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Brydolf et al.

[11] **3,750,337**

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[54] **SLIDING DOOR CORNER CONNECTOR**

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[52] U.S. Cl. ..... 49/411, 16/90, 287/189.35, 287/189.36 H

[51] Int. Cl. F16b 7/22, F16b 9/00

[58] Field of Search ..... 49/409-411; 16/90-95; 287/189.35, 189.36 D, 189.36 H

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[57] **ABSTRACT**

This symmetrical corner connector is particularly useful for sliding door hardware and fastens on without screws or other connectors. Such a door has a panel having a G-shaped stile along each side and a U-shaped rail at the top and bottom, all of which engage the edges of the panel to form the structure of the door. The connector has a central channel for receiving a door suspension member and, on each side thereof, has a wing for engaging the back wall of the stile. An ear on each side of the connector near one end fits over the end of the stile to engage the interior thereof. A tang on each side near the opposite end of the connector fits through a slot in the stile and engages it in opposition to both the ear and wing. In addition, the tang has a spring clip for engaging the interior of the stile for preventing withdrawal of the tang. A hook extends over the top of the rail and through a slot to engage the front face of the panel.

24 Claims, 4 Drawing Figures

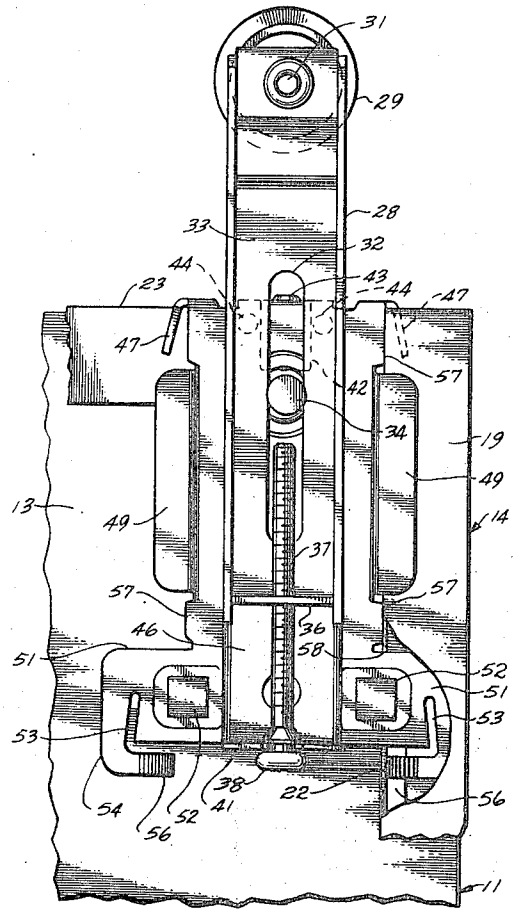


FIG. 1

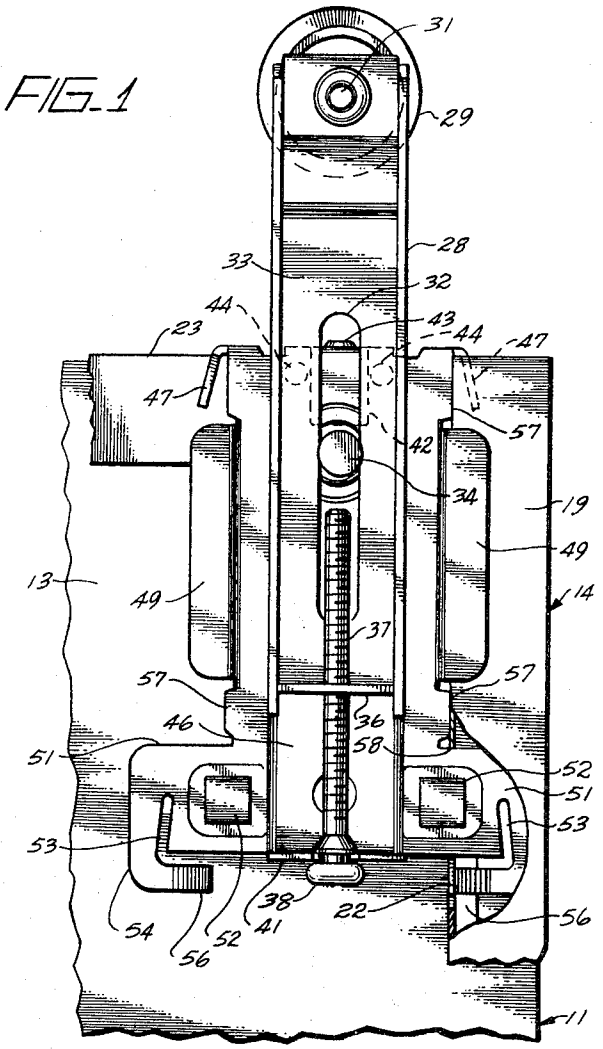


