

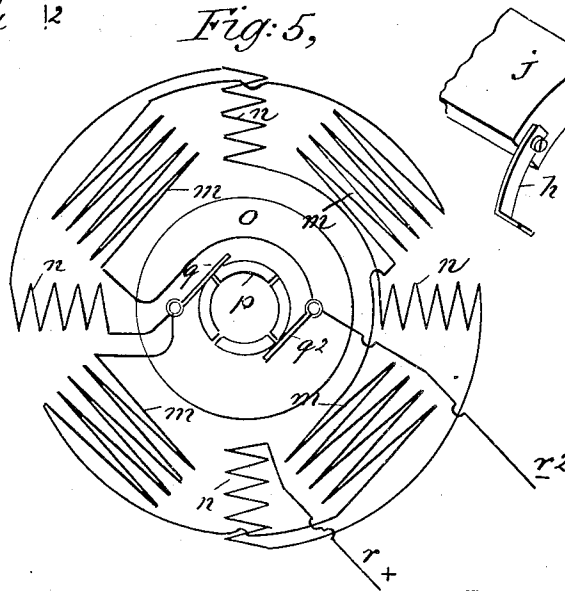
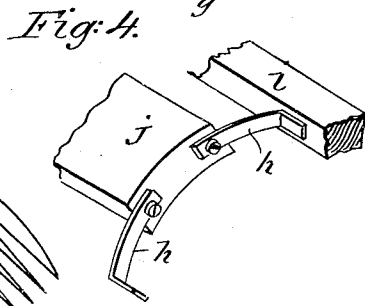
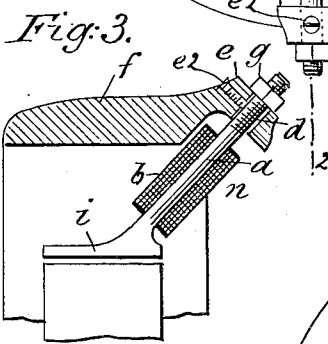
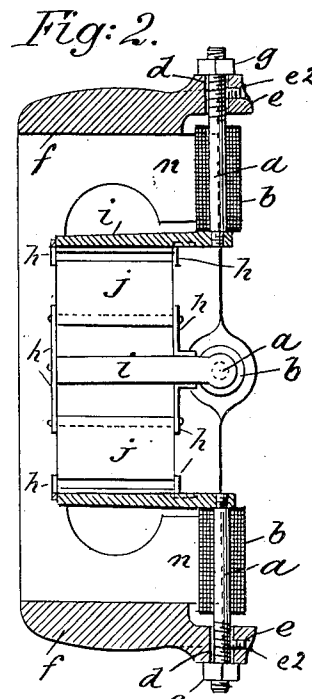
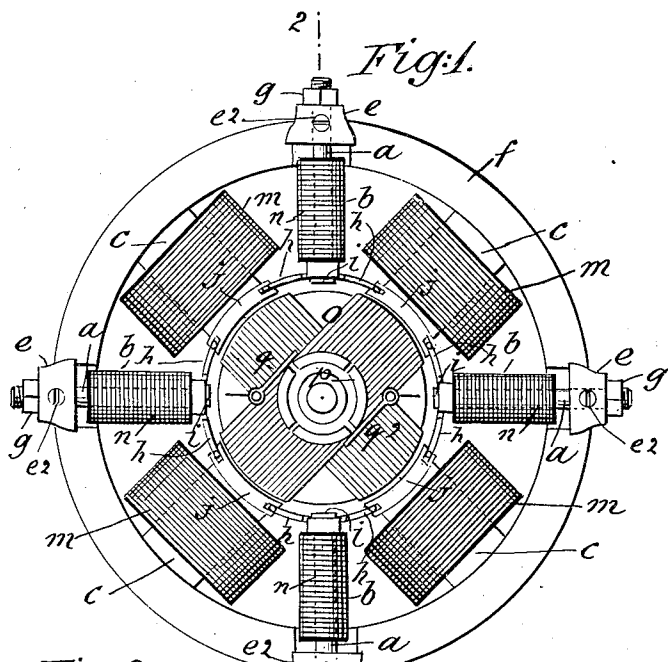
No. 830,025.

PATENTED SEPT. 4, 1906.

L. TORDA.

DYNAMO ELECTRIC MACHINE AND THE LIKE.

APPLICATION FILED JUNE 2, 1905.



