March 31, 1942. W. E. REICHARD 2,278,381

PROCESS FOR MAKING GOLF BALL CENTERS AND THE RESULTANT PRODUCT

Filed May 14, 1940

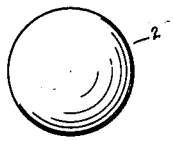


FIG. 1



FIG. 5

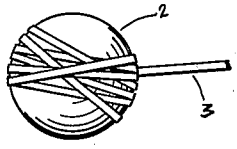


FIG. 2

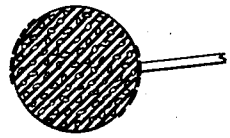


FIG. 6

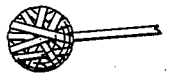


FIG. 3

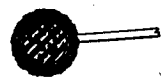


FIG. 7

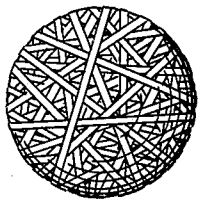


FIG. 4

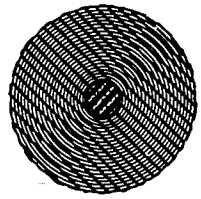


FIG. 8

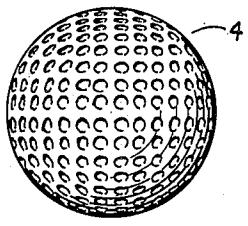


FIG. 9

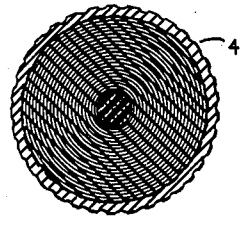


FIG. 10

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UNITED STATES PATENT OFFICE

2,278,381

PROCESS FOR MAKING GOLF BALL CENTERS, AND THE RESULTANT PRODUCT

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Application May 14, 1940, Serial No. 335,106

10 Claims. (Cl. 154—19)

At the present time golf balls, as commonly made and used, comprise a suitably weighted centrally disposed core of spherical form, upon which a winding of rubber threads is applied to substantially increase the diameter approximately by the thickness of said winding surrounding the said core, and thereafter covers commonly comprising balata material are molded over the exterior surfaces of the said rubber thread winding.

It has also been proposed, prior hereto, to eliminate the said core which commonly comprises a hollow rubber sphere, commonly filled with suitable incompressible material, and to make the ball portions disposed within the molded cover entirely of a rubber thread winding.

Such proposals have not, so far as I am aware, been usccessful in producing golf balls of uniform characteristics, this resulting from the difficulty in initiating the winding and in ensuring that the central portion of the ball, i. e., the ball after winding has been partially accomplished, be of proper uniform characteristics as to density and distribution at the extreme center of the ball, and considerable waste in manufacture is very apt to occur, due to the difficulty of maintaining the thread winding at the ultimate ball center in proper position on the winding machine, and without breakage or snarling of the threads, and similar difficulties.

Also, if sufficient care is taken to avoid difficulties of the above character, the time of winding and therefore the labor cost of producing the ball is substantially increased.

Golf ball winding machines now commonly in use depend on the pre-existence of a core on which to apply the thread winding, in order to properly position said core uniformly about the precise center of the ball, and to achieve the benefits of rapid and precise winding of the present type of winding machines. Therefore, it is highly desirable to retain the ability to employ winding machines of the present highly developed types for the winding of golf ball centers.

My invention therefore more particularly relates to the replacement of the usual type of non-collapsible centers in golf balls with a center which, in contrast, is collapsible, particularly during the initial stages of the winding process, but which due to said winding is so collapsed that it will occupy but a relatively small portion of the volume of the finished wound center, and which may be readily quite precisely positioned at the geometrical center of the said golf ball wound center.

An object of my invention, therefore, is to provide an improved process for producing a golf ball center which is of compressible rubber material throughout, and wherein the core upon which the thread winding is uniformly applied compresses the collapsible core thereof to such an extreme degree that its volume will be diminished to a small fraction of its initial size, and whereby the thread winding for said center may be readily and speedily applied by the usual type of ball winding machine, such, for instance, as typified by the machine of the patent to Arthur F. Pym, No. 1,918,714, dated July 18, 1933, or the patent to Hyram N. Huse, No. 1,959,760, dated May 22, 1934, or other machines adapted to achieve the same purpose by initially winding the thread on a prepared center core.

