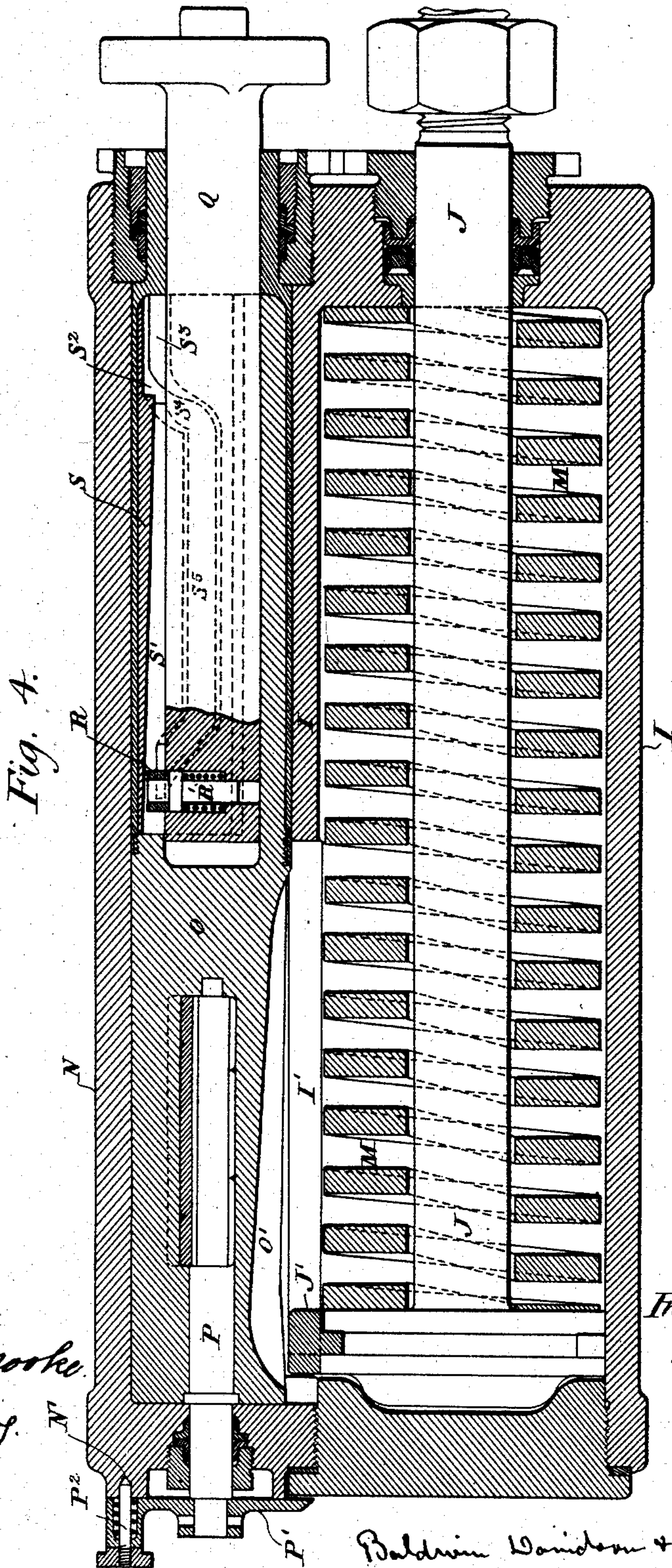
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P. NORDENFELT.

APPARATUS FOR CONTROLLING THE RECOIL AND RUNNING OUT OF GUNS.

No. 436,376.

Patented Sept. 16, 1890.



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(No Model.)

