United States Patent

Kida et al.

[15] **3,672,381**

[45] **June 27, 1972**

[54] COLLAPSIBLE UMBRELLA CAPABLE OF AUTOMATIC OPENING

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[30] **Foreign Application Priority Data**

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Nov. 14, 1969 Japan 44/90147

[52] **U.S. Cl.** **135/22**, 135/24
[51] **Int. Cl.** **A45b 25/14**, A45b 25/16
[58] **Field of Search** ..... 135/20–26, DIG. 2, 135/DIG. 3

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[57] **ABSTRACT**

This invention discloses a collapsible umbrella capable of automatic opening which comprises a center rod which is contractile and provided with an automatic umbrella opening mechanism; a rib assembly comprising 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 the 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. Such an umbrella is capable of automatical and instantaneous opening by one-touch operation. In addition, such an umbrella is capable of presenting a good appearance in its open position and being collapsed neatly in its closed position.

6 Claims, 6 Drawing Figures

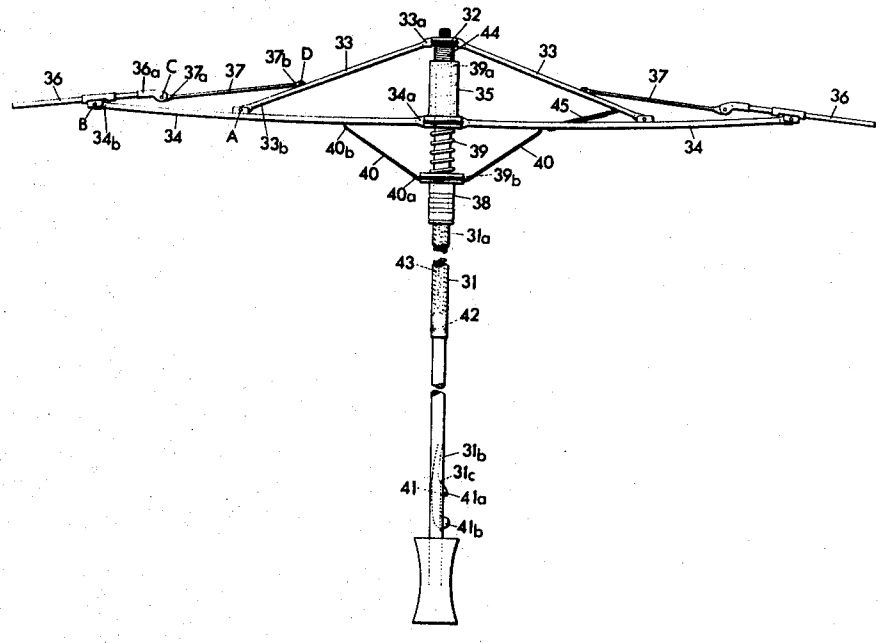

Fig. 1

