March 7, 1967 R. FAHRBACH 3,307,991

METHOD AND APPARATUS FOR WINDING TOROIDAL COILS

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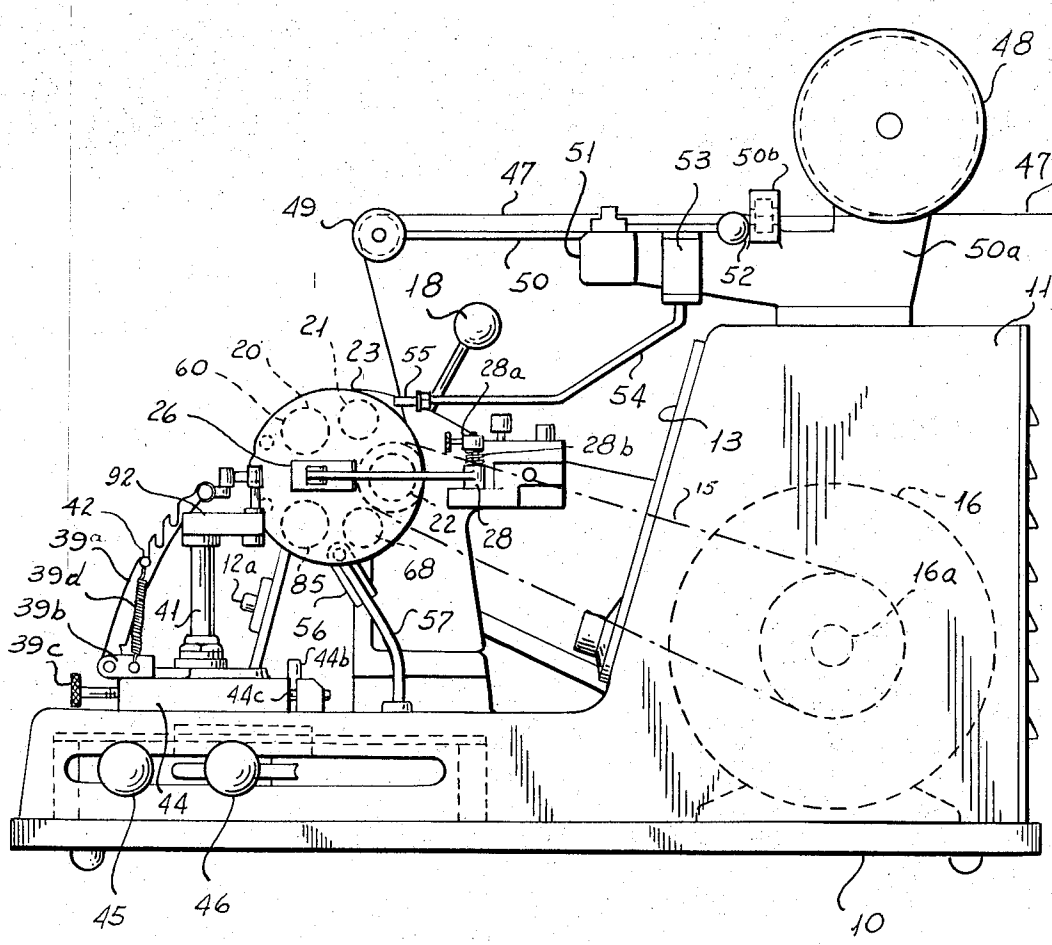


Fig 1

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March 7, 1967 R. FAHRBACH 3,307,991