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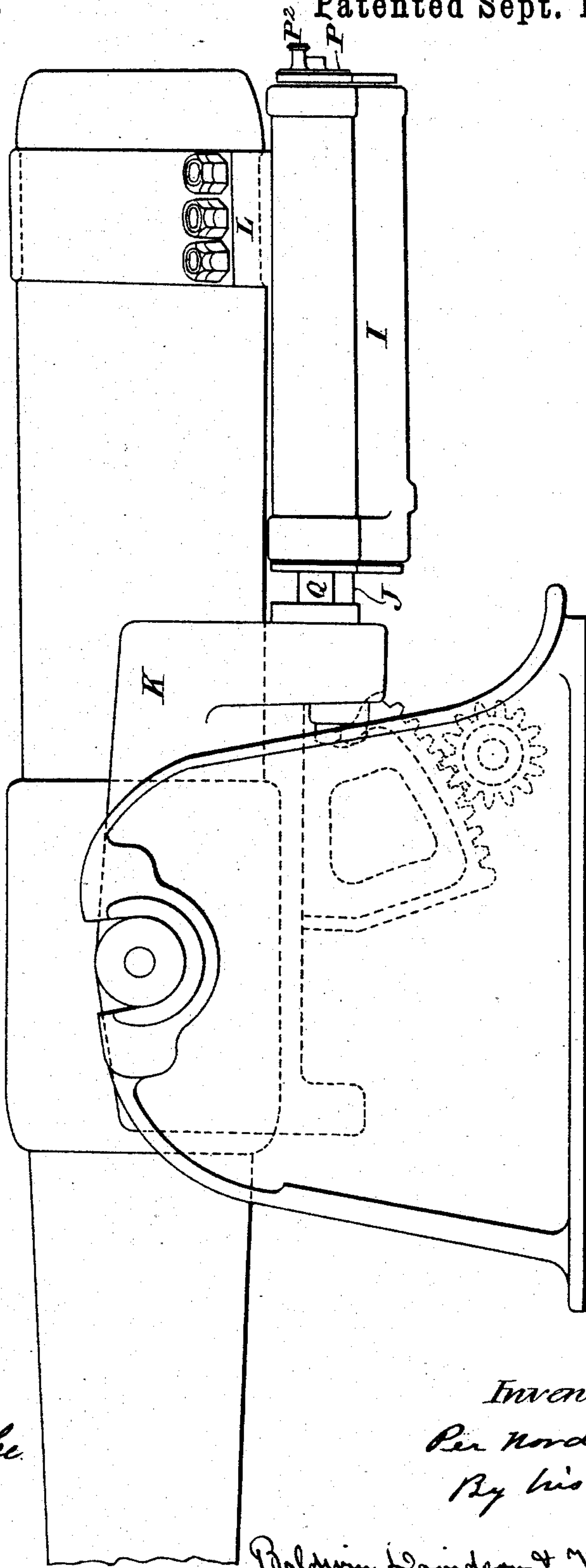
P. NORDENFELT.

APPARATUS FOR CONTROLLING THE RECOIL AND RUNNING OUT OF GUNS.

No. 436,376.

Patented Sept. 16, 1890.

Fig. 5.



Witnesses

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(No Model.)

5 Sheets—Sheet 5.

P. NORDENFELT.  
APPARATUS FOR CONTROLLING THE RECOIL AND RUNNING OUT OF GUNS.  
No. 436,376. Patented Sept. 16, 1890.

Fig. 6.

