(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 735 226 A2

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**02.10.1996 Bulletin 1996/40**

(51) Int. Cl.[6]: **E06B 3/48**

(21) Application number: **96102810.7**

(22) Date of filing: **26.02.1996**

(84) Designated Contracting States:
**BE DE ES FR NL**

(30) Priority: **29.03.1995 IT VE950009 U**

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## (54) A panel for building multi-panel sliding-folding doors

(57) A panel for building multi-panel sliding-folding doors, said panel comprising an intermediate member (4) provided with an elongated male member (12) and an elongated female member (14) engaging a female member (14') and a male member (12') of two adjacent panels, respectively, characterized in that:

- said intermediate member (4) is formed by two metal sheets (6, 8) with a layer (10) of insulating material sandwiched therebetween,
- said male member (12) is provided with a curved portion (22) and with a pawl-shaped portion (26) having a curved outer wall (28), both portions being connected to a cylindrical sleeve (24), both said curved portion and wall (22, 28) having the shape of arcs of circle with their centers of curvature coincident and located on the axis of said cylindrical sleeve (24),
- said female member (14) is provided with a curved inwardly projection (38) the shape of which is substantially complementary to the outer surface of said sleeve (24) which rotatably rests on said projection (38) and is retained by a blocking means (46) applied to a flat portion (36) of said female member (14), on a tab substantially in contact with and rubbing against said curved portion (22) of the male member (12) when this latter (12) is rotated in respect of the former (14), said female member (14) being provided on the side opposite to that carrying the curved projection (38) with a curved reinforcing rib (48) in form of arc of circle whose center of curvature is located on the axis of said leeve (24).

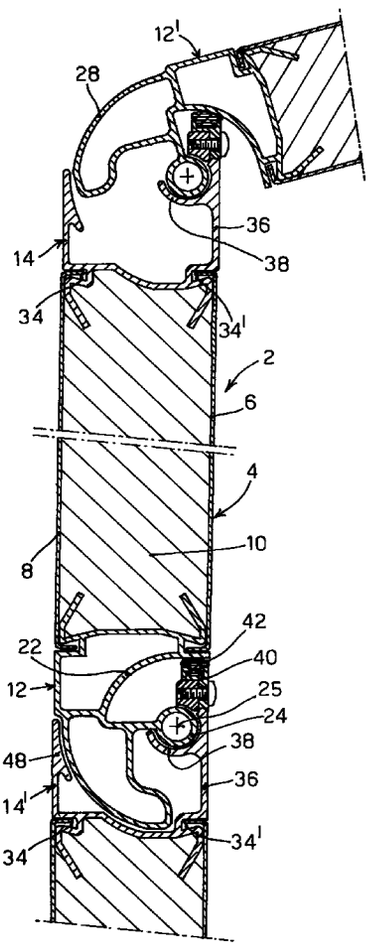


FIG. 2

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## Description

The present invention relates to a composite panel for building multi-panel sliding-folding doors.

There are known doors or gates comprising a plurality of self-supporting panels that are pivotally jointed together along their edges and slidable on wheels along a pair of guide rails that extend parallel to both the edges of the opening to be closed and the ceiling.

Generally the panels of the known multi-panel sliding-folding doors are coplanar both when the door is fully closed and when it is fully opened, while changing their mutual positions when passing from a condition to the other and viceversa. Therefore, they are subjected to a first rotation about a common pivot axis and then to a second rotation in the opposite direction with the angle formed between two adjacent panels that can be as great as 45° and greater.

The manufacturers of such panels are well aware of a problem that they have attemped to solve, namely the risk of the user's fingers being crushed between two adjacent panels when the user attempts to manually open or close the door. Actually when the panels are driven or moved from the coplanar configuration into the angled configuration, the jointed edges of two adjacent panels are moved nearer to each other at the inner side of the door and the user might be accidentally hurt by having his/her fingers crushed between two panels.

Moreover, at the outer side of the sliding door, the edges of two jointed panels are moved apart when the door is driven from the coplanar condition to the angled condition, and then the opposite movement brings again the edges nearer to each other, with similar danger for the user.

Several arrangements have been proposed in order to overcome the above mentioned drawback, all the suggestions being based on a particular configuration of the panel edges, aimed either to hinder the fingers from entering the space between two angled panels at the outer side of the door, or to ensure that the gap formed between two angled panels at the inner side of the door is not narrowed beyond a predetermined safety value.

