(No Model.) 2 Sheets—Sheet 1.

W. J. STILL.

ELECTRICAL ROTARY MOTOR.

No. 498,585. Patented May 30, 1893.

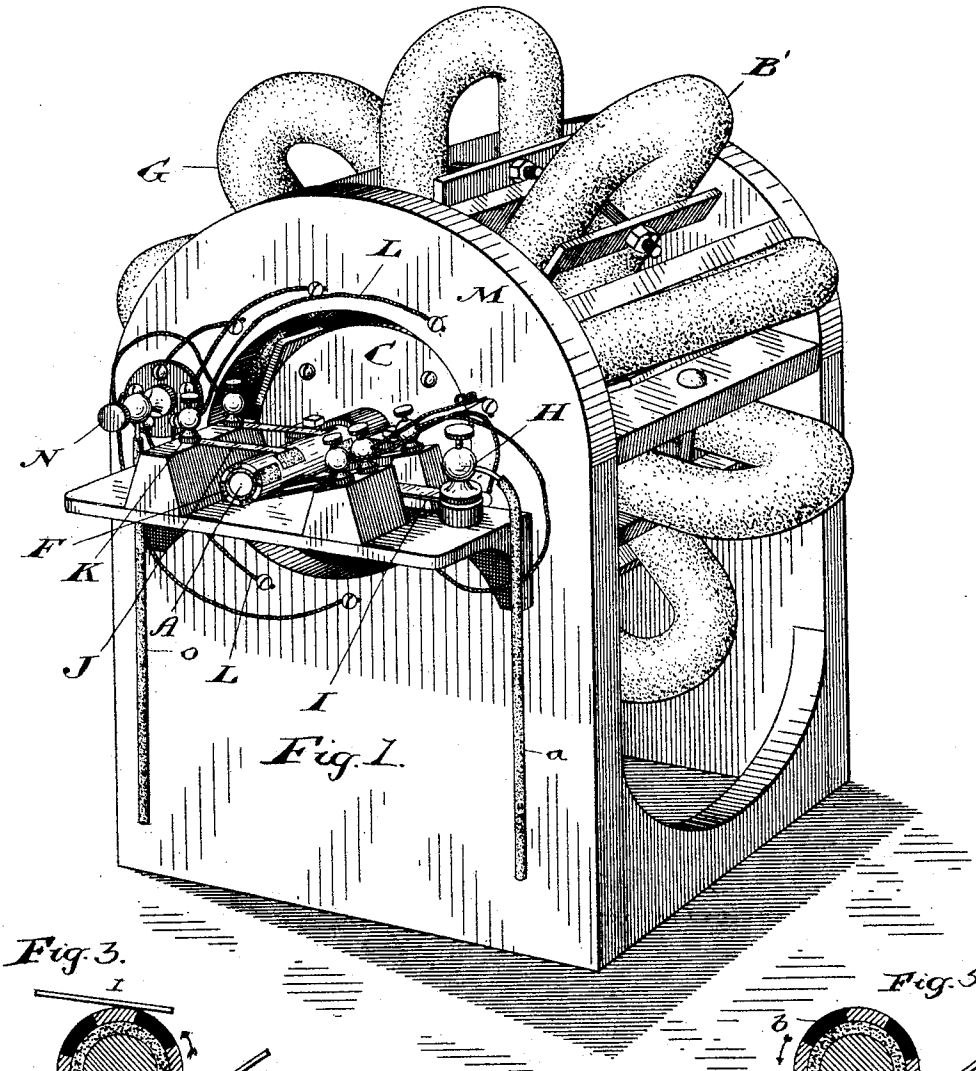

Fig. 1.

Fig. 3.

Fig. 4

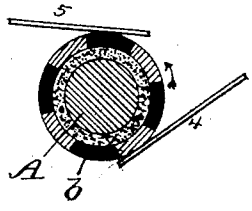

Fig. 5.

Witnesses

J. Edw. Maybee

W. G. McMillan.

Inventor

Wm. J. Still

by Donald & Ridout & Co.

Attys.

(No Model.) 2 Sheets—Sheet 2.

W. J. STILL.

ELECTRICAL ROTARY MOTOR.

