

1,061,947.

Patented May 13, 1913.
3 SHEETS—SHEET 1.

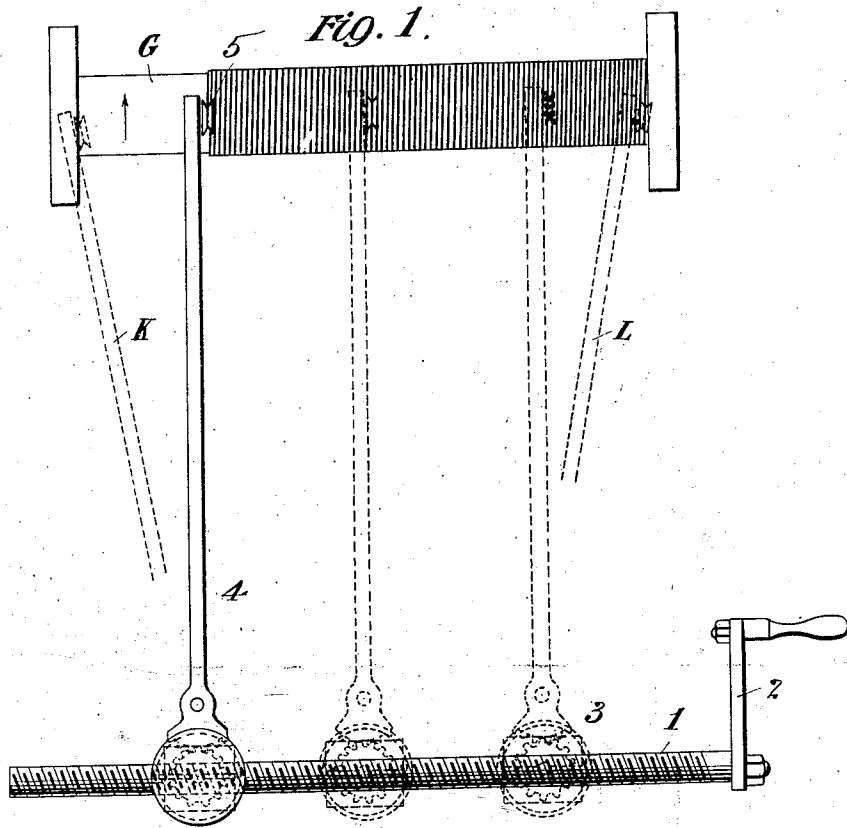
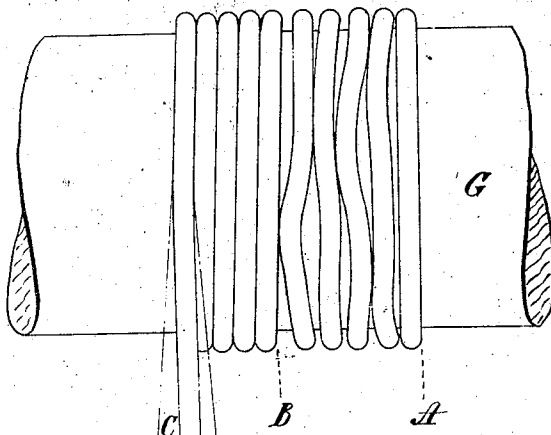


Fig. 2.



