Oct. 25, 1955 P. H. ROGERS 2,721,708

SELF-CENTERING TOROIDAL CORE HOLDING AND DRIVING FIXTURE

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FIG. 1

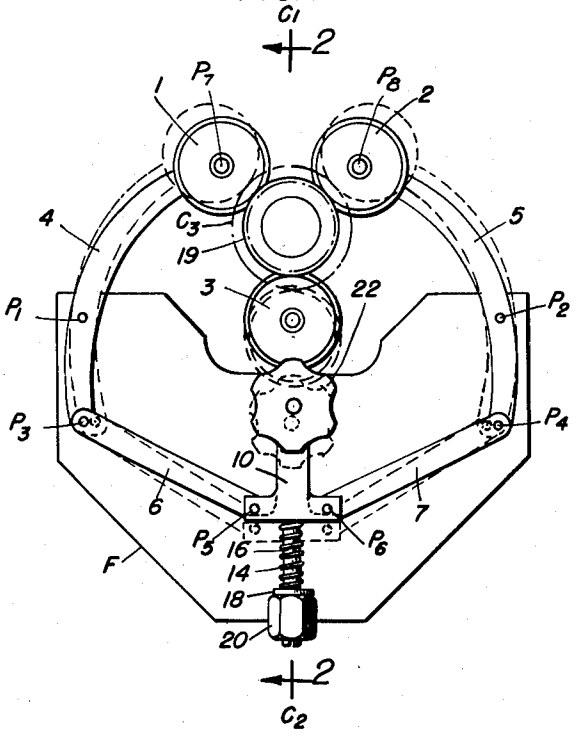
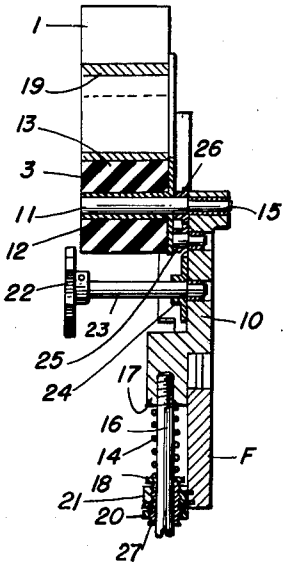


FIG. 2



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SELF-CENTERING TOROIDAL CORE HOLDING AND DRIVING FIXTURE

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This invention relates in general to an apparatus for winding coils and, more particularly, relates to a self-centering core holding and driving fixture which engages the outer periphery of the coil as it is wound.

The general purpose of the apparatus comprising the instant invention is to support, hold, and rotate a toroidal ring or core that is being wound with wire to form a toroidal coil. While being wound, the coil may be rotated either manually or driven through a gear train to maintain the lead necessary in winding toroidal coils. As the wire is laid onto the core, thereby increasing the diameter of the coil thereof, the apparatus of the instant invention automatically keeps the coil on the same winding center.

Apparatus of this type have been disclosed in the prior art, such as the machines disclosed in U. S. Patent 2,441,439 and granted May 11, 1948, to Roland D. Nelson.

The main object of the instant invention is to provide an improved holding and driving fixture for coils which is of simpler and more economical construction than the prior apparatus of a similar type.

Another object of the instant invention is to provide an improved coil form holding and driving fixture which maintains proper centering of a windable coil form as the external diameter of the coil increases as it is wound.

Still another object of the instant invention is to provide an improved coil form holding and driving fixture which employs spring-biased rollers surrounding the outer periphery thereof where only one spring adjustment is needed to vary the holding forces on the rollers.

A feature of the instant invention is in providing a coil-winding apparatus comprising the combination of at least three spaced movable rollers arranged to engage the coil winding at spaced points, a pair of levers pivoted at respective points between the ends thereof and connected at one end to a different one of said spaced rollers, a linkage coupling the other end of the levers to the other spaced roller to couple any movement of any roller to the other rollers, and an adjustable coil spring pressing against one of the elements of the linkage to force the rollers against the outer periphery of the coil.

Other objects and features of the instant invention will become apparent upon making reference to the specification and drawings wherein:

Figure 1 is an elevational view of the preferred embodiment of the instant invention; and

Figure 2 is a cross-sectional view of the apparatus in Figure 1 looking in the direction of the arrow 2—2.

For a clear description of the instant invention, reference is now had to the drawings. The portion of Figure 1 shown in solid lines shows the position of the apparatus before the first layer of winding is placed on the coil; the dotted lines show the position of the apparatus when one or several layers of the winding have been placed on the coil form. The details of the apparatus which actually feeds the winding to the coil form have been omitted since the invention does not relate to such apparatus which is well known in the art. The apparatus shown in the drawings and described hereafter refer only to the fixture which rotates and holds the coil in place about a fixed center point as it is wound.

In the drawing, it will be seen that the preferred embodiment of the instant invention includes a frame portion F on which are supported levers **4** and **5** pivoted to the plate about fixed points P_1 and P_2, respectively. Rollers **1** and **2** are carried at one end of the levers **4** and **5**. A roller **3** is coupled to the levers **4** and **5** through a linkage (including elements **6**, **7**, and **10**) which will be described in more detail hereinafter. A spiral spring **14** presses against a portion of this linkage and presses rollers **1**, **2**, and **3** against the outer periphery of a coil form **19**.

