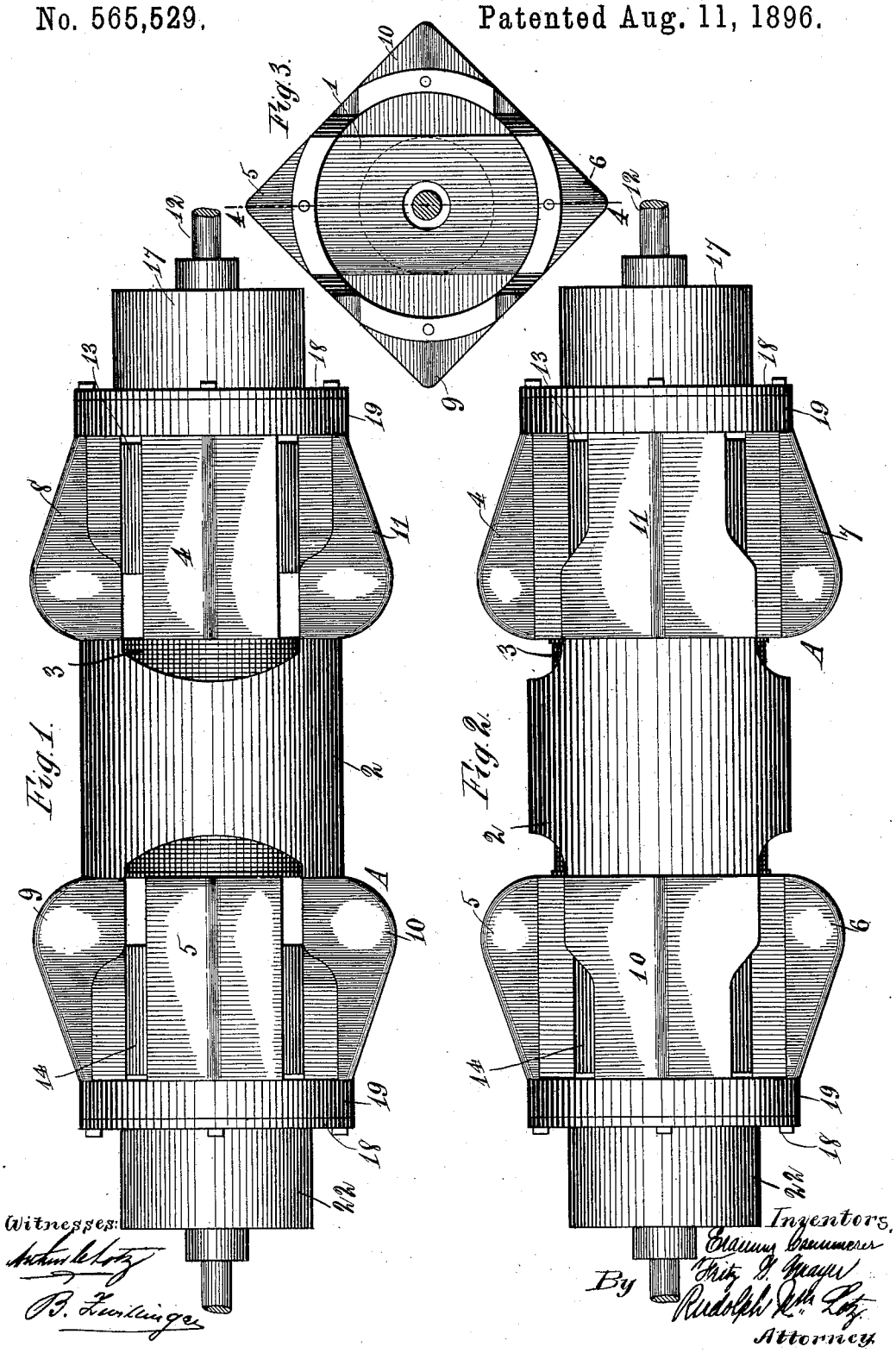
(No Model.) 3 Sheets—Sheet 1.

E. CAEMMERER & F. G. MAYER.

DYNAMO ELECTRIC MACHINE.

No. 565,529. Patented Aug. 11, 1896.



(No Model.) 3 Sheets—Sheet 2.

E. CAEMMERER & F. G. MAYER.

DYNAMO ELECTRIC MACHINE.

No. 565,529. Patented Aug. 11, 1896.

