(No Model.) 3 Sheets—Sheet 1.

J. F. McELROY.

COMBINED DYNAMO ELECTRIC GENERATOR AND CURRENT DIRECTOR.

No. 536,816. Patented Apr. 2, 1895.

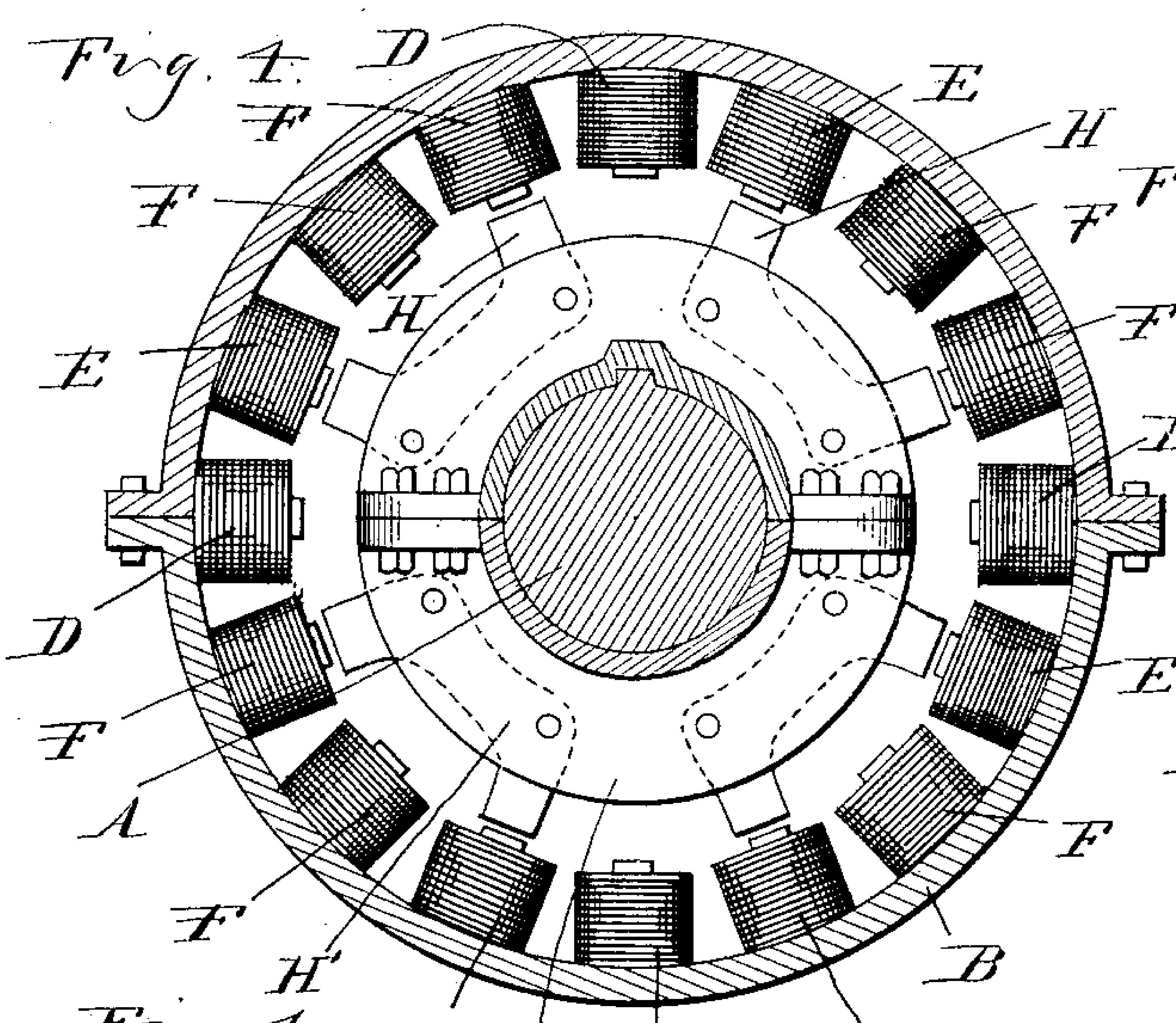

Fig. 1

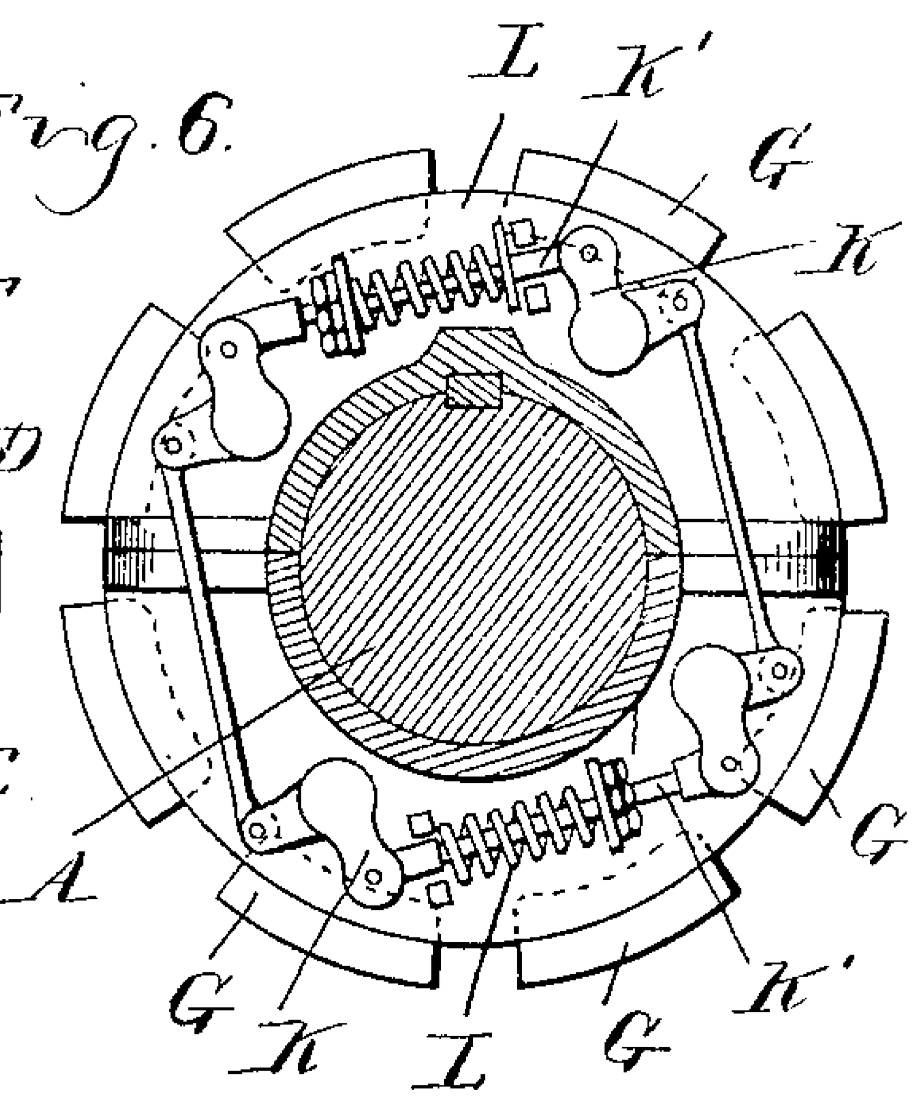

Fig. 6.

