No. 696,354. Patented Mar. 25, 1902.

F. H. RICHARDS.

MANUFACTURE OF GOLF BALLS.

(Application filed Jan. 8, 1902.)

(No Model.) 2 Sheets—Sheet 1.

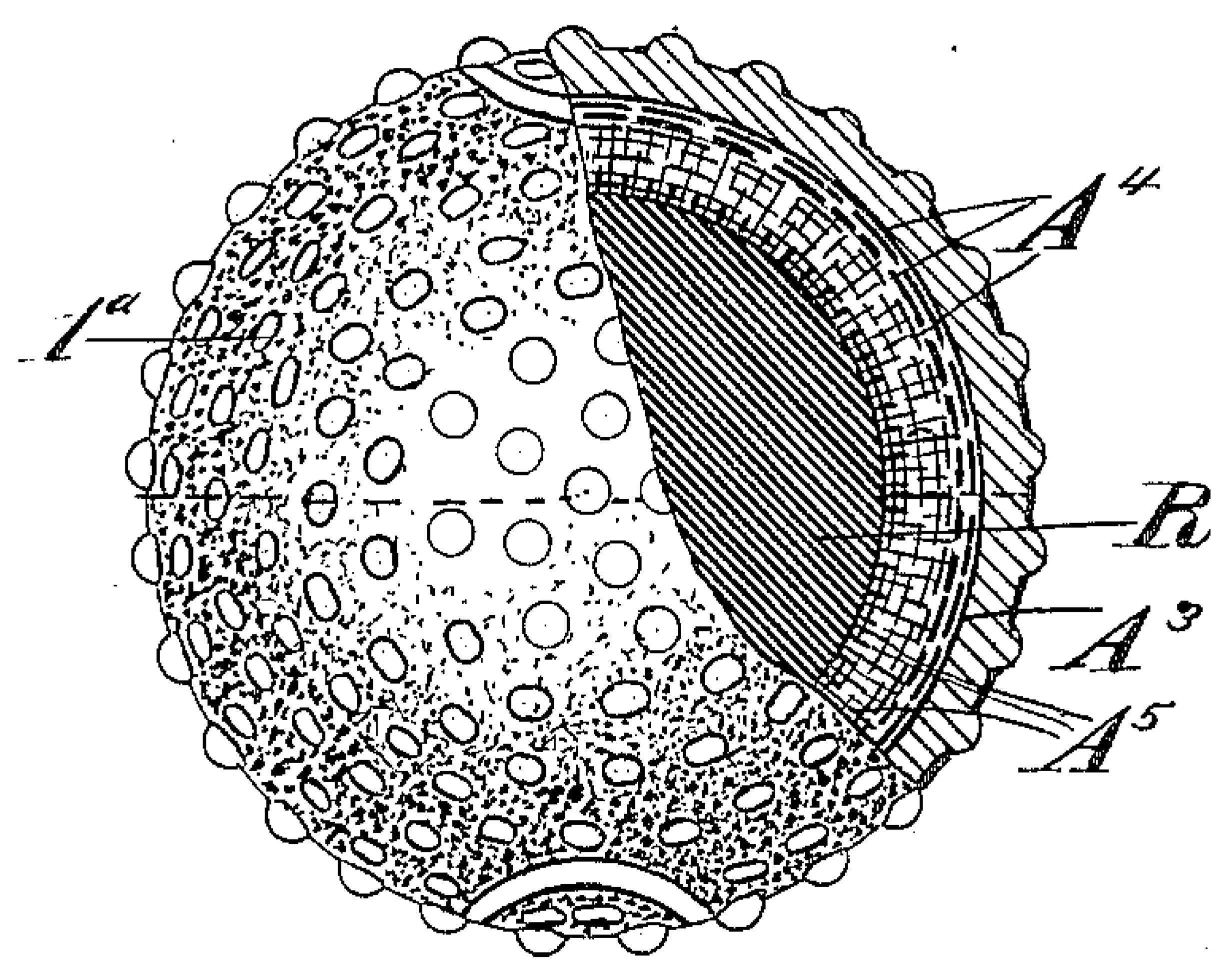

Fig. 1.

