No. 888,050. PATENTED MAY 19, 1908.

J. A. STRATTON.

FIELD MAGNET WINDING.

APPLICATION FILED MAR. 31, 1906.

2 SHEETS—SHEET 1.

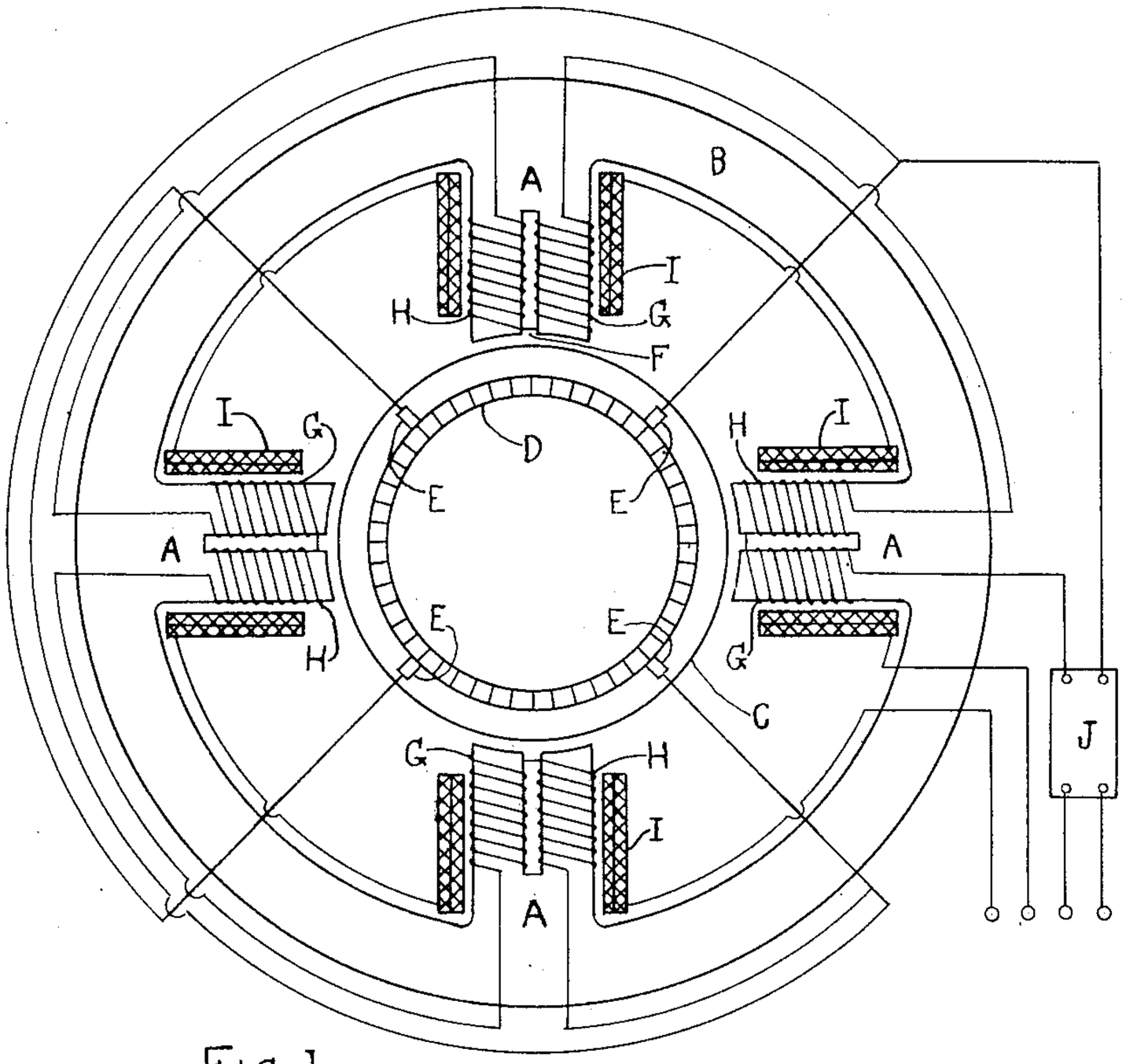

FIG. 1

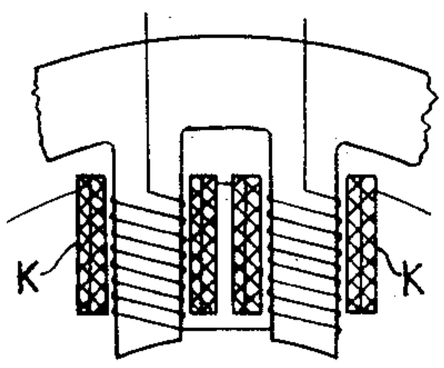

FIG. 2

WITNESSES:

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2 SHEETS—SHEET 2.

