(No Model.) 2 Sheets—Sheet 1.

J. J. WOOD.

MAGNET WINDING MACHINE.

No. 437,387. Patented Sept. 30, 1890.

FIG. 2.

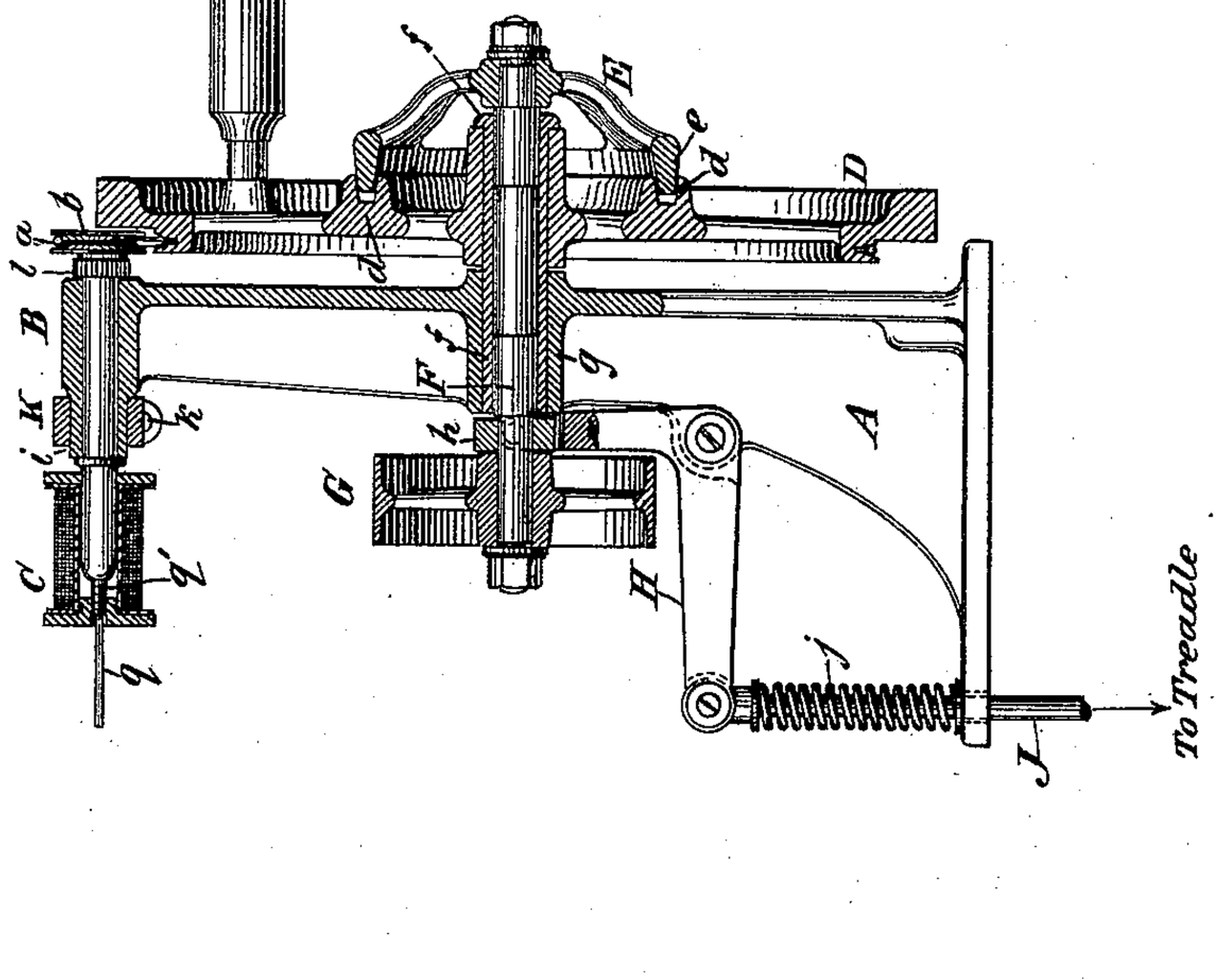
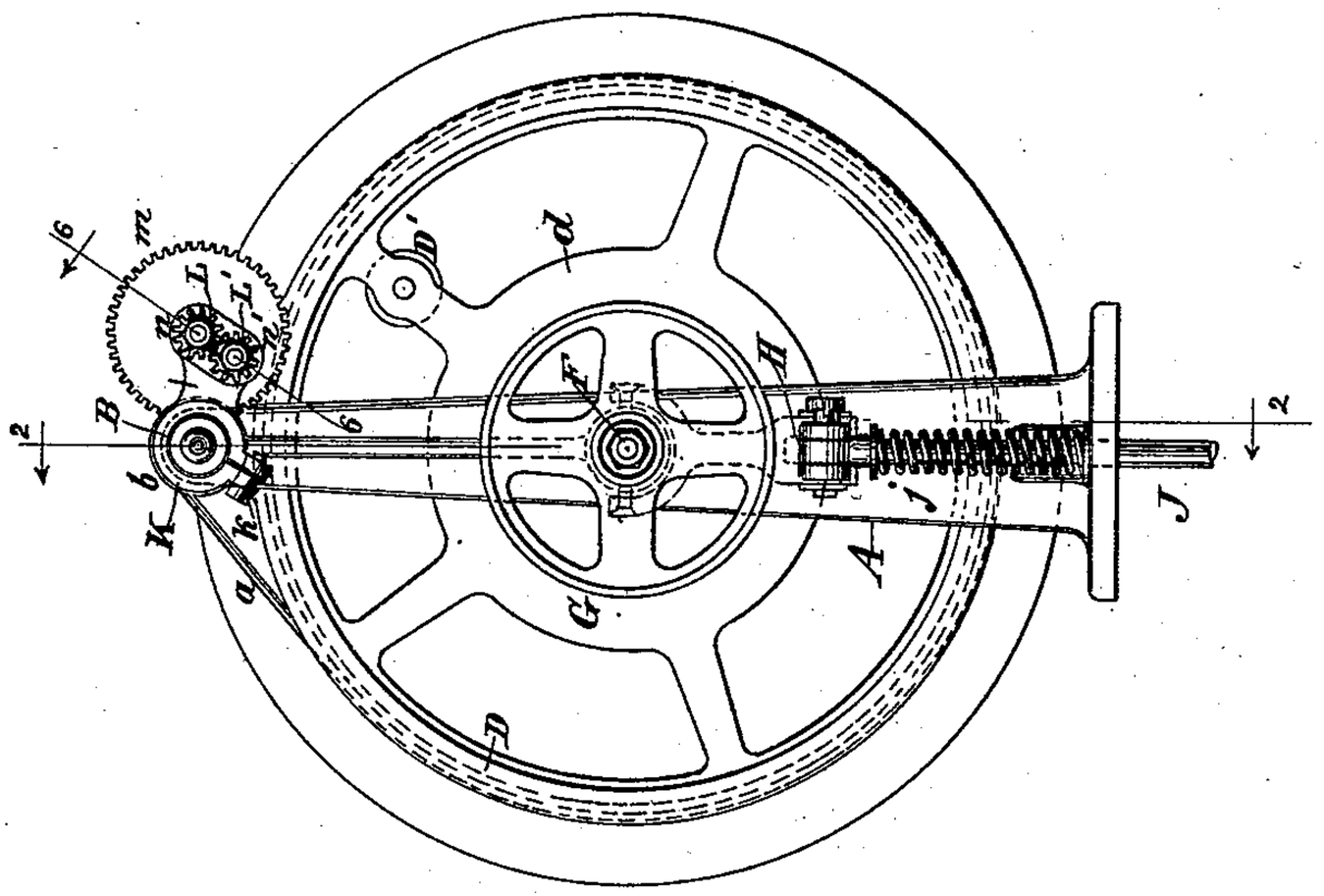


