(No Model.) 4 Sheets—Sheet 1.

G. WILKES.

COMMUTATOR AND CONNECTION FOR DYNAMOS.

No. 512,853. Patented Jan. 16, 1894.

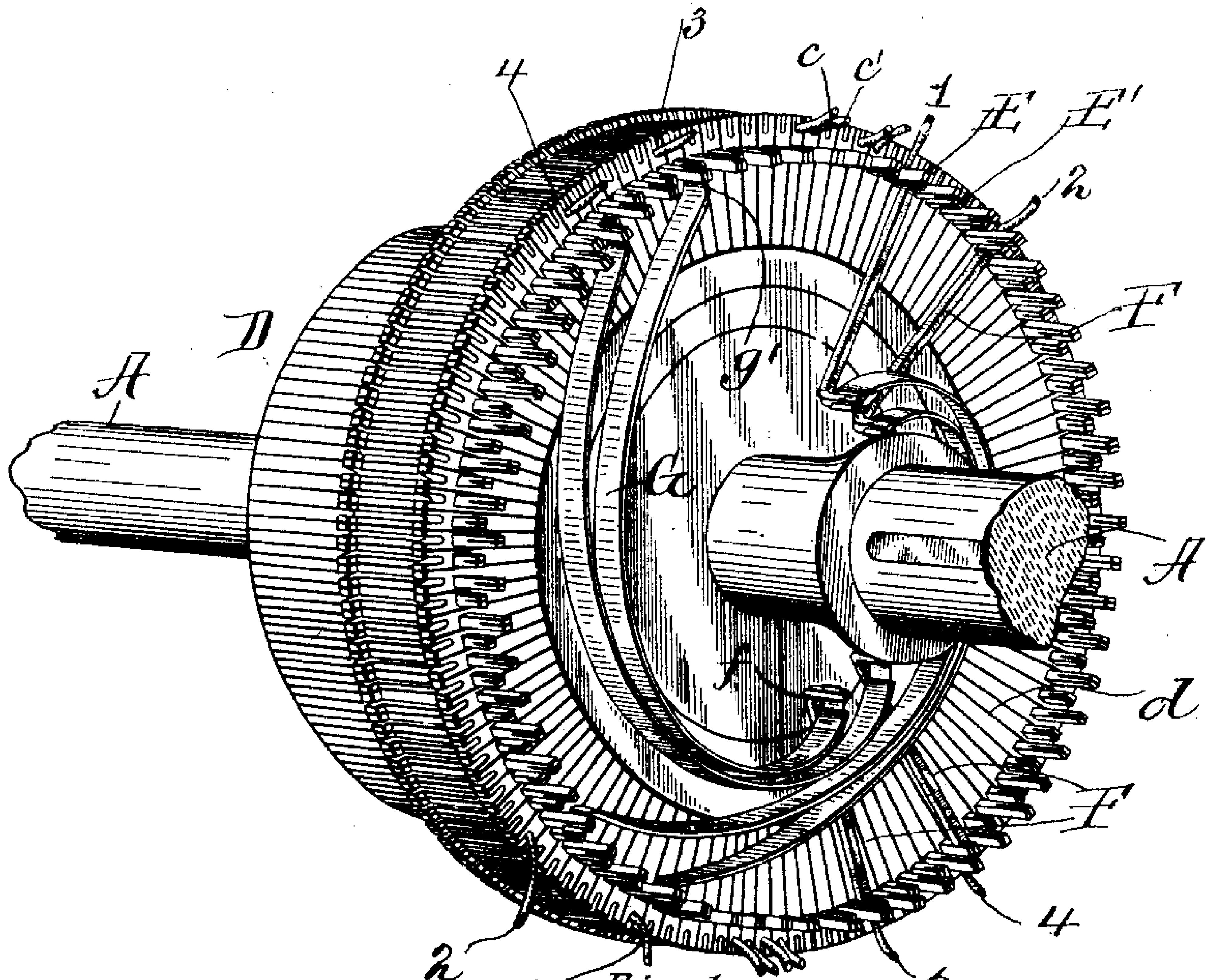

Fig. 1.

