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(54) **A method for fabricating a sports racquet with string port holes**

Verfahren zur Herstellung eines Sportschlägers mit Öffnungen für die Bespannung

Procédé de fabrication d'une raquette de sport avec des trous pour le cordage

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Description

[0001] The present invention relates to a method for fabricating a sports racquet, which may be, for example tennis, squash, badminton, and racquetball racquets.

[0002] Sports racquets have a head portion containing an interwoven string bed, a handle, and a shaft portion connecting the head portion to the handle.

[0003] In conventional racquets, holes for anchoring the ends of the strings are formed in the frame by drilling small string holes in the frame after the racquet is molded. Generally, each string hole accommodates a single string. Plastic grommet pegs, which are formed on grommet and bumper strips that extend along the outside surface of the frame, extend through the string holes to protect the strings from the sharp edges of the drilled holes.

[0004] Co-owned PCT application WO 2004/075996 discloses a sports racquet in which some adjacent pairs of small string holes along the sides, tip, and throat bridge of the racquet are replaced by enlarged string holes having two inwardly facing string bearing surfaces which are spaced apart by a distance corresponding to the distance between two contiguous main strings or cross strings (referred to herein as "string port holes"). Preferably the frame is formed of a double tube of carbon fiber-reinforced composite material (a so-called graphite frame), in which the string port holes are molded into as the racquet as the racquet is pressure molded. As a result of using two tubes, each forming one-half of the enlarged string hole, the string holes can have rounded edges and do not require the use of grommet pegs or strips. Also, in the regions between string holes, the adjoining walls of the two tubes are fused together to form a stiffening wall inside the frame. The result is a racquet which has improved torsional stiffness and lighter weight. The racquet is made in a mold having a mold cavity in the desired shape of the frame. The mold has two halves. A prepreg tube containing an inflatable bladder is placed in each mold half. A plurality of mold insert members, having an outside surface in the desired shape of the string port holes, as well as a plurality of pins to form conventional string holes, are positioned between the two prepreg tubes and the mold is closed. The bladders are then inflated while the mold is heated to cure the composite resin. After removing the racquet frame from the mold, the mold insert members and pins are removed leaving string port holes and conventional string holes, respectively.

[0005] It is possible to form a racquet with string port holes using a single frame tube. For example, the racquet frame can be molded from a single prepreg tube, with the holes being drilled after molding. However, drilling string holes, and particularly large string holes such as string port holes, weakens the frame. Alternatively, it is possible to construct the frame by molding two frame halves separately, and then joining the two halves, e.g., by gluing, welding, fusing, or electro-fusing. However, it would be desirable to employ improved methods of forming a racquet frame having port string holes and which is formed from a single frame tube.

[0006] German patent application nr. DE3922701A1 describes a method for forming a sports racquet frame according to the preamble of the following claim 1 while US patent nr. US5234657 describes a method for forming a sports racquet frame according to the preamble of the following claim 4.

[0007] Thus, the present invention provides a sports racquet provided with a frame that is made using a prepreg tube containing an inflatable bladder therein. The prepreg tube is placed inside a mold which, when closed, forms a mold cavity in the desired shape of the frame. In one embodiment, the mold cavity contains a plurality of mold members. Each mold member has a first surface to press portions of opposite sides of the prepreg tube into contact with one another, and a second surface in the shape of the sidewall of a string port hole. The second surface is oriented so that a string port hole is formed in the string bed plane in the direction of either main strings or cross strings, depending on its location. The mold members may be an integral part of the mold or may be separate pieces that are placed inside the mold cavity. After the mold is closed, the bladder is pressurized so that the prepreg tube conforms to the shape of the mold as well as the second surface. Thus, the mold member forms string port holes blanks which are blocked by the pressed-together portions of said prepreg tube. At the same time, the mold is heated such that said prepreg tube cures. Thereafter, the pressed-together portions blocking the string port holes are removed so that the string port holes extend through the racquet frame. The portions of the pressed-together portions lying radially outwards of the string port holes form a part of the sidewall of the string port holes after the center sections are removed. Preferably, the string port holes are molded so that the entrances are rounded. If desired, grommet members may be inserted in the string port holes, or the entrances may be shaped to seat O-rings, or the holes may be used without grommet members or O-rings. In another embodiment, the mold members extend completely across a portion of the mold cavity, alternately from the upper or lower mold cavity wall. When the bladder is pressurized, the mold members shape the prepreg tube in a serpentine fashion, forming a plurality of string port holes which are open in a direction perpendicular to said string bed plane alternately in an upward and downward direction. If desired, the upper and lower surfaces of the head portion of the frame may each be covered by a cover ring, which closes the open sides of the string port holes. The cover rings are secured to the frame by any suitable means, such as gluing, welding, co-curing, fusion, or electro-fusion. The string port holes can have any suitable shape, such as elliptical, circular, polygonal, rounded, convex, concave, or irregular. The use of enlarged string holes allows the overall weight of the racquet to be reduced and makes stringing easier. They also improve the performance of the racquet, reduce production

costs, vibration, and shock, and improve comfort.

[0008] Other features and advantages of the invention will become apparent from the following description of preferred embodiments, taken in conjunction with the drawings, in which:

Fig. 1 is a perspective view of a sports racquet frame according to the invention;

Figs. 2a and 2b are top and cross-sectional schematic views of a portion of a mold which may be used to form the racquet frame of Fig. 1;

Fig. 2c shows the Fig. 2b mold with an inflated prepreg tube positioned inside;

Fig. 3 is a front view of a section of a racquet frame after molding;

Figs. 4 and 5 are enlarged sectional views, taken through lines 4-4 of Fig. 3, of the racquet frame after molding and after the string port hole is unblocked, respectively;

Fig. 6 is a side view of a grommet which may be used in the string port holes of the racquet of Fig. 1;

Fig. 7 is an exploded, perspective view of another embodiment of a racquet frame, in which O-rings are inserted in the string port holes;

Fig. 8 is a perspective view of another embodiment of a racquet frame according to the invention;

Fig. 9 is an exploded, perspective view of the frame of Fig. 8 and a pair of cover rings; and

Fig. 10 is a perspective view of the racquet frame of Fig. 9 after the cover rings have been attached.

[0009] Referring to Fig. 1, a tennis racquet frame includes a head portion 10 which includes a throat bridge 12, a pair of converging shafts 14, and a handle portion 16. The head portion 10 includes a plurality of conventional string holes 18 and a plurality of consecutive port string holes 20. A handle (not shown) is mounted on the handle portion 16, and thereafter the handle may be wrapped with a grip.

