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PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Folding Door with Flexible Joint.

We, PANELFOLD DOORS, INC., of 1090 East 17th Street, Hialeah, Florida, United States of America, a corporation organised and existing under the laws of the State of Florida, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention generally relates to a folding door and more particularly to that type of folding door formed of a plurality of vertically elongated rigid panels adapted to be folded in relation to each other somewhat in the nature of an accordion so that, when the door is in the closed position, the panels are in extended angular position with the accordion formation generally being substantially shallow. In the open position of the door, the panels are folded in face-to-face relationship to each other at one side of the door opening thereby requiring a minimum of space for the door and incorporating all of the advantages of a folding door such as the ease of opening and closing, ease of installation and the like.

The present invention concerns an improved joint construction between the panels which not only provides a joint between the panels but specifically provides a complete seal between adjacent panels for eliminating the passage of air, light and sound through the door panel. It is well-known that sound and light will travel even through a very minute opening and with the present invention, the joint between the adjacent folding panels is completely sealed throughout the length of the panels. Ancillary to this, the joint is constructed in a manner which renders the entire joint quite attractive in appearance. Previously, there have been developed folding doors and the present invention represents an improvement on such folding doors. In some of the prior patented devices the panels are interconnected by spring devices and an insert of wood material or an insert of whatever material from which the panels are constructed, for purposes of somewhat concealing the joint.

However, the spring devices are generally not concealed at all times and also do not provide a seal throughout the length of the panels, due to warpage of the panels. Therefore, the present invention has certain advantages over the prior art in that it produces a complete air-light-and-noise seal from top to bottom of the folding door thereby rendering the door more effective for its particular purposes while at the same time not materially increasing the manufacturing cost thereof.

The invention consists in a folding door comprising a series of vertically elongated panels arranged in edge to edge relation and flexible joints, sealingly connecting the edges of adjacent panels together, each side edge of each panel having a longitudinal groove therein, and each joint comprising at least one body portion comprising an elongated, substantially rigid strip or strips interposed between the two panels, and two longitudinal flanges projecting in substantially opposing directions from the body portion when the door is in its extended position, each flange being received in the longitudinal groove in the side edge of the adjacent panel, the joint having a flexible portion or portions for enabling pivotal movement of adjacent panels relative to one another.

The particular construction of the joint between the panels of the present invention may be incorporated in a construction em-

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ploying the pantograph suspension arrangement, in an arrangement in which carriers for supporting the panels are engaged directly with the panels, directly with a fastening plate on the top edge of the panels, or directly with single links interconnecting the panels, whereby the joint is effective if the panels have a fixed axis of pivotal movement or whether the axis of relative pivotal movement is not positively fixed but nearly fixed by the sealed connection.

Embodiments of the invention are described below with reference to the accompanying drawings, wherein:

Figure 1 is a perspective view of the present invention illustrating a folding door employing a pantograph linkage;

Figure 2 is a partial perspective view illustrating the joint of the present invention incorporated into a folding door having a link connection between the panels forming a fixed pivotal axis;

Figure 3 is a partial perspective view of the present invention incorporated into the folding door having a fixed axis between the panels, but without the pantograph linkage;

Figure 4 is a sectional plan view illustrating the relationship of the panels and the joints therebetween;

Figure 5 is a plan view illustrating one form of insert forming a connection between the panels;

Figure 6 is a detailed sectional view, on an enlarged scale, of another form of the joint between adjacent panels;

Figure 7 is a detailed sectional view illustrating a slightly modified form of joint;

Figure 8 is a detailed sectional view of another form of joint; and

Figure 9 is a detailed sectional view of a very important form of joint.

Referring now specifically to the drawings, the numeral 10 generally designates the joint of the present invention incorporated into a folding panel door. The numeral 12 generally designates one side jamb while the numeral 14 generally designates the other jamb. The folding door comprises a plurality of vertically elongated panels 18 formed of wood or other suitable material which have substantially flat edges 20 and parallel front and rear surfaces 22, which may also be considered inner and outer surfaces; this arrangement renders the panels relatively easy to manufacture. The joint 10 of the present invention is used to interconnect the edges of adjacent panels 18 together in a manner described hereinafter.

The panels 18 may be supported in any of several different ways. In Figure 1, there is illustrated a pantograph linkage including a plurality of crossed links 24 and 26 having a carrier support assembly 28 at the point of intersection thereof. The ends of the links are pivotally attached at points 30 and 32 with the hinge axis formed by the point 32 coinciding with the hinge axis of the panels 18. In other words, the links 24 are attached to the panels 18, and thus the pivot point 32 forms a fixed axis for pivotal movement between the panels 18. In this form of construction of a panel door, all of the panels 18 will move simultaneously during the movement of the panels between an open and closed position.

