This invention relates to a method of manufacturing golf balls and similar balls in which a hard lively ball is desired.

Golf balls are commonly made by applying a large number of windings of rubber thread or tape under tension to a rubber core and then vulcanizing or otherwise applying a cover of rubber, or other suitable material, over the tape or thread windings. It has been proposed to increase the liveliness of the ball by adding to the tension of the rubber windings the pressure exerted by an inert gas or liquid confined under pressure within the core. This has been done in the case of gases by forming a hollow in the center of the core and placing therein suitable chemicals which, when subjected to the heat of vulcanization, would combine to form a gas to give the desired pressure. If the gas pressure is to be effective it must be created after the winding operation and the heat generated by the final vulcanization of the cover has in the past been utilized to supply the heat necessary to activate the gas forming chemicals at the center of the ball. This has proved objectionable since the heat of necessity passes through the rubber windings to reach the chemicals and the elasticity of the windings is to some extent destroyed. Various attempts to minimize this difficulty have been made as by the use of low temperature vulcanization but this results in a slow evolution of the chemicals into gas and the subjection of the rubber windings to the transmission of heat for a substantial period. It has also been a practice to inject liquid under pressure into the center of the finished ball by means of a hollow needle. This latter method entails substantial labor and expensive equipment and involves a damage to the windings by the passage of the needle and uncertainty in the complete closure of the aperture made by the needle.

It is the principal object of my invention to provide a method by which pressure may be created at the center of a golf ball after the ball has otherwise been completed finished without passing heat through the windings or mutilating the windings by the insertion of a needle, and with a substantial decrease in equipment and labor costs and a substantial saving in time. Other and further objects will be apparent from the following specification and claims.

The accompanying drawing illustrates diagrammatically one manner of practicing the invention, the ball being indicated in section.

In carrying out my invention, suitable predetermined quantities of gas producing chemicals or materials are placed in the core cavity of the ball accompanied by a small piece of metal such as tin-foil or the like and the manufacture of the ball completed in the usual or any suitable manner. By "completed" is meant that degree of structural completion desired and at which the increased pressure should be added to provide the best performance of the ball in its intended use. Usually this will be after the windings have been applied but may be prior to or after the application of the cover, and before or after painting or otherwise finishing the surface. I then pass the completed ball into or through the field of a high frequency coil as indicated in broken line in the drawing. The metal foil is preferably very thin and the piece may be bent into angular form to give added assurance that a metal surface is properly positioned in the field. The action of the high frequency field, as that term is used, is to induce a current in the metal and raise its temperature to a point sufficient to activate the chemicals or cause combustion of the material associated with the metal in the core cavity. Depending on the chemicals or materials used and the size and intensity of the field, the ball may be held for a longer or shorter period in the field or, with semi-explosive, explosive or detonating materials, the ball may be passed continuously through the field. The gas producing chemicals heretofore usually used, such as ammonium nitrate or a mixture of ammonium chloride and sodium nitrate, may be used in the practice of my method but one of the advantages of the method is that it permits the use of many classes of materials heretofore impossible of such use, which are quicker in action and involve a minimum production of heat. For example, gun powder and many other semi-explosive or explosive materials, similar nitrogen producing compounds, or materials in which the reaction once started is self-sustaining, capable of producing a sufficient volume of substantially inert gas and ignitable or reacting only at sufficiently high temperatures to preclude activation within the range of temperatures involved in the manufacture of the ball, may be used. As illustrating the small quantities of materials required, assuming a core cavity 7 mm. in diameter, and that it is desired to create a pressure of 1200 lbs. per square inch within the core, the desired pressure could be obtained with approximately .064 gram of black powder, using a piece of thin tin-foil presenting an effective area about \( \frac{1}{3} \) square. Whatever type of gas producing chemical or
material is used, or the type of reaction produced, the production of heat is localized at the center of the ball, the temperature of the windings of the coil, and the elasticity of the material affected by the high frequency field, and the incidental heat produced may be largely or entirely dissipated in the core or central portion of the ball.

The method permits a wide range of choice to the manufacturer in meeting technical requirements or specific factory conditions. For example, if to meet safety regulations or fire underwriter’s requirements, it is desirable or necessary in a particular instance to use relatively slow acting or high heat producing materials, refrigeration may be used to maintain the outer portion of the ball, including the windings, at a predetermined temperature during the time the ball is within the high frequency field without impairing the action produced at the center. A similar result in a degree can be obtained by providing a layer of heat insulating material between the core and the windings.

The method further permits incidental refinement and improvement of the product. For example, the cover may be compounded to vulcanize at very low temperatures or even be air cured, or the elasticity lost by vulcanizing the cover at a high temperature may be compensated by producing an increased pressure at the center.

Again, since it is no longer necessary to conduct heat through the ball to the core cavity, the core may be compounded and cured so as to minimize dispersion of gas into the ball structure.

Further, since the method permits the selection of gas producing materials which require the use of exceedingly small quantities, the core cavity need be no larger than necessary to accommodate the gas forming material and the required area of tin-foil or other metal. On the other hand, the cavity may be as large as desired. The materials used may partly or completely fill the cavity and may be powdered, liquid, gelatinous, or in semi-solid or solid form to facilitate uniform winding by preventing any tendency of the core to collapse or deform under the winding pressure. The gas forming material may be molded in spherical form with the metal inside, and itself form the ball core or the major portion thereof, being covered with a gas retarding covering of rubber or other suitable material by dipping, molding, or in any other suitable manner.

The apparatus required may be exceedingly simple and in its simplest form may comprise any suitable means for creating a high frequency field such as a conventional high frequency coil of small copper tubing through which a flow of cooling water is maintained and carrying an alternating current having for example a frequency of 300 kc., the power consumption being about 1 or 2 kw., together with suitable means for passing the balls successively into or through the field of the coil in the desired timed relation. It will be understood that the above discussion is intended to indicate generally the wide range of operating detail and construction made possible by my method and is not to be taken as narrowly definitive of the scope of my invention.

What I claim is:
1. The method of manufacturing golf balls and the like which comprises enclosing within the center of the ball a quantity of a gas producing material in company with a piece of metal, completing the ball structure as desired and inducing in said piece of metal an electric current of sufficient intensity to activate the gas producing material.

2. The method of manufacturing golf balls and the like which comprises enclosing within the center portion of the ball a gas producing material in company with a piece of metal bent in angular formation, completing the ball structure as desired and inducing in said piece of metal an electric current of sufficient intensity to activate the gas producing material.

3. The method of manufacturing golf balls and the like which comprises enclosing within the center portion of the ball a quantity of gas producing material, completing the ball structure as desired and activating the gas producing material by the generation of heat at the center portion of the ball without raising the temperature of the other portions of the ball substantially above their normal tolerance.

4. The method of manufacturing golf balls and the like which comprises enclosing within the center portion of the ball a quantity of material gasifying above a predetermined temperature, completing the ball as desired, and raising the center portion of the ball to said predetermined temperature by the generation of heat at said center portion without deleteriously heating the other portions of the ball.

5. The method of manufacturing golf balls and the like which comprises enclosing within the center portion of the ball a quantity of gas producing material in association with an electric conductive material and inducing in said material an electric current sufficient to activate the gas producing material.

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