

CONCEALED HINGE

1. Field of the Invention

The present invention relates to a hinge, and more particularly to a concealed hinge.

5 2. Description of Related Art

In order to provide aesthetic appeal and an anti-theft effect, high-priced door assemblies nowadays utilize concealed hinges as disclosed in European Patent Nos. EP2105561A3, EP2551431B1, EP1780357A2, and EP2754807B1 rather than traditional exposed hinges. With reference to Fig. 24, conventional
10 concealed hinges disclosed in the former-mentioned patents each respectively has a first retaining body 91, a second retaining body 92, and a pivoting assembly 93. The first retaining body 91 is recessed in a door frame. The second retaining body 92 is recessed in a door leaf. The pivoting assembly 93 is pivotably mounted to the first retaining body 91 and the second retaining body 92 via a first shaft 931
15 and a second shaft 932.

The pivoting assembly 93 has two first guide blocks 933, two second guide blocks 934, a body 935, and four detachable pins 936. The two first guide blocks 933 are pivotably mounted to the body 935 via two of the four detachable pins 936, and the two first guide blocks 933 are respectively slidably mounted
20 within two first slide grooves 912 of the first retaining body 91. The two second guide blocks 934 are pivotably mounted to the body 935 via the other two of the four detachable pins 936, and the two second guide blocks 934 are respectively slidably mounted within two second slide grooves 922 of the second retaining

body 92.

When the door leaf pivots relative to the door frame, the second retaining body 92 pivots relative to the body 935, and the two second guide blocks 934 respectively slide within the two second slide grooves 922. At the same time, the body 935 pivots relative to the first retaining body 91, and the two first guide blocks 933 respectively slide within the two first slide grooves 912. With such a configuration, the two first slide grooves 912 of the first retaining body 91 face the second slide grooves 922 of the second retaining body 92 when the door assembly is closed. At the same time, the two first guide blocks 933 abut two end surfaces of the two first slide grooves 912 of the first retaining body 91, and the two second guide blocks 934 abut two end surfaces of the two second slide grooves 922 of the second retaining body 92. In this way, the pivoting assembly 93 is almost concealed between the first retaining body 91 and the second retaining body 92 when the door assembly is closed. Thus the door assembly utilizing the conventional concealed hinge attains the aesthetic appeal and the anti-theft effect.

However, the conventional concealed hinge has the following drawbacks.

1. The two first guide blocks 933 and the two second guide blocks 934 are made of plastic in order to enable the pivoting assembly 93 to pivot smoothly relative to the first retaining body 91 and the second retaining body 92 and to lower noise made in the pivoting of the door leaf relative to the door frame. When a fire accident breaks out, the two first guide blocks 933 and the two second guide blocks 934 would melt due to the low melting point of plastic. Then

the two first guide blocks 933 and the two second guide blocks 934 would lose their effect in guiding the pivoting assembly 93 to pivot relative to the first retaining body 91 and the second retaining body 92. Also, the two first guide blocks 933 and the two second guide blocks 934 would lose their effect in
5 keeping the body 935 connected to the first retaining body 91 and the second retaining body 92, therefore causing the tilt of the door leaf relative to the door frame. Then the door leaf would not be able to pivot relative to the door frame.

2. To assemble the conventional concealed hinge in a convenient way, each one of the two first guide blocks 933 is mounted within a respective one of
10 the two first slide grooves 912 with an opening, and each one of the two second guide blocks 934 is mounted within a respective one of the two second slide grooves 922 with an opening. The opening of each one of the two first slide grooves 912 and the opening of each one of the two second slide grooves 922 remain unblocked after the assembly of the conventional concealed hinge. That is,
15 each one of the two first guide blocks 933 can slip out of the opening of the respective first slide groove 912, and each one of the two second guide blocks 934 can slip out of the opening of the respective second slide groove 922. When the first shaft 931 and the second shaft 932 are broken or separate from the pivoting assembly 935, the two first guide blocks 933 and the two second guide
20 blocks 934 would be unable to keep the body 935 connected to the first retaining body 91 and the second retaining body 92, thereby causing the separation of the door leaf and the door frame. Then the door leaf would not be able to pivot relative to the door frame or would even fall on users and cause injuries.

3. The two first guide blocks 933 are pivotably mounted to the body 935 via two of the four detachable pins 936, and the two second guide blocks 934 are pivotably mounted to the body 935 via the other two of the four detachable pins 936. With such a configuration, each one of the four detachable pins 936 may fall from the body 935, from the first guide block 933 or from the second guide block 934 in the pivoting of the pivoting assembly 93 relative to the first retaining body 91 and the second retaining body 92. Each one of the four detachable pins 936 may even fall from the body 935 due to melting of the guide blocks 933, 934 in a fire accident. Since each one of the two first guide blocks 933 is pivotably mounted to the body 935 via a respective one of the four detachable pins 936, each one of the two first guide blocks 933 would rotate relative to the other one of the two first guide blocks 933 rather than move simultaneously. That is, the two first guide blocks 933 rotate eccentrically. Then the pivoting of the pivoting assembly 93 relative to the first retaining body 91 may be stucked, and abrasion between each one of the two first guide blocks 933 and a respective one of the two first slide grooves 912 increases. Then life expectancy of the conventional concealed hinge decreases. The same problem exists in the two second guide blocks 934.

4. The first retaining body 91 has a fixing portion 913 protruding thereon, and the fixing portion 913 has multiple horizontal racks 914 for adjusting the door leaf in a vertical direction. Although the multiple horizontal racks 914 provide enough supporting capacity for the door leaf in the vertical direction, the fixing portion 913 lacks mechanisms providing a positioning effect

and a limiting effect to the door leaf in a horizontal direction. Thus, the door leaf could not be adjusted to a precise position in the horizontal direction, and the door leaf may still move along the horizontal direction after being adjusted due to lack of the limiting effect of the fixing portion 913.

5 To overcome the shortcomings of the conventional concealed hinge, the present invention tends to provide a concealed hinge to mitigate or obviate the aforementioned problems.

 The main objective of the present invention is to provide a concealed hinge. The concealed hinge comprises a first retaining body, a second retaining
10 body, and a pivoting assembly. The first retaining body has two sides, a first connecting portion, a first joint portion, a first containing space, two first slide grooves, two first baffles, and a first channel. The first connecting portion is disposed at one of the two sides of the first retaining body. The first joint portion is disposed at the other one of the two sides of the first retaining body. The first
15 containing space is recessed in the first joint portion of the first retaining body. The two first slide grooves are formed in the first joint portion, are respectively located above and below the first containing space of the first retaining body, and communicate with the first containing space of the first retaining body, and each one of the two first slide grooves extends from the first joint portion to the first
20 connecting portion of the first retaining body. The first channel is formed through a top of the first connecting portion and communicates with the two first slide grooves of the first retaining body.

