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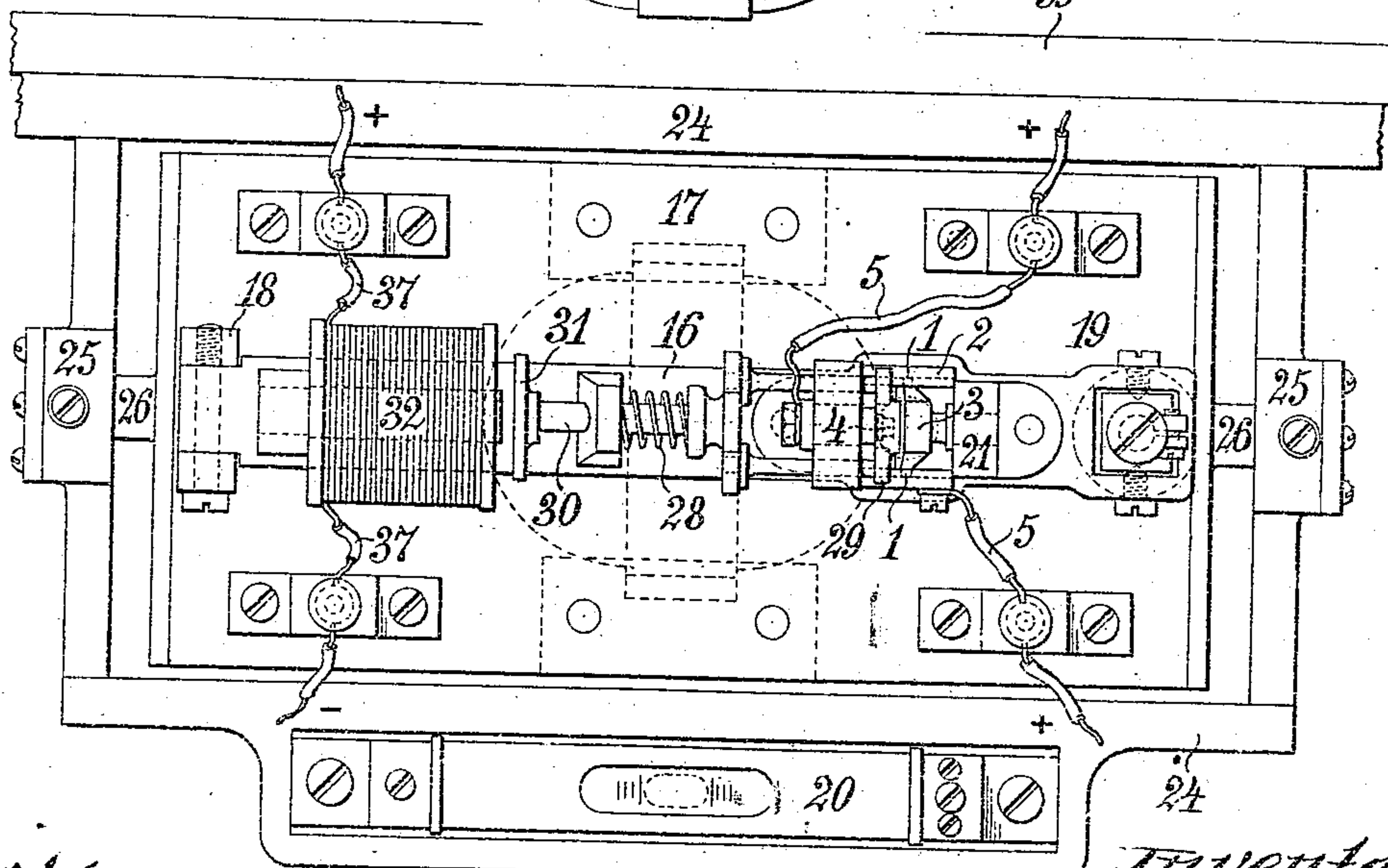
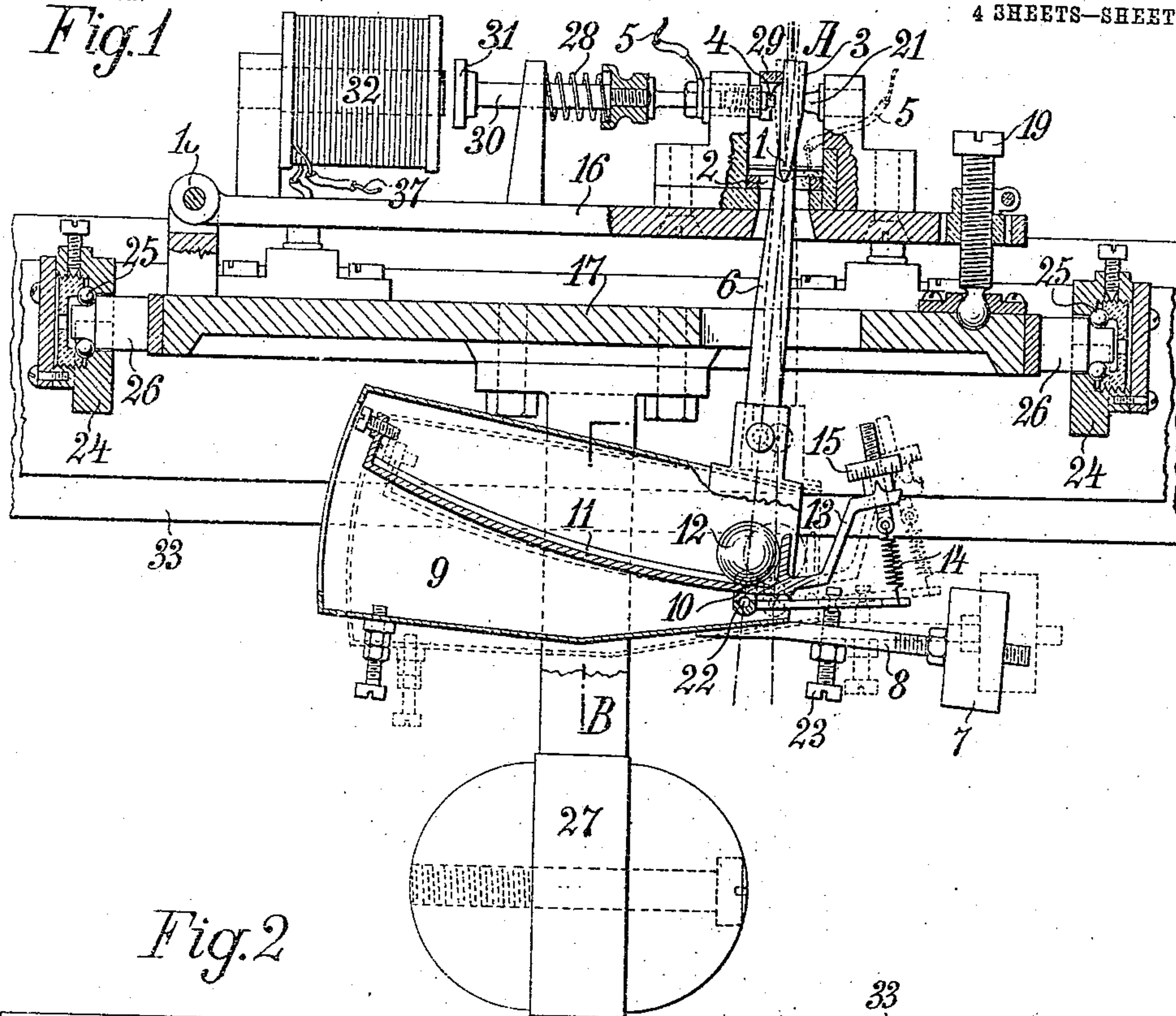
PATENTED FEB. 3, 1903.

