No. 804,595. PATENTED NOV. 14, 1905.

N. K. GARHART.

ELECTRICAL CONTROLLER.

APPLICATION FILED MAY 25, 1905.

4 SHEETS—SHEET 1.

Fig. 2.

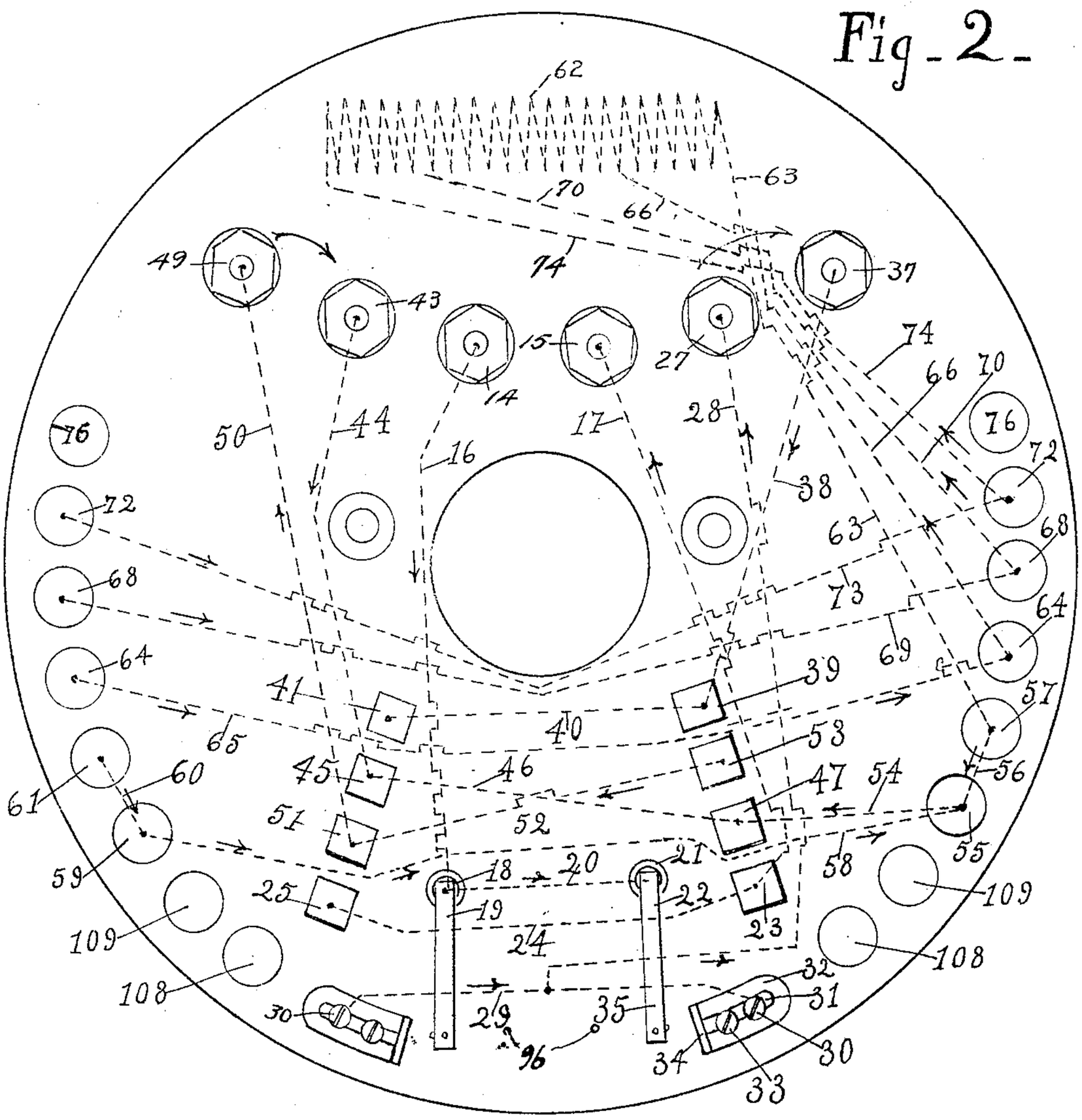
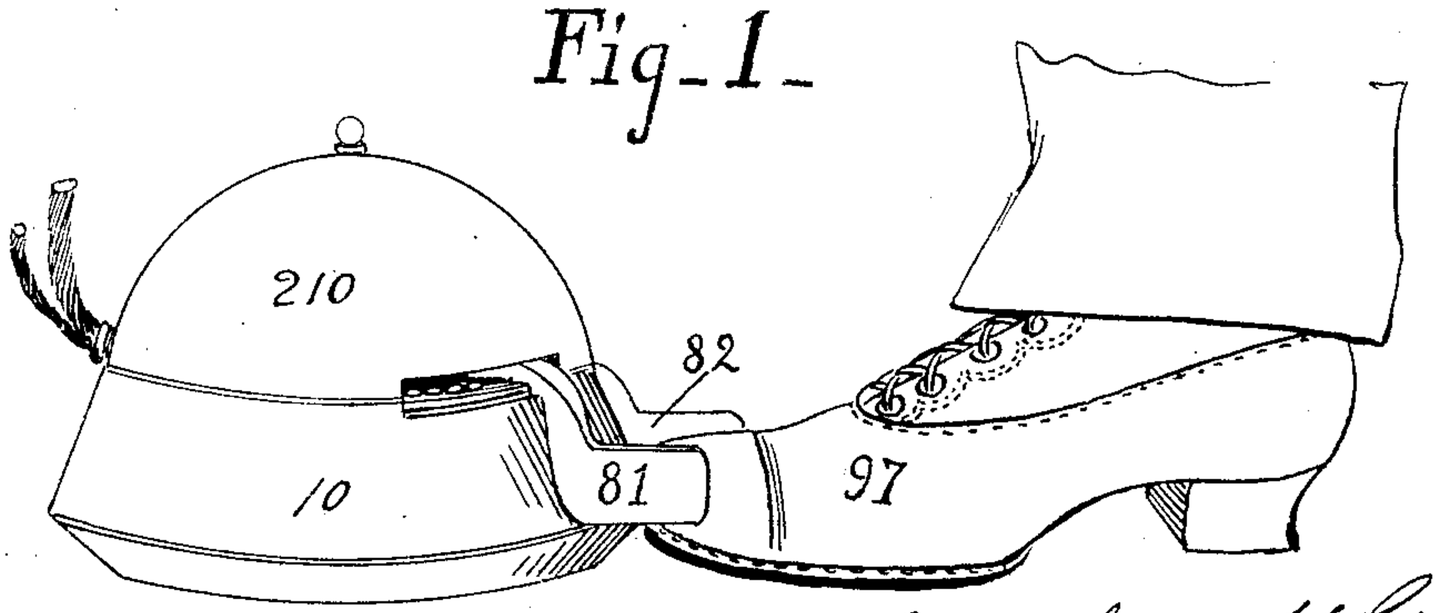


