

(No Model.)

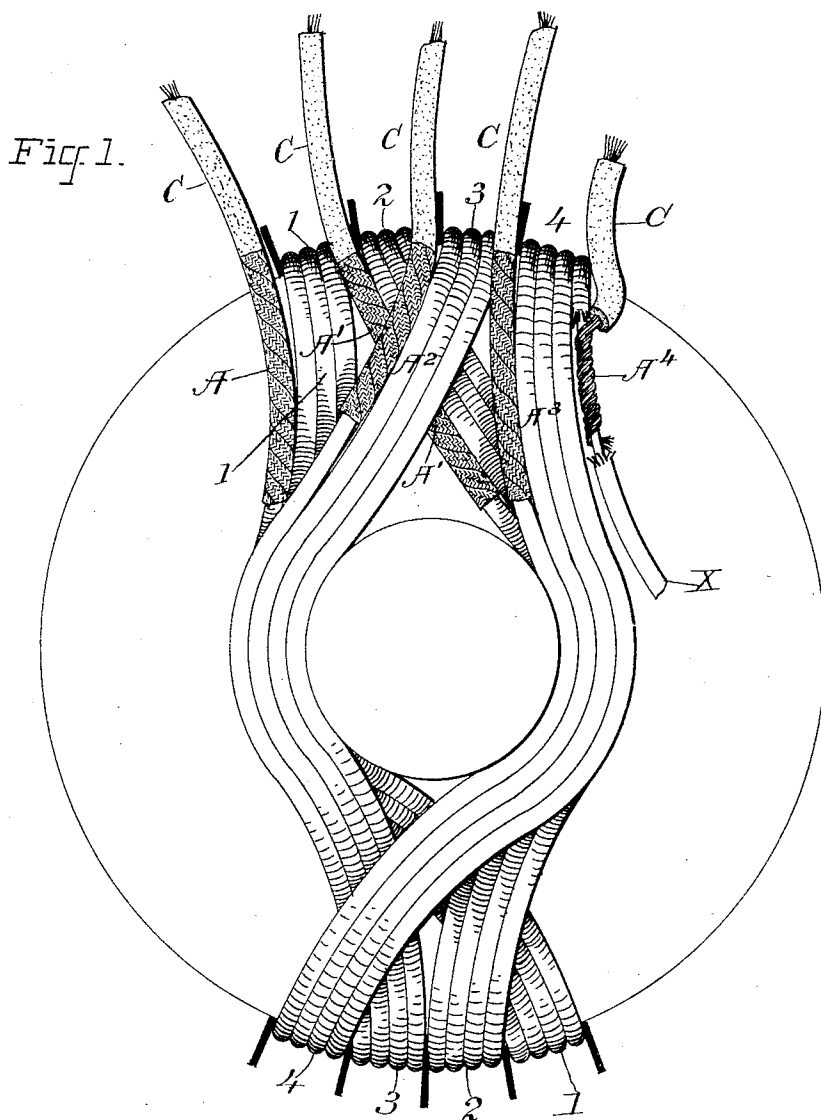
2 Sheets—Sheet 1.

M. J. WIGHTMAN.

ARMATURE FOR DYNAMO ELECTRIC MACHINES.

No. 479,179.

Patented July 19, 1892.



ATTEST:
J. A. Murdock
T. F. Conway

INVENTOR:
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By H. C. Townsend
Attorney

(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

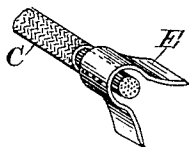


Fig. 4.

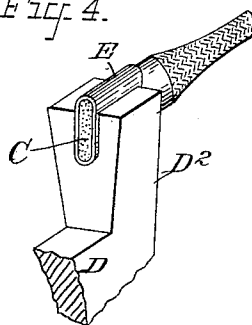


Fig. 2.

