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(54) Tennis racquet.

(57) A racquet for tennis or the like, which comprises a frame with an appended handle with a plurality of guides mounted in spaced relationship along the frame in its plane. Each guide has an outwardly oriented portion concave in a plane normal to the plane of the frame and each guide is constructed of a self-lubricating and shock absorbent material. A string laced around the guides forms a ball impact grid within the frame. In one embodiment the guides are spools positioned between a pair of laterally opposed members forming the frame and in another embodiment the guides are bosses fixed to the outside of the frame with tangential apertures through the frame. In a further embodiment the guides are spools resting in sockets, or in a circumscribing channel, on the frame in its plane.

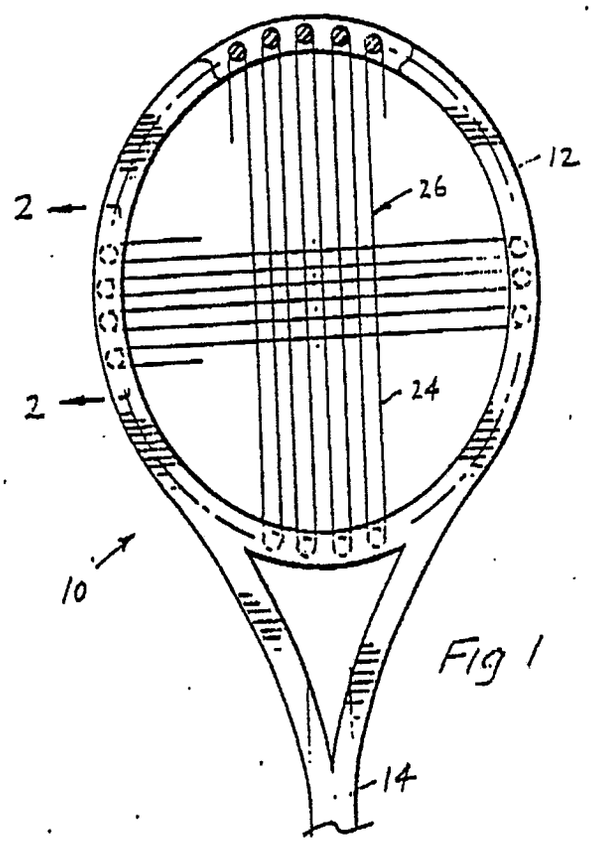

Fig 1

EP 0 345 397 A2

This invention relates to a tennis racquet or the like

Tennis racquets are strung with a single string which is threaded continuously through apertures in the racquet frame to form a grid, in the manner shown for instance in United States Patent No. 3,843,121 issued October 22, 1974 to Thomas B. Edlefson. In such a construction the string is bent at a severe angle where it engages the frame. When the grid is impacted by a ball the string stretches in those portions which are impacted but the tensile force is not distributed through the entire string because the string binds where it engages the frame. Consequently the tension in the string becomes uneven over the whole area of the grid.

To overcome this problem it has been proposed, for instance in U.S. Patent No. 4,591,165 to Sines et al, to provide a rounded portion where the string passes over the frame, allowing the string to slip. As an alternative to slippage Sines provides a rocker element over which the string passes. In each of these embodiments a rigid material is required.

It has been discovered by the applicant that by passing the racquet string over a shock absorbent material certain unexpected advantages are obtained, namely (1) the ball rebounds faster off the string grid, (2) there is less torque on the player's wrist, and (3) there is less deflection of the racquet and therefore less vibration as well as less power required to hit the ball a given distance.

Essentially the invention consists of a racquet for tennis or the like, comprising: a circumferential frame with an appended handle; a plurality of guides mounted on the frame in spaced relationship along the frame in the plane thereof, each guide having at least an outwardly oriented portion concave transversely to the frame and being constructed of a self-lubricating and shock absorbing material; and a string laced over the guides in the concavities thereof to form a ball impact grid within the frame.

