

UNITED STATES PATENT OFFICE

2,035,774

PRODUCTION OF PLAY BALLS

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No Drawing. Application June 30, 1933, Serial
No. 678,466. In Great Britain July 27, 1932

11 Claims. (Cl. 18—50)

This invention concerns improvements in or relating to the production of play balls, as for example tennis balls.

The object of the present invention is to produce play balls, for example, tennis balls free from seams and other irregularities.

Heretofore, the inner cores or gas containers of play balls such as tennis balls have usually been produced from shaped strips of compounded rubber mixings. The handling of such strips is, however, extremely difficult and inaccurate and defective joints with consequent leakage therefrom are a common occurrence.

In some cases the spherical container has been formed from two hemispherical cups of compounded rubber mixings, but this does not remove the difficulties of manipulation by hand or the consequent risk of leaky joints.

Tennis balls and similarly inflated balls also suffer from leakage, which may be due to one or more of the three following causes:—

1. The highly compounded nature of the rubber compound of which the spherical gas container is formed;

2. Imperfect joints, due in a large measure to the extreme flexing of the component parts;

3. Ineffective sealing of the aperture through which gas is inserted when means such as hypodermic needle is employed for the purpose.

It is desirable, therefore, to be able to produce play balls, such as tennis balls, from fluid rubber or the like compositions, which can be evenly distributed inside a spherical mould and subsequently solidified so as to produce a hollow rubber or the like core of even thickness and free from joints.

According to the present invention the method for the production of play balls, for example tennis balls, comprises introducing into hollow spherical moulds predetermined amounts of aqueous dispersions of the kinds hereinafter specified which are or have been made capable of gelling on the application of heat, closing the moulds, subjecting the moulds to rotation about a variable axis and effecting total gelling of the aforesaid dispersions.

It is desirable that the moulds containing the aqueous dispersions aforesaid should be subjected to rotation for some time prior to effecting the total gelling of the aforesaid aqueous dispersions, and furthermore, it is desirable that the moulds should be still in rotation while gelling is taking place.

Gelling of the aqueous dispersions aforesaid contained within the moulds can be effected by

the application of heat to the outside of the moulds.

Subsequent to gelling of the aforesaid dispersions the moulds are preferably cooled, opened, and the balls dried.

Thereafter the balls are preferably replaced in moulds and vulcanized.

It is desirable that vulcanization should be effected under such conditions that the external pressure on the ball acting through the joints of the mould is substantially less than the pressure on the ball on the mould, as for example, by immersion of the mould in boiling water or by heating the mould in superheated steam.

To effect even distribution of the aqueous dispersions aforesaid in the hollow spherical moulds, the aforesaid moulds can be rotated simultaneously about two or three axes at right angles to each other.

Approximately even distribution of the aqueous dispersions aforesaid has been obtained, for example, by placing the spherical mould containers on two cylindrical rollers revolving in the same direction, the rollers at the same time moving backwards and forwards in opposite directions to each other along their horizontal axes.

Improved distribution of the aqueous dispersions aforesaid has been obtained by subjecting the spherical mould containers to a rotatory motion about three mutually normal axes.

To obtain the desired inflation of the ball, several methods can be adopted. For example, inflation may be effected by floating on the liquid aqueous dispersions aforesaid in the mould a capsule or ampule, for example of paraffin, containing a gas generating composition, for example a moist mixture of sodium nitrite and ammonium chloride. In this case the first heating on the rotator should be restricted so that the capsule material is not fused and the gas generating mixture does not react, and so that no substantial inflation takes place at this stage. When the dried ball is placed in the mould, the latter can be immersed in boiling water for 15 minutes to effect complete inflation before remoulding.

During this second heating the capsule material may conveniently be fused and allowed to flow over the inner surface of the ball, thus improving the gas-retaining properties of the latter.

