Feb. 28, 1950 R. F. SMITH 2,499,344

METHOD OF MAKING GOLF BALLS

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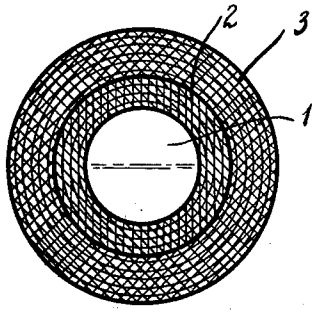


FIG-1

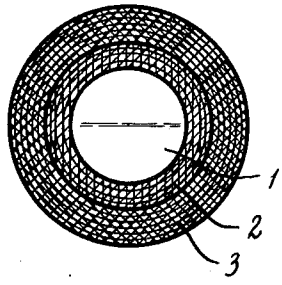


FIG-2

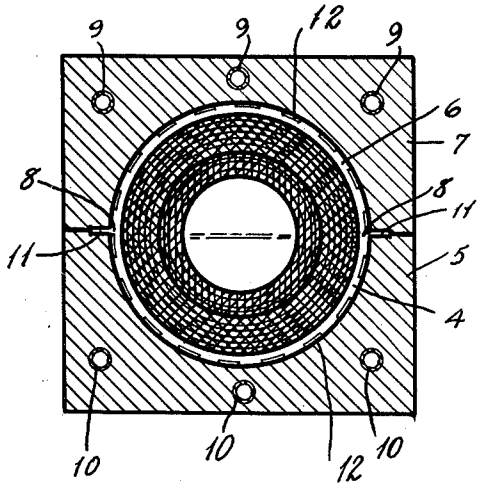


FIG-3

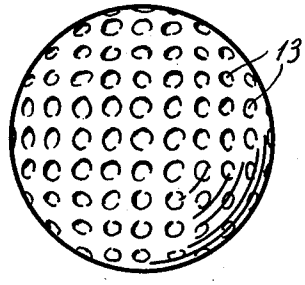


FIG-4

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METHOD OF MAKING GOLF BALLS

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7 Claims. (Cl. 154—19)

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My invention relates to an improved method of manufacturing golf balls.

More specifically my invention relates to the making of an improved golf ball whereof the layer of rubber winding between the central core and the outer cover will communicate a greater pressure to said core and cover surfaces than golf balls made according to previously known methods.

Prior to my invention, efforts to increase the internal pressure exerted radially outwardly against the outwardmost confining ball cover have, so far as I am aware, been confined to such expedients as injecting additional liquid or gas into the central core of a fully completed golf ball, usually by means of a hypodermic needle forced successively through the outermost cover and intervening rubber winding into the interior of the core, which core is in the form of a hollow rubber sphere.

Golf balls manufactured according to such prior methods have been found to vary considerably in initial performance and with increased variation as actually used, as a result of the injected liquid frequently disturbing the concentricity of the different portions of the core shell and also as a result of subsequent leakage of liquid through the aperture of its wall caused by the injection of the needle therethrough. As distinguished from the prior methods, the resiliently effective internal pressure exerted against the outer cover of the ball made according to my improved method is achieved by the attempted expansion of the rubber winding which is interposed between the golf ball core and the outer cover and this I accomplish without requiring the walls of the core or the completed ball to be punctured or otherwise disturbed subsequent to the completion of manufacture.

My improved method involves the manufacture of golf balls according to an improved method wherein the so-called ball center, comprising a central core and a winding of rubber tape and/or thread, wound under tension upon said core, is contracted in diameter by abstraction of heat from the winding, and while contracted, a layer of suitable thermoplastic material, such as gutta percha, balata, or like materials, sometimes including additional materials, is molded onto the exterior surfaces of the wall center in the usual way.

An object of my invention is to provide an improved method for making golf balls wherein subsequent to the application of the cover thereto the rubber winding interposed between the core

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and the cover is effective to increase its effort to expand to a degree greatly beyond the degree of such effort where golf balls are manufactured according to previously known methods.

