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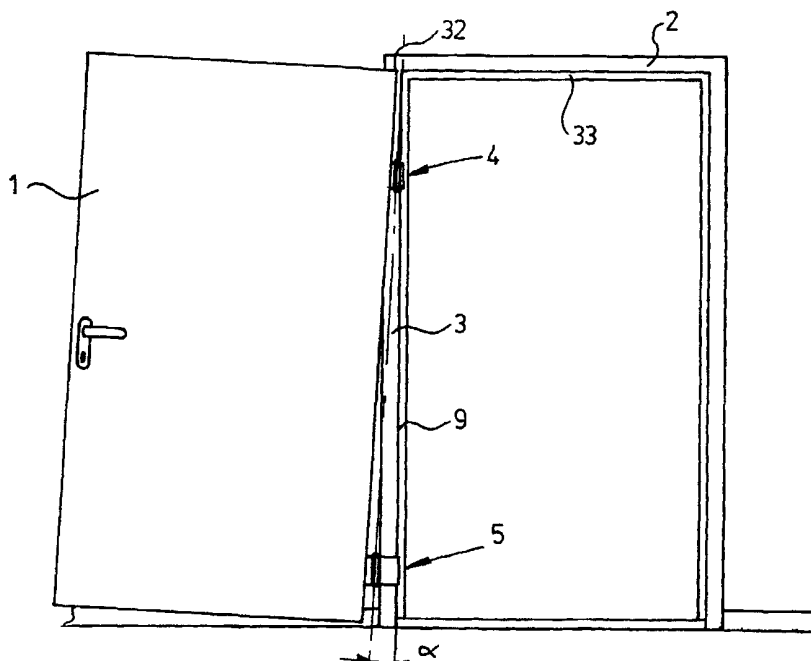
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(54) Title: SELF-CLOSING DOOR PROVIDED WITH A SELF-CLOSING HINGE MECHANISM, AND A SELF-CLOSING HINGE MECHANISM OF THIS TYPE



(57) Abstract: The invention relates to a self-closing door provided with a self-closing hinge mechanism, the hinge axis of which is inclined with respect to the vertical. As seen in the closed state of the hinge mechanism, the hinge axis runs substantially parallel to the plane defined by the door, and the hinge axis, as seen from the bottom upwards, slopes towards the door. The angle of the hinge axis with respect to the vertical is preferably less than 3°, such as for example 1°. The invention also relates to a self-closing hinge mechanism.



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Self-closing door provided with a self-closing hinge mechanism, and a self-closing hinge mechanism of this type

5 The present invention relates to a self-closing door provided with a self-closing hinge mechanism, the hinge axis of which is inclined with respect to the vertical.

A self-closing door of this type and a self-closing hinge mechanism intended for this door are known from US-A-4,233,708. The self-closing door known from this document, or more accurately the self-closing gate known from
10 this document, adopts a vertical position in the closed state. The axis of rotation of the hinge mechanism used in this case runs along the inside of the rectangular post which supports the gate. In this case, in the closed state the hinge axis intersects the plane which is covered by the gate. When the gate is opened, it adopts an inclined position, as a result of which it can close automatically under the influence of the
15 force of gravity when it is released. The self-closing hinge mechanism from US-A-4,233,708 has a number of drawbacks. One of the drawbacks is that if the hinge mechanism which is known from this document is used for a gate or door which, in a closed state, has to lie inside a frame, a relatively great lateral clearance is required between the gate/door and the vertical frame part which is remote from
20 the hinge mechanism. This clearance has to be large in particular at the bottom of the gate/door. This is because that longitudinal edge of the gate/door which is remote from the hinge mechanism, when the gate/door is swinging closed, moves not only towards the plane enclosed by the door frame but also towards the vertical jamb to which the hinge mechanism is attached. A further drawback of the hinge
25 mechanism which is known from US-A-4,233,708 is that it requires a relatively great frame depth (the dimension perpendicular to the plane enclosed by the frame) or that it is necessary to accept the hinge mechanism projecting forwards out of the frame. This problem will occur in particular in the case of a door, since a door will easily be two to three times as high as a gate. A third drawback is that a gate/the
30 door with a hinge mechanism as described in US-A-4,233,708, when the hinge mechanism is completely inside the door frame, can only be opened to an angle of 90°, since in this position the gate/door will come into contact with the inner surface of the vertical jamb. This problem could be overcome by positioning the hinge axis entirely in front of the frame, in which case the hinge mechanism
35 projects out of the frame. The drawback of this solution, however, is that when the gate/door is opened further than 90°, the gate/door will not close automatically, but rather will automatically open to its full extent. These drawbacks make the self-closing door mechanism described in US-A-4,233,708 particularly unsuitable for indoor use, and also unsuitable for use on outside doors of buildings.

The hinge axis of the self-closing hinge mechanism described in US-A-4,233,708, together with the vertical, encloses a plane which, as seen in the closed state of the hinge mechanism, is at right angles to the plane enclosed by the door in the closed state. The hinge axis of the hinge mechanism described in US-A-4,233,708 can therefore be considered to be composed of a principal vertical component and a single inclination component which is transverse with respect to the plane covered by the closed door. German laid-open specification 2,239,419 likewise discloses a hinge mechanism according to the preamble of Claim 1, which hinge mechanism differs from the hinge mechanism from US-A-4,233,708 in that the so-called inclination component is composed of two inclination sub-components, namely a first inclination sub-component which, as seen when the door is closed, is perpendicular to the plane covered by the door, and a second inclination sub-component which, as seen when the door is closed, runs parallel to the plane covered by the door.