H. VON PÉCHY & V. REA.  
AUTOMATIC FIRING APPARATUS FOR SHIPS' GUNS.

APPLICATION FILED AUG. 11, 1902.

NO MODEL.

4 SHEETS—SHEET 1.



Witnesses:

*James Julius Hochfelder*

*Inventors'*  
*Heinrich von Péchy*  
*By Victor Rea*  
*James L. Norris*

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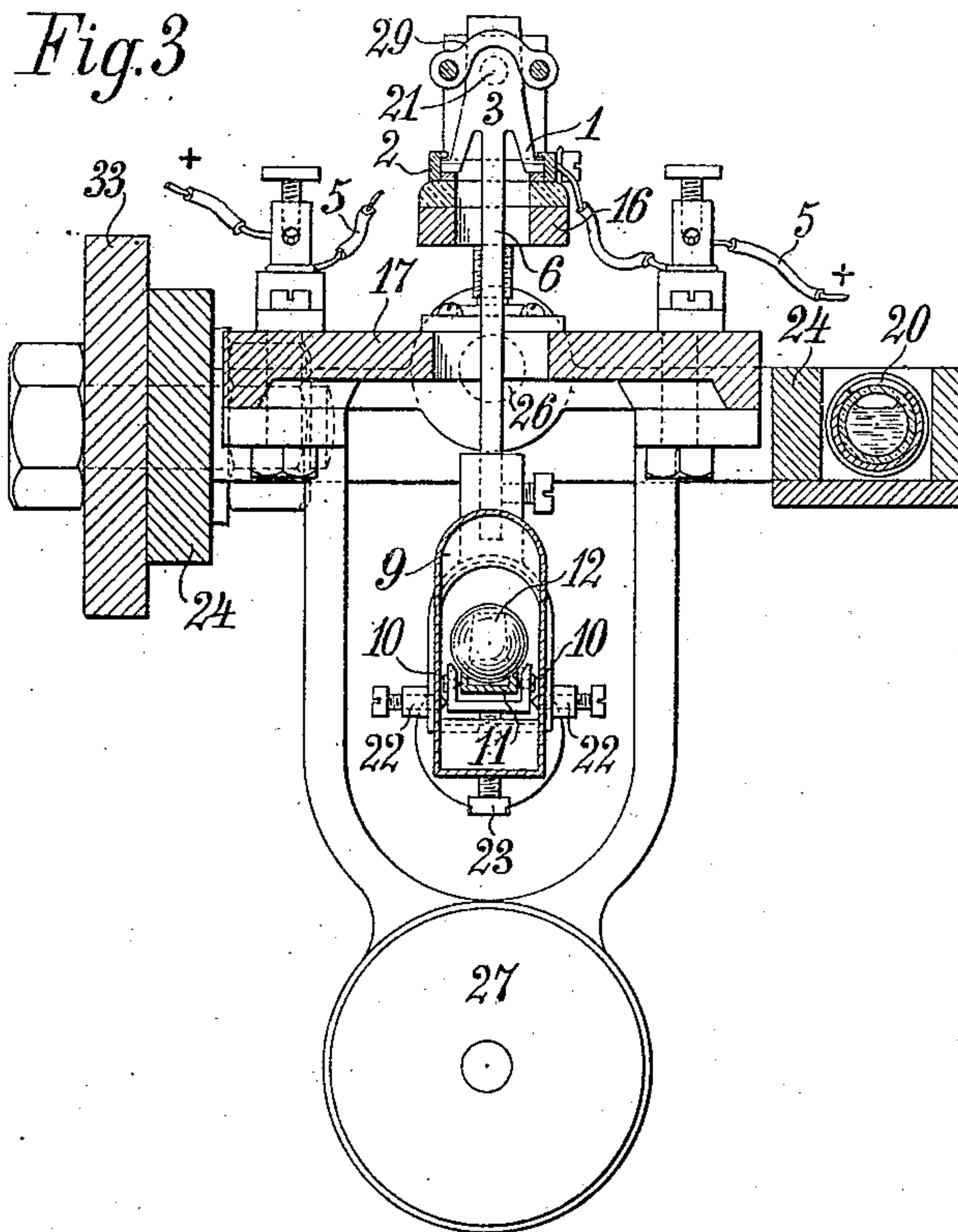
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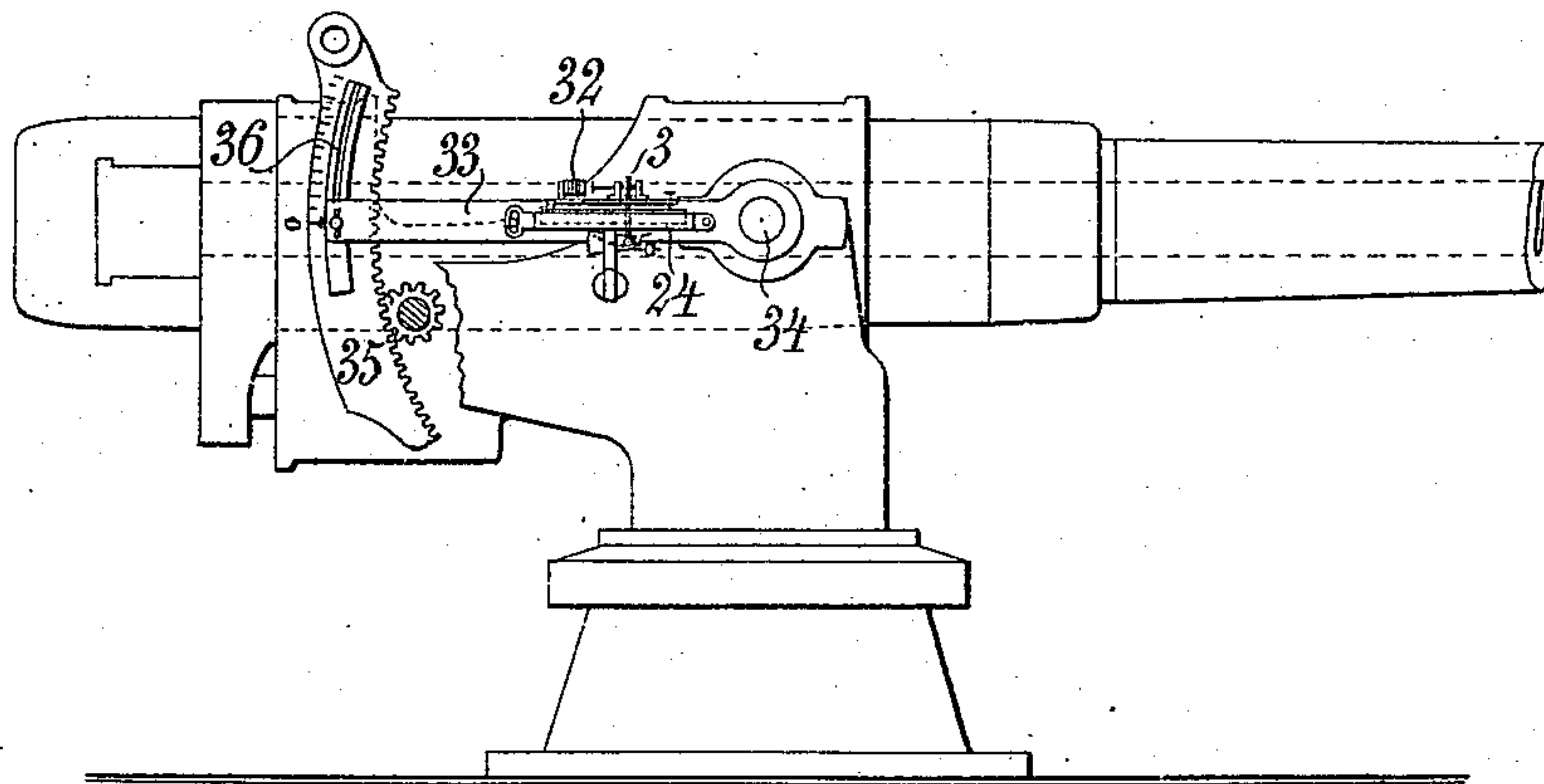
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NO MODEL.

