Feb. 2, 1960 W. A. FORDECK 2,923,485

COIL WINDING APPARATUS

Filed Feb. 25, 1957

4 Sheets-Sheet 1

FIG. 1

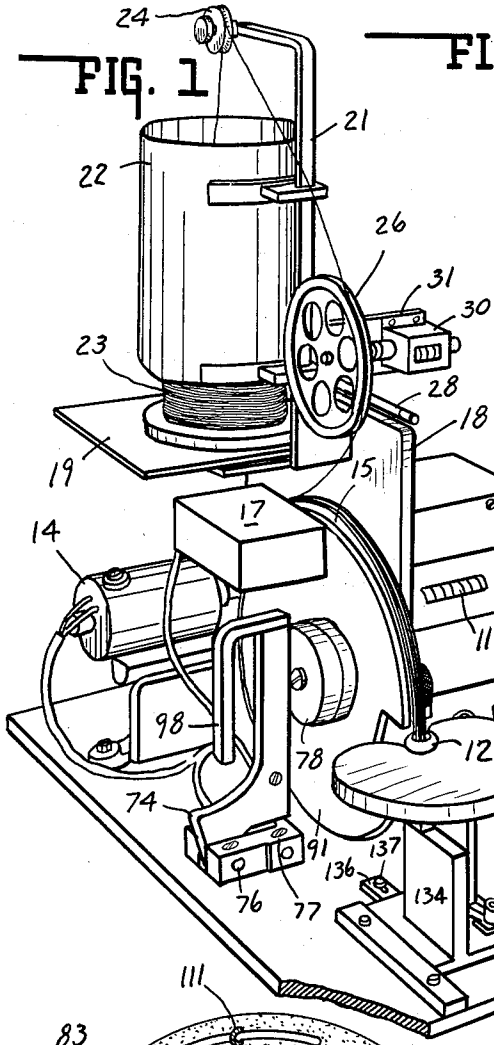


FIG. 7

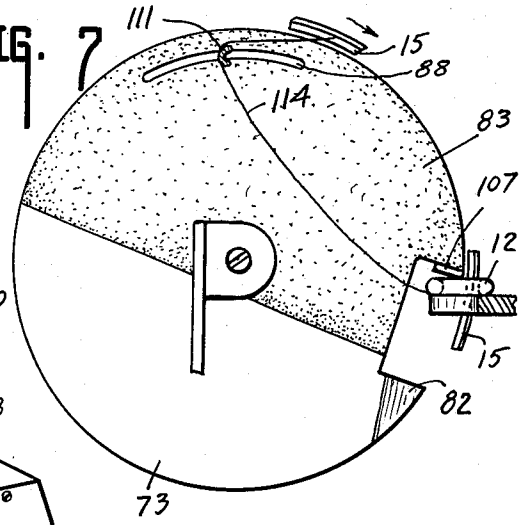


FIG. 9

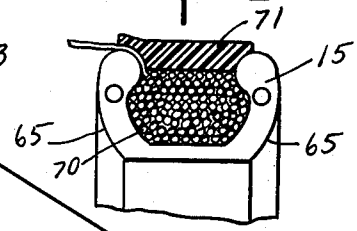


FIG. 10

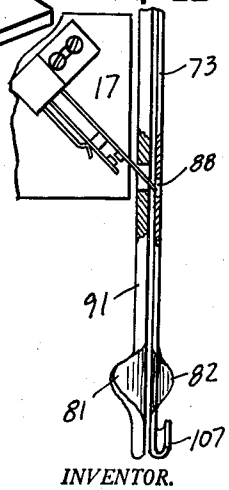
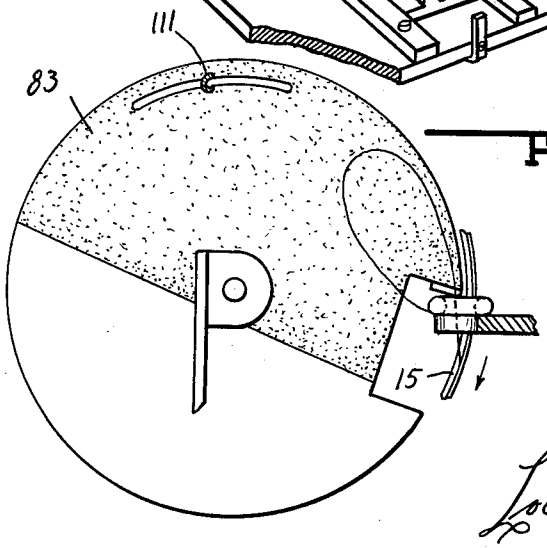


FIG. 8



INVENTOR.
WILLIAM A. FORDECK.

BY
Lockwood, Galt, Woodard & Smith
ATTORNEYS.

