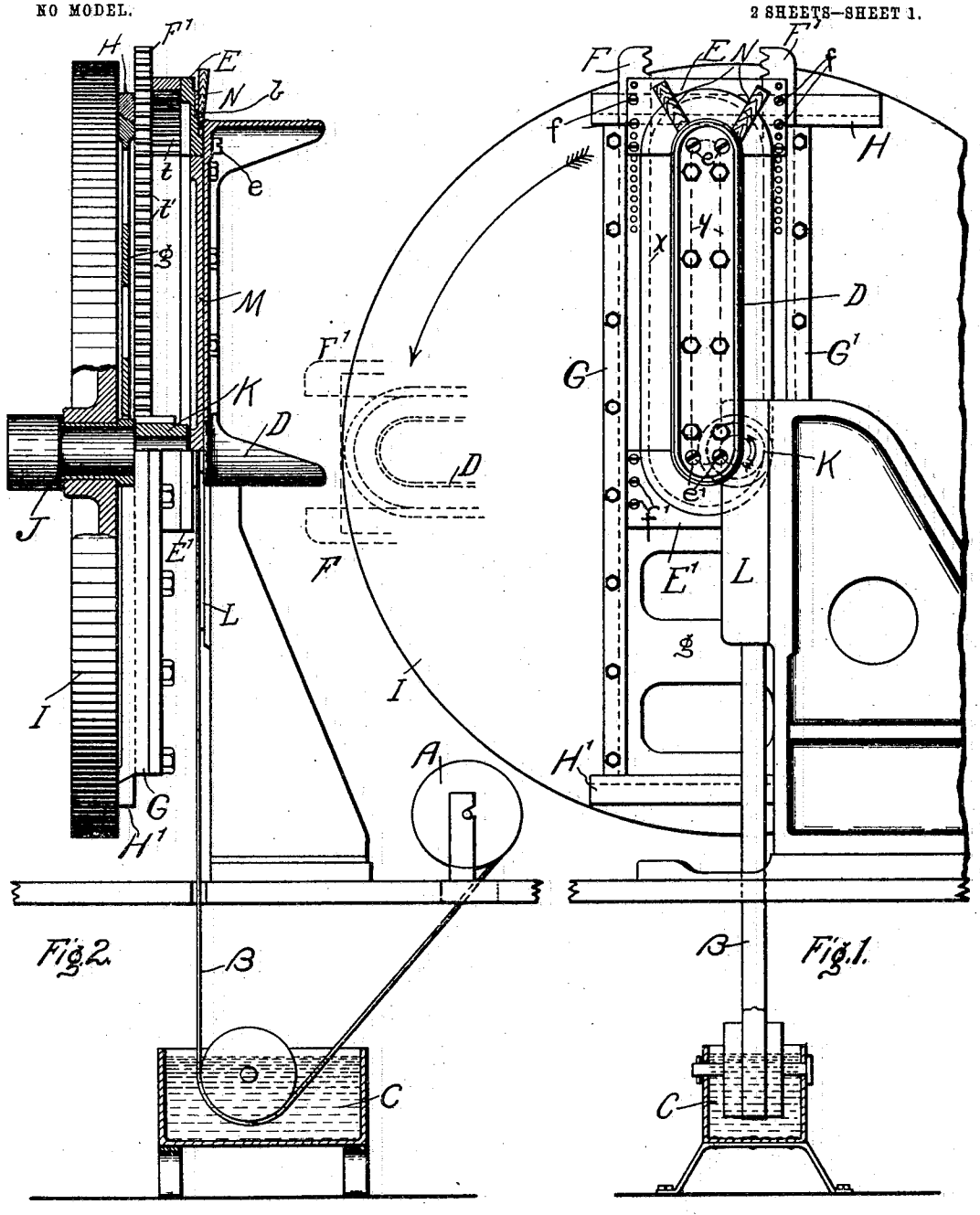
No. 766,370. PATENTED AUG. 2, 1904.