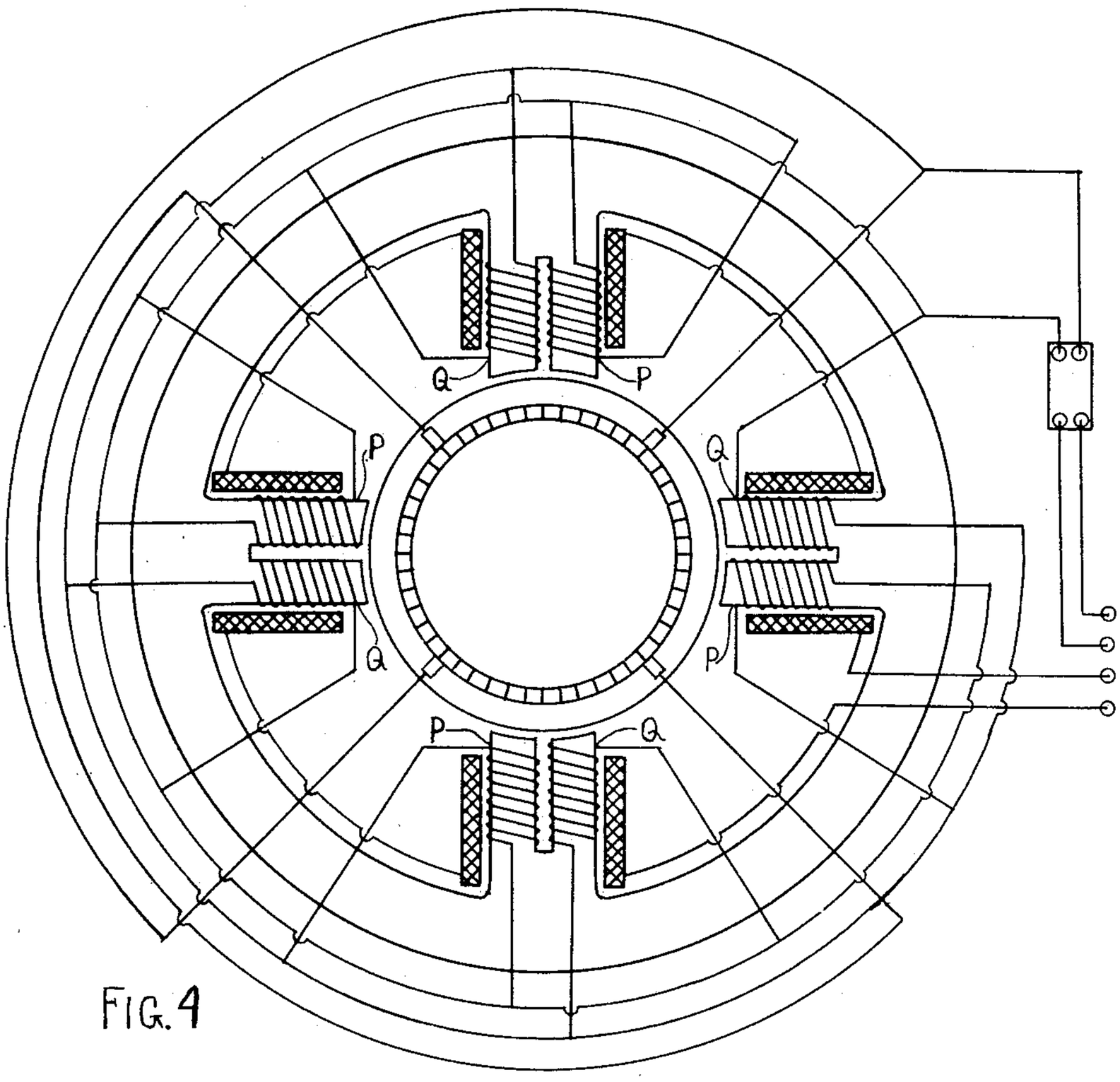

FIG. 4

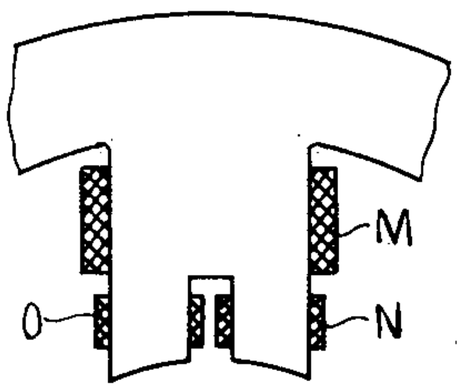

FIG. 3

WITNESSES:

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UNITED STATES PATENT OFFICE.

JULIAN A. STRATTON, OF CHICAGO, ILLINOIS.

FIELD-MAGNET WINDING.

No. 888,050. Specification of Letters Patent. Patented May 19, 1908.

Application filed March 31, 1906. Serial No. 309,215.

To all whom it may concern:

Be it known that I, JULIAN A. STRATTON, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Field-Magnet Windings, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to improvements in field-magnets of direct-current machinery in which auxiliary field-windings are provided for the purpose of producing sparkless commutation.

The object of my invention is to provide means for automatically shifting or displacing the magnetic field in a direct-current machine, be it motor or generator, in accordance with the variations of the load and in such manner that good commutation may be obtained under varying conditions of load or speed without having to shift the brushes themselves. To attain this object, the present invention contemplates that each pole-piece be divided into halves and that each half be wound in such a way that the regular field over one half of each pole-piece is strengthened while over the other half it is correspondingly weakened. The windings which thus modify the regular field are called hereinafter, "auxiliary" windings, by the action of which a distortion or displacement of the field as a whole is produced. The amount of this displacement of the field varies with the current flowing in the auxiliary windings, which are connected either in series with the armature, or with the armature in such a way that the current flowing through the auxiliary windings will be proportional to the armature current. Thus it is provided that the strength of the fields set up by the auxiliary windings shall be proportional to the armature current, whereby good commutation is obtained under varying loads without shifting the brushes.

