METHOD OF WINDING BALLS

Filed Nov. 1, 1935

INVENTOR.

FRANK HONIG

BY

Emery, Booth, Vanney & Whittmore

ATTORNEYS.
This invention relates to the art of winding strands on cores of spherical or similar shape to make articles such as base balls, golf balls and the like, and has for an object the provision of improvements in this art.

The invention comprehends improved process and apparatus for winding under tension some filamentary material such as cotton, silk, rubber, wire and the like of any desired length, wound such as round, square, flat, oval or other shape, on a starting core of any suitable material and form. The invention also relates to the product of this process and apparatus.

Some of the more specific objects of the invention are: to provide a very simple process and apparatus which are fundamentally correct in principle for winding spherical objects; to provide mechanism which will wind a plurality of balls simultaneously; to provide for winding either hard or soft coverings on a core without damaging, by chafing or otherwise, the filament being wound; to provide for winding upon either a hard or soft core; to wind without interruption, either due to broken filaments or for changing balls; and to provide other advantages and features of novelty which will be apparent as the description of a specific embodiment of the invention proceeds.

For convenience of description we may refer to the sphere being wound as if it were the earth. At a given moment the circle of rolling will be called the polar circle; the circle at right angles to the polar circle and passing through the drive point of the sphere at the same given moment will be called the equatorial circle; and the poles will be located where the axis perpendicular to the equatorial plane intersects the polar circle.

According to the present invention a single driving member serves to produce the winding motion to the core to be wound into a sphere. To this single driving member there is imparted a single directional motion in such form as would result from three separate simultaneous circular motions superimposed one over another, namely, a circular motion represented by a circle passing through the poles of a sphere, a second circular motion represented by a circle coinciding with the equator of the sphere, and a third circular motion represented by a comparatively small circular having its center at one of the points where the polar circle crosses the equatorial circle.

These circular motions are so combined into one resultant motion as to produce a constantly shifting speed relationship between the several circular motions. For example, the speed along the polar circle is constantly changed, decreased or increased; the equatorial circle is turned about the poles so that it will take the position formerly occupied by the polar circle and vice versa. The third circular motion is a motion similar to that described by the true poles of the earth rotating about the magnetic poles.

That is to say, if the normal axes or centers of each separate circulatory motion are considered with relation to each other, then these centers or axes are continuously moved about in relation to each other to produce an ever changing relationship between the several circular movements. (In contradistinction to the prior art, in which such relationship as may be present, remains constant and fixed, and their motions intermittent and terminating.) In the following description and illustration there will be shown and explained several ways in which this combination of circulatory motions and their constant change of relationship may be accomplished.

The relationship of these separate circular motions, as illustrated in the figures, is shown as such that for each revolution of the polar circle the equator is rotated approximately 30 degrees. The third or distributing circular motion is completed once for each 30 degrees turn in the equator, or once for each revolution of the polar circle plus the gain factor, as a predetermined size of the sphere. The relationship of these separate circular motions is further changed by the fact that as the winding progresses the ball increases in size; however, the linear speed of the winding filament or the peripheral speed of the ball remains constant during the winding operation.

The invention may be embodied in many different forms, all of which essentially comprise a single driving member to which a resultant single directional motion is imparted by the constantly changing interrelationship of three separate circular motions. For example, the resultant single directional motion may be produced on the face of a disc, or on the periphery of a cylinder, cone or sphere, any of which may have a circular or other cross-sectional shape.

However, the invention is not in any way restricted to the use of the devices to be described for the illustration of the invention; in fact, the invention may be practised with the core to be wound resting on top of a table and the palm of the operator's hand moved about in the several and continuous circulatory motions above described. In this way, the description of the invention encompasses a broad range of practical applications.
the invention is closely followed, and with some practice, very excellent results may be obtained. However, naturally, it is preferred to embody the invention in some mechanical device to obtain consistently uniform results. In the following description and illustration a preferred exemplary mechanical embodiment will be shown and explained.

The mechanical embodiment of the invention which appears best adapted to perform a variety of winding for universal production demand, comprises a disc-shaped driving member. For this reason disc type apparatus has been selected to illustrate the principles of the invention herein.

