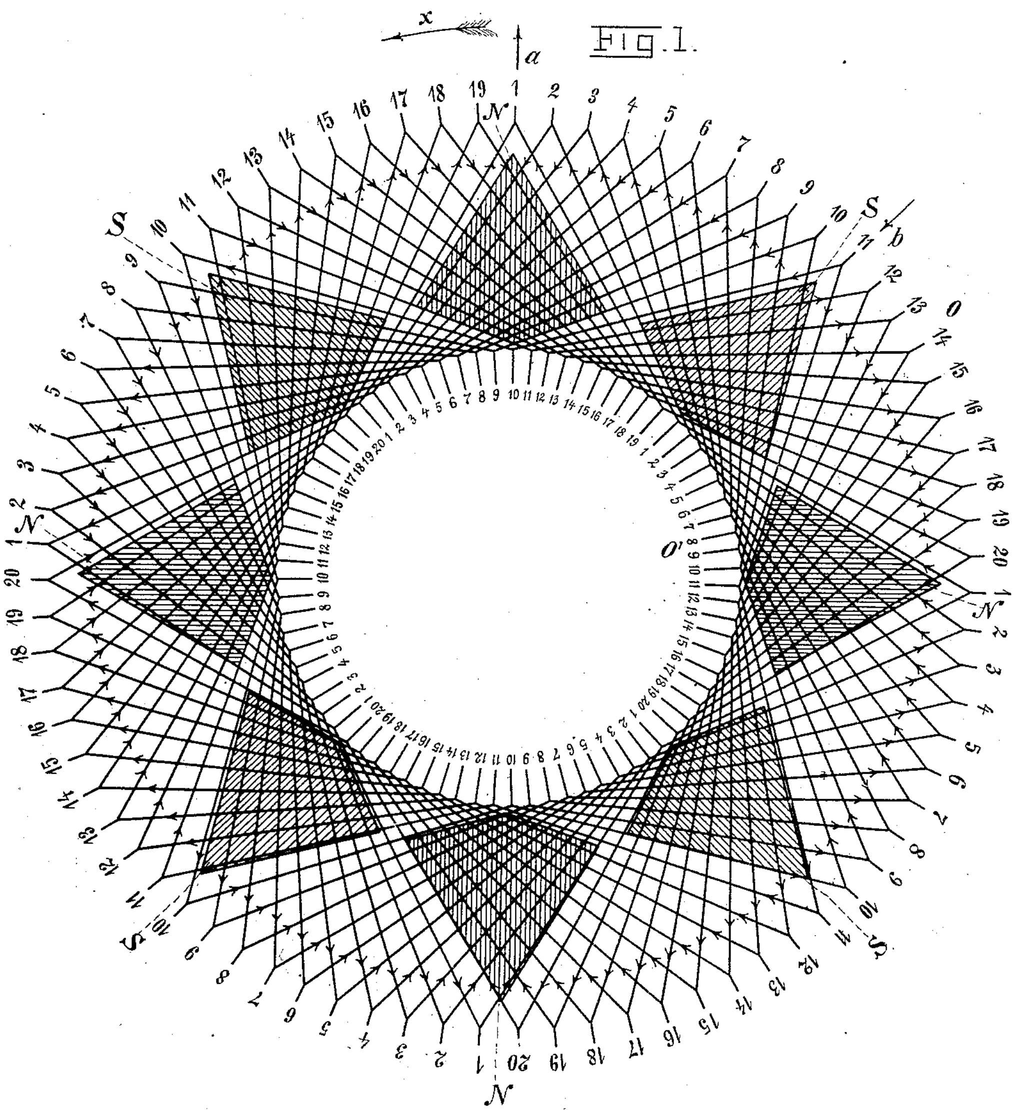
(No Model.) 7 Sheets—Sheet 1.

W. FRITSCHE.

DYNAMO ELECTRIC MACHINE.

No. 386,775. Patented July 24, 1888.

Fig. 1.



Witnesses:-
[illegible]
[illegible]

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his attorney.

(No Model.)

