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(54) **VIBRATION ATTENUATING BALL RACQUET**

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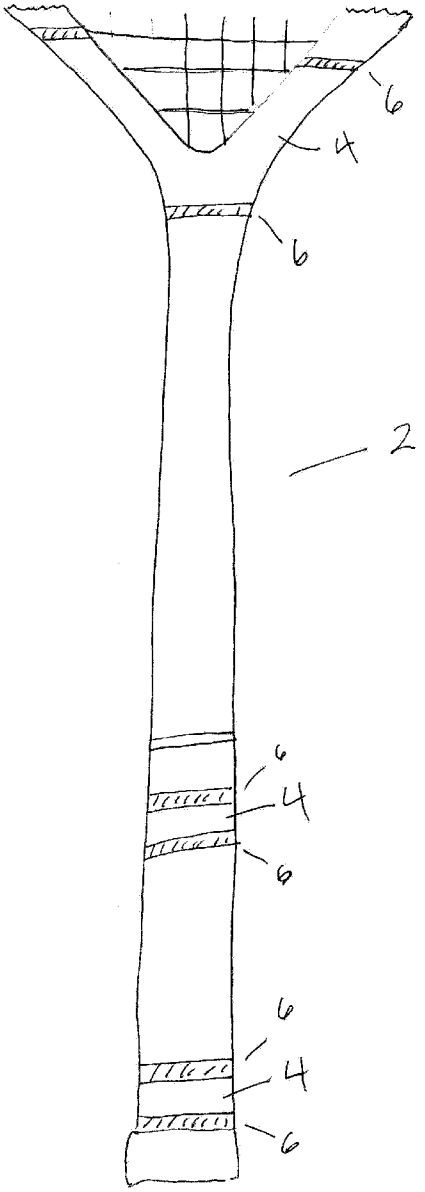
(57) **ABSTRACT**

Disclosed is a ball racquet having a vibration attenuating compound inserted within the frame of the racquet. The attenuating compound comprises a gel formed from an expoxidized vegetable oil. The gel compound can be placed in varying parts of the racquet. Furthermore more than one insert can be placed within the hollow confines of the racquet structure.