METHOD AND APPARATUS FOR WINDING TOROIDAL COILS

Filed April 1, 1963 4 Sheets-Sheet 2

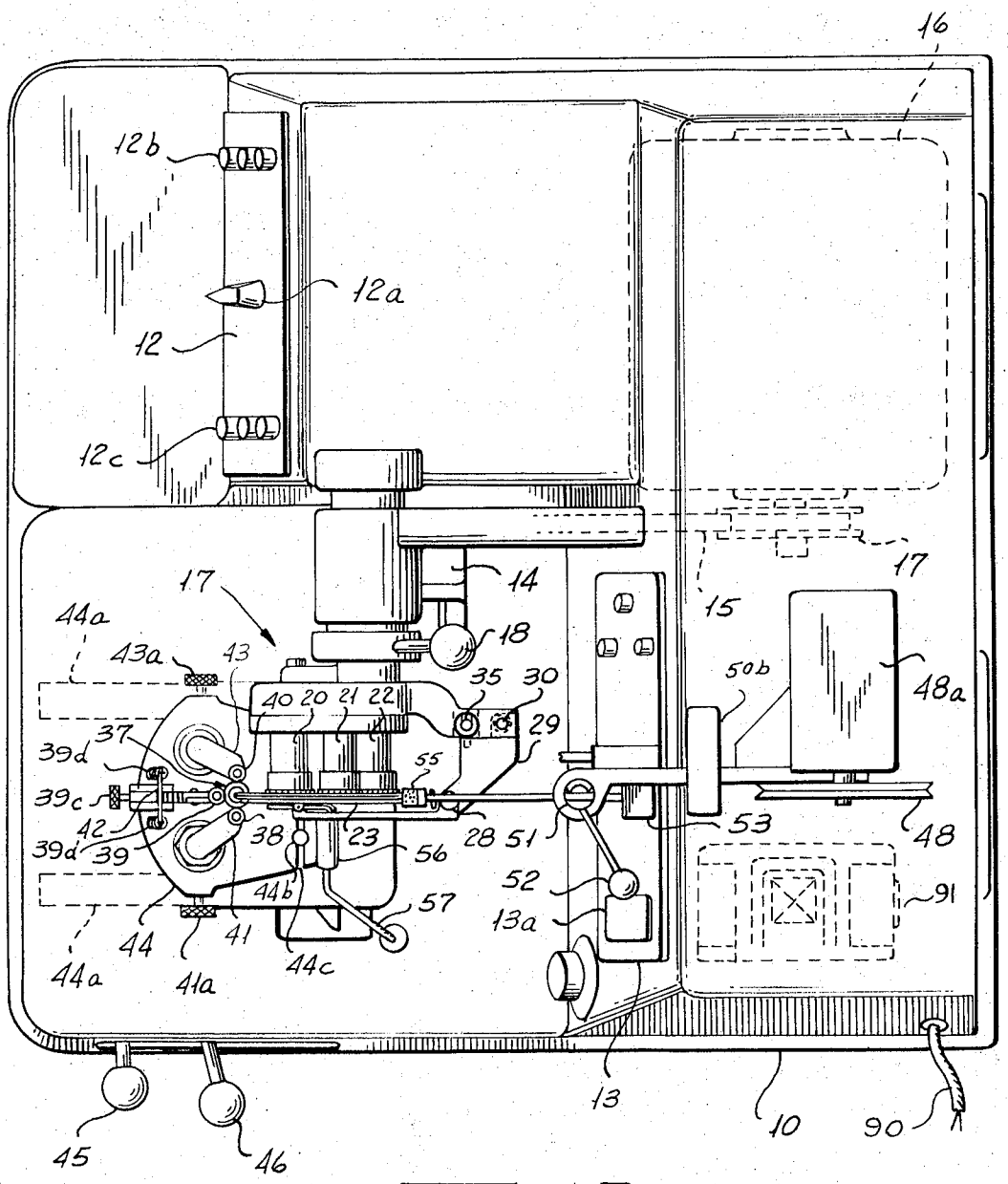


FIG 2

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March 7, 1967 R. FAHRBACH 3,307,991

METHOD AND APPARATUS FOR WINDING TOROIDAL COILS

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Fig 3

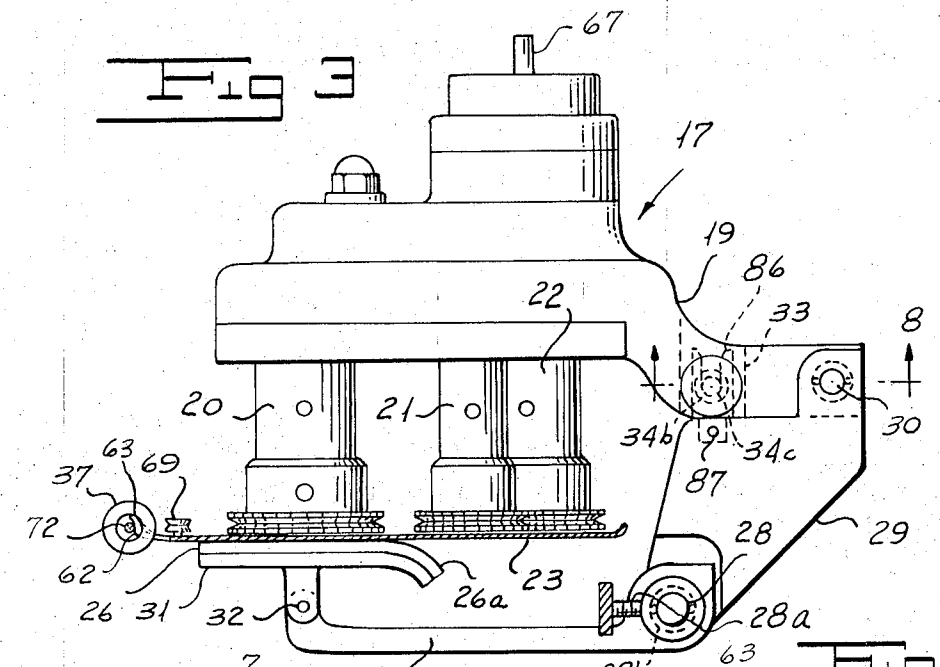


Fig 6

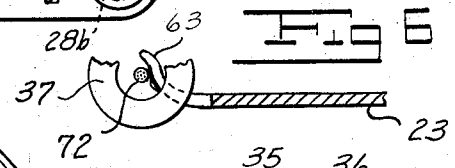
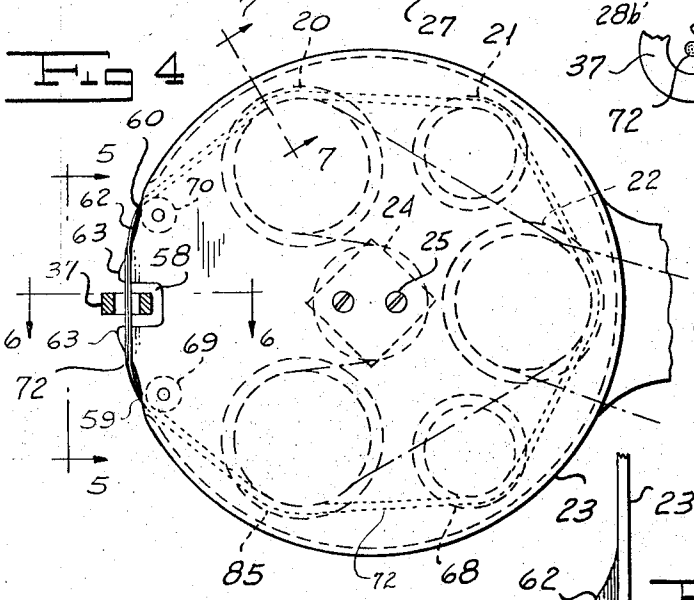