This furnishes a clear illustration of the true rolling action which takes place between the disc and the ball being wound, and also furnishes a clear understanding of the motions and their interrelated combination.

As will be seen from the selected illustrative embodiment, one of the important advantages of this invention is that it permits the employment of very simple apparatus; another is that it provides for the winding of a plurality of balls on the same machine at the same time, which is very economical in floor space and attendants required; another is that the filament or tape is wound on the core in one continuous length, that is, without breaking of the filament due to the chafing or other causes during the winding operation. Certain features of the invention disclosed herein are claimed in my copending applications, Serial Number 79,251, filed May 12, 1936, and 79,252, filed May 12, 1936.

The planetary eccentric type of mechanical embodiment may be said to correspond to the practice of the invention on a top of a table with the palm of the hand moving in a plane parallel with the top of the table.

Perhaps it may be clearer to state that the planetary eccentric type represents the invention practiced with the constantly changing relationship of the several circular motions performed with the axis of each circular motion remaining parallel to the axis of every other of the circular motions but moving closer to or further away from each other.

An illustrative embodiment of the invention will now be described, reference being made to the accompanying drawing, wherein:

Fig. 1 is a vertical section, partly in side elevation of winding apparatus of the disc type adapted to wind four balls simultaneously;

Fig. 2 is a partial end elevation taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary section taken on the line 3—3 of Fig. 1 to show the ball holding mechanism; and

Fig. 4 is a diagrammatic view in the nature of a development, to illustrate the separate circular motions and the single resultant motion and the manner in which the filament is distributed on the core.

Referring first to Fig. 4 for a graphical explanation of the motions involved, the line A represents a fragmental development of a circle rolling in a single direction, as for example a circle rolling on the face of a disc when the disc is rotated about its geometric center. Circle B represents the primary orb in which the secondary, or satellite orb represented by the circle C revolves. The distances along line A between the crossings of lines 1, 2, 3, 4, and 6 represent the developed circumference of a smaller circle rolling along line A. This smaller circle may be a sphere rolling along the face of a disc in a circular path represented by the development of line A, which for clearness of explanation, may be referred to as circle A.

The rotative center, as distinguished from the geometric center, of the circle A is located on the satellite orb C and is carried about in an orbital movement on circle B. Thus, the rotative center of circle A is carried about in a compound orbital movement as represented by the rotative center 15 on the orb circle B. As a result of such compound orbital movement imparted to the rotative center of circle A the development of this circle then will take the form as indicated at line A1, and a smaller circle rolling on line A then will follow the resultant direction A caused by the movement of the rotative center of circle A in the compound orbital movement of B and C.

As a point on the orb B moves away from a given point for a distance of 180 degrees and moves toward the same point for the next 180 degrees it produces a lead to the right, as shown below the line 3, or to the left, as shown above the line 3. The motion produced by the orb B is referred to as the "lead", while the motion produced by the orb C is referred to as the "distribution". A point on orb C also has a right and left hand lead similar to that of a point on the orb B.

When the lead produced by the orb B and orb C are interposed in the movement illustrated, then the small circle or sphere rolling along the line A1 will have a constant gain in its development which is illustrated by the distances along the line A1 between the crossings of lines 1—1", 2—2", 4—4" and 5—5". In this figure the starting point was taken at line 3. Translating the resultant motion A into a winding motion, the filament wound on the roll rolling on line A1 will take the form of said line.

Referring to the illustrative form of mechanism embodying the invention shown in Figs. 1 to 3, a frame or housing 6 which supports the mechanism has attached thereto circular end plates 7 in which a large shaft 8 is journaled. The shaft 8 is driven through the medium of a gear 9 fast thereon and a pinion 10 meshing with gear 9 and fast on the main drive shaft 11. The main shaft 11 is mounted in bearings in a bracket 12 secured to the top of the main frame 6 and may if desired drive several units like the one herein described. Power may be supplied to the shaft 11 at any desired point along its length from any suitable means.

The shaft 8 is held in proper longitudinal position relative to the bearing plates 7 by its rear 9 at one end and by a collar 13 fast thereto near the other end.

