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F. H. RICHARDS.

MANUFACTURE OF PLAYING BALLS.

(Application filed Dec. 9, 1901.)

(No Model.)

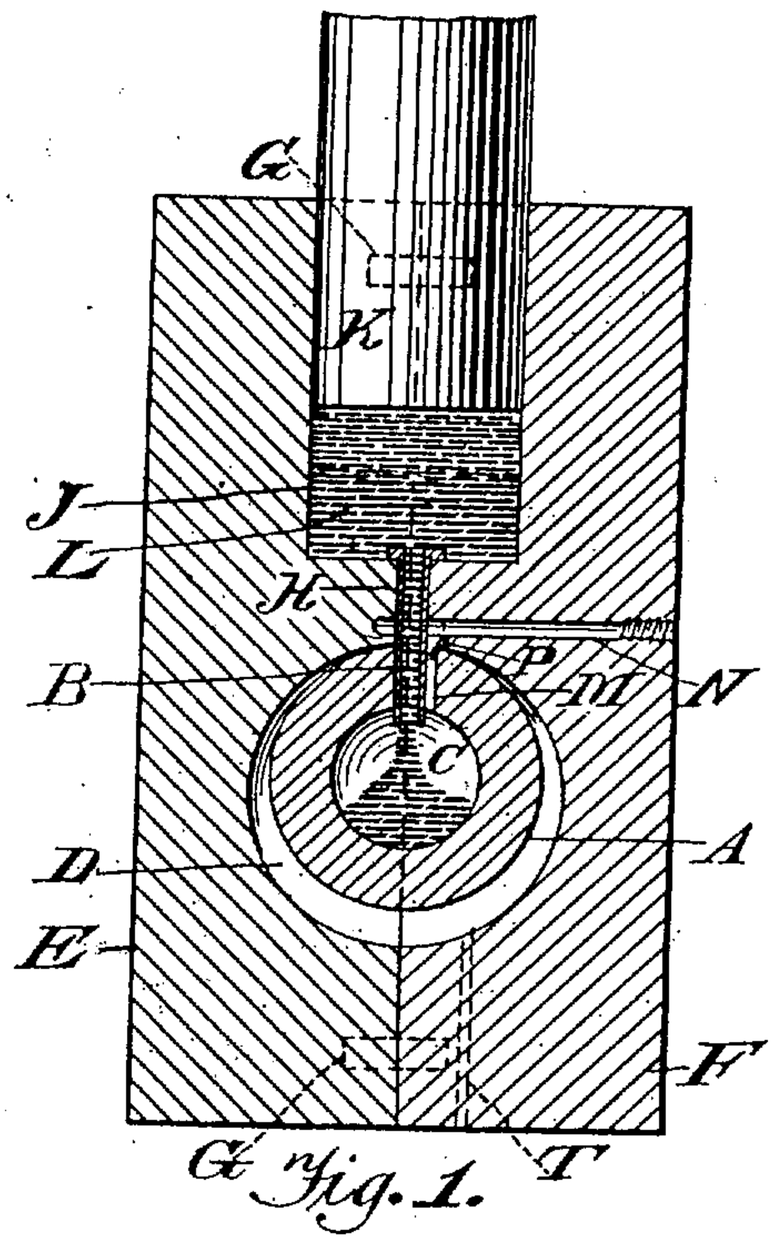

Fig. 1.

