No. 789,444. PATENTED MAY 9, 1905.

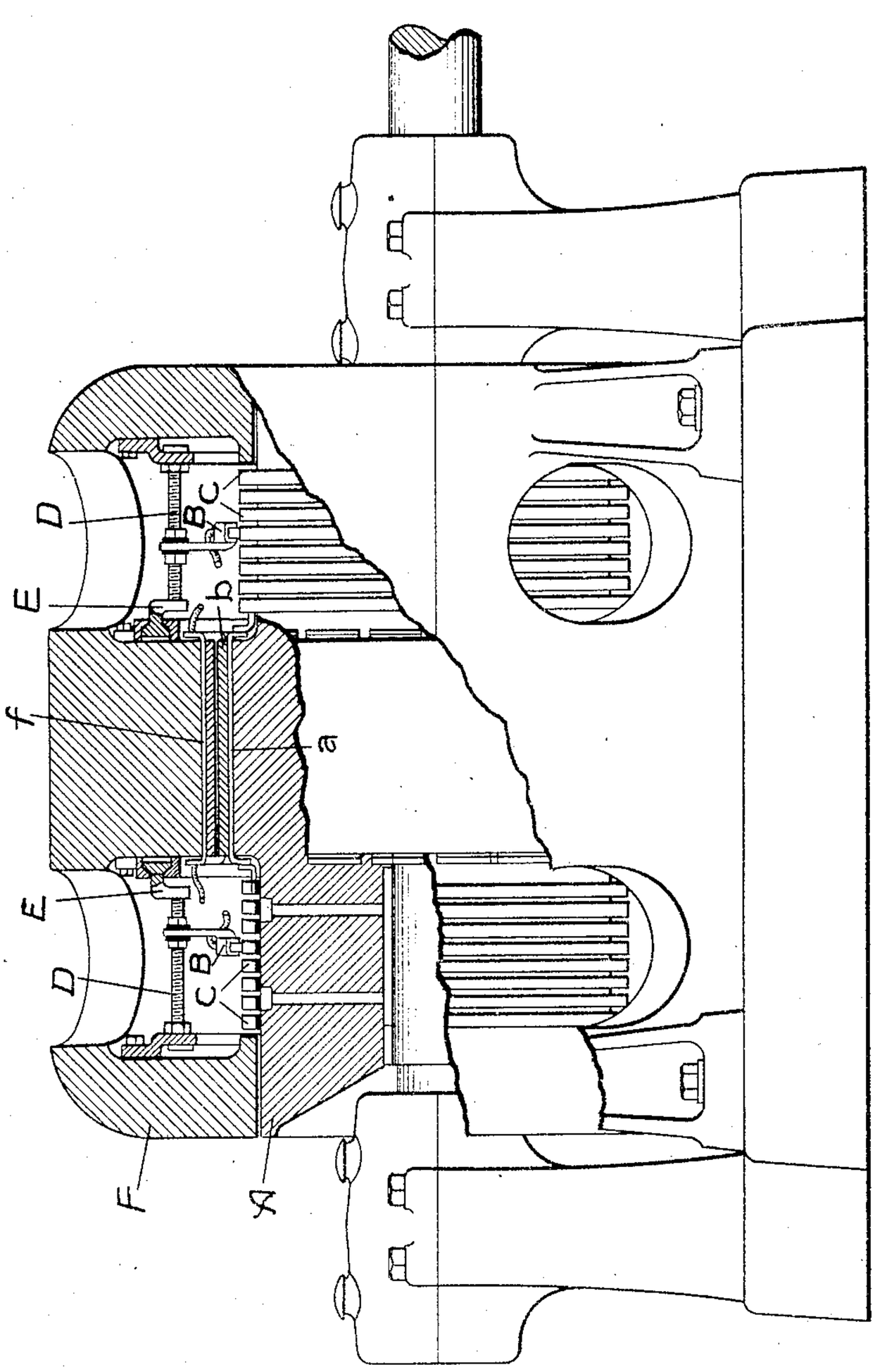
J. E. NOEGGERATH.

ELECTRIC MOTOR.