4 SHEETS—SHEET 2.



*Fig.4*



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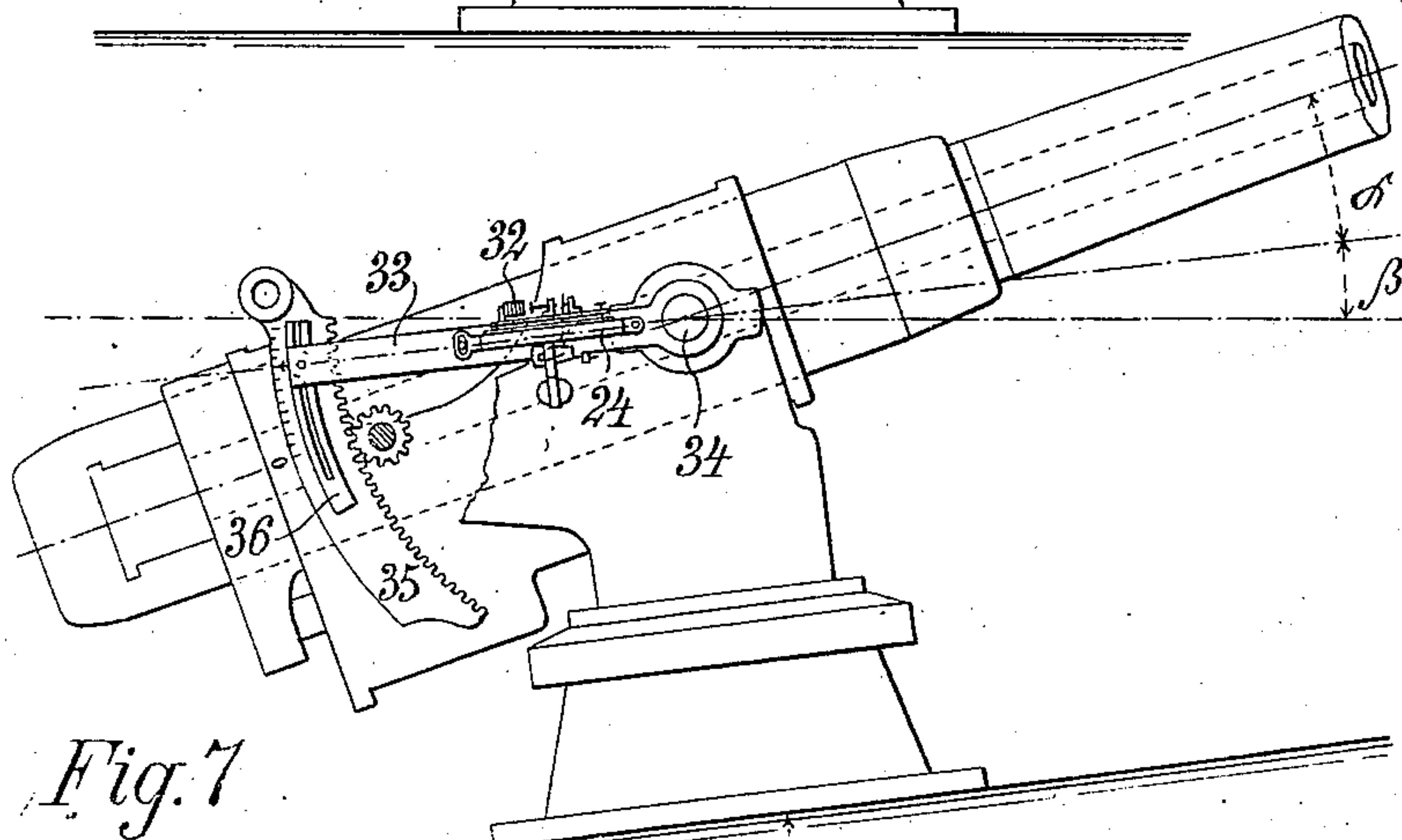
