No. 745,926. PATENTED DEC. 1, 1903.

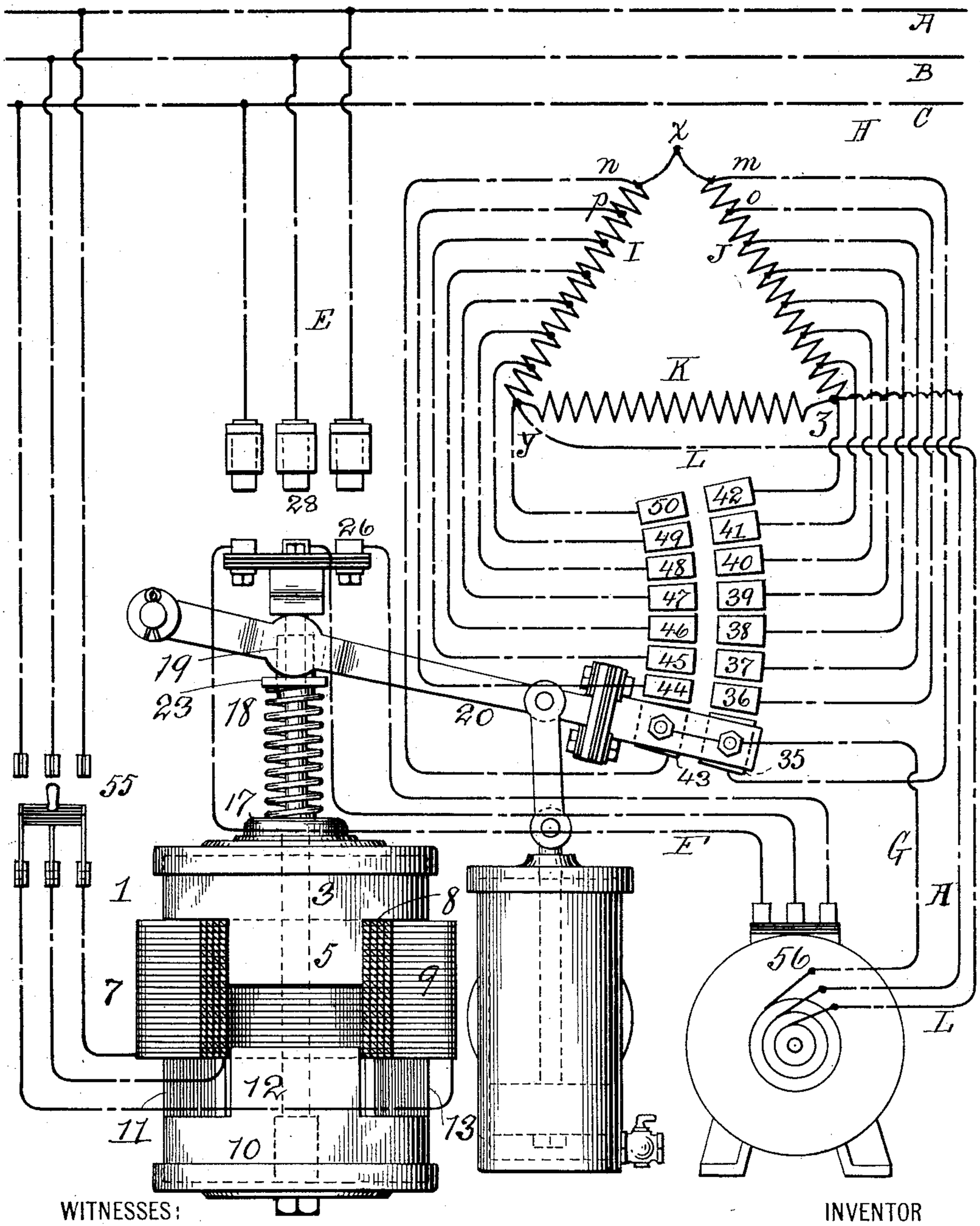
A. SUNDH.