Alternatively, inflation can be obtained by providing the mould with a one-way valve through which a gas at a predetermined pressure is forced into the upper part of the mould after

closing, and before rotation and gelling of the aqueous dispersions aforesaid.

When the dispersions are subsequently gelled the ball produced while surrounded by the walls of the mould will contain gas under pressure, and in this case the ball is vulcanized without removal from the mould. It is to be observed that the ball is still porous but the pores are filled with water. Subsequent to vulcanization the ball is removed and dried in a draught of warm compressed air. During the subsequent drying shrinkage occurs and the ball becomes substantially non-porous.

A still further way of producing the desired inflation within the ball is to produce the ball without inflation and subsequently inflate it by storage for a period in a compressed gas, any tendency to subsequent leakage being reduced by treatment with, for instance, a rubber solution. This solution may be employed at the same time as an adhesive for securing coating of felt or disintegrated felt or other suitable material.

Another way of producing the desired inflation within the ball is to make use of a hollow spherical mould provided with a screwed plug bearing a fine pointed wire projecting radially towards the center of the sphere. On this wire is mounted in suitable position a filling plug comprising a core of a masticated rubber-resin mixture in a covering of uncured latex rubber. When the ball is then formed, dried and vulcanized as herein described the product will bear the filling plug as an integral part of its structure. For additional security the screwed plug, wire and filling plug may prior to the formation of the ball be detached and heated to a suitable temperature, say 100° C., being then immediately replaced in the spherical container, immediately after which the ball is formed as described, this heating procedure induces an increased setting of rubber in the region of the filling plug, which is accordingly more securely enveloped in the wall of the product.

Inflation may be effected by the introduction through a hypodermic needle inserted through the filling plug of air or any other fluid medium desired.

Advantage may also be taken of this construction to introduce into the interior of the ball fluid material suitable to form a gas retaining lining, e. g. a mixture of gelatine and glycerine, such material being distributed over the inner surface of the ball by rolling by hand or mechanically with or without the further application of heat.

The emulsions or dispersions comprise those consisting of or containing rubber, gutta-percha, balata or similar vegetable resins occurring naturally or artificially obtained.

Such artificial aqueous dispersions may include those of coagulated rubber, vulcanized rubber, synthetic rubber, waste or reclaim. If desired any of the aforementioned dispersions may be used alone or in admixture with one another.

Any of the aforesaid dispersions may contain the usual known compounding ingredients and/or may be in concentrated form.

Concentrates such as are obtained in U. S. Patent No. 1,846,164 or in British Patent No. 219,635, to which may be added any one or more of the usual compounding ingredients, may also be used.

Examples of substances used for making the aforesaid dispersions capable of gelling on the

application of heat are sodium or potassium silicofluoride, ammonium persulphate, or reagents which by chemical interaction with one another upon the application of heat produce one or more substances in situ which function as active coagulating or gelling agents, for example a mixture of zinc oxide and ammonium sulphate.

The following is an example of a method for the production of play balls according to the present invention.

A latex mixing of the following composition:—

	Parts by weight
Rubber (as latex) -----	87.7
Sulphur -----	1.5
Tetramethyl thiuramdisulphide -----	0.30
Mineral oil -----	5.0
Lamp black -----	1.0
Gas black -----	0.5

is prepared from a 60% rubber latex obtained by centrifugal action.

The solid content is approximately 45 to 50% the latex mixing is cooled to about 5° C.

To 100 grams of this mixing 2.4 grams of 50% zinc oxide dispersion is added, as well as 4 ccs. of a 25% aqueous solution of ammonium sulphate also previously cooled.

72 grams of this mixing is then poured into the ball mould, a capsule of paraffin containing a moist mixture of sodium nitrite and ammonium chloride is also introduced, the mould is then closed and placed on a rolling machine of the type comprising two cylindrical rollers revolving in the same direction, the rollers at the same time moving backwards and forwards in opposite directions to each other along their horizontal axes.

