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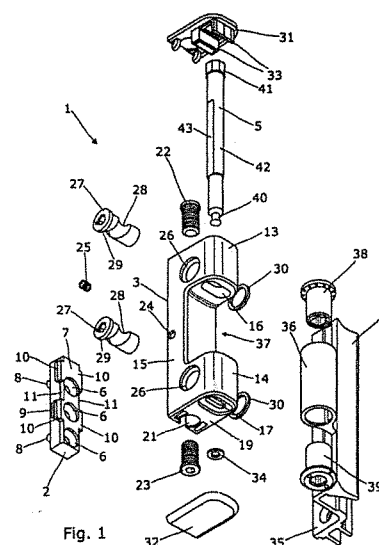
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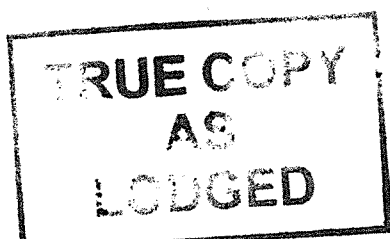
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(54) **A hinge**

(57) A hinge 1 for attaching a sash to a frame, the hinge permits adjustment in each of a vertical, horizontal and compression direction when installed and comprises a mounting block 2 to be fitted to a frame; a hinge body 3 to be mountable on the mounting block; and a flag assembly 4. The hinge body comprises first and second hinge arms 13, 14, with first and second hinge pin receiving bores 16, 17. The flag assembly comprises a flag barrel 36 to fit between the first and second hinge arms. A hinge pin 5 is arranged to pass through the first hinge pin receiving bore, the flag barrel and the second hinge pin receiving bore to pivotally connect the flag assembly and hinge body. Axial adjusting means 38, 39 are disposed between the hinge pin and the flag barrel to adjust the axis of rotation of the flag assembly in a compression direction. Also claimed is an adjustable hinge with adjustment possible in both left and right-handed applications. Also claimed is a hinge comprising only two separate parts a mounting block; and a combined hinge body and flag assembly. <Figure 1>





"A hinge"

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The present invention relates to hinges for doors. More particularly, but not exclusively, it relates to security hinges which permit adjustments in three dimensions. Currently available security hinges of this kind are called 3D flag hinges.

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Such security hinges comprise a flag assembly fitted to the door sash and connected by a hinge pin to a hinge body fitted to the door frame. For outward opening doors the hinge is exposed and, as a result, all fixing points should be concealed and the hinge should contain features that resist any form of disassembly from the door sash. Design features that do allow disassembly should only be accessible with the door in the open/unsecured condition.

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UK standards recognise security in terms of resistance time to attack with tools that are readily available and can be carried by an intruder. It is said that if an intruder spends more than three minutes trying to break into a building through a door by attacking the hinges, the intruder is likely to move onto another building as any more time spent could result in detection and maybe apprehension. Accordingly, security hinges have been devised with a view to increasing the amount of time it takes an intruder to enter a building by breaking the hinges and bursting open the door whilst still enabling various instalment adjustments of the door sash through the hinge, and ease of door sash fabrication/installation without sacrificing security. Desirably, such hinges should be for both inward and outward opening doors.

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There is also a need for security hinges to enable energy efficiency, i.e. for the door sashes to be 'close-fitting' with the door frame, to avoid the egress of warm air/ingress of cold air which would normally pass through any gaps left between the door frame and door sash following fabrication/installation of the door using security hinges. To this end, and commonly, a 'seal' between the door sash and door frame is achieved by use of a neoprene gasket. In order to ensure an air tight seal, the gap between the door frame and door sash should be adjustable (gasket compression) to allow for any manufacture and installation variances.

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The Applicants have sold successfully, for a number of years, 'lift off' security hinges under the trade mark NEXUS with enhanced door security being provided by stabilising/localising pins on the hinge body and flag assembly locating into the door

frame and door sash, and by preventing hinge pin knock-out. The hinge body carries an eccentrically mounted hinge pin projecting upwardly from a splined bearing bush in a complementary eccentric bore in a base portion of the hinge body below the bottom edge of the flag assembly. The flag assembly is connected to the hinge pin by lifting it onto the hinge pin or disconnected by lifting it off the hinge pin. The NEXUS design allows for on-site adjustments in three directions, namely lateral (horizontal), height (vertical) and compression (in-and-out) movement of the order of $\pm 5\text{mm}$, $+4\text{mm}/-1\text{mm}$ and $\pm 0.75\text{mm}$ respectively. These adjustments are made horizontally by sliding one part of the flag assembly acting on the hinge pin with respect to another part and vertically by a screw acting axially on the hinge pin through the splined bush in the base portion. For compression adjustment, two kinds of adjustment are necessary, namely coarse and fine adjustment. Coarse compression adjustment is achieved by inserting or removing so-called frame packer(s), which come in different thicknesses, between the hinge body and the door frame during installation and fine adjustments by removing and turning and replacing the bush carrying the hinge pin in a different rotational position in the eccentric bore in the base portion. Thus, the compression adjustment is achieved by the combination of packer(s) and an eccentric hinge pin. However, as such packers are separate from the hinge body, they can be misplaced and are not liked by installers. A separate sash cover fixed over the moving part of the flag assembly and an end cover fitted into the end of the hinge pin bore carrying an anti-hinge pin knock-out feature completes the flag assembly for security and aesthetics.

Most door hinges require a degree of assembly by the installer/fabricator when building the door. Supplying hinges as 'a bag of parts' (six including an end cap in the case of the Nexus hinge) not only increases the time to manufacture the door but also may result in the door hinge being installed incorrectly. For example, if the wrong frame packer is fitted, an effective door seal may not be achieved. The greater the number of hinge parts, the longer correct installation can take and the more likely it is that the hinge will be incorrectly assembled.

Moreover, hinges like the NEXUS hinge are installed by fitting the hinge body to the door frame and the flag assembly to the door sash separately and then lifting the door sash so as to locate the flag assembly onto a pin fitted on the hinge body. For standard doors such an arrangement is generally limited for use with outward opening doors only since there is normally insufficient clearance to lift off inward opening doors.

Instead of the combination of coarse adjustment provided by frame packers and fine adjustment provided by the eccentrically mounted hinge pin, compression adjustment may be achieved by the use of an eccentric hinge pin only having eccentrics on the pin and which itself is turned to effect the compression, for example, as described in the specification of UK Patent No. 2 383 081. UK Patent No. 2 399 387 also describes a hinge wherein compression adjustment is achieved by virtue of an eccentric hinge pin.