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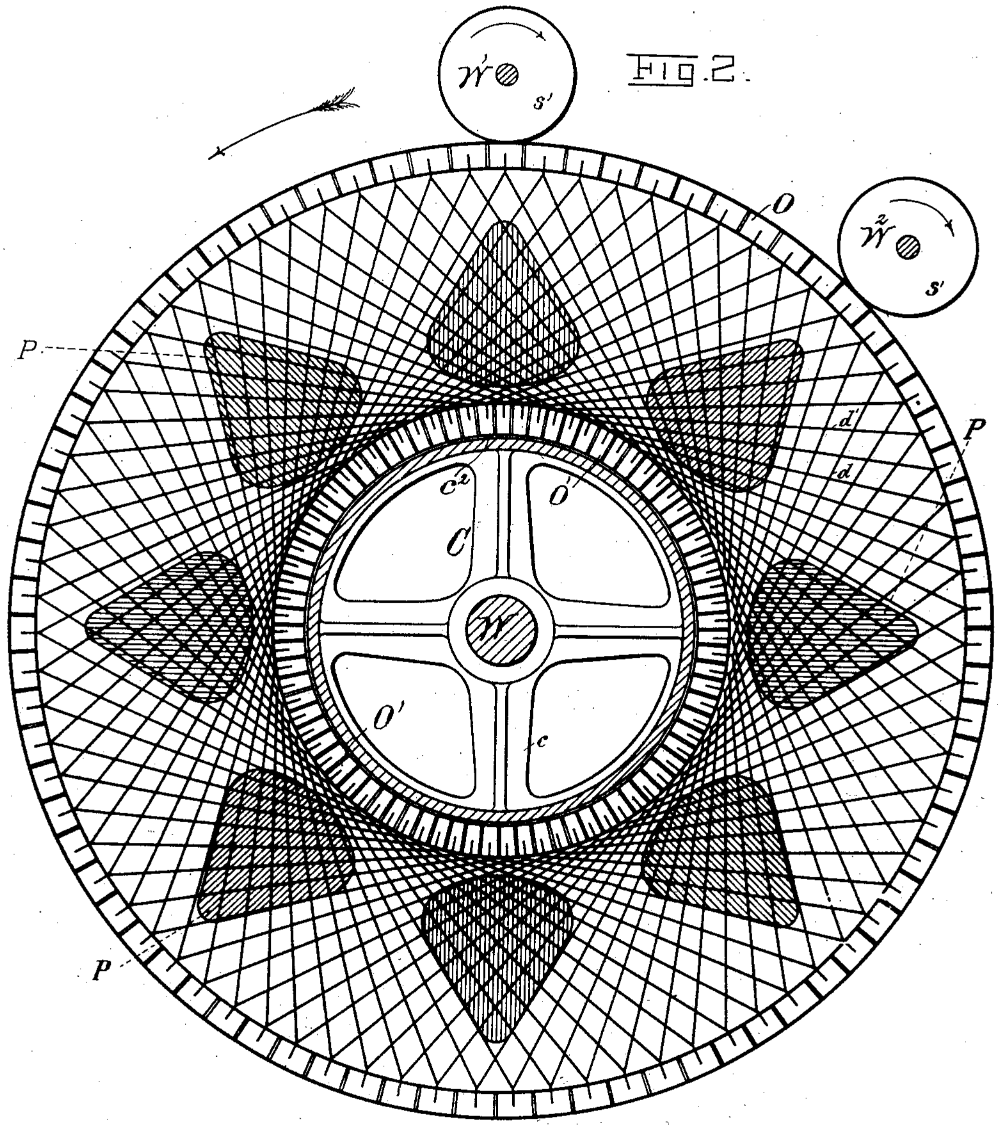
FIG. 2.



