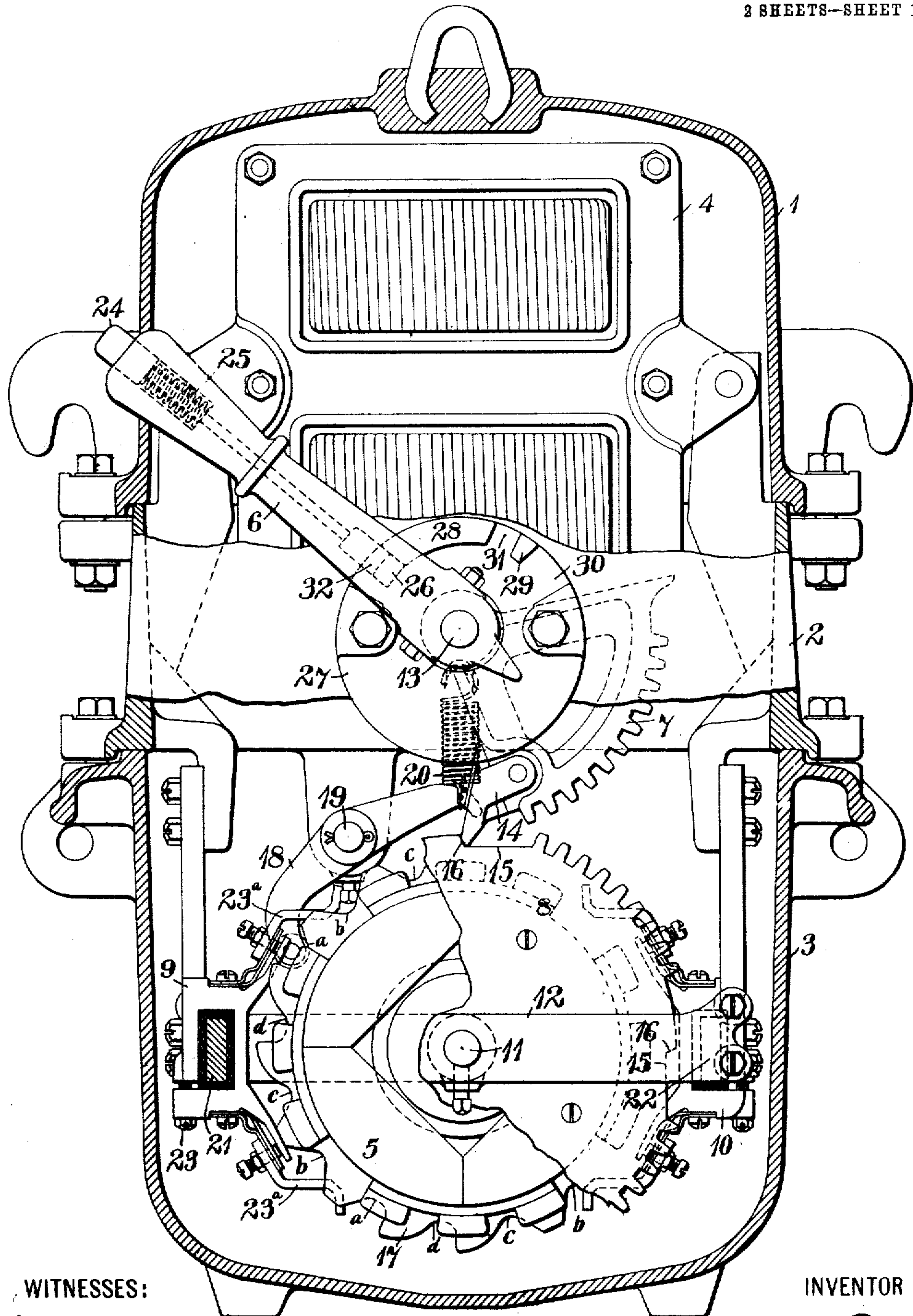


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 CONTROLLER FOR ELECTRIC MOTORS.
 APPLICATION FILED MAR. 3, 1906.

910,951.

Patented Jan. 26, 1909.

