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GOLF BALL

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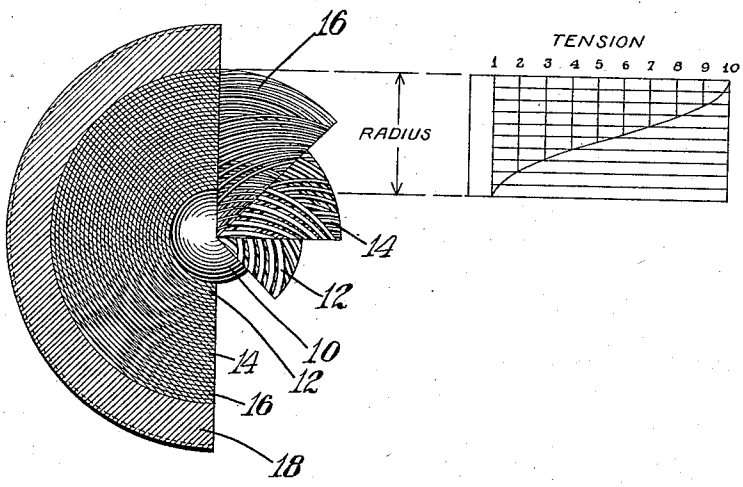

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GOLF BALL

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This invention relates to golf balls of the type which have a resilient core wound of rubber thread. The invention consists in improvements in the character or structure of the winding whereby the ball is made more responsive to the blow of the driver, so that it may be relied upon for longer flights than balls heretofore known.

The range of a golf ball is determined in a large part by two factors; first, the distance or magnitude of the distortion of its resilient core under the impact of the club and, second, by the speed or activity with which the core reassumes its normal shape after being distorted. The range of the ball, therefore, may be improved by so constructing the core as to facilitate the distortion of its outer zone, or at least to permit such distortion to take place without substantial internal resistance. The action of the outer zone of the core is of primary importance in determining the flight of the ball because it is only this portion of the ball which is of sufficient diameter to be susceptible of substantial distortion. The rebound effect is intensified by rendering the outer zone of the core as highly resilient as possible, as for example, by highly tensioning the rubber thread of its windings. I have discovered that these desirable results may be attained by winding the core with a progressively increasing tension in the rubber thread of which it is constructed. Under such conditions, the center portion of the core consists of soft rubber which is highly flexible and easily distorted but not particularly active in its rebound characteristics. It thus supplies a support which may be readily distorted without substantial resistance when the outer zone of the core is distorted by the blow of the driver. On the other hand, the outer zone of the core, formed by the highly tensioned rubber thread, is extremely resilient and active in its rebound characteristics and the vigorous reaction of this portion of the core contributes largely to increase the range of the ball. It will be apparent also that by increasing the magnitude of the distortion, the ball will remain in contact with the face of the club for a correspondingly longer period, a condition which contributes also to increase the range of its flight. In one aspect, therefore, my invention consists in a golf ball in which the tension of the core is increased in a movable manner as the diameter of the core increases, forming at the center of the core a body characterized chiefly by its flexibility and at the surface thereof a zone characterized chiefly by its high resiliency.

As an additional and preferred feature, I contemplate a golf ball in which the tension of the windings is increased progressively rather than abruptly. A rate of tension increase represented substantially by a sine curve is particularly advantageous as under these conditions there is no violent change of tension between adjacent portions of the core but instead, a smooth increase of tension, first at a relatively slow rate in the inner portion of the core, then changing smoothly into a rapid increase in the rate of tension increase as the diameter of the core is increased, and this again changing into a slower rate of increase in the tension adjacent to the outer surface thereof. This condition is not only most desirable from the standpoint of increasing the range of the golf ball but also because it results in a stable internal condition, making the ball unlikely to become misshapen in use.

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 the figure is a view, on an enlarged scale, of the golf ball partly in section and partly in elevation, showing different stages of the winding, together with a diagrammatic representation of the tension conditions throughout its winding.

I have illustrated my invention as embodied in a golf ball having a solid spherical center 10 of soft rubber, although it would be within the scope of the invention to employ a liquid center or other center of flexible characteristics.

The core of the ball is formed by winding rubber thread upon the center 10, and in forming the inner windings 12 of the core I

prefer that the rubber thread should be tensioned to a relative slight degree so that the inner body of the core shall have maximum flexibility and little surface tension. Referring to the diagram, it will be seen that in the portion corresponding to the radius of the center 10 the elongation of the rubber thread is indicated by the ratio 1-to-1, that is to say, the thread is wound in its natural untensioned length.