CONTROLLER FOR ALTERNATING CURRENT MOTORS.

APPLICATION FILED AUG. 5, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.



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NO MODEL. 2 SHEETS—SHEET 2.

FIG. 2.

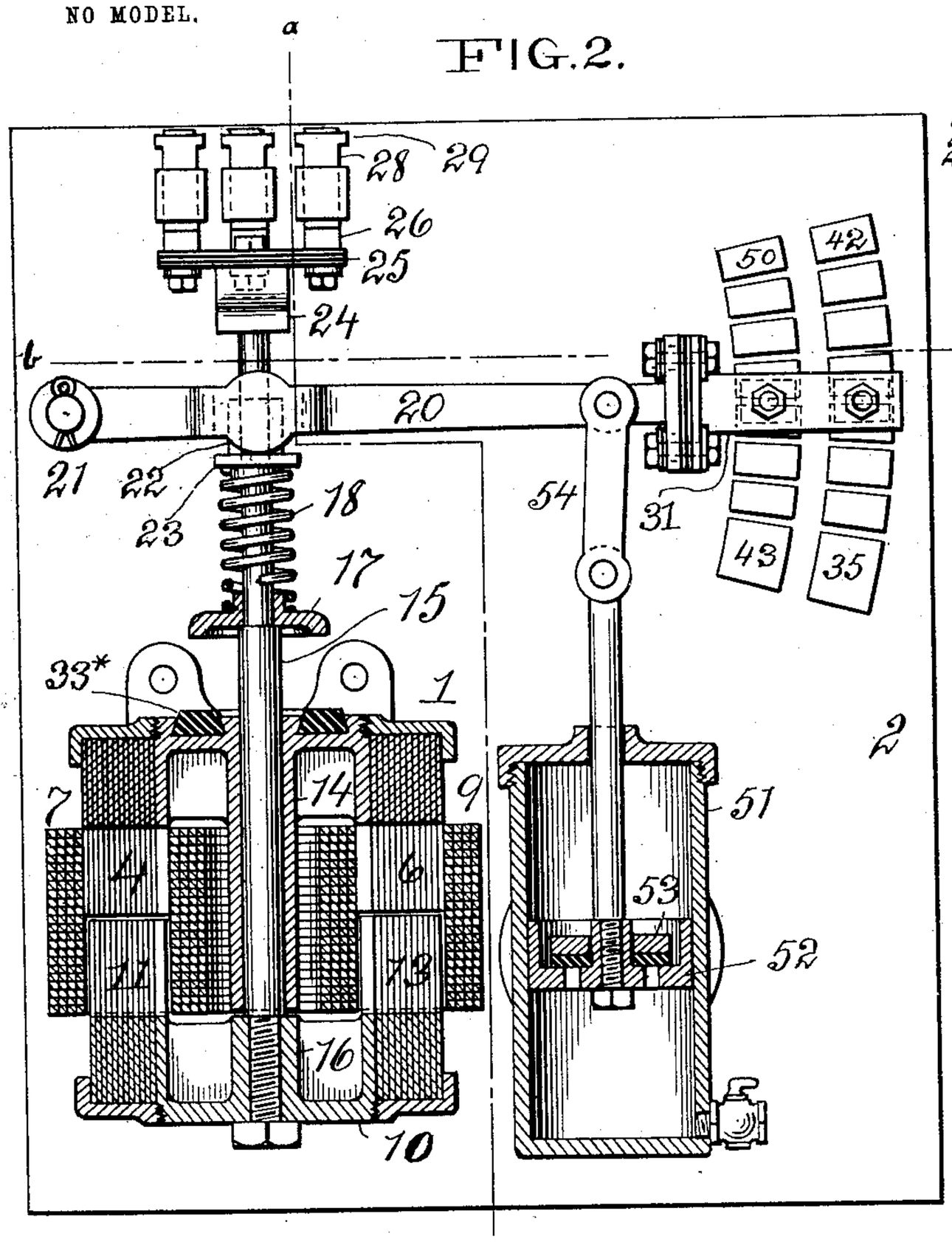


FIG. 3.