APPLICATION FILED SEPT. 1, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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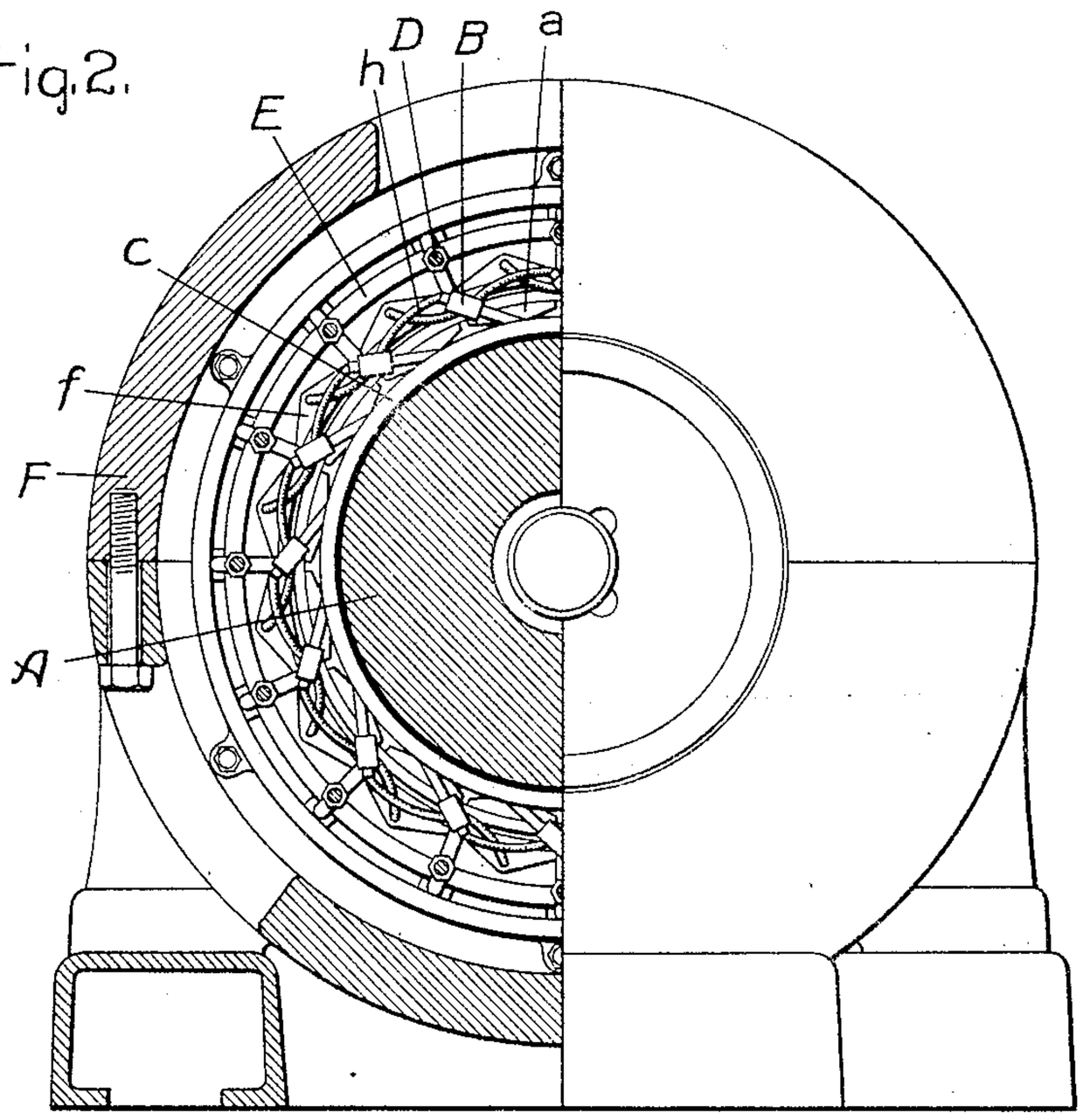
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

JAKOB E. NOEGGERATH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 789,444, dated May 9, 1905.

Application filed September 1, 1904. Serial No. 222,990.

To all whom it may concern:

Be it known that I, JAKOB E. NOEGGERATH, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Motors, of which the following is a specification.

My invention relates to dynamo-electric machines of the "homopolar" type, and has for its main object to provide a simple form of high-speed motor having series characteristics and readily controllable as regards speed. The features constituting my invention are, however, not necessarily limited in their application to motors, but may be employed generally in dynamo-electric machines, whether generators or motors.

Homopolar machines are particularly adapted for operation at high speeds, since the construction is simple and since difficulties of commutation do not enter. Furthermore, machines of this type may readily be designed to develop at high speeds the necessary counter electromotive force for operating at ordinary voltages.

My invention consists in so arranging the connections between the armature-conductors and the stationary conductors of the machine that these connections themselves serve to magnetize the machine, and that by varying the effective length of these conductors the field strength may readily be varied. This variation of effective length may be accomplished in a simple manner by shifting the position of the brushes relative to the stationary conductors.

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

Figure 1 shows a side elevation, partly in cross-section, of a unipolar machine arranged with adjustable brushes in accordance with my invention; and Fig. 2 shows an end elevation of the same, illustrating the arrangement of the connections from the brushes to the stationary conductors.