FIG. 1.



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INVENTOR:
James J. Wood,
By his Attorneys,
Arthur G. Fraser & Co.

(No Model.) 2 Sheets—Sheet 2.

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FIG. 3.

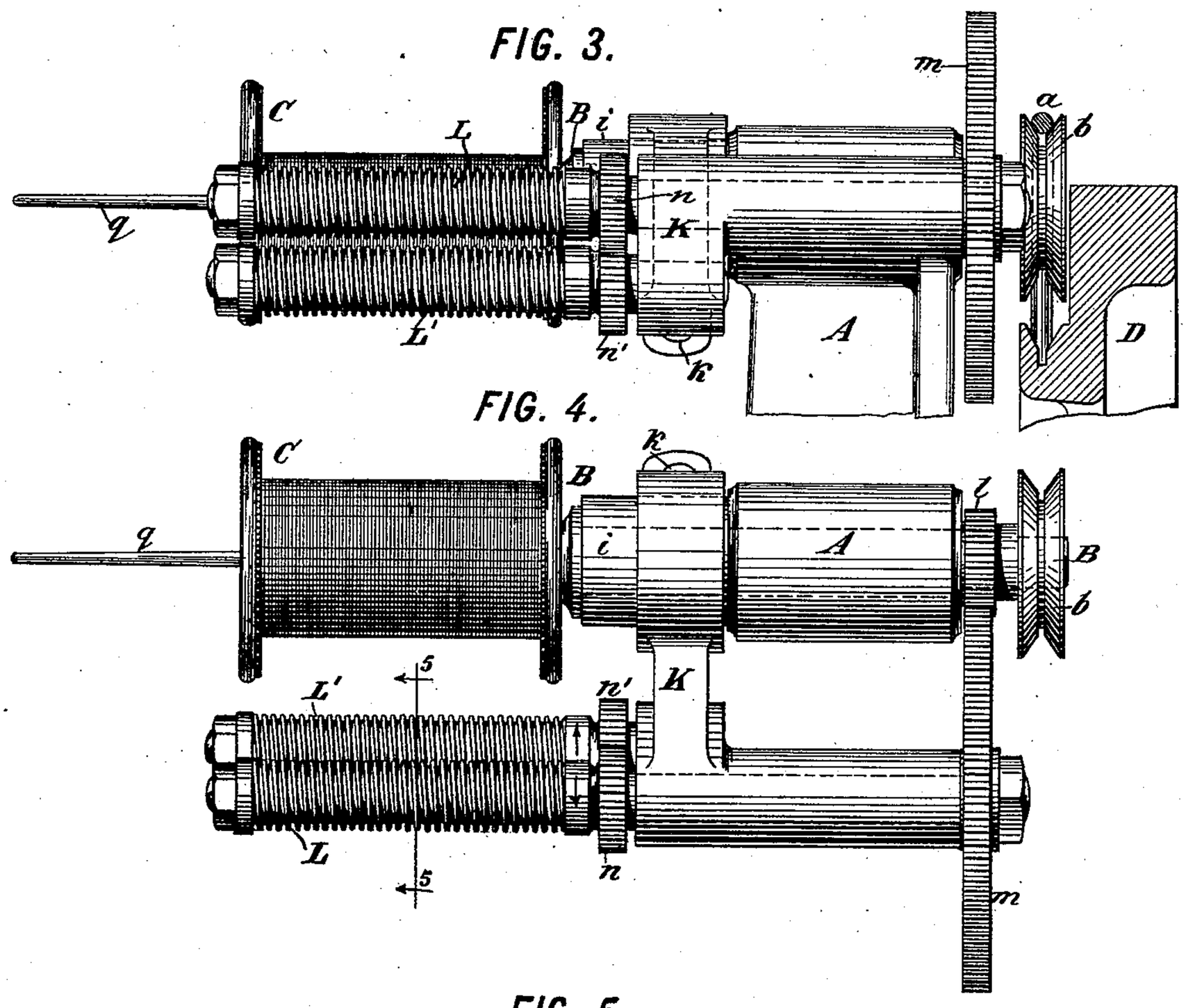

FIG. 4.

FIG. 5.