In the case of the aforementioned hinges, installation is achieved by fitting the hinge body to the door frame and the flag assembly to the door sash separately and then locating the hinge pin to connect the door frame and sash together. An anti-extraction screw is employed to prevent the hinge pin from being driven out of the assembled hinge when attacked by an intruder. However, this requires the installer to fit the anti-extraction screw when the door is commissioned. Also, such hinges are necessarily supplied to the installer in several parts, i.e. the hinge body, flag assembly and hinge pin, which is inconvenient and time consuming to assemble. Furthermore, the eccentric hinge pin complicates installation of the hinge because it must be precisely aligned with respect to the hinge body and the flag assembly in order to be inserted correctly.

A further drawback associated with existing hinges is that two different configurations of hinge are often required depending on whether the door to be installed is mounted left-handed or right-handed. This further complicates the installation procedure and increases the chances of errors occurring during installation.

It is against this background that the present invention has been devised. It is an aim of the present invention to provide a hinge which substantially overcomes or mitigates at least some of the above problems.

According to the aspect of the present invention, there is provided a hinge for attaching a sash to a frame, the hinge permitting adjustment of the sash relative to the frame in each of a vertical, a horizontal and a compression direction when installed, the hinge comprising:

- a mounting block for fitting to the frame;
- a hinge body slidably mountable for movement in the vertical direction on the mounting block, the hinge body comprising spaced apart first and second hinge arms provided with respective first and second hinge pin receiving bores

a flag assembly for fitting to the sash, the flag assembly comprising a flag barrel for fitting between the first and second hinge arms;

5 a hinge pin arranged to pass through each of the first hinge pin receiving bore, the flag barrel and the second hinge pin receiving bore so as to pivotally connect the flag assembly to the hinge body; and

axial adjusting means disposed between the hinge pin and the flag barrel for moving the axis of rotation of the flag assembly in the compression direction in dependence on rotation of the hinge pin with respect to the hinge body,

10 wherein the second hinge pin receiving bore comprises an elongate slot to permit movement in the horizontal direction of the hinge pin relative to the second hinge pin receiving bore, and wherein a leading end of the hinge pin extends through the elongate slot and is formed over so as to have a diameter greater than the width of the slot.

15 Preferably, the axial adjusting means comprises at least one flag bush receivable within the flag barrel, the or each flag bush having: an outer diameter concentric with the flag barrel; and, an eccentric bore formed therethrough for receiving the hinge pin therein.

20 More preferably, the hinge pin comprises a central portion received with the eccentric bore of the or each flag bush, the respective cross-sections of the central portion and the eccentric bore being shaped such that rotation of the hinge pin with respect to the hinge body causes rotation of the at least one flag bush within the flag barrel.

25 Still more preferably, the central portion of the hinge pin comprises at least one flat and the eccentric bore of the or each flag bush comprises at least one flat, which is aligned with the at least one flat of the central portion of the hinge pin.

Conveniently, the or each flag bush comprises a collar which abuts against an end of the flag barrel to limit the extent to which the or each flag bush is inserted within the flag barrel.

30 Preferably, the hinge comprises two flag bushes, each of the two flag bushes being disposed in respective opposite ends of the flag barrel.

35 Preferably, the hinge pin comprises a trailing end having an octagonal cross-section disposed within the first hinge pin receiving bore, the hinge comprising an end cap attachable to the hinge body, the end cap comprising a pair of parallel tongues arranged

to project into the first hinge pin receiving bore when the first end cap is attached to the hinge body and to receive the trailing end of the hinge pin therebetween when an opposed pair of sides of the octagonal trailing end of the hinge pin are aligned parallel to the tongues, the spacing between the tongues being selected so as to prevent rotation of the hinge pin within the hinge body.

Preferably, the hinge comprises hinge pin retaining means to retain the hinge pin from within the hinge body when the flag assembly has been pivotally connected to the hinge body, the hinge pin retaining means being inaccessible when the hinge body is mounted on the mounting block.

Preferably, the hinge pin comprises the leading end and the trailing end, and wherein the first hinge pin receiving bore comprises a step therein and the transition between the trailing end of the hinge pin and a central portion of the hinge pin defines a shoulder which abuts against the step within the first hinge pin receiving bore to prevent movement of the trailing end therepast.

More preferably, the hinge comprises a hinge pin washer disposed between the elongate slot and the formed over leading end of the hinge pin.

Advantageously, the hinge is arranged such that adjustment in the vertical, horizontal and compression directions is possible when the hinge is used in both left and right-handed applications.

Preferably, the hinge body comprises first and second vertical adjustment screws disposed at opposite ends thereof and arranged such that the first vertical adjustment screw acts on the mounting block to achieve adjustment of the hinge in the vertical direction when the hinge is used in a left-handed application and the second vertical adjustment screw acts on the mounting block to achieve adjustment of the hinge in the vertical direction when the hinge is used in a right-handed application.

Conveniently, the hinge comprises only two separate parts for supplying to fabricators/installers, said parts being:

- the mounting block; and
- the combined hinge body and flag assembly.

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view of an embodiment of a hinge according to the present invention;

Figure 2 is a top perspective view of the hinge shown in Figure 1;

Figure 3A is a perspective view illustrating the attachment of the flag assembly to the hinge body of the hinge of Figures 1 and 2;

Figure 3B is a top plan view of the flag assembly of Figure 3A;

Figure 4A is a perspective view showing the hinge pin and horizontal adjusting means of the hinge of Figures 1 and 2;

Figure 4B shows front, side and top and bottom plan views of the hinge pin and horizontal adjusting means shown in Figure 4A;

Figures 5A is a rear plan view of the hinge of Figure 1 in an assembled state;

Figures 5B and 5C are cross-sectional views along the lines A-A and B-B of the hinge shown in Figure 5A, respectively;

Figure 5D is a side plan view of the hinge shown in Figure 5A;

Figures 5E and 5F are cross-sectional views along the lines C-C and D-D of the hinge shown in Figure 5D, respectively;

Figure 6 is a perspective view showing the attachment of a door sash to a door frame using the hinge of Figures 1 and 2;

Figures 7A and 7B are respective rear plan views showing the engagement of the hinge body with the mounting block of the hinge of Figures 1 and 2;

Figure 8A is a rear plan view of the hinge of Figures 1 and 2 in an assembled state with the hinge body mounted on the mounting block;

Figures 8B and 8C are cross-sectional views along the lines A-A and B-B in Figure 8A, respectively;

Figures 9A and 9B show a rear plan view and a bottom perspective view of the hinge of Figures 1 and 2 when used for a left-handed application, respectively; and

Figures 10A and 10B show a rear plan view and a bottom perspective view of the hinge of Figures 1 and 2 when used for a right-handed application, respectively.