FIG. 3

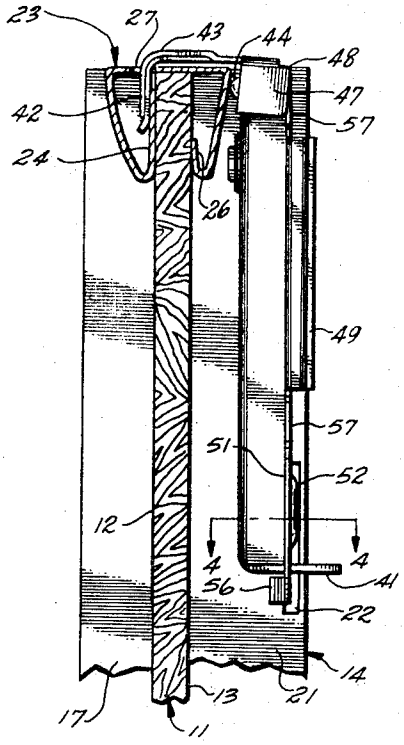


FIG. 2

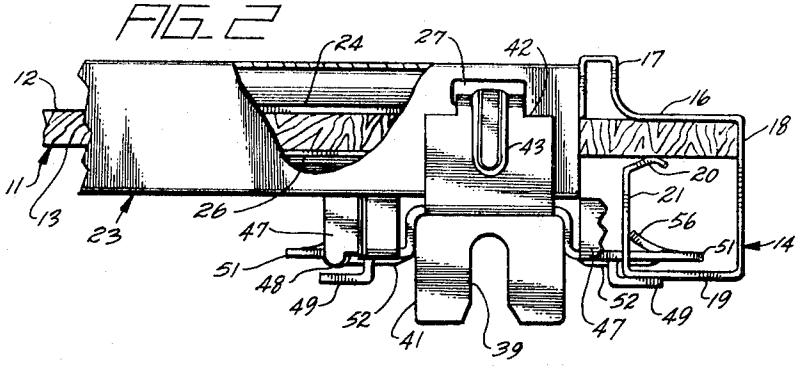
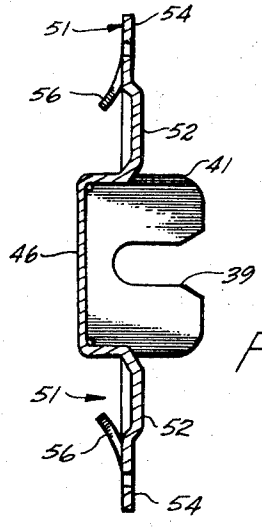


FIG. 4



SLIDING DOOR CORNER CONNECTOR

BACKGROUND OF THE INVENTION

Sliding doors made of lightweight panels have become increasingly popular in recent years for use in homes, apartments, and mobile homes. Typically, a track for supporting the door is provided along the upper portion of the door frame. A hanger having a wheel fits into this track to support the weight of the door. Additionally, a guide track may be provided along the floor and a guide mounted on the bottom of the door to slide along the track to keep it in alignment. This invention relates partly to the hardware for connecting the hanger and guide to the door.

Such lightweight doors are typically made with a rectangular panel about three-sixteenths to one-fourth inch thick, one face of which forms a decorative face on a closet door and the opposite face of which is inside the closet. A hollow metal stile extends vertically along each side edge of the door. The stile typically is sufficiently springy to frictionally engage the edge of the panel. One such stile has a hollow G-shaped cross-section for gripping the door panel. Along the top and bottom edges of the door panel, there is typically a metal rail which is also springy and frictionally engages the door panel. A variety of rail designs have been employed and they are basically a U-shaped channel within which the top or bottom edge of the door fits.