Witnesses

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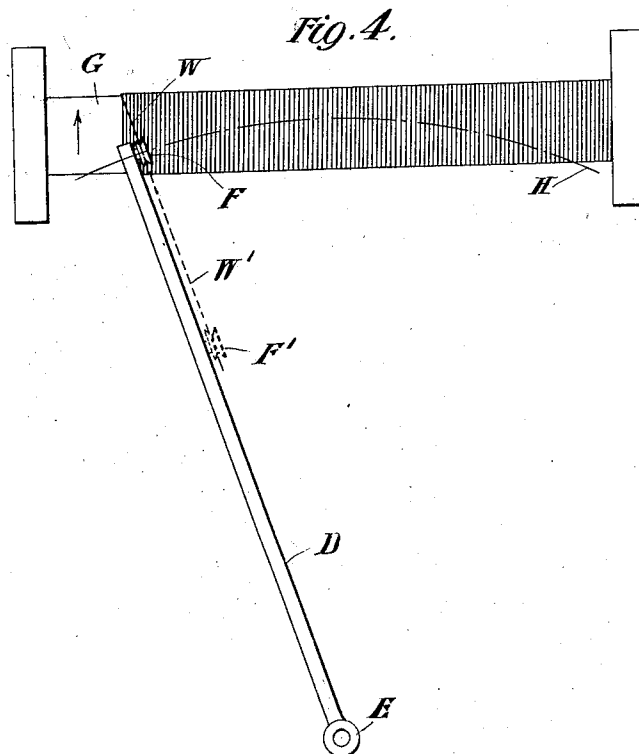
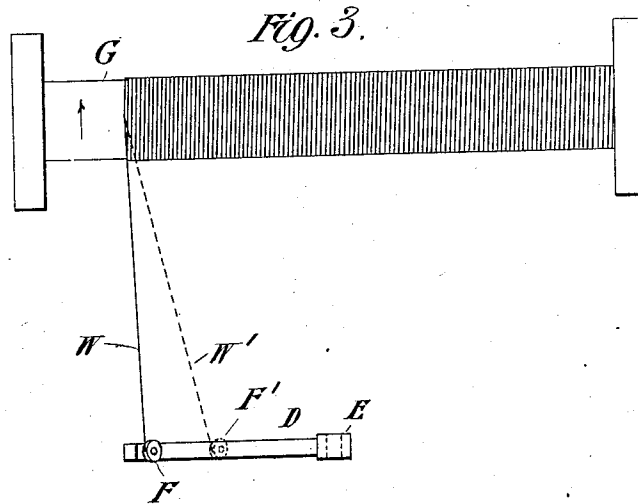
By his Attorneys

Rosenbaum & Stockbridge

E. R. PHILLIPS.
WINDING MACHINE.
APPLICATION FILED FEB. 21, 1906.

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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 5.

