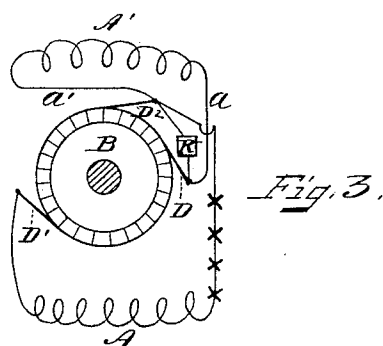
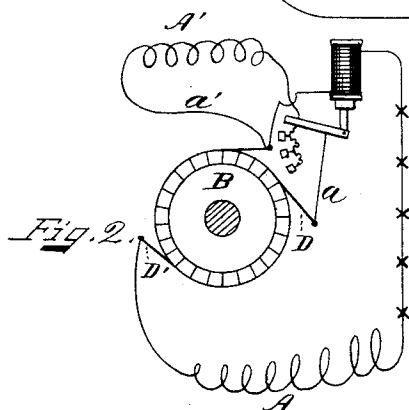
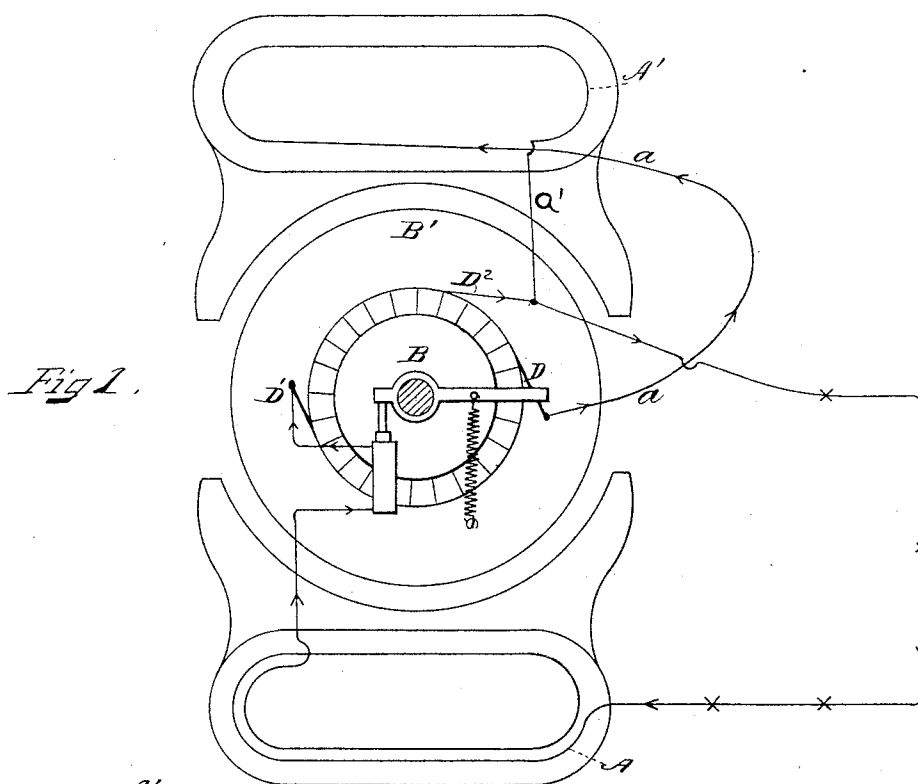


(No Model.)

W. H. ELKINS.
DYNAMO.

No. 460,372.

Patented Sept. 29, 1891.



Witnesses:
J. E. Maynard
H. E. Ruick

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W. H. Elkins

UNITED STATES PATENT OFFICE.

WILLIAM HENRY ELKINS, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE AMERICAN ELECTRIC MACHINERY COMPANY, OF PORTLAND, MAINE.

DYNAMO.

SPECIFICATION forming part of Letters Patent No. 460,372, dated September 29, 1891.

Application filed November 28, 1890. Serial No. 372,839. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY ELKINS, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Dynamos, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a diagram illustrating one form of my invention. Figs. 2 and 3 are diagrams also illustrating my invention with slight modifications.

My invention is a dynamo with one coil or set of coils for the north and another for the south pole, which differ materially in the number of turns, the terminals of the field-coil, having the greater number of turns, being connected one to one of the main brushes and the other to an auxiliary brush, and the coil of the other pole forming a part of the main or work circuit.

B indicates the commutator, B' the armature, and D D' the main brushes, all as usual. The extra brush D² is placed near the brush D, and the brushes D and D² are in electrical connection through the field-coil A' by means of the conductors *a* and *a'*, conductor *a* connecting one terminal of field-coil A' with brush D and conductor *a'* connecting the other terminal of field-coil A' with brush D², or, what is the same in substance, with that part of the work-circuit between D² and the translating devices in the work-circuit. The main or work circuit is from brush D², or from the junction of conductor *a'* with the conductor from brush D², to main brush D' and through field-coil A and the lamps or other translating devices.