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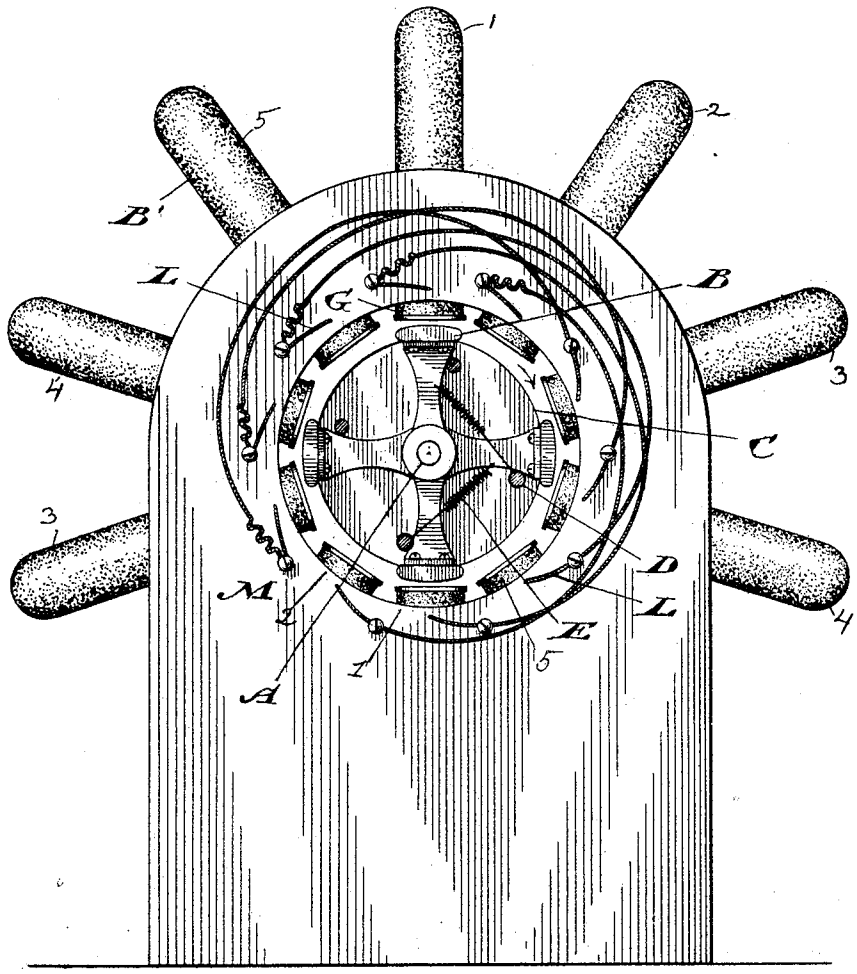

Fig. 2

Witnesses
J. Edw. Mayhew
H. G. McMillan

Inventor
Wm J. Still
by Donald & Ridout & Co.
Attys

UNITED STATES PATENT OFFICE.

WILLIAM JOSEPH STILL, OF TORONTO, CANADA.

ELECTRICAL ROTARY MOTOR.

SPECIFICATION forming part of Letters Patent No. 498,585, dated May 30, 1893.

Application filed December 28, 1891. Serial No. 416,288. (No model.) Patented in England February 9, 1892, No. 2,544; in Austria-Hungary February 19, 1892, No. 9,764 and No. 27,096; in Switzerland February 23, 1892, No. 4,653; in Norway March 3, 1892, No. 2,634; in France March 12, 1892, No. 220,088; in Belgium March 12, 1892, No. 98,760, and in Italy March 17, 1892, 31,499/15.

To all whom it may concern:

Be it known that I, WILLIAM JOSEPH STILL, of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented a certain new and Improved Electrical Rotary Motor, (for which I have obtained Letters Patent in Great Britain, No. 2,544, dated February 9, 1892; in France, No. 220,088, dated March 12, 1892; in Belgium, No. 98,760, dated March 12, 1892; in Austria-Hungary, No. 9,764 and No. 27,096, dated February 19, 1892; in Switzerland, No. 4,653, dated February 23, 1892; in Italy, No. 31,499/15, dated March 17, 1892, and in Norway, No. 2,634, dated March 3, 1892,) of which the following is a specification.

