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(54) **A BAT FOR PLAYING BALL GAMES**

SCHLÄGER FÜR BALLSPIELE

RAQUETTE POUR JEUX DE BALLE

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Description

FIELD OF INVENTION

[0001] This invention relates to a bat having an unstressed perforated striking head, for use in playing ball games such as paddle tennis or padel tennis games in playing areas smaller than traditional tennis courts as land becomes evermore scarce and expensive in modern cities.

[0002] In this specification, the term "lattice" is intended to refer to lattice or grid structures which are thin in relation to their lengths and breadths and which are perforated by a series of openings of a variety of shapes.

[0003] In this specification, the term "ball" must be interpreted sufficiently broadly to include a reference to a ball, sphere, shuttlecock or the like, which is configured to be struck by a bat in a "bat and ball" game.

BACKGROUND OF THE INVENTION

[0004] Plastics bats having unstressed perforated ball-striking heads, are known. Such bats are considered a cheaper and more robust alternative to conventional strung racquets or solid faced bats. The present invention is not concerned with bats having heads comprising a single solid panel which may or may not be partially perforated such as solid wooden bats, nor is it concerned with bats having stressed striking surfaces such as strung squash or tennis racquets.

[0005] It is also not concerned with padel bats having ball-striking surfaces made from thin glass fibre reinforced membranes having a thickness of about 1mm, which are stretched across outer surfaces of frames of such bats. Such padel bats are typically filled with plastic foam material and perforated but do not have significant surface ribbing to impart spin to a ball.

[0006] An advantage of the use of rigid-faced bats is the reduced level of the trampoline or spring like effect of strung racquets upon impact with a ball which generates more speed off the face of the racquet causing the ball to fly further and faster necessitating the use of a larger playing area. The rise in popularity of relatively new bat and ball games using rigid-faced bats, such as Paddleball, Paddle tennis, Pickleball and Padel on smaller courts is evidence of a swing to smaller courts at the expense of the game of tennis played on conventional larger size courts. Many such bats are heavier and shorter in length than tennis racquets to reduce the bat stroke and ball speed for the smaller courts they are used on.

[0007] An important commercial advantage of plastics bats is that they are simple and quick to produce, for example, in an injection moulding process and considerably cheaper than strung tennis racquets or bats made from solid wood.

[0008] One of the problems with moulded plastic bats has been the fact that many such bats have not been able to reproduce the sweet and solid impact feel experienced with solid wooden bats, tennis racquets or paddle tennis bats which exhibit excellent impact feel.

[0009] Bats having unstressed perforated ball-striking heads need to be appropriately weighted for the balls they are to be used with and offer also low air resistance. Such bats should be of a weight which is easy and practical for players to use and wield for any particular type of game.

[0010] For a good ball-striking feel, such bats need to be relatively rigid and offer minimal uncomfortable vibrations upon impact with a ball. The rigidity of the ball-striking head is derived from its thickness, the stiffness of its material and its structural design but it is an important design consideration that this is not achieved at the expense of increased mass of the bat or decreased striking head area. Thicker ball-striking heads tend to dampen and reduce impact vibration. It is therefore advantageous for the ball-striking head of a bat to have an adequate thickness which reduces vibration upon impact with a ball and renders the head sufficiently rigid, without making the bat excessively heavy.

[0011] US 2017/282030 A1 discloses a bat for playing ball games comprising a handle and a ball-striking head having a monolithic structure comprising a pair of spaced apart outer lattices which define rigid, unstressed ball-striking surfaces and a plurality of discrete internal struts which are integrally moulded with the lattices so as to extend between the lattices.

[0012] It is an object of the present invention to provide an appropriately weighted bat having a perforated ball-striking head which provides a solid low vibration impact feel combined with low air resistance and an acceptable striking head area for striking balls.

SUMMARY OF THE INVENTION

[0013] According to the invention there is provided a plastics bat comprising the features of claim 1. The plastics bat includes a handle and a ball-striking head for striking resilient balls, the ball-striking head having a monocoque construction and including:

a first discrete unstressed plastics lattice defining a first ball-striking surface of the bat;
a second discrete unstressed plastics lattice defining a second ball-striking surface of the bat; and
at least one peripheral support structure,
the lattice structures being connected to opposite sides of the peripheral support structure at outer peripheral regions of the lattice structures in a spaced apart arrangement wherein an internal space is defined between the lattice structures absent of any load-bearing internal support structures,
wherein each of the first and second lattice structures is in the form of a double lattice comprising a pair of spaced planar lattice elements supported by internal struts

[0014] Each of the first and second lattices may have a unitary monolithic structure.

[0015] In a first embodiment of the invention, each of the first and second lattice structures may comprise a number of spaced intersecting laths arranged in an open grid pattern wherein openings are defined between the intersecting laths.

[0016] In a second embodiment of the invention, each of the first and second lattice structures may comprise a distributed network of alternating webs and unobstructed openings.

[0017] The peripheral support structure of the ball-striking head of the bat may comprise an outer ring frame to which the lattice structures are connected.

[0018] The lattice structures may be fixedly connected to the outer ring frame along peripheral edge regions of the lattice structures.

[0019] The lattice structures and the outer frame may form a continuous load-carrying outer skin surrounding the unobstructed internal space.

[0020] The ball-striking head of the bat has a monocoque construction wherein the lattice structures together with the outer ring frame, forms an outer skin surrounding the hollow internal space. The ball-striking head of the bat forms a true monocoque system wherein the internal space defined between the lattice structures is characterised by the absence of any load-carrying support structures. As such, the outer skin comprising the lattice structures and the outer frame, carries the compressive forces and loads applied to the ball-striking head when a ball is struck by the ball-striking surfaces of the lattice structures.

[0021] According to a second aspect of the invention, there is provided a bat and ball kit comprising the plastics bat as defined and described hereinabove; and a resilient ball having a diameter of between 40mm and 90mm and a weight of between 7.5g and 75g.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Further features of the invention are described hereinafter by way of examples of the invention with reference to and as illustrated in the accompanying diagrammatic drawings. In the drawings:

Figure 1 shows a plan view of a first embodiment of a bat for playing ball games, which is not in accordance with the invention;
Figure 1A shows enlarged detail A of Figure 1;
Figure 2 shows an exploded three-dimensional view of the bat of Figure 1;
Figure 3 shows a three-dimensional view of the bat of Figure 1, as seen from one side of the bat;
Figure 4 shows a three-dimensional view of the bat of Figure 1, as seen from an opposite side of the bat;
Figure 5 shows a sectional end view of the bat of Figure 1, sectioned along section line V-V of Figure 1;
Figure 5A shows enlarged detail B of Figure 5;
Figure 5B shows a three-dimensional view of enlarged detail C of Figure 5;
Figure 6 shows a sectional side view of the bat of Figure 1, sectioned along section line VI-VI of Figure 1;
Figure 6A shows enlarged detail D of Figure 6;
Figure 6B shows enlarged detail E of Figure 6A;
Figure 7 shows a plan view of a second embodiment of a bat for playing ball games, in accordance with the invention;
Figure 7A shows enlarged detail F of Figure 7;
Figure 8 shows an opposite plan view of the bat of Figure 7;
Figure 9 shows a sectional side view of the bat of Figure 7, sectioned along section line IX-IX of Figure 7;
Figure 10 shows a sectional end view of the bat of Figure 7, sectioned along section line X-X of Figure 7; and
Figure 10A shows enlarged detail G of Figure 10.

