IMPROVEMENTS RELATING TO STRUTLESS-TYPE UMBRELLA

FIELD OF THE INVENTION

This invention is generally in the field of umbrellas, and relates to s strutless-type umbrella.

BACKGROUND OF THE INVENTION

Up to date most if not all umbrellas in the market make use of struts extending between the umbrella stick and the canopy for supporting the canopy ribs at some mid portion thereof. Strutless umbrellas (i.e. having a canopy without stretchers extending between the umbrella post and the ribs) are known in the patent literature, and are described for example in the following patents:

US 5,711,234 discloses a strutless umbrella which includes a central post, either an inner plunger or tube, a canopy assembly including ribs pivotally mounted on the upper end of the central post. Links connect the ribs to the inner plunger or tube. Movement of one of the ribs moves the plunger or tube which moves the remaining ribs. A latch pin holds the umbrella in the open position.

US 5,638,846 discloses an umbrella having a simplified construction which dispenses with the stretcher members (struts) of conventional umbrellas and has one end hinged to the central portion of each rib. Said umbrella includes a runner axially slidable along the umbrella pole between a folded position in which the ribs can be folded against the pole, and an unfurled position in which the runner engages the ribs and holds them in the extended position. For this purpose, the runner comprises an upper frusto-conical portion engageable with the ends of the reinforcing portions of the ribs. It can be appreciated that according to US 5,638,846, the ribs are to be folded by gravity acting on their own weight, since there is no user activated mechanism for folding them.

AT 231634 discloses strutless umbrella aimed at protecting from radioactive rain following nuclear disaster. The umbrella ribs extend into the umbrella crown into which being incorporated a guiding device placed inside the stick tube and operable from the umbrella's handle. The guiding device comprises an actuation rod passing upwardly through the stick tube, and a grooved plate mounted on the rod. The center ends of the canopy ribs formed in the shape of spheres enter the grooved plate. Above the plate, a pressure spring is mounted on the actuation rod and supported on its next end in the stick head which is mounted on the umbrella crown.

Other strutless umbrellas, developed by the inventor of the present application, utilize a canopy conducting mechanism, which may be useful for electrical umbrellas. The canopy conducting mechanism has short movement between open and closed states of the umbrella and is based on pin and slide joints between the umbrella ribs and between a canopy conducting member.

Needless to say that the appearance of strutless umbrellas is neater and more elegant when compared to that of umbrellas having struts. Furthermore, strutless umbrella enables a user to bring the canopy very close above his head, which may improve the protection the umbrella provides, especially in hard and windy weather conditions.

SUMMARY OF THE INVENTION

There is a need in the art to improve a canopy conducting mechanism of strutless umbrellas. This is associated with the following:

One problem that should be addressed when designing a strutless umbrella is the dimensions of the umbrella in its folded state, which should preferably not significantly exceed those of the conventional umbrellas (with struts). It will thus be advantageous to have a canopy deployment and closing mechanism providing for substantially regular diameter (that of the conventional umbrella) of the folded strutless umbrella. It appears that it is not simple to comply with this requirement.

Reduction in the weight of umbrellas, whether or not they are strutless, will also be welcomed by users. The motivation of umbrella designers to reduce the number and

weight of umbrella components is therefore acknowledged. Moreover, this should be done without significantly affecting umbrella's strength, durability, and fitness to comply with intense winds.

As mentioned above, strutless umbrellas have no struts to help in lifting and lowering the ribs between deployed and closed states of the umbrella. Considering for example the above-mentioned patents, the following should be noted:

The umbrella of US 5,638,846, having no struts, leaves the control on folding the canopy to the gravity force acting on it.

According to AT 231634 and US 5,711,234, the mechanisms for pivoting the ribs for lifting or lowering them are based on pushing and puling them through an extension of the rib body made between their pivot axis and the area above the top of the stick. Therefore, in these mechanisms the length of the extension of the ribs together with the dimensions of other parts of the mechanisms located above the top of the stick define a minimum to the possible diameter of the folded umbrella. Since said extension of the rib acts as a lever arm, it can be appreciated that the forces acting on both the extension and the pivotal connection of the rib are in an inverse relation to the length of the extension. The longer the extension is, the lower the acting forces are, and *vice versa*. Therefore, in order to reduce the acting forces, the lever arms should be extended respectively, resulting in enlargement in the diameter of the folded umbrella.