Another object of my invention is to provide an improved golf ball wherein the entire center within the outer enclosing cover may be of vulcanized substantially compressible rubber material.

Other objects of my invention, and the invention itself, will become clear and apparent to those skilled in the art to which my invention appertains, by reference to the accompanying specification wherein one manner of carrying out my improved process, and one embodiment of a product resulting from the employment of said process, in the form of a golf ball wound center, is described, and by reference also to the accompanying drawing referred to in the said description and forming therewith this specification.

In the drawing:

Fig. 1 illustrates a golf ball center core formed entirely of sponge rubber, which may be employed in a practical reduction to practice of my present invention;

Fig. 2 illustrates an initial stage of applying a a rubber thread winding to the said core;

Fig. 3 illustrates the said core with the thread winding partially applied thereto, after the winding has reached a critical partial stage;

Fig. 4 illustrates the complete wound center;

Figs. 5, 6, 7, and 8 illustrate medial sectional views of Figs. 1, 2, 3, and 4, respectively;

Fig. 9 illustrates a side elevational view of a finished golf ball, with a balata containing cover molded thereon, in the usual manner for covering golf balls; and

Fig. 10 is a medial cross-sectional view of the ball of Fig. 9.

Referring now to the various figures of drawing, in Figs. 1 to 10 of which like parts are designated by like reference characters, the spherical core 2, in the embodiment illustrated, is a spherical body of sponge rubber having extremely nu-

merous small air-containing cells, either of the intercommunicating or non-intercommunicating formation.

Fig. 1 is intended to represent such sphere having a normal diameter of one inch at normal ambient temperature, and intended to be incorporated into a golf ball structure.

Fig. 2 illustrates the core **2** at the beginning of the step of process involving the application of a vulcanized elastic rubber thread winding thereto, several turns of such winding having been applied thereto in a substantially negligible length of time, and with the temperature of the core reduced nearly to the temperature of frozen carbon dioxide gas, at which time it is substantially non-resilient, non-compressible, and non-collapsible.

Fig. 3 illustrates the rubber thread winding, indicated at **3** in the different figures, applied to the core for perhaps fifteen or twenty seconds, at such a very rapid rate that the core is wound to a depth of a plurality of layers of thread applied in constantly changing directions, and, due to concurrent collapsing of the core which more rapidly reduces the core diameter than does the application of thread increase the diameter of the wound core, the wound core reaches the least diameter that it achieves during any part of the winding period.

Fig. 4 illustrates the ultimate fully wound golf ball center comprising the thread winding and core, and illustrates, proceeding from the critical point as illustrated in Fig. 3, that the application of layers of thread winding, following the point where the partially wound core is at least diameter, progressively build up in diameter solely due to the tense predominating effect of the application of more and more layers of tensed rubber thread, until the center is completely wound.

Figs. 5, 6, 7, and 8 are medial cross-sectional views of Figs. 1, 2, 3, and 4, respectively, showing the relative amounts of sponge rubber core and thread winding applied on the initial core **2**, frozen as in Fig. 1, and progressively wound as in Figs. 2, 3, and 4, the latter figure illustrating the completely wound center. The entire winding time in the embodiment described may be taken as being about 75 seconds.

Figs. 9 and 10 illustrate the wound center preferably enclosed by the usual golf ball cover **4** of balata and rubber material, in the usual manner.

My improved process relies upon the ability to provide for the thread winding a core **2** which, when the winding is initiated, is substantially non-resilient, non-yielding, and strongly resisting deformation, and wherein the core **2** is formed of vulcanized sponge rubber containing air cells throughout its mass, and the said sponge rubber sphere, being initially readily resiliently yieldable to collapsing pressure after being subjected to the said "freezing" low temperature, will be non-elastic and will strongly resist collapsing pressures.

It is my experience in the practice of my improved process that such spheres, commonly having an exterior diameter of for instance one inch, should preferably contain an exceedingly large number of relatively small air cells uniformly interspersed throughout the body thereof, and such a sponge rubber core, previously vulcanized throughout, upon being "frozen," while its extremely low temperature is substantially maintained, will afford very strong resistance against compressive diminution of diameter resulting from collapsing forces or pressures applied to its exterior.

