S. R. BERGMAN.

INDUCTION MOTOR.

APPLICATION FILED MAR. 22, 1909.

936,292. Patented Oct. 12, 1909.

Fig. 1.

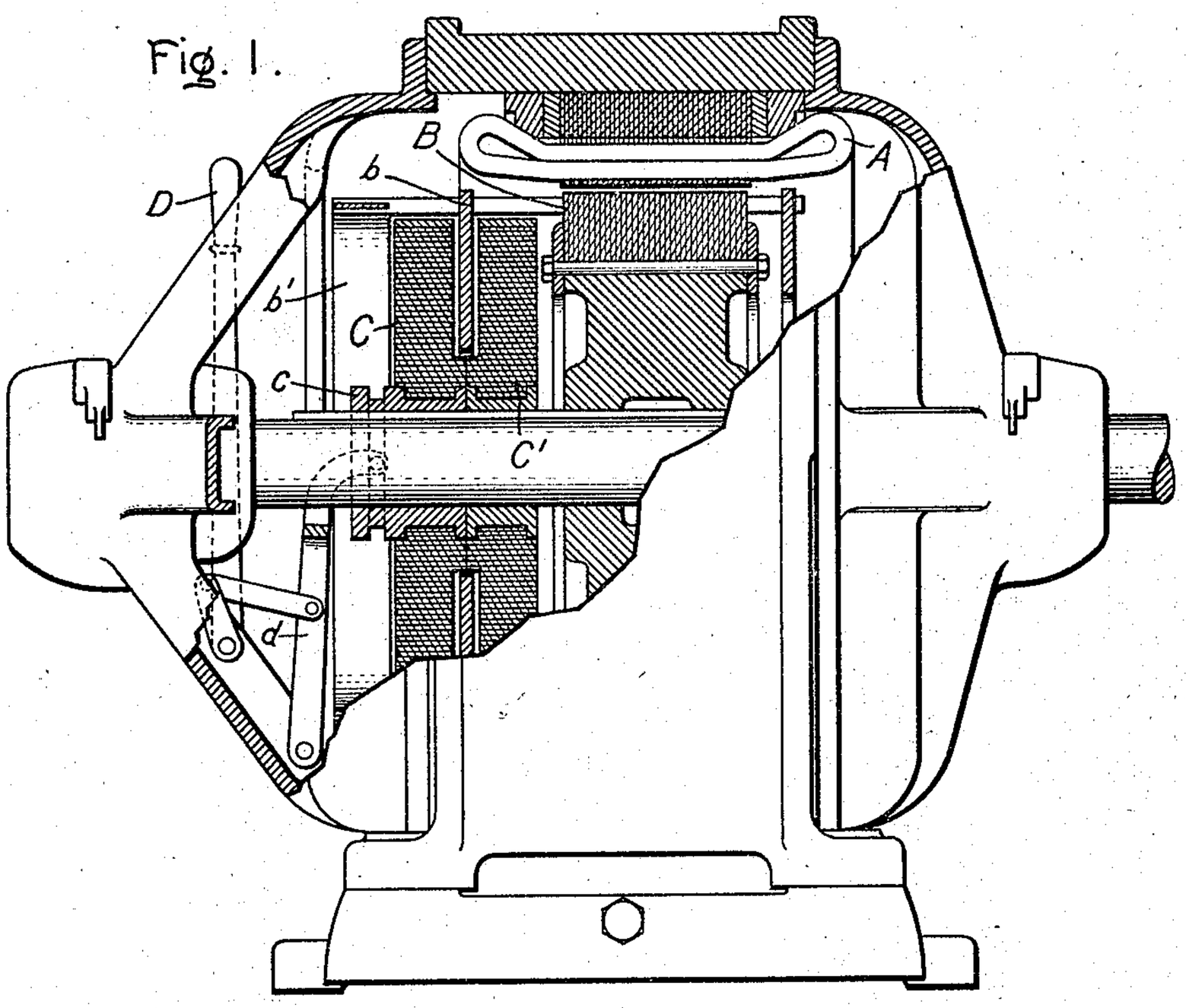
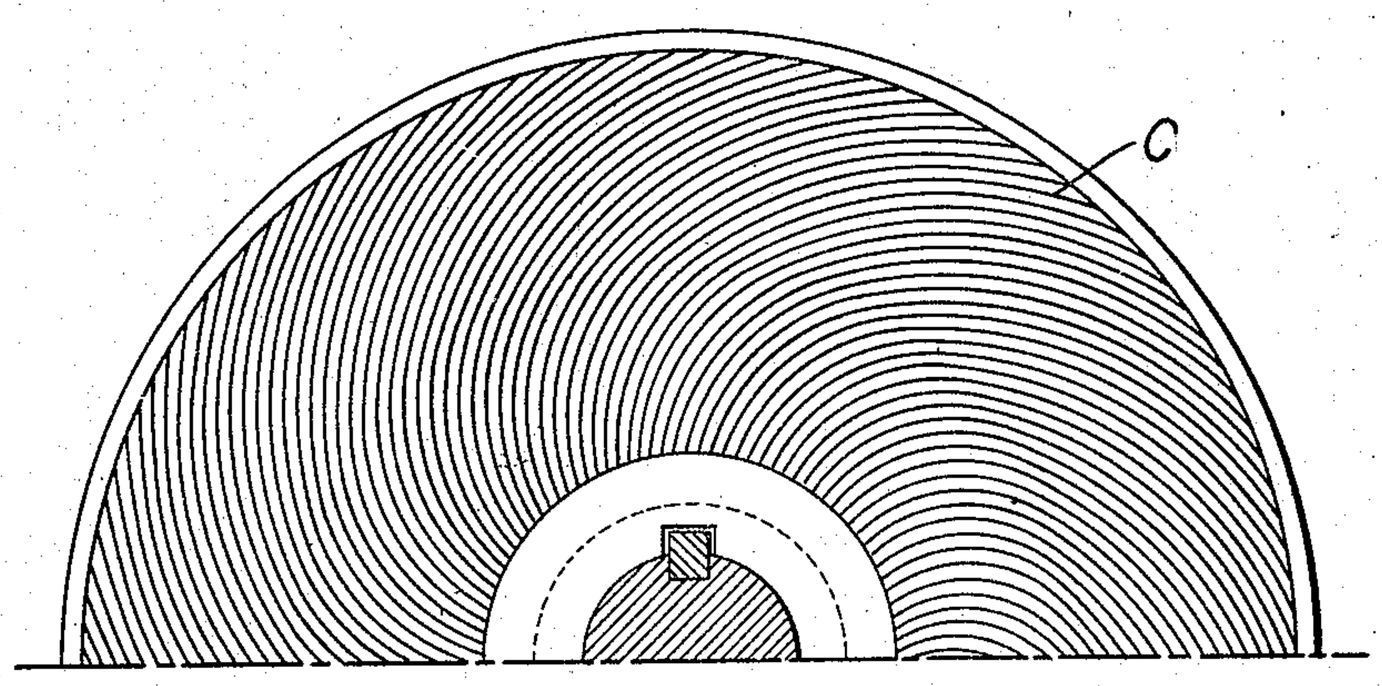


