(No Model.)

A. J. HOLT, Dec'd.

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REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 396,932. Patented Jan. 29, 1889.

Fig. 1.

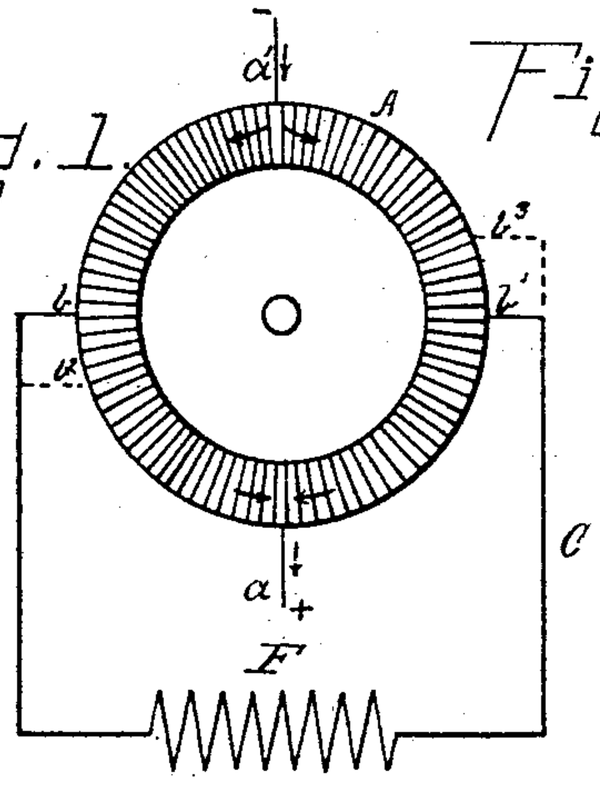


Fig. 2.

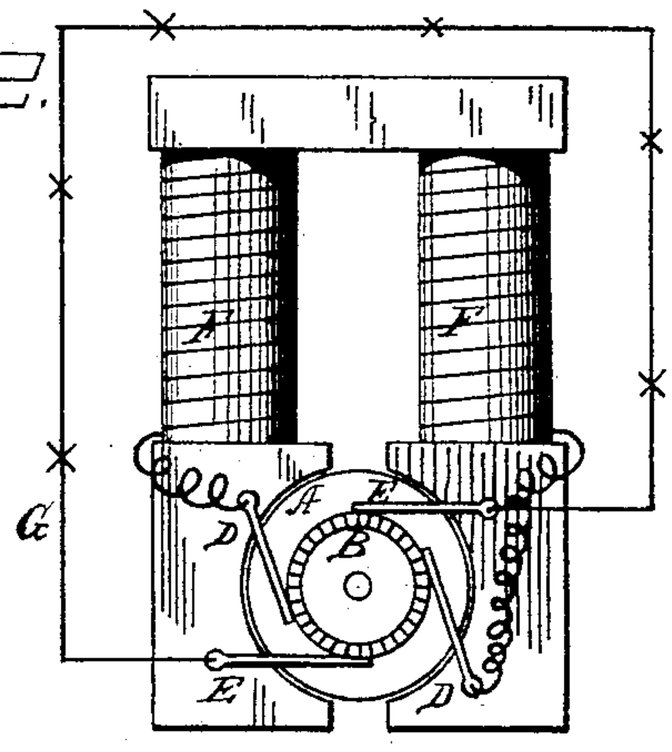


Fig. 3.

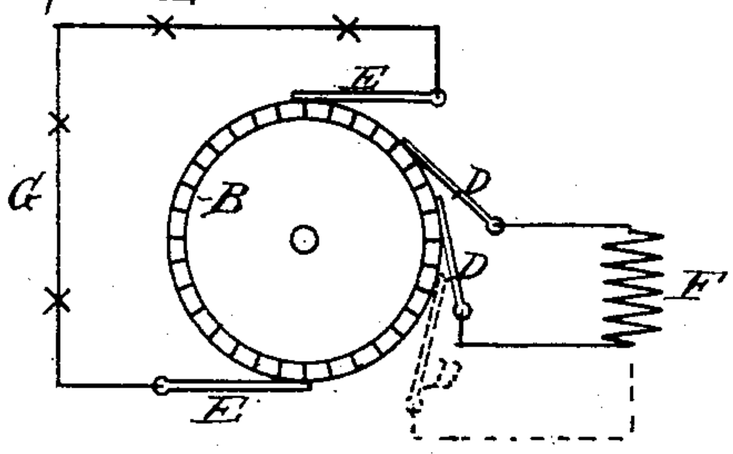


Fig. 4.