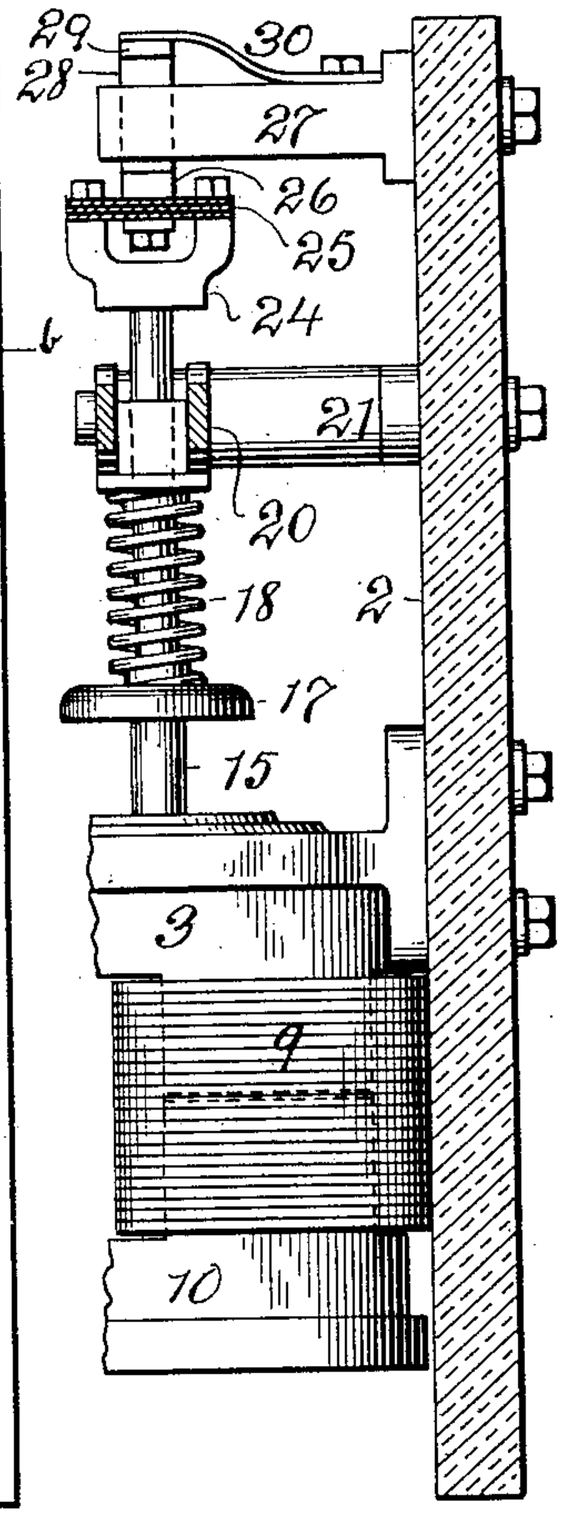