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DYNAMO-ELECTRIC MACHINE AND THE LIKE.

No. 830,025.

Specification of Letters Patent.

Patented Sept. 4, 1906.

Application filed June 2, 1905. Serial No. 263,381.

To all whom it may concern:

Be it known that I, LUDWIG TORDA, a subject of the Emperor of Austria-Hungary, residing at Barking, in the county of Essex, England, have invented certain new and useful Improvements in Dynamo-Electric Machines and the Like, of which the following is a specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates generally to dynamo-electric machines with commutators, and especially to continuous-current machines, and has for its principal object to improve such machines by means of auxiliary or commutating magnets.

The invention consists, essentially, of the construction and arrangement of commutating-magnets, which, compared with existing devices of this class, offers some electrical and constructional advantages.

Hitherto the employment of commutating-magnets has been restricted, owing to their use involving complications of the whole machine, extra cost, and the uncertainty in the design of the commutating-magnets, and for this reason the application of special means for adjustment—as, for instance, separate resistances for the regulation of the current in the commutating-magnet winding.

With commutating-magnets constructed according to this invention the cost is reduced to a minimum and the magnets are easily adjustable without use of separate resistances. Its application will be found especially advantageous for high-speed dynamos and motors, for variable-voltage dynamos, and for variable-speed motors for high-voltage and high-amperage machines, but also for normal types of machines.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which—

Figure 1 is a front view of a dynamo constructed according to my invention; Fig. 2, a section on the line 2 2 of Fig. 1, with the armature removed; Fig. 3, a view similar to Fig. 2 and showing a modification; Fig. 4, a perspective view of a detail of the construction, illustrating the mechanical connections between the pole-pieces of the commutating-

magnets and the field-magnets; and Fig. 5, a diagrammatic view of the field and commutating windings.

In the drawings forming part of this specification I have indicated at *f* the yoke of an ordinary dynamic electrical machine within which are mounted a plurality of main magnets *m* and commutating-magnets *n*, said commutating-magnets *n* comprising a core *a* and the usual winding *b* therefor, and said cores *a* are movable in holes *d*, formed in lugs *e* on the yoke *f*, and said cores *a* are held in the lugs *e* by means of nuts *g* or in any other suitable manner, and secured to each of the cores *a* is a pole-shoe *i*.

The main magnets *m* are provided with the usual magnet-cores *c* and windings therefor, and also with pole-shoes *j*, and the main-magnet pole-shoes *j* and commutating-magnet pole-shoes *i* are secured together by means of bands or strips *h* of suitable electrical conductivity, and said strips or bands *h* serve also as mechanical strengtheners for the pole-shoes *i* and hold the same rigidly in their proper positions. In practice I prefer to shape the commutating-magnet cores so that the pole-shoes thereof are placed between the pole-shoes of the main magnets in order that the common plane of all the main-magnet cores and the shoes thereof may also be the common plane of the commutating pole-shoes, but not that of the commutating-magnet cores, which are placed in a plane parallel to the former plane, and I prefer to make the cores of the commutating-magnets longer than the cores of the main magnets, and because of the arrangement of the commutating-magnet cores *a* in the lugs *e* the air-gap between the armature and commutating-magnet shoes is made easily adjustable. In this manner I can apply a commutating-magnet core so formed that the length of the magnet-coil winding which affects the cost of the device will be reduced to a minimum.

For a given number of ampere-turns which is to generate the necessary commutating field the length of the winding, and therewith the weight of the commutating-magnet, copper for a certain current density, will be a minimum when the mean length of a turn is as short as possible. The mean length of a turn will be the shortest when the core-section is circular in shape and when the number of ampere-turns per inch length of the core has a reasonably low value. As a rule

it will be found advantageous to make the core length of the commutating-magnets longer than that of the main magnets.

The size of the core-section of a given magnetic material is dependent on the strength of the commutating field necessary for reversing sparklessly the current in the armature-coils undergoing commutation. On the other hand, the necessary strength of the commutating field is dependent on the so-called "reactance" voltage of the armature-coil under commutation. The greater the reactance voltage the stronger must be the commutating field. The size of the core-section is therefore dependent upon the reactance voltage.

