

SUNSHADE SYSTEM OF UNITIZED CURTAIN WALL

Field of the Invention

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The present invention relates to a curtain wall structure, and more specifically, to a sunshade device arranged on a unitized curtain wall.

Background of the Invention

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A conventional sunshade device arranged on a unitized curtain wall is assembled at the construction site. However, the assembly procedure is complex, requiring a large amount of workload. In addition, the assembly operation is inconvenient, and easy to be influenced by poor on-site environment and weather condition. Therefore, the quality of assembly cannot be guaranteed. Moreover, the sunshade device is generally mounted on the unitized curtain wall. When the sunshade device is damaged, it is relatively difficult to repair.

Summary of the Invention

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The technical problem to be solved by the present invention is to provide a sunshade system of a unitized curtain wall, with which a sunshade device of the sunshade system can be assembled on the unitized curtain wall as an integral piece at factory, and the transportation thereof would not be influenced.

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The technical solution to the above technical problem used in the present invention is to provide a sunshade system of a unitized curtain wall, comprising a curtain wall unit and a sunshade device mounted on the curtain wall unit. The sunshade device is connected to the curtain wall unit through a rotating shaft structure having a defined rotating angular range, so that the sunshade device can rotate into a stretched state, or a folded state, in which the sunshade device is adjacent to the curtain wall unit.

The sunshade device comprises a lateral sunshade assembly, and the rotating

shaft structure comprises a lateral rotating shaft structure. The lateral sunshade assembly is rotatably connected to the curtain wall unit through the lateral rotating shaft structure, and restricted within an angular range between the stretched state, which is realized through downwardly rotating the lateral sunshade assembly, and the
5 folded state, which is realized through upwardly rotating the lateral sunshade assembly to be adjacent to the curtain wall unit.

The lateral rotating shaft structure comprises a shaft tube, two lateral shaft cores respectively mounted at two ends of an inner passage of the shaft tube, and two lateral
10 fixing elements. The lateral fixing elements fix the lateral shaft cores on the curtain wall unit, and the lateral sunshade assembly is fixedly connected to the shaft tube.

The shaft tube is provided at its inner wall with a pair of diametrically opposite first limiting protrusions and a pair of diametrically opposite second limiting
15 protrusions, and the lateral shaft core is provided at its outer wall with a pair of diametrically opposite first stoppers.

When the lateral sunshade assembly rotates downwardly to the stretched state, the first stoppers abut with the first limiting protrusions to prevent further downward
20 rotation of the lateral sunshade assembly. And when the lateral sunshade assembly rotates upwardly to the folded state, the first stoppers abut with the second limiting protrusions to prevent further upward rotation of the lateral sunshade assembly.

The shaft tube and the lateral shaft core are provided at respective walls thereof
25 with respective threaded holes. The thread hole of the shaft tube faces toward the thread hole of the lateral shaft core in position when the lateral sunshade assembly rotates into the stretched state.

A lateral groove is arranged on an outer wall of the shaft tube. The thread hole
30 arrange at the wall of the shaft tube is located in the bottom portion of the lateral groove, the upper portion of which is closed by a lateral cover.

The sunshade device comprises a longitudinal sunshade assembly, and the

rotating shaft structure comprises a longitudinal rotating shaft structure. The longitudinal sunshade assembly is rotatably connected to the curtain wall unit through the longitudinal rotating shaft structure, and restricted within an angular range between the stretched state, which is obtained through outwardly rotating the longitudinal sunshade assembly, and the folded state, which is obtained through inwardly rotating longitudinal sunshade assembly to be adjacent to the curtain wall unit.

The longitudinal rotating shaft structure comprises a longitudinal shaft core, a primary shaft tube, a secondary shaft tube and a longitudinal fixing element. The primary shaft tube is movably mounted on the longitudinal shaft core and fixedly connected to the curtain wall unit through the longitudinal fixing element. The secondary shaft tube is fixedly mounted on the longitudinal shaft core, and connected with the longitudinal sunshade assembly.

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The primary shaft tube is provided at its inner wall with a pair of diametrically opposite third limiting protrusions and a pair of diametrically opposite fourth limiting protrusions. The longitudinal shaft core is provided at its outer wall with a pair of diametrically opposite second stoppers.