Fig. 1.



Witness
Claude Thorn.
N. Allemong.

Inventor
Nathan K. Garhart
By V. H. Lockwood Attorney

No. 804,595. PATENTED NOV. 14, 1905.

N. K. GARHART.

ELECTRICAL CONTROLLER.

APPLICATION FILED MAY 25, 1905.

4 SHEETS—SHEET 2.

Fig_3_

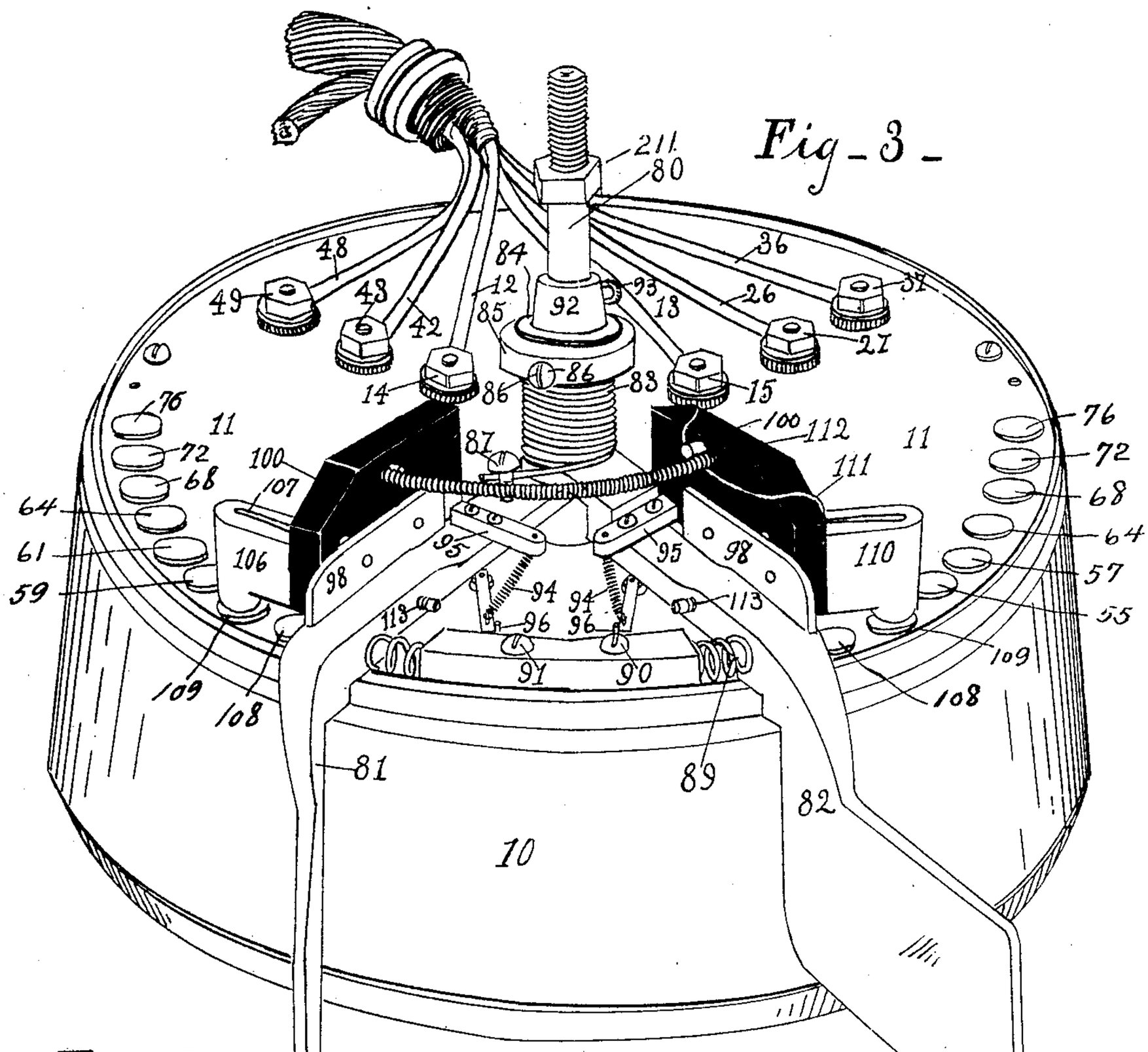


Fig_4_

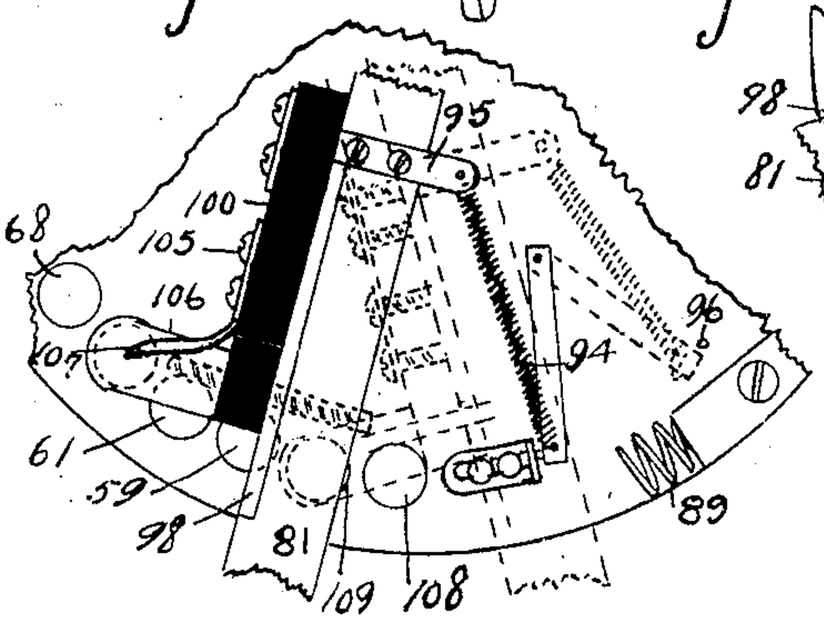
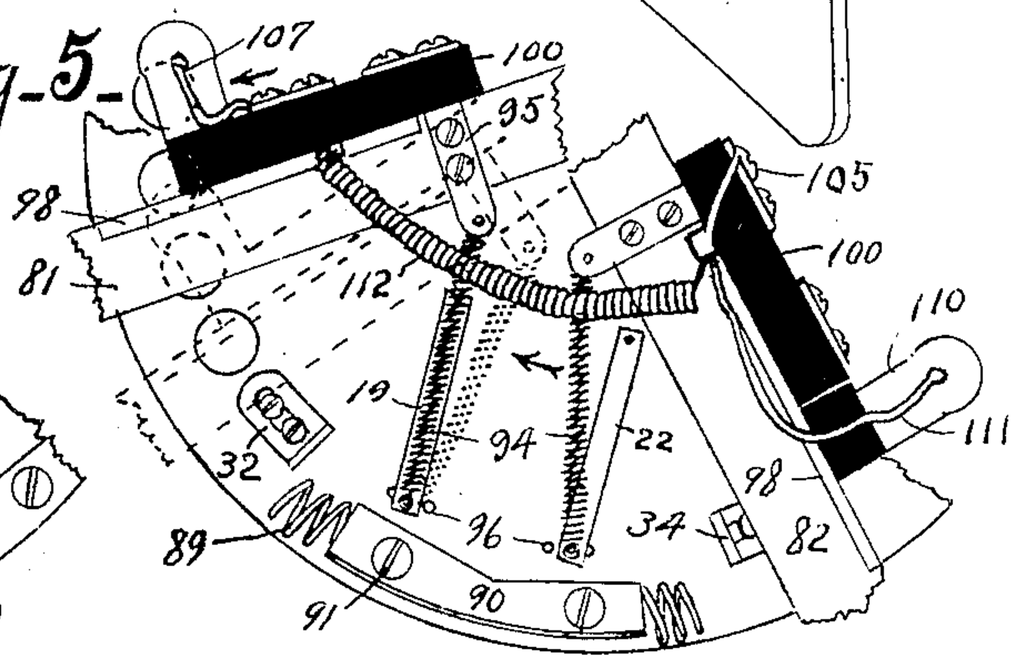