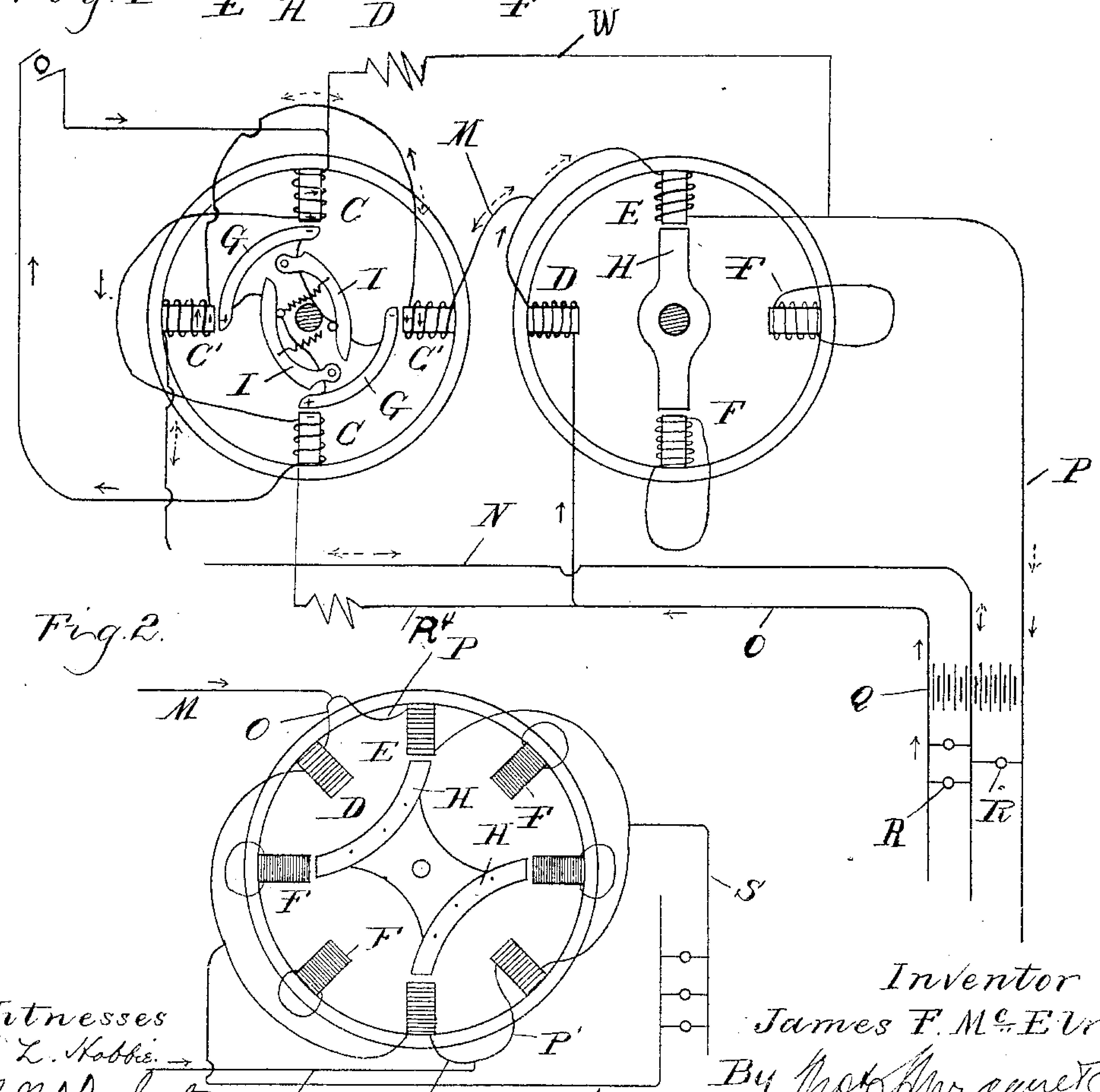

Fig. 2.

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