J. L. HALL.

TRAINING MECHANISM FOR GUNS, PROJECTORS, AND THE LIKE.

APPLICATION FILED AUG. 2, 1906.

953,139. **Patented Mar. 29, 1910.**

5 SHEETS—SHEET 1.

Fig. 1.

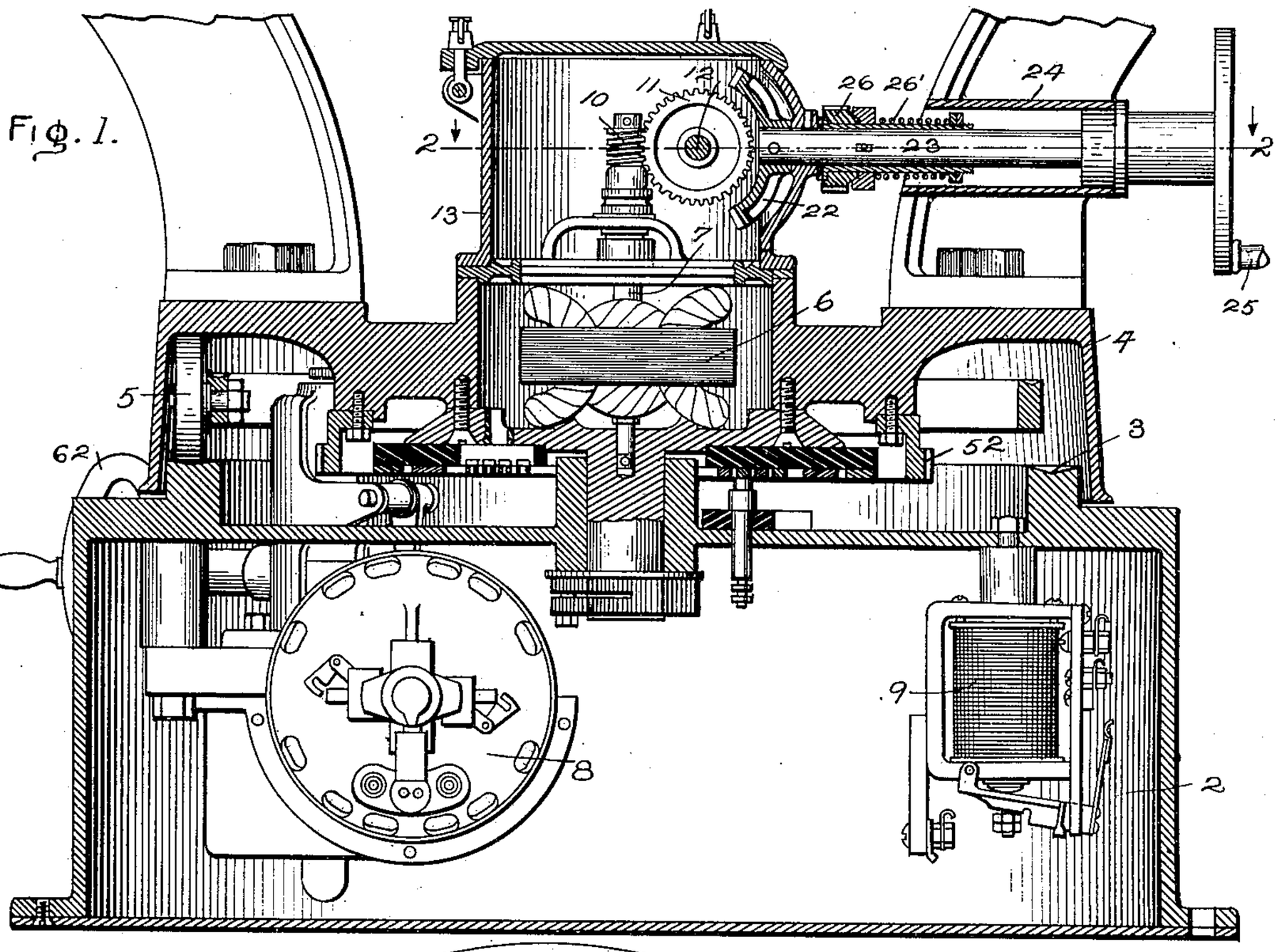
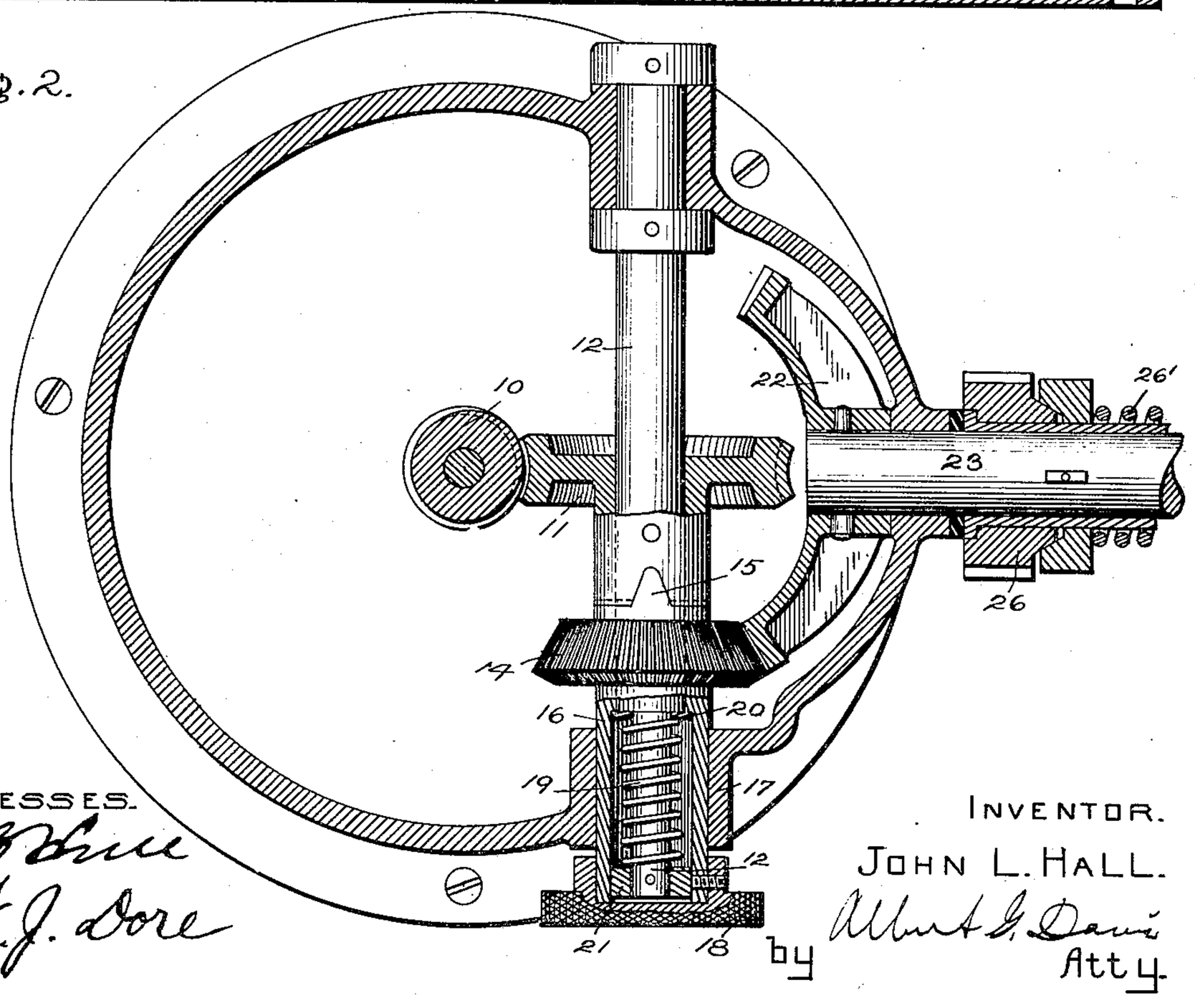


