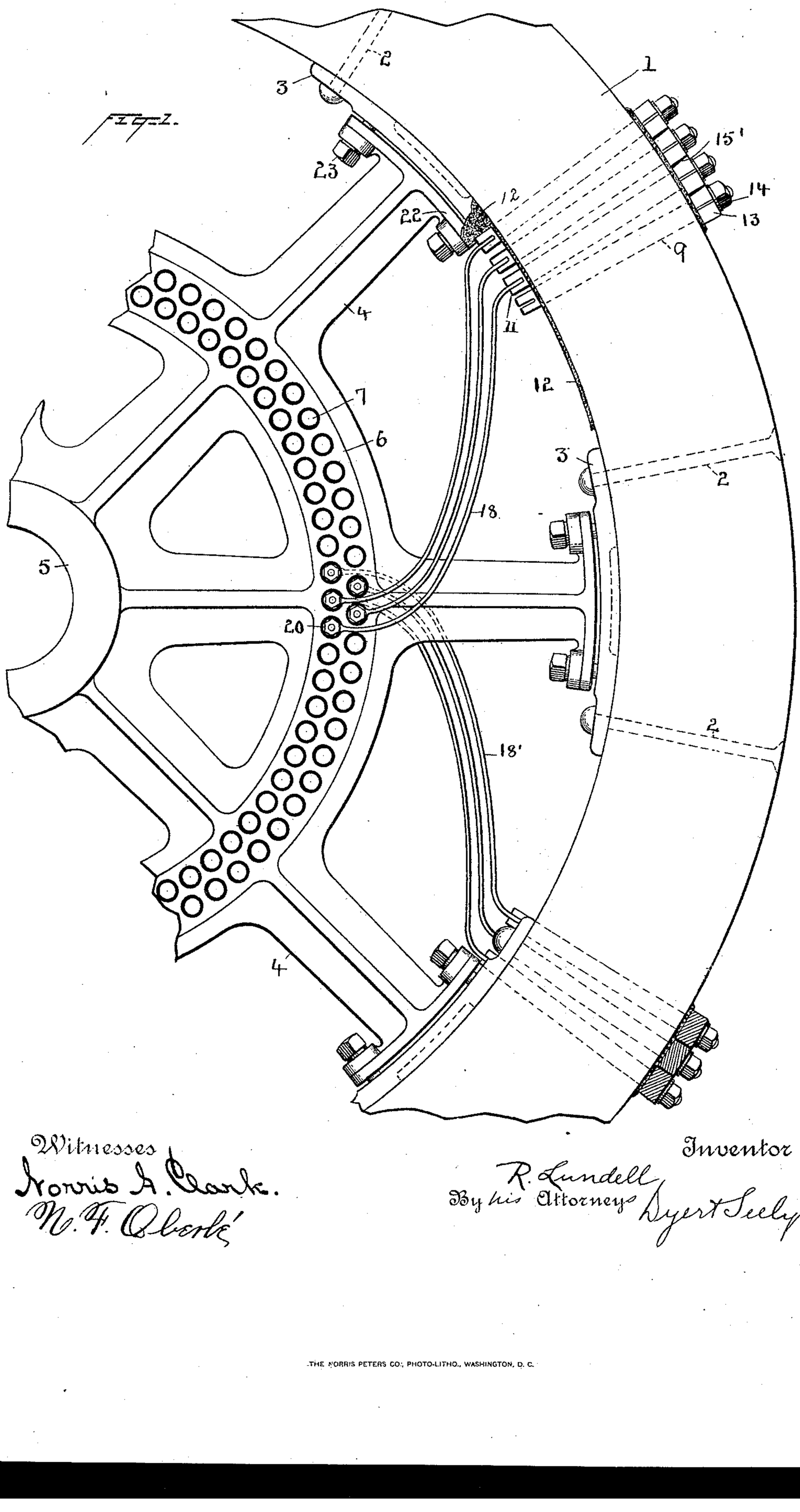
(No Model.) 2 Sheets—Sheet 1.

R. LUNDELL.

ARMATURE FOR ELECTRO MAGNETIC MACHINES.

No. 487,755. Patented Dec. 13, 1892.