The rollers preferably revolve at approximately 24 revolutions per minute. After the mould has been subjected to rotation for 15 to 20 seconds it is heated by blowing steam from a pipe on to it for two minutes. The mould is allowed to rotate for a further period of one minute. It is then cooled under water and opened.

The ball is dried in an air draught at 45° to 50° C., overnight, then placed in a mould, and the latter then transferred to a small steam pan.

The ball is vulcanized in 15 minutes, the steam in the outer jacket of the pan being at 80 lbs. per square inch, a slow flow of steam at atmospheric pressure being at the same time passed through the pan.

The mould is subsequently removed, cooled in water, opened and the vulcanized inflated ball removed.

Having now particularly described our said invention and in what manner the same is to be performed, what we claim is:—

1. A method for the production of play balls, which comprises introducing into hollow spherical moulds predetermined amounts of aqueous dispersions capable of gelling on the application of heat, closing the moulds, subjecting the moulds to rotation about a continuously varying axis to spread said dispersion uniformly throughout the entire inner surface of said mould, and effecting total gelling of the aforesaid dispersions.

2. A method as claimed in claim 1, wherein the moulds containing the aqueous dispersions aforesaid are subjected to rotation prior to effecting the total gelling of the aforesaid aqueous dispersions.

3. A method as claimed in claim 1, wherein the moulds are still in rotation while gelling is taking place.

4. A method as claimed in claim 1, wherein subsequent to gelling of the aforesaid dispersions the moulds are preferably cooled, opened and the balls dried, and subsequent to drying are replaced in
5 moulds and vulcanized.

5. A method as claimed in claim 1, wherein subsequent to gelling of the aforesaid dispersions the moulds are preferably cooled, opened and the balls dried, and subsequent to drying are replaced
10 in moulds and vulcanized under such conditions that the external pressure on the ball acting through the joints of the mould is substantially less than the pressure of the ball on the mould.

6. A method as claimed in claim 1, wherein the
15 desired inflation of the ball is obtained by floating on the liquid aqueous dispersions aforesaid in the mould a small fusible container containing a gas generating composition, restricting the first heating on the rotator so that the capsule material is
20 not fused and the gas generating mixture does not react and subsequent to placing the dried ball in the mould heating the latter to effect complete inflation before moulding.

7. A method as claimed in claim 1, wherein
25 inflation is obtained by providing the mould with a one-way valve through which a gas at a predetermined pressure is forced into the upper part of the mould after closing and before rotation and gelling of the aqueous dispersions aforesaid.

30 8. A method as claimed in claim 1, wherein inflation is obtained by providing the ball with a filling plug supported on a fine pointed wire projecting radially toward the centre of the mould during moulding.

35 9. A method for the production of inflated play-

balls which comprises introducing into hollow spherical moulds predetermined amounts of aqueous dispersions of rubber material, closing the moulds, subjecting the moulds to rotation
5 about a variable axis to spread said dispersion uniformly over the walls of said mould, and setting said dispersion while the mould is being rotated and the dispersion uniformly distributed over the inner surface thereof.

10 10. A method for the producing of play balls which comprises introducing into hollow spherical molds predetermined amounts of aqueous dispersion capable of gelling on the application of heat, closing the molds, subjecting the molds to rotation
15 and continuously varying the axis of rotation relative to any given axis of the mold to spread the aqueous dispersion uniformly over the inner wall of the mold while holding the center of the mold substantially stationary, and effecting the gelling of the dispersion.
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11. A method for the production of play balls which comprises introducing into a hollow spherical mold a predetermined amount of aqueous dispersion capable of gelling on the application of heat, closing the mold, subjecting the mold to
25 rotation about a horizontal axis, and continuously and variably changing the axis of the mold relative to said axis of rotation while maintaining the center of the mold substantially fixed, and effecting gelling of the dispersion on the inner
30 surface of said mold.

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