Referring to Figures 1 and 2, the hinge 1 generally comprises a mounting block 2 to be fitted, for example, to the frame of a door, a hinge body 3 adapted to attach to the mounting block 2, and a flag assembly 4 to be fitted to a door sash, the flag assembly 4 capable of being pivotally mounted to the hinge body 3 by means of a hinge pin 5.

- The mounting block 2 comprises an elongate member having a substantially rectangular cross-section. A plurality of countersunk holes 6 are provided in a front face 7 or mounting face of the mounting block 2 to enable the mounting block 2 to be attached to a door frame by a corresponding plurality of screws passing through the respective countersunk holes 6. A pair of locating pins 8 project from a rear surface of the mounting block 2. The locating pins 8 are adapted to engage with a corresponding pair of holes formed in the door frame to which the hinge 1 is to be fitted so as to maintain the mounting block 2 in the correct position during installation.
- 5 An elongate slot 9 is provided in each side of the mounting block 2. Each slot 9 is orientated parallel to the length of the mounting block 2. A plurality of mounting block ears 10 project laterally from the front face 7 of the mounting block 2 for securing the hinge body 3 thereto as will be described in more detail later. The mounting block ears 10 are formed in two pairs having respective gaps 11 therebetween.
- 10 The hinge body 3 is of a generally U-shaped configuration having spaced apart first and second hinge arms 13, 14 and a central portion 15 disposed therebetween. The first and second hinge arms 13, 14 are provided with respective first and second hinge pin receiving bores 16, 17 formed therethrough. Each hinge pin receiving bore 16, 17 comprises a slot shaped opening to allow for horizontal adjustment of the hinge pin 5 therein as will be described in more detail later.
- 15 A first end face 18 of the hinge body 3 comprises a first threaded bore 20 disposed adjacent to the first hinge pin receiving bore 16. The first threaded bore 20 is adapted to receive a first vertical adjustment screw 22 therein. The first vertical adjustment screw 22 is provided with a hexagonal opening therein to enable it to be adjusted using a corresponding hexagonal key. Similarly, a second end face 19 of the hinge body 3 is provided with a second threaded bore 21 for receiving a second vertical adjustment screw 23.
- 20 A hole 24 is provided in each side of the central portion 15 of the hinge body 3 to enable the insertion of an anti lift-off screw 25 therein. Furthermore, each of the first and second hinge arms 13, 14 comprises a circular bore 26 formed therethrough for receiving turnable means 27 which constitute horizontal adjusting means for making horizontal adjustments of the flag assembly 4 relative to the hinge body 3. Each turnable means 27
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comprises a cylinder having a helical groove 28 formed around its circumference. Each end of the cylinder is provided with a hexagonal hole to enable the turnable means 27 to be rotated by a corresponding hexagonal key when installed in the hinge body 3. Each turnable means 27 is secured within a respective one of the circular bores 26 by means of a collar 29 disposed at one end thereof and by a washer 30 which is fastened to the opposite end, after the turnable means 27 has been inserted into its circular bore 26 by forming over the end of the turnable means 27. The circular bores 26 intersect the first and second hinge pin receiving bores 16, 17 respectively, such that, when the hinge 1 is assembled, respective ends of the hinge pin 5 are received within respective ones of the helical grooves 28 of the turnable means 27. Accordingly, rotation of the turnable means 27 causes horizontal adjustment of the hinge pin 5, as will be described in more detail later.

The hinge 1 also comprises first and second end caps 31, 32 which are push-fitted to the respective first and second ends of the hinge body 3 once the hinge pin 5 has been installed. The first end cap 31 is provided with a pair of tongues 33 which project into the first hinge pin receiving bore 16 when the first end cap 31 is attached to the hinge body 3. Furthermore, the hinge 1 comprises a hinge pin washer 34 for use in securing the hinge pin 5 to the hinge body 3 as will be described in more detail later.

The flag assembly 4 comprises a flag 35 for attachment to the sash of a door (not shown in Figures 1 and 2) and a flag barrel 36 for engagement with the hinge body 3. The flag barrel 36 is a hollow cylinder which is sized so as to be accommodated in a space 37 defined between the first and second hinge arms 13, 14 of the hinge body 3. The flag assembly 4 further comprises first and second flag bushes 38, 39.

The hinge pin 5 comprises a leading end 40, a trailing end 41 and a central portion 42 disposed therebetween. The trailing end 41 of the hinge pin 5 has an octagonal cross-section with a hexagonal bore formed therein for receiving an appropriately sized hexagonal key or Allen key. The central portion 42 of the hinge pin 5 is generally cylindrical but is provided with a plurality of flats 43. The hinge pin 5 tapers toward the leading end 40 and terminates in a tip which has a smaller diameter than that of the central portion 42.

Referring to Figures 3A and 3B, the flag assembly 4 is attached to the hinge body 3 by first inserting the first and second flag bushes 38, 39 into respective ends of the flag barrel 36. The outer diameter of each flag bush 38, 39 is concentric with the flag barrel

36 and sized so as to be an interference fit therewith, which is sufficient to retain the flag bushes 38, 39 within the flag barrel 36 during assembly of the hinge 1 but which permits relative movement between the flag barrel 36 and the flag bushes 38, 39 when the door sash is opened and closed once the hinge 1 has been installed.

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Each flag bush 38, 39 has a collar 44 disposed at one end which is arranged to abut against the respective end of the flag barrel 36 when inserted therein. Each flag bush 38, 39 also has an eccentric bore 45 formed therethrough. The cross-section of the eccentric bore 45 is shaped so as to match the cross-section of the central portion 42 of the hinge pin 5 and correspond to the flats 43.

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The flag assembly 4 is attached to the hinge body 3 by placing the flag barrel 36 in the space 37 between the hinge arms 13, 14 and inserting the leading end 40 of the hinge pin 5 through each of the first hinge pin receiving bore 16, the first and second flag bushes 38, 39 and the second hinge pin receiving bore 17. Due to the flats 43 on the central portion 42 of the hinge pin 5, the hinge pin 5 can only be inserted through the flag bushes 38, 39 when properly aligned thereto. Accordingly, each flag bush 38, 39 is provided with a projection 46 on the collar 44 to indicate the orientation of the flag bush 38, 39 within the flag barrel 36. Furthermore, the trailing end 41 of the hinge pin 5 is provided with a notch 47 which is positioned such that, when the projections 46 on the flag bushes 38, 39 are aligned with the notch 47 on the hinge pin 5, the flats 43 on the hinge pin 5 are aligned with the eccentric bores 45 of the flag bushes 38, 39 to enable insertion therethrough.