 The second retaining body has two sides, a second connecting portion, a

second joint portion, a second containing space, two second slide grooves, two second baffles, and a second channel. The second connecting portion is disposed at one of the two sides of the second retaining body. The second joint portion is disposed at the other one of the two sides of the second retaining body. The second containing space is recessed in the second joint portion of the second retaining body. The two second slide grooves are formed in the second joint portion, are respectively located above and below the second containing space of the second retaining body, and communicate with the second containing space of the second retaining body, and each one of the two second slide grooves extends from the second joint portion to the second connecting portion of the second retaining body. The second channel is formed through a bottom of the second connecting portion and communicates with the two second slide grooves of the second retaining body.

The pivoting assembly is pivotably mounted to the first retaining body and the second retaining body, and has a body, two first guide blocks, a first guide shaft, a first pivot shaft, two second guide blocks, a second guide shaft, and a second pivot shaft. The body is pivotably mounted to the first retaining body and the second retaining body, and has two ends received in the first containing space of the first retaining body and the second containing space of the second retaining body, respectively. The two first guide blocks are made of metal. Each one of the two first guide blocks is slidably mounted within a respective one of the two first slide grooves of the first retaining body and has a first passing hole formed vertically within. The first guide shaft is inserted through the first retaining body,

the body, and the two first guide blocks vertically via the first channel of the first retaining body. The first guide shaft has two ends respectively received in the two first guide blocks, such that the first guide shaft moves along with the two first guide blocks. The first pivot shaft is inserted through the body and the first retaining body. The two second guide blocks are made of metal. Each one of the two second guide blocks is slidably mounted within a respective one of the two second slide grooves of the second retaining body and has a second passing hole formed vertically within. The second guide shaft is inserted through the second retaining body, the body, and the two second guide blocks vertically via the second channel of the second retaining body. The second guide shaft has two ends respectively received in the two second guide blocks, such that the second guide shaft moves along with the two second guide blocks. The second pivot shaft is inserted through the body and the second retaining body.

Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

IN THE DRAWINGS:

Fig. 1 is a perspective view of a concealed hinge in accordance with the present invention;

Fig. 2 is an exploded perspective view of the concealed hinge in Fig. 1;

Fig. 3 is another front exploded perspective view of the concealed hinge in Fig. 1;

Fig. 4 is another rear exploded perspective view of the concealed hinge

in Fig. 1;

Fig. 5 is an exploded perspective view of a body of the concealed hinge in Fig. 1;

Fig. 6 is another exploded perspective view of the body of the concealed hinge in Fig. 5;

Fig. 7 is an enlarged perspective view of a first guide block of the concealed hinge in Fig. 3;

Fig. 8 is a cross sectional perspective view of the first guide block of the concealed hinge in Fig. 7;

Fig. 9 is a top view of the concealed hinge in Fig. 1;

Fig. 10 is a cross sectional side view of the concealed hinge along line 10-10 in Fig. 9;

Fig. 11 is a cross sectional side view of the concealed hinge along line 11-11 in Fig. 9;

Fig. 12 is a cross sectional side view of the concealed hinge along line 12-12 in Fig. 9;

Fig. 13 is a side view of the concealed hinge in Fig. 1;

Fig. 14 is an enlarged and cross sectional top view of the concealed hinge along line 14-14 in Fig. 13;

Fig. 15 is an enlarged exploded perspective view in partial section of the concealed hinge in Fig. 1;

Fig. 16 is a perspective view of the body without a central shaft of the concealed hinge in Fig. 1;

Fig. 17 is an exploded perspective view showing the assembly of a first retaining body and a pivoting assembly of the concealed hinge in Fig. 1;

Fig. 18 is another exploded perspective view showing the assembly of a first retaining body and a pivoting assembly of the concealed hinge in Fig. 1;

5 Fig. 19 is an exploded perspective view showing the assembly of a second retaining body and the pivoting assembly of the concealed hinge in Fig. 1;

Fig. 20 is an exploded perspective view showing how to assemble the central shaft, a first pivot shaft, and a second pivot shaft of the concealed hinge in Fig. 1;

10 Fig. 21 is an operational top view of the concealed hinge in Fig. 1;

Fig. 22 is another operational top view of the concealed hinge in Fig. 1;

Fig. 23 is an operational top view of the concealed hinge in Fig. 1; and

Fig. 24 is an exploded perspective view of a concealed hinge in accordance with the prior art.

15 With reference to Figs. 1 and 2, a concealed hinge in accordance with the present invention includes a first retaining body 10, a second retaining body 20, a pivoting assembly 30, and at least one mounting plate 40.

With reference to Figs. 3, 4, and 13, the first retaining body 10 has a first connecting portion 11, a first joint portion 12, a first containing space 13, two
20 first slide grooves 14, two first baffles 15, and a first channel 16. The first connecting portion 11 and the first joint portion 12 are disposed at two sides of the first retaining body 10 respectively. The first containing space 13 is recessed in the first joint portion 12. With reference to Figs. 3, 4, and 10, the two first slide

grooves 14 are formed in the first joint portion 12, are respectively located above and below the first containing space 13, and both communicate with the first containing space 13. Each one of the two first slide grooves 14 extends from the first joint portion 12 to the first connecting portion 11, forms through the first connecting portion 11 as shown in Fig. 4, and thereby forms a first opening 141 on the first connecting portion 11. The two first baffles 15 are formed on the first joint portion 12 and block the two first slide grooves 14, respectively. Each one of the two first baffles 15 has a first vent 151 formed thereon and communicating with a respective one of the two first slide grooves 14. Each one of the two first vents 151 facilitates routine maintenance and cleaning since air flows in the corresponding first slide groove 14 via the first vent 151. However, it is not necessary for each one of the two first baffles 15 to have the first vent 151 formed thereon.

The first channel 16 is formed either through a top of the first connecting portion 11 or through a bottom of the first connecting portion 11 along a vertical direction. In the configuration that the first channel 16 is formed through the top of the first connecting portion 11, the first channel 16 communicates with the first slide groove 14 located above the first containing space 13 and the first slide groove 14 located below the first containing space 13 via the first containing space 13. In the configuration that the first channel 16 is formed through the bottom of the first connecting portion 11, the first channel 16 communicates with the first slide groove 14 located below the first containing space 13 and the first slide groove 14 located above the first containing space 13 via the first containing

space 13. The purpose of having the first channel 16 formed through the first connecting portion 11 is to provide a convenient way for users to assemble the present invention. The first retaining body 10 does not necessarily have to include the first channel 16. The first retaining body 10 is either recessed in a door frame A or a door leaf B. In the present invention, the first retaining body 10 is recessed in the door frame A as shown in Fig. 21.