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When the longitudinal sunshade assembly rotates outwardly to the stretched state, the second stoppers abut with the third limiting protrusions to prevent further outward rotation of the longitudinal sunshade assembly. And when the longitudinal sunshade assembly rotates inwardly to the folded state, the second stoppers abut with the fourth limiting protrusions to prevent further inward rotation of the longitudinal sunshade assembly.

The longitudinal shaft core and the primary shaft tube are provided at respective walls thereof with individual threaded holes. The thread hole of the longitudinal shaft core faces toward the thread hole of the primary shaft tube in position when the longitudinal sunshade assembly rotates into the stretched state.

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A longitudinal groove is arranged on an outer wall of the primary shaft tube. The

thread hole arrange at the wall of the primary shaft tube is located in the bottom portion of the longitudinal groove, the upper portion of which is closed by a longitudinal cover.

5 The secondary shaft tube is formed by a front cover and a rear cover. The front cover is fixed to the longitudinal sunshade assembly through a screw, and the front cover, the rear cover and the longitudinal shaft core are fixed together through screws.

10 Compared with the prior arts, the sunshade system of a unitized curtain wall of the present invention has the following advantages. The components of the sunshade system are assembled at factory, instead of at the construction site as conventionally. Therefore, the labor cost necessary at the construction site can be significantly reduced, the operation duration can be shortened, the costs can be saved, and the progress of works will not be influenced by poor on-site environment and weather
15 condition. In addition, the sunshade device is assembled at factory, thus ensuring the quality thereof. Moreover, the sunshade device can be mounted on the unitized curtain wall in the folded state, thus facilitating the transportation with the curtain wall unit. Finally, when the sunshade device is damaged, the sunshade device can be temporarily rotated 90 degrees, so that the repair can be convenient.

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Brief Description of the Drawings

Fig. 1 is a side view of a sunshade system of a unitized curtain wall according to the present invention;

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Fig. 2 is an exploded view of a lateral sunshade assembly 2;

Fig. 3 shows the lateral sunshade assembly 2 in its assembled state;

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Fig. 4 schematically shows the lateral sunshade assembly 2 in its folded state;

Fig. 5 is an enlarged view showing the connection between an end of a shaft tube 31 and a lateral shaft core 32;

Fig. 6 is a lateral cross-sectional view showing the connection between the shaft tube 31 and the lateral shaft core 32 when the lateral sunshade assembly 2 is in its stretched state;

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Fig. 7 is a lateral cross-sectional view showing the connection between the shaft tube 31 and the lateral shaft core 32 when the lateral sunshade assembly 2 is in its folded state;

10 Fig. 8 is an exploded view of a longitudinal sunshade assembly 5;

Fig. 9 shows the longitudinal sunshade assembly 5 in its assembled state;

Fig. 10 shows the longitudinal sunshade assembly 5 in its folded state;

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Fig. 11 is a lateral cross-sectional view showing the connection between a longitudinal shaft core 61 and a primary shaft tube 62 when the longitudinal sunshade assembly 5 is in its stretched state;

20 Fig. 12 is a lateral cross-sectional view showing the connection between the longitudinal shaft core 61 and the primary shaft tube 62 when the longitudinal sunshade assembly 5 is in its folded state

25 **Detailed Description of the Embodiments**

The present invention will be described in further detail with reference to preferred embodiments shown in the accompanying drawings.

30 As shown in Fig. 1, a sunshade system of a unitized curtain wall according to the present invention comprises a curtain wall unit 1, and a sunshade device mounted on the curtain wall unit 1. The sunshade device is connected to the curtain wall unit 1 through a rotating shaft structure, which has a defined rotating angular range, so that

the sunshade device can be rotated into a stretched state or a folded state.

The term "stretched state" used in the context indicates a state in which the plane where the whole sunshade device is located is approximately perpendicular to the curtain wall unit 1; in this state, the best sunshade effect can generally obtained. By contrast, the term "folded state" used in the context indicates a state in which the plane where the whole sunshade device is located is approximately parallel to, and thus adjacent to the curtain wall unit 1.

