Concealed Door Hinge And Method Of Installing The Concealed Door Hinge

Field of the Invention

The present invention relates broadly to a concealed door hinge and method of installing the concealed door hinge.

Background

One of the problems in the door manufacturing industry is the presence of gaps between a door-frame and door-panel. Sometimes, the gaps between a door-frame and door-panel are inconsistent and substantially high (e.g. 5 mm or more) because conventionally, a door-frame is permanently fixed before mounting a respective door-panel with hinges. As such, the presence of conventional door hinges to attach a door-frame and a door-panel create an imminent gap. Moreover, precision mounting cannot be achieved when installing a conventional door-panel and door-frame, because of irregularities in the floor levels. Furthermore, there is no mechanism to adjust the door-frame to reduce the gaps between door-frame and door-panel during installation.

Recently, attempts to improve the design of door hinges have resulted in hinges, such as a butt hinge, Soss hinge or a pivot hinge.

Butt hinges are commonly used in a door-set of flats and condominiums. However, butt hinges, after installation, are physically seen and cannot be used in frameless designs. Furthermore, butt hinges do not facilitate any adjustment of the door-frame during installation.

Though hidden, after installation, Soss hinges are seldom used because the intrinsic mechanical movements of parts tend to allow a door-panel to sag slightly. Furthermore, half of a Soss hinge must be embedded into a door-frame, which cannot facilitate a frameless design. In addition, Soss hinges do not facilitate any adjustment of door-frame during installation.

In a pivot hinge, since a door-panel is attached to the door-frame by means of two pivots, one pivot on top while the other pivot at the bottom of a door-panel, structural integrity is compromised. Furthermore, since a metal plate must be installed onto the floor for holding the pivot, dirt and dust are accumulated on the metal plate, making it

unsuitable to be installed in bedrooms and in places within a house or apartment. In addition, pivot hinges do not facilitate any adjustment of door-frame during installation

Accordingly, there is a need to provide a door hinge, which seeks to address one or more of the above problems.

Summary of the Invention

According a first aspect of the present invention, there is provided a door hinge comprising: a first hinge plate and a second hinge plate, the first and second hinge plates being rotatably movable relative to each other about a pivot axis, wherein the first hinge plate comprises a first mounting plate for fastening the hinge to a door-panel, wherein the second hinge plate comprises a second mounting plate for fastening the hinge to a door-frame, wherein the first hinge plate is substantially orthogonal to the first mounting plate and the second hinge plate is substantially orthogonal to second mounting plate.

The first mounting plate may be substantially rectangular and intersecting the first mounting plate discretely along a width of the first mounting plate and towards an edge of the first mounting plate.

The second hinge plate may be substantially orthogonal to a proximal edge of an angle bracket, the distal edge of the angle bracket intersecting the second mounting plate discretely along a width of the second mounting plate such that a channel is formed between the angle bracket and the second mounting plate, said channel accommodating the turning radius of the door-panel.

The angle bracket may comprise a first flange and a second flange that are substantially perpendicular, the second flange intersecting the edge of the second hinge plate and the first flange intersecting a width of the second mounting plate.

The outer intersecting portion of the first and second flanges may be chamfered to facilitate the turning radius the door-panel.

The second flange may comprise through holes for inserting a fastener to fasten the mounting plate to the door-frame.

One of the edges of the first and second hinge plates may have a plurality of co-operable cylindrical bearings through which the pivot axis is engaged.

Each of the first mounting plate and the first hinge plate; and the second mounting plate, the angle bracket, and the second hinge plate, may be integrally formed.

The first and second mounting plates may have a plurality of screw holes that are countersunk for fastening, respectively, the door and the door-frame, using screws.

The door hinge may be made of steel.

According to a second aspect, there is provided a door set comprising a door-frame and a door-panel made of wood, the door set installed using the above door hinge, wherein the door-frame has a fixed part that is attached to a door wall and a movable part, the movable part is adjustable horizontally and vertically after installing the door-panel so that the gap between the movable part of the door-frame and door-panel is reduced.

The movable part of the door-frame may be fastened to the fixed part by air nails once the final position of the movable part is decided and punctures caused by the air nails may be covered with wood putty.

Any gap between the movable part of the door-frame and the door wall may be hidden using an architrave, the architrave blends with the moving part of the door-panel and flushes with the outer edges of the adjustable door-frame.

According to a third aspect, there is provided a door set comprising a door-frame and a door-panel, the door set installed using the above door hinge, wherein the door-frame is embedded centrally into a door wall and a pair of opposing L-shaped plates are inserted in between the door-frame and door wall, on either sides, such that one arm of each L-shaped plate forms the terminal portion of the door wall, whereby the door-frame is hidden in between the two L-shaped plates.