With reference to Figs. 3, 4, and 13, the second retaining body 20 is substantially the same as the first retaining body 10. The second retaining body 20 has a second connecting portion 21, a second joint portion 22, a second containing space 23, two second slide grooves 24, two second baffles 25, and a second channel 26. The second connecting portion 21 and the second joint portion 22 are disposed at two sides of the second retaining body 20 respectively. The second containing space 23 is recessed in the second joint portion 22. With reference to Figs. 3, 4, and 10, the two second slide grooves 24 are formed in the second joint portion 22, are respectively located above and below the second containing space 23, and both communicate with the second containing space 23. Each one of the two second slide grooves 24 extends from the second joint portion 22 to the second connecting portion 21, forms through the second connecting portion 21 as shown in Fig. 4, and thereby forms a second opening 241 on the second connecting portion 21. The two second baffles 25 are formed on the second joint portion 22 and block the two second slide grooves 24 respectively. Each one of the two second baffles 25 has a second vent 251 formed thereon and communicating with a respective one of the two second slide

grooves 24. Each one of the two second vents 251 facilitates routine maintenance and cleaning since air flows in the corresponding second slide groove 24 via the second vent 251.

With reference to Fig. 14, each one of the two second baffles 25 further
5 has a divergent section 252 located between a respective one of the two second vents 251 and a respective one of the two second slide grooves 24. An inner diameter of the divergent section 252 gradually increases from the corresponding second vent 251 to the corresponding second slide groove 24. Each one of the two first baffles 15 also has a divergent section located between a respective one
10 of the two first vents 151 and a respective one of the two first slide grooves 14 optionally. However, it is unnecessary for each one of the two second baffles 25 to have the second vent 251 and the divergent section 252.

The second channel 26 is formed either through a top of the second connecting portion 21 or through a bottom of the second connecting portion 21
15 along the vertical direction. In the configuration that the second channel 26 is formed through the top of the second connecting portion 21, the second channel 26 communicates with the second slide groove 24 located above the second containing space 23 and the second slide groove 24 located below the second containing space 23 via the second containing space 23. In the configuration that
20 the second channel 26 is formed through the bottom of the second connecting portion 21, the second channel 26 communicates with the second slide groove 24 located below the second containing space 23 and the second slide groove 24 located above the second containing space 23 via the second containing space 23.

The purpose of having the second channel 26 formed on the second connecting portion 21 is to provide a convenient way for the users to assemble the invention. The second retaining body 20 does not have to include the second channel 26. The second retaining body 20 is recessed in either the door frame A or the door leaf B. In the present invention, the second retaining body 20 is recessed in the door leaf B as shown in Fig. 21.

With reference to Figs. 2 to 4, the pivoting assembly 30 is pivotably mounted to the first retaining body 10 and the second retaining body 20, and has a body 31, two first guide blocks 34, a first guide shaft 35, a first pivot shaft 32, two second guide blocks 36, a second guide shaft 37, a second pivot shaft 33.

The body 31 is pivotably mounted to the first retaining body 10 and the second retaining body 20, and the body 31 has two ends received in the first containing space 13 of the first retaining body 10 and the second containing space 23 of the second retaining body 20, respectively. With reference to Figs. 5 and 6, the body 31 has a first joint element 311, a second joint element 312, and a central shaft 313.

With reference to Fig. 6, the first joint element 311 has a first pivoting portion 3111 and two first extension blocks 3112. The first pivoting portion 3111 is disposed vertically in the first joint element 311. The two first extension blocks 3112 are formed on the first pivoting portion 3111, extend along a horizontal direction, and are disposed at a spaced interval along the vertical direction.

With reference to Fig. 6, the second joint element 312 is connected to the first joint element 311 and has a second pivoting portion 3121 and two second

extension blocks 3122. The second pivoting portion 3121 is disposed vertically in the second joint element 312. The two second extension blocks 3122 are formed on the second pivoting portion 3121, extend along the horizontal direction, and are disposed at a spaced interval along the vertical direction. In the present invention, the two second extension blocks 3122 of the second joint element 312 and the two first extension blocks 3112 of the first joint element 311 are arranged in an alternate order along the vertical direction. Each one of the two second extension blocks 3122 of the second joint element 312 extends along an opposite direction relative to that of each one of the two first extension blocks 3112 of the first joint element 311.

With reference to Figs. 4, 5, and 12, the central shaft 313 is mounted to the two second extension blocks 3122 of the second joint element 312 and the two first extension blocks 3112 of the first joint element 311 along the vertical direction, such that the body 31 is assembled. The first joint element 311 and the second joint element 312 are respectively pivotable about the central shaft 313.

With reference to Figs. 3 to 5, in the present invention, the body 31 further has two bushings 314. One of the two bushings 314 is located between the two first extension blocks 3112 of the first joint element 311, and the other one of the two bushings 314 is located between the two second extension blocks 3122 of the second joint element 312. However, the body 31 does not have to include the two bushings 314.

Configuration and components of the body 31 are not limited in the present invention. Configuration and components that enable the body 31 to be

pivotably mounted to the first retaining body 10 and the second retaining body 20, and configuration and components that enable the two ends of the body 31 to be slidably received in the first containing space 13 of the first retaining body 10 and the second containing space 23 of the second retaining body 20 respectively are
5 what the invention is aiming to claim.

With reference to Figs. 3, 4, and 10, each one of the two first guide blocks 34 is inserted into a respective one of the two first slide grooves 14 via a corresponding first opening 141 and is slidably mounted within the respective first slide groove 14. Each one of the two second guide blocks 36 is inserted into
10 a respective one of the two second slide grooves 24 via a corresponding second opening 241 and is slidably mounted within the respective second slide groove 24. Each one of the two first slide grooves 14 does not have to include the first opening 141, and each one of the two second slide grooves 24 does not have to include the second opening 241, either. Each one of the two first guide blocks 34
15 and each one of the two second guide blocks 36 can be inserted in the corresponding first slide groove 14 and the corresponding second slide groove 24 in other ways.

Each one of the two first guide blocks 34 can slide within the corresponding first slide groove 14, but each one of the two first guide blocks 34
20 cannot slip out of the corresponding first slide groove 14 along a lateral direction relative to the sliding direction. A cross sectional shape of each one of the two first guide blocks 34 may be a circle, and a cross sectional shape of the corresponding first slide groove 14 may also be a circle. Thus each one of the two

first guide blocks 34 can rotate relative to the corresponding first slide groove 14. The above-mentioned configuration also applies to each one of the two second guide blocks 36 and the corresponding second slide groove 24.