DETAILED DESCRIPTION OF THE INVENTION

[0023] With reference to Figures 1 to 6 of the drawings, a first embodiment of a bat for playing ball games, which is not in accordance with the invention, is designated generally by the reference numeral 10. The bat is injection moulded of plastics material and is specifically adapted for playing ball games in playing areas smaller than traditional tennis courts. The bat 10 comprises, broadly, a handle 12 and a ball-striking head 14 for striking resilient balls.

[0024] The ball-striking head 14 has a symmetrical configuration comprising a peripheral support structure in the form of a rigid outer ring frame 16 which is injection moulded integrally with the handle 12, a first discrete single lattice structure 18 comprising a single lattice which is connected along an outer peripheral region of the lattice structure to a first side of the outer ring frame 16 and a second discrete lattice single structure 20 comprising a single planar lattice which is connected along an outer peripheral region of the lattice structure to an opposite second side of the outer ring frame 16.

[0025] The lattice structures 18, 20 are unstressed and of polypropylene, while the outer ring frame 16 is of acrylonitrile butadiene styrene (ABS) material.

[0026] The first lattice structure 18 is in the form of a semi-rigid single planar lattice element having an open perforated monolithic unitary construction, comprising a plurality of intersecting laths 22 which are arranged in an open grid pattern. The laths 22 extend longitudinally and laterally, intersecting one another at right angles, with openings 23 being defined between the laths. The lattice structure 18 includes a pair of spaced annular locating formations 24.1 and 24.2 which extend circumferentially around the laths 22 and which define back-to-back annular locating grooves 26 between them. Circumferentially spaced holes 27 are defined in a bridging base

section 29 of the lattice structure defining the grooves, the purpose of which will be explained hereinbelow.

[0027] The second lattice structure 20 is identical to the first lattice structure 18 and is in the form of a semi-rigid single planar lattice element having an open perforated monolithic unitary construction, comprising a plurality of intersecting laths 22 which are arranged in an open grid pattern. The laths extend longitudinally and laterally, intersecting one another at right angles, with openings 23 being defined between the laths. The lattice structure 20 includes a pair of spaced annular locating formations 24.1 and 24.2 which extend circumferentially around the laths 22 and which define back-to-back annular locating grooves 26 between them. Circumferentially spaced holes 27 are defined in a bridging base section 29 of the lattice structure defining the grooves, the purpose of which will be explained hereinbelow.

[0028] The lattice structures 18 and 20 are securely connected to opposite sides of the outer ring frame 16 so as to define rigid unstressed ball-striking faces 28 and 30, respectively. In the assembled condition of the bat, the lattice structures 18 and 20 are spaced apart with opposing inner sides of the lattice structures 18, 20 defining an internal space 32 between them. The internal space is characterised by the absence of any internal load-bearing support structures. In this example, the internal space is hollow and unobstructed.

[0029] The outer ring frame 16 comprises a rigid annular wall 34 having a first outer edge 36 which is received within the groove 26 of the lattice structure 18 and a second outer edge 38 which is received within the groove 26 of the lattice structure 20 for locating the lattice structures 18 and 20 with respect to the outer frame 16. The outer edges 36, 38 of the wall 34 each define a plurality of spaced locating studs 40 projecting outwardly from the peripheral edges 36, 38. Each of the studs is located in one of the locating holes 27. The studs 40 provide weld pegs for ultrasonic spot welding 42 of the lattice structures 18, 20 to the outer frame 16. As such, the studs are melted and fused to the lattice structures in an ultrasonic welding process. In order to enhance the connection of the lattice structures to the outer frame, the lattice structures may be additionally bonded to the outer frame using a suitable adhesive.

[0030] With reference to Figures 7 to 10 of the drawings, there is provided a second embodiment of the bat in accordance with the invention, designated generally by the reference numeral 100. The bat 100 is similar to the bat 10 with a difference being that the single lattice structures 18 and 20 are replaced by double lattice structures. In Figures 7 to 10 of the drawings, those features of the bat 100 that are the same as and/or similar to those of the bat 10, are designated by the same and/or similar reference numerals. As such, the bat 100 comprises, broadly, a ball-striking head 214 having a symmetrical configuration comprising a peripheral support structure in the form of an outer ring frame 16 which is integrally moulded with a handle 12, a discrete first double lattice structure 118 and a discrete second double lattice structure 120 which are rigidly connected at outer peripheral regions thereof to opposite sides of the outer ring frame in the same manner in which the lattice structures 18 and 20 are connected to the outer ring frame 16 of the bat 10.

[0031] Each double lattice structure 118,120 has a plastics moulded unitary monolithic construction and comprises a pair of spaced single planar inner and outer lattice elements 52, 54 supported by internal struts. A further difference between the bat 10 and the bat 100, is that the lattice elements 52, 54 each comprise a connected network of alternating webs 122 and unobstructed openings 44. As such, each lattice structure 118, 120 includes the inner lattice element 54 and the outer lattice element 52 and a plurality of internal struts 46 which are integrally moulded with the lattice elements so as to extend between the lattice elements. Outer sides of the outer lattice elements 52 of each double lattice structure 118, 120 define rigid ball-striking faces 128, 130, respectively. The webs 122 each define four triangular apertures 48 providing escape paths for air which is compressed between a ball and the outer lattice elements when the ball is struck by the bat, for noise attenuation purposes.

[0032] The double lattice structures 118, 120 each include a pair of spaced annular locating formations 24.1 and 24.2 which extend circumferentially around the network of webs and openings and which define back-to-back annular grooves 26 between them. Outer edges 36, 38 of the wall 34 of the outer frame are received in the inner grooves with the studs 40 being received within the holes 27 defined in the bridging base sections 29 of the lattice structures and secured via an ultrasonic welding process in the same manner as for the lattice structures 18, 20 of the bat 10.

[0033] As for the bat 10, the double lattice structures 118, 120 of the bat 100 are spaced apart so as to define a hollow unobstructed internal space 132 between them.

[0034] The ball-striking heads 14, 114 of the bats 10, 100, respectively, have a monocoque construction wherein the lattice structures together with the outer ring frames thereof, form a continuous outer skin surrounding the hollow internal space 32,132. The ball-striking heads 14,114 thus form a true monocoque system wherein the internal space defined between the lattice structures is characterised by the absence of any load-carrying support structures. As such, the outer skin comprising the lattice structures and the outer frame carries the compressive forces and loads applied to the ball-striking head when a ball is struck by the ball-striking surfaces of the lattice structures. The monocoque construction of the ball-striking head imparts stiffness and strength to the ball-striking head, allowing the ball-striking head to have a desirable lightweight construction which in turn allows the construction of a relatively thick ball-striking head which enhances overall rigidity of the ball-striking head.