Fig. 2.



WITNESSES.

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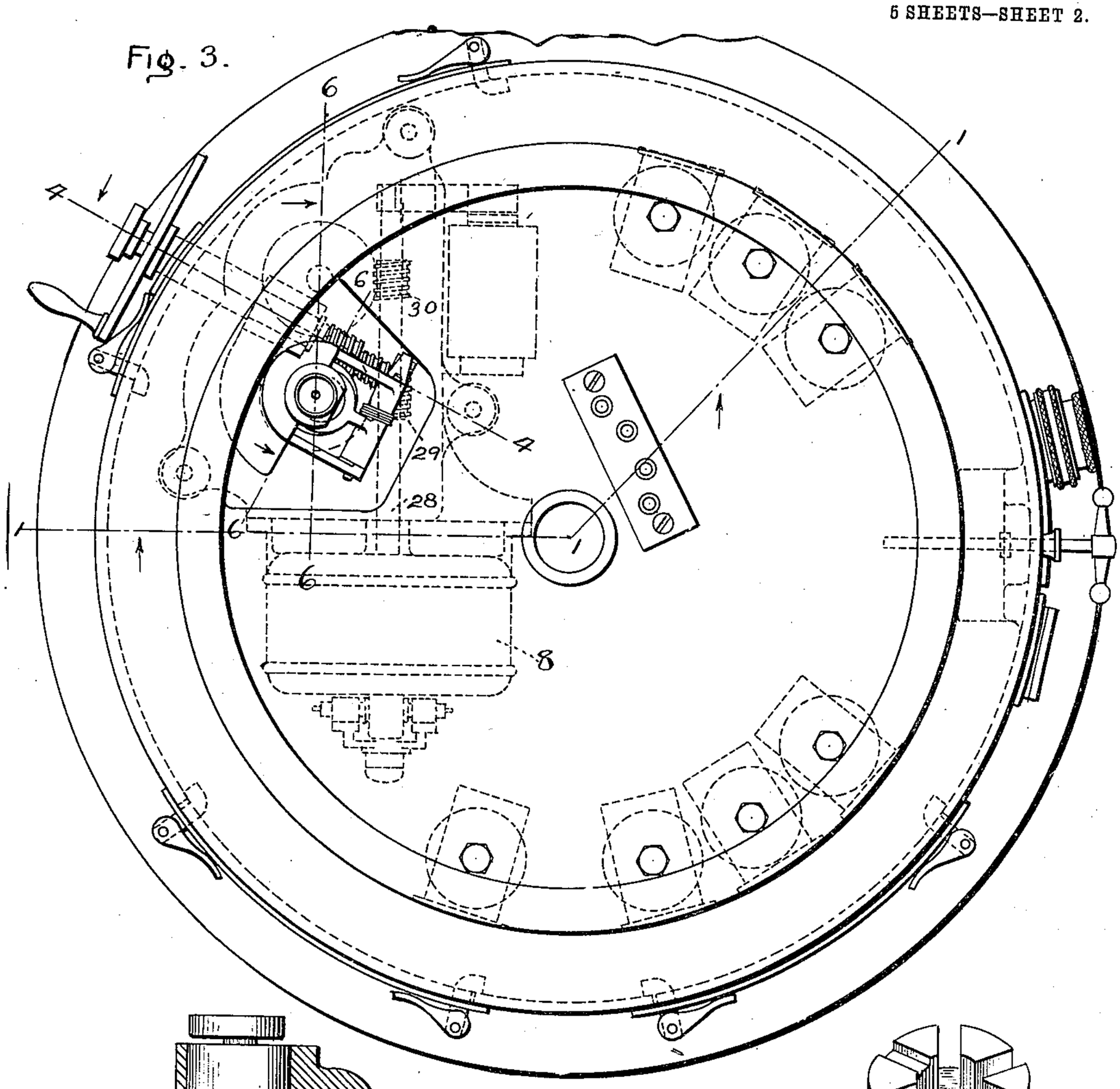
5 SHEETS—SHEET 2.

Fig. 3.