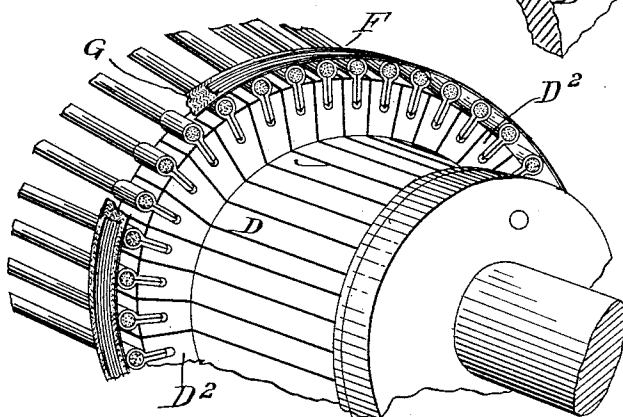


Fig. 5.

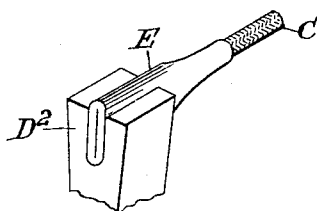
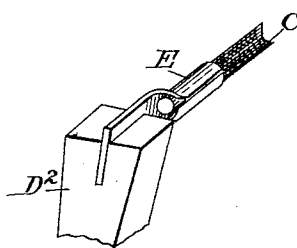


Fig. 6.



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UNITED STATES PATENT OFFICE.

MERLE J. WIGHTMAN, OF SCRANTON, PENNSYLVANIA.

ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 479,179, dated July 19, 1892.

Application filed October 28, 1891. Serial No. 410,069. (No model.)

To all whom it may concern:

Be it known that I, MERLE J. WIGHTMAN, a citizen of the United States, and a resident of Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Armatures, of which the following is a specification.

My invention relates to dynamo-electric machines, motors, and similar electric apparatus, in which a revolving body or carrier is wound with electric conductors provided at suitable points with lead wires or conductors joined to the windings and connecting the same with the segments or blocks of the commutator, collecting device, or other electrical connection revolving with it.

The object of my invention is to overcome certain difficulties which are particularly troublesome in the armatures of electric-railway motors, though my invention is also applicable to the armatures of stationary motors. The difficulty referred to is the breaking of the lead-wire, due to crystallization, which seems to result from the constant mechanical vibration to which the leading-wires are subjected.

A further object of my invention is to improve the connection of the lead-wires with the commutator-segments, the object being to produce a simple and effective connection and one which may at the same time be readily detached or disconnected.

The invention consists in the manner of connecting the lead-wires to the winding of the armature, as well as in the manner of connecting to the commutator-segments. The usual practice heretofore followed in winding-armatures, especially those of the Gramme or Siemens type, in which a closed conductor-circuit exists, is to provide a loop or bend in the winding between the consecutive coils of the closed circuit, such loops projecting from between the coils and being attached directly to the commutator-segments by means of screws, solder, or by any other well-known means. A more recent practice adopted in the connection to the coils of the armature is to make loops or bends at the desired point; but to cut these loops near the winding of the armature and to the projecting ends thus obtained solder or clamp a piece of flexible cable, which is at its opposite ends connected to

the commutator or other device. Neither of these methods are found in practice, however, to prevent the breaking of the leads due to the crystallization of the wire. The difficulty has become particularly troublesome in the armatures for street-railway motors, owing to the great amount of jarring to which they are subjected. In these armatures, as usually wound, the wire or loop leading from between the coils has been found to break near the armature upon the winding or where the wires are attached to the commutator-segments. When flexible cables have been used as the lead-wires joined to the projecting wires or loop, they have been found to break or crack just inside the point of connection, to repair which and preserve the continuity of the winding on the outer layer is very difficult and on the inner layer impossible.