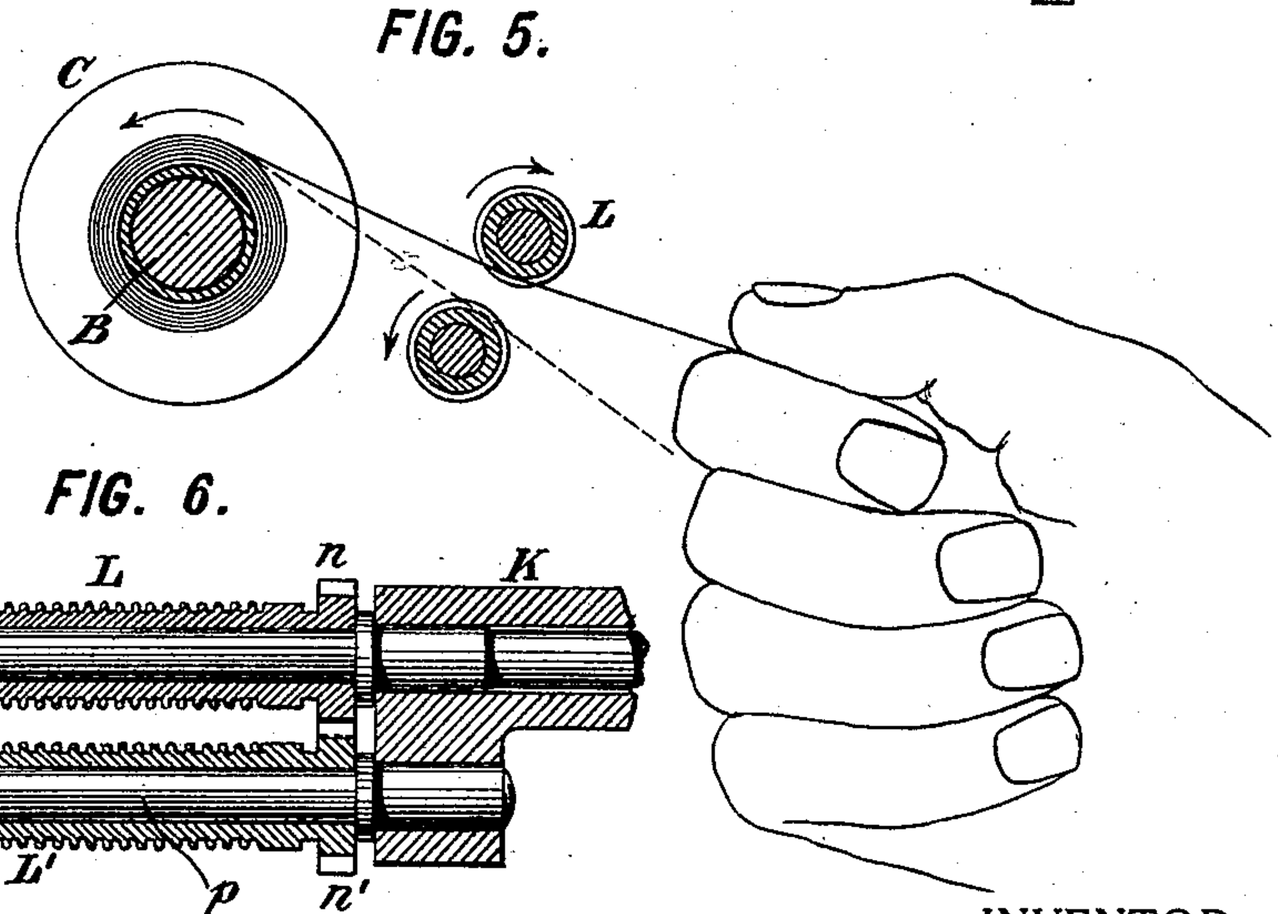

FIG. 6.

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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF BROOKLYN, NEW YORK.

MAGNET-WINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 437,387, dated September 30, 1890.

Application filed July 29, 1890. Serial No. 360,289. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Magnet-Winding Machines, of which the following is a specification.

This invention provides an improved machine for facilitating the winding of wire on the spools or bobbins of electro-magnets.

In the winding of magnets, especially those wound with fine wire in many convolutions, it is customary to fasten the spool of the magnet on a spindle and rotate it while the operator directs the wire onto the spool in successive layers by passing the wire through the hand and moving the hand from side to side in order to cause the wire to travel from end to end of the spool in the winding on of each layer. Considerable skill is required in this operation, and at best the layers are unevenly wound, so that the wire is not laid as compactly as is desirable. The new machine provided by my invention is adapted to enable the wire to be wound more rapidly and in more regular layers, while requiring less skill on the part of the operator. The invention is characterized by the provision, as guides for directing the wire to the spool and regulating its travel from end to end thereof, of two parallel rotative spindles having spiral grooves similar to screw-threads. The operator has only to direct the wire against one of the spindles, so that it shall enter the groove thereof, whereby it is propelled in one direction along the spool, and when it reaches the end of the spool the operator has only to move the wire out of the groove of this spindle and into the groove of the other spindle, which is so directed as to propel the wire in the opposite direction along the spool.

Figure 1 of the accompanying drawings is an elevation of the machine viewed from the left of the operator. Fig. 2 is a vertical section thereof, on the line 2 2 in Fig. 1, viewed from the position of the operator. Fig. 3 is an elevation, on a larger scale, of the upper portion of the apparatus, including the magnet-spool and the guide-spindles. Fig. 4 is a plan thereof. Fig. 5 is a transverse section thereof, on the line 5 5 in Fig. 4, illustrating the operation. Fig. 6 is a section of the guides on the line 6 6 in Fig. 1.

