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(54) Hinged access cover

(57) An access cover assembly comprising a cover member and an outer frame, said cover member comprising a generally rectangular inner frame having a so-called hinged edge along which the cover member pivots, two opposing side edges and a front edge said inner frame being adapted to be filled with an appropriate filling material such as screed or concrete, said cover member being pivotally mounted to said outer frame member by means of a two-link double pivot system comprising a first link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally

mounted to a fixed point on the cover member and a second link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member, said links being spaced apart along a side edge of the cover member, wherein two such double pivot systems are provided, one at each end of the hinged edge of the cover member, the two pivot systems working in mutual interrelationship with each other; and wherein the cover assembly further comprises a resilient means adapted to provide mechanical assistance in opening and closing the cover member.

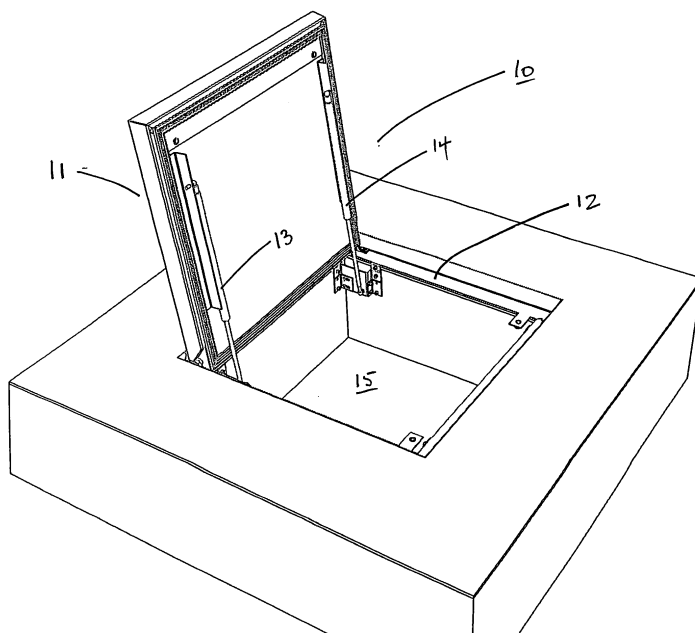


FIG 1

EP 1 626 130 A1

Description

Field of the Invention

[0001] The present invention relates to access covers. It is particularly applicable, but in no way limited, to access covers of the kind in which a cover member is pivotally mounted within a frame and wherein the cover member incorporates an inner frame intended to be filled with concrete or other appropriate filling material.

Background to the Invention

[0002] Heavy duty access covers are known *per se* and are used widely in the United Kingdom and around the world in a number of applications. For example, they are used as manhole covers and as chamber access covers where regular or intermittent access to the manhole or chamber is required. Typical applications include airports, factories, hospitals, hotels, offices, railway stations, schools, shopping centres and universities. Where these covers have to carry heavy traffic the depth of the cover may be up to 80 millimetres and much of this depth is filled with concrete or screed, optionally topped with a decorative surface such as tiles or a composite flooring material laid on top of the screed to match the surrounding floor.

[0003] To date these access covers have been of the lift in/lift out design as described in GB2145138, the entire text of which is incorporated herein by reference and which is intended to form an integral part of the present disclosure.

[0004] These access covers are generally held in the closed position by some form of locking bolt(s) or catch(es), and lifting blocks are provided to receive lifting keys which allow for manual or mechanical lifting of the cover. Typically this lifting is done by hand by two or more operatives working in a co-ordinated fashion to lift the cover clear of its frame and then to one side to reveal the chamber or manhole opening. However, The Manual Handling Operations Regulations 1992, as updated in 2002, which implement European Directive 90/269/EEC, now place strict obligations on employers and manufacturers to carry out risk assessments where any lifting task is involved and to reduce weights to be lifted to a minimum where it is practical to do so. Thus Health & Safety Legislation is now such that manual lifting of such weights, and these covers can be exceptionally heavy, weighing up to around 180 Kg/m², is no longer advised.

[0005] It is an object of the present invention to overcome or mitigate the above problems and to provide an access cover having a hinged arrangement and where the cover has a counterbalanced construction, or which is motorised, and which may be opened safely by one person.

Summary of Invention.

[0006] According to a first aspect of the present invention there is provided an access cover assembly comprising a cover member and an outer frame, said cover member comprising a generally rectangular inner frame having a so-called hinged edge along which the cover member pivots, two opposing side edges and a front edge, said inner frame incorporating a tray adapted to be filled with an appropriate filling material such as screed or concrete, said cover member being pivotally mounted to said outer frame member by means of a two-link double pivot system comprising a first link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member and a second link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member, said links being spaced apart along a side edge of the cover member, wherein two such double pivot systems are provided, one at each end of the hinged edge of the cover member, the two pivot systems working in mutual interrelationship with each other; and wherein the cover assembly further comprises a biasing means adapted to provide mechanical assistance in opening and closing the cover member.

[0007] This two link double pivot system avoids the need to have a hinge extending along the hinged edge of the cover and this arrangement provides a strong, counterbalanced access cover.

[0008] Preferably the biasing means comprises a resilient biasing means such as a spring.

[0009] In a particularly preferred embodiment the biasing means comprises a gas spring. Gas springs of various forces are commercially available.

[0010] Preferably two springs are provided, one on each side edge of the cover member.

[0011] In an alternative embodiment the biasing means comprises a drive means such as an electric motor with an associated gearbox. In this case the springs or resilient biasing means can be dispensed with and the cover member is raised and lowered at the touch of a button or other instruction. The drive means may also comprise a hydraulic pump. Hydraulically activated opening and closing doors are known *per se* so this type of technology, as known to the hydraulics expert, may be incorporated into these covers.

[0012] Preferably the first and second links are of substantially dissimilar lengths, the length of the link located closest to the hinged edge of the cover member, being termed the first link, being shorter than the link located farthest away from the hinged edge of the cover member, being termed the second link.

[0013] Preferably said cover member is adapted to move between a closed configuration wherein the cover member is accommodated substantially within the outer frame and an open configuration in which the cover member is substantially perpendicular with respect to the outer

frame, a bearing surface on the first link contacting a bearing surface on the outer frame when the cover member is in the open configuration.

[0014] Preferably the cover member moves between the closed configuration and the open configuration the first link moves through an arc of substantially 90° i.e. the angle of rotation of the first link corresponds substantially to the angle of rotation of the cover member with respect to the outer frame.

[0015] Preferably the cover member moves between the closed configuration and the open configuration the second link moves through an angle of substantially less than 90°.

[0016] Preferably the front edge of said cover member is angled away from the outer frame to prevent the front edge of the cover from engaging the outer frame during opening and closing of the cover.

[0017] Advantageously lock down means such as lock down points are provided in the outer frame to enable the cover member to be secured to the outer frame. Where the biasing means comprises a drive means such as an electric motor, the lock down means may comprise an electronic lock eg. associated with the electric motor.

[0018] According to a second aspect of the invention there is provided a method of pivotally connecting two components said components comprising a substantially rectangular cover member having a hinged edge and an outer frame providing a seat for said cover member said method comprising providing a two-link double pivot system connecting the cover member to the outer frame.

[0019] Preferably said two-link double pivot system comprises a first link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member and a second link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member, said links being spaced apart along a side edge of the cover member, wherein two such double pivot systems are provided, one at each end of the hinged edge of the cover member, the two pivot systems working in mutual interrelationship with each other.

[0020] Preferably said method also comprises providing a biasing means adapted to provide mechanical assistance in opening and closing the cover member.

[0021] Preferably the biasing means comprises a resilient biasing means such as a spring, and preferably a gas spring.

[0022] Preferably two springs are provided, one on each side edge of the cover member.

[0023] Alternatively, the biasing means may comprise a drive means such as an electric motor with an associated gearbox.

[0024] Preferably the first and second links are of substantially dissimilar lengths, the length of the link located closest to the hinged edge of the cover member, being the first link, being shorter than the link located farthest away from the hinged edge of the cover member, being

the second link.

[0025] Preferably said cover member is adapted to move between a closed configuration wherein the cover member is accommodated substantially within the outer frame and an open configuration in which the cover member is substantially perpendicular with respect to the outer frame.

[0026] Preferably when the cover member moves between the closed end and the open configuration the first link moves through an arc of substantially 90° i.e. the angle of rotation of the first link corresponds substantially to the angle of rotation of the cover member with respect to the outer frame.

[0027] Preferably when the cover member moves between the closed configuration and the open configuration the second link moves through an angle of substantially less than 90°.

Brief Description of the Drawings

[0028] In order that the present invention may be readily understood, it will now be described by way of example only, with reference to the following drawings in which:-

Figure 1 illustrates a perspective view of a manhole cover according to a first embodiment of the present invention in the open configuration and set into a surface;

Figure 2 shows a perspective view of the access cover and outer frame of the embodiment shown in Figure 1;

Figures 3, 4 and 5 show side elevations of the embodiment shown in Figure 2 in fully open, partly open and closed configurations respectively;

Figures 6, 7 and 8 show side elevations of a second embodiment of the present invention in fully open, partly opened and closed configurations respectively;

Figures 9, 10 and 11 show the pivot detail of the above embodiments in fully open, partly open and closed configurations respectively;

Figure 12 illustrates a perspective view of an access cover, and outer frame in its closed configuration showing the edge and corner details;

Figure 13 illustrates a cross-section showing an edge detail of the access cover and the outer frame; Figures 14 and 15 illustrate typical dimensional details for the first embodiment and the second embodiment respectively.

Description of the Preferred Embodiments

[0029] Embodiments of the present invention will now be described by way of example only. These examples are the best ways currently known to the Applicant of putting the invention into practice, but they are not the only ways in which this could be achieved.

[0030] Referring to Figure 1, this shows an access cov-

er assembly, generally shown as 10, in an open configuration and set into a surface. This surface is typically a floor slab but it will be understood that these covers have a wide application both for internal and external use to cover manholes, ducts, chambers and the like. Figure 1 illustrates a cover member 11 pivotally connected to an outer frame 12 with gas springs 13, 14 one at each end of the hinged side of the cover, connecting the cover member to the frame. The outer frame is set into an aperture in the floor and is set below the level of the top of the floor or recessed into the floor to allow for the thickness of the cover member. In this way the top of the finished level of the cover member is level with the top of the surrounding floor. Examples of the depth of the cover member and suitable fill materials are described below.