Feb. 2, 1960 W. A. FORDECK 2,923,485

COIL WINDING APPARATUS

Filed Feb. 25, 1957

4 Sheets-Sheet 2

FIG. 5

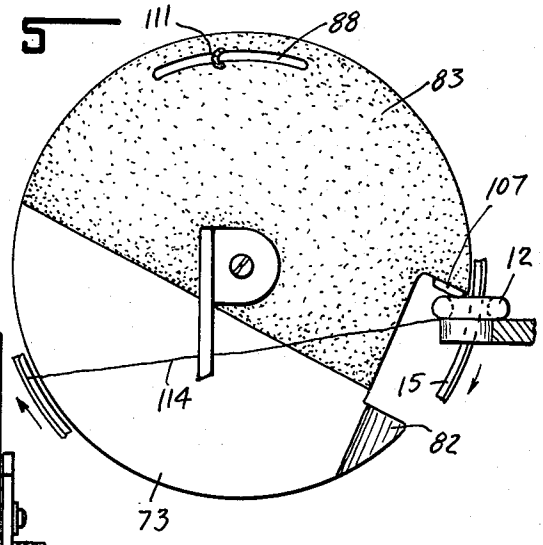
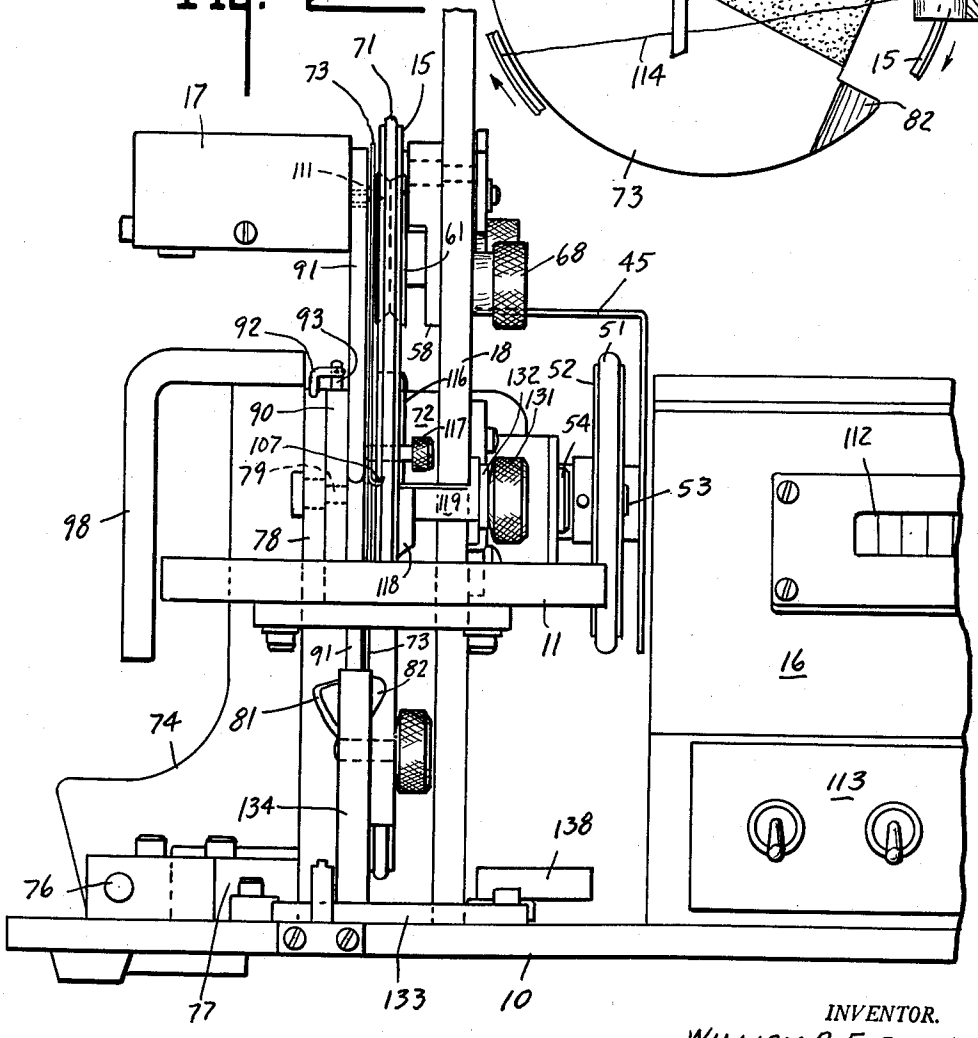


FIG. 2



INVENTOR.
WILLIAM A. FORDECK.

BY
Lockwood, Galt, Woodard & Smith.
ATTORNEYS.