Let A designate a suitable supporting frame or standard adapted to be fastened on top of a work bench or table of convenient height, at which the operator may stand or sit. The upper end of this frame is formed with a bearing for the spindle B, on which the spool C of the magnet to be wound is held during the winding operation. This spindle B has fixed on it a belt-pulley *b*, driven by a belt *a* running in a groove in a large driving-wheel or fly-wheel D, which is provided with a crank D′, in order that it may be driven by hand, when desired. The wheel D is formed with a ring *d*, having a V-groove turned in its outer face to be engaged by the rim *e* of a clutch-wheel E. This clutch-wheel is fixed on a shaft F, which passes through a bearing-bushing *f*, fixed in a hub *g* on the frame A, and on the exterior of the projecting portion of which bushing the hub of the wheel D turns. On the other end of the shaft F is fastened a belt-pulley G, designed to be driven by a belt from beneath. The shaft F is capable of a slight longitudinal movement, in order to press the rim of the clutch-wheel E into the groove *d* to engage and drive the fly-wheel D. The shaft F is thus moved by an elbow-lever H, the upper arm of which is pivoted to a ring or collar *h*, confined between shoulders on the shaft F, while the lower arm of the lever is pivoted to a rod J, extending downwardly and adapted to be connected to a treadle. A spring *j* normally presses this rod upwardly and throws the clutch E out of engagement. By pressing down on the treadle the lever H is tilted against the tension of this spring, the clutch E is engaged, and the fly-wheel D is driven by power, thus communicating rapid rotation through the belt *a* and pulley *b* to the spindle B.

On the prolonged sleeve or bushing *i*, within which the spindle B turns, is frictionally clamped by means of a screw *k* a small bearing-frame K, carrying two guide-spindles L and L′. The frame K is formed with an elongated bearing, in which the spindle L turns. On the right-hand end of this spindle is fixed a gear-wheel *m*, which is driven by a pinion *l*, fixed on the spindle B. On this spindle L

is fixed a pinion n, which meshes with a pinion n' on the spindle L', whereby the latter is driven from the former, the two rotating in opposite directions and preferably at the same speed. The guide-spindles L and L' are formed with spiral grooves on that portion of their exterior which is in line with the magnet-spool, in order that these spiral grooves may engage and guide the wire as it is formed onto the spool. The grooves are substantially screw-threads, except that they are preferably rounded at their bottoms, and the ridges between them are also rounded to avoid any sharp corners, which might otherwise injure the insulated covering of the wire. Preferably the spirally-grooved portions of the spindles are formed as sleeves or tubes. That of the spindle L is fastened rigidly to it, so that it rotates with the spindle, and the sleeve of the spindle L' is constructed, preferably, as a loose tube made integrally with or fastened to the pinion n', and rotating freely on a fixed pin or stud p, the end of which is rigidly fastened to the frame K, as shown in Fig. 6. This construction is preferred as being most convenient and mechanical, but it might be greatly varied. Whatever particular construction of guiding-spindles is adopted the two spindles should be arranged parallel with each other and with the axis of the spindle B, and at a suitable distance from the latter to conveniently guide the wire as it is fed to the spool thereon, and the two guiding-spindles should be arranged somewhat close to each other, as shown in Fig. 5. Since they are geared to revolve in opposite directions their spiral grooves or screw-threads should be inclined both in the same direction—that is to say, they should both be either right-hand or left-hand threads.

In the operation of winding on the wire the operator guides the wire with one hand, the wire passing through between the spindles L L'. By drawing the wire upwardly so that it enters a groove in the guide-spindle L, it is caused to travel laterally from one end of the magnet-spool to the other at a speed determined by the pitch of the spiral groove and the speed of the spindle L proportionally to that of the spindle B. The speed of travel thus imparted to the wire will be so proportioned as to wind on the successive convolutions of the wire close together and make a close and continuous layer of wire on the spool. When the wire reaches the end of the spool, the operator has only to move his hand downwardly to bring the wire into the groove of the guide-spindle L', whereby the wire is propelled in the opposite direction by the groove of this spindle, and travels back to the opposite end of the spool. Hence the operator has only to move his hand up when the wire reaches one end of the spool and move his hand down when the wire reaches the other end, keeping the wire at a proper tension by holding it between the thumb and finger, as is usual in winding wire onto magnets. In Fig. 5 the upper position of the wire is shown by a full line at x, and its lower position by a dotted line at x'.