The material of the door wall adjacent to the L-shaped plate may be any one of ordinary plaster, granite, marble, stainless steel or aluminium.

The inner edges of the door-panels may have a plastic or stainless steel shield to cover the void cut into the inner wall of the door-panel and to enhance the appearance of the door hinge when the door-panel is opened.

The shield may be spray-painted with a paint of the same colour as the door hinge.

According to a fourth aspect, there is provided a frameless door set comprising a door-panel installed using the above a door hinge, wherein the adjacent wall and the outer layer of the door-panel may be stone clad, wherein the body of the door-panel is made of steel and comprises a plurality of steel ribs and the stone clad layer is formed using a premix of cement, sand and adhesive.

The adjacent wall housing the stone door clad door-panel may comprise a pair of clamping plates, one end of which are fixed to an inner wall by a pair of mechanical fasteners, while the other end extend in an outer wall, wherein the extended part of the clamping plates are fastened to the outer edges of an elongate L-shaped metal plate, the L-shaped metal plate having a plurality of mounting holes for fastening respective the door hinges.

The above door-panel may operable to open up to an angle of about 120 degrees.

According to a fifth aspect, there is provided a continuous wall comprising a plurality of the above door sets when each of the door-panels are in closed position, the continuous wall completely concealing the door hinge.

According to a fifth aspect, there is provided a method of installing a door set comprising a door-panel and a door-frame, the method comprising the steps of: routing a door-panel to form two or more cavities, each of the cavities for accommodating the above door hinge; fixing a door-frame to a door wall; fastening the mounting plates of each of the concealed door hinges on a respective portion of the door-frame; and installing the door-panel by inserting the fastening plates of each of the door hinges into the respective cavities and fastening the fastening plates to the respective cavities.

The method may further comprise the steps of: inserting an adjustable door-frame on to the door-frame, along the two sides and the top of the door-frame; moving the adjustable door-frame horizontally and vertically towards the door-panel to minimise the

gap between the door-panel and the door-frame; fastening the adjustable door-frame to the door-frame using air nails once the position of the adjustable door-frame is achieved; and sealing the punctures caused by the air nails.

The method may further comprise the step of plugging the gaps existing adjacent to the adjustable door-frame and the wall using an architrave, wherein said architrave blends with the adjustable door-frame and flushes with the outer edges of the adjustable door-frame.

According to a sixth aspect, there is provided a method of installing a door set comprising a door-panel and a hidden door-frame comprising the steps of: routing a door-panel to form two or more cavities, each of the cavities for accommodating the above door hinge; embedding a door-frame centrally into the door wall; inserting a pair of opposing L-shaped plates between the door-frame and door wall, on either sides, such that one arm of each L-shaped plate forms the terminal portion of the door wall whereby the doorframe is hidden by the L-shaped plates; fastening the mounting plates of the respective door hinges to the door-frame; and installing the door-panel by inserting the fastening plates of each of the door hinges into the respective cavities and fastening the fastening plates to the respective cavities.

According to a seventh aspect, there is provided a method of installing a frameless door set comprising a stone clad door-panel adjacent to a stone clad wall, the method comprising the steps of: providing the above door hinges; providing a stone clad door-panel, wherein the body of the stone clad door-panel is made of steel and comprises a plurality of steel ribs and the stone clad layer is formed using a premix of cement, sand and adhesive; installing a pair of clamping plates into the door wall, one end of which are fixed to the inner door wall by a pair of mechanical fasteners, while the other end extend in to the outer door wall; fastening the extended part of the clamping plates to the outer edges of an elongate L-shaped metal plate, the L-shaped metal plate having a plurality of mounting holes for fastening respective the door hinges; fastening the mounting plates of each of the door hinges on a respective portion of the L-shaped metal plate; installing the stone clad door-panel by inserting the fastening plates of each of the door hinges into the respective cavities and fastening the fastening plates to the respective part of the metallic stone-clad panel.