Figure 3 illustrates a simplified version of supporting mechanism in which links 34 are attached directly to the panels 18, the links 34 being hingedly connected together by hinge pins 36. Attached to the central portion of the links 34 are carrier support assemblies 38 for engagement with the trackway. Here, the panels 18 pivot independently of each other but the axis of pivotal movement between the panels 18 is fixed and determined by the hinge pin 36. In Figure 2, there is shown another version of the invention in which the panels 18 are connected by links 39 engaged with the panels at the centre thereof and generally forming one-half of a lazy tong assembly with the panels themselves forming the other half of the assembly. The panels and links 39 are supported directly by carrier support assemblies 40 secured directly to the upper edge of the panels 18 and links 39 at the central point thereof for direct engagement with a track. Here, the panels can move independently of each other while the axis of pivotal movement therebetween generally will remain substantially positively fixed. The links 39 in Figure 2 may be dispensed with thus leaving the carrier assemblies 40 connected directly to the panels 18. In Figures 1 to 3, the links 24, 26, 34 and 39 may be secured in any suitable manner to the panels, and the carrier assembly such as the carrier assembly 28 is supported from a suitable trackway supported from the jambs 12 and 14 in any suitable manner for moving support of the panels as they move between an open and closed position. The particular details of the supporting mechanism for the panels and the particular details of the trackway and the like do not form part of the present invention but have been illustrated to show the different ways of effectively employing the novel joint.

The joint 10 includes an elongated insert, which may be considered a moulding and is designated by numeral 44; this insert includes parallel inner and outer surfaces 46. The edges 48 of the moulding 44 diverge slightly from each other and then are provided with an inwardly curved notch 50, as is clearly illustrated in Figures 6—8. The notch 50 receives the end edge 20 of a panel 18 when the folding door is in closed position, as illustrated in Figure 4. When the door is in its open position, the panels 18 are

positioned alongside of each other and generally have the edges thereof disposed adjacent or alongside of the surface 46 of the moulding 44. This is the situation in all four variations of the invention as illustrated in detail in Figures 5—8.

Each edge of the panel 18 is provided with a longitudinally continuous groove 52 having an enlargement 54 formed in the bottom thereof for receiving a connecting strip 56 of flexible plastic material such as vinyl or the like which is flexible and resilient due to the "memory" characteristics of the material.

Each edge portion of the moulding 44 is provided with a groove 58 communicating with the surface 46 adjacent its juncture with the recess 50. The inner end of the longitudinally continuous groove 58 is also provided with an enlargement 60 and each edge of the sealing strip 56 is provided with an enlargement 62 received in the enlargements 54 and 60 respectively. The sealing strips 56 may be assembled with the panels 18 and the mouldings 44 by means of longitudinal sliding interlocking engagement. Once the flexible strips 56 have been incorporated into the panels, then the panels are pivotally secured together by the flexible strip 56 and also the flexible strip 56 forms a completely sealed joint between the panels 18. Inasmuch as the flexible strip 56 is resilient, the relationship between the panels 18 and the mouldings 44 will be retained and, as illustrated in Figure 6 and also in Figure 4, the mouldings 44 somewhat conceal the joint when unfolded and also, only a very minimum part of the flexible sealing strip 56 is observable from the side of the door in which the grooves 58 are placed in the mouldings 44.

Figure 7 illustrates a slightly modified form of joint, generally designated by numeral 64 in which the panels 66 are identical to the panels 18 and the moulding 68 is identical to the moulding 44 except that the moulding 68 is formed in two pieces with an arcuate groove or space 70, formed between the two components 72 and 74 of the moulding 68. Disposed in the arcuate space 70 is a continuous sealing strip 76 having enlarged edges 78 received in the grooves 80 and the enlargements 82 on the inner edge thereof respectively. The space 70 communicates with the edges of the moulding 72 adjacent the corner juncture thereof with the surface thus even further substantially concealing the sealing strip as it passes from the moulding 72 to the panels 66.

Figure 8 illustrates another modified form of the present invention generally designated by numeral 84 in which all of the structure is the same as in Figure 7 except that a lateral rib 86 is employed for retaining the sections 72^1 and 74^1 of the moulding 68^1 in assembled relation. In Figure 7, the portions of the moulding 68 may be adhesively secured to the flexible sealing strip 76, whereas in Figure 8 the sections of the moulding may be attached to the sealing strip 76 by virtue of the ribs 86 received in corresponding grooves in the sections 72^1 and 74^1.