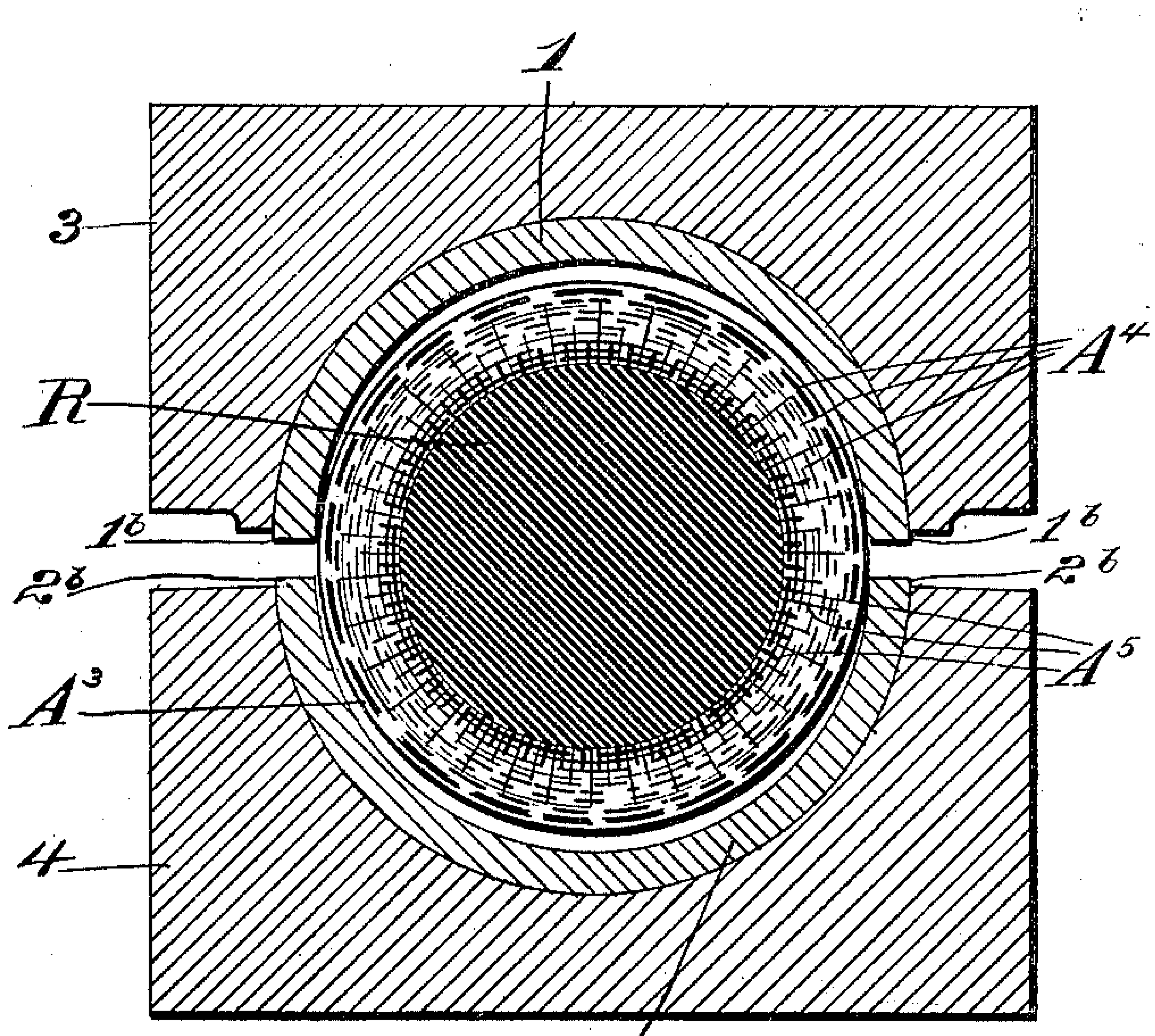

Fig. 2.

