No. 697,927. Patented Apr. 15, 1902.

F. H. RICHARDS.

GOLF BALL.

(Application filed Mar. 8, 1902.)

(No Model.) 2 Sheets—Sheet 1.

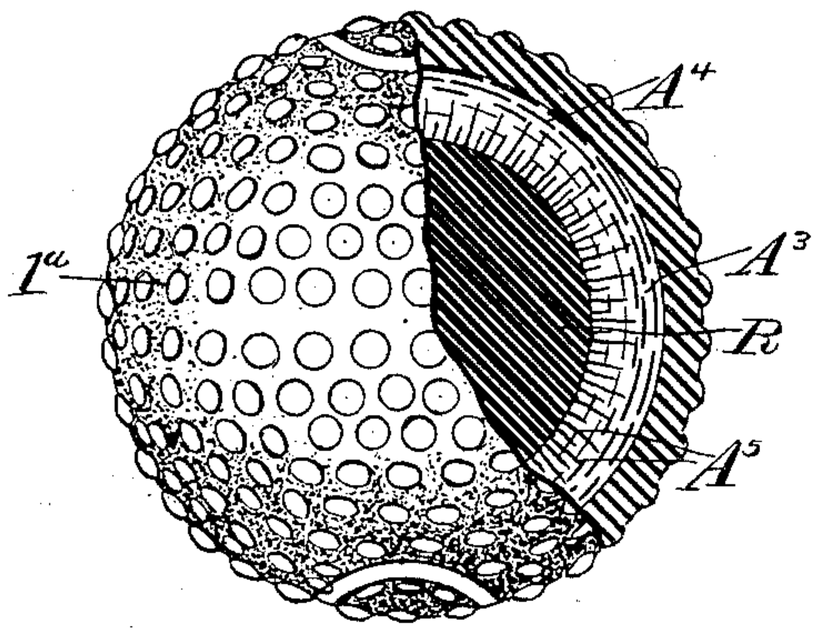

Fig. 1.