The operation is as follows: The brushes D D² are adjusted at full load, so that a certain portion of the current in the main circuit is supplied directly by brush D² and the other portion by brush D through field-coil A'. For example, if a constant current of ten amperes is required in the work-circuit from D² to D', I prefer to so adjust brushes D and D² that there will be a current of five amperes from the commutator B through brush D² and five amperes from the commutator through brush D, conductor *a*, field-coil A', and conductor *a'*, these two currents unit-

ing at the junction of conductor *a'* with the work-circuit. If now one lamp be cut out or the resistance of the work-circuit decreased, the current will tend to increase above the ten amperes desired; but if the brush D be moved toward the brush D², or vice versa, the current through the circuit *a A' a'* will be decreased and the field weakened, as A' is one of the field-coils. While the mere motion of the brushes D D² to bring them nearer together reduces the current in circuit *a A' a'*, the reduction of that current weakens the field, and this in turn reduces the difference of potential between the highest and lowest points in the commutator, which still further reduces the current in circuit *a A' a'*, so that a slight approach of the brushes D D² produces a marked effect. This reduction of the field strength also alters the distribution of the total current, for if the current in *a A' a'* be reduced to four amperes the current supplied to the main circuit directly from brush D² must be six amperes, in order to keep a constant current of ten amperes in the main circuit. These figures are of course for explanation merely, and I use them simply because I have found in practice that my dynamo works admirably with five amperes in the regulating-circuit *a A' a'* when at full load and with a constant current of ten amperes in the work-circuit. In that case for symmetry I make the coil A' with twice as many turns as the coil A; but this is obviously a detail of construction which may be varied, as will be clear to all skilled in the art. The number of turns in coil A' relatively to those in coil A will not in practice need to be more than two to one, and may well be three to two or four to three. The gist of the matter is to divide the current in the work-circuit into two parts, one of which is variable and passes through the coil of one pole—in this case the coil or set of coils indicated by A'—while the other is kept constant by variations in the first and passes through the work-circuit of which the coil of the other pole—in this case that indicated by A—forms a part.

My theory is that the difference of potential between the brushes D and D² is sufficient, in view of the resistance in the circuit *a A'*

a' , to give the current desired through field-coil A' , and that by shifting brush D toward brush D^2 the current in the regulating-circuit $a A' a'$ is varied by varying the difference of potential between brushes D and D^2 .

The simplest way to vary the current through the regulating-circuit $a A' a'$ is to move one of the brushes D or D^2 , and I prefer to move the brush D . The movement of D from the point of maximum potential to a point of lower potential on the commutator B will reduce the current through the regulating-circuit, and vice versa, if D^2 be stationary; but the movement of D^2 from a higher to a lower potential will increase the current through the regulating-circuit, and vice versa, if D be stationary; but certain practical objections exist to moving brush D^2 , and I therefore prefer to move brush D to regulate the current in the regulating-circuit $a A' a'$. This regulating movement of either or both the brushes $D D^2$ may obviously be by hand or by mechanism, as will be clear without further description.

Another way to vary the current through regulating-circuit $a A' a'$ is to use a variable resistance R in that circuit, as indicated in Fig. 2, for if R be very small practically the current through coil A' will be the same as in Fig. 1; but by increasing R either by hand or by mechanism the current through coil A' may be varied, as before described.

A third way of varying the current through circuit $a A' a'$ is by means of a shunt-circuit a^2 , of which a variable resistance R forms a part, as indicated in Fig. 3. Here if R be very small practically no current will pass through coil A' ; but if R be very large practically the same currents will pass through A' as if there were no shunt-circuit.

My dynamo, whether used as a generator or motor, can be regulated with facility and accuracy, and will be found very sensitive, as a slight variation in the current through the regulating-circuit, however caused, will suffice to keep the current in the work-circuit constant, although the resistance in the work-circuit be considerably and suddenly varied. I have shown conductor a' terminating at brush D^2 ; but it will be obvious that it may connect with the main circuit at any point between D^2 and the translating devices.

I am aware that it is not new to divide the current of a dynamo into two parts and to vary one of the parts that passes through the whole or a part of the field-coil, as that is shown in Patent No. 336,962 to Tesla, dated March 2, 1886, and I disclaim all that is shown

in that patent; but in my dynamo the ampere-turns in the field-coil of one pole are varied by varying the current through the regulating-circuit $a A' a'$, and those in the field-coil of the opposite pole, which has always a practically-constant current, are practically constant. In short, in my invention I control one pole only, and this is the distinguishing characteristic of my invention.

The main practical difficulty with all dynamos in which the current is divided and a part of it only used to energize the field is that it is difficult to prevent sparking at small loads. Moreover in all such dynamos heretofore known the entire field required the full current at full load; but in my invention that part of the field-coil in the regulating-circuit $a A' a'$ never carries the full current, and I have discovered that by regulating the current, energizing one pole only of the field, I practically prevent sparking, make the dynamo nearly self-regulating, and can readily produce a practically-constant current by a very slight variation of the regulating-current, in addition to the instantaneous and automatic variation in the regulating-current produced by varying the load.

What I claim as my invention is—

1. In a dynamo, the regulating-circuit $a A' a'$ through field-coil A' on one leg of the field-magnet and containing a materially greater number of turns than the other field-coil A , the work-circuit through coil A on the other leg of the field-magnet and containing a materially smaller number of turns than coil A' , the main brushes $D D'$, and the extra brush D^2 , the terminals of the main circuit being the extra brush D^2 and the main brush D' and the terminals of the regulating-circuit being the main brush D and that part of the work-circuit near extra brush D^2 , all combined and operating substantially as described.

2. The method of regulating dynamos by dividing the main current into two portions, carrying both of those portions through the work-circuit and through a coil on one leg of the field-magnet, which coil has a materially smaller number of turns than the coil on the other leg of the field-magnet and carrying the other portion before it joins the first through the latter coil, which has a materially greater number of turns than the former coil, all substantially as described.

WILLIAM HENRY ELKINS.

Witnesses:

EDWARD S. BEACH,
JOHN R. SNOW.