[0035] In addition, the monocoque construction of the

ball-striking head serves to absorb vibration forces imparted to the bat when a ball is struck by the bat by transmitting the vibration forces throughout the outer skin of the ball-striking head. In vibration tests conducted on the bats in accordance with the invention, by the Applicant, it was established that the monocoque design of the ball-striking head significantly reduces vibration transmitted via the ball-striking head to the handle. In the vibration acceleration tests conducted by PACE-WOOD BENCHMARK - Acoustic engineers for the Applicant, impact vibration transmitted to the handle of the bat, expressed in vibration acceleration in metres/second^2 (m/s^2), was measured at levels below 40m/s^2 which provides the bats with a comfortable impact feel comparable to good quality strung tennis racquets.

[0036] The bats 10, 100 are designed for use with resilient balls having a bounce of at least 90cm when subjected to a drop test wherein such balls are dropped from a height of 100 inches (254cm) onto a rigid, hard horizontal, solid and flat impact surface. More specifically, the bats are designed for use with resilient balls having a diameter of between 40mm and 90mm and a weight of between 7.5g and 75g. The invention extends to a bat and ball kit including one or both of the bats 10,100 and a resilient ball as described hereinabove.

[0037] The relatively thick heads of the bats 10, 100 provide the bats with a sufficiently rigid construction to mitigate vibration upon impact with balls thereby providing the bats with a desirable impact feel. Furthermore, the apertures 48 in the webs 122 of the double lattice structures of the bats 100 provides for moderation of sound levels upon impact with a ball, such that decibel sound levels and the pitch thereof resulting from impact with balls, is moderated or modulated to acceptable levels.

Claims

1. A plastics bat (10) including a handle (12) and a ball-striking head (14) for striking resilient balls, the ball-striking head having a monocoque construction and including:

   a first discrete unstressed plastics lattice structure (18) defining a first ball-striking surface of the bat (28);
   a second discrete unstressed plastics lattice structure (20) defining a second ball-striking surface of the bat (30); and
   at least one peripheral support structure (16), wherein
   the lattice structures are connected to opposite sides of the peripheral support structure at outer peripheral regions of the lattice structures in a spaced apart arrangement wherein an internal space (32) is defined between the first and second lattice structures absent of any load-bearing internal support structures,

   characterized in that each of the first and second lattice structures is in the form of a double lattice comprising a pair of spaced planar lattice elements supported by internal struts.

2. The plastics bat as claimed in claim 1, wherein each of the first and second lattices has a unitary monolithic structure.

3. The plastics bat as claimed in claim 1 or claim 2, wherein each of the first and second lattice structures comprises a number of spaced intersecting laths (22) arranged in an open grid pattern wherein openings (23) are defined between the intersecting laths.

4. The plastics bat as claimed in any one of claims 1 to 3, wherein each of the first and second lattice structures comprises a distributed network of alternating webs (122) and unobstructed openings (44).

5. The plastics bat as claimed in any one of claims 1 to 4, wherein the peripheral support structure of the ball-striking head of the bat comprises an outer ring frame to which the lattice structures are connected.

6. The plastics bat as claimed in claim 5, wherein the lattice structures are fixedly connected to the outer ring frame along peripheral edge regions of the lattice structures.

7. The plastics bat as claimed in claim 5 or claim 6, wherein the lattice structures and the outer frame form a continuous load-carrying outer skin surrounding the unobstructed internal space.

8. A bat and ball kit comprising the plastics bat as claimed in any one of claims 1 to 7 and a resilient ball having a diameter of between 40mm and 90mm and a weight of between 7.5g and 75g.

Patentansprüche

1. Kunststoffschläger (10) mit einem Griff (12) und einem Ballschlagkopf (14) zum Schlagen elastischer Bälle, wobei der Ballschlagkopf eine Monocoque-Konstruktion aufweist und Folgendes aufweist:

   eine erste diskrete, unbelastete Kunststoffgitterstruktur (18), die eine erste Ballschlagfläche des Schlägers (28) eingrenzt;
   eine zweite diskrete, unbelastete Kunststoffgitterstruktur (20), die eine zweite Ballschlagfläche des Schlägers (30) eingrenzt; und
   mindestens eine periphere Stützstruktur (16), wobei
   die Gitterstrukturen mit gegenüberliegenden

Seiten der peripheren Stützstruktur an äußeren peripheren Bereichen der Gitterstrukturen in einer beabstandeten Anordnung verbunden sind, wobei ein Innenraum (32) zwischen der ersten und der zweiten Gitterstruktur ohne jegliche lasttragende innere Stützstrukturen eingrenzt ist,
dadurch gekennzeichnet, dass die erste und die zweite Gitterstruktur jeweils die Form eines Doppelgitters aufweisen, das ein Paar beabstandeter ebener Gitterelemente umfasst, die durch innere Streben gestützt werden.

2. Kunststoffschläger nach Anspruch 1, wobei das erste und das zweite Gitter jeweils eine einheitliche monolithische Struktur aufweisen.

3. Kunststoffschläger nach Anspruch 1 oder Anspruch 2, wobei die erste und die zweite Gitterstruktur jeweils eine Anzahl beabstandeter, sich kreuzender Leisten (22) umfassen, die in einem offenen Gittermuster angeordnet sind, wobei zwischen den sich kreuzenden Leisten Öffnungen (23) eingegrenzt sind.

4. Kunststoffschläger nach einem der Ansprüche 1 bis 3, wobei die erste und die zweite Gitterstruktur jeweils ein verteiltes Netz aus abwechselnden Stegen (122) und unverbauten Öffnungen (44) umfassen.

5. Kunststoffschläger nach einem der Ansprüche 1 bis 4, wobei die periphere Stützstruktur des Ballschlagkopfes des Schlägers einen äußeren Ringrahmen umfasst, mit dem die Gitterstrukturen verbunden sind.

6. Kunststoffschläger nach Anspruch 5, wobei die Gitterstrukturen entlang der peripheren Randbereiche der Gitterstrukturen fest mit dem äußeren Ringrahmen verbunden sind.

7. Kunststoffschläger nach Anspruch 5 oder Anspruch 6, wobei die Gitterstrukturen und der Außenrahmen eine durchgehende, lasttragende Außenhaut bilden, die den freien Innenraum umgibt.

8. Schläger- und Ballset, das den Kunststoffschläger nach einem der Ansprüche 1 bis 7 und einen elastischen Ball mit einem Durchmesser zwischen 40 mm und 90 mm und einem Gewicht zwischen 7,5 g und 75 g umfasst.

Revendications

1. Raquette en plastique (10) comprenant un manche (12) et une tête de frappe de balle (14) pour frapper des balles élastiques, la tête de frappe de balle comportant une construction monocoque et comprenant :

une première structure en treillis plastique discrète non contrainte (18) définissant une première surface de frappe de balle de la raquette (28) ;
une seconde structure en treillis plastique discrète non contrainte (20) définissant une seconde surface de frappe de balle de la raquette (30) ; et
au moins une structure de support périphérique (16),
dans laquelle les structures en treillis sont connectées à des côtés opposés de la structure de support périphérique au niveau des régions périphériques extérieures des structures en treillis dans un agencement espacé dans lequel un espace interne (32) est défini entre les première et seconde structures en treillis dépourvues de toute structure de support interne porteuse,
caractérisée en ce que chacune des première et seconde structures en treillis se présente sous la forme d'un double treillis comprenant une paire d'éléments en treillis plans espacés supportés par des entretoises internes.