Fig_5_



Witness
Claude T. Boen.
N. Allmong

Inventor
Nathan K. Garhart
By W. H. Lockwood
Attorney

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

No. 804,595. PATENTED NOV. 14, 1905.

N. K. GARHART.

ELECTRICAL CONTROLLER.

APPLICATION FILED MAY 25, 1905.

4 SHEETS—SHEET 3.

Fig. 7.

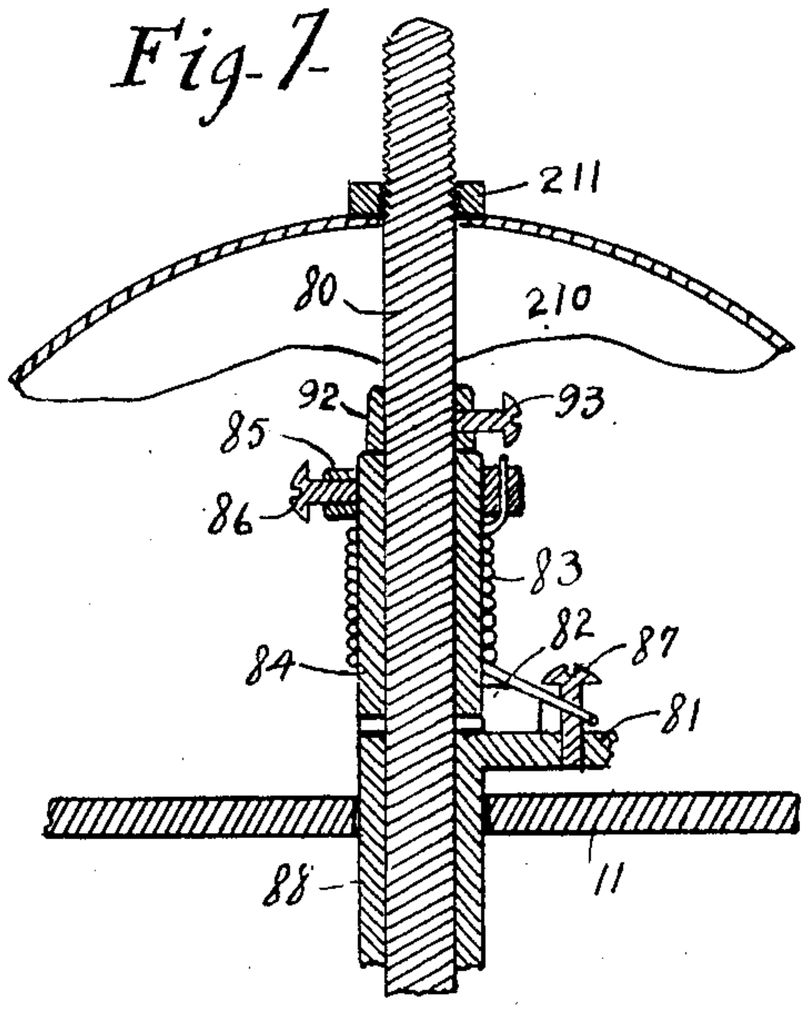


Fig. 6.