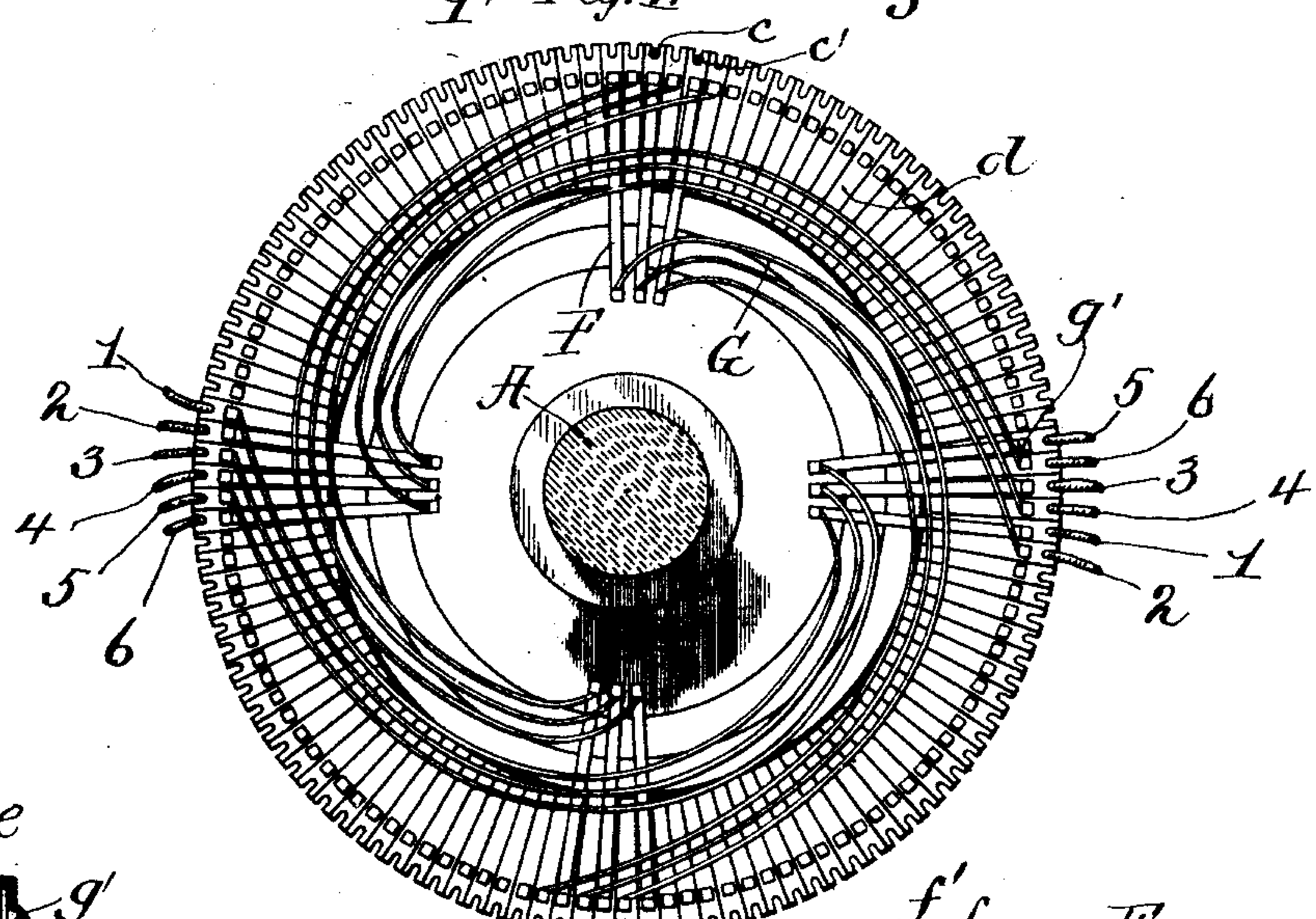

Fig. 2.

