United States Patent

Kida et al.

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[54] **RIB ASSEMBLY FOR FOLDING UMBRELLA**

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[52] **U.S. Cl.**.....**135/25**

[51] **Int. Cl.**.....**A45b 19/00**

[58] **Field of Search**.....135/20, 22, 23, 25, 26

[56] **References Cited**

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[57] **ABSTRACT**

A rib assembly for a folding umbrella which comprises a support rib, a receiving rib, an end rib and a connecting rib which are so assembled that they are adapted to form a quadrilateral in the open position of umbrella, said receiving rib being adapted to be held at substantially right angles with a center rod of the umbrella in said open position, one or more corners of said quadrilateral being made slidable and/or one or more sides of said quadrilateral being made contractile and extensible, thereby enabling the length of at least one side of the quadrilateral to be varied. Thus, there can be provided a folding umbrella capable of being easily opened with a little force and folded neatly while making an external appearance of the umbrella beautiful or nice at the open position thereof.

5 Claims, 4 Drawing Figures

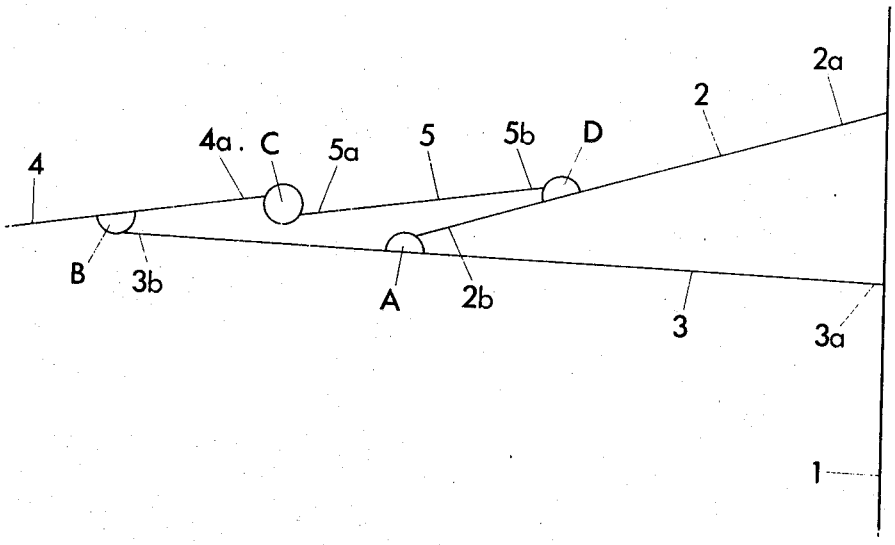

Fig. 1

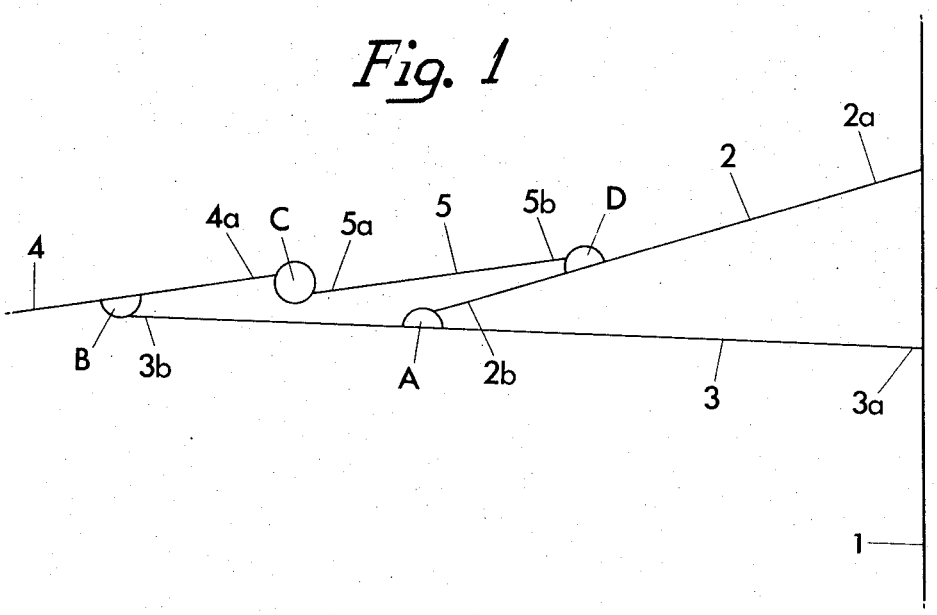

Fig. 3A

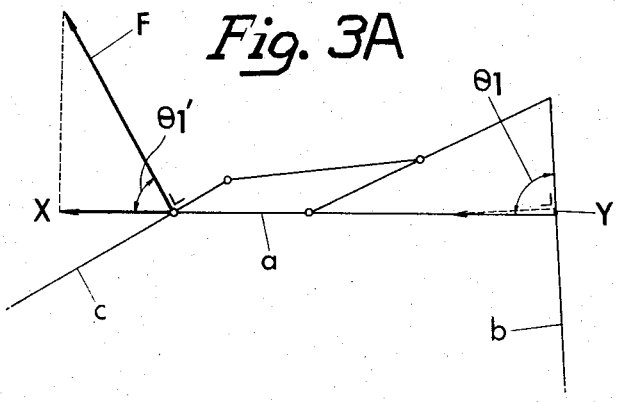

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Fig. 2

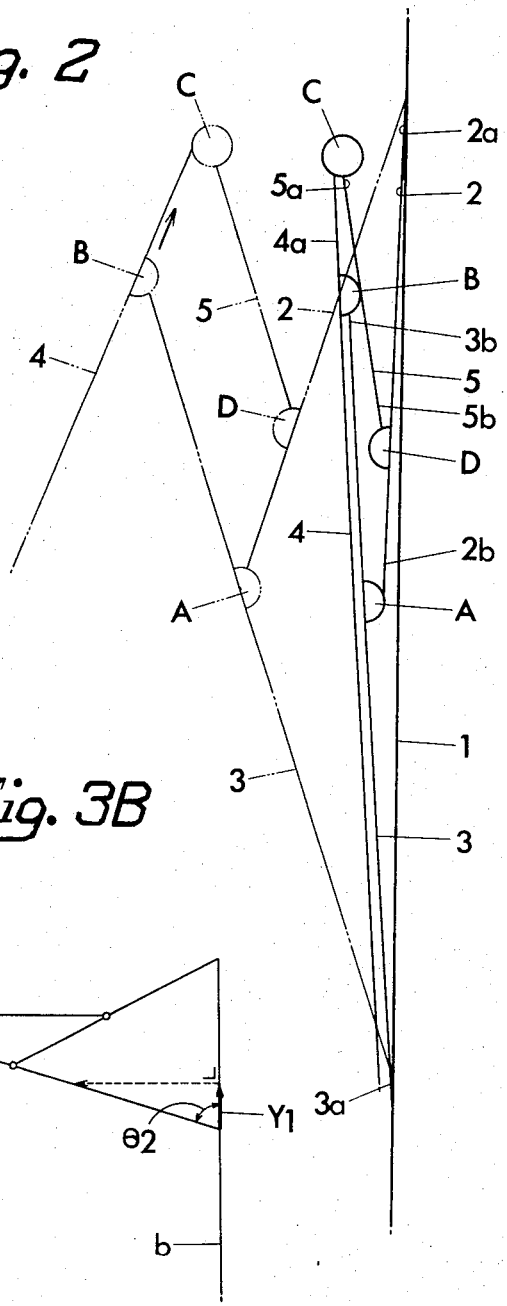
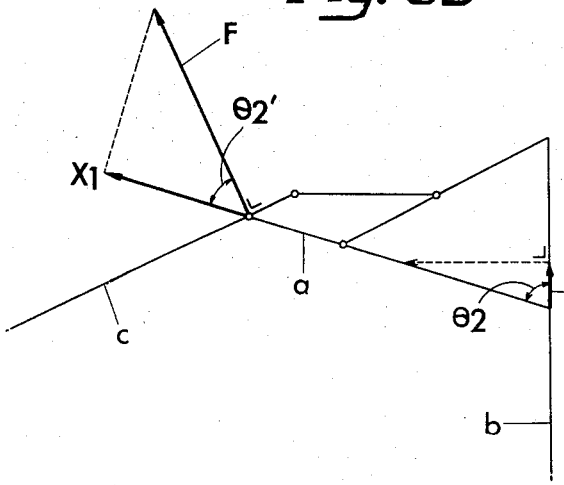