J. F. MIDDLETON.

WINDING MACHINE.

APPLICATION FILED MAY 8, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



WITNESSES:

L. A. Hawkins

Wm. H. Jones.

INVENTOR.

James F. Middleton.

BY Richard Lyon

ATTORNEY.

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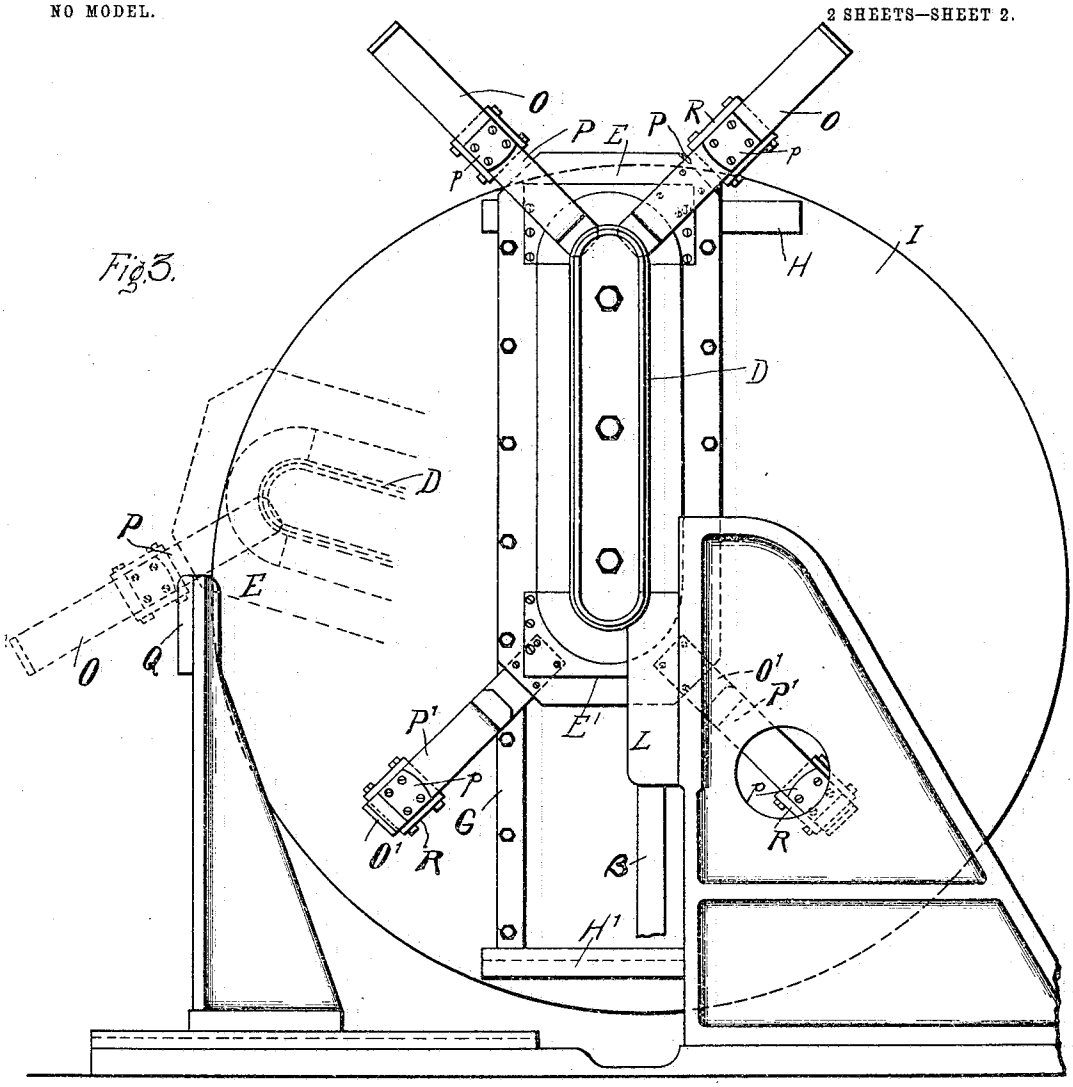
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APPLICATION FILED MAY 8, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.