In addition, with reference to Fig. 14, a cross sectional area of each one
5 of the two first vents 151 is smaller than that of each one of the two first guide blocks 34, and a cross sectional area of each one of the two second vents 251 is smaller than that of each one of the two second guide blocks 36, too. With the above-mentioned configuration, each one of the two first guide blocks 34 and each one of the two second guide blocks 36 will not slip out of the corresponding
10 first slide groove 14 and the corresponding second slide groove 24 from the first joint portion 12 and the second joint portion 22. Moreover, with reference to Figs. 7 and 8, each one of the two first guide blocks 34 and each one of the two second guide blocks 36 are made of metal with a higher melting point relative to plastic, which prevents each one of the two first guide blocks 34 and each one of the two
15 second guide blocks 36 from melting in a fire accident. In the present invention, each one of the two first guide blocks 34 and each one of the two second guide blocks 36 are covered with a covering layer 38 made of plastic respectively, such that each one of the two first guide blocks 34 and each one of the two second guide blocks 36 slide within the corresponding first slide groove 14 and the
20 corresponding second slide groove 24 more smoothly and with lower noise, respectively. The covering layer 38 may be made of rubber or other materials. Each one of the two first guide blocks 34 and each one of the two second guide blocks 36 may not be covered by the covering layer 38.

Furthermore, with reference to Figs. 4, 7, and 10, each one of the two first guide blocks 34 has a first positioning portion 341 formed on its outer surface and a first passing hole 342 formed vertically within. The first guide block 34 slidably mounted in the first slide groove 14 located above the first containing space 13 has the first positioning portion 341 protruding from a bottom of the outer surface of the first guide block 34. The first guide block 34 slidably mounted in the first slide groove 14 located below the first containing space 13 has the first positioning portion 341 protruding from a top of the outer surface of the first guide block 34. The first passing hole 342 of each one of the two first guide blocks 34 is aligned with the first passing hole 342 of the other one of the two guide blocks 34 and the first channel 16 of the first retaining body 10. Since the first positioning portion 341 protrudes on the outer surface of the first guide block 34, a cross sectional shape of each one of the two first guide blocks 34 is not a circle. With such a configuration, the first positioning portion 341 prevents the first guide block 34 from rotating relative to the corresponding first slide groove 14.

With reference to Figs. 4 and 10, each one of the two second guide blocks 36 has a second positioning portion 361 formed on its outer surface and a second passing hole 362 formed vertically within. The second guide block 36 slidably mounted within the second slide groove 24 located above the second containing space 23 has the second positioning portion 361 protruding from a bottom of the outer surface of the second guide block 36. The second guide block 36 slidably mounted within the second slide groove 24 located below the second

containing space 23 has the second positioning portion 361 protruding from a top of the outer surface of the second guide block 36. The second passing hole 362 of each one of the two second guide blocks 36 is aligned with the second passing hole 362 of the other one of the two guide blocks 36 and the second channel 26 of the second retaining body 20. Since the second positioning portion 361 protrudes on the outer surface of the second guide block 36, a cross sectional shape of each one of the two second guide blocks 36 is not a circle. With such a configuration, the second positioning portion 361 prevents the second guide block 36 from rotating relative to the corresponding second slide groove 24.

The first positioning portion 341 of one of the two first guide blocks 34 ensures the corresponding first passing hole 342 is aligned with the first passing hole 342 of the other one of the two first guide blocks 34 and the first channel 16 of the first retaining body 10 after each one of the first guide blocks 34 is mounted within the corresponding first slide groove 14. Thereby, the first guide shaft 35 can be inserted into the first passing hole 342 of each one of the two first guide blocks 34 via the first channel 16 as shown in Fig. 10. The second positioning portion 361 of one of the two second guide blocks 36 ensures the corresponding second passing hole 362 is aligned with the second passing hole 362 of the other one of the two second guide blocks 36 and the second channel 26 of the second retaining body 20 after each one of the second guide blocks 36 is mounted within the corresponding second slide groove 24. Thereby, the second guide shaft 37 can be inserted into the second passing hole 362 of each one of the two second guide blocks 36 via the second channel 26 as shown in Fig. 10.

In another embodiment, the first positioning portion 341 may be recessed in the corresponding first guide block 34, and each one of the two first slide grooves 14 has a protrusion with a contour corresponding to that of the first positioning portion 341 of each one of the first guide blocks 34 protruding from its inner surface. The second positioning portion 361 may be recessed in the corresponding second guide block 36, and each one of the two second slide grooves 24 has a protrusion with a contour corresponding to that of the second positioning portion 361 of each one of the second guide blocks 36 protruding from its inner surface. The assembly of the first positioning portion 341 of each one of the two first guide blocks 34 and the corresponding protrusion of each one of the two first slide grooves 14 also ensures that the first passing hole 342 of each one of the two first guide blocks 34 is aligned with the first passing hole 342 of the other one of the two first guide blocks 34 and the first channel 16 of the first retaining body 10. The assembly of the second positioning portion 361 of each one of the two second guide blocks 36 and the corresponding protrusion of each one of the two second slide grooves 24 also ensures that the second passing hole 362 of each one of the two second guide blocks 36 is aligned with the second passing hole 362 of the other one of the two second guide blocks 36 and the second channel 26 of the second retaining body 20. In still another embodiment, each one of the first two guide blocks 34 may not have the first positioning portion 341, and each one of the two second two guide blocks 36 may not have the second positioning portion 361, either.

In the present invention, with reference to Figs. 8 and 14, each one of the

two first guide blocks 34 extends along a direction of the corresponding first slide groove 14. Sizes of circumferences of each one of the two first guide blocks 34 gradually increase from two ends of each one of the two first guide blocks 34 to a center of each one of the two first guide blocks 34 along the direction of the corresponding first slide groove 14. Each one of the two second guide blocks 36 extends along a direction of the corresponding second slide groove 24. Sizes of circumferences of each one of the two second guide blocks 36 gradually increase from two ends of each one of the two second guide blocks 36 to a center of each one of the two second guide blocks 36 along the direction of the corresponding second slide groove 24. Therefore, each one of the two first guide blocks 34 has a convex portion formed around itself, and each one of the two second guide blocks 36 also has a convex portion formed around itself. The convex portion of each one of the two first guide blocks 34 decreases friction between the inner surface of the corresponding first slide groove 14 and said first guide block 34, and the convex portion of each one of the two second guide blocks 36 also decreases friction between the inner surface of the corresponding second slide groove 24 and said second guide block 36. Therefore, each one of the two first guide blocks 34 can slide more smoothly in the corresponding first slide groove 14 without stucked within, and each one of the two second guide blocks 36 can slide more smoothly in the corresponding second slide groove 24 without stucked within, too. Each one of the two first guide blocks 34 has four round corners, and each one of the two second guide blocks 36 has four round corners, too. With such a configuration, each one of the two first guide blocks 34 can slide more

smoothly in the corresponding first slide groove 14 without stuck within, and each one of the two second guide blocks 36 can slide more smoothly in the corresponding second slide groove 24 without stuck within, too. However, configurations of each one of the two first guide blocks 34 and each one of the two second guide blocks 36 are not limited in the present invention.