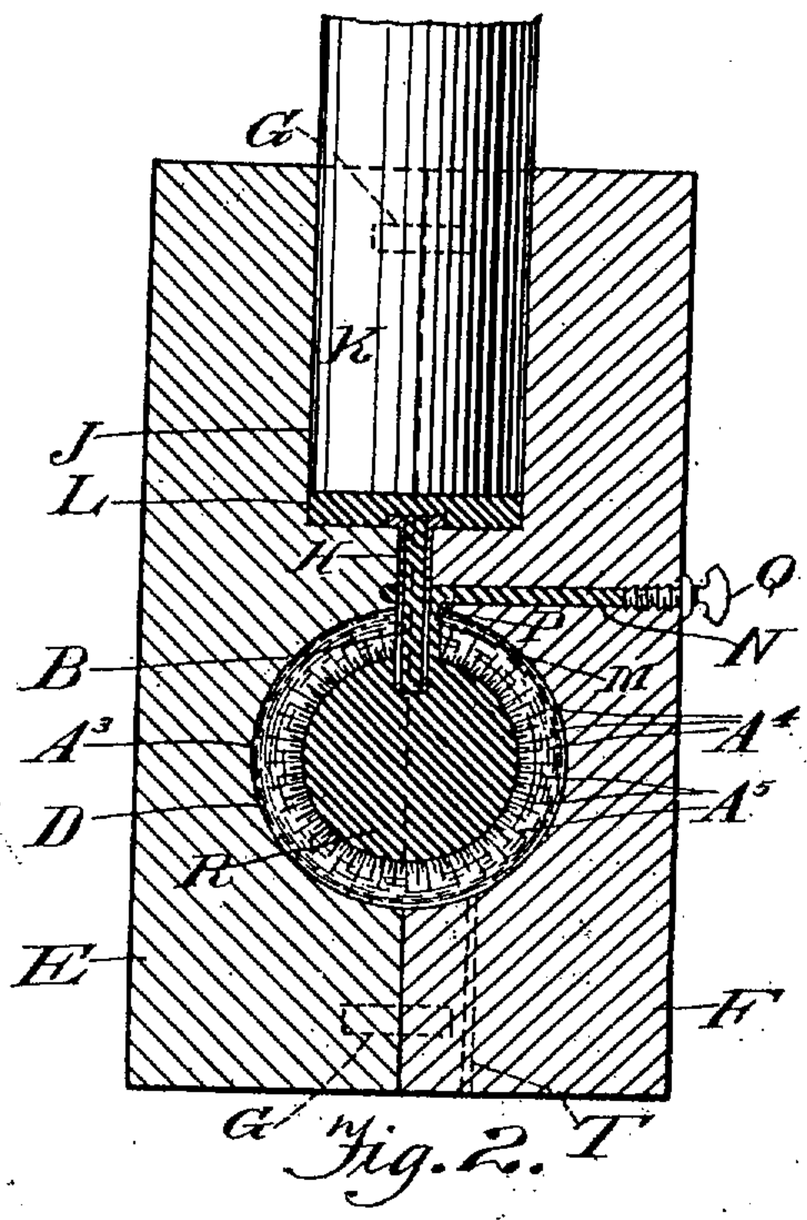

Fig. 2.

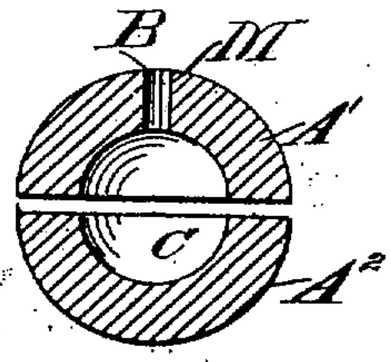

Fig. 3.

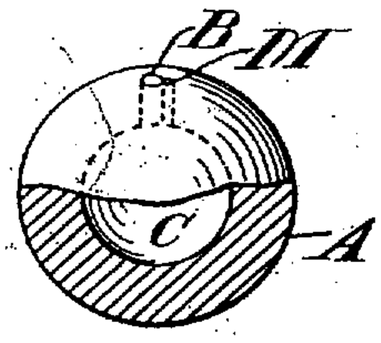

Fig. 4.