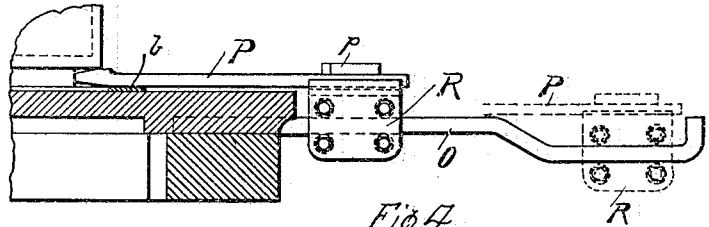


Fig. 4.

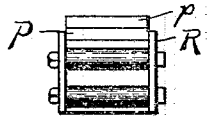


Fig. 5.

WITNESSES:

L. S. Hawkins

Wm. H. Jones

INVENTOR.

James F. Middleton.

BY Richard Lyon

ATTORNEY.

No. 766,370. Patented August 2, 1904.

UNITED STATES PATENT OFFICE.

JAMES F. MIDDLETON, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO STANLEY ELECTRIC MANUFACTURING COMPANY, OF PITTSFIELD, MASSACHUSETTS, A CORPORATION OF NEW JERSEY.

WINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 766,370, dated August 2, 1904.

Application filed May 8, 1903. Serial No. 156,213. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. MIDDLETON, a citizen of the United States, and a resident of Pittsfield, Massachusetts, have invented certain new and useful Improvements in Winding-Machines, of which the following is a specification.

My invention relates to machines for winding metal strip into coils. In many cases it is desirable that coils should be formed of metal strip wound on edge, since this arrangement produces a compact and solid coil and one that radiates heat more readily than a coil formed of several flat layers separated by insulation. Such coils are especially advantageous for the field-coils of large dynamo-electric machines and for other purposes where large current-carrying capacity is desired. The objection to the use of such coils is the difficulty that has been found heretofore in winding strip of large cross-section on edge.

The object of my invention is to provide means for winding such coils which shall be quick and economical in operation, which shall produce an even and regular winding, which shall prevent the strip from bending out of its proper plane due to the strains arising in winding on edge, and which shall wind coils of widely-varying shape and size.

Referring to the drawings, Figure 1 shows a front elevation of a machine embodying my invention. Fig. 2 shows a side view of the same partly in cross-section. Fig. 3 shows a front elevation of another form of my invention, and Figs. 4 and 5 show certain details of the form seen in Fig. 3.

Referring especially to Figs. 1 and 2, A represents a spool or bobbin of copper strip mounted so as to be free to revolve as the strip B is drawn off from it. C is an oil-tank, through which strip B is passed in order to cover it with a film of oil for purposes of lubrication and of more readily dissipating the heat generated by the strain of winding. D is a coil-form of the dimensions desired for the inner face of the coil and is bolted to the plates E E′ by bolts *e e′*. Plates E E′ are adjustably bolted to rods F F′ by bolts *f f′*. Plates E E′ have a semicircular inner face and carry gear-teeth *t* thereon, and rods F F′ carry gear-racks *t′* on their inner faces, forming, with the gear-teeth on plates E E′, a continuous oblong gear-rack, (indicated by dotted line *x* in Fig. 1,) the ends of the oblong rack, however, not being in the same vertical plane with the sides. Rods F F′ are adapted to move longitudinally in guides G G′, which are connected by web *g* and which are adapted to move laterally in guides H H′. Guides H H′ are secured fast to face-plate I, which is loosely mounted on shaft J. Secured to shaft J is the gear K, which is adapted to mesh with the gears on plates E E′ and the racks on rods F F′, or, in other words, with the oblong rack. L is a stop adapted to bear against the groove between form D and plates E E′ and against plate M, carried by form D. The bearing-surface for stop L is indicated by dotted line *y* in Fig. 1.

