

CORNER GUIDE AND FITTING

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to and incorporates by reference the entire contents of Japanese Patent Application No. 2014-204216 filed in Japan on October 2, 2014.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a corner guide and a fitting using the corner guide.

2. Description of the Related Art

In such fitting, an operating handle provided on a vertical jamb of a sash is operated to select the mode of opening the sash in a window frame by swinging inward to the side or tilting inward. In this type of fitting, a linkage member is provided on each of the vertical jamb and a horizontal jamb of the sash to slide along each longitudinal direction. The linkage members are linked with a corner guide, and the linkage member provided on the vertical jamb is linked to the operating handle. When the linkage member provided on the horizontal jamb slides, the linkage state of a link between the window frame and the

horizontal jamb changes. When the linkage member provided on the vertical jamb slides, the linkage state of a locking mechanism provided between the window frame and the vertical jamb changes. The corner guide is configured with a case accommodating a strip member. The case has L-shaped with a pair of guiding parts extending along longitudinal directions of the horizontal jamb and the vertical jamb. Guiding paths provided in the guiding parts communicate via an arc-shaped linkage path. The strip member is a thin plate made of a flexible metal and slidably disposed along the guiding paths of the guiding parts and the linkage path. The linkage members are coupled to ends of the strip member, each via a slider.

The fitting is configured that two linkage members are coupled together via the strip member so that by operating the operating handle, the linkage member provided on the horizontal jamb slides and thereby the linkage state of the link and the locking mechanism changes in conjunction with the linkage member provided on the vertical jamb. In this manner, the mode of opening the sash in the window frame can be selected between inward-side-swing or inward-tilt (for example, see JP 4-12952 Y).

As for the corner guide configured as described above, the slider and the linkage member should be connected outside the case. Therefore, the connection between the

slider and the linkage member becomes remote from the end face of one of the guiding parts by at least a sliding distance of the linkage member. This requires the sash to which the corner guide is applied to be large in size.

SUMMARY OF THE INVENTION

In view of such problem, an object of the present invention is to provide a corner guide and a fitting which minimize the increase in the size of the sash to which the invention is applied.

According to one aspect of the present invention, a corner guide is provided on a corner of frames extending along intersecting directions to provide linkage between linkage members so as to slide one of the linkage members in conjunction with sliding of the other linkage member. Each of the linkage members is provided on depth face of the respective frames and sliding along longitudinal direction. There is provided the corner guide including: a case; a flexible strip member; and a cover member. The case includes: a pair of guiding parts each extending along longitudinal direction of each of the frames; a guiding path provided in the respective guiding parts; and an arc-shape linkage path continuously connecting guiding paths provided in the guiding parts. The flexible strip member is slidably disposed along the guiding paths and the

linkage path provided in the guiding parts. The cover member is attached to the linkage path and the guiding path provided in the other guiding part to restrict out-of-plane movement of the strip member. The guiding path provided in one of the guiding parts includes: a pair of guide grooves configured to slidably accommodate both side rims of the strip member to restrict out-of-plane movement of the strip member; and a slide groove provided between the guide grooves. The linkage path and the guiding path provided in the other guiding part are opened through a region of the case opposing a depth face of the frame and have dimension allowing out-of-plane movement of the strip member.

According to the present invention, one of the guiding parts allows the strip member and the linkage member to be coupled through a slide groove so that the linkage member can overlappingly be disposed with the guiding part. This minimizes the increase in the size of the sash to which the invention is applied. Furthermore, region of the guiding path and the arc-shaped linkage path of the other guiding part opposing the depth faces of the frames are opened, so that even when the case is formed by die forming, the die needs not be complex.

The present invention is characterized in that the cover member of the corner guide is made of a resin material, has an engagement protrusion, and is configured

to be held on the case by the engagement of the engagement protrusion.

According to the invention, the cover member can easily and surely be attached to the case.

Furthermore, according to the present invention, the corner guide is configured that the strip member includes a slider on the end portion positioned in the guiding path provided in the other guiding part and is coupled to the linkage member via the slider, and that the cover member includes an accommodating groove for accommodating the slider between a pair of wall portions and is held on the case with each of the respective wall portions disposed between each of both side rims of the slider and the case.

According to the present invention, the wall portions of the cover member made of a resin material is disposed between both side rims of the slider and the case, and thus rims of the slider slide against the wall portions when the slider slides. Thus, the slider slides smoothly.

The fitting according to the present invention is characterized by including any one of the corner guides described above provided on the arris of the top jamb and the vertical jamb, and that the linkage member on the top jamb slides via the corner guide in conjunction with the sliding of the linkage member on the vertical jamb made by the operating handle provided on the vertical jamb.

According to the present invention, one of the guiding parts allows the strip member and the linkage member to be coupled through a slide groove, so that the linkage member can overlappingly be disposed with the guiding part. This minimizes the increase in the size of the sash. Furthermore, region of the guiding path and the arc-shaped linkage path of the other guiding part opposing the depth faces of the frames are opened, so that even when the case is formed by die forming, the die needs not be complex.

The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a fitting to which a corner guide, an embodiment of the present invention, is used viewed from the inside of the room;

FIG. 2 is a vertical cross sectional view of the fitting illustrated in FIG. 1;

FIG. 3 is a horizontal cross sectional view of the fitting illustrated in FIG. 1;

FIG. 4 illustrates a mechanism for selecting the mode of opening and closing a sash in a window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room, where an operating handle is turned to a locking position;

FIG. 5 illustrates the sash in a state illustrated in FIG. 4 viewed from a sash leading edge side;

FIG. 6 is a perspective view of a hinge device of the fitting illustrated in FIG. 1 viewed from the inside of the room;

FIG. 7 is an exploded perspective view of a hinge device provided on the upper part of the fitting illustrated in FIG. 1 viewed from the inside of the room;

FIG. 8 is an exploded perspective view of a hinge device provided on the lower part of the fitting illustrated in FIG. 1 viewed from the inside of the room;

FIG. 9 is a perspective view illustrating an essential portion of the mechanism for selecting the mode of opening and closing the sash in the window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room;

FIG. 10 illustrates a mechanism for selecting the mode of opening and closing the sash in the window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room, where an operating handle is turned to an inward-side-swing position;

FIG. 11 illustrates the sash in a state illustrated in FIG. 10 viewed from the sash leading edge side;

FIG. 12 is an enlarged perspective view illustrating an essential portion of the mechanism for selecting the mode of opening and closing the sash in the window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room, where an operating handle is turned to the inward-side-swing position;

FIG. 13 is a perspective view illustrating the sash opened toward the inside of the room from the state illustrated in FIG. 10;

FIG. 14 illustrates the mechanism for selecting the mode of opening and closing the sash in the window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room, where an operating handle is being turned from the inward-side-swing position to an inward-tilt position;

FIG. 15 illustrates the sash in a state illustrated in FIG. 14 viewed from the sash leading edge side;

FIG. 16 illustrates a mechanism for selecting the mode of opening and closing the sash in the window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room, where an operating handle is turned to the inward-tilt position;

FIG. 17 illustrates the sash in a state illustrated in FIG. 16 viewed from the sash leading edge side;

FIG. 18 is a perspective view illustrating the sash tilted to the inside of the room from the state illustrated in FIG. 16;

FIG. 19 is an enlarged view illustrating an essential portion of the sash in a state illustrated in FIG. 18 viewed from the sash leading edge side;

FIG. 20 is a horizontal cross sectional view of a frame hinge bracket of the hinge device illustrated in FIG. 6 attached to a frame;

FIG. 21 is an exploded perspective view illustrating a structure for attaching the frame hinge bracket illustrated in FIG. 8 to the frame;

FIG. 22 is a perspective view of the frame hinge bracket illustrated in FIG. 21 with a back plate attached thereon;

FIG. 23 is a perspective view of the frame hinge bracket illustrated in FIG. 21 with a stopper part attached between the frame hinge bracket and the back plate;

FIG. 24 is an exploded view illustrating the jamb hinge bracket and the back plate of the hinge device illustrated in FIG. 8;

FIG. 25 is a horizontal cross sectional view of the jamb hinge bracket illustrated in FIG. 24 attached to a jamb;

FIG. 26 is an exploded perspective view illustrating a structure for attaching the jamb hinge bracket illustrated in FIG. 25 to a jamb;

FIG. 27 is an exploded perspective view illustrating a structure for attaching the jamb hinge bracket illustrated in FIG. 25 to a jamb;

FIG. 28 is a perspective view of the jamb hinge bracket illustrated in FIG. 24 with a back plate attached thereon;

FIG. 29 is an exploded perspective view illustrating a structure for attaching the frame hinge bracket of the hinge device illustrated in FIG. 7 to a frame;