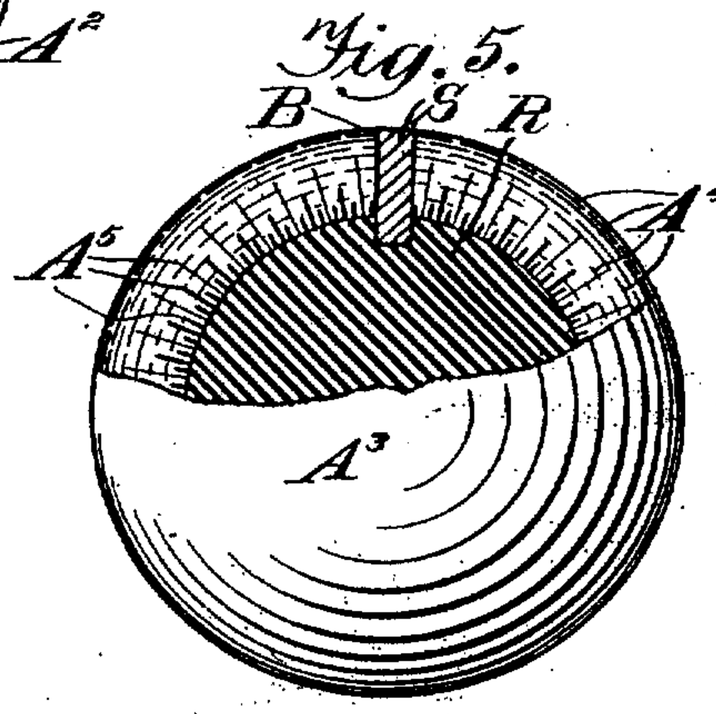

Fig. 5.

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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF PLAYING-BALLS.

SPECIFICATION forming part of Letters Patent No. 696,352, dated March 25, 1902.

Application filed December 9, 1901. Serial No. 85,140. (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 Playing-Balls, of which the following is a specification.

This invention relates to springy playing-balls, and especially to those to which it is desired to impart great momentum, so that they may fly a long distance.

Playing-balls have sometimes been made of soft rubber in the form of hollow spheres; but these are so yielding that they suffer violent distortion from the blows of implements, so that undue power is consumed in altering the shape of the ball, which, moreover, fails to receive sufficient impetus to carry it very far, particularly since the ball is normally in a dead condition and does not become resisting or lively until it has been considerably distorted by the blow and does not always react before it leaves the implement. It has heretofore been sought to overcome some of these objections by winding tensioned rubber thread into a ball. This does not, however, produce a solid ball, as the winding is irregular and numerous interstices occur, rendering the ball uncertain in action, so that it does not always give the same response to the same blow. Moreover, the outer layer of elastic thread binds the inner layers, preventing them from acting longitudinally. Since the inner threads are merely placed under compression by the outer threads, the slight difference in action obtained over that of a soft-rubber ball is scarcely enough to justify the expense of making a wound ball. Moreover, the rubber thread is not thoroughly cured, and the effect of putting it under longitudinal tension is to lessen its life, so that in a very short time the ball is rendered unfit for use. The action of even a low degree of heat is injurious to the tensioned and uncured rubber thread, causing derangement of the shape of the ball, especially if the latter is allowed to lie with one side exposed to the hot sun, the cooler portions of the tensioned threads contracting as the other portions weaken in the heat.

The object of my invention is to avoid these objections and to produce a ball which is capable of absorbing from an implement a great momentum, so that it may carry or fly a long distance. I aim to minimize the distortion of the ball, so as to avoid waste of driving force in changing and rechanging its shape. I also aim 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 of the ball. I further aim to prolong the life of the ball.

In the drawings forming part of this specification, Figure 1 is a cross-section of one kind of apparatus which may be employed in producing my improved ball, an unformed ball being shown in the apparatus and a process of manufacture being also indicated. Fig. 2 is a view similar to Fig. 1, but showing a ball as formed and ready to be withdrawn. Fig. 3 is a cross-section of a blank used in forming my improved ball, indicating one way in which said blank may be made from sections. Fig. 4 is a view of a blank made in one piece. Fig. 5 is a view, upon a larger scale, of a ball made in accordance with my improvements, a portion being broken away, so as to exhibit certain characteristics.

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

Preferably I employ a hollow sphere A, Fig. 4, made of soft india-rubber, which may, if desired, be pure rubber, but is preferably a rubber compound having firmness and strength or toughness. An opening B communicates with the hollow C of the sphere, which may be made either integral, as at Fig. 4, or of hemispheres A′ and A², Fig. 3, said hemispheres being suitably united. I place the sphere A 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, which may be considerably larger than the blank sphere 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. By means of said 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. 1. 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 main 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 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. 2, 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. 2. The air may escape from the chamber between the mold-section 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 is allowed to 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. 2 and 5.) The core is thus closely joined to the envelop in which it is molded. The mold may then be taken apart and the ball removed, the funnel H being withdrawn and the hole left thereby in the ball being filled with a rubber plug S, Fig. 5. 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 complete ball. In practice I find that by making the core two-thirds of the diameter of the finished ball excellent results are obtained when the core is made of gutta-percha compressed and the shell is 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 5 and being most pronounced at or near the outer or surface portion of the ball. The inner portion of said envelop is also 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 the inner portion of the envelop is practically in a state of compression, the median portion is both compressed and tensioned, while the extreme outer portion is in a state of tension only.