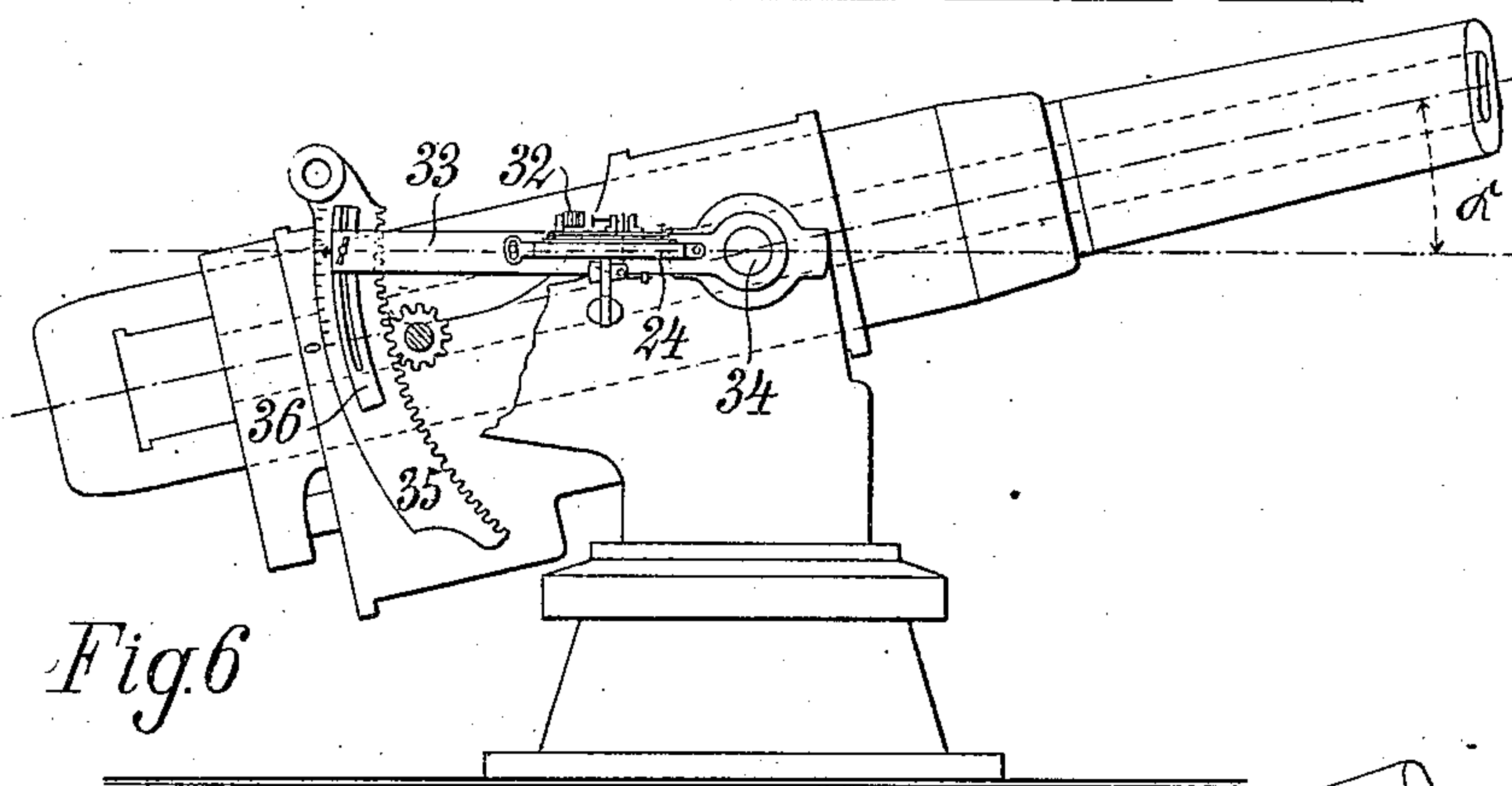
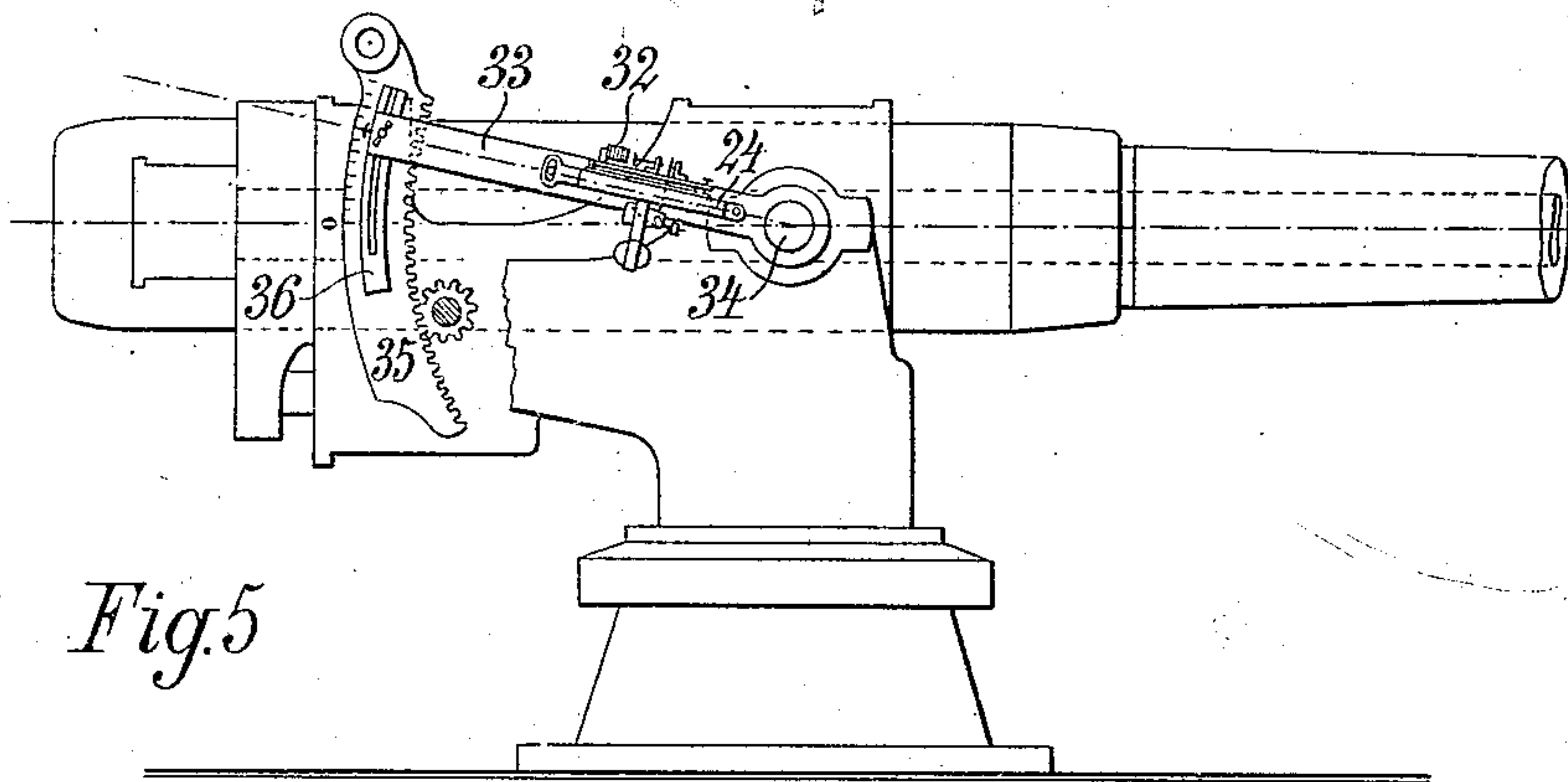
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4 SHEETS—SHEET 3.