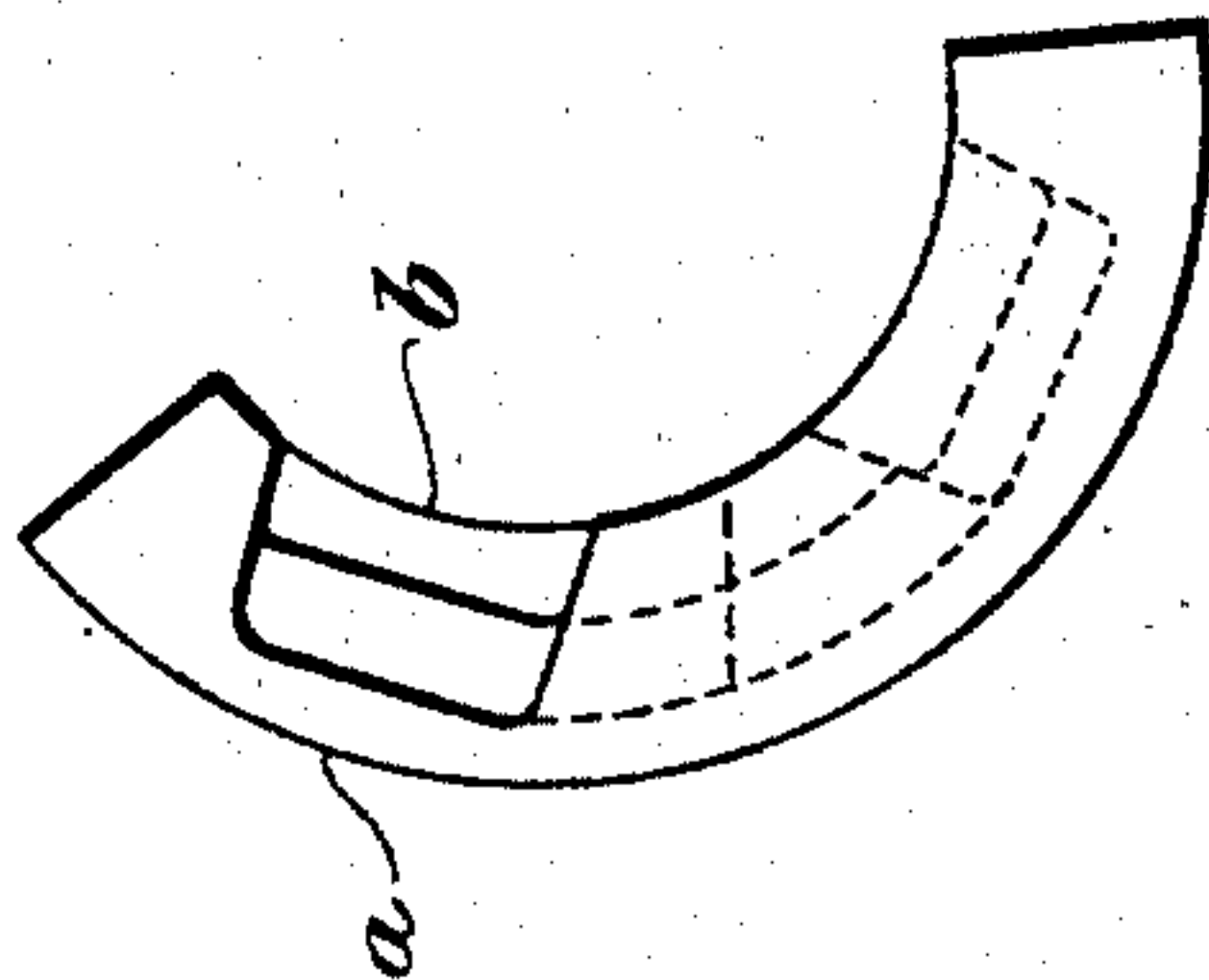


Fig. 7.

