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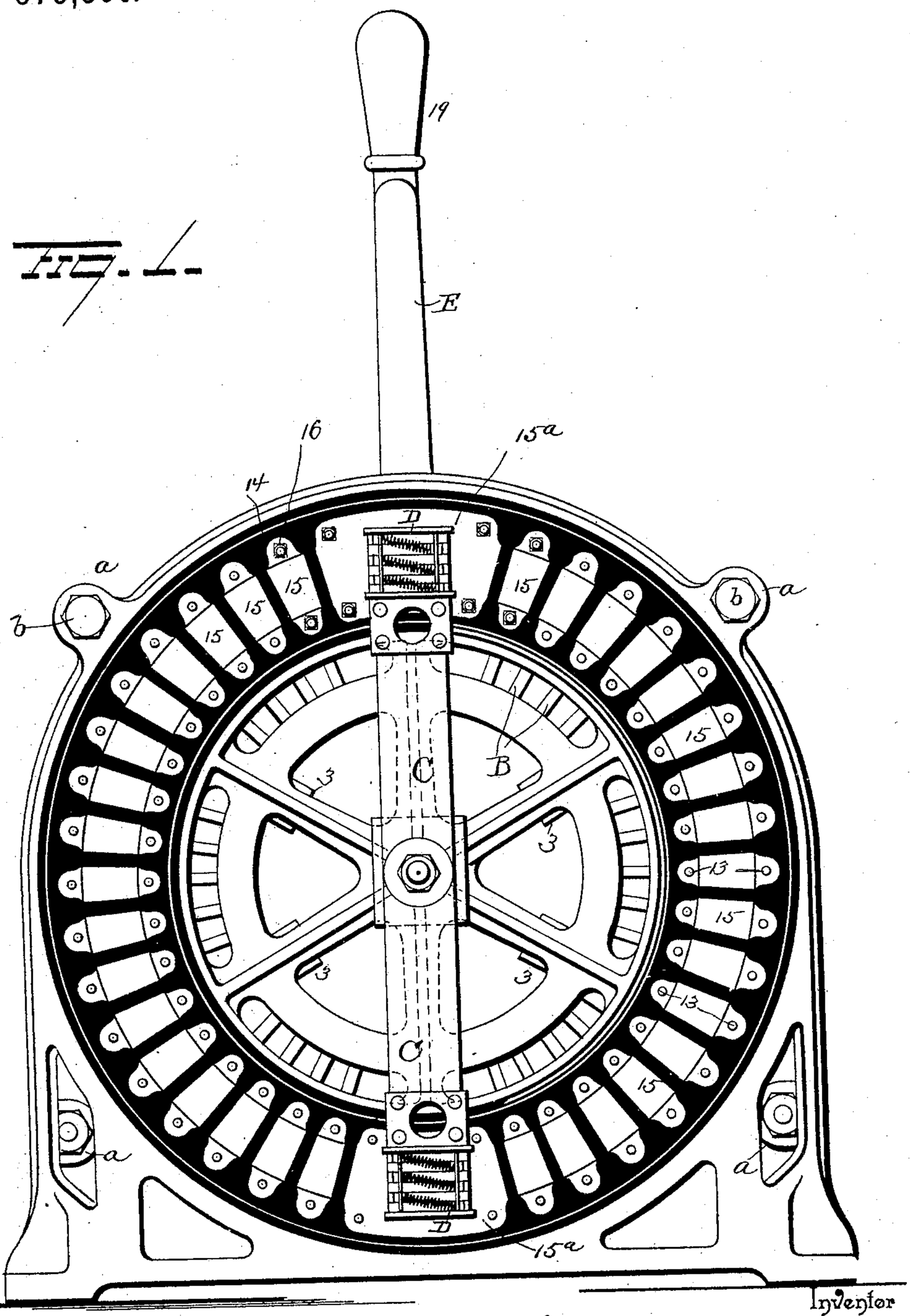
W. H. MORGAN.

ELECTRICAL CONTROLLER.

No. 575,366. Patented Jan. 19, 1897.

FIG. 1.



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(No Model.) 7 Sheets—Sheet 2.

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Fig. 2.