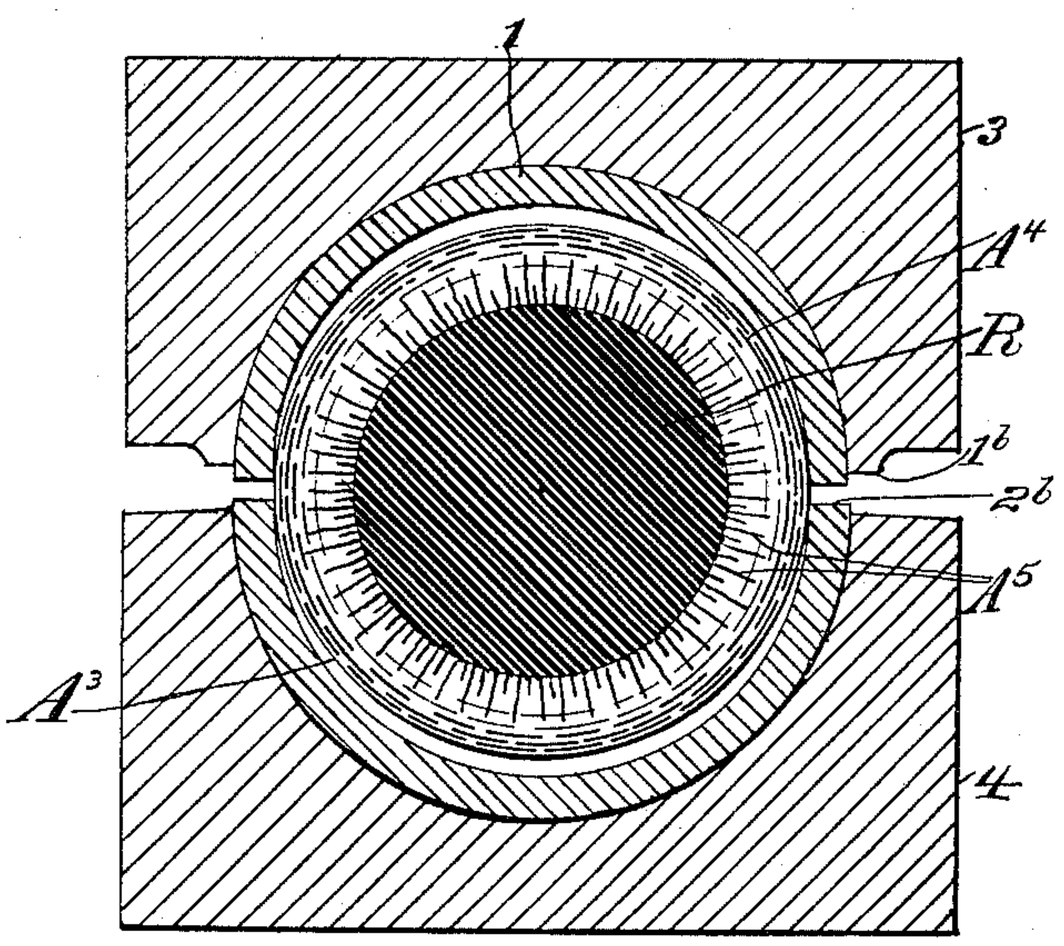

Fig. 2.

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Fig. 3.

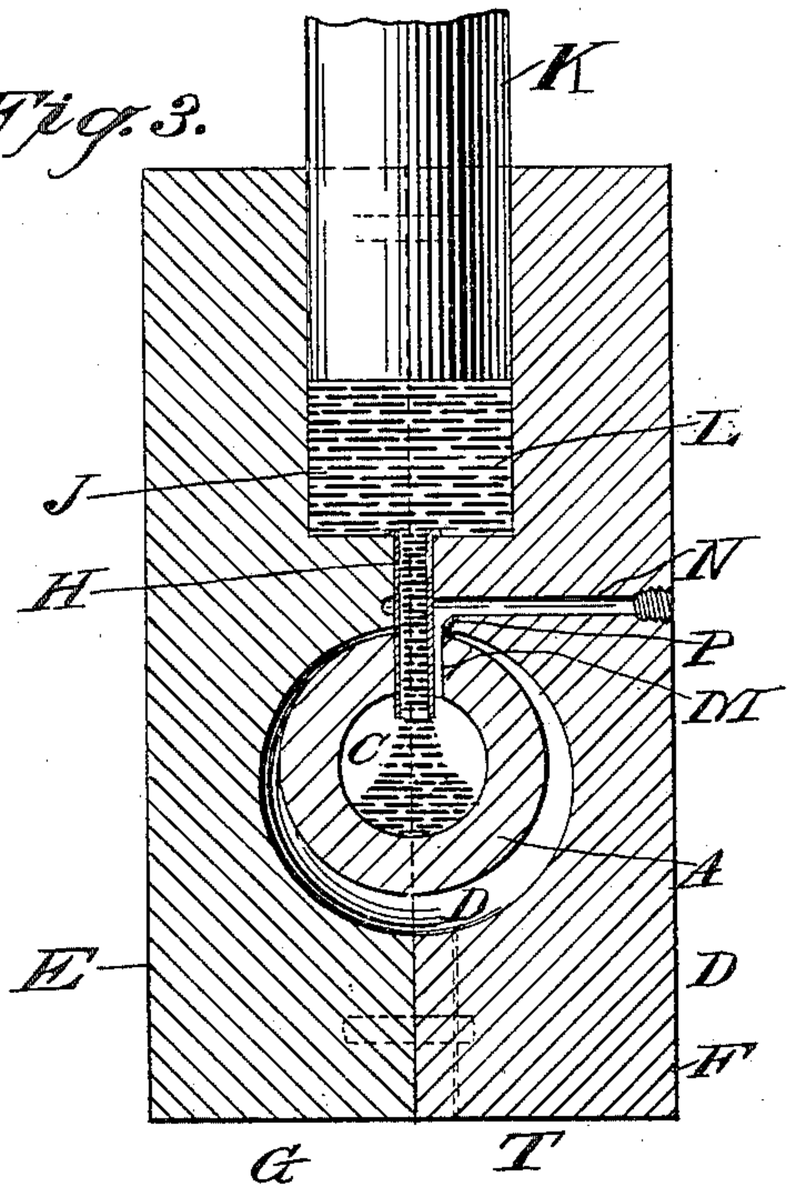


Fig. 4.