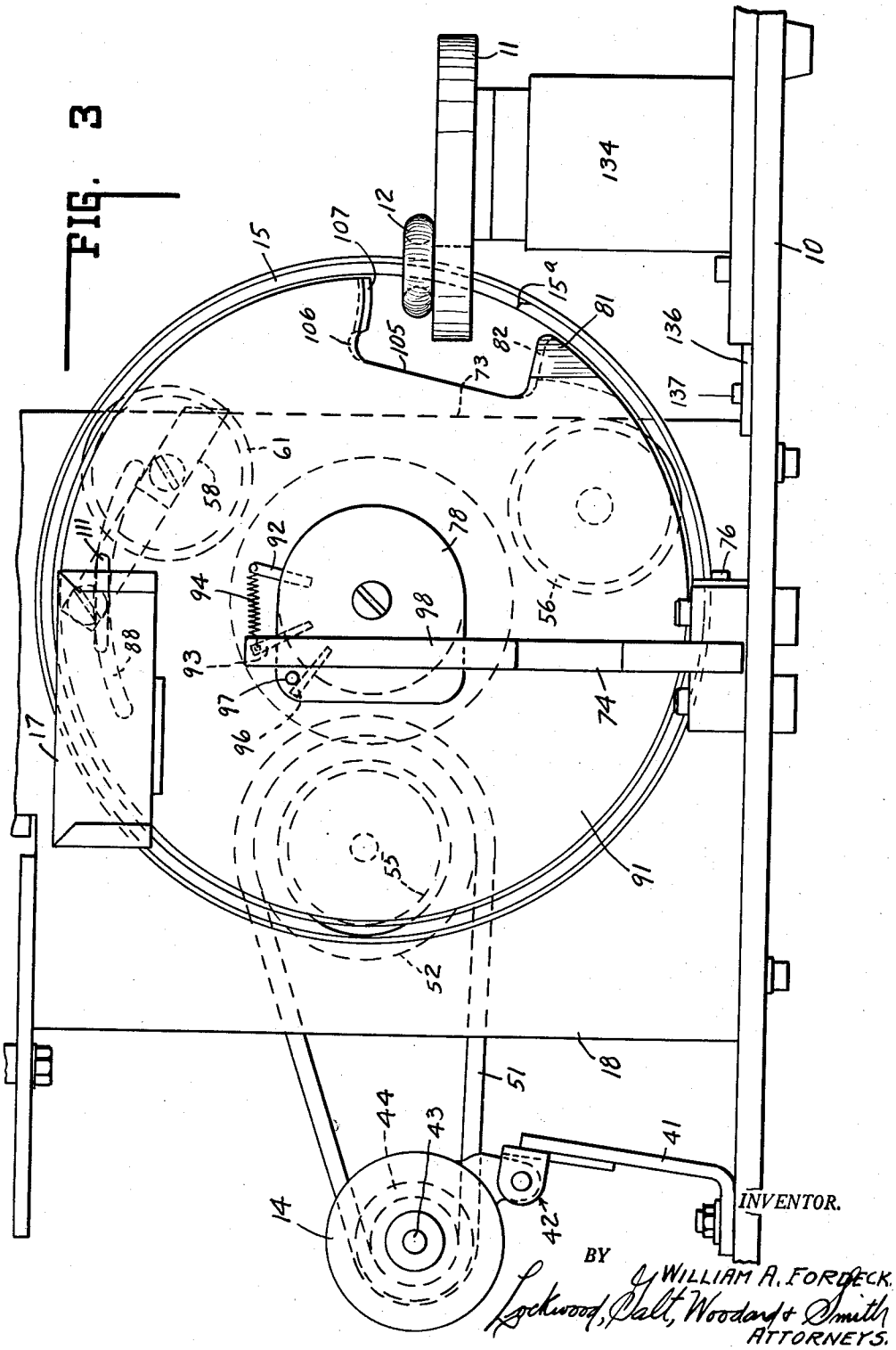
Feb. 2, 1960 W. A. FORDECK 2,923,485

COIL WINDING APPARATUS

Filed Feb. 25, 1957

4 Sheets-Sheet 3

FIG. 3



INVENTOR.
WILLIAM A. FORDECK.

BY
Lockwood, Galt, Woodard & Smith
ATTORNEYS.

Feb. 2, 1960 W. A. FORDECK 2,923,485

COIL WINDING APPARATUS

Filed Feb. 25, 1957

4 Sheets-Sheet 4

FIG. 4

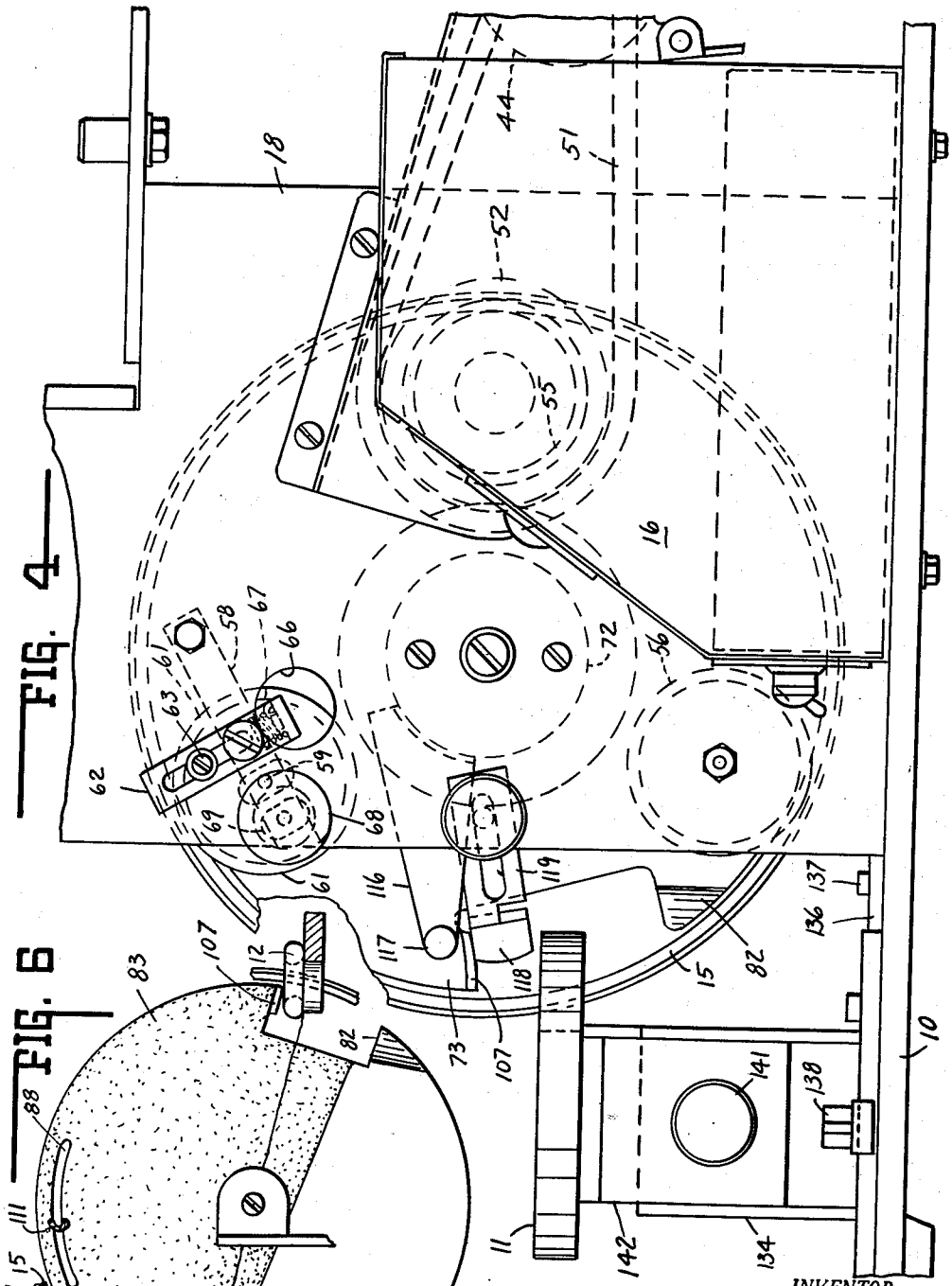


FIG. 6

INVENTOR.
WILLIAM A. FORDECK.

