

(No Model.)

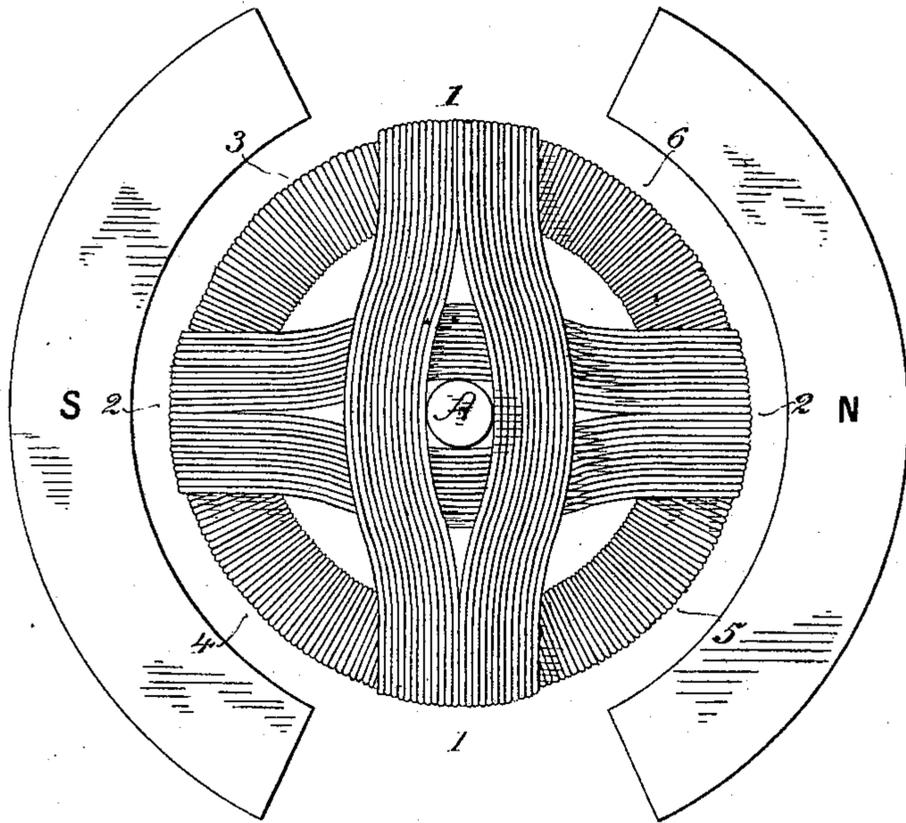
2 Sheets—Sheet 1.

A. G. WATERHOUSE.  
DYNAMO ELECTRIC MACHINE.

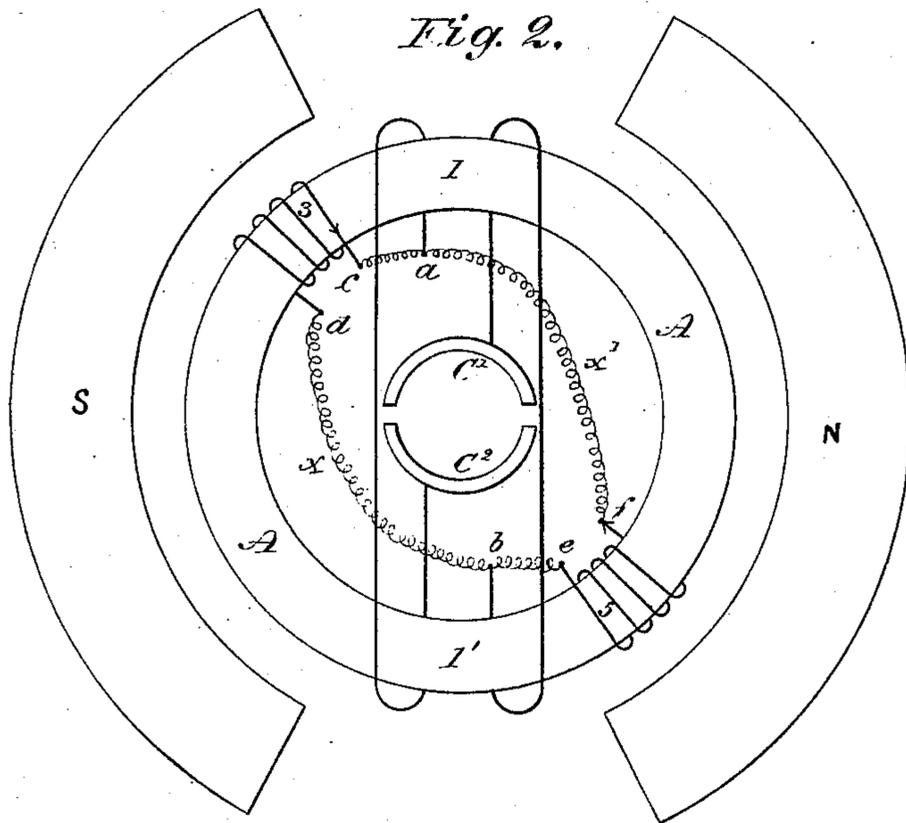
No. 304,382.

