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WINDING MACHINE

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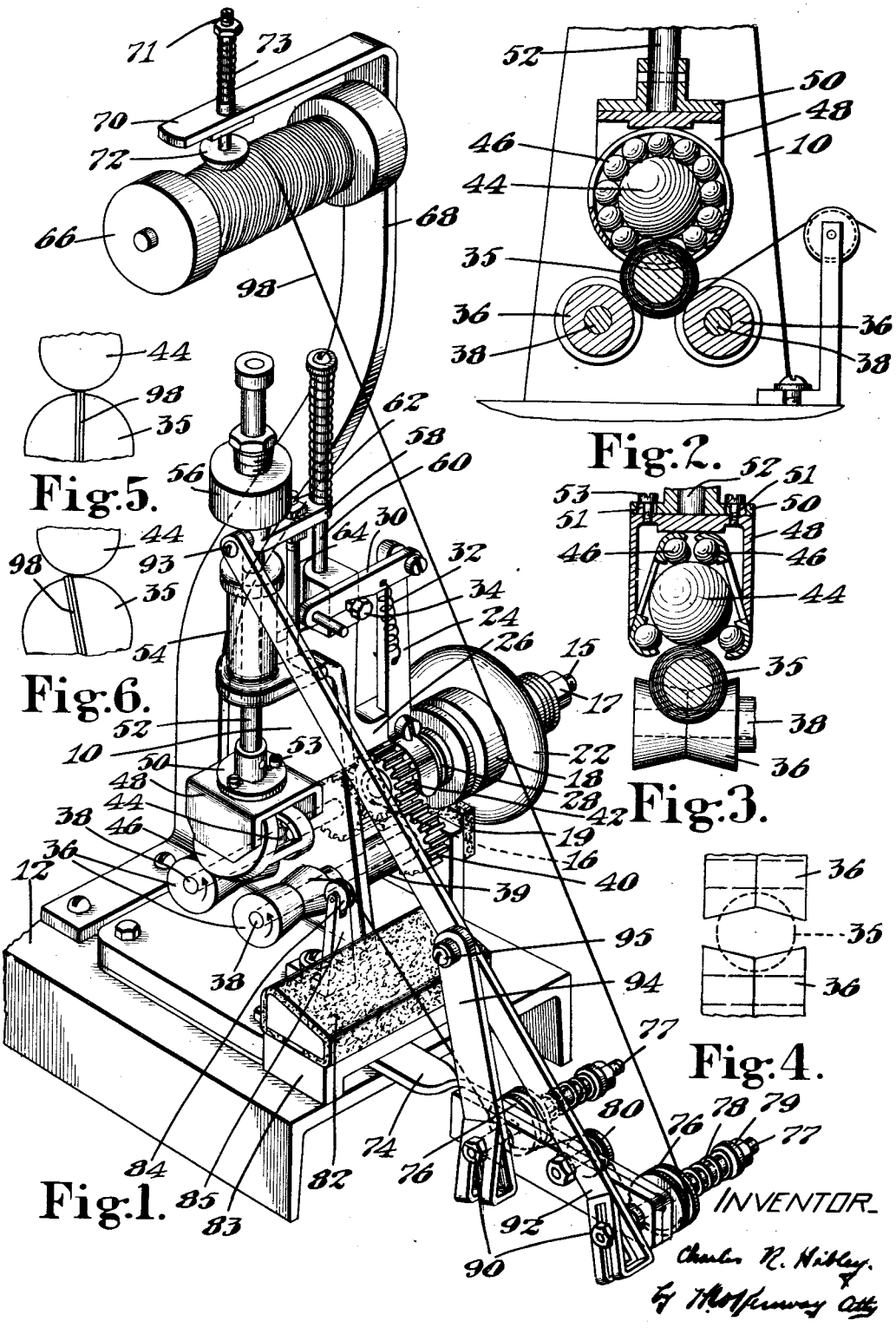

Fig.1.

Fig.2.

Fig.3.

Fig.4.

Fig.5.

Fig.6.

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WINDING MACHINE

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This invention relates to machines for winding spherical cores such as those used in the construction of golf balls, and its object is to provide a winding machine by which cores may be wound with greater uniformity and accuracy of shape than heretofore and in an improved manner which prevents displacement of the center or kernel upon which the core is wound.