Brief Description of the Drawings

The present invention is further described by way of non-limiting embodiments, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a concealed door hinge in accordance with an embodiment;

Figure 2a is a front view of an installation of door-panels with adjustable door-frames using the concealed door hinge of Figure 1;

Figure 2b is a partial sectional view of Figure 2a showing an installation of a door-panel, a door-frame and the concealed door hinge of Figure 1;

Figures 2c-2e are various sectional views of the concealed door hinge of Figure 2b;

Figure 2f is a sectional view of Figure 2a with the door-panels in a closed position;

Figure 2g is a sectional view of Figure 2a with the door-panels in an open position;

Figure 3a is a front view of an installation of door-panels with hidden door-frames using the concealed door hinge of Figure 1;

Figure 3b is a partial sectional view of Figure 3a showing an installation of a door-panel, a hidden door-frame and the concealed door hinge of Figure 1;

Figures 3c-3e are various sectional views of the concealed door hinge of Figure 3b;

Figure 3f is a sectional view of Figure 3a with the door-panels in a closed position;

Figure 3g is a sectional view of Figure 3a with the door-panels in an open position;

Figure 4a is a front view of an installation of a marble/granite clad door-set using the concealed door hinge of Figure 1;

Figure 4b is a partial sectional view of Figure 4b showing an installation of the marble/granite clad door-set and the concealed door hinge of Figure 1;

Figures 4c-4e are various sectional views of the concealed door hinge of Figure 4c;

Figure 4f is a sectional view of Figure 4a with the door-panels in a closed position; and

Figure 4g is a sectional view of Figure 4a with the door-panels in an open position.

Detailed Description of Preferred Embodiments

Embodiments of the present invention can help in installing a door-frame and a door-panel in which a hinge and its mounting screws are concealed from sight, which, in turn, can help in improving the building aesthetics.

Embodiments of the present invention can assist in reducing gaps between a door-panel and a door-frame by using an adjustable door-frame.

Embodiments of the present invention can assist in achieving a door-panel with a hidden door-frame whereby a variety of finishing materials can be used in the door-wall adjacent to the hidden door-frame which, in turn, can help in improving the building aesthetics.

Embodiments of the present invention can assist in achieving a frameless door-panel suitable for using a stone clad door-panel to blend with the adjacent stone-clad wall, which, in turn, can help in achieving a door set with sufficiently strong and sturdy construction and improved aesthetics.

Figure 1 is a perspective view of a concealed door hinge 100 in accordance with an embodiment.

The door hinge comprises of a first member 110 and second member 120. The first member 110 and second member 120 can move relative to each other about a rotating hinge 130. The component parts of the first member 110, the second member 120 and the rotating hinge 130 are made of a hard metal e.g. stainless steel or hardened steel.

The first member 110 consists of a mounting plate 111 (e.g. having a thickness of about 5 mm, width of about 33 mm and a length of about 137 mm) and an angle bracket 107. The mounting plate 111 and angle bracket 107 form a channel 117 in between them to accommodate the turning radius of a door-panel (refer to Figure 2b).

The angle bracket 107 consists of two perpendicular flanges, a first flange 107b (e.g. having a thickness of around 4.5 mm, width of about 28-33 mm, and a length of about 137 mm) and a second flange 107a (e.g. having a thickness of around 4.5 mm, width of about 19 mm, and a length of about 137 mm). The outer edge of the angle bracket 107,

at the center, is chamfered (e.g. having a dimension of about 4 mm x 4mm) to facilitate the turning radius of a door-panel (refer Figure 2a).

The edge of the first flange 107b is welded at a discrete position on the width of the mounting plate 111, along its length, such that the first flange 107b is perpendicular to the mounting plate 111. The edge of the second flange 107a is welded to the hinge plate 109 e.g. having a thickness of about 3 mm, width of about 7 mm, length of about 127 mm. An edge of the hinge plate 109 has a pair of cylindrical bearings 108 for attaching the hinge plate 109 to a spindle 131 of the rotating hinge 130. Alternatively, the angle bracket 107, the mounting plate 111, and the hinge plate 109 can be extruded together.

The mounting plate has a plurality of screw holes 115a. 115b that are used for fastening the mounting plate 111 to a door-frame (refer Figure 2b) by means of e.g. screws or bolts/nuts. In an embodiment, the mounting plate 111 has three screw holes 115a with a diameter of about 7 mm and three screw holes 115b with a diameter of about 5 mm. The screw holes 115a and 115b are positioned on the opposite sides of the mounting plate 111. The screw holes 115a are countersunk with diameter of about 10 mm, while screw holes 115b are countersunk with a diameter of about 8 mm.

A stainless steel woodscrew or machine screw can be used for fastening the mounting plate 111 to the door-frame (refer Figure 2b).

In an embodiment, the angle bracket 107 has three through holes 113 having a diameter of about 12 mm that are positioned to be concentric to the screw holes 115b. These through holes 113 are used for inserting a fastener (e.g. a crew driver) while fastening the mounting plate to the door-frame (refer Figure 2b).