FIG. 30 is a perspective view of the frame hinge bracket illustrated in FIG. 29 with a back plate attached thereon;

FIG. 31 is a perspective view of the frame hinge bracket illustrated in FIG. 29 with a stopper part attached between the frame hinge bracket and the back plate;

FIG. 32A is a plan view illustrating a structure for attaching the jamb hinge bracket of the hinge device illustrated in FIG. 7 to the sash where the operating handle is turned to a locking position;

FIG. 32B is a cut-out perspective view illustrating a structure for attaching the jamb hinge bracket of the hinge

device illustrated in FIG. 7 to the sash where the operating handle is turned to a locking position;

FIG. 33A is a plan view illustrating a structure for attaching the jamb hinge bracket of the hinge device illustrated in FIG. 7 to the sash where the operating handle is turned to the inward-side-swing position;

FIG. 33B is a cut-out perspective view illustrating a structure for attaching the jamb hinge bracket of the hinge device illustrated in FIG. 7 to the sash where the operating handle is turned to the inward-side-swing position;

FIG. 34 is a plan view of the jamb hinge bracket rotated in a state illustrated in FIG. 33A;

FIG. 35A is a plan view illustrating a structure for attaching the jamb hinge bracket of the hinge device illustrated in FIG. 7 to the sash where the operating handle is turned to the inward-tilt position;

FIG. 35B is a cut-out perspective view illustrating a structure for attaching the jamb hinge bracket of the hinge device illustrated in FIG. 7 to the sash where the operating handle is turned to the inward-tilt position;

FIG. 36A is a plan view of the jamb hinge bracket rotated in a state illustrated in FIG. 35A;

FIG. 36B is a cut-out perspective view illustrating the jamb hinge bracket rotated in a state illustrated in FIG. 35A;

FIG. 37 is a perspective view illustrating an essential portion of the mechanism for selecting the mode of opening and closing the sash provided on the lower end portion of the window frame of the fitting illustrated in FIG. 1 viewed from the inside of the room;

FIG. 38 is a perspective view of the mechanism illustrated in FIG. 37 viewed from the sash leading edge side;

FIG. 39 is an exploded perspective view of the mechanism illustrated in FIG. 38;

FIG. 40 is a perspective view of an intermediate operating device to which the operating handle is provided in the fitting illustrated in FIG. 1;

FIG. 41 is an exploded perspective view of the intermediate operating device illustrated in FIG. 40;

FIGS. 42A and 42B are horizontal cross sectional views of the intermediate operating device illustrated in FIG. 40;

FIG. 43 is a perspective view of the corner guide used in the fitting illustrated in FIG. 1;

FIG. 44 is an exploded perspective view of the corner guide illustrated in FIG. 43;

FIGS. 45A and 45B illustrate a procedure of assembling the corner guide illustrated in FIG. 43, where FIG. 45A is an exploded perspective view illustrating the strip member attached to the case, and FIG. 45B is a perspective view illustrating the cover member attached to the case;

FIG. 46 is a cross sectional view of the corner guide illustrated in FIG. 43;

FIG. 47 is an exploded perspective view of the corner guide illustrated in FIG. 43; and

FIG. 48 is an enlarged cross sectional view taken along the line A-A in FIG. 46.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferable embodiment of a corner guide and a fitting according to the present invention will be described in detail referring to the attached drawings. FIGS. 1 to 5 illustrate a fitting to which a corner guide, an embodiment of the present invention, is used. An exemplary fitting described below includes a window frame 10 and a sash 20 and is called a drehkip window, in which the sash 20 opens from the window frame 10 to the inside of the room by two modes which are inward-side-swing and inward-tilt. It is to be noted that in the following description, a term "depth direction" is used to indicate the direction directed to the indoor side of the fitting

from outdoor side of the fitting or the direction directed to the outdoor side of the fitting from the indoor side of the fitting. A term "depth face" is used to indicate a face along the depth direction, and terms "width face" is used to indicate a face along a direction perpendicular to the depth direction unless otherwise specified.

Schematic Configuration of Fitting

The window frame 10 is configured by assembling a top frame 11, a bottom frame 12, and right and left vertical frames 13 and 14 in a four-side frame structure. Each of the frames 11, 12, 13, and 14 of the window frame 10 is formed by extrusion forming of a metal, such as aluminum or an aluminum alloy, and has a substantially constant cross sectional shape throughout the entire length. The sash 20 is configured by assembling a top jamb (frame) 22, a bottom jamb 23, and right and left vertical jambs (frames) 24 and 25 on four sides of the plane member 21, such as a square glass plate, to form a four-side jamb structure. The sash 20 has a size appropriate to cover the opening of the window frame 10. Similarly to the frames 11, 12, 13, and 14, each of the jambs 22, 23, 24, and 25 of the sash 20 is formed by extrusion forming of a metal, such as aluminum or an aluminum alloy, and has a substantially constant cross sectional shape throughout the entire length.

The fitting includes hinge devices 100 and 200 provided on the upper portion and the lower portion, respectively, of the region between the vertical frame located in the right side in FIG. 4 (hereinafter referred to as "hinge-side frame 13") and the sash 20, a locking device 300 provided on the lower portion of the region enclosed by the vertical frame located in the left side in FIG. 4 (hereinafter referred to as "sash leading edge-side frame 14"), the bottom frame 12, and the sash 20, and an intermediate operating device 400 provided on the vertical jamb of the sash 20 located in the left side in FIG. 4 (hereinafter referred to as "sash leading edge-side jamb 25"). The vertical jamb located in the right side in FIG. 4 is referred to as a hinge jamb 24 to distinguish from the sash leading edge-side jamb 25.

As illustrated in FIGS. 6 to 8, the hinge device 100 is configured with a frame hinge bracket 120 and a jamb hinge bracket 130 coupled together through a vertically extending hinge shaft 110, and the hinge device 200 is configured with a frame hinge bracket 220 and a jamb hinge bracket 230 coupled together through a vertically extending hinge shaft 210. To distinguish between two upper and lower hinge devices in the description hereinafter, the hinge device provided in the lower side will be referred to as a lower hinge device 100 and components thereof will be

denoted using a term "lower", and the hinge device provided in the upper side will be referred to as a upper hinge device 200 and components thereof will be denoted using a term "upper".

In the lower hinge device 100 as illustrated in FIGS. 6 and 8, the lower jamb hinge bracket 130 is supported so as to rotate about the axis of the lower hinge shaft 110 and tilt about the bottom end of the lower hinge shaft 110 relative to the lower frame hinge bracket 120. The lower frame hinge bracket 120 is attached to the depth face of the hinge-side frame 13, and the lower jamb hinge bracket 130 is attached to the depth face of the hinge jamb 24.

The upper hinge device 200 is configured that the upper jamb hinge bracket 230 is supported so as to rotate about the axis of the upper hinge shaft 210 relative to the upper frame hinge bracket 220. The upper frame hinge bracket 220 is attached to the depth face of the hinge-side frame 13, and the upper jamb hinge bracket 230 is attached to the top face of the top jamb 22 via an upper link mechanism 240. As illustrated in FIGS. 4, 6, and 7, the upper link mechanism 240 includes a main link 242 linking a jamb fixed bracket 241 fixed to the top face of the top jamb 22 and the upper frame hinge bracket 220 of the upper hinge device 200 and a locking link 243 provided so as to slide along the longitudinal direction of the jamb fixed

bracket 241. By sliding the locking link 243, the upper link mechanism 240 changes between a locked state (illustrated in solid lines in FIG. 7) where the main link 242 is kept aligned with the longitudinal direction of the jamb fixed bracket 241 and an unlocked state (illustrated in two-dot chain lines in FIG. 7) where the main link 242 is allowed to pivot relative to the jamb fixed bracket 241.

The locking device 300 controls the opening and closing of the sash 20 in the window frame 10 by changing the engaging state between the sash leading edge-side frame 14 and the sash leading edge-side jamb 25 and the engaging state between the sash leading edge-side jamb 25 and the bottom frame 12. In the embodiment as illustrated in FIGS. 4, 5, and 9, the locking device 300 is configured with a controlling rod 310 including a lock pin 311 and a full-open-stopper protrusion 312, a control block unit 320 including a lock receiver 321 and a protrusion receiver 322, and a lower block member 330 including a rod insertion hole 331. The controlling rod 310 is provided on the depth face of the sash leading edge-side jamb 25 so as to vertically slide with the lock pin 311 and the full-open-stopper protrusion 312 protruding toward the depth face of the sash leading edge-side frame 14. The control block unit 320 is attached to the depth face of the sash leading edge-side frame 14 with the lock receiver 321 and the protrusion

receiver 322 protruding toward the depth face of the sash leading edge-side jamb 25. The lower block member 330 is attached to the top face of the bottom frame 12 with the rod insertion hole 331 opening upward.

