No. 794,135. PATENTED JULY 4, 1905.

E. C. WRIGHT.

INDUCTION MOTOR.

APPLICATION FILED NOV. 24, 1903.

3 SHEETS—SHEET 1.

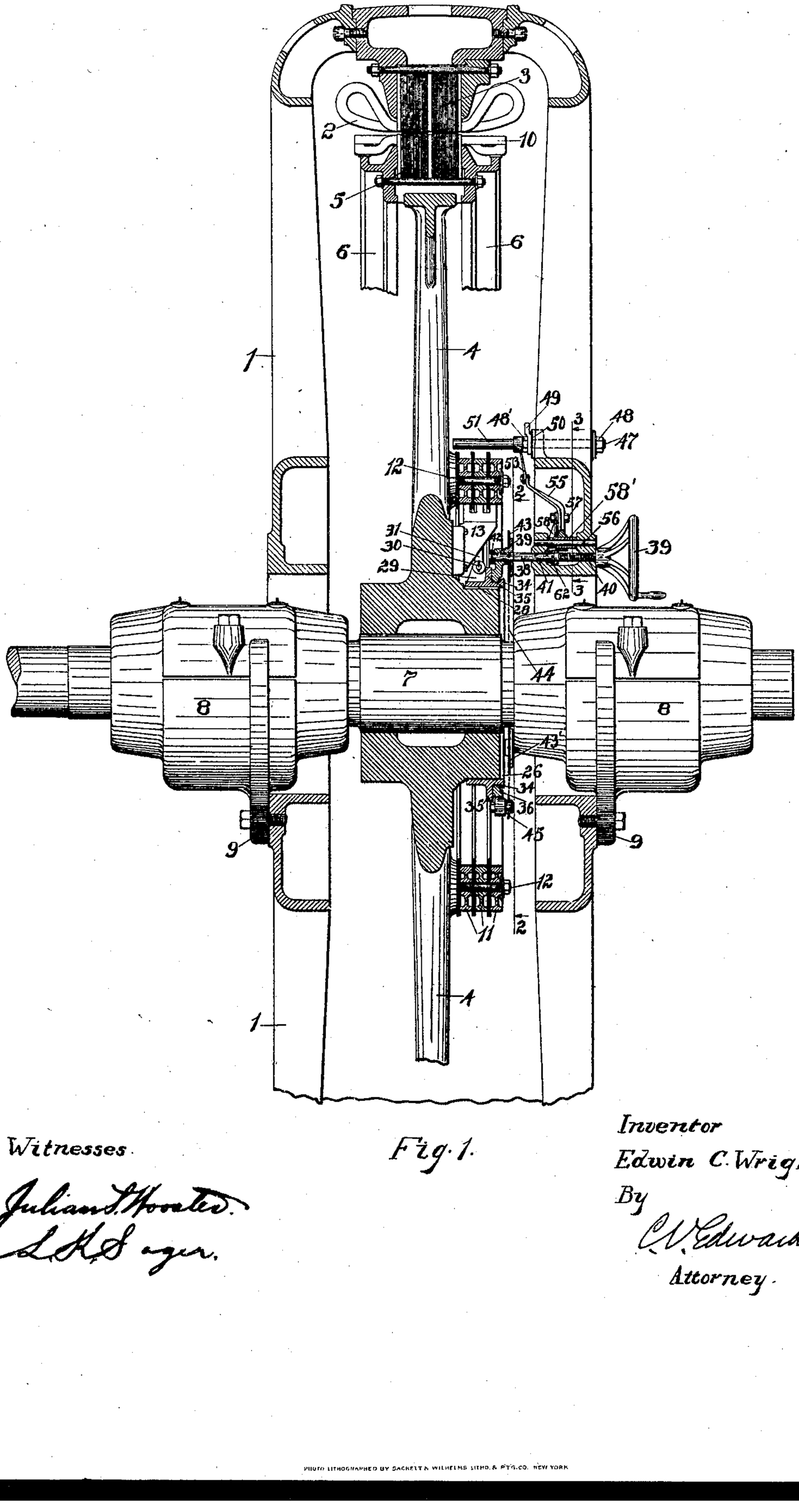

Fig. 1.

Witnesses.

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3 SHEETS—SHEET 2.