The auxiliary windings may be placed in series with each other and with the armature, or they may be connected in groups, the groups being placed in series with the armature. They are proportioned with regard to the constants of the machine to which they are applied. In any case the essential features which must obtain are that the current which flows through the auxiliary windings shall be proportional to that flowing in the armature and that the relative path of current flow through the auxiliary windings shall be as is hereinafter shown and described. The direction of current flow through the auxiliary windings as a whole depends upon whether the machine is to be operated as a generator or as a motor. For a generator, the windings are connected so as to shift the field backward with respect to the direction of rotation of the armature, which corresponds to the forward shifting of the brushes in common practice in machines not provided with these auxiliary windings; while for a motor, the auxiliary windings are connected so as to shift the field forward with respect to the direction of rotation of the armature, which corresponds to the ordinary shifting of the brushes backward in common practice with motors not provided with auxiliary windings. The amount of this displacement of the field as a whole varies with the current which flows through the auxiliary windings, which varies with the current which flows through the armature because of the manner in which the auxiliary windings are connected with the armature; and the result of this displacement of the field as a whole, the auxiliary windings being properly proportioned and connected with relation to the constants of the machine, is that, although the brushes are placed at the electrical neutral points, the armature conductors passing the point of commutation are subjected to a resultant magnetic field of the proper polarity and strength to overcome the effect of self-induction and secure good commutation. This resultant magnetic field may be regarded as made up of two components: (1) the field produced by the current through the regular or main field windings; and (2) the commutating field produced by the current through the auxiliary windings, which, as before stated, varies with the current through the armature directly and insures thereby the commutating field being of an intensity which will neutralize the effects of self-induction, armature reaction and the like, whatever may be the speed or load variations, by subjecting the armature conductors to the proper magnetic conditions at the point and time of commutation.