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When installed within the hinge body 3, the hinge pin 5 can be rotated in order to adjust the flag assembly 4 relative to the hinge body 3 in a compression direction, i.e. movement of the flag barrel 36 toward/away from the central portion 15 of the hinge body 3. In the present embodiment, the eccentric bores 45 of the flag bushes 38, 39 are arranged such that, when installed, the axis of the hinge pin 5 is offset from the axis of the flag barrel 36 by 0.75mm.

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Accordingly, when a hexagonal key is inserted into the trailing end 41 of the hinge pin 5 and turned, this causes corresponding rotation of the flag bushes 38, 39 within the flag barrel 36, and the offset of the eccentric bores 45 causes the flag barrel 36 to move toward or away from the central portion 15 of the hinge body 3. An offset of 0.75mm allows for a compression adjust over a range of 1.5mm. The trailing end 41 of the hinge pin 5 can be turn to any one of four positions, which are dictated by the orientation of the octagonal shape of its outer surface. In more detail, the

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tongues 33 of the first end cap 31 are spaced apart by a distance which is sufficient to allow the octagonal trailing end 41 of the hinge pin 5 to be received therebetween when an opposed pair of sides of the octagon are aligned parallel to the pair of tongues 33. Thus, with the first end cap in place, the tongues 33 prevent any rotation of the hinge pin 5 within the hinge body 3 which may otherwise result from repeated opening and closing of an attached door sash, and thereby maintain the desired amount of compression.

To aid installation of the hinge 1, a disposable insert 48 may be used to lock the position of the hinge pin 5 and flag bushes 38, 39 within the flag barrel 36 whilst the flag 35 is attached to a door sash. The insert 48 fits over the trailing end 41 of the hinge pin 5 and is provided with a pair of pins 49 which project through corresponding holes 50 in the collar 44 of the first flag bush 38 and engage with a pair of grooves 51 (only one of which is visible in Figure 3A) formed on the inner surface of the flag barrel 36. Thus, relative movement between the hinge pin 5 and flag bushes 38, 39 and the flag barrel 36 is prevented.

Referring to Figures 4A and 4B, when installed in the hinge body 3, the hinge pin 5 engages with each of the turnable means 27. More specifically, the hinge pin 5 is received within the helical groove 28 of each of the turnable means 27 at respective points lying between each of the leading and trailing ends 40, 41 and the flats 43 on the central portion 42, where the cross-section of the hinge pin 5 is circular. With this configuration, linear movement of the hinge pin 5 in the direction of the arrow A in Figures 4A and 4B, and therefore movement of the flag assembly 4 relative to the hinge body 3, is achieved by rotation of each of the turnable means 27 together in the same direction, either clockwise or anti-clockwise.

As mentioned previously, each of the first and second hinge pin receiving bores 16, 17 in the hinge body 3 have a slot shaped profile which allows for movement of the hinge pin 5 therein. This is shown in more detail in Figures 5A to 5F, which show the hinge 1 in its assembled state. Referring in particular to Figure 5B, when installed in the hinge body 3, the hinge pin 5 is mounted so as to prevent it from being 'knocked-out' of the hinge body 3 by an intruder. The transition between the octagonal trailing end 41 of the hinge pin 5 and the central portion 42 forms a shoulder which abuts against a step 52 in the first hinge pin receiving bore 16.

Furthermore, the tip of the leading end 40 of the hinge pin 5 extends through the second hinge pin receiving bore 17 and the hinge pin washer 34. The hinge pin 5 is secured

within the hinge body 3 by 'forming over' the leading end 40 of the hinge pin 5, for example by means of spin riveting. The result is that the tip of the leading end 40 is flattened over the hinge pin washer 34. The second hinge pin receiving bore 17 is formed with a step 53 which the hinge pin washer 34 abuts against thereby preventing axial movement of the hinge pin 5 within the hinge body 3. The hinge pin washer 34 provides a flat smooth surface which aids movement of the hinge pin 5 relative to the second hinge pin receiving bore 17 of the hinge body 3 when the turnable means 27 are rotated. In the present embodiment, each of the turnable means 27 can be rotated through an angular range of about 135 degrees, which translates to a +4.00mm/-4.00mm movement of the hinge pin 5, and thus the flag assembly 4 in the horizontal direction.

Referring to Figure 6, the door frame 53 and door sash 54 are conveniently made of PVC-U, which is what the hinge 1 is primarily intended for, although the door frame and sash can be made of other suitable materials depending on their intended use. To install the hinge 1, the mounting block 2 is first fitted to the door frame 53 by inserting the locating pins 8 in appropriate holes drilled in the door frame 53, and passing fixing screws 55 through the countersunk holes 6 and into a steel reinforcement (not shown) in the hollow interior of the door frame 53. The door sash 54 is attached to the flag 35 of the flag assembly by a suitable screw fixing. Next, the hinge body 3 is attached to the mounting block 2.

Referring to Figures 7A and 7B, the rear surface of the hinge body 3 constitutes a mounting surface 56 configured to enable attachment of the hinge body 3 to the mounting block 2. The mounting surface 56 comprises a recess 57 for receiving the mounting block 2 therein, the recess 57 having a plurality of shoulders 58 disposed around its periphery. The shoulders 58 are spaced apart and have gaps 59 therebetween. Accordingly, when the hinge body 3 is aligned with the mounting block 2 as shown in Figure 7A, the ears 10 of the mounting block 2 pass through the gaps 59 between the shoulders 58 on the mounting surface 56 of the hinge body 3, such that the mounting block 2 is received within the recess 57. As shown in Figure 7B, subsequent downward movement of the hinge body 3 with respect to the mounting block 2 causes the shoulders 58 on the mounting surface 56 to hook over the ears 10 of the mounting block 2, thereby securing the hinge body 3, and thus the sash 54 to the door frame 53.

The provision of the ears 10 on the mounting block 2 and the shoulders 58 on the hinge body 3 that interengage when the door sash 54 is fitted to the door frame 53 enable the vertical lift required to remove/fit the door sash 54 to be limited to 11mm in the present embodiment. The hinge 1 having the above-described configuration is therefore suitable for both inward and outward opening applications.