[0010] As described in greater detail in WO 2004/075996, string port holes on opposite sides of the head 10, as well as opposed port string holes in the tip and throat bridge 12, are offset relative to one another. In this manner, e.g., along the sides, a string segment 22 which bears against the lower bearing surface 24 of one port string hole 20a, after crossing the string bed, bears against the upper bearing surface 26 of the string port hole 20b, wraps around the outside surface of the head 10, and bears against the lower bearing surface 30 of the next adjacent port string hole 20c before again crossing the string bed. Such stringing is used both for the cross strings 22 and the interwoven main strings (not shown). The interwoven main and cross strings form a string bed lying substantially in a string bed plane.

[0011] In a conventional inflation molding process, a prepreg tube, formed of sheets of uncured carbon fiber-reinforced epoxy resin, and containing an inflatable bladder, is placed inside of a mold which, when closed, has a cavity shaped as a sports racquet frame. After closing the mold, the bladder is inflated, so that the prepreg tube assumes the shape of the mold, and the mold is heated so as to cure the epoxy. The frame is then removed and string holes are drilled. The present invention also uses a mold having a cavity in the shape of the racquet frame. However, as shown in Figs. 2a and 2b, the mold 32, which includes mold halves 32a and 32b, includes a plurality of mold members 34. The mold members 34 have a first surface 36 that, when a prepreg tube is placed in the mold and the mold is closed, presses opposite sides of the tube together. The mold members 34 have a second surface 38 which is in the shape of a string port hole 20. As shown, preferably the mold members 34 have a curved base 35, at least in the direction where the strings enter and leave the holes.

[0012] The mold members 34 extend in the string bed plane in the direction of the strings. When the bladder of the prepreg tube is inflated and the material is cured, the opposed surfaces of the prepreg tube below surface 36 remain pressed together and fuse. The surrounding prepreg material 37, however, assumes the shape of the surface 38, as shown in Fig. 2c.

[0013] After curing, the frame is removed from the mold. As shown in Figs. 3-4, the frame will have a plurality of string port hole blanks 40 consisting of the sidewall 42 and the pressed-together portions 44. As shown in Fig. 5, the portions of the pressed together portions 44 which block the string port hole are easily removed so that the string port holes 20 extend through the frame in the plane of the string bed. When the string port hole is opened up, the portion of the pressed together portions 44 lying radially outwards of the port string hole 20 form a wall 46 which becomes part of the sidewall 42 of the port string hole 20.

[0014] Although the port string hole is described as having a single sidewall 42, which is the case if the port string hole 20 has a round, oval, or otherwise curved cross sectional shape, the port string holes 20 may have other shapes such as rectangular in which case they have more than one sidewall. As used herein, however, the term "sidewall" refers to the wall, or the more than one wall, defining the opening of the string port holes 20.

[0015] The entrances to the string port holes 20 can be molded to be rounded, e.g., due to the curved base 35 of the mold member 34, and thus do not require the use of bumper or grommet strips. However, as shown in Fig. 6, if desired grommet members 50 may be provided and inserted into the string port members 20 prior to stringing. The grommet members 50 may be selected to change the weight, balance, and moments of inertia (mass and polar) of the racquet.

[0016] Conventional grommet or bumper strips are preferably used with the conventional string holes, since these are drilled and have sharp edges which could otherwise damage the strings.

[0017] Alternatively, as shown in Fig. 7, the string port holes 201 can be molded so that their entrances form a

seat for O-rings.

[0018] Figs. 8-10 show another embodiment of the invention. As in the case of Figs. 1-7, the racquet frame is formed a single, continuous tube 60 of prepreg material. The frame may also include a throat bridge (not shown). In the mold, the prepreg tube is molded into a serpentine shape forming a plurality of contiguous string port holes 62 which have an open side alternately facing up and down.

[0019] Such frame may be molded in a mold similar to the mold in Figs. 2a-2b except that the mold members 34 are replaced by mold members, depicted schematically by element 64, which extend all the way across the mold cavity, in the direction of the strings, alternately from the upper and lower mold cavity wall.

[0020] Preferably, the entrance to the string port holes 62, i.e., where the strings enter and leave the holes on the outer surface of the frame, are molded to have a guide lip 66, to guide and secure the end of the string entering and leaving the string hole. Also, preferably the string contacting walls 68 of the string port holes 62 are flat and oriented parallel to the string direction and perpendicular to the string bed plane. This has two advantages. First, when a ball impacts the string bed, the string is constrained against movement, on opposite sides of the racquet, only by the guide lips 66. Because the strings are constrained only on the outer side of the racquet frame, their effective length is increased, providing more power. Second, after the ball has left the string bed, the strings will rub against the surfaces 68, which will damp string vibration, providing a more comfortable feel. The racquet frame of Fig. 8 may be used with the open string port holes 62. Alternately, if desired the upper 70 and lower 72 surfaces of the head portion of the frame head portion may be covered by a pair of cover rings 74, as shown in Figures 9-10. The cover rings 74 may be of any desired material, such as aluminum, magnesium, titanium, carbon fiber tube, nano- material, or wood. Also, the cover rings 74 may have any desired cross-sectional shape, e.g., round, square, or semi-circular. The foregoing represent preferred embodiments of the invention. Variations and modifications will be apparent to persons skilled in the art, without departing from the inventive concepts disclosed herein. For example, in the embodiment shown in Figures 9-10, instead of having a cover ring 74 that extends completely around the head portion of the racquet, a plurality of curved ring segments may be used. For example, the racquet may have ring segments that cover only portions of the frame having port holes (e.g., that cover the upper and lower surfaces of the sides, tip, and throat bridge). In the portions of the racquet having conventional string holes, no ring covering would be provided. Or, ring segments can be provided to cover only part of the frame regions containing port holes, e.g., covering only the tip and throat bridge regions, or covering only the sides. All such modifications and variations are intended to be within the scope of the invention, as defined in the following claims.

Claims

1. A method for forming at least a portion of a sports racquet frame having at least one string port hole (20) formed therein and a string bed plane, said string port hole consisting of an enlarged string hole having two inwardly facing string bearing surfaces (24) which are spaced apart by a distance corresponding to the distance between two contiguous main strings or cross strings (22), the method comprising the following steps of:

(a) providing a prepreg tube containing an inflatable bladder therein;
(b) placing said prepreg tube inside a mold which, when closed, forms a mold cavity in the desired shape of at least a portion of said frame, said mold cavity containing at least one mold member (34), said mold member having a first surface and a second surface;
(c) pressurizing said bladder so that said prepreg tube conforms to the shape of the mold and said second surface;
(d) heating said mold such that said prepreg tube cures;
(e) removing the portions of pressed-together portions (44), which block a string port hole so that the string port hole extends through the racquet frame,

characterized in that:

- in said step (b), said first surface (36) presses portions of opposite sides of said prepreg tube substantially into contact with one another, said second surface being in the shape of the sidewall of a string port hole, said second surface being oriented to form a string port hole in said string bed plane in the direction of either main strings or cross strings; and
- in said step (c), said mold member forms thereby a string port hole blank having a sidewall blocked by a portion of the pressed-together portions (44) of said prepreg tube; and
- in said step (e), portions of said pressed together portions (44) are left to lay outside of said string port hole to form a wall (46), which becomes part of the sidewall (42) of said string port hole.

