

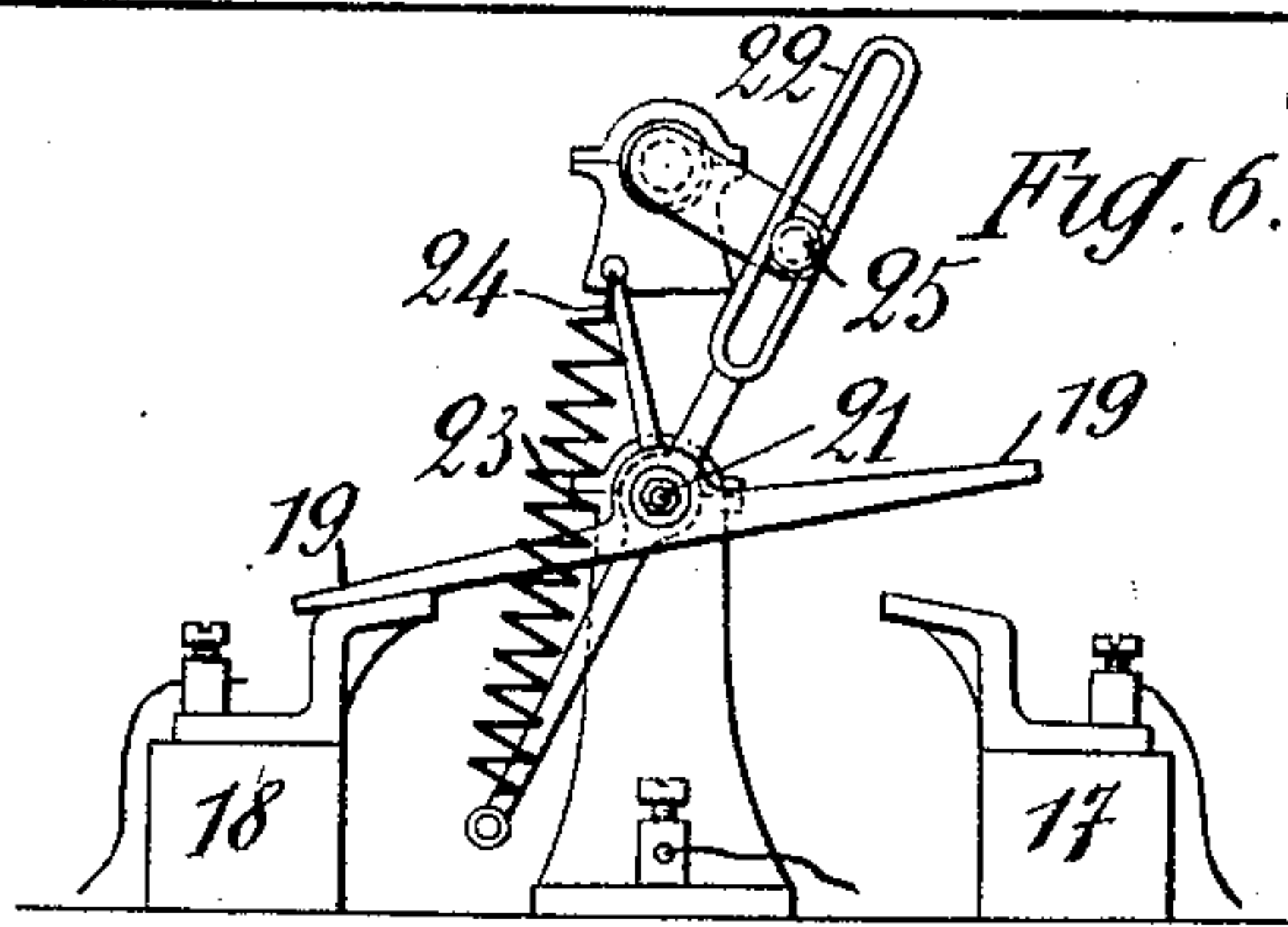