In one embodiment the guides are spools positioned between a pair of laterally opposed members forming the frame and in another embodiment the guides are bosses fixed to the outside of the frame with tangential apertures through the frame. In a further embodiment the guides are spools resting in sockets or in a circumscribing channel on the frame in its plane.

Example embodiments of the invention are shown in the accompanying drawings in which:

Figure 1 shows one embodiment of a tennis racquet according to the invention;

Figure 2 is a cross-section taken along line 2-2 of Figure 1;

Figure 3 is an exploded view of the section of the racquet shown in Figure 2;

Figure 4 is a perspective view of the spool and pin arrangement shown in Figure 3;

Figure 5 shows a first alternative embodiment of the invention;

Figure 6 is a partial side view of the racquet of Figure 5 taken in the direction of arrows 6-6;

Figure 7 is a perspective view of that portion of the racquet shown in Figure 6.

Figure 8 shows an attachable boss of the racquet of Figure 5;

Figure 9 shows a second alternate embodiment of the invention;

Figure 10 is an enlarged section of the portion 10 of Figure 9;

Figure 11 is a cross-sectional view taken along line 11-11 of Figure 10;

Figure 12 is a perspective view of the spool of Figures 10 and 11; and

Figure 13 is a variation in the embodiment of the racquet of Figures 9 to 12.

Figure 14 is a further variation in the embodiment of the racquet of Figures 9 to 12;

Figure 15 is an end view of the racquet of Figure 14; and;

Figure 16 is a cross-sectional view taken along line 16-16 of Figure 14.

The embodiment of the invention shown in Figures 1 to 3 of the drawings consists of a tennis racquet 10 having an oval head or frame 12 with an appended handle 14.

Frame 12 comprises a pair of spaced members 16 which are laterally opposed to each other with respect to the plane of the frame and carry between them a plurality of spaced sheaves or guides 18 each comprising a hollow cylindrical spool of self-lubricating and shock absorbent material having a concave circumferential surface 20 with a portion of the concavity being outwardly oriented with respect to the frame and being transverse to the frame. As seen in Figures 3 and 4, guides 18 are mounted for free rotation each on a pin 22 fixed on one frame member 16 and extending normally from that frame member to meet the opposing frame member, the frame members being held together by the pins which press fit into holes 23 and additionally may be glued in the holes.

Frame 12 is strung by lacing a string 24 around each of guides 18 to form a ball impact grid 26.

In use, a ball striking grid 26 will produce shock and tensile forces in string 24 in the area of

impact and the shock will be absorbed by guides 18 while the tension will be transmitted throughout the entire string because the string passes in an uninterrupted curve around guides 18.

The first alternate embodiment shown in Figures 5 to 7 of the drawings consists of a conventional racquet 30 having a solid circumferential frame 32 with an outside surface 34 in the plane of the frame and having spaced passages 35 about its circumference, the passages passing through the frame in the plane thereof to the outside surface. A ring of spaced, semi-cylindrical guides in the form of half sheaves or bosses 36 of self-lubricating and shock absorbent material are carried on surface 34 of racquet 30. Each boss 36 has a concave circumferential surface outwardly oriented with respect to the frame. Also, each boss 36 has a cylindrical diameter equal to the shortest distance between any two passages 35 whereby the passages are substantially tangential to the bosses. As seen in Figure 8, each boss 36 may be a separate element carrying an adhesive protected by an overlying sheet of removable protective material 37 (a peel-off cover) which allows the boss to be fixed on frame 32.

Racquet 30 is prepared for stringing by adhering bosses 36 to outside surface 34 of frame 32 between each two adjacent apertures 35 as seen in Figures 6 and 7. Bosses 36 may be supplied in bulk for this purpose. Thereafter racquet 30 is strung by passing a string 40 through passages 35 and around bosses 36 in the usual manner to form a ball impact grid 42. If desired, bosses 36 can vary in diameter in accordance with the distance between any two passages 35 in order that string 40 will pass through the passages without touching them, thus preventing shock forces from passing into frame 32.

As in the previous embodiment, in use, the shock forces created in the string by a ball striking grid 26 will be absorbed by bosses 36 and the tensile forces will be distributed evenly throughout string 24 because the string passes around bosses 36 and has no angled bend to interfere with such forces.