 5.

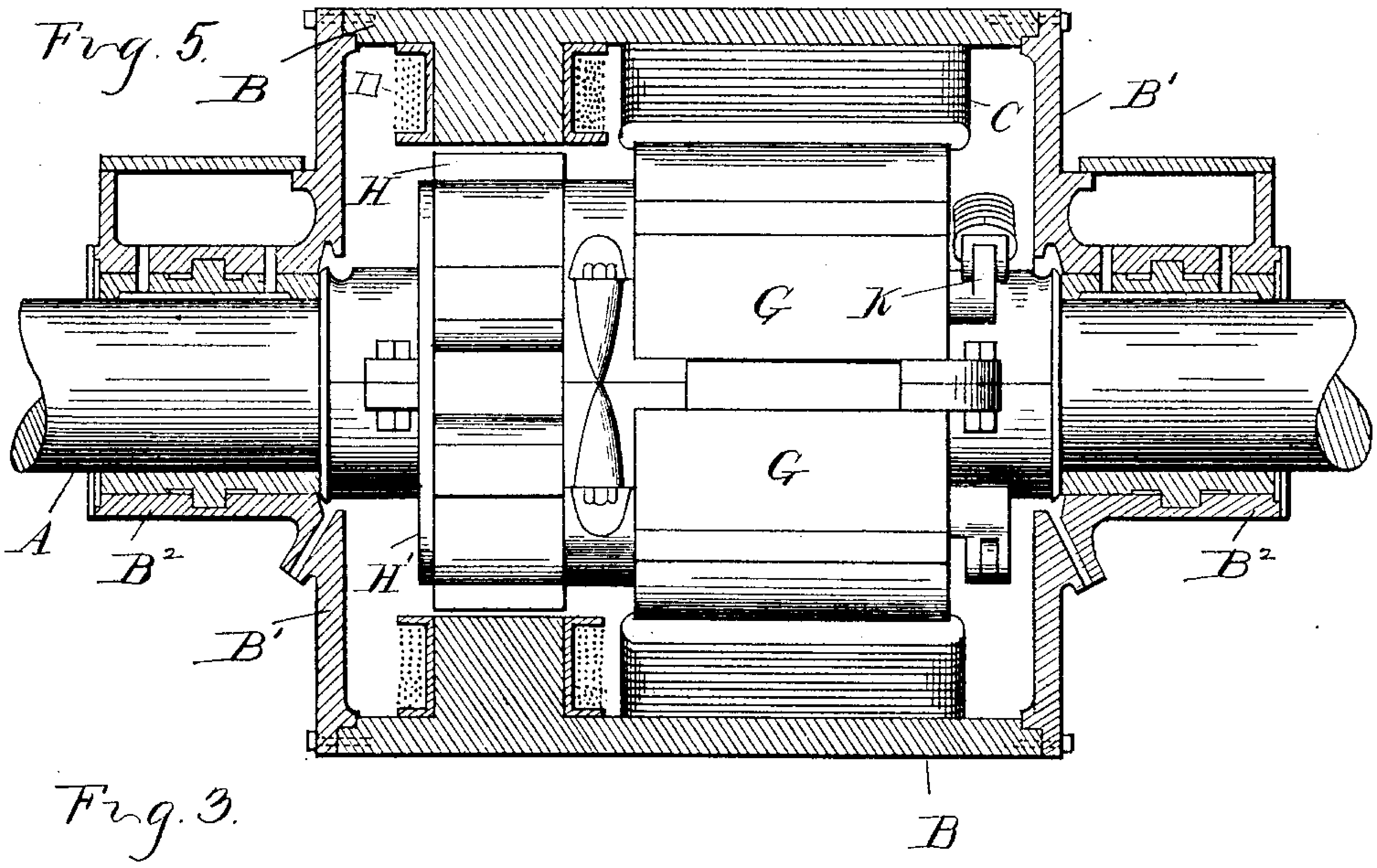


Fig. 3.