Referring to AT 231634, it is to be noted that the minimum diameter of the folded umbrella is the distance measured between the bent corners of two opposite ribs. This minimal diameter would be about 130% of the crown's diameter. Also, the diameter of the actuation rod together with twice the wall thickness of the grooved plate adds to the lengths of two opposite rib extensions from pivot pin to sphere in defining a minimum possible diameter of the crown. It is further to be noted that the contact area between the plate and the ends of the ribs is pointed, since it is the area between a flat surface of the plate tangential to the sphere. As the acting forces are high, pressure between the surfaces becomes extremely high, which may result in accelerated wearing of both the surface of the plate and the spheres. The diameter of the pivot pin is about only 5% of the lever arm (i.e. the distance from the pivot pin to the sphere). Accordingly, the contact area between the pin and the apertures in which it pivots is

very small, and thus the pressure between the contacting surfaces of the pin and the apertures will be high, causing accelerated wearing of the pivot connection.

The present invention solves the above problems by providing a novel configuration of a rib assembly for strutless umbrella (having a pin and slide canopy conducting mechanism), enabling reduction of the umbrella diameter when in its folded state. This is achieved by providing at least one of the following configurations of the rib assembly comprised of a longitudinal rib body having a pivot member at its end, and a rib lever extending from the rib body: (i) the pivot member is located in a corner formed between the rib body and the rib lever; (ii) the rib lever extends from the rib body in an angle of between 110 – 160 degrees; (iii) the rib lever has a goggles shaped profile; (iv) the height of the rib body is similar to the max distance between the round surfaces of the rib lever; (v) the max thickness of the rib lever is certainly smaller comparing to the max distance between the rounded surfaces of the rib lever; (vi) the round sliding surfaces of the rib lever are substantially planner in a direction parallel to a pivoting axis of the rib; (vii) the pivot member is formed as a pair of lateral protrusions protruding from the pivot point to form a pivoting axis from the same piece of material of the rib; (viii) the distance between the pivot member and the free end of the rib lever does not exceed about 200% of the max distance between the round surfaces of the rib lever; (ix) the free end of the rib lever has a coin shape tapering towards the free end; (x) the free end of the rib lever has a coin shape truncated at the free end; (xi) the pivot member has a diameter greater than about 20% of the rib lever's length.

According to one broad aspect of the invention, there is provided an umbrella rib assembly for use in strutless umbrella having a pin and slide canopy conducting mechanism, the rib assembly comprising a longitudinal rib body having a pivot member at its end, and a rib lever extending from the rib body, and being characterized in that the pivot member and the rib body together with the rib lever present a single piece of material, and the pivot member is located in a corner formed between the rib body and the rib lever.

The material of the pivot member and the rib body may be a polymeric material.

Preferably, the rib lever extends from the rib body in an angle of between 110 – 160 degrees. The rib lever may have a goggles shaped profile. The rib lever preferably has rounded upper and lower sliding surfaces, with the height of the rib body being similar to a maximal distance between said rounded surfaces. The maximal thickness of the rib lever is preferably smaller as compared to a maximal distance between the rounded upper and lower sliding surfaces of the rib lever. The rounded surfaces are preferably substantially planner in a direction parallel to a pivoting axis of the rib assembly.

Preferably, the pivot member is formed as a pair of lateral protrusions protruding from a pivot point to form a pivoting axis from the same piece of material. A distance between the pivot member and the free end of the rib lever preferably does not exceed about 200% of the maximal distance between round upper and lower sliding surfaces of the rib lever.

Preferably, the configuration is such that the free end portion of the rib lever has a coin shape tapering towards the free end of the rib lever, or a coin shape truncated at the free end of the rib lever. The diameter of the pivot member is greater than about 20% of the rib lever's length.