Referring to Figures 8A, 8B and 8C, when the hinge body 3 is mounted on the mounting block 2, the first vertical adjustment screw 22 abuts against a top surface 60 of the mounting block 2. Accordingly, vertical adjustment of the hinge 1, i.e. vertical adjustment of the door sash 54 within the door frame 53, is achieved by screwing or unscrewing the first vertical adjustment screw 22 within the first threaded bore 20.

In the presently described embodiment, the first vertical adjustment screw 22 may be used to adjust the door sash 54 by -1.0mm / + 4.0mm in the vertical direction relative to the door frame 53. In more detail, lowering of the door sash 53 is possible by virtue of the fact that the first vertical adjustment screw 22 is screwed into the first threaded bore 20 such that it projects into the recess 57 of the hinge body 3 by 1 mm before the hinge body 3 is mounted to the mounting block 2. Accordingly, after the hinge body 3 has been fitted to the mounting block 2, unscrewing the first vertical adjustment screw 22 such that it does not project into the recess 57 results in a lowering of the hinge body 3, and thus the door sash 54, of 1mm. Conversely, the door sash 54 may be raised with respect to the door frame 53 by screwing the first vertical adjustment screw 22 further into the first threaded bore 20. The head of the first vertical adjustment screw 22 is shaped such that the amount by which it can be screwed into the first threaded bore 20 is limited. The maximum vertical adjustment may thus be selected so as to prevent the ears 10 of the mounting block 2 from disengaging from the shoulders 58 of the mounting face 56 of the hinge body 3 when at the upper limit of the vertical adjustment range.

The hinge body 3 is further secured to the mounting block 2 by the anti lift-off screws 25 which are screwed into the holes 24 in the central portion 15 of the hinge body 3 such that they project into the respective elongate slots 9 in the sides of the mounting block 2. The shape of the elongate slots 9 allows for movement of the hinge body 3 in the vertical direction relative to the mounting block 2 with the anti lift-off screws 25 in place.

The outward appearance of the hinge 1 is symmetrical about the line B-B in Figure 5A, which makes the hinge 1 suitable for either left or right-handed applications, with no

reconfiguration of the hinge 1 required for either application. Referring to Figures 9A and 9B, when used for a left-handed application, i.e. on the left side of a door frame, the hinge 1 is orientated with first hinge arm 13 uppermost, i.e. in the orientation shown in Figures 1 and 2. In this orientation, the first vertical adjustment screw 22 abuts the top surface 60 of the mounting block 2. Conversely, referring to Figures 10A and 10B, when used for a right-handed application, the second hinge arm 14 is uppermost and the second vertical adjustment screw 23 abuts the top surface 60 of the mounting block 2.

It is a particular advantage of a hinge having the above-described configuration that adjustments in three dimensions (vertical, horizontal and compression directions) can be readily made, regardless of whether the hinge 1 is mounted left or right-handed. In particular, vertical adjustment of the hinge 1 is possible by screwing the first vertical adjustment screw 22 into or out of the first threaded bore 20 in the case that the hinge 1 is mounted left-handed, or screwing the second vertical adjustment screw 23 into or out of the second threaded bore 21 in the case that the hinge 1 is mounted right-handed. Horizontal adjustment is achieved by rotating each of the turnable means 27, both of which are provided with a hexagonal hole in each end so as to enable them to be turned using a hexagonal key regardless of which way round the hinge 1 is installed. Furthermore, compression adjustment is possible by using a hexagonal key to rotate the hinge pin 5 as described previously. When the hinge 1 is mounted left-handed the trailing end 41 of the hinge pin 5 will be disposed at the upper end of the hinge body 3, and vice versa when the hinge is mounted right-handed.

Moreover, regardless of which way round the hinge 1 is installed, one of the anti lift-off screws 25 will always be inaccessible when the door sash 54 attached to the flag assembly 4 is in a closed state. Accordingly, whichever way round the hinge 1 is mounted, an intruder will be prevented from lifting the hinge body 3 off the mounting block 2. Thus, the same hinge assembly can be used for both left and right handed doors without having to adjust, remove or reposition any part.

The above-described hinge 1 provides the advantages of adjustment in three-dimensions and enhanced security with a compact hinge body 3 which, advantageously, is supplied to an installer in just two separate parts, the mounting block 2 and the combined hinge body and flag assembly 3, 4. Thus, installation time is reduced and the likelihood of the hinge 1 being installed incorrectly is also reduced. Furthermore, 'hinge pin knock-out' is

readily prevented by forming over the leading end 40 of the hinge pin 5 after it has been inserted through the second hinge pin receiving bore 17.

CLAIMS:

1. A hinge for attaching a sash to a frame, the hinge permitting adjustment of the sash relative to the frame in each of a vertical, a horizontal and a compression direction when
5 installed, the hinge comprising:

a mounting block for fitting to the frame;

a hinge body slidably mountable for movement in the vertical direction on the mounting block, the hinge body comprising spaced apart first and second hinge arms provided with respective first and second hinge pin receiving bores;

10 a flag assembly for fitting to the sash, the flag assembly comprising a flag barrel for fitting between the first and second hinge arms;

a hinge pin arranged to pass through each of the first hinge pin receiving bore, the flag barrel and the second hinge pin receiving bore so as to pivotally connect the flag assembly to the hinge body; and

15 axial adjusting means disposed between the hinge pin and the flag barrel for moving the axis of rotation of the flag assembly in the compression direction in dependence on rotation of the hinge pin with respect to the hinge body,

wherein the second hinge pin receiving bore comprises an elongate slot to permit movement in the horizontal direction of the hinge pin relative to the second hinge pin
20 receiving bore, and wherein a leading end of the hinge pin extends through the elongate slot and is formed over so as to have a diameter greater than the width of the slot.

2. A hinge according to claim 1, wherein the axial adjusting means comprises at least one flag bush receivable within the flag barrel, the or each flag bush having:

25 an outer diameter concentric with the flag barrel; and,

an eccentric bore formed therethrough for receiving the hinge pin therein.

30 3. A hinge according to claim 2, wherein the hinge pin comprises a central portion received with the eccentric bore of the or each flag bush, the respective cross-sections of the central portion and the eccentric bore being shaped such that rotation of the hinge pin with respect to the hinge body causes rotation of the at least one flag bush within the flag barrel.

4. A hinge according to claim 3, wherein the central portion of the hinge pin comprises at least one flat and the eccentric bore of the or each flag bush comprises at least one flat, which is aligned with the at least one flat of the central portion of the hinge pin.

5 5. A hinge according to any one of claims 2 to 4, the or each flag bush comprising a collar which abuts against an end of the flag barrel to limit the extent to which the or each flag bush is inserted within the flag barrel.