Witnesses:

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4 SHEETS—SHEET 4.

Fig. 8

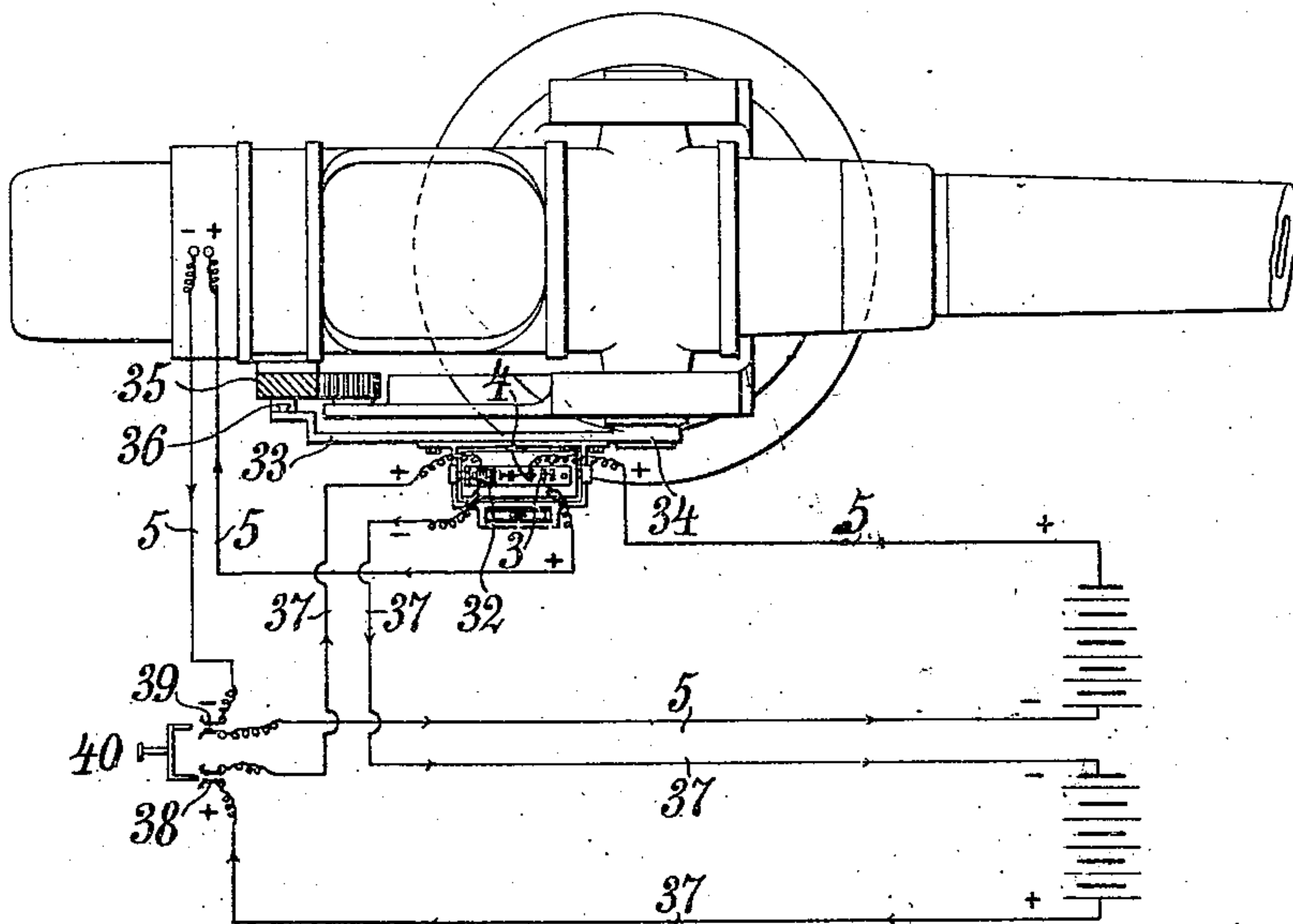


Fig. 9

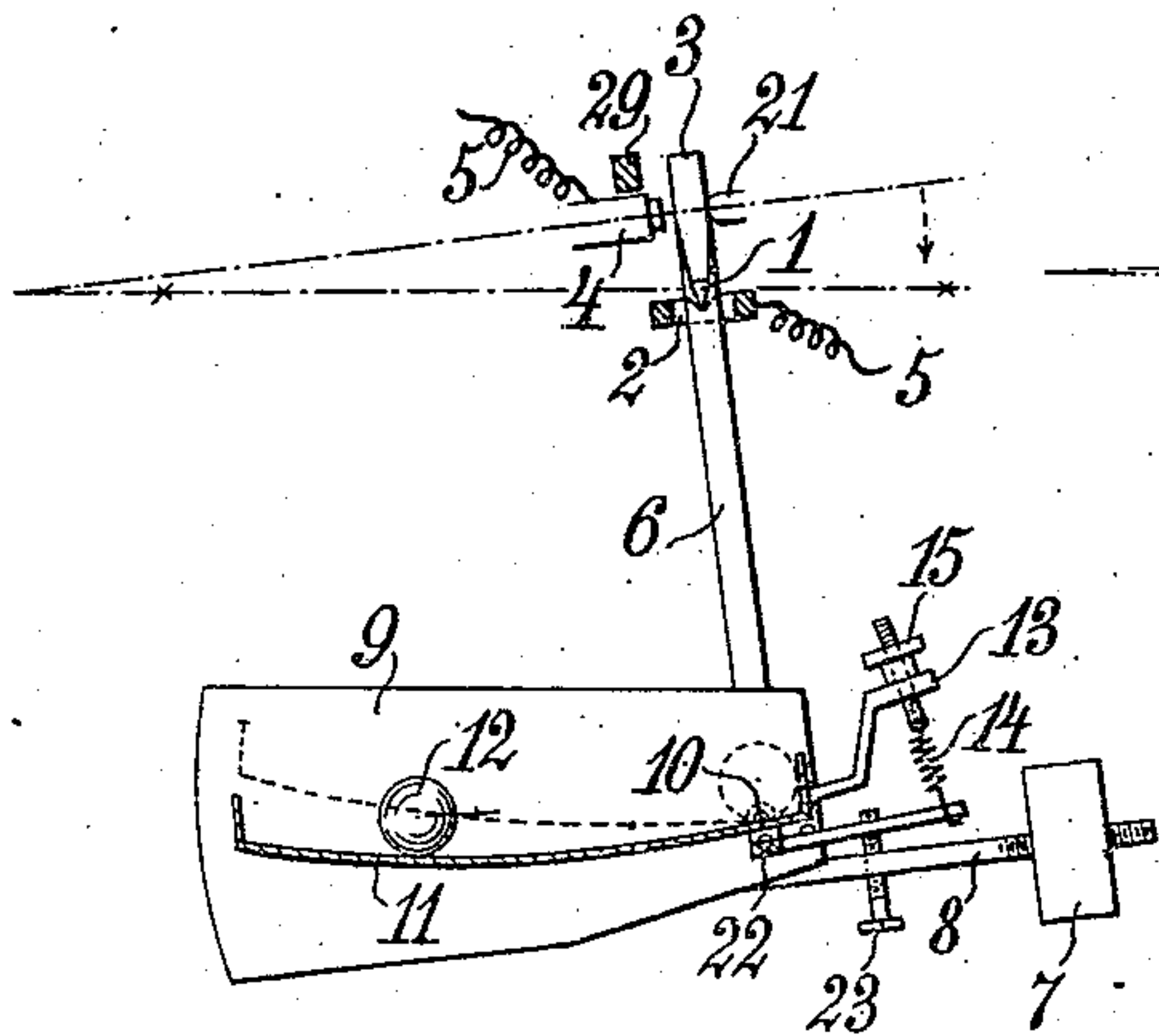