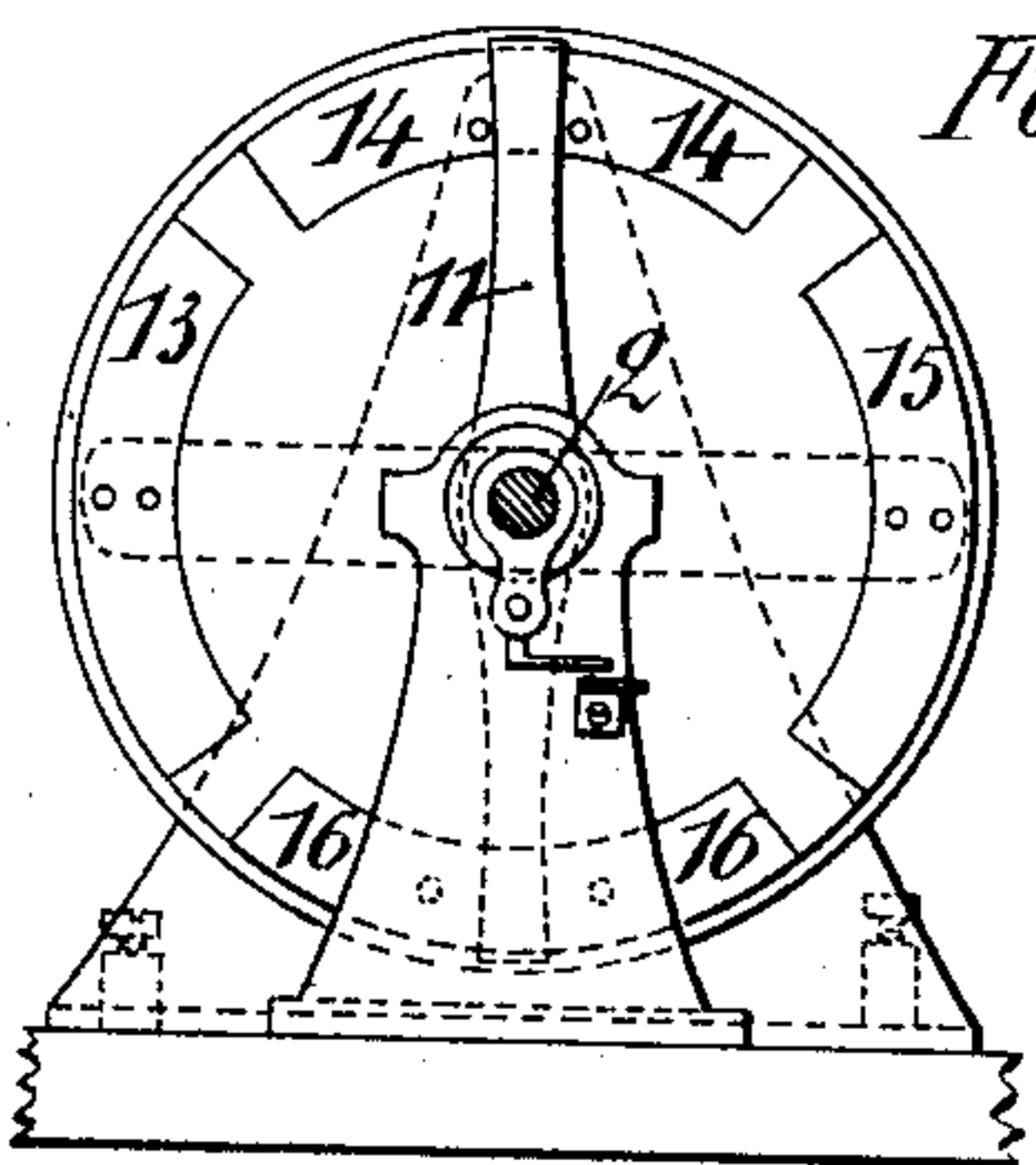
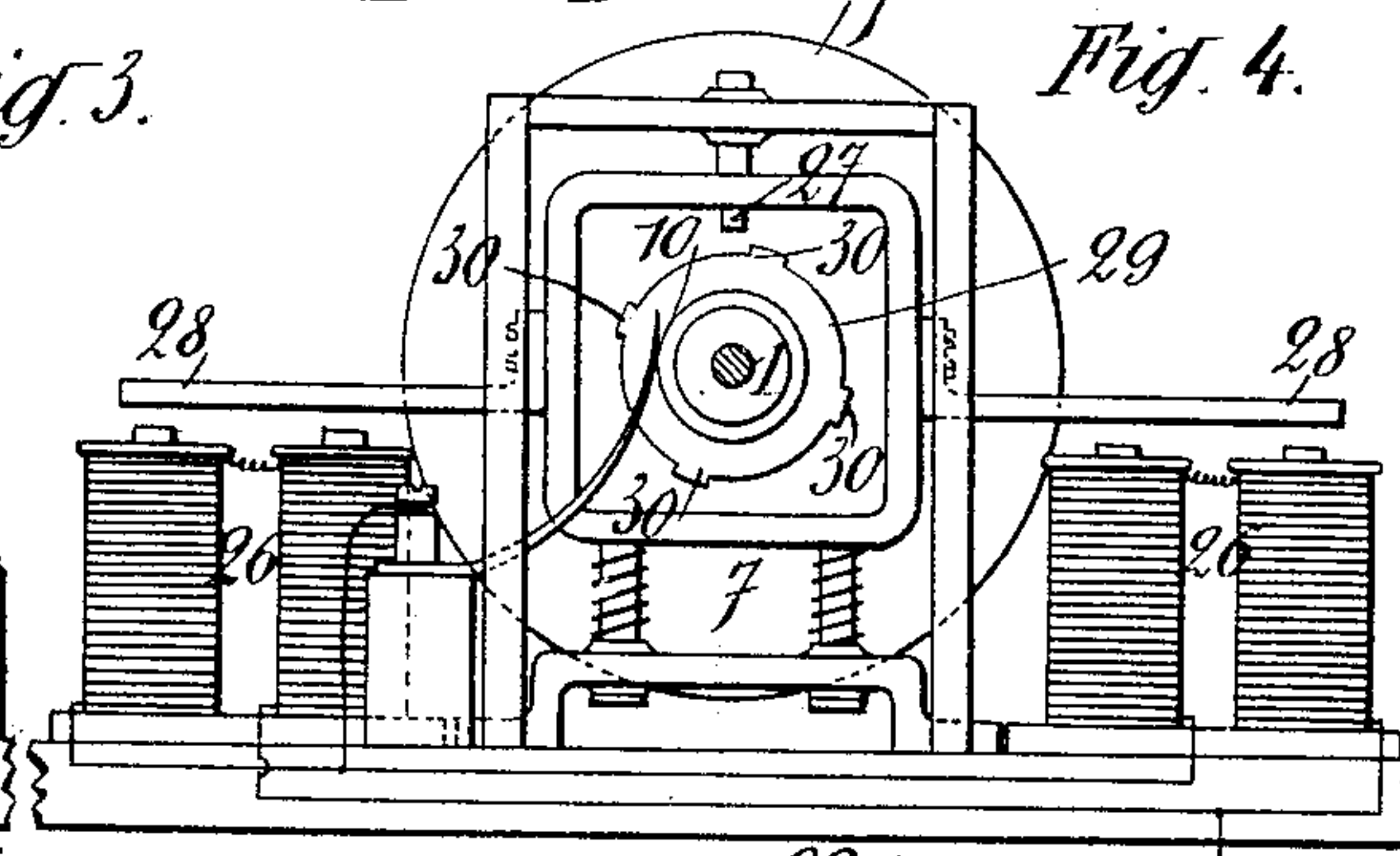