According to another aspect of the invention, there is provided a strutless umbrella comprising a plurality of the rib assemblies, each configured as described above.

Each of the rib assemblies is preferably pivotally mounted in a housing having a base part connected on top of the umbrella's stick and a cap part secured on top of the base part. A corresponding number of pairs of recesses is provided between the base part and the upper part, each pair of recesses accommodating a pivot axis of one of the rib assemblies.

Preferably, the free ends of the rib levers are located between upper and lower restricting members forming a slide in which rounded upper and lower surface of the rib levers can slide when the rib assemblies are forced to pivot upon a linear movement of the slide in line with the longitudinal axis of the umbrella. The upper and lower restricting members are secured to each other and to the upper edge of a rod passing

through the stick, by means of a screw. Preferably, a distance between the round surfaces of the rib lever is greater than a distance between slides which serve mirroring ribs. The rib assemblies preferably have gradually reduced thickness towards their distal ends resulting in flexibility of the ends of the rib assemblies useful for obtaining mushroom shaped canopy.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, preferred embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figs. 1A to **1C** illustrate, in partial vertical cross section view, three states during the operation of a canopy conducting mechanism of the present invention based on pin and slide joint;

Fig. 2 illustrates a partial lateral cross section view of the canopy conducting mechanism in its state of Fig. 1B;

Fig. 3 illustrates a side view of an umbrella rib according to the embodiment of Figs 1A to 2, made of one piece of material;

Fig. 4 illustrates a top view of the canopy rib of Fig. 3;

Fig. 5 illustrates another embodiment of an umbrella rib according to the present invention;

Fig. 6 illustrates the rib of Fig. 5 with the free end of its rib lever situated in a canopy conducting member;

Fig. 7 illustrates another embodiment of a rib according to the present invention;

Fig. 8 illustrates a top view of the ribs and the base part of the housing in the embodiment of Fig. 7;

Fig. 9 illustrates an isometric view of a cap of a rib housing, to be mounted on a base part;

Fig. 10 illustrates an isometric view of the base part of the embodiment of Fig. 8; **and**

Fig. 11 illustrates in isometric another embodiment of a two-part housing connected on top of an umbrella stick.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Referring to **Figs. 1A-1C and 2**, there is illustrated an example of a canopy conducting mechanism of the present invention, which in the present example is based on a pin-and-slide joint. The latter is of the type defining an elongated contact region between a pin (i.e., a cylindrically-like element with circular or other rounded base surfaces) and a slide plane, the contact region thus being a line along the cylinder-like generator. **Figs. 1A-1C** show, in partial vertical cross section view (taken at **A-A** of Fig. 2), three operational states, respectively, of the mechanism, and **Fig. 2** shows a partial lateral cross section view (taken at B-B of Fig. 1B) of the canopy conducting mechanism in its state of Fig. 1B.

In the illustrated embodiment, a pin **300** of the pin-and-slide joint is actually the end portion of a rib lever **303** of an umbrella rib body **301**. Pin **300** is also referred to in the context of the present invention as "the free end of the rib lever". In this example, pin **300** has a coin-like shape, i.e. a cylinder of a relatively small height, namely having a diameter significantly larger than its thickness (measured perpendicular to the figure plane), and is tapered toward the free end of the pin. This feature can be seen clearly in Fig. **2**. The pin **300** is mounted for sliding movement along a hollow cell **311** (will be referred to also as "slide **311**") made in a canopy conducting member **310**, which actually is a hub comprising a plurality of such hollow cells **311** arranged in a spaced-apart radial array about a common center.