In the manufacture of golf balls it is customary to employ a small kernel of pure rubber or an acid-filled and frozen kernel, and to wind upon this kernel a tensioned elastic thread, forming a spherical core of great resiliency. It is of the utmost importance to carry out the winding process symmetrically so that the kernel shall at all times occupy the geometric center of the core and to arrange the windings so as positively to prevent displacement of the kernel when the finished ball is subjected to the rough treatment incident to its use. If the kernel is displaced in winding or becomes displaced in use, the flight as well as the travel of the ball upon the green is rendered irregular.

In winding machines as heretofore constructed, the attempt has been made to rotate the core about axes predetermined in accordance with harmonic or other fixed type of mechanical movement but there are so many uncertain factors in the winding operation such, for example, as slippage of the core, and variations in the tension of the thread, that the results secured are not uniform and not always satisfactory, particularly in respect to the maintenance of a symmetrical position of the kernel in the core.

An important feature of my invention consists in controlling the rotation of the core automatically by the shape of the core as wound, as distinguished from the mechanical predetermination of its position heretofore attempted. Accordingly, in one aspect my invention comprises a machine having means for supporting and rotating a sphere, such as a core, in combination with a thread guide and means for detecting the zone of maximum diameter as the sphere is wound, and causing it to assume another position with respect to the thread guide. Having detected the zone of maximum diameter, the sphere is turned immediately to a position determined by a zone of undersize diameter therein. Viewed from this standpoint my invention consists in a winding machine including means for detecting a zone of undersize diameter and automatically positioning the sphere so that such zone is presented in operative relation to the thread guide. I have discovered that these results may be accomplished by providing a rotary detector member having a point contact with the sphere substantially in the plane of the thread guide and most freely rotatable in substantially the same plane, said member being pressed yieldingly against the core as it is wound and tending to shift the core angularly in its support by reaction with the ridge, valley or other surface irregularity caused in the contour of the sphere by the windings thereon. This action being entirely automatic and depending directly upon the location of the turns of thread upon the core, is effective and certain to a degree which insures an accuracy, compactness and uniformity of product heretofore unavailable.

As herein shown the detector may take the form of a ball mounted for free rotation as a contact member, the latter being arranged to run upon the surface of the driven core at a point disposed substantially in the winding plane or zone. It will be apparent that in this manner a relatively unstable condition of equilibrium is established and that the ball thus mounted and yieldingly pressed against the core being wound tends always to react against any surface irregularity and roll with the core transversely with respect to the winding zone to present a fresh or undersize portion of its periphery in winding position.

Other features of the invention relate more particularly to the thread handling mechanism thereof and consist in means for regulating and controlling the tension of the thread being wound in accordance with the diameter of the core. I have found that it is desirable to increase the tension on the thread as the diameter of the core increases. In accordance with still another feature of the invention, the tension mechanism is controllably related to the detecting device or ball which controls the angular position of the core and which in carrying out its intended function is displaced as the diameter of the core increases in the winding operation. The utilization of a single device for controlling the angular position of a core with respect to the winding zone and also for controlling the tension of the thread being wound is believed to be broadly novel in winding machines.

The elastic thread supplied to the core being wound is preferably delivered from a reel mounted outside the tension mechanism and it is desirable to insure uniform conditions of delivery from the supply reel. In accordance with another feature of the invention, I provide a shoe which normally engages the thread windings

upon the supply reel and is suspended or counterbalanced in such a fashion that its retarding effect upon the delivered thread is progressively reduced as the diameter of the windings decreases. This insures uniform conditions of delivery and prevents over-running of the reel, particularly when the latter is full and the moment arm of the tension thread is at a maximum.

My invention also contemplates the provision of automatic mechanism for stopping the winding operation when the core has attained a predetermined diameter. In accordance with still another feature of the invention, it is proposed to control the stopping mechanism by the displacement of the core-position-controlling device, thus deriving an additional function therefrom and contributing to a machine of compact design.

In winding machines as heretofore constructed, it has been the practice to use elastic thread specially prepared and cleaned for use in core making. I propose, however, to embody in the machine of my invention a thread cleaning device operating at a point adjacent to that at which the thread is delivered to the core to clean the thread of talc or other foreign matter and by this expedient I am enabled to dispense with preliminary cleaning or treating operations upon the thread.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawing, in which

Fig. 1 is a view in perspective of the machine;

Fig. 2 is a sectional view, on an enlarged scale, showing the parts of the machine which position and rotate the core;

Fig. 3 is a similar sectional view at right angles to that shown in Fig. 2;

Fig. 4 is a fragmentary plan view showing the relation of the core to its supporting rollers; and

Figs. 5 and 6 are diagrammatic views indicating the positioning action of the core and core positioning ball.