My invention is particularly adapted to motors in which variable speed is secured by varying the field strength. As the auxiliary windings supply that component of the field which provides for commutation, the effect of armature reaction upon a weakened field

does not seriously affect commutation, since the commutating field is regulated by the load current. Further, a motor with this system of auxiliary field windings will commutate equally well running in either direction with the brushes at the neutral points, provided the currents in the armature and auxiliary field windings be kept in the same direction relatively to each other. The simultaneous reversal of the armature and auxiliary field currents, in reversing motors or generators, is accomplished by placing the reversing switch so as to include both the armature and auxiliary field windings circuits.

It will be understood that the brushes are placed at the electrical neutral points in only those machines which are designed to be frequently reversed and that the actual or geometrical position of the brushes will depend upon the nature of the armature winding and the relative position of the commutator segments in such machines. In motors which run in only one direction under conditions requiring only infrequent reversals, it is not necessary that the brushes be maintained at the electrical neutral points but they may be given an initial shift as in the ordinary motors without auxiliary windings. In this case the auxiliary windings serve to assist the "commutating fringe" of the regular field, thereby providing for good commutation under variable loads without further shifting of the brushes being required. The method of connection and function of the auxiliary windings are the same as before. The initial shifting of the brushes in this case, however, permits the use of fewer turns on the auxiliary windings.

In the drawings illustrating the principle of my invention and the best mode now known to me of applying that principle, Figure 1 is a diagrammatic representation of a direct-current machine provided with my new field winding; and Figs. 2, 3 and 4 show modifications, hereinafter referred to.

The drawings illustrate my invention as applied to a four-pole machine but it will be understood readily that it may be equally well applied to any other multipolar machine or to a bipolar machine. The pole-pieces A project inwardly from the yoke B towards the armature C provided with a commutator D upon which rests the brushes E. They (the pole-pieces A) are divided, the plane of division extending in the direction of the axis of rotation or longitudinal axis of the armature and the depth and width of the slot F being such as will just accommodate the auxiliary windings G and H. The winding G on one half of each pole-piece is such as will strengthen the field produced by the regular or main winding I, while the winding H is such as will tend to weaken that field; or vice versa. The regular or main winding I lies outside of both auxiliary windings G, H and may be connected in series or shunt with the armature C, or may be separately excited, if desired. The auxiliary windings are in series with the armature C and in circuit with the armature and auxiliary coils G, H, is a switch J by means of which the reversal of current through the armature and auxiliary coils may be made simultaneously.

In Fig. 2 the main windings K are placed upon each half of the pole-piece separately, while in Fig. 3 the main windings M and the auxiliary windings N and O are mounted tandem upon the divided pole-pieces.

In Fig. 4 the auxiliary windings P and Q are shown grouped and placed in circuit with the armature.

What I claim is:

1. In a dynamo electric machine, a field pole comprising a pair of stems, compensating magnet coils surrounding the stems and so connected as to have the current therethrough vary with the variation of current strength in the armature circuit, and a field coil surrounding the stems and the compensating magnet coils.

2. In a dynamo electric machine, the field pole comprising a pair of stems, compensating magnet coils surrounding the stems and connected in series with the armature of the dynamo electric machine, and a field coil surrounding the stems and their compensating magnet coils.

In testimony whereof I hereunto set my hand in the presence of two witnesses at said Chicago this 23rd day of March, 1906.

JULIAN A. STRATTON.

Witnesses:

CHARLES N. FENSTERMACHER,

HARRY L. CHAPMAN.