Referring to Fig. 7 and 8 on page 7, third paragraph of DE-2,239,419, the hinge described in DE-2,239,419 is obtained by taking two hinges as shown in Fig. 1 and bending them through opposite, different angles. The first inclination sub-component is in this case attributable to the oppositely directed bending distances Y, each of different magnitude, and the second inclination sub-component is attributable to the bending distances X, the bending distance X in Fig. 7 being different from the bending distance X in Fig. 8, as can also be seen from DE-2,239,419, page 9, last two lines and page 10, top two lines. The drawbacks associated with the hinge mechanism described in US-A-4,233,708 also apply to the hinge mechanism described in German laid-open specification 2,239,419.

The object of the present invention is to provide a self-closing door provided with a self-closing hinge mechanism and to provide a self-closing hinge mechanism, which can be used to overcome the above drawbacks.

In a self-closing door of the type described, according to the invention this object is achieved by the fact that, as seen in the closed state of the hinge mechanism, the hinge axis runs substantially parallel to the plane defined by the door and, as seen from the bottom upwards, slopes towards the door. When the door is in the closed position, the hinge axis then has substantially no inclination component in the direction of the plane defined by the door. It thus becomes possible to position the door frame, in particular the vertical jamb thereof which is remote from the hinge mechanism, with little or no clearance, or at least with a clearance which is customary in conventional inside doors, indoor and outdoor doors. The final phase of the closing movement of the doors according to the invention, namely that of moving into the frame opening, in the door according to

the invention takes place virtually identically to with a conventional door.

Furthermore, a hinge mechanism of this type does not require any additional depth for the door frame. The angle α of the hinge axis with respect to the vertical will be greater than 0° . The angle of the hinge axis with respect to the vertical, according to the invention, need not be more than 5° , and will preferably be less than 3° . An angle of the hinge axis with respect to the vertical of approximately 2° or even smaller has proven to be more than adequate for the self-closing action. It has been found that even an angle of the hinge axis with respect to the vertical of approximately 1° or even less can suffice.

10 According to the invention, it is particularly advantageous if the door has a front surface, which faces towards the opening direction of the door, if, as seen in the closed state of the hinge mechanism, the hinge axis has an orthogonal projection onto the plane in which the front surface of the door lies, and if the said orthogonal projection touches the front surface at most in its top corner which is on the side of the hinge mechanism. This prevents the top corner of the door which is located on the side of the hinge mechanism, during the final phase of closing of the door, from describing a path which temporarily lies further inside the frame than in the final closed position. It thus becomes possible to use the door according to the invention in conventional door frames without having to adapt the said door frames, in particular in the vicinity of the corresponding top corner thereof. In this case, it should in particular be borne in mind that in the closed position close-fitting contact between the back surface of the door and a bearing surface of the frame which runs parallel thereto is desirable in order for the door to be well sealed with respect to the frame. For this purpose, incidentally, sealing strips are often used, so that the seal is ensured even more successfully. The measure according to the invention which has just been discussed ensures that, when sealing strips of this type are used, these sealing strips will not be damaged by the door.

 In order to ensure that the door is pushed to slightly in the closed position, according to the invention it is advantageous if, as seen in the closed state of the hinge mechanism, the hinge axis, as seen in the opening direction of the door, runs through or along the front of the plane in which the front surface of the door lies. Assuming that the door will be entirely recessed inside the door frame in the closed position, this in practice will mean that the hinge axis runs through or even in front of the plane which is covered by the visible surface of the door frame.

35 To withdraw the hinge mechanism from sight as far as possible, in particular in the closed position of the door, and also to make it relatively easy to use in conventional doors and door frames, in a self-closing door according to the invention, in which the hinge mechanism comprises one or more hinge assemblies, in which each hinge assembly comprises a door leaf which is attached to the door

and a frame leaf which is or can be attached to a door frame, and in which door leaf and frame leaf are connected to one another in such a manner that they can rotate about the hinge axis, it is advantageous if the door leaf is a leaf which is bent substantially at right angles, the second door-leaf part, which is remote from the hinge axis, being intended to be attached to a longitudinal edge surface of the door and the first door-leaf part of which, which adjoins the hinge axis, is intended to run parallel to the visible surface of the door frame when the door is in the closed position.

To allow the door and the hinge mechanism to be fitted easily and reliably, in a self-closing door according to the invention in which the hinge mechanism comprises one or more hinge assemblies, in which each hinge assembly comprises a door leaf which is attached to the door and a frame leaf which is or can be attached to the door frame, and in which door leaf and frame leaf are connected to one another in such a manner that they can rotate about the hinge axis, according to the invention it is advantageous if the frame leaf has a first frame-leaf part, which adjoins the hinge axis and is provided, at a distance from the hinge axis, with a second frame-leaf part which is substantially at right angles to the said first frame-leaf part, the frame-leaf part preferably being a leaf which is bent substantially at right angles. During fitting, the second frame-leaf part will bear as a stop against the inner surface of the door frame which is at right angles to the visible surface of the door frame.