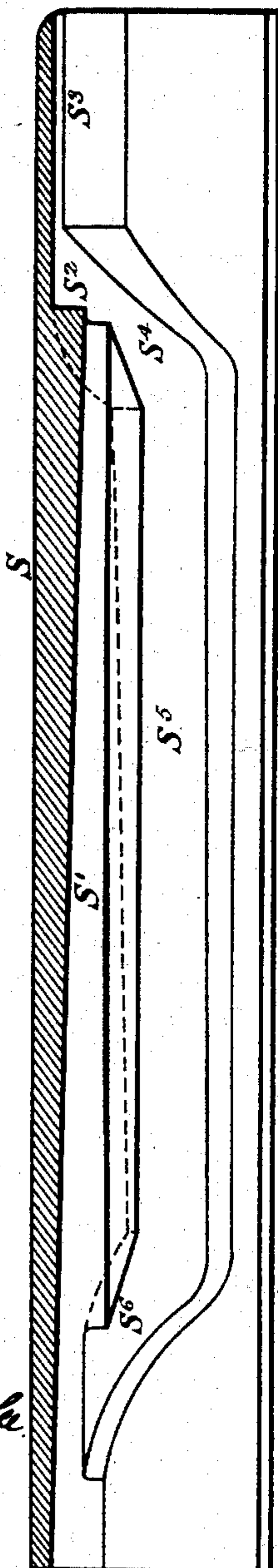
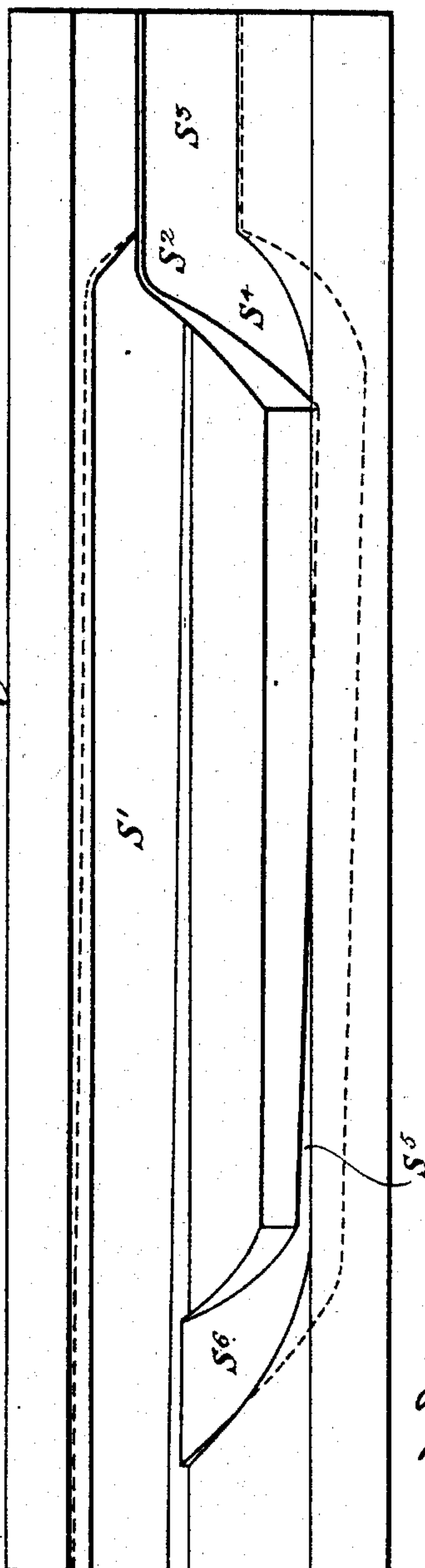


Fig. 8.



Witnesses.

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# UNITED STATES PATENT OFFICE.

PER NORDENFELT, OF WESTMINSTER, ENGLAND, ASSIGNOR TO THE MAXIM-NORDENFELT GUNS AND AMMUNITION COMPANY, LIMITED, OF SAME PLACE.

## APPARATUS FOR CONTROLLING THE RECOIL AND RUNNING OUT OF GUNS.

SPECIFICATION forming part of Letters Patent No. 436,376, dated September 16, 1890.

Application filed May 21, 1890. Serial No. 352,635. (No model.)

*To all whom it may concern:*

Be it known that I, PER NORDENFELT, engineer, a subject of the King of Sweden, residing at 32 Victoria Street, in the city of Westminster, England, have invented certain new and useful Improvements in Apparatus for Controlling the Recoil and Running Out of Guns, of which the following is a specification.

In recoil apparatus in which some of the force of the recoil is stored up by the compression of a spring or otherwise, and is at the end of the recoil allowed to at once run out the gun, the recoil is usually controlled by a hydraulic cylinder, the fluid in which has to pass through a small passage or passages in the side of the cylinder from one side of the piston to the other during the recoil, and power is at the same time stored by the compression of a spring.

To control the running forward of the gun by the spring at the end of the recoil, I use a single cylinder, and when the running out takes place I cause the passage in the side of the cylinder which was used during recoil for allowing liquid to pass from one side of the piston to the other to be put out of action and another substituted for it.

Figure 1 is a back elevation; Fig. 2, a cross-section; Fig. 3, a longitudinal section through the line *a b*, Fig. 1; Fig. 4 a longitudinal section through the line *c d*, Fig. 1, of recoil and running out apparatus, in which a single cylinder is used and the passage for allowing liquid to pass the piston during recoil is changed for another during the running out. Fig. 5 is a side elevation of a gun and mounting to which this apparatus is applied. Figs. 6 to 8 are views of part of the mechanism in which is formed the groove used for causing one passage to be changed for another. Fig. 6 is an end view of the part. Fig. 7 is a section through the line *a b*, Fig. 6; and Fig. 8 is a face view.