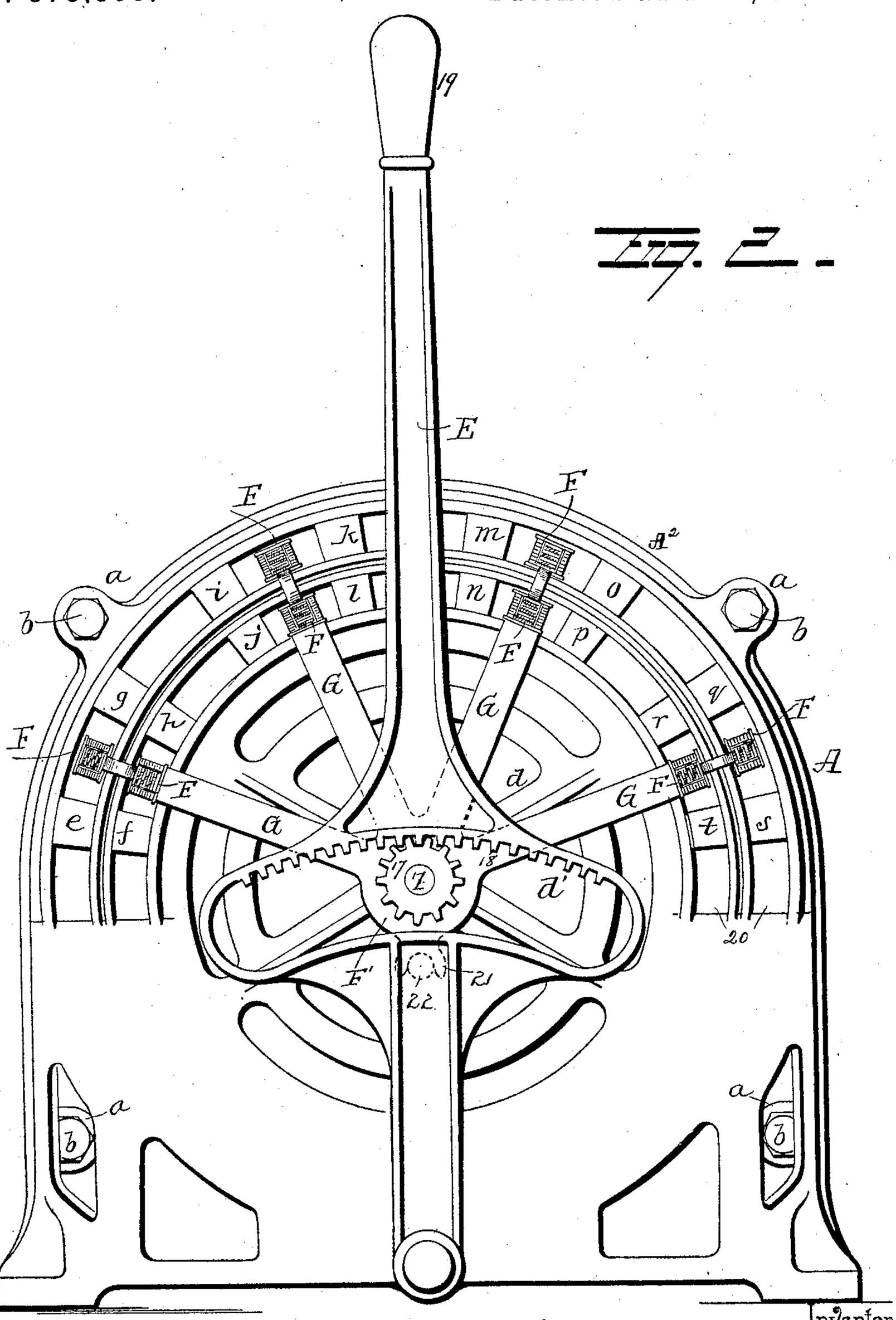

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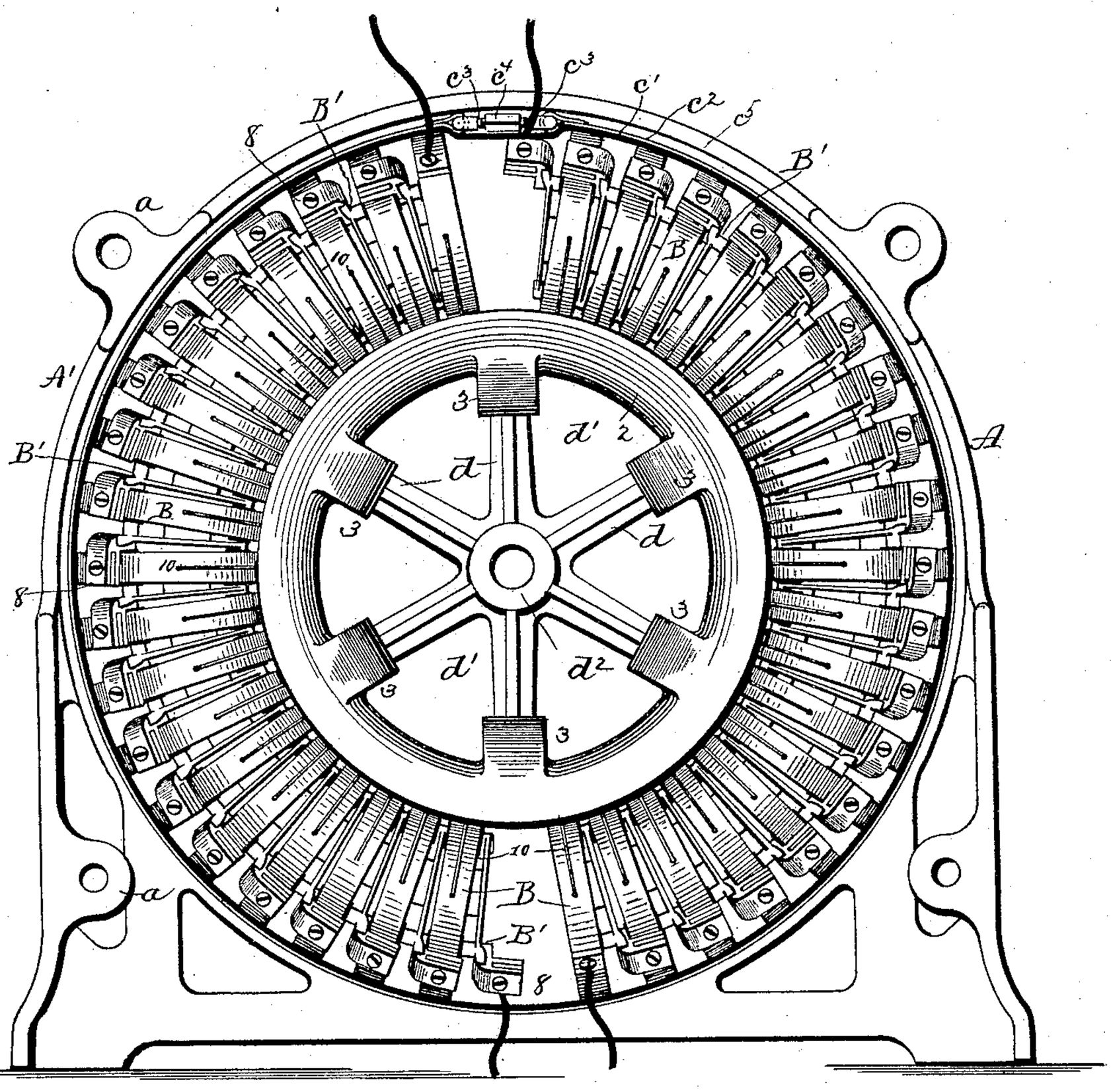
Fig. 3.