In Figure 5, there is shown an insert generally designated by numeral 88 which is of one-piece moulded construction from resilient vinyl material including an enlarged main body portion 90 which may be either hollow or solid with projecting flanges 92 thereon having enlarged edges 94. The enlarged edges 94 are for purposes of reception within the grooves in adjacent panels 18. The shape of the main body portion 90 is somewhat similar to the insert moulding 44 in that it has diverging face 96 on the edges thereof similar to the faces 50, which may also be termed recesses.

In the forms of the invention illustrated in Figures 5—8, the insert or main body portion for the moulding actually forms substantially a "near" fixed hinged point in that a very small area of flexible panel is left free of the panels 18 or the main body portion of the connector, thus leaving very small latitude as far as movement in a lateral direction is concerned, but still permitting adequate area for pivotal movement of the adjacent panels.

The form of the invention illustrated in Figure 9 is generally designated by reference numeral 110 and includes a hollow central body portion 112 having a pair of projecting flexible wings or tabs 114 connected thereto having enlarged edges 116 received in corresponding grooves 118 in rigid panels 120. In this form of the invention, the edges of the panels 120 do not engage the side walls 122 of the hollow body at all. The body may be hollow or shallow but in both instances the flexibility lies in the wings or tabs 114, and the butt edges of the panels 120 do not come into contact with the hollow body 112 at all. Of course, the edges of the body 112 may be provided with flanges 124 which will or may overlie the adjacent edges of panels 120 when the panels are extended to their unfolded condition even if the unfolding is substantially rectilinear, which never occurs in this type of folding door structure.

The direct relationship between the panels 18 and the insert including the flexible strips —whether they be of two piece construction with the insert or integral with the moulding or insert such as is shown in Figure 5— provides a definite hinge axis even when used without any connecting links at the top edges of the panels. These inserts all include an enlarged central rigid area which, in itself, substantially forms a hinge point for relative movement between the panels.

In all forms of the invention the essential features lie in the provision of a continuous flexible resilient sealing strip extending between the panels and an interposed moulding or insert for providing a connection between the panels and providing a sealed joint between the panels for eliminating passage of air, light, dirt and noise. Further, the material of the mouldings and panels may be variable and the connecting flexible members are substantially concealed and, if desired, may be coloured in a manner compatible with the colour of the mouldings and panels to be substantially indistinguishable therefrom.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:—

1. A folding door comprising a series of vertically elongated panels arranged in edge to edge relation and flexible joints, sealingly connecting the edges of adjacent panels together, each side edge of each panel having a longitudinal groove therein, and each joint comprising at least one body portion comprising an elongated, substantially rigid strip or strips interposed between the two panels, and two longitudinal flanges projecting in substantially opposing directions from the body portion when the door is in its extended position, each flange being received in the longitudinal groove in the side edge of the adjacent panel, the joint having a flexible portion or portions for enabling pivotal movement of adjacent panels relative to one another.

2. A folding door as claimed in claim 1 wherein the flanges project at or near to one side of the body portion.

3. A folding door as claimed in claim 2 wherein the two surfaces of the body portion adjacent the side edges of the adjacent panels diverge outwardly from the said one side of the body portion.

4. A folding door as claimed in any of claims 1 to 3 wherein the body portion comprises a single elongated substantially rigid strip and the flanges are formed of a flexible, resilient material, the flanges constituting the flexible portions of the joint.

5. A folding door as claimed in claim 4 wherein each flange comprises an elongated, flxeible strip one end of which is anchored in the body portion and the other end of which is received in the longitudinal groove of the adjacent panel.

6. A folding door as claimed in claim 4 wherein the flanges comprise a single elongated, flexible strip the centre portion of the strip being disposed in a longitudinal arcuate groove formed in the body portion, such that the ends of the strip project from the body portion and are received in the longitudinal grooves of the adjacent panels.

7. A folding door as claimed in claim 4 wherein the body portion comprises an elongated strip having a trapezoidal cross-section, the longitudinal flanges being formed integrally with the body portion and projecting from two nearest adjacent corner edges of the strip.

8. A folding door as claimed in claim 7 wherein the body portion is a hollow strip.

9. A folding door as claimed in claim 7 wherein the body portion is a solid strip.

10. A folding door as claimed in any of claims 5 to 9 wherein the two surfaces of the body portion adjacent the side edges of adjacent panels are recessed so as to cooperate with the side edges of the panels tor limiting outwards pivoting movement of the panels in the course of unfolding the door.

11. A folding door as claimed in any of the foregoing claims wherein the panels are movably supported from an overhead trackway.