[0031] The access cover assembly of Figure 1 is shown in clearer detail in Figure 2 where the floor has been omitted. The assembly is generally rectangular in shape and in this context the term "rectangular" has a very broad meaning. It includes a "square" shape and also includes quadrilateral shapes in which the opposing sides need not necessarily be parallel.

[0032] The outer frame is adapted to be installed into the base concrete foundation and around the perimeter of an aperture in a floor. A variety of fixing methods are possible such as anchor lugs extending outwardly from the outer frame into the structure of the floor. Alternatively, the outer frame may be secured to the side of the aperture using conventional screw or bolt fixings.

[0033] The outer frame is formed from four lengths of angle joined together at the corners. Typically the outer frame is formed from a metal such as stainless steel or aluminium and the lengths joined by welding or by proprietary mitre fixings. Welding is preferred because of the strength and durability of the finished joint. Materials other than metal can be used if the application requires and materials such as plastics or fibre-filled composites may be employed. The material will be selected by the materials specialist and any material with sufficient strength and durability and acceptable physical appearance, bearing in mind that the top edge of the frame will be visible in the finished floor, can be used.

[0034] The cover member 11 is formed from an inner rectangular frame 18 closed by a cover frame base and which is filled with concrete or other appropriate filling material to form a cover member which fits closely within the outer frame. The filling material can stop short of the desired finish level and can be overlaid with a floor covering such as ceramic tiles, marble, terrazzo, resin, parquet or the like. The inner rectangular frame is, similar to the outer frame, formed from four lengths of angle.

[0035] Seals 20 set in a seal housing 21 are provided in the bottom of the cover member where it contacts the outer frame.

[0036] In use the cover member moves between a closed configuration, shown in Figure 5, in which the cover member is accommodated substantially within the out-

er frame and an open configuration, shown in Figure 3, in which the cover member is substantially perpendicular with respect to the outer frame.

[0037] Thus far the construction is similar to known access cover assemblies. However, in this invention the cover member is pivotally mounted to the outer frame in a novel way. It will be appreciated that, due to the depth of the cover member 11 and the outer frame 12, the close fit required between the two and the sealing contact required between the seal 20 and the outer frame 12, it is not a simple matter to hinge the two components together. This is because any pivotal movement between the cover member and the outer frame must be such as to provide clearance between the two components. A simple hinge arrangement along the so-called hinged edge 30 of the cover member would not be practical because the front edge of the cover member would bind against the outer frame. Because of the depth of these load bearing covers, the front face of the cover member would need to be steeply tapered away from the face of the outer frame in order to prevent binding. The result of this is that the lip of the outer frame on which the cover member rests has to be increased in width. This reduces the workable size of the aperture covered by the access cover assembly. Any reduction in aperture size is highly undesirable.

[0038] In addition, a hinge running along the hinged edge of the cover member would be both unsightly and liable to damage by traffic passing over the cover. The aesthetic appearance of these covers is an important factor in the minds of those specifying and purchasing them. Such covers are often placed in public places where they are highly visible. Similarly, a simple pivot between the side walls of the cover member and the outer frame along an axis parallel with and close to the wall of the outer frame but spaced below the upper co-operating edges of the cover and the frame would also not be practical because, whilst the hinge would not be visible, the co-operating edges would bind against each other.

[0039] Instead, a two-link double pivot systems has been developed as shown in Figures 9 to 11, which overcomes these problems, and which also allows for a counterbalanced action making the cover member easy and safe to open and close.

[0040] Referring to Figure 11, this shows the corner hinge detail of a cover member 11 inside an outer frame 12. A first link 32 has a first end of the link pivotally mounted around a pivot point 33 on the outer frame. The second end of this link is pivotally mounted around a pivot point 34 on the frame of the cover member. The action and movement of these pivots is constrained by a second link 35 which has a first end pivotally mounted around a pivot point 36 on the outer frame. The second end of this second link is pivotally mounted around a pivot point 37 on the frame of the cover member.

[0041] The first and second links are spaced apart from each other along the side edge of the outer frame by a pre-determined distance, the first link being closest to

the hinged edge of the cover. The first link is also shorter in its length than the second link i.e. the distance between pivot points 33 and 34 is less than the distance between the pivots points 36 and 37. The first link has a bearing surface 38 adapted to bear on a corresponding bearing surface 39 on the outer frame when the cover member is in its open configuration. This, and the gas springs described below, prevent the cover from opening beyond a certain point. In this example approximately 5° past vertical.

[0042] Importantly, the second link 35 is "C" shaped in its profile, that is to say the width of the link viewed in a direction perpendicular to the plane of Figure 11 is narrower in the centre portion of the link than it is at the two pivot ends. This arrangement means that the pivot point 34 nests into the body of the link 35 when the cover is in the open configuration. This enables the two links to be positioned closer together than might otherwise have been the case and leads to a more compact pivot assembly. A mirror image of this pivot assembly is provided on the opposite side edge at the other end of the hinged edge of the cover. These two pivot assemblies operate in mutual interrelationship with each other.

[0043] The relative size and shape of the pivot links 32 and 35, particularly the "C" shaped profile of the pivot link 35 positioned furthest from the hinged edge, and the relative positions of the pivot points 33, 34, 36 and 37 with respect to each other, results in the relative movement of these two pivot links with respect to one another as shown in the opening and closing sequence features in Figures 11 to 9 inclusive. It will be appreciated that the cover member is constrained to move down and away from the top hinged edge of the outer frame as it opens to prevent the edge of the frame and the edge of the cover from binding together. When the cover member is in its fully open position, ie approximately 5° past vertical, the hinged edge of the top of the cover member comes to rest well or substantially below level of the top of the outer frame. That is to say the hinged edge of the top of the cover member comes to rest substantially below the finished level of the surrounding surface. This sequence is also shown in Figures 3, 4 and 5 which show the gas springs in more detail.

[0044] Gas springs 13 and 14 are provided which act as a resilient biasing means to counterbalance the weight of the cover. One end 41 of the gas spring 13 is pivotally fixed to the cover member around pivot point 41. The other end 42 of the gas spring 13 is pivotally mounted on an outer frame support bracket 43 attached to the aperture wall. Equivalent fixing points are provided on the other gas spring 14. The force exerted by the gas springs is calculated by the designer to provide sufficient force to make opening and closing the cover an operation that can be carried out easily and safely by a single operative. Gas springs of an appropriate type are available from Dictator Engineering Ltd, Inga House, Northdown Business Park, Lenham, Kent MC17 2DL, England.

[0045] The introduction of one or more gas springs into

the arrangement together with the respective bearing surfaces 38 and 39 brings a further unexpected advantage. It is no longer necessary to include a notched articulated lever in the pivot combination in order to prevent the open cover from going substantially past vertical. This new arrangement is therefore much safer than any prior art pivot assemblies.

[0046] It will be appreciated the gas springs are just one convenient form of resilient biasing means which could be used for this purpose. Coil springs or leaf springs could also be employed.

[0047] A second embodiment is illustrated in Figures 6, 7 and 8. This embodiment uses shorter gas springs 53 and 54 because the cover member is smaller in its front to back dimension than the cover member in the embodiment shown in Figures 3, 4 and 5.

[0048] The hinge assemblies in this invention are particularly compact and are contained within small recesses 61 and 62 in the cover member as shown in Figure 12. These recesses are covered in use with metal plates to match the edge of the outer frame and the edge of the cover assembly. They are thus located away from, and protected from damage from passing traffic.

[0049] The front edge detail of the cover assembly is shown in more detail in Figure 13. The front edge 23 of the cover member 11 is tapered slightly, to create sufficient clearance between the front edge of the cover member and the outer frame to allow for the initial movement of the cover member as it opens. A threaded lifting block 26 is provided in the cover member together with associated socket head securing screw 27 and stainless steel sock 28. This arrangement enables the cover member to be secured in place and provides a means of opening the cover when access is required.

[0050] Typically dimensions for an access cover assembly of this type are shown in Figures 14 and 15 which correspond to the first and second embodiments respectively. These dimensions are given by way of example only and are not intended to be limiting.

[0051] This novel pivot arrangement provides the opportunity to motorise the opening and closing of the cover member. Thus in a further embodiment there is provided a biasing means adapted to open and close the cover member without requiring manual lifting by an operator. The biasing means may take the form of an electric motor (not shown) which acts as a drive means to open and close the cover member. The motor thus acts as an electric actuator. A switch is provided to activate the motor and the switch may be manually activated or activated by remote control. The motor acts through a gearbox and clutch assembly in conventional fashion.

[0052] It will also be appreciated that the electric motor could be replaced by a hydraulic pump using a liquid or a gas as the hydraulic fluid. In practice, incorporating a hydraulic pump may be a technically simpler and less complex method of operation, since it is possible to hydraulically operate a gas spring of the type shown in Figures 1 to 8. A switch mechanism is still required to activate

the hydraulic pump to raise or lower the cover as required.
[0053] In the case of an electric or hydraulic actuator, the lock down means may be an electronic lock associated with the electric or hydraulic actuator rather than a mechanical lock down means as shown in Figure 13. This has the advantage that no additional penetrations through the filling material in the cover member are required. The lock down means shown in Figure 13 are prone to filling up with dirt and debris and are also prone to damage by passing traffic. Dispensing with a visible lock down means is therefore a positive advantage.