In **Fig. 1A**, the canopy conducting member **310** is shown in its uppermost position above the umbrella stick (not illustrated), with the pin **300** forcing the rib lever **303** upwards, thus keeping the rib body **301** downwards, which corresponds to a closed canopy state. When the canopy conducting member **310** moves down to the position illustrated by **Fig. 1B**, it forces the free end of the rib lever downwardly and furthermore to slide inwardly inside the hollow cell **311**, thus forcing the rib body **301** to rotate upwardly about the pivot member **302**, to a mid position which corresponds to a partially open state of the canopy. By further lowering the canopy conducting member **310** to the lowermost position, as illustrated by **Fig. 1C**, the free end of the rib lever is forced downwards and laterally outwards from the hollow cell **311**, thus forcing the rib body **301** to further pivot about the pivot member **302**, to the position which corresponds to the open state of the umbrella. As can be appreciated, the pin-and-slide joint formed by the free end ("pin") **300** and slide **311** allows to convert the up-down vertical movement of the conducting member **310** into a pivoting movement of the lever **303** and the rib body **301** about the pivot member **302**. It is appreciated that the rib lever **303** may be designed shorter than illustrated, and actually the free end (pin) **300** itself may function as a rib lever.

As shown in **Fig. 2**, in the state illustrated by Fig. **1B**, the ribs **301** are in a mid location with the canopy partially opened and with the free end **300** of each rib lever **303** being maximally slid along the slide **311** in the direction of the central axis of the conducting member **310**. This is in contrast to what is shown in Figs **1A** and **1C** in which the free end **300** of the rib lever reaches its maximal opposite slid along the slide **311**, i.e. its max distance from the center of the conducting member **310**. The up-down movement of the conducting member can be achieved by a hub extension **312** (shown in Figs **1A-1C**) extended into the stick of the umbrella.

Reference is made to **Figs. 3 and 4** illustrating side and top views, respectively, of an umbrella rib assembly according to the above-described embodiment of Figs **1A to 2,** and made of one piece of material. The rib assembly can be produced from plastic casting, as one (integral) unit comprising rib lever **303** and its free end **300**, pivot members **302** from both rib's sides, and rib body **301**. The rib body **301** itself may have recesses **304** from both its sides, thus reducing its weight with negligible lose of strength. The opposite end portion **305** of the rib body **301** can be made gradually

tapered, such that its thickness at the end of the rib body **301** is sufficiently reduced as to make it flexible. As a result, when the canopy is fully opened the rib body **301** is forced to the arched shape illustrated by doted line **306**, due to a stress exerted by the canopy fabric (not illustrated) which is dimensioned and designed in a mushroom shape, forcing the flexible ends of the rib bodies to bent downwardly. The stress exerted by the canopy fabric significantly increases the forces acting on the rib lever **303**, on the pivot member **302**, and significantly increases the pressure in the tangential contact between the round surfaces of the coin shaped free end **300** and the surfaces of the slide **311**. However, the above-described umbrella rib construction includes several features which allow it to comply with extreme acting forces: the rib assembly has a pivoting axis defined by the pivot member **302** having a diameter greater than about 15% of a distance between it and the central axis of the coin shaped "pin" **300**, and is furthermore integral (made from the same piece of material) to the rib body. The tangential contact between the round surfaces of the coin shaped "pin" **300** and the surfaces of the slide **311** is linear and not pointed, The rib assembly has a massive lever structure **303** having a height (measured in the figure plane perpendicularly to the longitudinal axis of the lever arm) averagely greater than half its length and twice its width. As shown in **Fig. 4**, the rib assembly has flat end **305** which is flexible in the direction perpendicular to the illustration plane, due to reduced thickness of the end of the rib body.

Accordingly, the present invention provides an umbrella having a canopy conducting mechanism described above, wherein the rib bodies are made of a rigid material and have gradually reduced thickness at their distal ends resulting in flexibility thereof useful for obtaining mushroom shaped canopy.