The invention also relates to a self-closing hinge mechanism which is intended for a self-closing door according to the invention.

The invention relates in particular to a self-closing hinge mechanism for a door which is to be hung in a door frame and of the type in which the hinge axis is inclined with respect to the vertical, comprising one or more hinge assemblies each having a door leaf, which is to be attached to the door, and a frame leaf, which is to be attached to the door frame, the door leaf and the frame leaf being connected or connectable to one another in such a manner that they can rotate about the hinge axis, characterized in that the frame leaf is provided with a first frame-leaf part, which is intended to be positioned against, or at least along, the visible surface of the frame and adjoins the hinge axis, and in that the door leaf is provided with a first door-leaf part, which adjoins the hinge axis, in that in the closed state of the hinge assembly the first door-leaf part runs parallel to the first frame-leaf part and covers this first frame-leaf part on the side thereof which is remote from the frame. According to an advantageous embodiment which has already been explained above, it is then advantageous, according to the invention, if the frame leaf has a second jamb-leaf part which is bent at right angles along a fold line and is intended to be positioned against or at least along that section of the

door frame which lies inside the door passage. According to an advantageous embodiment which has likewise already been explained above, it is advantageous, according to the invention, if the door leaf is provided with a second door-leaf part which is bent at right angles and is intended to be attached to a longitudinal edge surface of the door.

The present invention will be explained in more detail below with reference to an exemplary embodiment which is illustrated in the drawing, in which:

Fig. 1 shows a diagrammatic front view of a self-closing door according to the invention, in the closed position;

Fig. 2 shows a front view of the door shown in Fig. 1, but now in the open position;

Fig. 3 shows a perspective view of a top hinge according to the invention, specifically the top hinge for the door shown in Fig. 1 and 2;

Fig. 4 shows a perspective view of a bottom hinge according to the invention, specifically the bottom hinge of the door shown in Figures 1 and 2; and

Fig. 5 shows an enlarged view of detail V from Fig. 1.

The figures show a door 1 with a front surface 31 which faces towards the opening direction and a door frame 2 with a vertical jamb 3 which bears the top hinge 4 and a bottom hinge 5. The hinges 4 and 5 have a common axis of rotation 7 which is at an angle α with respect to the vertical. This angle α is approximately 1° . When the door is in the closed position, the hinge axis 7 runs parallel to the plane which is covered by the door and, when referring to Fig. 1, runs parallel to the plane of the drawing. Referring to Figure 1 and 2, the hinge axis 7 therefore runs parallel to the plane of the drawing, at an angle α with respect to the vertical.

Figures 3 and 4 show a perspective view of the top hinge and the bottom hinge according to the invention, in the partially open state. In Fig. 3 and 4 (and to some extent also the other figures), 8 denotes the visible surface of the vertical jamb 3, and 9 denotes the surface which faces into the door opening, at right angles to the visible surface. The vertical longitudinal edge of the door 1, which in the closed position faces towards the inner surface 9 of the vertical jamb 3, is denoted by 6. The bearing surface against which the back panel of the door comes to bear when the door is closed and which is substantially at right angles to the inner surface 9 of the frame is denoted by 33.

The detail V from Fig. 1, which is shown in Fig. 5, illustrates that the hinge axis 7, or at least the orthogonal projection thereof onto the plane in which the front surface 31 of the door lies, does not cross the front surface 31 of the door. In the example shown, the hinge axis 7 touches the inside corner of the outer surface of the door frame. It should be noted that if appropriate it is possible for the

hinge axis 7, or at least the orthogonal projection thereof onto the plane in which the front surface 31 lies, touches the corner 32 of the front surface 31. Positioning the hinge axis 7 in such a way that at least its orthogonal projection onto a plane in which the front surface 31 of the door lies does not intersect this front surface (in
5 which case the said orthogonal projection would have two intersections with the peripheral contour of the front surface 31) ensures that the final phase of closing the door, namely the door moving into the frame, is virtually identical, down to the smallest detail, to a conventional door moving into the frame. In this embodiment, not only is it possible to use conventional frames (i.e. frames of conventional
10 dimensions), but also it is not necessary to adapt the shape of the conventional frame locally. A hinge mechanism according to the invention with a hinge axis 7 whose orthogonal projection onto the plane in which the front surface of the door will lie in the closed position at most touches the outer contour of the front surface 31 and does not intersect this outer contour is for this reason eminently suitable for
15 the so-called replacement market.

Referring to Fig. 3, the top hinge 4 comprises a frame leaf 11, 13, also referred to as jamb leaf 11, 13, which is attached or at least intended to be attached to the vertical jamb 3. The top hinge also comprises a door leaf 14, 16 which is rotatably attached to the frame leaf 11, 13 along the hinge axis 7 and, moreover, is
20 intended to be attached to the door 1. The frame leaf comprises a first frame-leaf part 13 which adjoins the hinge axis 7 and in the fitted state runs parallel to the visible surface 8 of the vertical jamb 3, preferably will bear against this surface, and a second frame-leaf part 11, which in the fitted state will bear against the inner surface 9 of the vertical jamb 3. The first frame-leaf part 13 and second frame-leaf
25 part 11 are connected to one another via a right-angled fold 12. The door leaf comprises a first door-leaf part 14, which adjoins the hinge axis 7, and a second door-leaf part 16. The first door-leaf part 14 and the second door-leaf part 16 are connected to one another via a right-angled fold 15. The second door-leaf part 16 is intended to support the door 1 by means of screws 10 or in some other way, and
30 will run parallel to the vertical longitudinal edge 6, preferably will bear against this edge or will be slightly recessed therein. In the closed position of the door, the second door-leaf part 16 will bear against the second frame-leaf part 11. The first door-leaf part 14 is intended to lie along or against the frame-leaf part 13 in the closed position of the door.