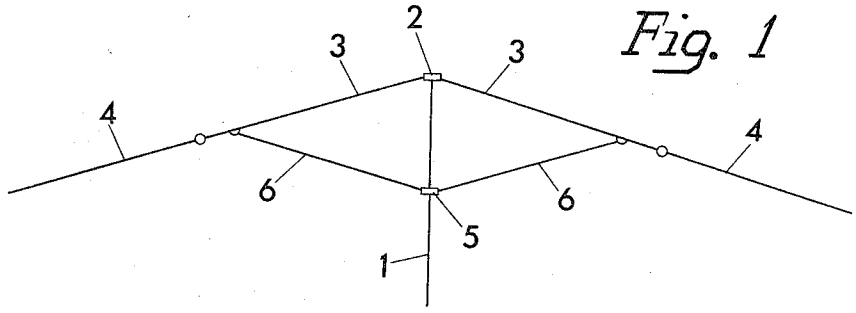

Fig. 2

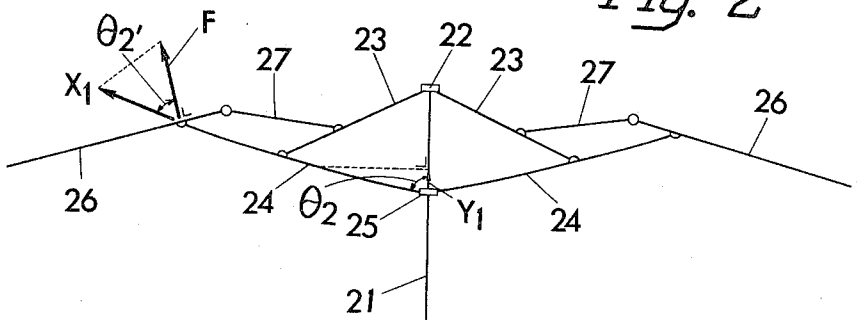

Fig. 3

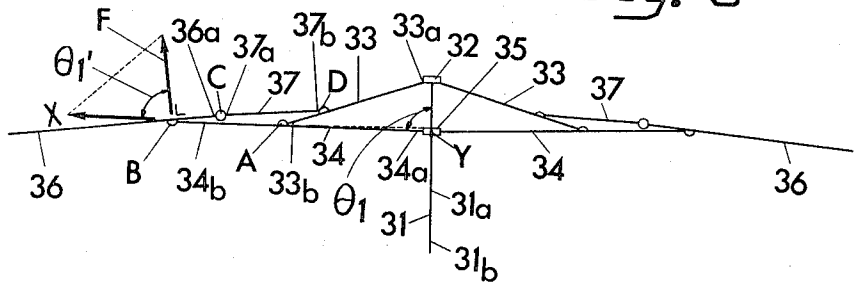

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Fig. 4

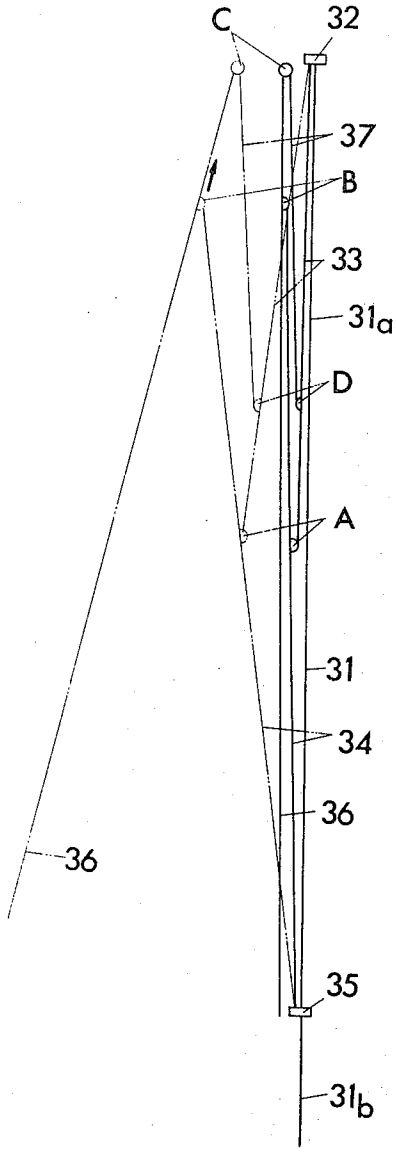

Fig. 6

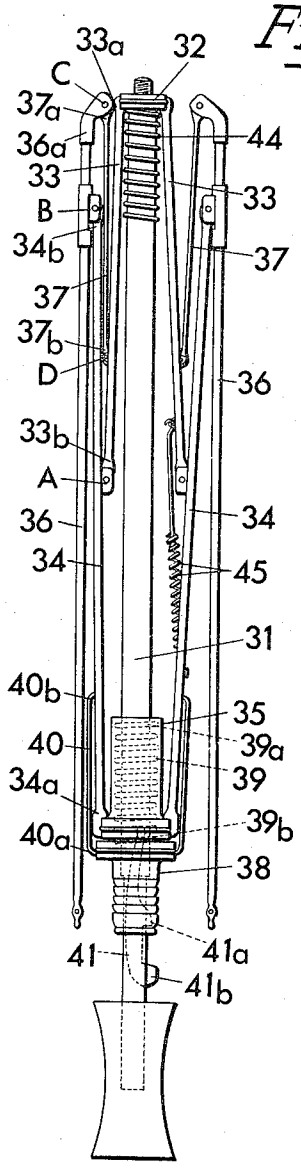

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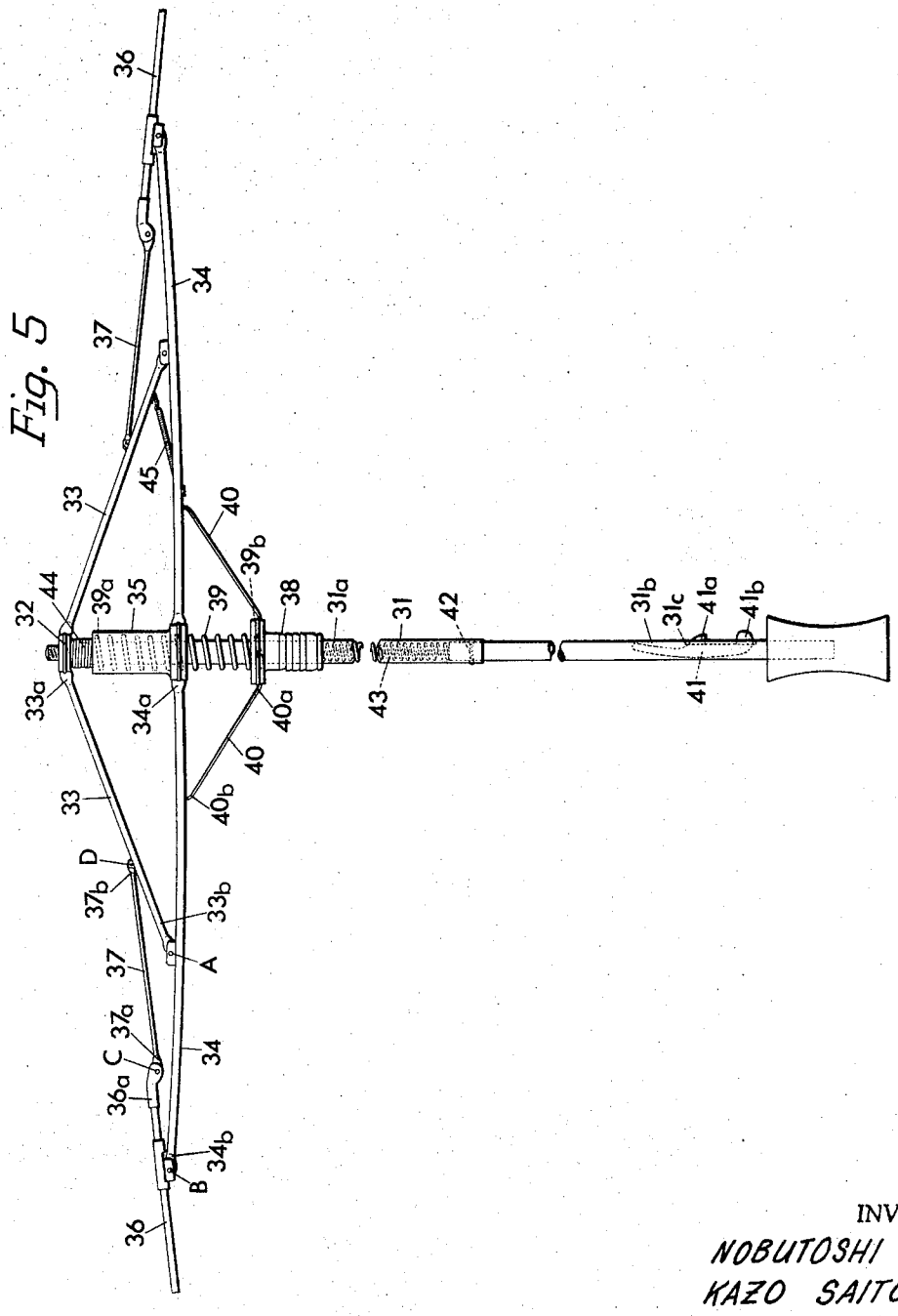
Fig. 5



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COLLAPSIBLE UMBRELLA CAPABLE OF AUTOMATIC OPENING

CROSS REFERENCE TO RELATED APPLICATION

U.S. Ser. No. 16,680, filed Mar. 5, 1970.