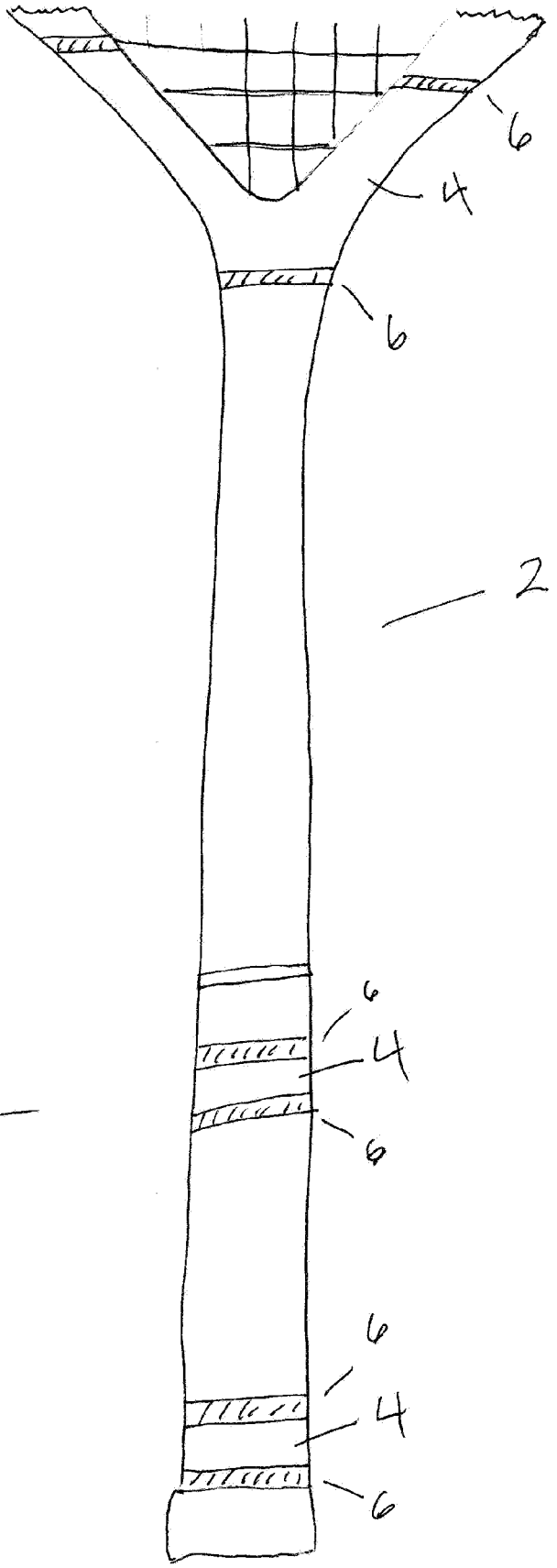


Figure 1

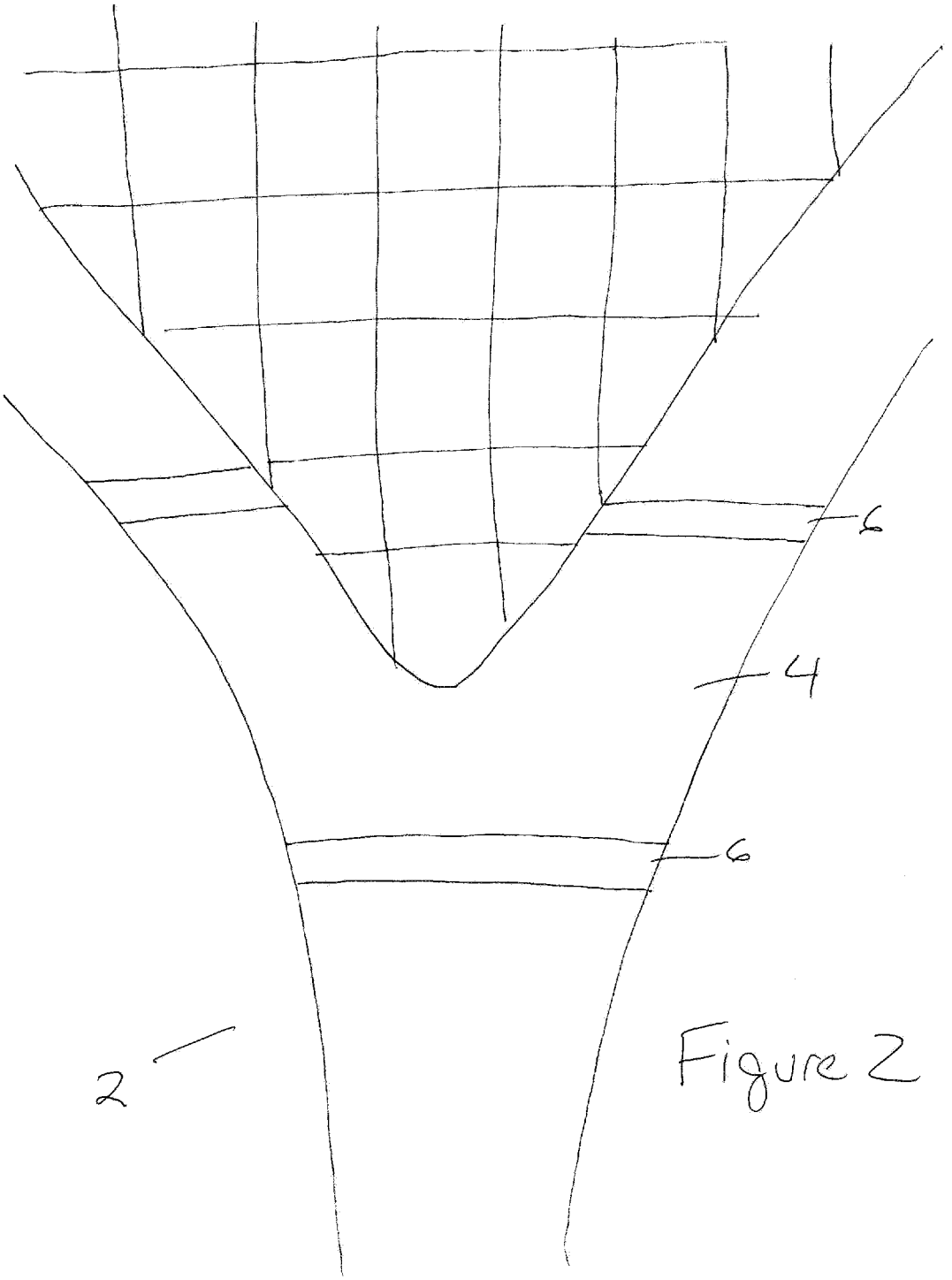


Figure 2

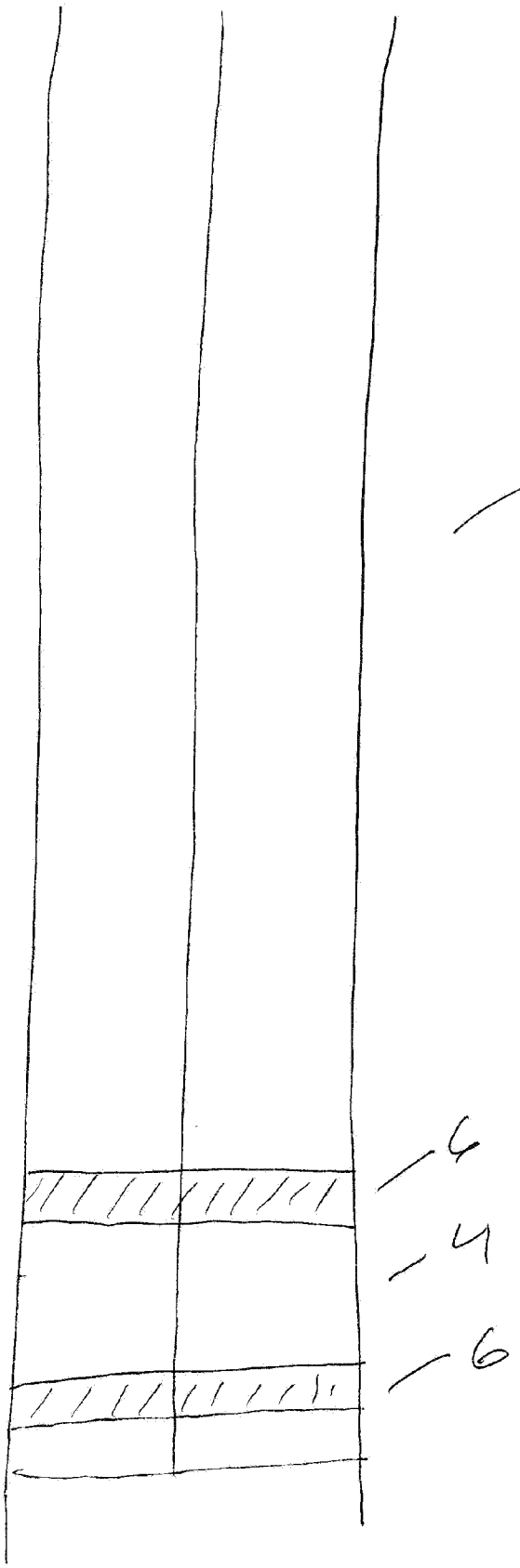


Figure 3

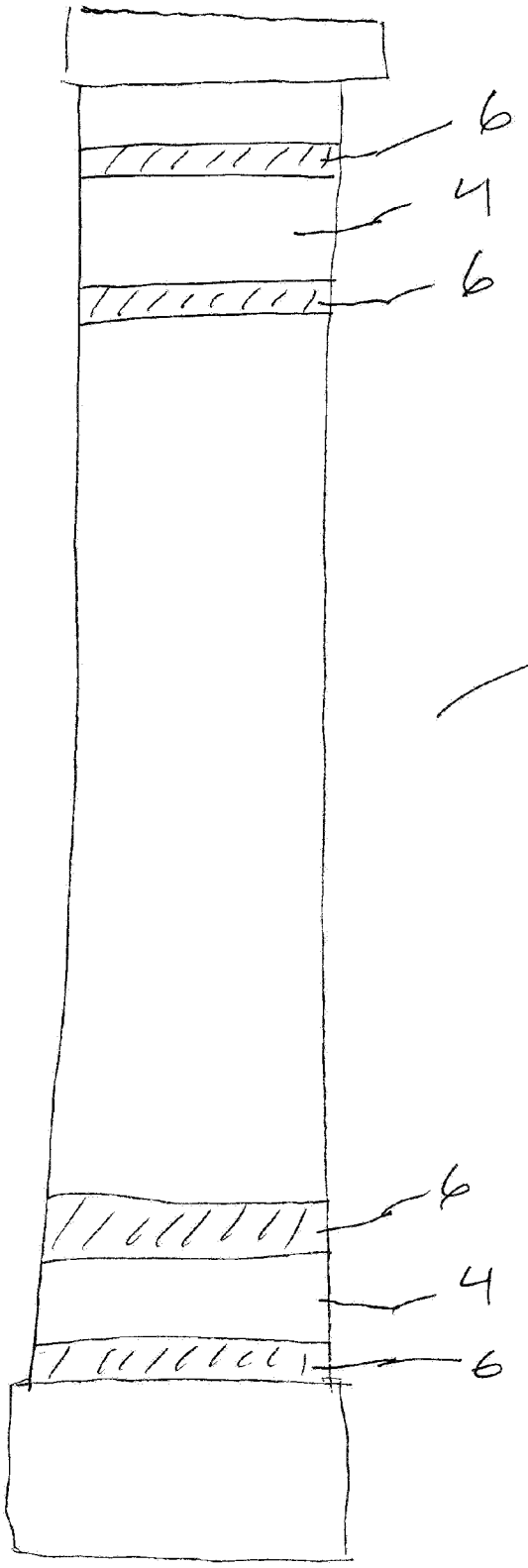


Figure 4

VIBRATION ATTENUATING BALL RACQUET

RELATED APPLICATIONS

[0001] The present application relies upon U.S. Provisional Patent Application Ser. No. 60/954,106, filed Aug. 6, 2007, the contents of which are incorporated herein in their entirety.

TECHNICAL FIELD

[0002] The present apparatus relates to a ball racquet having attenuation properties and in greater detail the present apparatus relates to a tennis racquet having a gel insert for attenuating vibrations.

BACKGROUND