Claims

1. An access cover assembly comprising a cover member and an outer frame, said cover member comprising a generally rectangular inner frame having a so-called hinged edge along which the cover member pivots, two opposing side edges and a front edge, said inner frame incorporating a tray adapted to be filled with an appropriate filling material such as screed or concrete, said cover member being pivotally mounted to said outer frame member by means of a two-link double pivot system comprising a first link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member and a second link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member, said links being spaced apart along a side edge of the cover member, wherein two such double pivot systems are provided, one at each end of the hinged edge of the cover member, the two pivot systems working in mutual interrelationship with each other; and wherein the cover assembly further comprises a biasing means adapted to provide mechanical assistance in opening and closing the cover member.
2. An access cover assembly as claimed in Claim 1 wherein biasing means comprises a resilient biasing means such as a spring.
3. An access cover assembly as claimed in Claim 1 or Claim 2 wherein the biasing means comprises a gas spring.
4. An access cover assembly as claimed in Claim 2 or Claim 3 wherein two springs are provided, one on each side edge of the cover member.
5. An access cover assembly as claimed in Claim 1 wherein the biasing means comprises a drive means.
6. An access cover assembly as claimed in Claim 5 wherein said drive means comprises a motor.
7. An access cover assembly as claimed in Claim 6 wherein said drive means comprises an electric motor together with an associated gearbox.
8. An access cover assembly according to any preceding claim wherein the first and second links are of substantially dissimilar lengths, the length of the link located closest to the hinged edge of the cover member, being termed the first link, being shorter than the link located farthest away from the hinged edge of the cover member, being termed the second link.
9. An access cover according to any preceding claim wherein said cover member is adapted to move between a closed configuration wherein the cover member is accommodated substantially within the outer frame and an open configuration in which the cover member is substantially perpendicular with respect to the outer frame, a bearing surface on the first link contacting a bearing surface on the outer frame when the cover member is in the open configuration.
10. An access cover assembly as claimed in Claim 9 wherein when the cover member moves between the closed configuration and the open configuration the first link moves through an arc of substantially 90° i.e. the angle of rotation of the first link corresponds substantially to the angle of rotation of the cover member with respect to the outer frame.
11. An access cover as claimed in Claim 10 wherein when the cover member moves between the closed configuration and the open configuration the second link moves through an angle of substantially less than 90°.
12. An access cover assembly according to any preceding claim wherein the front edge of said cover member is angled away from the outer frame to prevent the front edge of the cover from engaging the outer frame during opening and closing of the cover.
13. An access cover assembly according to any preceding claim wherein one or more lock down means are provided to enable the cover member to be secured to the outer frame in its closed configuration.
14. An access cover assembly according to Claim 13 wherein said lock down means comprises one or more lock down points located in the outer frame.
15. An access cover assembly according to Claim 13, when dependent on Claim 7, wherein said lock down means comprises an electronic lock associated with the electric motor.
16. A method of pivotally connecting two components

said components comprising a substantially rectangular cover member having a hinged edge and an outer frame providing a seat for said cover member said method comprising providing a two-link double pivot system connecting the cover member to the outer frame.

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17. A method according to Claim 16 wherein said two-link double pivot system comprises a first link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member and a second link having a first end pivotally mounted to a fixed point on the outer frame and a second end pivotally mounted to a fixed point on the cover member, said links being spaced apart along a side edge of the cover member, wherein two such double pivot systems are provided, one at each end of the hinged edge of the cover member, the two pivot systems working in mutual interrelationship with each other.
18. A method according to Claim 16 or Claim 17 wherein said method also comprises providing a biasing means adapted to provide mechanical assistance in opening and closing the cover member.
19. A method according to Claim 18 wherein the biasing means comprises resilient biasing means such as a spring, and preferably a gas spring.
20. A method according to Claim 19 wherein two springs are provided, one on each side edge of the cover member.
21. A method according to Claim 18 wherein said biasing means comprises a drive means.
22. A method according to Claim 21 wherein said drive means comprises a motor, such as an electric motor, together with an associated gearbox.
23. A method according to any of Claims 16 to 22 inclusive wherein the first and second links are of substantially dissimilar lengths, the length of the link located closest to the hinged edge of the cover member, being the first link, being shorter than the link located farthest away from the hinged edge of the cover member, being the second link.
24. A method according to any of Claims 16 to 23 inclusive wherein said cover member is adapted to move between a closed configuration wherein the cover member is accommodated substantially within the outer frame and an open configuration in which the cover member is substantially perpendicular with respect to the outer frame.
25. A method according to Claim 24 wherein when the

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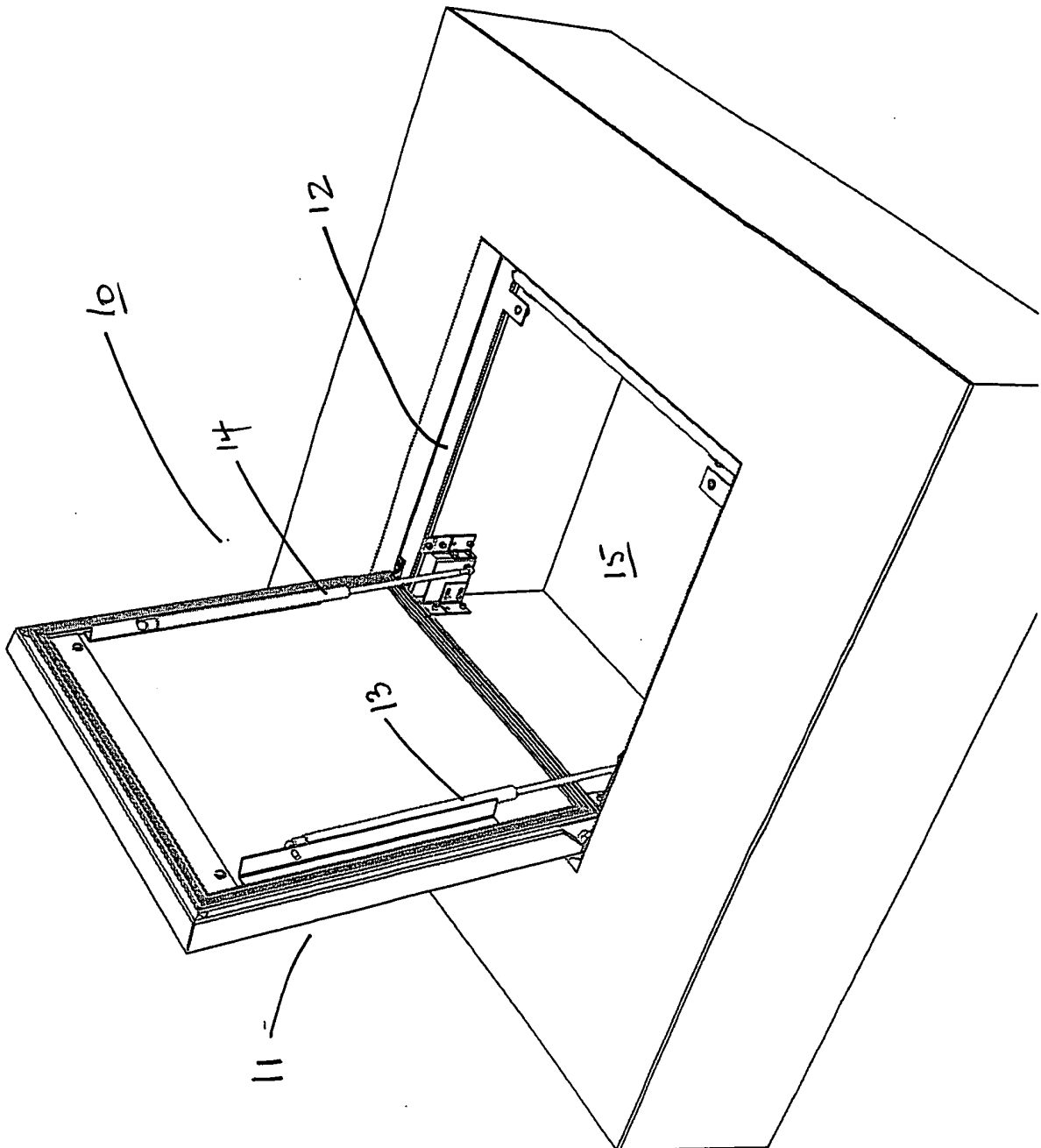
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cover member moves between the closed end and the open configuration the first link moves through an arc of substantially 90° i.e. the angle of rotation of the first link corresponds substantially to the angle of rotation of the cover member with respect to the outer frame.

26. A method according to Claim 25 wherein when the cover member moves between the closed configuration and the open configuration the second link moves through an angle of substantially less than 90°.