Leaving strip B out of consideration for the moment, the operation is as follows: Suppose the parts of the machine to be in the positions shown in Figs. 1 and 2 and suppose gear K to be turning in the direction indicated by the small arrow in Fig. 1. At this point gear K is just beginning to mesh with the semicircular gear on the inside of plate E′. Since stop L prevents any movement of form D and its supporting parts to the right in Fig. 1, it is evident that the rotation of gear K will produce a rotation of the oblong rack formed by plates E E′ and rods F F′. The oblong rack can rotate only by turning face-plate I. Hence face-plate I turns in the direction of the large arrow, carrying the oblong rack and form bodily with it. As face-plate I turns and gear K moves across plate E′ it is evident that rods F F′ must move laterally relatively to face-plate I, since face-plate I is concentric with gear K, while there is relative motion between rods F F′ and gear K, (laterally to rods F F′.) It is to secure this lateral

motion of rods F F′ and form D relative to face-plate I that guides G G′ are made movable in guides H H′.

The position of the form D and the oblong rack when face-plate I has turned ninety degrees is shown in dotted lines in Fig. 1. Face-plate I continues to turn until it has turned one hundred and eighty degrees, and the form D and the oblong rack are again vertical, but at the bottom of the face-plate instead of at the top, as in the original position as shown in Fig. 1. At this point stop L comes in contact with the flat side of bearing-surface *y* and the rotation of face-plate I is stopped. At this point also gear K leaves plate E′ and meshes with the rack on rod F—*i. e*, with the flat side of the oblong rack. Hence it is obvious that while face-plate I remains stationary rods F F′ move upward in guides G G′ until they reach the height shown in Fig. 1. At this point gear K meshes with plate E, which is now at the bottom of the form, and the cycle is repeated, making another half-revolution of the face-plate and restoring all parts to their original positions. (Shown in Fig. 1.)

It is evident from the foregoing that if the copper strip is held edgewise on the form it will be wound into a coil corresponding in internal dimensions to the form, one turn of the coil being produced by every revolution of the face-plate. To prevent the strip from bending out of its own plane by the strain of winding wedges N, of hard wood or other suitable material, may be driven into the groove between form D and plates E E′, thus holding the strip B pressed flat, as indicated at *b*, Figs. 1 and 2. The wedges should be driven in before the form reaches the position shown in Fig. 1, and should be knocked out after the form has passed the position shown in dotted lines. When wedges N are knocked out, the strip springs out onto form D, which holds the coil-turns until the coil is all wound.

In order to do away with the manual labor involved in driving in and knocking out the wedges, the automatic device shown in Fig. 3 may be used. O O and O′ O′ are four arms carried by plate E E′, on which slide automatic wedges P P and P′ P′, operated by gravity. When the arms are in the positions shown at O O, the wedges slide down and hold the copper strip fast. As face-plate I revolves and the arms reach the position shown in dotted lines, the wedges strike stop Q, are knocked out of engagement with the copper strip, and fall to the outer end of the arms by gravity, as shown at P′ P′.

Fig. 4 shows an enlarged detail view of one of the arms and wedges. The wedge P is supported on a roller-carriage R, which runs freely on arm O. The position of the wedge P when engaging the strip at *b* is shown in full lines and its position when at the outer end of arm O is in dotted lines. The outer end of arm O is bent back, as shown, in order to clear strip B in revolving. *p* is the projecting part of wedge P, which strikes stop Q. (Shown in Fig. 3.)

Fig. 5 shows an end view of roller-carriage R.