Fig 4



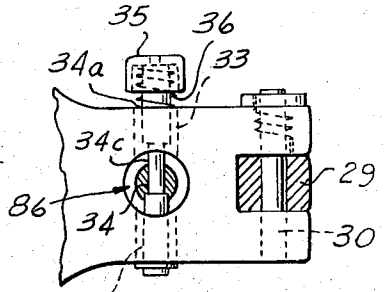


Fig 8

Fig 5

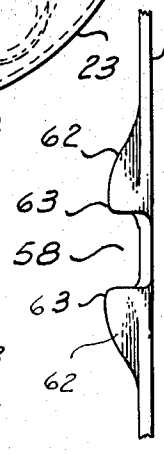
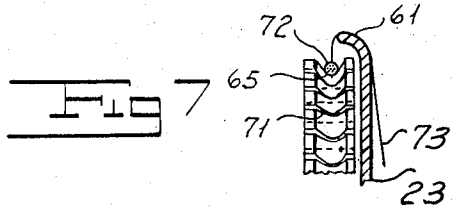


Fig 7



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March 7, 1967 R. FAHRBACH 3,307,991

METHOD AND APPARATUS FOR WINDING TOROIDAL COILS

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FIG 9

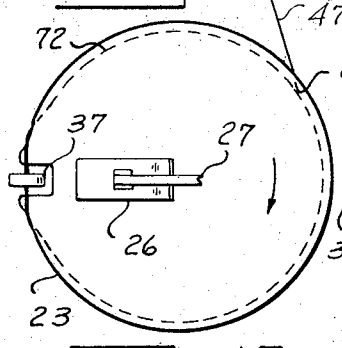


FIG 10

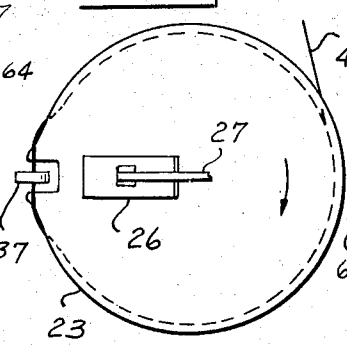


FIG 11

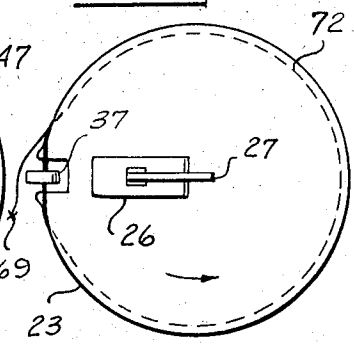


FIG 12

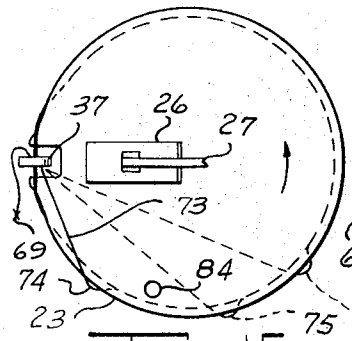


FIG 13

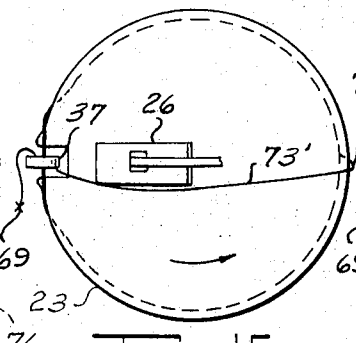


FIG 14

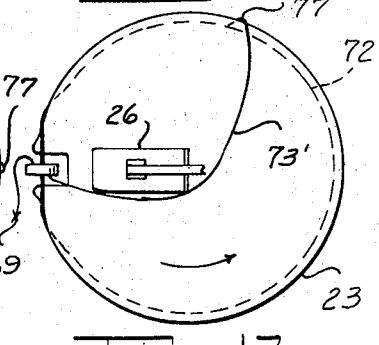


FIG 15

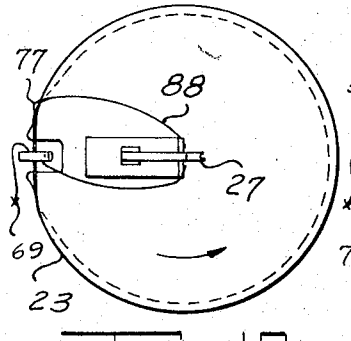


FIG 16

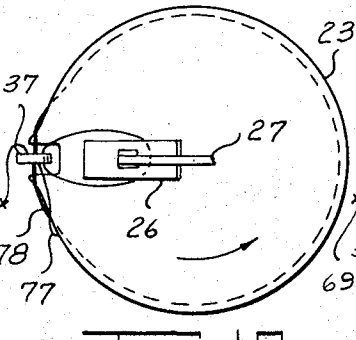


FIG 17

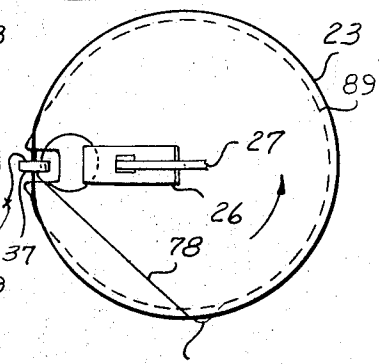


FIG 18

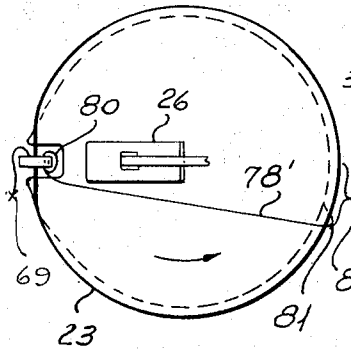
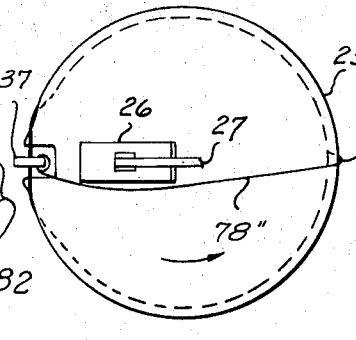


FIG 19



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United States Patent Office 3,307,991
Patented Mar. 7, 1967

3,307,991

METHOD AND APPARATUS FOR WINDING TOROIDAL COILS

Rudolf Fahrbach, Union, N.J., assignor to Universal Manufacturing Company Incorporated, Irvington, N.J., a corporation of New Jersey

Filed Apr. 1, 1963, Ser. No. 269,565
9 Claims. (Cl. 156—172)

This invention relates to an apparatus and method for winding toroidal coils and, more particularly, to such apparatus and method wherein no structure other than the strand used to wind the coil passes through the core upon which the strand is wound.

Toroidal coil winding machines usually comprise an annular shuttle and bobbin for carrying and dispensing the strand to be wound upon a toroidal coil. The annular bobbin of such machines interlinks the core by passing through the aperture thereof so that strand carried on the shuttle can be transferred from the bobbin to the core. The problem with such machines is that the space in the aperture of a core remaining after winding the strand about the core must be greater than the space needed for the shuttle structure passing through the aperture.

A first step to a solution of this problem is disclosed in United States Patent No. 751,816 issued in 1904 to A. J. Strong on a "Process of Winding." The Strong patent shows a method of winding wire on a ring without any extraneous structure passing through the aperture of the ring. One further solution is disclosed in United States Patent No. 2,905,399 issued in 1959 to C. W. Baker on a "Ring Winding Machine." The Baker patent provides mechanism for winding wire on a ring also without extraneous structure passing through the aperture; the complexity of Baker, however, renders it impractical for commercial use. Both Strong and Baker depend on the operator of the machine to separate or peel a strand portion from the bundle of wire for forming the strand as a winding on the ring. Although Baker's machine is automatic after starting the first winding, it is not able to apply windings on the core in a reverse-winding sense.