The driven elements of the machine are mounted in an upright frame 10 which is rigidly bolted to a base plate 12 adapted to be supported on a bench or column at convenient height for the operator.

The frame 10 is provided with a boss from which projects a stationary horizontal shaft 15 upon which is journaled a hollow shaft 16. A loose pulley 18 is journaled upon the hollow shaft 16 and this is driven from a motor or other convenient source of power. The outer face of the pulley is lined with leather or similar material and is adapted to drive the hollow shaft 16 by frictional engagement with the inner face of a small hand wheel 22 pinned to the outer end of the shaft. The pulley 18 is shifted into clutching engagement with the hand wheel 22 by a forked lever 24 pivotally mounted at the outer end of a boss 26 on the frame 10 and acting on the pulley through the medium of thrust washers 28. A latch piece 30 is pivotally connected to the upper end of the forked lever 24, being pulled downwardly by a tension spring 32 extending obliquely between it and the lever 24, and this latch piece cooperates with a stop pin 34 set in the machine frame to hold the pulley 18 in its outer or driving position when it is desired to operate the machine.

The hollow shaft 16 is mounted for a slight longitudinal movement limited in an outward direction by an adjustable stop nut 17 on the outer end of the stationary shaft 15. A stationary brake shoe 19 is arranged in position to be engaged by the rim of the hand wheel when the shaft 16 is permitted to move inwardly and so brings the machine to rest promptly when the clutch is disengaged. When the machine is running and the shaft 16 displaced outwardly by the pressure of the driven clutch member or pulley 18, the hand wheel revolves clear of the brake. It will be noted that the spring 32 tends to move the latch piece 30 and lever 24 in a closing scissors movement when once the latch is tripped and, consequently, the upper end of the lever 24 swings outwardly and its forked end shifts the hollow shaft inwardly by engagement with a pinion 42 fast on its inner end.

The ball or spherical core 35 to be wound is supported by a pair of similar driven rollers 36 carried by parallel horizontal shafts 38 journaled in bearings 39 in the machine frame. Each of the shafts 38 is provided at its outer end with a pinion 40 and both of these pinions mesh with the pinion 42 fast on the hollow shaft 16. The axis for the shaft 16 is disposed symmetrically above the axes of the shafts 38 and both these shafts are, therefore, driven in the same direction, that is to say, anti-clockwise as seen in Fig. 1.

The rollers 36 are fast upon the shafts 38 and taper inwardly from each end so that the maximum spacing of the rollers is in the location of their central horizontal zone and their points of nearest approach are at either end. The rollers 36 thus form between them a tapering receptacle in which a sphere will automatically center itself in position half way between the axis of the rollers and opposite the central zone thereof. This centering action of the sphere, moreover, takes place regardless of its size. While the location of its center rises as the core is wound and its size increases, the center is not shifted either longitudinally or transversely with respect to the rollers. The rollers are so located with respect to each other that the smallest core to be wound will not slip through between them and in every instance the rollers engage and support the core at a plurality of points spaced about its lower hemisphere. In fact, the rollers furnish four points of support for a sphere, one in each quadrant and at opposed angles of inclination.

It has been pointed out that the core or sphere 35 is supported and positioned by the engagement of the rollers 36 at four points in its lower hemisphere. The sphere is engaged also at a single point in its upper hemisphere by a metal ball 44 by which it is pressed continuously downwardly in a yielding manner into position between the rollers.

The ball 44 is mounted to turn freely in a pair of obliquely arranged ball bearings 46 secured in a yoke 48 attached to a casting 50 on the lower end of a vertical shaft 52. The shaft 52 is mounted for vertical movement in a bearing 54 formed in the upper end of the frame 10 and is provided with a weight 56 by which it is at all times forced downwardly so that the ball 44 shall exert a uniform measured pressure upon the core 35 being wound continuously during the winding operation. It is desirable that the vertical axis of the ball 44 should coincide with the vertical axis of the sphere supported by the rollers 36 and to this end the casting 50 is provided with transverse slots 51 through which pass the attaching screws 53 which hold the yoke to the casting. By loosening these screws the yoke 48

may be shifted transversely and the desired relation established.