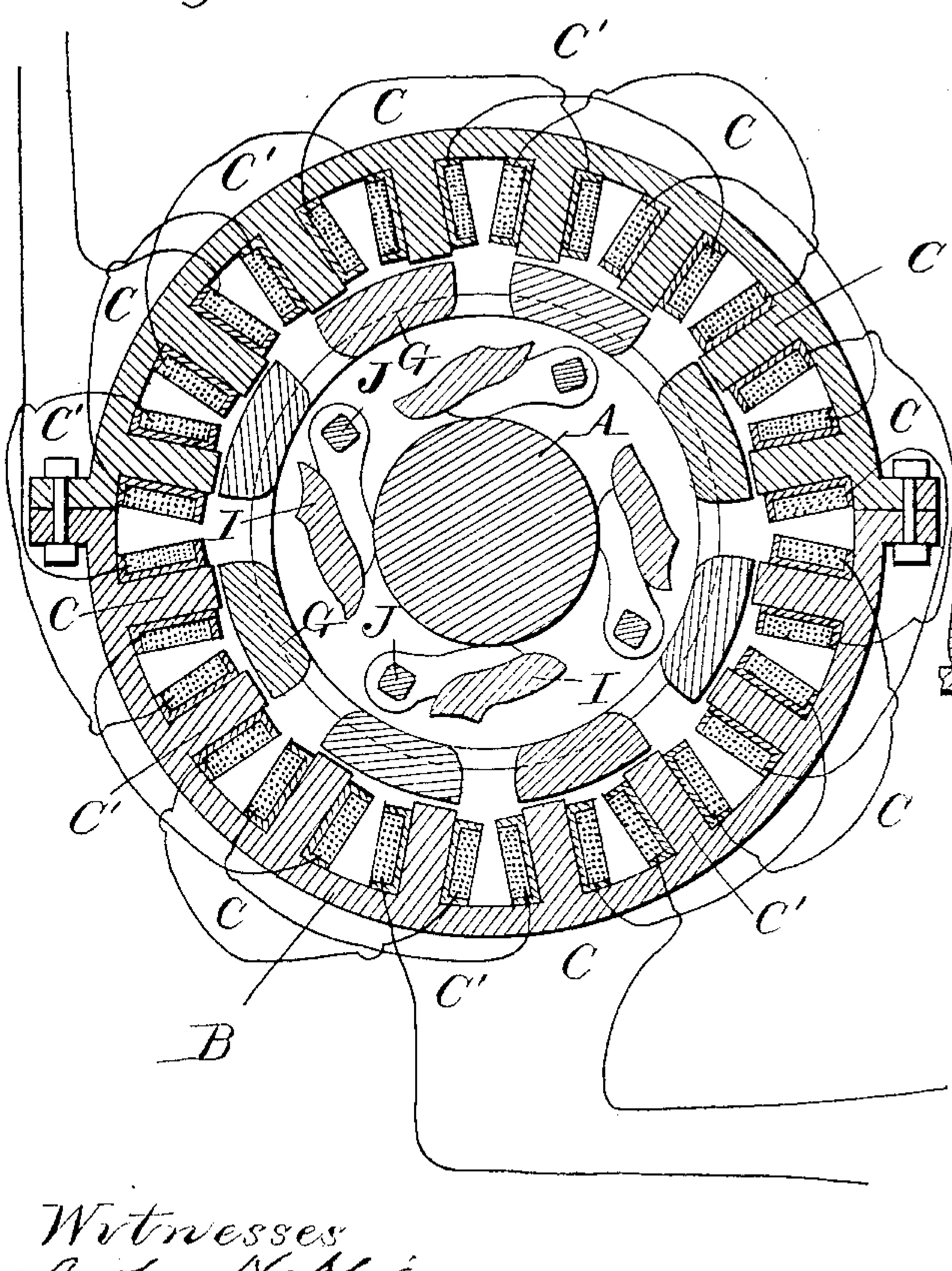
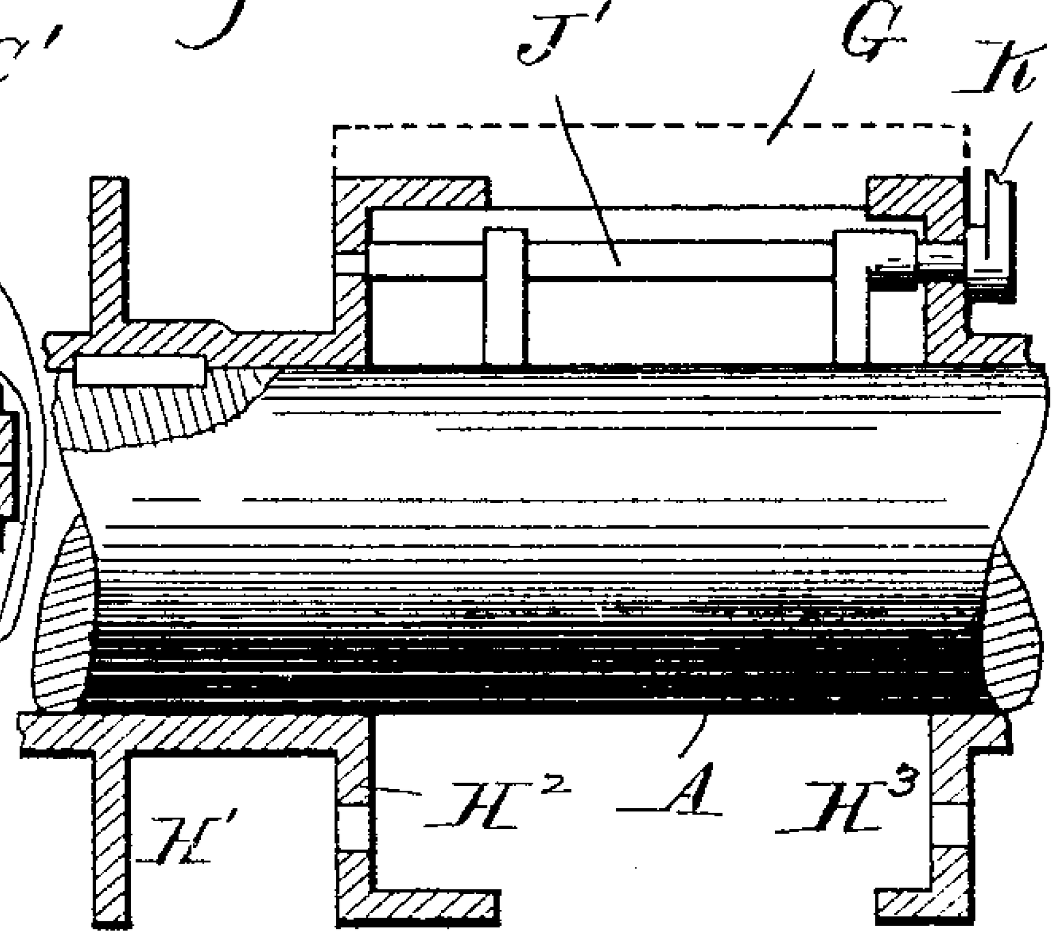