2. Raquette en plastique selon la revendication 1, dans laquelle chacun des premier et second treillis présente une structure monolithique unitaire.

3. Raquette en plastique selon la revendication 1 ou la revendication 2, dans laquelle chacune des première et seconde structures en treillis comprend un certain nombre de lattes d'intersection espacées (22) disposées selon un motif de grille ouvert dans lequel des ouvertures (23) sont définies entre les lattes d'intersection.

4. Raquette en plastique selon l'une quelconque des revendications 1 à 3, dans laquelle chacune des première et seconde structures en treillis comprend un réseau distribué de bandes alternées (122) et d'ouvertures non obstruées (44).

5. Raquette en plastique selon l'une quelconque des revendications 1 à 4, dans laquelle la structure de support périphérique de la tête de frappe de balle de la raquette comprend un cadre annulaire extérieur auquel les structures en treillis sont connectées.

6. Raquette en plastique selon la revendication 5, dans laquelle les structures en treillis sont connectées de manière fixe au cadre annulaire extérieur le long des régions de bord périphériques des structures en treillis.

7. Raquette en plastique selon la revendication 5 ou la revendication 6, dans laquelle les structures en treillis et le cadre extérieur forment une peau extérieure porteuse continue entourant l'espace intérieur non-obstrué.

8. Kit raquette et balle comprenant la raquette en plastique selon l'une quelconque des revendications 1 à 7 et une balle élastique comportant un diamètre compris entre 40 mm et 90 mm et un poids compris entre 7,5 g et 75 g.