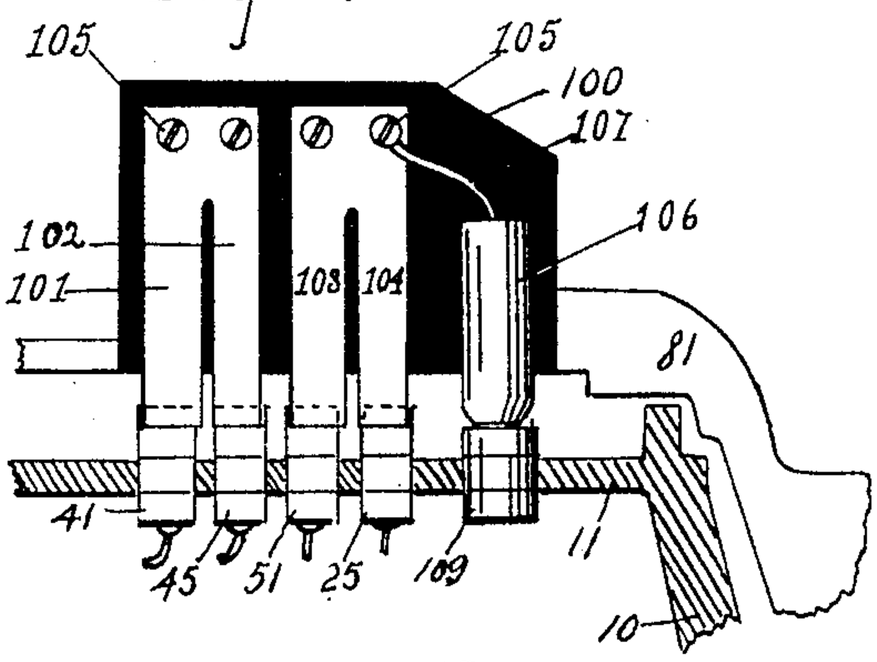


Fig. 9.

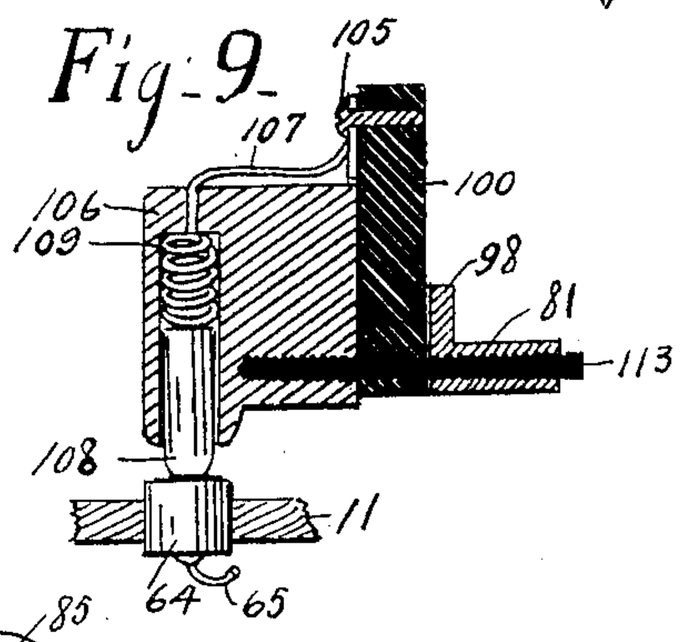
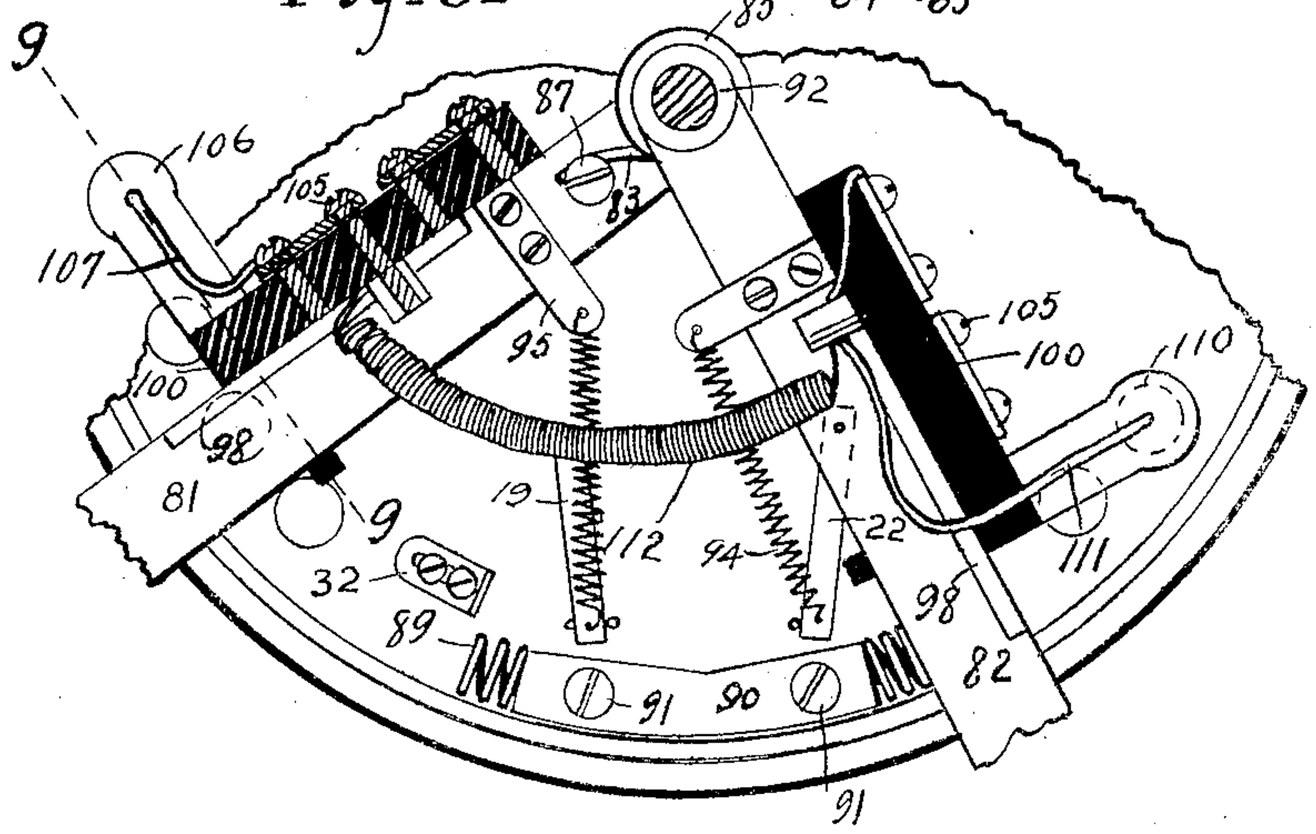