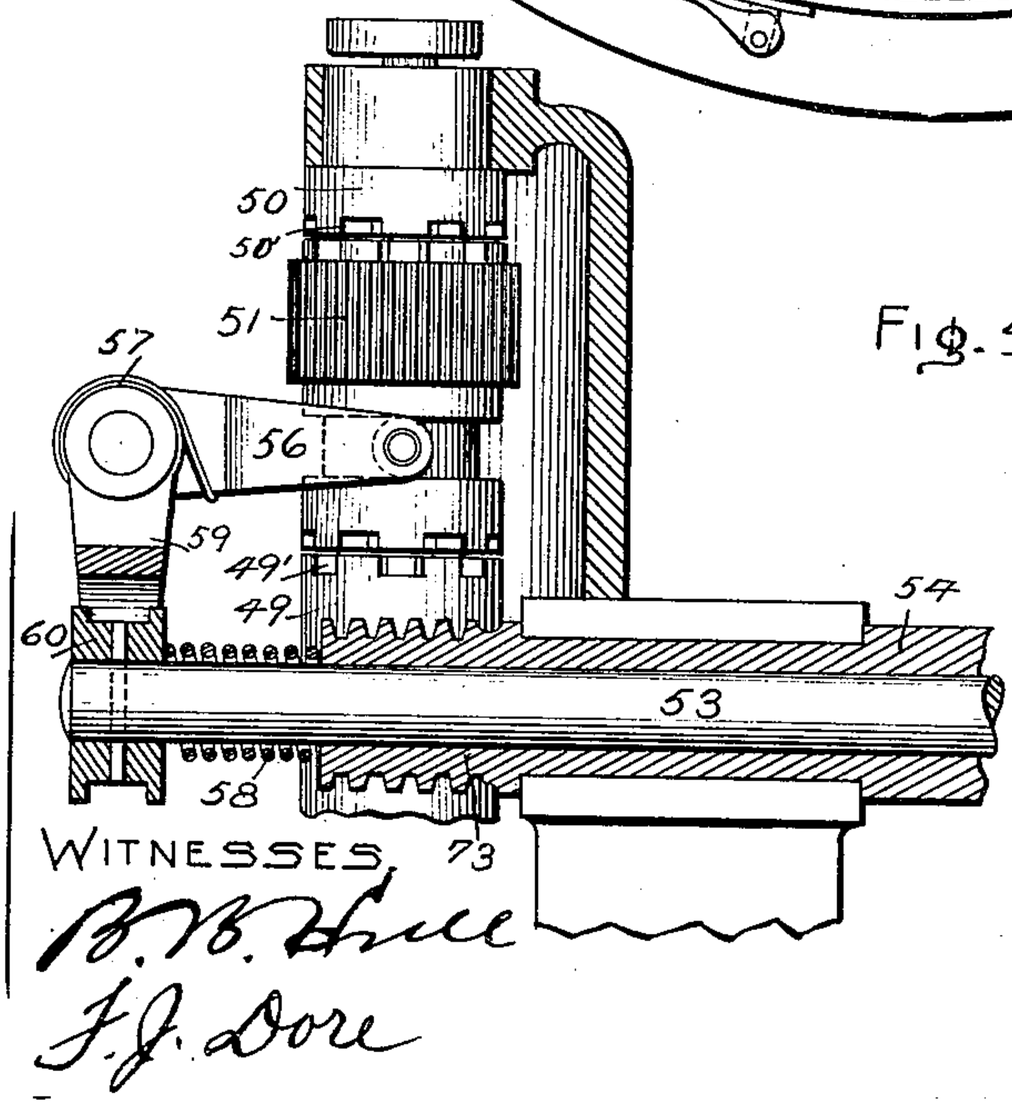


Fig. 4.

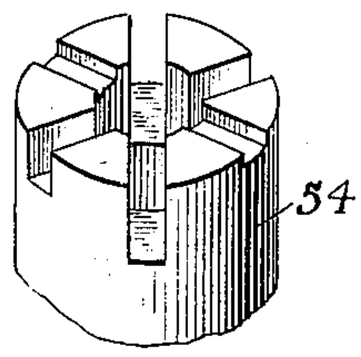


Fig. 12.

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5 SHEETS—SHEET 3.

Fig. 5.

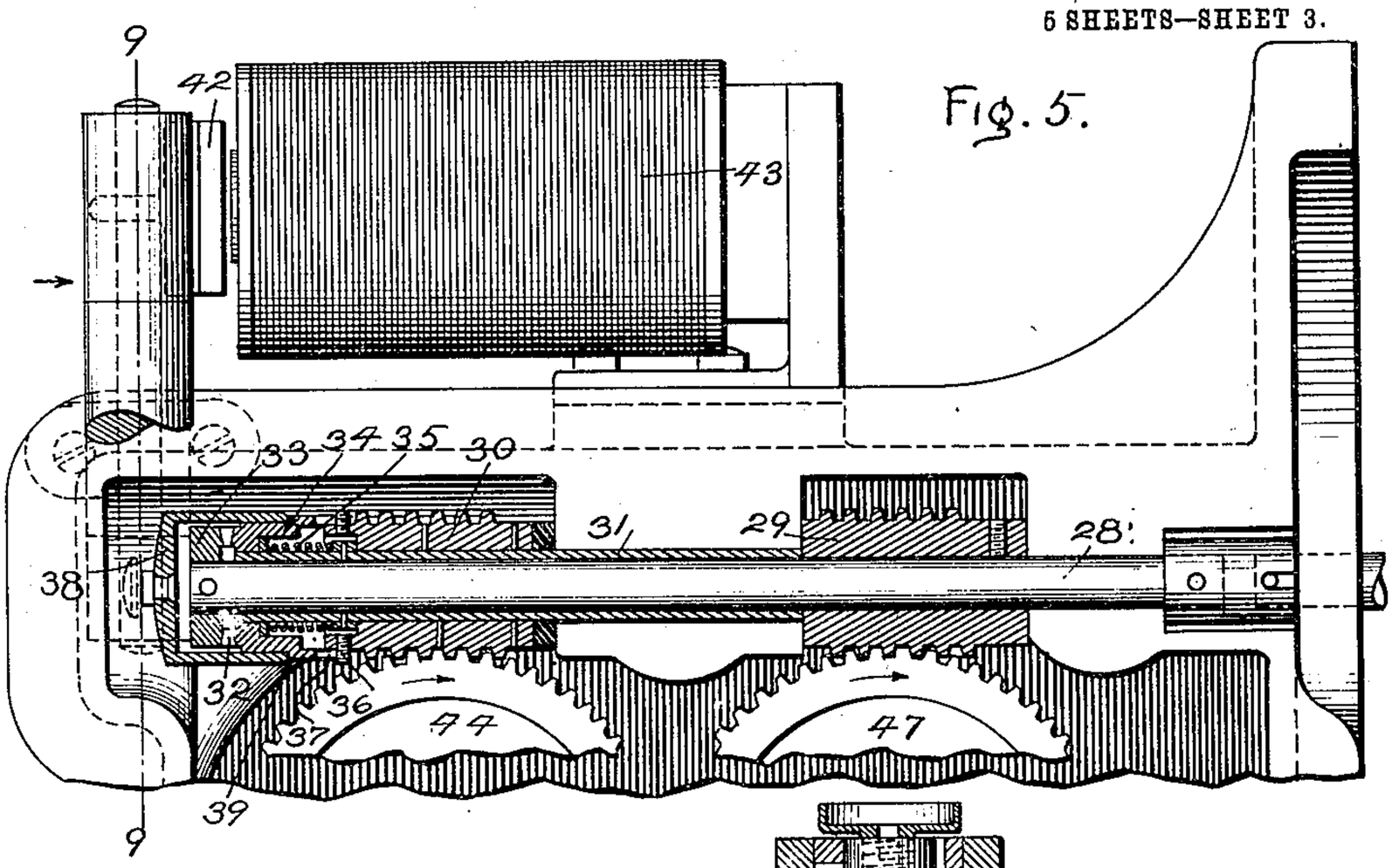
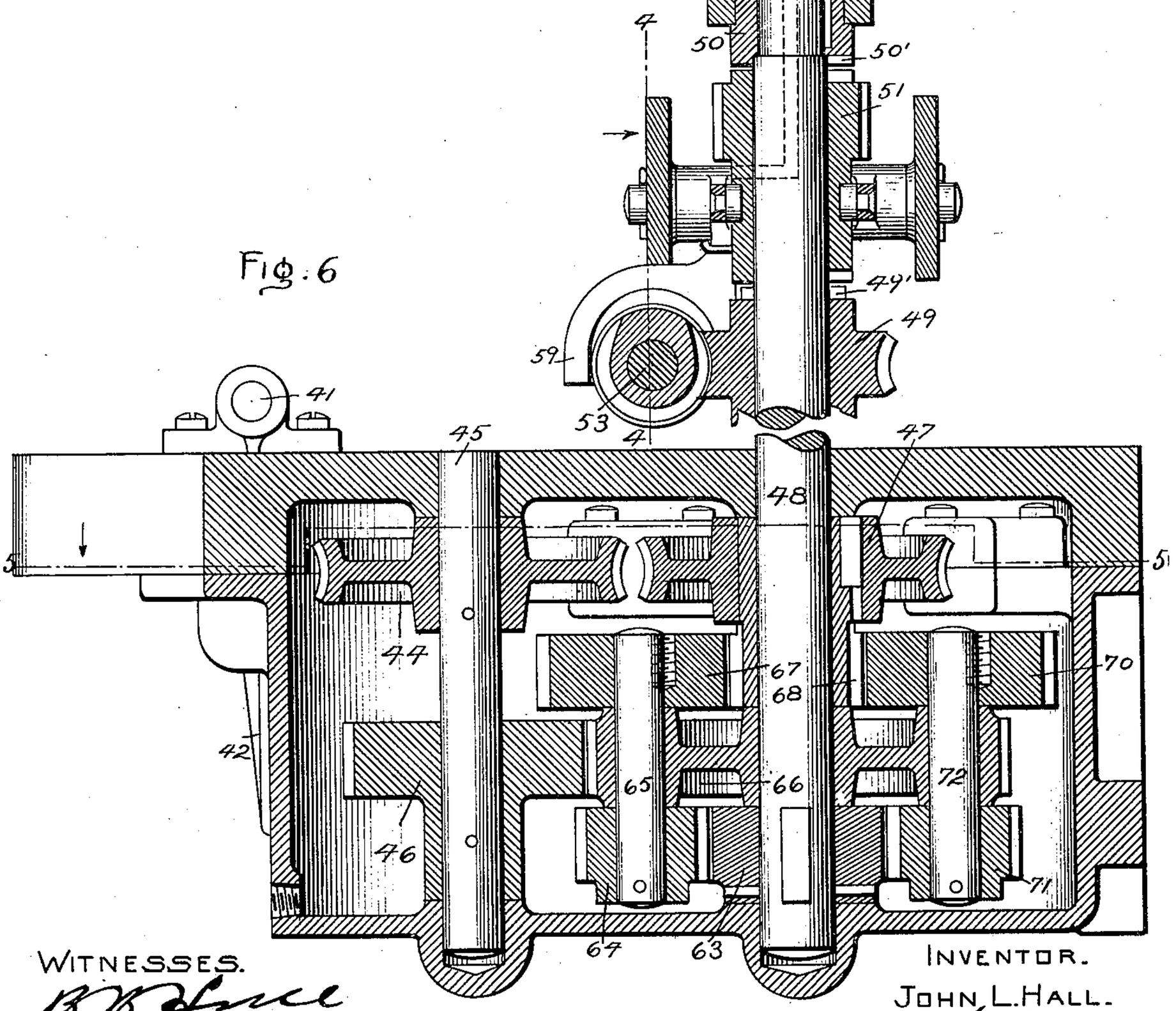