2. A method according to claim 1, **characterized in that** said mold includes a head forming portion, a shaft forming portion, and a handle forming portion, and wherein a single prepreg tube is placed in said head, shaft, and handle forming portions.

3. A method according to claim 1, **characterized in that** said mold cavity contains a plurality of mold

members (34) for forming a plurality of string port holes (20).

4. A method for forming at least a portion of a sports racquet frame having at least one string port hole (62) formed therein and a string bed plane, said string port hole consisting of an enlarged string hole having two inwardly facing string bearing surfaces (68) which are spaced apart by a distance corresponding to the distance between two contiguous main strings or cross strings, the method comprising the steps of:

(a) providing a prepreg tube containing an inflatable bladder therein;
(b) placing said prepreg tube inside a mold which, when closed, forms a mold cavity in the desired shape of at least a portion of said frame, said mold cavity containing at least one mold member (64); and
(c) pressurizing said bladder so that said prepreg tube conforms to the shape of the mold and said mold member; and
(d) heating said mold such that said prepreg tube cures;

characterized in that in said step (b) said mold member is sized and oriented to mold a string port hole (62) through the frame in said string bed plane, said mold member extending across said mold cavity from an upper or lower mold cavity wall, said string port hole being open in a direction perpendicular to said string bed plane.

5. A method according to claim 4, **characterized in that** it further comprises the step of securing a cover member over an open side of said string port hole such that said hole is open through the frame only in said string bed plane.

6. A method according to claim 5, **characterized in that** said mold cavity contains a plurality of mold members (64) for forming a plurality of string port holes (62).

7. A method according to claim 6, **characterized in that** the step of forming a plurality of adjacent string hole ports which are open along one side alternately in opposite directions, wherein said mold members extend alternately from an upper and lower mold cavity wall.

8. A method according to claim 7, **characterized in that** the frame includes a head portion having upper and lower surfaces (70, 72), comprising the step of securing a pair of cover plates (74) over the upper and lower surfaces to cover the open sides of the string port holes.

9. A method according to claim 8, **characterized in that** said mold cavity contains a plurality of mold members for forming a plurality of string port holes.

10. A method according to claim 4, **characterized in that** said mold includes a head forming portion, a shaft forming portion, and a handle forming portion, and wherein a single prepreg tube is placed in said head, shaft, and handle forming portions.

Patentansprüche

1. Verfahren zum Ausbilden mindestens eines Abschnittes eines Sportschlägerrahmens, in dem mindestens eine Saitenaufnahmeöffnung (20) ausgebildet ist und der eine Bespannungsebene aufweist, wobei die Saitenaufnahmeöffnung aus einer vergrößerten Saitenöffnung mit zwei nach innen gerichteten Saitenauflageflächen (24) besteht, die einen Abstand voneinander aufweisen, der dem Abstand zwischen zwei nebeneinander liegenden Hauptsaiten oder Quersaiten (22) entspricht, wobei das Verfahren die folgenden Schritte umfasst:

(a) Bereitstellen eines Prepreg-Rohrs, in dem eine aufweitbare Blase enthalten ist;
(b) Einbringen des Prepreg-Rohrs in eine Form, die, wenn sie geschlossen ist, einen Formhohlraum bildet, der die gewünschte Gestalt mindestens eines Abschnittes des Rahmens aufweist, wobei der Formhohlraum mindestens ein Formelement (34) enthält, wobei das Formelement eine erste Oberfläche und eine zweite Oberfläche aufweist;
(c) Unterdrucksetzen der Blase, so dass das Prepreg-Rohr sich der Gestalt der Form und der zweiten Oberfläche anpasst;
(d) Erwärmen der Form, so dass das Prepreg-Rohr aushärtet;
(e) Entfernen der Abschnitte von aneinander gepressten Abschnitten (44), die eine Saitenaufnahmeöffnung blockieren, damit die Saitenaufnahmeöffnung durch den Schlägerrahmen hindurch geht,

dadurch gekennzeichnet, dass:

- in Schritt (b) die erste Oberfläche (36) Abschnitte von einander gegenüber liegenden Seiten des Prepreg-Rohrs im Wesentlichen in gegenseitigen Kontakt drückt, wobei die zweite Oberfläche die Gestalt der Seitenwand einer Saitenaufnahmeöffnung aufweist, wobei die zweite Oberfläche so ausgerichtet ist, dass sie eine Saitenaufnahmeöffnung in der Bespannungsebene in Richtung entweder der Hauptsaiten oder der Quersaiten bildet; und

- in Schritt (c) das Formelement dadurch einen Raum für die Saitenaufnahmeöffnung bildet, der eine Seitenwand aufweist, und von einem Abschnitt der aneinander gepressten Abschnitte (44) des Prepreg-Rohres blokkiert wird; und
- in Schritt (e) Abschnitte der aneinander gedrückten Abschnitte (44) außerhalb der Saitenaufnahmeöffnung liegen gelassen werden, um eine Wand (46) zu bilden, die Teil der Seitenwand (42) der Saitenaufnahmeöffnung wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Form einen einen Kopf bildenden Abschnitt, einen einen Schaft bildenden Abschnitt und einen einen Griff bildenden Abschnitt aufweist, und wobei ein einziges Prepreg-Rohr in die einen Kopf, einen Schaft und einen Griff bildenden Abschnitte eingebracht wird.

3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Formhohlraum eine Vielzahl von Formelementen (34) aufweist, um eine Vielzahl von Saitenaufnahmeöffnungen (20) auszubilden.