Referring to **Fig. 5**, there is illustrated another embodiment of an umbrella rib **1** according to the present invention. The figure focuses on the area of a rib lever **3** and its meeting area with a rib body **5**. The rib lever extends from the rib body in an angle A. This angle is in the range of between 110 – 160 degrees, and is preferably about 135 degrees. A pivot member **2** is located in a corner **4** formed between the rib body **5** and the rib lever **3**. The rib lever **3** has a goggles shaped profile. This is identifiable by a valley **6** formed between two hills **6a** and **6b**. The hill **6a** forms an upper round surface to be in tangential contact with a surface of an upper slide member aimed at preventing free pivoting of the lever upwardly. An upside-down hill **6c** forms a lower round

surface, mirroring said upper round surface **6a**, to be in tangential contact with a surface of a lower slide member (not shown) aimed at preventing free pivoting of the lever downwardly. The height of the rib body **5** (the height being measured between the upper and lower surfaces **7** and **8** of the rib body **5** near its meeting area with the rib lever **3**) is similar to the max distance between the round surfaces **6a** and **6c** of the rib lever **3**. The depth of the valley **6** is preferably of the minimal value which still permits sufficient rotation of the canopy rib for approaching its fully deployed position. A mirroring valley **9** fulfills a similar function in the opposite rotation direction of the rib, i.e. permits sufficient rotation of the rib for approaching its fully closed position. As can be appreciated the max thickness of the rib lever **3** (measured e.g. along line **10** between the opposite flat walls of the lever) is certainly smaller comparing to the max distance between the round surfaces **6a** and **6c** of the rib lever. The round sliding surfaces **6a** and **6c** of the rib lever are substantially planner in a direction parallel to the pivoting axis **11** of the rib. The pivot member **2** is formed as a pair of lateral protrusions from the lateral flat walls of the rib (only one is seen in this Figure) to form the pivoting axis from the same piece of material of the rib.

It can be appreciated that a distance between the pivot member **2** and the free end of the rib lever **3** does not exceed about 200% of the max distance between the round surfaces **6a** and **6c** of the rib lever. The pivoting member **2** has a diameter greater than about 20% of the rib lever's length. Thus, the forces acting on the pivot members will be dispersed over a greater contact are between the pivot axis and the apertures in which it is situated, exerting reduced pressures. The free end of the rib lever has a coin shape tapering towards the free end thus allowing to crowd together rib levers of a plurality of umbrella ribs closest to the umbrella's centerline axis.

Fig. 6 illustrates the rib **1** of Fig. 5 with the free end of its rib lever **3** situated in a slide **20** formed in a canopy conducting member **19** constituted by upper and lower restricting members **21** and **22**. In such canopy conducting member **19**, the round surfaces **6a** and **6c** of the rib levers can slide when the ribs are forced to pivot upon a linear movement of the conducting member in line with the longitudinal axis of the umbrella (i.e. as indicated by an arrow **W**).

As can be appreciated, the max distance between the rounded surfaces **6a** and **6c** is grater than the distance (measured as the diameter of a tubular portion **23** of the restricting members **21** and **22**) between slide's portions which serve mirroring ribs. This is to emphasize how close to the longitudinal centerline of the umbrella the rib levers may approach. It is appreciated that the tapering of the rib levers towards the free ends of the levers allows to crowd together the plurality of free ends of the rib levers in the very center of the umbrella, from above the stick.

According to the illustrated embodiment, the upper and lower restricting members **21** and **22** are two exemplars of the same part formed from plastic material and arranged to face one another to form the slide **20** in between. The parts are to be connected together by screw or bolt inserted through a hole **24** and passing through inside the tubular portion **23** to secure the conducting member to the top edge of an actuation rod (not seen) passing through the stick.

Fig. 7 illustrates yet another embodiment of a rib according to the present invention. A rib **31** has a rib body **35** and a rib lever **33**. The free end of the rib lever **33** has a coin shape truncated at the free end. It is to be noted that when the rib **31** is in a mid position between fully deployed and fully closed states of the umbrella, the free ends of the rib lever **33** reach their closest distance to the umbrella's centerline axis. Therefore, by having the coin shaped free end truncated, it becomes possible to locate the ribs **31** closer to the centerline. The truncation does not affect the functionality of round surfaces **36**a and **36**c of the lever **33**. Two mirroring ribs **31** are depicted, the left one demonstrates the rib orientation in deployed state of the umbrella while the right one demonstrates the rib orientation in closed state of the umbrella. It should be understood that the configuration of **Fig. 7** (i.e., different orientations of the ribs) does not exist in a fully assembled umbrella, since they are all correlated by the canopy conducting member which govern their orientation and movements.