The sunshade device may include a lateral sunshade assembly 2 and/or a longitudinal sunshade assembly 5. Generally, the length direction of the lateral sunshade assembly 2 is in a horizontal direction, while that of the longitudinal sunshade assembly 5 is in a vertical direction. Correspondingly, the rotating shaft structure includes a lateral rotating shaft structure 3 and/or a longitudinal rotating shaft structure 6. The lateral sunshade assembly 2 is rotatably connected to the curtain wall unit 1 through the lateral rotating shaft structure 3, and thus be limited in an angular range defined between the stretched state as shown in Fig. 3, which can realized through downwardly rotating the lateral sunshade assembly 2, and the folded state as shown in Fig. 4, which can realized through upwardly rotating the lateral sunshade assembly 2 to be adjacent to the curtain wall unit 1. The longitudinal sunshade assembly 5 is rotatably connected to the curtain wall unit 1 through the longitudinal rotating shaft structure 6, and thus be limited in an angular range defined between the stretched state as shown in Fig. 9, which can realized through outwardly rotating the longitudinal sunshade assembly 5, and the folded state as shown in Fig. 10, to which can realized through inwardly rotating the longitudinal sunshade assembly 5 to be adjacent to the curtain wall unit 1.

As shown in Figs. 2 and 3, in the present embodiment, the lateral sunshade assembly 2 includes a front lateral sunshade plate 21, a rear lateral sunshade plate 22, and two first interconnected plates 23 arranged at respective sides. The front lateral sunshade plate 21 and the rear lateral sunshade plate 22 are arranged in parallel but spaced with each other, and are securely connected at end faces thereof with a front portion of the first interconnected plates 23 through screws. As shown in Fig. 5, a

round hole 231 is provided at a rear portion of each first interconnected plate 23, and a plurality of threaded holes 232 are provided around the round hole 231.

Conventionally, there are various rotating shaft structures which can define a defined rotating angular range. In the present embodiment, as shown in Fig. 2, the lateral rotating shaft structure 3 includes a shaft tube 31, two lateral shaft cores 32 respectively mounted at two ends of an inner passage of the shaft tube 31, and two lateral fixing elements 33. Each lateral fixing element 33 fixes one of the lateral shaft cores 32 on the curtain wall unit 1. The lateral sunshade assembly 2 is fixedly connected to the shaft tube 31, which can rotate within a certain angular range with respect to the lateral shaft cores 32. In this manner, the lateral sunshade assembly 2, together with the shaft tube 31 fixedly connected thereto, can rotate within a certain angular range with respect to the lateral shaft cores 32.

The connection for the above components of the lateral rotating shaft structure 3 will be illustrated as follows.

As shown in Fig. 5, the lateral fixing element 33 is provided with a plurality of threaded holes 331 at a front part thereof. The lateral shaft core 32 is provided at an end thereof with a plurality of screw seats 322, each corresponding to one of the threaded holes 331 in position. A screw passes through a respective threaded hole 331 of the lateral fixing element 33 and a respective round hole 231 arranged the rear portion of a first interconnected plate 23, and thus is locked on a respective screw seat 322, so that the lateral fixing element 33 can be fixedly connected to the lateral shaft core 32 at the front part thereof, and to the curtain wall unit 1 through screws at the rear part thereof.

As shown in Fig. 6 or Fig. 7, the shaft tube 31 is also provided at an end thereof with a plurality of screw seats 314, each corresponding to one of the threaded holes 232 arranged around the round hole 231 at the rear portion of the first interconnected plate 23 in position. A screw passes through the threaded holes of the first interconnected plate 23 and of the shaft tube 31, thus fixedly connecting the lateral sunshade assembly 2 with the shaft tube 31.

As shown in Figs. 5, 6 and 7, the shaft tube 31 is provided at its inner wall with a pair of diametrically opposite first limiting protrusions 311, and a pair of diametrically opposite second limiting protrusions 312. In addition, the lateral shaft core 32 is provided at its outer wall with a pair of diametrically opposite first stoppers 321.

When the lateral sunshade assembly 2 rotates downwardly into the stretched state as shown in Fig. 3, the pair of first stoppers 321 of the lateral shaft core 32 exactly abuts with the pair of first limiting protrusions 311 of the shaft tube 31, as shown in Fig. 6. Therefore, further downward rotation of the shaft tube 31 and the lateral sunshade assembly 2 fixed therewith will be prevented. In order to enable the stretched state more stable, the first stopper 321 and the first limiting protrusion 311 each have an L-shaped cross section, so that the two L shaped members, when abutted, will fit with each other with little risk of disengagement. When the lateral sunshade assembly 2 rotates upwardly into the folded state as shown in Fig. 4, the pair of first stoppers 321 of the lateral shaft core 32 exactly engages with the pair of second limiting protrusions 312 of the shaft tube 31, as shown in Fig. 7. Therefore, further upward rotation of the shaft tube 31 and the lateral sunshade assembly 2 fixed therewith will be prevented.