Fig. 7



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COMBINED DYNAMO ELECTRIC GENERATOR AND CURRENT DIRECTOR.

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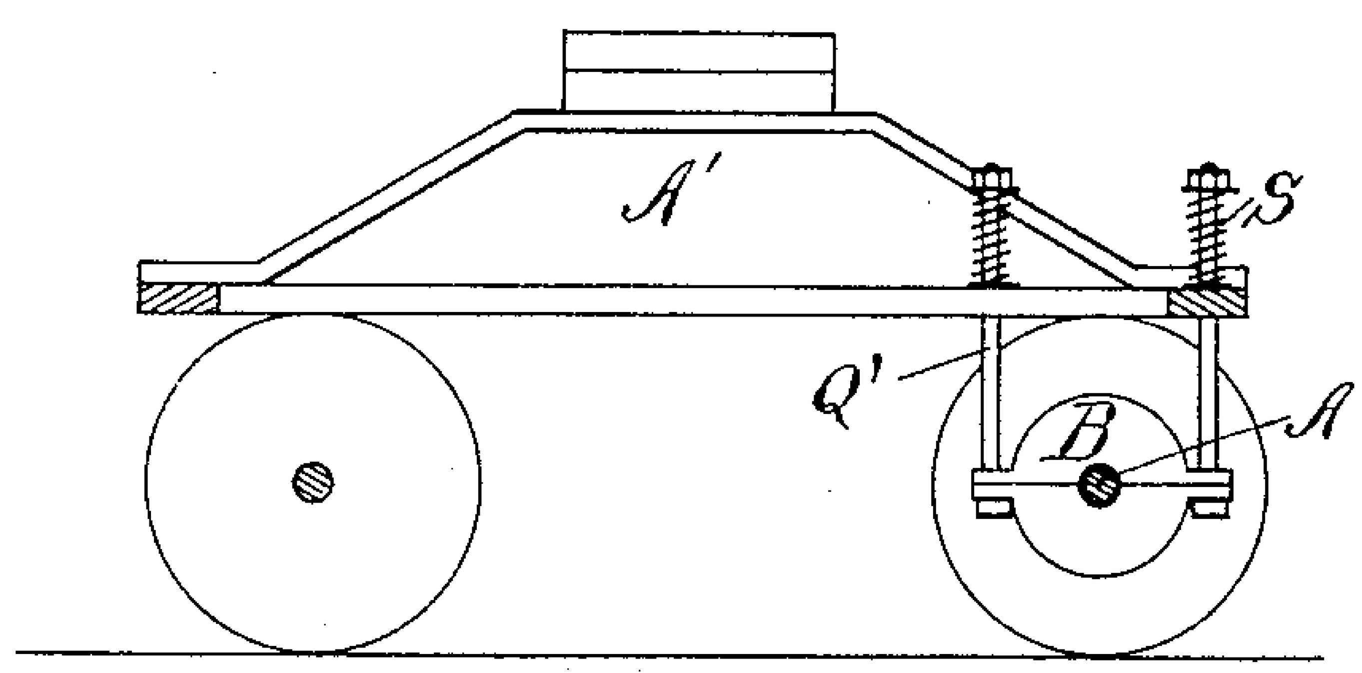
Fig. 8.