35 Referring to Fig. 4, the bottom hinge 5 comprises a frame leaf 21, 23, also referred to as the jamb leaf 21, 23, which is attached or at least intended to be attached to the vertical jamb 3. The bottom hinge 5 also comprises a door leaf 24, 26 which is rotatably attached to the frame leaf 21, 23 along the hinge axis 7 and moreover is intended to be attached to the door 1. The frame leaf comprises a first

frame-leaf part 23, which adjoins the hinge axis 7 and in the fitted position runs parallel to the visible surface 8 of the vertical jamb 3, preferably will bear against this surface, and a second frame-leaf part 21, which in the fitted position will bear against the inner surface 9 of the vertical jamb 3. The first frame-leaf part 23 and the second frame-leaf part 21 are connected to one another via a right-angled fold 22. The door leaf comprises a first door-leaf part 24, which adjoins the hinge axis 7, and a second door-leaf part 26. The first door-leaf part 24 and second door-leaf part 26 are connected to one another via a right-angled fold 25. The second door-leaf part 26 is intended to support the door 1 by means of screws or in some other way, in which situation the door-leaf part 26 will run parallel to the vertical longitudinal edge 6, preferably will bear against this edge or be slightly recessed therein. In the closed position of the door, the second door-leaf part 26 will bear against the second frame-leaf part 21. The first door-leaf part 24 is intended to rest along or against the frame-leaf part 23 in the closed position of the door.

As will be clear from Fig. 3 and 4, the higher the relevant hinge is located, the shorter the first frame-leaf part 13, 23 and the first door-leaf part 14, 24 thereof transversely to the hinge axis 7 will be. In particular, the distance between the hinge axis and the fold 12, 22 or the fold 15, 25 at the top of each hinge will in each case be shorter than at the bottom of the hinge.

If the angle α of the hinge axis 7 with respect to the vertical is 1° , the angle between the hinge axis 7 and the fold 12, 22 will also be 1° , and the angle between the hinge axis 7 and the fold 15, 25 will likewise be 1° .

The hinge is attached to the frame 3 and the door 1 by means of diagrammatically indicated screws 10.

As should be clear from Fig. 3 and 4, that part of the hinges which lies outside the door frame 1 will rest flat against the visible surface 8 of the vertical jamb 3, at least in the closed position of the door. Therefore, the hinges project scarcely if at all in the closed position of the door. If appropriate, the hinges 4 and 5 may be completely or almost completely recessed in the door frame.

In Fig. 1, the S diagrammatically indicates the clearance between the door and the door frame 2, which according to the present invention could be very small or even absent altogether, as is the case in conventional doors, and which in the hinge mechanism described in US-A-4,233,708 has to be relatively great, since otherwise the door or gate cannot be opened from the closed position or cannot move into the frame from the open position.

As will be clear to an average person skilled in the art, numerous variants to the invention as defined in the claims are conceivable within the scope of the said claims. For example, it is eminently possible and, with a view to the replacement market - in which the hinges of conventional doors with conventional

hinges are replaced - highly advantageous for the hinge itself to be designed in such a way that the hinge elements allow some adjustment/adaptation of the hinge axis in order to allow the hinge axes of the hinge elements used to be aligned. For this purpose, it is very possible to have recourse to the adjustable hinges described

5 in German laid-open specification 2, 239,419.

CLAIMS

1. Self-closing door (1) provided with a self-closing hinge mechanism (4, 5), the hinge axis (7) of which is inclined with respect to the vertical, characterized in that, as seen in the closed state of the hinge mechanism (4, 5), the hinge axis (7) runs substantially parallel to the plane defined by the door (1) and, as seen from the bottom upwards, slopes towards the door (1).
2. Self-closing door (1) according to Claim 1, characterized in that the door (1) has a front surface (31), which faces towards the opening direction of the door, in that, as seen in the closed state of the hinge mechanism (4, 5), the hinge axis (7) has an orthogonal projection onto the plane in which the front surface (31) of the door (1) lies, and in that the said orthogonal projection touches the front surface (31) at most in its top corner (32) which is on the side of the hinge mechanism (4, 5), and preferably does not cross the front surface.
3. Self-closing door (1) according to Claim 1 or 2, characterized in that the angle α of the hinge axis (7) with respect to the vertical is greater than 0° .
4. Self-closing door (1) according to one of the preceding claims, characterized in that the angle α of the hinge axis (7) with respect to the vertical (30) is less than 5° , preferably less than 3° .
5. Self-closing door (1) according to one of the preceding claims, characterized in that the angle α of the hinge axis (7) with respect to the vertical (30) is approximately 1° .
6. Self-closing door (1) according to one of the preceding claims, characterized in that, as seen in the closed state of the hinge mechanism (4, 5), the hinge axis (7), as seen in the opening direction of the door, runs through or along the front of the plane in which the front surface (31) of the door (1) lies.
7. Self-closing door (1) according to one of the preceding claims, in which the hinge mechanism comprises one or more hinge assemblies (4, 5), in which each hinge assembly (4, 5) comprises a door leaf (14, 16; 24, 36) which is attached to the door (1) and a frame leaf (11, 13; 21, 23) which is or can be attached to a door frame (3), and in which door leaf (14, 16; 24, 26) and frame leaf (11, 13; 21, 23) are connected to one another in such a manner that they can rotate about the hinge axis (7), characterized in that the door leaf (14, 16; 24, 26) is a leaf which is bent substantially at right angles, the second door-leaf part (16; 26), which is remote from the hinge axis (7), being intended to be attached to a longitudinal edge surface (6) of the door (1) and the first door-leaf part (14; 24) of which, which adjoins the hinge axis (7), is intended to run parallel to the visible surface (8) of the door frame (3) when the door (1) is in the closed position.