FIG 1



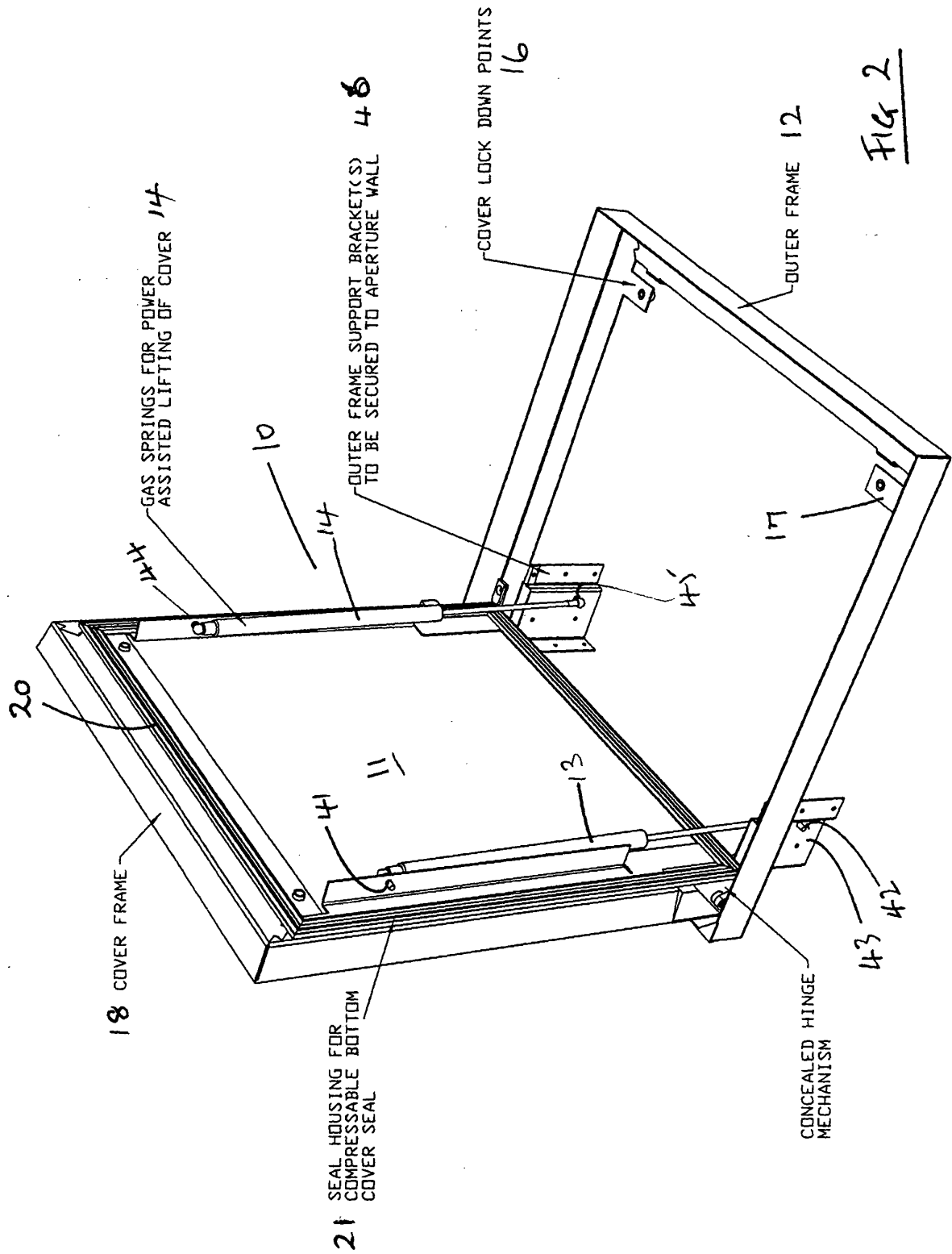


FIG 3

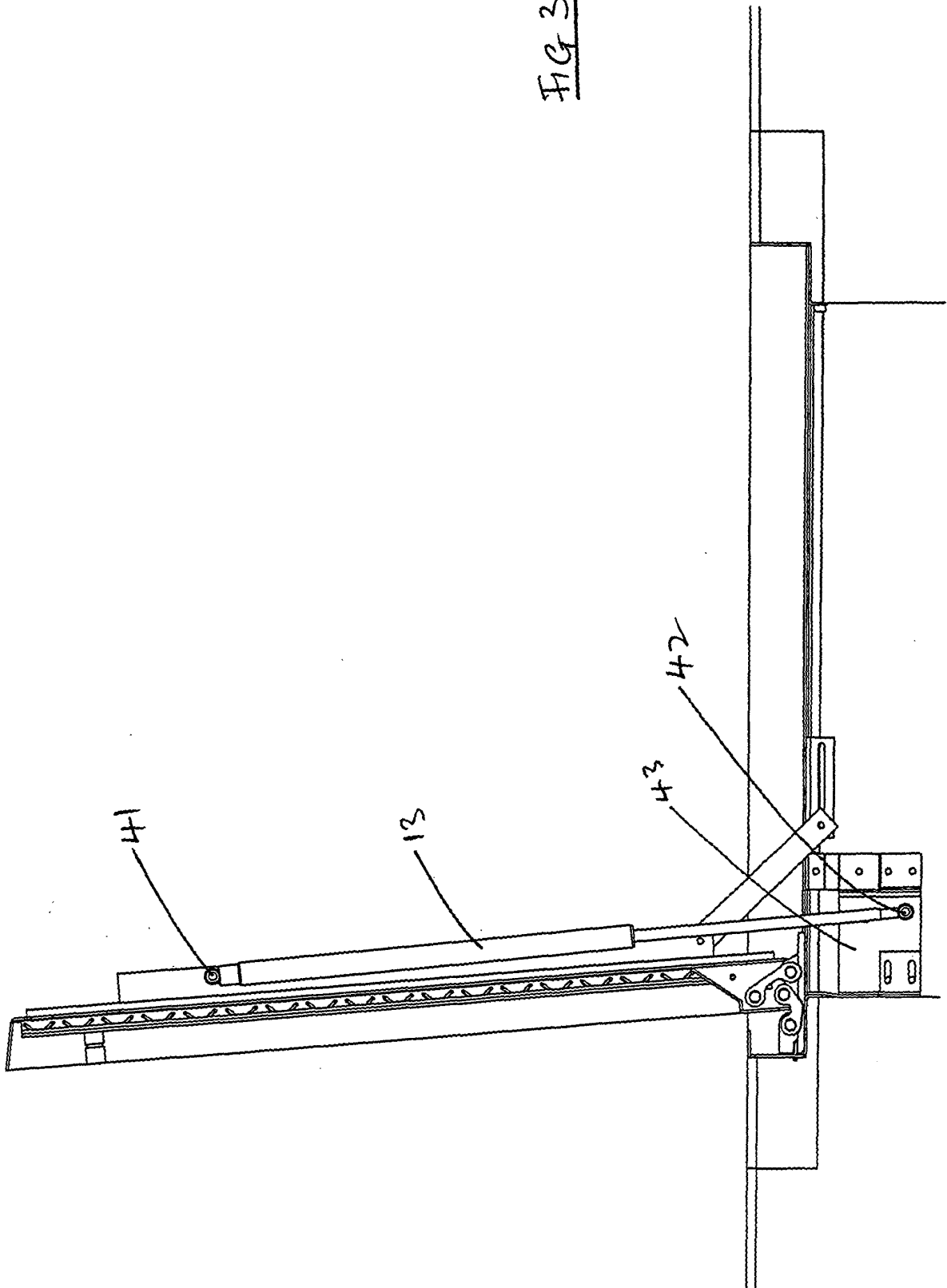
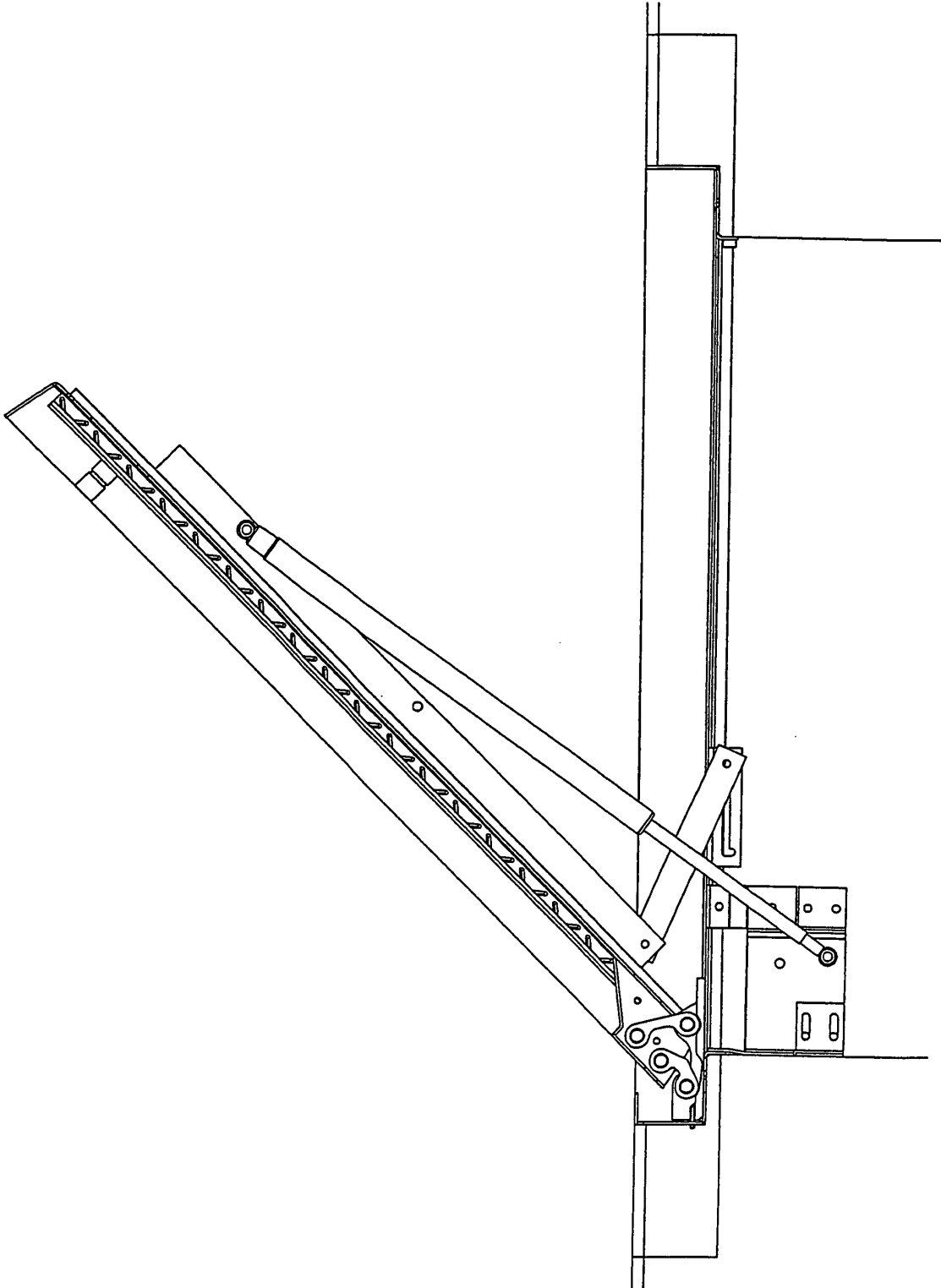