Another object of my invention is to provide an improved golf ball provided with a rubber winding interposed between a central core and the outer confining cover which after the cover is applied and responsive to ambient temperatures will strongly tend to expand and thereby exert considerably increased expansive pressure both against the outermost cover and inwardly against the outer surface of the core.

Another object of my invention is to provide an improved method for manufacturing golf balls characterized by the exposure of the wound ball center to such a cooling medium as Dry Ice (solidified carbon dioxide gas), or other material, reduced to exceedingly low temperature, and placing the cover on the resultantly contracted center while the contraction of the center is substantially maintained.

Another object of my invention is to provide an improved golf ball so constructed, as to greatly increase the retractive effort of the rubber winding which is interposed between the golf ball core and the inner surface of the golf ball cover, said increase becoming effective only after the cover is applied.

Another object of my invention is to effect economies in the cost of manufacture of golf balls, which arise from the lack of necessity of applying the rubber winding under as great tension as heretofore, but which after application of the cover becomes highly tensed.

Other objects of my invention and the invention itself will be better understood by reference to the accompanying specification which relates to a specific embodiment of my invention, and wherein references are had to the accompanying illustrated drawings indicating the different steps of the process which are susceptible to indicative illustration.

In the drawings,

Fig. 1 is a view of a golf ball center comprising a central spherical core, and a rubber winding applied thereto, the core being illustrated in elevation and the winding being indicated as if in diametrical cross section.

Fig. 2 is very similar to that of the view of Fig. 1, the central core being the same as in Fig. 1 but the windings being illustrated as contracted as a result of heat being abstracted from the center of Fig. 1.

Fig. 3 illustrates the contracted wound center

of Fig. 2 encased in a spherical two-mold cavity, with a layer of thermoplastic cover material interposed between the outermost circumferential surfaces of the center and the inner walls of the cavity and indicating liquid conduits adapted to successively convey cooling, heating, and cooling liquid for subjecting the ball and cover to variations in temperature dura molding process.

Fig. 4 illustrates the resultant covered golf ball.

The golf ball of my invention preferably comprises a central core 1, and said core may preferably comprise a thin walled hollow rubber shell which is preferably filled with a substantially incompressible liquid, said liquid being of any suitable composition, and may or may not be subject to expansion or contraction, responsive to changes of temperature.

However, the principles of my invention are well served by making the spherical core 1 in any suitable size and weight, of any suitable solid material, with or without the use of a liquid filling.

Over the core 1, I preferably provide a rubber filling comprising successive superimposed rubber windings, the first 2, being preferably of a thin rubber tape and wound under tension and over the tape winding 2 I preferably provide a superposed winding 3 of rubber thread also wound under predetermined tension.

Should a liquid-filled core be employed, the core 1 may, in known manner, be subjected to chilling by abstraction of heat therefrom by placing it in proximity to "Dry Ice," whereby the central liquid becomes solidified to afford a solid spherical base, which is form-sustaining during the winding operations, and upon which the rubber winding may be superposed.

The freezing of the central core liquid may be accomplished without substantially affecting the volume of space occupied thereby, it being well known that suitable liquid, which does not appreciably expand or contract when frozen, has commonly been employed for a central core for golf balls.

The wound center, constructed as indicated in Fig. 1, will preferably be of appreciably greater diameter than those previously covered, to adapt it for covering by a confining cover of the same effective thickness, as heretofore employed.

The next step of the process is the subjecting of the entire wound center illustrated in Fig. 1 to the chilling effect of Dry Ice or other freezing medium whereupon the abstraction of heat from the winding or windings 2 and 3 causes the wound center to be appreciably reduced in diameter as roughly indicated in Fig. 2 which shows that, whereas the core retains its original diametrical dimension, the rubber winding is reduced in volumetric content.

Inherently rubber material will contract greatly, when cooled, to a greater degree than any similar material and, since the rubber winding was previously wound under tension, its contraction will not increase the tension of the winding but will decrease said tension, because of the effect of the resulting shorter length of the chilled convolutions.

I have found that the abstraction of heat from the windings which reduces the temperature thereof to approximately 100+ degrees below Fahrenheit zero, is not attended by breakage of the tape or thread winding material, under normal conditions of handling.