Witnesses
Norris A. Clark.
N. F. Clarke

Inventor
R. Lundell
By his Attorneys Dyer & Seely

(No Model.) 2 Sheets—Sheet 2.

R. LUNDELL.

ARMATURE FOR ELECTRO MAGNETIC MACHINES.

No. 487,755. Patented Dec. 13, 1892.

Fig. 2.

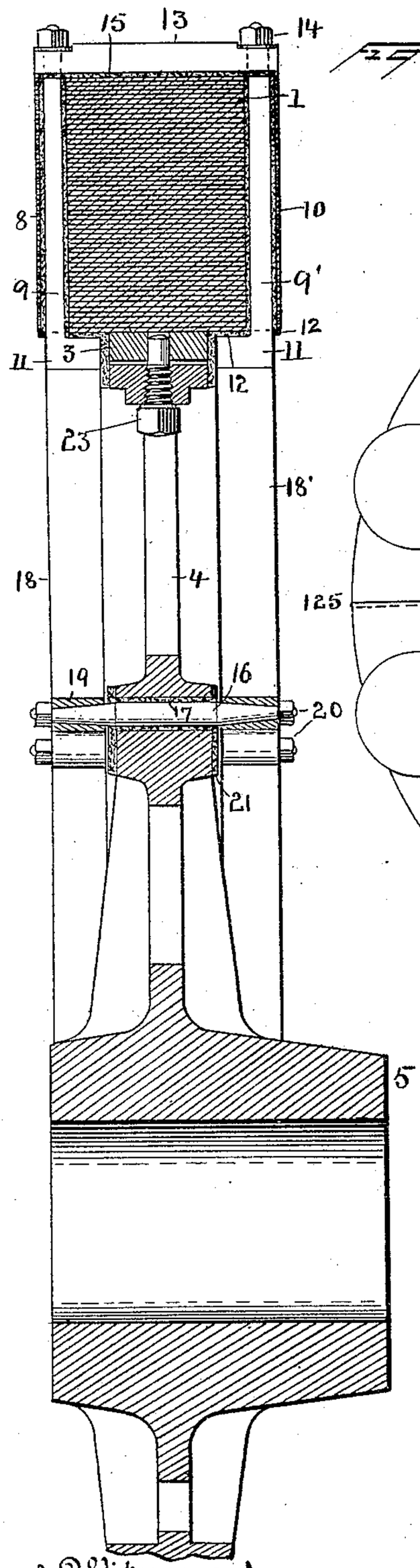
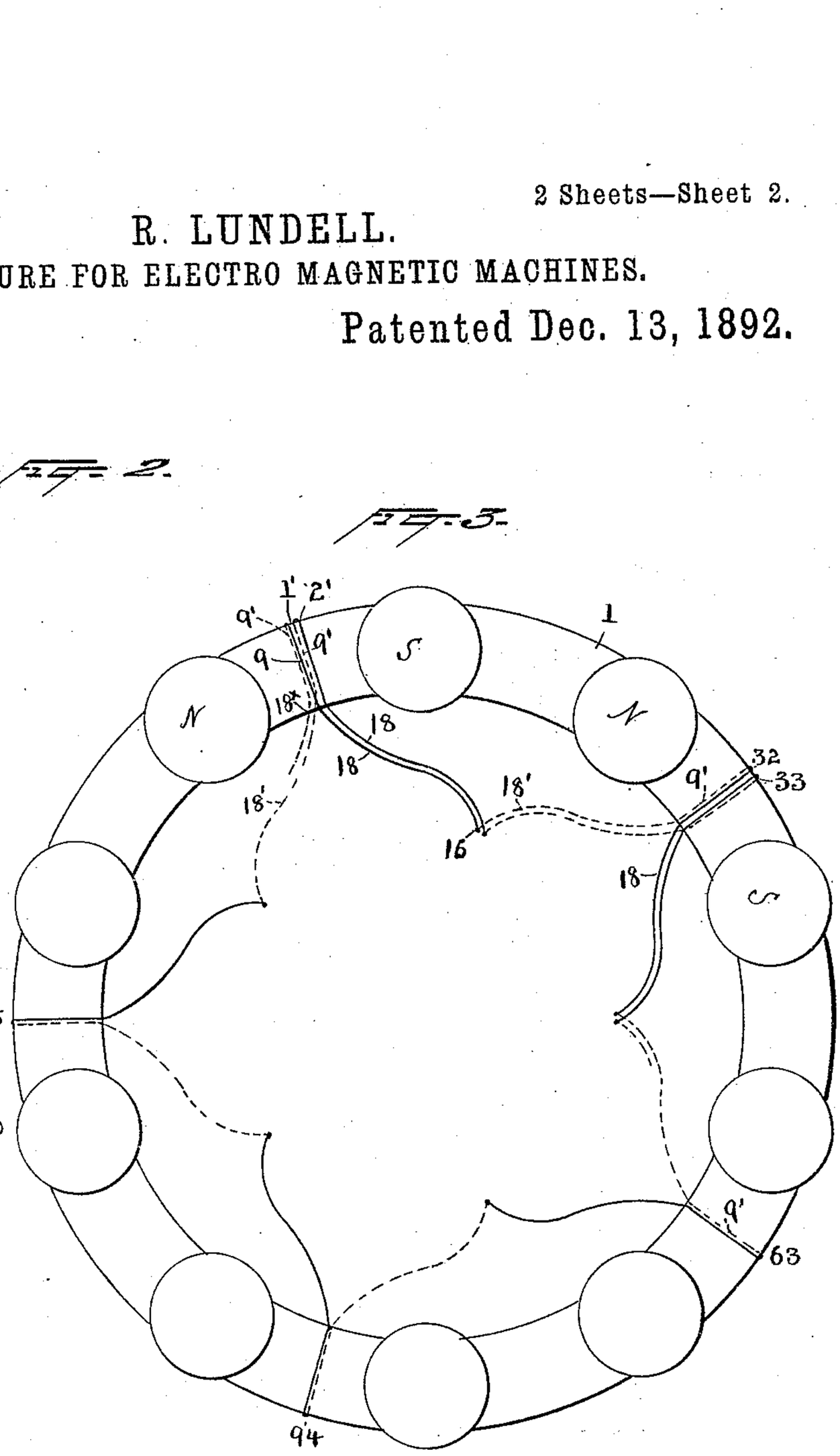