As shown in Fig. 5, the shaft tube 31 and the lateral shaft core 32 are provided at respective walls with a threaded hole 315 and a thread hole 323 respectively. When the lateral sunshade assembly 2 rotates into the stretched state, the threaded hole 315 faces toward thread hole 323 in position. In this case, a bolt 35 passing through the threaded holes of the shaft tube 31 and the lateral shaft core 32 can fix the two members together, with no relative rotation therebetween. In this manner, the lateral sunshade assembly 2 can be securely maintained in the stretched state. In order to enable the threaded hole and the bolt invisible from outside of the shaft tube 31 for the sake of appearance, a lateral groove 313 is arranged on the outer wall of the shaft tube 31. The threaded hole 315 arranged at the wall of the shaft tube 31 is located at the bottom area of the lateral groove 313, the upper opening thereof being closed by a lateral cover 34. In this manner, the threaded hole and the bolt will be hidden.

As shown in Figs. 8, 9 and 10, the longitudinal sunshade assembly 5 includes a longitudinal sunshade plate 51, and two second interconnected plates 52 which are fixed at an upper end face and a lower end face of the longitudinal sunshade plate 51 through screws, respectively.

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The longitudinal rotating shaft structure 6 comprises a longitudinal shaft core 61, a primary shaft tube 62, a secondary shaft tube 63, and a longitudinal fixing element 64. The primary shaft tube 62 is fixedly connected to the curtain wall unit 1 by means of the longitudinal fixing element 64, and movably mounted on the longitudinal shaft core 61, so that the primary shaft tube 62 can rotate with respect to the longitudinal shaft core 61 in a certain angular range. The secondary shaft tube 63 is fixedly mounted on the longitudinal shaft core 61, and connected with the longitudinal sunshade assembly 5. In this manner, the longitudinal sunshade assembly 5, together with the secondary shaft tube 63 and the longitudinal shaft core 61 fixed thereto, can rotate with respect to the primary shaft tube 62 in a certain angular range.

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The connection for the above components of the longitudinal rotating shaft structure 6 will be illustrated as follows.

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As shown in Figs. 11 and 12, the longitudinal shaft core 61, having an approximately round-shaped cross section, is provided at its outer wall with a pair of diametrically opposite second stoppers 611, and at its inner wall with a plurality of screw seats 612 extending to the end face thereof.

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The primary shaft tube 62 is provided at its inner wall with a pair of diametrically opposite third limiting protrusions 621 and a pair of diametrically opposite fourth limiting protrusions 622, and at its outer wall with a pair of diametrically opposite longitudinal grooves 623. The primary shaft tube 62 is further provided at its rear part with an engagement groove 624, which has a rectangular cross section.

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The longitudinal fixing element 64 is fixed on the curtain wall unit 1 with a screw at its rear part. The front part of the longitudinal fixing element 64 has an

approximately T-shaped cross section. The T-shaped front part is clamped within the engagement groove 624 arranged at the rear part of the primary shaft tube 62, and fixed thereon through a screw.

5 As shown in Fig. 8, the secondary shaft tube 63 is formed by a front cover 631 and a rear cover 632. The front cover 631 is fixed to the longitudinal sunshade assembly 5 through a screw. The rear cover 632 is firstly mounted on the longitudinal shaft core 61, and then engaged with the front cover 631. Finally, the front cover 631, the rear cover 632 and the longitudinal shaft core 61 are fixed together through screws.
10 To obtain a pleasing appearance, a longitudinal cover 633 is arranged on the region where the screw is located in the side wall of the secondary shaft tube 63.