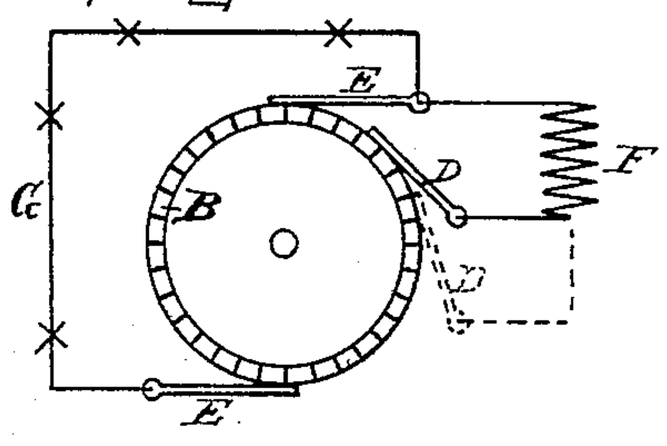


Fig. 5.

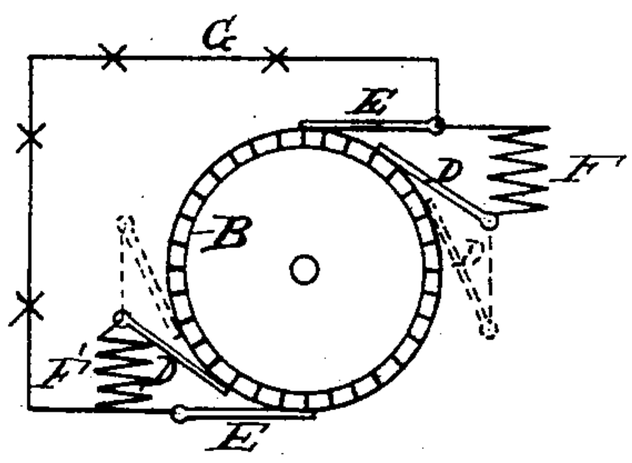
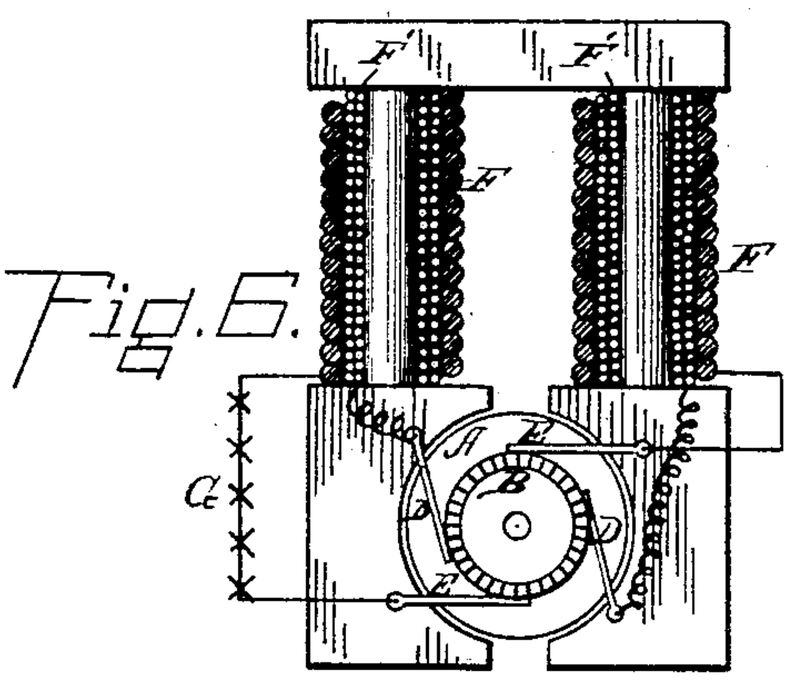


Fig. 6.



WITNESSES

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REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 396,932, dated January 29, 1889.

Application filed May 13, 1884. Serial No. 131,391. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR J. HOLT, of Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Dynamo-Electric Machines; and I 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 pertains to make and use the same.

My improvements relate to dynamo-electric machines in which the field is energized, in whole or in part, by a "derivation" or "shunt" from the main circuit. Such machines comprise the two classes, "shunt-wound" and "compound," or "shunt and series wound;" and my invention, which applies to both classes, consists, essentially, in so connecting the field-magnet circuit to the armature and external circuits as to dispense with the large amount of fine wire usually placed on the field-magnets of such machines, and at the same time to allow of a perfect regulation of such machines without the aid of useless resistances. These objects I attain by so connecting the field-circuit to the armature-circuit that the difference of potential at the respective ends of the field-circuit can be varied at will from a maximum equal to the total electro-motive force furnished by the machine down to zero, preferably keeping it at a point considerably below the maximum.