With the ball center of Fig. 2 in the contracted state, and of over-all reduced diameter, such center is then introduced into a two-part mold cavity, as indicated in Fig. 3, each part of the cavity being provided with a lining comprising a hemispherical balata, gutta percha or equivalent thermoplastic cup.

After insertion of the ball in embraced relation to the balata or like cups, the uppermost part 7 of the mold is clamped down tightly over the ball center and said cover material to securely and confiningly clamp the opposing edges 8 of the hemispherical cups 4 and 6 together, the dimensions of the mold cavity thus substantially perfected by the closing of the mold being so related to the contracted ball of Fig. 2 that the ball center is closely held centered within the balata cups.

The molding of the cover onto the rubber filling, comprising said core and thread winding, is then achieved in any previously known suitable manner, and by circulation of ice water or other chilled liquid through conduits, such as indicated at 9 and 10, the two mold parts 5 and 7 are first chilled.

The pre-chilling of the mold parts avoids unduly rapid abstraction of heat by the mold parts from the winding of the wound center, and the interpositioning of the thermoplastic cups 4 and 6 between the outer surfaces of the filling 3 exercises a sufficient heat insulation effect as to prevent excessive abstraction of heat from said winding.

According to the prevailing practice a somewhat thin space indicated at 11 is provided to receive excess cover material which is squeezed out of the mold cavity during the molding operation. The molding surfaces of the molding dies 5 and 7 are preferably provided with small inwardly directed protuberances 12, which by indenturing, provide the indentations 13, Fig. 4, commonly provided on the outer surfaces of the ball cover.

After closing the mold upon the balata embraced filling center, a source of superheated steam is put in communication with the conduits 9 and 10 and the mold parts are therefore heated to a relatively high temperature preferably above 212 degrees Fahrenheit, 290 degrees being suitable, to thermally cause the previously solid balata or other thermoplastic material of the cups 4 and 6 to become plastic and fluid, whereupon the substantially confined cover material of the cups flows freely around the confronting surfaces of the exterior of the wound center of Fig. 2 and around the "dimple" projections 12 of the cavity walls and will penetrate between the interstices of the outermost layers of rubber thread 2.

The penetration of balata material through the outermost interstices between the different convolutions of rubber thread securely anchors the interior of the golf ball cover to the exterior of the thread winding 3.

After such a period of time as is required to render the balata or like cover material substantially plastic, the flow of superheated steam through conduits 9 and 10 is discontinued and before the molding heat has substantially increased the temperature of the rubber winding, and ice water is again directed through said conduits to again achieve chilling of the mold to congealingly solidify the cover material in superposed relation about the wound center, to permit ready removal of the covered ball from the

cavity, being then completed as indicated in Fig. 4.

Upon communication of ambient atmospheric temperature to the ball filling comprising the winding, through the intervening cover, said filling being closely confined by the but slightly resilient cover, such thermal expansion of said filling which then occurs renders the winding more compact than has been heretofore been the case, even when the tape or threads of said filling winding is applied while tensed as close to the elastic limit thereof as is practically possible.

Although the present method of manufacturing golf balls may be employed where the filling winding is applied under the maximum possible tension, yet for most purposes, it may be more desirable for reasons of economy to employ my method to such a winding applied under tension which is safely below the elastic limit of the rubber material. The application of highly tensed winding is commonly accompanied by frequent breaking of the rubber thread and also commonly, the complete winding may involve separate lengths of winding with the ultimate result that the completed ball will not sufficiently resist inwardly directed compressive force and may have to be junked, or sold at a much lower price than a ball having a continuous winding could be sold for.

Actually, balls made according to my improved method employ heavier thread, wound well under the elastic limit of the rubber material, can be wound without danger of breaking the thread and under a relatively lower tension than heretofore employed for balls of the best quality, and by the effect of the final thermal expansion of the ball filling its radial outwardly directed pressure asserted on the ball cover, makes such a ball resist inwardly directed compressive effects.