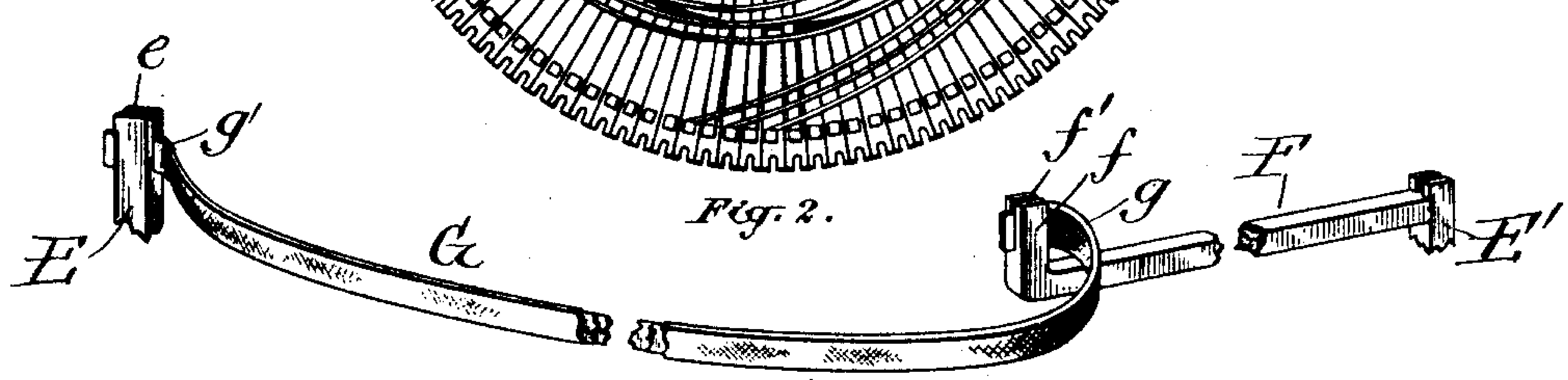

Fig. 3.

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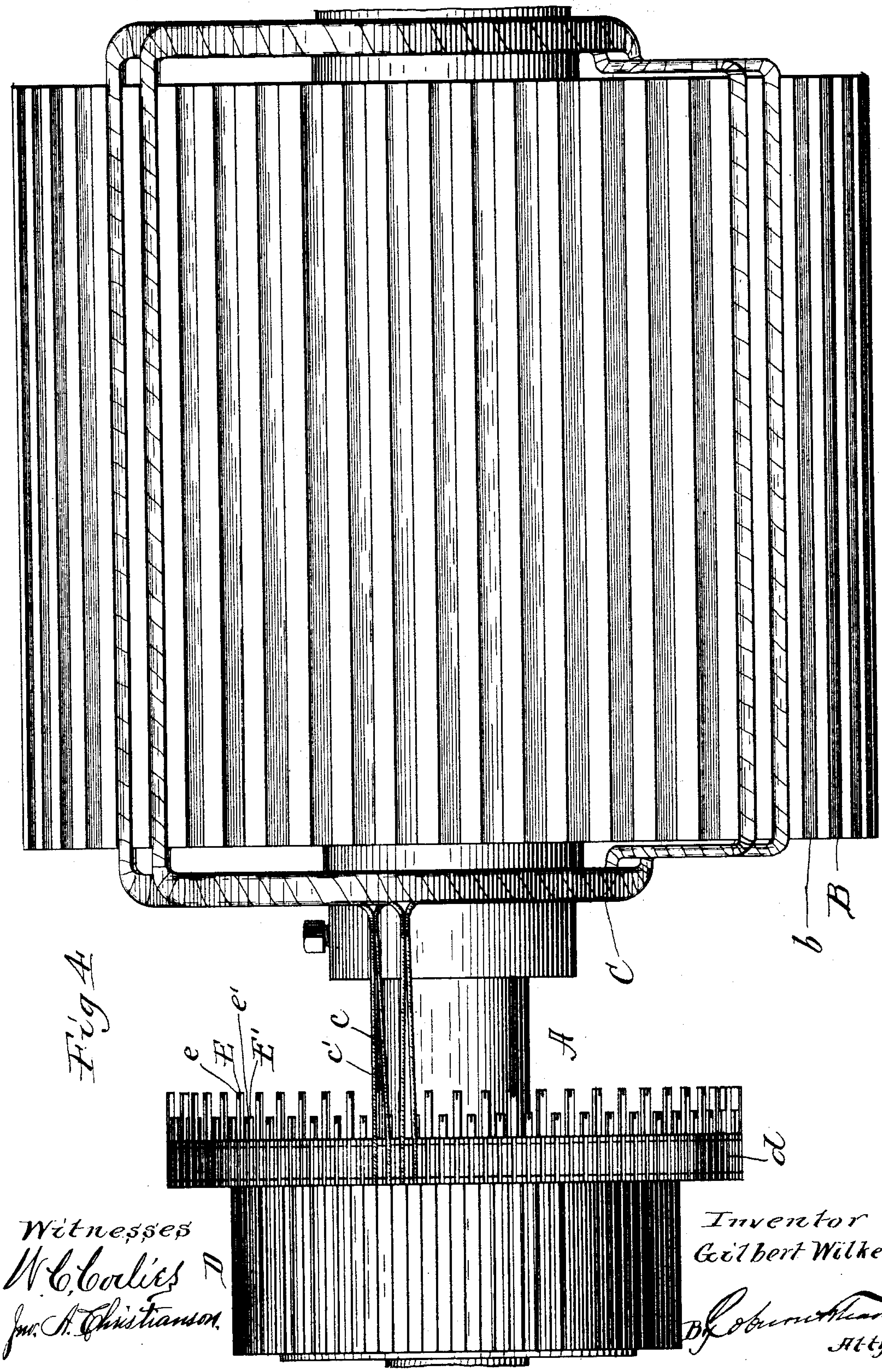