At the corners of the door, a connector is used for securing the rail and stile together. This invention provides an improved connector. The interconnected stiles and rails thus form a substantially rigid frame around the door panel supporting the weight thereof and preventing twisting. It is convenient to provide the door suspension hardware in combination with the corner connector. At the top of the door, a hanger and wheel may be mounted on the corner connector for supporting the weight of the door. In this way, the weight is carried principally by the frame without relying solely on frictional engagement between the door panel and the stile. At the bottom corners of the door, a guide member may be mounted on the corner connector.

It is desirable to have a single corner connector usable in all four corners of the door. This assures minimized cost of tooling and inventory, thereby yielding the lowest possible cost of corner connector. It is also desirable that the connector be made symmetrically so that when assembled with a hanger or guide, a single combined unit may be employed in either side corner of the door. Many combined hanger and corner connector assemblies have either been right- or left-handed so that it is necessary to assemble, supply, stock and use two different kinds of corner hardware. Thus, for each door that is hung, it is necessary to have four different pieces of hardware; namely, a right- and left-handed hanger assembly, and a right- and left-handed guide assembly. It is far preferable if the assembled corner connector and door suspension hardware is unhanded or symmetrical so that the supply and inventory problem is cut in half.

Among the early models of corner connectors were some that were fastened to the stile and rail by sheet metal screws or the like. The time required for installing such a corner connector is fairly high since at least two, and preferably three, threaded connections were needed for rigidity. Efforts have, therefore, been directed to corner connectors that can clip to the stile and rail so that they can be rapidly installed by hand. One such corner connector shown in U.S. Pat. No. 3,450,426 slips end-wise into a substantially E-shaped stile and locks into a slot in a rail.

In another prior art corner connector, a pair of L-shaped hooks fit through slots in a door stile and a T-shaped latching barb fits into a slot in the rail to pull the two together. Not only was this connector used in left- and right-handed models but also it was subject to dislodgement when the door was slammed against the jamb, particularly when the panel was made with insufficiently close tolerances.

In another prior art corner connector, three barbed tangs extend laterally from the connector. Two of these fit through slots in the stile and the third is jammed between the stile and the door panel. An L-shaped hook fits into a slot in the rail. This connector is installed by laying it flat against the back face of the panel with the L-shaped hook in a slot in the rail and it is then slid sideways until the barbs on the tangs engage the stile for preventing withdrawal of the connector. This combined connector and door suspension hardware necessarily comes in left- and right-handed models. Jamming a barbed tang between the panel and stile may cause damage to one or the other of these members. It is also found to be extremely difficult to remove such a corner connector for repair or replacement.

It is therefore desirable to provide a corner connector that will clip to the stile and rail without the use of fasteners and without any substantial danger of damage to the door or its associated hardware. Such a corner connector should be cheap to manufacture, both in the tooling and in the materials required. It should be adapted to receive a variety of door suspension hardware, such as, hangers or guides, and when such suspension hardware is assembled on the corner connector, it should be unhanded or symmetrical to minimize manufacturing, assembly, ordering, stocking, shipping, and use problems. The corner connector should fit tightly to the stile and rail so that it will not come loose when the door is slammed or when subjected to vibrations.

BRIEF SUMMARY OF THE INVENTION

Therefore, in practice of this invention according to a presently preferred embodiment, there is provided a symmetrical corner connector for a door having a panel, a stile along an edge of the panel, and a rail along an adjacent edge of the panel. The connector has a central channel for receiving a door suspension member. Along each side of the central channel is a wing for engaging the outer back wall of the stile. An ear at one end fits over the end of the stile for engaging the interior thereof. A tang near the opposite end fits through a slot in the stile and engages it in opposition to the wing and ear. An elastic detent on the tang engages the interior of the stile for preventing withdrawal thereof. Preferably, a hook extends over the top of the rail and slips through a slot to engage the front face of the door panel.

