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PLAY BALL

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Fig. 1

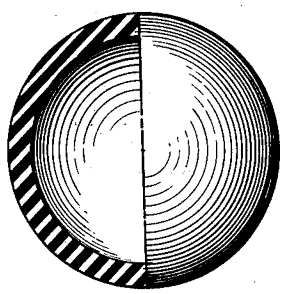


Fig. 2

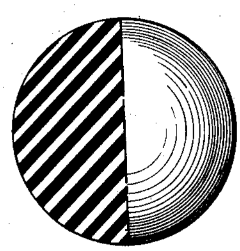
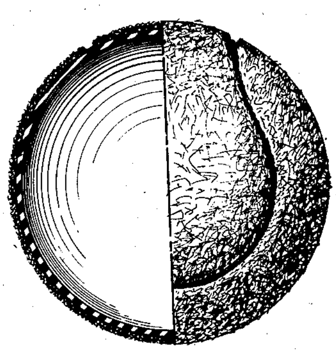


Fig. 3



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PLAY BALL

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10 Claims. (Cl. 273—58)

This invention relates to improved balls and particularly, to play balls of minimized variation in rebound with varying temperatures of play with the balls. More specifically, the invention relates to tennis, squash racket, hand, lacrosse, and other balls of minimized temperature coefficient of rebound. The invention also relates to the process of manufacturing play balls and lastics of minimized temperature coefficient of rebound.

For various sports there are strict, official requirements as to size, weight, rebound, and also compression in case the ball is gas-filled. There has long been need of play balls which do not show a great variation in height of rebound when used in different seasons or at widely different temperatures.

The official international tolerances for rebound of tennis balls, for instance, is quite small, 53 to 58 inches of rebound for a drop of 100 inches, at 20° C. However, a conventional tennis ball which bounces 55 inches at 20° C. (68° F.) bounces only 47 inches at 41° F. but bounces 63 inches at 100° F.

Likewise, a squash racket doubles ball of standard and widely used brand, dropped from a given height upon a hard surface, will bounce nearly twice as high at 100° F. as at 52° F.

This property may be expressed in terms of the temperature coefficient of rebound, determined by comparing the heights of rebound of a ball dropped from a height of 100 inches upon a rigid steel plate, at two temperatures. In the case of the squash racket doubles ball referred to, the rebound was 53 inches at 100° F. and 27 inches at 52° F.

The ratio of rebounds between a temperature of 100° F. and temperature of 52° F. in the above example is, therefore, 53 to 27 or, as reduced, 1.96 to 1. The percentage change in rebound between the temperatures of 52° F. and 100° F. is 1.96–1 divided by 1, or 96%.

The temperature coefficient of rebound is calculated for the present purpose as the percentage change in rebound for 1° F. over the range of temperature at which tests were made. In the example of the squash racket doubles ball given above, therefore, the temperature coefficient of rebound is computed by dividing the percentage change of rebound between 52° F. and 100° F. (96) by the difference between 52° F. and 100° F. (48° F.) and is equal to 2.

The temperature range used in the above calculations is one which is commonly met with in the same locality at different times in the year, and in different localities at the same time of the year. Thus, in a given section of the United States, the temperature varies over a very wide range between summer and winter and even between summer and spring or fall, while in Canada and in Florida, for example, the temperatures are widely different during the same time of year, as in the spring. The variation in rebound of now commonly used standard balls caused by these differences in temperature or climate presents unsuspected difficulties for the player.

It is, therefore, an important object of the present invention to provide a playing ball in which the variation in rebound under widely different temperature and climatic conditions is maintained within very close limits.

As will appear later, we make a squash racket doubles ball of temperature coefficient of rebound as low as 0.8. Likewise, we make squash racket singles balls or hand balls with a temperature coefficient of rebound as low as 0.3 or 0.4. With such balls, therefore, the difficulty due to variation in rebound under varying temperature conditions is substantially reduced or minimized.

Data from which to calculate the coefficient of rebound for a given material may be determined by making it into a finished ball, with usual admixtures and manufacturing steps, and then noting the height of rebound of the ball when allowed to fall upon a horizontal, smooth steel plate, at different temperatures.

The invention comprises balls of minimized temperature coefficient of rebound. It comprises, also, play balls containing an elastic mixture of a rubbery material and a modifying agent of substantially lower temperature coefficient of rebound than the said rubbery material. In another embodiment, the invention comprises balls including ingredients adapted to produce in mixed form an elastic mixture of minimized temperature coefficient of rebound, one ingredient having a positive coefficient and the other having a negative coefficient.

The invention is illustrated in the attached drawing to which reference is made.

Figs. 1, 2, and 3 are sectional views of play balls constructed in accordance with our invention. Fig. 1 is a view of a handball, Fig. 2 a solid play ball, and Fig. 3 a tennis ball.

The balls of Figs. 1 and 2 are composed of our improved composition of minimized coefficient of rebound except that the ball of Fig. 1 includes some air or other filling gas. The tennis ball includes the resilient member 4, constituted of the said composition, and conventional covering 5.