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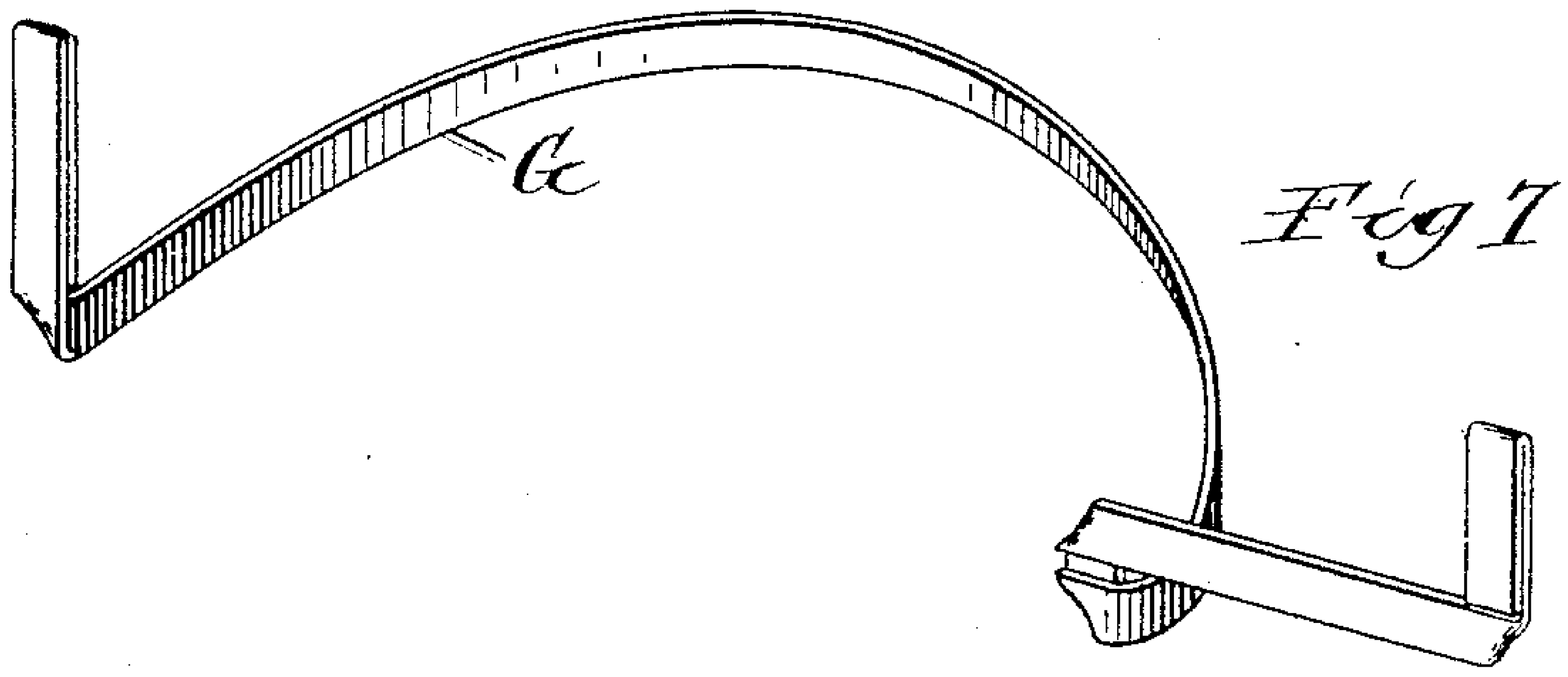