Fig. 3.



Witnesses
Norris A. Clark.
N. F. Oberly

Inventor
R. Lundell,
By his Attorneys
Dyer & Seely.

UNITED STATES PATENT OFFICE.

ROBERT LUNDELL, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO EDWARD H. JOHNSON, OF SAME PLACE.

ARMATURE FOR ELECTRO-MAGNETIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 487,755, dated December 13, 1892.

Application filed February 5, 1892. Serial No. 420,385. (No model.)

To all whom it may concern:

Be it known that I, ROBERT LUNDELL, a citizen of the United States, residing in New York, county and State of New York, have invented a certain new and useful Improvement in Armatures for Electro-Magnetic Machines, of which the following is a specification.

The present invention relates to the mechanical construction and the electrical connections of armatures of the ring type, and more especially to those of large diameter, such as used in certain multiple-pole machines.

The main object of the invention is to provide a construction which shall be strong and simple and in which the electrical connections can be readily made; and the invention consists in the several features and combinations hereinafter described, and set forth in the claims.

In the armature to be described all of the armature-coils are connected in series, the coils or convolutions being connected according to the well-known formula $\frac{n \pm 1}{p \div 2}$, where n is the number of coils and p the number of poles on one side of the armature.

The armature illustrated is adapted for use with a magnet having, say, ten poles on each side thereof and to be mounted directly on the shaft of an engine.

In the drawings, Figure 1 is a side view of a section of the improved armature. Fig. 2 is a central section thereof, and Fig. 3 is a diagram illustrating the connections.

