(No Model.) 2 Sheets—Sheet 1.

J. RIDDELL.

MACHINE FOR WINDING ARMATURE COILS.

No. 532,821 Patented Jan. 22, 1895.

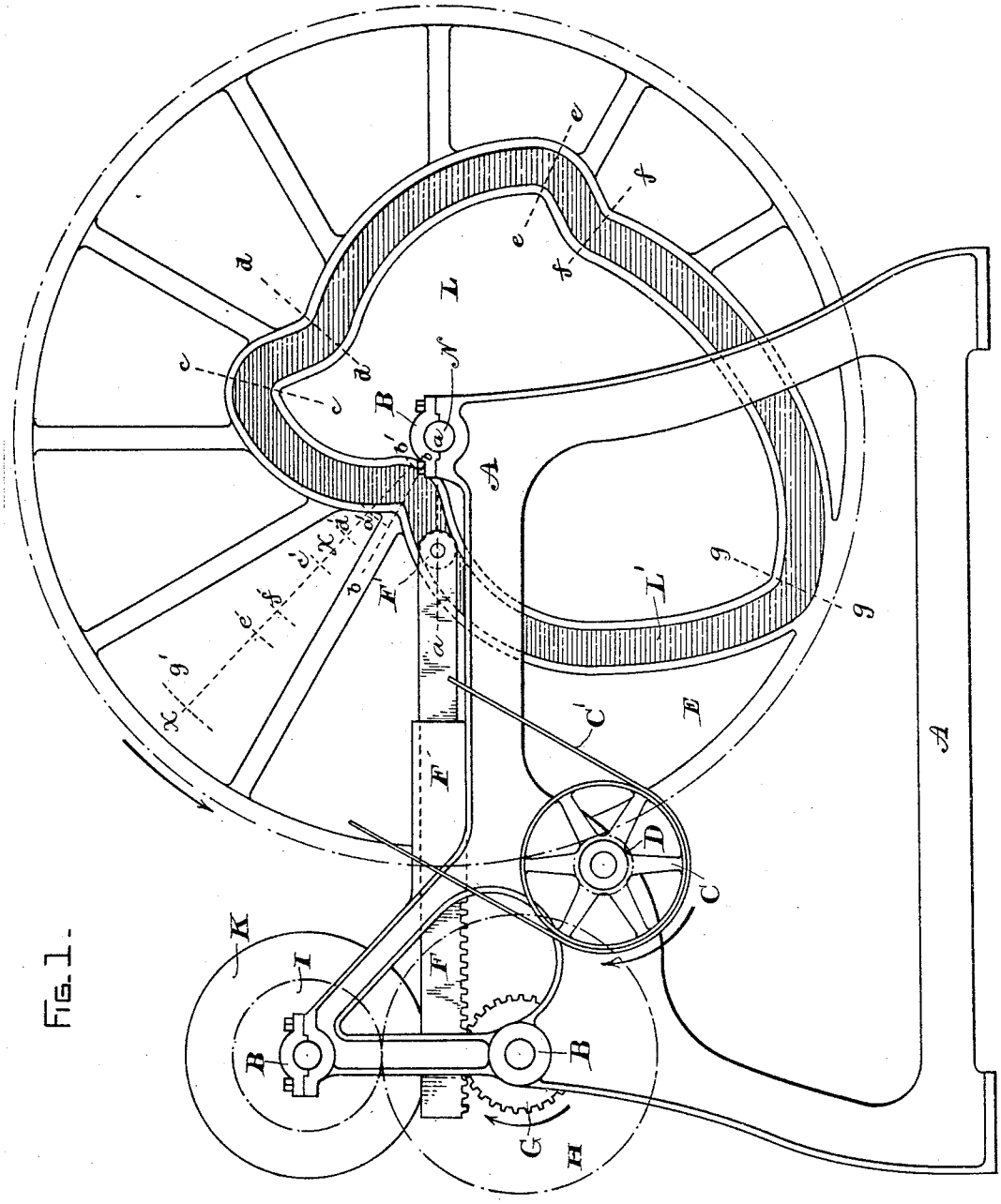

FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

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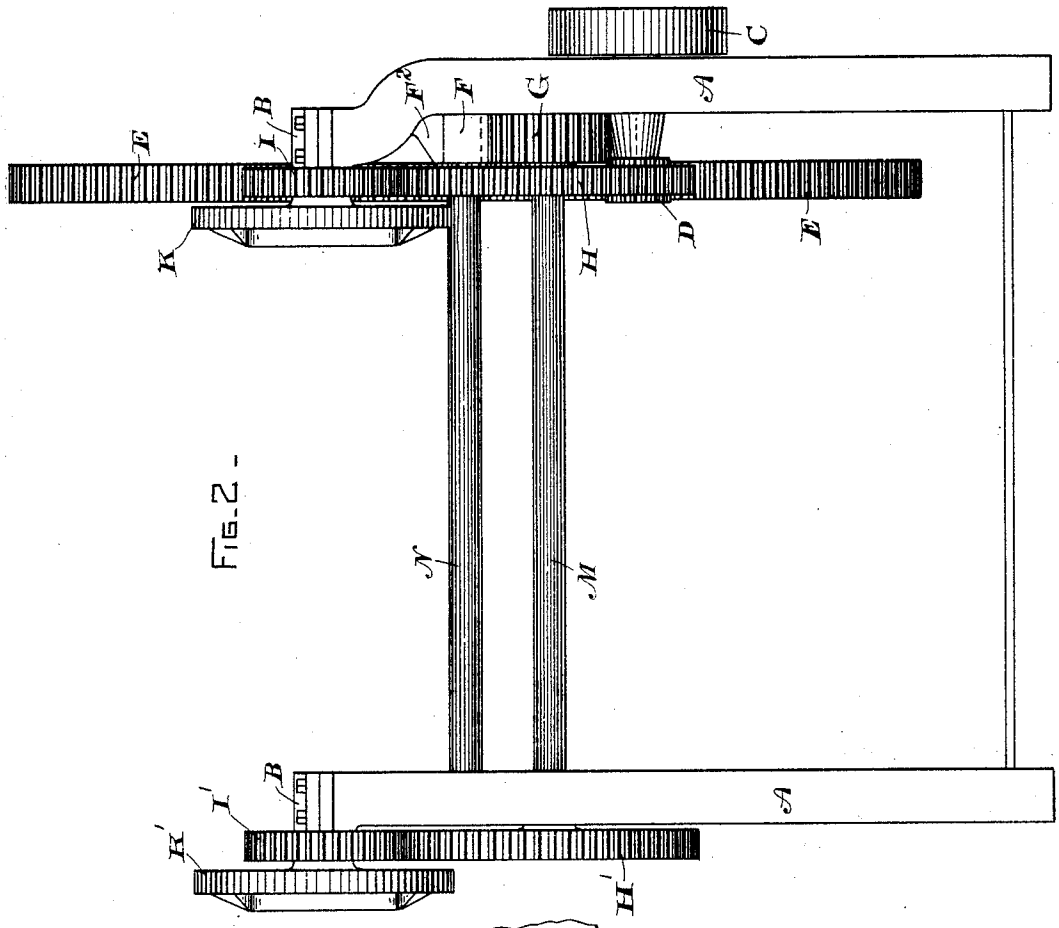

FIG. 2.

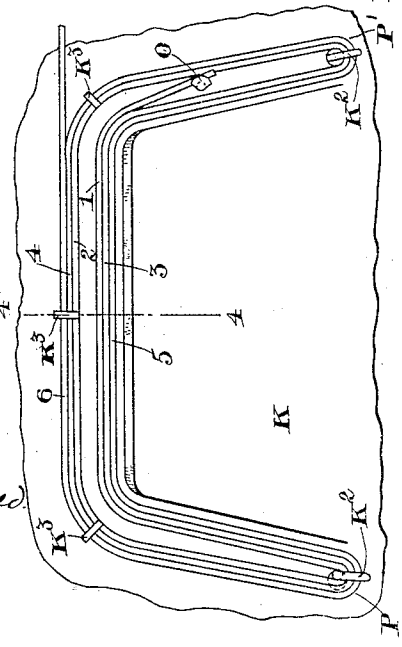

FIG. 3.

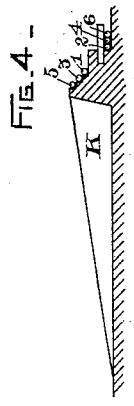

FIG. 4.

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UNITED STATES PATENT OFFICE.

JOHN RIDDELL, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF BOSTON, MASSACHUSETTS.

MACHINE FOR WINDING ARMATURE-COILS.

SPECIFICATION forming part of Letters Patent No. 532,821, dated January 22, 1895.

Application filed October 19, 1894. Serial No. 526,375. (No model.)

To all whom it may concern:

Be it known that I, JOHN RIDDELL, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented a new and useful Machine for Winding Armature-Coils, set forth in the accompanying specification.

My invention consists in an improved machine for winding armature coils by which they may be wound with both of the terminals upon the outside of the coil, as hereinafter set forth and claimed.