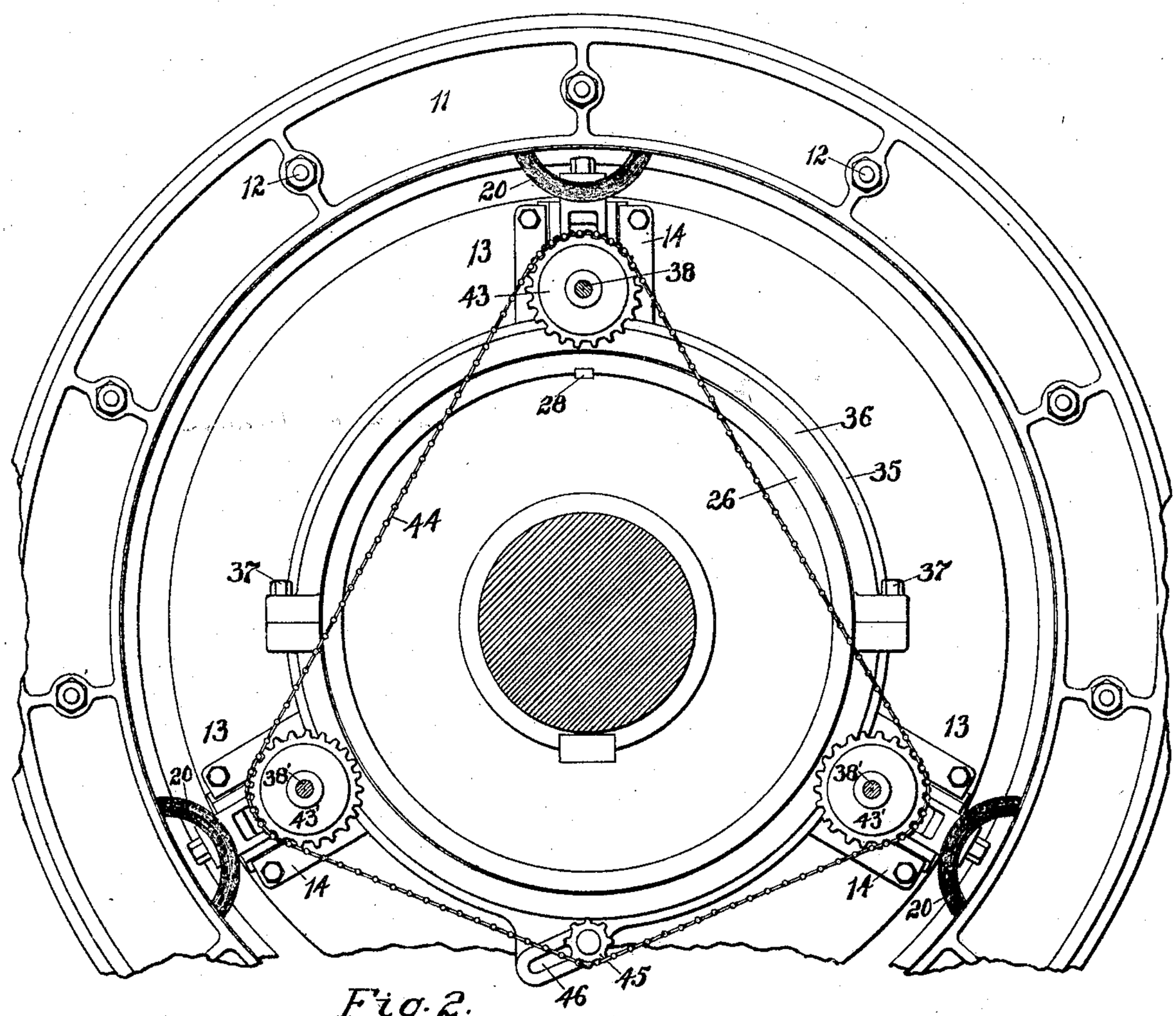

Fig. 2.