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(No Model.) 7 Sheets—Sheet 4.

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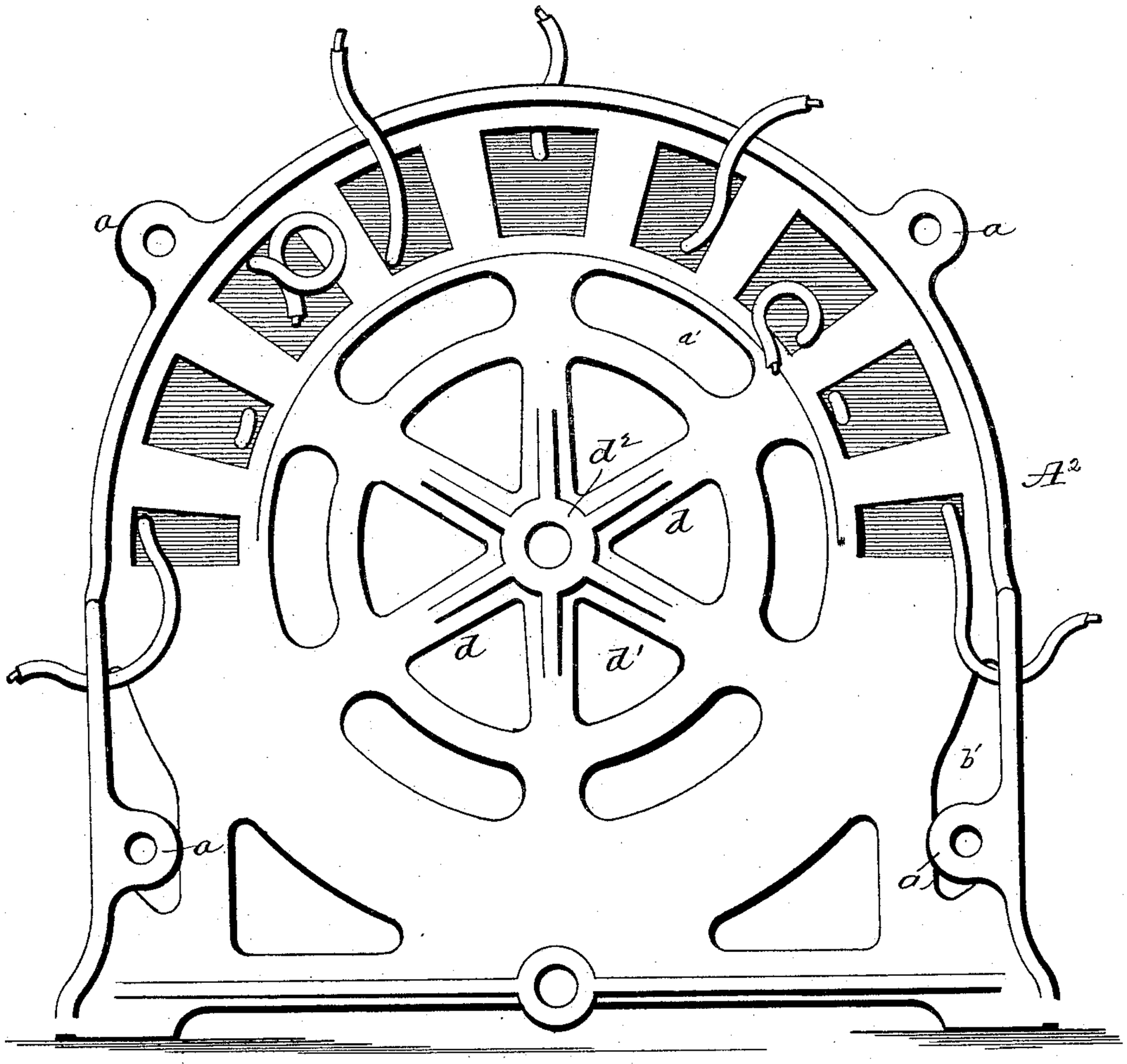
Fig. 4.