With reference to Figs. 3, 4, and 10, to mount the second joint element 312 to the first retaining body 10, insert the two second extension blocks 3122 of the second joint element 312 into the first containing space 13 of the first retaining body 10. Next, insert each one of the two first guide blocks 34 into the corresponding first slide groove 14, and make the first passing hole 342 of each one of the two first guide blocks 34 align with the first passing hole 342 of the other one of the two first guide blocks 34 and the first channel 16 of the first retaining body 10. The two second extension blocks 3122 of the second joint element 312 are located between the two first guide blocks 34. Then insert the first guide shaft 35 through the first retaining body 10, the body 31, and the two first guide blocks 34 vertically, which enables the first guide shaft 35 to move along with the sliding of the two first guide blocks 34 in the two first slide grooves 14 of the first retaining body 10.

To put it more specifically, the first guide shaft 35 is sequentially inserted into the first channel 16 of the first retaining body 10, the first passing hole 342 of one of the two first guide blocks 34, one of the two second extension blocks 3122 of the second joint element 312, one of the two bushings 314 located between the two first extension blocks 3112 of the first joint element 311, the

other one of the two second extension blocks 3122 of the second joint element 312, and the first passing hole 342 of the other one of the two first guide blocks 34. With such an assembly, two ends of the first guide shaft 35 are respectively received in the first passing holes 342 of the two first guide blocks 34, such that

5 the two second extension blocks 3122 of the second joint element 312 are pivotally mounted to the first guide shaft 35 and are capable of moving in the first containing space 13 of the first retaining body 10 along with the sliding of the two first guide blocks 34 in the two first slide grooves 14 of the first retaining body 10 and the movement of the first guide shaft 35.

10 In the same way, the first joint element 311 is mounted to the second retaining body 20 in the same way that the second joint element 312 is mounted to the first retaining body 10. With reference to Figs. 3, 4, and 10, the second guide shaft 37 is inserted through the second retaining body 20, the body 31, and the two second guide blocks 36 vertically via the second channel 26, which enables

15 the second guide shaft 37 to move along with the sliding of the two second guide blocks 36 in the two second slide grooves 24 of the second retaining body 20. The two first extension blocks 3112 of the first joint element 311 are located between the two second guide blocks 36. With such an assembly, two ends of the second guide shaft 37 are respectively received in the second passing holes 362 of the

20 second guide blocks 36, such that the two first extension blocks 3112 of the first joint element 311 are pivotally mounted to the second guide shaft 37 and are capable of moving in the second containing space 23 of the second retaining body 20 along with the sliding of the two second guide blocks 36 in the two second

slide grooves 24 of the second retaining body 20 and the movement of the second guide shaft 37.

The first retaining body 10 may not have the first channel 16, and the second retaining body 20 may not have the second channel 26. Each one of the two first guide blocks 34 may not have the first passing hole 342, and each one of the two second guide blocks 36 may not have the second passing hole 362. In such a configuration, the first connecting portion 11 of the first retaining body 10 should be in the open status rather than the closed status as shown in Fig. 4, and then the two second extension blocks 3122 of the second joint element 312 can be extended out of the first connecting portion 11. Next, insert the first guide shaft 35 into the two second extension blocks 3122, and then insert the two ends of the first guide shaft 35 into the two first guide blocks 34, respectively. At last, pull the second joint element 312 into the first containing space 13 from the first connecting portion 11, and make the two first guide blocks 34 slidably mounted within the corresponding first slide grooves 14. The same configuration applies to the second retaining body 20 and the assembly of the second retaining body 20 and the first joint element 311. In this way, the pivoting assembly 30 can be mounted to the first retaining body 10 and the second retaining body 20 with the two first baffles 15 formed on the first joint portion 12 and the two second baffles 25 formed on the second joint portion 22.

With reference to Figs. 3, 9, and 11, the first pivot shaft 32 is inserted through the first retaining body 10 and the first pivoting portion 3111 of the first joint element 311, such that the first pivoting portion 3111 of the first joint

element 311 is pivotally mounted to the first pivot shaft 32. The second pivot shaft 33 is inserted through the second retaining body 20 and the second pivoting portion 3121 of the second joint element 312, such that the second pivoting portion 3121 of the second joint element 312 is pivotally mounted to the second pivot shaft 33.

With reference to Figs. 6, 11, and 12, in the present invention, the pivoting assembly 30 further has two first separating elements 391, two second separating elements 392, three central separating elements 393, and multiple casing pipes 394. The two first separating elements 391 sleeve the first pivot shaft 32 and are made of metal. With reference to Fig.11, one of the two first separating elements 391 is located at a top end of the first pivoting portion 3111, and abuts against the first pivoting portion 3111 and the first retaining body 10. The other one of the two first separating elements 391 is located at a bottom end of the first pivoting portion 3111, and abuts against the bottom end of the first pivoting portion 3111 and the first retaining body 10. The two second separating elements 392 sleeve the second pivot shaft 33, and are made of metal. One of the two second separating elements 392 is located at a top end of the second pivoting portion 3121, and abuts against the top end of the second pivoting portion 3121 and the second retaining body 20. The other one of the two second separating elements 392 is located at a bottom end of the second pivoting portion 3121, and abuts against the bottom end of the second pivoting portion 3121 and the second retaining body 20. With reference to Fig.12, the three central separating elements 393 sleeve the central shaft 313 and are made of metal. Each one of the three

central separating elements 393 is located between one of the two first pivoting portions 3111 and one of the two second pivoting portions 3121, such that the first joint element 311 and the second joint element 312 can pivot about the central shaft 313 without direct contact with each one of the two first pivoting portions 3111 and the adjacent second pivoting portion 3112.