This invention solves this difficult problem in a novel manner and with the use of relatively less complex mechanism whereby the need of any structure passing through the aperture of the core other than the strand being used to wind on the core is obviated. The invention lends itself to reversible operation as will be explained.

I have invented an improved toroidal coil winding machine which comprises means for forming a bundle of loops of wire so that the bundle is interlinked with the core. The loops of wire are provided with a tacky adhesive which keeps the loops in a cohesive bundle. During the winding operation the bundle is rotated in the desired winding-sense direction regardless of the winding-sense used to form the bundle. Means are provided for peeling one and only one loop from the bundle and guiding it by tensioning means onto the core to form a winding thereon. Upon the formation of the winding on the core another loop is peeled from the bundle to again form a winding on the core.

Accordingly, it is the principal object of the invention to provide a toroidal coil winding machine that avoids the need of any extraneous structure through the core.

It is a further object of the invention to provide a machine which will enable the winding of a coil in any of the two winding senses regardless of the sense of loading the strand prior to winding.

It is still a further object of the invention to provide a machine which is simple in construction and thereby

overcomes the disadvantages of analogous machines of the prior art.

Other and further objects will appear from the following description.

In general, my invention contemplates the provision of a bundle of wire loop strands carried on a plurality of pulleys having grooves on each for frictionally carrying the bundle in a plane generally perpendicular to the plane of the core. The bundle is wound upon the pulleys after passing the strand through the aperture of the core from a single strand of length sufficient to wind the core with the desired number of windings.

As the strand is formed into the bundle the surface of the strand is treated with a tacky material to develop cohesive action between contiguous strands. The tacky surface is produced by use of a quick-drying cement or by the application of alcohol to render tacky the surface portion of the usual insulating compound put on such wire, such as varnish, lacquer, shellac or the like. A plate is spaced from and parallel to the plane of the bundle. The plate is preferably of circular geometry and is provided with a peripheral recess for receiving the core. A lip is formed on the periphery of the plate extending toward the bundle and terminating just short of the plane defined by the bundle. The lip is smoothly curved to automatically guide the wire from the bundle onto the face of the plate opposite from the bundle. The edges of the recess between which the core is disposed are extended in the form of fingers through the plane of the bundle to behind the bundle away from the plate. These extension fingers are grooved with a smooth surface to receive and guide the bundle through the aperture of the core. A strand portion under tension causes one loop to be peeled from the bundle across the plate lip onto the opposite face thereof away from the bundle.