Patented Sept. 2, 1884.

*Fig. 1.*



*Fig. 2.*



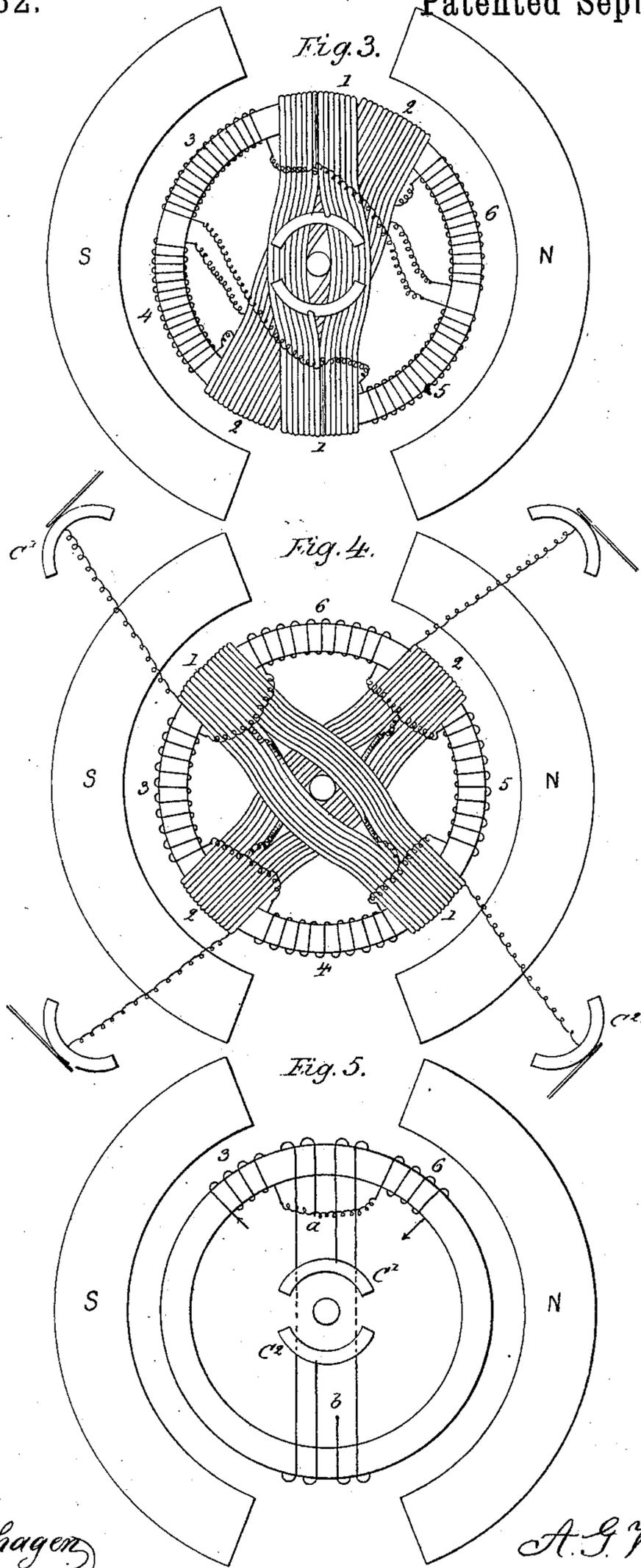
Witnesses:  
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Inventor:  
*A. G. Waterhouse*  
By his Attorney: *W. C. Townsend*

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 By his Attorney: *W. C. Tomison*

# UNITED STATES PATENT OFFICE.

ADDISON G. WATERHOUSE, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE SCHUYLER ELECTRIC LIGHT COMPANY, OF SAME PLACE.

## DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 304,382, dated September 2, 1884.

Application filed March 10, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, ADDISON G. WATERHOUSE, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a specification.

My invention relates to the winding of the armatures of dynamo-electric machines; and it consists in the combination, upon one and the same ring or cylinder armature, of coils wound after what is known as the "drum fashion"—that is, over the exterior of said cylinder longitudinally and across the ends—and coils wound after the "ring fashion"—that is, wound in and out around the circumferential axis of the ring or cylinder—said coils being properly combined with one another, and a commutator to permit the currents induced in the two kinds of coils to re-enforce and assist one another in any desirable manner, either for tension or quantity.

I will herein describe some of the various ways in which the two kinds of coils may be combined, but do not limit myself to the arrangements shown, as such coils may be combined in very many ways; and the invention consists, broadly, in a ring or cylinder armature having both ring and drum coils combined and connected with one another in any suitable manner.

Figure 1 of the accompanying drawings represents in end view a ring or cylinder armature wound with two kinds of coils—viz., "drum" and "ring" coils. Fig. 2 illustrates digrammatically one method of combining the coils arranged as shown in Fig. 1. Fig. 3 shows a modified disposition upon the armature of the two kinds of coils. Fig. 4 illustrates still another method of combining the drum and ring coils, and Fig. 5 is a detail view of the connection of a portion of said coils.

In Fig. 1, N and S represent the ordinary curved field-of-force poles between which the rotary armature of a dynamo-electric machine is placed.

A indicates the armature shaft, to which the

armature ring or cylinder carrying the coils is connected in any proper manner. Armature coils or bobbins wound upon said ring or cylinder after the drum fashion are indicated at 1, and similar coils wound in a plane at right angles to the first are indicated at 2. Ring-coils wound in the fashion adopted in a Pacinotti or Gramme machine are indicated at the four spaces 3 4 5 6 intervening between the drum-coils. A method of connecting said coils or bobbins is shown in Fig. 2. In this case the coils 1, which to all intents or purposes are a single bobbin, being wound in substantially the same plane, are supposed to be in two parts, either overlying or placed beside one another or arranged in any other suitable manner.

Supposing, for the sake of simplicity in description, that the two halves are wound in the same direction, the beginning of one half is connected to the plate C' of a suitable commutator, while its end, at b, is connected to a wire, X, which joins two ends of coils, 3 and 5, placed in a plane adjoining that of coils 1. The beginning of the other half is, however, connected to the junction-wire, X', between coils 3 and 5, while its end is connected to the commutator-segment C<sup>2</sup> on the opposite side of the commutator-cylinder.

Assuming that coils 3 and 5 are wound in the same direction and in such a direction that the end of coil 5 at e will be of opposite polarity to the end b of coils 1 when coils 5 and those portions of coils 1 on the same half of the armature are moving in the same magnetic field, then the beginning of coil 3 is connected by wire X with the end e of coil 5, and the end c of coil 3 is connected by wire X' with the beginning f of coil 5. Therefore when coils 3 and 5 are in opposite magnetic fields their terminals d e will be of the same polarity, and the current from said coils will flow from said coils in multiple arc or for quantity, and will combine for tension with the current of a coil of proper polarity connected to the junction-wire X, the proper polarity of current for such combination being found at the terminal b of the drum-coil 1. In the same manner the ends c f of the ring-coils