Thus it has been possible to solve the general problem, but in turn this has originated other particular problems, such as complications in the manufacturing of the panels, a reduced thermal insulation, the need for specially designed hinges, the limited angular displacement between the panels and a worsening of the durability and tightness of the seals.

The object of the present invention is to provide a panel for use in building multi-panel doors of the sliding-folding type that does not require the use of applied hinges and that meets the present provisions concerning accident prevention by effectively preventing the accidental crushing of the user's finger between the panels.

In accordance with the invention the above object and other that will become evident from the description are achieved through a panel for building multi-panel sliding-folding doors, said panel comprising an intermediate member provided with an elongated male member and an elongated female member engaging a female member and a male member of two adjacent panels, respectively, characterized in that:

- said intermediate member is formed by two metal sheets with a layer of insulating material sandwiched therebetween,
- said male member is provided with a curved portion and with a pawl-shaped portion having a curved outer wall, both portions being connected to a cylindrical sleeve, both said curved portion and wall having the shape of arcs of circle with their centers of curvature coincident and located on the axis of said cylindrical sleeve,
- said female member is provided with a curved inwardly projection the shape of which is substantially complementary to the outer surface of said sleeve which rotatably rests on said projection and is retained by a blocking means applied to a flat portion of said female member, on a tab substantially in contact with and rubbing against said curved portion of the male member when this latter is rotated in respect of the former, said female member being provided on the side opposite to that carrying the curved projection with a curved reinforcing rib in form of arc of circle whose center of curvature is located on the axis of said leeve.

The present invention will be further described hereinafter with reference to the attached sheet of drawings, in which:

Fig. 1 is a partial cross-section schematically illustrating the joint of two panels when they are coplanar with each other; and

Fig. 2 schematically illustrates the same detail of Fig. 1, when the two panels form the maximum angle therebetween.

As shown in the Figures, the composite panel according to the invention for building multi-panel sliding-folding doors or gates is indicated as a whole at 2. The panel comprises an intermediate member 4 made up by two painted metal sheets 6, 8 with a layer 10 of insulating high density polyurethan material sandwiched therebetween that impart a high insulation to the panel.

The panel further comprises two elongated members, preferably of extruded aluminum, located and secured on the two opposed lateral edges of the panel 2 and extending substantially the length thereof that are adapted for engagement with corresponding members on the adjacent panels.

More particularly the panel is provided with an elongated male member 12 and an elongated female member 14, respectively, that are to be pivotally connected to

a corresponding female member 14' and a male member 12' of two adjacent panels.

In a cross section view, the male member 12 is formed on its inner side (i.e. the one facing the inner side in the door) with a projection 16 embedded in the layer 10 of insulating material, and with a recess or seat 18 for engaging a folded edge 20 of the inner sheet 6. The male member 12 is further provided with an arcuate or curved portion 22, and with a pawl-shaped portion 26 having a curved outer wall 28. Both curved portions 22, 28 have the shape of arcs of circle with their centers of curvature coincident and located on the axis 25 of a cylindrical sleeve 24 integral with the male member 12.

The base or root of the portion 26 is connected with one end of a flat portion 30 forming the visible surface of the male member in the coplanar condition, the other end of which forms a recess 32 similar to the recess 18 for engaging a folded edge 20' of the outer sheet 8.

A projection 16' is formed near the recess 32 and is embedded in the layer 10 of insulating polyurethan material.

Similarly to the male member 12, the female member 14 is provided in the portion facing the intermediate member 4 with two recesses 34, 34' for engaging the corresponding folded edges of adjacent sheets 6, 8, and with a flat portion 36 having a curved inwardly projection or craddle 38 the shape of which is substantially complementary to outer surface of the sleeve 24.

The inner flat portion 36 of the female member is further provided with a tab formed with a recess 40 for housing a dust-proof insert 42, substantially in contact with the curved portion 22 of the male member and rubbing against said curved portion when this latter is rotated in respect of the former.

Between the recess 40 and the projection 38 the tab of the inner flat portion 36 is further provided with a stopping block 44 in which a grub screw 46 can be screwed for rotatably retaining the sleeve 24 between the curved projection 38 and said stopping block 44. More precisely, the grub screw 46 retains the insert or stopping block 44 which is kept in contact with said sleeve 24 for preventing the radial disengagement of the sleeve from the projection 38 of the female member 14 after the male and female members have been radially coupled together.

The outwardly facing flat portion of the female member 14 is coplanar with the outer sheet 8 of panel 4, and is formed with a curved reinforcing rib 48 in form of arc of circle whose center of curvature coincides with the two above mentioned centers of curvature.