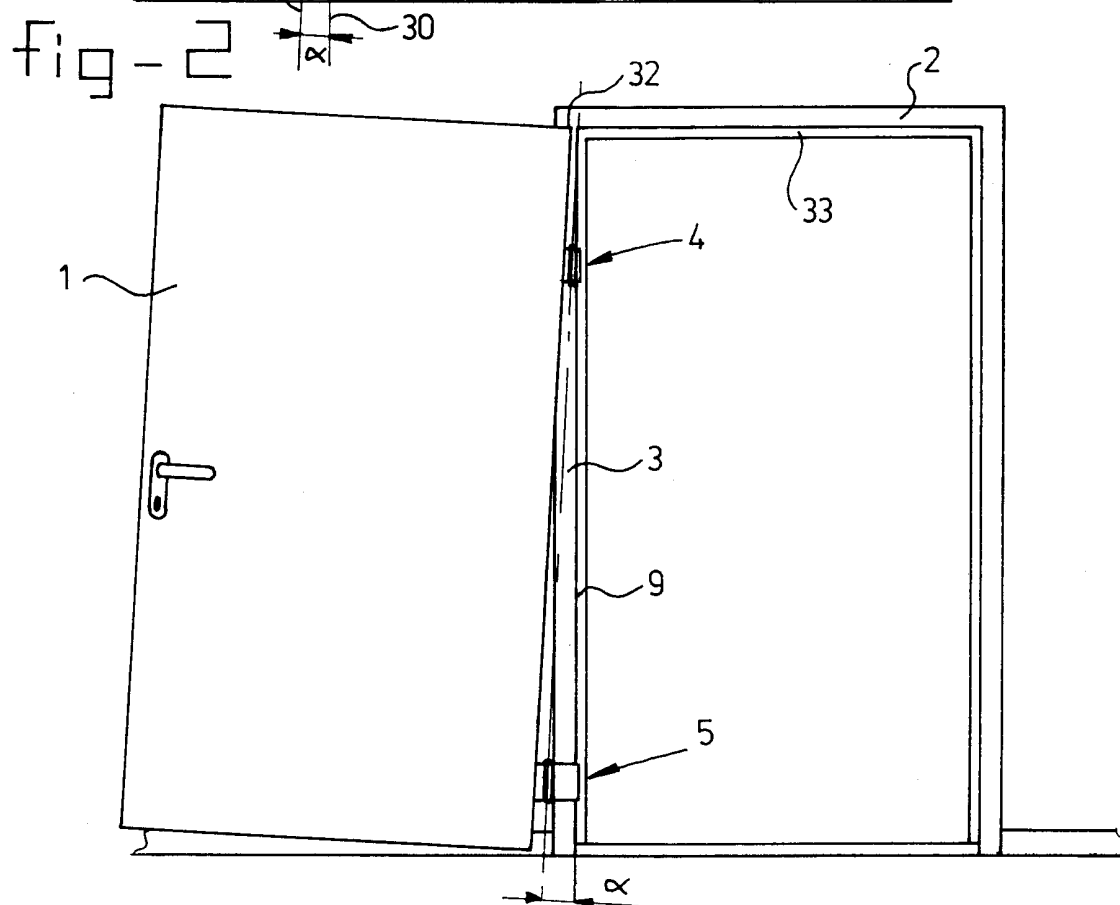
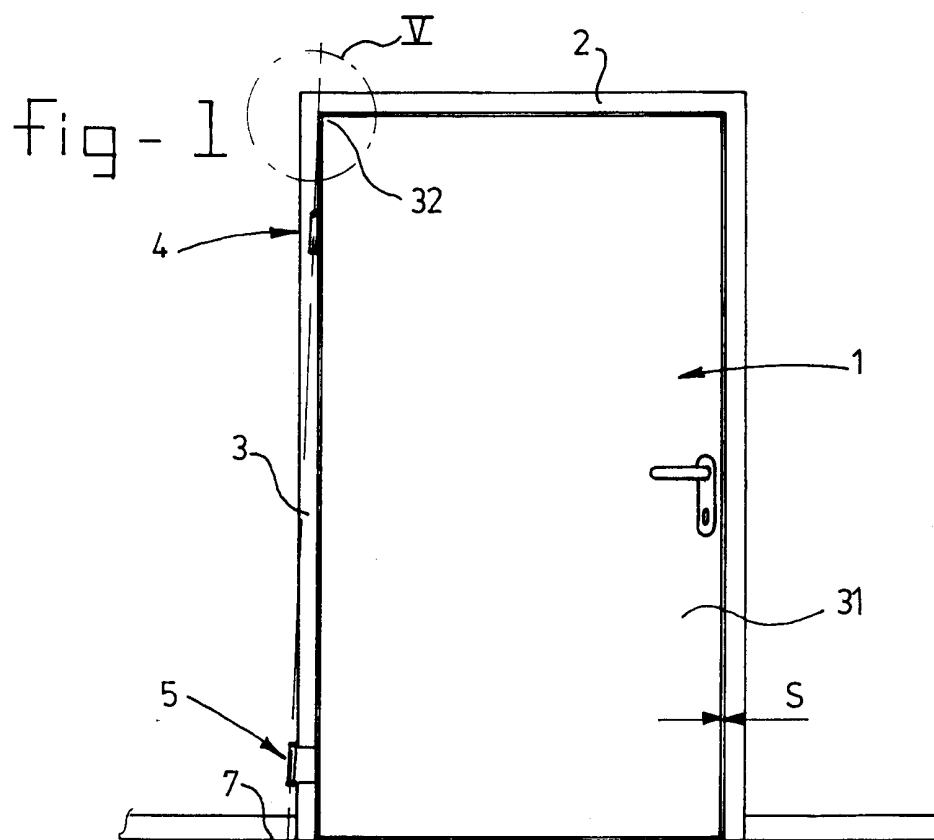
8. Self-closing door (1) according to one of the preceding claims, in which the hinge mechanism comprises one or more hinge assemblies (4, 5), in which each hinge assembly (4, 5) comprises a door leaf (14, 16; 24, 26) which is attached to the door (1) and a frame leaf (11, 13; 21, 23) which is or can be
5 attached to a door frame (3), and in which door leaf (14, 16; 24, 26) and frame leaf (11, 13; 21, 23) are connected to one another in such a manner that they can rotate about the hinge axis (7), characterized in that the frame leaf (11, 13; 21, 23) has a first frame-leaf part (13; 23), which adjoins the hinge axis (7) and is provided, at a distance from the hinge axis (7), with a second frame-leaf part (11; 21) which is
10 substantially at right angles to the said first frame-leaf part (13; 23), the frame leaf preferably being a leaf which is bent substantially at right angles.