It will be perceived that the material of the entire ball from center to periphery is in an abnormal condition, the core being under compression and the envelop being both compressed and longitudinally tensioned, so that an extraordinary degree of efficiency is attained, every affected particle of the ball acting with promptness and vigor in response to a blow. Although the outer part of the shell or jacket is in a soft condition and effectually cushions the blow of an implement, still the effect of a blow is different from the effect upon a ball having a uniform softness of texture throughout. In the latter case a severe blow would violently distort the ball, thus wasting power which should be utilized in giving impetus to the ball, whereas in my ball the softness resides only at the surface, and as soon as this slight resistance is overcome a high resistance is met, due to the presence of the relatively hard solid core, which not only itself absorbs momentum from the implement, but also by reason of its solidity prevents undue distortion of the ball, so that nearly all of the force going from the implement to the ball is utilized to impart velocity thereto. It will also be understood that under the shock of a blow the solid core is slightly displaced from its true central position, thereby affecting somewhat the material of the envelop at the opposite side of the ball from the implement and also affecting other portions of the envelop, so that almost if not all the material of the envelop is called into action and instantly reacts, thereby imparting a high degree of activity or liveliness to the ball and causing the same to leave the implement at high velocity. Only a slight distortion is produced at any portion of the ball, whose entire mass is thus rendered active in restoring the ball to its original spherical shape, and hence in reacting against the implement. 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 this instance this ratio is very high, the ball feeling quite soft to a light touch, but offering a hard resistance to pressure. The ball thus has practically all the desirable qualities of the usual soft-rubber ball and also a phenomenal flying or carrying power. Owing to the rapidly-increasing resistance even a heavy blow effects only a slight distortion of the envelop and that only over a small area thereof, so that very little force is absorbed in changing and rechanging the form of the ball. Moreover, the period during which the driver may continue to deliver power into the ball itself is increased, with the result of giving to the ball a longer flight. The compressed core not only retains the envelop in an expanded state, but also supports the same when struck, and by the combined elasticity of core and envelop an extremely active and powerful ball is produced.

It will be noted that my rubber envelop is different from one which is applied in the usual manner in the form of a green or uncured coating upon a center piece, since a coating made in such manner must be vulcanized in place, and in this process the whole mass of rubber becomes equalized in density and inert or normally without tension. By having the interior of the rubber envelop or coating in a state of compression while the outer portion is in a state of longitudinal tension the efficiency of the ball is improved and the envelop is not merely an inert portion having no force or tension except that which is directly caused by a driver.

It is to be understood that my invention is not limited in all cases to the use of a springy center piece or core, 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 finished ball, since instead of employing the partially-cured rubber threads of which balls are wound, which are susceptible to many deleterious influences, I employ rubber of firm texture and highly vulvanized, 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. In the rubber-thread balls it is usual to stretch the thread nearly to the breaking-point while winding, and owing to such violent treatment the thread rapidly loses its life, particularly since it is not well cured, while in my ball better results are obtained by subjecting rubber which is well cured to considerably less tension, thereby conducing to long life of the ball. Further, by tensioning the rubber after the manner of my invention it is given a promptness in action which is not possible in a rubber-thread ball, the action of the inner layers whereof is seriously impeded by the binding effect of the outer layers of thread. Moreover, in a rubber-thread ball the tension is in only one direction, whereas in my elastic envelop the tension is in all directions around the circumference of the ball, and hence the activity of all of the particles of the rubber envelop is fully developed, or, in short, the ball carries no dead-weight. Moreover, the ball thus formed has a uniform solidity or density which is not found in a thread ball on account of its interstices, and hence the same blow always produces the same results, enabling the user to play to better advantage. Should the original ball 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 ball, which is a desideratum.