12. A folding door as claimed in claim 11 wherein the upper edges of said panels are provided with supporting strips attached thereto, said strips being hingedly connected together and means engaged with the central portions of the strips for supporting the strips and the panels from the overhead trackway.

13. A folding door as claimed in claim 11 comprising a pantograph linkage attached to the panels and movable in the overhead trackway.

14. A folding door as claimed in any of claims 1 to 7 wherein the panels are movably supported from an overhead trackway by means of a pantograph linkage, the pantograph linkage being attached to the upper edge of the panels with the linkage including a plurality of pairs of crossed links with one link of each pair being secured to a panel with the ends thereof connected to adjacent links and forming a hinge axis for the panels, the point of intersection of the links being supported from the overhead trackway.

15. A folding door substantially as hereinbefore described with reference to Figures 1 to 4 and 6 of the accompanying drawings.

16. A folding door as claimed in claim 15, modified as shown in Figures 7 or 8 of the accompanying drawings.

In all forms of the invention the essential features lie in the provision of a continuous flexible resilient sealing strip extending between the panels and an interposed moulding or insert for providing a connection between the panels and providing a sealed joint between the panels for eliminating passage of air, light, dirt and noise. Further, the material of the mouldings and panels may be variable and the connecting flexible members are substantially concealed and, if desired, may be coloured in a manner compatible with the colour of the mouldings and panels to be substantially indistinguishable therefrom.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:—

1. A folding door comprising a series of vertically elongated panels arranged in edge to edge relation and flexible joints, sealingly connecting the edges of adjacent panels together, each side edge of each panel having a longitudinal groove therein, and each joint comprising at least one body portion comprising an elongated, substantially rigid strip or strips interposed between the two panels, and two longitudinal flanges projecting in substantially opposing directions from the body portion when the door is in its extended position, each flange being received in the longitudinal groove in the side edge of the adjacent panel, the joint having a flexible portion or portions for enabling pivotal movement of adjacent panels relative to one another.

2. A folding door as claimed in claim 1 wherein the flanges project at or near to one side of the body portion.

3. A folding door as claimed in claim 2 wherein the two surfaces of the body portion adjacent the side edges of the adjacent panels diverge outwardly from the said one side of the body portion.

4. A folding door as claimed in any of claims 1 to 3 wherein the body portion comprises a single elongated substantially rigid strip and the flanges are formed of a flexible, resilient material, the flanges constituting the flexible portions of the joint.

5. A folding door as claimed in claim 4 wherein each flange comprises an elongated, flxeible strip one end of which is anchored in the body portion and the other end of which is received in the longitudinal groove of the adjacent panel.

6. A folding door as claimed in claim 4 wherein the flanges comprise a single elongated, flexible strip the centre portion of the strip being disposed in a longitudinal arcuate groove formed in the body portion, such that the ends of the strip project from the body portion and are received in the longitudinal grooves of the adjacent panels.

7. A folding door as claimed in claim 4 wherein the body portion comprises an elongated strip having a trapezoidal cross-section, the longitudinal flanges being formed integrally with the body portion and projecting from two nearest adjacent corner edges of the strip.

8. A folding door as claimed in claim 7 wherein the body portion is a hollow strip.

9. A folding door as claimed in claim 7 wherein the body portion is a solid strip.

10. A folding door as claimed in any of claims 5 to 9 wherein the two surfaces of the body portion adjacent the side edges of adjacent panels are recessed so as to cooperate with the side edges of the panels for limiting outwards pivoting movement of the panels in the course of unfolding the door.

11. A folding door as claimed in any of the foregoing claims wherein the panels are movably supported from an overhead trackway.

12. A folding door as claimed in claim 11 wherein the upper edges of said panels are provided with supporting strips attached thereto, said strips being hingedly connected together and means engaged with the central portions of the strips for supporting the strips and the panels from the overhead trackway.

13. A folding door as claimed in claim 11 comprising a pantograph linkage attached to the panels and movable in the overhead trackway.

14. A folding door as claimed in any of claims 1 to 7 wherein the panels are movably supported from an overhead trackway by means of a pantograph linkage, the pantograph linkage being attached to the upper edge of the panels with the linkage including a plurality of pairs of crossed links with one link of each pair being secured to a panel with the ends thereof connected to adjacent links and forming a hinge axis for the panels, the point of intersection of the links being supported from the overhead trackway.

15. A folding door substantially as hereinbefore described with reference to Figures 1 to 4 and 6 of the accompanying drawings.

16. A folding door as claimed in claim 15, modified as shown in Figures 7 or 8 of the accompanying drawings.

17. A folding door substantially as hereinbefore described with reference to Figures 5 or 9 of the accompanying drawings.

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