Fig 7

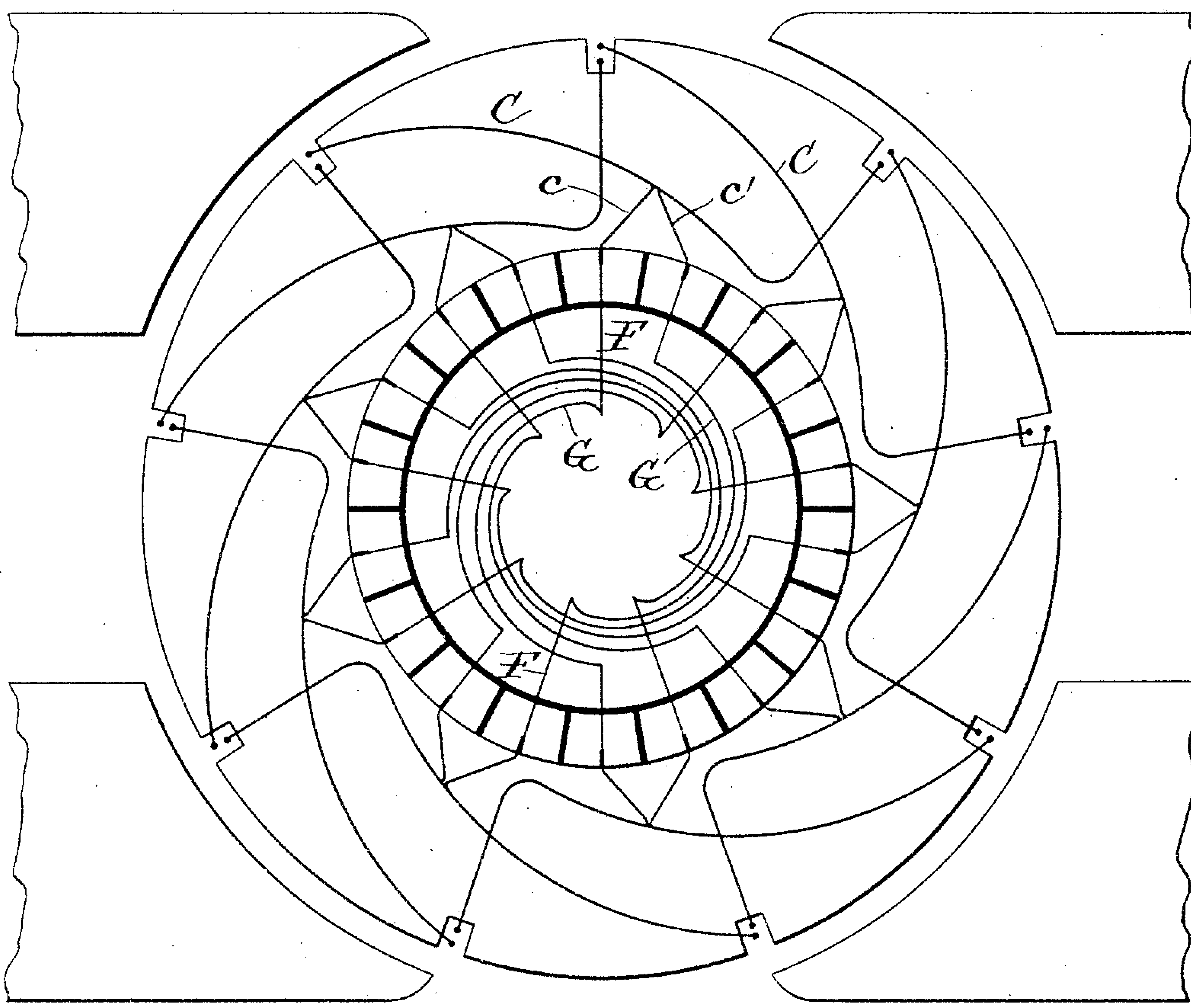

Fig. 5.