4. Verfahren zum Ausbilden mindestens eines Abschnittes eines Sportschlägerrahmens, in dem mindestens eine Saitenaufnahmeöffnung (62) ausgebildet ist und der eine Bespannungsebene aufweist, wobei die Saitenaufnahmeöffnung aus einer vergrößerten Saitenöffnung mit zwei nach innen gerichteten Saitenauflageflächen (68) besteht, die einen Abstand voneinander aufweisen, der dem Abstand zwischen zwei nebeneinander liegenden Hauptsaiten oder Quersaiten (22) entspricht, wobei das Verfahren die folgenden Schritte umfasst:

(a) Bereitstellen eines Prepreg-Rohrs, in dem eine aufweitbare Blase enthalten ist;
(b) Einbringen des Prepreg-Rohrs in eine Form, die, wenn sie geschlossen ist, einen Formhohlraum bildet, der die gewünschte Gestalt mindestens eines Abschnittes des Rahmens aufweist, wobei der Formhohlraum mindestens ein Formelement (64) enthält, wobei das Formelement eine erste Oberfläche und eine zweite Oberfläche aufweist;
(c) Unterdrucksetzen der Blase, so dass das Prepreg-Rohr sich der Gestalt der Form und der zweiten Oberfläche anpasst; und
(d) Erwärmen der Form, so dass das Prepreg-Rohr aushärtet;

dadurch gekennzeichnet, dass in Schritt (b) das Formelement so bemessen und ausgerichtet wird, dass es eine Saitenaufnahmeöffnung (62) durch den Rahmen in der Bespannungsebene formt, wobei das Formelement sich von einer oberen oder unteren Formhohlraumwand durch den Formhohlraum erstreckt, wobei die Saitenaufnahmeöffnung senkrecht zur Bespannungsebene offen ist.

5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** es ferner den Schritt des Befestigens eines Abdeckelements über einer offenen Seite der Saitenaufnahmeöffnung umfasst, so dass die Öffnung nur in der Bespannungsebene durch den Rahmen offen ist.

6. Verfahren nach Anspruch 5, **dadurch gekennzeichnet, dass** der Formhohlraum eine Vielzahl von Formelementen (64) enthält, um eine Vielzahl von Saitenaufnahmeöffnungen (62) zu bilden.

7. Verfahren nach Anspruch 6, **dadurch gekennzeichnet, dass** der Schritt des Ausbildens einer Vielzahl von nebeneinander liegenden Saitenaufnahmeöffnungen, die an einer Seite offen sind, abwechselnd in einander entgegengesetzten Richtungen wobei die Formelemente abwechselnd von einer oberen und einer unteren Formhohlraumwand ausgehen.

8. Verfahren nach Anspruch 7, **dadurch gekennzeichnet, dass** der Rahmen einen Kopfabschnitt mit oberen und unteren Oberflächen (70, 72) aufweist, den Schritt des Befestigens eines Paares von Abdeckplatten (74) über den oberen und unteren Oberflächen umfasst, um die offenen Seiten der Saitenaufnahmeöffnungen abzudecken.

9. Verfahren nach Anspruch 8, **dadurch gekennzeichnet, dass** der Formhohlraum eine Vielzahl von Formelementen aufweist, um eine Vielzahl von Saitenaufnahmeöffnungen zu bilden.

10. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Form einen einen Kopf bildenden Abschnitt, einen einen Schaft bildenden Abschnitt und einen einen Griff bildenden Abschnitt aufweist, und wobei ein einziges Prepreg-Rohr in die einen Kopf, einen Schaft und einen Griff bildenden Abschnitte eingeführt wird.

Revendications

1. Procédé de formation d'au moins une partie d'un cadre de raquette de sport ayant au moins un orifice de passage de corde (20) formé à l'intérieur et un plan de cordage, ledit orifice de passage de corde consistant en un orifice de corde élargi et ayant deux surfaces de support de corde orientées vers l'intérieur (24) qui sont espacées à une distance correspondant à la distance entre deux cordes verticales ou transversales contiguës (22), le procédé comprenant les étapes suivantes consistant à :

(a) fournir un tube de préimprégné contenant une vessie gonflable à l'intérieur ;
(b) placer ledit tube de préimprégné à l'intérieur d'un moule qui, lorsqu'il est fermé, forme une cavité de moule de la forme désirée d'au moins une partie dudit cadre, ladite cavité de moule contenant au moins un élément de moule (34), ledit élément de moule ayant une première surface et une deuxième surface ;
(c) mettre sous pression ladite vessie de manière à ce que ledit tube de préimprégné s'adapte à la forme du moule et à ladite deuxième surface ;
(d) chauffer ledit moule de sorte que ledit tube de préimprégné durcisse ;
(e) retirer les parties des parties comprimées ensemble (44), qui bloquent un orifice de passage de corde de sorte que l'orifice de passage de corde s'étende à travers le cadre de raquette,

caractérisé en ce que :

- dans ladite étape (b), ladite première surface (36) comprime les parties des côtés opposés dudit tube de préimprégné sensiblement en contact les unes avec les autres, ladite deuxième surface étant de la forme de la paroi latérale d'un orifice de passage de corde, ladite deuxième surface étant orientée pour former un orifice de passage de corde dans ledit plan de cordage dans la direction des cordes verticales ou des cordes transversales ; et
- dans ladite étape (c), ledit élément de moule forme ainsi une découpe d'orifice de passage de corde ayant une paroi latérale bloquée par une partie des parties comprimées ensemble (44) dudit tube de préimprégné ; et
- dans ladite étape (e), des parties desdites parties comprimées ensemble (44) sont laissées à l'extérieur dudit orifice de passage de corde pour former une paroi (46), qui devient une partie de la paroi latérale (42) dudit orifice de passage de corde.

2. Procédé selon la revendication 1, **caractérisé en ce que** ledit moule comprend une partie formant la tête, une partie formant le cadre, et une partie formant le manche, et où un seul tube de préimprégné est placé dans lesdites parties formant la tête, le cadre, et le manche.

3. Procédé selon la revendication 1, **caractérisé en ce que** ladite cavité de moule contient une pluralité d'éléments de moule (34) pour former une pluralité d'orifices de passage de corde (20).

4. Procédé de formation d'au moins une partie d'un cadre de raquette de sport ayant au moins un orifice de passage de corde (62) formé à l'intérieur et un plan de cordage, ledit orifice de passage de corde consistant en un orifice de corde élargi ayant deux surfaces de support de corde orientées vers l'intérieur (68) qui sont espacées par une distance correspondant à la distance entre deux cordes verticales ou transversales contiguës, le procédé comprenant les étapes consistant à :

(a) fournir un tube de préimprégné contenant une vessie gonflable à l'intérieur ;
(b) placer ledit tube de préimprégné à l'intérieur d'un moule qui, lorsqu'il est fermé, forme une cavité de moule de la forme désirée d'au moins une partie dudit cadre, ladite cavité de moule contenant au moins un élément de moule (64), et
(c) mettre sous pression ladite vessie de manière à ce que ledit tube de préimprégné s'adapte à la forme du moule et audit élément de moule ; et
(d) chauffer ledit moule de sorte que ledit tube de préimprégné durcisse ;

caractérisé en ce que dans ladite étape (b) ledit élément de moule est dimensionné et orienté de manière à mouler un orifice de passage de corde (62) à travers le cadre dans ledit plan de cordage, ledit élément de moule s'étendant transversalement à ladite cavité de moule à partir d'une paroi de cavité de moule supérieure ou inférieure, ledit orifice de passage de corde étant ouvert dans une direction perpendiculaire audit plan de cordage.