Fig. 3B



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RIB ASSEMBLY FOR FOLDING UMBRELLA

This invention relates to a rib assembly for a folding umbrella, and more particularly to a rib assembly for a folding umbrella comprising a receiving rib, a support rib, an end rib and a connecting rib which are adapted to form a quadrilateral in the open position while the receiving rib is held at substantially right angles with a center rod of the umbrella.

The conventional folding umbrella of such kind which is commercially available has such rib structure that in the open position of umbrella, the receiving rib is held at an acute angle to the center rod. For opening such conventional umbrella, a considerably strong force is needed at the end of opening operation, which has made the umbrella of this type unsuitable for ladies and children. As a result of the study by the present inventors, it has now been found that in order to facilitate the opening operation, the rib assembly should be so constructed that the receiving rib is held at substantially right angles with the center rod in the open position of umbrella.

It is, therefore, an object of the present invention ro provide a rib assembly for a folding umbrella which overcomes the shortcomings in the prior art as discussed above.

It is another object of the present invention to provide a rib assembly for a folding umbrella, which is so constructed that a receiving rib is held at substantially right angles with a center rod in the open position of umbrella thereby to enable the opening operation of the umbrella to be effected with a relatively little force while making a good external appearance when the umbrella is open, and that it can be collapsed or folded neatly when the umbrella is closed.

In accordance with the present invention, there is provided a rib assembly for a folding umbrella which comprises a support rib, a receiving rib, an end rib and a connecting rib which are so assembled as adapted to form a quadrilateral when the umbrella is opened, said receiving rib being adapted to be held at substantially right angles with a center rod in the open position of the umbrella and a slide means which is provided at a corner of the quadrilateral or at an intermediate portion of a side of quadrilateral for making variable the length of at least one side of the quadrilateral, thereby enabling the rib assembly to be neatly folded when the umbrella is closed.

The foregoing and other objects, features and advantages of the invention may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a diagrammatical side view of a rib assembly according to the present invention, showing the open position thereof;

FIG. 2 is a diagrammatical side view of the rib assembly of FIG. 1, showing the closed position thereof;

FIG. 3A is a view explaining the dynamics of a rib assembly in which a receiving rib is adapted to be held at substantially right angles with a center rod in the open position; and

FIG. 3B is a view explaining the dynamics of a rib assembly in which a receiving rib is adapted to be held at an acute angle to a center rod in the open position.

In FIGS. 1 and 2, like parts or portions are designated with like reference numerals.

Referring now to the drawings, the force needed to open the umbrella at the instant of opening operation will be first discussed in connection with FIG. 3A in which a receiving rib *a* is at a substantially right angle to a center rod *b* in the open position, and FIG. 3B in which a receiving rib *a* is at an acute angle to a center rod *b* in the open position.

θ_1 designates the angle defined by the receiving rib *a* and the center rod *b* in FIG. 3A, with θ_1 being substantially 90°.

θ_1' designates the angle defined by the extension line of the receiving rib *a* and the line normal to the end rib *c* in FIG. 3A, and $0° < \theta_1' < 90°$.

On the other hand, θ_2 designates the angle defined by the receiving rib *a* and the center rod *b* in FIG. 3B, and θ_2 is an acute angle.

θ_2' designates the angle defined by the extension line of the receiving rib *a* and the line normal to the end rib *c* in FIG. 3B, and $0° < \theta_2' < 90°$.

There are relationships of $\theta_1 > \theta_2$ and $\theta_1' > \theta_2'$.

Assuming that F designates a force needed to open the umbrella at the instant of opening operation, namely a component force normal to the end rib *c*, the respective component forces X and X_1 of the force F in the direction of the extension line of the receiving rib *a* are represented as follows:

$X = F \cos \theta_1'$ (FIG. 3A)

$X_1 = F \cos \theta_2'$ (FIG. 3B)

Accordingly, if the force X and the force X_1 are exerted on the end rib *c*, respectively, the umbrella can be opened.