On the ends of levers **4** and **5** opposite the end connected to the rollers **1** and **2**, respectively, is connected the linkage above-referred-to. This linkage comprises arm members **6** and **7** which are pivotably connected to the respective ends of levers **4** and **5** at the points P_3 and P_4. The other ends of arm members **6** and **7** are pivotably connected to a link member **10** about pivots P_5 and P_6. The rollers are spaced about an imaginary triangle so that a coil form **19** is supported along substantially three lines which are spaced along all sides of the coil form **19**.

Link member **10** carries roller **3** on the end thereof. Spiral spring **14** which is placed under compression by means which will be hereinafter described, exerts a force on link member **10** tending to press roller **3** upwardly as viewed in Figure 1. This same force is transmitted to rollers **1** and **2** through arm members **6** and **7** and levers **4** and **5** to solidly press rollers **1**, **2**, and **3** against the outer periphery of coil form **19**. The levers **4** and **5** together with arm linkage members **6** and **7** are arranged to cause direct equal motion of coil members **1**, **2**, and **3**.

In the construction shown in Figure 1, roller **1**, lever **4**, and arm member **6** are symmetrically related to roller **2**, lever **5**, and arm member **7** about a center line C_1—C_2. This center line of the apparatus passes midway between rollers **1** and **2** through the center of coil form **19**, through the center of the roller **3**, and along the axis of spiral spring **14**.

Assuming that the dimensions of the coil are increased from the periphery of coil form **19** to the large circle C_3 shown in dotted lines, then rollers **1** and **2** will pivot about fixed pivoted points P_1 and P_2 and move outwardly to the position shown by the dotted lines in Figure 1. Roller **3** moves downwardly to the position shown by the dotted lines; and, in this position, the coil is firmly supported about the same center point as before. The new position of levers **4** and **5** and arm members **6** and **7** and link member **10** is also shown in dotted lines in Figure 1.

Other more specific details of the apparatus forming the preferred embodiment of the invention will now be described.

Reference is now had to Figure 2 which shows the apparatus of Figure 1 in cross section and includes a cross-sectional view of roller **3** which is similar to rollers **1** and **2**. Roller **3**, as does rollers **1** and **2**, comprises a central shaft member **11** which extends into an opening **15** in link member **10** in which it is supported for rotary movement. A flange member **12** is fixed to shaft **11** and carries a rubber boot **13** which contacts the periphery of the coil to be wound. In a similar manner, rollers **1** and **2** are rotatably supported in openings in the ends of levers **4** and **5**. The mechanical details of the connections of levers **4** and **5** to frame member F at pivot points P_1 and P_2 and also the details of the connections of the arm members **6** and **7** to the associated levers and link members at pivot points P_3, P_4, P_5, and P_6 need not be described in detail since any well-known means may be used. Suffice it to say, that such connections may comprise a cylindrical pin extending from one of the

members which is in sliding engagement with the walls of a circular hole in the other member.

The resilient means for providing an adjustable force to press the roller against the coil comprise a spiral spring **14** surrounding a shaft **16** which is threaded into link member **10**; one end of the spiral spring **14** rests against the face **17** of link member **10** and is placed under compression by means of an adjustable locking means comprising a plate member **18**, which surrounds shaft **16** and abuts the other end of spiral spring **14** and a bushing **27** which is in threaded engagement with stationary back plate **21** and a locking nut **20** which is also in threaded engagement with the bushing **27**. The spring tension is adjusted by varying the position of bushing **27** in stationary back plate **21** so as to move plate **18** along shaft **16** to compress the spring or relieve the pressure against the spring. Link member **10** moves along the surface of frame F.

It should be apparent that the only stationary parts of the apparatus shown in the drawings are frame F, back plate **21**, and pivot points P_1 and P_2.

During the coil winding process, it is important to impart rotary motion to the coil form **19**. This may be accomplished by means of a knob **22** fixed to a shaft **23** which is rotatably supported on link member **10**. On the bottom portion of shaft **23** is a gear **24** fixed for rotation with shaft **23**. Motion of gear **24** is coupled to roller **3** by means of a gear train including idler gear **25** supported in an opening in link member **10**, and a gear **26** fixedly connected to shaft **11** of roller **3** and engaging idler gear **25**. Roller **3** is rotated by rotating knob **22**. Knob **22** is designed to be turned by hand, but, of course, any motor or other rotary power source may be connected to shaft **23** by any suitable coupling means to impart motion to roller **3**. Roller **3**, in turn of course, imparts motion to coil form **19**.

When the coil is wound, link member **10** is pulled to the rear which moves the rollers out of contact with the coil so that the coil may be readily removed.