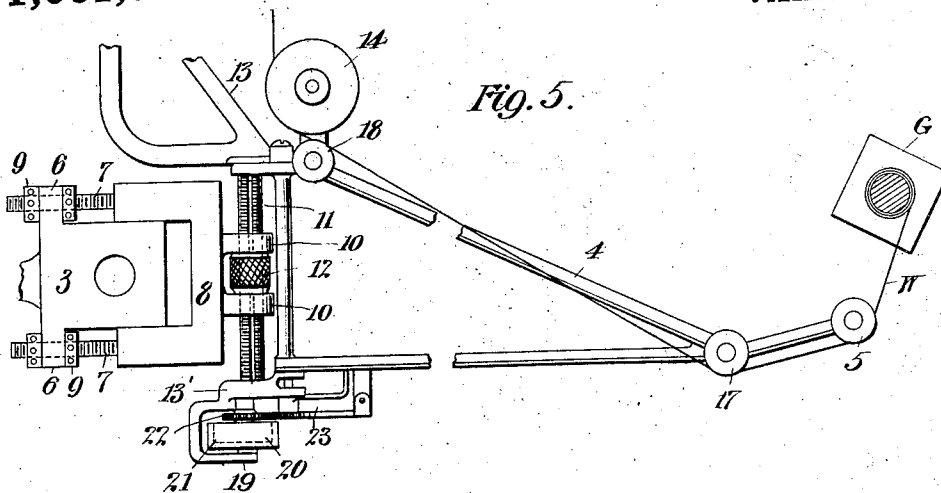
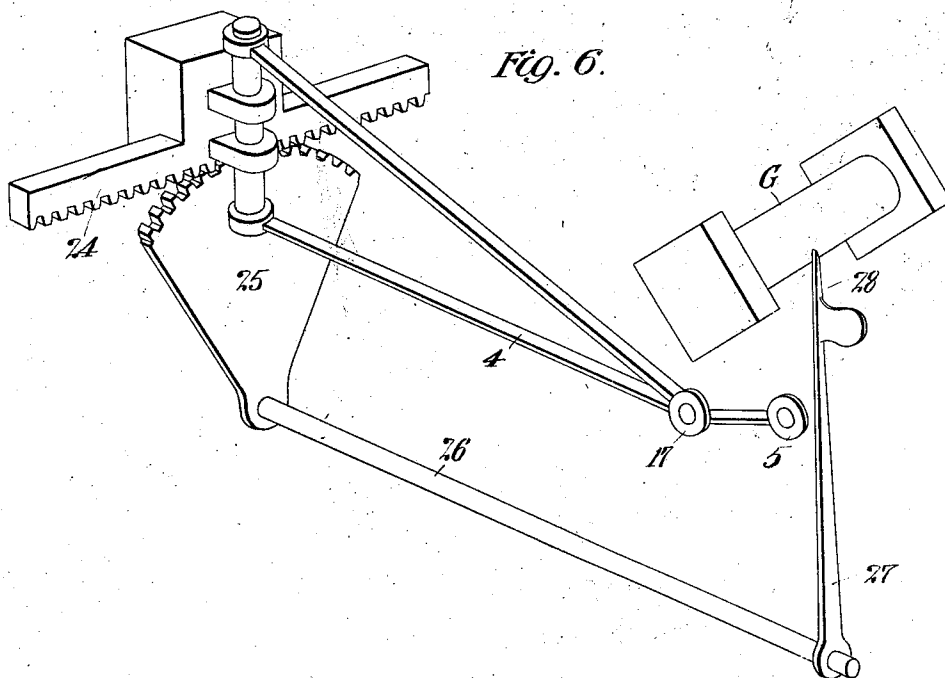


Fig. 6.



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UNITED STATES PATENT OFFICE.

EUGENE R. PHILLIPS, OF PHILLIPSDALE, RHODE ISLAND.

WINDING-MACHINE.

1,061,947.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed February 21, 1906. Serial No. 302,213.

To all whom it may concern:

Be it known that I, EUGENE R. PHILLIPS, a citizen of the United States, residing at Phillipsdale, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Winding-Machines, of which the following is a full, clear, and exact description.

My invention relates to a method of winding metallic wire by the tension of the wire itself as it traverses the successive layers.

The machines and processes for winding ordinary wire, cord, twine, thread, etc., are not applicable to the purposes of electrical winding, since insulated copper magnet wire cannot be made to wind itself in any regular predetermined feed or pitch, corresponding to any fixed feed of a mechanism. Either by reason of the insulation or variations in the temper of the metal, or on account of slight irregularities or kinks in the wire produced by the insulating processes, magnet windings have a tendency to wind first with a coarse pitch and then with a fine one, so that it is impossible to adjust any automatic mechanism to properly guide the filament.

By the present invention I aim to wind the wire by its own tension, and in a smooth regular and rapid manner.

In the drawings: Figure 1 is a bottom view showing the essential features of my invention diagrammatically represented; Fig. 2 is a front view showing a partly completed spool, the wire being on an enlarged scale; Fig. 3 is a front diagrammatic view illustrating the old winding operation; Fig. 4 is a bottom view of the same; Fig. 5 is a side elevation of a practical construction embodying the principles of my invention; Fig. 6 is a perspective view showing a slightly modified form of construction.

In order that the present invention shall be made clear I have indicated in the drawing (see Fig. 2) a very much enlarged and exaggerated representation of a partially completed spool. The wire is shown applied in somewhat the form it takes in practice with a kinked portion between the points A and B, and a straight uniform portion between the points B and C. It will be seen that the feed between the points A and B is very much greater than that between the points B and C.