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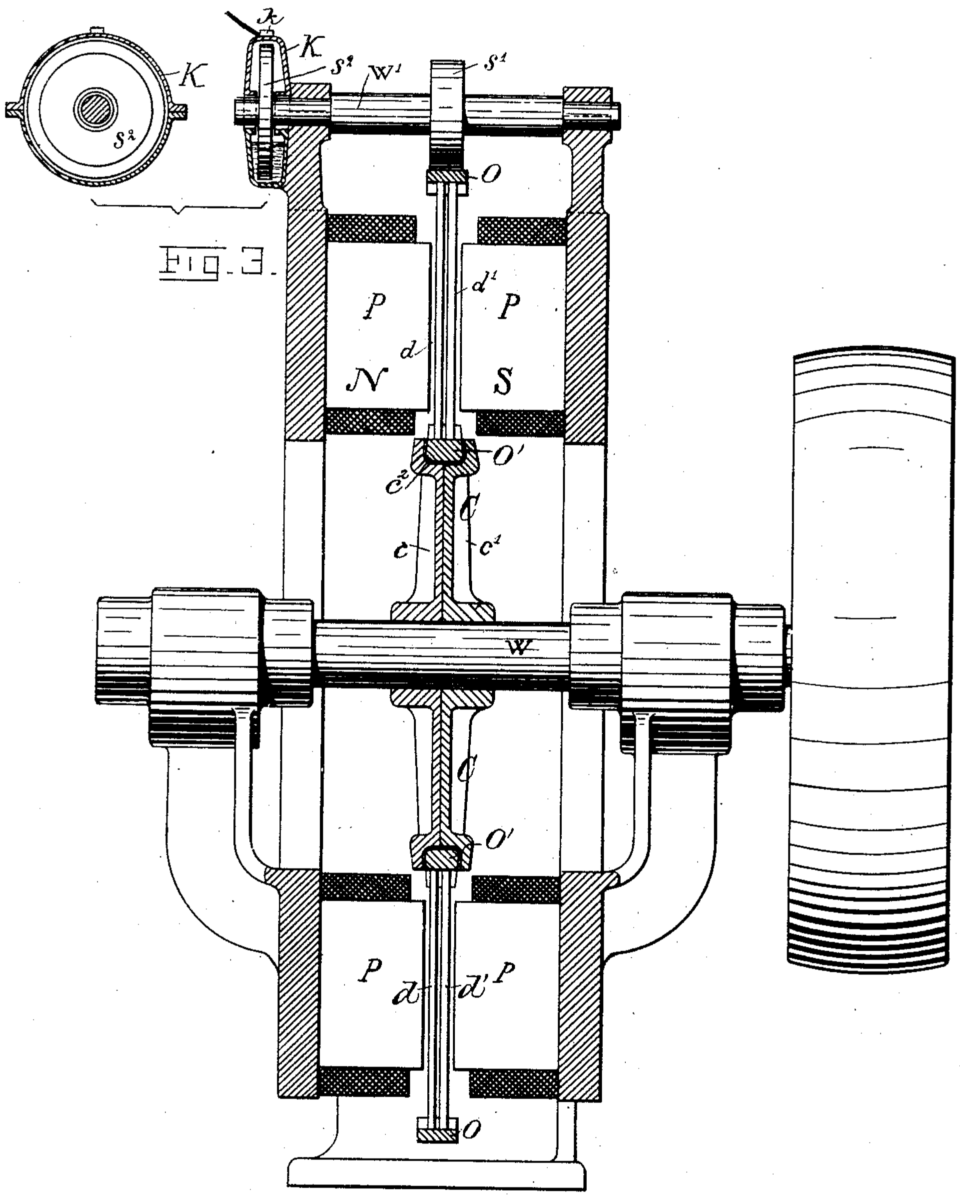

Fig. 3.

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DYNAMO ELECTRIC MACHINE.