The second moving member 120 consists of a fastening plate 101 (e.g. having a thickness of about 3 mm, width of about 34 mm and a length of around 127 mm) having a plurality of screw holes 103. In an embodiment, the fastening plate 101 has five screw holes 103 that are positioned in a staggered manner. Each screw hole has a diameter of about 7 mm and countersunk with a diameter of around 10mm.

A hinge plate 105 (e.g. having a thickness of about 3 mm, width of about 7 mm, length of about 127 mm) is welded to the fastening plate 101. The hinge plate 105 is discretely

positioned perpendicular to the fastening plate 101, along the length of the hinge plate. The hinge plate 105 has three cylindrical bearings 108 for attaching the hinge plate 105 to a spindle 131 of the rotating hinge 130. Alternatively, the fastening plate 101 and hinge plate 105 can be extruded together.

The rotating hinge 130 consists of an elongate spindle 131 (having e.g. a diameter of about 8 mm), a pair of bearings 133 (having e.g. a diameter of about 14 mm) and a pair of plugs 135. During assembly of the door hinge 100, the first moving member 110, the second moving member 120, the bearings 106, 108, 131 are positioned and the spindle 131 is inserted through them and a pair of plugs 135 are plugged on either sides to form the door hinge 100.

Figure 2a is a front view of an installation of door-panels with adjustable door-frames using the concealed door hinge of Figure 1.

In the present embodiment, the door-frames 201 and the door-panels 203 can be made of e.g. timber or any suitable wood. The embodiment shows an installation of four door-panels 203 and four door-frames 201, installed above a floor 200, using concealed door hinges 100 (refer Figure 2b). It can be seen that the door-hinges 100 are completely hidden and results in a continuous wall of door-panels.

Figure 2b is a partial sectional view of Figure 2a showing an installation of a door-panel, door-frame and the concealed door hinge 100 of Figure 1

Firstly, a door-panel 203 is prepared before installation, whereby two or more cavities 215 are formed appropriately at the edges of the door-panel 203 using a router. Each of the cavities 215 accommodates a door hinge 100.

Subsequently, a door-frame 201 is fixed to a door wall comprising an inner layer of bricks and mortar 205 and an outer layer of plaster or mortar 207.

After this, the mounting plates 111 of each of the concealed door hinges 100 are fastened, to a recessed portion 210 of a respective door-frame 201using a plurality of screws 211, by a fastener (e.g. screw driver) inserted via the through holes 113.

Subsequently, the door-panel 203 is installed whereby the fastening plates 101 are inserted into the respective cavities 215 and a plurality of screws 221 are used to fasten each of the fastening plates 101 of a respective door hinge 100 to the door-panel 203.

Subsequently, an adjustable door-frame 209 is inserted into another recessed portion 220, along two side potions and top potion of the door-frame 201. Typically, the adjustable door-frame 209 consists of three individual pieces, one piece corresponding to the top portion of the door-frame 201 and two pieces corresponding to the side potions of the door-frame 201.The three pieces of the adjustable door-frame 209 are moved horizontally towards the two sides and vertically towards the top of the door-panel 201 such that the gap 216 between the door-panel 203 and the door-frame 201 is minimized. Once the final position of the three pieces of the adjustable door-frame 209 is decided, air nails are used to fasten the adjustable door-frame 209 to the door-frame 203. The punctures caused by the air nails can be covered e.g. with wood putty.

It can be appreciated that the three pieces of the adjustable door-frame 209 not only minimise gaps between the door-panel and the door-frame 201, but also compensates for the irregularities in the level of the floor 200.

It can be appreciated that the architraves 213 not only hide gaps between the door-panel and the door-frame 201 upon installation of a door set, but also hides any hairline cracks that appear in the door wall 207 adjacent a door-panel 201.

Gaps 214 existing adjacent to the adjustable door-frame 209 and the wall 207 can be hidden using an architrave, which blends with the adjustable door-frame and makes the outer edges of the adjustable door-frame 209 to flush with the wall 207, along the two sides and the top.

The adjustable door-frame 209 helps in reducing the gap 216 between the door-frame 201 and the door-panel 203 to about 1.5 mm. Furthermore, the gap 216 between the door-frame 201 and the door-panel 203 is consistent throughout.

Figures 2c-2e are various sectional views of the concealed door hinge 100 of Figure 2b.

Figures 2c is a sectional view of the concealed door hinge 100 of Figure 2b in a direction of 206 showing the angle bracket 107, mounting plate 111, screw holes 115a, through holes 113, hinge plates 105, 109, plug 135 and the bearings 106, 108, 133.