The cores thus "frozen" are then quickly placed in a ball thread winding machine, which may be of any of the usual types employed in connection with the application of a thread winding to golf ball cores, and the thread winding is applied under tensile stress applied to the thread, which stress is preferably maintained of a requisite uniform tension during winding, and almost immediately the warming effect of the ambient air surrounding the winding machine, and the conduction of heat to the core through the ambient air, through the thread winding being applied, and through the contacting surfaces of the winding machine, gradually reduces, during the winding, the resistance to collapsing at first possessed by the "frozen" core when first placed in the winding machine immediately following the "freezing" step of process previously mentioned, and progressively and relatively rapidly, as the rapid winding of the vulcanized elastic tensed rubber thread upon the core progresses, heat is being transferred from the outer surface of said core inwardly towards its center, and while the winding is proceeding.

In a very short time, which in actual experience in performing the process of the present invention, has taken only about fifteen or twenty seconds, of the winding time, the core has progressively become warm to such an extent that the core collapsing pressure exerted on the core by the winding being applied, will so collapse, i. e., inwardly compress, the core to such an extent that the core has, within such short elapsed time, been so reduced in volume that the total diameter of the core plus the added thickness of the partially applied winding is substantially less than the initial diameter of the "frozen" core alone.

In other words, instead of the application of progressively positioned layers of tensed rubber threads increasing the over-all diameter of the core plus the layers of threads applied in such time, the partially wound core at the end of fifteen or twenty seconds, or thereabouts, may be substantially less than the original diameter of one inch, initially possessed by the originally "frozen" spherical core.

In other words, during this part of the winding process, due to the communication of heat to the "frozen" core, starting at its surface and progressing toward its center, which progressively increases its collapsibility, and with the concurrent application of contracting core-collapsing pressure by the effect of tensed resilient thread winding applied to such core, in such an approximate aforesaid period of time, the original "frozen" core, having an initial diameter of, say, one inch, plus the thickness of the winding, will then be of substantially less diameter than merely the initial diameter of the core alone, and the core itself will have been substantially reduced in diameter to a fraction of such initial diameter of one inch.

In the practical application of my improved process, a point is soon reached where the partially wound core including the partial winding, has reached its minimum diameter, which is no more than, and is, as stated, caused to be substantially less than, the initial diameter of the "frozen" cover. As winding continues, the added layers of vulcanized tensed thread begin to achieve an increase in diameter of the wound core until a predetermined over-all diameter is achieved.

Expressed in another way, the application of

the winding to the initially "frozen" core is much in the nature of a race between two different resultant effects, to-wit: first, the contracting effect of the inward pressure by the wound resilient rubber threads tending to collapse and reduce the diameter of the core which is progressively concurrently achieving increased temperature by heat proceeding toward its axial center from its outer surface portions; and second, the natural progressive increase in diameter of the wound core because of the application of more and more rubber thread material applied to its exterior.

In the early stages, the contracting effect is predominant, assuming that the winding is accomplished as herein contemplated under conditions of ambient air temperatures of, say, 70°. I contemplate sometimes varying the ambient room temperature where the winding is accomplished, to vary the rate at which heat is communicated to the initially "frozen" core, in order that the rate of increase of collapsibility of said core may be suitably regulated to keep step with the rate of winding in the desired contemplated described relationship.

It may be said that even after the core plus the initial part of the winding, as above referred to, begins to increase in total diameter, and for sometime thereafter, the core, due to the collapsing effect, is still decreasing but at a slower rate, and when the winding is completed the core, particularly the central parts thereof, is still much cooler than the winding, particularly in its radially outer portions, to accomplish an effect hereinafter more specifically described.

When the wound ball center, as illustrated in Figs. 4 and 8 hereof, is completed, due to the various effects above described and due to the continuously additive compressive effect of the winding on the core, the core is ultimately reduced from an initial diameter, in the embodiment illustrated, of one inch to an ultimate diameter preferably of about 3/8", and the entirely wound center is substantially of uniform density and weight throughout all portions, from its periphery to its axis, where the core is made of vulcanized sponge rubber material.

The center, as contemplated, may have an outside diameter of about 1.42", and with the subsequently applied balata and rubber casing, makes the golf ball of my invention of the desired generally prescribed diameter of 1.62".

From the foregoing, it is readily deducted that the core, having an initial normal diameter of one inch, is ultimately reduced to a diameter of approximately 3/8", and therefore ultimately the core is reduced in volume to approximately 1/20 of its initial volume, although its density is correspondingly increased to correspond approximately with the density of the portion of the wound center comprising the rubber threads. The reduction of core diameter, as disclosed for the present embodiment, is above given as approximately to 1/20 of initial normal volume, but within the scope of my invention substantial advantages are achieved by collapsing the core to such reduced volumes as 1/4 of the initial volume, and on the other hand, even greater reduction than to 1/20 of initial volume may be achieved.