9. Self-closing hinge mechanism (4, 5) intended for a self-closing door (1) according to one of the preceding claims.

10. Self-closing hinge mechanism for a door (1) which is to be hung in a
15 door frame (2) and of the type in which the hinge axis (7) is inclined with respect to the vertical (30), comprising one or more hinge assemblies (4, 5) each having a door leaf (14, 16; 24, 26), which it to be attached to the door, and a frame leaf (11, 13; 21, 23), which is to be attached to the door frame (3), the door leaf (14, 16, 24, 26) and the frame leaf (11, 13; 21, 23) being connected or connectable to one
20 another in such a manner that they can rotate about the hinge axis (7), characterized in that the frame leaf (11, 13; 21, 23) is provided with a first frame-leaf part (13, 23), which is intended to be positioned against, or at least along, the visible surface (8) of the frame (2) and adjoins the hinge axis (7), and in that the door leaf (14, 16; 24, 26) is provided with a first door-leaf part (14; 24), which adjoins the hinge axis
25 (7), in that in the closed state of the hinge assembly (4, 5) the first door-leaf part (14, 24) runs parallel to the first frame-leaf part (13; 23) and covers this first frame-leaf part (13; 23) on the side thereof which is remote from the frame (3).

11. Self-closing hinge mechanism according to Claim 10, characterized in that the frame leaf (11, 13; 21, 23) has a second jamb-leaf part (11; 21) which is
30 bent at right angles along a fold line (12) and is intended to be positioned against or at least along that section (9) of the door frame (3) which lies inside the door passage.

12. Self-closing hinge mechanism according to Claim 10 or 11, characterized in that the door leaf (14, 16; 24, 26) is provided with a second door-
35 leaf part (16, 26) which is bent at right angles and is intended to be attached to a longitudinal edge surface (6) of the door (1).