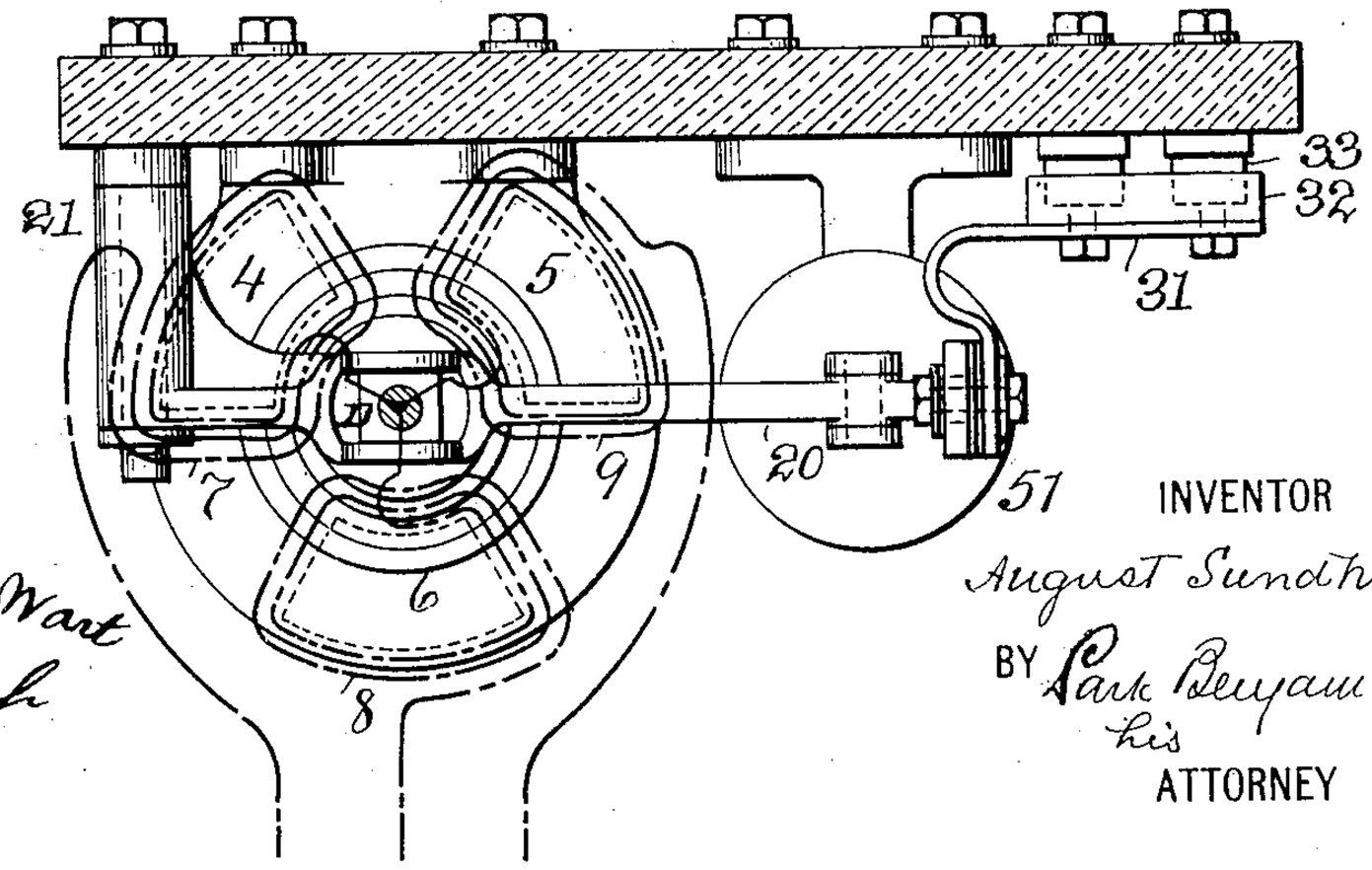