When the longitudinal sunshade assembly 5 rotates outwardly to the stretched state as shown in Fig. 9, the pair of second stoppers 611 of the longitudinal shaft core 61 abut against the pair of third limiting protrusions 621 of the primary shaft tube 62,
15 as shown Fig. 11, so that further outward rotation of the longitudinal shaft core 61 and the longitudinal sunshade assembly 5 fixedly connected thereto will be prevented. In order to enable the stretched state more stable, the second stopper 611 and the third limiting protrusion 621 each have an L-shaped cross section. When abutted, the two
20 L-shaped members exactly fit with each other, with little risk of disengagement. When the longitudinal sunshade assembly 5 rotates inwardly to the folded state as shown in Fig. 10, the pair of second stoppers 611 abut against the pair of fourth limiting protrusions 622 of the primary shaft tube 62, as shown Fig. 11, so that further inward rotation of the longitudinal shaft core 61 and the longitudinal sunshade assembly 5
25 fixedly connected thereto will be prevented.

As shown in Fig. 8, the longitudinal shaft core 61 and the primary shaft tube 62 are provided at respective walls with threaded holes respectively. When the longitudinal sunshade assembly 5 rotates into the stretched state, the threaded hole
30 provided the wall of the longitudinal shaft core 61 faces toward that provided the wall of the primary shaft tube 62 in position. In this case, a bolt 66 passing through these threaded holes can fix the longitudinal shaft core 61 and the primary shaft tube 62 together, with no relative rotation therebetween. In this manner, the longitudinal

sunshade assembly 5 will be securely maintained in the stretched state. In order to enable the threaded holes and the bolt invisible from outside of the primary shaft tube 62 for the sake of appearance, the threaded hole arranged at the wall of the primary shaft tube 62 is located at the bottom area of the longitudinal groove 623, the upper opening thereof being closed by a longitudinal cover 65. In this manner, the threaded holes and the bolt will be hidden.

It can be realized from the foregoing that according to the sunshade system of a unitized curtain wall of the present invention, the lateral sunshade assembly 2 or the longitudinal sunshade assembly 5 is mounted in advance on the curtain wall unit 1 through the lateral rotating shaft structure 3 or the longitudinal rotating shaft structure 6 at factory. During transportation, the lateral sunshade assembly 2 or the longitudinal sunshade assembly 5 can be rotated to the folded state so as to save space. During assembly at the construction site, the lateral sunshade assembly 2 or the longitudinal sunshade assembly 5 will be firstly rotated to the stretched state, and then the lateral rotating shaft structure 3 or the longitudinal rotating shaft structure 6 is fixed through screws, so that the lateral sunshade assembly 2 or the longitudinal sunshade assembly 5 cannot further rotate and thus is restricted in the stretched state stably. Finally, the assembled curtain wall unit will be hoisted to the target position. In this way, the workload and operation duration necessary for assembling the sunshade device at the construction site can be significantly reduced.

The foregoing is merely preferred embodiments of the present invention, but is not intended to be limitation of the present invention. It will be apparent to those skilled in the art that various changes and modifications can be made to the present invention. Any modifications, equivalent substitutions, improvements, and the like within the spirit and principles of the present invention are intended to be included within the scope of the present invention.

CLAIMS

1. A sunshade system of a unitized curtain wall, comprising a curtain wall unit (1) and a sunshade device mounted on the curtain wall unit (1),

5 wherein the sunshade device is connected to the curtain wall unit (1) through a rotating shaft structure having a defined rotating angular range, so that the sunshade device can rotate into a stretched state, or a folded state, in which the sunshade device is adjacent to the curtain wall unit (1),

wherein the sunshade device comprises a lateral sunshade assembly (2), and the
10 rotating shaft structure comprises a lateral rotating shaft structure (3), whereby the lateral sunshade assembly (2) is rotatably connected to the curtain wall unit (1) through the lateral rotating shaft structure (3), and restricted within an angular range between the stretched state, which is realized through downwardly rotating the lateral sunshade assembly (2), and the folded state, which is realized through upwardly
15 rotating the lateral sunshade assembly (2) to be adjacent to the curtain wall unit (1),

wherein the lateral rotating shaft structure (3) comprises a shaft tube (31), two lateral shaft cores (32) respectively mounted at two ends of an inner passage of the shaft tube (31), and two lateral fixing elements (33), the lateral fixing elements (33) fixing the lateral shaft cores (32) on the curtain wall unit (1) and the lateral sunshade
20 assembly (2) being fixedly connected to the shaft tube (31),

wherein the shaft tube (31) is provided at its inner wall with a pair of diametrically opposite first limiting protrusions (311) and a pair of diametrically opposite second limiting protrusions (312), and the lateral shaft core (32) is provided at its outer wall with a pair of diametrically opposite first stoppers (321), and