My invention consists, essentially, in making the attachments of the flexible lead-wires to the armature-conductors at such points that the parts of the lead-wire at or near the point of connection where they are rigid will be bound down by the armature winding themselves, thus leaving the flexible portion only of the lead-wire free and subject to vibrations.

My invention consists, further, in winding the whole armature as a continuous winding or coil, which is divided into the proper number of sections by connection of the leading-wires directly to the windings and in binding or clamping the point of connection against vibration and displacement by the armature windings themselves.

My invention consists, also, in certain other features of improvement and details of construction hereinafter described, and more particularly specified in the claims.

In the accompanying drawings, Figure 1 illustrates my invention as carried out in connection with an ordinary Siemens winding. Fig. 2 illustrates a part of the commutator with the lead-wires attached in accordance with my invention. Fig. 3 shows one way of applying a terminal to the lead-wire suitable for use in making the connection illustrated in Fig. 2. Figs. 4, 5, and 6 illustrate in perspective modifications in the construction of the lead-wire terminals.

Referring to Fig. 1, the lead-wires, which

are usually made of flexible copper cable of from fifty to one hundred strands of fine wire, are shown at C. The armature-drum is shown in end view at the end where the connections
 5 of the lead-wires are made and four several coils are shown as having been applied, the end of the wire-winding which would be applied in the fifth armature-space being broken away at X. The points of attachment of the
 10 lead-wires with the armature-windings are indicated at A, A', A², A³, and A⁴, A being the point where the winding of the armature is supposed to start.

I have shown and described my invention
 15 as applied to a Siemens winding, the point A being the point where the winding begins. The wire used in winding is bared and the strands of fine wire forming the cable which makes the lead-wire C are twisted or wrapped
 20 around it in the manner indicated at A⁴. This attachment or connection with the armature-winding might be made in any other way, but preferably is done by winding or twisting, as shown. If desired, the connection
 25 may be perfected by soldering, after which a suitable wrapping is applied to insulate the joint, as indicated at A, A', A², and A³. The coil 1 is then wound, the wire winding passing down over the head of the
 30 armature shown and up over the opposite end of the armature and across the top in the coil-space 1. Four turns are shown as made. When the end of the last turn at the top of the armature is reached, the wire forming the
 35 armature-winding is bared without cutting or bending the same, and connection is made by the second lead wire or cable C in the same way at the point A'. The wire-winding is then carried down over the head of the arma-
 40 ture, as shown, and four turns applied in the coil-space 2. The end of the last turn is then bared and connection made at A², as before, without bending or twisting and the winding continued into the space 3. This winding is
 45 applied over the point of attachment of the leading wire or cable C at A', thus binding or clamping down the point of attachment and preventing any vibration at such point. The end of the coil 3 is indicated at A³, at
 50 which point connection is made as before, and the winding continued in the space 4. The end of coil 4 is indicated at A⁴, and the armature-winding is then continued from such point into the next space, but in such
 55 way as to bind or clamp down the point of attachment of the lead-wire at A³. In this manner the winding of the armature is carried on until completed. After completion the lead-wires will be found to project from between
 60 the coils and the points of attachment of all but the last of them with the armature-winding will be bound or held down in place by said windings. In each case the point of connection with the armature-winding is made
 65 at such point that it will lie in position where it may be bound down in place by a coil-

winding, subsequently applied in the operation of forming the completed armature.

It is obvious that each point of attachment may be bound down by the wire of a succeeding winding, which follows at a greater or less
 70 interval the making of the connection which is to be bound or held down in place. It is better, however, to apply the windings symmetrically, so that each point of attachment
 75 will be bound by a winding which is near to it in the order of application of the coils to the successive sections.