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UNITED STATES PATENT OFFICE.

JAMES F. McELROY, OF ALBANY, NEW YORK, ASSIGNOR TO THE CONSOLIDATED CAR HEATING COMPANY, OF WHEELING, WEST VIRGINIA.

COMBINED DYNAMO-ELECTRIC GENERATOR AND CURRENT-DIRECTOR.

SPECIFICATION forming part of Letters Patent No. 536,816, dated April 2, 1895.

Application filed January 2, 1892. Serial No. 416,801. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. McELROY, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Generators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to new and useful improvements in dynamo-electric generators, and the object of my invention is to produce a type of dynamo especially adapted for use on railway-trains, or more generally speaking on moving vehicles, where the power for operating the dynamo is derived from the motion of the train or vehicle itself.

In generating electricity for lighting railway cars it is deemed the most practical way to drive the dynamo by power derived from the motion of the train, so as to dispense with the use of a separate motor. This can be done by placing the dynamo within a car or upon the locomotive and connecting it by suitable gearing with one of the axles of the trucks, or with any other revolving part, or, as is still more desirable by placing it on one of the axles itself. The plan which I preferably favor is to place the dynamo upon the forward axle of the front truck of the locomotive. It does not require much argument to show why the present types of dynamos are not well adapted to such use. One of the objections is the use of contact brushes, which unless given constant attention are a frequent source of trouble, and the objection against them becomes almost prohibitive to their use when the dynamo is in an exposed and inaccessible position as it will be when placed under a car or locomotive. Further as the speed of a dynamo, when operated by the motion of a train, varies within very wide limits, it becomes at once necessary to provide some means to automatically govern or regulate the strength of the current to the general requirements of the circuit for maintaining the lights, such regulation being directly dependent upon the speed of the dynamo irrespective of other regulating devices usually provided for and operated by the current generated. While devices for this purpose are applied to dynamos in present use, their construction is not adapted for the special use on consideration, as they either involve the use of contacts which are as objectionable as brushes, or cannot be used in the exposed and limited position on an axle under the car or locomotive. Further it is undesirable to use an armature wound with wire, the principal objection being, that in cases of its burning out, to which contingency it is always subjected especially under the conditions of use on a railway train, it would involve a great amount of labor to remove it from its place.

The type of dynamo which I have designed, meets the requirements of its use on railway trains and briefly described involves the following features: An outer cylindrical casing surrounds and incloses all the working parts which are in such a compact form as to readily find place under the frame of a truck between two wheels. The heads of the casing have journals through which the axle passes out, and the armature revolves within and is secured upon the axle. The outer casing carries both the generating and exciting magnets and the armature carries no wire. Thus no commutator or collector is necessary. The current generated is alternating in its character, and to straighten it in part or wholly for the purpose of maintaining the field of the dynamo, and for charging storage batteries on the cars, I employ what I call a current director which in its general appearance is a counterpart of the generator, and has a circular range of coils secured to the casing, and a revolving armature secured upon the axle, and both inclosed in the same casing with the generator. A governor is inclosed within the revolving armature and operates by the centrifugal force of movable iron bridges to decrease the magnetism of the field coils with the increase of speed, according to the requirements of the circuits.

In a previous application, Serial No. 377,383, I have already described a dynamo-electric generator showing some of the general features of my present invention, and I will therefore confine myself in the following description more particularly to the added improvements.

In the drawings, Figures 1 and 2 are diagrammatic representations of the generator and current director which I employ to illustrate the general principle. The difference between the two is that the current in Fig. 1 is distributed by means of three wires, while in Fig. 2 it is distributed by means of two wires only. Figs. 3 and 4 are cross-sections of the generator and current director respectively. Fig. 5 is a longitudinal central section through the outer casing with the armatures of the generator and current director in side elevation. Fig. 6 is an end elevation of the armature of the generator. Fig. 7 is a longitudinal central section through the armature frame of the generator. Fig. 8 is a diagram section of a car truck showing in elevation the connection of the dynamo frame to the truck.

A represents the axle of a moving vehicle, car or locomotive truck to which my dynamo is secured.