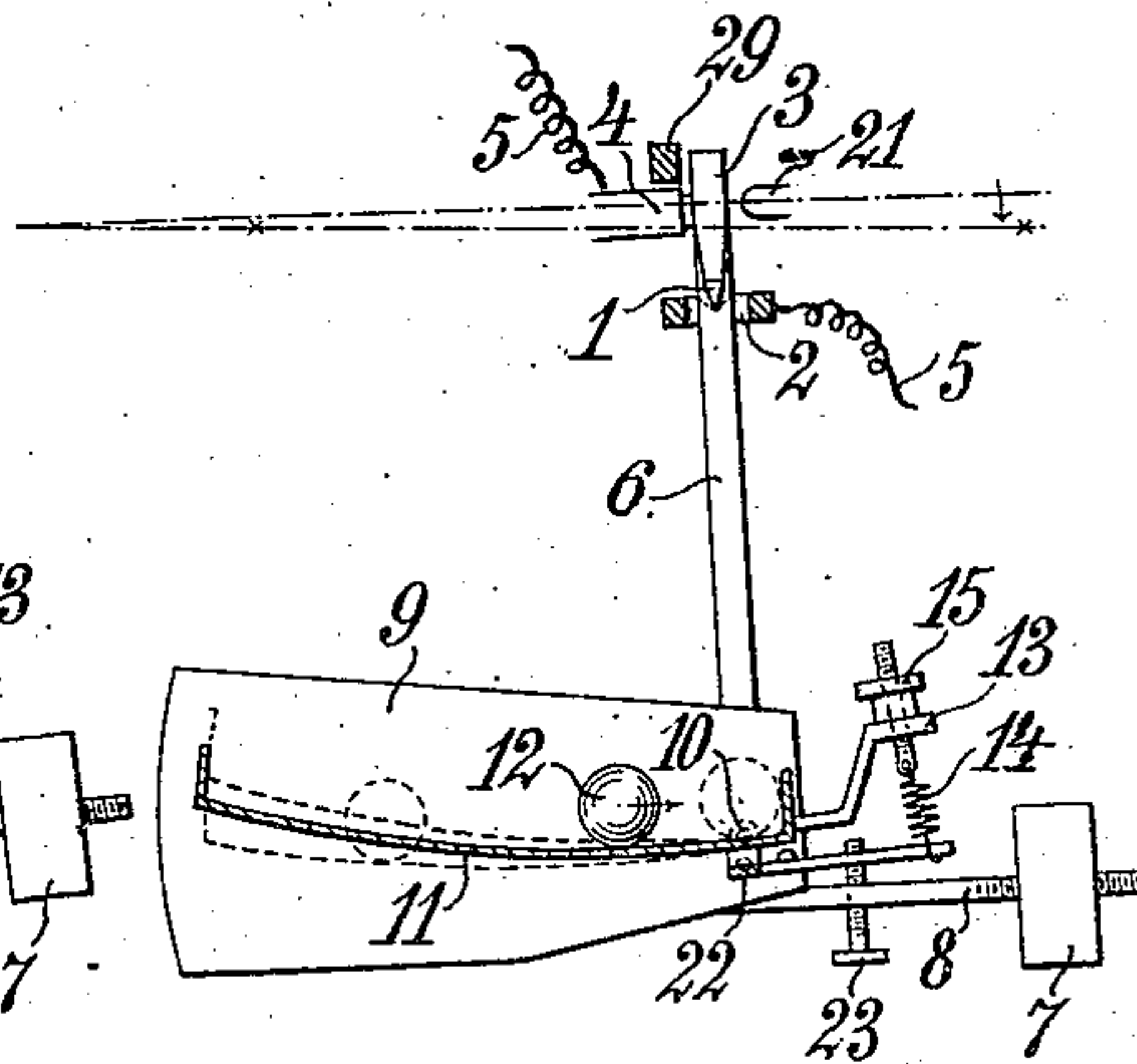


Fig. 10



Witnesses:

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# UNITED STATES PATENT OFFICE.