Rotatably mounted on the shaft 8 to one side of the axis thereof is a planet shaft 15, the same being carried by anti-friction bearings 14 retained in member 8 by retainer plates 16. The center of shaft 15 describes the orb B referred to in Fig. 4.

Means are provided for driving shaft 15 as it moves in its orbit. The means shown comprises a pinion 17 fast on the shaft mounted within a recess 16 in the member 8 and meshing with a gear 21 rotatably mounted on a shaft 20 secured in lugs 19 formed on the member 8. The gear 21 meshes with an internal ring gear 22 made fast within the main frame 6. As the shaft 8 15
rotates the planet shaft will be rotated through the gears 17 and 21 from the ring gear 22.

Means are provided for securing the interrelation to the other motions of the small circle of motion referred to as the orb circle C in Fig. 4. The means shown for accomplishing this consists of the core driving discs 25 which are rotatably mounted at either end of the machine. Each disc bears an inwardly extending driving stud 27, located conveniently close to its geometric center, which engages within an elongated slot 28 formed in the end of the shaft 8. Each disc 25 is provided with an eccentrically disposed circular opening therethrough within which operate an eccentric bushing 23 fast on planet shaft 15. Anti-friction bearings 24 may, if desired, be interposed between the eccentric bushing 23 and the disc 25. Each disc 25 is retained on the shaft 15 by a retaining plate 26 secured to the end of the shaft.

Each disc 25 is thus rotated about a point located on the orb C, that is, on the circle described by the center C of the eccentric bushing 23 (Fig. 1) which is to one side of the center B of the shaft 15 which lies in the orb B. The disc 25, then, is in reality an eccentric. This would be very easily understood if the rotational speed of disc 25 had been made different from that of shaft 8, but, as herein shown, the disc 25 and shaft 8 have the same rotational speed due to the pin-and-slot connection 27, 28. The present construction is preferred because it obviates an additional train of gears required if the disc 25 is to be driven at a different speed from that of shaft 8, as may be required for some classes of work.

Each eccentric 25 is provided on its working face with some means for securing frictional contact with the core or work piece which it is to drive. The means herein shown comprises an annular ring 29 of a cushioning friction material such as rubber cemented in a groove formed in the disc 25.

Each of the winding discs is adapted to wind two cores and since the present machine has two discs it is adapted to wind four cores at once. The winding positions are indicated in Fig. 2. The cores or balls, or rather their positions, may be indicated by the numerals 30, 31 and 32. These are the only ones visible in the drawings but it will be understood that there is a fourth one or position on the left hand disc 25 in Fig. 1 which lies behind core 30 in that figure, and behind core 32 in Fig. 2, which is not visible in the drawing.

Each of these cores or balls bears against the annular friction track 29 on one of the discs 25 and the winding operation performed on each ball is entirely independent of the winding operations on the other balls. That is, the winding on each core may be started and stopped and cores inserted and removed at any winding position at any time without stopping the machine or interfering with the winding of the other cores.

Means are provided for holding the cores pressed against the discs 25. As indicated above, the winding of each core is independent of that of all others, so the holding means for each core will be independent of all others. The four holding devices for the present machine are identical in construction—though two are mounted upside down with respect to the other two due to the difference in direction of travel of the disc at opposite sides—so a description of one will serve for all.

Each core holding device is mounted on a bracket 33 which is secured to the main frame 2 by a bolt and slot anchorage to permit suitable adjustment toward and from the geometric center of disc 25. By such adjustment some variation in the dimensional relation of the line A (Fig. 4) to the orb C and orb B can be made and by such changes in their relations the final pattern of winding the filament on the core is changed. That is, by making the circle A larger or smaller with relation to the orbs C and B, the gain as indicated between the lines 1—4, 2—2', 4—4' and 5—5' can be made larger or smaller as desired. As a result, the strands of filament on the core will lay closer together or wider apart for each convolution of the core being wound.