The vertical component forces Y, Y_1 of the force F at the center rod *b*, namely the forces actually needed for the user to open the umbrella, are represented as follows, considering that the X and X_1 are the forces acting on the end rib *c*:

$Y = X \cos \theta_1$ (FIG. 3A)

$Y_1 = X_1 \cos \theta_2$ (FIG. 3B)

Since $X = F \cos \theta_1'$ and $X_1 = F \cos \theta_2'$, it follows that $Y = F \cos \theta_1' \cos \theta_1$ and $Y_1 = F \cos \theta_2' \cos \theta_2$. Since $\cos \theta_1 < \cos \theta_2$ and $\cos \theta_1' < \cos \theta_2'$, it follows that $F \cos \theta_1' \cos \theta_1 < F \cos \theta_2' \cos \theta_2$. Thus, between the forces Y and Y_1 which are actually needed for the user to open the umbrella, there is a relationship of $Y < Y_1$. This shows that less force is needed to open the umbrella in case a rib assembly are so constructed that the receiving rib *a* is held at a substantially right angle to the center rod *b* in the open position.

On the other hand, it has been found that one difficult problem is encountered when the umbrella is so constructed as to facilitate opening operation, that is, to provide substantially right angle between the receiving rib *a* and the center rod *b* while making a good external appearance of the umbrella in its open position. Such difficult problem is that the rib assembly so constructed as to not only have the above-mentioned right-angled structure but also give a good appearance of the umbrella in its open position can not be collapsed or folded neatly (as shown by dash and dot line in FIG. 2) when the umbrella is intended to close.

The present invention has been made to overcome the above-mentioned difficulty.

Referring now to FIG. 1 and FIG. 2 which illustrate a preferred embodiment of the present invention, the numeral 1 designates a center rod of well-known multi-

stage telescopic structure. The numeral 2 designates a support rib having its base end 2*a* pivotally connected to an upper rib holder (not shown) fixed to the center rod 1 at the top end portion thereof. The numeral 3 designates a receiving rib having its base end 3*a* pivotally connected to a lower rib holder (not shown) which is slidably fitted to the center rod 1. The tip end 2*b* of said support rib 2 is pivotally connected to the receiving rib 3 at an intermediate portion of the latter. The intersecting point of the receiving rib 3 and the support rib 2 is hereinafter referred to as a pivotal point A. 4 designates an end rib. The tip end 3*b* of the receiving rib 3 is pivotally connected to the end rib near the base end 4*a* thereof. The intersecting point of the receiving rib 3 of the end rib 4 is hereinafter referred to as a pivotal point B. The numeral 5 designates a connecting rib having one end 5*a* pivotally connected to the base end 4*a* of said end rib 4 and the other end 5*b* pivotally connected to the support rib 2 at its intermediated portion. The intersecting point of the connecting rib 5 and the support rib 2 is hereinafter referred to as a pivotal point D. The intersecting point of the connecting rib 5 and the end rib 4 is hereinafter referred to as a pivotal point C. A collapsible sub-rib may be pivotally connected to the tip end of the end rib 4, although not shown in the drawings.

As shown in FIG. 1, according to the present invention, the rib assembly is so constructed that the receiving rib 3 is held at a substantially right angle to the center rod 1 in the open position. Thus, it is possible to open the umbrella easily with a relatively little force. With this rib assembly as shown in FIG. 1 and FIG. 2, when an umbrella cloth is secured at the upper rib holder and the end rib 4, the contour of the umbrella cloth in the open position becomes substantially arcuate, thereby presenting beautiful appearance as an umbrella. In this connection, however, in order to realize such desired appearance, it is inevitably necessary that the quadrilateral formed by the four ribs be an irregular one, so that the several ribs adjacent the umbrella cloth form a smooth and continuous line adjacent and below said cover, as clearly seen in FIG. 1 and FIG. 2. Consequently, with such a rib assembly, when the lower rib holder is slidingly moved down to close the umbrella, the receiving rib 3 and the end rib 4 will not be laid one upon another as shown by dash and dot line in FIG. 2. As a result, the umbrella can not be collapsed or folded neatly and completely.