The problem of winding armature coils by machinery has been met by a number of solutions none of which is entirely satisfactory, although all are improvements upon hand winding in many respects. Nearly all of these improvements are of limited application and have particular reference only to some one coil which they are capable of winding, and for many other coils the process of hand winding is still the only one available. One of the forms of coil of which this is particularly true is that now nearly always used in the better class of motors, such as motors for railway work in which toothed armatures are employed, and in which the coils are arranged to be laid upon the armature body, being wound before the armature is assembled and not wound in place, as in older forms. These coils have a number of bends in their length, and are of peculiar shape, rendering it difficult to apply machinery to their construction. They have therefore generally been wound upon forms by hand, and are more expensive than if wound by machinery, at the same time not getting that absolute interchangeability which is so desirable in all apparatus.

To obviate some of the difficulties of the hand winding method, and to a great degree its expense, I have devised the following described improved machine. In the operation of this machine the winding of the coil is begun upon the inside as applied to the form, and the coil is then opened so that the end at which the winding was begun is brought at the outside of the coil, thus bringing both of the terminals upon the outside. The machine consists of a large gear wheel carrying a cam driven by any suitable power, the cam being arranged to cause the reciprocation of a rack meshing with a pinion, the pinion driving a wheel carrying the form and causing the form to have a peculiar reciprocating motion better described hereinafter. Between the rack and the form I may interpose gearing or not at will, but I prefer to do so inasmuch as it enables me to make the cam of smaller size and to reduce the cost of the machine. The peculiar feature of the cam is that it first causes a partial rotation of the form, then a rotation in the opposite direction of greater extent than the first, then another partial rotation and then a rotation in the opposite direction again, and so on, this being the arrangement for a machine winding a so-called "three-turn" coil, though by alterations in the cam a four-turn coil may be wound if desired, it only being necessary to add to the length of the cam in a way which would be understood by those skilled in the art.

The accompaning drawings show a machine embodying my invention.

Figure 1 is a side elevation looking to the left in Fig. 2, Fig. 2 being an end elevation looking to the right in Fig. 1, Fig. 3 being an enlarged view of the coil when completed in place on the form, and Fig. 4 being a section upon the line 4—4 of Fig. 3, through the form, showing the wires of the coil in place.

In Fig. 1 A is a suitable frame for the machine. B, B, &c., are bearings for the various wheels which are arranged in the usual manner. C is a pulley actuating the apparatus, and C′ the belt. Upon the pulley C is a pinion D driving the main gear wheel E of the apparatus. This gear wheel E carries a cam L, more fully described hereinafter, actuating a rack F in a bearing F^2 in the frame, by means of the cam roller F′ traveling in the groove L′ of the cam. The rack F meshes with the pinion G upon the gear wheel H and this in turn meshes with the gear I upon the face plate K, carrying the form upon which the coil is wound.

The same parts are shown in Fig. 2, with the additional parts, M, which is a shaft fixed to the wheel H and upon the end of which a second wheel similar to the wheel H, and marked H′, is carried meshing with a second pinion I′ driving another former plate K′,

similar to the plate K. N is a shaft on which is mounted the wheel E, and which also forms a support for the frame of the machine. It is manifest that this duplication of parts may be extended as far as desired, the shaft M running through any number of wheels H or driving any convenient number of forms, so that one cam and gear wheel E will be sufficient to give motion to all of them, the number being only limited by the number of operators who can conveniently work together. By preference I give the wheel only a moderate speed of rotation, so that necessary attention may be given to the winding of the coils.

Referring again to Fig. 1, the cam L is of peculiar construction. It is, as indicated, a return cam, that is to say, one adapted to actuate the cam roller F′ in either direction at will. It is divided in the drawings into a number of parts by dotted lines *a*—*a*, *b*—*b*, *c*—*c*, &c., and an inspection of its contour will show that it first draws the rack F by means of the roller F′ toward the center of the large wheel carrying the cam. This gives an initial rotation to the wheel G in the direction of the arrow, (the arrows upon the belt and upon the large wheel E indicating the direction of their constant rotation, while the motion of the wheel H is a reciprocating rotation or rotary reciprocation.) The gearing between the rack and pinion and between the wheel H and the pinion I is such as to give to the plate K carrying the form on which the coil is wound a half rotation. This first part of the rotation, it will be seen by inspecting the wheel E, and the construction of the cam, is very slow, inasmuch as the motion is very near the center of the wheel, and this gives the operator time to get the wire properly adjusted to begin the coil and saves the necessity for stopping the wheel to perform this part of the operation. By this time the cam roller will be at the dotted line *b*—*b*, and the next part of its motion, as will be seen, is away from the center until the part of the cam at the dotted line *c*—*c* takes the position of the dotted line *a*—*a*, as shown in the drawings, in which case the cam roller will have been forced away from the center by its travel in the cam to such a distance as to cause the plate K to rotate one and one-half times, but in the opposite direction to its former rotation. Continuing the rotation, the dotted line *d*—*d* is brought to a horizontal position and in this case the path of the cam roller F′ will be again toward the center of the wheel, rotating the plate K a half turn in its original direction of rotation. Between *d*—*d* and *e*—*e* the path of the cam roller is again away from the center, and the rotation is one and one-half times again, and so between the lines *e*—*e* and *f*—*f*, it is one-half a turn, and from *f*—*f* to *g*—*g* it is about three-quarters of a turn. Upon the line *x*—*x* the reference letters *a′* to *g′* inclusive show the distances from the center to which the cam roller F′ is brought successively, it being first at the point *a′*, then passing directly to the position *b′* nearest the center. It then passes to *c′* and then comes back on its track to *d′* whence it goes to *e′* and then comes back again to *f′* and then goes to *g′*, as already indicated on the cam. These movements are so proportioned as to cause the proper rotation of the plate K, as already indicated.