The second alternate embodiment shown in Figures 8 to 12 of the drawings consists of a racquet 50 having a solid circumferential fram 51 with a plurality of spaced outwardly opening sockets 52 each having sidewalls 54 and a bottom 56 which has a centrally disposed ridge 58 lying in the plane of the frame. A plurality of spaced passages 60 extend through frame 50 about its circumference, one pair of adjacent passages opening into each socket 52. Guides 62, each consisting of a cylindrical spool with a concave circumferential surface 64, rest one in each socket 52 astride ridge 58, the spool being located between adjacent passages 60. A circumferential groove 65 is centrally located in surface 64 of each guide 62. Guides 62 are held in sockets 52 by stringing racquet 50 to have a string 66 pass sequentially around each guide 62. The radius of groove 65 is only slightly larger than the radius of string 66 whereby the string is able to slip along the groove but lateral movement is inhibited. Of course grooves similar to grooves 65 could be carried by guides 20 or bosses 36 in the previously described embodiments, and the grooves could comprise the concavities.

The structure of this second embodiment allows pressure to be passed directly inwardly from guides 62 against frame 51 and also allows rotational movement of the guides.

In the variation shown in Figure 13 an outwardly opening channel 70 is located circumferentially about frame 51 in the plane of the frame. Channel 70 has a pair of opposed side walls 72 and a bottom74 with a centrally disposed longitudinal ridge 76. Guides 62 are held in channel 70 by strings 66 as before.

Guides 18, bosses 36 and guides 62 are each formed of a self-lubricating and shock absorbent material, such as nylon, Teflon (a trade mark) or Delrin (a trade mark) or similar polymeric material, which provides a smooth, low friction and low wear surface. Such material is necessarily different from the material of frame 12 which is chosen to withstand stresses of another type.

It will be appreciated that the invention is applicable to squash racquets or racquets of like construction used in other sports, and the shape of the frame may be other than oval, for example round.

In a further embodiment as shown in Figures 14 and 15 the plurality of guides 36 in Figures 5 to 7 could be replaced by a continuous composite strip 80 resting in a longitudinal, outwardly facing groove 82 in frame 12. Strip 80 comprises an inner element 84 of shock absorbent material and an outer element 86 cradled in the inner element out of contact with frame 12. Inner element 84 may be made of material such as teflon or nylon while outer element 86 may be made of material such as hard plastic. Between pairs of passages 35, element 86 is shaped semi-cylindrically to form guides in the form of bosses 88 preferably each with an outwardly oriented concave circumferential surface 90. In this embodiment shock absorbent inner element 84 cradles outer element 86 which carries strings 40 and separates the outer element from frame 23 of racquet 10. Guides 88 could be formed separately from element 86. Also strip 80 could be set on the outer periphery of frame 12 without the existence of groove 82.

Claims

1. A racquet for tennis or the like, comprising:
a circumferential frame with an appended handle;
a plurality of guides mounted in spaced relationship along the frame in the plane thereof, each guide having at least an outwardly oriented portion concave transversely to the frame, each guide being constructed of a self-lubricating and shock absorbent material; and
a string laced around the guides in the concavities thereof to form a ball impact grid within the frame.

2. A racquet as claimed in claim 1 in which each guide is formed of a polymeric material.

3. A racquet as claimed in claim 1 in which the frame comprises a pair of laterally opposed members having the guides positioned between the members.

4. A racquet as claimed in claim 3 in which the guides are freely rotatable spools, each spool having a concave circumferential surface.

5. A racquet as claimed in claim 4 in which a plurality of pins interconnect the opposed members of the frame and the spools are freely rotatable one on each pin.

6. A racquet as claimed in claim 1 in which the frame has a plurality of spaced passages passing therethrough in the plane thereof, the guides being semi-cylindrical bosses fixed on the outside surface of the frame between each pair of adjacent passages whereby the passages are substantially tangential thereto, each boss having a concave semi-circumferential surface.