Fig. 6.



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TRAINING MECHANISM FOR GUNS, PROJECTORS, AND THE LIKE.

APPLICATION FILED AUG. 2, 1906.

953,139. Patented Mar. 29, 1910.

5 SHEETS—SHEET 4.

Fig. 7.

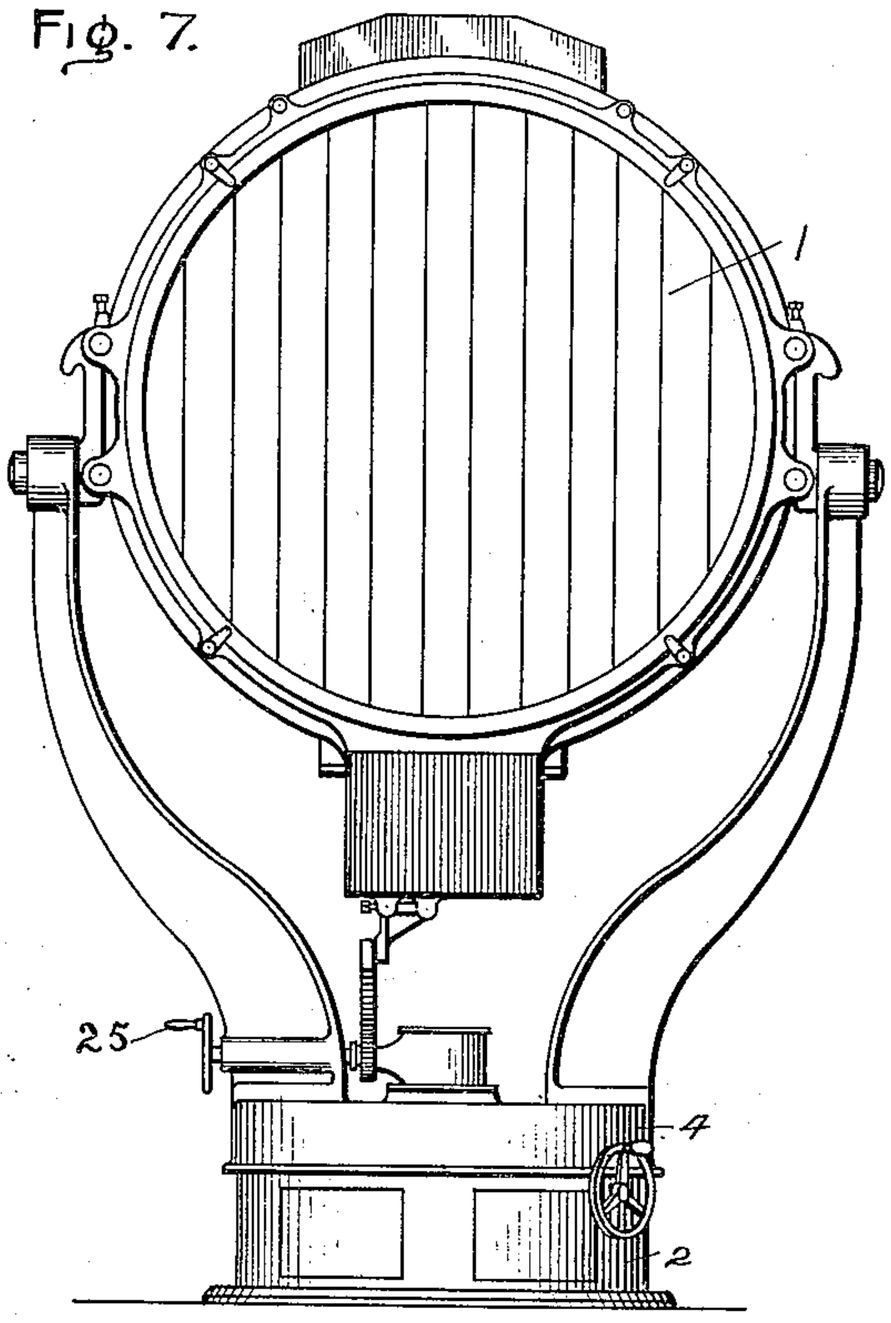


Fig. 8.