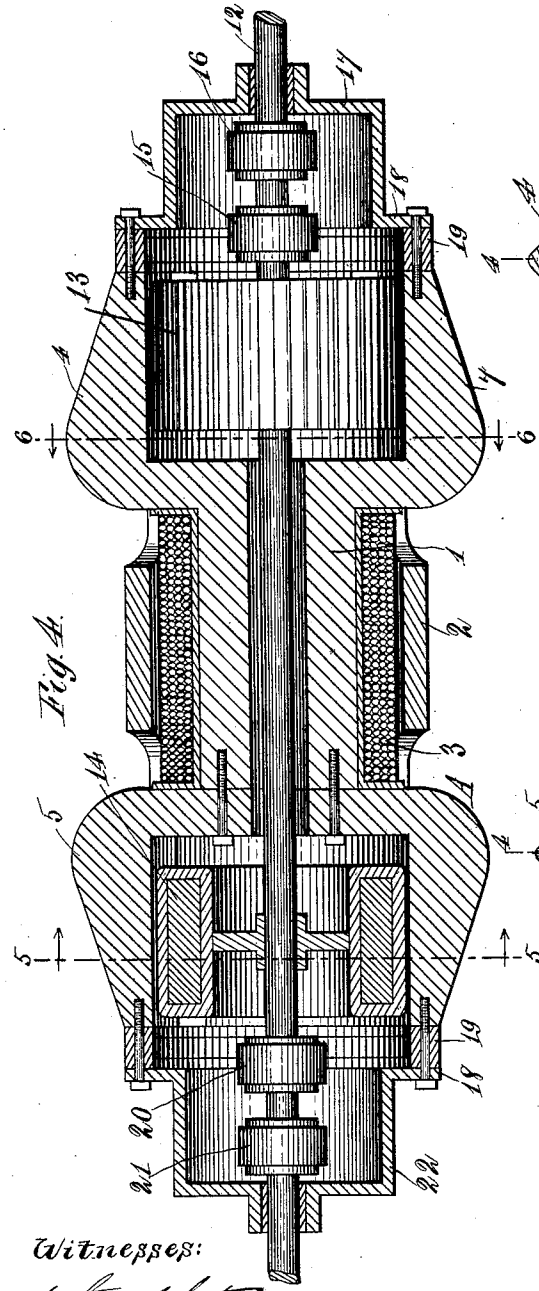


Fig. 4.

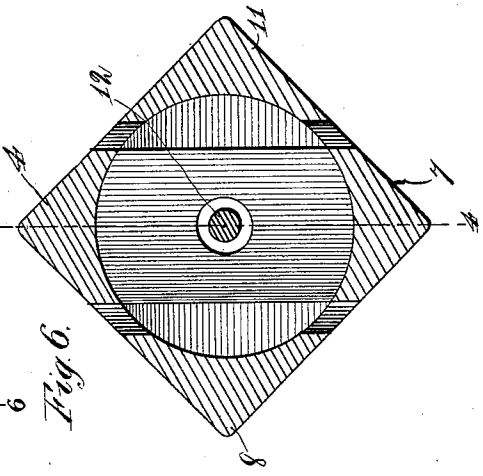


Fig. 6.

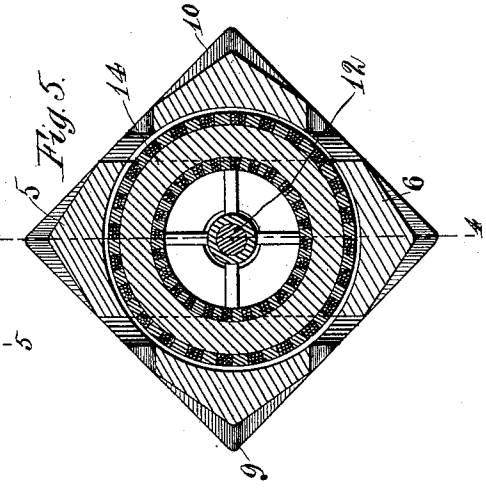


Fig. 5.

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 7.

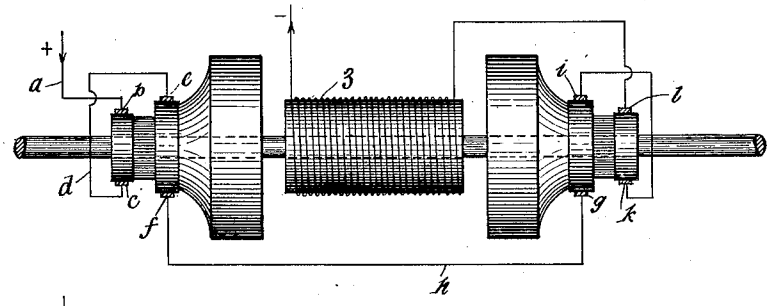


Fig. 8.