10 6. A hinge according to any one of claims 2 to 5, comprising two flag bushes, each of the two flag bushes being disposed in respective opposite ends of the flag barrel.

15 7. A hinge according to any preceding claim, wherein the hinge pin comprises a trailing end having an octagonal cross-section disposed within the first hinge pin receiving bore, the hinge comprising an end cap attachable to the hinge body, the end cap comprising a pair of parallel tongues arranged to project into the first hinge pin receiving bore when the first end cap is attached to the hinge body and to receive the trailing end of the hinge pin therebetween when an opposed pair of sides of the octagonal trailing end of the hinge pin are aligned parallel to the tongues, the spacing between the tongues being selected so as to prevent rotation of the hinge pin within the hinge body.

20 8. A hinge according to any preceding claim comprising hinge pin retaining means to retain the hinge pin from within the hinge body when the flag assembly has been pivotally connected to the hinge body, the hinge pin retaining means being inaccessible when the hinge body is mounted on the mounting block.

25 9. A hinge according to claim 7 or claim 8 when dependent on claim 7, wherein the hinge pin comprises the leading end and the trailing end, and wherein the first hinge pin receiving bore comprises a step therein and the transition between the trailing end of the hinge pin and a central portion of the hinge pin defines a shoulder which abuts against the step within the first hinge pin receiving bore to prevent movement of the trailing end therepast.

30 10 A hinge according to claim 9, comprising a hinge pin washer disposed between the elongate slot and the formed over leading end of the hinge pin.

35

- 11 A hinge according to any preceding claim, wherein the hinge body comprises first and second vertical adjustment screws disposed at opposite ends thereof and arranged such that the first vertical adjustment screw acts on the mounting block to achieve adjustment of the hinge in the vertical direction when the hinge is used in a left-handed application and the second vertical adjustment screw acts on the mounting block to achieve
5 adjustment of the hinge in the vertical direction when the hinge is used in a right-handed application.

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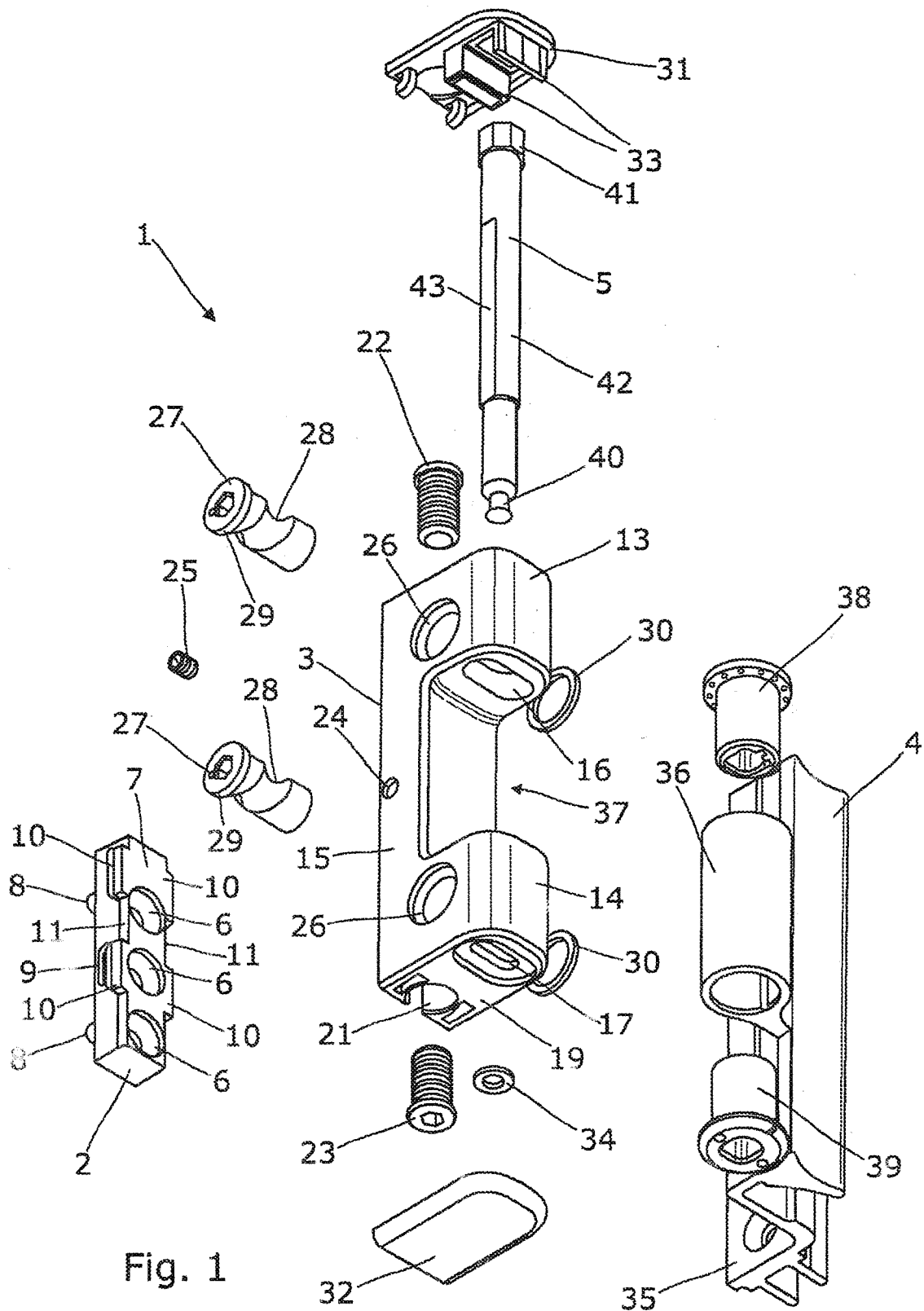