Figures 2d is a sectional view of the concealed door hinge 100 of Figure 2b in a direction of 204 showing the angle bracket 107, mounting plate 111 and screw holes 115a, 115b.

Figures 2e is a sectional view of the concealed door hinge 100 of Figure 2b in a direction of 208 showing the fastening plate 101, hinge plate 105 and screw holes 103.

Figure 2f is a sectional view of Figure 2a in a direction of 202 showing *inter alia* the door-panels 203 in a closed position, door walls 205, 207, door-frames 201, 202, concealed door hinges 100 and architraves 213. The outer walls of the door-panels 203 are flush and exhibit a wardrobe effect.

The door-frames 202 at the centre, in the embodiment, have a slightly different construction compared to the door-frame 201 at the side. The central door-frames 202 are cross-shaped having a pair of longer arms 202a and another pair of shorter arms 202b. The edges of the longer arms 202a are parallel to the door wall 205, while the edges of the shorter arms 202b are perpendicular to the door wall 205. Recessed portions 240, 250 are provided between the two shorter arms 202b. The first recessed portion 240 and an adjacent edge of a longer arm 202a form a door rest for the door-frame 203. The second recessed portion 250 is used for mounting a door hinge 100 for mounting an adjacent door-panel 203.

Figure 2g is a sectional view of Figure 2a in a direction of 202 showing *inter alia* the door-panels 203 in an open position, door wall 205, 207, door-frames 201, 202, concealed door hinges 100 and architraves 213. As shown, the angle of rotation 230 of the door-panels can vary up to about 120 degrees.

Optionally, the inner edges of the door-panels 203 can have a shield 223 (e.g. made of plastic or stainless steel) to cover the void cut 225 into the inner wall of the door-panel 203 as well as to enhance the appearance of the door hinge 100 when the door-panel 203 is opened. The shield 223 can be spray painted with a paint of the same colour as the door hinge 100.

The mounting screws 211, 221 used in the present embodiment (for mounting e.g. timber door and timber frames) can be e.g. a stainless steel wood screw.

In an embodiment, the mounting screws 211 for fixing the fastening plate 101 can have e.g. a length of about 25 mm, counter sunk head diameter of about 9 mm, and thread diameter of about 5 mm.

In an embodiment, the mounting screws 221 for fixing the fastening plate using screw hole 115a can have e.g. a length of about 25 mm, counter sunk head diameter of about 7.5 mm, and thread diameter of about 4mm. The mounting screws 221 for fixing the fastening plate using screw hole 115b and the mounting screws 211 for fixing the mounting plate 111 can have e.g. a length of about 25 mm, counter sunk head diameter of about 9 mm, and thread diameter of about 5 mm.

The explanation for Figures 2a to 2g is in general applicable to Figures 3a to 3g.

Figure 3a is a front view of an installation of door-panels with hidden door-frames using the concealed door hinge of Figure 1.

Figure 3b is a partial sectional view of Figure 3a showing an installation of a door-panel, a hidden door-frame and the concealed door hinge of Figure 1.

Firstly, a door-frame 301 is embedded centrally into the door wall 207 and a pair of opposing L-shaped plates 313 are inserted in between the door-frame 301 and door wall 207, on either sides, such that one arm of each L-shaped plate 313 forms the terminal portion of the door wall 207.

Subsequently, as described above, each of the mounting plates 111 of a respective door hinge 100 are fastened to the door-frame 301 embedded between the two L-shaped plates.

It can be appreciated that the outwardly protruding edges of the two L-shaped plates are flush with the wall portion 207.

Alternatively, the door-frame 301 attached with the L-shaped plates 313 on either sides, may be directly mounted to the brick wall 205, before being covered with mortar to form

the outer wall 207. In this case, the outer edges of the two L-shaped plates 313 serve as a reference while the brick wall 205 is covered with mortar to form the outer wall 207.

After this, a door-panel 203 is installed to a respective door-frame 301, whereby the fastening plates 101 are inserted into the respective cavities 215 and a plurality of screws 221 are used to fasten each of the fastening plates 101 of a respective door hinge 100 to the door-panel 203.

The above embodiment can help in installing a door-panel 203 with a hidden door-frame 301, whereby a wide selection of building materials (e.g. ordinary plaster, granite / marble, stainless steel / aluminium, etc) can replace the ubiquitous doorframes, which, in turn helps in achieving improved building aesthetics.

Figures 3c-3e are various sectional views, which are identical to Figures 2c-2e.