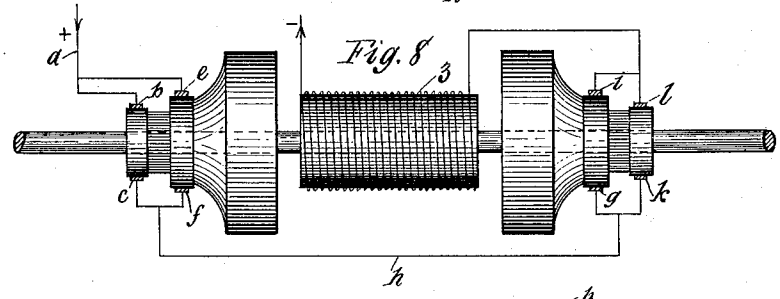


Fig. 9.

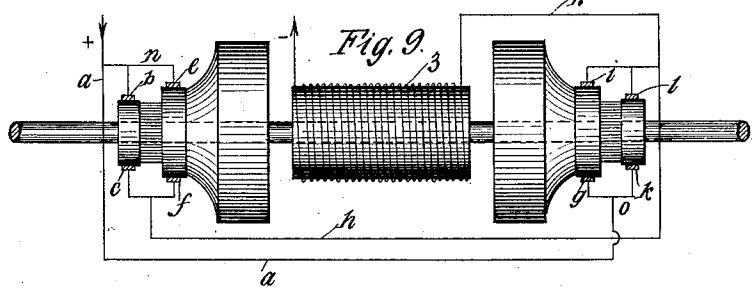
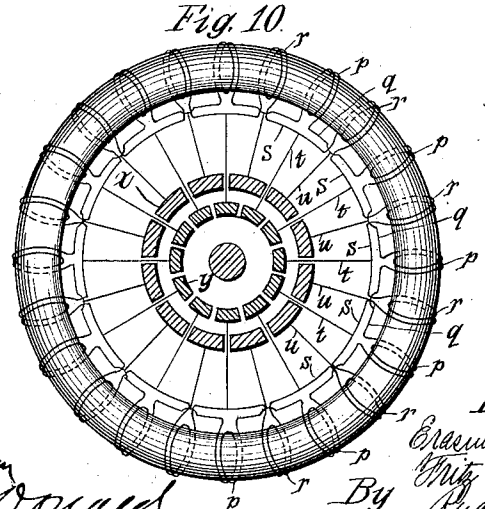


Fig. 10.



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UNITED STATES PATENT OFFICE.

ERASMUS CAEMMERER AND FRITZ G. MAYER, OF CHICAGO, ILLINOIS.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 565,529, dated August 11, 1896.

Application filed December 4, 1895. Serial No. 571,075. (No model.)

To all whom it may concern:

Be it known that we, ERASMUS CAEMMERER and FRITZ G. MAYER, subjects of the Emperor of Germany, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Dynamo-Electric Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a novel construction in a dynamo-electric machine, the object being to provide a machine of this character of simple and durable construction and efficient and economical operation; and it consists in the features of construction and combinations of parts hereinafter fully described and specifically claimed.

In the accompanying drawings, illustrating our invention, Figure 1 is a view in elevation of a dynamo-electric machine constructed in accordance with our invention. Fig. 2 is a side elevation of same at an angle of ninety degrees from Fig. 1. Fig. 3 is an end elevation of same with the end cap or bearing and armature removed. Fig. 4 is a longitudinal section of same on the line 4 4 of Figs. 3, 5, and 6. Fig. 5 is a sectional view through one end of same on the line 5 5 of Fig. 4 and showing the armature in section. Fig. 6 is a sectional view of same on the line 6 6 of Fig. 4 with the armature removed. Figs. 7, 8, and 9 are diagrammatic views showing the various connections for different speeds of the machine. Fig. 10 is a diagrammatic view of the double armature employed and the manner of connecting the same with the commutators.

Our invention relates more particularly to the novel construction of the field-magnets in a so-called "iron-clad" type dynamo and in the combination, with said field-magnets, of a plurality of armatures revolving in one and the same magnetic field, the advantages of which will be hereinafter described.