5. Procédé selon la revendication 4, **caractérisé en ce qu'**il comprend en outre l'étape de fixation d'un élément de revêtement sur un côté ouvert dudit orifice de passage de corde de sorte que ledit orifice soit ouvert à travers le cadre uniquement dans ledit plan de cordage.

6. Procédé selon la revendication 5, **caractérisé en ce que** ladite cavité de moule contient une pluralité d'éléments de moule (64) pour former une pluralité d'orifices de passage de corde (62).

7. Procédé selon la revendication 6, **caractérisé en ce que** l'étape de formation d'une pluralité d'orifices de passage de corde adjacents qui sont ouverts le long d'un côté alternativement dans des directions opposées, où lesdits éléments de moule s'étendent alternativement à partir d'une paroi de cavité de moule supérieure et inférieure.

8. Procédé selon la revendication 7, **caractérisé en ce que** le cadre comprend une partie de tête ayant des surfaces supérieure et inférieure (70,72), comprenant l'étape de fixation d'une paire de plaques de

revêtement (74) sur les surfaces supérieure et inférieure pour recouvrir les côtés ouverts des orifices de passage de corde.

9. Procédé selon la revendication 8, **caractérisé en ce que** ladite cavité de moule contient une pluralité d'éléments de moule pour former une pluralité d'orifices de passage de corde.

10. Procédé selon la revendication 4, **caractérisé en ce que** ledit moule comprend une partie formant la tête, une partie formant le cadre, et une partie formant le manche, et où un seul tube de préimprégné est placé dans lesdites parties formant la tête, le cadre, et le manche.