By operating a operating handle 401, the intermediate operating device 400 operates a sliding block 410 to change the state of the upper link mechanism 240 to the locked state or the unlocked state and to change the locking state of the locking device 300. The operating handle 401 is provided on the width face of the sash leading edge-side jamb 25 facing the inside of the room and can be turned about an axis extending along the depth direction. In the embodiment as illustrated in solid lines in FIG. 1, the operating handle 401 can be turned 90 degrees counterclockwise in FIG. 1 from a position where the distal end points vertically downward (hereinafter referred to as "locking position") to a horizontal position (hereinafter referred to as "inward-side-swing position"), and further, total of 180 degrees to a position where the distal end points vertically upward (hereinafter referred to as "inward-tilt position"). The sliding block 410 is provided on the depth face of the sash leading edge-side jamb 25 so as to vertically slide. As illustrated in FIG. 9, the lower end of the sliding block 410 is coupled to the controlling rod 310 of the locking device 300 via a lower

linkage member 402. The connecting path extends from the upper end of the sliding block 410 reaching the top face of the top jamb 22 via an upper linkage member 403 and a corner guide 500, and further reaches the locking link 243 of the upper link mechanism 240 via a top jamb linkage member 404.

Operation of Selecting Mode of Opening and Closing Fitting

When the operating handle 401 in the fitting configured as described above is turned to the locking position, the sliding block 410 is positioned at the uppermost on the sash leading edge-side jamb 25 as illustrated in FIGS. 4 and 5. In this state, the upper link mechanism 240 is locked by the locking link 243, while the main link 242 is kept aligned with the longitudinal direction of the jamb fixed bracket 241. The lower end of the controlling rod 310 of the locking device 300 is outside the rod insertion hole 331 of the lower block member 330, and the lock pin 311 is positioned in front of the lock receiver 321 while the full-open-stopper protrusion 312 is positioned clear of the protrusion receiver 322. In this state, even when the sash 20 is pulled toward the inside of the room with the operating handle 401, the lock pin 311 abutting the lock receiver 321 prevents the sash 20 from opening.

From the above state, by turning the operating handle 401 to the inward-side-swing position, the sliding block 410 slides downward along the sash leading edge-side jamb 25 as illustrated in FIGS. 10 and 11 and the upper linkage member 403 and the lower linkage member 402 slide downward. At the same time, the locking link 243 of the upper link mechanism 240 slides toward the sash leading edge-side pulled by the corner guide 500, still keeping the locked state. The controlling rod 310 of the locking device 300 slides downward to a position where the lock pin 311 is in a position clear of the lock receiver 321 as illustrated in FIG. 12. The lower end of the controlling rod 310 is outside the rod insertion hole 331 of the lower block member 330, and the full-open-stopper protrusion 312 is in a position clear of the protrusion receiver 322. Thus in this state, the sash leading edge-side jamb 25 can move away from the sash leading edge-side frame 14 by pulling the sash 20 toward the inside of the room with the operating handle 401. As illustrated in FIG. 13, the sash 20 can be opened toward the inside of the room by swinging about the upper hinge shaft 210 of the upper hinge device 200 and the lower hinge shaft 110 of the lower hinge device 100 (opening the sash 20 by inward-side-swing).

By turning the operating handle 401 to the position illustrated in FIGS. 14 and 15 and further to the inward-

tilt position, the sliding block 410, the upper linkage member 403, and the lower linkage member 402 slide downward along the sash leading edge-side jamb 25 as illustrated in FIGS. 16 and 17. The locking link 243 slides toward the sash leading edge-side to unlock the upper link mechanism 240, and thereby the main link 242 can swing relative to the jamb fixed bracket 241. In the locking device 300, the lower end of the controlling rod 310 is inserted in the rod insertion hole 331 of the lower block member 330 with the lock pin 311 kept in a position clear of the lock receiver 321 and the full-open-stopper protrusion 312 kept in a position clear of the protrusion receiver 322. Thus in this state, the top jamb 22 can move away from the top frame 11 by pulling the sash 20 toward the inside of the room with the operating handle 401 as illustrated in FIGS. 18 and 19. The sash 20 can tilt toward the inside of the room by pivoting about the lower end of the lower hinge shaft 110 of the lower hinge device 100 and the lower end of the controlling rod 310 inserted in the rod insertion hole 331 of the lower block member 330 (opening the sash 20 by inward-tilt).

Detailed Configuration of Fitting

The components of the fitting described above will further specifically be described below along with the characterizing feature of the application.

Configuration of Window Frame 10 and Sash 20

As illustrated in FIGS. 2 and 3, the frames 11, 12, 13, and 14 of the window frame 10 are configured with first frame components 11A, 12A, 13A, and 14A provided in the indoor side, second frame components 11B, 12B, 13B, and 14B provided in the outdoor side, and heat insulators 11C, 12C, 13C, and 14C, respectively. The heat insulators 11C, 12C, 13C, and 14C are each provided between the first frame component and the second frame component. A pair of frame-side attachment pieces 15 is provided on each of the first frame components 11A, 12A, 13A, and 14A. The frame-side attachment pieces 15 protrude from the depth face, which faces the sash 20, of each of the first frame components 11A, 12A, 13A, and 14A toward the sash 20 and have at distal ends thereof substantially right-angled bends protruding toward each other. The frame-side attachment pieces 15 and the depth face form a frame-side guiding groove 16.

Similarly to the window frame 10, the jambs 22, 23, 24, and 25 of the sash 20 are configured with first jamb components 22A, 23A, 24A, and 25A provided in the indoor side, second jamb components 22B, 23B, 24B, and 25B provided in the outdoor side, and heat insulators 22C, 23C, 24C, and 25C, respectively. The heat insulators 22C, 23C, 24C, and 25C are each provided between the first jamb

component and the second jamb component. A pair of jamb-side attachment pieces 26 is provided on each of the first jamb components 22A, 23A, 24A, and 25A. The jamb-side attachment pieces 26 protrude from the depth face, which faces the window frame 10, of each of the first jamb components 22A, 23A, 24A, and 25A toward the window frame 10 and have at distal ends thereof substantially right-angled bends protruding toward each other. The jamb-side attachment pieces 26 and the depth face form a jamb-side guiding groove 27. The top jamb linkage member 404 provided on the top jamb 22 of the sash 20 and the upper linkage member 403, the lower linkage member 402, and the controlling rod 310 of the locking device 300 provided on the sash leading edge-side jamb 25 are slidably disposed in the jamb-side guiding groove 27.

Configuration of Lower Frame Hinge Bracket 120 Used in Lower Hinge Device 100

As illustrated in FIGS. 21 to 23, the lower frame hinge bracket 120 of the lower hinge device 100 is integrally formed to include a pair of column-shape lower frame shaft supports 121 and lower frame attachment portions 122 each extending outward from the circumferential surface of each lower frame shaft support 121 and having a substantially right-angled bend. As illustrated in FIGS. 8 and 20, the lower frame hinge

bracket 120 is attached to the depth face of the hinge-side frame 13 by the lower frame attachment portion 122 and a lower frame back plate 140 holding therebetween a bent portion 15a of the frame-side attachment piece 15 in the indoor side with a pair of lower frame shaft supports 121 projecting toward the inside of the room further than the width face of the hinge-side frame 13 facing the indoor side.

As illustrated in FIGS. 21 to 23, a pair of lower frame shaft supports 121 is coaxially provided on the upper and lower portions of the lower frame attachment portion 122 and separated from each other along the axial direction. A semispherical ball-receiving recess 121a is provided in the upper end face of the lower frame shaft support 121 provided in the lower side.

The lower frame attachment portion 122 has a size large enough to cover a pair of frame-side attachment pieces 15 provided on the hinge-side frame 13 and includes a lower frame screw hole 122a and a lower frame protrusion insertion hole 122b. The lower frame screw holes 122a are provided at upper and lower ends of the lower frame attachment portion 122, and the lower frame protrusion insertion hole 122b is provided between the lower frame screw holes 122a. As illustrated in FIG. 20, a supporting portion 123 is provided on the region of the lower frame

attachment portion 122 facing the depth face of the hinge-side frame 13. When the lower frame attachment portion 122 covers the depth face of the hinge-side frame 13, the supporting portion 123 contacts the depth face of the hinge-side frame 13 between a pair of frame-side attachment pieces 15. The supporting portion 123 includes an engaging portion 124 and a hooking portion 125. The engaging portion 124 is grooved in the face of the supporting portion 123 facing the outdoor side. When the lower frame attachment portion 122 covers the depth face of the hinge-side frame 13, the bent portion 15a of the frame-side attachment piece 15 in the outdoor side engages with the engaging portion 124. The hooking portion 125 protrudes from the distal end of the supporting portion 123 toward the inside of the room.