B is the inclosing cylindrical casing made in halves and provided with detachable heads B', having suitable hubs B^2 in which journal bearings are formed to support the casing upon the revolving axle, suitable connections as shown in Fig. 8 being provided to secure the casing to the frame of the vehicle or truck to hold it in its position. This support consists of the bolts or rods Q' passing through the truck frame, and through flanges on the casing, springs S sleeved over bolts and beneath the heads thereof forming a spring support for the casing. This construction is the same as shown and described by me in Letters Patent No. 469,656. To the inside of the cylindrical wall of the casing are secured the circular range of electro magnets C C', the former of which are placed in the exciter circuit, and shall be called therefore the field magnets, and the latter being placed in the working circuit shall be called the generating coils. These magnets C C' alternate with each other and have their cores preferably formed integral with the casing B to form a closed magnetic system, and the winding of the field magnets is such as to make them alternate positive and negative field poles. Within the same casing is another circular range of electro-magnets D, E, F, which form a part of the current director. The magnets D and E are contained in different branches of the dynamo circuit and serve as variable resistances to the passage of the current, and the magnets F are in independent circuits and form choke coils, all as more fully hereinafter described.

The generator and current director are provided with unwound armatures. Those of the generator consist of bars or laminations of iron G adapted to revolve in close proximity to the poles of the fixed magnets. They are magnetically insulated from each other and are adapted to magnetically connect the poles of two adjoining magnets simultaneously in pairs. The armature for the current director is made of horse shoe shaped bars H preferably made of laminated iron with poles adapted to revolve in proximity to the poles of the electro-magnets of the current director, and adapted to magnetically connect one magnet with its second adjacent magnet, the arrangement being such that with each phase of the generator its generating magnets are joined in pairs alternating with a positive and then with a negative field magnet pole while coincident therewith one half of the coils in the current director are alternately connected with the choke coils.

The armatures of the generator and current director are secured to a non-magnetic frame which as shown in Fig. 7, consists of three disks H' H^2 H^3. Between the former two the armatures of the current director are bolted, and to the latter two the armatures G are secured peripherally, suitable flanges being formed on the disks for the purpose. The disks H' H^2 may be cast together. The outer disk H^3 is made separately. The whole frame is firmly secured to the axle and preferably made in sections to be readily placed in position thereon.

Within the interior of the frame or body, which carries the armature of the generator, are inclosed the hinged governor weights I. They are of magnetic material and are secured upon shafts J which are journaled in the heads H^2 H^3, and are provided on the outside with cranks K, which are connected in any suitable manner to equalize their action, or in pairs by links K' upon which are sleeved the springs L, which act under compression between a fixed abutment on the frame and an adjustable abutment on the link. The governor weights are free to play between the axle and the armatures G, and are moved on their hinges by the centrifugal force of the rotation of the axle under the control of the springs, which, when there is no motion keep them withdrawn against the axle. In motion the centrifugal force tends to throw them outwardly, whereby their faces approach the armatures G and tend to close the gap between the adjacent ends of the armatures, and in their most extended position they fit closely with their faces against, and completely bridge the gap between these armatures. The adjusting devices of the springs are to regulate the degree of compression with which they resist the centrifugal force of the weights.

The operation of the dynamo is as follows: By examining Fig. 3 it will be seen that if the shaft which carries the soft iron armatures be revolved there will be certain phases in which the radially projecting polar extensions of the soft iron armatures will be in exact juxtaposition with the inwardly projecting polar extensions of the electro-magnets. If now the electro-magnets which constitute the field magnets are charged by the exciter circuit, a maximum number of lines of force will at that moment enter the soft iron armature at one of the polar projections and pass out through the other polar projections into the electro-magnets which form the stationary armature. As the soft iron armatures draw away from such position the number of lines of force entering them will be diminished and a minimum will be reached when the polar extensions are exactly midway between the polar extensions of the magnets. It is obvious therefore that when the shaft is revolved rapidly the change of magnetic induction will create an electro motive force which will produce currents in the working circuit, and by winding the field coils alternately in opposite directions as shown in drawings an alternating current may be generated.