The present invention relates to a collapsible umbrella capable of automatic opening and more particularly to a collapsible umbrella which can be automatically and instantaneously opened by one-touch operation.

Though there has been an umbrella which is capable of automatic opening, it is not of a collapsible type, and no umbrella has heretofore been known which is both collapsible and capable of automatic opening. While, nowadays a collapsible type umbrella is widely and commonly used and accordingly a demand for a collapsible type umbrella capable of automatic opening has recently increased. In view of such demand, the present invention has been made on the basis of a completely new idea to provide a collapsible umbrella capable of automatic opening.

According to the present invention, there is provided a collapsible umbrella capable of automatic opening which comprises a center rod which is contractile and provided with an automatic umbrella opening mechanism; and a plurality of rib assemblies each comprising 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 the umbrella, said receiving rib being adapted to be held at substantially right angles with the center rod of the umbrella in said open position, one or more corners of said quadrilateral being slidable and/or one or more sides of said quadrilateral being contractile and extensible whereby the length of at least one side of the quadrilateral is variable, said automatic umbrella opening mechanism comprising a sliding rib-holder holding the receiving rib, an actuating rib-holder holding a tension rib which has an end connected to the receiving rib at its intermediate portion, a compression spring held between the sliding rib-holder and the actuating rib-holder, a compression spring inserted in said center rod and an engaging means adapted to make an engagement with the actuating rib-holder when the umbrella is collapsingly folded, the engagement of said engaging means with said actuating rib-holder being adapted to be released by the manual operation thereby to perform the automatic and instantaneous opening of the umbrella.

Therefore, it is an object of the present invention to provide a collapsible umbrella which is capable of automatic opening.

It is another object of the present invention to provide a collapsible umbrella capable of automatic opening of the kind mentioned which can be instantaneously opened by one-touch operation.

It is a further object of the present invention to provide a collapsible umbrella capable of automatic opening having such a character as mentioned above which can be readily opened without failure.

It is a still further object of the present invention to provide a collapsible umbrella capable of automatic umbrella having such a character as mentioned above which can present a good appearance in its open position and can be neatly folded when closed.

It is a still further object of the present invention to provide a collapsible umbrella capable of automatic opening having such a character as mentioned above which is simple in its structure and can be manufactured and sold at a reasonable cost.

The foregoing and other objects, features and advantages of the present invention will be apparent from the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a diagrammatic view of a rib assembly used in a conventional collapsible umbrella, with its construction fully opened;

FIG. 2 is a diagrammatic view of a rib assembly used in another conventional collapsible umbrella, with its construction fully opened;

FIG. 3 is a diagrammatic view of a rib assembly used in a collapsible umbrella capable of automatic opening according to the present invention, with its construction fully opened;

FIG. 4 is a diagrammatic view of the same rib assembly as shown in FIG. 3, with its construction collapsed.

FIG. 5 is a side view of a collapsible umbrella capable of automatic opening according to the present invention, shown in its open position and with its cloth removed; and

FIG. 6 is a side view of the same umbrella as shown in FIG. 5, shown in its closed position and with its cloth closed.

Referring now to FIG. 1, there is illustrated a rib assembly of a conventional collapsible umbrella, in which numeral 1 designates a center rod of multi-stage telescopic structure. Numeral 2 designates an upper rib-holder or a fixed rib-holder mounted on a top end portion of said center rod 1. To said upper rib-holder 2 is pivotally connected one end of a support rib 3. The other end of said support rib 3 is pivotally connected to an end rib 4. Numeral 5 designates a lower rib-holder or a sliding rib-holder which is slidably fitted to said center rod 1 and numeral 6 designates a receiving rib which is connected to said support rib 3 at its intermediate portion. In order to collapsingly close the thus constructed umbrella, the end rib 4 is required to be folded back to be laid upon the support rib. Accordingly, with such rib construction, it is very difficult to design the umbrella as collapsingly closed in the abovementioned state so as to be able to automatically open by providing a simple automatic umbrella opening mechanism to the umbrella.