The invention relates to that class of electrical motors in which a series of armatures are connected to the driving shaft and are surrounded by a series of magnets, the magnetizing and demagnetizing of which cause the revolving of the shaft to which the armatures are connected, and the object of my present invention is to so construct the motor that any delay in the demagnetizing of the magnet after it has performed its duty shall not detain or check the revolving of the shaft, and it consists essentially in journaling the armature upon the driving shaft and connecting it thereto by means of a disk fixed to the shaft having pins projecting from it in front of each armature, a spring or springs being arranged to hold the armature against its pin in such a manner that should the demagnetizing of the magnet be momentarily delayed, the detaining of its armature will not check the revolving of the shaft on which the armature is journaled.

Figure 1, is a perspective view of the side of the motor on which the commutator is located. Fig. 2, is an elevation of the opposite side of the motor. Figs. 3, 4, and 5 are detail sectional views of the commutator and shaft showing the brushes 1 to 5 inclusive which are in electrical connection with the wires of the respective pairs of field magnets and the commutator sections, illustrating the relative disposition of the said brushes and the respective commutator sections at the same instant.

In the drawings A, represents the driving shaft, and B, the armatures which, as indicated, are four in number, arranged on a spider journaled upon the shaft A.

C, is a disk fixed to the shaft A, and having four pins D, projecting from it, one before each armature B. Each armature B, may be provided with a spring E, or a single spring might be arranged to accomplish the desired purpose, which is to hold each armature B, against its particular pin D.

F, is a commutator which is fixed to the shaft A.

The magnets G, arranged around the armatures B, are held in a suitably constructed frame, as indicated, and in number should not be less than ten for four armatures and are arranged in pairs in connection with the commutator F, as hereinafter described, in such a manner that one pair of magnets shall be fully magnetized, two pairs fully demagnetized, one pair in process of being magnetized and one pair in process of being demagnetized, which proportion I find gives the best results. As all the magnets G, are connected to the commutator in the same manner, it will only be necessary for the purpose of this specification to explain how one pair is connected.

On reference to Fig. 1, it will be seen that the current enters the motor through the north terminal *a*, which connects with the binding post H, from which binding post the brush I, projects to the commutator F. There being ten magnets arranged in pairs, there are necessarily five brushes J, each projecting to the commutator from its respective binding post.

As I propose to explain the connection of only one pair of magnets, I only letter one of the binding posts K, from which binding post the wire L, extends to a point in the frame M, opposite to the magnet marked B′, with one leg of which magnet the said wire L, connects. On reference to Fig. 2, it will be seen that this wire L, passes through the opposite side of the frame M, and is continued around the frame to the magnet opposite to B′, and connected to one of its legs, so that the current shall pass through the said magnet and again pass through the frame M, by the wire L, to the

binding post N, of the south terminal *o*, thus completing the circuit. Each of the magnets is independently connected to the commutator in exactly the same way as the magnet B' and its mate and the commutator is constructed so that in succession each pair of magnets shall be magnetized at the same time that two pairs are demagnetized, one pair in the act of being magnetized and one pair in the act of being demagnetized, and owing to the manner in which the armatures are connected to the driving shaft A, which will be more fully set forth hereinafter any delay or hesitation in the demagnetizing immediately after they have performed their work when magnetized, (which delay of course would be very slight,) will not check in the slightest degree the free rotation of the shaft A.

I speak of the armatures as being constructed in the form of a spider, but of course it will be understood that this construction is not obligatory, as they may be made in any form and arranged in any manner so long as they are loose upon the shaft A, and are connected so that they will operate in the manner already described. I also wish to disclaim any intention of confining myself to the arrangement of the pins D, on the disk C, as any means by which the armatures may be connected so that they may move freely in one direction and their motion arrested if moved in the opposite direction, will answer the purpose of my invention. Of course it will be understood that the magnets might be connected to the shaft in the manner described and the armatures arranged around to take the place of the magnets. I therefore wish it to be understood that the claims are intended to include the transposing of these elements.

For the sake of clearness in describing the operation of the machine, the pairs of magnets will be designated by the numerals 1 to 5 inclusive and the brushes connected with each pair will be designated by a corresponding numeral. Hence, on reference to Figs. 3, 4 and 5 it will be seen that the pair of magnets No. 1 are in process of being demagnetized; No. 2 in process of being magnetized; No. 3 fully demagnetized; No. 4 fully magnetized; and No. 5 fully demagnetized.