To avoid friction against the insulated covering of the wire the spindles L are revolved in such direction that their projecting sides move toward the magnet-spool, or, in other words, in the same direction as the wire. Furthermore, the spindles L L' are rotated at such speed that at the radial distance of their guiding-grooves they move at a surface-speed equal to that of the wire at some period during the winding on, and preferably at the mean speed of the wire. (It will be understood that the speed of the wire increases between the beginning and the end of the winding operation, since the radius of the spool of wire on which it is winding continually increases as each layer is wound on.) Thus the wear upon the wire is reduced to the minimum.

In the construction shown the protruding end of the spindle B, on which the magnet-spool C is thrust, is made of such diameter as to afford an easy fit with the bore of the spool. The particular construction of spool shown is closed at one end, with the exception of a central screw-threaded perforation. To provide a means for fastening such a spool and driving it with the spindle, the spindle is provided with a projecting pin q, and the base portion of this pin is enlarged and screw-threaded at q' to screw into the threaded hole in the spool, as shown in Fig. 1. The direction of this screw-thread is such that the spindle B in its normal rotation tends to screw itself into the thread, and consequently carries the spool with it. The pin q affords a convenient means for winding the end of the wire into a coil. When the spool is filled, the operator having stopped the machine by releasing the clutch E, turns the crank D backwardly a short distance, so that by the backward rotation of the spindle B its screw q' is unscrewed from the magnet-spool, which is held stationary by the operator. The spool may then be slipped off and an empty one substituted.

My invention is not limited to this one particular method of engaging the magnet-spool. The means of engagement may be varied according to the construction and proportions of the magnet-spool. For those magnets which are wound directly on the core, or after the insertion of the core, the spindle B will be made in accordance with any construction heretofore known for engaging such magnets and driving them while winding on the wire; or any means of holding and rotating the magnet or magnet-spool may be used, such as are commonly used in lathes for holding and rotating the parts to be operated upon. Hence it is to be understood that by the word "spindle" I mean either a spindle properly so called, or any equivalent means for holding and rotating the magnet or magnet-spool to be wound.

The sizes and proportions of the guide-spindles L L′, the pitch of their grooves, and the proportionate speed of their rotation may be varied according to the varying sizes of wire to be used and the sizes and proportions of magnets to be wound, or in any manner that judgment or taste may dictate. My invention is not limited to these details of construction. The construction shown in the drawings is that which my experience thus far has shown to be the best of any of which I am aware.

I claim as my invention the following-defined novel features and combination, substantially as hereinbefore specified, namely—

1. The combination, with means for revolving the magnet or spool, of two spirally-grooved guide-spindles, between which the wire may pass, driven in such directions relatively to the direction of their grooves that when the wire is held against one it will be moved in one direction along the spool, and when held against the other it will be moved in the opposite direction.

2. The combination of a spindle for revolving the magnet or spool, two parallel rotative guide-spindles having spirally-grooved portions between which the wire may pass, and gearing for rotating them in opposite directions at a speed so proportioned to the pitch of their grooves and the size of wire to be wound as to guide the wire onto the spool in layers, the wire being guided to the right or left according as it is brought into the groove of one or other of the spindles.

3. The combination of a spindle for revolving the magnet or spool, two parallel rotative guide-spindles having spirally-grooved portions between which the wire may pass, and gearing for rotating them in opposite directions, with their reciprocally-approaching surfaces moving in the same direction as the wire and at a surface-speed approximating the speed of the wire.

4. The combination of a spindle for revolving the magnet or spool, two spirally-grooved guide-spindles between which the wire may pass, geared together to revolve in opposite directions, and gearing interposed between one of said spindles and the spool-carrying spindle for driving it therefrom.

5. The combination of a spindle for revolving the magnet or spool, a bearing-frame, a spirally-grooved guide-spindle having a bearing in said frame, gearing for driving it from the spool-carrying spindle, a second spirally-grooved guide-spindle arranged parallel with the first and consisting of a tubular sleeve turning on a stud fixed in said bearing-frame, and intermeshing pinions on the guide-spindle, whereby the second spindle is driven from the first.

6. The combination of a spindle for revolving the magnet or spool, a driving-wheel geared thereto, a driving-shaft movable longitudinally, a clutch for coupling said shaft to said driving-wheel that the latter may be driven from the shaft, a clutching-lever engaging the shaft for moving it longitudinally to engage or disengage the clutch, and a spring for normally disengaging the clutch.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
GEORGE H. FRASER,
ARTHUR C. FRASER.