As subsequently described, the ball, immediately after being completely wound, still is much cooler in its central portion, and subsequent to completion of the winding process the temperatures become equalized throughout the ball. This effects a subsequent reaction of pressure between the core and the outer portions of the ball, as subsequently herein described, so that the ball ultimately substantially throughout its mass is of substantially the same density, avoiding any possibility of its center of gravity being elsewhere than at the precise center of the wound ball.

In the preferred embodiment golf ball and process, as illustrated and described herein, when the winding is fully applied to what is determined to be the proper over-all external diameter, the ball is ready for the application of the outer cover, which is applied in the usual manner, by molding a cover which may, for instance, consist of mixed balata and rubber, together with coloring and weighting material, as may be desired, and the ball is vulcanized in any suitable way, preferably as set forth in the co-pending joint application of Reichard, Olin, and Cramer, Serial No. 249,780, filed January 7, 1939, by the immersing of the completely covered ball in a suitable vulcanizing solution. Thereafter, the ball is subjected to the well-known painting operation.

In the above process, a very important fact is involved which contributes to the tension of the winding ultimately disposed within the cover, and that is that the ball when completely wound may still be substantially cooler in its central portion, due to the initial "freezing" temperature applied to the core, and such wound ball center, slowly achieving the temperature of the ambient air, will tend to expand from the center outwardly, due to the property of thermostatic expansion, but while such action is still going on the contracting pressure of the very many layers of highly tensed rubber threads will prevent any unduly appreciable expansion of the wound center as a whole, so that the effect of the warming of the central portions to ambient temperatures contributes to the pressures exerted between the outer and inner portions of the ball, so that the wound ball center is firmer than would otherwise be the case.

Although I am aware that this result is to a measure secured to a lesser degree in prior winding of golf balls having substantially incompressible initially "frozen" cores, I believe I am the first to achieve this result, and the first to achieve it in increased degree, where the core is a vulcanized rubber, collapsible, preferably cellular core. This will be understood better when it is explained that such prior hollow cores have been commonly filled with substantially non-compressible plastics, or liquids, and the radially reacting pressures due to initial chilling of the cores have only been effective as between the relatively inner and outer layers of wound rubber threads, whereas in my improved golf ball this action is exerted from the precise center of the ball to its exterior layer of wound rubber threads.

Moreover, balls employing such prior non-collapsible cores, during the winding and/or covering, are subject to slight displacement of such incompressible centers from the proper co-axial position within the thread winding, and too frequently the weight of the ball is not so uniformly disposed concentrically relative to the peripheral surfaces of the wound center or completed ball, thereby contributing to undesirable inaccuracies in the use of the completed ball, as when putting or when driving the ball in distance strokes by a golf club.

The example above given relates more particularly to a ball of the requisite size and weight of those proscribed for use in tournament play-

ing throughout the United States at the present time, but of course it will be understood, and I am fully aware, that my invention is not limited to golf balls having this precise limitation as to sizes and weights, nor is it limited to the manufacture of golf balls only, since playing balls for other games than the game of golf, and golf balls of other sizes, may profitably employ in their making the process as substantially herein described, with a better more concentric disposition of weight, and with the efficient desired firmness of the resulting ball, and achieve the desirable "clock" sound of such firm live golf balls, the making of which is by my improved process provided for.

Although I have, for the purpose of an understanding of the process and improved article involving the inventive principle of my invention, in a preferred manner of practicing the process, and for the resultant ball which is a preferred embodiment of the article formed, assigned dimensions for the complete ball and the core thereof, I am aware that my invention may be practiced with cores of other materials than sponge rubber, and of differing initial and ultimate dimensions, and with single and plural numbers of rubber threads simultaneously applied, i. e., single, double, triple, etc., thread windings, and that correspondingly the total winding period and particular portions thereof may be increased or reduced, with increasing reduction or increase of the rate of increase of temperature of the "frozen" core, and my invention in its broader aspects is not limited to such variations herein given, nor to the materials herein referred to, being limited only by the scope of the appended claims.

Having described my improved process in a preferred embodiment, and an improved resultant product, in one form, I am aware that numerous and extensive departures may be made from the embodiment process and ball, the making of which is herein described, but without departing from the spirit of my invention, which is only limited by the claims of the patent for which application is hereby made.

