June 14, 1932. W. E. HUMPHREY 1,863,339

APPARATUS FOR PRODUCING HOLLOW RUBBER ARTICLES

Filed May 7, 1931

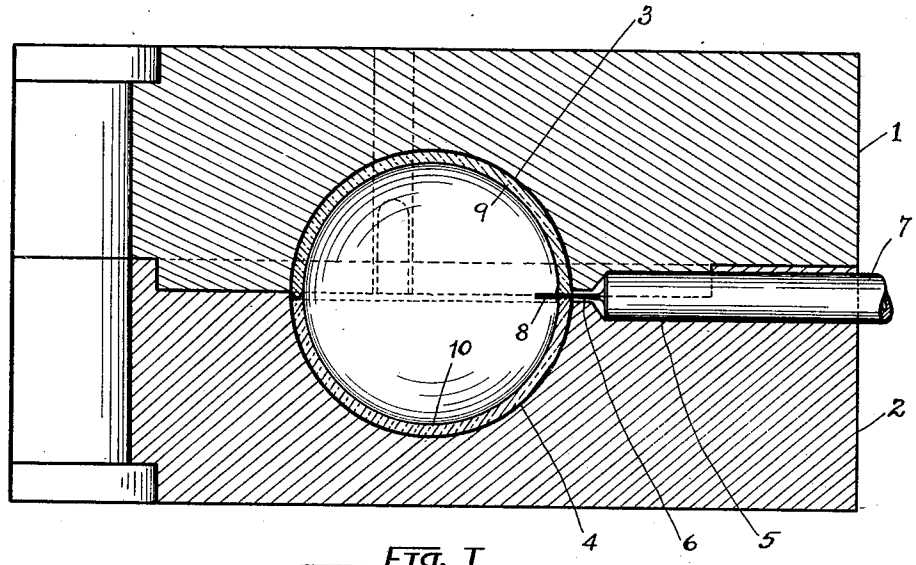


Fig. I

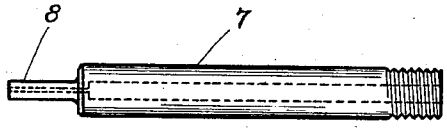


Fig. II

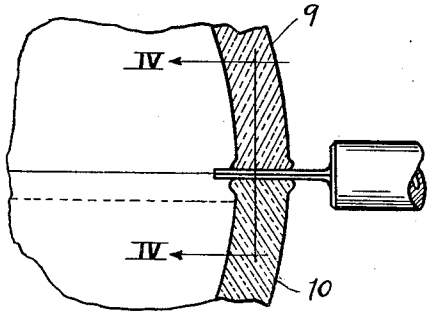


Fig. III

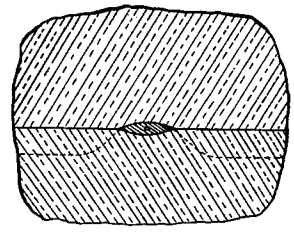


Fig. IV

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UNITED STATES PATENT OFFICE

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APPARATUS FOR PRODUCING HOLLOW RUBBER ARTICLES

Application filed May 7, 1931. Serial No. 535,658.

This invention relates to hollow rubber articles and, in practical application, specially, to playing balls, and to apparatus employed in their production. The object in view is a playing ball of superior character and quality.

In the accompanying drawing Fig. I is a view in section of a vulcanizing mold for tennis balls, in which the present invention is embodied; Fig. II is a view in plan of an inflation needle which is a member of the assembly shown in Fig. I; Fig. III is a diagrammatic view, drawn to larger scale and illustrating the inflation needle in service and in association with the components of a ball in course of fabrication; and Fig. IV is a view in section, on the plane indicated at IV—IV, Fig. III.

In an application for Letters Patent of the United States, Serial No. 504,772, filed December 26, 1930, by Paul M. Aultman and Archibald C. Bowers, apparatus of the character indicated is shown and described, and the present invention is found in an improvement in a detail of the apparatus of that earlier application.

Tennis balls consist esentially of thin-walled spheres of rubber, compounded to afford the desired resilience. They are minutely standardized in size, in wall thickness, in weight, as well as in resilience. In the manufacture of a tennis ball two hemispherical shells are molded and more or less completely vulcanized; the so prepared shells are brought together edge to edge with vulcanizable cement upon their edges; and integration of the assembled parts and completion of the ball are effected by vulcanization, while the blank is under compressive strain. Vulcanization under compressive strain is effected within a snug-fitting mold, the gaseous body within the hollow of the blank being of such character and quantity that under the temperature of vulcanization it affords internal pressure of the desired carefully determined magnitude.