BY
Lockwood, Galt, Woodard & Smith.
ATTORNEYS.

United States Patent Office 2,923,485 Patented Feb. 2, 1960

2,923,485

COIL WINDING APPARATUS

William A. Fordeck, Garrett, Ind., assignor to The Magnavox Company, Fort Wayne, Ind., a corporation

Application February 25, 1957, Serial No. 642,136

4 Claims. (Cl. 242—4)

The present invention relates to coil winding apparatus and particularly to apparatus for winding toroidal coils of medium to fine wire at high speed.

In the winding of toroidal coils of relatively fine wire, it is conventional to rotate a wire laden annular bobbin through the central opening in the toroidal core or coil form with the wire being stripped from the bobbin to wind a turn on the coil with each rotation of the bobbin through 360°. To maintain tension on the wire as the bobbin rotates through the sector of its rotation in which wire is stripped therefrom, the use of sliders or wire control devices which ride on the rim of the bobbin and thereby aid in controlling wire tension have been customary. This arrangement requires that sliders having various amounts of sliding friction be provided for use with wire of various sizes and for differeing operating speeds of the coil winding apparatus.

A further difficulty with the conventional arrangement exists in that as the bobbin rotates through the loop forming sector of its rotation, the wire is no longer under tension and the loop is positionally uncontrolled. The tendency for fouling and breakage of the wire during this portion of the bobbin's rotation when the wire loop is free of tension and uncontrolled positionally is aggravated as the speed of the bobbin is increased or as the size of wire being wound is reduced. Another problem encountered in this area is that as the loop is formed the tension or pull on the wire already wound on the core or coil form is relaxed or often completely non-existent, permitting the wound wire to become loose.

The present invention provides an apparatus which meets these difficulties by providing an annular take-off garter or wire controlling means which overlies the wire carried by the bobbin and functions to properly tension a relatively wide range of wire sizes. Changeover time when shifting from one wire size to another is thereby reduced. Further, in the present invention, a wire movement resisting surface is provided which is slideably engaged by the wire loop as it is formed by the bobbin resulting in maintaining control of the loop and the tension of the wire throughout a complete revolution of the bobbin.

An object of the present invention is to provide a coil winding apparatus which includes a bobbin loading assembly and a bobbin stripping arrangement suitable for winding coils of a relatively wide range of wire sizes at high speed which may be of the order of 700 to 1200 turns per minute.

A further object is to provide a high speed coil winding apparatus in which the tension and position of the wire loop formed by the bobbin is controlled throughout each complete revolution of the bobbin.

A further object is to provide a coil winding apparatus in which the plate having a wire movement resisting surface has limited rotational freedom so that it may be made to abut the wire coil as it is being formed and will shift in position automatically to accommodate the wire

turns as they are wound upon the core, this arrangement assuring that for each coil turn the wire loop is continuously in engagement with the plate surface prior to its final placement on the core.

A further object is to provide a coil winding apparatus which utilizes the movement of the wire loop as it is formed by the bobbin to accurately register or count the coil turns as they are wound at high speeds.

A further object is to provide a low cost coil winding apparatus which can be rapidly set up for a given wire size and coil form size, shifted to wind other wire sizes on other core form sizes with a minimum of changeover time, and successfully operated by relatively unskilled personnel after a minimum of training.

These and other objects will become apparent as the description proceeds with reference to the accompanying drawings.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is a perspective view of the apparatus embodying the invention.

Fig. 2 is a front view of the apparatus shown in Fig. 1.

Fig. 3 is a left hand side view of the apparatus of Fig. 1, omitting the wire spool supporting apparatus.

Fig. 4 is a right hand side view of the apparatus of Fig. 1, also omitting the wire spool supporting apparatus.

Fig. 5 is a fragmentary view showing certain parts of the coil winding apparatus at one stage in the formation of a coil turn.

Fig. 6 is a view similar to Fig. 5 with the coil turn in a further stage of its formation.

Fig. 7 is a view similar to Fig. 6 with the coil turn in a further stage of its formation.

Fig. 8 is a view similar to Fig. 7 with the coil turn in a final stage of its formation.

Fig. 9 is a partial cross section of the annular bobbin used in the invention.

Fig. 10 is a partial top plan view, with parts broken away, of the wire loop forming apparatus of this invention.

Referring initially to Fig. 1, there is shown an embodiment of the invention which comprises a base **10** having mounted thereon a work supporting table **11** which serves to position a toroidal coil form or core **12**, about which a multiple turn coil of relatively fine wire is to be wound. A coil winding bobbin **15** and accompanying parts are mounted centrally on the base **10**, together with the bobbin driving motor **14**. It will be understood that the annular bobbin is provided with suitable means at **15***a* for manually separating it and rejoining it at some point along its length so that a closed coil form, such as toroid **12**, can receive the bobbin through its central opening.

