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**A sports racket frame.**

A sports racket frame comprises a head portion, a throat portion (14) extending outwardly from the head portion, a handle portion (16), and an outer envelope (30) formed from a plurality of long fibrous elements pre-soaked in a thermosetting resin. The outer envelope comprises fibrous cleavages (or slits) (52) located in a predetermined area of the handle portion to obstruct shock wave transmission from the head portion to the handle portion of the racket frame. The cleavages cut through between 5% and 95% of the total number of fibres of the predetermined area of the handle portion.

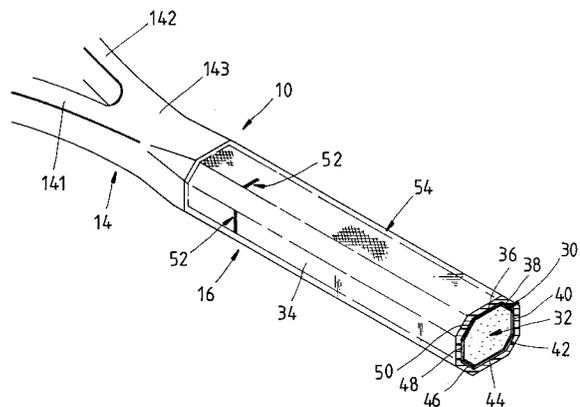


FIG. 2

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The present invention relates to a tennis racket, a squash racket, and a badminton racket, and more particularly to a sports racket made of a fiber reinforced composite material capable of minimizing the shock exerting on the hand of a player using the sports racket.

Generally speaking, a sports racket of conventional type made of a fiber reinforced composite material comprises an outer envelope of a fiber reinforced plastic. In the process of making such a sports racket as mentioned above, the outer envelope is formed by means of placing the intertwined fabric boards containing long fibers and thermosetting resin into a mold. As a result, the head portion and the handle portion of the racket are similar in terms of their cross-sectional structures. In view of a shock-transmitting system, the structural uniformity of the head portion and the handle portion, which are made into a unitized body, is responsible for an easy transmission of shock with a minimum of obstruction. It is readily apparent that the shock generated by an impact of a ball on the ball-hitting surface of the racket described above is subject to transmitting easily from the head portion to the handle portion and then on to the hand which holds the racket.

In order to find a solution to the problem described above, a number of inventions have been developed and disclosed. For example, the inventor of Taiwan Patent No. 78201997 discloses a sports racket having means to prevent the shock of striking a ball from transmitting to the handle. However, the constructional complexity of this invention makes it impractical from the standpoint of manufacture thereof and also results in a great deal of compromise of shock-absorbing effect thereof.

A sports racket having a shock-absorbing means of elastic sponge is suggested by the inventor of Taiwan Patent No. 75210508. This disclosure emphasizes the use of spongy pieces of a high elasticity, which are inserted into the strings forming the ball-hitting surface so as to absorb the shock generated on the strings. However, the arrangement as such does not serve to mitigate the shock exerting on the racket frame.

The Taiwan Patent No. 78210299 discloses a sports racket having a frame structure capable of obstructing the transmission of shock, in which a plurality of grooves are constructed on the handle portion of the racket. Each of the grooves is covered with a shock-absorbing strap, which serves to hinder the shock wave. In fact, the transmission of the shock wave from the head frame to the grip portion can not be effectively averted by means of a structure of such design as disclosed in this invention.

Additionally, the Taiwan Patent No. 78211558 discloses an improved structure for use in absorb-

ing the shock exerting on a sports racket, which is characterized in that the edge of inner circumference of the head frame comprises a plurality of grooves, which are made into a unitized body of the head frame. A shock-absorbing rib bar is embedded in each of the grooves. It must be pointed out that the shock generated on the strings traversing the shock-absorbing rib bar can be effectively absorbed. However, the shock generated on those strings which do not traverse the shock-absorbing rib bar is not effectively mitigated. In addition, the inventor of this disclosure ignores the fact that the structural design as suggested results in a technical difficulty of stretching the strings across the head frame of the racket.