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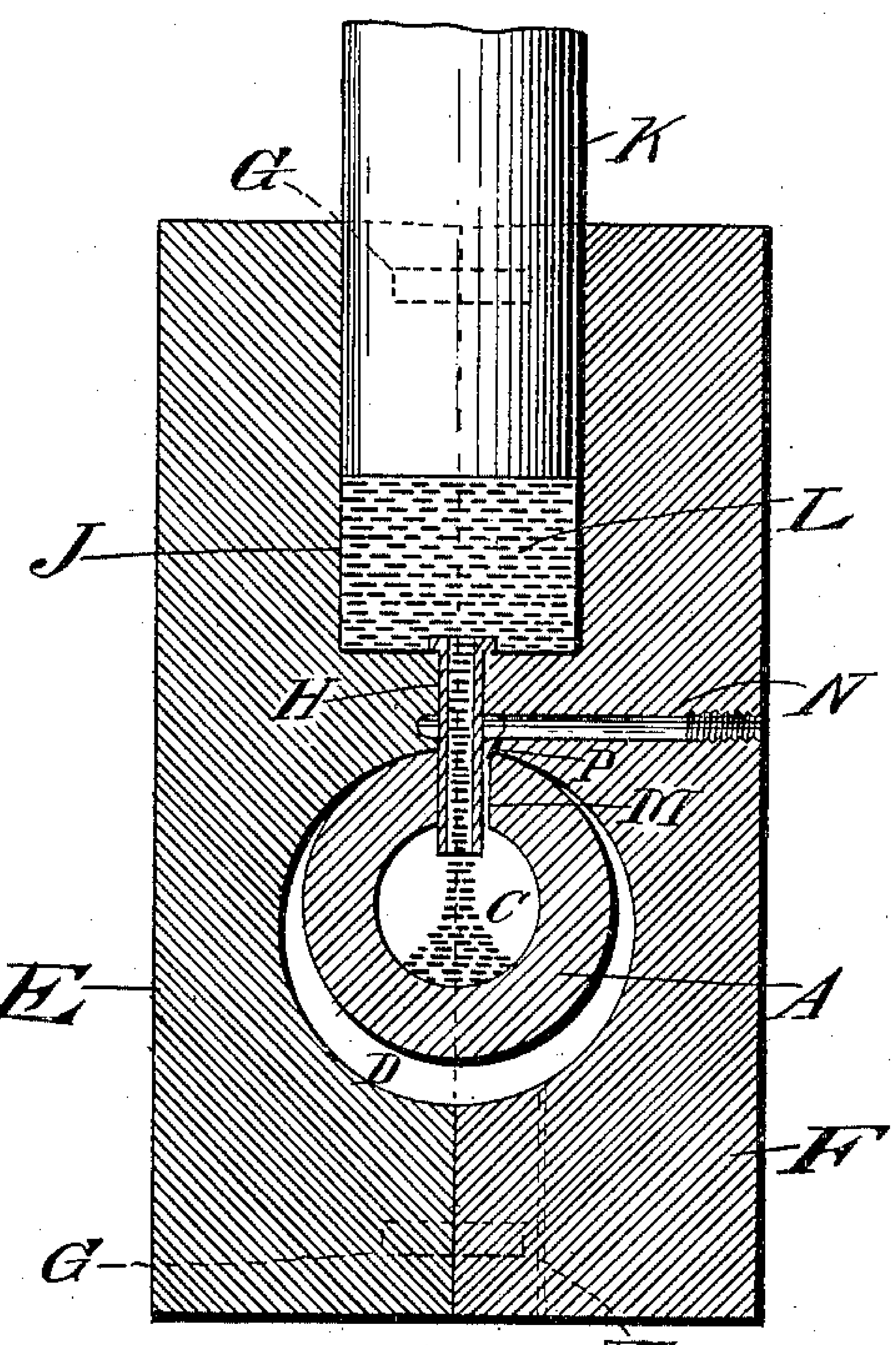

Fig. 3.