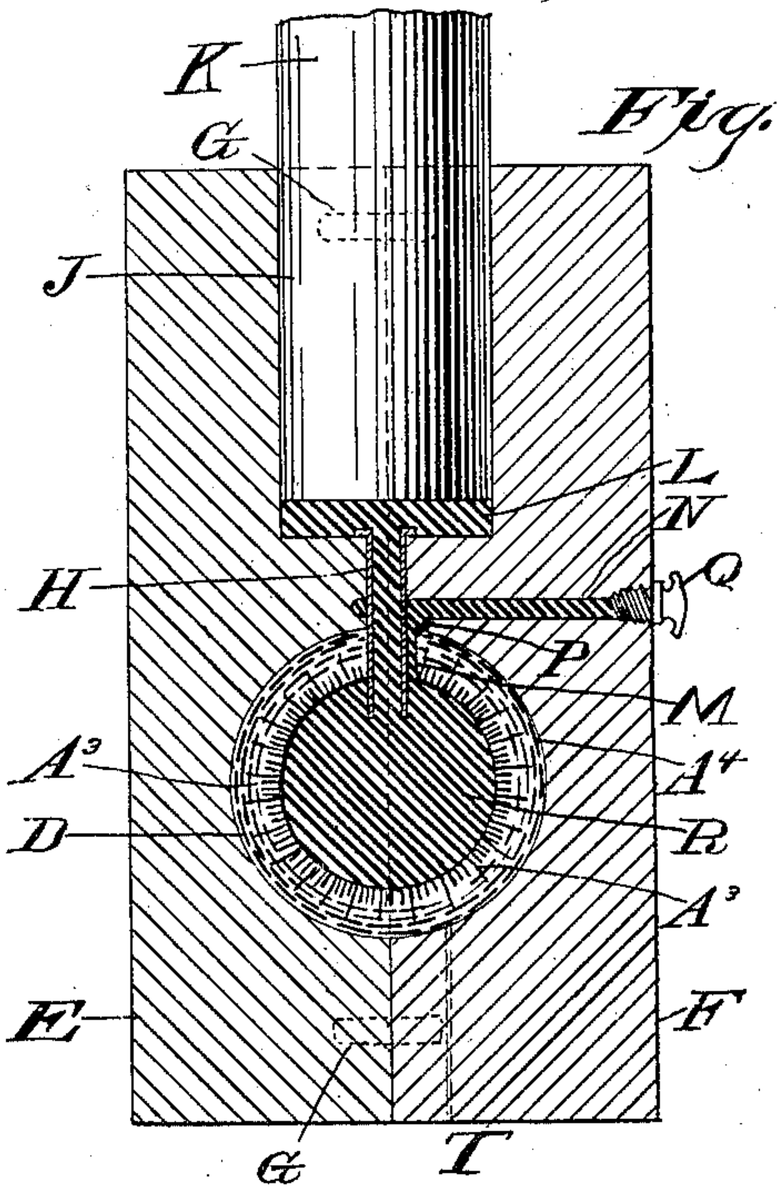


Fig. 5.

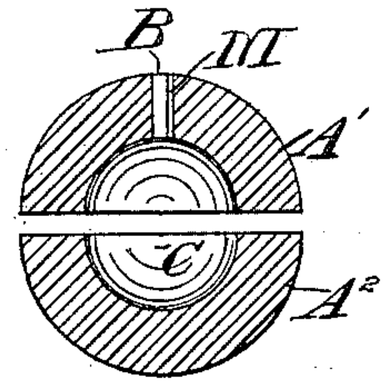
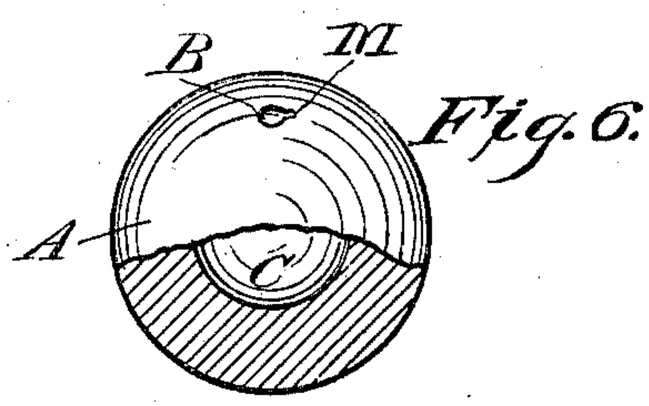


Fig. 6.