The winding of magnet spools has been accomplished by machines employing a pair of swinging arms joined to one another, and

in other ways, and such processes are highly efficient for conducting the wind through a limited distance on the spool. The winding becomes less efficient, however, as the swinging arm deviates from the perpendicular, and in order that the improvement secured by my present invention may be made clear, I will consider the reason why the simple swinging arm, as employed in the usual form of winding machine, works with a diminishing efficiency as the arm deviates from the perpendicular.

Referring to Figs. 3 and 4, which show the old means for winding, D indicates an arm pivoted at the point E and having a delivery roller F from which the wire passes to the spool G. The arm is shown considerably inclined to the spool, greater than would probably be operative in actual practice. The wire passes along the arm to the roller F, and from thence diagonally upward, but it is evident that the bottom projection, as shown in Fig. 4, will always be a straight line, since otherwise a force would be created to swing the arm until the delivered wire lay in the plane of the arm. The condition of the winding at this time is illustrated in Fig. 3. There is yet a considerable distance on the spool to be wound, but it is clear that the wire W has by this time so much backward inclination, on account of being constrained to remain in the plane of the arm D, that it has a tendency to mount upon the preceding turns and reverse the layer. If the said roller F were farther back upon the arm as at F', the above conditions would be much augmented, as shown at W' in Fig. 3. Accordingly it is desirable to place the delivery roller F as far forward upon the arm as possible, but it cannot be located too far forward or there will be insufficient force from the wire tension to swing the arm. Moreover, the arc of movement shown at H would bring the delivery roller too far forward at its central position. It is, therefore, clear that the ordinary forms of winding machines employing swinging arms cannot be used for spools of any but short lengths. In order to wind spools of any length it is necessary to have a different arrangement, and by the present invention I aim to secure substantially the ideal conditions which practice requires.

Referring again to Fig. 2 of the drawing it will be seen that if the spool G is ro-

tated and the wire W maintained in an almost perpendicular relation under suitable tension, that the wire will be properly coiled upon the spool. If the wire W by reason of excessive feed acquires the inclination W^2 , the feed will be too coarse, and if on account of an insufficient feed, it takes the inclination W^3 , the turn will have a tendency to mount upon the preceding one. The ideal condition is to have a very slight rearward inclination so that the turn will coil closely against the preceding one without mounting upon it.

Referring now to Fig. 1, I will explain the essential principles of my invention, and show that it is effective for the purpose of securing the ideal conditions. 1 indicates a lead screw having a handle 2 by which it is turned. 3 indicates a block internally threaded so as to move upon the lead screw, and having a swinging arm 4. 5 indicates the delivery roller, parts 4 and 5, corresponding to the parts D and F of the diagrammatic representation previously referred to. G indicates the spool which is shown with one layer partially wound, and the various positions which the arm 4 can acquire are indicated in dotted lines along the length of the spool. In the use of this apparatus, the swinging arm 4 is positioned approximately perpendicular to the spool, and the winding commenced under suitable conditions of tension and speed. As long as the arm 4 is perpendicular, or substantially so, the plane of the wire corresponds with the ideal conditions above mentioned, and shown in Fig. 2 at W. In other words, the wire is being directed to the spool in almost perpendicular relation, but lagging very slightly behind on account of the friction of the swinging arm pivots. The delivery roller may be located some distance back of the front edge of the spool, as indicated in Fig. 1, so that a considerable force is created to move the arm, even with very fine wire. Accordingly the arm is fed properly and follows the layer, without lagging appreciably behind so that the wire would have a tendency to mount a preceding turn. As the arm becomes deflected owing to the progress of the wind, the conditions become less and less favorable, although they are sufficiently favorable for all practical purposes during a moderate arc of movement of the arm.