7. A racquet as claimed in claim 1 in which the frame includes a plurality of outwardly opening sockets spaced circumferentially along the frame in the plane thereof, a pair of spaced passages in the frame opening into each socket, the guides comprising a plurality of spools each having concave circumferential surfaces, the spools resting one in each of said sockets and between each pair of adjacent passages opening into said socket.

8. A racquet as claimed in claim 7 in which the bottom of each socket has a centrally disposed ridge in the plane of the frame, each spool resting astride the ridge.

9. A racquet as claimed in claim 1 in which the frame includes an outwardly opening channel located circumferentially along the frame in the plane thereof and a plurality of pairs of spaced passages in the frame opening into the channel, the guides comprising a plurality of spools with concave circumferential surfaces located one between each pair of adjacent passages.

10. A racquet as claimed in claim 9 in which the channel has a pair of opposed side walls and a bottom, the bottom having a centrally disposed longitudinal ridge, each spool resting astride the ridge.

11. A racquet as claimed in claim 1 in which the outwardly oriented concave portion of each of the guides comprises a centrally located groove lying in the plane of the frame and having a radius slightly larger than the radius of the string.

12. For use in a tennis racquet or the like having a frame comprising a pair of laterally opposed members, a plurality of spools positionable for free rotation between the members in spaced relationship along the frame and circumferentially concave in a plane normal to the plane of the frame, each guide being constructed of a self-lubricating and shock absorbent material.

13. A guide as claimed in claim 12 in which each guide is formed of a polymeric material.

14. A guide as claimed in claim 12 in which the concavity surface comprises a centrally located circumferential groove having a radius slightly larger than the radius of the string.

15. For use in a tennis racquet or the like having a frame with a plurality of spaced passages passing therethrough in the plane thereof, a guide fixable to the frame on the outside surface thereof between each two adjacent passages whereby the passages are substantially tangential thereto, each guide comprising a semi-cylindrical boss having a concave semi-circumferential surface and a flat base, each guide being constructed of a self-lubricating and shock absorbent material.

16. A guide as claimed in claim 15 in which each guide is formed of a polymeric material.

17. A guide as claimed in claim 15 in which the flat base carries an adhesive with an overlying sheet of removable protectable material.

18. A guide as claimed in claim 15 in which the concave surface of the boss comprises a centrally located semi-circumferential groove having a radius slightly larger than the radius of the string.

19. For use in a tennis racquet or the like having a frame with a plurality of spaced passages passing therethrough in the plane thereof and a plurality outwardly opening sockets spaced circumferentially along the frame in the plane thereof with a pair of spaced passages opening into each socket, a guide comprising a spool having a concave circumferential surface receivable in the socket between the passages.

20. A guide as claimed in claim 19 in which the concave surface of the guide comprises a centrally located circumferential groove having a radius slightly larger than the radius of the string.

21. A racquet for tennis or the like, comprising:
a circumferential frame with an appended handle;
a strip resting on the outer periphery of the frame in the plane thereof, the strip comprising an inner element of shock absorbent material and an outer element having a plurality of outwardly oriented guides positioned one between each pair of passages in the frame; and
a string laced around the guides to form a ball impact grid within the frame.

22. A racquet as claimed in claim 21 in which the frame has an outwardly facing longitudinal groove in the plane thereof, the strip resting in the groove.