Fig. 2



Witnesses:
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UNITED STATES PATENT OFFICE.

SVEN R. BERGMAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INDUCTION-MOTOR.

936,292. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed March 22, 1909. Serial No. 484,910.

To all whom it may concern:

Be it known that I, SVEN R. BERGMAN, a subject of the King of Sweden, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Induction-Motors, of which the following is a specification.

My invention relates to induction motors, and its object is to improve the starting characteristics of motors having secondary windings of the squirrel-cage type.

The squirrel-cage winding is the simplest and cheapest form of secondary winding for induction motors, but as compared with coil windings has hitherto possessed the disadvantage that resistance cannot be inserted in circuit with it to reduce the starting current and to increase the starting torque. By my invention this disadvantage is removed.

A squirrel-cage winding in a well designed induction motor with small air gap has comparatively low reactance, since the only portion of the winding which is embedded in iron is in inductive relation to the primary winding and has a comparatively small leakage flux.

My invention consists in providing means for varying the reactance of the end-rings of the squirrel-cage winding. I accomplish this by providing a laminated magnetic body, which may be moved toward or away from the end-ring. At starting the body is moved close to the end-ring, which is then nearly embedded in magnetic material, so that its reactance is high. When the motor is up to speed the magnetic body is moved away from the end-ring, so that the reactance of the end-ring is reduced to the usual small amount.