By my present invention I arrange means by which the operator, who is necessarily present during the winding operation, can forcibly move the arm support laterally an amount corresponding to its movement, so that its perpendicular relation is constrained to continue. For this purpose I have indicated the lead screw 1 threaded into the block 3, and operated by the handle 2, so that the operator may turn the handle and

keep the wire guiding arm approximately perpendicular. If the arm is approximately perpendicular, it is sufficient for all practical purposes, and it is perfectly within the capabilities of any operator to maintain the arm approximately perpendicular, particularly if said arm is comparatively long. Under these circumstances, the arm will sometimes be exactly perpendicular to the spool, and sometimes forward and sometimes back of such relation, but the wire will substantially follow the ideal path, as indicated in Fig. 2, under all these conditions, due to the very slight retardation of the arm pivots. As will afterward appear, I provide means for minutely adjusting the delivery roller forward and back with relation to the spool, so that any predetermined tension can be made effective to feed the arm along with the progress of the layer. Inasmuch as the arm always remains substantially perpendicular, this distance remains constant for any adjustment. It is evident that the delivery roller would be located at different places for different kinds of wire, and in any case at a point sufficiently far forward to prevent lateral deviations of the arm from appreciably varying the inclination of the wire, and at the same time sufficiently far back to give sufficient force to make the arm follow the progress of the layer. Thus the proper position of the delivery roller is a sort of balance or compromise, which has to be determined by experiment for each particular job. As the layer approaches the heads of the spool, it is desirable to reverse the same, and the operator may accordingly allow the arm 4 to acquire considerable inclination at the two heads of the spool, as indicated in dotted lines at K and L in Fig. 1. When the arm acquires such an inclination, the wire has a tendency to mount upon the preceding turn, or, in other words, reverse itself, which is exactly what is desired at the two heads of the spool. Accordingly the inclination would be so arranged that the reverse would just occur at the time the layer had reached the heads of the spool.

A practical form of construction.—In the present application I will describe a simple form of construction for carrying into effect the foregoing principles. The mechanism is presented largely for the purpose of illustration, and reference is to be had to my companion application, Patent No. 1,057,008, dated Mar. 25, 1913, for the full specifications of a certain type of commercial machine embodying my invention. The present case aims to present the essential parts of the mechanism in suggestive form, by which they can be worked out to suit varying requirements by different persons skilled in the art, who may desire to construct and use the same for their particular purposes.

Referring to Fig. 5, the internally threaded block or nut 3, has ears or lugs 6 thereon, which loosely receive screw studs 7 projecting from a head 8. 9 indicate nuts upon said screw studs by which they are clamped to the lugs 6, and by which the head 8 can be impelled forward and back into any desired relation. Upon the head 8 I provide a pair of projections 10 adapted to receive a threaded rod 11, which is splined so as to be vertically, but non-rotatably, movable through said projections 10. 12 indicates a thumb nut upon said threaded rod 11, and between the projections 10, by which the rod can be vertically adjusted. Upon the rod 11 I rigidly secure the wire carrying frame, having parts 13 and 13'. The part 13 carries a grooved wheel or roller (not shown), by which the wire is supplied, and delivered to the swinging arm 4. The arm 4 is journaled in the heads 13 and 13', and I make this arm very long in practice so that its extremity may swing through a considerable distance without imparting any considerable inclination to the arm. 14 designates a grooved roller on the arm which receives the wire in alinement with the arm pivots. 17 designates an additional grooved roller, and from which the wire is led to the delivery roller 5 upon the outer end of the arm. 18 designates a clamp for holding the wire when it is not being drawn upon a spool. The friction of the arm 4 upon its pivotal supports is sufficient to give the necessary amount of rearward inclination or lag to the wire under ordinary circumstances, but I provide means for increasing the resistance in case the tension of the wire or other factors requires it. For this purpose I arrange a dash pot 19, comprising a cup 20, secured upon the wire carrying head, and having fans or blades 21 therein. 22 designates a gear wheel secured to the fans or blades and meshing with a segment gear 23, coaxial with and secured to the arm 4. The relation is such that as the arm 4 swings back and forth, this segment gear 23 imparts rotative movement to the gear 22, and fans 21, so that these move back and forth within the cup 20. The cup 20 is filled with a varying amount of oil of more or less viscous character, depending on the needs of any particular class of work.