Fig. 8.



Witness
Claude Bown.
N. Allmony

Inventor
Nathan K. Garhart
By W. H. Lockwood
Attorney

No. 804,595. PATENTED NOV. 14, 1905.

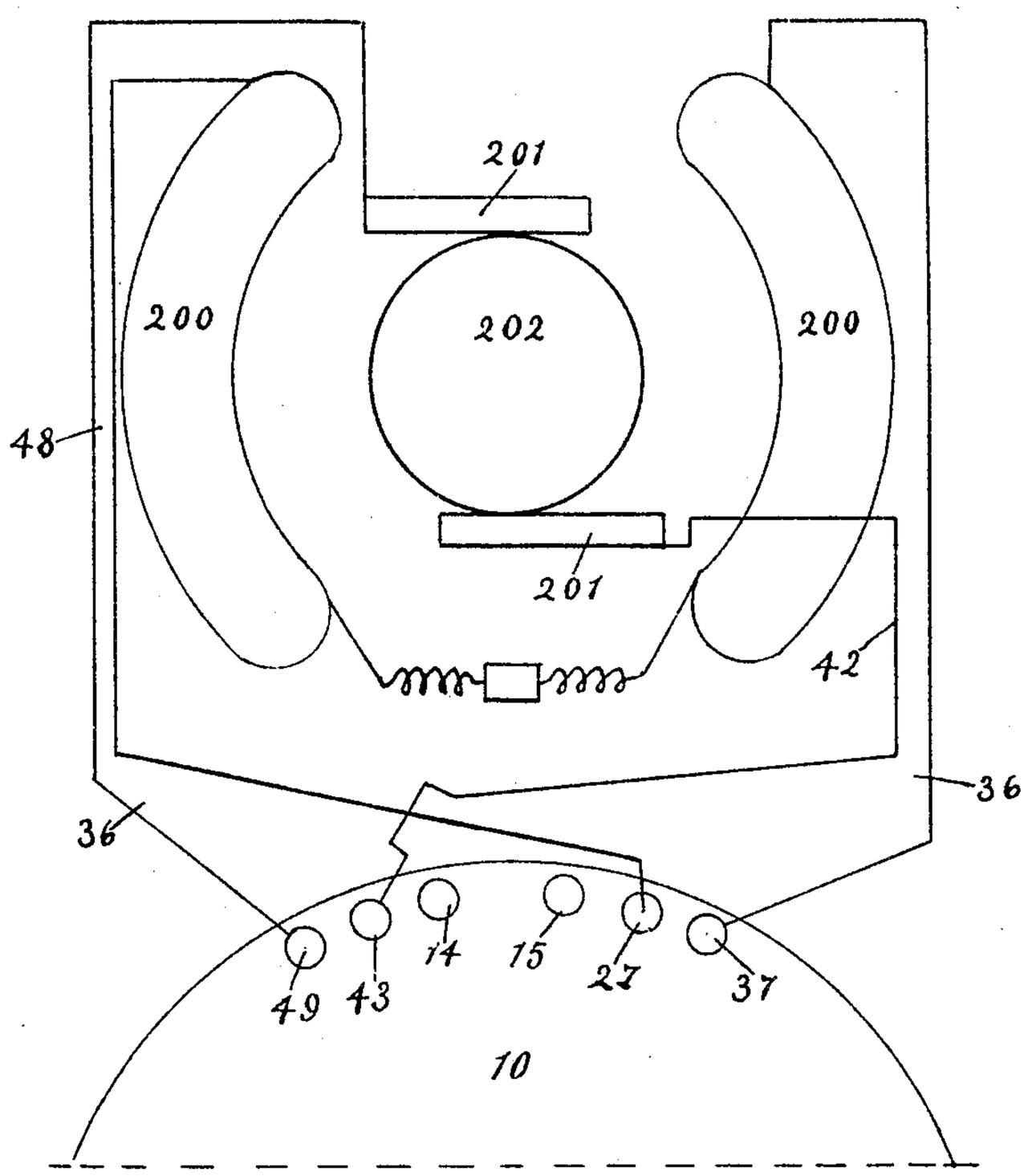
N. K. GARHART.

ELECTRICAL CONTROLLER.

APPLICATION FILED MAY 25, 1905.

4 SHEETS—SHEET 4.

Fig. 10.



Witnesses
N. Allemong.
W. M. Gentle.

Inventor
Nathan K. Garhart
By W. H. Lockwood
Attorney

UNITED STATES PATENT OFFICE.

NATHAN K. GARHART, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO GARHART DENTAL MANUFACTURING COMPANY, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

ELECTRICAL CONTROLLER.

No. 804,595. Specification of Letters Patent. Patented Nov. 14, 1905.

Application filed May 25, 1905. Serial No. 262,145.

To all whom it may concern:

Be it known that I, NATHAN K. GARHART, of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Electrical Controller; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like numerals refer to like parts.

The object of this invention is to provide an electrical controller that is especially suitable for electrical motors for dental engines; but the invention is not limited to any particular use of motors.