Each one of the multiple casing pipes 394 is made of plastic. The multiple casing pipes 394 are respectively located between an outer surface of the first pivot shaft 32 and an inner surface of the first pivoting portion 3111, between an outer surface of the second pivot shaft 33 and an inner surface of the second pivoting portion 3121, between an outer surface of the central shaft 313 and an inner surface of one of the two first extension blocks 3112, between the outer surface of the central shaft 313 and an inner surface of the other one of the two first extension blocks 3112, and between the outer surface of the central shaft 313 and an inner surface of one of the two second extension blocks 3122. The multiple casing pipes 394 can effectively reduce friction between the first pivoting portion 3111 and the first pivot shaft 32 while the first pivoting portion 3111 is pivoting about the first pivot shaft 32. Friction between the second pivoting portion 3121 and the second pivot shaft 33 is reduced while the second pivoting portion 3121 is pivoting about the second pivot shaft 33 by disposing the multiple casing pipes 394. While the first joint element 311 and the second joint element 312 are pivoting about the central shaft 313, friction between the two first extension blocks 3112 and the central shaft 313 and friction between one of the two second extension blocks 3122 and the central shaft 313 are also reduced

because of the multiple casing pipes 394. The pivoting assembly 30 does not have to include the two first separating elements 391, the two second separating elements 392, the three central separating elements 393, and the multiple casing pipes 394.

5 With reference to Figs. 1, 2, and 15, the at least one mounting plate 40 has a mounting surface 41, and the mounting surface 41 has a mounting tooth portion 411. The first retaining body 10 has at least one fixing portion 17. The at least one fixing portion 17 protrudes from a top surface of the first retaining body 10, and has a fixing surface 171. The fixing surface 171 has a tooth portion 172.

10 The fixing surface 171 of the at least one fixing portion 17 is mounted to the mounting surface 41 of the at least one mounting plate 40, and the tooth portion 172 is engaged with the mounting tooth portion 411. In the present invention, the mounting tooth portion 411 is a combination of multiple horizontal racks and multiple vertical racks, and the tooth portion 172 is also a combination

15 of multiple horizontal racks and multiple vertical racks, forming a skid-proof crossed toothed structure. In another embodiment, the mounting tooth portion 411 may be a combination of multiple racks inclined along two different directions.

 The mounting plate 40 is fixed either on the door frame A or on the door

20 leaf B to adjust position where the first retaining body 10 is recessed in the door frame A or the door leaf B by the mounting relationship of the mounting surface 41 and the fixing surface 171. In the present invention, the mounting plate 40 is fixed on the door frame A to adjust position where the first retaining body 10 is

recessed in the door frame A as shown in Fig. 21. That is, position of the first retaining body 10 relative to the mounting plate 40 can be adjusted along the horizontal direction and the vertical direction according to practical need before the first retaining body 10 is recessed in the door frame A. After the position of the first retaining body 10 relative to the mounting plate 40 is adjusted and the first retaining body 10 is recessed in the door frame A, the door frame A can be supported by the mounting relationship of the mounting surface 41 and the fixing surface 171. Since both the tooth portion 172 and the mounting tooth portion 411 are combination of multiple horizontal racks and multiple vertical racks, the engaging relationship of the tooth portion 172 and the mounting tooth portion 411 limits the movement of the at least one fixing portion 17 along both the horizontal and vertical directions. As the pivoting assembly 30 is pivotably mounted to the first retaining body 10 and the second retaining body 20 is recessed in the door leaf B, the door leaf B will not move along the horizontal direction and fall.

The concealed hinge of the present invention is assembled by the following steps:

Step 1: With reference to Figs. 6, 11, 12, and 16, insert the two first separating elements 391, the two second separating elements 392, the three central separating elements 393, and the multiple casing pipes 394 to the first joint element 311 and the second joint element 312 of the body 31.

Step 2: With reference to Fig. 16, mount the first joint element 311 and the second joint element 312 together, and arrange the two second extension

blocks 3122 of the second joint element 312 and the two first extension blocks 3112 of the first joint element 311 in an alternate order along the vertical direction.

Step 3: With reference to Figs. 16 to 18, insert the two second extension
 5 blocks 3122 of the second joint element 312 into the first containing space 13 of the first retaining body 10 from the first joint portion 12, and align the two second extension blocks 3122 with the first channel 16 of the first retaining body 10.

Step 4: With reference to Figs. 17 and 18, insert each one of the two first
 10 guide blocks 34 into a respective one of the two first slide grooves 14 via the corresponding first opening 141. Then align the two first guide blocks 34 with the first channel 16 of the first retaining body 10.

Step 5: With reference to Figs. 10, 17 and 18, insert the first guide shaft
 35 sequentially into the first channel 16 of the first retaining body 10, the first passing hole 342 of one of the two first guide blocks 34, one of the two second extension blocks 3122 of the second joint element 312, one of the two bushings
 15 314 located between the two second extension blocks 3122 of the second joint element 312, the other one of the two second extension blocks 3122 of the second joint element 312, and the first passing hole 342 of the other one of the two first guide blocks 34.

20 Step 6: With reference to Figs. 3, 16 and 19, insert the two first extension blocks 3112 of the first joint element 311 into the second containing space 23 of the second retaining body 20 from the second joint portion 22, and align the two first extension blocks 3112 with the second channel 26 of the second retaining

body 20.

Step 7: With reference to Figs. 10 and 19, insert each one of the two second guide blocks 36 into a respective one of the two second slide grooves 24 via the corresponding second opening 241. Then align the two second guide
5 blocks 36 with the second channel 26 of the second retaining body 20.

Step 8: With reference to Figs. 10 and 19, insert the second guide shaft 37 sequentially into the second channel 26 of the second retaining body 20, the second passing hole 362 of one of the two second guide blocks 36, one of the two first extension blocks 3112 of the first joint element 311, one of the two bushings
10 314 located between the two first extension blocks 3112 of the first joint element 311, the other one of the two first extension blocks 3112 of the first joint element 311, and the second passing hole 362 of the other one of the two second guide blocks 36.

Step 9: With reference to Figs. 11 and 20, insert the first pivot shaft 32
15 sequentially through an upper hole formed on the first retaining body 10, one of the two first separating elements 391, the first pivoting portion 3111 of the first joint element 311, two of the multiple casing pipes 394 respectively located adjacent to the top end of the first pivoting portion 3111 and the bottom end of the first pivoting portion 3111, the other one of the two first separating elements
20 391, and a lower hole formed on the first retaining body 10. Therefore, the first pivoting portion 3111 of the first joint element 311 is pivotally mounted to the first pivot shaft 32 relative to the first retaining body 10.

Step 10: With reference to Figs. 11 and 20, insert the second pivot shaft

32 sequentially through an upper hole formed on the second retaining body 20, one of the two second separating elements 391, the second pivoting portion 3111 of the second joint element 311, two of the multiple casing pipes 394 respectively located adjacent to the top end of the second pivoting portion 3111 and the bottom end of the second pivoting portion 3111, the other one of the two second separating elements 391, and a lower hole formed on the second retaining body 20. Therefore, the second pivoting portion 3111 of the second joint element 311 is pivotally mounted to the second pivot shaft 32 relative to the second retaining body 20.