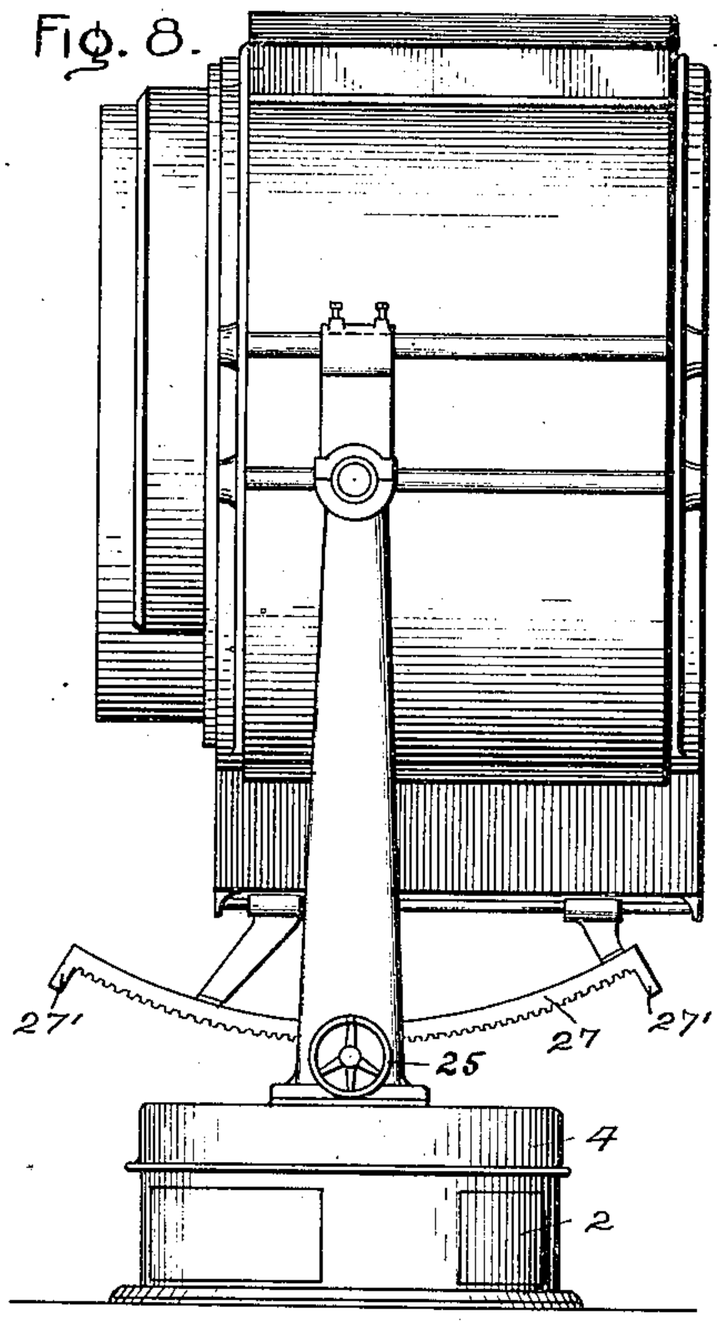


Fig. 9.

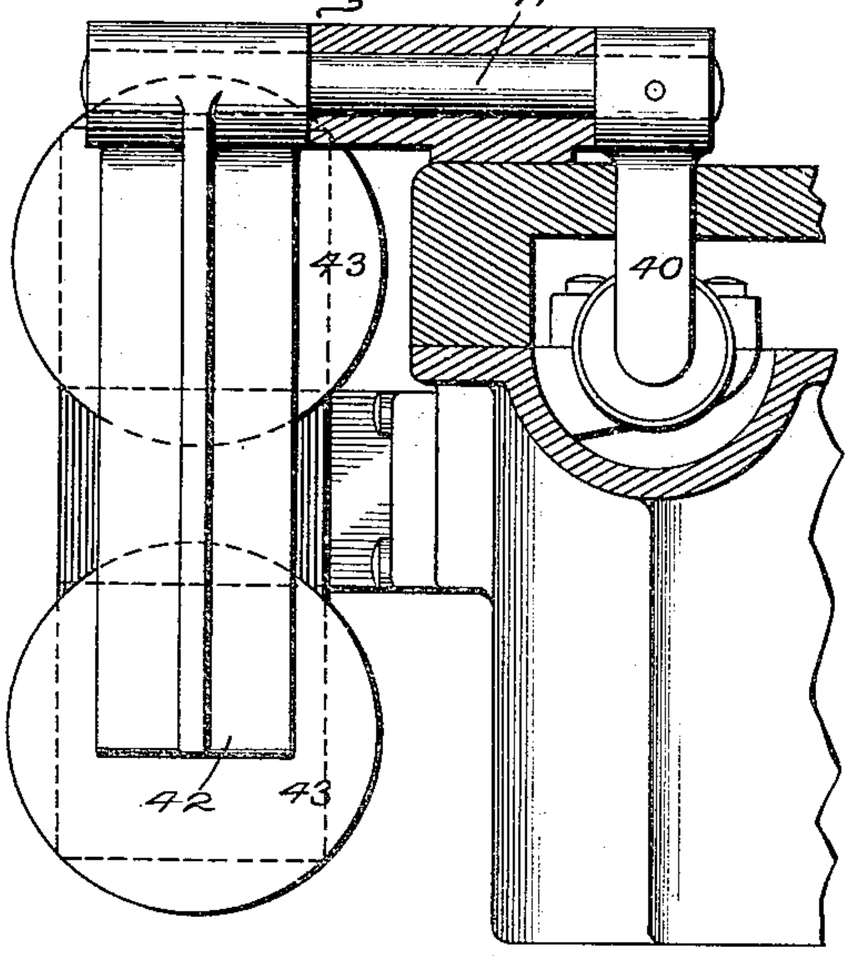
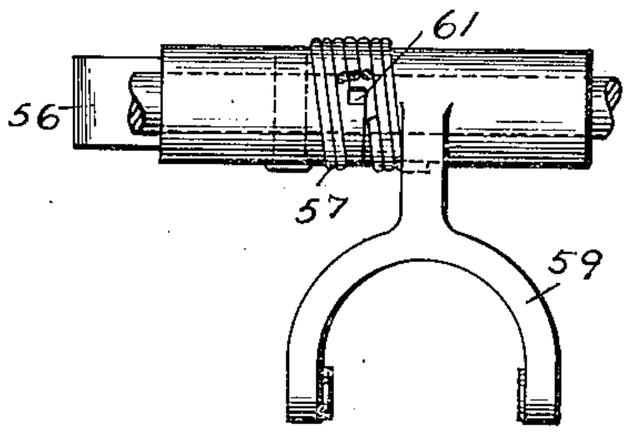


Fig. 10



WITNESSES.