FIG. 4.



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No. 745,926. Patented December 1, 1903.

UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK.

CONTROLLER FOR ALTERNATING-CURRENT MOTORS.

SPECIFICATION forming part of Letters Patent No. 745,926, dated December 1, 1903.

Application filed August 5, 1903. Serial No. 168,266. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, of Yonkers, Westchester county, New York, have invented a new and useful Improvement in Controllers for Alternating-Current Motors, of which the following is a specification.

The invention relates to a controller for alternating-current induction-motors.

The invention consists, broadly, in the combination of an alternating-current induction-motor with a single controlling-electromagnet in shunt-circuit therewith, and hence energized by the alternating current. This, so far as I know, is wholly new in the art. As here embodied the said electromagnet directly controls a variable resistance in the armature-circuit of the motor.

As herein shown, the apparatus embodies an alternating-current magnet of the type set forth in United States Letters Patent No. 733,549, granted to David L. Lindquist July 14, 1903. The movement of the armature of said magnet is short in extent and rapid in operation. In order to give to the movable member controlled thereby—here a pivoted resistance-varying lever—a slower and greater travel, I provide an accumulator in which a part of the power of the moving armature is stored and which after the armature has completed its movement operates independently of said armature to move the said lever a further distance. The said lever controls resistances disposed in the rotor-circuit and causes the same to be gradually cut out in starting said motor.

In the accompanying drawings, Figure 1 is a general view showing the circuit connections and the positions of the parts when the controlling-electromagnet is not energized. Fig. 2 is a vertical section showing the position of the parts after the magnet has completed its stroke and established circuit between the stator of the motor and main line, but before all of the resistances are cut out of the rotor-circuit. Fig. 3 is a section on the line *a a*, and Fig. 4 is a section on the line *b b* of Fig. 2.

Similar letters and numbers of reference indicate like parts.

1 is the controlling-magnet, bolted to the back plate 2. Said magnet has an upper cylindrical core 3 with three downwardly-extending projections 4 5 6. The coils 7 8 9 are wound on said projections and extend below the same, so that each core projection occupies about half the interior of the coil wound thereon. The magnet-armature 10 is similarly shaped, with projections 11 12 13 constructed to enter the coils 7 8 9 and to fill the space therein when drawn in by the attraction of the excited magnet. Centrally disposed within the magnet-core is a sleeve 14, through which passes the rod 15, which is threaded at its lower end and secured by a nut in a central sleeve 16 of the armature 10. The construction of the aforesaid magnet designed to be operated by an alternating current I do not herein claim.

The rod 15 is shouldered to receive a fixed downwardly-flanged collar 17, which forms an abutment for a helical spring 18 surrounding said rod and at its upper end meeting the lower flanged portion 23 of a sliding collar 19.

20 is a lever-arm pivoted at 21 to the back plate 2 and having a slot through which passes rod 15 and a portion of collar 19. The lower edge 22 of the rod on each side of the slot is rounded and bears on the upper side of the collar-flange 23.

At the upper end of the rod 15 is a fork 24, which carries a plate 25 of insulating material, in which are secured the three contacts 26.

Secured to the back plate 2 are three brackets 27, at the outer end of each of which is a vertically-sliding contact-pin 28. Each contact-pin has an enlarged head 29 to prevent its falling through the aperture in bracket-arm 27, and bearing on said head is a leaf-spring 30, secured to said arm.

Bolted to the end of lever-arm 20 and insulated therefrom is a bent spring 31, to the extremity of which is secured a block 32, carrying contacts 33. Said contacts are constructed to sweep over and meet two parallel series of fixed contacts 35 36 37 38 39 40 41 42 and 43 44 45 46 47 48 49 50 as the arm 20 is swung on its pivot.

51 is a dash-pot cylinder secured to the back plate 2. The piston 52 has openings closed when said piston rises by the valve-disk 53, but opened by the lifting of said valve-disk

when the piston descends. The piston-rod is connected to lever 20 by a link 54.

55 is a hand-switch, and 56 is a three-phase motor to be controlled.

The main three-phase conductors A B C are respectively connected through switch 55 to the coils 7 8 9 of magnet 1, the terminals of said coils being connected as shown at D, Fig. 4. The fixed contacts 28 also are connected by wires E to said main conductors. The contacts 26, carried by rod 15, are connected by wires F to the stator of the motor, the rotor of which is connected by wire G to contact-plate 35, by wire H to a point *z* between the two ohmic resistances K J, and by wire L to a point *y* between the two ohmic resistances I and K, which point is also connected to the fixed contact 50. The resistances I J K are in delta connection, the point *z* between resistances J K being connected to contact-plate 42. The remaining fixed contacts are connected in pairs to points on the resistances I J. Thus contacts 36 and 44 are connected, respectively, to point *m* on resistance J and point *n* on resistance I, the distance of said points from the junction-point *x* being the same. Similarly, contacts 37 and 45 are connected to points *o* and *p*, and so on.