The application of my invention will be best understood by reference t› the accompanying drawings, in which—

Figure 1 is a diagram illustrating the principle of my invention. Fig. 2 shows a dynamo with my invention applied, the circuit-connections being shown diagrammatically. Figs. 3, 4, and 5 show modified applications. Fig. 6 shows the application of the invention to a machine of the compound type.

Referring to Fig. 1, A represents a Gramme ring, and $a\,a'$ its points of maximum and minimum potential where the current enters and leaves the ring by the main commutator-brushes. Now, as the rise of potential in the two halves of the ring correspond, there is for every point on one side a corresponding point on the other side of the same potential, and these two corresponding points will in general be found equally distant from the point a or a'. If two such points, as at $b\,b'$, be bridged by a conductor, C, it is obvious that no current will flow; but if, on the contrary, the bridge be connected at points $b^2\,b^3$, as shown by the dotted lines, or connected in any way to two points of different potential, it is evident that a current must flow from the point of higher to the point of lower potential through the bridge; and it is also evident that the intensity of this current will gradually increase as the points $b^2\,b^3$ approach the points $a\,a'$. If, now, the bridge-wire C be made to include the field-coils F, we will have a construction of machine which, from its analogy to the Wheatstone bridge, may be appropriately termed "bridge-wound," and which, while retaining all the advantages of a shunt-wound machine possesses none of its disadvantages.

My invention is most easily applied to an armature of the Gramme or Siemens type, and, as shown in Fig. 2, I prefer to derive the field-current from the armature by a supplementary pair of commutator-brushes, D D, the main commutator-brushes E E supplying only the external circuit, G. B represents the ordinary Gramme commutator.

It will be seen that by rocking, either by hand or automatically, the supplementary brushes D D it is possible to obtain any difference of potential between the ends of the field-coils within the working-limits of the machine, and thus provide a perfect regulation of the machine, whether it be used as a motor or a generator, thus doing away entirely with the use of resistances for regulating the field-circuit. Under certain circumstances the machine will be self-regulating after once obtaining the proper position of the supplementary brushes for the particular installation in which the machine is used. Moreover, it will be seen that as the difference of potential at the extremities of the field-coils can by my method be made normally much lower than that of the main brushes, there will be no need of using field-coils of high resistance in order to cut down the current in the field-circuit, for by suitably proportioning the relations of the resist-

ance, number of convolutions, and strength of current, coarse wire may be used.

I have found serious objections to the use of high-resistance field-coils. In the first place the cost is very great; secondly, it being necessary to use just as thick insulation on the fine wire as on the coarse, the amount of space taken up by the insulation is very much greater in the fine-wire coil, correspondingly lessening its magnetic effect with a given current; thirdly, in an ordinary shunt-wound or compound-wound machine the "extra current," which occurs if the circuit is broken, is of such high electro-motive force as to cause a discharge of current between some points of weaker insulation with more or less danger to the machine. This danger renders necessary the use of even thicker insulation than would otherwise be required.

Although I prefer the bridge method of deriving the field-current, as shown in Fig. 2, it evidently lies within the scope of my invention to place both of the supplementary brushes on one side of the commutator, as shown in Fig. 3, or to use but one such brush, as shown in Fig. 4, the other terminal of the field-circuit being connected to one of the main brushes. Fig. 5 shows practically the same construction as Fig. 4, with another supplementary brush connected with the other main brush, so as not to disturb the electrical balance of the armature. In this case there are two field-magnet circuits, F and F′, which might, in the construction shown in Fig. 2, be placed one on each leg of the magnet. In Fig. 6 is shown an application of my invention to a machine of the compound type. In this machine the field-coils F are in series with the armature and external circuit, and act in conjunction with the field-coils F′, which are connected with the armature by supplementary brushes, according to my present invention, as described above.

It will be seen that in the bridge method the current in the field may not only be reduced to zero, but may be reversed by giving sufficient motion to the supplementary brushes. This would render the machine especially applicable for motive purposes.

Other combinations involving my invention may obviously be made, and I do not wish to confine myself to the specific constructions shown.

Having thus described my invention, I claim as new—

In a compound-wound dynamo-electric machine, the combination, with the commutator, of commutator-brushes connected to the field-coils included in series with the armature and external circuit, and independently-adjustable commutator-brushes connected with the field-coils in derived circuit and located on the commutator at points intermediate between the points of maximum and minimum potential of the armature, substantially as set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 5th day of May, 1884.

ARTHUR J. HOLT.

Witnesses:
EDWARD TAGGART,
FRED W. STEVENS.