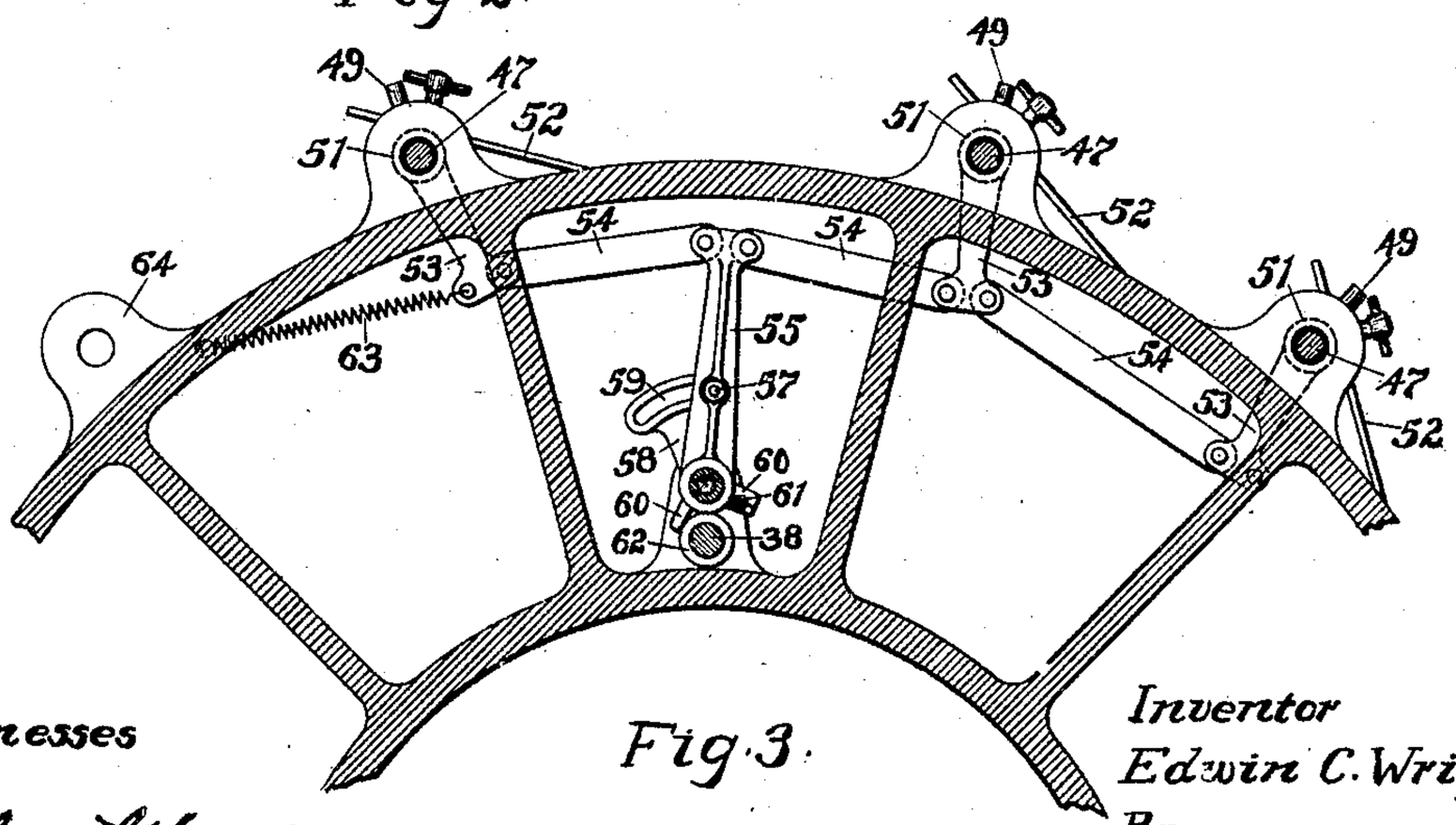

Fig. 3.

Witnesses

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3 SHEETS—SHEET 3.