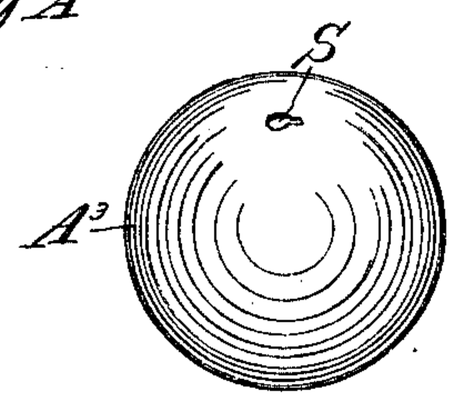


Fig. 7.

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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE KEMPSHALL MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

GOLF-BALL.

SPECIFICATION forming part of Letters Patent No. 697,927, dated April 15, 1902.

Application filed March 8, 1902. Serial No. 97,227. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Golf-Balls, of which the following is a specification.

This invention relates to balls such as used in golf and other games; and its object is to produce a ball of improved quality and increased efficiency, and especially to increase its flying power when given a hard blow without unduly increasing its sensitiveness to a light blow. I aim to produce a ball which is capable of absorbing from an implement a great momentum, to secure an improved cooperative action between the several portions of the ball, particularly of the shell or cover and the layer lying immediately within the same, and especially to minimize distortion of the ball so as to avoid waste of force in changing its shape, to produce a ball having uniform action, so that a given blow may always produce the same result, thus conducing to reliability and accuracy of action, and also to prolong the life of the ball. To these ends I preferably compress a layer of soft rubber between a core of gutta-percha and a shell of the same material, said rubber layer consisting of a hollow sphere previously distended upon said core.

In the drawings forming a part of this specification, Figure 1 is a view of a finished ball made in accordance with my present improvements, a portion thereof being broken away, so as to exhibit its construction. Fig. 2 is a diagrammatic view illustrating the manner of compressing a shell upon an inner ball. Fig. 3 is a view illustrating a stage in the process of forming an inner ball. Fig. 4 is a view similar to Fig. 3, but showing the process at a later stage. Fig. 5 is a cross-section of a blank used in forming a portion of my improved ball, indicating one way of making said blank in section. Fig. 6 is a view of a blank made in one piece, and Fig. 7 is a view of a distended sphere which forms the center piece or filling of a finished ball.

In the several views similar parts are designated by similar characters of reference.

Preferably I employ a hollow sphere A, made of soft india-rubber, preferably a compound having firmness or toughness and highly vulcanized. An opening B may communicate with the hollow C of the sphere, which may be made either integral, as at Fig. 6, or of hemispheres A′ and A², Fig. 5, said hemispheres being suitably united. I place the sphere in a spherical chamber D, formed in a mold consisting of opposing halves E and F, having registering dowels G and clamped together by any suitable means. Each of said members E and F may have one-half of the chamber D and which may be considerably larger than the spherical blank A. Into the opening B in the latter I insert the mouth of a funnel H, which is shown as penetrating into the hollow C, although this is not important in all cases. If no opening is provided in the blank, a funnel of suitable shape may be forced through the rubber at any point. By means of the funnel the interior C of the ball is placed in communication with a vessel or receptacle J, formed or provided in the apparatus above the chamber D, said receptacle preferably being round and having a closely-fitting plunger K.

I place in the receptacle J a quantity of material, preferably gutta-percha, which may by the action of heat be reduced to a plastic or fluid condition, as at L, Fig. 3. This material flows down the funnel H into the hollow of the rubber sphere A and drives out the air through a vent H, which in this instance is illustrated as a groove formed in the side wall of the opening B and lying without the funnel H. In the portion F of the mold there may be provided a vent N, communicating at P with the ball-vent M, so that the air escaping from the ball may be conducted out of the apparatus. The fluid or plastic material may therefore settle or be forced by the plunger K through the funnel H, so as to completely fill the interior of the ball A, whereupon the vent N in the mold may be closed by a screw-plug Q, Fig. 4, the overflow of the material into or through said vent indicating to the workman that the hollow C has been filled. By means of suitable appliances the plunger K may be pressed still farther down, so as to force more of the filling material into the interior of the ball, causing the wall thereof to yield and distending the ball until it completely fills the large