Referring now to said drawings, A indicates the frame of the machine, which consists of a magnetic core 1 and an outer or surrounding cylinder 2. The said core 1 is provided with a magnetic spool 3 and pole-shoes 4, 5, 6, and 7. The said pole-shoes 5 and 6 are cast in a separate piece, which is secured to the core after the magnetic spool and outer or surrounding cylinder has been slipped over the core. The said outer cylinder 2 is provided with four pole-shoes 8, 9, 10, and 11. The said pole-shoes on said core 1 and cylinder 2 are situated directly opposite each other or at an angle of one hundred and eighty degrees from each other transversely and longitudinally in line with each other, that is to say, the pole-shoes 4 and 5 on the core 1 are placed longitudinally in line with each other, while the pole-shoes 5 and 6 are one hundred and eighty degrees from each other. In this manner when the outer cylinder 2 is slipped over the core the pole-shoes on the same will be situated at angles of ninety degrees from the pole-shoes on the core. The said pole-shoes on said core 1 and cylinder 2 are so situated that their inner faces are in the same cylindrical plane and equidistant from the outer circumference of the armature. The said core 1 is hollow, to admit of the passage of the shaft 12, carrying the armatures 13 and 14 therethrough. After said cylinder 2 has been slipped over said cylindrical core 1 and said shaft 12, carrying armature 13 and commutators 15 and 16 at one end thereof, has been placed in said opening in said core the cap 17, which forms the bearing for said shaft, is slipped over the same and secured by the peripheral flange 18 to the ends of the pole-shoes on said core and cylinder, thus holding the same in proper position with relation to each other and to the armature. The said cap 17 is preferably made of some non-magnetic metal, but may be of iron, in which case it will be necessary to insert a washer 19 of some non-magnetic substance between the same and said pole-shoes, for obvious reasons. The armature 14 and commutators 20 and 21 are then secured upon the other end of said shaft and a cap 22 slipped over same and secured to the ends of the opposite pole-shoes. In this manner it will be seen that we form a multipolar magnetic field, in which the magnetic circuit will be as follows: Supposing the pole-shoes 4 and 7 on the core to be N and the pole-shoes 5 and 6 to be S, then the pole-shoes 8 and 11 on the cylinder 2 would be S and the pole-shoes 9 and 10 would be N. Now, then, the magnetic lines of force would make the circuit, passing from S to N

through the core 1, thence through the armature-core to S of the cylinder, thence through the cylinder to N, and thence through the armature-core to S of the core 1, thus completing the circuit and forming equal magnetic fields in which said armatures revolve.

As a further improvement in combination with the above-described magnetic field we prefer to provide a plurality of armature-windings on one core, thus forming a plurality of armatures having the same core and revolving in the same magnetic field. For purposes of description we will call these "double" armatures. Thus if we have two double armatures on one shaft the double armature at one end will revolve in one magnetic field and the other in another magnetic field, both magnetic fields, however, being, in consequence of our construction, equal, and therefore the induction for the different armature-windings will be equal. This is of great advantage in multiple connection, as each armature will be equally loaded.

We do not, of course, wish to be limited to magnetic fields having any particular number of poles, as the number may be increased or diminished, as may be found desirable; nor do we wish to be limited to the shape of the core and outer casing, which may be cylindrical or any other shape, though we have shown only the cylindrical form as the most practical.

By means of this construction we obtain the advantage of giving our dynamo a very compact form, and, further, all the working mechanical parts of the same, such as the winding on the magnets and armature, are protected against injury.

By means of our construction we also gain the advantage of requiring only one exciting-coil on the field-magnets. The greatest advantage which we obtain, however, lies in the fact that the action of the magnetic lines of force in the cores of the two double-voltage armatures or common armatures are identical, and for that reason the armatures act in harmony with each other, no matter how they are connected, in multiple or series connection. The above advantage is also present in dynamo-electric machines now in use in which two armatures revolve in one magnetic circuit, but we obtain the additional advantage of having a greater number of magnetic circuits in consequence of our construction and use only one magnetic spool, while in all other dynamo-electric machines of a similar class at least two magnet-spools are employed. By the use of only one magnet-core we require only one magnet-spool, in which the magnetic lines of force are generated and make their circuits through the poles, the number of circuits being determined by the number of poles.

A further object of our invention is to provide an absolute and economical regulation of speed under variable loads, and we obtain such regulation, not by varying the current in the different exciting-coils by different connection of the same, but by different connections of the various armature windings.