The lower frame back plate 140 includes a lower frame holder portion 141 which is to be disposed between the lower frame attachment portion 122 of the lower frame hinge bracket 120 and the depth face of the hinge-side frame 13 and inserted in the frame-side guiding groove 16 of the frame-side attachment piece 15 in the indoor side. As illustrated in FIG. 21, the lower frame back plate 140 is provided with a lower frame positioning protrusion 142, a lower frame screw hole 143, and a lower frame back plate protrusion 144. The lower frame positioning protrusions

142 are formed on upper and lower ends of the lower frame back plate 140 to contact the end faces of the lower frame attachment portions 122. The lower frame screw hole 143 is an internal-thread hole located so as to overlap with the lower frame screw hole 122a of the lower frame attachment portion 122 when the lower frame back plate 140 is overlappingly placed on the lower frame attachment portion 122. When the lower frame back plate 140 is overlappingly placed on the lower frame attachment portion 122, the lower frame back plate protrusion 144 engages in the lower frame protrusion insertion hole 122b of the lower frame attachment portion 122 to restrict the relative movement of the lower frame attachment portion 122 and the lower frame back plate 140.

As illustrated in FIG. 20, the lower frame hinge bracket 120 of the lower hinge device 100 is attached to the hinge-side frame 13 by engaging the bent portion 15a of the frame-side attachment piece 15 in the outdoor side with the engaging portion 124 of the supporting portion 123, positioning the lower frame holder portion 141 of the lower frame back plate 140 in the frame-side guiding groove 16 of the frame-side attachment piece 15 in the indoor side, screwing a fixing screw 150 into the lower frame screw hole 143 of the lower frame back plate 140 through the lower frame screw hole 122a, and inserting a stopper part 160 in

a gap between the lower frame back plate 140 and the frame-side attachment piece 15 in the outdoor side. The stopper part 160 is made of a resin material and has a cross sectional shape which allows the longitudinally middle portion to contact the frame-side attachment piece 15 and the lower frame back plate 140. The hooking portion 125 of the supporting portion 123 provided on the lower frame attachment portion 122 is fitted between the stopper part 160 and the depth face of the hinge-side frame 13. A grip portion 161 formed in a wide thin plate is provided on the proximal end of the stopper part 160 to make the insert operation easier. An insertion guide 162 having a smaller cross sectional area than the space between the frame-side attachment piece 15 and the lower frame back plate 140 is formed on the distal end of the stopper part 160. An outward projecting engagement portion 163 is provided on the external surface of the distal end of the insertion guide 162. The engagement portion 163 engages with an engagement recess 145 formed in the lower frame back plate 140 to prevent unintended detaching of the stopper part 160 from the lower frame hinge bracket 120.

With the lower frame hinge bracket 120 of the lower hinge device 100 attached in a manner described above, there is no need to provide the hinge-side frame 13 with a hole to insert a fixing screw therein. This is

advantageous in providing the fitting with water-tightness. Moreover, even in a case when the fixing screw 150 becomes loose, the stopper part 160 restricts the lower frame back plate 140 from separating from the frame-side attachment piece 15 in the indoor side, so that the bent portion 15a of the frame-side attachment piece 15 is kept held between the lower frame hinge bracket 120 and the lower frame back plate 140. Thus the detaching of the lower frame hinge bracket 120 from the hinge-side frame 13 can be prevented.

When the lower frame hinge bracket 120 is attached as described above, the lower frame back plate protrusion 144 of the lower frame back plate 140 is in engagement with the lower frame protrusion insertion hole 122b of the lower frame attachment portion 122 and the distal end of the supporting portion 123 is in contact with the depth face of the hinge-side frame 13. Therefore, even when an external force as shown in the arrow A in FIG. 20 is applied to the lower frame hinge bracket 120, the lower frame hinge bracket 120 is restricted from moving relative to the hinge-side frame 13 and thereby should not come off easily.

Configuration of Lower Jamb Hinge Bracket 130 Used in Lower Hinge Device 100

As illustrated in FIGS. 24, 26, 27, and 28, the lower jamb hinge bracket 130 of the lower hinge device 100 is integrally formed to include a column-shape lower jamb

shaft support 131 and a lower jamb attachment portion 132 extending outward from the circumferential surface of the lower jamb shaft support 131 and having a substantially right-angled bend. As illustrated in FIGS. 8 and 25, the lower jamb hinge bracket 130 is attached to the depth face of the hinge jamb 24 by the lower jamb attachment portion 132 and a lower jamb back plate 170 holding therebetween a bent portions 26a of a pair of jamb-side attachment pieces 26 with the lower jamb shaft supports 131 projecting toward the inside of the room further than the width face of the hinge jamb 24 facing the indoor side.

As illustrated in FIGS. 26 to 28, the lower jamb shaft support 131 has an axial length such that the lower jamb shaft support 131 can be disposed between a pair of lower frame shaft supports 121 provided on the lower frame hinge bracket 120. The lower hinge shaft 110 has a column-shape with a spherical portion 111 on the lower end thereof. The lower hinge shaft 110 is fixed at the upper end thereof to the lower jamb shaft support 131 of the lower jamb hinge bracket 130 with the spherical portion 111 externally exposed. The spherical portion 111 of the lower hinge shaft 110 has a dimension which allows itself rolling in the ball-receiving recess 121a of the lower frame shaft support 121.

The lower jamb attachment portion 132 has a size large enough to cover a pair of jamb-side attachment pieces 26 provided on the hinge jamb 24 and includes a lower jamb screw hole 132a, a lower jamb protrusion insertion hole 132b, and a pair of insertion portions 132c. The lower jamb screw holes 132a are provided at upper and lower ends of the lower jamb attachment portion 132, and the lower jamb protrusion insertion hole 132b is provided between the lower jamb screw holes 132a. As illustrated in FIGS. 24, 26, 27, and 28, an insertion portions 132c protrude from the face of the lower jamb attachment portion 132 facing a pair of jamb-side attachment pieces 26 and have bent portions protruding in directions separating from each other. As illustrated in FIG. 25, the insertion portions 132c can be inserted between a pair of jamb-side attachment pieces 26 with the bent portions disposed in the jamb-side guiding grooves 27 of the jamb-side attachment pieces 26. As can be understood from FIG. 25, when the lower jamb attachment portion 132 is in contact with the jamb-side attachment piece 26, a pair of insertion portions 132c are positioned separated from both the bent portions 26a of the jamb-side attachment pieces 26 and the depth face of the hinge jamb 24.

As illustrated in FIG. 25, the lower jamb back plate 170 is integrally formed to include a lower jamb holder 171

which is inserted in the jamb-side guiding groove 27 of the jamb-side attachment piece 26 and a sash support 172 protruding at a right angle from an end portion of the lower jamb holder 171. The lower jamb holder 171 has a cut-out 173 in the region corresponding to the insertion portion 132c provided on the lower jamb attachment portion 132.

As illustrated in FIG. 26, the lower jamb back plate 170 is provided with a lower jamb screw hole 171a and a lower jamb back plate protrusion 171b. The lower jamb screw hole 171a is an internal-thread hole located so as to overlap with the lower jamb screw hole 132a of the lower jamb attachment portion 132 when the lower jamb back plate 170 is overlappingly placed on the lower jamb attachment portion 132. When the lower jamb back plate 170 is overlappingly placed on the lower jamb attachment portion 132, the lower jamb back plate protrusion 171b engages in the lower jamb protrusion insertion hole 132b of the lower jamb attachment portion 132 to restrict the relative movement of the lower jamb attachment portion 132 and the lower jamb back plate 170. The lower jamb back plate protrusion 171b has in the central portion thereof a supporting screw hole 171c. The supporting screw hole 171c penetrates the lower jamb back plate 170, and a back plate supporting screw 180 is screwed into the supporting screw

hole 171c. The back plate supporting screw 180 turned to be tightened projects from the lower jamb back plate 170 toward the depth face of the hinge jamb 24 through the lower jamb protrusion insertion hole 132b of the lower jamb attachment portion 132.

The lower jamb hinge bracket 130 of the lower hinge device 100 can be attached to the hinge jamb 24 by slightly screwing a fixing screw 181 into the lower jamb screw hole 171a to previously overlap the lower jamb back plate 170 on the lower jamb attachment portion 132, inserting the lower jamb holder 171 and the insertion portions 132c in the jamb-side guiding groove 27 of the jamb-side attachment piece 26 from the bottom face of the hinge jamb 24, and tightening the fixing screw 181 with the sash support 172 kept in contact with the bottom face of the hinge jamb 24. Now, the bent portion 26a of the jamb-side attachment piece 26 provided on the hinge jamb 24 is held between the lower jamb hinge bracket 130 and the lower jamb holder 171 of the lower jamb back plate 170, and the lower jamb hinge bracket 130 is supported on the hinge jamb 24.