Recently a collapsible umbrella having such a rib assembly as shown in FIG. 2 has been widely seen in the market. Stated illustratively, the umbrella comprises a center rod 21 of telescopic structure and an upper or fixed rib-holder 22 mounted on said center rod 21. To said fixed rib-holder is pivotally connected one end of a support rib 23 and the other end of said support rib 23 is connected to a receiving rib 24 at its intermediate portion. One end of said receiving rib 24 is held by a lower or sliding rib-holder 25. The other end, namely, the tip end of said receiving rib 24 is pivotally connected to an end rib 26 at its intermediate portion. Said end rib 26 is in turn connected to the support rib 23 at its intermediate portion through the medium of a connecting rib 27. In this kind of umbrella, unlike the umbrella as shown in FIG. 1, it is required only to push the sliding rib-holder 25 to open the umbrella and there is no need to preparatorily extend the end rib. Then, it seems that automatic opening of the umbrella will be possible if an automatic umbrella opening mechanism is employed in said umbrella. However, the conventional collapsible umbrella of this kind which is commercially available has such rib structure that, in its open position, the receiving rib 25 is held at an acute angle to the center rod from the view point of presenting a good appearance of contour to the umbrella. Accordingly, for opening such a conventional umbrella, a considerably strong force is needed especially at the end of opening operation. Therefore, a spring employed must be considerably strong to automatically open the umbrella and, even after the umbrella is automatically opened, there is the possibility that the umbrella will close when a relatively strong force is applied onto the outside of the umbrella.

In order to facilitate the opening operation; in other words, in order to decrease the force required for opening the operation, the rib assembly should be so constructed, as shown in FIG. 3, so that the receiving rib 34 is held at substantially right angles with the center rod 31 in the open position of umbrella.

The force needed to open an umbrella at the instant of opening operation will be discussed in connection with FIG. 2 in which a receiving rib 24 is held at an acute angle to a center rod 21 in the open position and FIG. 3 in which a receiving rib 34 is held at substantially right angles with a center rod 31.

θ_1 designates the angle defined by the receiving rib 34 and the center rod 31 in FIG. 3, with θ_1 being substantially 90°.

θ_1' designates the angle defined by the extension line of the receiving rib 34 and the line normal to the end rib 36 in FIG. 3 and $0° < \theta_1 < 90°$.

On the other hand, θ_2 designates the angle defined by the receiving rib **24** and the center rod **21** in FIG. **2**, and θ_2 is an acute angle.

θ_2' designates the angle defined by the extension line of the receiving rib **24** and the line normal to the end rib **26** in FIG. **2**, 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 **26** or **36**, the respective component forces X and X_1 of the force F in the direction of the extension line of the receiving rib **34** or **24** are represented as follows:

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

$X_1=F\cos\theta_2'$ (FIG. 2)

Accordingly, if the force X and the force X_1 are exerted on the end rib **36** or **26**, respectively, the umbrella can be opened.

The vertical component forces Y, Y_1 of the force F at the center rod **31** or **21**, 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 **36** or **26**.

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

$Y_1=X_1\cos\theta_2$ (FIG. 2)

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 the rib assembly is so constructed that the receiving rib is held at substantially a right angle to the center rod in the open position.

In view of such a relation as $Y<Y_1$, the present invention has been made to provide a collapsible umbrella in which the receiving rib **34** is held at substantially right angles with the center rod **31** which is provided with an automatic umbrella opening mechanism, thus enabling the opening of the umbrella to be smoothly effected automatically.

Referring now to FIGS. **3** and **4** which illustrate a preferred embodiment of the present invention, numeral **31** designates a center rod of well-known telescopic structure. In this embodiment of the present invention, the center rod **31** divided into an upper part **31***a* and a lower part **31***b*. Numeral **33** designates a support rib having its base end **33***a* pivotally connected to a fixed rib-holder **32** fixed to the center rod **31** at the top end portion thereof. Numeral **34** designates a receiving rib having its base end **34***a* pivotally connected to a sliding rib-holder **35** which is slidably fitted to the center rod **31**. The tip end **33***b* of said support rib **33** is pivotally connected to the receiving rib **34** at its intermediate portion. The intersecting point of the receiving rib **34** and the support rib **33** is hereinafter referred to as a pivotal point A. Numeral **36** designates an end rib. The tip end **34***b* of the receiving rib **34** is pivotally connected to the end rib near the tip end **36***a* thereof. The intersecting point of the receiving rib **34** of the end rib **36** is hereinafter referred to as a pivotal point B. Numeral **37** designates a connecting rib having one end **37***a* pivotally connected to the base end **36***a* of said end rib **36** and the other end **37***b* pivotally connected to the support rib **33** at its intermediate portion. The intersecting point of the connecting rib **37** and the support rib **33** is hereinafter referred to as a pivotal point D. The intersecting point of the connecting rib **37** and the end rib **36** is hereinafter referred to as a pivotal point C.