One feature consists in providing a two-lever controller. The foot of the operator is held between the two levers, so that it can readily operate either one. In the case of electrical dental engines it is necessary that it should be capable of operating in either direction, so as to quickly reverse the motor. This is accomplished by the movement of one lever causing the motor-shaft to rotate in one direction and by the movement of the other lever causing rotation of the motor-shaft in an opposite direction and without distracting the attention of the operator from his work. The construction and wiring is such that if by accident both levers are operated at once it is impossible for any current to go through the motor.

Another feature of the invention consists in the "contact system" shown herein and the method for opening and closing the circuit. When one lever is moved forward, the circuit passes through the springs attached to the opposite lever and which are pressing against the contact-points adjacent said opposite lever. As the lever continues to move forward the pressure of these contacts increases, so that a safe and sure contact is always assured.

Another feature of the invention consists in the switch operating in connection with each lever. The arrangement is such that the switch does not close the circuit until the lever is moved forward to the first "speed" contact-button, and at this point the circuit is closed with a snap or quick action of the switch, and when either lever is returning to its unoperated position the circuit is not broken until it passes beyond the first speed contact-button and is leaving the first "sudden-stop" contact-button. At that point the switch snaps back and breaks the circuit. Before the circuit is broken the lever must have passed at least half-way over the first sudden-stop contact-button. The sudden operation of the switches makes it impossible for arcing to destroy the contacts. This arrangement and construction obviates the danger of burning out the motor in case the controller is accidentally moved so that one of the levers is against the operating-chair or any other object that holds it partly open. The lever has to be operated considerably before the circuit is closed through the controller. This is also of value when the operator unconsciously moves one of the levers when he is operating. Any slight movement of the lever will have no effect. It must be moved substantially one-half of its whole course before the circuit is closed.

The various features of this invention will be understood from the accompanying drawings and the following description and claims.

In the drawings shown herein to illustrate the general nature of my invention, Figure 1 is a side elevation of the controller and the operator's foot in position to actuate the controller-levers. Fig. 2 is a plan view of the controller with the cover removed, the wiring being shown in diagram by dotted lines. Fig. 3 is a perspective view of the controller with the cover removed. Fig. 4 is a plan view of a portion of what is shown in Fig. 3 with one lever in full lines in position for the circuit to be closed and in dotted lines in the inoperative position while the circuit is open, parts being broken away. Fig. 5 is a plan view of part of what is shown in Fig. 3, showing both levers, one lever in an unoperated position and the other in an operative position just previous to the closing of the circuit, the unoperated position of said last-mentioned lever being shown in dotted lines and parts being broken away. Fig. 6 is an outside elevation of a part of one of said levers with the spring-contacts in the unoperated position and the upper part of the controller being in vertical section, parts being broken away. Fig. 7 is a vertical central section through the means for mounting the levers and said controller. Fig. 8 is a plan view of a portion of the device including the two levers and a horizontal section through the spring-holding blocks on the levers, parts being broken away. Fig. 9

is a section on the line 9 9 of Fig. 8. Fig. 10 is a diagram showing the motor field and armature circuits.

In the construction herein illustrated, 10 is a casing having the top 11 for inclosing the wiring and a cover 210 thereon. The wiring and contact-points will be first explained. The wires 12 and 13 are the main wires leading from any suitable source of current-supply and connected, by means of the binding-posts 14 and 15, with the main circuit-wires 16 and 17 on the under side of the top or wiring plate 11. The main wire 16 is connected, by means of the post 18, with the switch 19, pivoted to said post, and through the wire 20 with the post 21, to which the corresponding switch 22 is pivoted. The other main wire 17 is connected with the contact-point 23 and by means of the wire 24 to the corresponding contact-point 25 on the other side of the switches. A field-wire 26 leads to the binding-post 27, and from that the wire 28 leads to the wire 29, which is connected with the two binding-posts 30, that extend through the slots 31 in the switch-contact plate 32. The plate 32 is rendered longitudinally adjustable by the set-screw 33, and its head 34, which is an upturned end, is engaged by the switch. The construction is the same on both sides of the machine as to these parts. Another field-wire 36 is connected with the binding-post 37, and it is connected by the wire 38 with the contact-point 39, and the wire 40 with the contact-point 41 on the other side of the machine.

The brush-wire 42 is connected with the binding-post 43 and the latter, by means of the wire 44, is connected with the contact-point 45 on one side of the machine and by the wire 46 with the contact-point 47 on the other side of the machine. Another brush-wire 48 is connected with the post 49, and a wire 50 runs from the latter to the contact-point 51, and from that a wire 52 runs to the contact-point 53. The wire 54 extends from the contact 47 to the first short-stop button 55, and from that a wire 56 leads to the second short-stop button 57. A wire 58 extends from said first short-stop button 55 to the first short-stop button 59 on the other side, and a wire 60 leads from said last-mentioned short-stop button to the short-stop button 61. The speed is controlled through the shunt resistance-coil 62, to which wires are connected at various points. The wire 63 leads from the short-stop button 57 to the end of the resistance-coil. The first speed contact-buttons 64 are connected with each other by a wire 65 and by a wire 66 with the resistance-coil about one-third of the distance from the end thereof. The second speed-buttons 68 are connected with each other by the wire 69 and by the wire 70 with the resistance-coil at 71, so that the current passing through said wire will meet with about two-thirds of the total resistance of said coil. The third speed contact-buttons 72 are connected with each other by the wire 73 and are connected by the wire 74 with the resistance-coil at the end. The fourth speed-buttons 76 are not connected with the resistance-coil at all.