2 SHEETS—SHEET 1.



WITNESSES:

Fred H. Miller
R. J. Dearborn

Fig. 1

INVENTOR

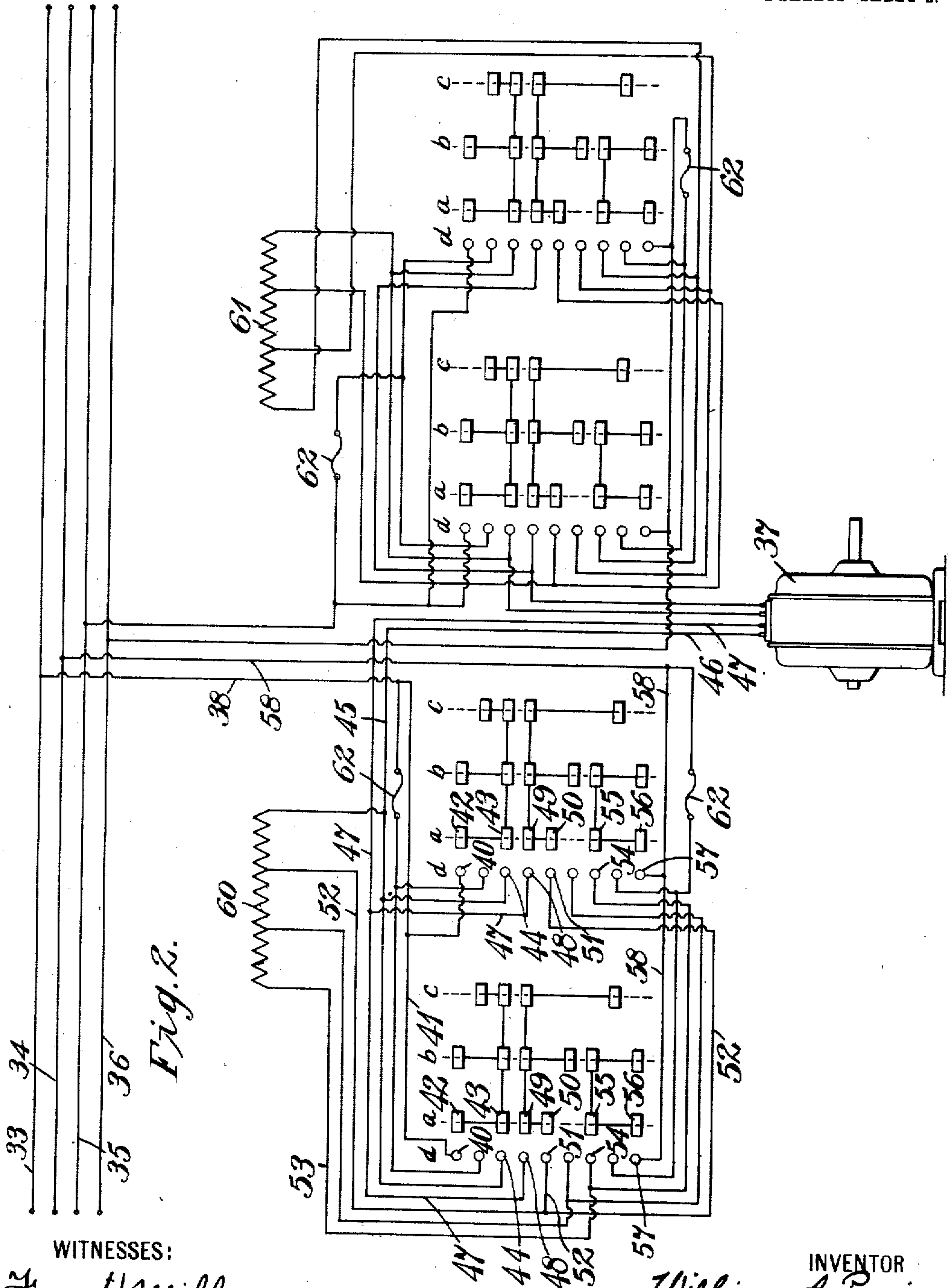
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UNITED STATES PATENT OFFICE.

WILLIAM A. PARIS, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

CONTROLLER FOR ELECTRIC MOTORS.

No. 910,951.

Specification of Letters Patent.

Patented Jan. 26, 1909.

Application filed March 3, 1906. Serial No. 304,092.

To all whom it may concern:

Be it known that I, WILLIAM A. PARIS, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Controllers for Electric Motors, of which the following is a specification.

My invention relates to controllers for electric motors and has special reference to such controllers, of the rotatable drum type, as are adapted for use with motors of relatively large size and capacity.

The object of my invention is to provide a controlling device of the class above specified that shall be simple, durable and compact in construction, and may comprise a contact-carrying drum adapted for operation in one direction only by means of an actuating device that is limited to a predetermined arc of rotation.

Rotatable, contact-bearing drums or cylinders are used to a considerable extent in connection with stationary engaging fingers in controller structures and when large electric currents are utilized, the fingers are made of such width that the total length of the drum is such as to occupy an excessive amount of space.