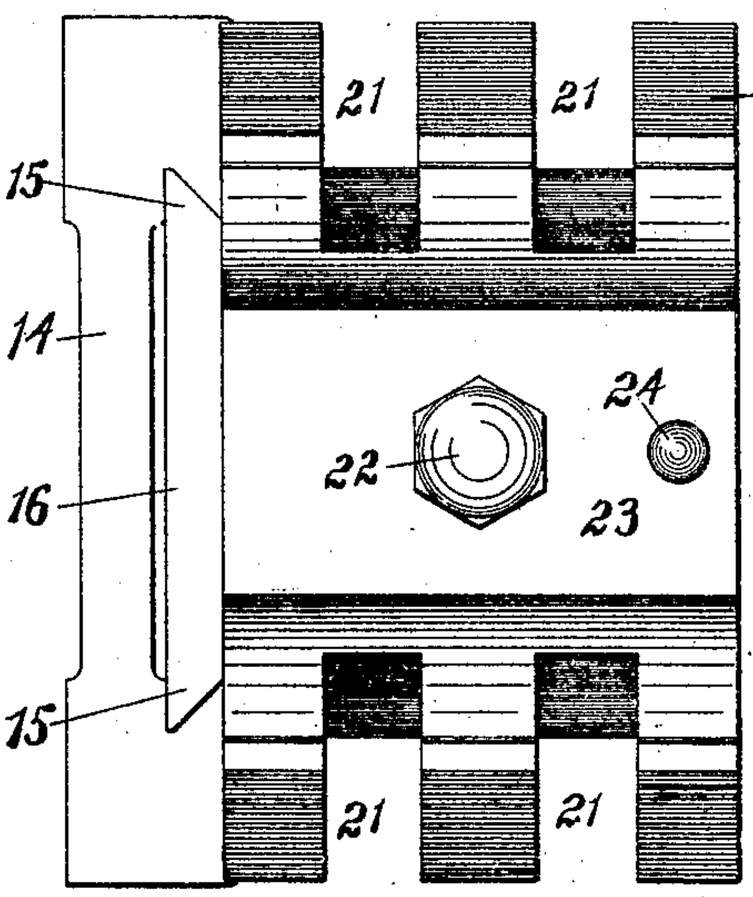

Fig. 4.

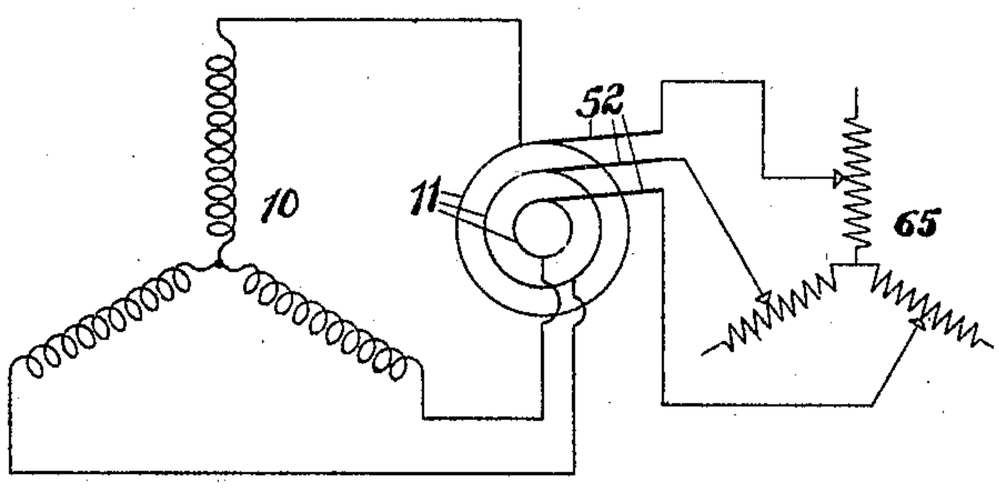

Fig. 8.