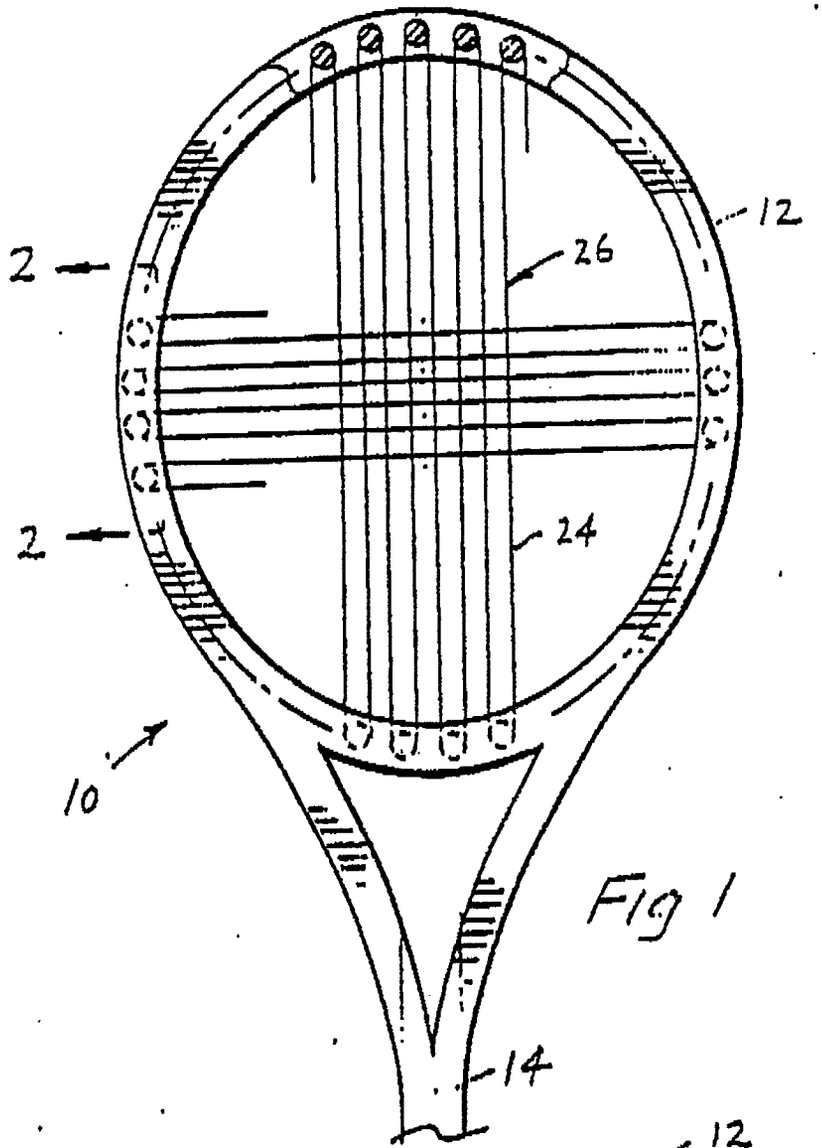

Fig 1

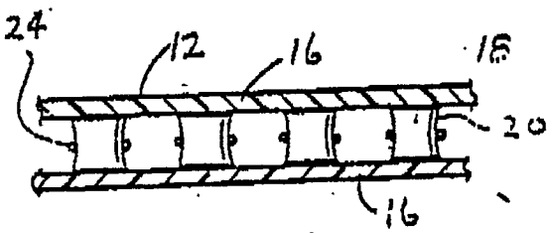

Fig 2

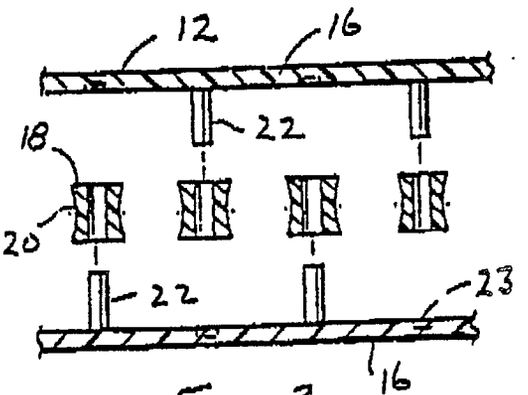

Fig 3

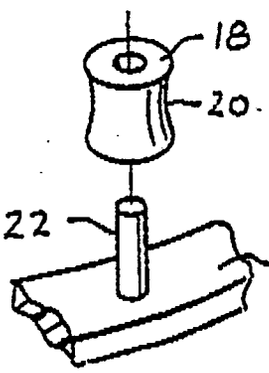