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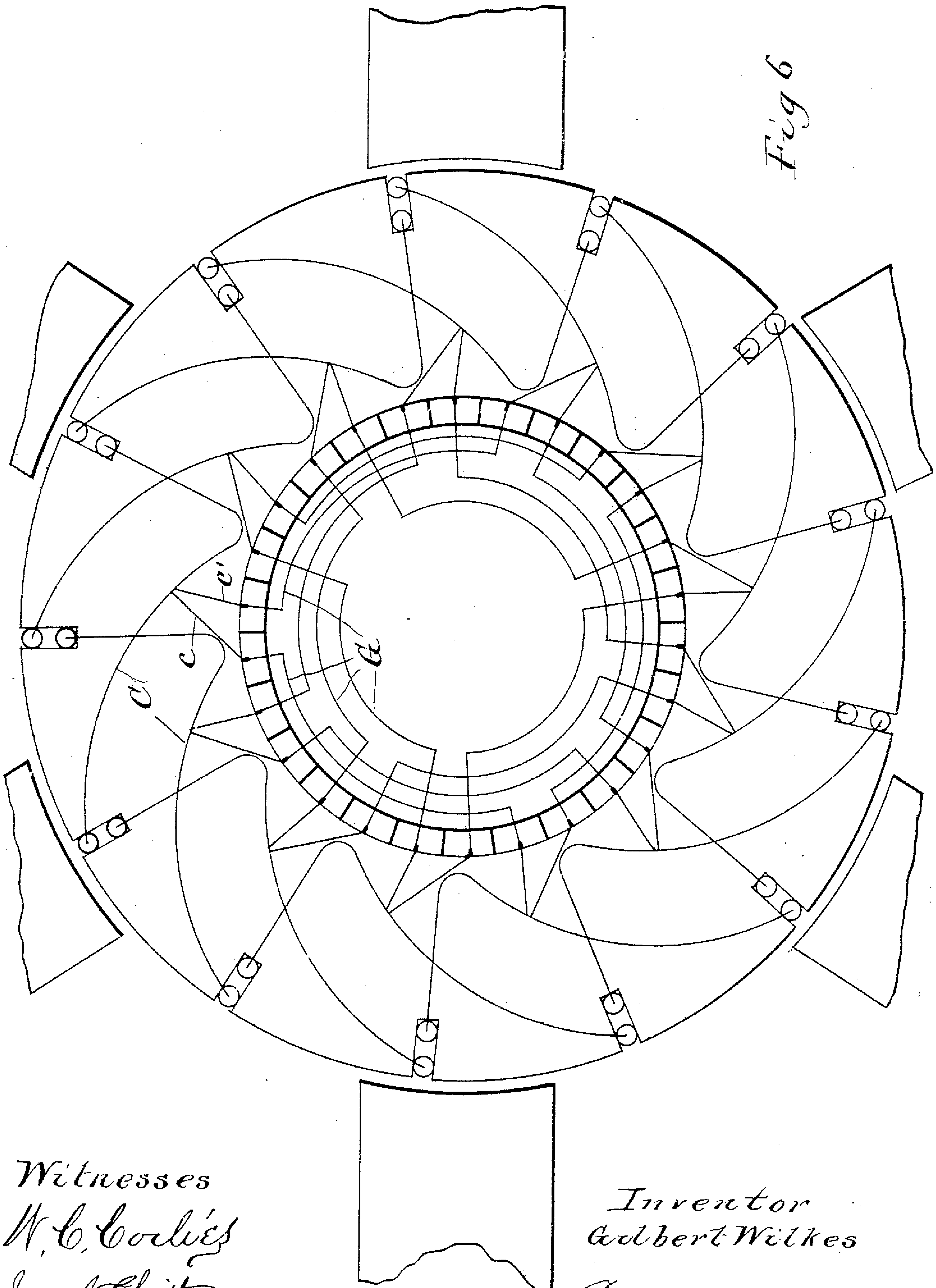

Fig 6

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UNITED STATES PATENT OFFICE.

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COMMUTATOR AND CONNECTION FOR DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 512,853, dated January 16, 1894.

Application filed October 2, 1893. Serial No. 486,994. (No model.)

To all whom it may concern:

Be it known that I, GILBERT WILKES, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Commutators and Connections for Dynamos, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a perspective view of a commutator of a multi-polar dynamo embodying my invention; Fig. 2, a back elevation of the same with the shaft in cross-section; Fig 3, an elevation of the cross-connection; Fig. 4, a side elevation of an armature and commutator constructed and connected to embody my invention; Fig. 5, a diagram of my invention as applied in a system of nine coils, nine slots, and eighteen commutator segments; Fig. 6, a similar view of a system with six poles and the corresponding number of coils, slots and segments; and Fig. 7 a modification of the cross-connection in Fig. 3.

In the drawings, Figs. 1 and 2 are upon one scale; Fig. 4 is upon an enlarged scale by itself; the diagrams, Figs. 5 and 6, are upon one and the same scale enlarged from that of Figs. 1 and 2; and Fig. 3 is upon a scale by itself still more enlarged.