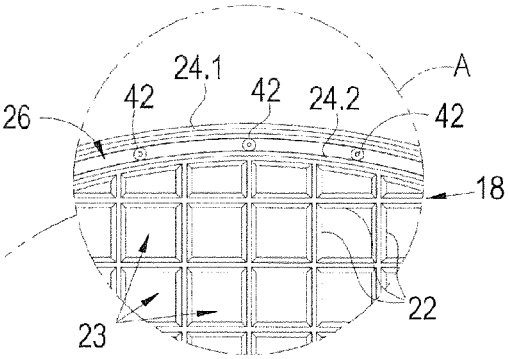

Figure 1A

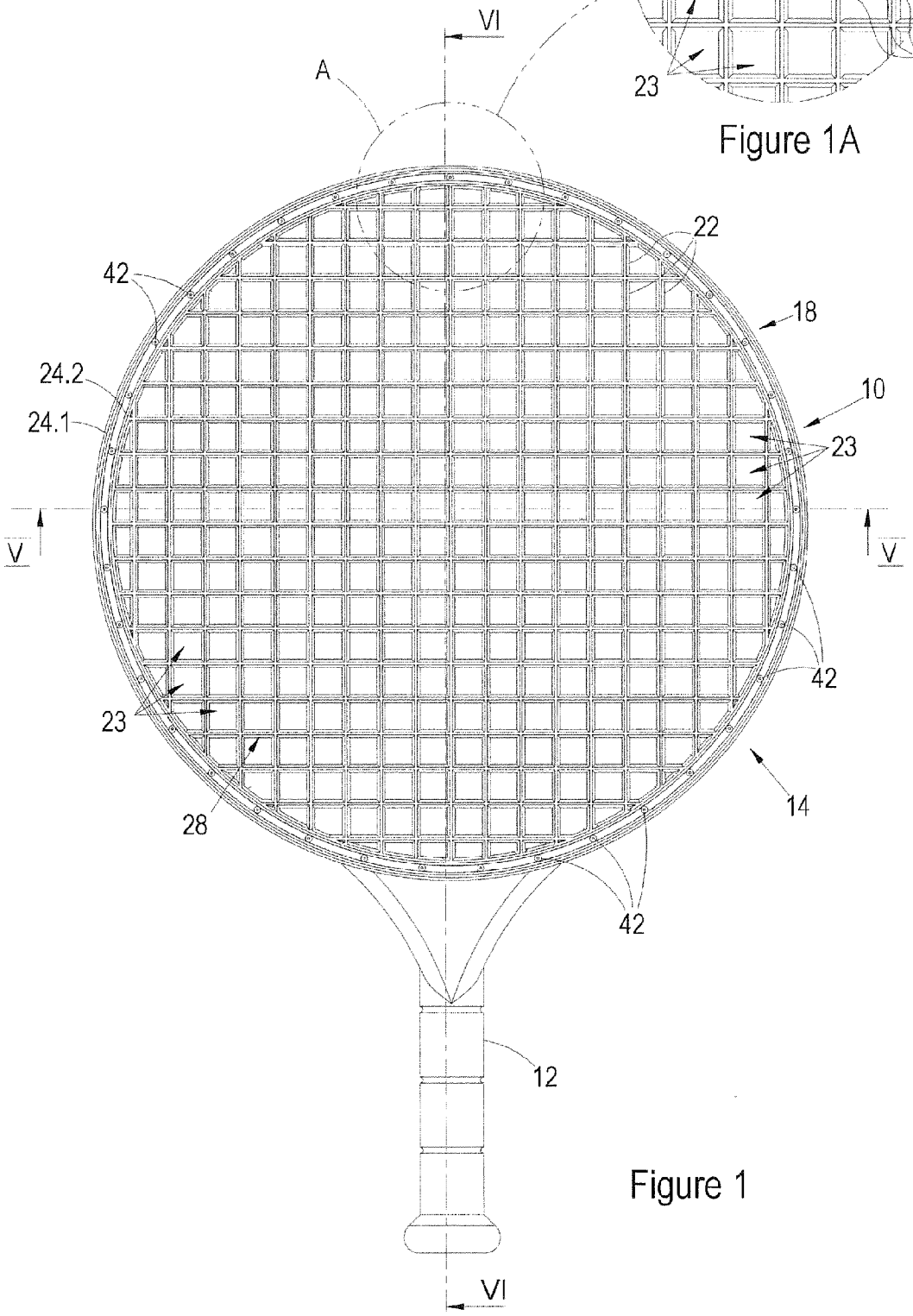

Figure 1

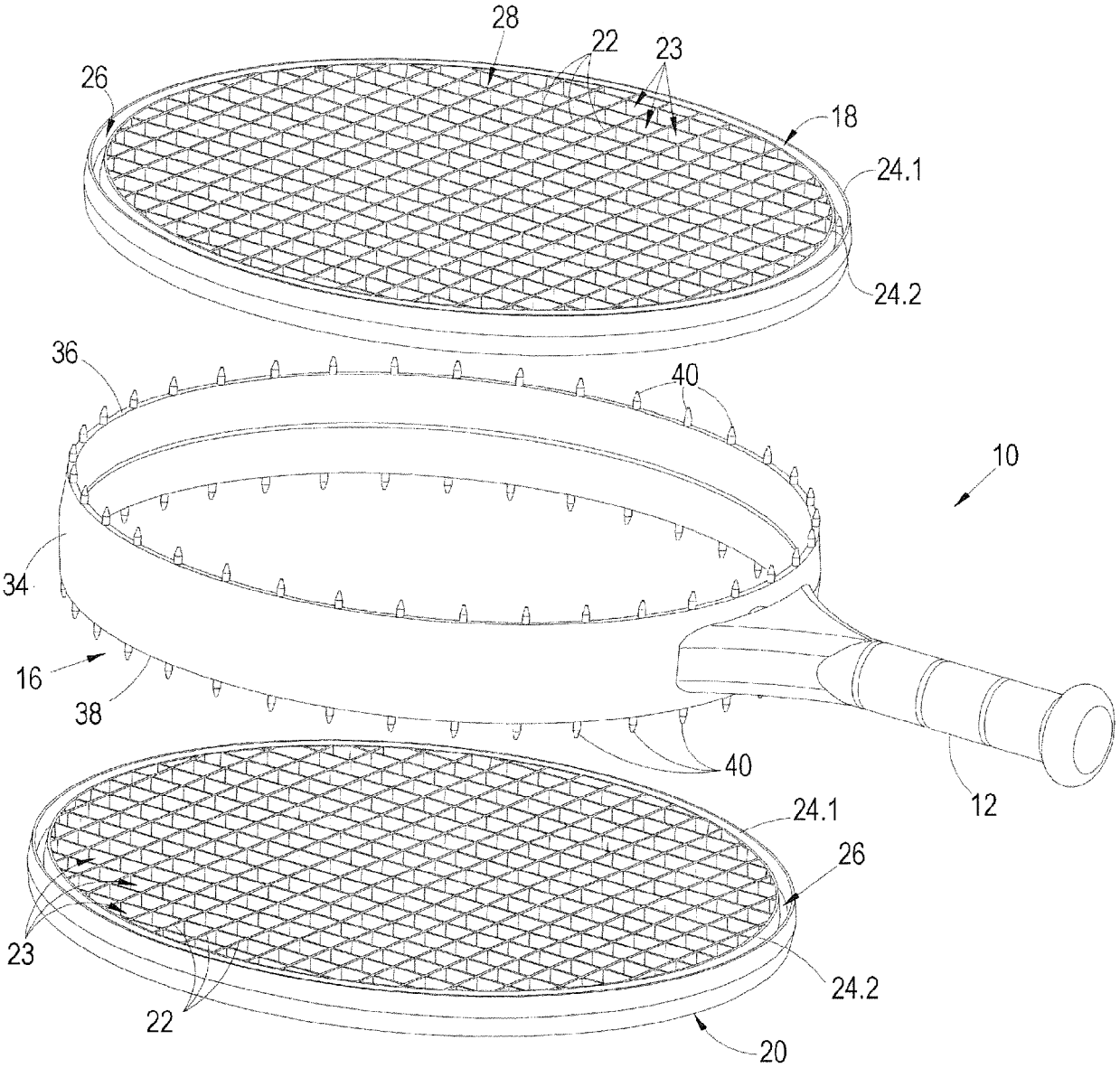

Figure 2

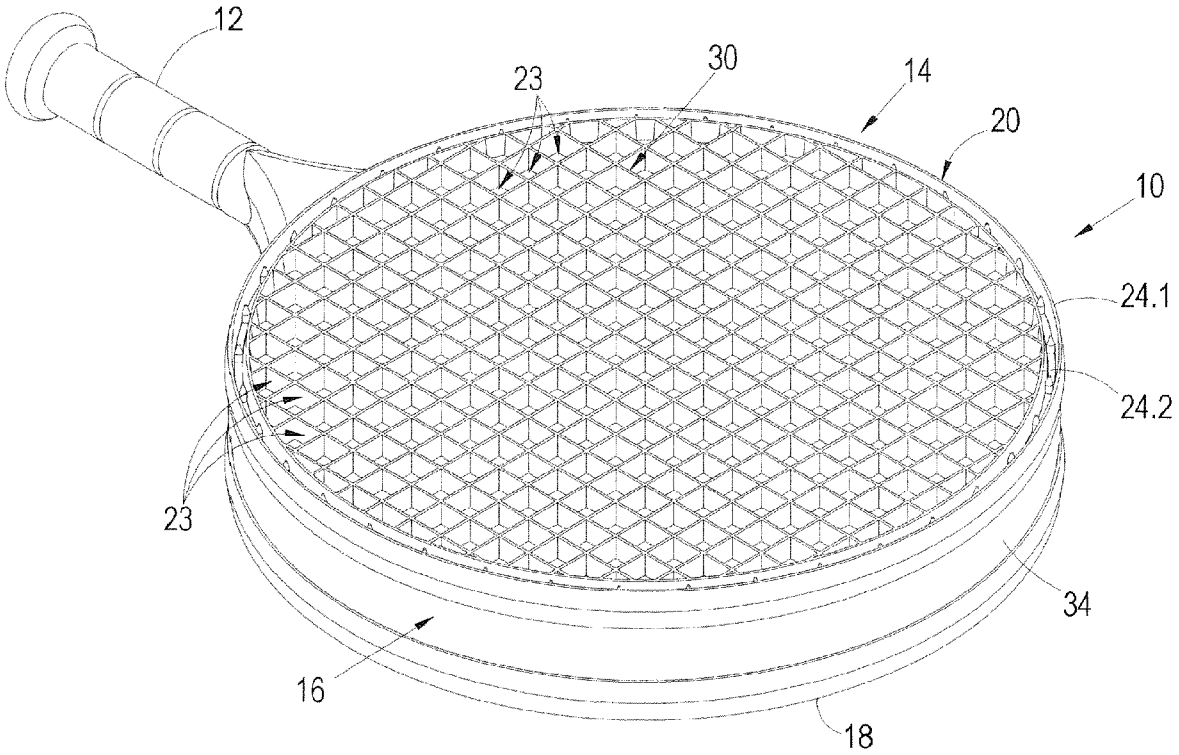

Figure 3

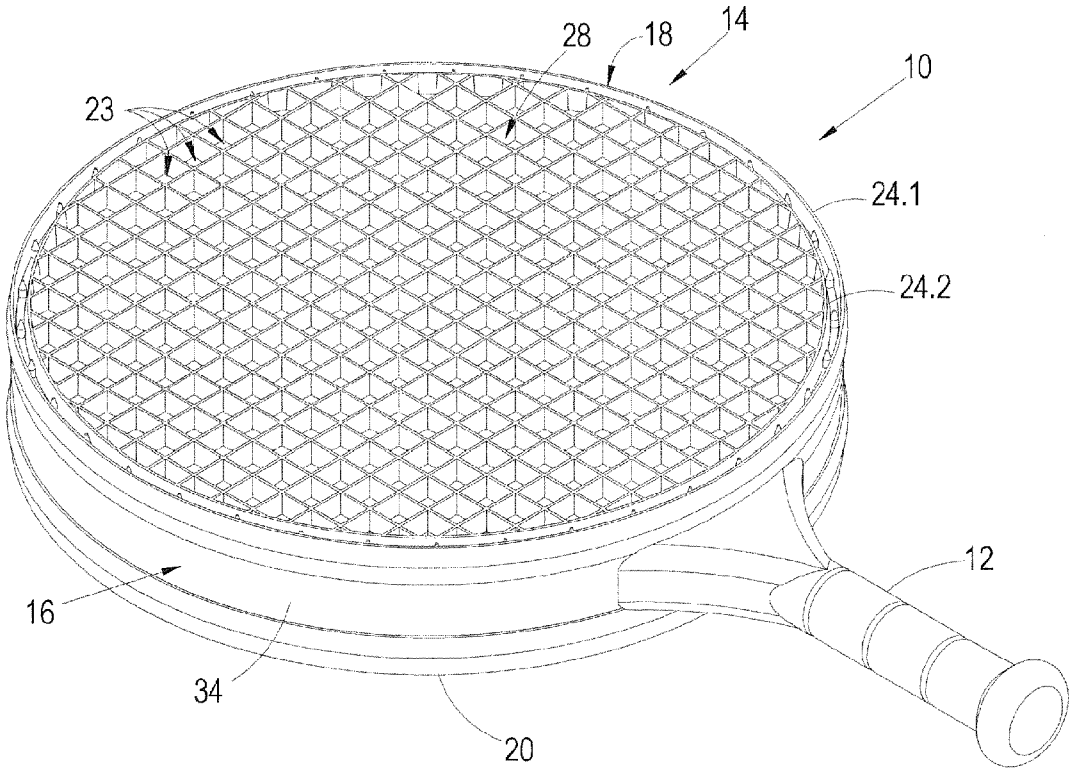