25 when the lateral sunshade assembly (2) rotates downwardly to the stretched state, the first stoppers (321) abut with the first limiting protrusions (311) to prevent further downward rotation of the lateral sunshade assembly (2); and when the lateral sunshade assembly (2) rotates upwardly to the folded state, the first stoppers (321) abut with the second limiting protrusions (312) to prevent further upward rotation of
30 the lateral sunshade assembly (2).

2. The sunshade system of a unitized curtain wall according to claim 1, wherein the shaft tube (31) and the lateral shaft core (32) are provided at respective walls

thereof with respective threaded holes, and the thread hole of the shaft tube (31) faces toward the thread hole of the lateral shaft core (32) in position when the lateral sunshade assembly (2) rotates into the stretched state.

5 3. The sunshade system of a unitized curtain wall according to claim 2, wherein a lateral groove (313) is arranged on an outer wall of the shaft tube (31), and the thread hole arrange at the wall of the shaft tube (31) is located in the bottom portion of the lateral groove (313), the upper portion of which is closed by a lateral cover (34).

10 4. The sunshade system of a unitized curtain wall according to any one of claims 1 to 3, wherein the sunshade device comprises a longitudinal sunshade assembly (5), and the rotating shaft structure comprises a longitudinal rotating shaft structure (6), and

the longitudinal sunshade assembly (5) is rotatably connected to the curtain wall
15 unit (1) through the longitudinal rotating shaft structure (6), and restricted within an angular range between the stretched state, which is obtained through outwardly rotating the longitudinal sunshade assembly (5), and the folded state, which is obtained through inwardly rotating longitudinal sunshade assembly (5) to be adjacent to the curtain wall unit (1).

20 5. The sunshade system of a unitized curtain wall according to claim 4, wherein the longitudinal rotating shaft structure (6) comprises a longitudinal shaft core (61), a primary shaft tube (62), a secondary shaft tube (63) and a longitudinal fixing element (64), the primary shaft tube (62) being movably mounted on the longitudinal shaft
25 core (61) and fixedly connected to the curtain wall unit (1) through the longitudinal fixing element (64), and the secondary shaft tube (63) being fixedly mounted on the longitudinal shaft core (61) and connected with the longitudinal sunshade assembly (5),

the primary shaft tube (62) is provided at its inner wall with a pair of
30 diametrically opposite third limiting protrusions (621) and a pair of diametrically opposite fourth limiting protrusions (622), and the longitudinal shaft core (61) is provided at its outer wall with a pair of diametrically opposite second stoppers (611), and

when the longitudinal sunshade assembly (5) rotates outwardly to the stretched state, the second stoppers (611) abut with the third limiting protrusions (621) to prevent further outward rotation of the longitudinal sunshade assembly (5); and when the longitudinal sunshade assembly (5) rotates inwardly to the folded state, the second stoppers (611) abut with the fourth limiting protrusions (622) to prevent further inward rotation of the longitudinal sunshade assembly (5).

6. The sunshade system of a unitized curtain wall according to claim 5, wherein the longitudinal shaft core (61) and the primary shaft tube (62) are provided at respective walls thereof with individual threaded holes, and the thread hole of the longitudinal shaft core (61) faces toward the thread hole of the primary shaft tube (62) in position when the longitudinal sunshade assembly (5) rotates into the stretched state.

7. The sunshade system of a unitized curtain wall according to claim 6, wherein a longitudinal groove (623) is arranged on an outer wall of the primary shaft tube (62), and the thread hole arrange at the wall of the primary shaft tube (62) is located in the bottom portion of the longitudinal groove (623), the upper portion of which is closed by a longitudinal cover (65).

8. The sunshade system of a unitized curtain wall according to claim 5, wherein the secondary shaft tube (63) is formed by a front cover (631) and a rear cover (632), the front cover (631) being fixed to the longitudinal sunshade assembly (5) through a screw, and,

the front cover (631), the rear cover (632) and the longitudinal shaft core (61) are fixed together through screws.