Figure 3c is a sectional view of the concealed door hinge 100 of Figure 3b in a direction of 306. Figure 3d is a sectional view of the concealed door hinge 100 of Figure 3b in a direction of 304. Figure 3e is a sectional view of the concealed door hinge 100 of Figure 3b in a direction of 308.

Figure 3f is a sectional view of Figure 3a in a direction of 302 showing *inter alia* the door-panels 203 in a closed position, door wall 205, 207, door-frames 301, 302 concealed door hinges 100 and L-shaped plates 313. The outer walls of the door-panels 203 are next to each another with no door-frames located between each individual door-panels 203 thereby achieving an uninterrupted arrangement of door-panels 203 that resemble a wardrobe.

The door-frames 302 at the centre, in the embodiment, have a slightly different construction compared to the door-frame 301 at the side. The central door-frames 302 are cross-shaped having a pair of longer arms 302a and another pair of shorter arms 302b. The edges of the longer arms 302a are parallel to the door wall 205, while the edges of the shorter arms 302b are perpendicular to the door wall 205. Recessed portions 340, 350 are provided between the two shorter arms 302b. The first recessed portion 340 and an adjacent edge of a longer arm 302a form a door rest for the door-frame 301. The second recessed portion 350 is used for mounting a door hinge 100 for mounting an adjacent door-panel 203.

Figure 3g is a sectional view of Figure 3a in a direction of 302 showing *inter alia* the door-panels 203 in an open position, door wall 205, 207, hidden door-frames 301, 302, concealed door hinges 100 and L-shaped plates 313. As shown, the angle of rotation 230 of the door-panels can vary up to about 120 degrees.

Optionally, the inner edges of the door-panels 203 can have a shield 223 (e.g. made of plastic or stainless steel) to cover the void cut 225 into the inner wall of the door-panel 203 as well as to enhance the appearance of the door hinge 100 when the door-panel 203 is opened. The shield 223 can be spray painted with a paint of the same colour as the door hinge 100.

The explanation for Figures 2a to 2g is in general applicable to Figures 4a to 4g.

Figure 4a is a front view of an installation of door-panels without door-frames using the concealed door hinge of Figure 1.

This embodiment can be advantageously used in places having a granite / marble clad steel door-panels 403 that blend with the surrounding granite / marble or any stone clad wall 401 e.g. in hotel lift lobbies, entrance lobbies etc.

For such door-panels 403, it is desirable to have exquisite aesthetic presentation wherein the wall 401 and the door-panels must be contiguous, without hinges in between the door-panels 403.

In such applications, the materials used in the fabrication of the door-panels, which can support a heavy stone clad outer layer, is preferably a hard metal e.g. steel. .

Figure 4b is a partial sectional view of Figure 4a showing an installation of the door-panel 403, and the concealed door hinge of Figure 1.

The body of the door-panel 403 has a steel plate 407 (e.g. having a thickness of about 1.5 mm) and a plurality of steel ribs 406 (e.g. having a thickness of about 1.5 mm). A stone clad outer layer (e.g. having a thickness of about 15 mm) is fastened to the body of the steel panel 403 using a premix 405 comprising sand, cement and adhesive.

The adjacent walls 425, 427 housing the heavy door-panels 403 are also be prepared before installing the door-panels 403. One end of a pair of clamping plates 413, 417 are fixed to the brick wall 425 respectively by a pair of mechanical fasteners 415, 419, such as a screw, a nut & bolt, while the other end of the clamping plates 413, 417 extend in to the sand and cemented layer 427. The extended part of the clamping plates 413, 417 are fastened to the outer edges of an elongate L-shaped metal plate 409 (e.g. steel plate having a thickness of about 6 mm).The L-shaped plate 409 has a plurality of mounting holes for accommodating a metal screw.

Firstly, as described above, each of the mounting plates 111 of a respective door hinge 100 are fastened to the L-shaped plate 409 using a plurality of metal screws 411.

After this, a door-panel 403 is installed, whereby the fastening plates 101 of the door hinge 100 are inserted into the respective cavities 215 and a plurality of metal screws 421 are used to fasten each of the fastening plates 101 of a respective door hinge 100 to the door-panel 403.

Figures 4c-4e are various sectional views, which are identical to Figures 2c-2e.

Figure 4c is a sectional view of the concealed door hinge 100 of Figure 4b in a direction of 406. Figure 4d is a sectional view of the concealed door hinge 100 of Figure 4b in a direction of 404. Figure 4e is a sectional view of the concealed door hinge 100 of Figure 4b in a direction of 408.