A pad is resiliently pressed against the face of the plate opposite from the bundle. This pad functions to form by tensioning a loop of wire that has been peeled from the bundle and guided to the front face of the plate. The pad is so shaped as to receive a portion of the loop-forming strand so that a loop is formed about the pad. The pad keeps the loop against the plate as the loop is reduced in size and tensioned toward the core. The pad releases the loop in the vicinity of the core, allowing the wire to be tensioned on the core to form a winding. As the winding is tensioned on the core, a second loop is automatically peeled from the bundle to repeat the winding operation. The operation is repeated thereafter automatically in sequence to wind a core with a desired number of windings.

In the accompanying drawings, to which reference is made in the following detailed description of one embodiment of the invention and in which like reference characters indicate like parts in the various views.

FIGURE 1 is a side elevation of the toroidal coil winding machine of the invention.

FIGURE 2 is a top plan view of the machine of FIGURE 1.

FIGURE 3 is a top plan view of the winding head of the machine including the pulleys, guide plate, and braking pad.

FIGURE 4 is a fragmentary side elevation view illustrating in detail the guide plate and pulleys of the machine.

FIGURE 5 is a side view of FIGURE 4, taken along view 5—5, of the recessed portion of the guide plate.

FIGURE 6 is a sectional view of FIGURE 4 taken along view 6—6.

FIGURE 7 is a sectional view of the guide plate and its pulley taken along view 7—7 of FIGURE 4.

FIGURE 8 is a sectional view of the interlock pad holding mechanism taken along view 8—8 of FIGURE 3.

FIGURES 9 through 19 inclusive illustrate several steps sequential in operation of the machine.

Referring more particularly to FIGURES 1 and 2, the machine is mounted on a platform **10** upon which is mounted a housing **11** including a control panel **12** and a counter panel **13**. The control panel includes a selector speed knob **12***a* and other control devices such as **12***b* and **12***c*, e.g., to start the apparatus and perform various control functions. Counter panel **13** includes a counter **13***a* which indicates the number of turns that have been completed on the core in response to a photocell counter to be explained.

Pedestal **14** is mounted on housing **11** and includes a drive shaft, not shown, connected by an endless belt **15** to the shaft **16***a* of motor **16** within housing **11**. Cable **90**, including the needed wires to the several electrical components, is connected to appropriate electrical sources not shown. A winding head **17** is preferably adapted for easily attachable and removable connection to the drive shaft and pedestal by means of a manually operated lever **18**. The details for an interchangeable head are more fully disclosed and claimed in my U.S. Patent 3,165,273, patented January 12, 1965, entitled "Toroidal Coil Winding Apparatus." The winding head **17** includes body portion **19** housing a gear train (not shown) driven by shaft **67** (FIGURE 3) for driving pulleys, **20**, **22** and **85** (see FIGURE 4). Idler rollers **21** and **68** are spring-loaded so that their axial position is displaceable depending upon the tension of the wire being carried thereon. Idler rollers **69** and **70** are rotatably mounted on the inner face of the plate **23** and positioned to guide the bundle of wire strands through the aperture of the core.

The pulleys and idlers are provided with transverse slots **71** (see FIGURE 7) to minimize the holding effect of the tacky surfaces of the wire to the grooves particularly at idler rollers **69** and **70**. The grooves **71** also act as passageways through which abraded particles of wire insulating material may be passed thereby by keeping the grooves clear of such particles.

A flat circular plate **23** is removably mounted to the housing **19** by means of a recessed plate **24** made flush with plate **23** (illustrated in FIGURE 4) and screws **25**.

A pad **26**, best seen in FIGURE 3, is resiliently pressed against the outer or viewable face of the plate **23** by an arm **27** resiliently pivoted at **28** about a member **29** which in turn is pivotally attached to housing **19**. A hinge **30** provided with a relatively strong spring capable of rapidly swinging members **29**, **27** and **26** in a counter-clockwise direction is seen in FIGURE 3. The pad is pressed against the plate **23** by action of the spring-loaded hinge **28**.

A coil spring **28***b* is disposed about a stud of the hinge (not shown). One end of spring **28***b* is internally connected so as to be fixed relative to member **29** and the other end is connected to arm **27** so that a torque is effected for clockwise rotation of arm **27** about hinge **28** thereby pressing pad **26** against the face plate **23**. Adjustment knob **28***a* provides connection to the upper end of coil **28***b* for adjustment of the tension of the spring. Pad **26** mounted on a shoe **31** is freely pivoted at pivot **32**. In the housing **19** there is provided a chamber **33** for receiving a forked member **86**. Member **86** is connected to member **29** by pin **87** passing through a rod portion of member **86** inserted in a recess of member **29**. Passing through the housing **19** within the chamber **33** is a latch pin **34** having upper **34***a* and lower **34***b* diameter portions greater than the middle diameter portion **34***c*. Pin **34** is provided with a manually pressable cap **35** and is maintained in the latched position shown, by the compression spring **36**. The tines on fork **86** are provided with recesses on their lower faces (not shown) for engagement with the shoulder of large diameter portion **34***b* of pin **34**. The portion **34***b* is kept in engagement with the recesses of the fork tines **86** by action of the spring **36**. When the button cap **35** is depressed pin **34** is pushed downwardly disengaging the portion **34***b* from the recess of the fork and the spring-loaded hinge **30** acts on the pad assembly rapidly swinging it counter-clockwise, as seen in FIGURE 3, away from the plate **23**. This rapid release mechanism allows quick access to plate **23** for cleaning or removal of the plate **23** or other purposes.