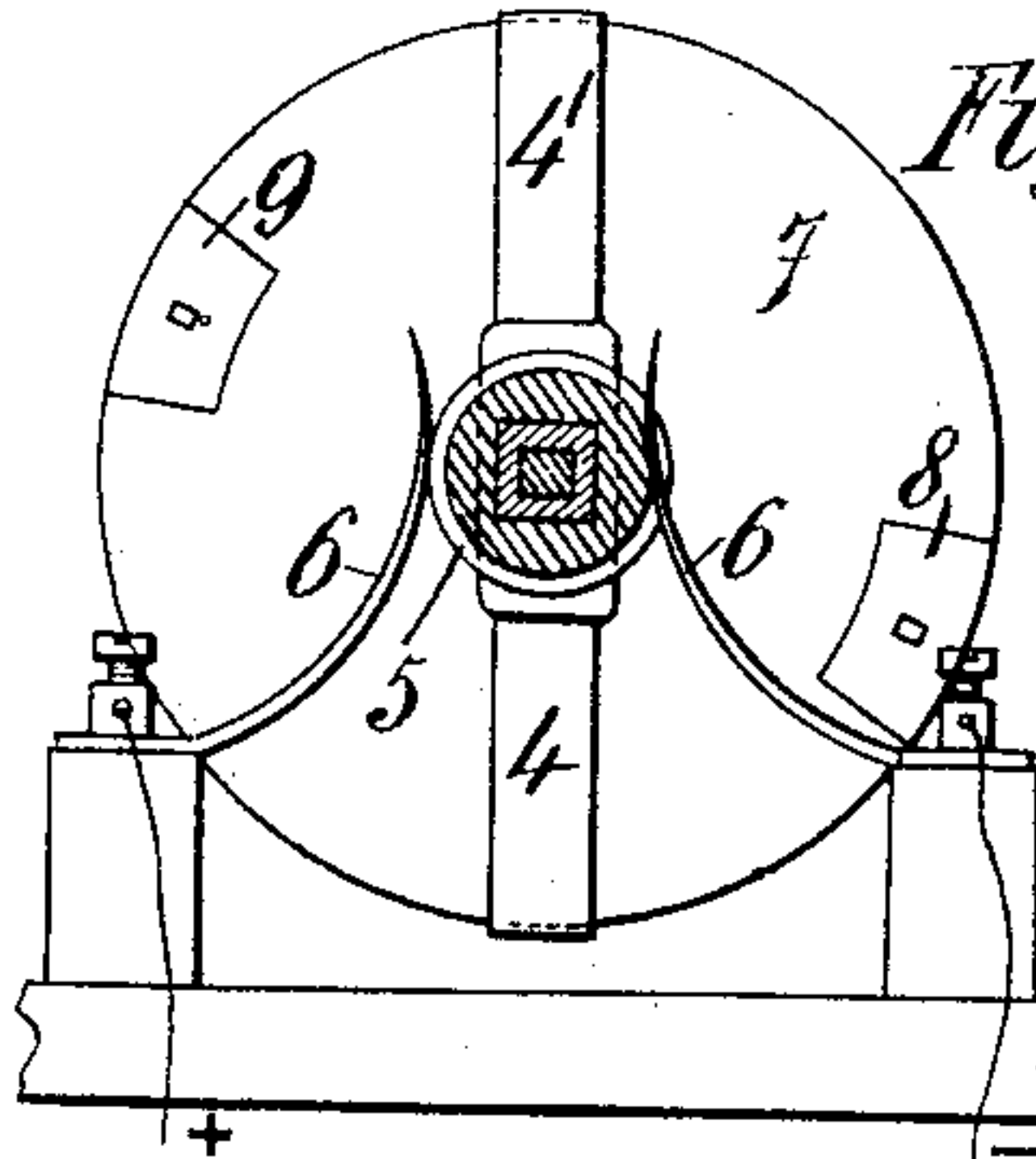