Figure 4f is a sectional view of Figure 4a in a direction of 402 showing *inter alia* the door-panels 403 in a closed position, door wall 425, 427, concealed door hinges 100, L-shaped plates 409, the steel plate 407 and steel ribs 405. The stone clad door-panels 403 are next to each another with no door-frames located between each individual door-panels 403 thereby achieving an uninterrupted arrangement of door-panels 403 that have improved aesthetics.

Figure 4g is a sectional view of Figure 4a in a direction of 402 showing *inter alia* the door-panels 403 in an open position, door wall 425, 427, concealed door hinges 100, L-shaped plates 409, the steel plate 407 and steel ribs 405. As shown, the angle of rotation 430 of the door-panels can vary up to about 120 degrees.

In an embodiment, the mounting screws 421 (e.g. machine screws made of stainless steel) for fixing the fastening plate using screw hole 115a can have e.g. a length of about 25 mm, counter sunk head diameter of about 7.5 mm, and thread diameter of about 4 mm. The mounting screws 421 (e.g. machine screws made of stainless steel) for fixing the fastening plate using screw hole 115b and the mounting screws 411 for fixing the mounting plate 111 can have e.g. a length of about 25 mm, counter sunk head diameter of about 9 mm, and thread diameter of about 5 mm.

Load tests performed indicates that each concealed hinge 100 can carry a load of 150 kg without any deformation. Therefore, a plurality of door hinges 100 can fulfill the mechanical and structural integrity of door designs.

The invention is not limited the above embodiments. However, those skilled in the art will recognize that the invention can be practiced, with modification, in the light of the information contained herein without departing from the scope of the invention.

Claims

1. A door hinge comprising:

a first hinge plate and a second hinge plate, the first and second hinge plates being rotatably movable relative to each other about a pivot axis,

wherein the first hinge plate comprises a first mounting plate for fastening the hinge to a door-panel,

wherein the second hinge plate comprises a second mounting plate for fastening the hinge to a door-frame,

wherein the first hinge plate is substantially orthogonal to the first mounting plate and the second hinge plate is substantially orthogonal to second mounting plate.

2. The door hinge as claimed in claim 1, wherein the first mounting plate is substantially rectangular and intersecting the first mounting plate discretely along a width of the first mounting plate and towards an edge of the first mounting plate.

3. The door hinge as claimed in claim 1 or 2, wherein the second hinge plate is substantially orthogonal to a proximal edge of an angle bracket, the distal edge of the angle bracket intersecting the second mounting plate discretely along a width of the second mounting plate such that a channel is formed between the angle bracket and the second mounting plate, said channel accommodating the turning radius of the door-panel.

4. The door hinge as claimed in claim 3, wherein the angle bracket comprises a first flange and a second flange that are substantially perpendicular, the second flange intersecting the edge of the second hinge plate and the first flange intersecting a width of the second mounting plate.

5. The door hinge as claimed in claim 4, wherein the outer intersecting portion of the first and second flanges is chamfered to facilitate the turning radius the door-panel.

6. The door hinge as claimed in claim 4 or 5, wherein the second flange comprises through holes for inserting a fastener to fasten the mounting plate to the door-frame.

7. The door hinge as claimed in any one of the preceding claims, wherein one of the edges of the first and second hinge plates have a plurality of co-operable cylindrical bearings through which the pivot axis is engaged.

8. The door hinge as claimed any one of the preceding claims, wherein each of
the first mounting plate and the first hinge plate; and
the second mounting plate, the angle bracket, and the second hinge plate,
are integrally formed.

9. The door hinge as claimed any one of the preceding claims wherein the first and second mounting plates have a plurality of screw holes that are countersunk for fastening, respectively, the door and the door-frame, using screws.

10. The door hinge as claimed any one of the preceding claims, wherein the door hinge is preferably made of steel.

11. A door set comprising a door-frame and door-panel made of wood, the door set installed using a door hinge as claimed any one of the preceding claims, wherein the door-frame has a fixed part that is attached to a door wall and a movable part, the movable part is adjustable horizontally and vertically after installing the door-panel so that the gap between the movable part of the door-frame and door-panel is reduced.

12. A door set as claimed in claim 11, wherein the movable part of the door-frame is fastened to the fixed part by air nails once the final position of the movable part is decided and punctures caused by the air nails is covered with wood putty.

13. The door set as claimed in claim 11 or 12, wherein any gap between the movable part of the door-frame and the door wall is hidden using an architrave, the architrave blends with the moving part of the door-panel and flushes with the outer edges of the adjustable door-frame.