[0003] Over the years, tennis racquets have been designed to hit the ball harder without sacrificing control of the ball when hit. Tennis racquets have been designed with a thicker head to make the racquet stiffer. It is believed that a stiffer racquet enables a player to hit the ball harder and faster. Such a design is shown in EPC 0477533. The tennis racquet has a thick head to reduce the deflection of the head when hitting the ball. It is believed that by reducing the deflection of the head, the power and accuracy imparted on the ball by a player is increased. The increased thickness of the head also reduces the twisting action of the head during play thus increasing the accuracy of play. The tennis racquet disclosed in the EPC patent incorporates a head configuration which increases the stiffness of the head and which resists torsional deformation during play.

[0004] Tennis racquets have also been designed to reduce vibration during play since such vibration adversely affects control of the ball during play. Many different strategies have been used to reduce vibration. These strategies have included the incorporation of vibration dampeners in the head of the racquet and/or on the string of the racquet. Another strategy includes the design of a racquet head which helps to suppress the vibration of the head. One such design is disclosed in U.S. Pat. No. 4,664,380. In such design, the cross-sectional height of the shaft is selected to be greater than the parallel thickness of the frame and the handle and the resonance frequency of to achieve such a resonance frequency, the head of the racquet is designed to be thicker than the handle of the racquet.