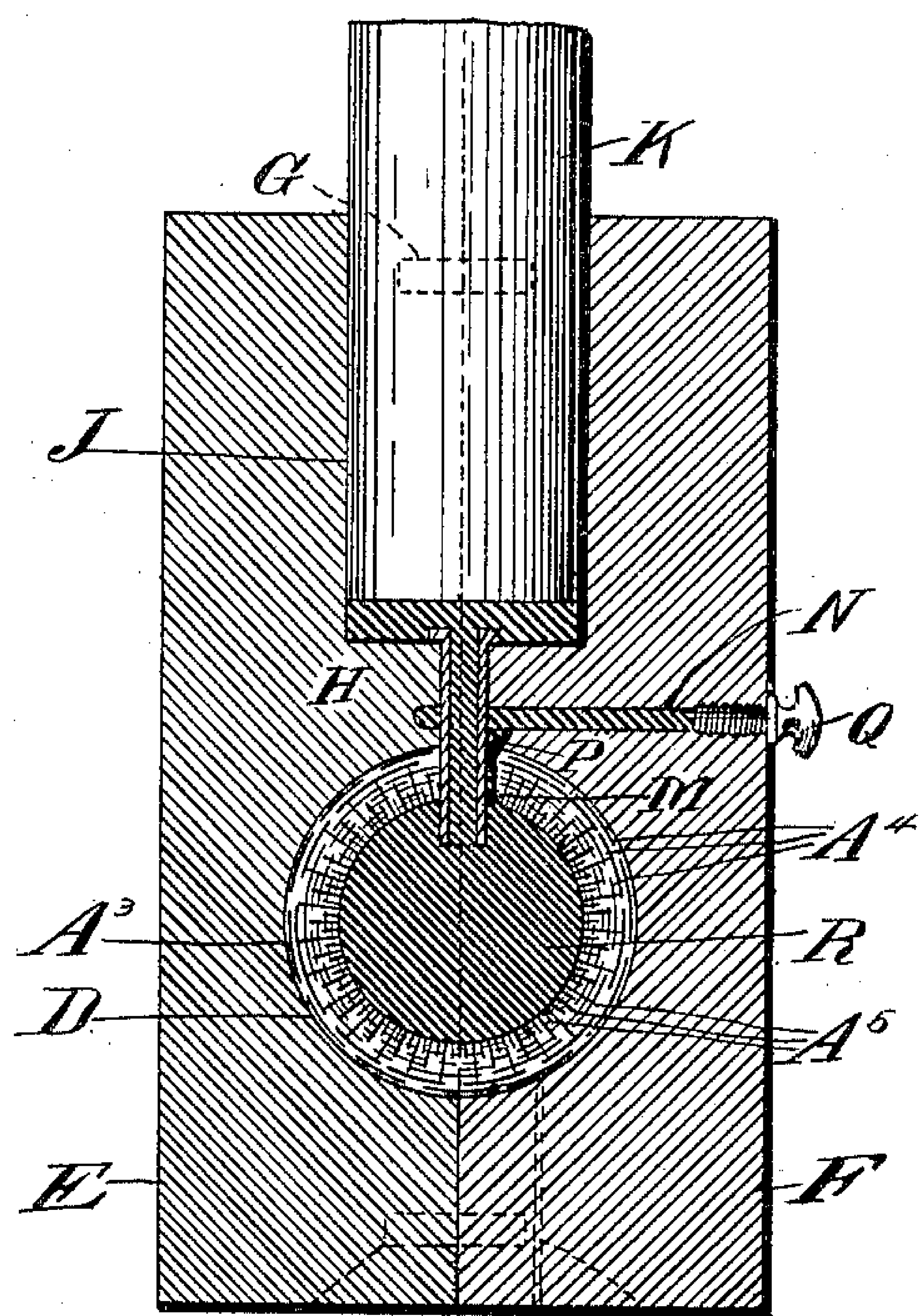

Fig. 4.