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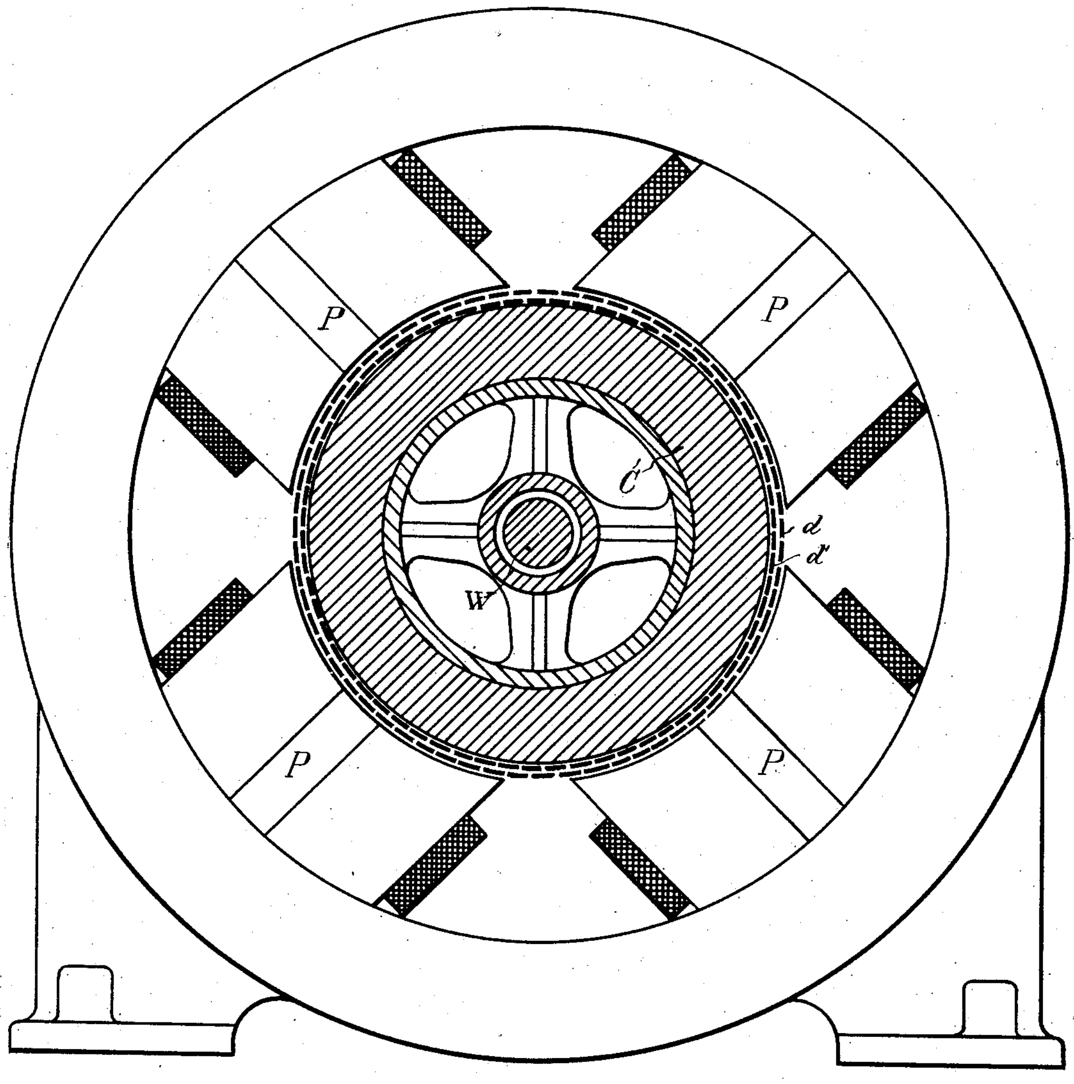
Fig. 4.



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DYNAMO ELECTRIC MACHINE.

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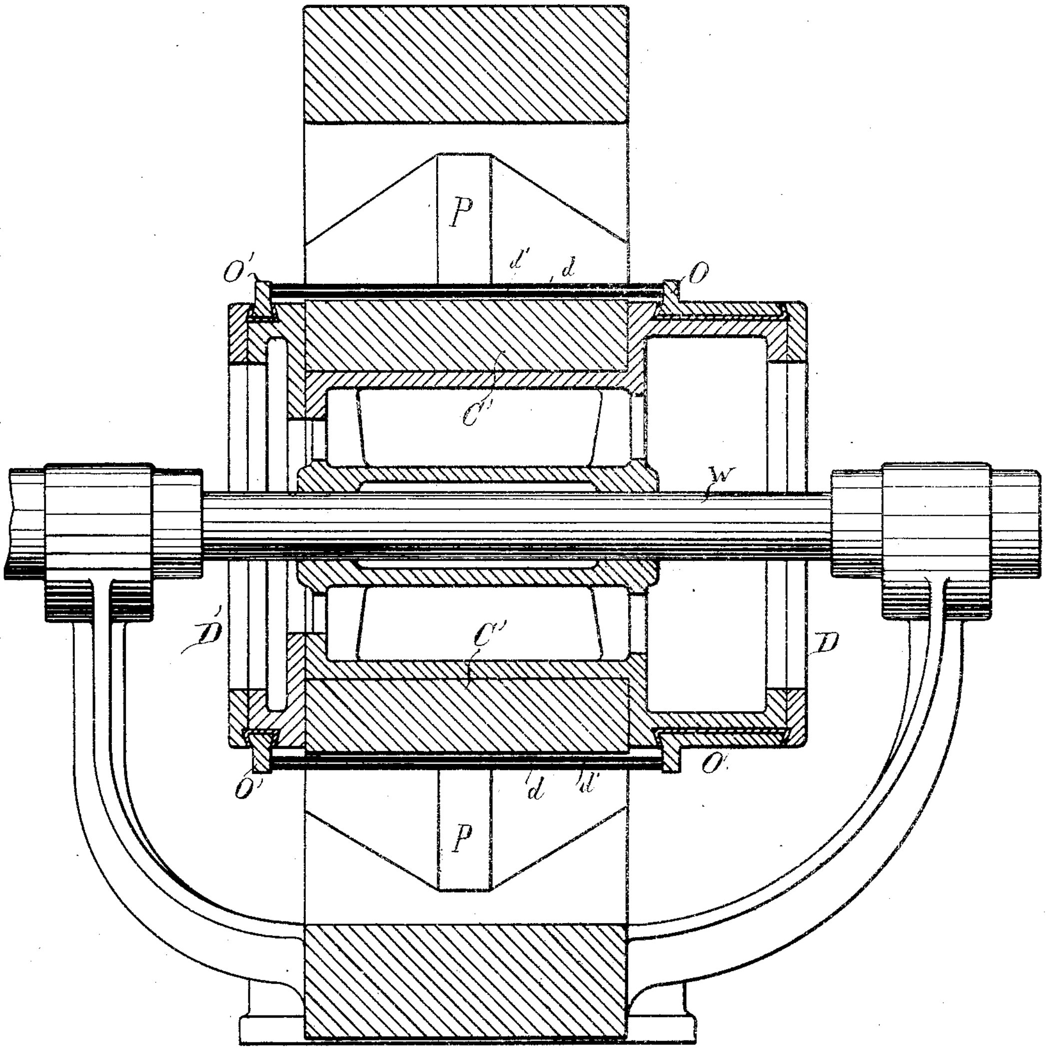
Fig. 5