With the lower jamb hinge bracket 130 of the lower hinge device 100 attached in a manner described above, there is no need to provide the hinge jamb 24 with a hole to insert a fixing screw therein. This is advantageous in providing the fitting with water-tightness. Moreover, even

in a case when the fixing screw 181 becomes loose, the insertion portion 132c of the lower jamb hinge bracket 130 is kept engaged with the bent portion 26a of the jamb-side attachment piece 26 because the insertion portion 132c is inserted in the jamb-side guiding groove 27 of the hinge jamb 24. Thus the separation of the lower jamb hinge bracket 130 from the lower jamb back plate 170 and the detaching of the sash 20 are prevented. As a result, the attachment and detachment of the lower jamb hinge bracket 130 can be performed easily.

When the lower jamb hinge bracket 130 is attached in a manner described above, the lower jamb back plate protrusion 171b of the lower jamb back plate 170 is in engagement with the lower jamb protrusion insertion hole 132b of the lower jamb attachment portion 132. Therefore, even when an external force is applied to the lower jamb hinge bracket 130, the lower jamb hinge bracket 130 does not come off easily because the insertion portion 132c is engaged with the bent portion 26a of the jamb-side attachment piece 26 and the lower jamb hinge bracket 130 is restricted from moving relative to the hinge jamb 24.

Moreover, even before screwing the fixing screw 181 into the lower jamb hinge bracket 130, the occurrence of positioning error can be avoided by screwing the back plate supporting screw 180 to push the lower jamb holder 171 of

the lower jamb back plate 170 onto the bent portion 26a of the jamb-side attachment piece 26 so as to restrict the relative movement of the lower jamb back plate 170 to the hinge jamb 24.

Operation of Lower Hinge Device 100

In the lower hinge device 100 configured as described above, the spherical portion 111 of the lower hinge shaft 110 is housed and supported in the ball-receiving recess 121a of the lower frame shaft support 121, thereby allowing the lower jamb hinge bracket 130 to rotate about a vertical axis and tilt about the lower end of the lower hinge shaft 110 relative to the lower frame hinge bracket 120.

Configuration of Upper Frame Hinge Bracket 220 Used in Upper Hinge Device 200

As illustrated in FIGS. 29, 30, and 31, the upper frame hinge bracket 220 of the upper hinge device 200 is integrally formed to include a column-shape upper frame shaft support 221 and an upper frame attachment portion 222 extending outward from the circumferential surface of the upper frame shaft support 221 and having a substantially right-angled bend. As illustrated in FIGS. 7 and 20, the upper frame hinge bracket 220 is attached to the depth face of the hinge-side frame 13 by the upper frame attachment portion 222 and a upper frame back plate 250 holding therebetween the bent portion 15a of the frame-side

attachment piece 15 in the indoor side to align the axis of the upper frame shaft support 221 with the axis of the lower frame shaft support 121, with the upper frame shaft supports 221 projecting toward the inside of the room further than the width face of the hinge-side frame 13 facing the indoor side.

The upper hinge shaft 210 has a column-shape and is fixed at the lower end thereof to the upper frame shaft support 221 of the upper frame hinge bracket 220 with the upper end of the upper hinge shaft 210 externally exposed.

The upper frame attachment portion 222 has a size large enough to cover a pair of frame-side attachment pieces 15 provided on the hinge-side frame 13 and includes an upper frame screw hole 222a and an upper frame protrusion insertion hole 222b. The upper frame screw holes 222a are provided at upper and lower ends of the upper frame attachment portion 222, and the upper frame protrusion insertion hole 222b is provided between the upper frame screw holes 222a. As illustrated in FIG. 20, a supporting portion 223 is provided on the region of the upper frame attachment portion 222 facing the depth face of the hinge-side frame 13. When the upper frame attachment portion 222 covers the depth face of the hinge-side frame 13, the supporting portion 223 is in contact with the depth face of the hinge-side frame 13 between a pair of frame-

side attachment pieces 15. The supporting portion 223 includes an engaging portion 224 and a hooking portion 225. The engaging portion 224 is grooved in the face of the supporting portion 223 facing the outdoor side. When the upper frame attachment portion 222 covers the depth face of the hinge-side frame 13, the engaging portion 224 engages with the bent portion 15a of the frame-side attachment piece 15 in the outdoor side. The hooking portion 225 protrudes from the distal end of the supporting portion 223 toward the inside of the room.

As illustrated in FIG. 20, the upper frame back plate 250 includes an upper frame holder portion 251 which is to be disposed between the upper frame attachment portion 222 of the upper frame hinge bracket 220 and the depth face of the hinge-side frame 13 and inserted in the frame-side guiding groove 16 of the frame-side attachment piece 15 in the indoor side. As illustrated in FIG. 29, the upper frame back plate 250 is provided with an upper frame positioning protrusion 252, an upper frame screw hole 253, and an upper frame back plate protrusion 254. The upper frame positioning protrusions 252 are formed on upper and lower ends of the upper frame back plate 250 to contact the end faces of the upper frame attachment portions 222. The upper frame screw hole 253 is an internal-thread hole located so as to overlap with the upper frame screw hole

222a of the upper frame attachment portion 222 when the upper frame back plate 250 is overlappingly placed on the upper frame attachment portion 222. When the upper frame back plate 250 is overlappingly placed on the upper frame attachment portion 222, the upper frame back plate protrusion 254 engages in the upper frame protrusion insertion hole 222b of the upper frame attachment portion 222 to restrict the relative movement of the upper frame attachment portion 222 and the upper frame back plate 250.

As illustrated in FIG. 20, the upper frame hinge bracket 220 of the upper hinge device 200 is attached to the hinge-side frame 13 by engaging the bent portion 15a of the frame-side attachment piece 15 in the outdoor side with the engaging portion 224 of the supporting portion 223, positioning the upper frame holder portion 251 of the upper frame back plate 250 in the frame-side guiding groove 16 of the frame-side attachment piece 15 in the indoor side, screwing each fixing screw 260 into each of the upper frame screw holes 253 of the upper frame back plate 250 through each of the upper frame screw holes 222a, and then inserting a stopper part 160 in a gap between the upper frame back plate 250 and the frame-side attachment piece 15 in the outdoor side. The stopper part 160 has a configuration same as that used in the lower frame hinge bracket 120 of the lower hinge device 100.

With the upper frame hinge bracket 220 of the upper hinge device 200 attached in a manner described above, there is no need to provide the hinge-side frame 13 with a hole to insert a fixing screw therein. This is advantageous in providing the fitting with water-tightness. Moreover, even in a case when the fixing screw 260 becomes loose, the stopper part 160 restricts the upper frame back plate 250 from separating from the frame-side attachment piece 15 in the indoor side so that the bent portion 15a of the frame-side attachment piece 15 is kept held between the upper frame hinge bracket 220 and the upper frame back plate 250. Thus the detaching of the upper frame hinge bracket 220 from the hinge-side frame 13 can be prevented.

When the upper frame hinge bracket 220 is attached in a manner described above, the upper frame back plate protrusion 254 of the upper frame back plate 250 is engaged in the upper frame protrusion insertion hole 222b of the upper frame attachment portion 222, and the distal end of the supporting portion 223 is in contact with the depth face of the hinge-side frame 13. Therefore, even when an external force as shown in the arrow A in FIG. 20 is applied to the upper frame hinge bracket 220, the upper frame hinge bracket 220 is restricted from moving relative to the hinge-side frame 13 and thereby should not come off easily.

Configuration of Upper Jamb Hinge Bracket 230 Used in Upper Hinge Device 200

As illustrated in FIGS. 6 and 7, the upper jamb hinge bracket 230 of the upper hinge device 200 includes a column-shape upper jamb shaft support 231 and an upper jamb attachment portion 232 extending outward from the circumferential surface of the upper jamb shaft support 231. The upper jamb hinge bracket 230 is provided on the upper end of the upper hinge shaft 210 via the upper jamb shaft support 231 so as to rotate about the axis of the upper hinge shaft 210 with its movement in the axial direction restricted.