FIG 4



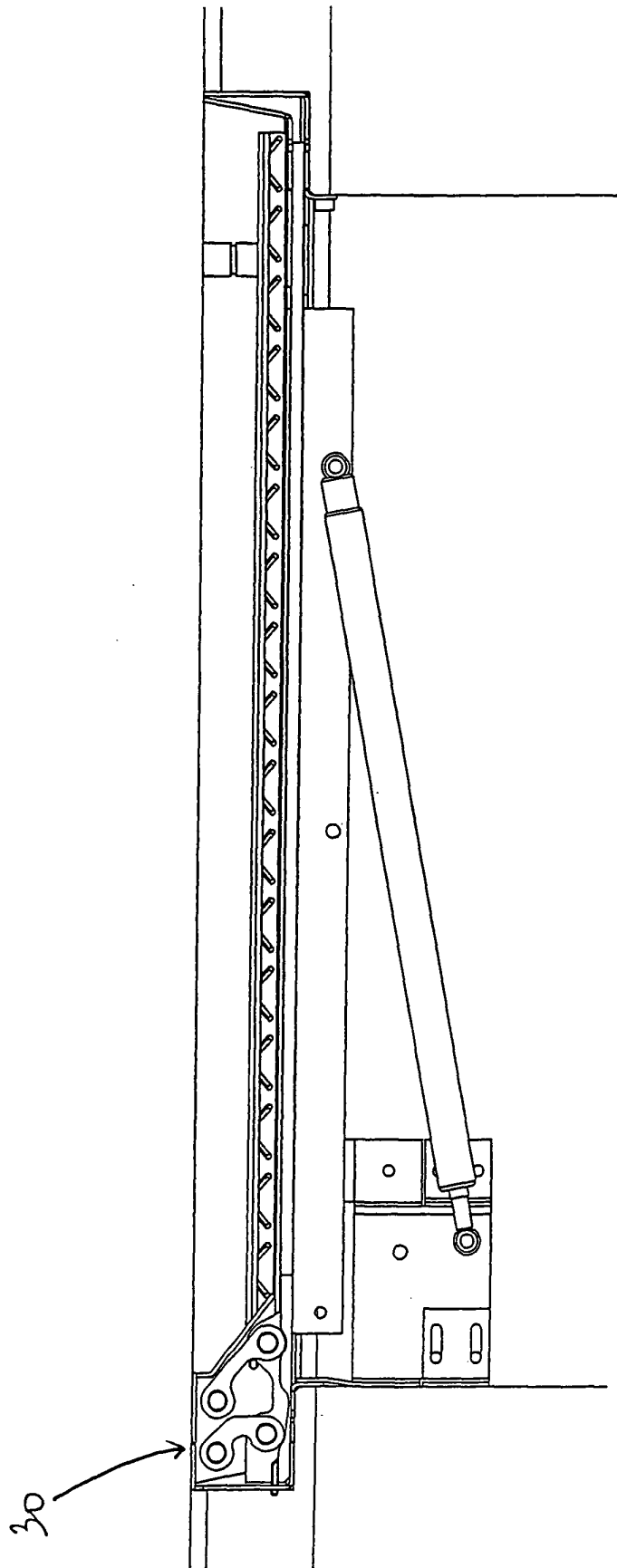


FIG 6

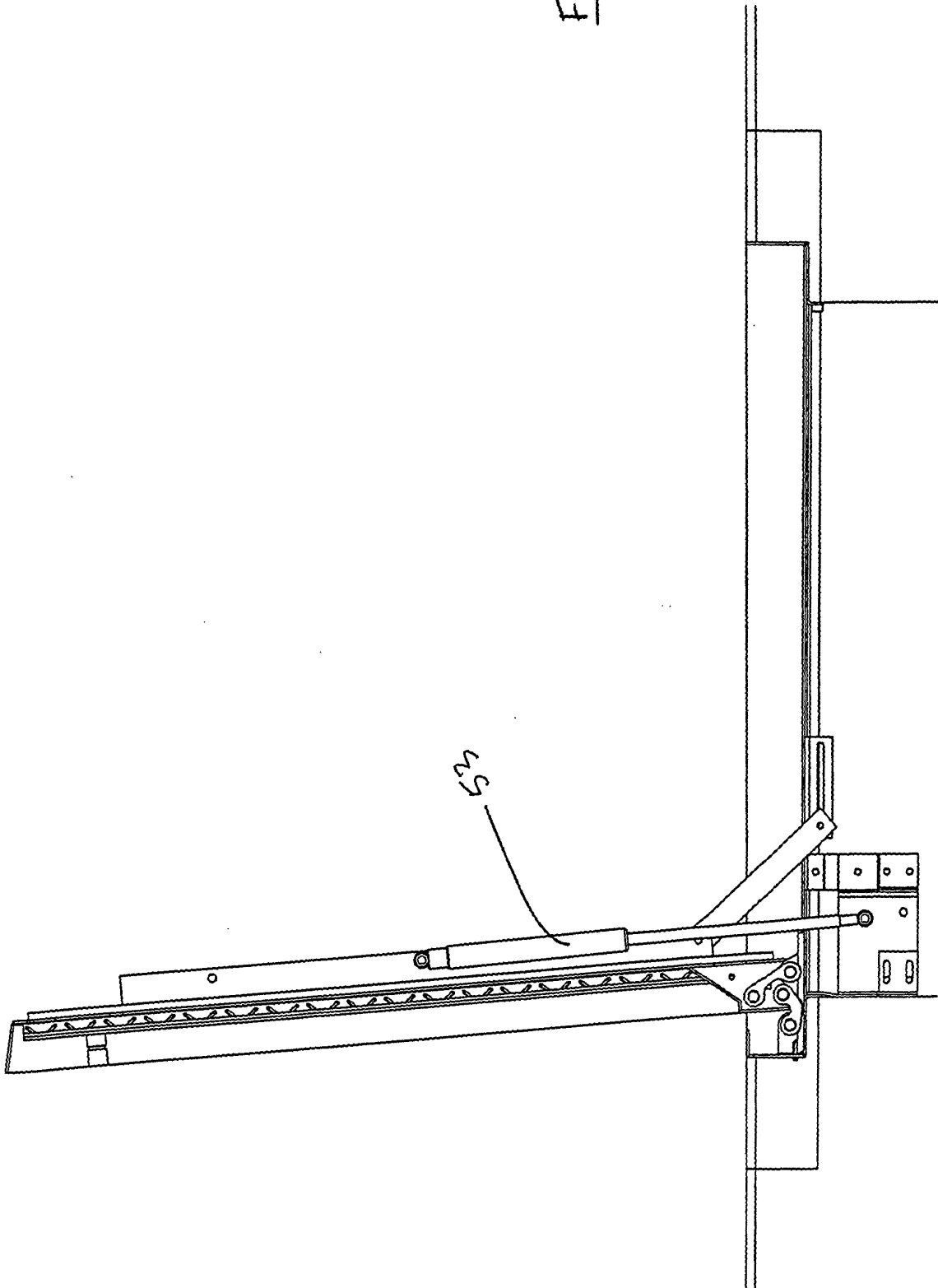
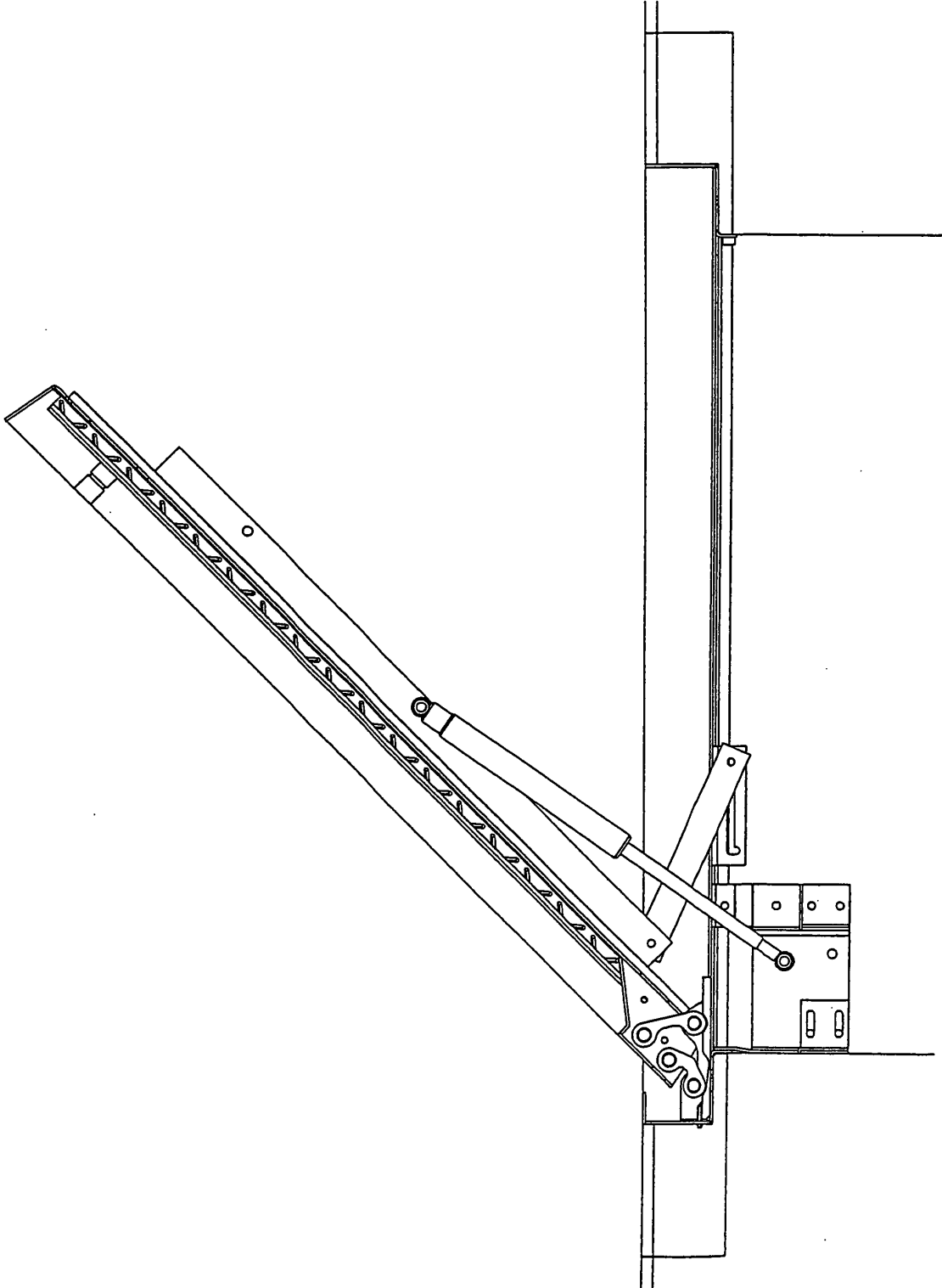


