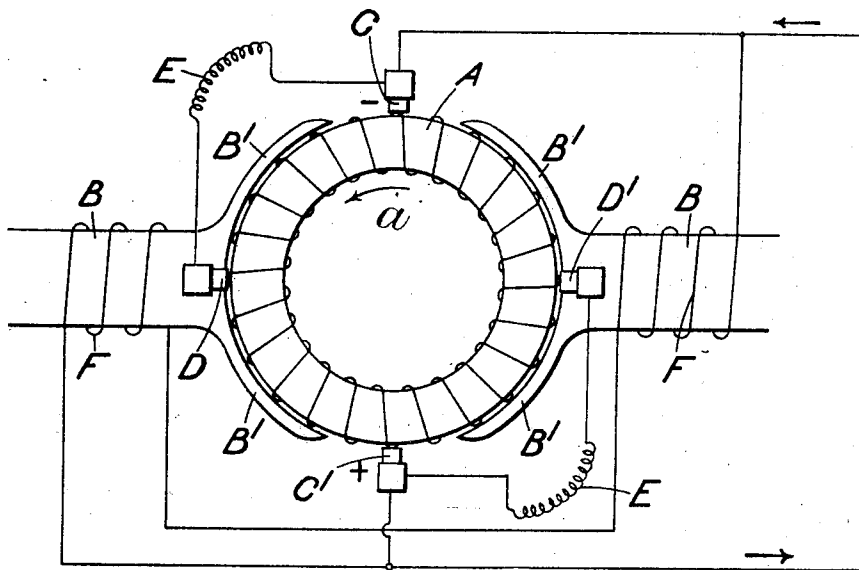


A. HILL.
DYNAMO ELECTRIC MACHINE.
APPLICATION FILED FEB. 23, 1911.

1,071,920.

Patented Sept. 2, 1913.



Witnesses.

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UNITED STATES PATENT OFFICE.

ABNER HILL, OF WARMINSTER, ENGLAND; ASSIGNOR TO TRIER AND MARTIN LIMITED, OF LONDON, ENGLAND.

DYNAMO-ELECTRIC MACHINE.

1,071,920.

Specification of Letters Patent.

Patented Sept. 2, 1913.

Application filed February 23, 1911. Serial No. 610,247.

To all whom it may concern:

Be it known that I, ABNER HILL, subject of the King of England, residing at Warminster, in Wiltshire, England, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a specification.

This invention relates to dynamo electric machines designed to give approximately constant current over a large range of speed and of the type in which auxiliary brushes are used.

Various arrangements have been proposed for modifying the characteristic of a dynamo by the provision of auxiliary brushes connected to each other or to the main brushes through field magnet windings or otherwise, and it is to this general class that the present invention belongs.

It has been suggested to employ auxiliary brushes connected to the main brushes through fixed or variable resistances in order to transform the demagnetizing force of the armature into a magnetizing force and form a zone of commutation extending symmetrically on each side of the neutral line so that the machine may run sparklessly at various loads with the brushes in one position. It has also been proposed to employ short-circuited brushes in a dynamo wherein, in order to obtain an external current always in one direction, the working magnetic field is produced by the armature and varies in direction with the direction of rotation.

According to this invention, the main brushes, which are in the ordinary or neutral position, are each joined through an external resistance, that is to say, not through a field-magnet winding, to an auxiliary brush half a pole pitch in advance, the arrangement being such that part of the main current at high speeds is supplied by the auxiliary brushes.

In the following description, the invention is described as applied to a two-pole machine although it will be understood that it is equally applicable to machines having a large number of poles.

The accompanying drawing shows diagrammatically a dynamo electric machine according to this invention. By way of example a two-pole dynamo is shown having a ring armature A driven in the direction indicated by the arrow *a* and field magnets

B having pole pieces B¹. The main or ordinary brushes are indicated at C and C¹ and are set in the ordinary or neutral position. The main brush C is connected through an external resistance E to an auxiliary brush D which is in advance of the main brush by about 90°, and the main brush C¹ is similarly connected through an external resistance E to a second auxiliary brush D¹. The amount of the resistance E will vary in accordance with the general design of the machine and it may be divided and be capable of adjustment in any known manner.