The panel according to the invention is further provided with wheels (not shown in the drawings) at the upper and lower end thereof, that allow the sliding of the panel along the guide rails mounted in the door frame (both not shown). When the door is forced to slide within the guides, the adjacent panels rotate in respect of each other about a vertical axis coincident with the axis 25 of the sleeve 24. Since the pivoting axis of the sleeve coincides with the axis on which the centers of curvature of the portions 28, 48 and 22 are located, any accidental trapping of the user's fingers between the edges of two adjacent panels is effectively prevented.

When the door is in a closed condition and any two adjacent panels are coplanar (as shown in Fig. 1), the male member 12 is housed in the chamber or space defined by the flat portions of the female member 14' that are visible from inside and outside.

In the open condition of the door the pawl-shaped portion 26 has been rotated (clockwise in Fig. 2) about the axis of the sleeve 24 which is retained between the curved projection 38 and said stopping block 44 but allowed to rotate. Due to the above illustrated configuration of the curved portions 28, 48, no gap is left for an accidental trapping of the user's fingers.

Resuming, the panel of the invention accomplishes the following advantages in respect of the conventional panels for building multi-panel sliding-folding doors:

it can be manufactured with an automatic continuous production cycle and therefore allows for a high productivity, a constant quality of the product and low costs, at the same time allowing to cut the panels to the required lengths;
it has no thermal conductive paths (bridges) and therefore ensures a high thermal insulation;
it does not require any additional hinge thus improving the door appearance;
it warrants an almost absolute safety against the risk of accidentally crushing the user's fingers, even when the angle between adjacent panels is greater than 45°.

## Claims

1. A panel for building multi-panel sliding-folding doors, said panel comprising an intermediate member (4) provided with an elongated male member (12) and an elongated female member (14) engaging a female member (14') and a male member (12' ) of two adjacent panels, respectively, characterized in that:

   - said intermediate member (4) is formed by two metal sheets (6, 8) with a layer (10) of insulating material sandwiched therebetween,
   - said male member (12) is provided with a curved portion (22) and with a pawl-shaped portion (26) having a curved outer wall (28), both portions being connected to a cylindrical sleeve (24), both said curved portion and wall (22, 28) having the shape of arcs of circle with their centers of curvature coincident and located on the axis (25) of said cylindrical sleeve (24),
   - said female member (14) is provided with a curved inwardly projection (38) the shape of which is substantially complementary to the outer surface of said sleeve (24) which rotata-

bly rests on said projection (38) and is retained by a blocking means (46) applied to a flat portion (36) of said female member (14), on a tab substantially in contact with and rubbing against said curved portion (22) of the male member (12) when this latter (12) is rotated in respect of the former (14), said female member (14) being provided on the side opposite to that carrying the curved projection (38) with a curved reinforcing rib (48) in form of arc of circle whose center of curvature is located on the axis of said sleeve (24).

2. A panel as claimed in claim 1, characterized in that said male member (12) and said female member (14) are made of aluminum extruded.

3. A panel as claimed in claim 1, characterized in that said blocking means comprises a grub screw (46) retaining an insert (44) which is kept in contact with said sleeve (24) for preventing the radial disengagement of the sleeve from the projection (38) of the female member (14) after the male (12) and female (14) members have been radially coupled together.

4. A panel as claimed in claim 3, characterized in that at the end of said tab (36) of the female member there is formed a recess (40) for housing a dust-proof seal (42).