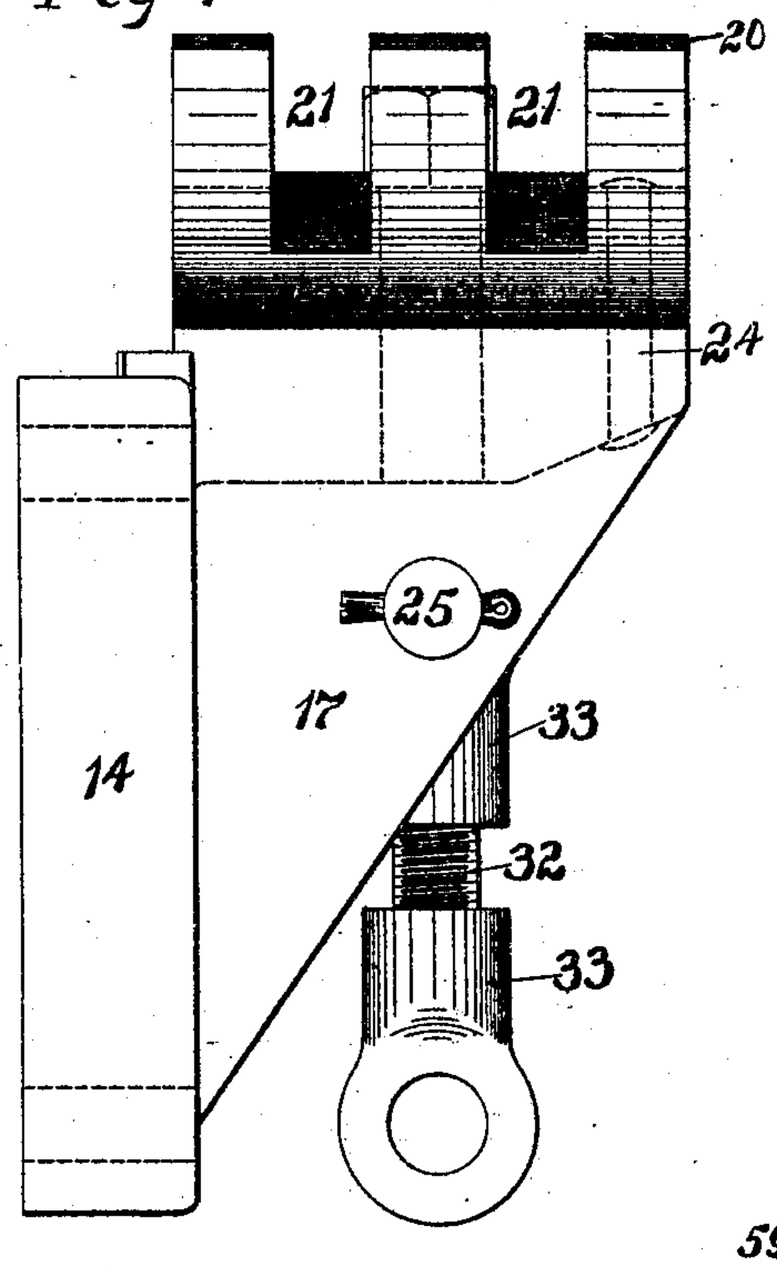

Fig. 5.

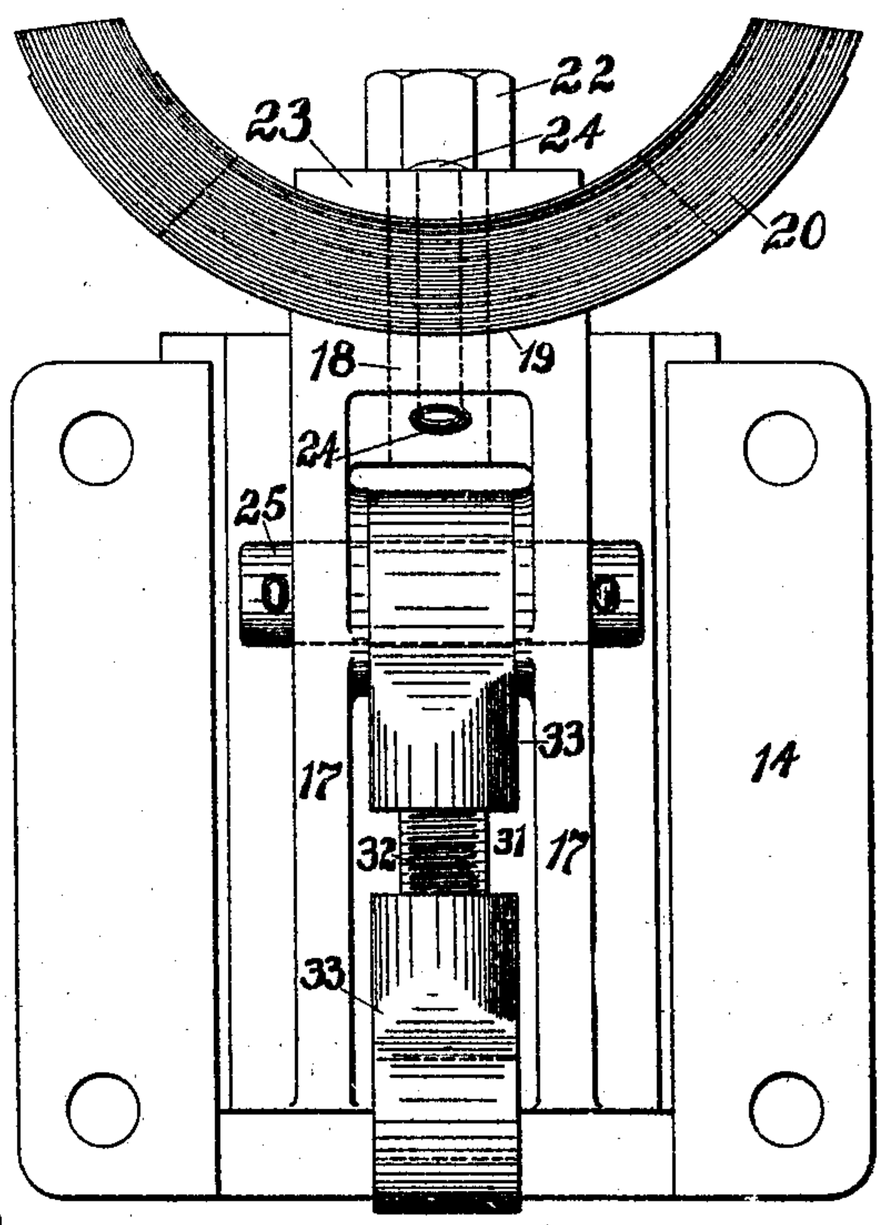

Fig. 6.