DRAWINGS

These and other features and advantages of the present invention will be appreciated as the same becomes better understood by reference to the following detailed description of a presently preferred embodiment

when considered in connection with the accompanying drawings wherein:

FIG. 1 illustrates, from the back side of a door, a corner connector constructed according to principles of this invention, including a door hanger;

FIG. 2 is a top view of the corner connector of FIG. 1;

FIG. 3 is a side view of the corner connector of FIG. 1; and

FIG. 4 is a transverse cross-section through the corner connector of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 1 thru 3 illustrate in three orthogonal views a corner of a door including a corner connector constructed according to principles of this invention. As illustrated in this presently preferred embodiment, the door comprises a flat panel 11, such as 1/4 inch plywood, which may have a decorative front face 12 and a more plain rear face 13. Along the side edge of the panel 11, there is a sheet metal stile 14 which is conveniently fabricated by roll forming.

As best seen in the top view of FIG. 2, the stile has a front wall 16 in engagement with the front face 12 of the panel. A raised gripping flange 17 is preferably provided along the length of the stile for use in lieu of a separate handle. A jamb edge or side wall 18 is adjacent the edge of the panel and during use of the door, engages the jamb. A back wall 19 is approximately parallel to the front wall 16 and is spaced a substantial distance away from the rear face 13 of the panel in order to provide stiffness. It will be noted, of course, that the gripping flange 17 also provides substantial stiffness. Extending between the back wall 19 and the rear face 13 of the panel is an inner leg 21. At the inner end of the inner leg 21, there is an inwardly directed foot 20 that engages the rear face 13 of the panel. The foot 20 is somewhat at an angle so as to form a tapered opening into which the edge of the panel may be inserted. Thus, it will be seen that the stile has a generally G-shaped cross-section (illustrated reversed in FIG. 2) with the top of the G corresponding to the front wall 16 and the bottom of the G corresponding to the back wall 19. The panel enters the mouth of the G between the cross bar (foot 20) and the top. The springyness of the sheet metal forming the stile accommodates some variation in thickness of door panel. A slot 22 is provided through the inner leg 21 as best seen in FIGS. 1 and 3.

Along the top edge of the door panel is a roll-formed sheet metal rail 23 which is essentially a U-shaped member fitted over the top edge of the panel and sufficiently springy to frictionally engage it. A face flange 24 within the hollow rail engages the front face 12 of the panel. Space is left between the face of the rail and the face flange to accommodate a portion of the connector and also to provide good abutment against the flange 17 on the stile. This prevents the end of the rail from slipping between the panel and stile. It is convenient to also provide a rear flange 26 on the rail which provides a rounded portion so that the door panel can be easily inserted during assembly. As best seen in FIG. 2, a slot 27 is provided in the top surface of the rail.

Identical stiles are provided along each side edge of the door and a rail like that at the top is provided along the bottom edge of the door. Closet doors are typically used in only a few standard heights and widths and, therefore, the stiles and rails can be pre-cut to length at the factor. Similarly, the slots 22 and 27 through the stile and rail, respectively, are punched at the factory and are similar at both ends of the parts. The stiles and rails are, therefore, unhanded or symmetrical and stock requirements are thereby minimized.

The corner connector which attaches to the rail and stile as hereinafter described, has bilateral symmetry to that it can be used in any corner of a door or the like. Except for those portions along the center of the connector, only half of the structural features will actually be in use in any specific installation of the connector on a door. Centrally located on the plane of symmetry of the connector is a U-shaped channel for receiving door suspension members.

As illustrated in FIG. 1, a hanger 28 is positioned in the central channel. A wheel 29 is mounted on a pin or rivet 31 at the end of the hanger. The wheel would fit in a track (not shown) when the door is hung. A guide slot 32 extends along the bight 33 of the hanger which is secured to the connector by a rivet 34 extending through the guide slot. A nut sheet 36 is folded up from the bight at the lower end of the hanger. A self-tapping adjustment bolt 37 is threaded through the nut sheet 36. The double head 38 of the adjustment bolt fits into a bolt retainer slot 39 (FIGS. 2 and 4) in a bolt retainer tongue 41 that extends normal to the principal extent of the channel along the connector. The relative positions of the hanger and connector are adjusted by turning the bolt 37. This permits adjustment of the door to the frame and track after it is hung. The hanger and its attachment and adjustment features are conventional and, for clarity, are deleted from the views of FIGS. 2 to 4. In lieu of the hanger, a conventional bottom guide for a door or other door suspension hardware can be fastened in place in the central channel.