As far as a sports racket having an outer envelope of fiber-reinforced plastic material is concerned, an effective method used to obstruct the transmission of the shock wave from the head frame to the handle portion of the racket has not been introduced so far.

It is, therefore, the primary objective of the present invention to provide a sports racket with a frame having a multi-layered structure made of fiber-reinforced composite material as the outer envelope thereof, which is capable of effectively mitigating the shock exerting on the hand of a player.

It is another objective of the present invention to provide a sports racket with a frame of fiber-reinforced plastic material, which is capable of effectively obstructing the shock wave transmission from the ball-hitting surface of the racket to the hand of a player using the racket.

It is still another objective of the present invention to provide a sports racket with a frame capable of absorbing the shock, which is generated on the ball-hitting surface upon being impacted by a ball and is subsequently transmitted to the hand of a player.

It is still another objective of the present invention to provide a sports racket with a frame whose rigidity and elasticity can be adjusted, in accordance with requirements of players, during the process of manufacture thereof.

In keeping with the principles of the present invention, the primary objectives of the present invention are accomplished by a sports racket having a frame, which comprises a head portion defining the ball-hitting surface and a shaft connected with the head portion at one end thereof. The frame further comprises an outer envelope, which is formed by a plurality of long cloths of fibrous fabric pre-soaked in a thermosetting resin and which is characterized in that it includes thereon a certain number of fibrous cleavages located on an area of the handle portion away from one end of the head portion at a predetermined distance. The fibrous

number of all fibrous cleavages must be in a pre-determined proportion to total fibrous number of the area of outer envelope wherein the fibrous cleavages are constructed. The fibrous cleavages serve to obstruct effectively the shock wave transmission from the head portion to the handle. As a result, the shock exerting on the hand of a player is greatly lessened.

The sum of fibrous number of all fibrous cleavages is proportional to the total fibrous number of the handle portion of outer envelope. Therefore, the ratio between the sum of fibrous number of all fibrous cleavages and the total fibrous number of the handle portion of outer envelope can be adjusted in accordance with a specific requirement. For example, if a greater rigidity and a greater striking force of a sports racket are called for, the ratio of the sum of fibrous number of all fibrous cleavages can be reduced accordingly. On the contrary, if a sports racket is intended for use by a beginner, a girl, or a child, the ratio of the fibrous cleavages can be increased. Generally speaking, the ratio between sum of fibers of fibrous cleavages and sum of fibers of the handle portion of outer envelope is 5%-95%.

The sports racket frame embodied in the present invention is characterized by a covering layer encasing the area of outer envelope where fibrous cleavages are constructed. The covering layer of a polymeric material or a fiber-reinforced plastic material serves to absorb the residue of shock wave.

The sports racket frame embodied in the present invention is further characterized by a certain number of inlays embedded in the area wherein the fibrous cleavages are constructed. The inlays, which are made of metal, wood, elastic plastic, fiber-reinforced plastic, etc., are used to absorb the shock and to reinforce the strength of the area wherein they are lodged.

The sports racket frame embodied in the present invention is still further characterized by a certain number of receiving slots constructed in the area of outer envelope wherein the fibrous cleavages are arranged. The receiving slots are used to accommodate the inlays securely in place.

The invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:-

FIG. 1 shows a three-dimensional view of a sports racket frame embodied in the present invention.

FIG. 2 shows a three-dimensional view of a portion of the first preferred embodiment of the present invention.

FIG. 3 shows a cross-sectional view of the second preferred embodiment of the present invention.

FIG. 4 shows a three-dimensional view of a portion of the third preferred embodiment of the present invention.

FIG. 5 shows an exploded view of a portion of the third preferred embodiment of the present invention.

FIG. 6 shows a cut-away view of a portion taken along line 6-6 as shown in FIG. 4.

FIG. 7 shows a cut-away view of a portion taken along line 7-7 as shown in FIG. 4.