Fig 4

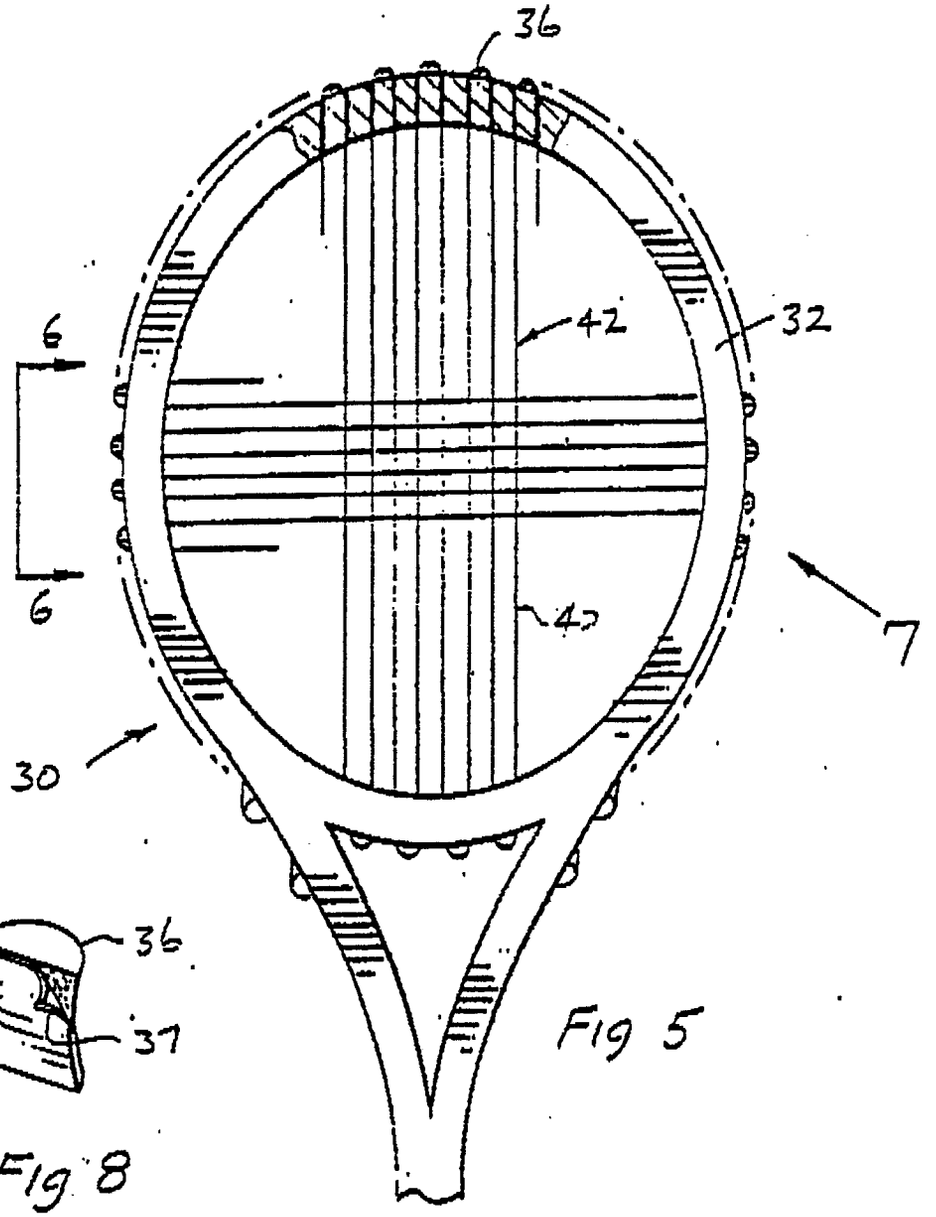

Fig 5

Fig 8

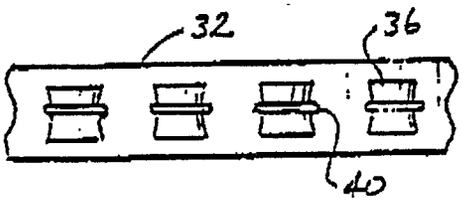

Fig. 6

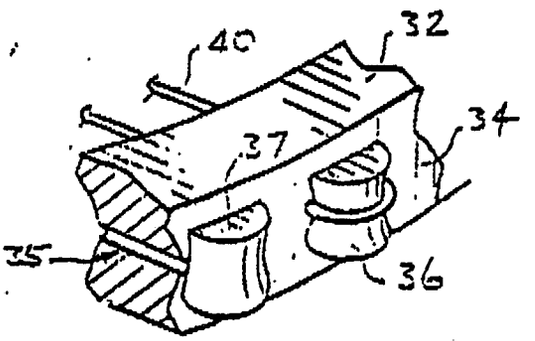

Fig 7