As the winding is continued and the diameter of the core increased, the rubber thread begins to be subjected to tension and to an increasing amount of elongation. The windings 14, constituting an intermediate zone of the core, for example, may be elongated from a ratio of 1-to-3 increasing to a ratio of 1-to-7, so that the flexibility of the body formed in this portion of the core gradually decreases, whereas the resiliency is gradually increased. Finally, the windings 16 of the outer part of the core are formed of rubber thread which is highly tensioned and increasingly tensioned to the outer surface of the core. For example, the tension may be increased in this zone, as indicated in the diagram, from an elongation ratio of 1-to-7 to 1-to-10.

In the manner above outlined, I am enabled to produce a core, the flexibility of which decreases progressively but without abrupt change from its inner to its outer portion and in which its resiliency or rebound characteristics increases in an inverse ratio as compared to its flexibilty. The result is that the outer zone of the ball, which is of sufficient size to be capable of substantial deformation, has the maximum tendency to rebound or to reassume its normal spherical shape after being distorted, whereas the inner portion of the core, which is limited by its diameter to a relatively small degree of distortion, has a maximum degree of flexibility so that it will not resist distortion in its outer zone.

The golf ball is completed by enclosing the core produced in the manner above outlined within an outer shell 18 of a wear-resisting rubber compound.

While the advantages of my invention are present in a ball in which the tension of the windings is increased with the diameter of the core, I believe that the most advantageous construction is that in which the rate of tension increase is represented by a sine curve, as in the diagram of the accompanying drawing. In this diagram, the abscissa represents the actual tension in the rubber thread in terms of elongation and the ordinate represents the diameter of the core. The axis of the abscissa is divided into ten divisions, the first of which, marked 1, indicates the normal untensioned length of a unit of rubber thread and the last, marked 10, indicating an elongation of 1-to-10 as compared to the normal length of the unit. The axis of the ordinate is divided into corresponding divisions equal in length to one-tenth of the thickness of the core measured along its radius. The curve plotted in this diagram represents the tension of the winding at successive points in the radius of the core and its inclination represents the rate of tension increase at that particular point. In a core wherein the rate of tension increase of the windings is represented by a sine curve, it will be apparent that the inner windings adjacent to the center 10 increase in tension first at a slow rate although at a constantly increasing rate. After passing out of the first phase of the curve, the rate of tension increase is very rapid, as indicated by the steep portion of the curve extending from the ratio of approximately 1-to-2 to the point where the ratio becomes 1-to-7. The rate of tension increase throughout the final phase of the curve then becomes slower and slower, so that an outer zone is formed of substantial thickness and of relatively high tension in its windings. In a ball wound in the manner thus explained, the change in tension between successive windings is practically imperceptible although each zone is of increasing resiliency and decreasing flexibility. Abrupt changes in tension are, however, substantially eliminated, there is no tendency to cleavage between the zones and a stable internal structure is insured.

It will be understood that the precise character of the tension increase and of the limiting ratios of elongation are of secondary importance only. I contemplate that a ball having the windings of its outer zone tensioned as much as 1-to-10 will be best adapted for the use of a professional golfer and that for less skillful players a maximum tension ratio of 1-to-7 or 8 may be preferable. The importance of balancing the characteristics of the ball to the characteristics of the individual player has not been fully appreciated prior to my invention. I have found, however, that by grading the tension of the core windings between different limits I am enabled to provide a graded series of balls from which the individual player may select the one best adapted to his own game.

In my prior application, Serial No. 404,299, filed November 2, 1929, I have disclosed a machine adapted for winding cores of the character herein set forth, although any core winding machine having provision for continuously varying the winding tension might be employed to produce the core of my invention.

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

1. A golf ball comprising a soft rubber center, a core consisting of rubber thread wound upon the center under low tension and increasing continuously and without abrupt

change in its tension as the diameter of the core increases, first at a relatively slow rate, then at an accelerated rate, then finally again at a reduced rate to a maximum tension at its outer surface, and an enclosing shell for said core.

2. A golf ball comprising a rubber center, a core consisting of rubber thread wound upon the center under low tension and forming therewith a highly flexible body which may be easily distorted, the tension of said thread increasing with the diameter of the core continuously and without abrupt change to a maximum tension at its outer surface, thereby forming a dense highly resilient zone enclosing a less resilient and more flexible body, and an enclosing shell for said core.

3. A core for a golf ball comprising a flexible center, and rubber thread wound thereon under low tension in its inner windings forming therewith a highly flexible body, the tension of said thread being increased continuously in a rate represented substantially by a sine curve, thereby forming as the surface is approached a dense highly resilient zone which may be distorted substantially without resistance of said flexible body and which tends to rebound rapidly.

4. A core for a golf ball comprising rubber thread wound under low tension in its inner windings thus forming a highly flexible inner body, the tension of said thread being increased continuously and without abrupt change but at a varying rate and forming a highly resilient outer zone wound under maximum tension and enclosing a body, the flexibility whereof decreases outwardly without abrupt change.

CHARLES R. SIBLEY.