Configuration of Upper Link Mechanism 240 Used in Upper Hinge Device 200

As illustrated in FIGS. 6, 7, and 32A to 36B, the main link 242 of the upper link mechanism 240 is a long thin plate of which proximal end is coupled to the upper jamb attachment portion 232. The main link 242 is coupled to the upper jamb attachment portion 232 by, for example, swaging or by a screw. In the main link 242, a slide pin 242a, a support link pin 242b, and a link lock pin 242c are provided in this order from the distal end. The slide pin 242a, the support link pin 242b, and the link lock pin 242c each extend in the vertical direction, protruding downward from the bottom face of the main link 242. A sub-link 244

is provided on the support link pin 242b of the main link 242. The sub-link 244 is a thin plate shorter than the main link 242. The sub-link 244 is supported at the proximal end so as to pivot about the axis of the support link pin 242b. A sub-link pin 244a is provided on the distal end of the sub-link 244. The sub-link pin 244a extends parallel to the support link pin 242b, protruding downward from the bottom face of the sub-link 244.

The jamb fixed bracket 241 is a thick plate member shorter than the main link 242, has a longitudinally elongate slide hole 241a at the distal portion, and is fixed on the top face of the top jamb 22 along the longitudinal direction of the top jamb 22. The sub-link 244 is pivotally supported on the jamb fixed bracket 241 by the sub-link pin 244a, and the slide pin 242a of the main link 242 is slidably accommodated in the slide hole 241a.

An engaging clip 245 is disposed in the slide hole 241a of the jamb fixed bracket 241. The engaging clip 245 is formed in a substantial U-shape having a curved proximal end and free distal ends. The engaging clip 245 is attached to the jamb fixed bracket 241 with the U-shaped proximal end positioned at the section of the slide hole 241a close to the hinge. The engaging clip 245 has a narrow portion 245a. The width of the engaging clip 245 is narrowed at the narrow portion 245a by bending opposing

portions of the engaging clip 245 near the proximal end toward each other. In the slide hole 241a provided with the engaging clip 245, the slide pin 242a should push back the narrow portion 245a against the elastic force of the engaging clip 245 to travel through the narrow portion 245a of the engaging clip 245. This restricts the sliding of the slide pin 242a. In the embodiment, the engaging clip 245 is provided to give restriction on the movement of the slide pin 242a toward the sash leading edge-side when the slide pin 242a is at an end of the slide hole 241a close to the hinge.

The locking link 243 is a long thin plate member having about the same length as the main link 242. The locking link 243 is supported on the bottom face of the jamb fixed bracket 241 so as to slide only in the longitudinal direction of the jamb fixed bracket 241. A pin holder 246 is provided on the end of the locking link 243 close to the hinge. The pin holder 246 has a pin receiving groove 246a of which top side and distal side are opened.

As illustrated in FIGS. 32A and 32B, when the locking link 243 and the main link 242 are aligned with each other and then the locking link 243 slides toward the hinge, the link lock pin 242c of the main link 242 is received inside the pin receiving groove 246a of the pin holder 246, and

thereby the jamb fixed bracket 241 is kept aligned with the main link 242 via the locking link 243 (locked state).

In contrast, when the locking link 243 slides toward the sash leading edge-side as illustrated in FIGS. 35A and 35B, the link lock pin 242c of the main link 242 comes out of the pin receiving groove 246a of the pin holder 246. Thus as illustrated in FIGS. 36A and 36B, the main link 242 and the jamb fixed bracket 241 can pivot relative to each other about the slide pin 242a of the main link 242 (unlocked state). By this relative motion, the linkage effect provided by the sub-link 244 linked to both the main link 242 and the jamb fixed bracket 241 slides the slide pin 242a through the slide hole 241a toward the proximal end. The slide pin 242a then pushes back the narrow portion 245a of the engaging clip 245 to travel therethrough. Unless an operational force large enough to push back the elastic force of the engaging clip 245 is applied, the slide pin 242a is held at the proximal end of the slide hole 241a.

Operation of Upper Hinge Device 200

In the upper hinge device 200 configured as described above, when the operating handle 401 is turned to the locking position, the inward-side-swing position, or the middle position between the inward-side-swing position and the inward-tilt position, the link lock pin 242c of the

main link 242 is housed in the pin receiving groove 246a of the pin holder 246. In this state, the jamb fixed bracket 241 cannot pivot relative to the main link 242. So that when the upper jamb attachment portion 232 pivots about the upper hinge shaft 210, the jamb fixed bracket 241 attached to the top jamb 22 of the sash 20 pivots together with the main link 242 about the upper hinge shaft 210 as illustrated in FIG. 34, and thus the sash 20 can be opened by inward-side-swing.

When the operating handle 401 is turned to the inward-tilt position, the link lock pin 242c of the main link 242 comes out of the pin receiving groove 246a of the pin holder 246. In this state, the jamb fixed bracket 241 can pivot relative to the main link 242. So that when the upper jamb attachment portion 232 pivots about the upper hinge shaft 210, the jamb fixed bracket 241 pivots relative to the main link 242 as required so as to allow the top jamb 22 to translate parallel to the top frame 11 as illustrated in FIGS. 36A and 36B, and thus the sash 20 can be opened by inward-tilt.

Configuration of Locking Device 300

As illustrated in FIG. 9, the controlling rod 310 of the locking device 300 is a long member having a cross section substantially identical to the upper linkage member 403 and the lower linkage member 402 provided on the sash

leading edge-side jamb 25. An insert-tilt protrusion 313 is provided on the lower end of the controlling rod 310. The insert-tilt protrusion 313 can be inserted in the rod insertion hole 331 provided in the lower block member 330. The width, in the depth direction, of the insert-tilt protrusion is smaller at the upper and lower end portions than the middle portion. The upper end portion of the insert-tilt protrusion 313 can tilt toward the inside of the room with the insert-tilt protrusion 313 inserted in the rod insertion hole 331 of the lower block member 330.

The lock pin 311 provided on the controlling rod 310 has a horizontally extending cylindrical shape. The full-open-stopper protrusion 312 protruding along the horizontal direction is provided in the middle section between the insert-tilt protrusion 313 and the lock pin 311.

As illustrated in FIGS. 37 to 39, the lower block member 330 has a rectangular solid shape having a rod insertion hole 331 in each of both ends on the top face. The lower block member 330 is fixed on the top face of the bottom frame 12 with one of end faces of the lower block member 330 in contact with the depth face of the sash leading edge-side frame 14 and one of the rod insertion holes 331 positioned directly below the controlling rod 310. The height of the lower block member 330 is previously determined such that the insert-tilt protrusion 313 can be

inserted in the rod insertion hole 331 only when the operating handle 401 is turned to the inward-tilt position. In FIG. 4, a sliding block 340 protrudes downward from the bottom face of the bottom jamb 23. The sliding block 340 makes contact with the top face of the lower block member 330 when the sash 20 is closed.

As illustrated in FIGS. 37 to 39, the control block unit 320 includes an upper block member 320A and a middle block member 320B which are independently formed. The lock receiver 321 is provided on the upper block member 320A, and the protrusion receiver 322 is provided on the middle block member 320B. The lock receiver 321 of the upper block member 320A and the protrusion receiver 322 of the middle block member 320B protrude toward the hinge-side frame 13.

The height of the lock receiver 321 is determined so as that, when the sash 20 is closed, the lock receiver 321 is positioned in front of the lock pin 311 of the controlling rod 310 when the operating handle 401 is turned to the locking position, and is clear of the lock pin 311 when the operating handle 401 is turned to the inward-side-swing position or the inward-tilt position.

The height of the protrusion receiver 322 is determined so as that, when the sash 20 is closed, the protrusion receiver 322 is below and clear of the full-

open-stopper protrusion 312 of the controlling rod 310 when the operating handle 401 is turned to the locking position or the inward-side-swing position, and is above and clear of the full-open-stopper protrusion 312 when the operating handle 401 is turned to the inward-tilt position. When the operating handle 401 is at a position between the inward-side-swing position and the inward-tilt position, the protrusion receiver 322 is at a height staying in front of the full-open-stopper protrusion 312. Therefore, when the operating handle 401 is at a position between the inward-side-swing position and the inward-tilt position, the motion of the sash 20 toward the inside of the room, separating from the window frame 10, is prevented. Thus, the detaching motion of the sash 20 to the inside of the room is prevented.

As illustrated in FIGS. 18 and 19, the locking device 300 according to the embodiment is configured that when the sash 20 tilts toward the inside of the room, the protrusion receiver 322 of the middle block member 320B comes close above the full-open-stopper protrusion 312 of the controlling rod 310. Thus, when the sash 20 is tilted toward the inside of the room, the upward movement of the sash 20 from the window frame 10 is restricted, so that the detaching of the sash 20 is prevented.