Since plates E E′ are adjustable on rods F F′, it is obvious that the size of the coil may be varied by adjusting the relative position of plates E E′ and substituting another form of the proper dimensions. Furthermore, it is evident that the machine is not limited to the particular shape of coil here shown, since the shape of the coil, as well as its size, is dependent upon the dimensions of the form. Hence by the use of different forms coils of widely-differing shape and size may be wound on this machine with equal facility.

I do not desire to limit myself to the particular construction and arrangement of parts here shown, since changes therein which do not depart from the spirit of my invention and which are within the scope of the appended claims will be obvious to those skilled in the art.

Having thus fully described my invention, I claim as new and desire to protect by Letters Patent—

1. In a winding-machine, a continuous rack formed of relatively adjustable parts, a gear adapted to drive said rack, and means for maintaining said rack in engagement with said gear.

2. In a winding-machine, a continuous gear-rack, a coil-former carried by said rack, a gear adapted to drive said rack, and means for maintaining said rack in engagement with said gear.

3. In a winding-machine, a shaft, a face-plate loosely mounted thereon, a continuous gear-rack carried by said face-plate, means for permitting lateral and longitudinal motion of said rack relative to said face-plate, a gear secured to said shaft and adapted to mesh with said rack, and means for maintaining said rack in engagement with said gear.

4. In a winding-machine, a shaft, a face-plate loosely mounted thereon, a continuous rack formed of relatively adjustable parts carried by said face-plate, means for permitting lateral and longitudinal motion of said rack relative to said face-plate, a coil-former carried by said rack, a gear secured to said shaft and adapted to mesh with said rack, and means for maintaining said rack in engagement with said gear.

5. In a winding-machine, a continuous gear-rack, a gear adapted to drive said rack, and a stop adapted to prevent rotation of said rack in certain positions thereof.

6. In a winding-machine, a continuous rack formed of relatively adjustable parts, a gear adapted to drive said rack, and a stop adapted

to prevent rotation of said rack in certain positions thereof and to maintain said rack at all times in engagement with said gear.

7. In a machine for winding metal strip, a continuous gear-rack, a coil-former carried thereby, a gear adapted to drive said rack, and means for holding the metal strip in a plane perpendicular to the surface of said former.

8. In a machine for winding metal strip, a continuous rack formed of relatively adjustable parts, a coil-former carried thereby, a gear adapted to drive said rack, means for maintaining said rack in engagement with said gear, and means for holding the metal strip in a plane perpendicular to the surface of said coil-former.

9. In a machine for winding metal strip, a continuous gear-rack, a coil-former carried thereby, a gear adapted to drive said rack, and means for automatically holding said metal strip in a plane perpendicular to the surface of said former during part of a revolution of said former and then releasing the metal strip.

10. In a machine for winding metal strip, a rotatable coil-former, and a series of gravity-operated wedges rotatable with said former and adapted to engage the metal strip and to hold it in a plane in which said former revolves.

11. In a machine for winding metal strip, a rotatable coil-former, and a series of devices adapted to be actuated by the rotation of the said former to serially engage the metal strip and to hold it in a plane in which said former revolves.

12. In a machine for winding metal strip, a rotatable coil-former, and a series of wedges adapted to be actuated by the rotation of said former to serially engage and disengage the metal strip.

13. In a winding-machine, a continuous rack formed of relatively adjustable parts, a gear adapted to drive said rack, and a coil-former carried by said rack.

14. In a winding-machine, a shaft, a face-plate loosely mounted thereon, a continuous rack carried by said face-plate and capable of lateral and longitudinal movement relative thereto, a gear secured to said shaft and adapted to drive said rack, and means for preventing rotation of said rack in certain positions thereof.

15. In a winding-machine, a continuous gear-rack, a gear adapted to drive said rack, a coil-former carried by said rack, and a series of devices actuated by the rotation of said rack and adapted to serially coact with said former.

Signed at Pittsfield, Massachusetts, this 2d day of May, 1903.

JAMES F. MIDDLETON.

Witnesses:

L. S. HAWKINS,

R. E. HAYNES.