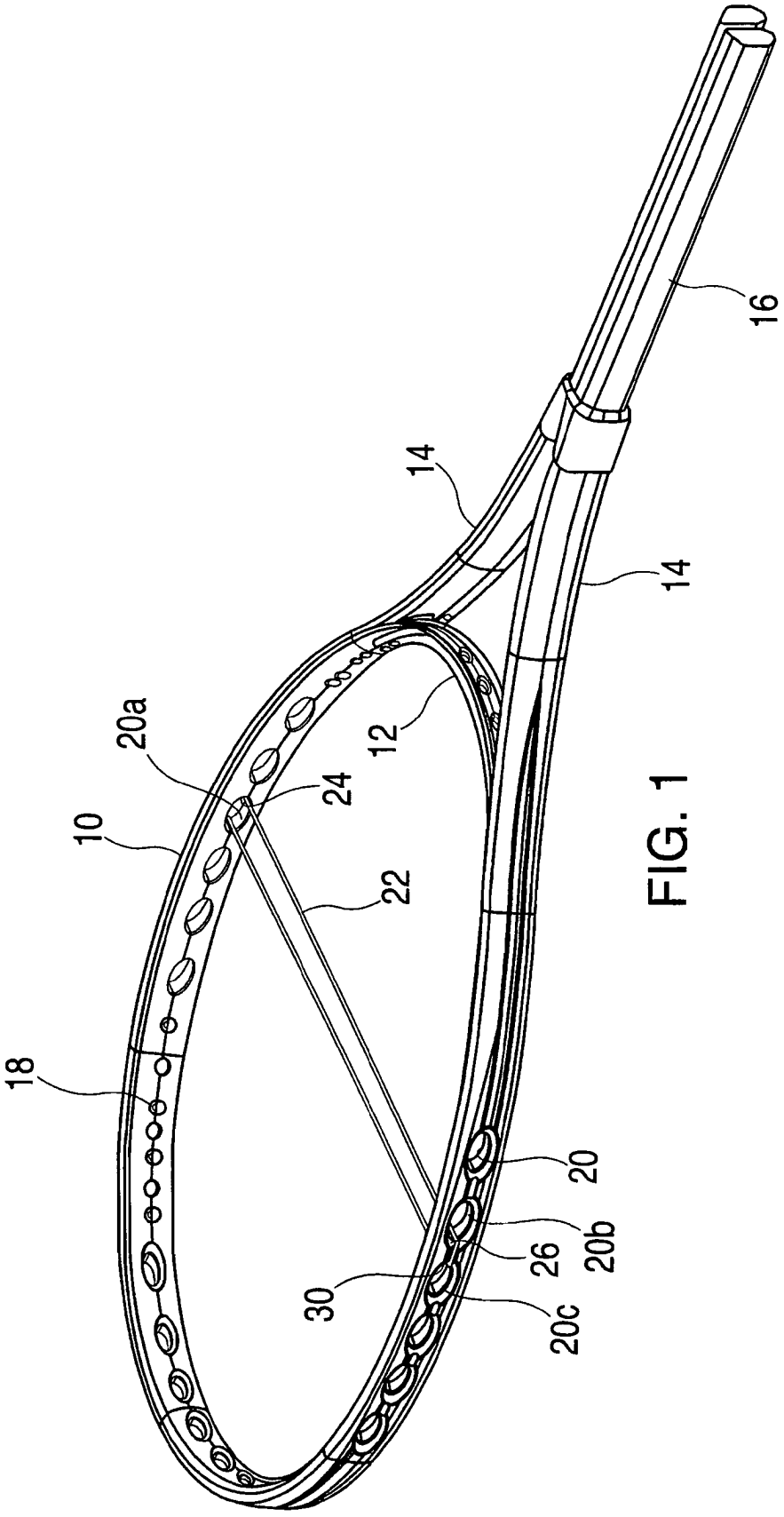

FIG. 1

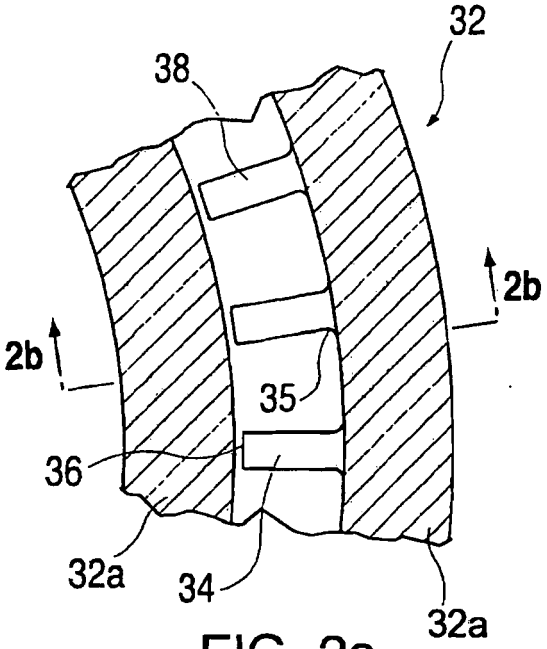

FIG. 2a

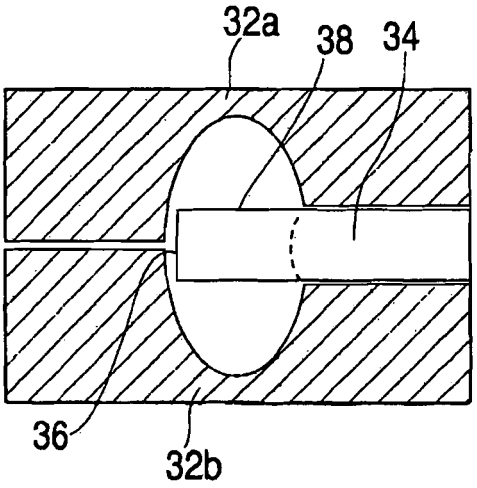

FIG. 2b

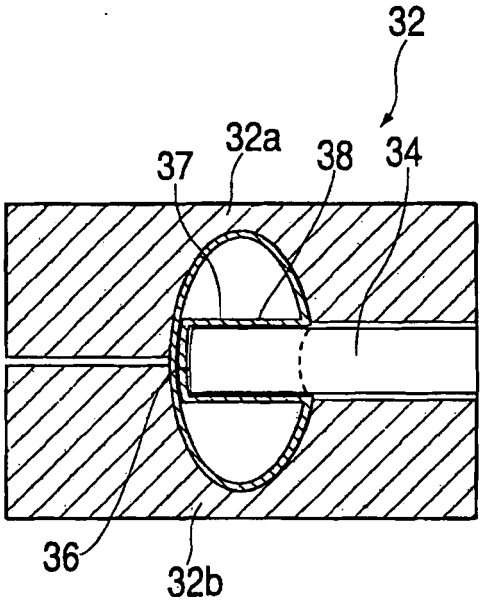

FIG. 2c

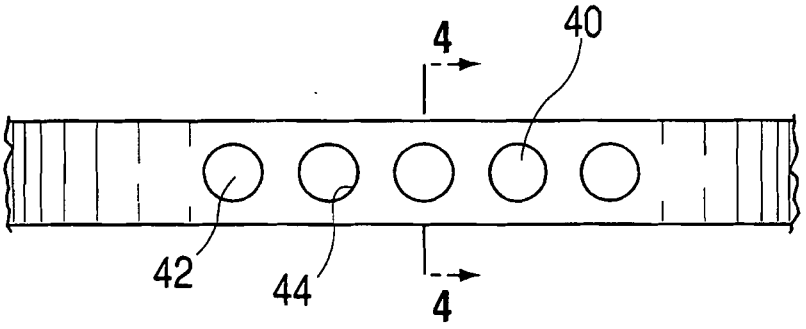