Modifications and variations may be resorted to within the scope of my invention. The claims herein are intended to cover a ball whether considered as complete and ready for use or as incomplete and intended only for the nucleus or filling of a larger ball. In my pending applications, Serial No. 85,892, filed December 14, 1901, and Serial No. 88,842, filed January 8, 1902, I show my present invention used as a filling. It is not essential in all forms of my invention that the core whereon my elastic envelop is stretched be of springy material or compressed nor intimately joined to the envelop nor in the form of a solid sphere. I believe I am the first to produce a ball consisting of an elastic spherical envelop stretched over a core.

The herein-disclosed playing-ball is made the subject-matter of my other pending application, Serial No. 84,529, filed December 3, 1901.

Having described my invention, I claim—

1. A process in producing playing-balls, consisting in forcing sufficient fluent mass into a hollow elastic sphere to swell or expand said sphere, and causing said mass to harden and form a permanent core therein.

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

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

4. A process in producing playing-balls, consisting in molding a core within a previously-formed collapsible hollow sphere.

5. A process in producing playing-balls, consisting in stretching a soft sheet-rubber envelop upon a core.

6. A process in producing playing-balls, consisting in distending a sheet-rubber envelop upon a core of gutta-percha.

7. A process in producing playing-balls, consisting in distending a soft sheet-rubber envelop upon a core of harder springy material.

8. A process in producing playing-balls, consisting in forcing a moldable mass through a hole formed in a hollow sphere causing said mass to harden and form a core, and then plugging said hole.

9. A process in producing playing-balls, consisting in forcing sufficient mass through a hole formed in a yielding hollow sphere to form a core whose bulk exceeds the original capacity of the sphere, so as to expand said sphere, and then plugging said hole.

10. A process in producing playing-balls, consisting in reducing a mass of solid matter to a fluent condition, introducing said mass through a hole formed in a hollow rubber sphere until said sphere is distended and then plugging up said hole.

11. 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, and causing said mass to harden while under pressure.

12. A process in producing playing-balls, consisting in reducing solid matter to a fluent state by means of heat, and forcing said matter into a hollow sphere.

13. A process in producing playing-balls, consisting in heating gutta-percha, and introducing it into a hollow rubber sphere.

14. A process in producing playing-balls, consisting in heating gutta-percha, and forcing it into a hollow rubber sphere so as to distend the latter and form a core therewithin.

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

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

17. 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, and plugging the vent.

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, and solidifying said gutta-percha while said sphere remains in said chamber.

19. 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.

20. 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, and plugging the opening in the sphere through which the gutta-percha is injected.

21. 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, and causing said gutta-percha to solidify while under pressure.

22. 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, and forcing extra fluent mass into the sphere so as to distend the latter.

23. 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, and forcing extra fluent mass into the sphere so as to distend the latter.

24. A process in producing playing-balls, consisting in stretching a soft envelop by forcing a fluent mass thereinto and causing said mass to form a permanent hard core or filling too large for the normal capacity of said envelop.

25. A process in producing playing-balls, consisting in stretching a soft envelop by forcing a fluent mass thereinto and causing said mass to form a permanent hard core or filling too large for the normal capacity of

said envelop, and also causing the exterior of said envelop to acquire a predetermined form.

26. A process in producing playing-balls, consisting in introducing a fluent mass into the interior of a collapsible envelop, causing the exterior of said envelop to acquire a predetermined form, and hardening said mass within said envelop while such form is maintained.

27. A process in producing playing-balls, consisting in reducing hard material to a fluent condition, filling an envelop therewith, and causing said material to harden within said envelop.

28. A process in producing playing-balls consisting in reducing hard material to a fluent condition, forcing it into an envelop so as to swell or expand the latter, and causing said material to harden so as to form a permanent core too large for the normal capacity of the envelop.

29. A process in producing playing-balls consisting in molding a hard springy core within a previously-formed soft-rubber envelop.

30. A process in making playing-balls, consisting in making an elastic envelop of approximate form but undersized, expanding said envelop to full size by running material within the same under pressure, closely confining said envelop while said material is under pressure therewithin, and causing said material to form a permanent core.

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