FIG. 7



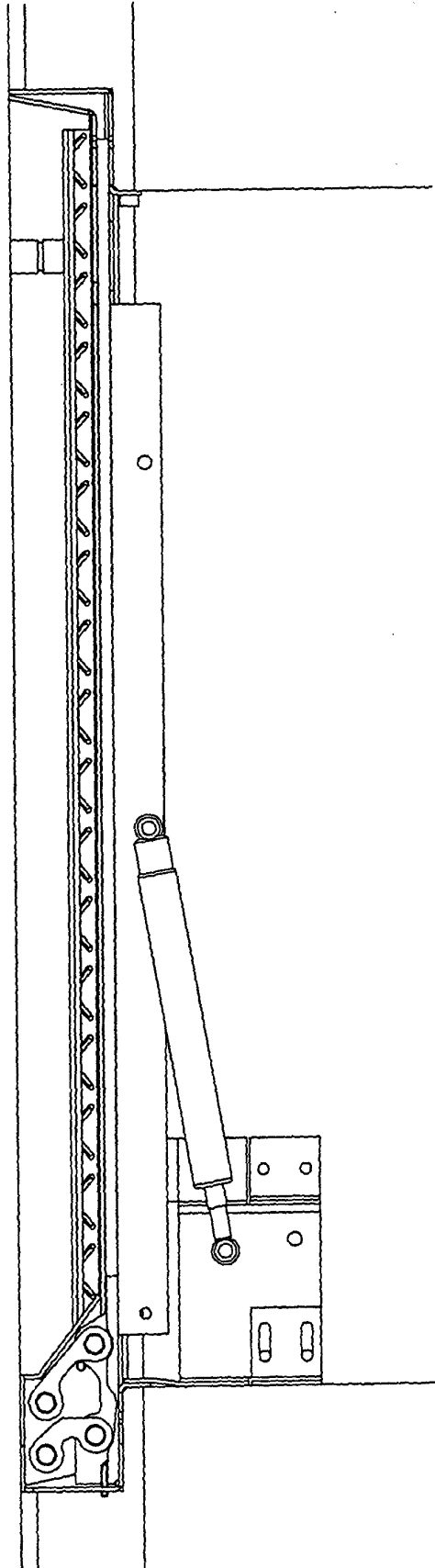
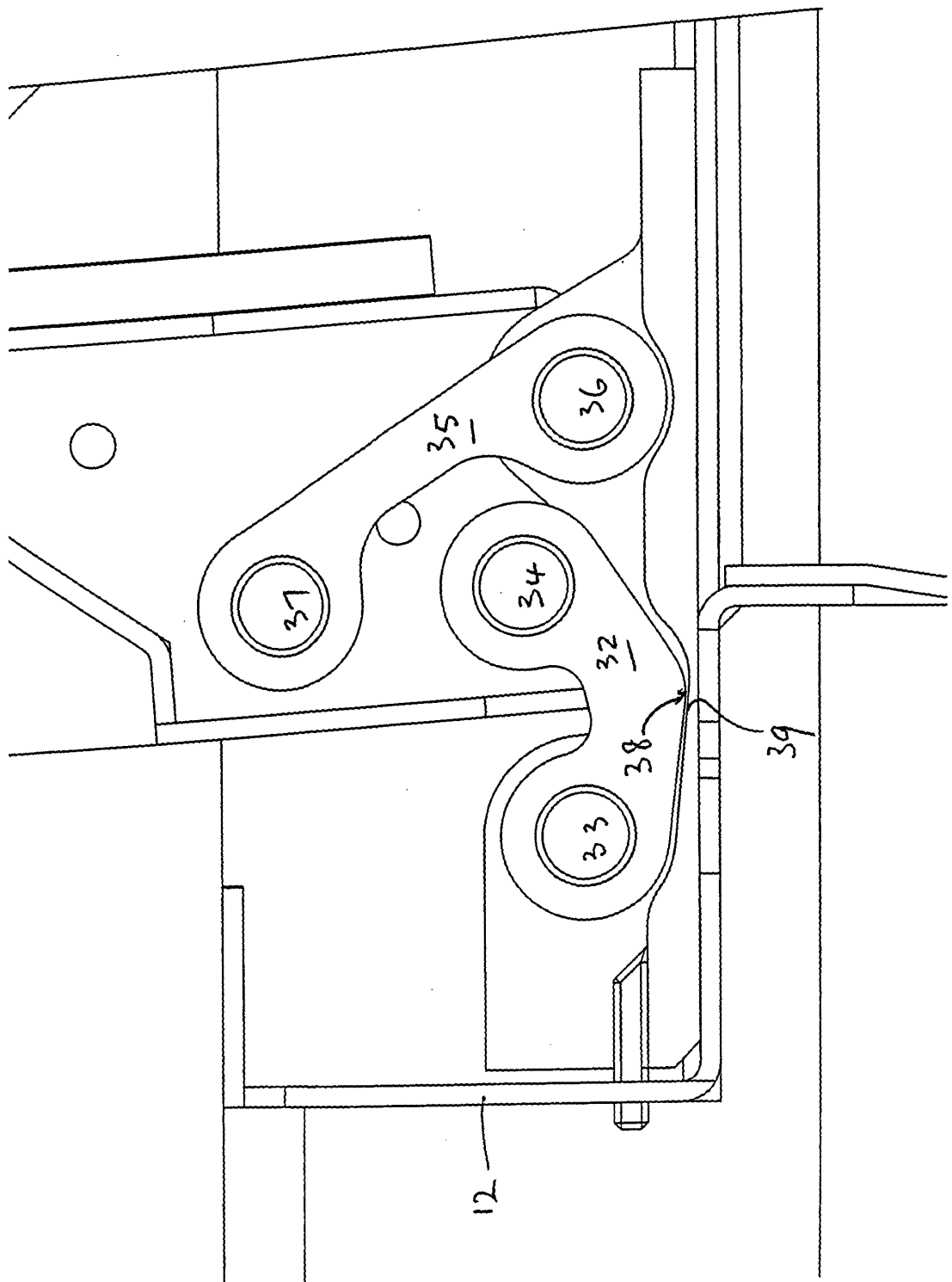


Fig 8



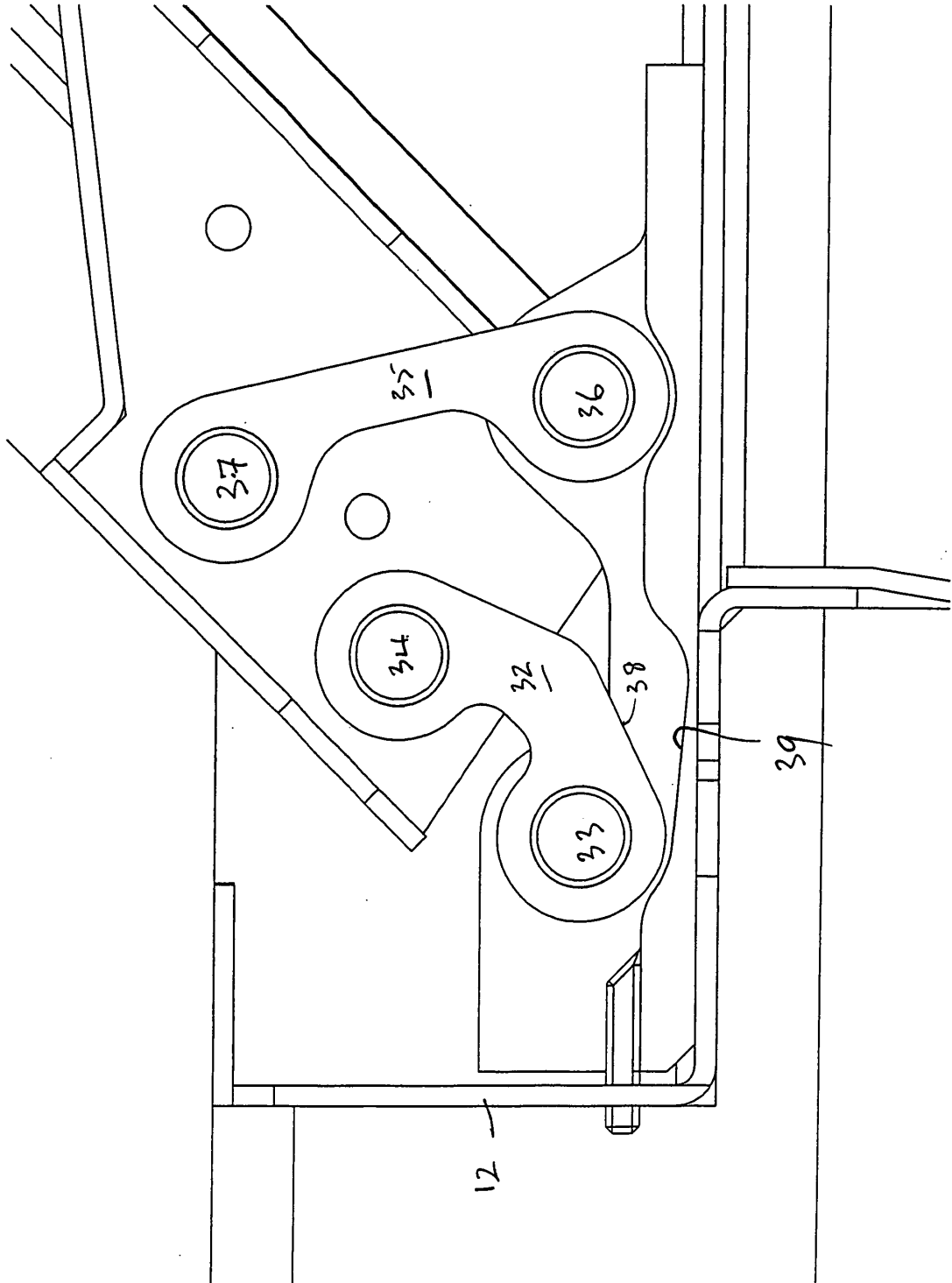
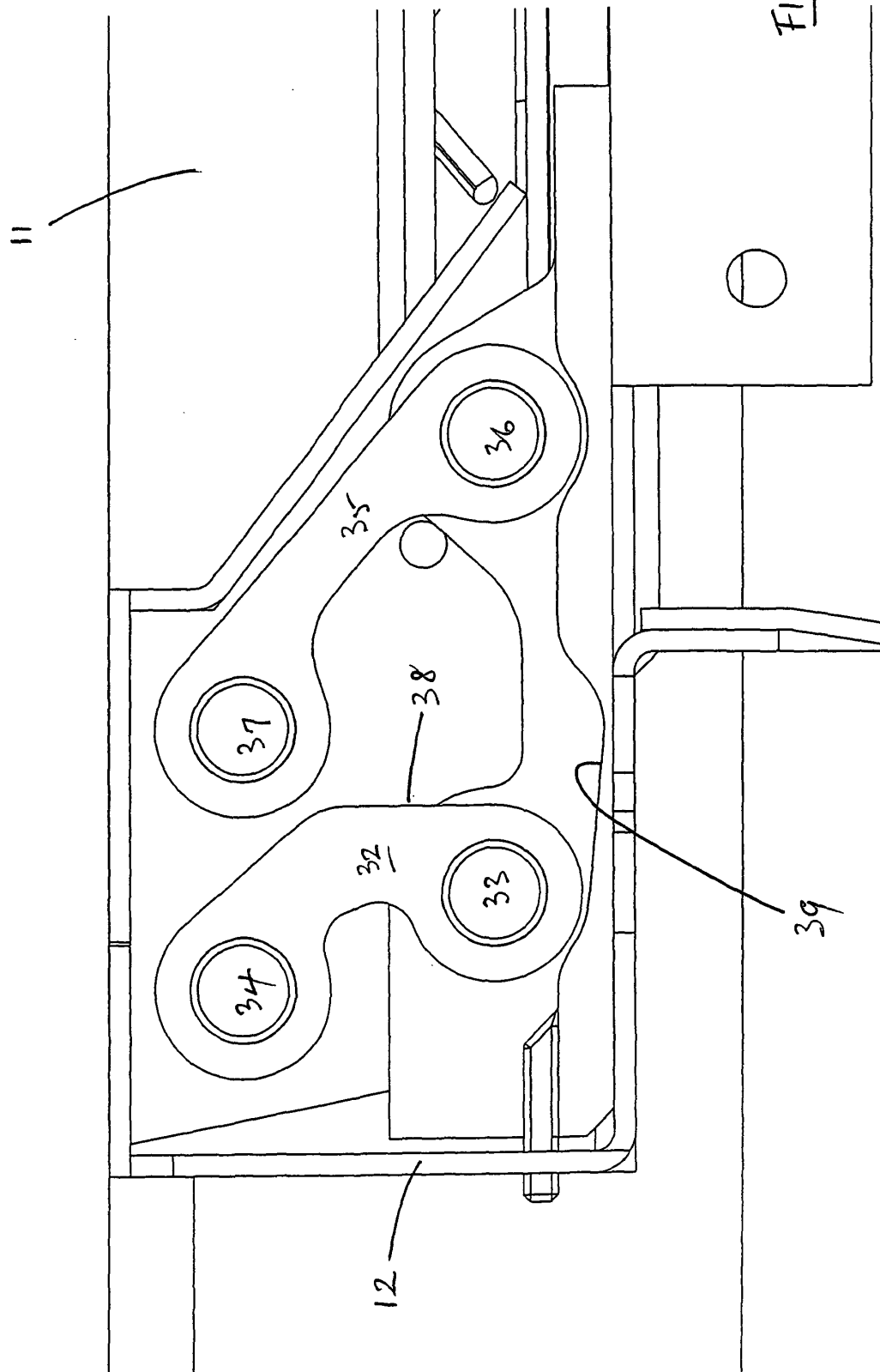