spherical chamber D in the mold, as at Fig. 4. The air may escape from the chamber between the mold-sections or through a vent. T. If desired, the core material may be subjected to great pressure after the rubber envelop contacts with the walls of the chamber. The gutta-percha or other material may pass from a liquid into a dry or hard condition while the plunger is still pressed down, so that the core thus formed is in a state of compression and so that the expanded condition of the rubber shell or envelop A^3 is made permanent by reason of this solidification of the core, (indicated by R, Figs. 1, 2, and 4.) The core is thus closely joined to the envelop in which it is molded. The mold EF may then be taken apart and the ball removed, the funnel A being withdrawn and the hole (if any) left thereby in the ball being filled with a rubber plug S, Fig. 7. The aperture BM may be omitted from the blank A, and instead of the funnel H a pointed injector may be forced through the blank at any point, rendering unnecessary the subsequent plugging. Preferably the diameter of the core R is more than half that of the distended envelop A^3. In practice I find that by making the core two-thirds of the diameter of the distended envelop excellent results are obtained when the core is made of gutta-percha compressed and the shell is of a firm quality of highly-vulcanized india-rubber.

The principal effect of expanding a core within the envelop resides in producing a longitudinal tension of the latter, such tension, which of course extends in all directions around the ball, being indicated by concentric broken lines A^4 at Figs. 2 and 4 and being most pronounced at or near the outer or surface portion of the ball. The inner portion of said envelop is also now in a state of compression between the outer portion of the envelop and the core, such compression being indicated by radial lines A^5 and being greatest near the inner surface of the envelop, where said radial lines are thickest. Thus at this stage the inner portion of the envelop is practically in a state of tension and considerable compression. The median portion is also both compressed and tensioned, while the extreme outer portion is in a state of tension only.

In using the term "compression" herein as applied to the rubber sphere or to the core I refer to the compressive tendency, which may or may not cause a condensation of the bulk of the material, the presence or absence of such condensation depending upon the character of the material used and upon the degree of pressure employed in forming the ball. It is to be understood that in case condensation of the bulk of the core or its soft envelop takes place it is due to the presence of air-spaces or impurities in the material. It is not essential in practicing my invention that the core or envelop be always condensed in bulk, so long as when the ball is finished the core, envelop, and shell have the substantial cooperative relation set forth.

The ball thus formed is placed between hemispherical segments 1 and 2, Fig. 2, formed of gutta-percha and highly compacted, and these assembled parts are placed between forming-dies, as 3 and 4, whereupon the dies are brought together by means of suitable mechanism, whereby the shells (which are preferably too large to fit snugly in the dies) are forced together until their edges are in intimate contact, preferably effecting a weld. The dies may be heated by steam or otherwise for bringing the material of the segments into suitable condition and consistency for compressing and welding them and completing the ball, as at 1^a, Fig. 1. If desired, the outer surface of the envelop A^3 or the inner surface of the shell-segments or all of said surfaces may be first given an application of suitable material or otherwise treated or prepared so that the shell may be caused to cling or adhere more tenaciously to the said envelop A^3.

The abutting edges of the original segments at 1^b and 2^b may be made somewhat full, thereby to furnish material for properly forming the weld between them as they are subjected to the final compression, at which operation the ball is finally shaped, and at the same time the material of the shell is compressed between the dies and the resisting center piece within the shell. This center piece is first prepared somewhat over size, and when the shell is compressed over the same the resistance of the center piece while under such compression furnishes a substantial support for sustaining the shell against the pressure of the forming-dies. Owing to the tension of the rubber envelop it is not liable to squeeze out between the edges of the segments as they come together. The shell is allowed to cool before the completed ball is removed from the dies. The compressing and heating solidifies and toughens the gutta-percha shell so that it becomes highly resistant or springy and nearly indestructible, and also places the center piece or the envelop A^3 under external compression. Thus it will be seen that the core R is in a compressed condition, while the envelop A^3 is in a condition throughout of longitudinal distention and transverse compression due partly to the compressing effect of the distended outer portion thereof at A^4 and also to the reduction of its mass resulting from compressing the shell 1^a thereon. At the same time the shell 1^a is in a state of longitudinal or circumferential tension due to the constant outward pressure of the inner envelop A^3. The material of the entire ball from center to periphery is hence, at least to some extent, under pressure or tension or both, and hence in an abnormal highly-alert condition, so that every particle of the ball which feels the impact of a blow acts with promptness and vigor in response thereto, and an extraordinary degree of efficiency is at-