It will be noted that the effective planes of the ball races of the ball bearings 46 diverge downwardly, including an angle of approximately 40°, and are symmetrically disposed with respect to a vertical axis and also the winding plane. While this arrangement is not essential, it has been found best suited for the requirements of the case and it contributes to the satisfactory operation of the machine to a marked degree because it provides for the turning of the detector most freely in the winding plane and less freely in a direction transversely thereof.

Above its bearing 54 the shaft 52 carries a bracket 58 having a horizontal arm perforated to receive a vertical guide rod 60 projecting from the frame 10 and having a compression spring 62 at its upper end tending always to force the bracket downwardly. Mid way between the shaft 52 and the guide rod 60 the bracket carries a tripping rod 64, the lower end of which underlies the latch piece 30 when the latter is engaged with the stop pin 34 to hold the clutch, comprised by the pulley 18 and hand wheel 22, in engagement. When, therefore, the shaft 52 is elevated to a predetermined height by the increasing size of the core, the latch is tripped, the clutch disengaged, and the machine brought to rest. The stopping of the machine is made more precise by the action of the brake shoe 19 already mentioned.

The elastic thread with which the cores are wound is supplied from an overhead reel 66 carried by a bracket 68 secured to the base plate 12 at the rear of the machine. At the upper end of the bracket 68 is an overhanging arm 70 in which is mounted a yielding brake shoe 72 bearing directly on the surface of the reel to prevent overrunning and maintain a suitable tension on the thread. The brake shoe 72 has a vertical stem 71 which extends upwardly through the arm 70 and is encircled by a weak compression spring 73 which bears against a nut at the upper end of the stem and acts to counterbalance the weight of the shoe 72. The result of this construction is to maintain a uniform tension upon the elastic thread in the roll, regardless of the diameter of the winding. When the winding is of maximum diameter and the moment arm of the reel relatively great, the shoe 72 is lifted to a point at which the spring 73 is fully extended and has little or no tendency to lift the stem 71. Consequently, the full weight of the shoe 72 is effective. On the other hand, as the diameter of the winding decreases and the moment arm of the reel is lessened, the shoe 72 moves downwardly in following the winding and the counterbalancing effect of the spring 73 becomes more and more pronounced.

A tension arm 74 projects outwardly from the base plate 12 and carries guiding and tension regulating devices for controlling the course of the thread to the core. These include a pair of tension guide rolls 76 mounted to turn on studs 77 which, in turn, are mounted for longitudinal movement in the tension arm and each provided with a compression spring 78 interposed between the outer face of the guide roll 76 and an adjustable stop nut 79 on the outer end of the stud. The tension guide rolls 76 are free to rotate upon the studs 77 except as they are retarded by the pressure of the springs 78 against them and, accordingly, the initial tension in the thread as delivered to the rotating core may be manually determined and adjusted by turning one or both of the nuts 79. An intermediate guide roll 80 guides the thread in its course from one roll 76 to the other. From the inner of the two guide rolls 76 the thread is directed to a wiping pad 82 and is drawn over the face thereof for the purpose of cleaning it of talc or the like. It then passes over another guide roll 84 carried by an adjustable bracket arm 85 and is led directly to the core in process of winding, being engaged between it and the surface of the right hand roller 36.

Each of the studs 77 is provided at its left-hand end, as shown in Fig. 1, with a head or nut 90 between which and the vertical face of the arm 74 is interposed the slotted wedge-shaped end of bars 92 and 94 respectively. The bar 92 extends upwardly and obliquely, being pivotally connected at its upper end by a pivot pin 93 to a part of the bracket 58 carried by the shaft 52. The bar 94 extends upwardly and is pivoted by a pivot pin 95 to the bar 92. Accordingly, as the shaft 52 is lifted by the increasing diameter of the core being wound, the studs 77 are drawn toward the left and the springs 78 are compressed against the guide rolls 76, retarding their turning movement and thereby increasing the tension upon the elastic thread passing to the core. In this way the tension upon the thread is increased progressively and automatically with the increasing diameter of the core.

It will be apparent that the rate of tension increase may be varied in accordance with any predetermined schedule by appropriately shaping the effective contour of the wedge-shaped ends of the bars 92 and 94.