A conventional counter mechanism **16** is also mounted on the base **10** and is actuated by a counting switch appropriately mounted within the switch housing **17**, as will be subsequently explained. A vertically mounted plate **18**, extending from the base **10** serves to mount a bobbin winding assembly including a wire spool supporting member **19** and an arm **21** having a horizontal portion which overlies the open end of a sleeve **22** carried by the arm **21**. As will be apparent from Fig. 1, the member **19** supports a spool of wire **23** which extends into the sleeve **22** and from which wire can be axially drawn out through the open upper end of the sleeve **22**. The end of the horizontal portion of the arm **21** carries a conventional tension adjusting means **24** adapted to convey wire to counter wheel **26** around which the wire may be looped once and then fastened to the bobbin. The wheel **26** is journalled in a bearing block (not shown) which has a pivotal mounting with respect to the upper edge of plate

18 and a member 28 extending from the bearing block can be manually moved in a horizontal plane to thereby displace slightly the axis of rotation of wheel 26 in a horizontal plane. An extending bracket 31 mounts a counter 30 whose shaft has a rotary connection to the wheel 26, the counter thus serving to count the rotations of the wheel 26.

After the wire is threaded as shown in Fig. 1 and as explained above, it will be apparent that when the bobbin 15 is rotated counterclockwise by drive motor 14 (by a motion transmission means to be subsequently explained) wire will be drawn from spool 23, at a tension determined by the tension adjusting means 24, and will be wrapped upon the bobbin 15. Manual oscillation of the axis of rotation of wheel 26 horizontally by means of the member 28 will serve to layer or distribute the wire on the bobbin 15, and the counter 30 serves to record the length of wire in feet placed on the bobbin by counting the revolutions of wheel 26 since the wheel has a circumference of one foot in length. When the desired length of wire has been placed on the bobbin 15, as indicated by the counter 30, the drive motor 14 is stopped and the wire is cut at some point between the bobbin 15 and the spool 23. The bobbin 15 is now loaded or wound with the required amount of wire and the bobbin winding apparatus just described has no further part in the coil winding operation.

Referring now to Figs. 2, 3 and 4, the drive mechanism for the bobbin 15 will be described. The base or table member 10 mounts a bracket 41 (Fig. 3) which cooperates with the drive motor 14 to form a conventional belt tensioning mount 42 for the motor 14. The motor shaft 43 (Fig. 3) carries a pulley 44 which accommodates drive belt 51 which drives a pulley 52 (Fig. 2) mounted on a shaft 53 having a suitable journal accommodation 54 in the upright plate 18. A suitable guard member 45 shields the belt 51 and pulley 52. As may best be seen in Fig. 3, the shaft 53 extends from the opposite side of the plate 18 and carries on this extension a bobbin driving wheel 55.

The vertical plate 18 also carries, mounted for rotation, thereon a bobbin contacting idler wheel 56. As may best be seen in Figs. 2 and 4, the plate 18 carries, pivotally mounted thereon at 57, an arm 58 which carries a stub shaft 59 (Fig. 4) having rotatably mounted thereon a further bobbin contacting idler wheel 61. A centrally slotted bracket 62 is adjustably mounted on the plate 18 by means of clamping screw 63 and has its lower extremity 64 extending inwardly through a suitable opening 66 in the plate 18 to provide a bottoming surface for a compression spring 67 which has engagement with the arm 58 and tends to urge it, and consequently the wheel 61, upwardly as viewed in Fig. 4. At its free end, the arm 58 carries a knurled knob 68, the shank of which extends through a suitable slot 69 in the plate 18.

The drive wheel 54 and idler wheels 56 and 61 are positioned in the same vertical plane and have their circumferential edges grooved to receive the annular bobbin 15 which is radiused as at 65 in cross section so as to provide an under surface which cooperates with the wheels 54, 56 and 61. Bobbin 15 includes a channel 70 which can suitably accommodate the desired supply of wire wound thereon by the bobbin winding mechanism previously described with reference to Fig. 1.

It will be understood that the bobbin 15 may be placed in position on the wheels 54, 56 and 61, and removed therefrom by manually lowering the wheel 61 through the medium of the knurled member 68. This bobbin releasing movement of the wheel 61 is accomplished against the force exerted by the compression spring 67 which provides the force necessary to retain the bobbin in driven contact with the drive wheel 54.

As may best be seen in Figs. 2 and 9, and fragmentarily in Fig. 5, a somewhat resilient ring or garter 71 overlies the wire which has previously been placed upon the bobbin 15. The garter 71 may be formed of any suitable, somewhat resilient material, such as plastic materials, and may be provided with a suitable means for joining its ends so that it can be removed and installed upon the bobbin 15 to accommodate the central opening of a toroidal core such as shown at 12, and, when installed, with provide a continuous closure for the circumference of the bobbin 15. As will be apparent from Fig. 5 and subsequent figures, in the coil winding operation, wire will be stripped laterally off the edge of the bobbin 15 against the frictional force exerted by the garter 71. From the foregoing it will be apparent that with the drive motor 14 in operation, the controller for which may be a conventional foot rheostat, the drive wheel 54, and consequently the annular bobbin 15, will be rotated clockwise (as viewed in Fig. 3) at a speed which is a function of the operating speed of the motor 14. It will be understood that to drive the bobbin in a clockwise direction for coil winding, the direction of rotation of the motor 14 must be reversed from its direction of rotation during the bobbin winding operation, this reversal of the direction of rotation of motor 14 being accomplished by conventional control means.

The loop control assembly will now be described, having reference principally to Figs. 1, 2, 3 and 5. Carried by a suitable hub 72 which extends from the plate 18 is a generally disc-shaped member or plate 73. Member 73 is of somewhat smaller diameter than the bobbin 15 and is spaced laterally therefrom so that the bobbin 15 may rotate freely adjacent the plate 73 when the coil winding operation is in progress. Plate 73 is so mounted on hub 72 as to be capable of frictionally resisted rotation thereabout, and, for a purpose to be subsequently explained, can therefore, be angularly positioned with respect to hub 72.