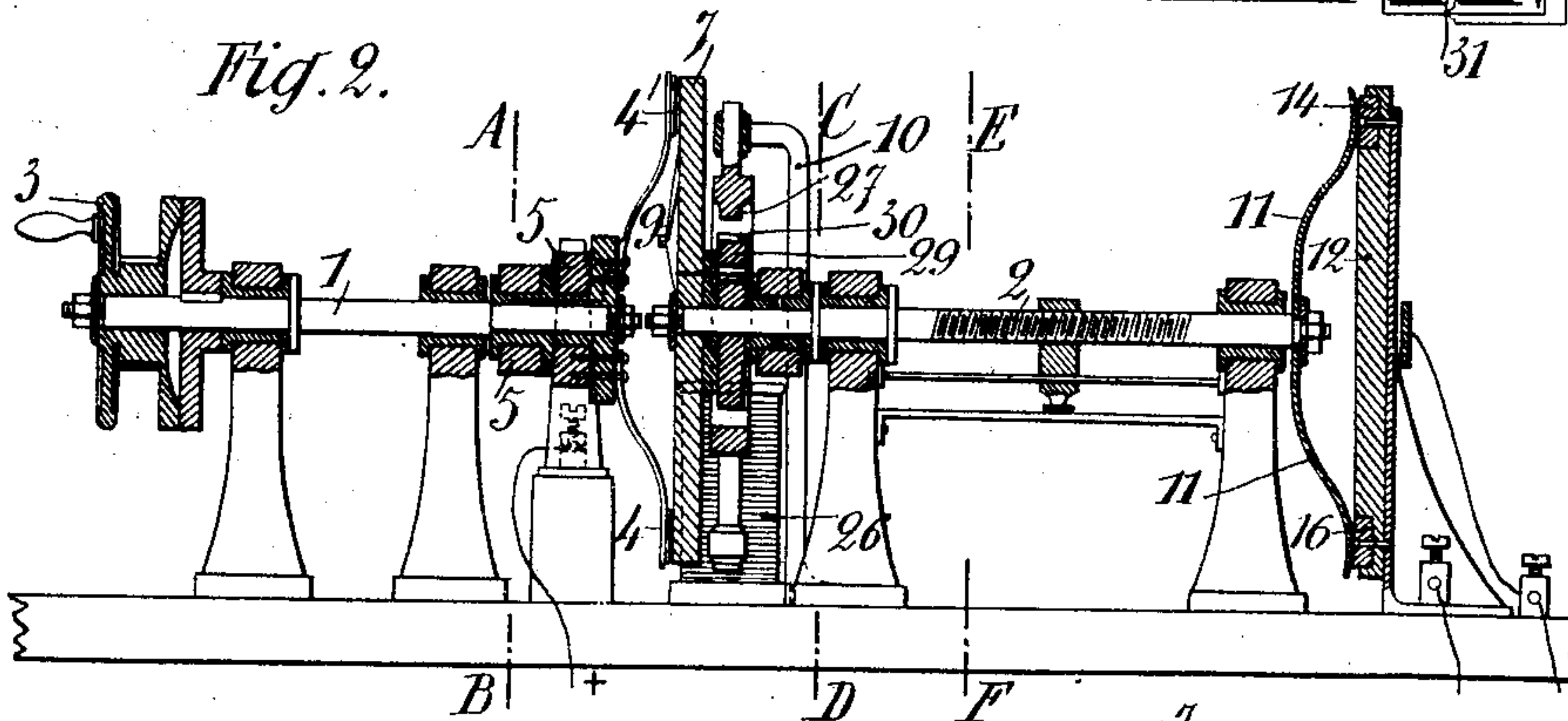