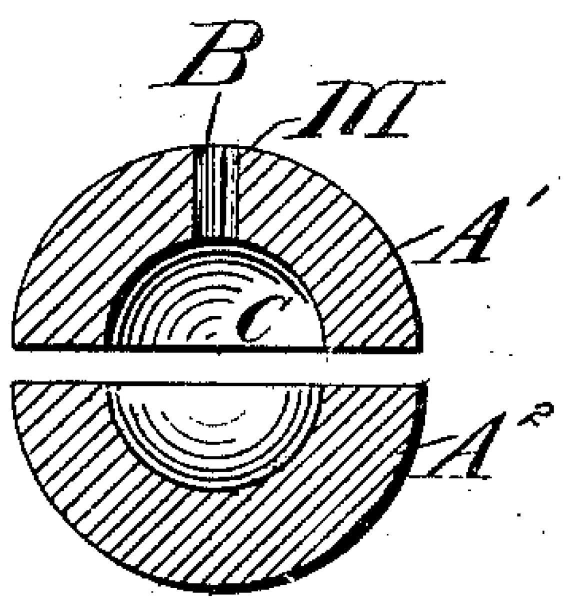

Fig. 5.

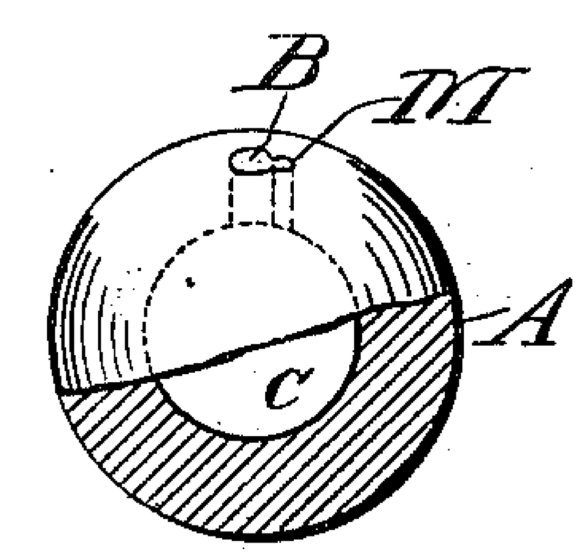

Fig. 6.

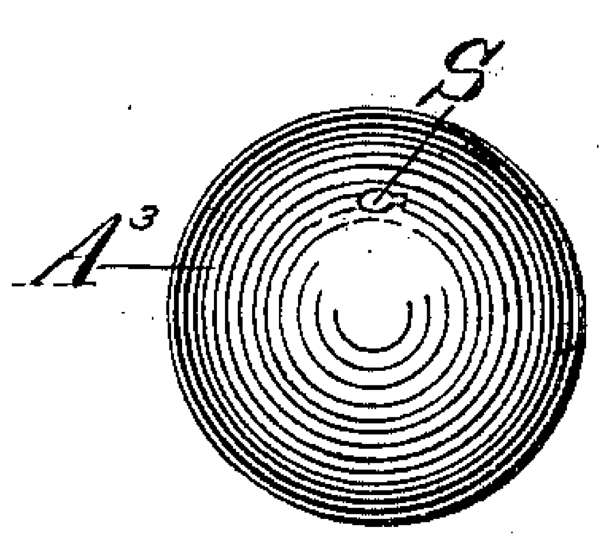

Fig. 7.

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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.

MANUFACTURE OF GOLF-BALLS.

SPECIFICATION forming part of Letters Patent No. 696,354, dated March 25, 1902.

Application filed January 8, 1902. Serial No. 88,842. (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 the Manufacture of 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 coöperative 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 celluloid, said rubber layer consisting of a hollow sphere previously distended upon said core.

In the drawings forming 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 sections. 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 A^2, 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 M, 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 said 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 walls 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. Sufficient force may be applied, if desired, to compress the rubber shell between the gutta-percha and 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 spherical rubber 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 E F may then be taken apart and the ball removed, the funnel H being withdrawn and the hole (if any) left thereby in the ball being filled with a rubber plug S, Fig. 7. The aperture B M 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. The ball thus formed is placed between hemispherical shell-segments 1 and 2, Fig. 2, formed, preferably, of celluloid in a suitable condition, preferably somewhat green or not completely cured, 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 shell-segments (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 material of the shell-segments is cemented or otherwise put in proper condition for the adherence of their edges under pressure, and when required the dies may be heated by steam or otherwise for bringing the material of the segments into suitable condition and consistency for compressing and uniting 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 joint 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 (including the spherical rubber envelop A^3 and the core R) within the shell. This center piece is first prepared somewhat oversize, 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 celluloid shell is allowed to cool before the completed ball is removed from the dies. The compression and heating solidifies and toughens the celluloid, so that it becomes highly resistant or springy and practically indestructible, and also places the envelop A^3 under external compression, whereby the core R is also affected to a certain extent. The rubber envelop being highly vulcanized is enabled to withstand the heat applied in forming the shell thereon. 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 distension 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 tension due to the constant outward pressure of the rubber 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 attained.