The type of compositions that may be used in making the elastic mixture for the improved balls is illustrated by the following examples:

(1) Rubber 40–60 parts by weight and 40–60 parts of a modifying agent, for 100 parts of the two materials, the said agent consisting of a relatively hard nonfriable reaction product of rubber with sulfuric acid, sulfonic acids, and/or sulfonyl chlorides. This agent, hereinafter

sometimes referred to as Thermoprene, may be made as described in U. S. Patent 1,605,180, issued to Fisher on November 2, 1926.

(2) Rubber 10–35 parts and balata 65–90 parts, for 100 parts of the two materials.

(3) Rubber 60–85 parts and A. X. F. 15–40 parts, for 100 parts of the said materials. A. X. F. is a somewhat elastic resinous material, made as described by Shinkle, Brooks, and Cody, in Industrial and Engineering Chemistry, vol. 28, pages 275–280, 1936. It has a specific gravity of about 1.06. It hardens without melting when heated. Alone it has very little tensile strength. It is insoluble in acetone, alcohol, and gasoline. It may be milled into rubber readily. It is a polyxylene lastic. It is a rubber soluble macromolecular organic material.

(4) Rubber 40–60 parts by weight, A. X. F. 30–50 parts, balata 15–25 parts, and Vistanex 15–25 parts, for 100 parts of the said materials. The ingredient referred to as Vistanex is of the general type of a rubberlike polymerization product of unsaturated petroleum gases such as produced in cracking petroleum. Vistanex is a polyisobutylene, rubber soluble, macromolecular organic material.

Rubber has a large positive temperature coefficient of rebound, as will appear from the data given for conventional balls of rubber. On the other hand, the modifying agents listed above have small coefficients over the temperature range under consideration.

In choosing the amounts of rubber or the like for blending with a modifying agent, the general rule applicable to the novel process of making uniform rebound lastics is to use relatively small proportions of rubber with an agent of only small negative coefficient of rebound and proper elasticity and larger proportions of rubber with an agent of larger negative coefficient. In any case, the composition must be selected so as to give not only the desired low temperature coefficient of rebound but also the desired level or amount of rebound. Thus, if one wants a comparatively high bouncing ball, the modifying agent in itself should be of high rebound characteristics or be used in relatively small proportion, and vice versa.

The selected materials, forming in the finished ball an intimate elastic mixture, are suitably compounded in usual manner and with ingredients commonly used for the purpose of curing, filling, pigmenting, and the like. The materials or admixtures may be blended, shaped, and cured with conventional machinery.

The following examples illustrate the invention more specifically:

A composition that may be used in making squash racket doubles balls is the following, all proportions being expressed here and elsewhere in the specification and claims as parts by weight.

Pale crepe crude rubber	50
A. X. F.	40
Balata, purified	20
Vistanex	20
Tuads (tetramethylthiuram disulfide)	8
Zinc oxide	20
Diphenyl guanidine	3
Rubber red C. D. (duPont)	2
Zinc stearate	6
Clay	15
Sulfur	4

In this formula, the various admixtures, beginning with tuads, serve their usual functions and may be replaced by equivalent materials.

The composition so made is shaped into shells (hollow hemispheres) and given a semi-cure, as, for instance, a cure for 10 minutes at a temperature of approximately 310° F. The shells are made into a ball, which is given a final cure, say, for 10 minutes at a temperature of about 325° F.

Such a stock made into a squash racket doubles ball, with inflation of 7 pounds of air to the square inch, showed good rebound characteristics. Thus, in an average of four tests, the height of rebound for a 100-inch fall varied from 28–29 inches, at a temperature of the ball of 52° F., to a rebound of 38–39 inches, for a temperature of 100° F.

In making a singles ball for squash, there were used the same ingredients as above, except that the proportions of the first four were changed to

Pale crepe rubber	40
A. X. F.	45
Balata	10
Vistanex	25

The other admixtures were in the same proportions as stated above. Shells made from this stock were given a semi-cure of 10 minutes at about 310° F. The balls made from the shells were inflated to 4 pounds and given a final cure of 10 minutes at about 325° F. With this singles ball, the rebound for 100-inch fall varied in 12 tests from 24–25 inches at 52° F. to 27–28 inches at 100° F. On the other hand, a regular commercial squash racket singles ball showed a rebound of 19–20 inches at 52° F. and 33–35 inches at 100° F. For the improved ball the rebound at 100° F. was only approximately 12% higher than the rebound at 52° F., whereas for the standard ball the rebound at the higher temperature was 79% higher than at the lower temperature.

For making a hand ball there was used a composition including

Smoked sheet rubber	163
A. X. F.	40.75
Zinc oxide	157.5
Litharge	272.0
Gas black	33.75
Sulfur	14.5
Captax	14.5
Tuads	9.75

This mixture was formed and shaped in the usual manner and given a semi-cure for 6 minutes at 20 pounds steam pressure and a final cure for 19 minutes at 70 pounds steam pressure. The inflation was made with 25 pounds of air. A ball so made showed only 15% more rebound at 103° F. than at 50° F.