In the figures, I is the cylinder, and J is its piston-rod secured to the rear end of the cradle K of the mounting. The cylinder I is formed in one piece with a portion L of a clamp-ring, which embraces the rear end of

the gun, and the cylinder is in this way fixed to the gun. The gun is free to slide endwise in the cradle, as in gun-mountings heretofore made.

M is a coiled spring placed around the piston-rod J.

I' is a slot formed through the side of the cylinder I and opening into a cylinder N, which is alongside of this cylinder and formed in one piece with it.

J' is a feather or projection on the piston fitting within the slot I' and obstructing the direct passage of liquid from one side of the piston to the other through the slot.

O is a cylindrical plug fitting and free to be turned within the cylinder N. In the side of the plug O is a cavity O', which during recoil is opposite to the slot I', and liquid can pass through it from one end of the cylinder I to the other. Through the center of the same end of the plug O is also a slot O<sup>2</sup>, within which is a block O<sup>3</sup> of a width somewhat less than the diameter of the plug. During the running out of the gun the plug is turned, as hereinafter described, into such a position that the end of the slot O<sup>2</sup> is opposite to the slot I', and then liquid passing from one side of the piston to the other has to pass through the slot O<sup>2</sup>, and the area of the passage so left for the passage of liquid can be controlled by moving the block O<sup>3</sup> into such a position as to at this time bring the side of the block nearer to or farther from the slot I'. To effect this a spindle P is passed through a stuffing-box in the end of the cylinder N, and made to extend into a hole formed into the plug O from the center of its end. This spindle passes through a slot formed in the block O<sup>3</sup>, and the portion which passes through the block is made eccentric. In this way if the spindle is locked in such a position that the longer radius of the eccentric is toward the cylinder I, then when the plug is turned into such a position that the slot O<sup>2</sup> is opposite the slot I', the block will be brought into comparatively close proximity to the mouth of this slot; and the area left for the passage of liquid will be small, but if the spindle is locked in position with the smaller radius of the ec-



centric toward the slot I' the space between the side of the block and the mouth of the slot I' will be large.

In order to be able to turn the spindle into any position desired, the end of the spindle has fixed upon it a disk P'. The disk carries a spring-bolt P<sup>2</sup>, the end of which can be made to enter any one or other of a number of small holes N' in the end of the cylinder N, and so the spindle can be locked in any position desired.

The way in which the plug O is turned, so as during recoil to have the cavity O' opposite the slot I', and during the running out to have the slot O<sup>2</sup> opposite to this slot, is as follows: The opposite end of the plug O to that which has the spindle P passing into it is made to pass out through a stuffing-box in the end of the cylinder N. This end of the plug is hollow and has extending into it a rod Q, which is fixed to the cradle K. The rod at its inner end has a pin R thrust out from its side by a spring R'. The pin enters a groove cut in the side of the hollow in the plug, or rather cut in the segment S of a cylinder, which lies in a corresponding recess made at the side of the hollow in the plug. Various views of this segment of a cylinder are shown at Figs. 6, 7, and 8. As will be seen, one part S' of the groove is straight and parallel with the axis of the plug. The stud travels along this part of the groove during the greater part of the recoil. The groove gradually decreases in depth, as shown at Fig. 7, until at S<sup>2</sup> it suddenly again becomes of the original depth and is also made to incline somewhat to the axis of the plug, as shown at Fig. 8, and then for a short distance S<sup>3</sup> the groove is again made straight. At S<sup>2</sup> the straight portion S<sup>3</sup> of the groove branches in two directions, one into the straight portion S' and the other into a short inclined groove S<sup>4</sup>, which at its end opens into a straight portion S<sup>5</sup>, which is parallel with the straight portion S'. At the end of the straight portion S<sup>5</sup> is another short inclined groove S<sup>6</sup> leading into the portion S' at some little distance from its end. The straight portion S<sup>5</sup>, like the straight portion S', is made gradually to decrease in depth, and the inclined continuation S<sup>6</sup> of the shallow end of the groove is made of this same shallow depth. When recoil takes place the pin R moves along the straight portion S' of the groove and is gradually forced back somewhat into the rod Q as the groove S' decreases in depth. At S<sup>2</sup> the pin R again springs out into a deeper portion of the groove, and the groove being slightly inclined at this point the plug O has a slight turn given to it, and then for the remainder of the recoil the pin R travels along the straight portion S<sup>3</sup>. Afterward at the commencement of the running out of the gun the pin R travels back along the straight portion S<sup>3</sup> until it comes against the shoulder S<sup>2</sup> and then, as it cannot ride over this shoulder, it must necessarily enter the inclined portion S<sup>4</sup>. The plug is consequently made to turn