At the opposite end of the channel from the bolt retainer tongue 41 is a hook 42 that, when installed, extends over the top of the rail 23 and through the rail slot 27 so as to firmly engage the face flange 24 on the rail. This effectively places the hook in engagement with the front face 12 of the panel. By engaging the front of the panel, greater strength and rigidity is obtained than possible with a member that engages only the rail. A stiffening rib 43 is preferably stamped into the hook, at least in its narrower segments. A pair of bumps 44 on the bight 46 of the channel are opposed to the hook and typically one or both of the bumps engage the inner side of the rail near its top so that it is firmly fixed in position. Typically, when installed, the side edge of the hook is in relatively tight engagement with the edge of the rail slot 27 nearest the end of the rail (see FIG. 2). A pair of connectors with hooks engaging the slots at the ends of the rail link the stiles at opposite door edges together.

At the end of the connector having the hook 42, there are provided a pair of ears 47 lying in planes transverse to the principal extent of the connector, that is, transverse to the plane of the panel. The ears are at an angle of about 15° from the plane of symmetry of the connector and, as seen in FIG. 3, are preferably somewhat skewed away from alignment with the balance of the connector. A hump 48 on the ear engages the inside of the back wall 19 of the stile. The inside surface of the ear 47 also engages the inside of the leg 21 on the stile.

On each side, a wing 49 extends laterally from the connector in a plane parallel to the plane of the bight

46 of the channel. One of the wings overlies the back wall 19 of the stile.

At the opposite end of the connector from the ears 47 are a pair of laterally extending tangs 51, one of which fits through the stile slot 22 so that a principal portion of the tang is within the stile. Each tang has a raised boss 52 which engages the side of the stile slot 22. Thus, it will be seen that the hump 48 on the ear 47, the wing 49, and the boss 52 mutually pinch the stile at three spaced apart points. The hump and boss tend to press against the stile in one direction and the wing, which is therebetween, tends to press against the stile in the opposite direction so as to be firmly engaged. The wings 49 can actually be omitted with a sacrifice in rigidity of the stile connection.

An L-shaped slot 53 in the tang 51 defines a spring arm 54 which is free to flex to a limited extent in a direction transverse to the principal extent of the connector. The spring arm 54 terminates in a curved clip finger 56 that curls out of the plane of the balance of the tang in a direction opposite to the raised boss 52. The end of the clip finger 56 is further from the upper surface of the boss 52 than the width of the stile slot 22 to form an elastic detent for the tang. Thus, when the tang is pressed through the slot, as hereinafter described, the spring arm and clip finger elastically deform to permit the finger to pass through the slot. As soon as it is through the slot, the clip finger springs back and the end engages the inside of the leg 21 of the stile so that it cannot be withdrawn and the connector is secured in place. A pair of shoulders 57 on the main body of the connector abut against the outside of the leg 21 of the stile in opposition to both the end of the clip finger 56 and the inside of the ear 47. Thus, the stile is mutually pinched between the ear 57 and clip finger 56 tending to engage it in one direction and the shoulders 57 therebetween tending to press it in the opposite direction. The separate raised shoulders can be deleted and the portion of the connector beneath the wing 49 can engage the side of the stile.

The stile slot 22 is spaced from the end of the stil a sufficient distance that there is tight engagement between the edge of the slot and the edge of the tang 51 at a load bearing point 58. When the corner connector is used with a door hanger, the weight of the door is transmitted by way of the stile to the tang at this point and, thence, via the connector and hanger to the wheel 29. Conversely, at the bottom of the door, a principal portion of the weight of the panel may be transmitted to the lower rail and, thence, to the connector via the hook 42. This direction of loading also transmits load between the connector and stile at the load bearing point 58, which is near the plane of symmetry of the connector and is in a portion thereof capable of withstanding substantial loads. It will be noted that there is substantially no load on the elastic detent to inhibit withdrawal of the clip. It will be noted that the entire corner connector can be blanked stamped and bent from ordinary sheet metal, such as, for example, U.S. Standard 21 gauge steel sheet making manufacture quite economical. Since it has bilateral symmetry, only one set of dies is needed to make the part. It will also be noted that it remains symmetrical when the suspension hardware is added thereby minimizing the problems of right- and left-handed parts.