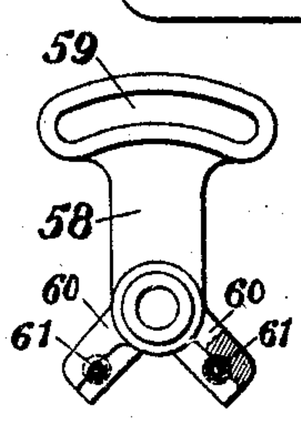

Fig. 7.

Witnesses
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No. 794,135. Patented July 4, 1905.

UNITED STATES PATENT OFFICE.

EDWIN C. WRIGHT, OF NEWPORT, KENTUCKY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE BULLOCK ELECTRIC COMPANY, A CORPORATION OF OHIO.

INDUCTION-MOTOR.

SPECIFICATION forming part of Letters Patent No. 794,135, dated July 4, 1905.

Application filed November 24, 1903. Serial No. 182,454.

To all whom it may concern:

Be it known that I, EDWIN C. WRIGHT, a citizen of the United States, residing at Newport, in the county of Campbell and State of Kentucky, have invented certain new and useful Improvements in Induction-Motors, of which the following is a full, clear, and exact specification.

My invention relates to dynamo-electric machines, and particularly to induction-motors.

It is desirable for the best-running conditions of induction-motors that the resistance of the closed secondary windings be very low. This low resistance is not advantageous, however, for starting, owing to the fact that the currents induced in the secondary windings are so large that they react upon the field and greatly weaken the same, giving a very low starting torque. If a resistance is inserted in the windings upon starting, the strength of the induced currents is correspondingly reduced and an effective starting-torque obtained. It is therefore common to insert resistance in circuit with the windings on starting and to gradually cut this resistance out as the motor comes up to speed. In this manner the requirements for best starting and running conditions are fulfilled.

The object of my invention is to provide a simple, positive, and easily-controlled means for inserting resistance in the rotor-circuit upon starting and to short-circuit the windings after the motor has obtained full speed.

By my invention leads from the rotor-windings are connected to slip-rings, and the windings are short-circuited by means located within the slip-rings. Means are also provided for raising the brushes after the rings are short-circuited, and the movement of a single handle accomplishes both operations.

My invention will be understood from the following description and accompanying drawings, and the novelty thereof set forth in the appended claims.

In the drawings, Figure 1 is a vertical sectional view of part of my improved motor with some parts in full. Fig. 2 is an enlarged sectional view on the line 2 2 of Fig. 1. Fig. 3 is a sectional view on the line 3 3 of Fig. 1. Figs. 4, 5, and 6 are respectively top, side, and front views of the short-circuiting means. Fig. 7 is a detail, and Fig. 8 is a diagram of connections.

The frame of the machine is indicated at 1, and the stator-windings 2 are carried by the laminations 3. The spider 4 of the rotor carries the laminations 5, which are bolted between the end heads 6. The shaft 7 of the rotor is journaled in bearings 8, which are supported by a flange 9, bolted to frame 1. The rotor-winding 10, which may be of any desirable form, is connected by leads to slip-rings 11. The three slip-rings are secured to the spider by bolts 12 and are well insulated, as shown. Short-circuiting switches 13 are slidably mounted upon the spider and when thrown outwardly make electrical connection between the rings. The structure of these short-circuiting switches is illustrated in Figs. 2, 4, 5, and 6. Three of these switches are shown, but any desirable number may be used. Each switch is provided with a guiding-plate 14, bolted to the revolving element within the slip-rings. The switch is dovetailed into this plate, as shown at 15. The body of the switch is composed of a back plate 16 and ribs 17, closed at the top by a web 18. The upper surface of this web is curved, as shown at 19, and seated thereon is the sheet-copper brush 20. The brush is in the form of a section of a cylinder making contact with each ring at its two edges and has cut-away portions 21 to allow clearance for the insulation between the rings. The brush is secured to the body of the switch by a machine-bolt 22, which engages the web 18, and a steel plate 23, extending the width of the brush, forms a seat for the head of the bolt and firmly clamps the laminations together. A rivet 24, passing through the laminations and web 18 at the front of the brush, keeps all parts from turning with reference to each other. Upon the hub of the revolving element is mounted an axially-slidable ring 26. This ring is prevented from turning with reference to the spider by the key 28. Lugs 29 are formed on the ring