10 Step 11: With reference to Figs. 12 and 19, insert the central shaft 313 into the two second extension blocks 3122 of the second joint element 312 and the two first extension blocks 3112 of the first joint element 311, such that the body 31 is assembled and the first joint element 311 and the second joint element 312 are respectively pivotable about the central shaft 313. To put it more specifically, the central shaft 313 is sequentially inserted into one of the two second extension blocks 3122 of the second joint element 312, one of the three central separating elements 393, one of the two first extension blocks 3112 of the first joint element 311 and the casing pipe 394 located therein, another one of the three central separating elements 393, the other one of the two first extension blocks 3112 of the first joint element 311 and the casing pipe 394 located therein, the other one of the three central separating elements 393, and the other one of the two first extension blocks 3112 of the first joint element 311 and the casing pipe 394 located therein.

After the above-mentioned steps are done, the concealed hinge of the present invention can be installed on a door assembly. With reference to Figs. 21 to 23, the first retaining body 10 is recessed in the door frame A, and the second retaining body 20 is recessed in the door leaf B. When the door leaf B pivots relative to the door frame A, the first joint element 311 pivots relative to the first retaining body 10 and pivots relative to the second joint element 312 about the central shaft 313. At the same time, the two second guide blocks 36 connected to the first joint element 311 respectively slide in the two second slide grooves 24 to make the two second extension blocks 3122 of the first joint element 311 received in the second containing space 23 of the second retaining body 20 as shown in Fig. 23. Likewise, the second joint element 312 acts in the same mechanism as the first joint element 311.

The concealed hinge in accordance with the present invention has the following advantages.

1. Being made of metal, the two first guide blocks 34 and the two second guide blocks 36 will not melt in the fire accident. Thus the present invention can prevent the tilt of the door leaf relative to the door frame in the fire accident mentioned in the description of related art.

2. Since the two first baffles 15 block the two first slide grooves 14 respectively and the two second baffles 25 block the two second slide grooves 24 respectively, each one of the two first guide blocks 34 and each one of the two second guide blocks 36 will not slip out of the corresponding first slide groove 14 and the corresponding second slide groove 24. Hence the pivoting assembly 30

will not separate from the first retaining body 10 and the second retaining body 20 directly even when the first pivot shaft 32 and the second pivot shaft 35 are broken or separated from the pivoting assembly 30, such that the separation of the door leaf B and the door frame A can be prevented.

5 3. As the two first guide blocks 34 are inserted by the first guide shaft 35 and the two second guide blocks 36 are inserted by the second guide shaft 37, the two first guide blocks 34 move simultaneously and the two second guide blocks 36 also move simultaneously. As a result, the pivoting assembly 30 pivots smoothly relative to the first retaining body 10 and the second retaining body 20.
10 Also, abrasion between each one of the two first guide blocks 34 and the corresponding slide groove 14 and abrasion between each one of the two second guide blocks 36 and the corresponding slide groove 24 can be decreased.

 4. Since both the tooth portion 172 and the mounting tooth portion 411 are combinations of multiple horizontal racks and multiple vertical racks, the
15 engagement of the tooth portion 172 and the mounting tooth portion 411 limits the movement of the at least one fixing portion 17 along both the horizontal and vertical directions. Therefore, the door leaf B will not move along the horizontal direction and fall.

 Even though numerous characteristics and advantages of the present
20 invention have been set forth in the foregoing description, together with details of the structure and features of the invention, the disclosure is illustrative only. Changes may be made in the details, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent

indicated by the broad general meaning of the terms in which the appended claims are expressed.

CLAIMS:

1. A concealed hinge comprising:
 - a first retaining body (10) having
 - two sides;
 - 5 a first connecting portion (11) disposed at one of the two sides of the first retaining body (10);
 - a first joint portion (12) disposed at the other one of the two sides of the first retaining body (10);
 - a first containing space (13) recessed in the first joint portion (12)
 - 10 of the first retaining body (10);
 - two first slide grooves (14) formed in the first joint portion (12), respectively located above and below the first containing space (13) of the first retaining body (10), and communicating with the first containing space (13) of the first retaining body (10), and each one of the two first slide grooves (14)
 - 15 extending from the first joint portion (12) to the first connecting portion (11) of the first retaining body (10);
 - two first baffles (15) formed on the first joint portion (12) and blocking the two first slide grooves (14) respectively; and
 - a first channel (16) formed through a top of the first connecting
 - 20 portion (11) and communicating with the two first slide grooves (14) of the first retaining body (10);
 - a second retaining body (20) having
 - two sides;

a second connecting portion (21) disposed at one of the two sides of the second retaining body (20);

a second joint portion (22) disposed at the other one of the two sides of the second retaining body (20);

5 a second containing space (23) recessed in the second joint portion (22) of the second retaining body (20);

two second slide grooves (24) formed in the second joint portion (22) of the second retaining body (20), respectively located above and below the second containing space (23) of the second retaining body (20), and
10 communicating with the second containing space (23) of the second retaining body (20), and each one of the two second slide grooves (24) extending from the second joint portion (22) to the second connecting portion (21) of the second retaining body (20);

two second baffles (25) formed on the second joint portion (22)
15 and blocking the two second slide grooves (24) respectively; and

a second channel (26) formed through a bottom of the second connecting portion (21) and communicating with the two second slide grooves (24) of the second retaining body (20); and

a pivoting assembly (30) pivotably mounted to the first retaining body (10)
20 and the second retaining body (20) and having

a body (31) pivotably mounted to the first retaining body (10) and the second retaining body (20), and having two ends received in the first containing space (13) of the first retaining body (10) and the second containing

space (23) of the second retaining body (20) respectively;

two first guide blocks (34) made of metal, and each one of the two first guide blocks (34) slidably mounted within a respective one of the two first slide grooves (14) of the first retaining body (10) and having a first passing hole (342) formed vertically within;

a first guide shaft (35) inserted through the first retaining body (10), the body (31), and the two first guide blocks (34) vertically via the first channel (16) of the first retaining body (10), and having two ends each received in a respective one of the two first guide blocks (34), such that the first guide shaft (35) moves along with the two first guide blocks (34);

a first pivot shaft (32) inserted through the body (31) and the first retaining body (10);

two second guide blocks (36) made of metal, and each one of the two second guide blocks (36) slidably mounted within a respective one of the two second slide grooves (24) of the second retaining body (20) and having a second passing hole (362) formed vertically within;

a second guide shaft (37) inserted through the second retaining body (20), the body (31), and the two second guide blocks (36) vertically via the second channel (26) of the second retaining body (20), and having two ends each received in a respective one of the two second guide blocks (36), such that the second guide shaft (37) moves along with the two second guide blocks (36);

a second pivot shaft (33) inserted through the body (31) and the second retaining body (20).