The brushes and the commutator sections are so disposed as to preserve the relationship between the magnets just described thereby effecting a continuous rotary motion of the armature and shaft.

The commutator F consists of a tube of brass insulated by a tube of vulcanite C from the shaft A, with which it revolves. The main brush I is in contact with a continuous section of the tube, but the brushes J, connected with the magnets make contact with sections of the tube which are broken by non conducting parts *b*. Consequently the course of the current is through the main brush I, through the tube of the commutator, through any brush that may be in contact with a section of the tube and so through the magnets connected thereto. The conducting and non conducting sections are arranged to make the connections in the order hereinbefore described. The details of the commutator show the position of the non conducting pieces in each of the three sections in relation to the brushes which are numbered to correspond with their magnets.

When the armatures are in the position shown in Fig. 2, No. 4 pair of magnets are attracting one pair of armatures and the other pair are exactly opposite No. 1 pair of magnets which are being demagnetized. Now it takes an appreciable time for the magnetism to fully leave them and the tendency is to check the revolution of that pair of armatures. Owing, however, to the method in which the armatures are connected to the shaft, the shaft is free to revolve without check, leaving the armature slightly behind till the magnets are entirely demagnetized when the spring again draws the armatures against the pins D. This action goes on constantly alternating between each pair of armatures as they come into a position similar to that shown. It will be observed that the load is carried by the positive connection effected between the shaft and the armature by means of the pins or stops D which extend across the path of the arms which carry the armatures, the spring or yielding connection E simply serving to keep the said arms and stops in contact under normal conditions and yielding, only, when the armature is delayed by reason of the magnets not wholly demagnetizing the instant the current is shifted.

The relation between the number of magnets and the number of armatures plays an important factor in the successful operation of the machine as it enables a pair of the armatures being under the influence of a pair of magnets at all times and obviates a dead center and results in the utilizing of the forces to the best possible advantage.

What I claim as my invention is—

1. In an electric rotary motor, the combination with the shaft, and the magnets disposed in a circle about the shaft, and adapted to be magnetized and demagnetized, of an armature mounted on the shaft and adapted to turn loosely thereon within certain limits, a positive connection between the said shaft and the armature to take the load and cause the shaft and the armature to revolve together, and a yielding connection permitting a momentary delay in the rotation of the armature by reason of the magnet not instantly demagnetizing without checking the speed of the shaft, and constructed to cause the said armature to regain itself and come in contact with a stop after being released from the delaying influence of the said magnet, substantially as and for the purpose described.

2. In an electric rotary motor, the combination with the shaft and the magnets disposed in a circle about the shaft, and adapted

to be magnetized and demagnetized, of an armature mounted on the shaft and turning loosely thereon within certain limits, a stop carried by the shaft and engaging with the armature to cause the shaft and the armature to revolve together and take the load, and a spring which keeps the armature and the stop in positive engagement under normal conditions, and permits the armature delaying without checking the speed of the shaft should the demagnetizing of the magnet be momentarily delayed, and adapted to cause the said armature to regain its lost motion after being released from the influence of the magnet which delayed its speed, substantially as specified.

3. In an electric rotary motor, the combination of a shaft, a series of ten magnets disposed in a circle around said shaft, and having the diametric oppositely disposed magnets connected in pairs, an armature, comprising four elements which are arranged equi distant about and mounted on the said shaft to turn loosely thereon within certain limits, a positive connection between the said shaft and the armature to take the load and cause the shaft and the armature to revolve together, a yielding connection to permit a momentary delay in the rotation of the armature by reason of the magnet not instantly demagnetizing, without checking the speed of the shaft, and constructed to cause the said armature to regain itself after being released from the delaying influence of the said magnet, a commutator, consisting of a tube having a continuous section, and three sections which are interrupted by non conducting portions, and brushes connected with the said magnets, and with the poles for supplying the current, whereby when the parts assume the position herein specified, the pair of magnets 1 are in process of being demagnetized, 2 in process of being magnetized, 3 fully magnetized, 4 fully magnetized, and 5 fully demagnetized, substantially as specified.

Toronto, December 19, 1891.

WILLIAM JOSEPH STILL.

In presence of—
DONALD C. RIDOUT,
F. R. CAMERON.