Figure 4

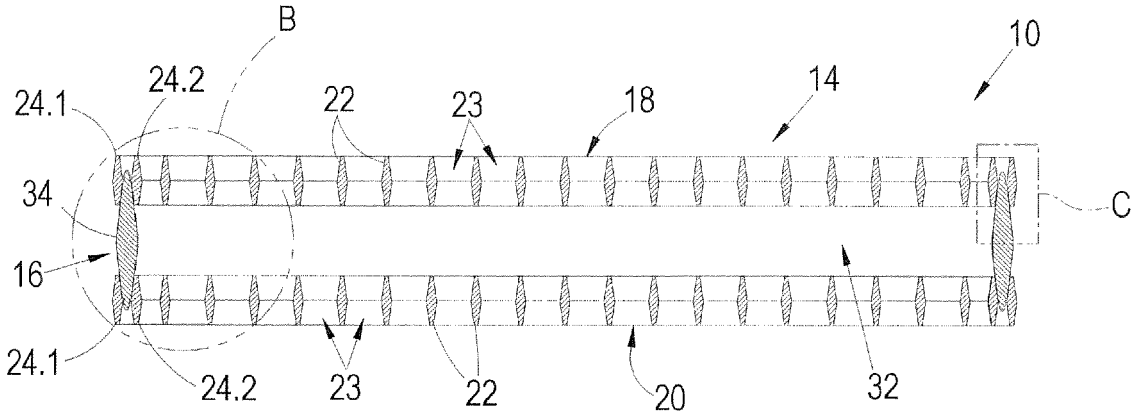

Figure 5

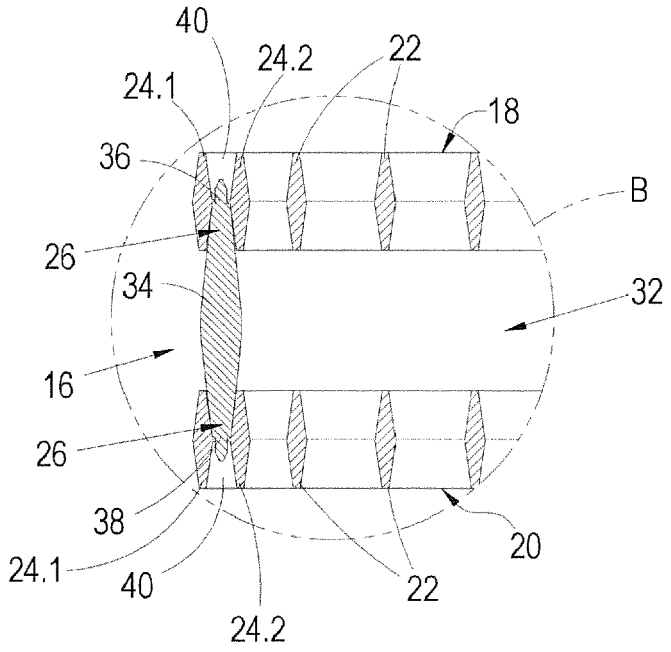

Figure 5A

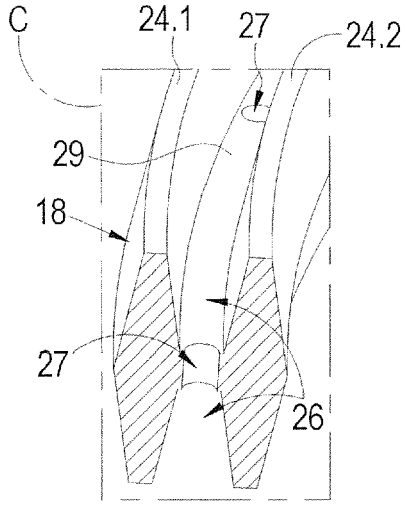

Figure 5B

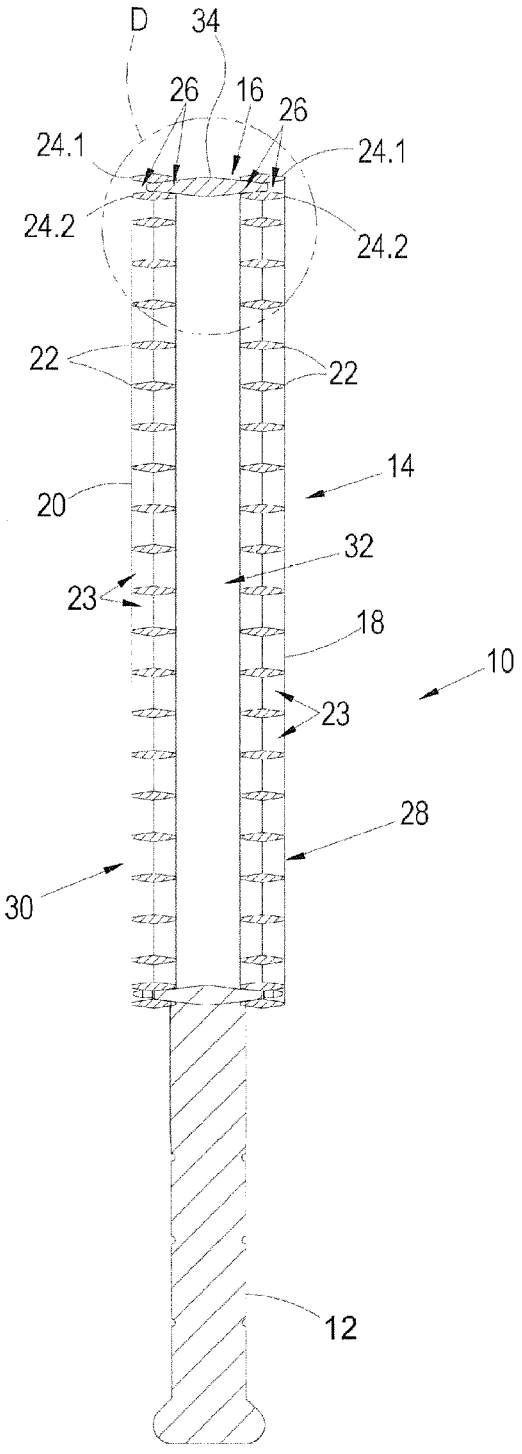

Figure 6

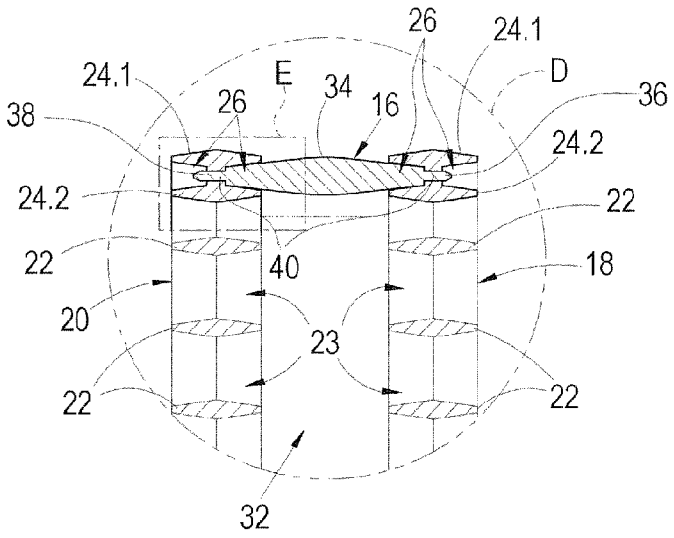