through a considerable angle, and then for the greater part of the remainder of the running out it is retained in the position into which it has been turned by the pin R traveling along the straight portion S<sup>5</sup>. Near the end of the running out the pin R enters the inclined portion S<sup>6</sup> of the groove and the plug is consequently turned back to its original position. As the pin passes along the straight portion S<sup>5</sup> and inclined portion S<sup>6</sup>, it is gradually pressed inward by the decrease of depth of these grooves; but so soon as the pin passes out of the inclined portion S<sup>6</sup> it springs out again and enters the straight portion S', which is here of its full depth.

In Figs. 1 and 2 the lower portion L of the clamp which embraces the gun, and which has the cylinders I and N formed in one piece with it, is shown to be also formed with a passage V through it, which is to form a bearing for an axis by which the breech mechanism of the gun is to be opened and closed; but as my present invention does not relate to breech mechanism, no breech mechanism is shown in the drawings.

I claim—

1. In apparatus for controlling the recoil and subsequent running out of guns, the combination, with a single cylinder filled with liquid and a piston, which are connected to the gun and the gun-mounting, of a spring compressed during recoil, two passages for conveying the liquid to opposite sides of the piston, one of which conveys liquid during recoil and the other during the running out of the gun, and means, substantially as described, for connecting one of said passages with the cylinder during recoil, and for disconnecting said passages and connecting the other passage with the cylinder during the running out of the gun.

2. The combination of the gun, the gun-cradle, the cylinder I, fixed to the gun, the piston fitting this cylinder, its piston-rod J, fixed to the gun-cradle, the spring M, contained within the cylinder and bearing against the piston, the slot I', formed along one side of the cylinder and opening into a cylindrical casing N, and the cylindrical plug O, contained within this casing and having two grooves formed along its sides, one of which is brought in front of the slot I' before recoil takes place and the other during the running out.

3. The combination of the gun, the gun-cradle, the cylinder I, fixed to the gun, the piston fitting this cylinder, its piston-rod J, fixed to the gun-cradle, the spring M, contained within the cylinder and bearing against the piston, the slot I', formed along one side of the cylinder and opening into a cylindrical casing N, the cylindrical plug O, contained within this casing, the two grooves O' O<sup>2</sup>, formed along it, means for bringing one groove in front of the slot I' before recoil takes place, and for bringing the other in front of the slot during the running out, and



the eccentric P, and sliding block O<sup>3</sup> for adjusting the area of the passage O<sup>2</sup>.

4. The combination of the gun, the gun-cradle, the cylinder I, fixed to the gun, the  
5 piston fitting this cylinder, its piston-rod J, fixed to the gun-cradle, the spring M, contained within the cylinder and bearing against the piston, the slot I', formed along one side of the cylinder and opening into a cylindrical casing N, the cylindrical plug O, con-

tained within this casing, the two grooves O' O<sup>2</sup>, formed along it, and the fixed rod Q, spring-pin R, and groove S', S<sup>2</sup>, S<sup>3</sup>, S<sup>4</sup>, S<sup>5</sup>, and S<sup>6</sup>, formed along the sides of a cylindrical recess in the plug O to turn the plug at the 15 times required.

PER NORDENFELT.

Witnesses:

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ANDRE CHRISTOYL.