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TRAINING MECHANISM FOR GUNS, PROJECTORS, AND THE LIKE.

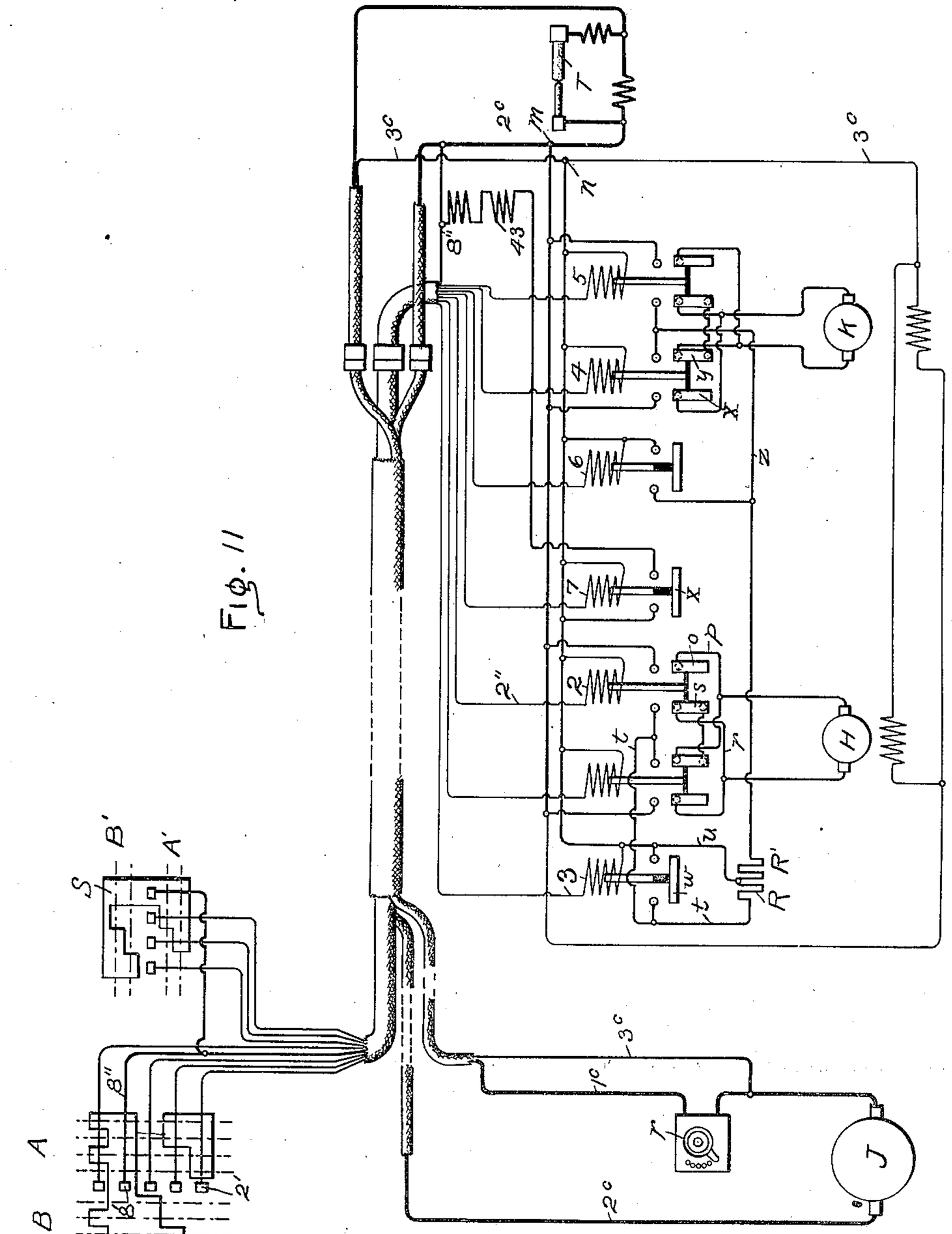
APPLICATION FILED AUG. 2, 1906.

953,139.

Patented Mar. 29, 1910.

5 SHEETS—SHEET 5.

Fig. 11



WITNESSES

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TRAINING MECHANISM FOR GUNS, PROJECTORS, AND THE LIKE.

953,139. Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed August 2, 1906. Serial No. 328,926.

To all whom it may concern:

Be it known that I, JOHN L. HALL, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Training Mechanism for Guns, Projectors, and the Like, of which the following is a specification.

This invention relates to means for training searchlight projectors, guns, and the like, and has for its object the provision of mechanism whereby the training in any direction and at varying speeds will be accomplished from a distant point and whereby the training may be instantly stopped when the desired position is reached.

In order that a searchlight or a gun may command the greatest possible territory and the range be unobstructed by buildings or other objects, these devices are often placed in a position distant from the point from which the objects in the path of the beam are to be viewed or from which the gun is to be operated. Because of the considerable distance oftentimes between the devices and the point of control, ordinary means of training cannot generally be used, and systems of control have, therefore, been devised by which electric motors located in the base of the gun or projector may accomplish the training and be controlled from the desired point.

It is important that the motors be so connected that they can be run at varying speeds, so that a slight movement can be made accurately and a greater movement made quickly, and, further, that means be provided for stopping the motors immediately when the desired position is reached. To accomplish these ends, I have provided electromagnetically-actuated switches controlled by the master controller from any desired point. These switches close the circuit through the armature of the motors in either direction through resistance, and also short-circuit the resistance. As the direction of the current through the fields of the motors remains the same, they can thus be made to rotate in either direction and at two speeds, depending on whether the resistance is or is not connected in the armature circuit.

In my previous patent, No. 739,599, many of the objects above referred to have been accomplished. It has been found, however, that while the arrangement of the circuits and gearing shown and described in said patent is perfectly operative, for certain purposes it is desirable that other means be provided. For instance, I have found that I may do away with the two rotary clutch magnets and substitute therefor a single stationary magnet. This arrangement eliminates one wire from the cable and also removes the objections of rotary contacts requiring slip rings and brushes. I have also provided a system of gearing in which a combination of positive and differential gearing is used to effect a considerable range of speed in a very efficient manner.

My invention, therefore, consists in the features of construction and in the arrangement and combination of elements hereinafter set forth and particularly pointed out in the claims annexed to and forming a part of this specification.

In the accompanying drawings, in which I have shown an embodiment of my invention as applied to a searchlight projector, Figure 1 is a sectional elevation of my projector turntable, the section being taken on the line 1—1 of Fig. 3: Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1; Fig. 3 is a plan view of the base with the turntable removed; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5 is a section taken on line 5—5 of Fig. 6; Fig. 6 is a section on the line 6—6 of Fig. 3; Fig. 7 is a front elevation of the complete projector provided with my improvement; Fig. 8 is a side view of the same; Fig. 9 is a section on the line 9—9 of Fig. 5; Fig. 10 is a detail of the yoke for shifting the turntable gear; Fig. 11 is a diagram of circuits; and Fig. 12 shows a detail of construction.