HEINRICH VON PÉCHY AND VICTOR REA, OF POLA, AUSTRIA-HUNGARY;  
SAID VON PÉCHY ASSIGNOR TO ANDOR VON PÉCHY, OF VIENNA, AUSTRIA-HUNGARY.

## AUTOMATIC FIRING APPARATUS FOR SHIPS' GUNS.

SPECIFICATION forming part of Letters Patent No. 719,857, dated February 3, 1903.

Application filed August 11, 1902. Serial No. 119,353. (No model.)

*To all whom it may concern:*

Be it known that we, HEINRICH VON PÉCHY and VICTOR REA, subjects of the Emperor of Austria-Hungary, residing at Pola, in the Province of Istria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Automatic Firing Apparatus for Ships' Guns; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

This invention relates to an automatic firing apparatus for ships' guns whereby the shot is fired and leaves the muzzle of the gun, whether the ship is rolling or not, at the moment when the axis of the barrel is at the elevation to suit the estimated range. It is essential that the ignition of the charge should be timed to occur with reference to the time that the shot remains in the barrel. Thus the ignition must be premature, and the degree of prematurity depends on the length of the barrel and the character of the explosive. It is constant for each caliber; but the degree and speed of rolling of the ship introduce variable factors. The axis of the barrel must therefore be moved quickly through an angle which increases or decreases with the rolling of the ship, and this movement must be effected while the ship is rolling until the correct elevation is attained, with a speed varying for each case. It follows that the circuit of the electric igniting-current must be closed sooner or later in order that the prematurity of ignition may remain the same while the speed of rolling varies. By the present invention the proper timing of the ignition is effected by means of a balance arranged beside the gun, the pointer of which constitutes an oscillating contact, while one-half of the beam carries a railway, groove, or like track kept in the position of rest by a spring, on or in which track a ball rolls from its position of equilibrium and depresses the track when the rolling of the ship is in the one direction. On the return motion of the ship the ball is checked in making its journey back in consequence of its inertia and

the inclination of its guide, whereupon the center of gravity of the balance is displaced to one side, so that the oscillating pointer closes the circuit for the electric ignition and the gun is fired. By means of the oscillating track the time at which the ball rolls with regard to the increasing and decreasing magnitude and speed of the rolling of the ship is automatically regulated in such a manner that the moment of the premature ignition is varied to suit the said movement of the ship. The balance-pointer is capable of being held by an electromechanically-liberated detent. The contact which is closed by the pointer and the device which liberates the detent may be controlled by one key, so that the shot is fired only at the will of the person handling the key.

The firing apparatus is provided with arrangements for putting its parts in the necessary horizontal position and for adjusting it to the gun and the range, as well as for allowing its use for any charge and caliber.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section; Fig. 2, a plan, and Fig. 3 a vertical section on line A B of Fig. 1. Figs. 4 to 7 are elevations of the gun in different positions with the firing device attached. Fig. 8 is a plan of the gun and firing device, showing diagrammatically the firing-circuit. Figs. 9 and 10 are detail views.

Referring to Figs. 1 to 3, the firing device consists, essentially, of a balance whereof the beam turns on the knife-edges 1, attached to the pointer 3 and carried on planes 2, insulated from the rest of the apparatus. The pointer 3 constitutes an oscillating contact, which closes the electric igniting-circuit 5, Fig. 8, when it touches the insulated contact 4, Fig. 10, urged by a spring, as shown in Fig. 1. The beam carried by the extension 6 of the pointer 3 consists of an arm 8 on the one side, carrying an adjustable counterpoise 7, and of a casing 9 on the other side. In this casing a curved track 11 turns on pivots 10 and serves as a way for the ball 12. This track 11 is kept in the position of rest (shown in Fig. 1) by a spring 14, attached to a rearwardly-projecting arm 13, the tension of the spring being adjustable by means of the nut 15. The knife planes 2 of the balance are



carried by an arm 16, hinged at 18 to the base-plate 17 and capable of being raised or depressed at its free end by the adjusting-screw 19. When the base-plate is quite horizontal, as indicated by the level 20, the pointer of the balance when this is not arrested but can swing freely does not rest, as shown in Fig. 1, against the insulated stop 21, but against the spring-contact 4, as indicated in dotted lines in Fig. 1. In the horizontal position of the firing device and the vertical position of the balance-pointer the ball is perpendicularly below the point of suspension of the balance-beam, and in order that this position of the ball may be accurately secured the bearings of the track 11 are carried between set-screws 22, Fig. 3, and may be adjusted with aid of a third set-screw 23, Fig. 1. The base-plate 17 of the apparatus is carried by trunnions 26 on ball-bearings 25 in the frame 24 and is kept by the weight 27 in the position in which the knife-planes of the balance are always horizontal. In order that there may be no closing of the circuit by the balance-pointer 3 when the firing apparatus is not in use, the pointer is normally pressed against the insulated stop 21, Fig. 1, by a bar or lock 29, urged by spring 28. This bar is connected by rods, one on each side of the contact 4, with the guide-bar 30, Fig. 2, which carries an armature 31, controlled by the magnet 32. When the magnet is energized, the armature is attracted and the bar 29 is drawn back, so that the pointer becomes free and can at the given moment close the circuit of the igniting-current.

The firing apparatus, which may be inclosed in a protective casing, is fixed to a rail 33, centered at one end on the trunnion 34 of the gun, Fig. 4, while the other end can be fixed by a set-screw relatively to a range-scale in a slot 36 on the toothed arc 35 of the elevating mechanism.

In Figs. 4 to 8 the firing apparatus is shown on the right-hand side of the gun; but if the elevating mechanism is on the left the firing apparatus may also be on that side. Fig. 8 shows that the igniting-circuit 5 and the magnet-circuit 37 are each provided with a contact 38 and 39, respectively, which are closed by a key 40, common to both, the arrangement being such that the electromagnet is first energized to withdraw the bar 29, and immediately thereafter the igniting-circuit is closed.