Fig. 1

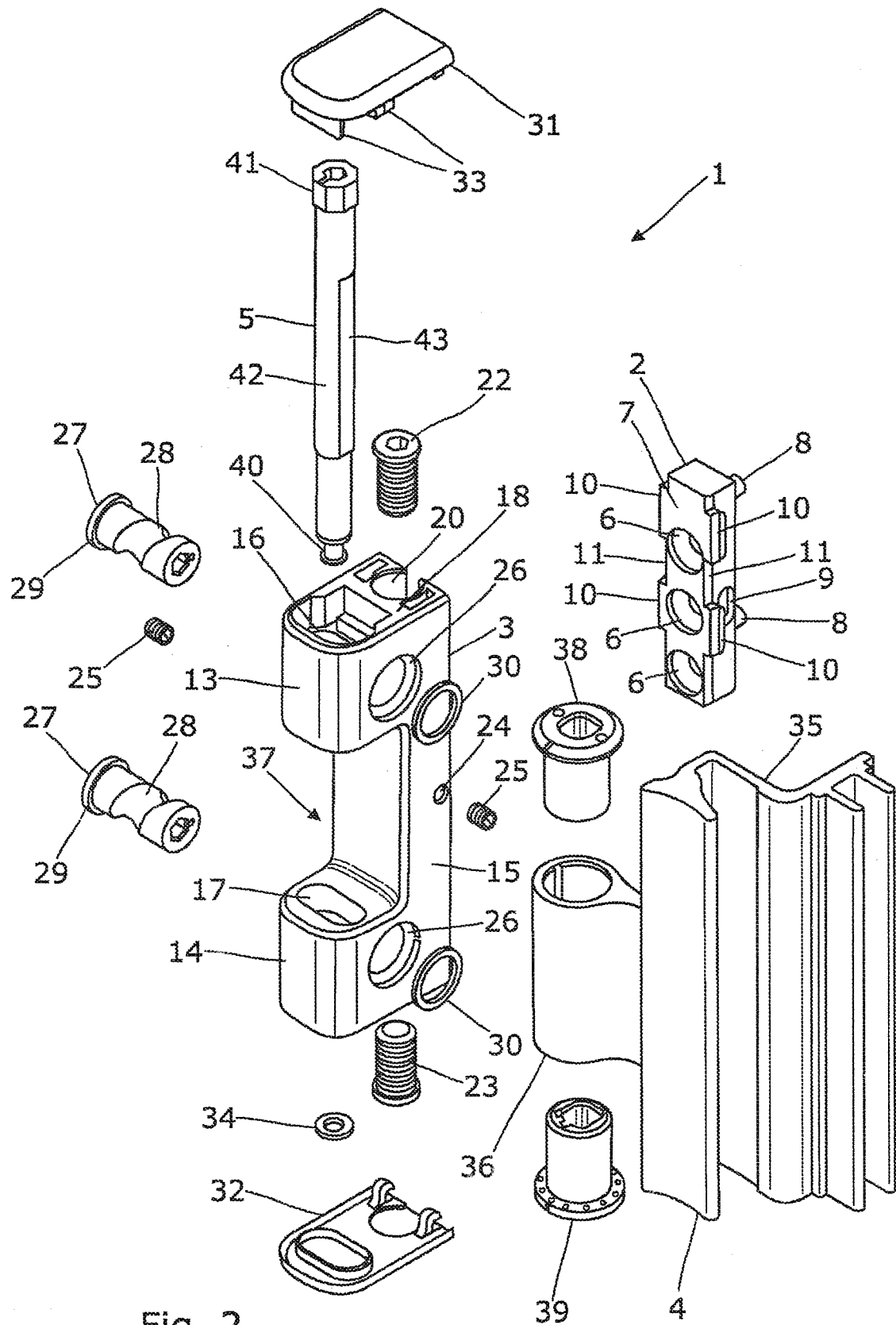


Fig. 2

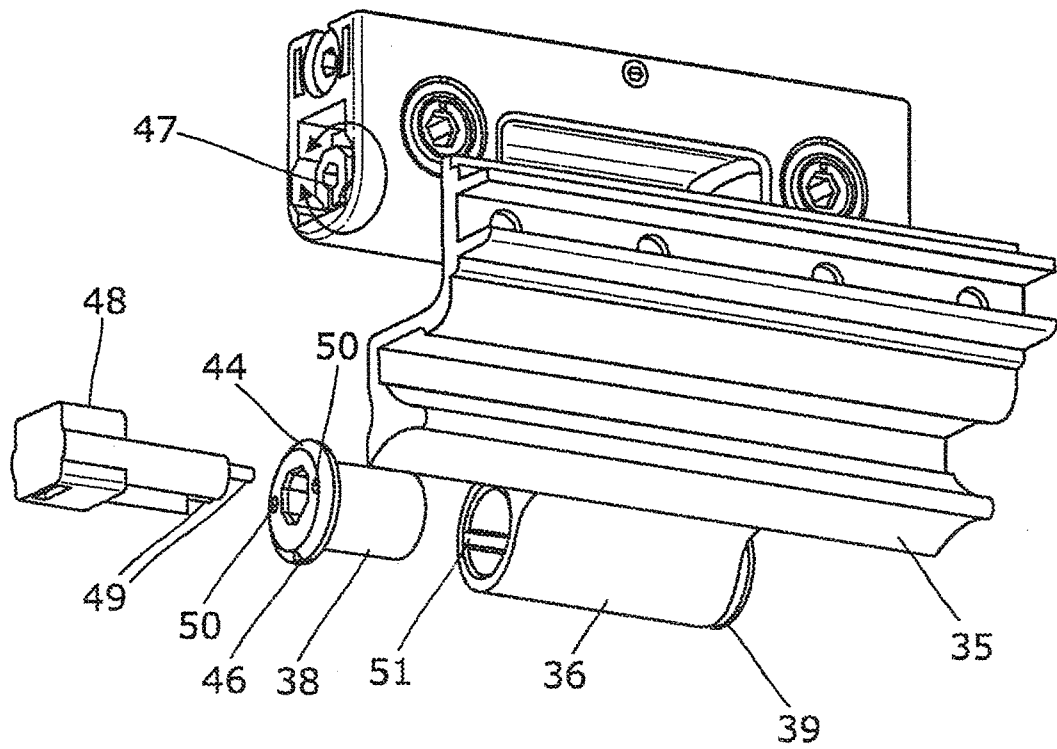


Fig. 3A

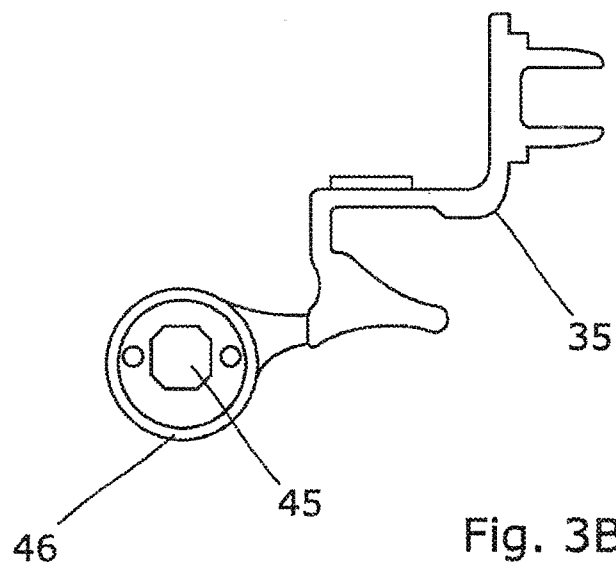


Fig. 3B

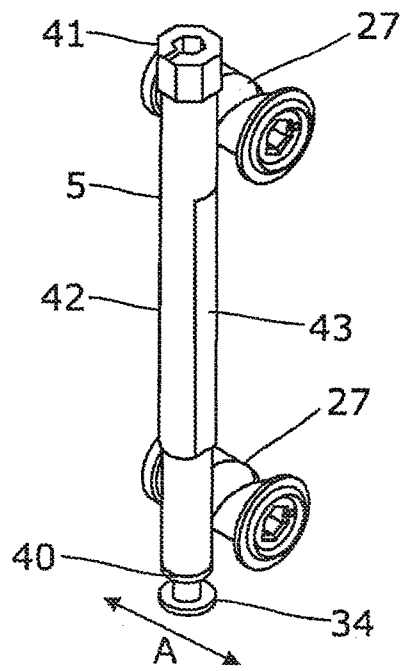


Fig. 4A