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(No Model.)

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DYNAMO ELECTRIC MACHINE.

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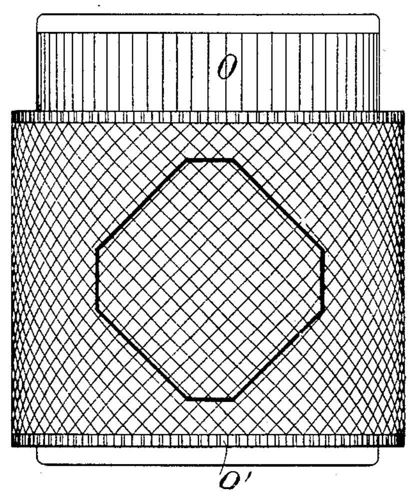
FIG. 6.



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(No Model.) 7 Sheets—Sheet 7.

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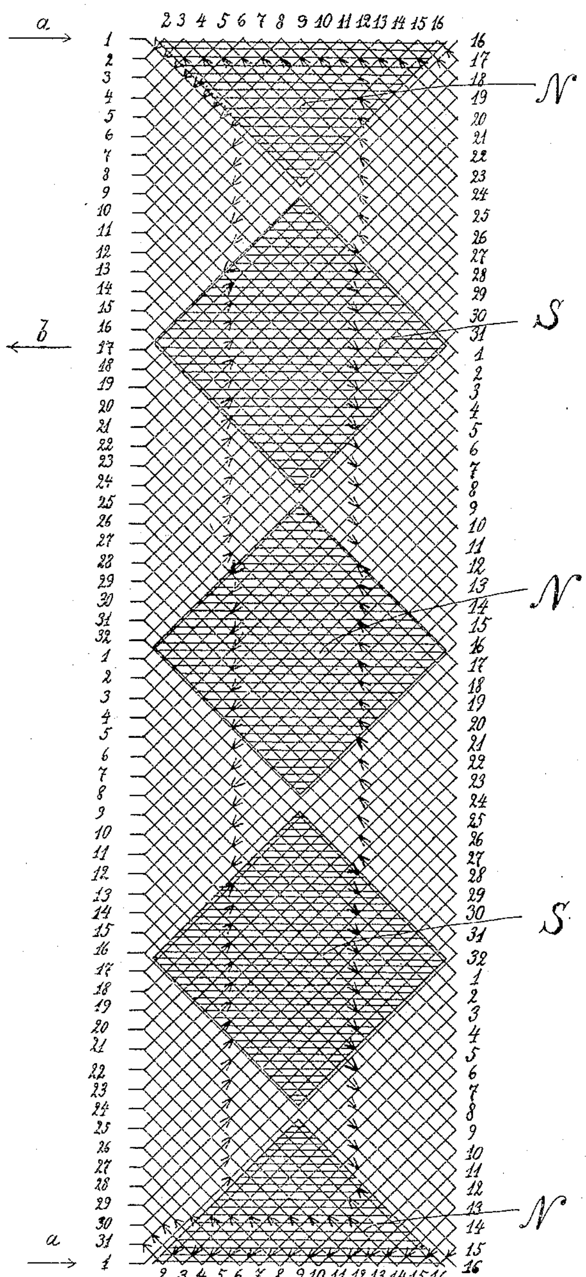
DYNAMO ELECTRIC MACHINE.