The condition of parts being as shown in Fig. 1, the operation is as follows: The hand-switch is closed. Magnet 1 thus becomes energized and attracts its armature, thus raising the rod 15. Inasmuch as the movement of the lever 20 is resisted by the dash-pot 13, the said lever is not moved by rod 15 until after a certain compression of the spring 18 takes place. Then the end spring 31 begins to move over the fixed contacts. The rod 15 continues to rise until its contacts 26 meet the contacts 28, any shock of meeting being prevented by the upward yielding of the last-named contacts permitted by the leaf-springs 30. When the upward travel of the rod is arrested, the spring 18, which is, in fact, an accumulator, is free to expand and by reason of its expansion to move the lever 20 over the remaining fixed contacts and finally to close circuit between the fixed contacts 50 and 42. As a consequence of this movement of the lever-arm to close circuit successively between contacts 44 36 and 45 37 and 46 38, and so on, it is obvious that increasing proportions of the ohmic resistances I J are cut out of the rotor-circuit, until finally when the lever-arm comes to rest and circuit is closed between contacts 50 42 all of said resistances are removed and the motor reaches full running speed.

When circuit is broken at the hand-switch 55, the armature 10 of magnet 1 drops quickly by its own weight, the valve 53 in the dash-pot piston opening to allow of free descent. The fractional resistances are then gradually cut into the rotor-circuit and the parts resume the position shown in Fig. 1, the collar 17 on magnet-rod 15 being received without jar upon an elastic cushion 33* on the upper side of the magnet-body.

I claim—

1. An alternating-current induction-motor and a single electromagnet in shunt-circuit therewith and directly controlling the same.

2. An alternating-current induction-motor, a variable resistance in the armature-circuit and a single electromagnet in shunt-circuit with said motor and directly controlling said resistance.

3. An alternating-current induction-motor, an electromagnet and resistances in the armature-circuit thereof, means for closing circuit through the motor-field and means for cutting out said resistances step by step, said circuit-closing means and said means for cutting out resistances being both controlled by said magnet.

4. Main-line conductors, and in branch circuit therewith (1) an alternating-current induction-motor, resistances in the rotor-circuit thereof and a circuit-closer for the field and (2) an electromagnet constructed to close said field-circuit and to vary said resistances.

5. An alternating-current induction-motor, a plurality of resistances in the rotor-circuit, a plurality of pairs of fixed contact-terminals connected to said resistances, a swinging arm sweeping over said terminals and establishing circuit successively between the units of the several pairs thereof and an electromagnet in circuit with said motor and controlling said arm.

6. The combination of an electromagnet, an armature, a supporting-rod for said armature, a fixed abutment on said rod, an independently-pivoted lever, a spring interposed between said lever and said abutment and a variable resistance controlled by said lever.

7. The combination of an electromagnet, an armature a supporting-rod for said armature, a fixed abutment on said rod, an independently-pivoted lever, a spring interposed between said lever and said abutment, a variable resistance controlled by said lever, circuit-terminals on said rod and independently-supported fixed circuit-terminals in the path of said rod-terminals.

8. The combination of an eiectromagnet, an armature, a supporting-rod for said armature, a fixed abutment on said rod, an independently-pivoted lever, a spring interposed between said lever and said abutment, a variable resistance controlled by said lever, and a dash-pot connected to said lever and opposing the motion thereof impressed by said armature when said magnet is energized.

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

AUGUST SUNDH.

Witnesses:
I. A. VAN WART,
J. LOESCH.