My invention further consists in providing two end-rings in parallel at one end of the conductors of the squirrel-cage winding, one of these end-rings being of high resistance, and the other of low resistance. The magnetic body is moved toward and away from the low resistance end-ring. At starting, since the reactance of the low resistance end-ring is high, because of the proximity of the magnetic mass, most of the current flows through the high resistance end-ring, so that not only is the starting current reduced, but the starting torque is relatively increased, as in an induction motor with a coil winding having a resistance inserted in series with the winding at starting. When the motor is up to speed, the magnetic body is moved away from the low resistance end-ring, which then carries most of the current, so that the winding then has the characteristics of the ordinary low resistance squirrel-cage.

My invention will best be understood by reference to the accompanying drawing, in which—

Figure 1 shows a side elevation, partly in cross section, of an induction motor arranged in accordance with my invention; and Fig. 2 shows an enlarged detail view of the laminated body.

In the drawings, A represents the stationary primary winding, and B the secondary rotary winding, which is of the squirrel-cage type. At the left-hand of the conductors are placed two end-rings *b* and b^1, which are in parallel, and one of which, *b*, has a low resistance, while the other, b^1, is of small cross section, and, therefore, has a high resistance.

C and C^1 represent two laminated magnetic masses which are carried by the rotor shaft. These masses are in the form of disks. The disk C^1 is fast to the rotor shaft. The disk C, while keyed to the rotor shaft so as to rotate with it, is movable axially on the shaft. The sleeve *c*, on which this magnetic disk is carried is engaged by a lever *d* pivoted on the motor frame and provided with a handle D.

At starting the handle and disk C are in the position shown in Fig. 1. The low resistance end-ring *b* is then nearly embedded in magnetic material, so that the reluctance for the flux surrounding the end-ring is low, and the reactance of the end-ring, therefore, high, so that the greater part of the current flows through the high resistance end-ring b^1, and the starting characteristics of the motor are those of a motor having a high resistance secondary. When the motor is up to speed the handle D is moved so as to shift the disk C to the left, away from the end-ring *b*. The reluctance of the flux path around the end-ring is thereby greatly increased, so that the reactance of the end-ring is much increased. The greater part of the secondary current then flows through the low resistance ring *b*, and the motor operates with the characteristics of a motor having a low resistance secondary winding.

In order to provide a solid compact con-

struction of the disk C, I preferably arrange the laminæ composing it in the form of involutes, as shown in Fig. 2.

I do not desire to limit myself to the particular construction and arrangement of parts here shown, but aim in the appended claims to cover all modifications which are within the scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. An induction motor having a primary winding, a secondary winding of the squirrel-cage type, and a starting device comprising means for varying the reactance of an end ring of the secondary winding.

2. An induction motor having a stationary primary winding, a secondary rotor winding of the squirrel-cage type, a laminated magnetic body carried by the rotor, and means for moving said body toward and away from an end-ring of the secondary winding.

3. An induction motor having a primary winding, a secondary winding of the squirrel-cage type having a high resistance end-ring and a low resistance end-ring in parallel at one end of the secondary conductors, and a starting device comprising means for varying the reactance of said low resistance end-ring.

4. An induction motor having a stationary primary winding, a secondary rotor winding of the squirrel-cage type having a high resistance end-ring and a low-resistance end-ring in parallel at one end of the secondary conductors, a laminated magnetic body carried by the rotor, and means for moving said body toward and away from said low resistance end-ring.

5. An induction motor having a stationary primary winding, a secondary rotor winding of the squirrel-cage type, a disk composed of magnetic laminæ arranged in the form of involutes, and means for moving said disk toward and away from an end-ring of said secondary winding.

6. An induction motor having a stationary primary winding, a secondary rotor winding of the squirrel-cage type having a high resistance end-ring and a low resistance end-ring in parallel at one end of the secondary conductors, a disk composed of magnetic laminæ arranged in the form of involutes, and means for moving said disk toward and away from said low resistance end-ring.

In witness whereof, I have hereunto set my hand this 19th day of March, 1909.

SVEN R. BERGMAN.

Witnesses:
DUGALD McK. McKILLOP,
CHARLES A. BARNARD.