As may best be seen in Fig. 5 and subsequent figures, the upper portion 83 of the outer face of plate 73 is treated to provide a wire movement resisting surface, a preferred form of such treatment being to electrostatically flock the area 83. With the fibres being applied to the area 83 by the conventional electrostatic flocking method, the major portion of such fibres will be retained on the plate 73 in erect position. As will subsequently be explained, the wire, during its loop formation stage, is laterally moved across the surface 83 and, it will be understood, this movement of the wire across face 83 will be resisted by the frictional forces thereby generated and also by the force exerted by the flocking fibres in resisting deformation as the wire loop is pulled laterally therethrough. It will thus be apparent that other forms of treatment of the surface 83 might be used which would provide a wire movement resisting action as the wire loop traverses such surface, however, the preferred embodiment in which the area 83 has applied thereto upstanding flocking fibres provides an excellent wire movement resisting surface since the force exerted by the fibres in resisting deformation and the frictional forces generated as the wire loop traverses the area 83 are both utilized to control the position and tension in the wire during loop formation. It will be further understood that the fibers may be of either organic or inorganic origin and that their upstanding orientation with respect to the plane of plate 73 may be accomplished by any suitable means as well as by the preferred electrostatic flocking method.

A generally L-shaped bracket 74 (Fig. 1) has a suitable pivotal mounting upon the pin 76 carried by the base 10. The opposite end of the base of the bracket 74 is held against the plate 10 by a suitable detent mechanism shown generally at 77 in Figs. 1 and 2. The upper end of bracket 74 rigidly supports a plate 78 which by means of a stub shaft 79 (Fig. 2) carries a hub 90 to which is rigidly attached a further generally disc-shaped plate 91 which may be formed of any suitable material but preferably of a transparent plastic material to facilitate viewing of the area between the plates 73 and 91, and

having thickness somewhat greater than that of the plate 73. Pins 92 and 93 extending from plate 78 and hub 90, respectively, carry a tension spring 94 therebetween, and, as may best be seen in Fig. 3, the hub 90 carries an additional pin 96 extending therefrom, which, together with pin 93, is adapted to cooperate with a pin 97 extending inwardly from the plate 78. It will be evident that the pins 96 and 93 establish, by contact with the stationary pin 97, the limits of a slight rotational freedom of the plate 91 with reference to the plate 78 such movement being resisted slightly by the tension spring 94.

A handle member 98 carried by the free end of bracket 74 provides for release of the bracket from the detent assembly 77 to permit pivotal movement of the bracket 74 about the pin 76 to thereby accomplish a limited outwardly tilted positioning of the whole assembly composed of the plate 91, hub 90 and plate 78. This manually accomplished tilting movement of the plate 91 permits limited access to the area adjacent the inner surface of the plate 73. The two plates 91 and 73 are generally identical in profile and each has at 105 and 106, respectively, a cut-away portion for accommodating the work holding table 11 and the core 12. Plate 73, as may best be seen in Fig. 3, has an inwardly extending lip 107 which extends generally behind the major plane of the bobbin 15 and is adapted to abut the upper portion of the coil turns as they are placed upon the core, this being particularly evident in Fig. 5 and subsequent figures. Adjacent the lower margin of the cut-away portion 105 (Fig. 3), plate 91 carries a lip 81 and plate 73 carries a similar, but oppositely extending lip 82, these lips also appearing in Fig. 2 and serving to guide the wire between the plates 73 and 91.

The coil turn counting means will now be described, having reference particularly to Figs. 1, 2, 3 and 7. Mounted in the upper area of the outer face of the plate 91 by means of suitable fastening means is the housing 17 which has mounted therein a counting switch. Extending from the housing 17 through a suitable slot therein, the counting switch is provided with an actuating member 111, which, as may best be seen in Fig. 7, has a smooth, hard wire engaging surface and is generally channel-shaped in cross section and extends across the distance separating the plates 91 and 73 through matching slots 88 in plates 91 and 73, permitting rectilinear displacement of the member 111 during the coil winding operation. As will be evident from Fig. 7, actuating member 111 is adapted to be contacted by the wire loop 114 formed with each rotation of the bobbin 15 while the coil winding operation is in progress. The subsequent rectilinear displacement of the member 111, which is terminated when the wire loop 114 slips off the end of member 111, serves to actuate the counter mechanism shown generally at 16 which has a count totaling index visible through the window 112. The control housing, of which the counter mechanism 16 forms a part, also provides a control panel 113 for suitably controlling the application of electrical power to the motor 14 and the counter mechanism 16. It will be noted that, as may be seen in Fig. 3, member 111 extends from the switch housing 17 at an angle to the plane of the plates 91 and 73 to prevent the sudden application of the actuating member displacing force on the wire 114.

The means for adjusting both the lateral position of the plate 73 and its angular position with relation to hub 72, the wire core or form positioning stop and the means for vertically and horizontally adjusting the work supporting table 11 will now be described with reference to Figs. 1, 2, 3 and 4. As may best be seen in Fig. 4, an arm 116 is rigidly carried by the hub 72 and extends radially therefrom carrying to its outer end, by threaded engagement, a knurled adjusting screw 117. The end of screw 117 abuts the inner face of plate 73 so that adjustment of screw 117 to the left as viewed in Fig. 2, serves to distort the plate 73 toward the plate 91, thereby repositioning laterally the flocked area 83, particularly that section adjacent the cut away portion 106.

Because of the limited freedom of rotation of both plates 91 and 73 and the frictional contact between the area 83 and the inner face of the plate 91 adjacent the end of adjusting screw 117, the screw 117 may be used as a handle for angularly moving plates 91 and 73 about their centers so that lip 107 of plate 73 may be manually brought to rest against the upper portion of the coil form 12, as shown in Fig. 5, after the core or coil form 12 has been positioned on table 11.