No. 386,775. Patented July 24, 1888.

FIG. 7.



Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

WALDEMAR FRITSCHE, OF BERLIN, GERMANY.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 386,775, dated July 24, 1888.

Application filed November 4, 1887. Serial No. 254,243. (No model.) Patented in Belgium September 27, 1887, No. 79,008; in France September 27, 1887, No. 186,093, and in Austria-Hungary February 26, 1888, No. 37,999 and No. 6,190.

To all whom it may concern:

Be it known that I, WALDEMAR FRITSCHE, engineer, a subject of the King of Prussia, residing at Berlin, Karlstrasse 31, Prussia, German Empire, have invented certain new and useful Improvements in Dynamo-Machines, (for which I have obtained Letters Patent in Belgium, dated September 27, 1887, No. 79,008; in France, dated September 27, 1887, No. 186,093, and in Austria-Hungary, dated February 26, 1888, No. 37,999 and No. 6,190;) 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Referring to the drawings, Figure 1 is a schematic view illustrating the mode of winding a disk-armature or arranging the rods or bars for such an armature. Fig. 2 is an elevation of the disk-armature. Fig. 3 is a vertical transverse section, shown partly in elevation, of a dynamo-electric machine embodying my improvements. Fig. 4 is a vertical transverse section of a cylindrical armature wound or having its rods or bars arranged according to my invention. Fig. 5 is a vertical transverse section, shown partly in elevation, provided with the cylindrical armature shown in Figs. 4 and 6. Fig. 6 is an elevation of said cylindrical armature, and Fig. 7 a projection of the perimeter thereof.

The invention relates to dynamo-electric machines; and it consists in the mode of winding the wire or cable or arranging the rods or bars; also, in the means for taking off the currents directly from the armature, whereby the usual commutator is dispensed with; also, in a disk-armature devoid of a core, and, finally, in certain structural features and combinations of parts, substantially as hereinafter fully described, and as set forth in the claims.

I will first describe the mode of winding a continuous wire or a plurality of wires or a cable; but it will be understood that in either form of armature, whether disk or cylindrical, rods or bars may be similarly arranged and in such a manner that in either case they will return upon themselves.

Referring to Fig. 1, two groups of wires are employed lying in one and the same plane and having their points of divergence or connection or contact in different planes on concentric circles.

For convenience of description I will refer hereinafter as points of contact to those points from which the wire passes from one place to the other, or at which the rods or bars are connected, for they are such practically.

The number of points of contact is the same on both circles and depends upon the number of poles. If the dynamo-electric machine has n poles and if each pole is to have m points of contact, the total number of points of contact in order to return the wire upon itself will be $n\times m-1$, or $n\times m-2$, or $n\times m-3$, &c., according as the wire is wound singly or in pairs or by threes, &c., in parallel planes. A disregard of this rule will result in an armature the sections of which are formed by wires or elements of unequal length, which results in loss of current and in the production of sparks, and this applies both to disk and cylindrical armatures.

The disk-armature shown in Figs. 1 and 2 has eight poles, each pole having ten points of contact; hence according to above rule each of the concentric circles will have $8\times10-1$ points of contact. This will give us four armature-sections, three of which have twenty points of contact on each of the concentric circles O and O′, while the fourth section will have only nineteen.

Although the contacts on both circles lie in the same radial planes, yet in view of the mode of winding or the inclination of each wire-section the points of contact of each section or element will lie in different radial planes, which difference will depend upon the degree of inclination of the wire-sections.