Fig. 7 also illustrates, in a vertical cross section view, a base part **40** of a housing in which the ribs are pivotally connected. The base part **40** has a truncated conical profile, comprising a circular groove **41** allowing connecting the housing on top of an umbrella stick, and a plurality of vertically oriented gaps **44** allowing the ribs to fold closer to the stick. As can be appreciated, due to the location of the rib pivot axis near a

corner **39** between the rib body **35** and the rib lever **33**, the diameter of the umbrella in its folded state will not significantly exceed a diameter **D** of the housing measured at its widest region.

Fig. 8 illustrates a top view of the ribs and the base part of the housing illustrated by Fig. 7. Reference is made also to Fig. 10 illustrating the base part in isometric view from above. The ribs **31** are pivotally connected to the umbrella's stick (not shown) through a rib housing whose base part **40** is connected to the upper end of the stick. The pivot connection is by pairs of protrusions **32** made from both rib sides near the end of the rib body **35** to form a pivot axis **32**. The pairs of protrusions **32** are situated in respective pairs of recesses **42** made in the rib holders **46** which in this example are formed as elevated members of the base part **40**. Each rib holder **46** contains two recesses **42** each for receiving a respective protrusion **32** of an adjacent umbrella rib body **35**.

A hexagonal tunnel **49** is formed in the bottom of the base part **40,** through which an actuation rod (not shown) can emerge from the stick to join a canopy conducting member e.g. of the type **310** of Fig. 1, or **19** of Fig. 6, to be accommodated within the housing.

For the purpose of description only, two of a total of eight umbrella ribs **31** are illustrated in this Figure, while spaces in the base part **40** for receiving the six remaining ribs are illustrated empty. Each rib receiving space in the base part **40** contains a gap **44** formed between two rib holders **46** which are base part members elevating from the housing collar **58**. The gaps **44** extend downwards the base part in order to allow the ribs approaching near the stick when pivoting towards a closed state of the umbrella.

The base part **40** further has bores **58** made in the top surface of the rib holders **46**, for receiving corresponding protrusions made in the bottom of the cap **62** (illustrated by Fig. 9). The connection between the bores **58** and the corresponding protrusions may be reinforced by screws each passing through a respective pair of protrusion and bore.

After the protrusions **32** of all the eight ribs are situated in the respective recesses with the free ends of the rib levers seating in the slides of the canopy conducting member, the housing cap **62** may be connected to the base part as to secure

the ribs by closing the recesses **42** from above thus preventing escape of the protrusions **32** from the recesses **42**.

Fig. 9 illustrates an isometric view of a cap **62**, showing its bottom, which matches the top of the base part **40**. The cap has pairs of recesses **42a**, made in closures **46a**, each closure **46a** cooperates with a corresponding rib holder **46** such that when the base part is closed by the cap, the recesses **42** made in the rib holders **42** and the recesses **42a** made in closures **46a** form pairs of cylindrical spaces accommodating respective pairs of protrusions **32** of the umbrella ribs **31**. It is to be noted that it is possible also to have recesses only in the rib holders **46** of the base part provided that they are sufficiently deep so as to accommodate the protrusions **32**. In such a case the bottom of the closures **46a** may be flat and yet keep the umbrella ribs closed between the cap **62** and the base member **42**. Protrusions **58a** are also being formed in the bottom of the closures 46a, and are matching the bores **58** made in the rib holders **46** of the base part **40**, so as to facilitate connecting the cap on top of the base part. A gap **44a** is formed between each pair of neighboring closures **46a**, forming extension to a corresponding gap **44** located between respective pair of neighboring rib holders **46**, thus allowing the umbrella ribs to pivot between a fully deployed state and a fully closed state.