FIG. 3

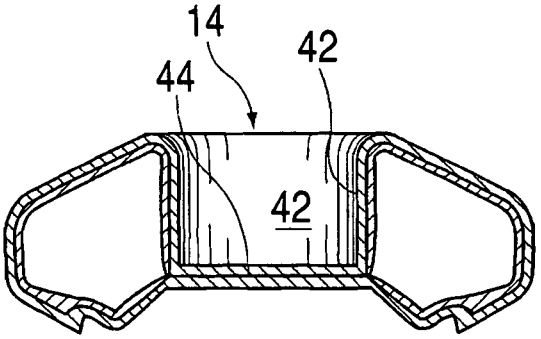

FIG. 4

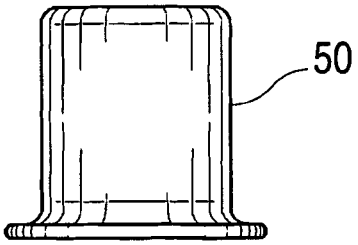

FIG. 6

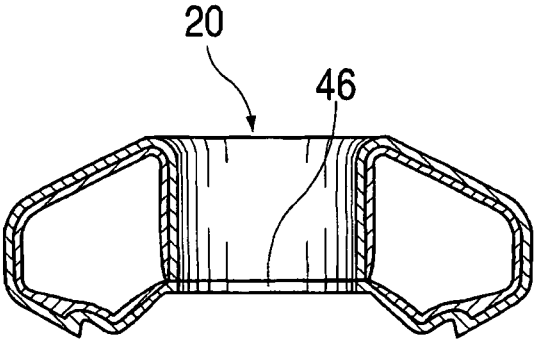

FIG. 5

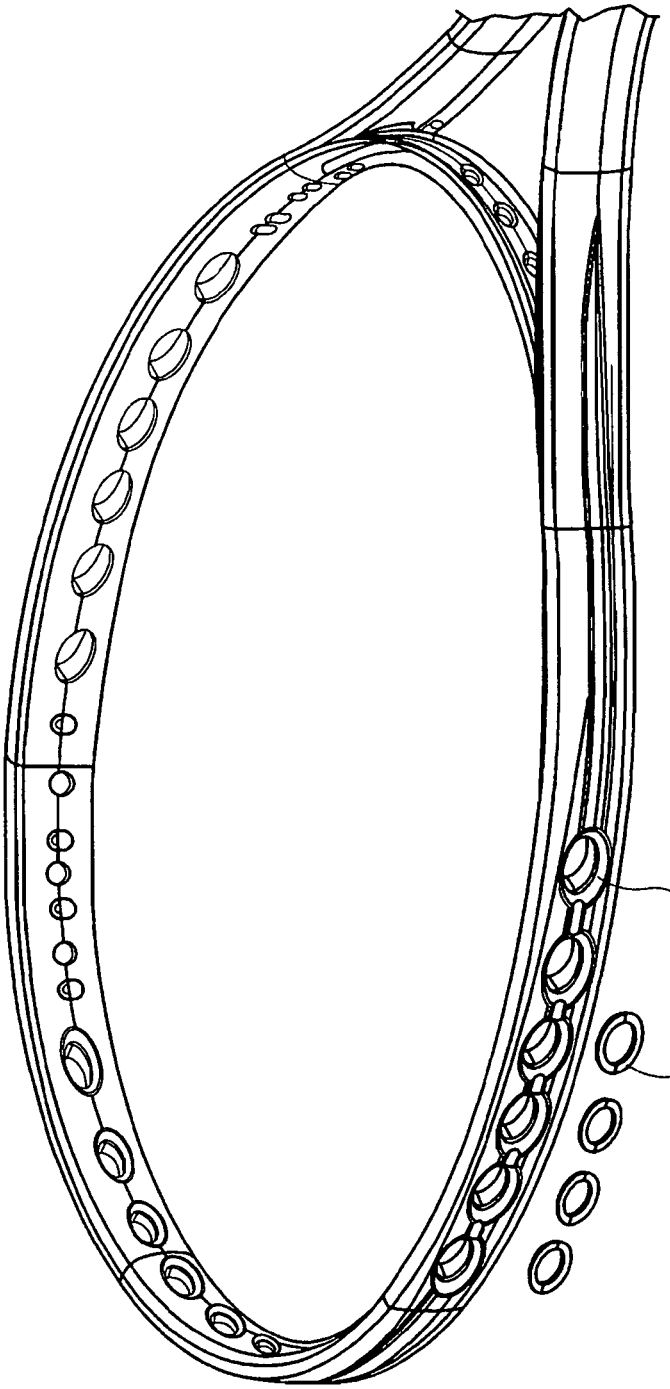

FIG. 7