26 for each switch and connected by a pin 30 and link 31 with the pin 25 of the switch. The link 31 is adjustable in length, a threaded portion 32 being engaged by the ends 33. When the ring 26 is moved inwardly to the position shown in Fig. 1, the switches move outwardly and short-circuit the slip-rings. An outward movement of ring 26 withdraws the switches from contact with the slip-rings.

The slidable ring is provided with a flange 34 and a rib 35. A ring 36 is located between this flange and rib and is made in two halves secured together by the bolts 37. A shaft 38, having the handle 39, is mounted in the stationary frame 1 and has a threaded portion engaging the frame at 40 and is further guided by the lug 41. The inner end of the shaft 38 engages the lug 39 on the ring 36 and is free to turn therein, but is prevented from longitudinal movement relatively thereto by the collar 42 and sprocket-wheel 43, which are fixed to the shaft 38. Two threaded shafts 38′ are similarly mounted in the frame 1 and are likewise provided with sprocket-wheels 43′ and are connected to the ring 36 in the same manner as above described with reference to shaft 38. A chain 44 passes around the three sprocket-wheels and an idler 45, as shown in Fig. 2. The idler is mounted upon a stud which is adjustable in the slot 46, formed on ring 36 for the purpose of taking up slack in the chain.

At suitable distances apart three brush-studs 47 are mounted in the frame 1 and are well insulated therefrom. Nuts 48 and 48′ secure the studs to the frame, and a terminal lug 49 is fixed between the nut 48′ and the insulation 50, which separates the lug from the frame. Upon each brush-stud is mounted a sleeve 51, which carries a brush 52, and each stud is thus electrically connected with one slip-ring. An arm 53 extends from each sleeve, and said arms are connected by fiber links 54 to an arm 55, freely mounted upon a sleeve 58′, which is in turn mounted upon a shaft 56, fixed in the stationary frame. The arm 55 is secured by a bolt 57 to another arm 58 integral with sleeve 58′. Arm 58 is provided with a curved slot 59 at its upper end, through which the bolt 57 passes, and can therefore be adjusted with reference to arm 55. From the lower end of arm 58 extend two lugs 60, in each of which is seated a steel ball 61. A small conical piece 62 is fixed upon the shaft 38 and is adapted to contact with one or the other of the steel balls 61. A spring 63 is attached at one end to one of the arms 53 and at the other to the fixed frame of the machine, as shown in Fig. 3, and therefore tends to keep the brushes in contact with the slip-rings. When the brushes are in contact with the rings, the arm 58 is adjusted to such a position with reference to the arm 55 as to bring one of the steel balls 61 in the path of cone 62. The device as shown in Fig. 3 is arranged for right-handed rotation of the machine. For rotation in the opposite direction the right-hand brush-stud and link 54 is shifted to the left and the stud supported in the additional opening 64, provided for that purpose. The spring is then attached to the frame at the right, taking a reverse position to that shown in Fig. 3. The arm 58 is then adjusted so as to bring the right-hand ball 61 in the path of the cone 62.

The electrical connections are diagrammatically illustrated in Fig. 8. The windings 10 are shown as connected in star form and are connected to the slip-rings 11. From the brushes 52 connections lead to an adjustable rheostat 65.

The operation of my device is as follows: Before starting the handle 39 is always turned to its outer position, and the short-circuiting switches 13 are then removed from contact with the slip-rings, and as the cone 62 does not then engage either of the balls 61 the brushes are kept in contact with the slip-rings by the spring 63. The full resistance 65 is then in circuit with the rotor-winding, and as the rotor speeds up this resistance is gradually reduced. After the resistance has been sufficiently reduced or cut out, the handle 39 is turned, which carries the shaft 38 inwardly as well as the shafts 38′ as they are likewise turned by means of the sprocket-wheels and chain 44. The inward movement of these shafts carries with them the ring 36, as well as the ring 26, which freely turns within the ring 36. The switches 13 are thus moved outwardly into engagement with the slip-rings and short-circuits them. The last few turns of the handle brings the cone 62 into engagement with one of the lugs 60 and forces the upper end of arm 55 to the right against the action of spring 63, and so raises the brushes. Although the last few turns of the handle are effective in raising the brushes, the movement of the switches is slight, as the links 31 are then in a nearly radial position, and this slight movement merely gives increased pressure against the slip-rings.