It will of course be understood that we do not wish to be limited to the above-described manner of regulating the speed, as same may of course be done in the manner now commonly employed.

In Fig. 7 we have shown the commutators connected in series as follows: The wire *a* (being connected with a positive pole of a dynamo) is connected with the brush *b*, the current passing therefrom through one armature-winding and thence to brush *c*. Wire *d* connects brush *c* with brush *e*, whence the current passes through the other armature-winding to brush *f*. Brush *f* is connected with brush *g*, thence through one winding of the other armature to brush *i*. Brush *i* is connected with brush *k*, whence the current passes through the last armature-winding and back to brush *l*, which is connected with magnet-coil 3, the other end thereof being connected with the negative pole of the dynamo. The above connection is obviously for slow speed.

Fig. 8 shows connection for medium speed. For this purpose the wire *a* is branched into two parts, one of which is connected with each of the brushes *b* and *e*, the current passing through both the armature-windings of one double armature, at the same time to brushes *c* and *f*, thence through wire *h* to brushes *g* and *k*, thence through both windings of the other double armature, thence to brushes *i* and *l* and through coil 3.

Fig. 9 shows connection for full speed. For this purpose wire *a* is connected by branches *n* with branches *b* and *e* and by branches *o* with branches *g* and *k*, the current passing simultaneously through all windings of both double armatures to brushes *c* and *f* and brushes *i* and *l*, which are connected with each other by branches from wire *h*, said wire *h* being also connected with coil 3.

In Fig. 10 we have illustrated the windings of the double armature and the connection between the same and the commutators. The coils *p* of said armature are connected with each other by wires *q* and are situated alternately with coils *r*, which are connected with each other by wires *s*. Each of said wires *q* is connected with the commutator *x* by a wire *t*, and each of said wires *s* is connected with commutator *y* by means of wire *u*. This construction is particularly adapted for use as an equalizer, and as such is very valuable. When used as an equalizer, it will give an absolute equalization or equal division of the voltage under variable loads in the different circuits. The brushes will run without sparking under any circumstances at normal load and do not require any adjustment.

Our dynamo-electric machine when used as a generator will generate a current of very high tension. For instance, if each armature-

winding (supposing four such windings) be wound for five hundred volts the total voltage would be two thousand volts, which would be generated with no greater danger of burning out than in an armature generating five hundred volts. Obviously our machine when used as a motor will be able to withstand so much greater pressure than the ordinary motor without danger of burning out.

We claim as our invention—

1. In a dynamo-electric machine, a field-magnet comprising a core provided with pole-shoes, a sleeve adapted to contain said core and having an equal number of pole-shoes therewith, and non-magnetic material interposed between said pole-shoes of said core and said sleeve whereby the magnetic lines of force generated in said core will be caused to pass through the armatures before completing the circuit through said sleeve.

2. In a dynamo-electric machine, a field-magnet comprising a hollow core, a sleeve adapted to contain said core, said sleeve and core having an equal number of pole-shoes arranged alternately, the pole-shoes on said core being situated respectively between the pole-shoes on said sleeve, and a shaft carrying the armature passing through said hollow core.

3. In a dynamo-electric machine, a field-magnet comprising a core requiring only one magnet-coil, a sleeve adapted to contain said core, and pole-shoes on said sleeve and said core arranged alternately and forming two equal magnetic fields at the ends of said sleeve and said core in which the armatures are adapted to revolve.

4. In a dynamo-electric machine, a field-magnet comprising a core requiring only one magnet-coil and provided with pole-shoes at its ends, a sleeve adapted to contain said core and provided with pole-shoes at its ends, adapted to extend between the pole-shoes on said core, and armatures mounted upon a shaft passing through said hollow core, adapted to revolve in the magnetic fields formed by said pole-shoes.

5. A dynamo-electric machine comprising a field-magnet consisting of a hollow core, a sleeve adapted to contain said core, said core and sleeve being provided with pole-shoes at their ends, and a shaft passing through said core and carrying armatures, said shaft running in bearings consisting of caps secured to the ends of said pole-shoes on said core and said cylinder and being insulated therefrom by a non-magnetic substance.

In testimony whereof we affix our signatures in presence of two witnesses.

ERASMUS CAEMMERER.
FRITZ G. MAYER.

Witnesses:
RUDOLPH WM. LOTZ,
ARTHUR C. LOTZ.