Core **37** is held in place in part by an idler roller **39** mounted for free rotation on an arm **39***a* pivoted on a standard **39***b* attached to the top of a table **44** secured to the top of the housing **11** of the machine. The arm **39***a* is provided with a knob **39***c* and a pair of springs **39***d* suitably attached to the arm and the standard. The core **37** is held by idler roller **39** against a pair of grooved driven rollers **38** and **40** mounted on vertical columns **41** and **43**, respectively, within which are included rotatable shafts appropriately rotating the driven rollers and thus core **37** in a selected direction or slowly reciprocating rotation by means of pinions meshing with a gear appropriately rotated within the housing, as well known in the art. Provisions are made by knobs **41***a* and **43***a* for adjusting the position of columns **41** and **43** and thus the rollers **38** and **40** depending on the size of the core **37** to be wound. Member **42**, connecting the two springs **39***d*, is positioned in any of the several teeth of arm **39***a*, and, together with knob **39***c*, provides for a wide range of tension adjustments for roller **39**.

The table **44** is removably attached by screw **44***b* in slot **44***c* to the housing **11** and connected to driving mechanisms not shown for driving the several shafts connected to the rollers. Table **44** is adapted for positioning along tracks **44***a* as is usual in the art. A manual lever **45** is connected to the core drive and clutch mechanism **91** with means not shown to engage or disengage the driving mechanism from the rollers and to reverse their direction of rotation. Manal lever **46** is connected to means not shown for connecting the table to the driving mechanism of the rollers and locking the table to the housing. The table **44** and the associated mechanism just described are well known in the art.

Insulated wire strand **47** to be wound on the toroidal core **37** is taken from a supply spool (not shown) guided about counter pulley **48** and guide pulley **49** mounted on arm **50** to bracket **50***a*. A counter **48***a* (FIGURE 2) measures the length of wire **47** passing about pulley **48**. A wire cutter is included in the device **51** provided with a manual lever **52** which is rotatable to cut the wire passing through the device **51** to the desired length. Guide **50***b* mounted on bracket **50***a* holds felt through which wire **47** is passed for cleaning the wire and holding the supply wire after being cut from that loaded in the machine.

Container **53** for a tacky producing liquid such as alcohol, preferably "propanol," is conveyed by tube **54** to a wick **55** through which wire **47** is passed. The wick **55** is moistened with alcohol from container **53** to render the insulation of the wire tacky.

A photocell assembly **56** is mounted on housing **11** by bracket **57** through which are carried the conductors to the associated circuitry not shown. The photocell is disposed behind a portion of the plate **23** provided with a hole through which an exciting light source not shown, but located in the front of plate **23**, is passed. The function of this assembly is to count the number of turns that are being applied to the core. The circuit details for such a photocell system are well known in the art and will be apparent to those skilled in this art.

Plate **23** is a flat circular plate of metal or plastic provided with a recessed cut-out **58** into which the core **37** is positioned. The peripheral portion of the plate **23** between the points **59** and **60** (FIGURE 4) is smoothly grooved into a lip portion **61** as best seen in the sectional view of FIGURE 7. The end of the lip portion defines a plane substantially in line with the plane of the bundle of wire loops **72** whereby a wire strand is peeled from

the bundle substantially vertically. The lip should not overhang the bundle so much as to force the wire to cross the lip at a sharply acute angle. Too sharp an angle may cause excessive strain which could snap the wire strand. In the shortest segment of the periphery of plate **23** between points **59** and **60**, plate **23** is provided with grooved portions **62** terminating in finger portions **63** as shown in FIGURES 3, 4, 5, and 6.

It is noted that the plate is so shaped and positioned with respect to the core **37** that there is a symmetrical relation of all parts with respect to the horizontal axis of the core. As will be described, this symmetrical relation allows for a reversible action of winding.

In operation a core **37** of selected size is manually positioned within the three-roller pedestal. The manual lever **45** is in the "Off" position to disengage the core rotating mechanism. Manual lever **46** is in the "engaged" position to lock the table **44** to the housing. Insulated wire strand **47** is manually guided around guide pulley **49** through the wick **55** to the right side of plate **23** along the grooves of the pulleys and idlers **22, 68, 85, 69**, through the aperture of core **37** around the several idlers and pulleys **70, 20** and **21** whereby the end has formed a complete loop as shown in FIGURE 9. The wick **55** carrying the fluid for rendering the insulating surface of the wire tacky is located as close to the winding head as possible so that when the insulation of the wire is wetted it will not dry so quickly as to render ineffective the tacky effect produced by the wetting action. As each wire with its tacky surface has attached itself to a contiguous tacky wire, I have found that continued tackiness is not essential. The end of the wire forming the first loop is twisted about or otherwise suitably connected to the wire strand with which it forms a loop, as illustrated at **64** as seen in FIGURE 9. The wire strand **47** while forming this first loop is guided through the grooves **65** on each of the rollers (see FIGURE 7).