In order to resolve such problem, according to the instant embodiment of this invention, the pivotal point B is made slidable by, for example, pivotally securing the tip end 3*b* of the receiving rib 3 to a sliding member slidably mounted on end rib 4. With such an arrangement, the receiving rib 3 and the end rib 4 can be overlaid together since the pivotal point B slides as shown in FIG. 2 by the solid line. Thus, it becomes possible to collapse or fold the umbrella neatly, that is, completely rather than partially as above discussed.

Although the pivotal point B is made slidable in the preferred embodiment described above, any other pivotal point A, C or D may be made slidable as well, or each side of the quadrilateral defined by the support rib 2, the receiving rib 3, the end rib 4 and the connecting rib 5 may be made telescopic by providing a sliding portion. Also more than one sliding portions may be provided. Furthermore, it is noted that it is also possible to make all the pivotal points A, B, C, and D slidable and to make all the sides of quadrilateral telescopic as far as the rib assembly is solidly held in the open position, thereby enabling the umbrella to be more compact when folded.

As described, according to the present invention, there is provided the rib assembly for a folding umbrella which comprises the support rib, the receiving rib, the end rib and the connecting rib which are so arranged that they form a quadrilateral when the umbrella is opened, said receiving rib being adapted to be held at substantially right angles with the center rod in the open position of the umbrella thereby to enable the umbrella to be opened with a little force, and one or more pivotal points of said quadrilateral being made slidable and/or one or more sides of said quadrilateral being made telescopic, thereby making the external appearance of the umbrella beautiful or nice and, at the same time, permitting the umbrella to be collapsed or folded neatly.

It is the matter of course that, in the actual umbrella, a plurality of the rib assembly of the present invention are secured to the center rod by means of the upper and lower rib holders.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a folding umbrella having a center rod, an upper rib holder fixedly secured to the center rod directly adjacent the upper end thereof, and a lower rib holder slideably mounted on said center rod intermediate the ends thereof, the improvement in a rib assembly comprising:

an elongated substantially straight receiving rib having the inner end thereof pivotally connected to said lower rib holder

an elongated substantially straight support rib having the upper end thereof pivotally connected to said upper rib holder, the lower end of said support rib being pivotally connected to said receiving rib at a location disposed intermediate its ends;

an elongated substantially straight end rib carried by said receiving rib and spaced from said support rib, said end rib being pivotally connected intermediate its ends to the outer end of said receiving rib;

an elongated substantially straight connecting rib connecting the upper end of said end rib to said support rib, said connecting rib having the outer end thereof pivotally connected to the upper end of said end rib, and said connecting rib having the inner end thereof pivotally connected to said support rib at a location disposed between the upper and lower ends of said support rib;

said support rib, said receiving rib, said end rib and said connecting rib forming a quadrilateral when the umbrella is in an open position and said receiving rib extending at substantially right angles relative to said center rod when the umbrella is in said open position, said quadrilateral having at least one pair of opposed sides which are nonparallel;

slide means on at least one of said ribs, said slide means being mounted for continuous free lengthwise sliding movement on said one rib and being pivotally interconnected to another of said ribs for enabling the length of at least one side of said quadrilateral to be varied during opening and closing of said umbrella; and

said support rib, said connecting rib and said end rib all having portions lying above said receiving rib and all being inclined downwardly away from said center rod in said open position of said umbrella to define a substantially smooth and continuous line adjacent and below an umbrella cover extending between the upper end of said center rod and the lower end of said end rib.

2. A rib assembly for a folding umbrella as claimed in claim 1, wherein the outer end of the receiving rib is pivotally secured to a sliding member slidably mounted on the end rib.

3. A rib assembly for a folding umbrella as claimed in claim 1 wherein each of the four corners of said quadrilateral is defined by a pivotal connection between the corresponding pair of said ribs connected at such corner.

4. A rib assembly for a folding umbrella as claimed in claim 3 wherein said slide means is located at at least one of said pivotal connections and includes means for allowing one of the ribs of said corresponding pair of ribs to slide along the other of said ribs of said corresponding pair during closure of said umbrella.

5. A rib assembly for a folding umbrella as claimed in claim 3 wherein at least one of said ribs includes a slideable portion to allow telescoping of said rib to change the length thereof during closure of said umbrella.

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