Various forms of core holding mechanisms may be employed. The particular one illustrated comprises a slide 34 mounted in guides in the bracket 33 and provided with rotatable core holding discs, an upper pair 35, 35 and a lower pair 36, 36, mounted on supporting shafts set at suitable angles to each other to form a cup-like pocket to hold the core so it is free to rotate as it is being driven by the disc 25.

The slide 34 is pressed toward the disc 25 by any suitable means, such as a compression spring 37 and may be pulled away from the disc by the operator, a handle 38 being provided on the slide 34 for this purpose.

Means are provided for starting the winding operation for each core and for halting the winding when the ball wound on the core has reached a predetermined size. The means herein shown comprises plates adapted to be interposed between the core and winding disc to break their contact. To this end there are mounted in vertical guides in the bracket 33 a feed or starting slide 44 and a stop slide 43. The stop slide is urged downward to a position between the core and the winding disc 25 by a tension spring 45 attached to lugs on the slide and on the bracket 33, respectively. The stop slide 43 is normally held in outward position by a sliding latch 46 mounted in suitable guides parallel to the slide 34. The latch is tripped when the ball has reached its predetermined size by the engagement of a lug 39 on the slide 34—by the engagement of a lug 39 on the slide 34—which, of course, moves outward as the ball increases in size—with an adjustable set screw 41 provided on the slide latch 46. By the adjustment of screw 41 the size of the ball will be altered, as will be obvious. Feed slide 44 is free to be moved at will in its guides, though it may have a slight binding action to avoid unauthorized movement. It is adapted to be moved between the core and winding disc 25 when the core is first inserted and while the slide 43 is latched in outer position to prevent the core from being turned immediately. When ready, the slide 44 is pulled downward to allow the core to engage the disc 25. Both the stop slide 43 and the feed slide 44 are provided with handles for manual manipulation.

Means are provided for feeding to the core the filament to be wound, preferably under tension. Suitable means for this purpose is shown in the drawing and comprises an idler 46 rotatably mounted on a fixed shaft 47 on the bracket 33 near the core position and a tensioning sheave or capstan 49 secured to a rotatable shaft 50 mounted in the other end of the bracket 51.
33. Any desired means may be employed for applying tension to the filament. However, I have found that a magnetic tensioning device seems to produce the most uniform result, such as a device herein contemplated. For example, a magnetic clutch device of the type illustrated in my Patent No. 1,862,297, granted July 7, 1932, may be employed to act on shaft 50 so as to place tension on the filament 48. It is not illustrated because it does not per se form any part of the present invention.

Whatever may be the kind of tensioning device used, the capstan 49 is retarded in rotation, caused by the pull of the filament originating in the winding action of the core caused by friction with the winding disc 25, to impart the desired tension to the filament.

A pressure or distributing idler 51 is rotatably mounted on a swingable arm 52 pivoted at an axis 53 on the frame 33. The idler serves to hold the convolutions of the filament in gripping engagement on the capstan 49 as well as to distribute the convolutions properly to prevent tangling with the oncoming and off-going filament. The idler may be held against the capstan by gravity or by a spring or other suitable means, not shown. For clearness of illustration the idler is shown separated from the capstan, but in operation it directly engages the capstan.

Means may be provided for heat-shrinking the filament on the core to obtain greater tension therein when this is desired and the filament is of such a nature as to be capable of responding to such treatment. The means herein described comprises an electric hot plate 54 located as near as convenient to the core being wound and in a position where the filament will pass over or near the heating surface. Any suitable temperature may thus be produced in the filament just prior to its winding on the core and as the hot filament is wound tightly on the core and is then permitted to cool on the core, an additional tension is set up due to shrinkage on cooling. For winding golf balls with a rubber filament a temperature of between 105° and 300° F. may be employed. Other temperatures may be employed in keeping with the requirements of the article being produced and the filamentary material being wound thereon. It is found that the additional tension due to heat shrinkage is beneficial because, for example, a golf ball so wound can be driven a considerably greater distance with a given impulse than a ball wound in the usual way.