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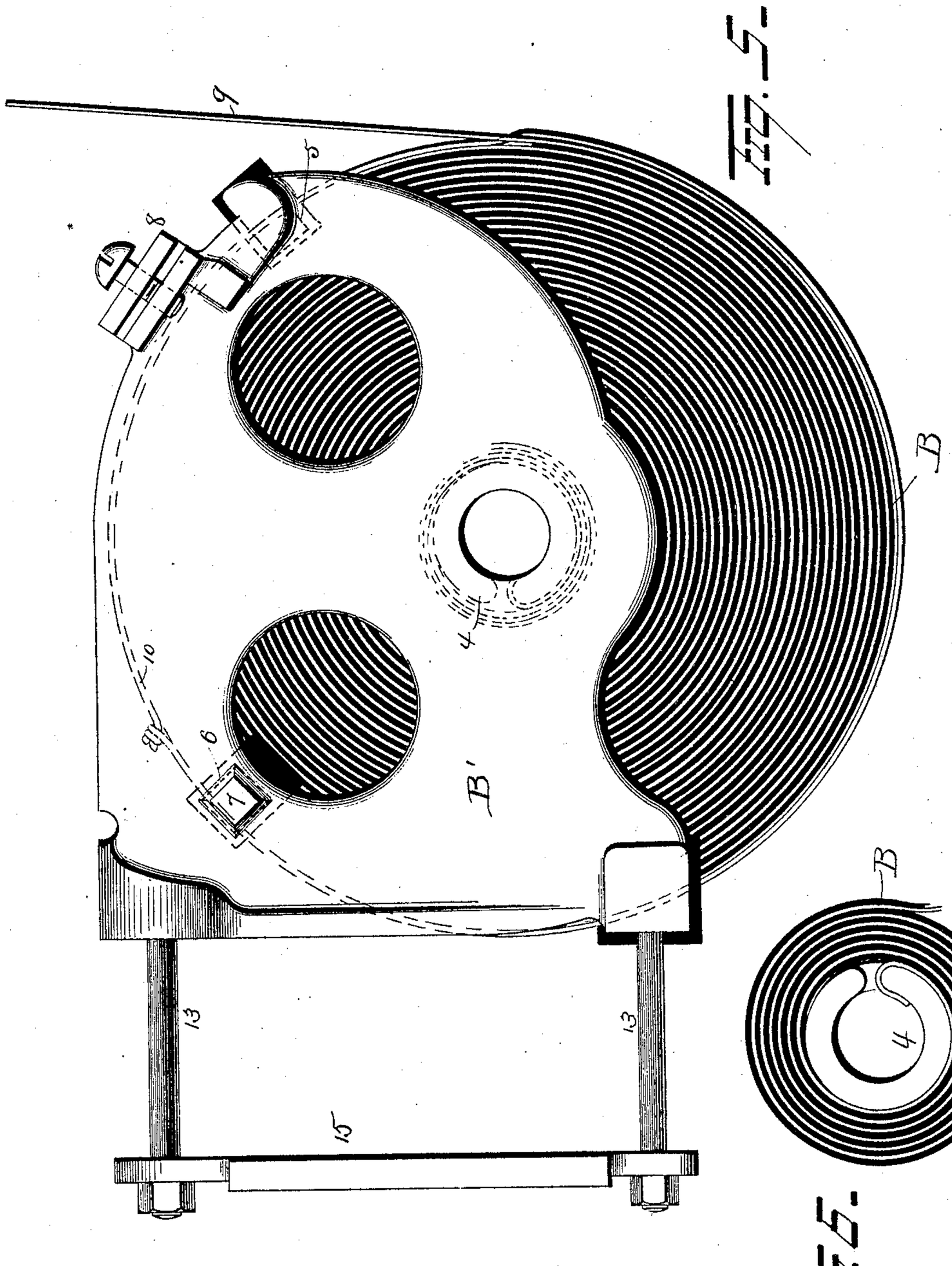

Fig. 1.

Fig. 2.

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(No Model.) 7 Sheets—Sheet 6.