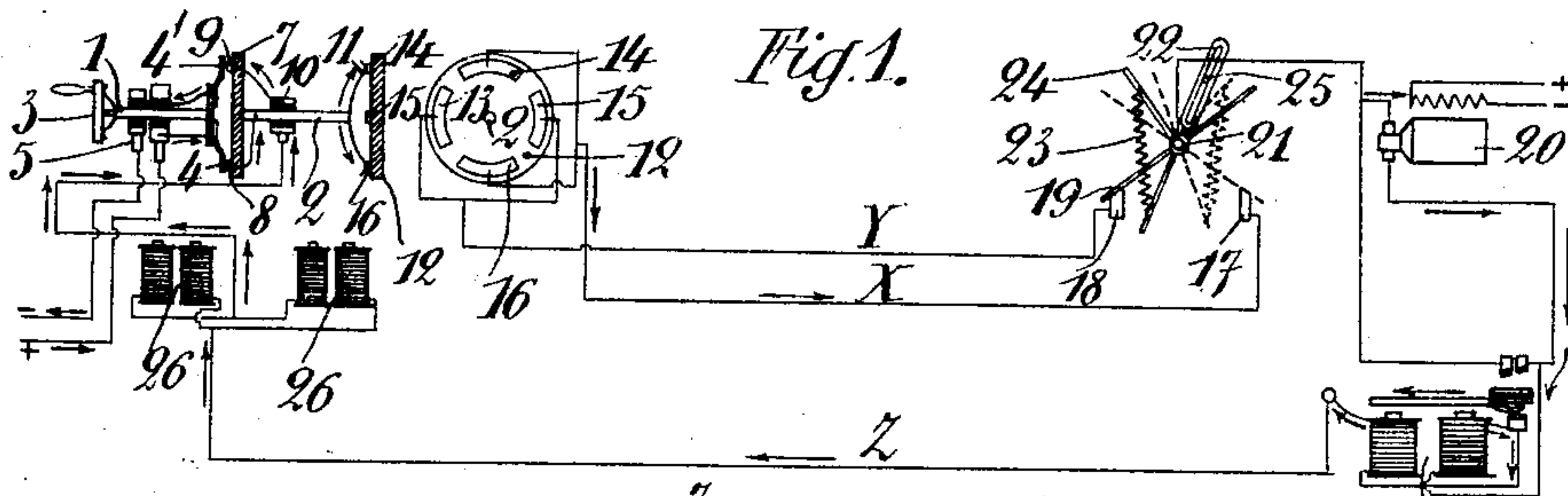
No. 686,942.