In operation, a filament is taken from a source of supply, not shown, and is given one or more turns in a clockwise direction about the capstan 49, then one or more turns in a counterclockwise direction about the idler 51 and again a partial turn about the capstan 49 in counterclockwise direction. It is then conducted over the guiding sheave 46 and the free end is given a few turns by hand about the core. Assuming the stop slide 43 to be latched in its outer position, the feed slide 44 is moved up into a position between the disc 25 and the core holding discs 35, 36. The slide 34 is moved outward to make space for the core, the core inserted, and the slide 34 released to grip the core between the holding discs 35, 36 and the slide 44. Any slack in the filament is taken up by back-winding the filament to the proper length of supply. Assuming the driving disc 25 to be in continuous operation, the slide 44 is pulled down when ready to permit the core to be engaged with the face of the disc 25 so that winding begins.

When the desired size has been reached the lug 39 on the slide 34 engages the set screw 41 on the slide latch 40 and withdraws the latch, whereupon the stop slide 43 being released moves down through the action of spring 45 and separates the ball wound on the core from the driving disc 25. The operator then removes the ball, resets the stop slide 43 and introduces a new core in the manner described above.

If it is desired to wind the filament with closer spacing the bracket 33 may be set closer to the geometric center of the disc 25; and, if a more open spacing is desired it is moved in the opposite direction. Thus any desired winding may be produced within the capacity of the device.

It will be apparent that a slight change in the characteristics of the machine necessary to change the relationship of the circle A, orb B or orb C (Fig. 4), will result in an entirely different development form for the limited area at A1 from that which is shown. The particular dimensional and speed relationships have been selected to produce a winding pattern on the surface of the finished ball which is well suited for the proper amalgamation of the wound filament and the cover to be placed thereon as, for example, the balata cover of golf balls.

While one embodiment of the invention has been illustrated and described with particularity, it is to be understood that the invention may be variously embodied within the limits of the prior art and the scope of the subjoined claims.

I claim:

1. The method of producing a spherical body formed of a core and a body of filamentary material wound thereon, which comprises, winding hot elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, under tension on a core to form convolutions thereon, and cooling the wound sphere subsequent to winding.

2. The method of producing a spherical body formed of a core and a body of filamentary material wound thereon, which comprises, winding hot elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, temperature between 100° and 300° F. so wound can be driven at a considerably greater distance with a given impulse than a ball wound in the usual way.

3. The method of producing a spherical body formed of a core and a body of filamentary material wound thereon, which comprises, winding hot elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, under tension on a core to form convolutions thereon, and permitting the convolutions to cool on said core subsequent to winding.

4. The method of producing a spherical body formed of a core and a body of filamentary material wound thereon, which comprises, producing elongation in a section of a continuous elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, by mechanical tension and simultaneously heating said section to elevate its temperature, winding said section on a core before its heat is dissipated, and permitting the convolutions to cool on said core.

5. The method of producing a spherical body
formed of a core and a body of filamentary material wound thereon, which comprises, simultaneously elongating and heating a section of a continuous elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, winding the hot filament on a core, and cooling the wound sphere.

6. The method of producing a spherical body formed of a core and a body of filamentary material wound thereon, which comprises, simultaneously heating and elongating elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, by mechanical tension, winding the hot filament on a core to form a sphere, and permitting said sphere to cool during the period of winding.

7. The method of producing a spherical body formed of a core and a body of filamentary material wound thereon, which comprises, winding elastic hot filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, under tension upon a core to form a spherical body, and simultaneously and/or subsequently cooling said sphere.

8. The method of winding spherical bodies, which comprises, simultaneously elongating and heating elastic filament, which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, winding said filament on a core to form a sphere, and cooling said sphere subsequent to winding.

9. The method of manufacturing spherical bodies which comprises, winding elastic filamentary material, which is capable of heat expansion and which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat, upon a core while said filament is hot, under tension, and permitting the wound sphere to cool subsequent to winding.

10. The method of manufacturing spherical bodies, which comprises, winding elastic rubber filamentary material which is able to retain most of its resiliency at temperatures between 100 and 300 degrees F, and which is capable of strand shrinkage to increase its tension in the wound body when relieved of heat upon a core while said filament is hot and under tension, and permitting the wound sphere to cool subsequent to winding.

FRANK HONIG