Figure 6A

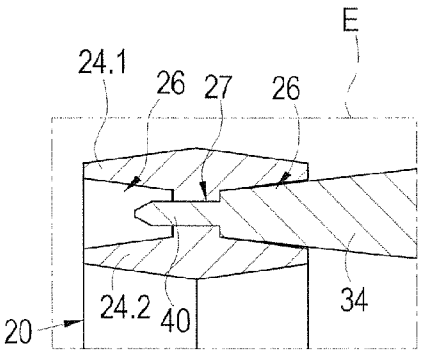

Figure 6B

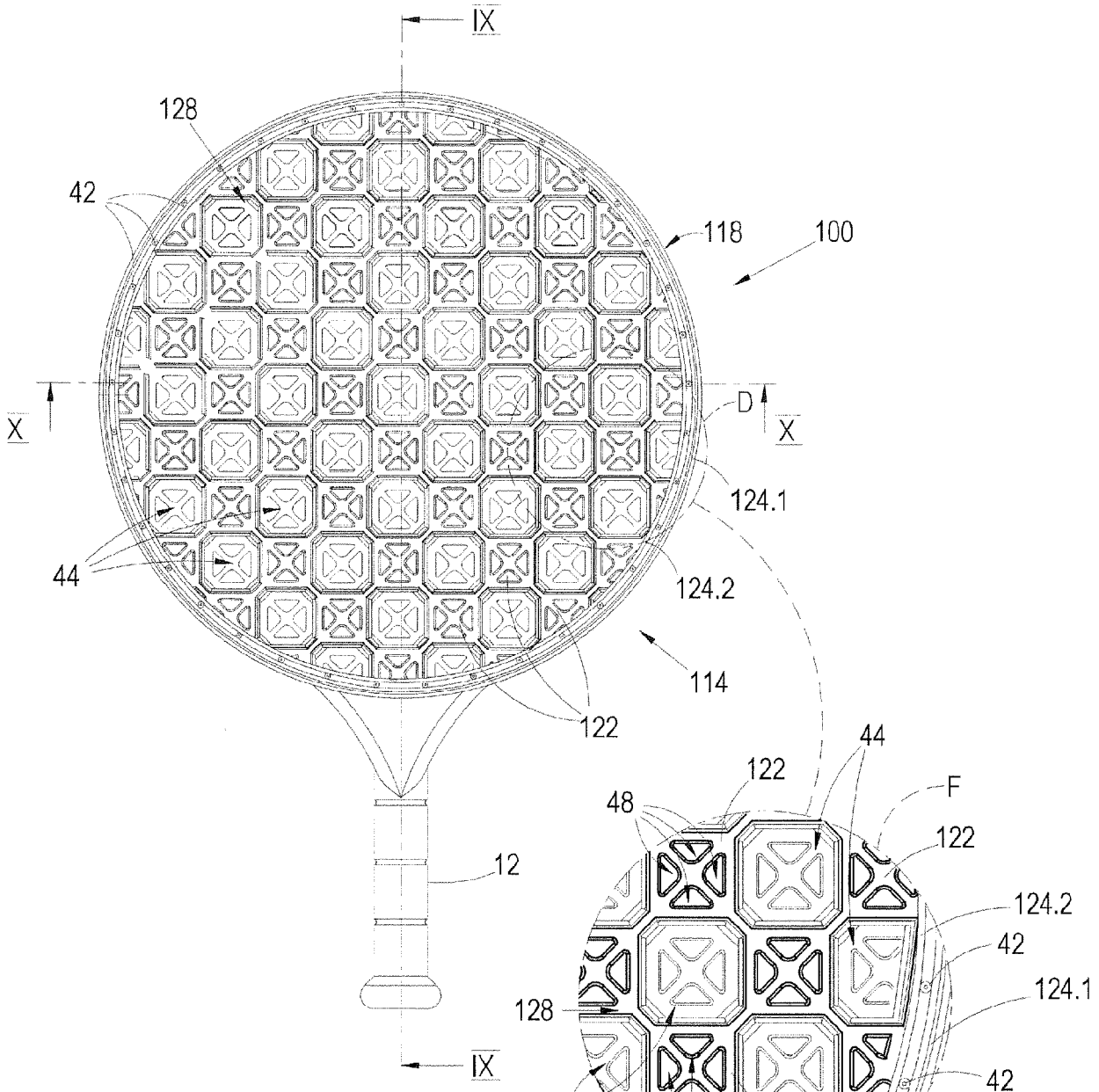

Figure 7

Figure 7A

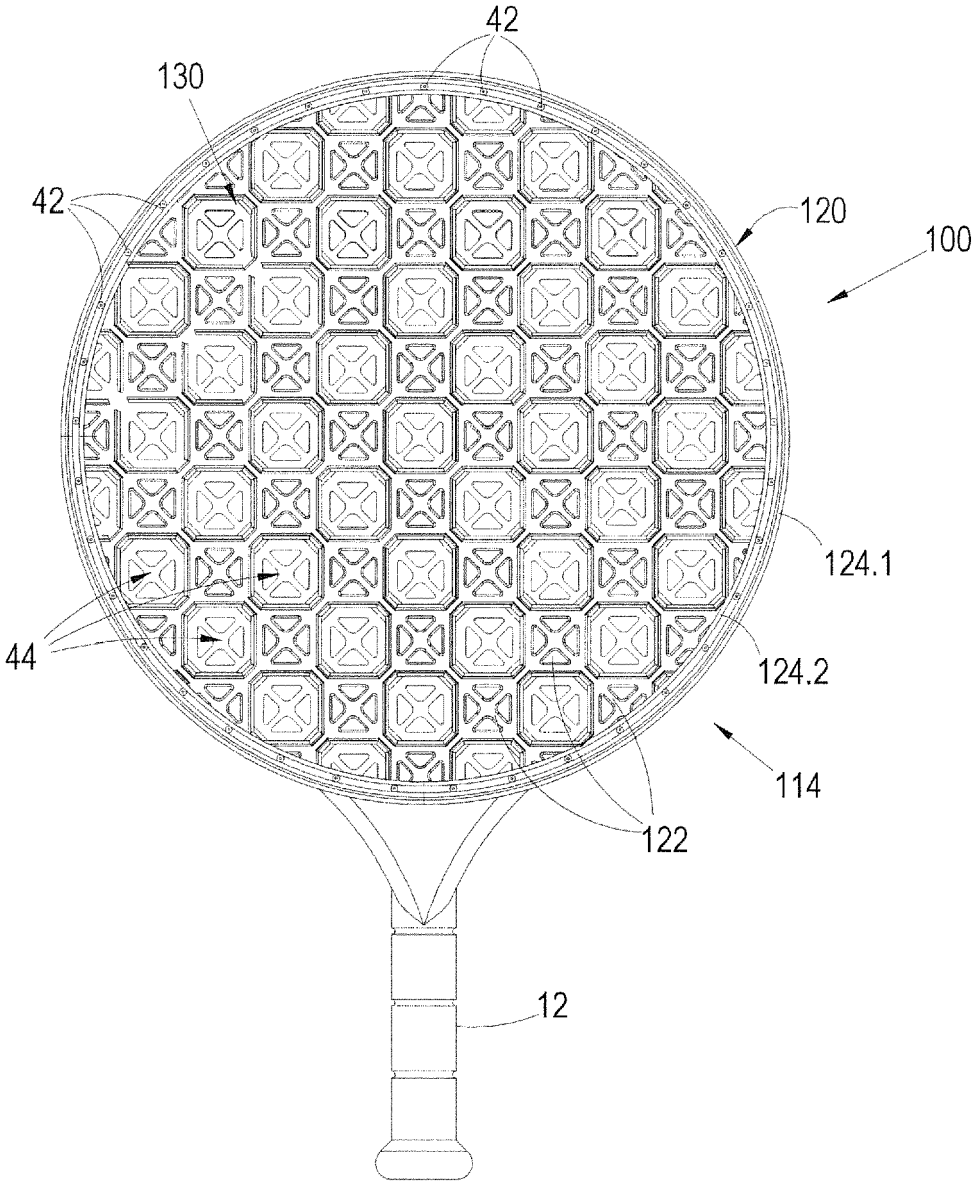

Figure 8

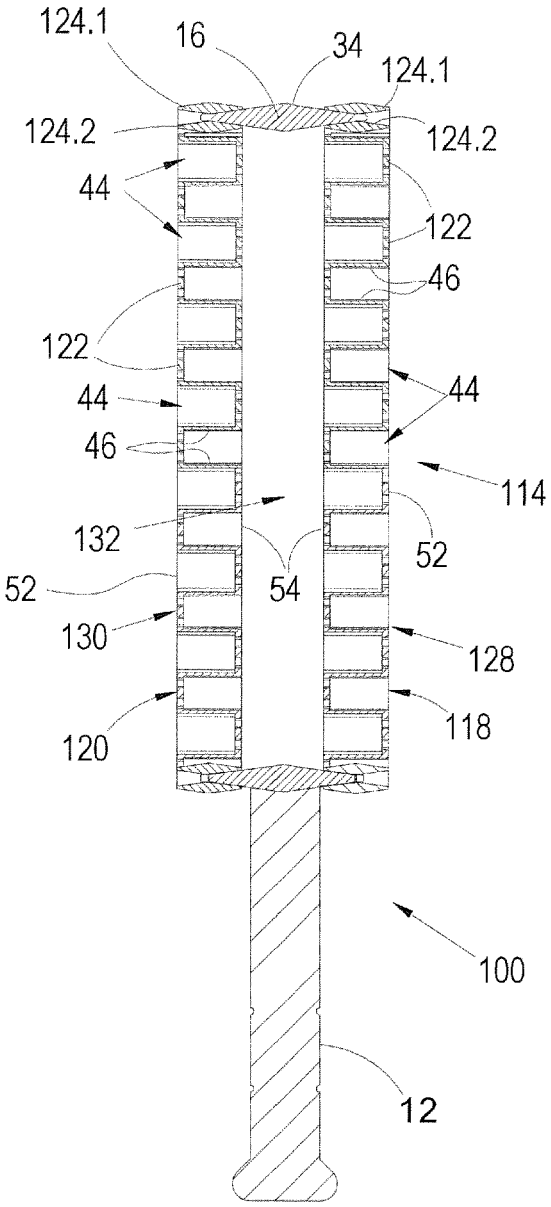