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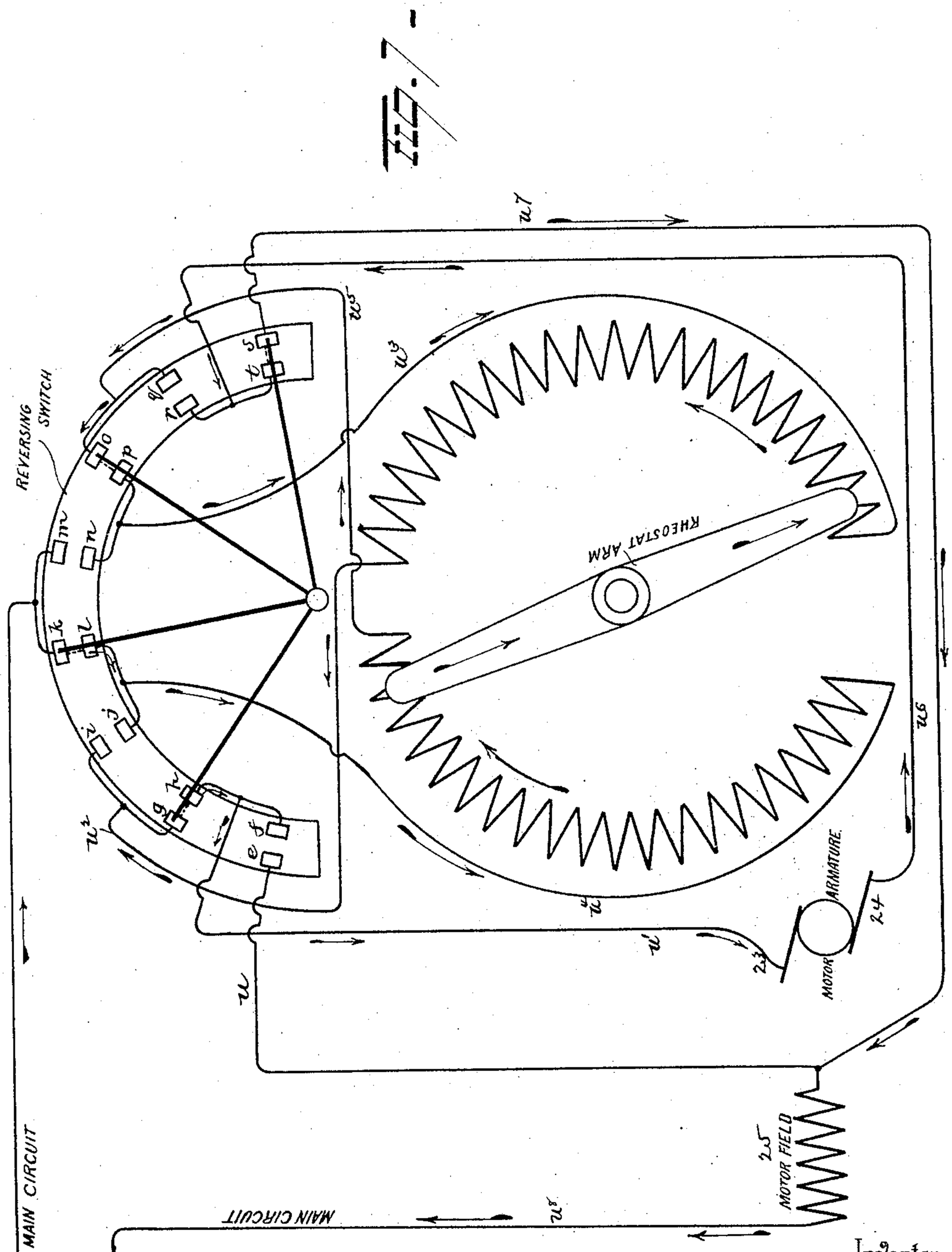