Patented Nov. 19, 1901.

P. M. LE HEGARAT.
ELECTRIC SERVOMOTOR.

(Application filed Mar. 12, 1901.)

(No Model.)



WITNESSES:

P. W. Wright
S. C. Connor

INVENTOR

PIERRE MARIE LE HEGARAT

BY

Howson and Howson
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

PIERRE MARIE LE HEGARAT, OF PARIS, FRANCE.

ELECTRIC SERVOMOTOR.

SPECIFICATION forming part of Letters Patent No. 686,942, dated November 19, 1901.

Application filed March 12, 1901. Serial No. 50,894. (No model.)

To all whom it may concern:

Be it known that I, PIERRE MARIE LE HEGARAT, torpedo quartermaster of the *Ban-din*, French Northern Squadron, (whose post-office address is care of 21 Boulevard Poissonniere, Paris, France,) have invented a new and useful Electric Servomotor, of which the following is a specification.

By the term "electric servomotor" I mean a device whereby an electric motor may be controlled from a distance in a certain and positive manner. The apparatus, combined with a motor, may be used for operating steering-gear, windlasses, search-lights, lifts or hoists, artillery-turrets, or kindred apparatus.

In the accompanying drawings, Figure 1 is a diagrammatic view showing the circuits and the schematic arrangement of the apparatus. Fig. 2 is a longitudinal section of the controlling mechanism. Fig. 3 is an elevation perpendicular to the shaft of the control and upon line A B of Fig. 2. Fig. 4 is a similar view on line C D of Fig. 2. Fig. 5 is a similar view on line E F of Fig. 2. Fig. 6 is a view of an essential part of my arrangement shown separately.

The coupling-up (or rendering interdependent) of the electric motor direct to a hand controlling device is effected in such a manner that if this motor revolves at greater speed than the control its current is cut off automatically, and it is put in short circuit until its advance (or lead) has been overtaken by the control. The motor then commences to work afresh. If, on the other hand, the motor lags behind the control, the latter is blocked and put into such a state that it cannot be actuated until it has lost the advance which it had gained upon the motor.

A control-shaft 1 2 is rotated by a hand-wheel 3, this shaft being formed in two separate portions 1 and 2, of which 1 carries two rubbing or spring contacts 4 4', which by means of two rings 5 5 and two brushes or spring-arms 6 6 remain in permanent communication with the poles of the source of electricity. The other portion 2 of the shaft is fitted with a plate or disk 7, of insulating material, upon which are fixed two blocks or contacts 8 9 in communication with the brushes of the motor by means of a ring and brush 10, in the first place, and, in the second place, by

means of the shaft 2. A certain amount of angular play is provided between the two portions, so that the shaft 1, furnished with the rubbing contacts 4 4', rotates to some small extent before carrying along the shaft 2, carrying the aforesaid blocks 8 9. It will be readily seen that according to the direction in which the hand-wheel is turned so will the plus contact-piece 4 be connected either with the block 9 and the brush 10 or with the block 8 and the shaft 2, the other negative contact-piece 4' being connected to the opposite block 8 or 9, as the case may be. It is obvious that this will constitute a pole-changer, with the peculiarity that the contact-arms and the contacts are all movable around an axis, maintaining the polarity of the contacts until the direction of the hand-wheel is changed. At the other end of the shaft 2 is placed a two-way commutator. This consists of a strip or spring-arm 11, carried by the said shaft 2. This strip moves in front of a fixed plate 12, carrying four blocks or contacts 13 14 15 16. The contacts diametrically opposite are connected two and two. From these pairs of contacts there proceed the conductors X Y, connected with two other contacts 17 and 18, situated upon the receiving-post near the motor to be coupled up. A bascule-lever 19 communicates permanently with one of the motor-brushes. It can assume two positions of rest, in which it comes into contact with one or the other of the two blocks 17 or 18. This lever is connected mechanically and in precisely similar fashion to the movements of the motor 20. It can assume two positions of rest. In each of its positions it makes contact, as stated, with one or the other of the two contacts 17 and 18. It is pivoted upon an axis, as well as another lever 22, furnished with a slot or slide. A spring 23 connects one of the extremities of the slotted lever 22 to an arm integral with the lever 19 and arranged approximately perpendicular thereto. The object of this spring is as soon as the lever 19 has left one of its positions to bring it sharply to the opposite position without allowing it to assume any intermediate position. This lever 19 thus abruptly changes position each time a predetermined number of revolutions has been effected.