In Patent No. 807,939, granted December 19, 1905 to the Westinghouse Electric & Manufacturing Company, as assignee of Henry D. James, a controlling device has been shown and described which is adapted for starting and operating electric motors and which comprises a rotatable contact-carrying drum the contacts of which are divided into two similar and opposite groups to be engaged by stationary contact fingers in a well known manner. An actuating device is also shown which is itself limited to a predetermined arc of rotation but which may cause the contact-carrying drum to rotate in one direction only. If the design of this general character is embodied in a controller adapted for use with motors of relatively large current capacity, the stationary contact fingers which engage the rotatable drum are necessarily made of considerable width in order to secure sufficient contact area to carry the current required. Since the number of contact fingers required is independent of the amount of current utilized, the total length of the contact-carrying drum must necessarily be increased out of all proportion to its diameter.

According to my present invention and in order to obtain an adequate area of contact between the fingers and the drum without any substantial increase in the length of the latter, I divide it into four similar segments and provide a plurality of specially constructed stationary contact fingers which may severally engage similar contact parts on two adjacent drum segments. In this way, the two spaced portions of each contact finger are in multiple circuit relation and are adequate for the increased current values without requiring an increase in the length of the drum.

Figure 1 of the accompanying drawing is a view, mainly in front elevation, but partially in section, of a controller constructed in accordance with my invention. Fig. 2 is a diagrammatic view of a control system showing the control drum of Fig. 1 developed into a single plane, and the circuit connections therefor.

Referring to Fig. 1 of the drawings, the controller illustrated therein has a combined supporting frame and inclosing casing, comprising three sections 1, 2 and 3. Located within the casing are transformers 4, a contact-carrying drum 5 and an actuating device therefor which comprises an operating handle lever 6, a gear segment 7, and a gear wheel 8 attached to the drum 5 and adapted to be engaged by the gear segment 7. The transformers 4 and two groups of stationary contact fingers 9 and 10 are rigidly attached to section 2 of the supporting frame, and the drum 5 is fixed to a shaft 11 which is rotatably mounted in bearing brackets 12 also supported by section 2 of the frame. The actuating gear segment 7 is rotatably mounted upon a shaft 13 parallel to the shaft 11, and is provided with a pawl 14. The gear wheel 8 has four relatively small and equally spaced blank portions 15, which are provided with notches 16 to be engaged by the pawl 14 on the gear segment 7.

The controller is adapted to occupy successively a plurality of positions *a*, *b*, *c* and *d* which are accentuated in the usual manner by a notched cam 17, and a cooperating pawl 18 that is fulcrumed upon a shaft 19 and is held in engagement with the periphery of the cam by a spring 20. The arrangement of contacts on the four segments of the drum 5 is identical, each one including the aforesaid controller positions. The two groups of

stationary contact members 9 and 10 are mounted on rods 21 and 22 which are parallel to the shaft 11, in the same horizontal plane and are provided with wrappings of insulating material. Each stationary contact member comprises a body portion which is rigidly clamped to one of the insulated rods by binding screws 23 and a pair of contact fingers 23^a which extend in opposite directions therefrom and are adapted to engage points on the circumference of the drum, which are separated by an arc of substantially 90°. In this way, when the controller occupies any one of its several positions, the contact fingers are all in engagement with corresponding contacts on the several drum segments, the two portions of a single contact member being in engagement with the contact parts of adjacent drum segments which complete suitable circuit connections that are in multiple relation with each other.

Some of the notches of the cam 17 may be of such form as to permit of rotation of the drum in either direction and others of such form as to limit its rotation to a single direction so that separate protective means may be employed for the starting and for the running positions of the controller, as set forth in the patent hereinbefore referred to, and also in Patent No. 803,233, granted October 31, 1905 to Westinghouse Electric & Manufacturing Company, upon an application filed by Henry D. James.

The handle lever 6 is provided with a push pin 24 which may be pressed inwardly against the action of a spring 25 to disengage a catch 26 from a stationary dial plate 27 located on case section 2 and provided with projections 28 and 29 to limit the motion of the handle and with a plurality of notches 30, 31 and 32 to further accentuate the positions *a* and *b*, which correspond to the running and "off" positions of the controller.

The arrangement of parts is such that when the pawl 18 engages one of the notches *a* in the cam 17, the drum then being in the "off" position, the catch 26 engages the notch 32 and the pawl 14 engages one of the notches 16 in the gear wheel 8. After the drum has been rotated through an angle of substantially 90° from one "off" position to the next, the gear segment 7 becomes disengaged from the gear wheel 8 at one of the blank portions 15 and may be returned to its first "off" position, without actuating the drum, to bring the pawl 14 into engagement with a second notch 16. The operation may then be repeated to move the drum through another 90°. Although the diameter of a drum constructed in this manner is relatively large, the proportions are better than in controllers of the usual character and the current-carrying capacity is materially increased.