Referring to FIG. 1, the sports racket frame 10 embodied in the present invention is shown comprising an oval head portion 12, a throat portion 14 including two branch arms 141 and 142 and a throat bottom 143. The handle portion 16 is coupled with the throat bottom 143.

The racket frame 10 embodied in the present invention further comprises an outer envelope 30, which is formed by heating and molding a plurality of the pre-oriented and intertwined cloths of carbonaceous fiber pre-soaked in the epoxy resin. The outer envelope 30 encases a foam core 32.

As shown in FIG. 2 illustrating the first embodiment of the present invention, the outer envelope 30 includes a concave area 34 constructed in the handle portion 16. The concave area 34 is octagonal in cross section thereof and is therefore composed of eight rectangular surfaces 36, 38, 40, 42, 44, 46, 48, and 50. Located on each of first, third, fifth, and seventh rectangular surfaces 36, 40, 44, and 48 is a fibrous cleavage 52 perpendicular to the axial center of the throat portion 14. These four fibrous cleavages 52 so constructed are not situated on the same plane. As far as the first embodiment of the present invention is concerned, the sum of fibrous number of all fibrous cleavages 52 (i.e. the number of fibres which have been cleaved) is about 50% of the total fibrous number (i.e. number of fibres) of the concave area 34. The shock wave, which is generated on the ball-hitting surface 22 and is subsequently transmitted along the head portion 12 and the throat portion 14, is effectively obstructed and mitigated in the concave area 34 before reaching the handle portion 16. As a result, the shock exerting on the hand holding the handle portion 16 is effectively minimized. In addition, the sports racket frame 10 of the first embodiment of the present invention comprises a covering layer 54, which is made of polymer and is used to encase the concave area 34 so as to absorb the residual shock wave and to reinforce the strength of the concave area 34.

Now referring to FIG. 3, the second preferred embodiment of the present invention is shown comprising a circular recess 53 with eight rectangular surfaces 55 therearound. Located on each of the first, the third, the fifth and the seventh rectangular surfaces is a fibrous cleavage 57, wherein an

inlay rod 56 is lodged. The inlay rod 56 is encased with a covering layer 59 in order to give the circular recess 53 an added rigidity. The inlay rod 56 may be made of a fiber-reinforced plastic material, a metal, a wood, an elastic plastic, or a ceramic material.

The third preferred embodiment of the present invention is illustrated in FIGS. 4-7. A circular recess 60 is constructed in the portion of outer envelope 30 located at the junction between the throat bottom 143 and the handle portion 16. The circular recess 60 has an octagonal cross section having eight adjacent rectangular surfaces 62, 64, 66, 68, 70, 72, 74, and 76. Located in each of the first, the third, the fifth, and the seventh rectangular surfaces 62, 66, 70, and 74 is a receiving slot 78 of a predetermined depth parallel to the axial center of the throat portion 14. In addition, each of the rectangular surfaces 62, 66, 70, and 74 comprises therein a fibrous cleavage 80 of a predetermined length. It must be noted that fibrous cleavages 80 of rectangular surfaces 62, 66, 70, and 74 are of different lengths and are arranged randomly on the different planes. The sum of fibrous number of the fibrous cleavages 80 is preferably about 40% of the total fibrous number of the circular recesses 60. In addition, a shock-absorbing rod 82 made of an elastic plastic is embedded in each receiving slot 78 of the first and the fifth rectangular surfaces 62 and 70. A reinforced rod 84 made of a fiber-reinforced plastic is lodged in each receiving slot 78 of the third and the seventh rectangular surfaces 66 and 74. Finally, the outer envelope 30, which has been so constructed as described above, is placed in an injection mold wherein a composite material containing short fibers and epoxy resin is used to form covering layers 86 encasing the circular recesses 60.