Referring to the drawings, 1 is the projector drum in which is an arc lamp of suitable construction. 2 represents the base of the projector provided on its upper face with a grooved projection 3 upon which the turntable 4 is adapted to rotate by means of antifriction rollers 5. At the center of the turntable is mounted an electric motor 6 having a vertical shaft 7 extending upward and geared to mechanism for training the projector in altitude. Inside of the base is an-

other electric motor 8 which is geared to the turntable so as to train the same in azimuth. The electromagnetically-operated switches 9, whereby the circuits of the motor are controlled, are likewise located in the base.

The mechanism whereby the vertical training of the projector is accomplished is as follows: Secured to the upper end of the motor shaft 7 is a worm 10 meshing with a worm wheel 11, secured to horizontal shaft 12 which has bearings in the motor casing 13 of the turntable. Loosely mounted on the shaft 12 is a beveled pinion 14 which has a hub adapted to clutch the hub of the gear 11 by means of the tongue 15. The opposite hub 16 of the pinion 14 is long and has a bearing at 17 in the motor casing. The outer end of the hub is provided with a knurled head 18, and within the hub is a coiled spring 19, one end of which is pressed against the hub at 20 and the other end against the collar 21 on the shaft 12, which latter at this point is reduced in size. By this arrangement the pinion 14 may be moved outward against the tension of the spring until the tongue 15 is out of engagement with the hub of wheel 11. This same movement throws the pinion out of engagement with gear 22 mounted on the inner end of shaft 23 which has a bearing in the motor casing and likewise in the projector arm at 24. The outer end of this shaft is provided with an operating handle 25, whereby the hand operation is accomplished. The gear 26 is splined to the inner end of the shaft and is adapted for longitudinal movement thereof. This gear meshes with the quadrant rack 27 on the projector body, so that as the gear 26 is rotated the projector is revolved to shift the beam of light in altitude. The rack 27 is provided at its ends with projections 27′ to prevent the gear 26 from running off the ends, and the gear 26 is spring-pressed by a spring 26′ into frictional engagement with the shaft so that it will slip if the strain becomes too great. When it is desired to operate this mechanism by means of the motor, the knurled head 18 is turned until the spring 19 forces the tongue 15 into engagement with the hub of worm wheel 11. The motor then drives through worm 10, worm wheel 11, pinion 14, gear 22, shaft 23 and gear 26 to rack 27. When it is desired to operate by hand, the gear 14 is withdrawn from engagement with gear 22 and is then turned so that tongue 15 rides on the end of the hub and holds it from engagement. By operating the handle 25 the projector can then be moved directly. In case it should be desirable to operate the projector more quickly and freely, the gear 26 may be shifted out of engagement with the rack 27, and the projector may then be moved in a vertical plane by simply grasping the barrel of the projector.

The mechanism whereby the training in azimuth, or the horizontal movement of the projector, is accomplished, is as follows: The shaft 28 of the motor 8 is provided with two worms, one of which, 29, is keyed to the shaft, and the other, 30, is loose, being mounted on a sleeve 31. This gear is clutched to the shaft by engagement at 32 of the teeth of a collar 33 secured to the shaft and the teeth of the hub 34, which slides on the sleeve 31 and is pressed into engagement with the collar 33 by means of the spring 35 and is caused to turn with the worm by means of the pins 36 entering slots 37. The hub is moved by means of a cap 38 engaging a shoulder 39, and the cap is moved inward by means of the arm 40 secured to rock shaft 41, which is rocked by armature 42 under the control of magnet 43. It will be seen that when the magnet 43 is energized and the armature 42 attracted, shaft 41 will be rocked to force the cap 38 inward, disengaging the teeth at 32 and unclutching the worm 30. This worm 30 engages with a worm wheel 44 secured to stub shaft 45, to which shaft is also secured a gear 46. The fixed worm 29 engages with worm 47 on shaft 48. Loosely mounted on shaft 48 is a gear 49 provided with clutch jaws 49′, and secured to the end of the shaft is a clutch member 50 similarly provided with jaws 50′. Slidably mounted between the member 50 and the worm 49 is a gear 51 which engages with the teeth 52 on the turntable to rotate the same. This wheel has clutch jaws at opposite ends and is adapted to be moved so as to clutch with either member 50, which is keyed to the shaft, or worm gear 49, which is loose thereon. The shifting of this gear is accomplished by means of a shaft 53, slidably mounted in sleeve 54 and provided at its outer end with a knurled head 55 having teeth engaging corresponding slots of different depths in the sleeve, so that the shaft may be moved back and forth to occupy three positions. In Fig. 4 it occupies the middle position and the jaws of the gear 51 are not in engagement with the jaws of either of the other members. If the shaft is pulled outward, the gear 51 is shifted by means of the yoke 56 so as to clutch with the member 50, and the gear will thereupon turn with the shaft 48. In case the jaws of the two parts of the clutch are not in proper alinement, the spring 57, which is placed under tension by the movement of the shaft, will cause the gear to shift and engagement to take place as soon as the proper position is reached. If the knurled head 55 is turned so as to allow shaft 53 to move backward in response to the tension of the spring 58, the gear 51 will be shifted until it clutches with the jaws 49′ on the worm gear 49. In case the jaws are not in alinement the spring 58 will keep the gear

pressed over until engagement can take place.

The construction of the yoke 56 is shown in Fig. 10 and consists of two parts pressed together by the spring 57, the yoke 56 engaging the slot in the hub of the gear 51 while the other portion 59 engages a slot in the collar 60 secured to shaft 53. The hubs of the two portions are provided with shoulders, as shown at 61, so as to permit a limited movement between the two. At the outer end of the sleeve 54 is an operating handle 62, for turning the projector by hand. Between the motor and the operating gear 51 there is interposed a train of gears whereby the speed may be quickly changed through a wide range. The faster speed is accomplished by means of positive gearing, while the slower speed is brought about by interposing a differential train of gearing. Secured to the lower end of the shaft 48, which drives the turntable gear 51, is a gear 63 which meshes with gear 64 secured to a stub shaft 65 journaled in the rim of a gear 66 loosely mounted on the shaft 48. The stub shaft 65 projects through gear 66 and has secured to its opposite end a gear 67 meshing with gear 68, to the hub of which the worm wheel 47 is secured. This worm wheel is driven by the worm 29 on the motor shaft, and, as the motor revolves, shaft 48 is driven through worm 29, worm wheel 47, gear 68, gear 67, gear 64 and gear 63. Similar gears 70 and 71 are mounted in the stub shaft 72 on the opposite side of gear 66 to equalize the strain. Gear 66 meshes with gear 46, which is driven through shaft 45 and worm wheel 44 from worm 30. When the faster speed is desired, the worm 30 does not rotate with the motor shaft, but the driving takes place through the positive gearing, as above described. When, however, a slower speed is required, worm 30 is clutched to the shaft by the deënergizing of magnet 43. The worm 30 thereupon drives worm gear 44, shaft 45 and gear 46. Gear 66 is therefore driven by gear 46 and is driven in the opposite direction to that in which the shaft 48 is rotated by the gear 63. A differential speed is thereby attained, which may be very much less than that attained by the positive gearing.