In order to install the corner connector, a stile and rail are positioned on a door panel substantially as shown in the drawings. The corner connector is then simply dropped into position with the ear 47 extending into the interior of the stile over the inner leg 21. The end of the hook 42 also extends into the rail slot 27. At this point, the connector is cocked at about 10°–15° from alignment with the stile. The 15° outward tilting of the ear is provided to accommodate this skewing during installation.

The connector is then pressed sideways so that the wing 49 overlies the back wall 19 of the stile and the tang 51 enters the stile slot 22. It is simply pressed over until the clip finger 56 snaps through the slot and engages the inside of the leg 21. The connector is then firmly secured in place and cannot be dislodged by vibration or slamming of the door. The entire installation can be accomplished in only a few seconds and entirely by hand without use of any tools.

If it should be desired to remove the corner connector for repair or replacement, it is only necessary to insert a screwdriver or the like through the open end of the stile so as to engage the clip finger 56 and press it towards the back wall of the stile. This permits the end of the clip finger to pass through the stile slot 22 and the connector is removed in a direct reverse of the movement of installation. Pressure need be applied only on the clip finger for easy removal rather than at 2 or 3 points as in prior connectors. Removal is accomplished in a matter of seconds merely with use of a screwdriver, and there is no substantial danger of damage to the panel, rail, stile or connector.

Although only a single embodiment of this invention has been described and illustrated in detail herein, many modifications and variations will be apparent to one skilled in the art. Thus, where door suspension is not a desideratum, the central channel can be dispensed with and the connector can be made smaller. As another example, the ears 57 could be made wider so that the ear that is not within the stile could engage the rear of the rail in lieu of the bumps 44. As another variation the ear 47 can be formed more in the shape of the hook 42 to engage either the gripping flange 17 or the leg 21 of the stile. It tends to be longer and narrower in such an arrangement and generally of lower strength. The other means for preventing withdrawal of the tang include a shallow notch at the point 58 rather than a spring finger 22. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a door having a flat panel, a stile along one edge and a rail along an adjacent edge, an improved corner connector comprising:

means for engaging the stile in a direction normal to the plane of the panel;

means for engaging the stile between three spaced apart points in a direction substantially parallel to the plane of the panel on the rear side thereof, said means including at least one member for extending through a slot in the stile and engaging an end of the slot for carrying weight of the door; and

means extending over the top of the rail and through a slot in the top of rail for holding the connector to the rail in directions parallel and normal to the plane of the panel.

2. In a combination as defined in claim 2, an improved connector wherein the means for holding the

connector to the rail also extends over the end of the panel for engaging the front of the panel.

3. In a combination as defined in claim 1, a rail having an internal face flange interposed between the front of the door panel and the means for engaging the front of the panel.

4. In a combination as defined in claim 1, an improved connector comprising ear means for engaging the interior of the stile through an open end thereof.

5. In a combination as defined in claim 4, an improved corner connector wherein the means for engaging in a direction parallel to the plane of the panel comprises:

a tang for extending through a slot in the stile at the opposite end of the connector from the ear;

elastic detent means on the tang for preventing withdrawal of the tang through the slot; and

at least one shoulder means on the connector for engaging the stile in opposition to the detent and the ear located therebetween.

6. In a combination as defined in claim 5, an improved connector wherein the means for engaging the stile in a direction normal to the plane of the panel comprises:

a raised boss on the tang for engaging the slot through the stile; and

a wing between the ear and boss for engaging the exterior of the stile in opposition to the ear and boss.

7. In a combination as defined in claim 6, an improved connector further comprising means for connecting a movable door suspension member thereto.

8. In a combination as defined in claim 7, an improved corner connector having bilateral symmetry wherein the means for engaging are present on each side of the plane of symmetry.