Fig. 10 illustrates an isometric view of the base part **40** illustrated by Fig. **8.**

Fig. 11 illustrates in isometric another embodiment of a two part housing **150** connected on top of umbrella stick **139.** Cap **162** of the housing **140** is secured to base part **140,** and eight umbrella ribs **131** are pivotally connected between the cap and the base part. Due to gaps **144** formed between pairs of neighboring rib holders **146,** the umbrella ribs may be folded to lay juxtaposed the stick **139** when the umbrella is closed. Thus, the diameter of the closed umbrella is determined by the diameter of the housing at its widest portion **180.** The ribs **131** do not significantly influence the diameter of the closed umbrella, since they are accommodated within the gaps. In this embodiment the cap **162** has integral threaded bolt protruding upwardly, useful for mounting a ferrule.

Those skilled in the art will readily appreciate that various modifications and changes can be applied to the embodiment of the invention as herein described without departing from its scope defined in and by the appended claims.

CLAIMS:

1. Umbrella rib assembly for use in strutless umbrella having a pin and slide canopy conducting mechanism, the rib assembly comprising a longitudinal rib body having a pivot member at its end, and a rib lever extending from the rib body, and being characterized in that the pivot member and the rib body together with the rib lever present a single piece of material, and the pivot member is located in a corner formed between the rib body and the rib lever.

2. The rib assembly of Claim **1,** wherein the rib lever extends from the rib body in an angle of between **110 – 160** degrees.

3. The rib assembly of Claim **1** or **2,** wherein the rib lever has a goggles shaped profile.

4. The rib assembly of any one of preceding Claims, wherein the rib lever of the rib body has rounded upper and lower sliding surfaces, the height of the rib body being similar to a maximal distance between said rounded surfaces.

5. The rib assembly of any one of preceding Claims, wherein a maximal thickness of the rib lever is smaller comparing to a maximal distance between rounded upper and lower sliding surfaces of the rib lever.

6. The rib assembly of any one of preceding Claims, wherein rounded upper and lower sliding surfaces of the rib lever are substantially planner in a direction parallel to a pivoting axis of the rib assembly.

7. The rib assembly of any one of preceding Claims, wherein the pivot member is formed as a pair of lateral protrusions protruding from a pivot point to form a pivoting axis from the same piece of material.

8. The rib assembly of any one of preceding Claims, wherein a distance between the pivot member and the free end of the rib lever does not exceed about 200% of the maximal distance between round upper and lower sliding surfaces of the rib lever.

9. The rib assembly of any one of preceding Claims, wherein a free end portion of the rib lever has a coin shape tapering towards the free end of the rib lever.

10. The rib assembly of any one of preceding Claims, wherein a free end portion of the rib lever has a coin shape truncated at the free end of the rib lever.

11. The rib assembly of any one of preceding Claims, wherein the pivot member has a diameter greater than about 20% of the rib lever's length.

12. The rib assembly of any one of preceding Claims, wherein, formed from a polymeric material.

13. A strutless umbrella comprising a plurality of the rib assemblies according to anyone of claims 1 to 12.

14. The umbrella of Claim 13, wherein each of said rib assemblies is pivotally mounted in a housing having a base part connected on top of the umbrella's stick and a cap part secured on top of the base part, pairs of recesses being formed between the base part and the upper part each accommodating a pivot axis of one of the rib assemblies.

15. The umbrella of Claim 14, wherein the free ends of the rib levers are located between upper and lower restricting members forming a slide in which rounded upper and lower surface of the rib levers can slide when the rib assemblies are forced to pivot upon a linear movement of the slide in line with the longitudinal axis of the umbrella, the upper and lower restricting members being secured to each other and to the upper edge of a rod passing through the stick, by means of a screw.

16. The umbrella of Claim 14, wherein the free ends of the rib levers are located between upper and lower restricting members forming a slide in which rounded upper and lower surfaces of the rib levers can slide when the ribs are forced to pivot upon a linear movement of the slide in line with the longitudinal axis of the umbrella, a distance between the round surfaces of the rib lever being greater than a distance between slides which serve mirroring ribs.

17. The umbrella of any one of Claims 13 to 16, wherein the rib assemblies have gradually reduced thickness towards their distal ends resulting in flexibility of the ends of the rib assemblies useful for obtaining mushroom shaped canopy.