It is well known that the greater the number of bars in the commutator the less will be the tendency to sparking in the machine.

In the ordinary systems of connection the number of bars in the commutator is equal to the number of slots in the armature, or sometimes to even half the number of said slots. It is also true that the greater number of slots in the armature the greater is the amount of space wasted, owing to the clearance that must be allowed in order to get the wires in, and also to the space necessary for the insulation in the slot; and both of these losses are practically constant for a slot of any usual width in a given size of armature. If, in a multi-polar dynamo, the coils of the armature be so connected that there will be only two paths for the current, (instead of two multiplied by the number of pairs of poles, as in the ordinary Gramme system of connections,) any dissimilarity between different pairs of poles will be eliminated, for, there being but two paths, these two will be similarly affected; in the ordinary system mentioned, dissimilarity causes different electro-motive forces in the different branches of the armature current, resulting in lack of balance and sparking, both of which objectionable results are obviated by the two path connections suggested above.

The object of my invention is to obviate the defects mentioned above, and it consists in such a construction and connection of the armature and commutator as will provide, in any magnetic system of four or more poles, only two paths for the current in the armature conductors; and in connection with this construction the establishment of a ratio of two to one between the number of segments in the commutator and the number of slots and coils.

I will now describe in detail the construction and operation of a dynamo armature and commutator in which I have embodied my invention in one practical way, and the particular improvements which I believe to be new and wish to secure by Letters Patent will then be set out more specifically in claims.

In the drawings, A represents an ordinary armature shaft, and B, an armature of the slotted type, being provided on its circumference with parallel slots, b, running lengthwise of the armature. The coils, C, here shown applied to the armature are of the special form and construction, or winding, which are set forth in my prior patent, No. 507,297, dated October 24, 1893. This is the winding of the coils preferred, but my invention, so far as the general features of the connection are concerned, is not limited to any special winding. It will be understood that the coils or windings are preferably symmetrical, however, this being a condition necessary to the best results with my invention; at the same time, I do not wish to be understood as limiting the application of the improvement to this particular construction of the coil. The connection wires, c, c', are run out at one end of the coils, as seen in Fig. 4.

The commutator, D, is secured on the shaft, A, as usual and is composed of a number of bars or segments, d, insulated as usual. The connection wires, c, c', extend, of course, from the respective coils to the commutator; but instead of the connection of the outer end of the coil and the connection of the inner end of the next coil going to one and the same segment of the commutator, they are connected to two adjacent segments, as seen in Fig. 4 and as indicated in the diagrams. The segments of this particular form of commutator are provided with a series of long arms, E, and short arms, E′, arranged alternately around the inside face of the commutator; that is, the alternate segments are provided with a long arm and a short arm respectively, projecting inward from their inner ends, as seen in Figs. 1 and 4. These arms are for the attachment of cross-connections, and for this purpose are slitted at their ends, as seen in Fig. 1, in which the slits are marked respectively *e* and *e′*. The cross-connection is composed of two parts, F and G, the former being a stiff bar, one end of which is tenoned to adapt it to be set in the slit of one of the projecting arms, while at the other end there is a right angled bend outward forming a short projecting arm, *f*, with a slit, *f′*, in its extremity. The other member, G, of the connection is a flat elastic strip, one end of which is bent around to form a kind of hook-shaped extremity, *g*, the end of which is left straight and flat and is adapted to be inserted in the slit, *f′*, of the bar, F, being carried around and inserted on the outer side of the arm *f*, as seen in Fig. 3. The flexible strip, G, is curved, and at its other end a short section is bent outward so as to make a straight tip, *g′*, adapted to be inserted in the slits, *e*, of the long arms, E, while the bars, F, are set in the slits of the short arms, E′, as seen in Figs. 1 and 2. This particular construction of the cross-connection permits the ready detachment of both parts of the connection from the commutator, and also permits the ready detachment of the flexible portion, G, independently of the bar, F, if desired. A similar connection may also be made with a single strip of copper, folded and bent to correspond with the straight and curved elements of the cross connection as shown above, and having its ends bent at right angles to fit into slots in the commutator arms, thus taking the place of the arms, E and E′.