14. A door set comprising a door-frame and door-panel, the door set installed using a door hinge as claimed any one of claims 1 to 10, wherein the door-frame is embedded centrally into a door wall and a pair of opposing L-shaped plates are inserted in between the door-frame and door wall, on either sides, such that one arm of each L-shaped plate

forms the terminal portion of the door wall, whereby the door-frame is hidden in between the two L-shaped plates.

15. The door set as claimed in claim 14, wherein the material of the door wall adjacent to the of the L-shaped plate is any one of ordinary plaster, granite, marble, stainless steel or aluminium.

16. The door set as claimed in claim 14 or 15, wherein the inner edges of the door-panels have a plastic or stainless steel shield to cover the void cut into the inner wall of the door-panel and to enhance the appearance of the door hinge when the door-panel is opened.

17. The door set as claimed in claim 16, wherein the shield is spray-painted with a paint of the same colour as the door hinge.

18. A frameless door set comprising door-panel installed using a door hinge as claimed any one of claims 1 to 10, wherein the adjacent wall and the outer layer of the door-panel is stone clad, wherein the body of the door-panel is made of steel and comprises a plurality of steel ribs and the stone clad layer is formed using a premix of cement, sand and adhesive.

19. The door set as claimed in claim 18, wherein the adjacent wall housing the stone door clad door-panel comprises a pair of clamping plates, one end of which are fixed to an inner wall by a pair of mechanical fasteners, while the other end extend in an outer wall, wherein the extended part of the clamping plates are fastened to the outer edges of an elongate L-shaped metal plate, the L-shaped metal plate having a plurality of mounting holes for fastening respective the door hinges.

20. A door set as claimed in any one of claims 11 to 19, wherein in the door-panel is operable to open up to an angle of about 120 degrees.

21. A continuous wall comprising a plurality of door sets as claimed in any one of claims 11 to 19 when each of the door-panels are in closed position, the continuous wall completely concealing the door hinge.

22. A method of installing a door set comprising a door-panel and a door-frame, the method comprising the steps of:

routing a door-panel to form two or more cavities, each of the cavities for accommodating a door hinge as claimed in any one of claims 1 to 10;

fixing a door-frame to a door wall;

fastening the mounting plates of each of the concealed door hinges on a respective portion of the door-frame; and

installing the door-panel by inserting the fastening plates of each of the door hinges into the respective cavities and fastening the fastening plates to the respective cavities.

22. A method of installing a door set as claimed in claim 21, further comprising the steps of:

inserting an adjustable door-frame on to the door-frame, along the two sides and the top of the door-frame;

moving the adjustable door-frame horizontally and vertically towards the door-panel to minimise the gap between the door-panel and the door-frame;

fastening the adjustable door-frame to the door-frame using air nails once the position of the adjustable door-frame is achieved; and

sealing the punctures caused by the air nails.

23. A method of installing a door set as claimed in claim 21 or 22, further comprising a step of plugging the gaps existing adjacent to the adjustable door-frame and the wall using an architrave, wherein said architrave blends with the adjustable door-frame and flushes with the outer edges of the adjustable door-frame.

24. A method of installing a door set comprising a door-panel and a hidden door-frame comprising the steps of:

routing a door-panel to form two or more cavities, each of the cavities for accommodating a door hinge as claimed in any one of claims 1 to 10;

embedding a door-frame centrally into the door wall;

inserting a pair of opposing L-shaped plates between the door-frame and door wall, on either sides, such that one arm of each L-shaped plate forms the terminal portion of the door wall whereby the doorframe is hidden by the L-shaped plates;

fastening the mounting plates of the respective door hinges to the door-frame; and

installing the door-panel by inserting the fastening plates of each of the door hinges into the respective cavities and fastening the fastening plates to the respective cavities.

25. A method of installing a frameless door set comprising a stone clad door-panel adjacent to a stone clad wall, the method comprising the steps of:

providing door hinges as claimed in any one of claims 1 to 10;

providing a stone clad door-panel, wherein the body of the stone clad door-panel is made of steel and comprises a plurality of steel ribs and the stone clad layer is formed using a premix of cement, sand and adhesive;

installing a pair of clamping plates into the door wall, one end of which are fixed to the inner door wall by a pair of mechanical fasteners, while the other end extend in to the outer door wall;

fastening the extended part of the clamping plates to the outer edges of an elongate L-shaped metal plate, the L-shaped metal plate having a plurality of mounting holes for fastening respective the door hinges;

fastening the mounting plates of each of the door hinges on a respective portion of the L-shaped metal plate;

installing the stone clad door-panel by inserting the fastening plates of each of the door hinges into the respective cavities and fastening the fastening plates to the respective part of the metallic stone-clad panel.