As will be observed, no loop or bend is employed at the point of connection, but the
 80 wire employed in winding two successive coils lies straight upon the head of the armature, so that, taking the case of the wire, which is shown in the drawings as having the lead C,
 85 connected at the point A', the part of the said wire winding above the lead-wire would be the end of one coil and the part below the lead-wire the beginning of the next or another coil. It will therefore be obvious that
 90 this method of winding and connecting the lead-wires does not require any cutting or excessive bending of the armature taken during the process of winding. It will be seen, further, that after the coils are in place the
 95 lead-wires C will project from between the coils and only the flexible portion of the lead-wires will be exposed to bending during the process of connection or subjected to vibration when the armature is in use. After completing the winding the free ends of the flexible
 100 conductor C may be attached to the commutator, as shown in the following figures, which are separated from Fig. 1 for the sake of simplicity.

The attachment to be now described is particularly adaptable to high-potential armatures, where a small current is conducted and a large number of segments is required. This
 105 advantage consists in the simplicity and the ease with which the lead-wires may be detached from the commutator. D indicates the segments or sections of a commutator provided with the usual projections or arms D², each of which is provided with a slot or saw-cut, as shown, into which the terminals of the
 110 lead-wires may be forced and, being grasped or in good frictional connection with the segments, will make good electrical connection. The terminals thus connected are held in place by means of a retaining-band F or
 115 other clamping device, such band being preferably formed of a wire-winding and being insulated from the terminals by a strip of insulation G. I prefer to employ for the leads suitable sheet-metal terminals, such as shown
 120 in the drawings.

In Fig. 3 the terminal E is shown as consisting of a strip of metal bent around the end of the flexible lead or cable and adapted to have its ends brought together and to be
 130 forced into the slot in the commutator-projection or arm D².

In Fig. 4 the metal terminal consists of a flattened tube into which the flattened end of the flexible lead is inserted and soldered. The terminal thus formed may be inserted or
5 forced into the slotted commutator-segment, as illustrated in the figure.

In Fig. 5 the terminal consists of a copper tube which is attached to the lead-cable by means of solder or otherwise, the opposite
10 open end of said tube being flattened and pressed into the slot in the commutator-segments.

In Fig. 6 the terminal consists of a strip of metal one end of which is wrapped around the lead wire or cable C and soldered thereto,
15 while its other end is left flat or straight for insertion into the slot of the commutator.

What I claim as my invention is—

1. In an armature, lead-wires having their
20 point of connection with the armature-wires bound down and clamped against vibration by the wire of a succeeding section wound directly upon it.

2. In an armature, flexible lead-wires attached directly to the armature-winding and bound down or clamped against vibration at the point of attachment by the armature-windings.

3. In an armature, lead-wires connected to the coil-sections beneath the coil-windings, and each bound down at the point of connection by the winding of a succeeding section.

4. In an armature, the combination, with the coil-sections, of a leading-wire connected
35 directly to a coil-winding where it lies upon the armature-head and held in place by another section wound over the point of connection.

5. The combination, with the armature-coils applied as a continuous winding without projecting loops, of leading-conductors twisted around the wire of said windings at proper points to divide the same into sections, the joints between the leading-wires and sections being each bound by the winding of a succeeding section, as and for the purpose described.
40 45

6. In an armature, flexible lead-wires having their points of attachment to the armature-conductors bound down or held against vibration by the armature-winding and their flexible portions only left free to vibrate.
50

7. In an armature, the combination, substantially as described, with the armature-windings, of flexible lead-wires having their
55 points of attachment to the armature bound down by the armature-winding and having their commutator ends fixed in radial slots in the commutator-segments.

8. The combination, with the flexible lead, of the attached flattened tubular terminal, and a slotted segment or block, in the slot of which the flattened tube is held.
60

9. The combination, with the flexible lead, of the attached flat-sheet-metal terminal, and commutator segments or blocks having radial slots adapted to receive and hold said flat sheet-metal terminal by friction.
65

Signed at Scranton, in the county of Lackawanna and State of Pennsylvania, this 12th
70 day of August, A. D. 1891.

MERLE J. WIGHTMAN.

Witnesses:

HORACE E. HAND,
W. H. JESSUP, Jr.