As shown in FIG. **3**, the rib assembly is so constructed that the receiving rib **34** is held at substantially right angles with the upper part **31***a* of the center rod **31** 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 FIGS. **3** and **4**, when an umbrella cloth is secured at the fixed rib holder **32** and the end rib **36**, the contour of the umbrella cloth in the open position becomes substantially arcuate, thereby presenting a 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, as clearly seen in FIGS. **3** and **4**. Consequently, with such a rib assembly, when the sliding rib holder **35** is slidingly moved down to close the umbrella, the receiving rib **34** and the end rib **36** will not be laid one upon another because a quadrilateral formed by the support rib **33**, the receiving rib **34**, the end rib **36** and the connecting rib **37** is not a parallelogram as shown by dash and dot line in FIG. **4**. As a result, the umbrella can not be collapsed or folded neatly. However, a parallelogram formed in the open position of the umbrella would spoil the appearance of the umbrella.

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 **34***b* of the receiving rib **34** to a sliding member slidably mounted on the end rib **36**. With such an arrangement, the receiving rib **34** and the end rib **36** can be overlaid together since the pivotal point B slides as shown in FIG. **4** by the solid line. Thus, it becomes possible to collapse or fold the umbrella neatly.

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 **33**, the receiving rib **34**, the end rib **36** and the connecting rib **37** 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 collapsingly folded.

Now, a collapsible umbrella embodying the present invention, to wit, a collapsible umbrella employing such a rib assembly as mentioned above and provided with an automatic umbrella opening mechanism so as to be capable of automatic opening is described in detail with reference to FIGS. **5** and **6**. In FIGS. **5** and **6**, like parts or portions are designated with like reference numerals.

As mentioned above, numeral **31** designates a center rod consisting of an upper part **31***a* and a lower part **31***b* and **32** designates a fixed rib-holder. Numerals **33**, **34**, **36** and **37** designate a support rib, a receiving rib, an end rib and a connecting rib, respectively. Numeral **35** designates a sliding rib-holder. Numeral **38** designates an actuating rib-holder fitted to said center rod **31** under the sliding rib-holder **35**. Numeral **39** designates a compression spring having an upper end **39***a* inserted between said sliding rib-holder **35** and said center rod **31** and a lower end **39***b* inserted between said actuating rib-holder **38** and said center rod **31**. Numeral **40** designates a tension rib having a base end **40***a* pivotally connected to said actuating rib-holder **38** and a tip end **40***b* pivotally connected to said receiving rib **34** between the base position **34***a* and the pivotal point A. Numeral **41** designates an engaging lever means adapted to engage with said actuating rib-holder **38** and provided inside the center rod **31** at its base portion. Both a stop **41***a* formed at an intermediate position of the engaging means and a push button **41***b* formed at its base portion project through an elongated slot **31***c* provided in the lower part **31***b* of the center rod **31**. Said stop **41***a* is adapted to engage with the lower end of the actuating rib-holder **38**. Numeral **42** designates a projection resiliently provided at the top portion of the lower part **31***b* of the center rod **31** and it acts to stop the extension of the center rod **31** by engaging with a small groove provided at the lower end portion of the upper part **31***a* of the center rod **31** when said center rod **31** is extended to its utmost position. Numeral **43** designates a compression spring inserted in the upper part **31***a* of the center rod **31** which acts to push out the lower part **31***b* of the center rod **31**. **44** is a shock absorber made of a spring or the like and provided under the fixed rib-holder **32** mounted on the top portion of the upper part **31***a* of the center rod **31**. **45** is a tension

spring to prevent the rib assembly from falling into a dead point at the instant of opening and provided between the support rib 33 and the receiving rib 34 in such a manner that it is positioned upside at the operation of opening the umbrella. At least one tension spring 45 is required for the purpose mentioned but, of course, two or more tension springs may be employed.