As is known, the reactance of a coil is greatly diminished by placing a closed circuit, preferably of the same shape, in close proximity to the coil. I therefore connect together the pole-shoes of the commutating-magnets, which are in close proximity of the armature-coils undergoing commutation, with strips, bars, or the like of good electrical conductivity in order to form a closed electric circuit, and said strips or plate may be of any preferred shape to accomplish the desired result. By this simple means the reactance voltage is diminished and correspondingly the section of the commutating-magnet cores and the weight of the magnet copper is reduced.

As the reactance is principally due to that portion of the armature-coils which is embedded in the armature-slot, it is sufficient to connect together the pole-shoes directly in the shortest possible way without following the shape of the armature-coil outside the slot. Although in case the reactance of those portions of the armature-coils which are not embedded in the slots represents proportionately a considerable amount, the said bands may receive a shape concentric to the armature. In this case it is preferable in most cases to connect the commutating pole-shoes with the tips of the main pole-shoes, thus reducing considerably the length of the connections. These connections may serve at the same time to increase the rigidity of the mechanical construction of the commutating-magnet system.

In case the pole-shoes are made of laminated iron, bolts of any suitable material in close proximity to the armature-surface, which at the same time are to hold together the laminations, are used as parts of the said closed circuits.

In order to be enabled to give a proper length to the magnet-cores and to easily adjust the commutating devices, I provide the lugs e on the yoke f of the machine, said lugs being provided with circular holes d , which correspond with the diameter of the commutating-cores a , and the said cores a are movable in these holes, and said lugs are preferably made

of an ample length in order to secure a sufficient contact-surface, and thereby reduce the magnetic resistance, and the lugs e are provided with set-screws e^2 for moving the commutating-magnets in the desired position.

As this invention enables the commutating-magnets to be constructed at a small cost, it has the further advantage that commutator-machines can be built on more rational lines than was possible hitherto, the chief consideration for the design being due in this as in other classes of electrical machinery to the heating alone.

In the above-described arrangement the axes of the magnet-cores radiate rectangularly to the pole-shoe face. As a more general disposition the cores can be arranged with their axes at any angle and in any suitable position relatively to the pole-shoe face. In this more general disposition the commutating-magnet cores do not have a common plane.

In Fig. 3 of the drawings I have shown a modification of the arrangement of the commutator-magnet cores a in that the said cores a are arranged obliquely, thereby enabling a longer core to be used and correspondingly a longer magnet-coil, thus reducing further the weight of the magnet copper, this result being produced without materially increasing the over-all dimensions of the machine, and it will be apparent that any suitable device for holding the cores a in position may be employed, and various other modifications within the scope of this invention may be made without departing from the spirit of my invention or sacrificing its advantages.

In Fig. 5 of the drawings the armature is shown at o , the commutator at p , the brushes at q and q^2 , the line-wires at r and r^2 , and the various connections between the field-magnets m and the armature-magnets n are shown in series, and the armature o is also shown in Fig. 1.

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

1. A dynamo-electric machine, comprising a yoke, a plurality of main pole-magnets arranged therein and around the armature of said electric machine, a plurality of commutating-magnets arranged in a different plane than said main magnets and the cores of said commutating-magnets being arranged radially in said yoke and being of a length greater than the cores of said main magnets, substantially as shown and described.

2. A dynamo-electric machine, comprising a yoke, a plurality of main pole-magnets arranged therein and around the armature of said electric machine, a plurality of commutating-magnets arranged in a different plane than said main magnets, the cores of said commutating-magnets being arranged radi-

ally in said yoke and being of a length greater than the cores of said main magnets, and a conductive strip or plate connecting said main-magnet cores with said commutating-magnet cores at the inner poles thereof, substantially as shown and described.

3. A dynamo-electric machine, comprising a yoke, a plurality of main magnets arranged therein and in a common plane, a plurality of commutating-magnets arranged in said yoke and in a common plane parallel to but removed from said main-magnet common plane and conductive strips or plates connecting the cores of said main magnets and said commutating-magnets at their inner poles, substantially as shown and described.

4. A dynamo-electric machine, comprising a yoke, a plurality of main-magnets in said yoke and the cores of which are arranged radially therein and in a common plane, a plurality of commutating-magnets in said yoke and in a plane parallel to said main-magnet common plane, plates or strips of conductive material connecting the cores of said main magnets with the cores of said commutating-magnets, and means for adjusting the cores of said commutating-magnets radially, substantially as shown and described.