In the disk-armature referred to the degree of inclination or divergence is such that the contact-point of one wire section or element on the inner circle, O′, will lie in a radial plane distant ten points from its point of divergence or contact on the outer circle, O. Starting, for instance, at the point 1 a of the outer circle, O, the point of contact of the wire on the inner circle, O′, will lie in a radial line ten points farther than said point 1 *a*, and this is the case for all of the sections. Inasmuch as the fourth section has only nineteen points, it is obvious that the wire will not return to point 1 *a* on the outer circle, O, but to the point 2 next thereto on the right, and so on through the other sections, the wire starting again from the point 3 next to the point 2 on the right of point 1 *a*. If this winding is continued, the wire will finally return upon itself at point 1 *a*, as will be readily understood. In conformity with the winding of such an armature, the shape of the field-magnets will be determined by four of the wire sections or elements diverging from two contact-points lying in the same radial plane, and will have the form or approximately the form of a trapezoid in cross-section, and the polarity of the field-magnets of a pair as well as that of the successive pairs will be reversed.

The direction of the induced currents through the winding is indicated by arrow-heads on the wire, so that the phenomena of induction and its effect in the armature may be readily comprehended; and if we suppose a north pole to lie above the plane of the diagram, Fig. 1, at 1 *a*, the rotation of the armature will be in the direction of the arrow *x*. The currents are taken off at two points on radial lines passing through the axis of two successive poles, as at *a* 1 and *b* 11, Fig. 1, as hereinafter described, the armature serving as commutator. If two or three, &c., parallel wires are to be wound, as described, the number of contact-points will be 78, 77, &c.

In practice the armature consists of a spoke-wheel, C, made of two sections, *c* and *c*′, each provided with a peripheral half-groove, c^2, whose lateral walls converge outwardly, so as to form a groove in the perimeter of the wheel decreasing in width outwardly. In this groove is clamped a ring, O′, formed by suitable blocks of insulating material, and the elements or points of contact arranged alternately to isolate the elements from one another and from the wheel, a suitable insulating material being interposed between the blocks and elements and the walls of the groove c^2. A similar outer ring, O, is formed and connected with the inner ring, O′, by insulated radial arms or spokes. When, however, rods or bars *d d*′ are employed instead of the wire, the said rods or bars serve as spokes to connect the two rings, as will be readily understood.

In either construction a stay-ring on opposite sides of the ring O may be employed to give the latter greater stability; or said ring O may be made of sufficient width to apply a tire or tires so arranged as to leave a space between them for the device used for taking off the current, either the stay-rings or tire or tires being suitably insulated from the contact-points.

The wheel is mounted on a shaft, W, Fig. 3, that has its bearings in a suitable frame, in which are also mounted two insulated shafts, W′ W^2, each carrying a disk, *s*′, for taking off the currents at the points 1 *a* and 11 *b*, as above set forth.

The shafts W′ W^2 project into a fluid-tight casing, K, suitably insulated from the frame of the machine and from their shafts, said casing carrying the line-wire binding-posts.

The casing is partially filled with a conductive fluid in which is partly immersed a disk, s^2—one on each shaft W′ W^2—the currents passing from disk *s*′ to disks s^2 through their respective shafts and through the fluid in the casing and the latter to line. The rapid revolution of the disks s^2 will distribute the conductive fluid over the entire inner surface of the casing, and so connect it electrically with the entire surface of the disk therein.

In an armature such as described, and more especially when bars or rods *d d*′ are used instead of wire, means for cooling it may be entirely dispensed with, as the ambient air can freely circulate around its elements. On the other hand, an armature is provided that is not only devoid of a core, but is of so small a diameter that the proximate magnets of a pair of field-magnets may be brought very close together—in fact much closer than is the case in any other armature with which I am acquainted—thereby reducing the dimensions of the machine very materially.

I have stated above that the mode of winding the wire or wires or arranging the rods or bars is applicable also to cylindrical armatures.

In Figs. 4, 5, 6, and 7 I have shown an armature with four poles, and according to the rule given above there may be 4×16−1 equal to sixty-three contact-points, or sixteen for three pole-sections and fifteen for the fourth.

Fig. 7 illustrates by a projection the perimeter of the cylindrical armature, the supposition being of course that the length of the perimeter is four times the width thereof. The winding is substantially the same as above described, the wires running from side to side, forming points of contact on opposite sides of the cylinder.