The heavier rubber thread is less expansive, the winding thereof is accomplished with less danger of breaking the thread and the resultant balls are not required to be junked or sold at a lower price, thereby effecting substantial economies in an article which must be sold in a very highly competitive market.

My improved golf ball may therefore comprise a more compacted rubber winding than has heretofore been economically possible and this fact, coupled with its uniformly high pressure effect upon the cover, achieves a very beneficial effect on the ball when used.

Whereas I have stated my preference that the initially wound center should have a diameter greater than its ultimate diameter, and whereas this statement comprehends winding the center to a greater diameter than centers have previously been wound for inclusion in a cover having the same thickness, yet at the same time this does not preclude the winding of my center to the same diameter as previously commonly employed, and then thermally contracting the winding so that a thicker cover may be used to afford greater durability, the outside diameter of the ball being, of course, required to be the standard diameter in both cases.

It will be understood that the present invention relating to contracting the rubber filling to 2—3 and in some cases including the core 1 by chilling it to extremely low temperature and applying the cover over the contracted rubber filling, is applicable to balls employing other filling materials than rubber, and which are similarly thermally contractable to a marked degree and I therefore, for the purpose of this application and the claims thereof, define the term rubber as comprising all substitute materials which may be employed for said filling, which contract when chilled and subsequently expand responsive to the communication of heat thereto when the said spherical filling is supplied with a superposed confining cover.

According to the particular advantage desired, I am aware that numerous departures may be made from the embodiment herein illustrated and described, without departing from the spirit of my invention and the scope of the appended claims.

I claim:

1. The method of making golf balls comprising the abstraction of heat from an elastic rubber winding of a golf ball center which is initially diametrically too large to be contained in a normal sized cover by exposure of said center to a medium such as Dry Ice, to effect thermo-contraction of the winding to reduce its outside diameter, then confining the chilled reduced center in a spherical mold cavity with a layer of suitable thermoplastic golf ball cover material substantially lining the walls of the spherical cavity, the cavity being of such diameter relative to the thickness of said lining and the contracted volume of said center as to exert confining pressure upon the outer surface of said lining and center, then so rapidly heating the mold cavity for such a limited period of time as to exteriorly apply sufficient heat to the cover material as to plasticize the same to permit portions of said material to enter interstices between the outermost convolutions of said center winding before the temperature of the winding material has become so increased as to effect substantial thermal expansion of said material, and thereafter abstracting heat from the mold cavity by chilling the mold cavity walls to congealingly solidify said cover material then removing the covered center from said cavity for exposure to normal atmospheric temperatures.

2. The method of making golf balls consisting of the application of a tensed rubber winding over a central core until the diameter of the wound center is substantially greater than its desired ultimate diameter, then extracting heat from the wound center by exposure thereof to a freezing medium which has been reduced to an exceedingly low temperature to effect thermal contraction of said winding to substantially decrease its diameter, and then compressively confining the chilled contracted wound center in a spherical mold cavity with a layer of suitable thermoplastic golf ball cover material interposed between the surface of said center and the walls of the cavity, then before the temperature of said winding has increased sufficiently to effect substantial thermal expansion thereof, heating the mold cavity to apply plasticizing heat to the cover material for an insufficient length of time to cause the molding heat to substantially permeate the chilled wound center, and then abstracting heat from the mold cavity to congealably solidify said cover in relative anchored relation to the outermost convolutions of said winding, and then removing the covered center from said cavity for subsequent exposure to ambient normal atmospheric temperatures.

3. The method of making golf balls consisting of providing a core by enclosing a noncompressible liquid in a spherical rubber envelope, abstracting heat from the liquid to cause the core to be form sustaining, applying a highly elastic