9. A bilaterally symmetrical corner connector for a door having a panel, a hollow stile along a side edge of the panel, and a hollow rail along an end of the panel comprising:

central means for receiving a door suspension member;

a wing on each side of the central means for engaging the outer back wall of the stile;

an ear on each side of the central means near one end for fitting over an open end of the stile including a portion for engaging the inner back wall of the stile; and

a tang on each side of the central means near the opposite end for fitting through a slot in the stile, and including a portion for engaging the stile in opposition to the wing and a spring clip for engaging the interior of the stile for preventing withdrawal of the tang.

10. A corner connector as defined in claim 9 further comprising a hook for extending over the rail and engaging the front face of the panel.

11. A corner connector as defined in claim 10 further comprising shoulder means on each side of the central means for engaging the exterior of the stile in opposition to the spring clip and a portion of the ear.

12. A corner connector as defined in claim 11 wherein the portion of tang for engaging the stile in opposition to the wing comprises a raised boss for engaging a portion of the slot through the stile; and wherein the spring clip comprises a spring arm connected to the tang and a finger on the arm twisted out of the plane of the tang in a direction opposite to the direction of raising of the boss, the finger extending in a direction from the outer end of the tang towards the central means.

13. A combination comprising:

a substantially rectangular door panel;

a generally U-shaped hollow rail along the top and bottom edges of the panel;

a slot through the bight of the U-shaped rail near each end thereof;

generally G-shaped hollow stile along each of the side edges of the panel, the panel entering the mounth of the G with the cross bar thereof adjacent the back of the panel;

a slot through the leg of the G-shaped stile near each end thereof; and

a bilaterally symmetrical corner connector at the back of the panel interconnecting an adjacent rail and stile comprising:

a central generally U-shaped channel for receiving a door suspension member, the plane of symmetry of the channel being the plane of symmetry of the connector,

a hook at one end of the channel passing through the slot in the rail,

means for engaging the rail in opposition to the hook,

an ear extending into the hollow interior of the stile through an open end thereof,

a wing extending laterally from the plane of symmetry engaging the back of the stile in opposition to the ear,

a tang extending laterally from the plane of symmetry of the connector through the slot in the stile and including a portion engaging the slot in opposition to the wing, and

an elastic detent for preventing withdrawal of the tang from the slot.

14. A combination as defined in claim 13 wherein the hook extends over the edge of the panel and engages the front face thereof.

15. A combination as defined in claim 14 wherein the rail further comprises an inner flange interposed between the hook and the front face of the panel.

16. A combination as defined in claim 15 wherein the means for engaging the rail in opposition to the hook comprises a raised portion on the channel extending towards the hook.

17. A combination as defined in claim 13 wherein the ear extends at an angle to the plane of symmetry for entry into the end of the stile while the connector is skewed relative to the stile.

18. A combination as defined in claim 13 wherein the elastic detent comprises:

a spring arm connected to the lateral end of the tang; and

a clip finger extending from the spring arm towards the plane of symmetry of the connector and curled towards the panel for engaging the inside of the leg of the G-shaped stile.

19. A combination as defined in claim 18 further comprising means on the connector between the ear and the clip finger for engaging the stile in opposition to the ear and clip finger.

20. A combination as defined in claim 19 wherein the hook extends over the edge of the panel and engages the front face thereof, and wherein the rail further comprises an inner flange interposed between the hook and the front face of the panel.

21. In a door having a flat panel, a stile along one edge and a rail along an adjacent edge, an improved corner connector comprising:

means extending through a slot in the top of the rail for engagement therewith;

ear means for engaging the interior of the stile through an open end thereof;

a tang extending through a slot in the stile for carrying weight of the door; and

means for preventing withdrawal of the tang from the slot.

22. In a combination as defined in claim 21, an improved connector wherein the means for engaging the rail extends over the end of the panel for engaging the front of the panel.

23. In a combination as defined in claim 22, a rail having a face flange interposed between the front of the door panel and the means for engaging the rail.

24. In a combination as defined in claim 22, an improved connector wherein the ear means engages the back of the stile in a direction normal to the plane of the panel, the tang includes a portion for engaging the back side of the slot through the stile; and further comprising means for engaging the back of the stile in opposition to the ear means and tang.

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