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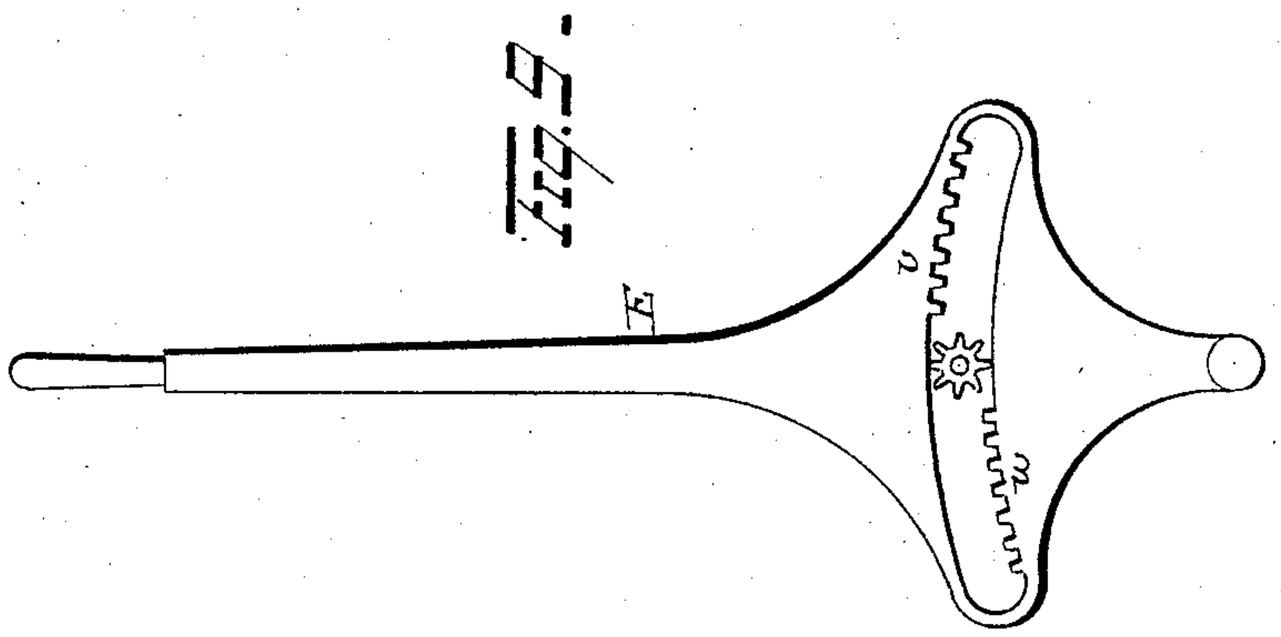

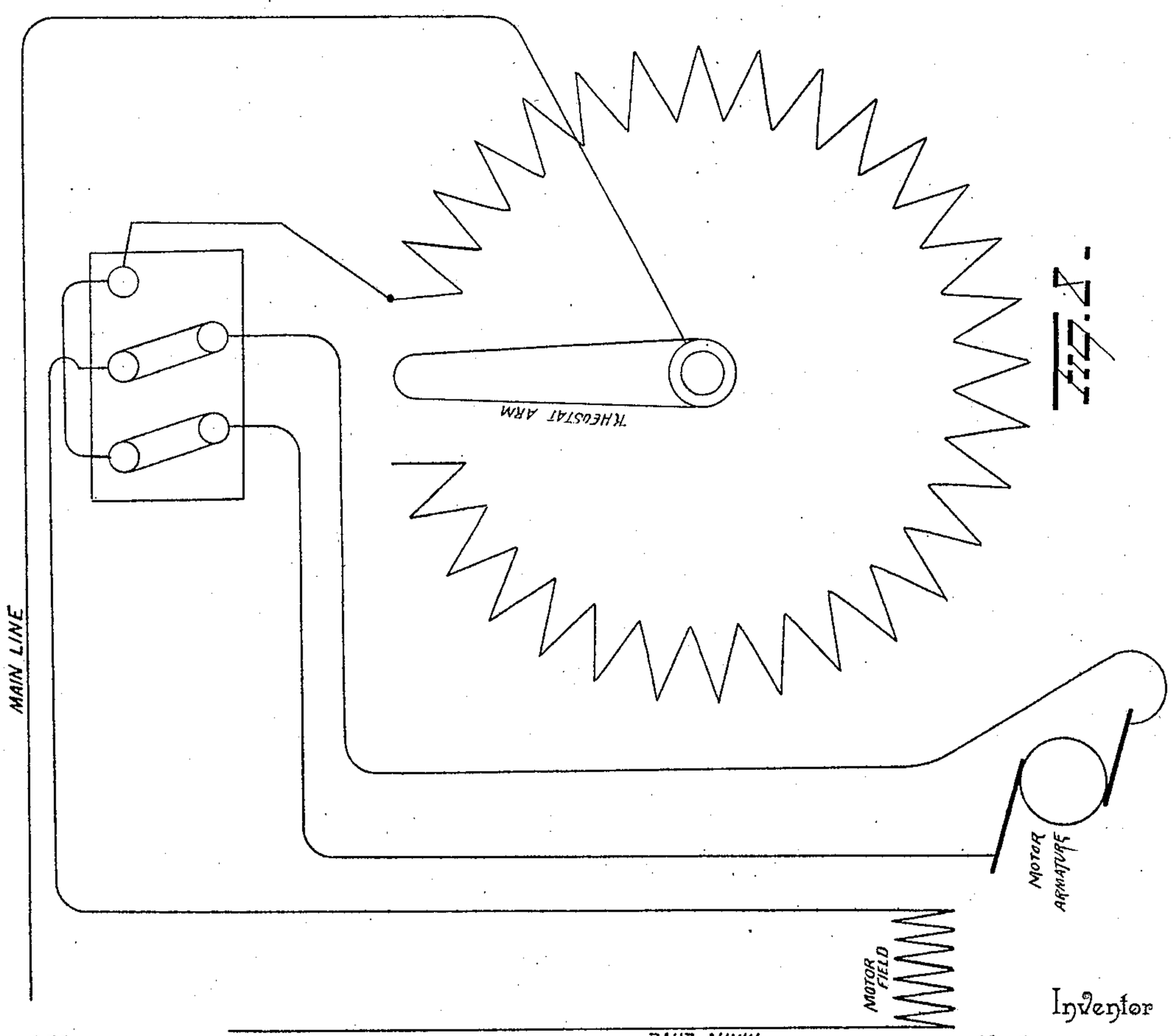

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UNITED STATES PATENT OFFICE.