The following is a set of dimensions which may be used with the exemplary embodiment shown in the drawings:

	Inches
Distance P_2—P_8 and P_1—P_7	4.661
Distance P_2—P_4 and P_1—P_3	2.350
Distance P_3—P_5 and P_4—P_6	4.275
Distance P_5 and P_6 to center C_1—C_2	.812
Vertical distance of P_5 and P_6 to center plane of roller 3	4.138
Distance between P_3 and P_7, and P_4 and P_8	6.553
Distance of P_1 and P_2 from center line C_1—C_2	4.750

(The above dimensions are measured from the centers of the appropriate pivot points P_1 to P_8.)

The diameter of the rollers used depends on the size of the coil to be wound.

Although the apparatus shown in the drawing is the preferred embodiment of the instant invention, many modifications may be made without deviating from the broader aspects of the invention. For example, if desired, rollers **1** and **2**, instead of being rotary cylindrical members, may be ball bearings supported by lever members **4** and **5**. Also the size and relationship of levers **4** and **5** and arm members **6** and **7** could be varied and still produce the functions of the members shown in Figures 1 and 2. It should be noted, however, that in order to insure equal radial movement of rollers **1**, **2**, and **3**, when, for example, the distances from pivot points P_1—P_7 and P_2—P_8 are selected, then the possible variance of the other dimensions, such as P_1—P_3, P_2—P_4, P_3—P_5, and P_4—P_6 is decreased to allow for equal movement of the three rollers.

Thus, the instant invention provides a very simple and effective way to externally support and rotate a coil form on which a winding is to be wound.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. A coil winding apparatus for winding a conductive coil on a coil form comprising at least three spaced movable rollers arranged upon axes parallel to the axis of the winding on the coil to directly engage and support the winding at spaced points, two levers pivoted at points between the ends thereof each having one of said spaced rollers pivoted on one end thereof, linkage means coupling the other ends of said respective pivoted levers to the other spaced roller for coupling any outward movement of one roller to the other rollers, said levers and linkage means being pivotally connected together for causing simultaneous and equal outward motion of all of said rollers as the coil diameter progressively builds up between them during winding, and resilient means for holding said rollers in pressing engagement with the outer periphery of the coil to be moved.

2. The combination of claim 1 characterized further by said linkage means including a link member pivotally mounting said other roller thereon for movement therewith and respective movable connecting arm members each having one end thereof in pivotal engagement with the end of one of said respective levers and the other end thereof in pivotal engagement with said link member.

3. A coil-winding apparatus for winding a conductive coil on a coil form comprising at least three spaced movable rollers arranged upon axes parallel to the axis of the winding on the coil to directly engage and support the winding at spaced points, two levers pivoted at points between the ends thereof each having one of said spaced rollers pivoted on one end thereof, linkage means coupling the other ends of said respective pivoted levers to the other spaced roller for causing simultaneous and equal outward movement of all of said rollers as the coil diameter builds up between them during winding, the linkage means including a ring member upon which the said third roller is pivotally mounted parallel to the other two rollers, and resilient means including a shaft threaded into said linkage means and movable therewith, a spiral spring mounted about said shaft and abutting against said linkage means to force said rollers toward the coil to be wound, adjustable lock means at the end of said shaft opposite said linkage means for holding said spring in compression.

4. The combination of claim 3 characterized further by said linkage means carrying a gear train for engagement with the said other roller for rotating it to impart rotary motion to the coil to be engaged thereby.

5. Coil winding apparatus comprising first, second, and third movable rollers spaced about a triangle to directly engage and completely support a coil form therein at spaced points, the said rollers and coil form being located on parallel axes, first and second lever arms pivoted at respective fixed points between the ends thereof, first and second means connecting portions on said first and second lever arms for pivotally mounting said first and second rollers thereon and for moving them as said lever arms pivot about said respective pivot points, a linkage means pivotally coupling points on said first and second levers on the sides of said levers opposite the said rollers connected to said third roller for pivotally coupling all of said rollers together for providing simultaneous and equal outward motion thereof as the diameter of the winding engaged thereby increases.

6. The combination of claim 5 characterized further by resilient means engaging the linkage means of one of the rollers for pressing all of said rollers inwardly to tightly engage the outer periphery of the coil to be wound.

7. Coil-winding apparatus comprising first, second, and third movable rollers spaced about a triangle to directly engage and completely support a coil form therein

at spaced points, the said rollers and coil form being located on parallel axes, first and second lever arms pivoted at respective fixed points between the ends thereof, first and second means connecting portions on said first and second lever arms for pivotally mounting said first and second rollers thereon and for moving them as said lever arms pivot about said respective pivot points, a linkage means pivotally coupling points on the first and second levers on the sides of the levers opposite the said rollers and connected to said third roller for pivotally coupling all of said rollers together for providing simultaneous and equal inward and outward motion thereof, said linkage means comprising arms extending about opposite sides of said third roller, first linkage means including respective movable connecting arm members each having one end thereof in pivotal engagement with the end of said first and second lever arms, and a link member connected to said third roller for movement therewith, the other end of said connecting arm members in pivotal engagement with said link member, said connecting arm member joining said link member on the side of said third roller opposite said first and second rollers.

8. The combination of claim 7 characterized further

by the connecting lever arms associated with said first and second rollers being symmetrically positioned relative to a center line passing between said latter rollers and through said third roller.

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