I claim:

1. The process of forming vulcanized rubber thread wound centers for golf balls or the like, comprising the subjection of a normally collapsible core to a relatively low temperature to first make said core relatively and substantially non-collapsible to such inwardly directed pressures as would be effected by the application of a tensed vulcanized resilient rubber thread thereto, and then gradually increasing the temperature of the said core by the communication of heat to its exterior surface while concurrently rapidly applying such a tensed winding thereto, said heat being communicated to the core center gradually from the surface of said core whereby said core is gradually made collapsible the application of the said winding being attended in initial stages by a substantial reduction in total diameter of said core and partially applied winding, relative to the initial diameter of said core, and characterized by the said total diameter of said core and winding being thereafter progressively increased until a predetermined maximum total diameter is reached.

2. The process of forming vulcanized rubber thread wound centers for golf balls or the like, comprising the subjection of a normally collapsible core to a relatively low temperature to first make said core relatively and substantially non-collapsible to such inwardly directed pressures as would be effected by the application of a tensed vulcanized resilient rubber thread thereto, and then gradually increasing the temperature of the said core by the communication of heat to its exterior surface while concurrently rapidly applying such a tensed winding thereto, said heat being communicated to the core center gradually from the surface of said core whereby said core is gradually made collapsible the application of the said winding being attended by such progressive gradual collapsing of the core as to reduce its diameter in opposition to the gradual increase of thickness of rubber thread applied to the core, whereby in initial stages of winding the total diameter of the partially wound center is not substantially greater than the initial diameter of the uncollapsed core.

3. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed collapsible core to increase its resistance to compressive stresses, then applying a core-contracting winding to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding to the inner portions of the core, said heat and said winding to said core being so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be not greater than one-fourth of its initial volume.

4. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed core of rubber or rubber-like material of substantially cellular form to increase its resistance to compressive stresses, then applying a core-contracting winding to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding to the inner portions of the core, the application of said heat and of said winding to said core being so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be not greater than one-fourth of its initial volume.

5. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed collapsible core formed to have air spaces substantially throughout a major portion of its volume to increase its resistance to compressive stresses, then applying a core-contracting winding to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding to the inner portions of the core, said application of said heat and of said winding to said core being so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be not greater than one-fourth of its initial volume.

6. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed collapsible core to increase its resistance to compressive stresses, then applying a core-contracting winding to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding

to the inner portions of said core whereby the application of said heat and of said winding to said core is so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be not greater than one-fourth of its initial volume, and wherein the winding operation is completed prior to the equalization of temperature of all portions of said core with the temperature of the outer portions of said winding.

7. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed collapsible core to increase its resistance to compressive stresses, then applying a core-contracting winding of vulcanized rubber or like resilient winding thread of substantial elongating stress to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding to the inner portions of said core whereby the application of said heat and of said winding to said core is so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be not greater than one-fourth of its initial volume, and wherein the winding operation is completed prior to the equalization of temperature of all portions of said core with the temperature of the outer portions of said winding.

8. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed core of rubber or rubber-like material of substantially cellular form to increase its resistance to compressive stresses, then applying a core-contracting winding of vulcanized rubber or like resilient winding thread of substantial elongating stress to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding to the inner portions of said core whereby said core is progressively rendered collapsible, the application of said heat and of said winding to said core is so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be not greater than one-fourth of its initial volume, and wherein the winding operation is completed prior to the equalization of temperature of all portions of said core with the temperature of the outer portions of said winding.

9. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed core of rubber or rubber-like material of substantially cellular form to increase its resistance to compressive stresses, then applying a core-contracting winding to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding inwardly to the center of the core whereby the application of heat and of said winding to said core is so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be between one-tenth and one-fortieth of its initial volume.

10. The process of preparing a substantially spherical wound ball comprising first abstracting heat from a previously formed collapsible core to increase its resistance to compressive stresses, then applying a core-contracting winding of vulcanized rubber or like resilient winding thread of substantial elongating stress to said core concurrently with the communication of heat to the surface of said core, the application of said heat progressively proceeding to the center of the core whereby the application of said heat and of said winding to said core is so correlated that upon the conclusion of the winding operation the said core will be so collapsed by the pressure exerted by said winding that its volume will be between one-tenth and one-fortieth of its initial volume, and wherein the winding operation is completed prior to the equalization of temperature of all portions of said core with the temperature of the outer portions of said winding.

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