As a result, about 40% of fibers forming the outer envelope 30 located at the front end portion of the handle portion 16 have been cleaved so as to obstruct effectively the transmission of the shock wave originating from the ball-hitting surface 22 upon an impact by a ball. The residual shock wave is absorbed by shock-absorbing rods 82 and covering layers 86. Therefore, the shock wave exerting on the hand of a player is effectively reduced to a minimum. Furthermore, the rigidity of the sports racket frame 10 is further enhanced by means of two reinforced rods 84 embedded in circular recesses 60 thereof so as to increase the striking force of the racket against the ball.

#### Claims

1. A sports racket frame comprising a head portion (12) forming a ball-hitting surface, a throat portion (14) extending outwardly from said

head portion, a handle portion (16), and an outer envelope (30) formed by a plurality of long fibrous elements pre-soaked in a thermosetting resin, characterized in that the outer envelope comprises fibrous cleavages (52;57;80) located at a predetermined area of said handle portion, and that the sum of fibrous number of said fibrous cleavages is 5%-95% of the total of fibrous number of the area of said outer envelope wherein said fibrous cleavages are constructed.

2. A sports racket frame in accordance with claim 1, wherein said fibrous cleavages are slits (52;57;80) of various shapes and sizes.
3. A sports racket frame in accordance with claim 1 or 2, further comprising covering layers (54;59;89) made of a predetermined material.
4. A sports racket frame in accordance with claim 1, 2 or 3, wherein said outer envelope includes an area being locations of said fibrous cleavages and being a recess (53;60) of a predetermined depth.
5. A sports racket frame in accordance with claim 4, wherein the area of said outer envelope containing said fibrous cleavages has inlay pieces (56;82,84) embedded therein.
6. A sports racket frame in accordance with claim 5, wherein the area of said outer envelope containing said fibrous cleavages includes therein receiving slots (78) arranged at a predetermined interval.
7. A sports racket frame in accordance with claim 3, wherein said covering layers are made of a polymeric material.
8. A sports racket frame in accordance with claim 5, wherein said inlay pieces are of a resilient material.
9. A sports racket frame in accordance with claim 5, wherein said inlay pieces are of a fibre-reinforced plastics material.
10. A sports racket frame in accordance with claim 5, wherein said inlay pieces are of metal.
11. A sports racket frame in accordance with claim 5, wherein said inlay pieces are of wood.

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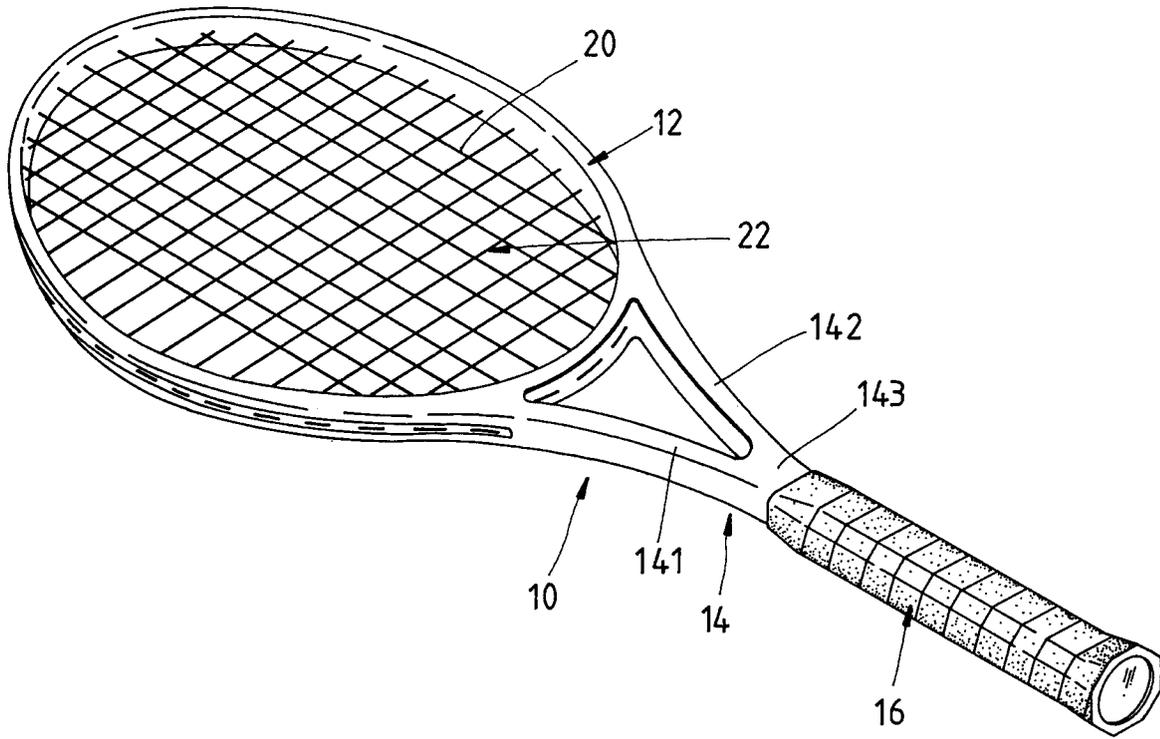