Fig 10



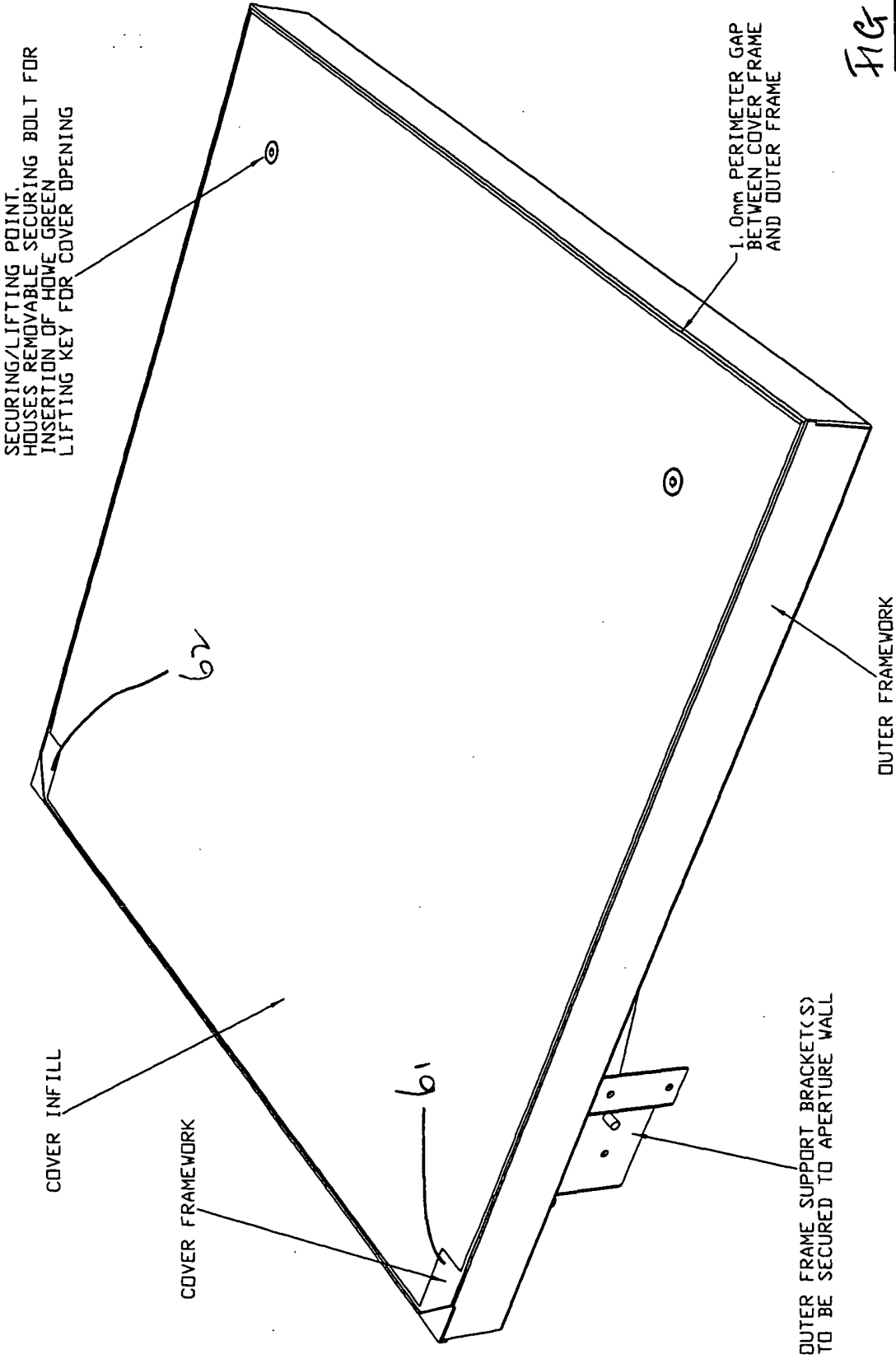


FIG 12

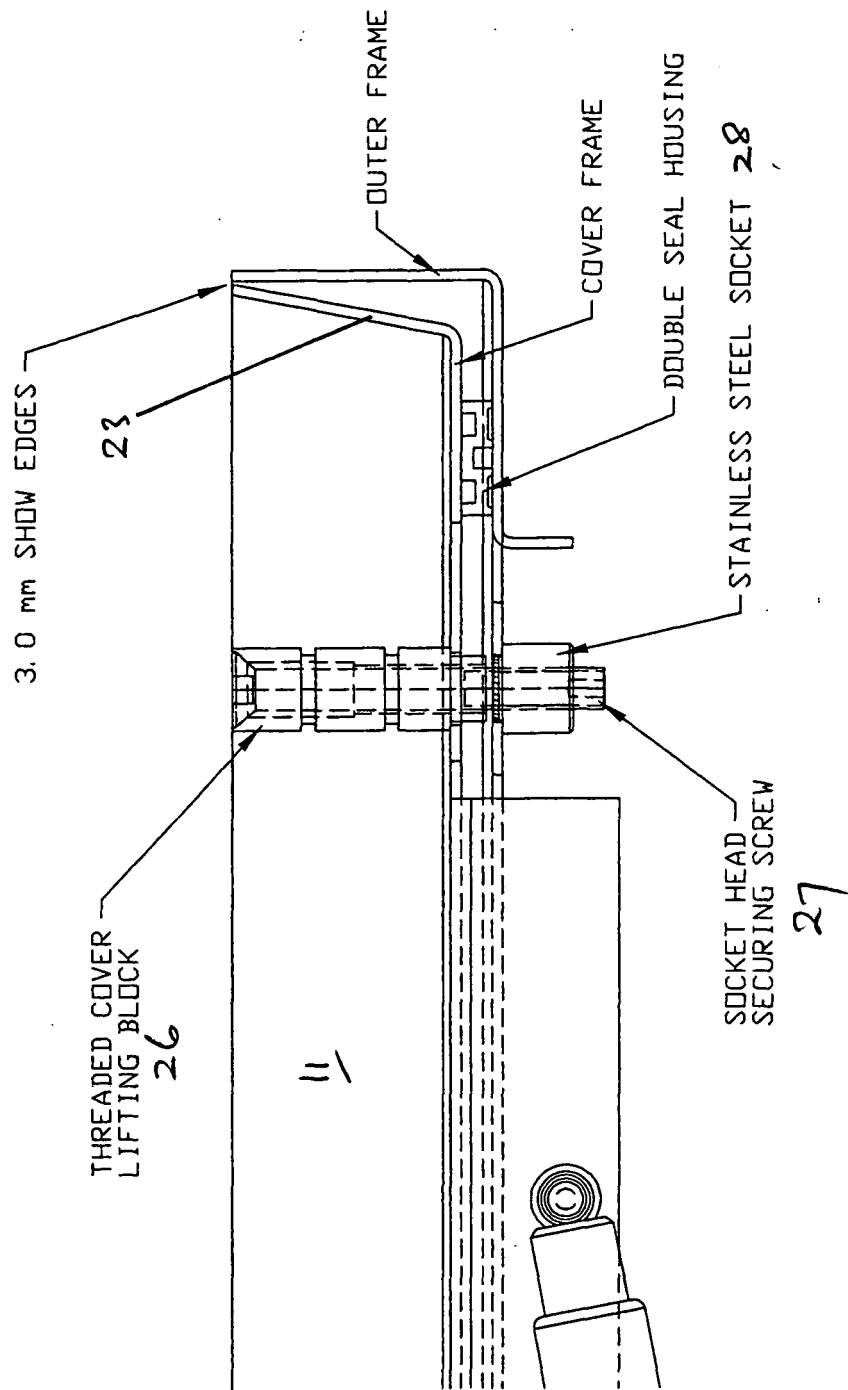


FIG 13

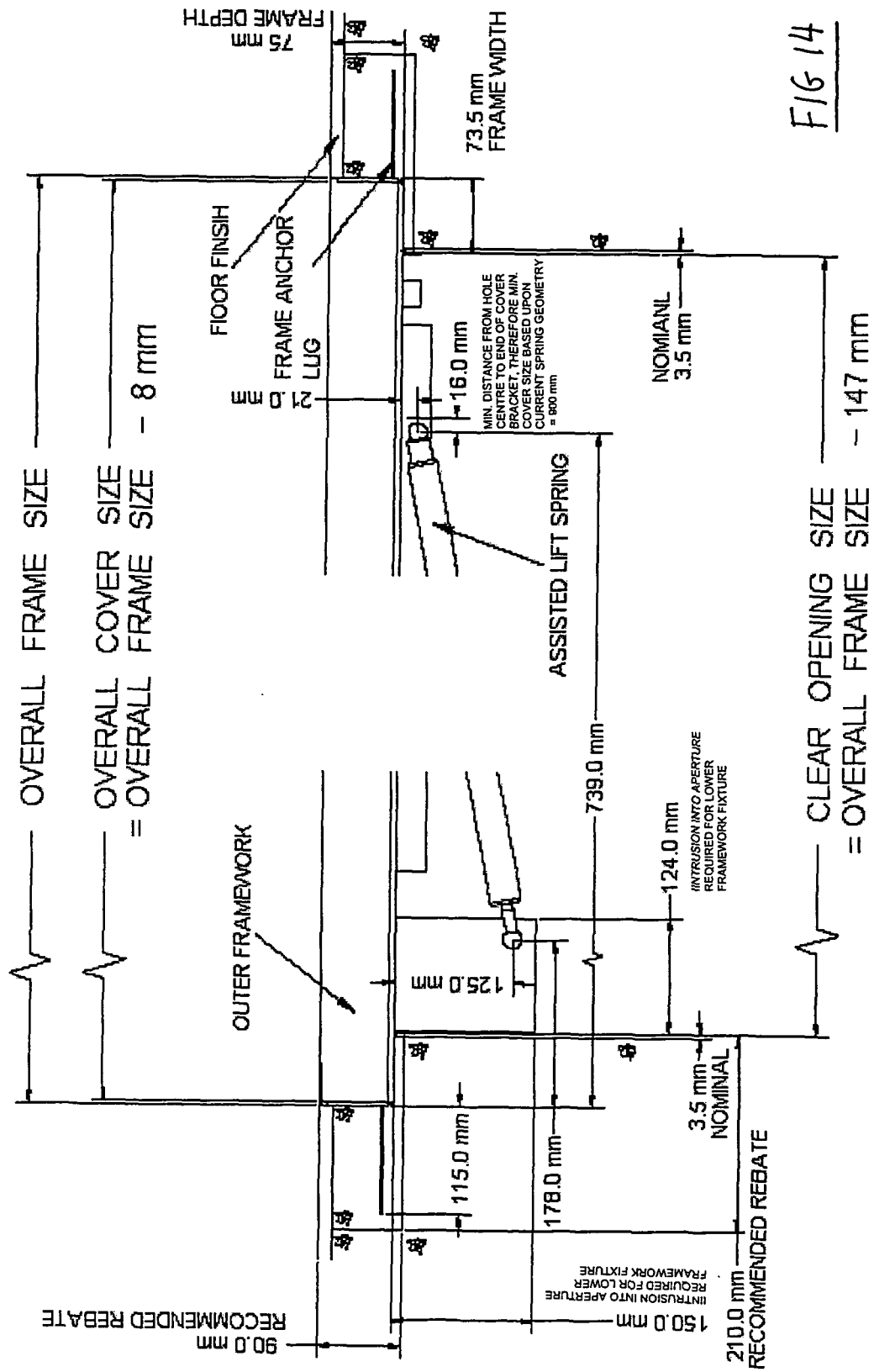


FIG 14

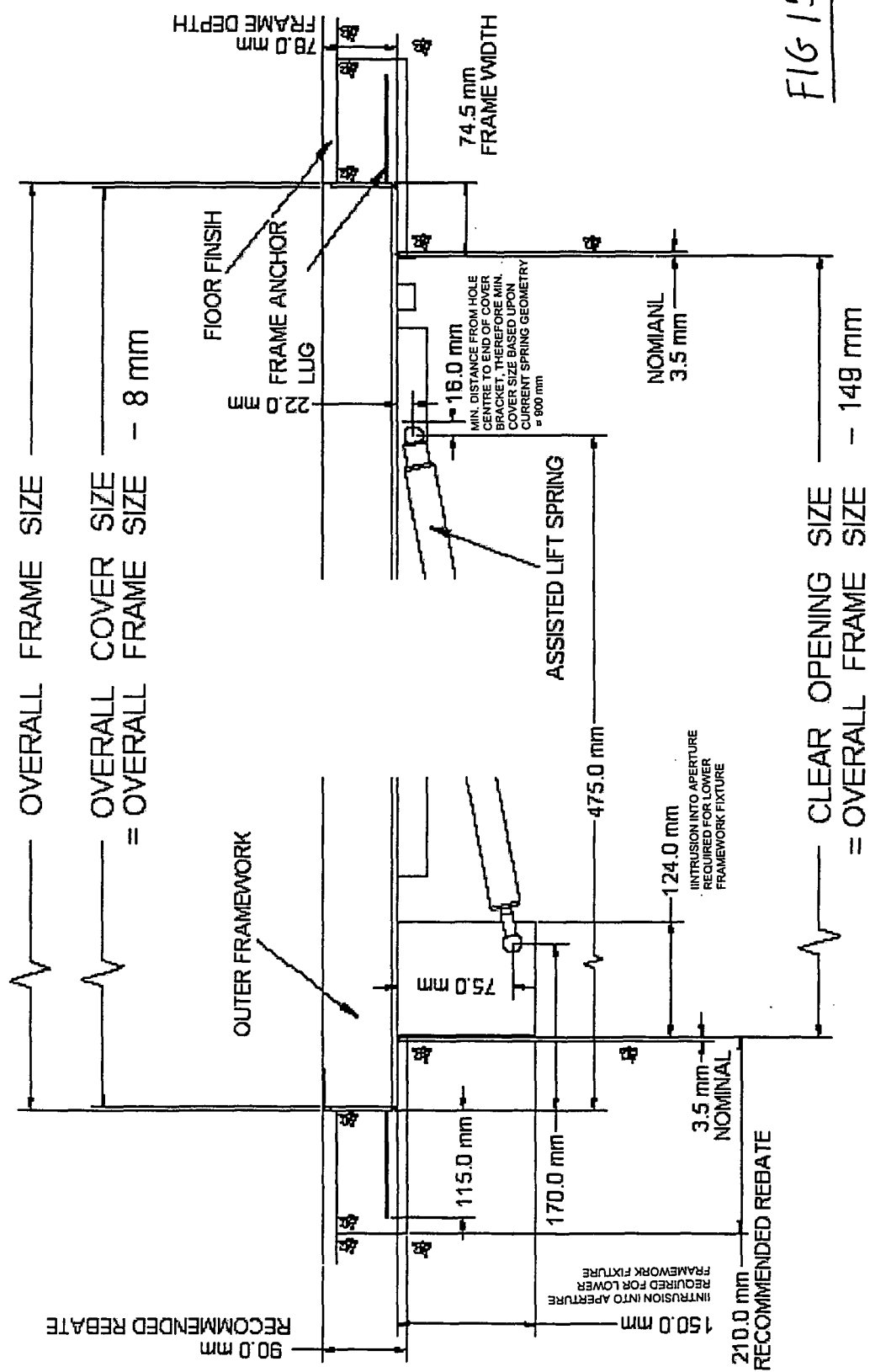


FIG 15



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 25 4861

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	AU 503 818 B2 (GATIC PTY LTD) 20 September 1978 (1978-09-20)	1-7, 9-12,21, 22	E02D29/14
X	* page 4, line 1 - page 6, line 2; figures 1-3 *	16-20, 24-26	
Y	----- US 4 637 752 A (CENTA ET AL) 20 January 1987 (1987-01-20) * abstract *	1-4,9-12	
Y	----- EP 1 046 754 A (KOELBLINGER, FRANZ) 25 October 2000 (2000-10-25) * paragraph [0009] *	5-7,21, 22	
A	----- EP 1 048 806 A (HANEDA HUMEPIPE CO., LTD) 2 November 2000 (2000-11-02) -----	13-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E02D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 December 2005	Examiner Nilsson, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 25 4861

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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16-12-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AU 503818	B2	20-09-1978	NONE

US 4637752	A	20-01-1987	AU 562904 B2 18-06-1987
			AU 3215884 A 12-03-1985
			CA 1210982 A1 09-09-1986
			DE 3474575 D1 17-11-1988
			EP 0181866 A1 28-05-1986
			GB 2145138 A 20-03-1985
			WO 8500843 A1 28-02-1985
			IE 55594 B1 07-11-1990
			NZ 209230 A 30-09-1987
			ZA 8406369 A 27-03-1985

EP 1046754	A	25-10-2000	NONE

EP 1048806	A	02-11-2000	US 6435763 B1 20-08-2002