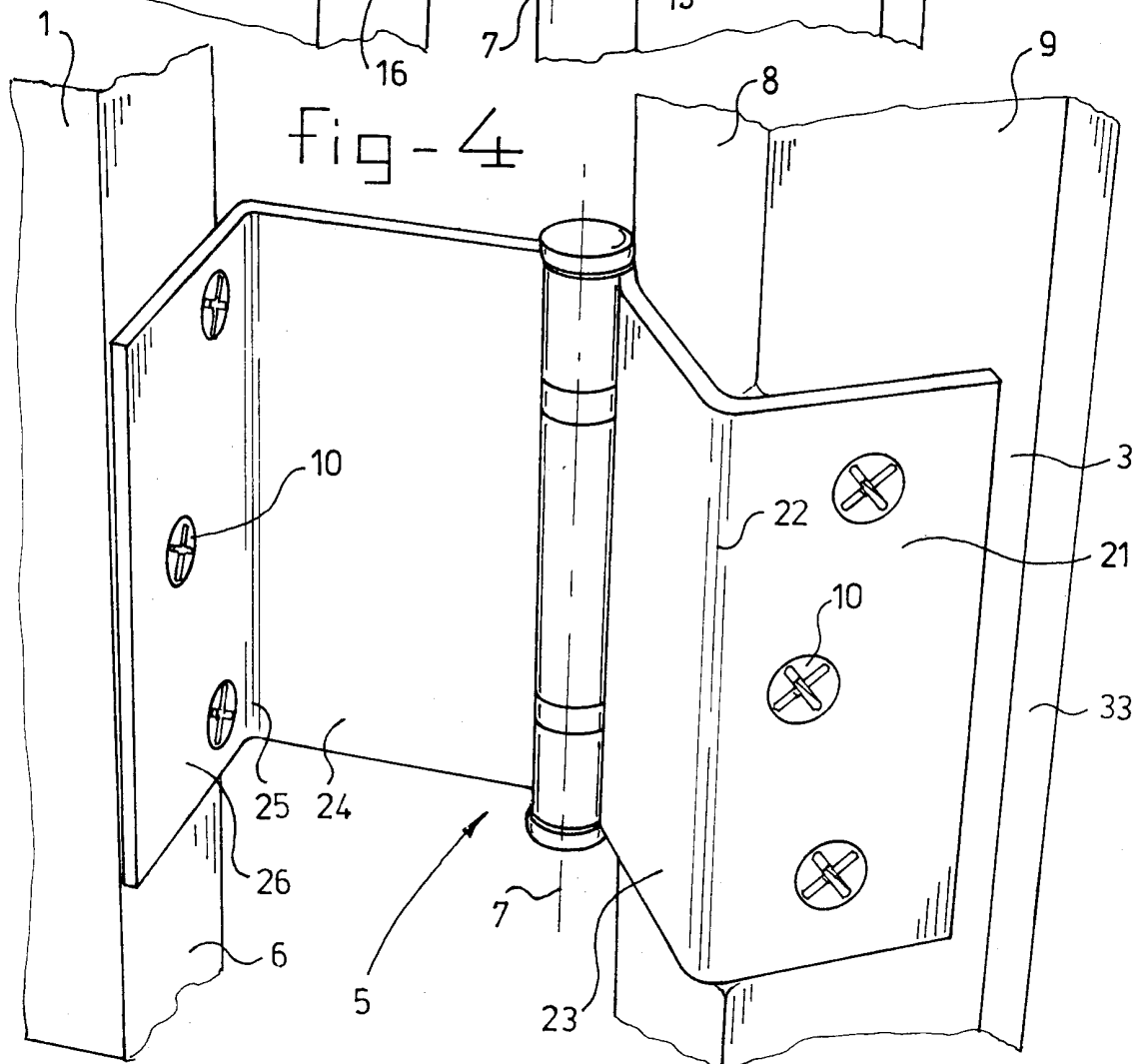
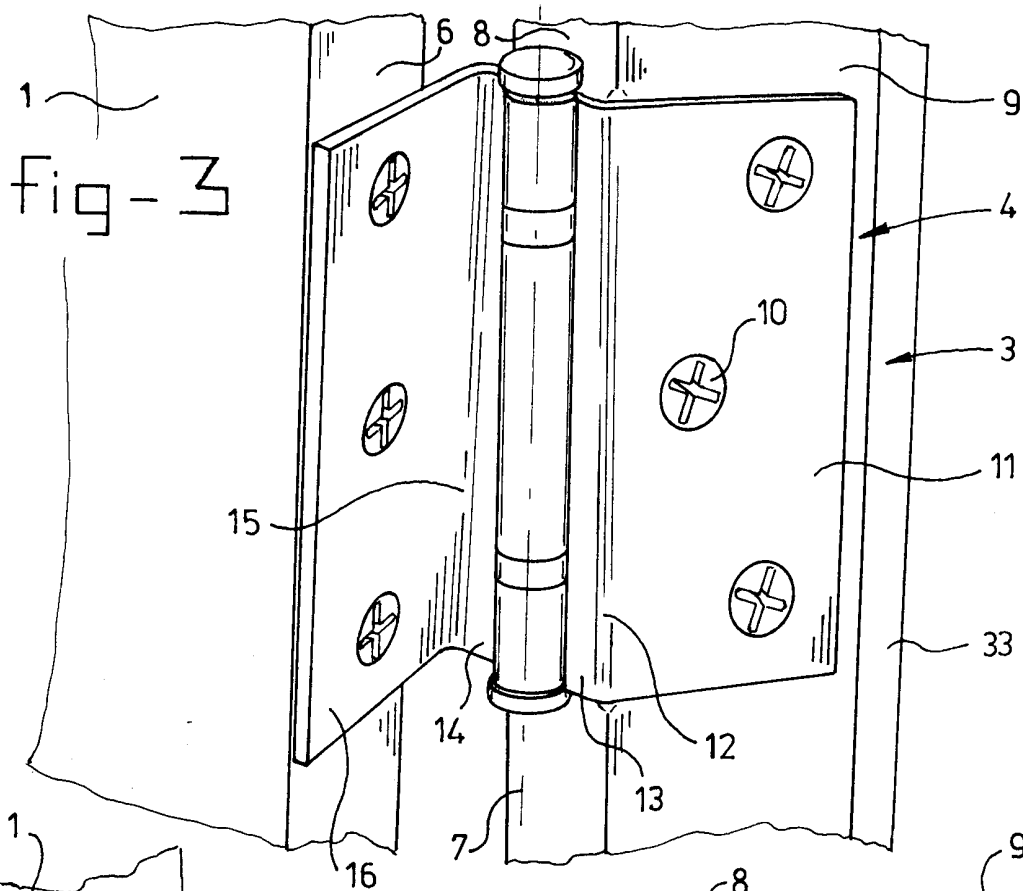
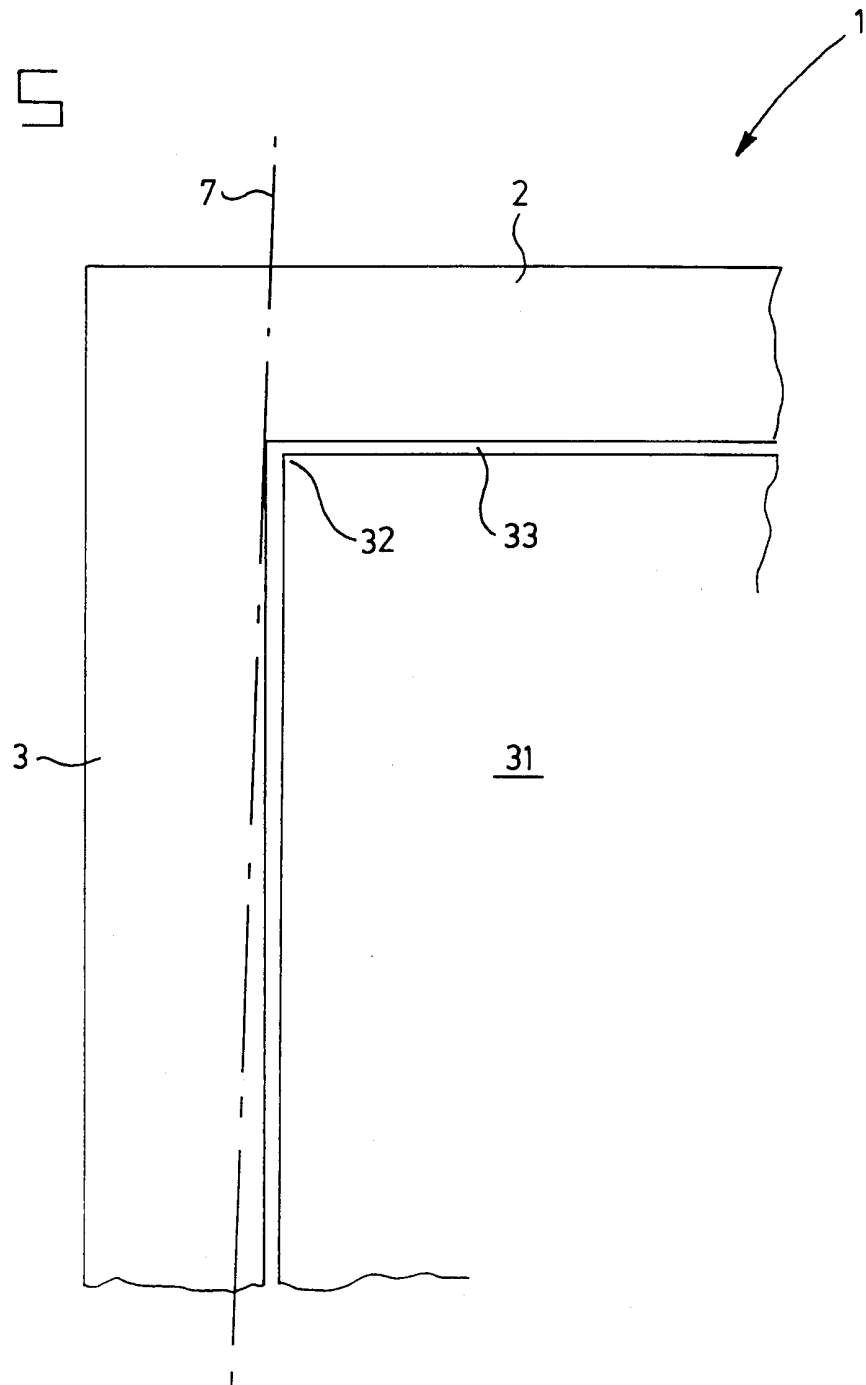


fig-5



INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E05F1/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E05F E05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 22 39 419 A (MAERTIN KLAUS PAUL) 15 February 1973 (1973-02-15) cited in the application	1-4, 6, 9
A	page 7, paragraph 3 page 8, line 2 page 9, last paragraph; figures	7, 8, 10-12
A	GB 2 117 040 A (BRITISH GATES AND TIMBER LIMIT) 5 October 1983 (1983-10-05) page 2, line 75 - line 115; figures	7, 8, 10-12
A	US 2 708 286 A (TOLLEFSON) 17 May 1955 (1955-05-17) column 1, line 17 - line 24; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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