No. 608,249. Patented Aug. 2, 1898.

C. S. BRADLEY.

ALTERNATING CURRENT INDUCTION MOTOR.

(Application filed Oct. 22, 1895.)

(No Model.)

Fig 1.

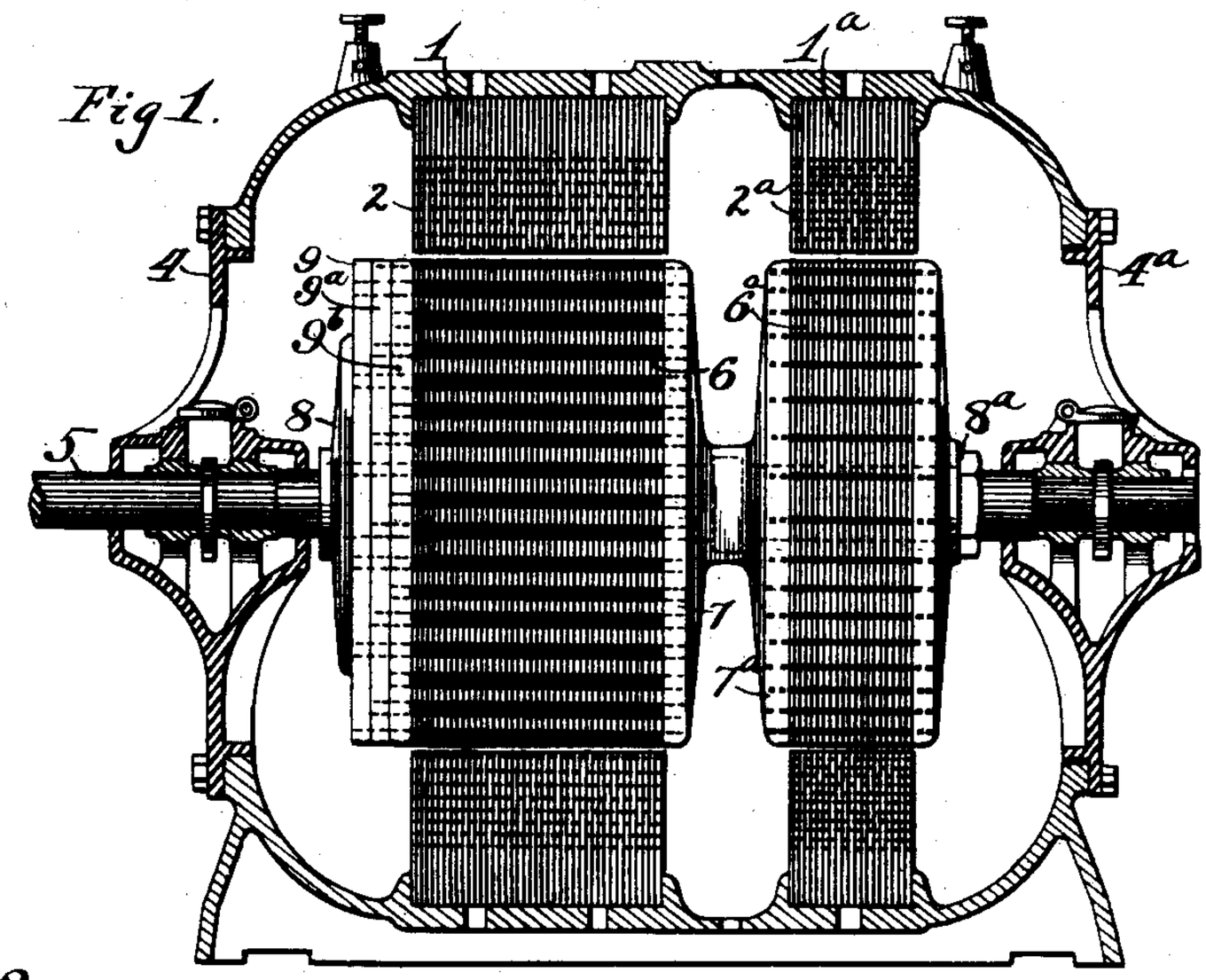


Fig 2

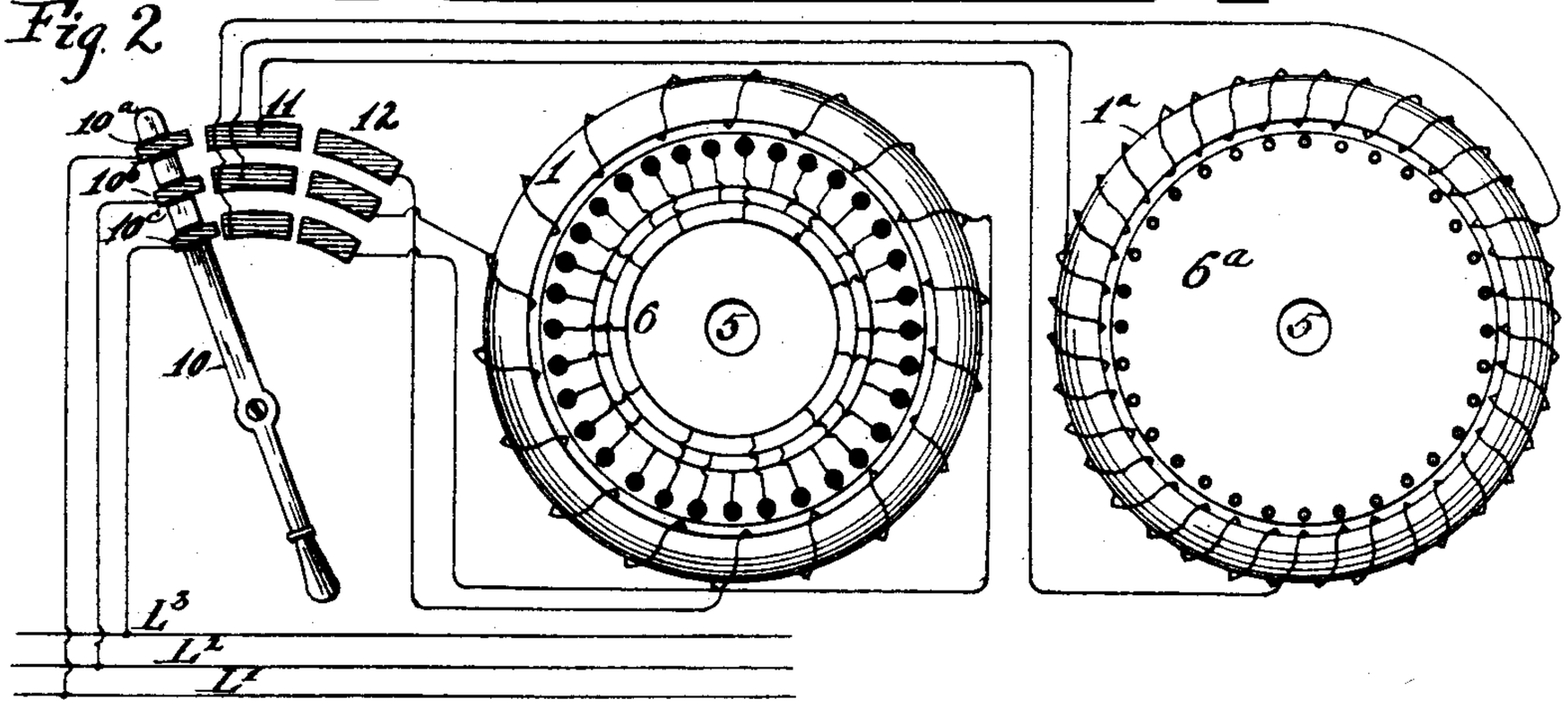
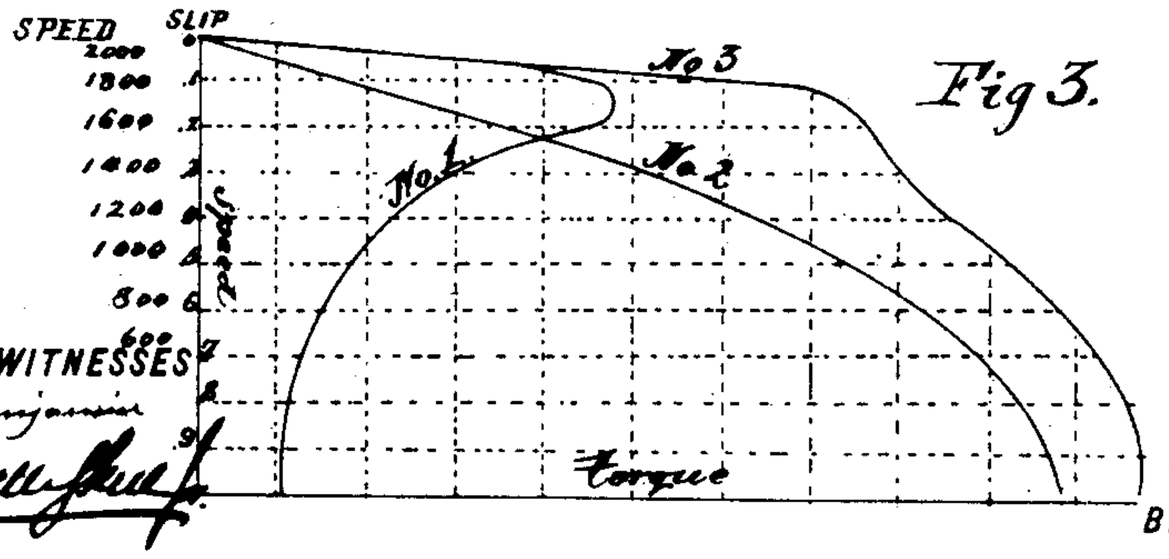