2. The concealed hinge as claimed in claim 1, wherein

each one of the two first guide blocks (34) has a first positioning portion (341) formed on its outer surface to prevent the first guide block (34) from rotating relative to the corresponding first slide groove (14); and

5 each one of the two second guide blocks (36) has a second positioning portion (361) formed on its outer surface to prevent the second guide block (36) from rotating relative to the corresponding second slide groove (24).

3. The concealed hinge as claimed in claim 2, wherein

10 each one of the two first guide blocks (34) has the first positioning portion (341) protruding on its outer surface; and

each one of the two second guide blocks (36) has the second positioning portion (361) protruding on its outer surface.

15 4. The concealed hinge as claimed in any one of claims 1 to 3, wherein

each one of the two first guide blocks (34) extends along a direction of the corresponding first slide groove (14), and sizes of circumferences of each one of the two first guide blocks (34) gradually increase from two ends of each one of the two first guide blocks (34) to a center of each one of the two first guide blocks (34) along the direction of the corresponding first slide groove (14); and

20

each one of the two second guide blocks (36) extends along a direction of the corresponding second slide groove (24), and sizes of circumferences of each

one of the two second guide blocks (36) gradually increase from two ends of each one of the two second guide blocks (36) to a center of each one of the two second guide blocks (36) along the direction of the corresponding second slide groove (24).

5

5. The concealed hinge as claimed in any one of claims 1 to 3, wherein

each one of the two first guide blocks (34) extends along a direction of the corresponding first slide groove (14), and each one of the two first guide blocks

10 (34) has four round corners; and

each one of the two second guide blocks (36) extends along a direction of the corresponding second slide groove (24), and each one of the two second guide blocks (36) has four round corners.

15 6. The concealed hinge as claimed in any one of claims 1 to 3, wherein

each one of the two first slide grooves (14) of the first retaining body (10) has a first opening (141) formed on the first connecting portion (11), and each one of the two first guide blocks (34) is inserted into a respective one of the two

20 first slide grooves (14) via a corresponding first opening (141); and

each one of the two second slide grooves (24) of the second retaining body (20) has a second opening (241) formed on the second connecting portion (21), and each one of the two second guide blocks (36) is inserted into a respective one

of the two second slide grooves (24) via a corresponding second opening (241).

7. The concealed hinge as claimed in any one of claims 1 to 3, wherein

5 each one of the two first guide blocks (34) is covered with a covering layer (38) made of plastic; and

each one of the two second guide blocks (36) is covered with a covering layer (38) made of plastic.

10 8. The concealed hinge as claimed in any one of claims 1 to 3, wherein

each one of the two first baffles (15) has a first vent (151) formed thereon and communicating with a respective one of the two first slide grooves (14), and a cross-sectional area of each one of the two first vents (151) is smaller than that
15 of each one of the two first guide blocks (34); and

each one of the two second baffles (25) has a second vent (251) formed thereon and communicating with a respective one of the two second slide grooves (24), and a cross-sectional area of each one of the two second vents (251) is smaller than that of each one of the two second guide blocks (36).

20

9. The concealed hinge as claimed in any one of claims 1 to 3, wherein

the concealed hinge has at least one mounting plate (40) having a

mounting surface (41), and the mounting surface (41) has a mounting tooth portion (411); and

the first retaining body (10) has at least one fixing portion (17) protruding thereon, and the at least one fixing portion (17) has a fixing surface (171) mounted to the mounting surface (41) and having a tooth portion (172) engaged with the mounting tooth portion (411).

10. The concealed hinge as claimed in any one of claims 1 to 3, wherein the body (31) of the pivoting assembly (30) further has

10 a first joint element (311) having

a first pivoting portion (3111) pivotally mounted to the first pivot shaft (32); and

two first extension blocks (3112) formed on the first pivoting portion (3111), disposed at a spaced interval along a vertical direction, pivotally mounted to the second guide shaft (37), being capable of moving in the second containing space (23) of the second retaining body (20) along with movement of the second guide shaft (37), and located between the two second guide blocks (36);

a second joint element (312) having

20 a second pivoting portion (3121) pivotally mounted to the second pivot shaft (33); and

two second extension blocks (3122) formed on the second pivoting portion (3121), disposed at a spaced interval along the vertical direction,

pivotally mounted to the first guide shaft (35), being capable of moving in the first containing space (13) of the first retaining body (10) along with movement of the first guide shaft (35), located between the two first guide blocks (34), and being arranged in an alternate order along the vertical direction with the two first
5 extension blocks (3112) of the first joint element (311); and

a central shaft (313) mounted to the two second extension blocks (3122) of the second joint element (312) and the two first extension blocks (3112) of the first joint element (311) along the vertical direction.

10 11. The concealed hinge as claimed in claim 10, wherein the pivoting assembly (30) further has

two first separating elements (391) sleeving the first pivot shaft (32) and made of metal, one of the two first separating elements (391) located at a top end of the first pivoting portion (3111) and abutting against the first pivoting portion
15 (3111) and the first retaining body (10), and the other one of the two first separating elements (391) located at a bottom end of the first pivoting portion (3111) and abutting against the bottom end of the first pivoting portion (3111) and the first retaining body (10);

two second separating elements (392) sleeving the second pivot shaft (33)
20 and made of metal, one of the two second separating elements (392) located at a top end of the second pivoting portion (3121) and abutting against the top end of the second pivoting portion (3121) and the second retaining body (10), and the other one of the two second separating elements (392) located at a bottom end of

the second pivoting portion (3121) and abutting against the bottom end of the second pivoting portion (3121) and the second retaining body (20); and

three central separating elements (393) sleeving the central shaft (313) and made of metal, and each one of the three central separating elements (393) is
5 located between one of the two first pivoting portions (3111) and one of the two second pivoting portions (3121).

12. The concealed hinge as claimed in claim 10, wherein the pivoting assembly (30) further has multiple casing pipes (394) made of plastic, and the
10 multiple casing pipes (394) are respectively located between an outer surface of the first pivot shaft (32) and an inner surface of the first pivoting portion (3111), between an outer surface of the second pivot shaft (33) and an inner surface of the second pivoting portion (3121), between an outer surface of the central shaft (313) and an inner surface of one of the two first extension blocks (3112),
15 between the outer surface of the central shaft (313) and an inner surface of the other one of the two first extension blocks (3112), and between the outer surface of the central shaft (313) and an inner surface of one of the two second extension blocks (3122).