The operation of the current director is explained in Figs. 1 and 2, which represents two arrangements. Either one I desire to use. In Fig. 1 one of the main leads M is branched through the magnets D, E, and the armature H (which in this diagram is straight instead of horse shoe shaped, as there is but one) in revolving connects at one phase of the generator the magnet E with one of the choke coils, and at the next phase it connects the magnet D with the other choke coil. A current wave in passing through the lead M will divide, the magnet E becomes energized, and being connected in a magnetic circuit with the choke coil F a regular transformer action will take place, and as the circuit of the coil F which becomes the secondary, has a low resistance, it will act upon the primary which is the coil E, reducing the resistance therein and thus permit the flow of the current through the coil of the magnet E. The coil D at this instance is blocked, and therefore the current wave will be mainly diverted into the branch wire P. In a similar manner, at the next phase the coil of the magnet D becomes active or open while the coil E is blocked and the current will mainly flow through the branch O. In this way, using the other main N of the dynamo a system of distribution by means of three conductors may be formed for charging a storage battery Q and maintaining lights R. By coupling the storage battery in halves between the three conductors, one phase of the current will charge one half and the next phase charge the other half, the circuit for one phase being established through the conductors P N, and in the next phase through the conductors N O. By this arrangement the dynamo may be sustained by its own current by connecting the field in shunt with the conductors O P, as shown by lines R^4, W in Fig. 1. Another arrangement, using two main conductors only for distribution is shown in Fig. 2. Here the lead M divides into two branches O and P with a resistance coil in each branch. The lead N divides similarly into two branches O′ P′, with a resistance coil placed in each branch. The branches O O′ are joined to a conductor R′ and the branches P P′ are joined to a conductor S. Now it is obvious that if at one phase the flow of the current is blocked through the branches P O′, and in the next phase it is blocked through the branches O P′ it will always flow in the same direction over the conductors R′ S. In the position of the parts shown in Fig. 2, it will be readily seen that the branches P O′ are blocked, and if the current impulse passes out over the lead M it will be directed into the conductor R′. At the next succeeding phase when the current impulses pass out over the lead N the branches O P′ are blocked, and the current will pass out onto the conductor R′ again. From this description it will readily be seen how the current director can be arranged either for a two or three wire system of distribution. The number of coils makes no difference as long as the phases in both the generator and current director are coincident.

The operation of the governor will be understood from its construction. The governor weights obviously control the strength of the field magnets as by their approach to the armatures G, they tend to form indirectly a magnetic bridge between field magnets of opposite polarity, and the closer they approach the more they will weaken the inductive influence of the field magnets upon the generator magnets. The springs L act as a constantly increasing resistance to the centrifugal force of the weights, the latter being connected by the links in a manner to compensate the variable action of the gravity in the different positions of the weights.

What I claim as my invention is—

1. In a dynamo electric generator, the combination of a circular range of fixed electromagnets alternately included in the field and generating circuits of the generator, with the field magnets alternately of opposite polarity, an outer cylindrical casing to which said magnets are secured and forming a magnetic circuit therefor, a revolving armature shaft, a series of unwound armatures, one for each pair of magnets, a hollow supporting body upon the armature shaft to which said armatures are peripherally secured, and centrifugal governor weights inclosed within said hollow body, substantially as described.

2. In a dynamo electric generator, the combination of a circular range of fixed electromagnets alternately included in the field and generating circuits of the dynamo with the field magnets alternately of opposite polarity, an outer cylindrical casing to which said magnets are secured and forming a magnetic circuit for the same, a revolving armature shaft, a series of unwound armatures, one for each pair of magnets, a hollow supporting body to which said armatures are peripherally secured, and centrifugal governor weights hinged within said hollow body and adapted to magnetically bridge the gaps between the armatures, substantially as described.

3. In a dynamo electric generator, the combination with a circular range of alternate generating magnets and field magnets of alternate positive and negative polarity and secured to an outer casing magnetically con-

necting said magnets, a revolving armature consisting of an armature shaft, two heads or disks secured upon the armature shaft, a series of armatures, one for each pair of magnets, peripherally secured to said disks and forming open gaps between their adjacent edges, hinged governor weights secured below said open gaps and adapted to magnetically bridge the same, and springs arranged to counteract the centrifugal force of said generator weights, substantially as described.

4. In a dynamo electric generator, the combination of the circular range of field and generating magnets C C′, the outer casing B, the armature shaft A, the disks H^2 H^3 of non-magnetic material secured upon said shaft, the armatures G adapted to connect adjacent pairs of magnets, the governor weights I, the shafts J, by which they are hinged, the cranks K secured to these shafts, the links K′ connecting them, and the springs L arranged upon these links to control the weights, substantially as described.

5. In a dynamo electric generator, the combination of a circular range of alternate generating magnets and alternate positive and negative field magnets, an outer casing magnetically connecting said magnets, a revolving armature shaft, a series of unwound armatures, one for each adjacent pair of magnets, peripherally secured upon a supporting armature core, alternating current leads from the generating magnets, a second circular range of electro-magnets within the same casing and comprising resistance coils included in branches of one or both leads from the generating coils and choke coils in independent circuits, and armatures for said second range of electro-magnets, whereby synchronously with the generation of the current in the generating coils, its passage through one of the two branches of the lead or leads is blocked by the formation of a magnetic circuit between a resistance coil and a choke coil, thereby directing the current, substantially as described.

6. In an alternating current generator and current director combined, the combination of a circular range of alternate generating magnets and alternate positive and negative field magnets, a second range of alternate pairs of magnetic resistance coils included in branches of two leads from the generating coils, and choke coils in independent circuits, an outer casing inclosing the two ranges of coils and forming a magnetic circuit therefor, a revolving armature shaft and two series of unwound armatures secured to said shaft and respectively adapted to synchronously connect the adjacent field and generator coils and one of each pair of resistance coils with a choke coil, whereby the current in one of the two branches of each lead from the generator becomes blocked to direct the current into working conductors connected to these branches, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES F. McELROY.

Witnesses:
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EDWIN A. SMITH.