As may be seen in Fig. 1, the work holding table 11 is generally kidney shaped, the area adjacent the indented portion being adapted to position the coil forming core 12. The inward limit for this positioning of the core 12 is adjustably established by a core stop 118 (Fig. 4) which is carried by a centrally slotted bracket 119 which has a clamping engagement with the plate 18 through the medium of a knurled adjustment screw 131. As may best be seen in Figs. 1 and 2, the work table 11 is supported by an assembly comprising a base plate 133 and a vertical member 134. The base plate 133 carries an extending slotted guide member 136 (Fig. 1) which cooperates with a guide pin 137 extending upwardly from the base plate 10. A winged clamping screw 138 serves to clamp the base plate 133 in horizontally adjusted position and a further knurled clamping screw 141 (Fig. 2) extends through an appropriately slotted depending member 142 and is threaded into the member 134, clamping screw 141 thereby serving to hold the work table 11 in verticalled adjusted position.

Operation

With the bobbin 15 reassembled in its annular form after accommodating a toroidal core or winding form thereon as shown in Fig. 1, the required length of wire is wound upon the bobbin by means of the bobbin winding assembly previously described with reference to Fig. 1. Thereafter the wire is cut adjacent the reel 27 and the garter 71 is threaded through the core 12, its ends connected to form the annular configuration, and positioned to overlie the wire wound on the bobbin 15. The free length of wire which now extends over the outer edge of the bobbin 15, as is apparent from Fig. 5 and subsequent figures, is then anchored to the core 12 by manually winding a turn upon the core 12.

During this initial positioning of the core 12 and anchoring of the wire thereto, the slight rotational freedom permitted the plates 91 and 73 may be utilized to facilitate access to the wire and positioning of the core, but after the core is properly positioned the plates 91 and 73 are rotated manually, as previously explained, so as to bring lip 107 of plate 73 into contact with the top of core 12, as shown in Fig. 5. The motor 14 may then be started and the consequent rotation of bobbin 15 will thereupon carry the point at which the wire 114 leaves the bobbin 15 into the wire stripping sector of the bobbin's rotation (Fig. 5). As the bobbin 15 rotates clockwise beyond its position of Fig. 5 toward its position of Fig. 6, it will be apparent that wire will be stripped off the side of the bobbin 15 until the wire bobbin junction has rotated to a point diametrically opposite the core 12.

As the point of junction of the wire and the bobbin is rotated into the position of Fig. 6, the wire stripping force will of course disappear, and the wire 114 will enter into the initial stage of loop formation. Although tension at this point no longer exists for stripping wire from the bobbin, the tension on the portion of the coil already formed on the core 12 will be maintained because of the engagement of the wire 114 with the wire movement resisting surface 83 of the plate 73. As the point of junction of the wire 114 and the bobbin 15 is rotated from the position of Fig. 6 to the position of Fig. 7, the wire loop 114 will be further formed and will be brought into contact with the actuating member 111

of the counting switch 17. Further rotation toward the position of Fig. 8 will cause the wire loop 114 to rectilinearly displace the switch actuating member 111 causing a count registration, the wire loop 114 thereafter sliding off the free end of the switch actuating member 111. During this portion of the loop forming cycle, as in the portion of the cycle shown in Fig. 6, the wire 114 is in continuous engagement with the wire movement resisting surface 83 of the plate 73 thereby holding the wire tightly around the core 12 and the wire loop 114 positionally controlled.

As the point of junction of the wire and the bobbin is carried in the position shown in Fig. 8, formation of the wire loop 114 is completed and further rotation of the bobbin 15, carrying the wire and bobbin junction again toward its position of Fig. 5, serves to tighten the wire loop around the core 12 completing a coil turn.

As the wire bobbin junction is rotated through the position of Fig. 8, again the wire loop 114, because of its sliding engagement with the area 83 of the plate 73, will be positionally controlled and sufficient tension will thereby be maintained on the wire 114 to hold the portion of the coil already on the core tightly in place. As the wire bobbin junction is again rotated into the position of Fig. 5, sufficient wire for the next coil turn will thereafter be stripped from the bobbin 15 and the loop forming process will proceed again as pointed out above.

It will be understood that during the coil winding operation, the core 12 may be manually rotated slowly in a horizontal plane to properly distribute the coil turns on the core 12. As the coil turns are built up on the core, the lip 107 on the plate 73 will remain in contact with the top layer of coil turns and the plate 73 will be correspondingly rotated slightly counterclockwise (as viewed in Fig. 5 and subsequent figures) to accommodate the increasing height of the coil as the turns accumulate. This automatic counterclockwise displacement of plate 73 as the coil turns are accumulated on the core forms an important feature of the present invention because it insures that the wire controlling surface 83 on plate 73 remains contiguous to the coil 12 from start to finish of the coil winding operation. By thus preventing the existence of a gap between the lip 107 and the coil 12 during the build-up of turns on the core, both the wire loops formed as the initial turns are placed on the coil and the loops formed as the final layer of turns are placed on the coil will be in contact with, and thereby positionally controlled by, the area 83 through the complete cycle of their formation including the final stage in which the loop is tightened about the core, there being no appreciable gap between area 83 and the core 12 which would leave the wire loop positionally uncontrolled and untensioned just prior to its final tightening on the core. When the desired number of turns have been wound upon the coil 12 as indicated by the counter at the window 112, the motor 14 is stopped, and the bobbin 15 and the garter 71 disassembled so that the wound coil 12 may be removed.

From the foregoing it will be apparent that the provision of a wire loop forming area between the two plates 91 and 73, the provision of the wire movement resisting surface 83 over a portion of the face of the plate 73 adapted to have sliding engagement with the wire loop as it is formed by the bobbin, and the automatic positioning of plate 73 as the turns accumulate on the core all provide for holding the partially formed coil tightly on the core and positionally controlling the wire loop throughout its formation. This arrangement permits coil windings of relatively fine wire to be placed upon the core at extremely high speed. The provision, by means of adjusting screw 117, for positioning a portion of the wire movement resisting area 83 of the plate 73 toward or away from the plane of the bobbin 15 serves as a means for adjusting the movement retarding force exerted on the wire 114 as it slides over the area 83 and permits accommodating the coil winding operation to wires of various size and tensile strength.