The armature-core 1 is preferably laminated and is made by coiling a suitable strip or ribbon in a well-known manner. The convolutions of said strip are held together by suitable means, preferably by the rivets 2, which serve, also, to secure the shoes 3 in place on the inner periphery of the ring-core. The shoes referred to are for the purpose of securing the central spider to the ring in the manner hereinafter fully described, there being the same number of shoes as there are spider-arms 4. Between the hub 5 and the outer ends of the arms 4 is a continuous ring or web 6, preferably, though not necessarily, integral with the spider-arms, and through which are transverse holes 7, arranged at regular intervals and preferably in two or more circles. Through the core 1 are formed two series of holes 8—one series near one side face or edge of the core and the other near the opposite side face or edge—the holes being at regular intervals and pointing toward the center of the spider. In the armature illustrated there are one hundred and fifty-four of these holes in each series, although of course the number of holes will vary with the size of the machine. Said holes are for the purpose of receiving the conducting bars or rods 9 9′, which are surrounded by insulating material, preferably in the form of tubes 10. Said bars 9 9′ are provided with enlarged rectangular heads 11 at their lower ends, projecting under the core, as shown, but separated therefrom by insulating material 12. This insulation is shown only on a small section of the armature in Fig. 1. These bars, as well as the holes to receive them, may be round in cross-section or other desired shape.

13 are cross-bars secured to the bars 9 9′ by nuts 14 and insulated from the core by the insulating-layer 15 and insulated from each other by intermediate insulation 15′, this preferably being held in a wedge-shaped space between adjacent cross-pieces, so that it is securely held in place. The two side bars 9 9′ and the connecting cross-piece 13 form a conductor, which may be described generically as a U-shaped conductor and which surrounds the main body of the core on three sides. It will be seen that when the nuts 14 are turned home they will not only secure the parts 9 and 13 together, but will cause them to tightly grasp the core. This holds the conductors in their proper position. The outer faces of the cross-pieces 13 are turned down, and against this surface the commutator-brushes, which may be two or more in number, bear.

In the holes in web 6 are cross-rods 16, insulated from the spider by insulating coatings or tubes 17 and preferably having tapering ends, as shown, there being the same number of these rods as there are of the conductors 9 9′.

18 18′ are conducting strips or bars on opposite sides of the armature, all of the same general shape and so curved that they will be

substantially parallel and a sufficient distance apart to prevent all danger of accidental contact throughout their length. When two circles of rods 16 are used, the alternate bars 18 will be longer than the others, as shown. Each of these strips or bars is connected at its outer end to one of the heads 11, preferably by being inserted in a slot in the end thereof and being soldered, while the inner ends are provided with sleeves 19, having conical or tapering openings adapted to fit onto the correspondingly-shaped ends of the rods 16, and to be secured and tightly wedged thereon by the nuts 20. Between the spider and the strips 18 18′ may be insulating-washers 21, which prevent any possibility of electrical contact between said parts. The end of each arm of the spider is provided with a flange 22, through which pass one or more radial bolts 23, which bolts are screw-threaded for that part of their length which passes through the flange, but which are smooth for that portion of their length which extends into or through the shoes 3. The arms of the spider are sufficiently short to leave a space of, say, a sixteenth of an inch between the outer surface of the flanges and the adjacent surface of the shoes. It will be seen that this arrangement makes a perfect provision for allowing the ring of the armature to expand and contract without distorting the same in the least degree, and at the same time the bolts 23, which are large and strong, are abundantly sufficient for transferring the motion of the driving-shaft to the armature-ring.

In Fig. 3 the parts are numbered to correspond with Figs. 1 and 2 so far as possible. The circles N S represent field-magnet poles at one side of the armature-ring 1. The dotted lines 18′ and 9′ correspond to the strips or bars 18′ and the conductors 9′ and are on the side of the armature most distant from the observer, while the full lines 18 and 9 are the corresponding parts on the side of the armature toward the observer. Starting at the first conductor 9 the connection will be as follows: By strip 18 to the cross-rod 16, through said rod to the strip 18′ on the opposite side of the armature, thence to the conductor 9′ in the thirty-second hole, thence through the cross-piece 13 at said point and to the succeeding strip 18, thence to the conductor 9′ in the sixty-third hole, and so on around, the conductor 18′ nearest to the starting-point being connected to the conductor 9 in the second hole, thence to the strip 18 to the conductor in hole thirty-three, and so on around until all the conductors forming the working coil of the machine are in series, the last connection being made with conductor 9′ at $18^{\times}$—that is, at the conductor in the rear hole one.