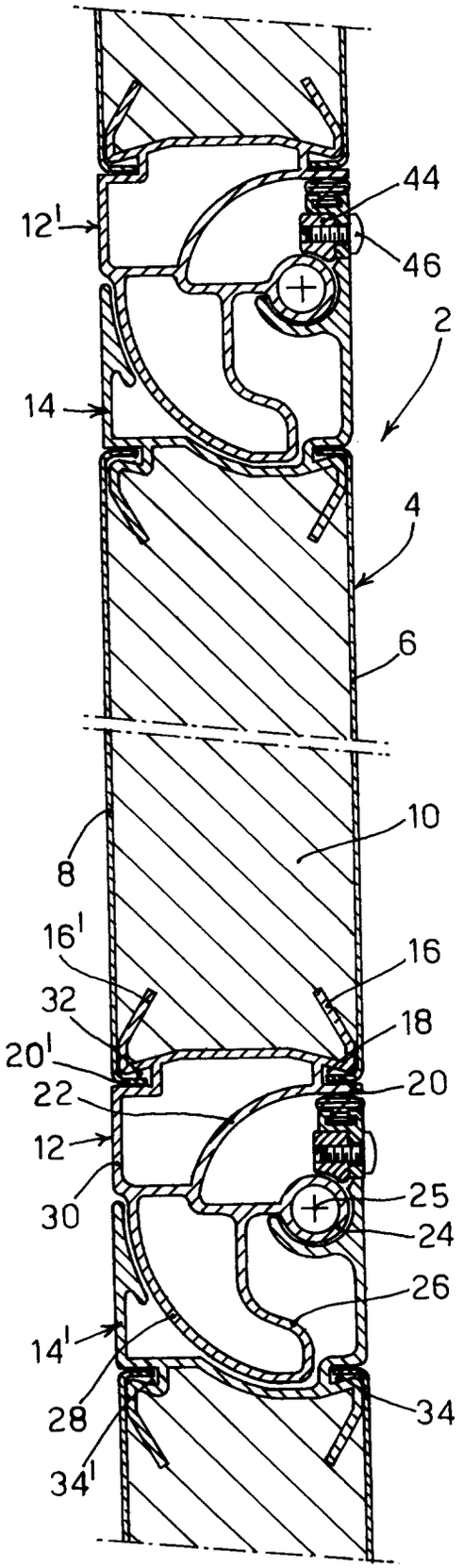
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FIG. 1

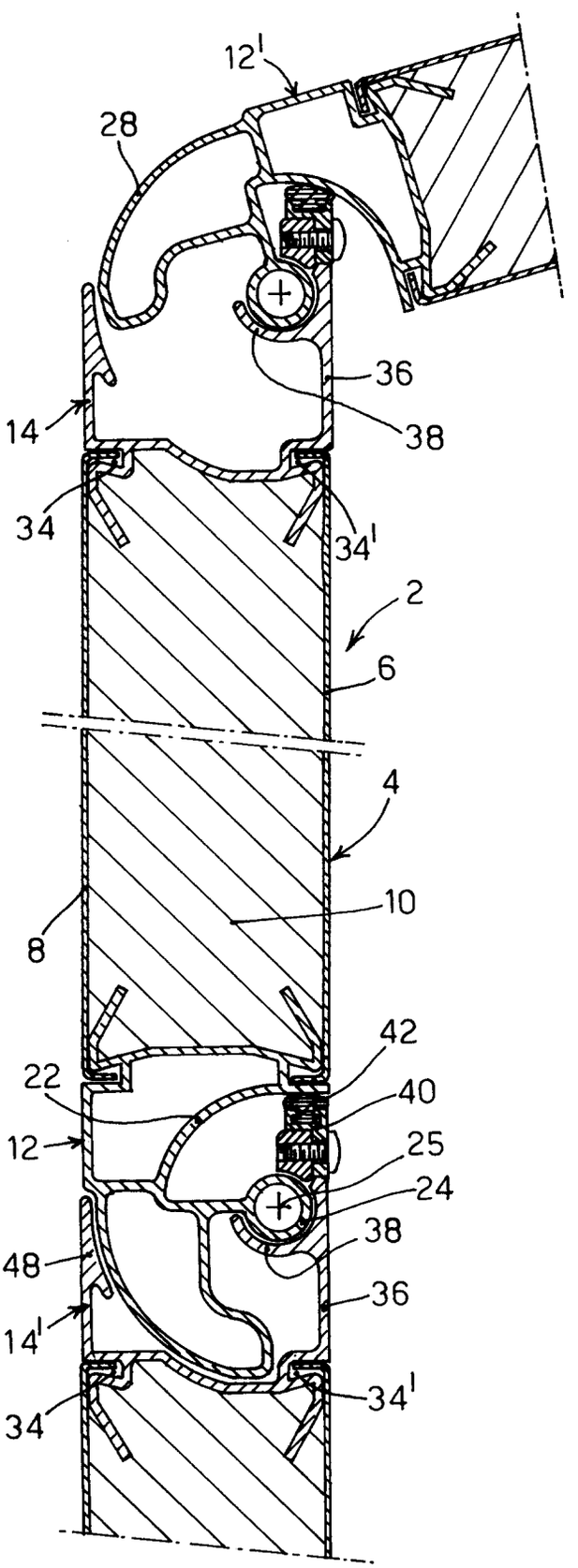
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FIG. 2