The wiping pad 82 is secured to a base 83 which may be positioned so that the elastic thread will be drawn across its face and may be moved to present a fresh surface from time to time. The provision of the wiping pad and its function in cleaning the elastic thread of talc and other foreign matter is of considerable importance in improving the quality of the wound core and also in permitting the use of elastic thread not previously treated to adapt it for use in cores; that is to say, the wiping pad 82 operating in the organization of the machine herein disclosed permits the use of a grade of commercial elastic thread which has not been heretofore utilized successfully in producing cores of the highest grade.

In the operation of the machine herein disclosed, the action of the ball 44, which is arranged to press yieldingly upon the core at a single predetermined point or very small area, is of great importance. Its operation is suggested in Figs. 5 and 6, in which the elastic thread 98 is represented as having been delivered to the core 35 in a series of turns forming a zone of larger diameter than that of the general curvature of the core. The ball 44, on account of its location, engages and presses against this zone of maximum diameter and rolls upon the core as the latter is being turned beneath it. An unstable condition of equilibrium is thus created and the slightest relative displacement will cause the core to turn so as to carry the raised zone away from the point of contact with the ball 44. In other words, the ball 44 detects the zone of maximum diameter in the core being wound and tends to shift it to carry that zone out of the winding plane. From another standpoint, it may be said that the ball 44 tends to find a zone of reduced diameter in the core and move it into the winding plane. The core may be shifted by its reaction with the ball 44 either about a horizontal

axis lying in the winding zone or about a vertical axis and in practice its shifting movement is a combination of these two movements. All of this action is carried out at high speed as the core is rapidly rotated, and the result is that a symmetrical core of accurate spherical shape is produced.

It is a striking characteristic of the machine, however, that the position of the core is automatically controlled by the contour of the core itself in its reaction with the rotary detecting device 44 rather than by being subjected to the control of external mechanisms. The shifting of the core usually takes place in a very irregular manner, a few degrees about a horizontal axis in one direction or another and then a few degrees about a vertical axis, but seldom, if ever, a complete turn in any one direction. The practical result of this is that the elastic thread being wound is not subjected to a twisting action but is led to the core in a substantially flat condition during the entire winding operation.

Meanwhile, the tension of the elastic thread is controlled from the start to the finish of the winding operation first by the action of the brake shoe 72 on the reel 66, the drag of which is reduced as the diameter of the turns on the reel decreases, and second by the guide rolls 76 which are retarded in their rotation progressively as the diameter of the core increases by the action of the wedge-shaped ends of the bars 92 and 94 upon the tension springs 78.

While the detector member is herein shown as having an entire spherical surface, it will be apparent that any member having the surface of its contact point curved or convex in two directions might be successfully substituted for it.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A winding machine comprising means for supporting and rotating a spherical core, opposed ball bearings mounted above the supported core with their effective planes in convergent relation, and a sphere mounted therein for free rotation in point contact with the core.

2. A winding machine comprising rollers for supporting and rotating a core, a head mounted for yielding movement toward and from said rollers, a ball mounted for free rotation in said head and arranged to make point contact with a core supported by said rollers and to lift said head as the diameter of the core increases, and adjustable thread tension mechanism including a wedge connected to said head and arranged to be moved by said head to increase its tension upon the thread.

3. A winding machine comprising rollers for rotating a core, and thread handling mechanism including a thread guide, tension mechanism, and a supply reel having a brake shoe mounted for engagement with the thread wound thereon and having a counterbalancing spring acting to reduce the pressure of the shoe on the thread as the diameter of the windings decreases.

4. A winding machine comprising rollers for supporting and rotating a core, means for supplying untreated elastic thread to the machine, and thread handling means including a tension device, a thread guide leading to the core, and an interposed adjustable wiper for cleaning the thread in its passage from one to the other.

5. A winding machine comprising spaced rolls for positioning and rotating a spherical core, means for delivering an elastic thread to the core, a thread tension device, a rotatable detector arranged to roll upon the core and also to be moved by the core as it is increased in diameter, and means operated by the detector for automatically and progressively increasing the effect of the tension device on the thread delivered to the core during the winding operation thereon.

6. A winding machine comprising means for supporting in predetermined position a spherical core to be wound and for rotating the core about a horizontal axis, a thread guide leading to the core, and a rotary detector member mounted upon bearings whose axes have a horizontal component to turn about a vertical axis coinciding with that of the core and also to rotate more freely about an axis at substantially right angles thereto by contact with the core and being thereby adapted to react transversely with the last wound turns on the core to shift the angular position of the core from time to time.