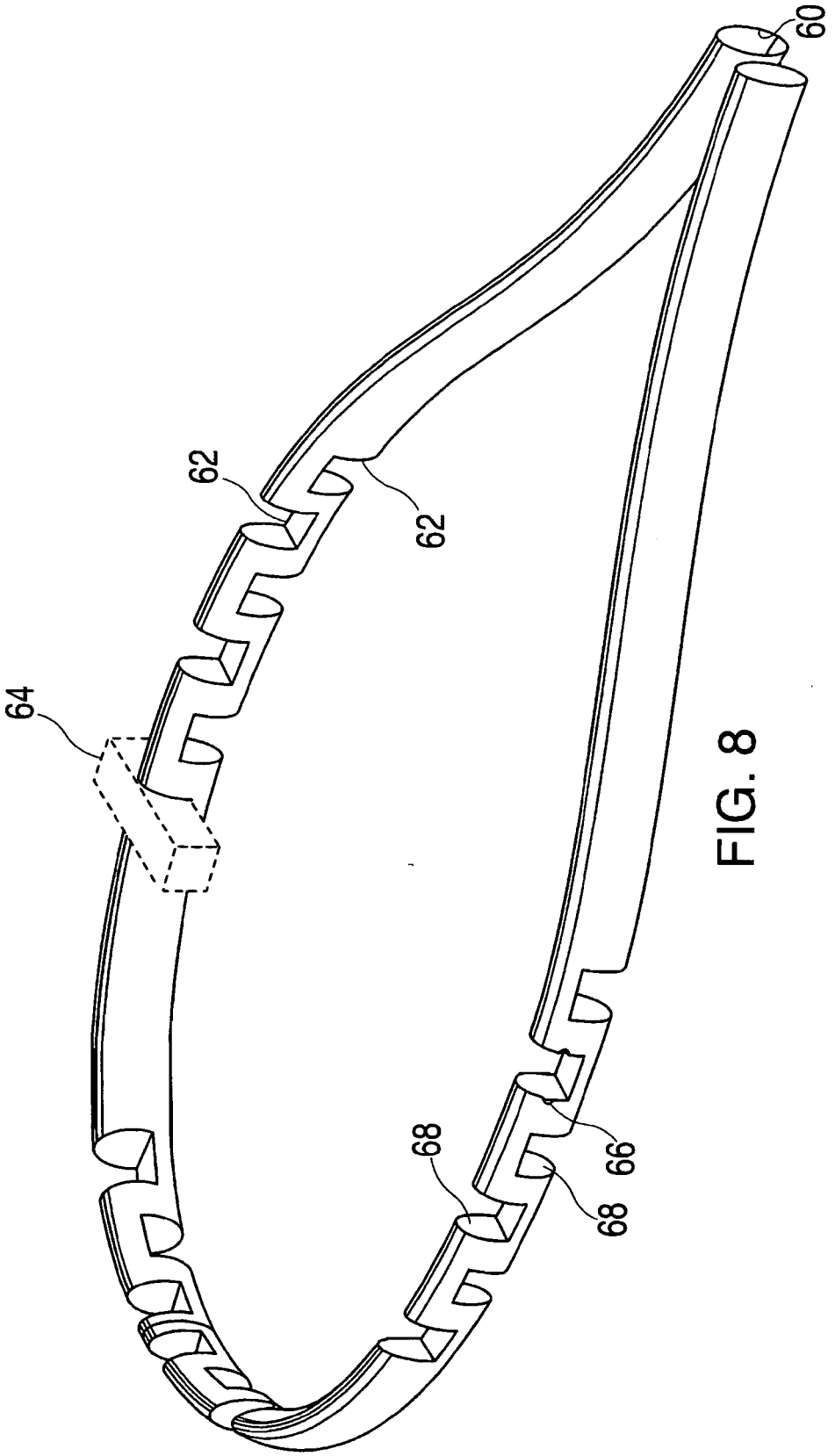

FIG. 8

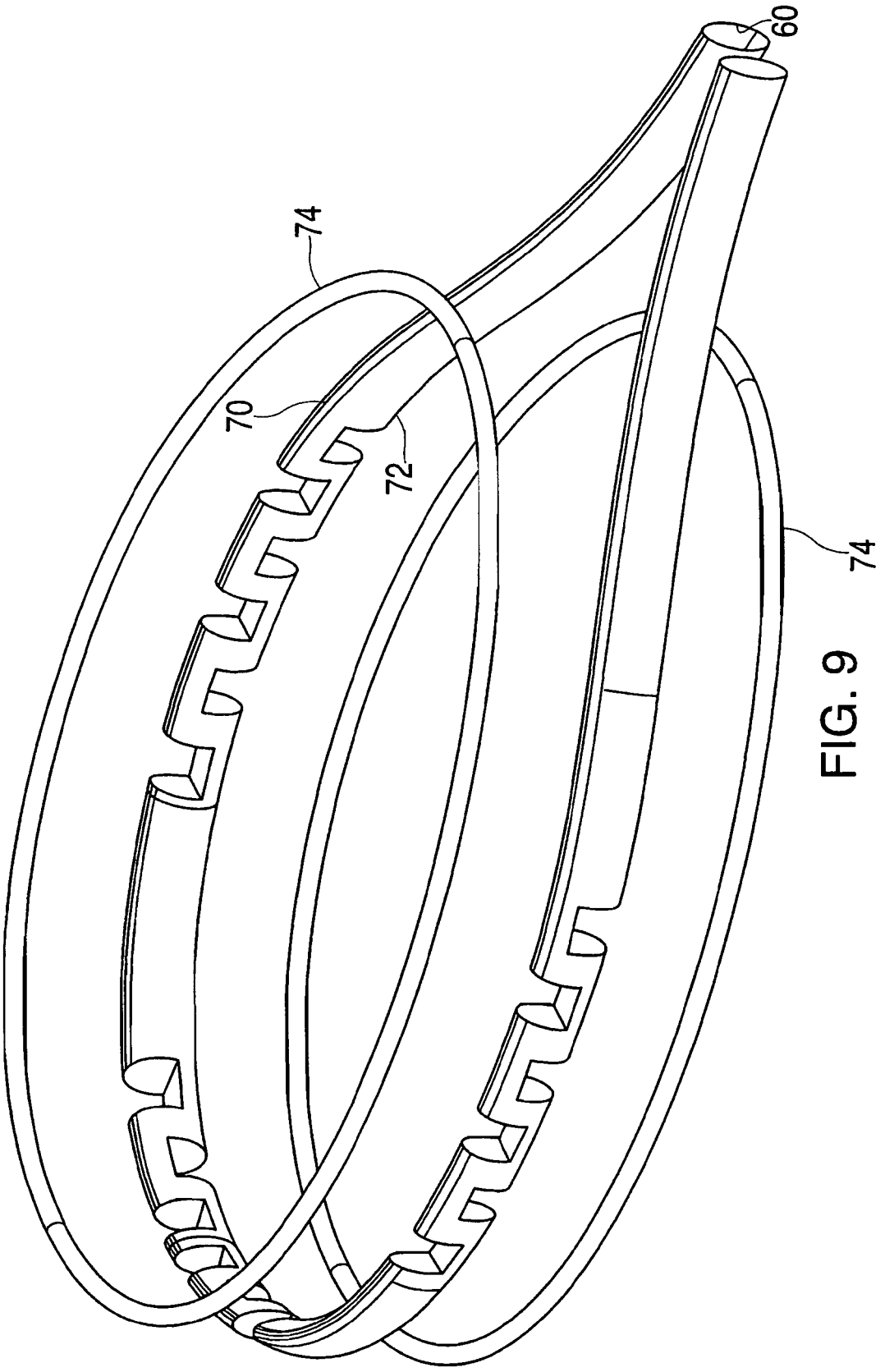

FIG. 9

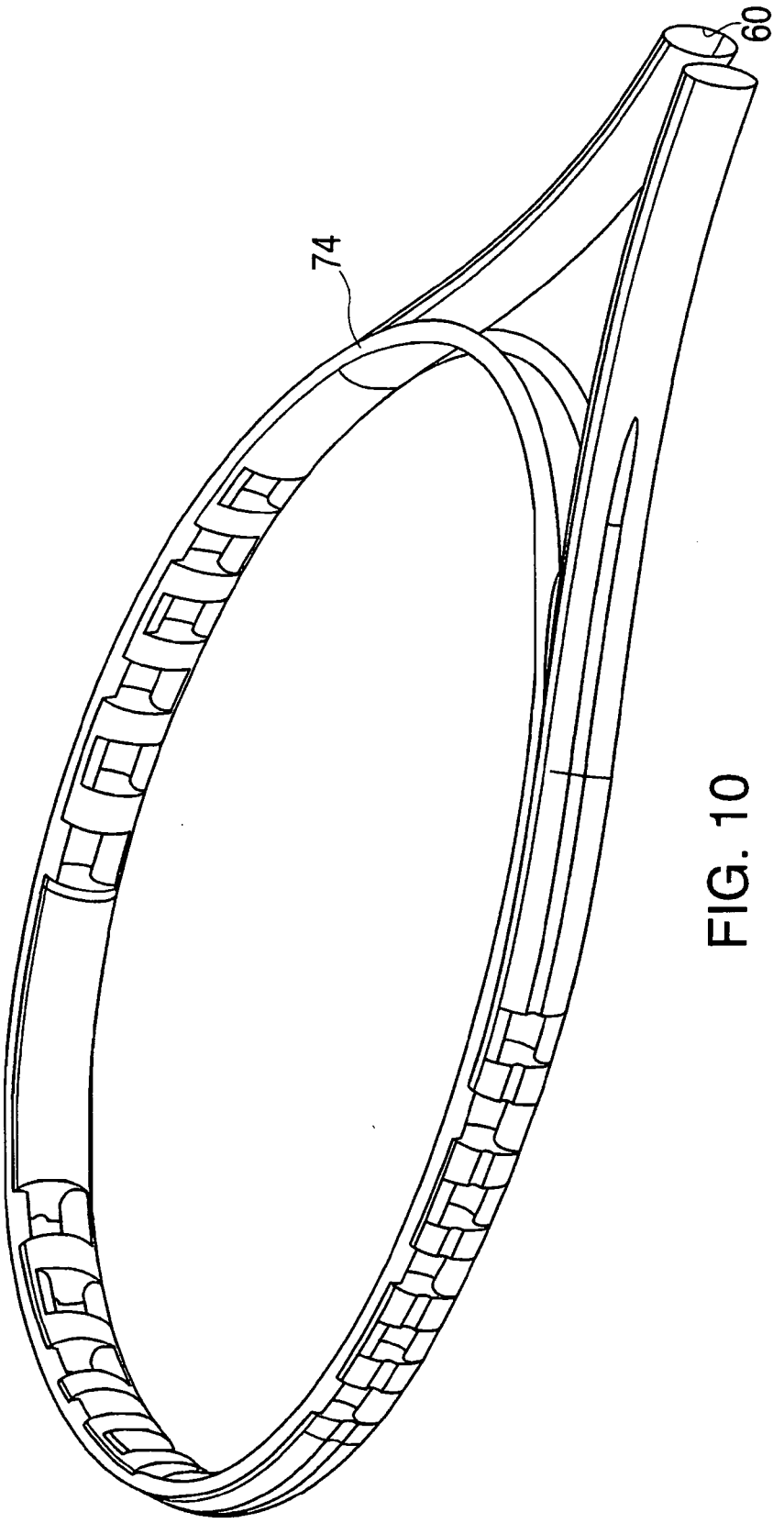

FIG. 10

REFERENCES CITED IN THE DESCRIPTION

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