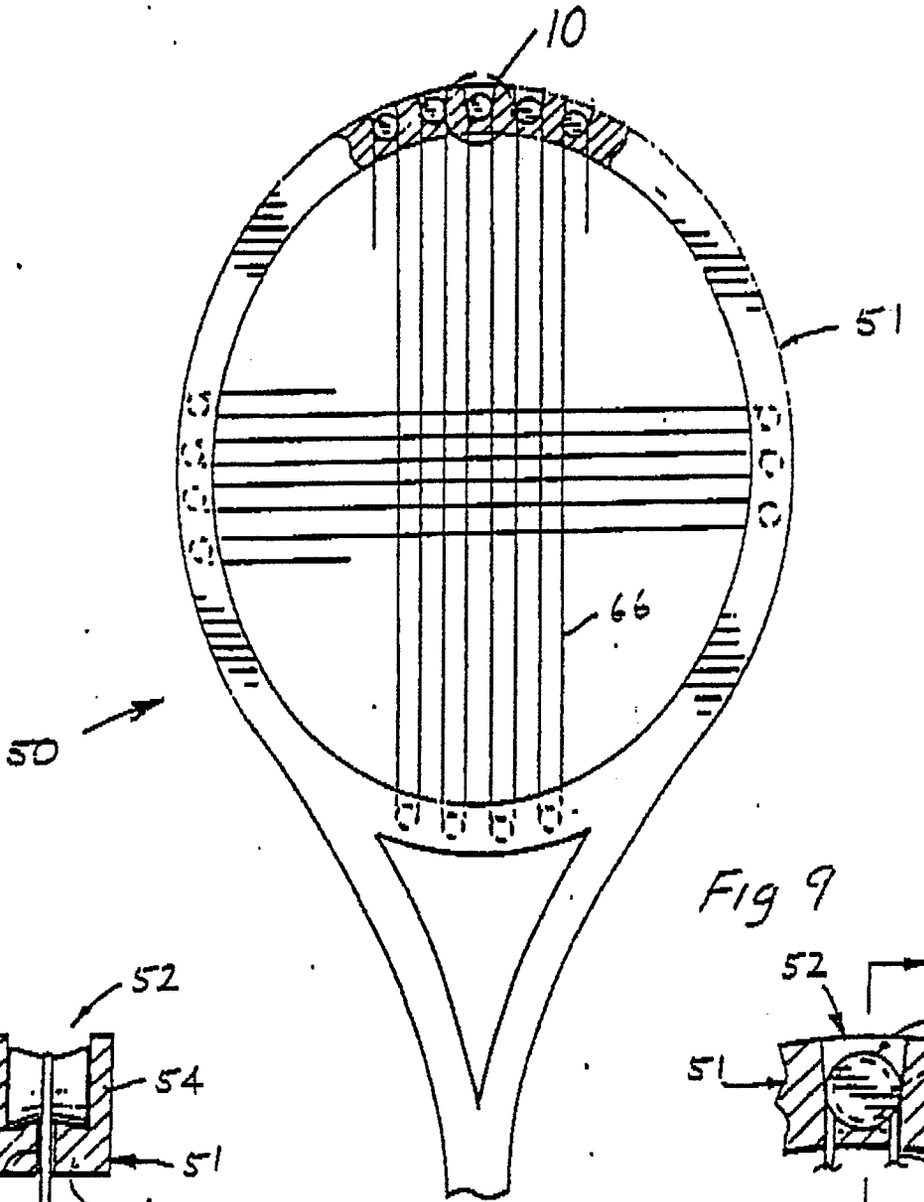

Fig 9

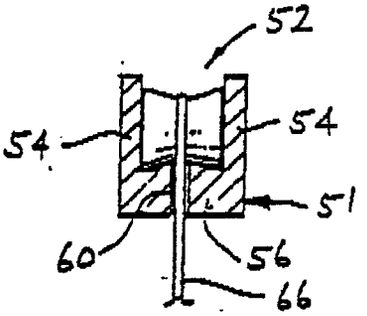

Fig 11

Fig 10

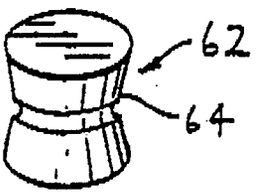

Fig 12

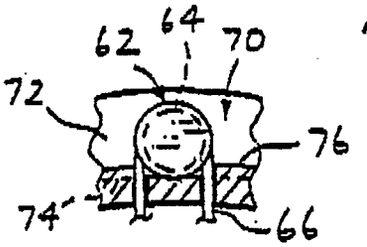