FIG. 1

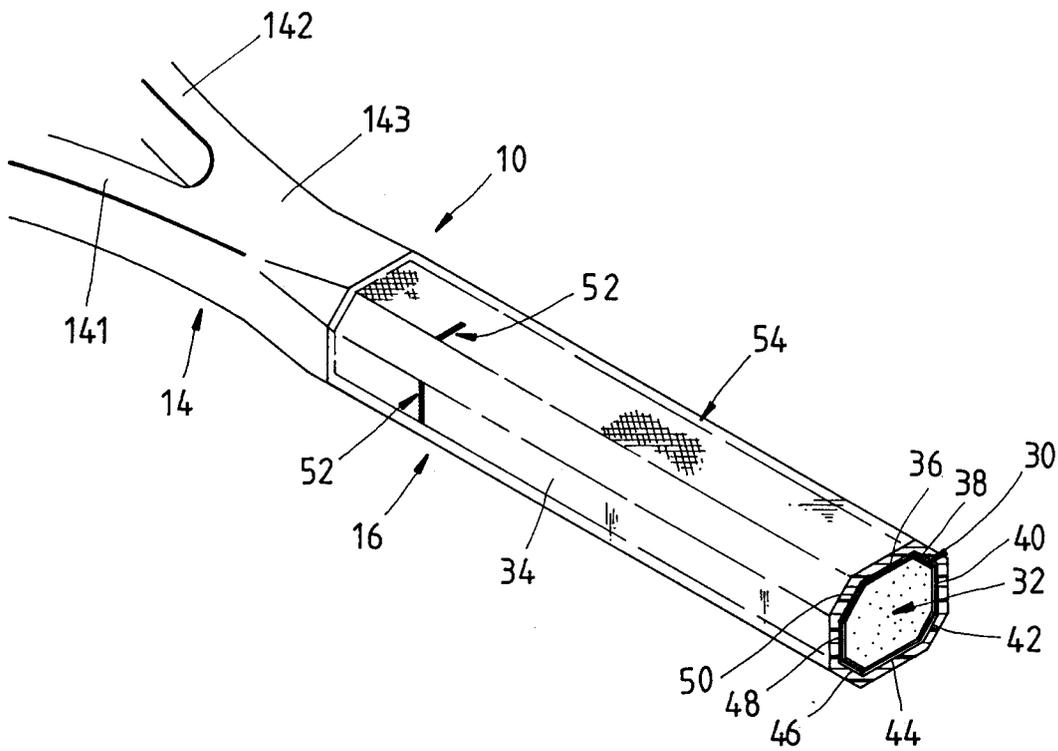


FIG. 2

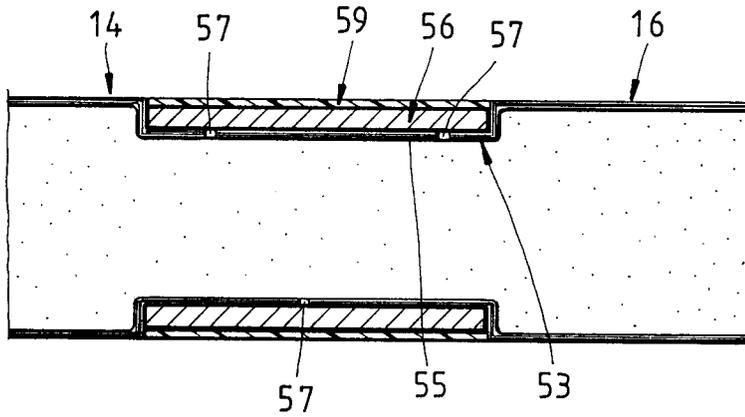


FIG. 3

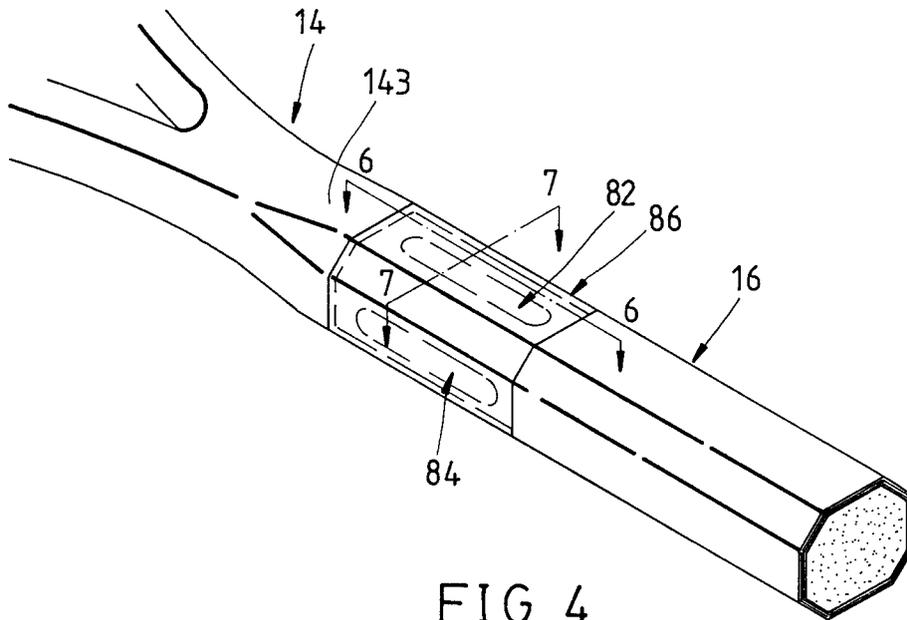


FIG. 4

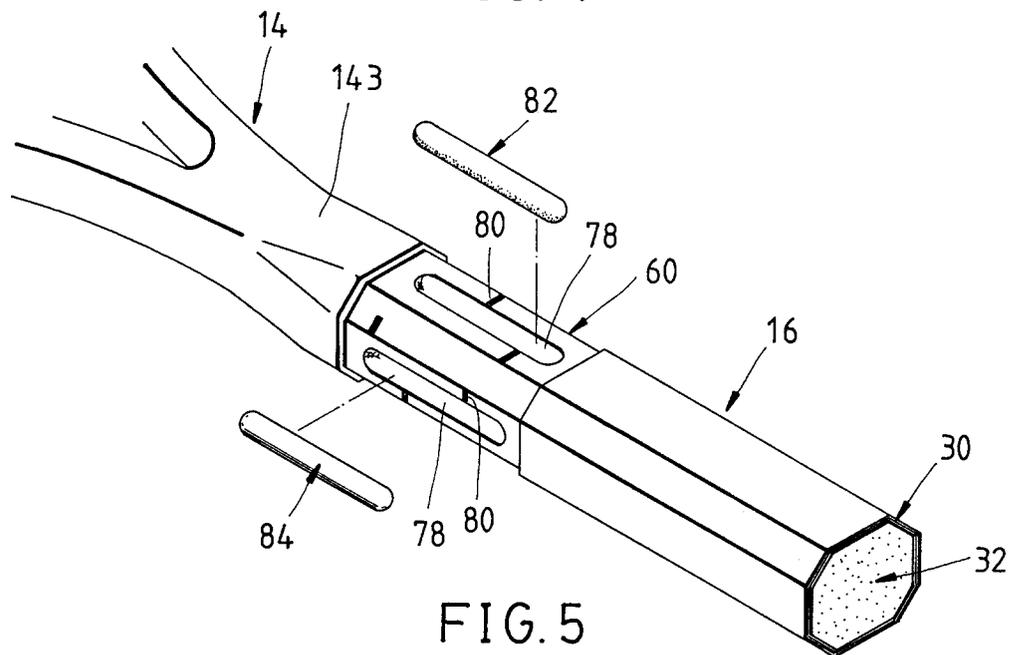


FIG. 5

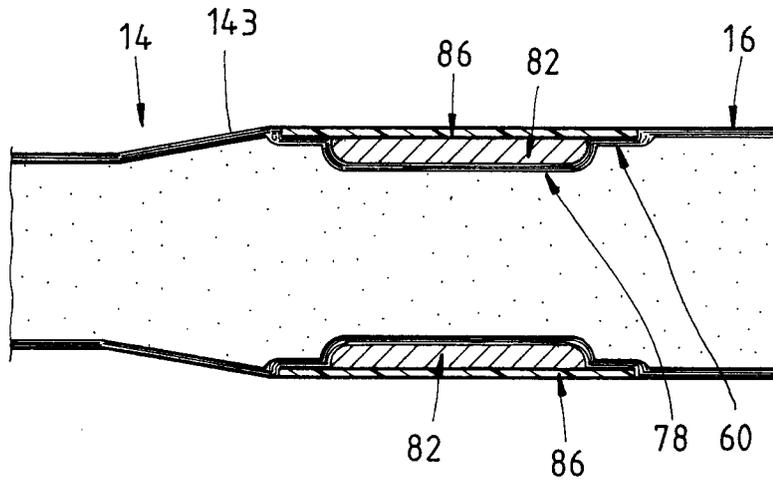


FIG. 6

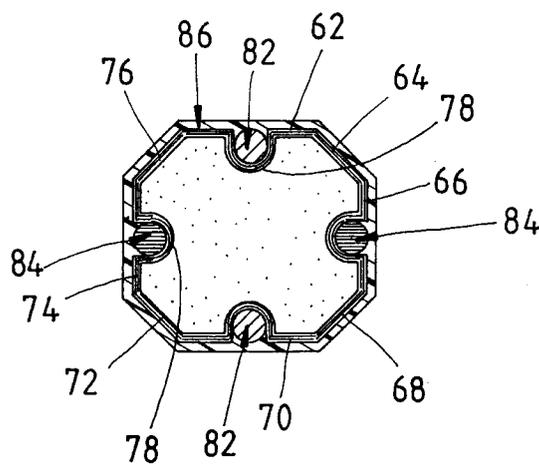


FIG. 7



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 233 128 (SKIS ROSSIGNOL) * claims 1-5; figure 1 * ---	1-3,7	A 63 B 49/00
Y	DE-A-3 101 687 (SOLID) * page 8, line 1 - page 9, line 14; figures 2,4 * ---	1-3,7	
A	EP-A-0 275 805 (SKIS ROSSIGNOL) * column 2, line 49 - column 3, line 22; column 4, lines 48-58; column 5, line 22 - column 6, line 14; figures 6-8 * ---	1,4,5,8	
A	GB-A- 170 717 (PROSSER) * page 2, lines 1-39; figures 1-3 * -----	1,4,5,8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 63 B
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 14-11-1991	Examiner MONNE E. M. B.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	