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Figure 9

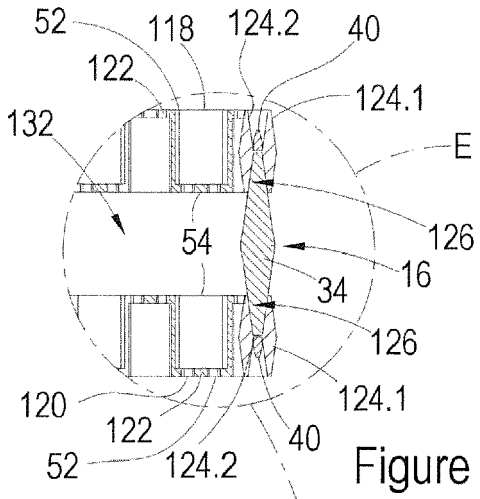

Figure 10A

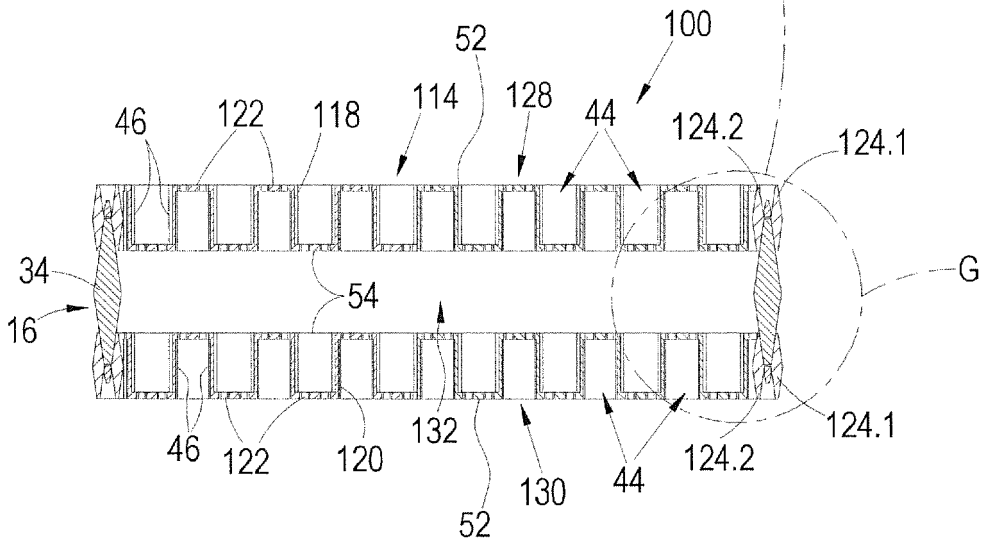

Figure 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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