Now, from the description above, it will be seen that the connection wires, *c*, *c′*, being connected to separate but adjacent segments of the commutator, are also connected respectively with a long arm, E, and a short arm, E′, which, by the cross-connections just described, are connected respectively to a short arm and a long arm on the opposite side of the commutator, to which connection wires of other coils adjacent to each other are attached, as already described, except that the relative arrangement is reversed. This results in providing two paths, and two only, for the current in the armature conductors, as will be understood from Fig. 2, in which this connection is illustrated with three sets of armature connecting wires, which are marked respectively 1, 2, 3, 4, 5, and 6. The relative connections from one side to the other of the commutator are indicated by the relative arrangement of these numerals on opposite sides in the figure, and the same construction and result are also illustrated by the diagram shown in Fig. 5.

The figures referred to in the description above illustrate a four-pole machine as indicated in Fig. 5; but the improvement is applicable to a machine of any number of pairs of poles.

In Fig. 6 a diagram is given illustrating the application of my improvement to a six-pole machine. In this case the armature coils do not, of course, reach over, or embrace, so large a portion of the armature, individually, as in a four-pole machine; but the general features of construction and connection described above are the same in this machine, as will be readily understood from an inspection of this diagram and comparison thereof with the diagram, Fig. 5.

In constructing the machine, the number of slots and coils provided for the armature may be represented by (N+1), N representing a number divisible by the number of poles, which, as shown in Fig. 5 and the preceding figures, would be four; while in Fig. 6 it would be six. Thus, for a four-pole machine the number of slots and coils would be, for instance, fifty-three, fifty-seven, sixty-one, sixty-five, sixty-nine, seventy-three, and so on; and as the commutator segments are double the number of slots and coils, as stated above, the corresponding numbers of these segments would be one hundred and six, one hundred and fourteen, one hundred and twenty-two, one hundred and thirty, one hundred and thirty-eight, one hundred and forty-six, and so on. As explained above, the cross-connections join all diametrically opposite bars, thus providing two paths for the current, as described above, and only two, and so curing the defects existing in armatures of the type mentioned above.

In a six-pole machine the number of coils and slots would be such, as fifty-five, sixty-one, sixty-seven, seventy-three, &c., and the number of commutator segments corresponding thereto would be one hundred and ten, one hundred and twenty-two, one hundred and thirty-four, one hundred and forty-six, &c. Each commutator bar in this case is connected to the one one hundred and twenty degrees in advance of it. The result is the same as mentioned above with a four-pole machine.

This improvement also secures another advantage. Each bar being connected as described, (in a four-pole machine directly with the bar diametrically opposite,) a number of sets of brushes equal to the number of field-poles of the machine may be used on the commutator to take off the current, without short-circuiting any additional coils, which is not the case in other systems of two parallels; or only two sets of brushes may be used, if this is preferred for convenience, as, for instance, on street railway motors.

Having thus described my invention, what I claim to be new, and desire to secure by Letters Patent, is—

1. In a dynamo electric machine, the combination of a slotted armature having a number of grooves which may be represented by (N+1), N being a number divisible by the number of poles, a number of coils equal to the number of slots and lying therein, a commutator having a number of bars or segments twice the number of coils, and suitable cross-connections for the segments, substantially as described.

2. In a dynamo electric machine, the combination of a slotted armature having a number of grooves which may be represented by (N+1), N being a number divisible by the number of poles, a number of symmetrical coils equal to the number of slots and lying therein, a commutator having a number of bars or segments twice the number of coils, and suitable cross-connections for the segments, substantially as described.

3. In a dynamo electric machine, the combination of a slotted armature having a number of grooves which may be represented by (N+1), N, being a number divisible by the number of poles, a number of symmetrical and interchangeable coils equal to the number of slots and lying therein, a commutator having a number of bars or segments twice the number of coils, and suitable cross-connections for the segments, substantially as described.

4. In a dynamo electric machine, the combination of a slotted armature, a number of coils equal to the number of slots and arranged therein, a commutator provided with a number of segments twice the number of coils, connection wires joining each coil with two separate independent commutator segments, and suitable cross-connections for the segments, substantially as described.

5. In a dynamo electric machine, a cross-connection for the commutator, consisting of arm, F, provided with slitted projection, *f*, and the elastic strip, G, provided with the bent tip, *g*, at one end, and straight tip, *g'*, at the other, substantially as described.

6. In a dynamo electric machine, a cross-connection for the commutator, consisting of a strip, formed as shown, having a straight member and a curved member joined at their inner ends and lying in parallel planes, displaced from each other in the direction of the axis of the armature shaft, and with the outer ends of both members joined at right angles to projections adapted to fit into slots in the commutator segments, substantially as described.

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Witnesses:
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