The shell 1^a is preferably somewhat thick, 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 rubber envelop 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 somewhat frangible material of the shell, inasmuch as by effectively opposing violent distortion at any particular point it prevents the shell from denting sharply enough to produce a crack or rupture, 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 confined inner ball, (including the rubber sphere and the core R,) 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 said inner 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 condition of the inner ball 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 A^3 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 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. Although other material than celluloid and even material not analogous thereto may be employed for the shell, still I prefer celluloid. This material being only slightly compressible and the amount of flexure which may be given it by a blow without injury thereto being comparatively limited, an important advantage of my invention resides in the efficient and uniform backing which is given a shell of this nature, whereby the highest efficiency of the ball is developed. The celluloid shell, it will also be understood, is smooth, and hence offers a minimum of resistance to the flowing of air over its surface during the flight of the ball and by reason of its slippery nature receives less opposition from the grass through which it is driven during the game. It not only retains its color, but also resists being chipped by an implement or stone against which it may be driven. In using the term "celluloid" I refer to celluloid compounds generally, and do not limit myself to any particular variety of such compound or to any particular grade or mixture of celluloid composition. 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 of 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 implement, 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. It is to be understood, however, 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 blank A be somewhat imperfect or irregular in construction or form, the expansion and solidification of the core in the described manner is 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.

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

In an application filed by Eleazer Kempshall September 27, 1901, Serial No. 76,814, is described and claimed a playing-ball having a celluloid shell compressed upon a yielding filling or core, and in another application filed by him December 18, 1901, Serial No. 86,348, is claimed the process of making a ball with a celluloid shell. In my pending application, filed December 3, 1901, Serial No. 84,529, is described and claimed the device used in my present improvements as a blank and illustrated at Fig. 7 herein, and in my other pending application, Serial No. 85,140, filed December 9, 1901, is claimed the process of making such blank. The claims herein are limited to novel features of invention not disclosed in any of said applications.

The herein-described playing-ball is made the subject-matter of my other pending application, filed December 14, 1901, Serial No. 85,892.

Having described my invention, I claim—

1. A process in producing playing-balls, consisting in filling and distending a hollow sphere by forcing a fluent mass thereinto, and providing said distended sphere with a hard, wear-resisting shell.

2. A process in producing playing-balls, consisting in forcing a fluent mass into the interior of a yielding sphere, hardening said mass to form a core, and compressing a shell upon said sphere.

3. A process in producing playing-balls, consisting in reducing material to a fluent condition, forcing it into a hollow sphere so as to fill and distend the latter, allowing said material to dry or harden so as to form a core, and incasing said sphere in celluloid.

4. A process in producing playing-balls, consisting in molding a core within a previously-formed hollow sphere, and securing a wear-resisting cover upon said sphere.

5. A process in producing playing-balls, consisting in distending a solid soft-rubber sphere upon a core, and forming a cover upon said envelop.

6. A process in producing playing-balls, consisting in distending a rubber envelop upon a core of gutta-percha, inclosing said envelop in a celluloid shell, heating said shell sufficiently to soften the celluloid, subjecting the shell while heated to compression upon said envelop, and maintaining the compression until the shell cools and hardens.

7. A process in producing playing-balls, consisting in forcing a mass through a hole into a hollow sphere so as to fill the hollow and form a core, then plugging said hole, and then compressing a shell upon said sphere.

8. A process in producing playing-balls, consisting in reducing a mass of solid matter to a fluent condition, introducing said mass through a hole in a hollow rubber sphere until said sphere is distended, then plugging up said hole, and then compressing a shell upon said sphere under heat and pressure.