Two methods chiefly have hitherto been employed for bringing to the desired value the pneumatic pressure within the ball during its vulcanization: one of these is to effect within a chamber of elevated pressure the assembly of the hemispherical shells within the mold; the other is to introduce into the space between the shells, just before bringing them together, proper quantities of substances which, under the temperature of vulcanization will react chemically and will by reaction generate gas in such quantity as to bring the pressure to the desired degree. Another method of increasing pressure within a ball—a method heretofore practiced only upon the integrated and otherwise completed article—is to drive a hollow needle through the wall of the ball and to inflate the ball through the driven needle to the desired degree of pressure. This method has involved, as a practical circumstance, the provision of a block of soft rubber or the like, applied to the inner wall of the ball, which block, remaining soft after completion of the ball, shall be a body through which piercing is effected. When the needle is withdrawn the soft rubber seals the wound. Such a block of soft rubber, when present, necessarily disturbs the balance of the ball.

The two mold parts 1 and 2 of the drawing are provided with hemispherical cavities 3 and 4. The mold parts meet in a plane which in Fig. I will be seen to be an equatorial plane. A radially arranged bore 5 with a prolongation 6 of reduced diameter is formed in the meeting faces of the mold parts, and in that bore may be set a pneumatic nozzle 7 with a hollow needle tip 8. This nozzle with its needle tip may in due time be withdrawn from the closed mold.

In the practice of this invention two complementary hemispherical shells 9 and 10 of rubber are prepared for union by facing their edges with layers of fluid or plastic vulcanizable rubber cement or its equivalent. The shells then are placed in the two mold parts 1 and 2; the pneumatic nozzle 7, 8 is brought to place, and the mold is closed with the parts in the positions shown in Fig. I. In bringing the shells 9 and 10 together the edges, engaging the needle tip 8 of the pneumatic nozzle, are slightly crushed; their plastic-faced surfaces contact upon the surface of the needle 8 and form a substantially com-

plete hermetic seal upon the needle, as is indicated at Fig. IV. Inflation through needle 8 follows, and is continued until the pneumatic pressure within the assembled ball has been raised to the desired and predetermined degree. The nozzle is thereupon withdrawn. After withdrawal of the nozzle, vulcanization of the seam of the ball within the mold proceeds in known manner, and the result is a properly vulcanized ball, perfectly balanced, and of accurately determined inflation pressure.

In the withdrawal of the needle from the seam between the meeting edges of the assembled shells 9 and 10 the elasticity of the rubber of which the shells themselves are formed, with the co-operation of the plasticity of the cement upon their edges, effects the immediate sealing of the opening, with no loss of the contained body of compressed gas.

The invention is found in the shape of the inflation nozzle, and particularly of its needle tip. As clearly shown in Fig. IV, this tip is of elongate cross-sectional shape and lies, when the parts are assembled and in operation, with the greater tranverse dimension extended in the line of meeting of the mold parts. The object in view is that the edges of the rubber shells where they are crushed in the manner described shall bear with sealing contact upon all the extent of the needle point and shall not gape apart on either side of the region of crushing strain; and that in consequence there shall be no appreciable or substantial escape of inflating gas, either during inflation or during the operation of withdrawing the needle from the inflated assembly within the mold. When the edges of the shells are brought together with the tip of the inflation nozzle extending across the seam, the edges are locally crushed and tend to assume a shape in which, from the points of maximum strain, the edges converge to points of meeting which are somewhat remote from the points of maximum strain. This elongation in the shape of the needle affords an approximation to the shape which the edges of the rubber shells tend to assume, and it is because of this approximation that security against gas escape is enhanced. The elongate cross-sectional shape of the needle tip may be, minutely, the shape of a lens, as the drawing shows it to be.

The degree of inflation will ordinarily be such as to serve both during vulcanization and during ultimate use of the ball.

I claim as my invention:

1. Vulcanizing apparatus for hollow rubber articles including a mold body having a seat for a pneumatic nozzle through its wall, and a pneumatic nozzle with hollow needle point of elongate cross-sectional shape applicable to and removable from such seat.

2. Vulcanizing apparatus for hollow rubber articles including a mold body consisting of separable parts and provided with a seat for a pneumatic nozzle formed at the line of meeting of two parts thereof, and a pneumatic nozzle with hollow needle point of elongate cross-sectional shape applicable to and removable from such seat, and when applied to such seat extending through the mold wall and into the cavity within the mold wall and with its major transverse dimension extended in the line of meeting of the mold parts.

In testimony whereof I have hereunto set my hand.

WALTER E. HUMPHREY.