Referring now to Fig. 3, it is observed that there is a vertical rod 80 mounted centrally in the controller, on which two levers 81 and 82 are pivoted at their ends. Said levers are both returned to their inoperative positions by a spring 83, that is coiled about the sleeve 84, secured to and extending upward from the inner end of the lever 82. The upper end of said spring is held in place by a collar 85, which has a set-screw 86 for fixing it to the sleeve 84. The lower end of said spring is lodged against a post or screw 87 on the lever 81, which latter lever has a downwardly-extending sleeve 88 around the post 80. The forward actuation of either lever tends to tighten the spring 83, and when either lever is released said spring tends to return the same to the unoperated position against the wires or bumpers 89 in the ends of the block 90, secured on the plate 11 by the screws 91. The sleeve 84 is held down by a washer 92 and the set-screw 93. The cover 210 is held down by the nut 211. The switches 19 and 22 are operated by said levers by means of the wires 94, which are connected with said switches at one end and at the other end with the arms 95 on the corresponding levers. The switches in their open or unoperated position are drawn by said wires against the stop-pins 96, and they are drawn in their closed or operative position against the contact-plates 34. Said levers 81 and 82 extend radially from the rod 80 beyond the periphery of the casing 10 and extend downward with a broad vertical plate at the outer ends which the foot 97 of the operator engages when the foot of the operator is moved laterally in one direction or the other. On the outer sides of said levers above the plate 11 there is an upwardly-extending flange 98, integral with the lever or otherwise connected therewith. To it there is secured a hard-rubber block 100, extending upward beyond the lever. On the outer surfaces or sides of said block 100 there are springs 101, 102, 103, and 104, secured by the screws 105 at the upper end and with their lower ends adapted to engage the contact-points 23, 25, 39, 41, 45, 47, 51, and 53. These springs are the same on both levers. The spring 101 on the left-hand lever engages the contact 41, and on the right-hand lever the spring engages contact-point 39. The spring 102 on the left lever engages point 45, and on the right lever the spring engages contact-point 53. The spring 103 on the left-hand lever engages the contact-point 51, and on the right-hand lever it engages the contact-point 47. The spring 104 on the left-hand lever engages the contact-point 25 and on the right-hand lever it engages the contact-point 23. The springs

are divided into two pairs, and the adjacent springs of each pair are connected at their upper ends, being formed from one plate, as shown in Fig. 6. There is a metal block 106 secured to the hard-rubber block 100 on the left-hand lever 81 by means of an insulating-screw 113. A similar metal block 110 is similarly secured to the right-hand lever. Each block 106 and 110 has a vertical opening 117 from the under side in which a vertically-movable spring-contact 108 fits, which is adapted to engage the various contact-buttons as the lever is moved, said spring-contact being pressed down by the spring 109. A wire 107 leads from one of the screws 105 on the insulating-block 100 to the metal block 106 in communication with the spring-contact 108. Likewise the wire 111 on the other lever leads from the screw 105 to the metal block 110 and communicates with spring-contact 108. A spiral wire 112 leads from the binding-screw 105, that holds the spring 102 on the right-hand lever to the binding-screw on the spring 103 on the other lever. This spring 112 is so formed that it will readily stretch and electrically connect the parts when the levers are moved to the limit of movement.

Referring now to the circuits and assuming that the right-hand lever has not been moved and that the left-hand lever has been moved, so that its spring-contact 108 is in touch with the first-speed contact-button 64, the current passes in over the wires 12 and 16 to the switch 19, which then is in contact with the head 34 of the left plate 32. Thence the current passes through the field-wires 28 and 29 and through the field back through the wires 36 and 38 to the contact-point 39, and thence through the springs 101 and 102 on the right-hand lever to the contact-point 53, and thence through the wire 52 to the contact-point 51, and thence through the wires 50 and 48 to the armature and back through the wires 42 and 44 to the contact-point 45, and thence through the wire 46 to the contact-point 47, and thence through the two springs 103 and 104 on the right-hand lever and out over the main-line wires 17 and 13. This constitutes the main circuit. The circuit is reversed when the levers are reversed.

In order to regulate the speed, resistance-circuits are added that run from one lever to the other. With the left-hand lever on the button 64 and the right-hand lever unmoved, as above assumed, a portion of the current that comes in over the wire 38 from the field instead of going through the main circuit to the armature, as heretofore described, passes through the springs 101 and 102 on the right-hand lever and the coil 112 extending between the levers, and wire 107 and spring-contact 108, thereby reaching the first-speed contact-button 64. Thence it passes along the wire 65 to the button 64 on the other side, and through the wire 66 to the resistance-coil 62, and back through the wire 63 to the sudden-stop buttons 57 and 55, along the wire 54 to the contact-point 47, and through the springs 103 and 104 on the right-hand lever to the contact-point 23, and out over the main wires 17 and 13. When the left-hand lever is moved to the contact-button 68, a higher speed will be attained, a smaller portion of the current passing through the wires 69 and 70 and the resistance-coil back through the wire 63, as heretofore described. When the lever is moved to the button 72, the shunt-current will pass over the wires 73 and 74 to the resistance-coil and back through the wire 63. With the lever on the button 76 the motor will operate at its normal speed without the influence of the resistance-coil. When the left-hand lever is moved back to one of the sudden-stop buttons 61 and 59, the current is short-circuited, cutting out the armature-circuit. In other words, the current passes from the sudden-stop contact-buttons through the wire 58 to the contact-buttons on the other side and back through the wire 54 and contacts 47 and 23 and out through the main wires 17 and 13, as heretofore described. This cuts out the resistance and brush and armature circuit, as the current passes from the field-circuit through the levers and immediately out over the main wire 17. This suddenly stops the machine, although the main circuit is still closed by the switch. When the lever is moved to the buttons 109 and 108, the main circuit is opened by the switch 19 being drawn by the wire 94 against the stop 96. When the left-hand lever is not operated and the right-hand lever is moved, the circuits are as follows: The current comes in over the wires 12, 16, and 20 to the switch 22, which will be closed, assuming the right-hand lever to have been operated far enough to close it—that is, to the button 64. Then the current passes through the wires 29 and 28 and 26 through the field and back over the wires 36, 38, and 40 to the contact 41. Thence it passes through the springs 101 and 102 on the left-hand lever and out to the armature over the wires 44 and 42 in a reverse direction as compared with the movement of the current when the left-hand lever is operated. The current then returns over the wires 48 and 50 to the contact-point 51 and passes through the springs 103 and 104 on the left-hand lever to the contact-point 25 and out over the wires 24, 17, and 13. This constitutes the main circuit when the right-hand lever is used. The resistance-circuit when the right-hand lever is used is as follows: The current coming in from the field over the wires 38 and 40 to the contact-point 41 passes through the springs 101 and 102 on the left-hand lever to contact 45, wires 46, 54, 56, and 63 to the resistance-coil, and back through wire 66 to button 64, up through spring 110, wires 111 112 107 to contact 25 at the other side, and out over wires 24 and