The field magnets B are excited by shunt coils F connected across the main brushes C, C¹. As C is the negative and C¹ the positive brush, the current in the resistance connecting the main brush C¹ with the auxiliary brush D¹ will, when the machine is running on open circuit, flow from C¹ to D¹ and, in the resistance connecting the other pair of brushes, will flow from D to C. The effect of these currents, which of course also flow in the armature coils between D¹ and C¹, and C and D, is to strengthen the main field.

As the load increases an armature reaction is set up which displaces the axis of the field forward and by so doing reduces the current in the resistances E and consequently the magnetic field is also reduced. When the axis of the magnetic field is displaced by 45°, there will be no current at all between the main and auxiliary brushes as they will then be at equal potentials. A further displacement of the magnetic field due to increasing load and speed will cause a current to flow again between the main and auxiliary brushes, but such current will now be in the reverse direction and its effect will be to weaken the main field instead of to strengthen it. Thus the output of the dynamo becomes self-regulating.

By suitably designing the machine it is possible to arrange that, when the dynamo is just running at sufficient speed to give the voltage for which it is intended but no current in the external circuit, the currents in the resistances E will be approximately equal to half the full-load current for which the dynamo is constructed. As the machine begins to give current to the external circuit, the currents in the resistances E drop until at about half-load there is no current flowing through them and the machine is then

working as an ordinary shunt dynamo. As the speed and load further increase, reverse currents begin to flow in the resistances E, and when the dynamo is giving its full current, about half of that current is supplied from the auxiliary brushes. This has the effect of giving a very uniform watt loss in the armature copper over the whole speed range, and, as at full-load the current in each resistance E is equal to about half the total current, the armature coils between the main and the auxiliary brushes are practically idle. Thus, the watt loss in the armature copper will then be only half of what it would be with an ordinary dynamo and consequently, for a given load, it is possible to use a smaller armature without overheating.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a dynamo electric machine, the combination of field magnets, an armature capable of rotation in the magnetic field, a plurality of main brushes in the ordinary or neutral position, a plurality of auxiliary brushes corresponding in number to the main brushes, each auxiliary brush being disposed half a pole pitch in advance of a main brush and external resistances connecting each main brush with the auxiliary brush in advance of it, the arrangement being such that as the load increases and consequently the axis of the magnetic field is displaced, the currents in the resistances are reversed and at heavy loads are in such a direction that part of the main current is supplied by the auxiliary brushes.

2. In a self regulating dynamo, the combination with field magnets, of an armature rotatable in the magnetic field, a plurality of main brushes situated in the neutral line, a plurality of auxiliary brushes corresponding in number to the main brushes, each auxiliary brush being permanently disposed half a pole pitch in advance of a main brush and substantially constant external resistances connecting each main brush with the auxiliary brush in advance of it, the arrangement being such that at rated voltage and open external circuit said resistances carry about one half the full load current of said dynamo and at about half-load no

current will flow therethrough while at full load full speed one half the total current will flow in each resistance, substantially as described.

3. In a dynamo electric machine of the class described, the combination of suitable means for producing a magnetic field, an armature disposed in said magnetic field, said armature and field being relatively rotatable, main brushes for the armature, an auxiliary brush for each main brush, and connecting means including a resistance between each main brush and the auxiliary brush associated therewith, each main brush and the auxiliary brush connected therewith being permanently spaced apart substantially half a pole pitch, for the purpose set forth.

4. In a self regulating generator designed to supply approximately constant current over a wide range of speed, the combination of field poles and windings on said poles for producing a magnetic field, an armature rotatable in said field, current supply mains, main brushes for the armature disposed in the ordinary or neutral position and connected to said supply mains, an auxiliary brush associated with each main brush, means connecting the auxiliary brush with its associated main brush and a supply main, a substantially constant resistance in circuit with said connecting means, each auxiliary brush being disposed substantially half a pole pitch in advance of the main brush connected therewith, the arrangement being such that when the armature is rotated at a speed sufficient to generate substantially no-load current at normal voltage the current in said connecting means will flow in one direction and when the armature supplies current in excess of about half the output of the generator the flow of current in said connecting means will be reversed and part of the armature current will flow through said auxiliary brushes.

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

ABNER HILL.

Witnesses:

FRANK TRIER,
R. W. MIAMS.