

A LINK MECHANISM WITH HIGH RIGIDITY FOR
OPENING AND CLOSING WINDOWS

The present utility model is related to a supporting element, more particularly, to a metal four link or five link mechanism for opening and closing windows.

At present, the metal link mechanisms are more and more popularly used for opening and closing windows, for example, a four-link or four link or five link mechanism is typical one. Since windows must stand up to storm, the link mechanism is required to have high strength, and high abilities of anti-deformation and of supporting. In prior art, the metal links are zigzagged with a straight fold of 45° (it mean that when seen from the top, the fold is straight and the angle included between deformation plane and extending plane of the link is 45°) in the middle of a or near the ends to improve the rigidity of the four link or five link mechanism, namely the ability of anti-deformation. It is required to design a new structure of deformation made of the same materials to further improve the ability of anti-deformation, as well as, to be manufactured easily. It is an object to provide a link mechanism for opening and closing windows which has a modified structure in contrast with the zigzag with a straight fold of 45° to improve the abilities of anti-deformation and of supporting, and to be manufactured easily.

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To achieve the above object, the present utility model provides a metal link mechanism for opening and closing windows, which consists of a plurality of links, comprises pull-push links, a guide groove and a slider, said members are movably coupled with each other by rivets, pull-push links can be zigzagged with an arc fold of which deformation surface is partial conical surface(P).

The aforesaid structure can improve the rigidity and the ability of supporting of metal link mechanism so that the object of the present utility model can be accomplished.

The present utility model is described with reference to the accompanying drawings, in which:

FIG. 1 is a view schematically showing the metal five-link mechanism in prior art;

FIG. 2 is a view schematically showing the straight fold of a angle of 45° which is formed in pull-push links in prior art;

FIG. 3 is a view showing the metal five-link mechanism according to the present utility model;

FIG. 4 is a plan view showing the arc fold which is formed in pull-push links according to the present utility model;

FIG. 5 is a side view showing the arc fold which is formed in pull-push links according to the present utility model;

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FIG. 6 is a view showing the pull-push link with a convex portion according to the present utility model.

The present utility model will be described in detail with reference to the accompany drawings.

Referring to FIG. 1. which shows the metal five-link mechanism in prior art, the five-link mechanism comprises pull-push links 11 to 14, a C-shaped guide groove 15 and a slider 16. When a force is applied to pull-push links, the slider 15 slides along the C-shaped guide groove 15 and carries the window to open and close. In FIG. 1, O denotes the central point which is turnable and connected by rivet, K denotes the straight fold of 45° which can improve the rigidity. It is shown in FIG. 1 that the pull-push links 11, 13, 14 are marked by K, namely they have the straight fold of 45° to form a movable frame which has high rigidity and strength.

Referring FIG. 2 which shows the straight fold of 45° formed in pull-push links, h is used to present the thickness of pull-push links made of metal, such as steel, y is used to present the measurement value of pull-push links after being deformed. In one example, h is about 2 mm to 3.0 mm, y is about 4mm. Referring FIG. 3 which shows a metal link mechanism for opening and closing windows according to an embodiment of the present utility model. The metal link mechanism is typically assembled with struts, so called pull-push links, having a thickness of 2-3mm and a width of 16-19mm

which are made of steel. The metal link mechanism consists of a plurality of links having different lengths, and in this embodiment it is a five-link mechanism comprising pull-push links 1 to 4, a C-shaped guide groove 5 and a slider 6. The slider 6 is limited to slide along the C-shaped guide groove 6.

Six points C are turnable connection points where the pull-push links are coupled with each other or the pull-push links are coupled with the slider by movable rivets connection. There is an arc area P in each of the pull-push links 1 and 2 respectively, which is the deformation area. In contrast with that in FIG. 1, it is an arc fold which is comprised of two segments of arc and the edge of pull-push link. The deformation of the arc fold generated in deferent cross section along the direction of length of pull-push link is more complex than that of straight fold. It is proved that the rigidity of whole link mechanism and the ability of supporting for windows are improved not only in theory but also in practice.

A strip area Q marked in each of the pull-push links 2 and 4 is a convex deformation which is often used to improve the rigidity and the ability of anti-deformation in metal structure.

Referring to FIG. 4 which further shows the arc fold of FIG. 3 according to the present utility model. An arc area P circled by ABEFA is use to denote the deformation surface which is partial conical surface. AB and EF are not in same plane, but at two

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segments of arc having deferent height, therefore area P marked with multiple segments of line between AB and EF is a partial conical surface.

Referring to FIG. 5 which is a side view showing a pull-push link with an arc fold, since P is conical surface, the width W is used to denote the width of deformation. The deformation of the arc fold according to the present utility model is larger than that of the straight fold shown is FIG. 2, therefore the abilities of anti-deformation and of supporting are improved.

Half conical angle $\varnothing$ used to present the oblique degree of the conical surface can be selected from a wide range. $\varnothing$ may be varied from 20° to 90° , such as 30° , 45° , or 60° and so on. When $\varnothing$ is 90° , the surface of P is changed to cylindrical surface which is also fall in the scope of the present utility model.

Referring to FIG. 6 which is cross section of the pull-push link with a convex portion, it is a relative large deformation that the pull-push link which has a thickness of 2mm and a width of 16mm is formed with a convex portion which is of the shape of strip or arc to improve the rigidity of pull-push link, for example, the height of the convex portion is 1-2mm, the width is 8-10mm.

In an embodiment of the present utility model shown is FIGs. 3 to 6, the length of long pull-push link 1 is about 21cm, the length of long pull-push link 2 is about 20.8cm, the length of the strut 3 is about

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8cm, the length of the strut 4 is about 7.2cm, the length of C-shaped guide groove 5 is about 31cm, the length of slider 6 is about 5.5cm, the thickness of pull-push links is about 2mm, the width of pull-push links is about 16mm.

In the movable frame shown in FIG. 3, only pull-push links 1 and 2 are zigzagged with an arc fold, pull-push links 2 and 4 are deformed with a convex portion. In fact, one or more pull-push links can be selected to be zigzagged with an arc fold. A pull-push link can be formed only with a convex portion, such as the strut 4, or can be not only formed with a convex portion, but also zigzagged with an arc fold, such as long pull-push link 2.

The zigzag with an arc fold according to the present utility model can be manufactured easily, and the rigidity and the ability of supporting of the link mechanism can be improved greatly.

**WHAT IS CLAIMED:**

1. A metal link mechanism for opening and closing windows, which consists of a plurality of links, comprises pull-push links, a guide groove and a slider, said members are movably coupled with each other by rivets, characterized in that pull-push links are formed with zigzags in the form of arc folds of which deformation surfaces are partial conical surfaces(P).
2. A metal link mechanism as claim 1, characterized in that one or more pull-push links are formed with zigzags in the form of arc folds.
3. A metal link mechanism as claim 1, characterized in that pull-push links can be formed with a convex portion(Q).
4. A metal link mechanism as claim 1, characterized in that the half conical angle of the conical surface(P) of said arc fold can be selected from a wide range from 20° to 90°.
5. A metal link mechanism as claim 1, characterized in that said link mechanism is four-link or four link or five link mechanism.