Fig 3.



WITNESSES

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CHARLES S. BRADLEY, OF AVON, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ALTERNATING-CURRENT INDUCTION-MOTOR.

SPECIFICATION forming part of Letters Patent No. 608,249, dated August 2, 1898.

Application filed October 22, 1895. Serial No. 566,453. (No model.)

To all whom it may concern:

Be it known that I, CHARLES S. BRADLEY, a citizen of the United States, and a resident of Avon, in the county of Livingston, in the State of New York, have invented certain new and useful Improvements in Alternating-Current Induction-Motors, of which the following is a specification.

This invention relates to alternating-current induction-motors.

The principal object sought to be obtained is to adapt such a motor to give a great starting torque without the employment of the auxiliary resistance of starting devices commonly employed for such a purpose.

My improvements particularly relate to the induction type of alternating-current motors, in which a closed circuit on one of the members is inductively energized by the other member, which is excited by currents supplied from a suitable source. In carrying out my invention I provide a motor with two independent field-magnets, each having a cooperating induction-armature, and provide means for cutting either or both field-magnets into or out of connection with the source of alternating current. The two field-magnet windings are adapted to produce different degrees of magnetic density in their respective cores, the one having the higher density being utilized for starting the motor, and the armature-winding of the latter is made of higher resistance than the other to produce a better working relation of the inducing and induced members under the great induction incident to low armature speeds. The switch is so constructed that both fields may, when desired, be rendered simultaneously active and thus develop a great running torque to carry a temporary extraordinary load.

The several features of novelty of the invention will be more particularly hereinafter described and will be definitely indicated in the appended claims.

In the accompanying drawings, which illustrate the invention, Figure 1 is a sectional view of a motor embodying my improvements. Fig. 2 is a diagrammatic view of the same, and Fig. 3 is a diagram of the speed and torque relations in the several positions of the switch.

1 1^a represent two field-magnets formed of punchings of soft-iron laminæ or plates provided with internal radial grooves 2 2^a, to receive the windings. One of the field-magnets 1 contains a larger number of plates than the other, so as to give less density per unit area of the magnetic field. The piles of plates are assembled and suitably placed in a mold, and a frame including a bed-plate is cast around them. The frame is provided at the sides with plates 4 4^a, suitably bored and provided with journal-boxes for the armature-shaft 5. The field-magnet coils are suitably supported in the radial grooves and the terminals carried to binding-posts mounted on a suitable part of the frame and properly insulated therefrom. The winding of the magnet 1^a is provided with a greater number of ampere-turns than that of 1, so as to produce a magnetic field of greater density. Upon the shaft 5 are mounted two armature-cores 6 6^a, composed of piles of iron laminæ radially grooved on the periphery to receive the conducting bars or wires which compose the closed-circuit windings. The type of winding shown is the "squirrel-cage," the conductors terminating at the ends in conducting disks or heads. The two field-magnets are preferably separated a sufficient distance to permit the coils to be readily placed in position, thus providing between the two armatures an open space into which openings may be made, as shown, from the outside of the frame to promote ventilation. The adjacent end disks of the two armatures may be formed of a single piece or casting of metal 7 7^a, and the outer heads may be screwed up firmly against the piles of plates by nuts 8 8^a on the armature-shaft. The successive conductors of armature 6 are connected progressively with a plurality of end disks 9 9^a 9^b, thus providing a different path for the several conductors differing phasially in electromotive force. The conductors and end plates are preferably insulated and the disks 9 9^a 9^b are also preferably insulated from one another. Thus all of the conductors terminate at one side in the common disk and at the other side connect with the respective disks 9 9^a 9^b in regular order, the number of conductors being a multiple of the number of disks. Thus the resultant currents in the several conduc-