The lever 19 is connected to its respective motor by means of a crank, of which the pin 25 engages the slot 22 and which is controlled from the motor by means of a train of suitable gear-wheels. Under these conditions the bascule-lever 19 oscillates periodically upon its axis, setting up contact with either the contact 17 or the contact 18. This lever is connected to the motor, as stated, so as to oscillate periodically each time the motor has made a certain number of revolutions. The motor is thus in relation at one of its brushes sometimes with the conductor X and sometimes with the conductor Y; but this brush will be in relation with the source of electricity only if the contacts 13 14 15 16 of the bascule-lever and of the two-way commutator are in agreement upon the same conductor X or Y.

The motor is connected at its second brush with a third conductor Z, which returns to the source by the reversing-commutator. An electromagnet wound with thick wire is arranged in series upon the conductor Z, a push or catch 27, carried by its armature 28, bearing upon a toothed disk 29 for so long as the current passes through the electromagnet and the motor. This disk 29, keyed upon the control-shaft, consists of a disk furnished with spurs or projections 30, which meet the catch 27 when the aforesaid armature is attracted. These spurs 30 are in number equal to that of the contacts 13 14 15 16 of the commutator—namely, four. When one of these spurs strikes against the catch or push-piece 27, the control is blocked and put into such a state that it cannot be worked. A relay 31 is placed in the circuit near the motor. Its armature serves to make contact with two terminals to short-circuit the motor when there is no current passing through the wire *z* and to break the short circuit when current is passing. It is obvious that short-circuiting a revolving-motor armature will have a braking effect upon it.

The working of this mechanism is as follows: If the hand-wheel 3 be rotated, the current starts from one of the poles of the source, passes into the reversing-commutator 4' 4, &c., proceeds to the movable strip or spring-arm 11 of the two-way commutator to one of the pairs of fixed contacts 13 14 15 16, passes into one of the conductors—X, for example—and following the circuit reaches the bascule-lever, which may be supposed in contact with the conductor X, contact 17, then to the motor, which commences to work, the relay 31 having broken the short circuit. The circuit continues by way of the conductor Z and the blocking-electromagnet 26, the reversing-commutator, and returns to the second pole of the source. The armature of the electromagnet 26 is attracted, and its catch 27 comes into contact with the toothed disk 29, which it will render immovable when one of the spurs 30 meets the projection 27. Two things may then happen: First, the motor by rea-

son of the regular working above described effects the change of contacts at the bascule-lever 19 before the catch 27 has met a spur 30. In this case, the contacts being not in agreement, the current is broken at the lever 19 and the motor stops; but the control continuing to turn again sets up an agreement between the contacts upon the conductor Y, the motor commences to work again, and the same phenomena are produced for so long as the control is acted upon. Second, the control revolves at a speed higher than that of the motor. One of the spurs then abuts against the catch 27, and the control is blocked until it has lost its advance upon the motor. As soon as this has caused the periodical oscillation of the lever 19 the catch 27 is lifted up, the blocking-electromagnet 26 ceases to be excited, and the movable spring-arm 11 of the two-way commutator is able to pass on to another block or contact in order to cause agreement between the contacts upon the conductor Y. It will be remarked that the spurs are placed in such a manner as to cause the blocking a little before the movable spring-arm 11 of the two-way commutator changes its position. Thus by either the stoppage of the motor or the blocking of the control the motor coupled up and the coupling control are caused to perform periods of constant amplitude in equal times. These periods are in practice a quarter of a turn for the control and for the motor the number of revolutions taking place between two oscillations of the lever. The coupling is thus obtained.

It will be remarked that the breakages of the current never take place upon the commutator 11, but always upon the lever or oscillator 19 and which in the first place changes contacts and of which the movements are fairly rapid in order to avoid the formation of a voltaic arc.