5. A dynamo-electric machine, comprising a yoke, a plurality of main magnets arranged in a common plane therein and the cores of said main magnets being provided with shoes at their inner poles and being arranged radially in said yoke, a plurality of commutating-magnets in said yoke and in a plane parallel to the plane of said main magnets, the cores of said commutating-magnets being also radially arranged in said yoke and being adjustable radially therein, substantially as shown and described.

6. A dynamo-electric machine, comprising a yoke, a plurality of main magnets arranged in a common plane therein and the cores of said main magnets being provided with shoes at their inner poles and being arranged radially in said yoke, a plurality of commutating-magnets in said yoke and in a plane parallel to the plane of said main magnets, the cores of said commutating-magnets being also radially arranged in said yoke and being adjustable radially therein, shoes connected with the inner poles of said commutating-magnet cores and projecting into the plane of said main-magnet cores and conductive strips or plates connecting said main-magnet shoes and said commutating-magnet shoes, substantially as shown and described.

7. In a dynamo-electric machine, a yoke, a plurality of main magnets radially arranged in a common plane therein, a plurality of commutating-magnets radially arranged in said yoke and in a common plane parallel to said first-named plane, the cores of said commutating-magnets being of a length greater than the cores of said main magnets, and

devices for connecting the inner poles of said main magnets with the inner poles of said commutating-magnets, substantially as shown and described.

8. In a dynamo-electric machine, a yoke, a plurality of main magnets radially arranged in a common plane therein, a plurality of commutating-magnets radially arranged in said yoke and in a common plane parallel to said first-named plane, the cores of said commutating-magnets being of a length greater than the cores of said main magnets, and devices for connecting the inner poles of said main magnets with the inner poles of said commutating-magnets, comprising a shoe on each of said main-magnet-cores, an inwardly-directed shoe on each of said commutating-cores, and a strip or plate of conductive material connecting the adjacent pairs of said shoes, substantially as shown and described.

9. In a dynamo-electric machine, a yoke, a plurality of main magnets radially arranged in a common plane therein, a plurality of commutating-magnets radially arranged in said yoke and in a common plane parallel to said first-named plane, the cores of said commutating-magnets being of a length greater than the cores of said main magnets, and devices for connecting the inner poles of said main magnets with the inner poles of said commutating-magnets, comprising a shoe on each of said main-magnet cores, an inwardly-directed shoe on each of said commutating-cores, and a strip or plate of conductive material connecting the adjacent pairs of said shoes, and means for adjusting said commutating-magnet cores radially of said yoke, substantially as shown and described.

10. A dynamo-electric machine, comprising a yoke and within which is arranged the usual armature, a plurality of main magnets radially arranged in said yoke and the inner core-poles of which are in a common plane with said armature and slightly removed from the armature, a plurality of commutating-magnets in said yoke and arranged in a common plane parallel to the armature-plane, the cores of said commutating-magnets being of a greater length than the cores of said main magnets thereby allowing for a decrease in the length of the winding and an increase in the number of the windings thereon, and electrical conductors connecting the main cores or shoes thereof with the commutating-cores, substantially as shown and described.

11. In a dynamo-electric machine, comprising a yoke, an armature and a plurality of main magnets, a plurality of commutating-magnets arranged in a common plane parallel to the plane of said main magnets, the cores of said commutating-magnets being of a length greater than the cores of said main magnets thereby allowing for a decrease in the length of each winding and an increase in

the number of windings thereon to produce the necessary commutating field, substantially as shown and described.

12. In a dynamo-electric machine, comprising a yoke, an armature and a plurality of main magnets, a plurality of commutating-magnets arranged in a common plane parallel to the plane of said main magnets, the cores of said commutating-magnets being of a length greater than the cores of said main magnets thereby decreasing the length of each winding and increasing a number of windings thereon to produce the necessary commutating field, and means for adjusting said commutating-cores or the pole-shoes thereof, substantially as shown and described.

13. In a dynamo-electric machine, comprising a yoke, an armature therein and a plurality of main magnets arranged in said

armature-plane, a plurality of commutating-magnets the cores of which are longer than the cores of said main magnets, shoes on said main-magnet cores, shoes on said commutating-magnet cores, electrical conductors connecting said shoes with each other, and means for increasing or decreasing the air-gap between said commutating-magnet shoes and said armature, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 15th day of May, 1905.

LUDWIG TORDA.

Witnesses:

H. D. JAMESON,
F. S. RANDS.