tained. The shell 1^a is preferably somewhat thick, the rubber sphere A^3 being preferably abut eighty-five per cent. of the diameter of the gutta-percha shell, as illustrated, tending to avoid denting or violent distortion thereof at one point when sharply struck and to diffuse the distortion over a comparatively large area, thus minimizing consumption of power in changing and rechanging the form of the ball, and also, as will be manifest, calling into action a large portion or all of the mass confined within the shell and causing it to coöperate effectually with the latter in instantly restoring the ball to normal form. It will also be understood that the outward pressure of the mass A^3 has the useful effect of constantly tending to maintain the shell 1^a in a true spherical form, and hence aids materially in the instant restoration of the shell to its spherical shape after a blow. In other words, the alteration of the shell from its true spherical form diminishes its interior capacity, hence putting under further compression every portion of the mass confined therewithin, including the elastic core R, and since every particle of the imprisoned mass actively opposes such compression the original form of the shell is regained while it is still in contact with the implement, with the result that the ball flies a phenomenal distance. Moreover, this very opposition of the confined mass to further compression renders it of especial value as a support or backing for the shell, inasmuch as by effectually opposing violent distortion at any particular point it prevents the shell from denting sharply enough to produce injury, thus improving the capacity of the ball for withstanding harsh usage. It will also be understood that the resilient and rupture-proof characteristics of the ball are greatly augmented by reason of the compressed condition of the inner ball, since it is rendered unnecessary for the shell to yield to a great depth in order to set up in the confined mass a degree of compression sufficient to properly support the shell against a blow. In other words, the first effect of a blow upon a playing-ball is usually to compress the material thereof until the limit of compression is reached, so that thereafter the implement can only impart momentum to the body of the ball without further distortion of the same; but by having a center piece in the ball in an initial state of high compression the preliminary work of compression to be performed by the implement is materially reduced, and the time during which the implement is occupied in compressing the ball is shortened, with the result that it is enabled more effectively to impart momentum directly to the ball, while better opportunity is afforded for the elasticity of the ball to come into play before it leaves the implement. Thus the tense inner ball A^3 is advantageous not only in cushioning or distributing the effect of the blow over a comparatively large area of the shell 1^a to prevent undue indentation and fracture thereof, but also in that it quickly reaches its limit of compression under a blow and with great energy springs back to its normal shape, so that the implement, although in motion, serves as a fulcrum or base from which the ball takes a spring. In short, the ball has capacity for receiving a large amount of power by transmission from the driver, with a minimum amount of transformation of power into work within the ball itself, and its efficiency is due in large measure to putting the elastic envelop in a state of high initial tension by means of a highly-compressed solid core. It will also be understood that when the ball is struck lightly by an implement it does not respond to the blow with so much promptness as to render the ball too springy for short drives or plays. In other words, when given a very light blow its latent elasticity is not brought into play and it acts more like a dead ball; but when struck a blow of medium force considerable of its latent power is called forth, and when given a severe blow it exhibits phenomenal energy. In some playing-balls the energy developed by the ball is proportionate to the force of the blow; but in the present instance the flying power of the ball increases vastly out of proportion to the force of the blow, thus rendering it in the highest degree desirable for both short plays and long drives. The shell is so stiff that a blow which is sufficient to send the ball a few feet or yards is insufficient to flex the shell, and hence the sensitiveness of the filling is not brought into use. A little harder blow flexes the shell slightly, but only affects a portion of the comparatively soft outer surface of the elastic inner envelop A^3, so that the latter to a moderate extent coöperates with the shell in reacting upon the implement. When a severe blow is given the ball, all portions thereof are brought into resilient action, as explained, the resisting action of the compressed resilient core R being of great importance in enabling the ball to gather headway. Said core R not only itself absorbs momentum from the implement, but also by reason of its solidity prevents undue distortion of the ball, envelop A^3, and as well of the shell 1^a, nearly all of the force going from the implement to the ball being hence utilized to impart velocity thereto. It will also be understood that under the shock of a blow the solid core, if slightly displaced from its true central position, affects somewhat the material of the envelop A^3 at the opposite side of the ball from the implement, and also affects other portions of the envelop, so that by reason of such displacement almost if not all the material of the envelop is called into greater action and more powerfully reacts, thereby imparting a higher degree of activity or liveliness to the ball and causing the same to leave the implement at higher velocity. It will be understood that the result of a blow will depend upon the velocity and weight of the imple-