9. A process in producing playing-balls, consisting in reducing a mass of yielding solid matter to a fluent condition, forcing said mass into a hollow rubber sphere, until said sphere is distended, causing said mass to harden while under pressure, and compressing a shell upon said sphere.

10. A process in producing playing-balls, consisting in reducing solid matter to a fluent state by means of heat, forcing said matter into a hollow sphere, and compressing a moldable shell upon said sphere by means of heat and pressure.

11. A process in producing playing-balls, consisting in heating gutta-percha, introducing it into a hollow rubber sphere, and molding a shell of celluloid upon said sphere.

12. A process in producing playing-balls, consisting in heating gutta-percha, forcing it into a hollow rubber sphere so as to distend the latter and form a core therewithin, and compressing upon said sphere a shell of moldable material.

13. A process in producing playing-balls, consisting in heating gutta-percha, then forcing it through a hole into the interior of a hollow rubber sphere so as to distend the latter, then plugging said hole with rubber, and then compressing a celluloid shell upon said sphere.

14. A process in producing playing-balls, consisting in heating gutta-percha, forcing it into a hollow rubber sphere so as to distend the latter, allowing said gutta-percha to solidify under pressure, and molding a celluloid shell upon said sphere under heat and pressure.

15. A process in producing playing-balls, consisting in forming a soft-rubber hollow sphere with a vent, inserting a funnel into said sphere, heating gutta-percha, causing said gutta-percha to flow through said funnel and force out the air through said vent, subjecting the gutta-percha to pressure so as to distend said rubber sphere, preventing the escape of the gutta-percha through said vent during the application of pressure, allowing the gutta-percha to harden under pressure, withdrawing the funnel, plugging the vent, inclosing said sphere in spherical segments of celluloid, and welding said segments and compressing said shell under heat and pressure.

16. A process in producing playing-balls, consisting in placing a hollow sphere of rubber within a larger spherical chamber, forcing heated gutta-percha into said sphere until it distends sufficiently to fill said chamber, solidifying said gutta-percha while said sphere remains in said chamber, withdrawing said sphere from said chamber, and compressing shell-segments upon said sphere under heat and pressure.

17. A process in producing playing-balls, consisting in placing a hollow sphere of rubber within a larger spherical chamber, forcing heated gutta-percha into said sphere, thereby causing the same to distend and to be compressed against the walls of said chamber, and drying or solidifying said gutta-percha before removing said sphere from said chamber, and compressing celluloid shell-segments upon said sphere by means of heat and pressure.

18. A process in producing playing-balls, consisting in placing a hollow sphere of rubber within a larger spherical chamber, forcing heated gutta-percha into said sphere until it distends sufficiently to fill said chamber, allowing said gutta-percha to solidify while said sphere remains in said chamber, plugging the opening in the sphere through which the gutta-percha is injected, and compressing a shell upon said sphere so as to hold the same under external compression.

19. A process in producing playing-balls, consisting in forming a hollow sphere of firm, highly-vulcanized rubber, inserting a funnel into said sphere, placing said sphere within a spherical chamber of larger diameter, heating gutta-percha, causing said gutta-percha to flow through said funnel into the interior of said sphere and drive out the air, preventing continued escape of gutta-percha, subjecting the gutta-percha to pressure so as to distend said sphere until it fills said chamber, causing said gutta-percha to solidify while under pressure, and forming a celluloid shell upon said sphere under heat and pressure.

20. A process in producing playing-balls,

consisting in introducing a fluent mass into a hollow sphere of india-rubber, permitting the air to escape from said hollow sphere, closing the air-vent, forcing extra fluent mass into the sphere so as to distend the latter, allowing said fluent material to solidify, and compressing heated celluloid segments upon said sphere.

21. A process in producing playing-balls, consisting in introducing a fluid mass into a hollow sphere of india-rubber, permitting the air to escape from said hollow sphere at a point near the point of introduction of said fluid mass, closing the air-vent, forcing extra fluent mass into the sphere so as to distend the latter, and molding a shell upon said sphere.

22. A process in producing playing-balls, consisting in forming a ball from a soft-rubber sphere by molding a hard core in said sphere and also inclosing said sphere in a wear-resisting shell; said process including an operation whereby said sphere is compressed between said core and said shell.

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