The driven rollers **20, 22** and **85** are actuated to rotate the first loop in the direction indicated in FIGURE 10 a number of turns to form additional loops from wire strand **47** of sufficient length to wind all the turns required on the core. Assuming that the circumference of the path of the wire strand about the several pulleys and idlers is ten times the circumference of each winding of the core, a core having 100 windings would require a bundle of wire of at least ten loops. Thus, the pulleys are rotated in the direction shown in FIGURE 10 to form ten loops of wire strand **47** in the grooves of the pulleys and through the core **37**. The wire coming from the counter pulley **48** is then cut by manual lever **52**. The cut end **69** shown in FIGURE 11 is then attached to the machine in a convenient location, for example, on attachment point **92** on the roller mounting as indicated in FIGURE 1. I have discovered that the location of attachment point **92** is not critical provided it is spaced from the plane of the bundle toward, on or past the plane of plate **23**.

Wire end **69** is, for this description, taken from the bundle portion above the core **37**. The controls of the machine are set for winding. The rollers drive the bundle **72** in the direction shown by the arrow in FIGURE 12. The wire starting from attachment **92** passes initially loosely through core **37**. At some point, **74**, the wire is adhered to the bundle. As the bundle is rotated counterclockwise, wire portion **73** is tensioned to cross lower groove portion **62** (FIGURE 5) away from the bundle path as indicated in FIGURE 12. The remaining wire loops of the bundle, not subjected to the tension, are carried within lower groove portion **62** and behind plate **23**. Further rotation of the bundle maintains a tension force causing wire portion **73** to be lengthened by peeling the portion tacked to the bundle from the bundle, as indicated in FIGURE 7. The increasing length of wire from the bundle is accomplished continuously with rotation of the bundle. Progressive increases of length are illustrated in FIGURE 12 by points **75** and **76**. At point **77**, as seen in FIGURE 13, the wire strand **73'** is now of a length substantially equal to the diameter of plate **23**. Further rotation of the bundle past the horizontal center line eliminates any further tensioning on the wire strand **73** and therefore stops the peeling action of the wire strand **73** from the bundle **72**. Further rotation of the bundle as seen in FIGURE 14 causes the wire strand **73'** to be guided around the pad **26** under the inclined portion **26a** (FIGURE 3) thereof. Pad **26** has a felt surface or the equivalent of texture insufficient to abrade or cut the wire as the wire is resiliently guided between the mating faces of pad surface and plate **23**. Upon further bundle rotation, strand **73'** is formed into a loop **88** as seen in FIGURE 15. Further rotation of the bundle causes loop **88** to be tightened by the braking effect of the pad and to be restrained under the pad to a gradually reducing size as shown in FIGURE 16. FIGURE 17 shows the loop reduced in size just prior to release. Simultaneously the tension on the loop being reduced in size by the pad **26** is not sufficient to start peeling the strand portion **78** from the bundle at point **77** in FIGURE 16. Strand **78** is initially comprised of the take-up portion of strand **73'** as loop **88** is reduced in size. The take-up portion is carried directly with the bundle by the contact point **77**. Contact point **77** holds the end of wire strand **73'** to the bundle since strand **73'** is not under enough tension at point **77** to peel additional strand from the bundle. Wire strand **78** increasing in length as loop **88** is reduced in length is shown in FIGURE 17. Upon further rotation of the bundle as seen in FIGURE 18 the first loop **88** has been tightened on the core as winding **80** and wire strand **78** is lengthened to **78'** by peeling action from the bundle as at point **81**. Upon further rotation of the bundle through the segment **82**, the wire length peeled from the bundle is approximately equal to the circumference of the winding on the coil. At point **83**, as seen in FIGURE 19, wire strand **78''** has reached a maximum length due to peeling action. Strand **78''** is then formed into a second loop as explained for the formation of loop **88**. Continued rotation of the bundle sequentially peels one and only one strand from the bundle which in turn is formed into a loop. This is continued until a selected plurality of windings are tightened on the core. It is understood that during the winding of turns of strand on the core, the core-positioning-and-rotating rollers are operating to rotate the core as desired to form helical turns on the core along any desired segment of the core. This mechanism and its opertaion as well known in the art. Accordingly, it is not necessary to describe it further.

As seen in FIGURE 12, an aperture **84** is provided through plate **23**. Aperture **84** passes light from a lamp, not shown, to the sensitive portion of photocell assembly **56** (FIGURE 1). It will be appreciated that any wire strand crossing the aperture **84** will momentarily break the light beam causing the photocell to detect the presence of a wire passing across the aperture. The photocell system thus counts each wire strand which in turn is numerically equal to a winding turn on the core. Even though the circumference of the bundle **72** may be many times the circumference of the winding to be placed on the core, only one revolution of the bundle is needed to perform one winding on the core. Accordingly, a photocell counting the passage of wire strands, for example **73** and **78**, is a precise count of the windings on the core.