17. The circuit is the same with the buttons 68 and 72, excepting that it passes through the respective wires 70 and 74, connecting said buttons with the resistance-coil. When the right-hand lever has been moved to the sudden-stop button 57 or 55, all the current will pass through the lever's connections and out over the wires 54, 24, and 17, thus cutting out the armature brushes and resistance and bringing the machine to a sudden stop. When the right-hand lever is moved back to the contact-button 109 or 108, the switch 22 will be drawn open by its spring and the main circuit broken.

In Fig. 10 there is shown a diagram of the circuit connection between the controller and the field and armature of the motor. The wire 26 connects the field 200 on one side of the motor with the controller, as shown in Fig. 3. The wire 36 runs to the field on the other side of the motor. The wire 42 runs to one brush 201, engaging the armature 202, and the wire 48 runs to the other brush.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an electric controller, two levers for operating said controller, one adapted to cause the motor to operate in one direction and the other adapted to cause the motor to operate in the opposite direction, means tending to move said levers toward each other, and means for stopping said approaching movement so said levers will be separated.

2. In an electrical controller, a pair of levers fulcrumed at the same point, means tending to draw said levers together, and electrical wiring connected with each of said levers adapted to operate the motor in different directions as one or the other of said levers is operated.

3. In an electrical controller, a pair of levers fulcrumed at the same point, one of said levers resting upon the other and having an upwardly-extending portion, a spring coiled about said portion with one end secured thereto, and means on the other lever for engaging and holding the other end of said spring whereby said spring will tend to draw said levers together, and electrical wiring adapted to operate the motor in different directions as one or the other of said levers is operated.

4. In an electrical controller, a pair of levers, a switch for each lever, means connected with each lever for operating its corresponding switch, and electrical wiring-switches whereby when one lever and its corresponding switch has been operated, the motor will be driven in one direction, and when the other lever and switch are operated, the motor will be driven in a reverse direction.

5. In an electrical circuit, an incomplete main circuit, an incomplete resistance-circuit, a pair of levers, and means thereon that enables the unoperated lever to complete the main circuit and the operated lever to complete and control the resistance-circuit.

6. In an electrical controller, an incomplete main circuit, an incomplete resistance-circuit, a pair of levers, an electrical connection between said levers, means connected with said levers that enables the unoperated lever to complete the main circuit, and means on said lever that enables the operated lever to complete and control the resistance-circuit.

7. In an electrical controller, two levers fulcrumed at the same point, a spring tending to hold said levers together, the tension of which on both levers increases as one of said levers is operated, a series of contact-buttons near the unoperated position of each lever and substantially in alinement with the fulcrum-point of said levers, springs on each lever for engaging the corresponding contact-points so that the springs on the unoperated lever will be pressed more strongly against the corresponding contact-points, an electrical connection between the springs on the two levers, a suitable wiring whereby there will be a main circuit completed by the springs on the unoperated lever, and a resistance-circuit completed by the electrical connection between the springs on the two levers.

8. In an electrical controller, a pair of levers fulcrumed at one point, a series of contact-points for each lever mounted in line therewith, springs on each lever adapted to engage said contact-points when said levers are in their unoperated position, a switch for each lever, means connected with each lever for operating its corresponding switch, a series of contact-buttons for each lever arranged in a position concentric with the fulcrum of the levers, means on each lever for electrically engaging said contact-buttons as either lever is operated, an electrical connection between said levers, the main circuit being connected with said contact-buttons and switches, a series of resistance-circuits connected with said contact-buttons, and an electrical connection between one pair of said springs on one lever and one pair of said springs on the other lever whereby when one lever is moved into engagement with any of said contact-buttons the resistance-circuit will be closed and the springs on the other lever will remain in contact with its contact-points and thereby close the main circuit.

9. In an electrical controller, a lever, contact-buttons some of which are "sudden-stop" buttons and others "speed" buttons, means on the lever for electrically engaging said buttons, a switch in the main circuit, and means connected with said lever for closing said switch that does not operate the same until after the lever has passed the "sudden-stop" buttons.

10. In an electrical controller, a lever, "sudden-stop" buttons in the path of the lever near the lever when in its unoperated position, "speed" contact-buttons remote from said lever when in such position, a switch for closing

the main circuit, and means connected with said lever for closing said switch that will not act on the switch when the lever is given an outward movement until after it has passed said contact-buttons.

11. In an electrical controller, a lever, a series of "speed" and "sudden-stop" contact-buttons, means on said lever for engaging said contact-buttons, electrical wiring connected with the "speed" buttons for varying the speed, electrical wiring connected with the "sudden-stop" buttons for short-circuiting the current when the lever is in electrical connection with them, a switch in the main circuit, and means connected with said lever for closing said switch after said lever has passed over said "sudden-stop" buttons in the series.

12. In an electrical controller, a lever, "sudden-stop" buttons in the path of the lever near the lever when in its unoperated position, "speed" contact-buttons remote from said lever when in such position, a switch for closing the main circuit, and a spring extending from the free end of said switch to said lever at a point behind the fulcrum of the switch, which spring will pass over the fulcrum of the switch as the lever is moved outward or inward, the parts being arranged so that the switch will not be closed by said means until after the lever has passed outward beyond the "sudden-stop" buttons and the switch will not be opened by said means until the lever has passed inward substantially beyond the "sudden-stop" buttons.

In witness whereof I have hereunto affixed my signature in the presence of the witnesses herein named.

NATHAN K. GARHART.

Witnesses:
W. H. BONHAM,
N. ALLEMONG.