The operation of, and the circuit connec-

tions for, the controller may be better understood by reference to Fig. 2, in which the control drum is developed in a single plane. In the system here illustrated, the controller is adapted to supply energy from a two-phase supply circuit 33—34—35—36 to an alternating current motor 37 for starting and continuously operating the same. Assuming that the controller occupies its "off" position *d*, as shown in the drawing; if the drum is now moved to occupy position *a*, circuits will be established as follows: from line conductor 33 through conductor 38 to contact fingers 40 which are joined by a conductor 41. From these points a multiple circuit is established through corresponding segments 42 and 43 in adjacent drum quadrants, which are identical to each other, as above indicated, to fingers 44 which are in engagement therewith and are joined by a conductor 45. Circuit is continued from this point through a conductor 46 to the motor. The opposite terminal of this phase of the motor winding is connected to the line conductor 34 through conductors 47, contact fingers 48, contact members 49 and 50, fingers 51, conductors 52 (which are connected to an intermediate point in a transformer winding 60), a portion of said transformer winding, conductor 53, contact fingers 54, segments 55 and 56, fingers 57 and conductors 58. The other phase of the motor is connected to the line conductors 35 and 36 through the remaining two quadrants of the drum and the transformer winding 61, circuit connections being established in exactly the same way as that already described for one phase of the motor, since the drum quadrants are identical.

As the controller is moved to position *b*, the circuit connections are adjusted in a well known manner to increase the voltage of the current supplied to the motor winding. When the position *c* is occupied, current is supplied from the line conductors directly through a plurality of fuses 62 and the control drum to the motor windings without the interposition of the voltage-reducing transformer windings 60 and 61. From position *c* the drum passes directly into its "off" position *d*, having then rotated through an angle of substantially 90°.

It will be readily understood by those skilled in the art that the total current supplied to each phase of the motor windings is equally divided between the contact segments and engaging fingers of adjacent drum quadrants, since they are connected in multiple circuit.

It is conceivable that various modifications may be effected in the circuit connections without departing from the spirit of my invention, and I desire that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. In a controller, the combination with a rotatable, contact-carrying member having a plurality of similar groups of contact segments, of stationary contact members which severally comprise two electrically connected fingers so disposed as to engage the rotatable member at two points separated by an arc of approximately 360° divided by the number of said similar groups.

2. In a controller, the combination with a rotatable, contact-bearing drum capable of continuous rotation in only one direction, and operating means therefor, of a plurality of stationary contact members that severally comprise two electrically connected but independently yielding fingers so disposed as to engage said drum at points which are separated by an arc of approximately ninety degrees.

3. In a controller, the combination with a rotatable, contact-bearing drum having a plurality of similar groups of control segments, and operating means therefor, of one-half as many groups of stationary contact members which severally comprise two electrically connected but independently yielding fingers so disposed as to engage said drum at points that are separated by an arc of substantially 360° divided by the number of said similar groups.

4. In a controller, the combination with a rotatable drum having four similar groups of contact ring segments equally disposed about the circumference thereof, and operating means therefor, of two groups of stationary contact members which severally engage said drum at four points equally disposed about the circumference of the drum.

5. In a controller, the combination with a rotatable drum having four similar groups of contact ring segments equally disposed about the circumference thereof, and operating means therefor, of two groups of stationary contact members which severally engage

said drum along four lines which are separated by arcs of substantially 90° .

6. In a controller, the combination with a rotatable drum having four similar groups of contact segments, and operating means therefor comprising a driving gear wheel attached to the drum, a segmental gear wheel which meshes with said driving gear wheel and an operating handle that is attached to said segmental gear wheel, of stationary contact members which severally engage said contact segments at four points equally disposed about the circumference of the drum.

7. The combination with a rotatable contact-carrying drum having four similar groups of contact segments, of stationary engaging contact members therefor which comprise two engaging fingers disposed in the same plane perpendicular to the axis of the drum and severally engaging the surfaces thereof at points which are separated by a material arc.

8. In a controller, the combination with a drum or cylinder having a plurality of similar groups of contact segments equally disposed about its circumference, of stationary contact fingers connected in multiple circuit and engaging corresponding segments of adjacent groups.

9. In a controller for electric motors, the combination with a control drum or cylinder having four similar groups of contact segments equally disposed about its circumference, of two sets of stationary contact members, comprising a plurality of two-part contact fingers the parts of which engage corresponding segments of adjacent groups on the drum.

In testimony whereof, I have hereunto subscribed my name this 24th day of February, 1906.

WILLIAM A. PARIS.

Witnesses:

ROSS W. COPELAND,
BIRNEY HINES.