Although I have described a specific form of my invention, it is understood that I am not limited to the exact construction shown, and it is evident that various changes may be made in the form of construction and still be within the scope of the claims.

I claim as my invention—

1. In an induction-motor, the combination of the revolving element having secondary windings, slip-rings connected to said windings, one or more switches adapted to short-circuit the slip-rings mounted within the same, an axially-movable ring mounted on said revolving element, links connecting said ring to the switches, a shaft having threaded

engagement with the fixed frame of the machine and connected to said axially-movable ring, and means for turning said shaft.

2. In an induction-motor, the combination of the revolving element having secondary windings, slip-rings connected to said windings, one or more switches adapted to short-circuit the slip-rings mounted within the same, an axially-movable ring mounted on said revolving element, links connecting said ring to the switches, means engaging said ring, shafts connected to said means and having threaded engagement with the fixed frame, gearing connecting said shafts, and means for turning one of said shafts.

3. In an induction-motor, the combination of the revolving element having secondary windings, slip-rings connected to said windings, one or more switches adapted to short-circuit the slip-rings mounted within the same, an axially-movable ring mounted on said revolving element, links connecting said ring to the switches, means engaging said ring, shafts connected to said means and having threaded engagement with the fixed frame, a sprocket-wheel on each of said shafts, a chain connecting said sprocket-wheels, and means for turning one of said shafts.

4. In an induction-motor, the combination of the revolving element having secondary windings, slip-rings connected to said windings, one or more switches adapted to short-circuit the slip-rings mounted within the same, an axially-movable ring mounted on said revolving element, links connecting said ring to the switches, means engaging said ring, shafts connected to said means and having threaded engagement with the fixed frame, a sprocket-wheel on each of said shafts, an adjustable idler, a chain connecting said sprocket-wheels and idler, and means for turning one of said shafts.

5. In an induction-motor, the combination of the revolving element having secondary windings, slip-rings connected to said windings, switches adapted to short-circuit the slip-rings, brushes mounted on studs fixed to the frame of the machine, a spring connected with said brushes and tending to force them into engagement with the slip-rings, and means operated by a single handle for moving above-mentioned switches into engagement with the slip-rings and for raising the brushes therefrom.

6. In an induction-motor, the combination of the revolving element having secondary windings, slip-rings connected to said windings, switches adapted to short-circuit the slip-rings, brushes mounted on studs fixed to the frame of the machine, a spring connected with said brushes and tending to force them into engagement with the slip-rings, an axially-movable ring mounted on said revolving element, links connecting said ring to the switches, a shaft having a threaded engagement with the frame of the machine and connected to said axially-movable ring, means controlled by the shaft for raising the brushes and a handle for operating the shaft.

7. In an alternating-current machine having collector-rings, the combination of studs fixed to the frame of the machine, sleeves having arms mounted on said studs, brushes on said sleeves, links connecting said arms, a spring tending to keep the brushes in contact with the collector-rings, an arm connected to said links and mounted upon a shaft in the frame, and means for turning said arm to raise the brushes.

8. In an alternating-current machine having collector-rings, the combination of studs fixed to the frame of the machine, sleeves having arms mounted on said studs, brushes on said sleeves, links connecting said arms, a spring connected with one of said arms and tending to keep the brushes in contact with the collector-rings, an arm connected to said links and mounted upon a shaft in the frame, a second arm mounted on said shaft and adjustably connected to said first-named arm, said second arm having projecting lugs, a second shaft having threaded engagement with the frame of the machine, a cone fixed to said last-named shaft and adapted to come into engagement with one or the other of said lugs and a handle for turning said second shaft.

9. In an alternating-current machine having collector-rings, the combination of studs fixed to the frame of the machine, sleeves having arms mounted on said studs, brushes on said sleeves, links connecting said arms, a spring connected with one of said arms and tending to keep the brushes in contact with the collector-rings, an arm connected to said links and mounted upon a shaft in the frame, a second arm mounted on said shaft and adjustably connected to said first-named arm, said second arm having projecting lugs, a ball seated in each of said lugs, a second shaft having threaded engagement with the frame of the machine, a cone fixed to said last-named shaft and adapted to come into engagement with one or the other of said balls, and a handle for turning said second shaft.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN C. WRIGHT.

Witnesses:
L. K. SAGER,
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