WILLIAM HENRY MORGAN, OF ALLIANCE, OHIO.

ELECTRICAL CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 575,366, dated January 19, 1897.

Application filed September 4, 1895. Serial No. 561,455. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY MORGAN, a resident of Alliance, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Electrical Controllers; and I 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.

My invention relates to an improvement in controllers for electric motors, one object of the invention being to produce an electric controller—viz., a combined rheostat and reversing-switch—of compact construction, which shall be capable of operation with currents of large voltage without injuriously affecting the working parts, and which can be easily operated by the movement of a single lever, in one direction or the other, to reverse the current through the armature-circuit and gradually cut the resistance first out of the circuit and then into the circuit.

A further object is to produce an electrical controller which shall be so constructed that ample provision will be made for ventilation.

A further object is to produce a controller for electric motors which shall be simple, strong, and comparatively light in construction and which shall be effectual in all respects in the performance of its functions.

With these objects in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation showing the contact-plates and switch-arm of the rheostat. Fig. 2 is an elevation showing the opposite face of the machine and the reversing-switch. Fig. 3 is an elevation with one side of the frame removed, showing the arrangement of the resistance-coils. Fig. 4 is an inner face view of the other part of the frame. Figs. 5 and 6 are detail views of a coil and the plate or wedge to which it is connected. Fig. 7 is a diagram illustrating the circuits. Figs. 8 and 9 are views illustrating a modification.

A represents a frame or shell made in two parts A' A^2, each part or half being made with perforated lugs a for the accommodation of bolts b, whereby to secure the parts of the frame or shell together.

The sides of the frame or shell A, and also the ends and curved top, are made with openings a' b' c^5 to permit an ample circulation of air through the controller for purpose of ventilation. The central portion of each part of the frame or shell is made in the form of spokes d, with intervening spaces d' for the admission of air, said spokes radiating from central hubs d^2, wh ch constitute bearings for a transverse shaft 1, the purpose of which will be hereinafter explained.

Within the shell A and adjacent to the respective parts A' A^2 thereof concentric rings 2 2 are disposed and connected together at intervals by means of curved plates or connectors 3, made integral with the respective rings 2 2. The annular frame thus formed constitutes a support for a series of resistance-coils B and the plates or wedges B′ to which said coils are attached.

The coils B are preferably arranged in two semicircular sets with gaps or spaces between their respective ends, and the coils of each set are electrically connected in series, as will be apparent from the following detail description of their construction and arrangement:

Each coil B is preferably composed of metallic ribbon, such as German silver, with asbestos, mica, or other suitable insulating material interposed between its convolutions. The inner end of each coil is electrically connected to a hub or boss 4, which may be either round or angular, projecting from one face of a plate or wedge B′, which latter is made with lugs 5 6, adapted to bear against one face of the coil, but electrically insulated therefrom, and with a lug 7, adapted to bear against, but insulated from, the adjacent coil, thus maintaining the coils B properly spaced apart and forming ventilating-spaces between them. Each plate or wedge B′ is also made with a laterally-projecting split ear 8 for the reception of the free or outer end 9 of the adjacent coil, each coil having been previously bound with a wire 10 and the end 9 left projecting from the body thereof. From this construction and arrangement of parts it will be seen that as the inner end of each coil is electrically connected with a plate or wedge B and its outer end electrically connected with

the adjacent plate or wedge B′ the coils of each set will be connected in series. When the coils B and plates or wedges B′ shall have been assembled, they will be bound circumferentially by an insulating-band c', held in place by a metallic strap c^2, to the ends of which screws c^3 are attached and enter a double nut c^4.

Each plate or wedge B′ is provided with two screw-threaded rods or stems 13 13, which project through a plate 14 of insulating material and through the respective ends of a contact-plate 15, the free ends of said rods or stems being provided with suitable nuts 16. The contact-plates 15 are arranged in two sets, corresponding with the arrangement of the resistance-coils B′, and between the respective ends of each set of contacts plates or blocks 15^a, preferably of insulating material, are disposed.

A switch-arm C is secured between its ends to one end of the shaft 1, above alluded to, and at each end carries a brush D or other suitable electrical contact device, adapted, when the shaft 1 is turned, to sweep over the contact-plate 15 of the resistance-coils and switch more or less resistance out of the circuit, according to the extent to which the shaft 1 is rotated. At the opposite end of the shaft 1 a pinion 17 is secured and adapted to mesh with the teeth of a rack-bar 18, disposed between the ends of an operating-lever E, pivotally connected at its lower end to the frame A and provided at its upper end (which terminates above the frame) with a suitable handle 19. It is apparent that a movement of the lever E in either direction will cause the shaft 1 to rotate and the brushes D, carried by the switch-arm C, to move over the contact-plates 15, cutting out the resistance-coils in pairs.