In the embodiment as illustrated in FIGS. 38 and 39, a contact rod 323 is provided on each of upper and lower ends of the middle block member 320B. The middle block member 320B and the upper block member 320A are attached to the depth face of the sash leading edge-side frame 14 with end faces of the contact rod 323 in contact with the top face of the lower block member 330 and the bottom face of the upper block member 320A. The length of the lower contact rod 323 is determined so as that the height of the protrusion receiver 322 provided on the middle block member 320B satisfies the conditions described above when the lower contact rod 323 is in contact with the top face of the lower block member 330. The length of the upper contact rod 323 is determined so as that the height of the lock receiver 321 provided on the upper block member 320A satisfies the conditions described above when the upper contact rod 323 is in contact with the bottom face of the upper block member 320A.

In the locking device 300 described above, by stacking the middle block member 320B on the lower block member 330 and the upper block member 320A on the middle block member 320B, each relative height of the lock receiver 321 and the protrusion receiver 322 to the lock pin 311 and the full-open-stopper protrusion 312 of the controlling rod 310 can precisely be determined. Accordingly, a smooth opening and

closing of the sash 20 can be secured without adding complexity to the assembling of the fitting.

Moreover, since the control block unit 320 is configured with the upper block member 320A and the middle block member 320B, the upper block member 320A and the middle block member 320B can commonly be used for left-right reversal sash 20, in which the control block unit 320 is attached to the opposite side.

In the embodiment as illustrated in FIG. 4, a sub-lock pin 311S is provided on the corner guide 500 longitudinally disposed on the sash leading edge-side jamb 25, and a sub-block member 320S having a sub-lock receiver 321S at a region corresponding to the sub-lock pin 311S is provided on the sash leading edge-side frame 14. Similarly to the lock pin 311 of the controlling rod 310 and the lock receiver 321 of the upper block member 320A, each height of the sub-lock pin 311S and the sub-lock receiver 321S is determined so as the sub-lock pin 311S and the sub-lock member to oppose each other only when the operating handle 401 is turned to the locking position.

Configuration of Intermediate Operating Device 400

As illustrated in FIGS. 40 to 42, the sliding block 410 of the intermediate operating device 400 is slidably provided in a device body 420 and includes a block body 411 and a rack member 412. The block body 411 is a thick block

which appears on the external of the device body 420. In the embodiment, the block body 411 is made of a zinc alloy considering of the quality of external appearance. The block body 411 includes three trigger-engagement grooves 411a, 411b, and 411c provided in the side rim in the indoor side. The rack member 412 is a thin plate member provided with a plurality of meshing holes 412a arrayed along the longitudinal direction. The rack member 412 is fixed on the face of the block body 411 opposing the device body 420 by swaging. In the embodiment, the rack member 412 is made of a metal having higher strength and anti-wear property than the block body 411, such as a stainless steel. The device body 420 is configured by coupling a body base 421 and a body cover 422, where the body base 421 is in the outdoor side and the body cover 422 is in the indoor side. The device body 420 includes a rack groove 423, a pinion housing 424, and a trigger housing 425.

The rack groove 423 is formed in one side face of the device body 420 in a trench-shape with both ends opened. As illustrated in FIGS. 42A and 42B, the rack groove 423 has an inverted T-shaped cross section which has a wide section near an inner bottom face 423a. The sliding block 410 is slidably held in the rack groove 423.

As illustrated in FIG. 41, the pinion housing 424 is provided in the device body 420 to form a cylindrical space

of which axis is perpendicular to the longitudinal direction of the rack groove 423. The pinion housing 424 communicates through a portion of the outer periphery thereof with the central portion of the rack groove 423. A handle insertion hole 424a is provided in the center of the cylindrical space of the pinion housing 424 to penetrate both end faces of the device body 420. The pinion housing 424 houses a pinion 430. The pinion 430 has a square attachment hole 431 in the center and a plurality of teeth 432 on the outer periphery. The pinion 430 is rotatably disposed in the pinion housing 424 with the teeth 432 meshing with the meshing hole 412a of the sliding block 410 and the attachment hole 431 exposed outside the device body 420 through the handle insertion hole 424a.

As illustrated in FIGS. 41, 42A and 42B the trigger housing 425 is a recessed portion formed between the rack groove 423 and the pinion housing 424. The trigger housing 425 is opened to the side face of the rack groove 423 provided in the body cover 422. The trigger housing 425 houses a trigger member 440. The trigger member 440 includes a trigger body 441 extending along the longitudinal direction of the rack groove 423, a pair of spring receiver 442 protruding from both end corners of the trigger body 441 in the outdoor side toward the hinge, and an engagement piece 443 protruding from the middle portion

of the rim of the trigger body 441 in the indoor side toward the sash leading edge-side. The trigger member 440 is disposed in the trigger housing 425 with the engagement piece 443 exposed outside. In the trigger housing 425 as illustrated in FIGS. 42A and 42B, a trigger spring 444 is provided between the body cover 422 and the spring receiver 442 of the trigger member 440. The trigger spring 444 continuously urges the trigger member 440 toward the outdoor side in the device body 420 to push the engagement piece 443 exposed outside the device body 420 onto the side rim of the sliding block 410.

As can be understood from FIG. 42A, the engagement piece 443 of the trigger member 440 projects from the sliding block 410. Thus, when the sash 20 is closed, the engagement piece 443 makes contact with the sash leading edge-side frame 14 and moves toward the inside of the room against the pressing force of the trigger spring 444, thus separating from the side rim of the sliding block 410 as illustrated in FIG. 42B.

The intermediate operating device 400 configured as described above is attached to the sash leading edge-side jamb 25 with the sliding block 410 vertically disposed on the depth face of the sash leading edge-side jamb 25 and the device body 420 housed in the sash leading edge-side jamb 25 as illustrated in FIGS. 13 and 14. The

intermediate operating device 400 is in the locking position when the sliding block 410 is positioned at the upper most relative to the device body 420 and the engagement piece 443 of the trigger member 440 is engaged with the lower most trigger-engagement groove 411a of the sliding block 410. The proximal end of the operating handle 401 is fitted in the attachment hole 431 of the pinion 430 with the distal end of the operating handle 401 pointing directly downward.

When the trigger member 440 and the engagement piece 443 are disengaged and the operating handle 401 is turned to the inward-side-swing position, the sliding block 410 slides downward and thus the engagement piece 443 can engage with a middle trigger-engagement groove 411b. When the operating handle 401 is further turned to the inward-tilt position, the sliding block 410 slides further downward and the engagement piece 443 can engage with the upper most trigger-engagement groove 411c.

When the sash 20 is opened, the intermediate operating device 400 functions that the engagement piece 443 of the trigger member 440 engages with either of the trigger-engagement grooves 411a, 411b, and 411c to restrict the movement of the sliding block 410 relative to the device body 420, and thus the operating handle 401 cannot be turned. Therefore, when the sash 20 is in an opened

position, the locked or unlocked state of the upper link mechanism 240 provided between the window frame 10 and the sash 20 and the locking state of the locking device 300 should not change unintentionally. Thus, the sash 20 opened with the operating handle 401 at the inward-side-swing position can securely be closed keeping the operating handle 401 at the same position, and the sash 20 opened with the operating handle 401 at the inward-tilt position can securely be closed keeping the operating handle 401 at the same position.

As for the sliding block 410 which is externally exposed when the sash 20 is opened, the block body 411 is made of a zinc alloy, which provides an advantage on the quality of external appearance. Furthermore, the rack member 412 which meshes with the pinion 430 is made of a metal with high strength and anti-wear property, so that the intermediate operating device 400 can surely be operated under a long operational time.

Configuration of Corner Guide 500

As illustrated in FIGS. 43 to 47, the corner guide 500 is configured with a strip member 520 slidably disposed in a case 510.

The strip member 520 is composed of a plurality of thin plate members made of a flexible metal. The strip member 520 has substantially constant width throughout the

length. Sliders 521 and 522 are connected to both ends of the strip member 520. The sliders 521 and 522 swage a plurality of thin plate members and provide connection between the upper linkage member 403 and the top jamb linkage member 404. In the embodiment, the sliders 521 and 522 are made of a zinc alloy, similarly to the sliding block 410 of the intermediate operating device 400.

The upper connection slider 521 connected to one end of the strip member 520 includes a connecting pin 521b provided on a block-shaped proximal portion 521a. As can be understood from FIG. 44, the proximal portion 521a of the upper connection slider 521 is formed to have minimum dimensions necessary to cover two swage holes provided in one end portion of the strip member 520 and a slightly smaller width than the strip member 520. The proximal portion 521a of the upper connection slider 521 is attached to one end of the strip member 520 without projecting out of the horizontal area of the strip member 520.

The lower connection slider 522 connected to the other end of the strip member 520 is integrally formed to include a guide insertion portion 522a and a slide guiding part 522b. The guide insertion portion 522a is formed in a square column having a slightly smaller width than the strip member 520. The guide insertion portion 522a is attached to the strip member 520 so as to longitudinally

project from the other end of the strip member 520. The slide guiding part 522b has a cross sectional shape similar to the upper linkage member 403.