In operation, the push button 41*b* of the engaging means 41 which projects through the elongated slot 31*c* is pressed to move the stop 41*a* back and disengage from the actuating rib-holder 38. Then, the compression spring 39 between said actuating rib-holder 38 and the sliding rib-holder 35 is sprung to push the sliding rib-holder 35 upward.

The actuating rib-holder 38 is then pushed upward through the medium of the tension rib 40 connected to the receiving rib 34 and, at the same time, the engagement of the upper part 31*a* with the lower part 31*b* of the center rod 31 by means of said stop 41*a* is released to make said upper part 31*a* extend by the action of the compression spring 43 provided in said upper part 31*a* of the center rod 31. As said rib-holder 35 and 38 are pushed up, the support rib 33, end rib 36, and connecting rib 37 connected to the receiving rib 34 are spread out with respective pivotal portions A to D acting as a fulcrum to open the umbrella. If opening operation is carried out with the center rod 31 laid horizontally, the receiving rib 34 completely lies upon the support rib 33 due to the weight of the receiving rib. Stated illustratively, the movement of the sliding rib-holder 35 and the actuating rib-holder 38 is prevented owing to the above-mentioned states of the support rib 33 and the receiving rib 34. In other words, said states of the support rib 33 and the receiving rib 34 forms a dead point preventing the movement of the sliding rib-holder 35 and the actuating rib-holder 38. If even one rib of the rib assembly falls in a dead point, opening of the umbrella could be effected. In this connection, one or more tension spring 45 may be employed to avoid the formation of such dead point. The opening operation is, generally, carried out with the engaging means 41 turned upside because said engaging means is pressed usually with a thumb. Accordingly, in the present embodiment, the tension spring is provided on the ribs positioned on the same side as said engaging means 41, thus preventing the ribs from assuming a dead point position. Such a tension spring 45 may of course be provided on the other ribs than the above-specified ribs.

In order to close the umbrella, the actuating rib-holder 38 is manually pulled down, which resultantly pulls down the sliding rib-holder 35 connected to said actuating rib-holder 38 through the medium of the tension rib 40. Said sliding rib-holder 35 is, then, drawn near said actuating rib-holder 38, and the compression spring 39 between these rib-holders 35 and 38 is compressed at the lowermost position of said rib-holders 35 and 38. On the other hand, as the rib-holders 35 and 38 are pulled down, the receiving rib 34 is folded along the center rod 31, and the support rib 33 together with the end rib 36 connected to said support rib through the connecting rib 37 is collapsed. When the lower part 31*b* of the center rod 31 is inserted into the upper part 31*a* of said center rod 31 against the action of the compression spring 43, the stop 41*a* formed on the engaging means 41 and projecting through the elongated slot 31*c* provided in the lower part 31*b* of the center rod 31 is brought into engagement with the actuating rib-holder 38, thereby to keep the center rod 31 in its contracted position. Thus, the closing operation is completed. In the present invention, a slidable means is provided on one of said pivot portions A to D or the rib members (in the drawings, the pivot point B is provide on a slide member 46) to collapse the umbrella neatly.

In the above-mentioned embodiment, the lower part 31*b* of the center rod 31 is adapted to be inserted in the upper part 31*a* of the center rod 31. Alternatively, the upper part 31*a* may be adapted to be inserted in the lower part 31*b* of the center rod 31. In the alternative case, the engaging means 41 is provided in the upper part 31*a* of the center rod 31 and the lower part 31*b* is provided with the elongated groove 31*b* through which the stop 41*a* and the push button 41*b* of said engaging means 41 projects. In the case, the compression spring 43 is, of course, inserted in the lower part 31*b* of the center rod 31.

The center rod 31 is not limited to a two-stage type rod and three or more-stage type center rod is also employable.