By connecting the working conductors by means of the strips 18 18′ it is not necessary to connect the ends 11 of the conductors 9 directly across the inner periphery of the ring. Hence this face or periphery can be utilized to support as large a number of shoes or similar devices for securing the spider as may be necessary without interfering in any manner with the connections, and these connecting-conductors are supported in such a way that they are open to the air on all sides. Since they are preferably supported entirely within the ring they do not add to the bulk of the armature nor materially increase the resistance which the armature meets from the air. Since these conductors or strips 18 are wedged onto the rods the electrical connection is perfect, and being large they offer little resistance to the current.

While I have described the working conductors as being supported within openings passing through the body of the armature-core, it will be evident that the mode of connecting said conductors may be applied in cases where the working conductors are not surrounded by the metal of the core; but the construction illustrated is preferred, since it enables me to bring the poles of the field-magnet close to the face or faces of the armature, and since it enables me to use large, solid conductors without heating instead of laminated conductors, which would be necessary were the conductors not surrounded by the metal of the core. The construction illustrated has the further advantage that the conductors are more securely and easily held in place.

What I claim is—

1. The combination, in an armature, of a core having a series of holes through it near each side face or edge, a series of U-shaped conductors insulated from the core, the legs of which conductors extend through said holes, and means for causing each U-shaped conductor to grasp the core, substantially as described.

2. The combination, in an armature, of a core having a series of holes through it near each side face or edge, a series of U-shaped conductors insulated from the core, the legs of which conductors extend through said holes, means for causing each U-shaped conductor to grasp the core, and means consisting of suitably-supported cross rods or bars, strips or bars symmetrically arranged on one side of the armature between the inner ends of the conductors and cross-rods, and similar strips or bars on the opposite side of the armature for connecting the U-shaped conductors to form the armature-coil, substantially as described.

3. The combination, in an armature, of a suitable spider, a series of transverse insulated cross-rods supported by said spider, an armature-core also supported by the spider, a series of conductors crossing the outer periphery and the two sides of the core, a series of strips or bars connecting the inner ends of the side conductors on one side of the armature to the cross-rods, and a similar series of strips or bars connecting the inner ends of the side conductors on the other side, substantially as described.

4. The combination, in an armature, of a spider having a hub and a perforated web, cross-conductors in said perforations, a ring-core supported by the spider and supporting insulated conductors surrounding the core except on its inner periphery, and series of bent strips or bars connecting the inner ends of said conductors to the cross-conductors in regular order, substantially as described.

5. The combination of the armature-conductors, the connecting-conductors 18 18′, extending away from the inner surface of the ring, and cross-conductors connecting the same, substantially as described.

6. The combination of the armature-core, the conductors surrounding the same except on its inner periphery, a spider secured to the armature-core, and conductors for connecting the armature-conductors to form the working coil, substantially as described.

7. The combination of the armature-core, the shoes on the inner periphery thereof, a spider secured to said shoes by radial bolts or devices, said devices being free to move radially within the shoes, whereby the armature-core is free to expand and contract without being distorted, substantially as described.

8. The combination of the armature-core, the shoes arranged on the inner periphery thereof, the spider having flanged arms equal in number to said shoes, and bolts extending through said flanges into holes in said shoes, the bolts being smooth at their outer ends, substantially as described.

9. The combination of an armature-core, a spider for supporting the same, the arms of said spider being slightly shorter when the core is warm than the distance from the center of the spider to the surface to which the arms are connected, and bolts for transferring power from the spider to the ring, said bolts being constructed to allow expansion and contraction, substantially as described.

10. The combination of an armature-core, a spider for supporting the same, radial bolts connecting the spider and armature, the sections of the bolts resting in one of said parts being smooth and free to move in its socket, whereby the bolts are adapted to transfer the power of the shaft to the armature-ring and at the same time to allow said ring to freely expand and contract, substantially as described.

This specification signed and witnessed this 21st day of January, 1892.

ROBERT LUNDELL.

Witnesses:
CHARLES M. CATLIN,
GEORGE B. BUCHANAN.