ment, as well as upon the weight of the ball, the depth of the depression produced in the ball, and especially upon the ratio of increase in resistance offered thereby in proportion to the force of the blow. In this instance this ratio is very high. Gutta-percha possesses to a superlative degree the quality of absorbing force from the implement by which it is struck, and by using this material for the shell a great advantage is gained, since golf-balls are of small size, and it is therefore important to utilize every part of the ball to augment its flying power or, in other words, to avoid carrying any dead-weight.

It is to be understood that my invention is not limited in all cases to the use of a springy center piece or core at R, since other cores may be employed within the scope of the invention so long as a spherical or segmental elastic hollow ball or shell is permanently expanded over a solid or hard core which is too large for the original capacity of the former.

An important advantage of my invention resides in the durability of the ball, since for the envelop A^3, I employ rubber of firm texture and highly vulcanized, and hence not liable to deterioration, so that the ball not only withstands severe usage, but remains in its original elastic condition for a long time, and remains intact even if the shell is destroyed. Excellent results are obtained by subjecting the well-cured rubber envelop to tension which is moderate relatively to the strength of the rubber, thereby conducing to long life of the ball. Moreover, by tensioning the rubber after the manner of my invention it is given a remarkable promptness in action, and the abnormal condition of the rubber is obtained, in large part at least, independently of the shell, hence avoiding the objection of subjecting the shell to destructive internal pressure. The tension is in all directions around the circumference of said envelop, and hence the activity of all of its particles is fully developed, or, in short, the ball carries no dead-weight. Moreover, the rubber envelop is heavy in proportion to its bulk, thus enabling considerable weight to be stored in a small shell, thus avoiding air resistance, while having capacity for prolonged flight. Moreover, my improved ball has a uniform solidity or density, and hence the same blow always produces the same result, enabling the user to play to better advantage.

Should the original rubber ball A be somewhat imperfect or irregular in construction or form, the expansion and solidification of the core in the described manner are found to compensate for such imperfection or irregularity, since the rubber envelop is caused to fit smoothly to the walls of the spherical chamber D in the mold, and such irregularities as may exist are caused to develop upon the inner surface of said envelop, where they become embedded with the solid core, and hence are rendered unobjectionable. Thus I produce a smooth true curvature of the periphery of the envelop, which is a desideratum. The core R is accurately centered in the envelop and the latter in the shell, so that the ball tends to run true instead of in a sinuous path, as is the case with some playing-balls.

My present improvements are applicable not only to golf-balls, but also, at least in part, to balls for use in playing billiards and analogous games, and it will be understood that the thickness of the shell and also the firmness and relative size of the center pieces may be varied in accordance with the requirements of any particular game or use for which the balls may be employed.

The exterior surface of golf-balls may be pebbled or scored. In Fig. 1 the ball is represented as furnished on the exterior surface with relatively slight elevations of a spherical conformation. In billiard-balls, of course, the outer surface should usually be smooth and spherical.

It will be seen that the rubber shell A^3, which is solid as distinguished from a sphere made by winding rubber threads, is inflated or distended by the injected plastic or other mobile mass R, such distention preferably being carried to the extent of expanding the rubber shell or increasing the diameter thereof, although expansion is not necessary in all instances. By the described injection process a uniformity of density of the core is produced not attainable by usual methods. The rubber shell A^3 is thus put into a uniform expanded condition, this quality being imparted by the hydraulic action of the fluent injected material, whereby I apprehend the lines of stress become radial and being preserved by the hardening of the material within the shell. By compressing upon the ball thus formed a casing of gutta-percha the rubber shell is squeezed between said casing and the gutta-percha core, as well as being in a state of expansion upon the latter, so that a particularly effective golf-ball is produced. In so far as certain features of my invention are concerned it is not essential in all cases that the filling be made of gutta-percha nor the shell thereon of soft rubber, since other materials may be used within the scope of my improvements.

Many variations in construction, arrangement, and method may be resorted to within the scope of my invention.