The operation of the apparatus is as follows: The gun being completely at rest, the apparatus is set horizontal by aid of the level 20 at the zero of the scale on the arc of the elevating mechanism, Fig. 4. In this position the apparatus and the axis of the barrel are parallel with the surface of the sea. For shooting the rail 33 is fixed at the point on the scale corresponding with the desired range, Fig. 5, in which position the angle between the barrel-axis and the axis of the rail 33 corresponds with the elevation to be given to the

gun. The gun-barrel is now raised by aid of the usual elevating mechanism (not shown in the drawings) until the firing apparatus is nearly horizontal, Fig. 6, in which position the barrel will have passed through the required angle of elevation  $\alpha$ . In this position the movable parts of the firing apparatus will have assumed the position shown in Fig. 1. If owing to the rolling of the ship the gun acquires a further elevation—say through the angle  $b$ —the balance-beam will retain its original position, because the detaining-bar 29 still holds the pointer 3. The ball 12, however, by reason of the inclined position of the apparatus starts rolling along its track and depresses it, Fig. 9, thus putting the spring 14 under increased tension and shifting the center of gravity of the balance to the left. As the rolling motion changes the firing apparatus is put ready for action by depressing the key 40, so as to close the contacts 38 39. The electromagnet 32 being now energized, the detaining-bar 29 is withdrawn from the pointer 3. Simultaneously with the return swing of the gun-barrel the ball begins its return journey. Owing to the reversal of the movement of the ball and to the fact that the track is raised only gradually, according to the degree of the backward movement of the ball, there is a delay in the said return journey, so that even before the apparatus has attained the horizontal position, the center of gravity of the balance having been displaced, the pointer 3 swings to the left and closes the circuit at contact 4, Fig. 10. So long as the apparatus does not approximate to the horizontal position the weight of the ball cannot influence the balance, notwithstanding the withdrawal of the detent, as the balance-beam always tends to keep the pointer in the vertical position, whereby the latter is held against the stop 21 until by the altered position of the apparatus the balance has acquired the necessary sensitiveness for shifting the center of gravity. When this happens, the charge is ignited somewhat early, as the barrel returns to the elevation previously fixed for the firing of the shot, so that the shot leaves the muzzle when the latter is, in fact, at the correct elevation.

The automatic firing apparatus here described permits a premature ignition suitable for the different degrees and speed of the rolling of the ship, for when the rolling motion of the ship increases the ball rolls farther out on its track, which is thus more depressed. If the speed of the rolling of the ship is great, the barrel will move quickly through the angle within which the ignition should occur. The ball, however, in consequence of its inertia and of the considerable inclination of its track will return over only a small part of its track—that is to say, it will suffer a considerable delay—so that the center of gravity of the balance is quickly displaced and the closure of the circuit is precipitated. If the degree of rolling is great, but the speed small,



the ball traverses a larger part of its track in returning, the displacement of the center of gravity occurs later, and the ignition is correspondingly postponed. If the rolling of the ship is small in degree and rapid, the ball returns only a short way and the delay is corresponding, so that here also the premature firing is at the right time. If the rolling is small in degree and slow, the delay in the return of the ball is very small and the ignition again occurs at the right moment. The firing apparatus set for a certain range acts when the ship is rolling or in a perfectly smooth sea and is not heeling without any further adjustment of elevation. If there is no rolling, but the ship is heeling, the barrel is raised or lowered by the elevating mechanism until the shot is fired. In a perfectly calm sea and when the firing apparatus is set for a certain range the delivery of the shot may be brought about without regard to the momentary position of the barrel by raising or lowering the latter.

To adjust the prematureness of the ignition to suit the magnitude of the charge and the caliber, the tension of the spring 14 is adjusted so as to vary the tendency of the track 11 to oscillate. For this purpose the spring 14 is regulated by a screw 15, having a nut divided to show different degrees of prematureness. Thus the firing apparatus becomes applicable to any size of shot.

We claim—

1. The combination with a gun, of a pendulum pivoted between its ends, an insulated stop adjacent to the upper end of said pendulum, an electric contact adjacent to the upper end of said pendulum opposite to said stop, a track attached to the lower end of said pendulum on the side opposite to said insulated stop, a body movable on said track, and an electric circuit extending through said electric contact and through said pendulum, which circuit is closed when said pendulum swings into contact with said electric contact.

2. The combination with a gun, of a pendulum pivoted between its ends, an insulated stop adjacent to the upper end of said pendulum, an electric contact adjacent to the upper end of said pendulum opposite to said stop, a track attached to the lower end of said pendulum on the side opposite to said insulated stop, a body movable on said track, means for adjusting the angle of said track with respect to said pendulum, and an electric circuit extending through said electric contact and said pendulum, which circuit is closed when said pendulum swings into contact with said electric contact.

3. The combination with a gun, of a pendulum pivoted between its ends, an insulated stop adjacent to the upper end of said pendulum, an electric contact adjacent to the upper end of said pendulum opposite to said stop, an electrically-operated lock for holding said pendulum in engagement with said insulated stop, a track attached to the lower end of said

pendulum on the side opposite to said insulated stop, a body movable on said track, and an electric circuit extending through said electric contact and through said pendulum, which circuit is closed when said pendulum swings into contact with said electric contact.

4. The combination with a gun, of a pendulum pivoted between its ends, an insulated stop adjacent to the upper end of said pendulum, an electric contact adjacent to the upper end of said pendulum opposite to said stop, a lock for holding said pendulum in engagement with said insulated stop, an armature on said lock, a magnet located adjacent to said armature, a normally open circuit extending through said magnet, means for closing said circuit, a track attached to the lower end of said pendulum on the side opposite to said insulated stop, a body movable on said track, an electric circuit extending through said electric contact and said pendulum, which circuit is closed when said pendulum swings into contact with said electric contact.

5. The combination with a gun; of a pendulum pivoted between its ends, an insulated stop adjacent to the upper end of said pendulum, an electric contact adjacent to the upper end of said pendulum opposite to said stop, a curved track attached to the lower end of said pendulum on the side opposite to said insulated stop, a body movable on said track, a normally open circuit extending through the gun-breech, the electric contact and the pendulum, a lock for holding the upper end of said pendulum in engagement with said insulated stop, an armature attached to said lock, a magnet located adjacent to said armature, a circuit extending through said magnet, and a key for simultaneously closing the circuit through said magnet and for partially closing the circuit through said gun-breech, said electric contact and said pendulum, which last-mentioned circuit is completely closed when said pendulum swings into contact with said electric contact.

6. The combination with a gun, of a pendulum pivoted between its ends, means for adjusting the angle of the gun with respect to said pendulum, an insulated stop adjacent to the upper end of said pendulum, an electric contact adjacent to the upper end of said pendulum opposite to said stop, a track attached to the lower end of said pendulum on the side opposite to said insulated stop, a body movable on said track, and an electric circuit extending through said electric contact and said pendulum, which circuit is closed when said pendulum swings into contact with said electric contact.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two subscribing witnesses.

HEINRICH VON PÉCHY.

VICTOR REA.

Witnesses:

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VINCENT BURES.