[0005] Tennis racquet head designs which have imparted stiffness and/or reduced vibration to the head during play have required the head thickness to be substantially increased. The increased head thickness, however, results in increased resistance during play which results in reduces swing speed and less racquet control especially during rapid racquet movement such as during volleying. In addition, the increased head size shifts the center of gravity of the racquet toward the top of the racquet. This shift in the center of gravity results in less racquet control.

[0006] In view of the state of the art for tennis racquets, there is a need for a racquet which has an improved aerodynamic profile and improved weight distribution to provide increased racquet control and power.

SUMMARY

[0007] The present apparatus includes a ball racquet having a vibration attenuating compound inserted within the frame of the racquet. The attenuating compound comprises a gel formed from an expoxidized vegetable oil. The gel compound can be placed in varying parts of the racquet. Furthermore more than one insert can be placed within the hollow confines of the racquet structure.

DRAWINGS

[0008] In the drawings:

[0009] FIG. **1** is an embodiment of the present invention showing the ball racquet having various points of the gel insert and stops within the hollow handle of the racquet;

[0010] FIG. **2** is a further embodiment having gel inserts in the "Y" portion of the racquet;

[0011] FIG. **3** depicts handle of the racquet or neck portion having gel inserts and stops; and

[0012] FIG. **4** illustrates a further embodiment wherein a plurality of gel inserts and stops are located within the handle of the racquet.

DETAILED DESCRIPTION

[0013] Disclosed is a ball racquet having a vibration attenuating compound inserted within the frame of the racquet. The attenuating compound comprises a gel formed from an expoxidized vegetable oil. The gel compound can be placed in varying parts of the racquet. Furthermore more than one insert can be placed within the hollow confines of the racquet structure.

[0014] The gel compound can be inserted into the tennis racquet using a tube at the base of the tennis racquet. The gel can be placed at different locations within the tennis racquet. The gel can place in more or fewer locations depending upon the performance and cost of production desired. The gel may be held in place within the tennis racquet using foam barriers. Of course other barriers may be used, foam is chosen in this example because of its light weight. The gel may be placed at the top "Y" portion of the racquet as shown in the drawings. Furthermore the gel can them be placed at the top and bottom portion of the grip and gel may be placed in the shaft portion of the racquet. Of course this design may be used for other racquets besides those used for tennis such as racquet ball.

[0015] Polymeric Gel

[0016] The energy absorbing polymeric compound may be comprised of most any polymeric gel. The gel incorporated into the envelope is both viscoelastic and shock-attenuating. An example gel is that disclosed in U.S. Pat. No. 7,041,719, the contents of which are hereby incorporated in their entirety.

[0017] An example gel compound is one that comprises an epoxidized vegetable oil combined with a prepolymer and a thermoplastic polymer. Additionally, a catalyst or an accelerant may be added to the energy absorbing compound to aid in the formation of the compound. Typically the activator or accelerant is a metal activator such as an alkyl tin compound.

[0018] The elastomeric compound includes an epoxidized vegetable oil which can function as a plasticizer. By way of example, the epoxidized vegetable oils can include epoxidized soybean oil, epoxidized linseed oil and epoxidized tall oil. Additional examples of epoxidized vegetable oils include epoxidized corn oil, epoxidized cottonseed oil, epoxidized perilla oil and epoxidized safflower oil. Epoxidized vegetable oils are typically obtained by the epoxidation of triglycerides of unsaturated fatty acid and are made by epoxidizing the reactive olefin groups of the naturally occurring triglyceride oils. Typically, the olefin groups are epoxidized using a peracid. One example of an acceptable epoxidized vegetable oil

is an epoxidized soybean oil, Paraplex G-62, available from C.P. Hall Company of Chicago, Ill. Paraplex G-62 can function as both a plasticizer and a processing aid and is a high molecular weight epoxidized soybean oil on a carrier having an auxiliary stabilizer for a vinyl group.