The operation of the mechanism above described for the horizontal movement of the turntable will now be understood from the above description. When it is desired that the turntable shall run free, the parts are left in the position shown in Fig. 4 and the projector may then be moved by grasping the barrel of the projector. When it is desired to drive by hand, the head 55 is turned until the spring 58 forces the gear 51 through yoke 56 into clutching engagement with worm wheel 49. The driving then takes place through hand wheel 62, worm 73 on sleeve 54, worm wheel 49, gear 51, to teeth 52 of the turntable. When it is desired to operate by means of the motor, the head 55 is drawn out until gear 51 clutches with clutch member 50, thereby clutching the gear 51 to the shaft. Driving then takes place from the worm 29, through worm 47, gears 68, 67, 64 and 63, to the shaft 48 and gear 51. When the magnet 43 is deënergized, worm 30 is driven, thereby causing a differential movement by driving the gear 66 backward.

The arrangement of circuits whereby the motors and the change of gearing are controlled will now be described.

Referring to Fig. 11, P represents the plate of the controller for horizontal shifting and S the controller plate for vertical shifting, the two operations being performed by a single handle. J represents the generator from which current is led to the projector lamp T, through rheostat r, wire 1^c, returning over wire 2^c. From the positive side of the generator, wire 3^c is run to the fields of the motors H and K, the former being for horizontal training and the latter for vertical training, the wire 3^c returning to junction point m with wire 2^c, thence back to generator. From the junction point n in wire 3^c current is led through the various switches in the base of the projector. When the handle of the master controller P is turned into the first position in direction B, the circuit of electromagnetic switch 2 is closed as follows: from the controller plate to stud 2′, thence through wire 2″ to magnet 2, thence back to junction n, wire 3^c, through the generator, wire 2^c and conductor 8″, back to the controller plate at stud 8′. Magnet 2 being energized and attracting its armature, establishes a circuit from wire 2^c, which is one side of the line, across the bridging contact o, thence through wire p, motor H, wire r, across contactor s, which is now raised, thence through wire t, section R of the resistance and wire u, back to the other side of the line at n. The circuit is thus completed through the armature and resistance R, giving a slow speed to the motor. When the controller handle is moved to the second position, magnet 2 will remain energized and magnet 3 will also be energized, the latter attracting its armature w so as to short-circuit the resistance R, whereupon the motor will run at a faster speed. When the controller handle is moved to the third position, magnet 3 will be deënergized and magnet 7 will be energized, the latter attracting its armature x so as to close a circuit through the magnet 43. This magnet being energized, throws out the differential portion of the gearing, thereby increasing the speed of training. When the controller arm is turned to the fourth and last position, magnets 2, 3 and

7 are all energized, the magnet 3 short-circuiting the resistance R, so as to give the motor its fastest speed together with the fastest arrangement of gearing. It will thus be seen that four speeds are obtained, two with the resistance out of circuit and two with the resistance in circuit. If the controller handle is turned in the direction A, the conditions will be reversed. The arrangements for the training in altitude are similarly effected through the controller plate S. When the controller handle is turned on to the first of the studs in the direction B′, the circuit of magnet 4 is completed, which, attracting its armature, completes the circuit from the junction *m*, across the contactor *x*, through the motor armature K, across contactor *y*, to wire *z*, thence through section R′ of the resistance back through wire *u* to junction *n*. The circuit is thus completed through the motor and the resistance for vertical training. By making contact with the next of the studs, the circuit of magnet 6 will be closed, which, upon attracting its armature, short-circuits the resistance R′; thus speeding up the motor. When the controller is reversed to direction A, magnet 5 will first be energized and then magnet 6, thereby passing a current through the armature K in the opposite direction, first with the resistance R in circuit and then with the resistance short-circuited, thereby obtaining two speeds of vertical control in either direction.

It will be understood that the controller handle may be shifted diagonally, making the desired connections through both motors and training both in altitude and azimuth simultaneously.

While I have described my invention with particular relation to the training of projectors, it should be understood, of course, that it is applicable to other fields of usefulness, as, for instance, in the training of guns and the like. Various modifications may, moreover, be made in the arrangement of apparatus above described, all of which will come within the spirit of my invention in so far as they are within the scope of the claims annexed hereto.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a training mechanism, the combination with a turn table, of an electric motor, a controller for said motor, positive gearing between the motor and the turn table and connections whereby the gearing may be changed from positive to differential gearing by movement of said controller.

2. In a training mechanism, the combination with a turn table, of an electric motor and a resistance therefor, positive gearing between the motor and the turn table, a controller and connections whereby the gearing may be changed from positive to differential gearing and the resistance varied by said controller.

3. In a training mechanism, the combination with a turn table, having a projector mounted thereon, of an electric motor geared to said turn table, a motor geared to said projector, a controller for said motors, and connections whereby the gearing between the motor and the turn table may be varied by movement of said controller.

4. In a training mechanism, the combination with a turn table, having a projector mounted thereon, of an electric motor geared to said turn table, a motor geared to said projector, a controller for said motors, positive gearing between the motor and the turn table, and connections whereby the positive gearing may be changed to differential gearing by movement of the controller.

5. In a training mechanism, the combination with a turn table, of an electric motor, a controller for said motor, fixed gearing between said motor and said turn table, loose gearing between said motor and said fixed gearing arranged to act differentially and connections whereby said train of loose gearing may be thrown into and out of operation by movement of said controller.

6. In a training mechanism, the combination with a turn table, of an electric motor, a controller for said motor, positive gearing between the motor and turn table, an electromagnetic device arranged to change said gearing from positive to differential gearing, and connections whereby the said electromagnetic device may be controlled by the movement of said controller.

7. In a training mechanism, the combination with a turn table having a projector mounted thereon, of an electric motor geared to said turn table, a motor geared to said projector, a controller for said motors, an electromagnetic device arranged to vary the gearing between the motor and the turn table and connections whereby said electromagnetic device may be varied by movement of said controller.

8. In a training mechanism, the combination with a turn table having a projector mounted thereon, of an electric motor connected by positive gearing to said turn table, a motor geared to said projector, a controller for said motors, an electromagnetic device arranged to change the gearing between the motor and turn table from positive to differential gearing and connections whereby said electromagnetic device may be controlled by movement of said controller.

In witness whereof, I have hereunto set may hand this first day of August, 1906.

JOHN L. HALL.

Witnesses:
BENJAMIN B. HULL,
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