tors differ in phase and a better operation of the motor results than when the conductors are in simple multiple and all inductively related to the same pole carry current of the same resultant phase.

The circuit connections for a triphase motor are shown in Fig. 2. A pivoted switch-lever 10 carries three insulated brushes 10^a 10^b 10^c, electrically connected, respectively, with supply-wires L' L^2 L^3 of a triphase circuit. Two groups of contact-blocks 11 and 12, three to each group, connect with suitable points of a rotary field-winding on the cores 1 1^a. The contact-blocks are so related that the switch may first, after closure of the circuit, connect with the field-magnet corresponding to the high-resistance armature 6^a and may then be further shifted so as to connect the other field-magnet in circuit, or may by placing the brushes at an intermediate point connect both field-magnets in circuit.

The performance of the motor in the different positions of the switch is shown in Fig. 3. Curve No. 1 shows the relation of torque and speed of the low-resistance armature, speed being measured on a vertical and torque on a horizontal line. It will be seen that the starting torque of such an armature is very low, increasing to a maximum as the slip decreases until a speed of eighteen hundred revolutions per minute is attained. Curve No. 2 shows the speed-torque relation of the high-resistance armature, the starting torque being very high and gradually decreasing as the speed rises and the induction grows weaker. Curve No. 3 shows the speed-torque relation when both fields are active, the running torque being the sum of the torques on both armatures and being of a fairly uniform value over quite a wide range of speed. In fact, with a field speed of two thousand per minute the running torque at eighteen hundred revolutions of the armature is about two-thirds of the starting torque. As hereinbefore stated, the field-magnet 1^a is wound to produce a very strong field. Since this winding is principally employed only in starting and for brief periods, the considerable heating of the motor with a dense field does not preclude its use. A great practical advantage of the construction is that the motor cannot be run above its rated power. A ten-horse-power motor cannot be continuously operated at fifteen-horse power, and a check upon the consumer's honesty in use of current is provided.

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

1. An alternating-current motor provided with two independent field-magnets wound to develop rotary magnetic fields, and two armatures of relatively high and low resistance cooperating with said fields.

2. An alternating-current motor provided with two independent field-magnets wound to develop rotary magnetic fields of different magnetic densities, and armatures coöperating with the respective fields.

3. An alternating-current motor provided with two armatures of relatively high and low resistance, independent coöperating field-magnets wound to develop a denser magnetic field about the high-resistance armature, and a switch for cutting out the coils corresponding to the denser field, when desired.

4. An alternating-current motor provided with two armatures of relatively high and low resistance, and independent field-magnets wound to develop rotary magnetic fields of different densities coöperating therewith.

5. An alternating-current induction-motor provided with an armature having a squirrel-cage winding connecting with a common conductor at one end, and separate conductors for the different current phases at the other end.

6. An alternating-current induction-motor provided with an armature having a squirrel-cage winding having a plurality of end plates to afford different paths for currents generated in conductors in different phase relations to the field-magnet poles.

7. An induction-motor secondary of the squirrel-cage type, the conductors of which are electrically connected at one end and at the other are divided into a number of sets or series, the conductors in each set having a common connection.

In testimony whereof I have hereunto subscribed my name this 26th day of June, A. D. 1895.

CHARLES S. BRADLEY.

Witnesses:
WM. V. HEAPHY,
ROBERT J. MCNALLY.