From the data given for the balls of the specific compositions shown in the above tables, the temperature coefficients of rebound may be calculated as follows:

The squash racket doubles ball increased in rebound from a mean of 28.5 to 38.5, for a temperature increase of 48° F. The percentage increase in rebound is approximately 35. The percentage increase per degree or the temperature coefficient of rebound is 35 divided by 48, or 0.73.

For the squash racket singles ball, the increase in rebound between the temperatures of 52° F. and 100° F. is approximately 3 inches, or 12%. The temperature coefficient of rebound in this instance is, therefore, 12 divided by 48, or 0.25.

Likewise for the hand ball showing an increase of 15% in the rebound, for a temperature difference of 53° F., the temperature coefficient is approximately 0.28.

The same general principles of formulation may be followed in making a solid play ball. The temperature coefficient of rebound of the rubber in the ball is modified by the inclusion of a material of negative coefficient.

The modifying agent for the solid ball may be one of those recited above. Also, it may be an olefin polysulfide of generally rubbery consistency, such as Thiokol. Thus, the solid ball may be composed, for example, of 40 to 60 parts of rubber and 40 to 60 parts Thiokol for 100 parts total weight of the two ingredients, in addition to conventional admixtures.

As used in this specification: A lastic is an organic material having over some temperature range the property of forcibly retracting to approximately its original size and shape after being appreciably distorted. Thiokol, Thermoprene, Vistanex, A. X. F. include equivalent materials sold under other trade names. A uniform rebound lastic is one having a thermal coefficient of rebound substantially less than that of rubber. The magnitude of the thermal coefficient of rebound is described in reference to the coefficient of rubber, and small coefficients include positive coefficients substantially less than that of rubber and all negative coefficients.

The mixture of materials of low coefficient of rebound usually constitute the major portion of the mass of the balls. In the case of the squash balls or hand balls, the said spheres constitute all or practically all of the mass of the balls, except for the contained gas. The spheres or resilient members of the balls consist essentially of compositions including a rubber-like material and a modifying agent therefor of lower coefficient of rebound than the said material. In the case of the tennis balls, the cover and the sphere including rubber-like material and modifying agent of the kind described constitute nearly all of the mass of the balls. In general the modifying agent to be used are preferably thermoplastic and resilient, as illustrated in the examples given above.

It will be understood that the details given are for the purpose of illustration, not restriction, and that variations within the spirit of the invention are intended to be included in the scope of the appended claims.

We claim:

1. As an article of manufacture a play ball, substantially all of the resilient mass of said ball consisting essentially of a cured intimate mixture of 40-60 parts rubber and 40-60 parts of the hard nonfriable reaction product of rubber with a material selected from the group consisting of sulfuric acid, sulfonic acids and sulfonyl chlorides, said ball having a rebound at 100° F. substantially the same as and not in excess of 12% more than the rebound at 52° F.

2. As an article of manufacture a play ball, having with respect to rubber a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said ball consisting essentially of an intimate mixture of rubber and polyxylene.

3. As an article of manufacture a play ball, having with respect to rubber a relatively small temperature coefficient of rebound, most of the resilient mass of said play ball consisting essentially of an intimate mixture of rubber balata, polyisobutylene, and polyxylene.

4. A play ball having with respect to rubber a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said play ball consisting essentially of an intimate mixture of, for each 100 parts thereof, approximately 40-60 parts of rubber, 30-50 parts of polyxylene, 15-25 parts of balata, and 15-25 parts of polyisobutylene.

5. A play ball having with respect to rubber a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said play ball consisting essentially of, for each 100 parts thereof, 60-85 parts of rubber and 15-40 parts of polyxylene.

6. As an article of manufacture, a play ball having, with respect to rubber, a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said ball consisting essentially of an intimate mixture of rubber and at least 20% modifying agent of rubber soluble macromolecular organic material chosen from the class consisting of thermoprene, polyisobutylene, polyxylene, polyalkenesulfide, and compositions consisting of synthetic organic macromolecular materials blended with balata.

7. As an article of manufacture, a play ball having, with respect to rubber, a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said ball consisting essentially of an intimate mixture of rubber and a modifying agent of chlorine free rubber soluble macromolecular organic material having a small temperature coefficient of rebound.

8. As an article of manufacture, a play ball having, with respect to rubber, a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said ball consisting essentially of an intimate mixture of a resilient material and a modifying agent of chlorine free rubber soluble macromolecular organic material chosen from the class consisting of thermoprene, polyisobutylene, polyxylene, polyalkenesulfide, and compositions consisting of synthetic organic macromolecular materials blended with balata.

9. As an article of manufacture, a play ball having, with respect to rubber, a relatively small temperature coefficient of rebound, substantially all of the resilient mass of said ball consisting essentially of an intimate mixture of rubber and thermoprene.

10. As an article of manufacture, a play ball comprising an elastic member constituting the major portion of the mass of the ball and including an intimate mixture of rubber and a substantial proportion of a thermoplastic resilient modifying agent of lower temperature coefficient of rebound than the rubber.

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