[0019] The elastomeric composition includes a prepolymer. Various prepolymers may be utilized in the present composition so long as they do not substantially hinder the desired viscoelastic, shock-attenuating attributes of the elastomeric compound. Typically, the prepolymer is an isocyanate.

[0020] The thermoplastic component can include most any thermoplastic compound having elastomeric properties. In one embodiment of the gel, thermoplastic compounds comprising polyurethane are excluded. Acceptable thermoplastic component includes polydienes. An example polydiene includes polybutadiene. Typically, the activator or catalyst is an alkyl tin compound is also added to the gel compound. A specific example of an alkyl tin compound is a dioctyltin carboxylate.

[0021] It is within the scope of the present invention to incorporate other additives such as fillers, pigments, surfactants, plasticizers, organic blowing agents, as stabilizers, and the like, in the manufacture of the reinforced polymeric shock absorbing envelope.

[0022] Referring now in greater detail to the drawings in which like numerals indicate like items throughout the several views, FIGS. **1-4** depict the present racquet in various embodiments of the present invention.

[0023] FIG. **1** is an overview of the racquet **2** having various gel inserts **4** at different locations within the racquet **2** including various stops **6**. One or more of the combinations of gel inserts **4** and stop **6** may be used in a racquet **2**.

[0024] FIG. **2** is a close up view of the "Y" portion of the racquet The gel **4** is placed at the shaft portion of the racquet and extends up through the branches of the "Y". The quantity of gel used depends upon the degree of vibration dampening one desires in a racquet. Thus, gel portion may extend further or be retarded from what is shown in this drawing. Additionally; the gel may be placed solely in the branch portions of the "Y". The gel is again held in place using a stop **6**, which can be formed from most any material capable of holding the gel **4** in place and not affect the attenuation properties of the racquet **2**. For example foam may be used.

[0025] FIG. **3** is a further view of the racquet **2** wherein the gel **4** is inserted into the shaft portion of the racquet. Shown in the drawing is dual hollow shaft racquet but other designs are contemplated such as single shaft racquets. Once again the gel **4** is held in place using foam inserts or stops **6**.

[0026] FIG. **4** illustrates the grip portion of a tennis racquet **2**. Within the grip portion of the racquet there may be placed two gel partitions **4** held in place using foam inserts **6**. One or more gel partitions are contemplated within this racquet.

[0027] While Applicants have set forth embodiments as illustrated and described above, it is recognized that variations may be made with respect to disclosed embodiments. Therefore, while the invention has been disclosed in various forms only, it will be obvious to those skilled in the art that many additions, deletions and modifications can be made without departing from the spirit and scope of this invention, and no undue limits should be imposed except as set forth in the following claims.

What is claimed is:

1. A vibration attenuating ball racquet comprising;

a hollow shaft having a polymeric gel insert therein.

2. The vibration attenuating ball racquet of claim **1**, further including stops holding the gel in place within the racquet.

3. The vibration attenuating ball racquet of claim **1**, wherein the polymeric gel comprises at least greater than 50% by weight of an epoxidized vegetable oil, a thermoplastic polymer; and a prepolymer.

4. The vibration attenuating ball racquet of claim **3**, further including an activator.

5. The vibration attenuating ball racquet of claim **3**, wherein the activator is an alkyl tin compound.

6. The vibration attenuating ball racquet of claim **3**, wherein the epoxidized vegetable oil is selected from the group consisting of soybean oil, linseed oil, and combinations thereof.

7. The vibration attenuating ball racquet of claim **3**, wherein the prepolymer comprises an isocyanate selected from the group of aliphatic, cycloaliphatic, araliphatic, aromatic, heterocyclic polyisocyaniates and combinations thereof.

8. The vibration attenuating ball racquet of claim **1**, wherein the polymeric gel comprises on a percent weight basis of the gel at least greater than about 50% of a vegetable based plasticizer, between about 20% and about 40% of a thermoplastic polymer, and between about 5% and about 20% of a prepolymer.

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