Any time during the operation of winding a coil on a core, the machine may be halted and restarted in a reverse winding-sense to cause the bundle **72** to rotate in the opposite direction of rotation whereby the windings on the core will be wound automatically in the sense opposite to that before halting the machine. This is accomplished without any other manipulation or adjustment of the machine because of the symmetry of the machine, particularly guide plate **23**. It will be appreciated that a strand to be peeled from the bundle must eventually be tensioned by the inner surface of the core and under ten-

sion will lengthen itself by peeling from the bundle regardless of the rotation sense of the bundle. For example, if the machine were halted at the position shown in FIGURE 17 and then operated to reverse the bundle rotation opposite to that shown, wire segment **78** unaltered in length would be carried by its point of contact **79** to the bundle **72** in the direction opposite to the arrow through the core **37**. Simultaneously, loop **88** would be unwound into a non-looped segment being slipped upwardly across plate **23** under pad **26**. Note that the aggregate length of segment **78** and the loop **88** is less than the diameter of plate **23**. Thus a point such as **89** (corresponding to **81** of FIGURE 18 for the original winding operation direction) will cause tension on the now-lengthened wire segment. The wire segment would then be further lengthened to a length corresponding to 78" (FIGURE 19) by peeling from the bundle. Note that the wire is peeled from the bundle in the same direction in which the strand was applied to the bundle during the formation of the bundle. It is noted that the sense of peeling for the reversed operation just described is opposite to the peeling of a strand portion from the bundle while winding a coil in the direction indicated by the arrow in FIGURE 17. Continued rotation in the reversed direction causes loops to be formed and tightened as windings on the core described above.

It will be seen that I have accomplished the objects of my invention. I have provided a toroidal coil winding machine that winds a toroidal coil upon a toroidal core without any extraneous structure passing through the aperture of the core. According to the method and machine of my invention, a core of very small dimensions may be wound and if desired all the space in the aperture of the core may be utilized to the last strand of wire than can pass through the aperture.

A given design of plate **23** can be used to wind cores of different sizes. A large departure in size of a core from a given design of plate **23**, however, will require a different plate similar to plate **23** except for change in size of recess **58** to accommodate the core. Thus, a core incapable of being received in recess **58** would require a plate of a larger recess.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is therefore to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. The method of winding wire upon a closed core, said wire having an insulated surface which is rendered tacky by a suitable solvent, comprising the steps of forming a single length of wire into a bundle of a plurality of loops substantially in a plane at an angle to the plane of the core upon a plurality of pulleys spaced from the aperture of said core frictionally engaging a portion of the loops, simultaneously guiding by a fixed, rigid, non-rotating plate an arcuate portion of said bundle through the aperture of the core, applying a suitable solvent to the wire to render the surface of the wire tacky for bonding contiguous loops, attaching one end of the wire to a fixed position, rotating the bundle, peeling rfom the bundle a portion of the loop last formed from the attached end, guiding the loop portion into a plane spaced from the plane of the bundle and substantially parallel to the plane of the bundle, tensioning the loop portion into a gradually shortened loop, tightening a portion of said loop portion on said core, repeating in sequence the peeling, guiding, tensioning and tightening steps, whereby a core may be wound with a plurality of windings.

2. In a machine for winding strand on a toroidal core, means for forming a bundle of strand loops from a single length of strand, means fixedly spaced from the aperture of a core for guiding an arcuate portion of said bundle through the aperture of said core whereby said bundle is interlinked with said core, rigid and non-rotating means for peeling a portion of only one loop from said bundle, and means for tightening a portion of said loop-portion about the core.

3. In a machine according to claim **2**, wherein said bundle forming means includes a plurality of pulleys frictionally engaging said bundle adapted to rotate said bundle in a plane, and tacking means for bonding contiguous loops of said bundle said tacking means comprising a tacky producing liquid for rendering tacky insulation on the strand, said strand having insulation of the type responsive to liquid to render same tacky.

4. In a machine according to claim **2** wherein said peeling means includes a plate spaced from said bundle, a recess in a portion of the periphery of said plate, said plate being oriented so that the core is positioned within said recess, a smoothly-curved lip formed along the non-recessed periphery of said plate and directed toward said bundle, said plate being oriented so that the plane defined by the edge of the lip includes the plane contiguous with the bundle portion nearest the plate, said lip having a finger portion extending from one edge of the recess through the plane defined by the bundle portion farthest from the plate and having a smoothly-curved groove adapted to guide the inner peripheral surfaces of the bundle.

5. In a machine according to claim **2** wherein said tightening means includes a pad resiliently pressed against the face of said plate opposite from said bundle, and adapted to tension the said one loop-portion between the pad and plate sufficiently to allow said loop-portion to be reduced and to be guided on said core.

6. A quick-release mechanism comprising in combination a first body and a second body, a pad pivotally attached to a rigid arm, a resilient hinge pivotally connecting said arm to a base member for resiliently pressing said pad against said first body, a second resilient hinge pivotally connecting said base member to said second body for resiliently urging said pad away from said first body, said second hinge having spring means for producing a substantial torque, and latch means for releasably attaching said base member to said second body to render ineffective said second resilient hinge, and manual means for releasing said latch whereby said pad is rapidly urged away from said first body.

7. A quick-release mechanism according to claim **6** including means for adjusting the tension of said first-mentioned resilient hinge.

8. A method according to claim **1**, comprising the additional steps of reversing the rotation of said bundle, peeling a subsequent portion of only one loop from said bundle on a plate having a pair of symmetrically oriented guide fingers, and tightening a portion of said subsequent portion on said core to form a winding on said core in a winding sense opposite to that of the first mentioned windings.

9. In a machine according to claim **4** wherein a pair of said finger portions are symmetrically disposed about said recess, whereby the winding sense of turns on said core can be reversed by guiding said bundle in a reverse direction.

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