Fig 13

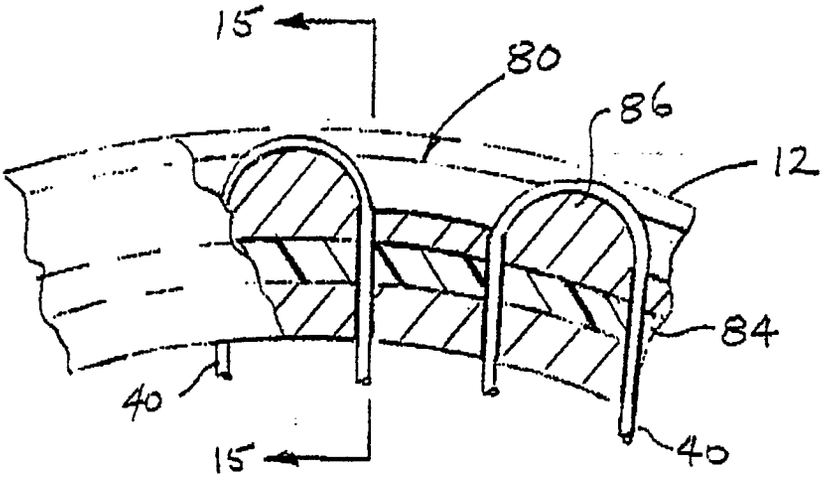

FIG. 14

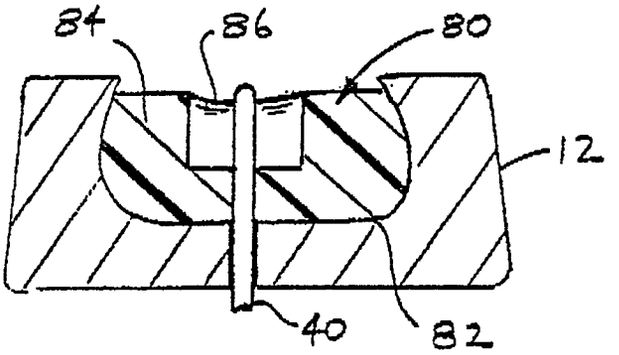

FIG. 16

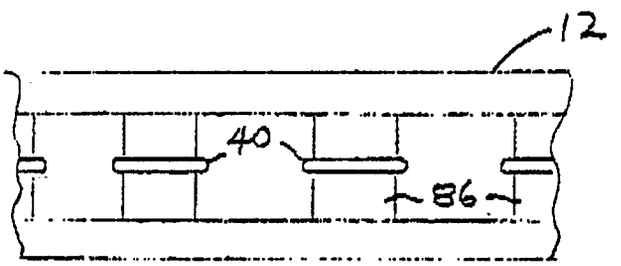

FIG. 15