The hand-wheel 3 is mounted frictionally upon the shaft of the control, so that this latter being blocked the hand-wheel can continue to be turned, and the hand of the operator constantly exercising a rotatory movement the shaft immediately begins to work as soon as the blocking ceases.

Displacement-indicators of any known arrangement are provided upon the motor and upon the control-shaft. Their indications when in agreement enable the operator to stop the motor at a predetermined position, and it is sufficient for him to cease to act upon the hand-wheel when the pointer is at the desired graduation.

My method of three-wire coupling-up of an electric motor directly to a hand-control can be applied in every case in which the use of servomotor apparatus may be useful, such as operating steering-gear, windlasses, lifts or hoists, maneuvering artillery-turrets, &c.

I claim as my invention—

1. The combination with an electric motor and a switch in circuit therewith, of a disk carrying a number of contacts, wires con-

necting the contacts with the switch, means for connecting certain of said contacts with a source of current-supply and a locking means adapted to prevent the change of connections to certain other such contacts when the motor is receiving current, but permitting such change when the motor is not receiving current, as and for the purpose set forth.

2. The combination with an electric motor and a switch in circuit therewith, of a disk carrying contacts, wires connecting said contacts with the switch and means for connecting certain of such contacts with the switch and with a source of current-supply, an electrically-operated locking means in circuit with the switch and adapted to prevent the change of connection between the source of supply and certain other contacts on the disk when the current is passing through the motor, substantially as and for the purpose set forth.

3. The combination with an electric motor and a switch in circuit therewith, of a disk carrying contacts, wires connecting said contacts with the switch, a shaft carrying a contact-arm adapted to make contact with certain of said contacts of the disk at one time, a locking device adapted to lock the shaft to prevent the removal of the arm from one set of contacts to another when the motor is receiving current, substantially as described.

4. The combination with an electric motor and a switch in circuit therewith of a disk carrying contacts, connections between the switch and contacts, a shaft carrying a contact-arm, an electrically-operated locking device adapted to limit the movement of the shaft when current is passing but not at other times and a pole-changer and hand-wheel, substantially as described.

5. The herein-described servomotor consisting of a switch operated by the motor to be controlled, said switch having more than one contact and adapted to change contacts upon a certain number of revolutions of the motor-shaft, a disk, a plurality of contacts thereon, wires between each switch-contact and certain disk-contacts, means for supplying current to certain of said disk-contacts and a locking device to prevent the change of current from said certain contacts to others when the motor is receiving current.

6. The herein-described servomotor consisting of a switch operated by the motor to be controlled, said switch having more than one contact and adapted to change contacts upon a certain number of revolutions of the

motor-shaft, a disk, a plurality of contacts thereon, wires between each switch-contact and certain disk-contacts, a shaft, a contact-arm thereon adapted to make contact with certain of the disk-contacts at one time, an electrically-operated locking device, to prevent the change of such contact when the motor is receiving current but not at other times, substantially as described.

7. The herein-described servomotor consisting of a switch operated by the motor to be controlled, said switch having more than one contact and adapted to change contacts upon a certain number of revolutions of the motor-shaft, a disk, a plurality of contacts thereon, wires between each switch-contact and certain disk-contacts, a shaft, a contact-arm thereon and a locking device electrically operated by the current passing through the motor-circuit adapted to limit the movement of the shaft when energized but not at other times, a pole-changer and hand-wheel, substantially as described.

8. A servomotor apparatus, comprising a switch, two contacts therefor, a conductor for each contact, a disk carrying two sets of contacts, each set connected to one switch-contact, a shaft, a contact-arm adapted to make contact with the disk-contacts, an electric locking device to limit the movement of the shaft at given times, and electrical connections to the contact-arm to the switch through the motor to the locking device and to the source of supply, substantially as described.

9. A servomotor apparatus, comprising a switch, two contacts therefor, a conductor for each contact, a disk carrying two sets of contacts, each set connected to one switch-contact, a shaft, a contact-arm adapted to make contact with the disk-contacts, an electric locking device to limit the movement of the shaft at given times, a pole-changer disk on said shaft, a contact-arm for said pole-changer on a second shaft and a hand-wheel for said shaft, a source of current-supply and connections between the pole-changer and the disk carrying the contacts, the switch, the motor and the locking device, substantially as described.

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

PIERRE MARIE LE HEGARAT.

Witnesses:

COURTNIS,
A. BARZINE.