It is obvious that if the winding is started, for instance, from the point 1 *a* on one side or edge and carried alternately from side to side in a zigzag manner, said wire will go from contact-point 1 on one side to contact-point 1 on the opposite side, except at the last section, and as this has only fifteen points the wire will start from point 2 at the right of point 1 *a*, and by continuing the winding said wire will finally return upon itself at the starting-point. The points of contact are isolated from one another in the manner substantially as described, thereby forming two parallel rings, O and O′, on opposite sides of the cylinder, said rings being clamped in grooves having the form of a dovetail in cross-section by means of end plates or disks, D D′. The cylinder or drum C in this case carries a core-piece, C', and is mounted on a shaft, W. The currents are taken off, as above described, from suitable points—say 1 *a* and 17 *b*, Fig. 7—in the manner and by the means above set forth. The poles in this arrangement will have the form of a square, as indicated by shading in Fig. 7. Of course an armature having a different number of poles may be constructed in the manner specified, in which case the poles will have the form of a rhombus.

P P indicate the field-magnets, the relative arrangement of which in either construction of armature will be readily understood. It is plainly indicated in the drawings and needs no detailed description.

In Figs. 4 and 5 I have shown, instead of the wires, bars or rods arranged in different planes in the manner described.

Although the means for taking off the currents are very convenient, I do not desire to limit myself thereto, as other means or arrangements may be adopted. For instance, the inner ring, O', may be made available as a commutator, or the points of contact of said inner ring, O', may be connected with a commutator mounted on the shaft W, and, instead of the rolling-contacts described, other means, such as springs, brushes, &c., may be employed to take off the currents.

Having now described my invention, what I claim is—

1. An armature for a multipolar dynamo-electric machine having two series of contact-points arranged either parallel to or concentric with one another, a conductor connecting said contact-points, arranged to form a series of partial triangles having their apices at the said contact-points and imaginary bases, the conductor being continued progressively throughout the entire series of contact-points, so that at the termination of the winding said conductor returns upon itself at the point of starting, substantially as and for the purpose specified.

2. An armature for a multipolar dynamo-electric machine having two series of contact-points arranged either parallel to or concentric with one another, a continuous conductor connecting said contact-points, arranged to form a series of partial triangles having their apices at the said contact-points, and imaginary bases slightly greater than the angular distance between two like poles of the field-magnets, the conductor being continued progressively throughout the entire series of contact-points, so that at the termination of the winding said conductor returns upon itself at the point of starting, substantially as described.

3. An armature for a multipolar dynamo-electric machine having two series of contact-points arranged either parallel to or concentric with one another, a continuous conductor connecting said contact-points, arranged to form a series of partial triangles having their apices at the said contact-points, and imaginary bases slightly greater than the angular distance between two like poles of the field-magnets, the conductor being continued progressively throughout the entire series of contact-points, so that at the termination of the winding said conductor returns upon itself at the point of starting, and field-magnet poles substantially corresponding to the angles produced by the intersections or crossings of said conductor, substantially as described.

4. An armature for a multipolar dynamo-electric machine having two series of contact-points of uneven number, a conductor arranged to form a series of partial triangles or two sides of a triangle with apices at said contact-points in both series, the said conductor being carried continuously and progressively throughout the entire series of contacts until at its termination it returns upon itself at the point of starting, substantially as described.

5. In a disk-armature, a pair of concentric rings, each containing a series of contact-points, and a conductor extending from one to the other ring on lines approximately tangent to the inner ring to one of the contact-points on the other ring, and thence returning directly and substantially at a tangent to another contact-point on the first ring, and so proceeding progressively throughout the entire series of contact-points until it returns upon itself at the starting-point, in combination with a series of field-magnets having poles substantially corresponding to the angles produced by the intersections or crossings of said conductor, substantially as described.

6. The combination, with an armature having a series of peripheral contacts, of a plurality of current-collectors, each comprising two revoluble contacts, one in contact with the armature and the other with a conductive fluid, and a conductive connection between the two, substantially as described.

7. The combination, with an armature having a series of peripheral contacts, of a plurality of current-collectors, each comprising two revoluble conductors, one in contact with the armature and the other in contact with a conducting-fluid contained in a conductive casing provided with means for securing thereto the line-wires, and a conductive connection between said rolling conductors, substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

WALDEMAR FRITSCHE.

Witnesses:

B. Roi,

A. Denclius.