As illustrated in FIGS. 46 and 47, the case 510 has a substantially L-shaped structure configured with a side guiding part 511 extending along the sash leading edge-side jamb 25 of the sash 20, which is an object to attach the embodiment thereon, and an upper guiding part 512 extending along the top jamb 22. The case 510 of the corner guide 500 is exposed outside the sash 20. Therefore in the embodiment, the case 510 is made of a zinc alloy, similarly to the sliding block 410 of the intermediate operating device 400. A supporting base 513 is provided to the upper guiding part 512 near the connection between the upper guiding part 512 and the side guiding part 511. The supporting base 513 provides a space between the distal portion of the upper guiding part 512 and the top face of the top jamb 22 when the upper guiding part 512 is in contact with the top face of the top jamb 22.

In the case 510, guiding paths 511a and 512a are provided in the side guiding part 511 and the upper guiding part 512, respectively, and a linkage path 514 is provided between the guiding paths 511a and 512a. The guiding paths 511a and 512a and the linkage path 514 each have a width large enough to slidably accommodate the strip member 520.

The guiding path in the side guiding part 511 (hereinafter referred to as "side guiding path 511a") and the guiding path in the upper guiding part 512 (hereinafter referred to as "upper guiding path 512a") linearly extend along the extending directions of guiding parts 511 and 512, respectively. The linkage path 514 is an arc-shaped path provided to continuously connect the side guiding path 511a and the upper guiding path 512a.

The side guiding path 511a and the linkage path 514 form openings on the region of the case 510 which oppose the sash leading edge-side jamb 25 and the top jamb 22. The openings have the same width as the side guiding path 511a and the linkage path 514 to allow the out-of-plane movement of the strip member 520. A term "out-of-plane movement" is used to indicate a movement in the depth direction. A cover member 530 is attached to the openings of the side guiding path 511a and the linkage path 514 opposing the jambs 25 and 22. The cover member 530 is made of a resin material and integrally formed to include a side cover 531 for covering the side guiding path 511a and a linkage cover 532 for covering the linkage path 514. The cover member 530 is detachably held on the case 510 by engaging an engagement protrusions 531a and 532a provided on the side cover 531 and the linkage cover 532 with an engagement grooves 511b and 513a of the case 510,

respectively. The engagement groove 513a which engages with the engagement protrusion 532a of the linkage cover 532 is provided on the supporting base 513 of the upper guiding part 512. The engagement groove 511b which engages with the engagement protrusion 531a of the side cover 531 is formed on the inner wall of the lower end of the side guiding path 511a.

As illustrated in FIGS. 46 to 48, when the linkage cover 532 is attached to the case 510, the linkage cover 532 is formed to provide a space between the linkage cover 532 and the linkage path 514 which allows only the strip member 520 to be inserted therein. On the region of the side cover 531 opposing the side guiding path 511a, an accommodating groove 533 is provided. The accommodating groove 533 is a space provided between a pair of wall portions 533a for accommodating the guide insertion portion 522a of the lower connection slider 522. A pair of wall portions 533a is formed to provide a space between the wall portions 533a and the side guiding path 511a allowing only the strip member 520 to be inserted.

As illustrated in FIGS. 44 and 47, the upper guiding path 512a includes a pair of guide grooves 512a1 for slidably accommodating both side rims of the strip member 520 and a slide groove 512a2 opened with a pair of guide grooves 512a1 on both sides. The slide groove 512a2 is

provided in the region of the upper guiding part 512 opposing the top jamb 22. The slide groove 512a2 has a width allowing the upper connection slider 521 connected to the strip member 520 to pass through.

In the corner guide 500 configured as described above, the side guiding path 511a and the linkage path 514 of the case 510 form openings of the same width as these paths in the region opposing the jambs 25 and 22, so that even when the case 510 is formed by die forming, the die needs not be complex. In addition, since the case 510 includes the openings of the same width as the side guiding path 511a and the linkage path 514 provided in the region opposing the jambs 25 and 22, and the slide groove 512a2 provided in the upper guiding path 512a, the strip member 520 previously connected to the upper connection slider 521 and the lower connection slider 522 can easily be disposed in the case 510 as illustrated in FIG. 47. Specifically, in the case 510 as illustrated in FIGS. 45A and 45B, the end of the strip member 520 connected to the upper connection slider 521 can be inserted in the guide groove 512a1 of the upper guiding path 512a from the linkage path 514, and the upper connection slider 521 can be inserted in the slide groove 512a2. Then the cover member 530 is attached to the case 510 to constitute the corner guide 500 in which the strip member 520 is slidably disposed in the case 510.

The corner guide 500 is configured to link the top jamb linkage member 404 and the upper linkage member 403 by fixing the side guiding part 511 to the depth face of the sash leading edge-side jamb 25 with the supporting base 513 provided on the upper guiding part 512 in contact with the top face of the top jamb 22, coupling the upper connection slider 521 to the top jamb linkage member 404 of the top jamb 22, and coupling the lower connection slider 522 to the upper linkage member 403 of the sash leading edge-side jamb 25.

In the corner guide 500 described above, the supporting base 513 provides a space between the upper guiding part 512 of the case 510 and the top face of the top jamb 22, and the upper connection slider 521 can slide in the slide groove 512a2. Thus, the connection between the upper connection slider 521 and the top jamb linkage member 404 can be located between the upper guiding part 512 and the top jamb 22, which allows the corner guide 500 to be used for a sash 20 with smaller dimensions.

Furthermore, the wall portions 533a of the cover member 530 made of a resin material is disposed between both side rims of the lower connection slider 522 and the case 510. Thus when the lower connection slider 522 slides in the corner guide 500, both side rims of the lower connection slider 522 slide against the wall portions 533a

made of a resin material, so that the lower connection slider 522 can slide smoothly.

The embodiment described above exemplifies the corner guide 500 applied for a drehkip window which supports the sash 20 in the window frame 10 so as that the sash 20 opens toward the inside of the room by two modes which are inward-side-swing and inward-tilt. However, the present invention is not limited to the embodiment. The present invention can be applied to any other fittings configured with a link between linkage members which are disposed on corners of depth faces of different frames extending along intersecting directions to slide along longitudinal directions of the frames.

The cover member 530 made of a resin material is exemplified, although a cover member made of a metal, similarly to the case 510, may be used.

According to the present invention, one of guiding parts allows the strip member and the linkage member to be coupled through a slide groove, so that the linkage member can be disposed to overlap with the guiding part. This minimizes the increase in the size of the sash. Furthermore, region of the guiding path and the arc-shaped linkage path of the other guiding part opposing the depth faces of the frames are opened, so that even when the case is formed by die forming, the die needs not be complex.

Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

What is claimed is:

1. A corner guide provided on a corner of frames extending along intersecting directions to provide linkage between linkage members so as to slide one of the linkage members in conjunction with sliding of the other linkage member, each of the linkage members being provided on depth face of the respective frames and sliding along longitudinal direction, the corner guide comprising:

a case including:

a pair of guiding parts each extending along longitudinal direction of each of the frames;

a guiding path provided in the respective guiding parts; and

an arc-shape linkage path continuously connecting guiding paths provided in the guiding parts;

a flexible strip member slidably disposed along the guiding paths and the linkage path provided in the guiding parts; and

a cover member attached to the linkage path and the guiding path provided in the other guiding part to restrict out-of-plane movement of the strip member, wherein

the guiding path provided in one of the guiding parts includes:

a pair of guide grooves configured to slidably accommodate both side rims of the strip member to restrict out-of-plane movement of the strip member; and

a slide groove provided between the guide grooves, and

the linkage path and the guiding path provided in the other guiding part are opened through a region of the case opposing a depth face of the frame and have dimension allowing out-of-plane movement of the strip member.

2. The corner guide according to claim 1, wherein

the cover member is made of a resin material, has an engagement protrusion, and is held on the case by engagement of the engagement protrusion.

3. The corner guide according to claim 2, wherein

the strip member includes a slider on an end positioned in the guiding path provided in the other guiding part and is coupled to the linkage member via the slider, and

the cover member includes an accommodating groove for accommodating the slider between a pair of wall portions and is held on the case with the respective wall portions disposed between each of both side rims of the slider and the case.

4. A fitting comprising

a corner guide according to any one of claims 1 to 3 provided on an arris of a top jamb and a vertical jamb, wherein

when a linkage member on the vertical jamb slides via an operating handle provided on the vertical jamb, a linkage member on the top jamb slides in conjunction with sliding of the linkage member on the vertical jamb via the corner guide.