The operation of the above mechanism will be understood from the preliminary description, and particularly the below description in connection with Fig. 4. It will be seen that I provide a swinging arm which is maintained in substantially perpendicular relation to the spool, no matter what the length thereof may be. The arrangement is also such that the delivery roller may be located at any position of forward or back adjustment by manipulating the nuts 9, which is a very important adjustment in

practice, as it enables the conditions to be exactly accorded to the needs of any particular wire. I am also enabled to adjust the arm 4 vertically by means of the thumb nut 12, which is desirable in case spools of unusually large or small size are wound. The arm 4 is so long that it is efficient for winding spools of short lengths, say two inches or under, without any movement of its supporting head or block. For short spools it is, therefore, sufficient to turn the lead screw till the block is at a mid-position, and then allow it to remain permanently in such relation.

In Fig. 6 I have indicated a slightly modified arrangement in which the lead screw 1 is dispensed with, and a rack and gear segment adjustment substituted therefor. The rack 24 is fixed to the wire carrying head, and the gear segment 25 meshes therewith and turns with the rod 26 projecting forwardly in the machine. 27 indicates an arm upon the rod 26, said arm having a pointer 28, which moves along the surface of the spool. The arrangement is such that the operator may follow the progress of the layer with the pointer, so that the support for the wire carrying arm likewise follows the course of the layer, and keeps the arm in perpendicular relation, or approximately so. With this arrangement the wire follows exactly in accordance with its particular needs, and the operator is able to keep the pointer approximately opposite the turn being completed without much difficulty. The delivery roller follows the progress of the layer exactly, and the arm support approximately in this case, as in the case where the operator manipulates the lead screw to keep the swinging arm perpendicular. If desired, the arm support may be positively moved back and forth by any ordinary to and fro motion, which while not exactly correct, is a near enough approximation to the actual requirements to keep the swinging arm about perpendicular with the spool. In my companion application above referred to I have described a mechanism for accomplishing this.

What I claim, is:—

1. A means for winding wire upon a spool, comprising a support movable bodily parallel to the spool, an arm pivoted to said support and mounted to have a freely swinging movement on either side of its central position perpendicular to the spool, said arm having a delivery device, and adjusting means for moving said delivery device forward and back transversely of both its own axis and that of the spool to vary its distance from the axis of the spool, whereby the direction of the wire passing from the delivery device to the spool is altered.

2. A means for winding wire upon a

spool comprising a freely swinging arm having a delivery device, a wire carrying frame, a vertically extending screw secured to said frame, a support, a nut carried by said support and engaged with said screw for adjusting said delivery device up and down, a block and adjusting screws carried by said block and bearing on said support for adjusting the delivery device back and forth.

3. A means for winding wire upon a spool, comprising an arm having a delivery device, a support upon which said arm is freely pivoted, a block on which said support is adjustably mounted, and adjusting means for moving said support forwardly and back on the block in the general direction of said arm with relation to the spool to be wound.

4. A means for winding wire upon a spool, comprising a support movable bodily parallel to the spool, a head mounted on said support and projecting therefrom toward the spool, an arm pivoted to said head and mounted to have a freely swinging movement on either side of its central position perpendicular to the spool, said arm having a delivery device, and adjusting

means for moving said head on the support to carry said delivery device toward and from the spool, and toward and from said support, whereby the direction of the wire passing to the spool from the delivery device is altered.

5. A means for winding wire upon a spool, comprising a support movable bodily parallel to the spool, a head mounted on said support and projecting therefrom toward the spool, an arm pivoted to said head and mounted to have a freely swinging movement on either side of its central position perpendicular to the spool, said arm having a delivery device, and screws engaged with said head and support and arranged to move the former in and out to carry the delivery device forward and back and thereby alter the direction or slant of the wire passing from the delivery device to the spool.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

EUGENE R. PHILLIPS.

Witnesses:

CHARLES R. UNDERHILL,
LEON H. ALLEN.