As described, according to the present invention, there is provided an umbrella which can be collapsed by one operation, to wit, pulling down the actuating rib-holder together with the sliding rib-holder. The pulling operation makes the receiving rib connected to said sliding rib-holder incline downwardly together with the support rib, which in turn makes the end rib upwardly drawn near the center rod through the medium of the connecting rib so that the cover can be folded. In addition, the umbrella can be collapsed neatly because the quadrilateral formed by the support rib, the receiving rib, the end rib and the connecting rib is a parallelogram at the time of closing. On the other hand, the opening of the umbrella is effected by relatively small force without failure owing to such a construction of the present invention that the receiving rib is held at substantially right angles with the center rod. Furthermore, according to the present invention, the center rod can be automatically extended and the umbrella can be smoothly opened in its horizontal position by virtue of the tension spring employed to avoid forming a dead point against the opening of the umbrella.

What is claimed is:

1. An automatically opening collapsible umbrella, comprising:

collapsible center rod means movable between a collapsed storage position and an extended use position, said collapsible rod means including at least upper and lower rod portions slidably mounted for slidable longitudinal movement relative to one another;

a collapsible rib assembly interconnected to said upper rod portion and movable between a collapsed storage position and an extended use position, said rib assembly including a support rib connected to said upper rod portion, a receiving rib connected to said rod means at a location below said support rib, said receiving rib being connected intermediate its ends to said support rib, an end rib carried by said receiving rib and spaced from said support rib, a connecting rib connected between said end rib and said support rib, whereby the support, receiving, end and connecting ribs form a quadrilateral when the rib assembly is in the open position, said quadrilateral having at least one pair of opposed sides which are nonparallel, said receiving rib extending at a substantially right angle from the longitudinal direction of said center rod means when the rib assembly is in the open position, and slide means associated with at least one of said ribs for enabling the length of at least one side of said quadrilateral to be varied during collapsing of the rib assembly into the closed storage position;

opening means coating between said rib assembly and said rod means for causing (1) said rib assembly to be automatically moved from its storage to its use position and (2) said center rod means to be automatically extended from its storage to its use position; and

engagement means coacting between the lower rod portion and said opening means for simultaneously holding both said rod means and said rib assembly in their storage positions, manual release of said engagement means permitting said rib assembly and said rod means to be automatically and substantially simultaneously moved to their use positions;

said opening means including a first rib-holder slidably mounted on said rod means and having one end of said receiving rib connected thereto, a second rib-holder slidably mounted on said rod means and slidably movable relative to said first rib-holder, a tension rib connected between said receiving rib and said second rib-holder,

said tension rib being connected to said receiving rib at a location spaced from the end thereof connected to said first rib-holder, first spring means coacting between said first and second rib-holders for normally resiliently urging same in opposite directions, second spring means coacting between said upper and lower rod portions for normally resiliently urging said rod means toward its use position, and said second rib-holder having means thereon adapted to be engaged by said engaging means when said rib assembly and said rod means are in their storage positions for securely maintaining the umbrella in a closed and collapsed position, manual operation of said engaging means causing same to release said second rib-holder whereby said first and second spring means cause said rib assembly and said rod means to be automatically and substantially simultaneously moved to their respective use positions.

2. An umbrella according to claim 1, further including tension spring means connected between said receiving rib and said support rib for normally urging said ribs into the position assumed by said ribs when the rib assembly is in its use position, said tension springs means being disposed so as to be on the upper side of the umbrella during a normal opening operation.

3. An umbrella according to claim 1, wherein said slide means includes a sliding member slidably mounted on said end rib, said sliding member being pivotally connected to the tip end of the receiving rib.

4. An umbrella according to claim 1, wherein the lower handle portion is provided with handle means on the lower end thereof, and said engagement means including an engagement member movably mounted on said lower rod portion adjacent said handle means, said engagement member having a stop member engageable with said second rib-holder for securely retaining said second rib-holder adjacent said handle means to thus lock said rib assembly and said rod means in their respective storage positions.

5. An umbrella according to 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, and said slide means being located at at least one of said pivotal connections and including 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 movement of the rib assembly between its storage and use positions.

6. An umbrella according to claim 1, wherein said end rib extends substantially radially relative to said center post and has the inner end thereof spaced a substantial distance from said rod means when said rib assembly is in its use position, said end rib and said receiving rib being folded in overlapping relationship relative to one another when the rib assembly is in its storage position.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3 672 381 Dated June 27, 1972

Inventor(s) Nobutoshi Kida, Kazo Saito

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 58; change "coating" to ---coacting---.

Signed and sealed this 5th day of December 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334