Further, the positioning of the counting switch with its actuator 111 in the upper area of the plate 91 permits the resultant of the forces applied by the wire loop 114 to the actuator 111 to be directed in the plane within which the actuator 111 is free to move to thereby provide accurate counting operation of the switch as the bobbin is rotated at high speed without straining or otherwise damaging the wire as it passes the switch actuating means 114.

In addition, while the invention embodied by the device described herein is particularly useful in the winding of toroidal cores, the feature related to positionally controlling the wire loop by its engagement with the wire movement resisting surface of the adjacent plate and the automatic positioning of the adjacent plate as the coil turns accumulate would also have utility in the winding of coil forms or cores other than those of toroidal shape.

While the foregoing describes a preferred embodiment of the invention, it will be understood by those skilled in the art that various modifications of the invention are possible. For example, the electrostatically flocked plate 73 may be modified by substituting for this type of flocking material various kinds of fabric material glued or otherwise attached to plate 73. Velvet material may be utilized, or any other kind of fabric or other material having operative frictional characteristics may be substituted to confine the wire loop and operate to maintain tension thereon. Other modifications may also be made, it being understood that the scope of the present invention is to be limited only by the appended claims.

The invention claimed is:

1. A high speed toroidal coil winding apparatus comprising an annular wire bearing bobbin adapted to have wire stripped laterally therefrom as said bobbin is rotated, power means for rotating said bobbin within its major plane, a support member for positioning within the path of movement of said bobbin the central opening of a toroidal core about which a coil is to be wound to thereby wrap wire about said member during rotation of said bobbin and to strip from said bobbin sufficient wire for a coil turn as said bobbin rotates through a sector of its angular path, means for confining said loop thereby maintaining wire tension, said means including a plate mounted in spaced parallel relation to the major plane of said bobbin and having a portion extending immediately adjacent to the turns in place on the core, the surface of said portion being slidably engaged by said wire loop as rotation of said bobbin proceeds through a loop forming sector, said plate being rotatably mounted whereby said wire loop passing over said plate will maintain said plate in said position relative to said turns as they accumulate on the core.

2. A high speed toroidal coil winding apparatus comprising an annular vertically mounted wire bearing bobbin adapted to have wire stripped laterally therefrom as said bobbin is rotated, power means for rotating said bobbin within its major plane, a support member for positioning within the path of movement of said bobbin the central opening of a toroidal core about which a coil is to be wound to thereby wrap wire about said member during rotation of said bobbin and to strip from said bobbin sufficient wire for a coil turn as said bobbin rotates through a sector of its angular path, means for confining said loop thereby maintaining wire tension and for controlling the position of the wire loop formed as the bobbin rotates beyond said stripping sector and into a loop forming sector, said means including a generally disc-shaped plate mounted vertically in spaced parallel relation to the major plane of said bobbin and having a portion movable into position adjacent to the turns in place on the core, the upper area of said plate being slideably engaged by said wire loop as rotation of said bobbin

proceeds through said loop forming sector, said plate being rotatably mounted whereby said wire loop passing over said plate will maintain said plate in said position relative to said turns as they accumulate on the core.

3. A high speed toroidal coil winding apparatus comprising an annular vertically mounted wire bearing bobbin adapted to have wire stripped laterally therefrom as said bobbin is rotated, power means for rotating said bobbin within its major plane, a support member for positioning within the path of movement of said bobbin the central opening of a toroidal core about which a coil is to be wound to thereby wrap wire about said member during rotation of said bobbin and to strip from said bobbin sufficient wire for a coil turn as said bobbin rotates through a sector of its angular path, means for confining said loop thereby maintaining wire tension and for controlling the position of the wire loop formed as the bobbin rotates beyond said stripping sector and into a loop forming sector, and means including a generally disc-shaped plate disposed vertically in spaced parallel relation to the major plane of said bobbin and mounted for limited rotational movement, the upper area of said plate being engaged by said wire loop as rotation of said bobbin proceeds through said loop forming sector, said plate having a cut-away portion formed therein accommodating said toroidal core whereby said plate rests upon said core minimizing the gap therebetween, said plate being movable to accommodate the turns accumulated on said core thereby maintaining said minimum gap as the winding operation proceeds.

4. Coil winding apparatus comprising an annular wire bearing bobbin and power means for rotating said bobbin

within its major plane, a support for positioning within the area bounded by said annular bobbin a core member about which a coil is to be wound to thereby wrap wire about said member during rotation of said bobbin and to strip from said bobbin sufficient wire for a coil turn as said bobbin rotates through a sector of its angular path, means for maintaining wire tension and controlling the position of the wire loop formed as the bobbin rotates beyond said stripping sector and into a loop forming sector, said means including a plate disposed in spaced parallel relation to the major plane of said bobbin and mounted for limited rotational movement, said plate having an area supporting erect fibres thereon and adapted to be engaged by said wire loop as said bobbin rotates through said loop forming sector, said fibred area of said plate having a cutaway portion formed therein accommodating said core member whereby said plate rests upon said core member minimizing the gap between said fibred area and said core member, said plate being movable to accommodate the turns accumulated on said core member thereby maintaining said minimum gap as the winding operation proceeds.

References Cited in the file of this patent

UNITED STATES PATENTS

2,672,297	Harder	Mar. 16, 1954
2,761,629	Wirth	Sept. 4, 1956
2,793,817	Clarke	May 28, 1957

FOREIGN PATENTS

153,368	Australia	Sept. 24, 1953