Having described my invention, I claim—

1. A ball comprising an integral hollow rubber sphere in a state of expansion upon a solid core, and a gutta-percha shell compressed upon said sphere.

2. A ball comprising an integral sphere of rubber expanded over a solid and relatively hard filling formed from plastic material, and a gutta-percha shell holding said sphere under compression.

3. A ball consisting of a whole thick spherical india-rubber sphere in a state of expansion over a solid sphere of gutta-percha, and a gutta-percha shell.

4. A ball comprising a whole sphere of firm india-rubber in a state of expansion over a solid sphere of gutta-percha, the diameter of the core being more than one-half that of said sphere, and a gutta-percha shell compressed upon said sphere.

5. A ball comprising an integral sphere of soft, elastic material expanded upon a solid core of gutta-percha, and a shell formed largely or wholly of gutta-percha and holding said sphere under compression.

6. A ball comprising a solid spherical gutta-percha core, a highly-vulcanized solid soft-rubber envelop expanded thereon, and a shell consisting at least partially of gutta-percha and gripping said envelop.

7. A ball consisting of a core formed of plastic material within a softer elastic sphere and holding the latter under tension, and a shell formed at least partially of gutta-percha and holding said sphere under compression.

8. A ball consisting of a thick, spherical india-rubber envelop A^3 stretched over a core of gutta-percha E and having an opening closed by a plug S, and a gutta-percha shell upon said envelop.

9. In a playing-ball, the combination of a spherical soft-rubber shell inflated or distended by a mobile mass injected thereinto, and a cover or casing of compressed gutta-percha upon said soft-rubber shell.

10. In a playing-ball, the combination of a spherical shell formed of springy material and inflated or distended by gutta-percha injected thereinto, and a casing formed of gutta-percha compressed upon said springy shell.

11. In a playing-ball, the combination of a springy shell inflated or distended by springy material injected thereinto, one of said shell and injected-material elements being harder than the other, and a casing of gutta-percha compressed upon said shell.

12. In a playing-ball, the combination of a seamless springy shell inflated or distended by springy material injected thereinto, one of said shell and injected-material elements being harder than the other, and a casing formed of segments of gutta-percha and welded and compressed upon said shell.

13. In a playing-ball, the combination of a springy shell inflated or distended by springy material injected thereinto, said shell being softer than said injected material, and a casing formed of compressed gutta-percha and holding the latter under compression.

14. In a playing-ball, the combination of a seamless rubber shell expanded by gutta-percha injected thereinto, and a casing formed of gutta-percha upon said rubber shell.

15. In a playing-ball, the combination of a spherical shell formed of springy material and inflated or distended by gutta-percha injected thereinto, and a casing formed of spherical segments of gutta-percha welded at their edges and compressed upon said spherical shell.

16. In a playing-ball, the combination of a shell formed of springy material and inflated or distended by springy mobile material injected thereinto, and a casing consisting at least partially of gutta-percha and holding said springy shell under compression.

17. In a playing-ball, the combination of a seamless springy shell inflated or distended by springy material injected thereinto, one of said shell and injected-material elements being harder than the other, and a casing of gutta-percha holding said seamless shell under compression.

18. In a playing-ball, the combination of a springy shell inflated or distended by springy material injected thereinto, said shell being softer than said injected material, and a casing consisting of welded segments holding said shell under compression; said casing consisting largely or wholly of gutta-percha.

19. In a playing-ball, the combination of a seamless rubber shell expanded by gutta-percha injected thereinto, and a gutta-percha casing compacted upon said shell and holding the latter under compression.

20. A playing-ball comprising a solid spherical envelop expanded upon a core and a casing of compressed gutta-percha upon said envelop.

21. In a playing-ball, the combination of a filling consisting of a spherical envelop of soft material expanded upon a solid sphere and a shell consisting of compressed segments of gutta-percha and holding said filling under compression.

22. A playing-ball comprising a solid soft spherical envelop expanded upon a solid sphere of gutta-percha, and a shell formed of gutta-percha and compressed upon said envelop.

23. A ball comprising an integral hollow rubber sphere in a state of expansion upon a hollow core, and a gutta-percha shell compressed upon said sphere, the diameter of said core being substantially two-thirds the diameter of said sphere, and said sphere having substantially eighty-five per cent. of the diameter of said shell.

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