In a former application, Serial No. 200,677, filed by me March 30, 1904, I have disclosed a number of novel features in the construction of homopolar machines and have illustrated a number of magnetic circuits adapted for use in such machines. The magnetic circuit shown in Fig. 1 is one of those shown in my former application, and the stationary conductors are used to neutralize armature reaction in the manner fully described in the former application.

In Fig. 1, A represents the armature, and F a structure that corresponds to the field, although no field-coil is shown in the figure. *a* represents an armature-conductor which is preferably formed as a flat strip held in place by a cylindrical binding-ring *b* in the manner described in my former application. The armature-conductor *a* is connected at each end to collector-ring C C. B B represent brushes bearing on the collector-rings and mounted on bars D D, which are carried by the adjustable rings E E. These rings are mounted in the manner ordinarily employed for brush-holder yokes, enabling the rings to be rotated so as to shift the position of the brushes. *f* represents a return-conductor or frame-conductor by means of which any two brushes at opposite ends of the machine may be connected so as to place two armature-conductors in series. The frame-conductors *f* are formed in the same shape as the armature-conductors *a*, and since they are adjacent to the armature-conductors and are carrying an equal amount of current in opposite direction they serve to neutralize the armature reaction.

Referring now to Fig. 2, it will be seen that each brush B instead of being connected to the nearest frame-conductor is connected by a flexible connection *h* to a frame-conductor *f*, which is displaced from the brush a fraction of a circumference. The several flexible connections taken together form one or more complete turns encircling an armature and carrying a current equal to that in each armature-conductor.

Now referring again to Fig. 1, it will be seen that if a coil were placed outside of and parallel to a collector-ring and energized by a current it would set up a flux which would pass down from the central portion of the frame across the central air-gap of the ma-

chine into the armature, cutting the armature-conductors, then outward axially to the end of the armature, and across the outer air-gap to the end of the frame. In other words, such a coil would produce a flux which would generate an electromotive force in the revolving armature-conductors. It is evident from Fig. 2 that the flexible end connections form just such a magnetizing-coil, and since the end conductors carry the armature-current the machine will act as a series-wound machine and as a motor will exhibit the characteristics of a series motor. Furthermore, it will be seen that by shifting the brushes in one direction or the other the effective length of each flexible conductor, and consequently the effective turns of the field, will be varied. This furnishes a convenient means for controlling the speed of the motor or for reversing the direction of rotation. The excitation produced by the end connections can be supplemented, if desired, by a field-coil arranged as disclosed in my former application; but for high speeds the end connections themselves will ordinarily be found to furnish sufficient excitation.

My invention is not limited to the particular form of magnetic circuit here shown; but the magnetic circuit and other parts may be greatly varied in construction and arrangement without departing from my invention. Accordingly I 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. In a dynamo-electric machine, a "homopolar" field structure, a revolving armature, conductors carried thereby, means for collecting current from said conductors, stationary conductors carried by said field structure, and connections from said collecting means to said stationary conductors, said connections each extending a fraction of a circumference in one direction around the armature, whereby the current in said connections produces the magnetization of the machine.

2. In a dynamo-electric machine, a "homopolar" field structure, a revolving armature, conductors carried thereby, means for collecting current from said conductors, stationary conductors carried by said field structure, connections from said collecting means to said stationary conductors, said connections each extending a fraction of a circumference in one direction around the armature, whereby the current in said connections produces the magnetization of the machine, and means for varying the effective length of said connections.

3. In a dynamo-electric machine, a "homopolar" field structure, a revolving armature, conductors carried thereby and connected at each end to collector-rings, brushes bearing on said rings, stationary conductors carried by the field structure, and connections between said brushes and said stationary conductors each extending a fraction of a circumference in one direction around the armature, whereby the current in said connections produces the magnetization of the machine.

4. In a dynamo-electric machine, a "homopolar" field structure, a revolving armature, conductors carried thereby and connected at each end to collector-rings, brushes bearing on said rings, stationary conductors carried by the field structure, connections between said brushes and said stationary conductors each extending a fraction of a circumference in one direction around the armature whereby the current in said connections produces the magnetization of the machine, and means for shifting the position of the brushes.

5. In a dynamo-electric machine, a "homopolar" field structure, stationary conductors carried thereby, a revolving armature, conductors carried thereby, means for collecting current from said conductors, and end connections between the several armature-conductors and stationary conductors comprising said collecting means, each of said connections extending a fraction of a circumference in one direction around the armature whereby the current in said connections produces the magnetization of the machine.

In witness whereof I have hereunto set my hand this 20th day of August, 1904.

JAKOB E. NOEGGERATH.

Witnesses:

MARIE LOUISE NEBUCKE,

HENRY HOLLMANN.