rubber winding, under tension onto said core, said core to provide a substantially spherical golf ball center, then abstracting heat from the winding by exposure thereof to an externally located exceedingly low temperature freezing medium such as "Dry Ice" for a sufficient period of time as to effect thermal contraction of said winding to substantially decrease its diameter, then closely confining the wound center, before it has reabsorbed sufficient heat as to substantially reexpand it, in a spherical mold cavity with a layer of suitable thermoplastic substantially tough golf ball cover material which is much less elastic than the winding rubber interposed between the surface of said center and the walls of the cavity, heating the walls of the mold cavity to communicate plasticizing heat to the cover material, and after said cover material is sufficiently fluent to cause portions thereof to enter the interstices of the outer convolutions of the contracted winding, and before said winding has been heated sufficiently to cause it to be substantially thermally expanded, abstracting heat from the mold cavity to congealingly solidify said material, with portions of said material disposed in relatively anchored relation to said outermost convolutions of the winding, whereby upon removing the golf ball from the mold for exposure to ordinary ambient atmospheric temperatures the cover will gradually be super-tensed, by the effect of attempted diametrical thermally effected expansion of the rubber material of said center.

4. The method of making golf balls consisting of the application of a tensed rubber winding over a central core until the diameter of the wound center is substantially greater than its desired ultimate diameter, then abstracting heat from the winding by exposure thereof to an exceedingly low temperature freezing medium to effect thermal contraction of said winding to decrease its volume, then while so contracted closely confining the contracted wound center in a spherical cavity of an unheated mold with a layer of suitable thermoplastic tough and flexible golf ball cover material which is substantially much less elastic than said winding material, interposed between the outer surface of said winding and the walls of the cavity and heating the walls of the mold cavity to communicate plasticizing heat to the cover material, before said winding has absorbed sufficient heat to substantially expand it, and when said cover material is sufficiently fluent to cause portions thereof to enter the interstices of the outer convolutions of the contracted winding and before any except the outer convolutions of said winding have substantially increased its temperature, rapidly abstracting heat from the mold cavity to congealingly solidify said cover in relatively anchored relation to said outer convolutions, whereby upon removing the golf ball from the mold for exposure to ordinary ambient atmospheric temperatures increased tensing of the cover is achieved to a substantial degree, as a result of consequent attempted diametrical expansion of the windings and the inherent inability of the material of the confining cover to stretch to an appreciable degree.

5. The method of making golf balls of the general type which comprises an outer confining cover of balata, gutta percha, or equivalent golf ball cover material which is tough, flexible and of low elasticity as compared to rubber and a filling of which at least a substantial portion is composed of highly resilient rubber confinedly disposed within the cover and having the outer surface of said filling interlocked with the inner surface of the cover, comprising first, imparting to a body of said filling material a spherical form with a substantially rough outer surface, then abstracting heat from the filling to reduce its temperature to an exceedingly low temperature to effect volumetric contraction of said filling, then while said filling is of reduced diameter effected by its said contraction, molding a layer of said cover material directly on to the said outer surface of said filling in a spherical confining mold cavity, then quickly abstracting heat from the cover, and removing the covered filling from said cavity, whereby upon exposing the covered golf ball to ambient atmospheric temperatures, said filling will thermally expand and will impart substantially increased circumferential-tension creating force to said cover.

6. The method of manufacturing golf balls characterized by the exposure of the ball center comprising a winding of tightly elastic rubber strand material, to such a cooling medium as Dry Ice, to reduce the temperature of said winding to an exceedingly low temperature approaching the temperature of said cooling medium to effect a thermal diametrical contraction thereof, and then, before said winding has substantially increased its average temperature, closely molding a cover comprising a substantially large portion of thermoplastic flexible and tough material which is of much less elasticity than the material of said winding on the contracted wound center, whereby upon subsequently exposing the covered ball to ambient atmospheric temperature conditions, the winding thereof will expand to substantially increase the tension of the cover.

7. The method of making golf balls, comprising the making of a spherical ball center by applying a rubber winding under tension over a central core, substantially contracting the diameter of the center by abstraction of heat therefrom, confining the contracted center closely and compressively within a mold cavity having a lining of thermoplastic ball-cover material which is of low elasticity as compared to rubber and is substantially tougher than rubber, heating the cavity walls while said material is compressed between said center and the cavity walls to plasticize the material, and then chilling the cavity walls to solidify the cover material, whereby the center is closely confined within the cover, then exposing said covered ball to temperatures equal to any ambient atmospheric temperature.

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