Referring now to Fig. 3, I show the form upon which the coil is wound, and by reference to Figs. 3 and 4, the order of the winding will be apparent.

Fig. 4 shows in section the arrangement of the form which is disclosed in Fig. 3, a platen or form in the shape of a trapezium with one side missing being provided with ways for the reception of the coil as it is wound, and with clips for retaining it in place until the completion of the winding, when these clips may be moved so as to release the wires. The wire is supposed to come toward the form from the left of the figure and to be provided with any suitable tension device such as is commonly employed in such operations. The end of the wire is first secured under the clip or clamp O, and the wire No. 1 is first wound until it reaches the point P. At this point the motion of the form is reversed, and the wire is brought back upon its track but upon the other part of the form, wire No. 1 passing from the clip O to the point P, wire No. 2 passing upon the other part of the form back again to the point P′. Then wire No. 3 is wound upon the first half of the form parallel to No. 1 as far as point P, then wire No. 4 on the second half, then wire No. 5 on the first, and lastly wire No. 6 upon the second half of the form, the order of the wire being best shown in Fig. 4. The coil is then taken from the form by turning the keys or clips K^3 into alignment with the central part, and slipped out from the clips K^3 and properly tapped or insulated in the ordinary way. As will be seen, wire No. 1 upon the inside of the coil will be upon the outside of the coil when the inner part thereof is brought toward the operator from the position shown in the figure, and the coil then becomes one of the ordinary six sided coils now well known in the art.

It is manifest that coils of other numbers of turns may be readily made, as already suggested, by an extension of the same principle, but in such a case it will be necessary to construct a separate cam for each number of wires in the coil. This however can readily be done in a machine of substantially the present construction, and any such formal variation I aim to embrace in the claims. It is also manifest that the part of the cam between the dotted lines *a*—*a* and *g*—*g* is only a pathway for the cam roller F′, serving to return it to its original position. During this part of the traverse it is quite possible for the operator of ordinary skill to remove the coil from the machine without stopping it, and to secure a new wire in its place ready to wind

the new coil as soon as the cam roller F′ reaches its original position.

Many details of the machine might be altered without departing from the invention, but all such mere variations I aim to embrace in the claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a machine for winding coils for dynamo-electric machines, a frame, a wheel rotating in the frame and carrying a cam, a plate carrying a form upon which the coil is to be wound, an intermediate mechanism between the wheel and the form-carrying plate, such intermediate mechanism adapted, in cooperation with the cam, to cause the form-carrying plate to rotate to a greater extent in one direction than in the other.

2. In a machine of the class described, a frame, a gear wheel rotating in the frame and carrying a cam, a rack reciprocated toward and away from the center of the cam-carrying wheel by the rotation of the cam, a plate carrying a form upon which the coil is to be wound, and gearing operated by the rack and adapted to rotate the form to a certain extent in one direction, then to a greater extent in the other direction, and to repeat the motions as desired.

3. In a machine of the class described, a frame, a cam carried by a gear-wheel rotating in the frame, a rack reciprocated by the cam, a form-carrying plate, and gearing between the rack and the form-carrying plate; the cam being composed of a series of shorter and longer portions alternating in position and at a greater or less distance from the center of the wheel carrying it, the shorter portions being adapted to draw the rack toward the center of the wheel, and the longer portions being adapted to move it away from such center, substantially as described.

4. In combination, a frame, a gear wheel rotating in the frame and carrying a cam, a rack reciprocated by the cam, form-carrying plates rotating in the frame, and gearing interposed between the rack and the form-carrying plates; whereby the reciprocation of the rack by the cam gives a simultaneous rotary reciprocation to all of the form-carrying plates.

In witness whereof I have hereunto set my hand this 12th day of October, 1894.

JOHN RIDDELL.

Witnesses:
B. B. HULL,
A. F. MACDONALD.