7. A winding machine comprising means for supporting and rotating a spherical core to be wound, a thread guide leading to the core, and a rotary detector member mounted upon bearings whose axes are inclined to the winding axis, thereby being constrained to rotate freely about an axis parallel to the winding axis of the core and also to turn less freely about an axis at an angle thereto.

8. A winding machine comprising means for supporting and rotating a spherical core to be wound, means for leading an elastic thread to the core, and a rotary detector member mounted to rotate freely about an axis parallel to the winding axis of the core upon bearings whose axes are inclined to the winding axis, whereby the detector is free also to turn less freely about an axis disposed at right angles thereto, the member having provision for bodily transverse movement to adjust the position of the said latter axis with reference to the core.

9. A winding machine comprising means for supporting and rotating a spherical core, a guide for delivering thread in a winding zone about the core, a rotary detector having its surface curved transversely to the winding zone, making point contact with the core substantially in the winding zone and being mounted on bearings disposed with their axes transverse to the plane of the winding zone so that the detector is constrained to rotate most freely in the plane of the winding zone, said bearings leaving the detector free to turn less freely in reacting with the wound thread automatically to shift the core as the winding operation progresses, said detector being bodily moved by the core as it increases in diameter, and driving means for the machine controllably related to said detector.

10. A winding machine comprising means for supporting and rotating a spherical core to be wound; a thread guide leading thereto and determining the winding zone of the core, and a rotary detector having its surface convex transversely with respect to the winding zone and having ball bearings disposed with their axes transverse thereto, thereby tending to confine the rotation of the detector to the plane of the winding zone while leaving it free to move transversely in reacting with the last wound turns to displace the core.

11. A winding machine comprising means for supporting and rotating a spherical core to be wound; a thread guide leading thereto and determining the winding zone of the core, and a rotary detector having its surface convex trans-

versely with respect to the winding zone and having ball bearings arranged with their axes transverse thereto thereby developing minimum slip with respect to the detector when the latter is rotating about an axis at right angles to the winding zone while leaving the detector free to move transversely thereto in reacting with surface irregularities in the core.

12. A winding machine comprising means for supporting and rotating a spherical core to be wound; a thread guide leading thereto and determining the winding zone of the core, and a rotary detector having its surface convex transversely with respect to the winding zone and having bearings disposed with their axes substantially perpendicular to the plane of the winding zone, thereby supporting the detector to turn most freely in the plane of the winding zone, said bearings presenting smooth surfaces to the detector whereon it may turn less freely in directions transverse thereto in reacting with the last wound turns on the core.

13. A winding machine having, in combination, rollers for supporting and rotating a core to be wound, a thread guide leading thereto and determining the plane of the winding zone of the core, a rotary detector making contact with the core in its winding zone, and ball-bearings for said detector mounted with their ball-races inclined equally and oppositely to the winding plane.

14. A winding machine comprising means for rotating a spherical core about a predetermined axis while leaving it free to be displaced about another axis disposed at right angles thereto, a thread guide for delivering thread in a definite winding zone, and a sphere contacting with the core in the winding zone and being mounted to rotate in bearings having their axes inclined so that the sphere is constrained to rotate most freely in the plane of the winding zone and to turn transversely thereto less freely in acting automatically to displace the core about its other axis as the diameter of the winding zone increases.

15. A winding machine comprising means for rotating a spherical core about an axis at right angles to its winding plane, a thread guide for delivering thread in said plane, a sphere contacting with the core in said plane and being mounted to rotate in bearings having axes inclined so that the sphere is constrained to rotate most freely in the winding plane and to turn transversely thereto less freely in reacting with the most recently delivered turns of thread to displace the core to one side or the other from the point of contact.

16. A winding machine comprising rollers for supporting and rotating a spherical core, a thread guide for delivering thread to the core in a defined zone, a ball mounted to rotate in point contact with the sphere in bearings having axes which are inclined with respect to the plane of the winding zone so that the ball is constrained to rotate most freely substantially in the plane of the winding zone and less freely transversely thereto, said ball being rotated by its engagement with the spherical core and having a rolling reaction with the contour irregularities in the core produced by the last wound turns to bring new surfaces of the core into the winding zone.

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