To the side A^2 of the frame or casing A two semicircular parallel trays 20 of insulating material are located and each tray contains eight contact blocks or plates, the blocks or plates in one tray being arranged in pairs with those in the other tray. The pairs of contact blocks or plates are lettered *e f*, *g h*, *i j*, *k l*, *m n*, *o p*, *q r*, *s t* in the drawings, and cooperate with a series of brushes F, carried by arms G, to produce a reversing-switch. Each arm G is provided with two brushes F, electrically connected together, whereby to electrically connect the contact-blocks in pairs.

The switch-arms F radiate from a common hub F′, mounted loosely on the shaft 1. The hub F′ is made with a depending bifurcated arm or fork 21 for the reception of a pin or projection 22 on the lever E. When the lever E is turned on its fulcrum it will, through the medium of the pin or projection 22 and the bifurcated arm or fork 21, cause the switch-arms F to be shifted from one set of contacts to another and the current through the motor and rheostat reversed. A continued movement of the lever will, as above explained, gradually cut out the coils of the rheostat. A reverse movement of the lever E will act first to switch in the coils of the rheostat, then operate the reversing-switch, and then gradually cut out the rheostat-coils when the lever passes its normal position.

The arrangement of circuits, as shown in Fig. 10, is as follows: The contact block or plate *e* of the reversing-switch is connected by wire *u* with one end of the field-magnet coil 25. The contact-plates *f h* are connected with the commutator-brush 23 by a wire *u′*. The contacts *g i* are connected with the one end of one set of the rheostat-coils by a wire u^2, while the other end of said set of coils is connected with the contacts *n p* by a wire u^3. One end of the other set of coils is connected by a wire u^4 with the contacts *j l*, while the other end of this set of coils is connected by a wire u^5 with the contacts *o q*. The contacts *r t* are connected with the commutator-brush 24 by a wire u^6, and the contact *s* is connected with the field-magnet coil 25 at u^7. The other end of the field-magnet coil is connected in the main circuit by a wire u^8. The connections being thus made, when the switch-arms are in the positions shown in Fig. 7 the circuit will be as indicated by the arrows. When the switch-arms are shifted so as to connect the alternating pairs of contact-blocks, the circuit through the armature will be reversed, as is apparent.

Instead of arranging the rheostat-coils in two sets, as above explained, the coils may be arranged in a single series, and with this arrangement a two-arm pole-changer or reversing-switch might be employed, as shown in the diagram, Figs. 8 and 9. With such arrangement the operating-lever E would be made with two oppositely-disposed racks *v w*, Fig. 9, at opposite sides of the axis of the lever, so that the rheostat switch-arm would be moved in the same direction, regardless of the direction of movement of the lever, the operation of the reversing-switch, however, being in accordance with the direction of movement of the lever.

Various slight changes might be made in the details of construction of my invention without departing from the spirit thereof or limiting its scope, and hence I do not wish to limit myself to the precise details of construction herein set forth; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a frame, of a variable resistance therein, a shaft mounted in the frame, a switch-arm for said variable resistance secured to said shaft, a series of contacts mounted on the frame, a hub mounted loosely on the shaft, a series of switch-arms radiating from said hub and coöperating with said contacts to produce a reversing-switch, a bifurcated arm projecting from said hub, a pivoted lever, a pin on said lever, coöperating with said bifurcated arm to operate the reversing-switch, a pinion carried by said

shaft, and a rack on the lever, coöperating with said pinion to operate the switch-arm of the variable resistance, substantially as set forth.

2. In an electrical controller, the combination of a series of wedges or plates, a hub or projection on each plate or wedge, a binding post or arm on each plate or wedge, a resistance having insulating material interposed between its convolutions, coiled on each hub or projection and electrically connected thereto, the free ends of the coils being connected with the binding posts or arms of the adjacent plates or wedges, and lugs on the plates or wedges bearing against the coils for spacing them apart, substantially as set forth.

3. In an electrical controller, the combination with an open main frame, of an annular open frame within the main frame, and an annular series of resistance-coils spaced apart and supported on said annular open frame, substantially as set forth.

4. In an electrical controller, the combination with a main frame made in two parts and having ventilating-opening therein, of an annular open frame disposed between the parts of the main frame and a series of resistance-coils supported on said annular frame, substantially as set forth.

5. In an electrical controller, the combination with a frame, of trays of insulating material mounted thereon, contact-plates located on said trays, a shaft, a hub mounted on the shaft, contact-arms projecting from said hub and coöperating with the contact-plates to produce a reversing-switch, a variable resistance, a switch-arm therefor secured to said shaft, and a lever adapted to turn the shaft and operate the reversing-switch at a single movement in either direction from its normal position, substantially as set forth.

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

WILLIAM HENRY MORGAN.

Witnesses:

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W. H. RAMSEY.