3 5 will at the same time be of the opposite polarity to that of terminals *e d*, and the junction-wire X' will therefore be of the opposite polarity to X, and the currents in X' will be of the proper polarity to combine for tension with that portion of coils 1 that begins at *a*, through which coil it will find an outlet to the commutator-plate C'. The path of the currents generated and the manner in which the currents of the drum and ring coils will in the present instance combine may be readily conceived and followed, if it be considered that in those portions of the coils that lie on the outside of the ring or cylinder the current will flow in opposite directions in opposite fields—that is, when the coils are opposite the pole S, they will flow in one direction, say, toward the observer and away from the face of the drawings, and when they are opposite the pole N they will flow in an opposite direction or toward the face of the drawings and away from the observer. If, then, under such supposition the armature be turned into such position that the coils 1 are in a plane passing through the pole-pieces N S the path of the current would be starting with segment C' through one half of coils 1 to *b*; thence through either coils 5 or 3 to *a*, and through the other half of coils 1 to plate C'. The current from coils 1 will then act in tension with the currents from coils 3 and 5, the currents from the two latter being taken into the general path for "quantity." In a position one hundred and eighty degrees removed the current would obviously pass in reverse direction. Such currents may be utilized in any of the usual ways, either by means of commutator-springs bearing on plates C' C', so as to make the currents in the outside circuit flow uniformly in one direction, or in case alternating currents be desired by making suitable connections to continuous metallic rings or surfaces, upon which the collecting-brushes would bear. When arrangement is made for uniform, or continuous, or straight currents, the commutator-springs are to be applied, so as to pass the dividing-line between plates C' C' at the time that drum-bobbin 1 is generating currents counter to those given by ring-coils 3 5. Under such conditions no injurious effect will follow the short circuit of the system, and yet a path will be preserved outside of the system shown for the currents of other systems, which may at such time be in a position of great or maximum activity, and which it may be desirable to combine for tension with the first system.

Ring-coils 4 and 6 can be combined in a similar way to that shown in Fig. 2, with the drum-coil 2, and the commutator and the system thus formed can be combined in well-known manner for tension effects with the first-described system by proper connection of the commutator-brushes.

Fig. 3 shows a disposition of the drum and ring coils, in which the drum-coils are in the same plane or adjoining one another, and the

ring-coils, taken together or as a single group, are in a plane in position at right angles to that of the drum-coils. Drum-coil 1 is connected with ring-coils 3 and 5, in substantially the manner already described, having regard to the polarities of the currents in the coils, so that the coils 3 and 5, working in quantity will be combined for tension with coils 1, but will oppose the currents of coils 1 when the neutral line divides the two planes in which said ring and drum coils are placed. Drum-coils 2 and ring-coils 4 and 6 are to be connected in a similar manner.

Fig. 4 illustrates a modification, in which the four ring-coils 3 4 5 6 are connected in the same closed circuit, as indicated, all of said coils being wound in the same direction, and the drum-coils are connected to the junction-wires of the ring-coils in the manner shown. In this case the circuit from the end *b* of a half-coil of 1 is in multiple arc through coils 5 and 6 on one side and 4 and 3 on the other, to the beginning of the other half of the drum-coil. All of the four ring-coils are in a similar connection between the drum-coils 2. Drum-coils 1 and 2, however, have the independent commutation indicated by the additional commutator-segments. The method of connection is in substance the same as before described, and is clearly indicated in Fig. 5, which shows a drum-coil, 1, and two contiguous ring-coils isolated from the rest.

I make no broad claim herein to an armature provided with two sets of coils, one set wound in ring and the other in drum fashion, as this will form the subject of another application for patent to be filed by me.

What I claim as my invention is—

1. In a dynamo-electric machine, the combination upon the same ring or cylinder armature of drum-coils and ring-coils electrically united in a common system.
2. The combination, with a ring or cylinder armature, of drum-coils connected at one set of ends with the commutator and at their other ends with ring-coils, substantially as described.
3. The combination, with a ring or cylinder armature, of ring-coils connected in a closed circuit, and a drum-coil connected at one end to a junction of two ring-coils, and at its opposite end to a commutator-segment or current-collecting device.
4. The combination, with a ring or cylinder armature, of ring-coils connected in a continuous or closed connection, and two drum-coils or halves of a drum-coil, each having a connection at one end to a junction of two ring-coils and at the opposite end to a commutator plate or segment.
5. The combination, with two ring-coils, having their first and last ends connected together, or those ends which are of the same polarity, when the two coils are in opposite magnetic fields, of a drum-coil or a portion of a coil, one terminal of which is connected to

the junction-wire of the ring-coils, while its other terminal is connected directly or indirectly to a commutator or current-collecting device of any suitable kind.

- 5 6. The combination, with drum-coils, of ring-coils in closed circuit and connected to a commutator through the drum-coils.

Signed at New York, in the county of New York and State of New York, this 5th day of March, A. D. 1883.

ADDISON G. WATERHOUSE.

Witnesses:

THOMAS TOOMEY,  
WM. H. BLAIN.