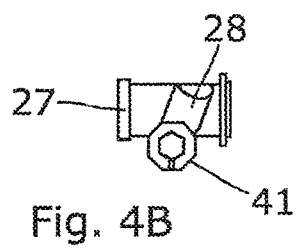
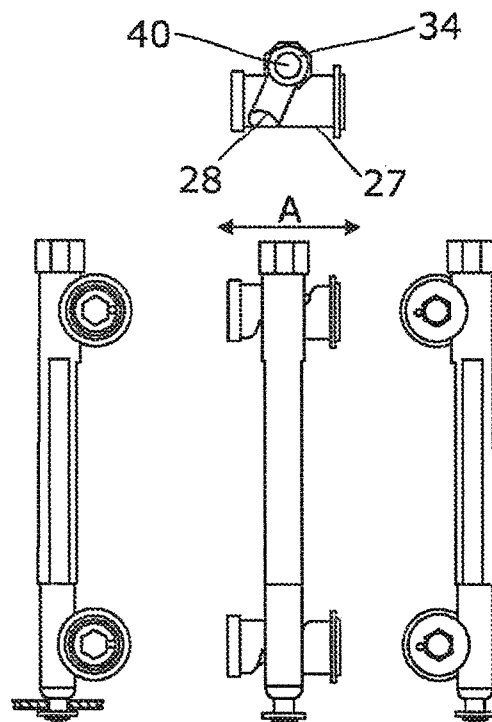


Fig. 4B

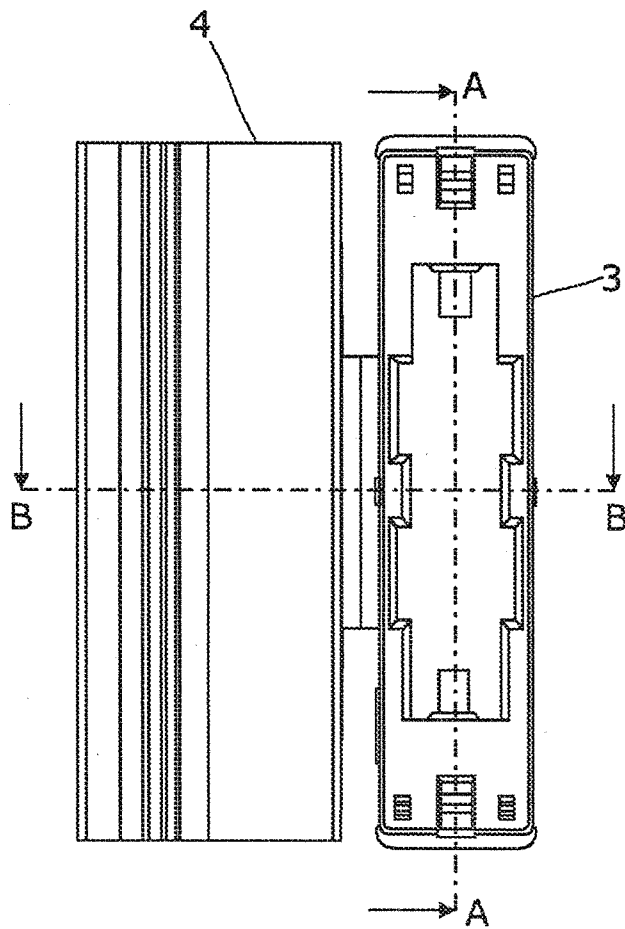


Fig. 5A

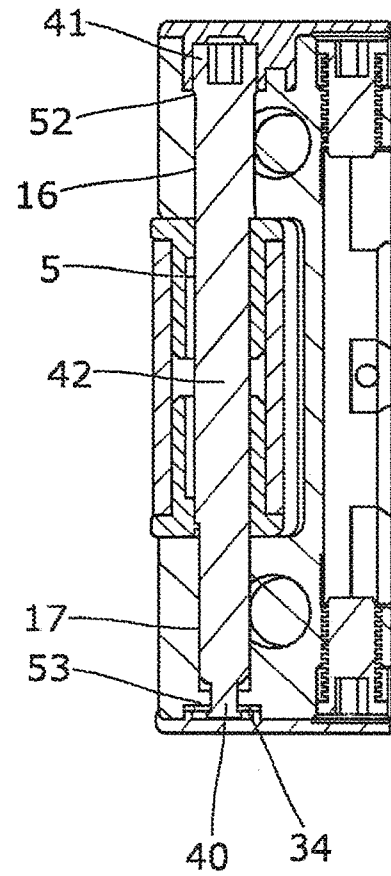


Fig. 5B

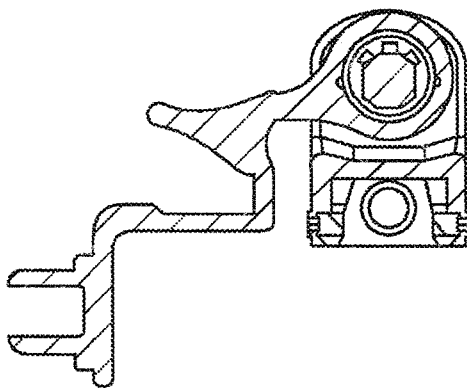


Fig. 5C

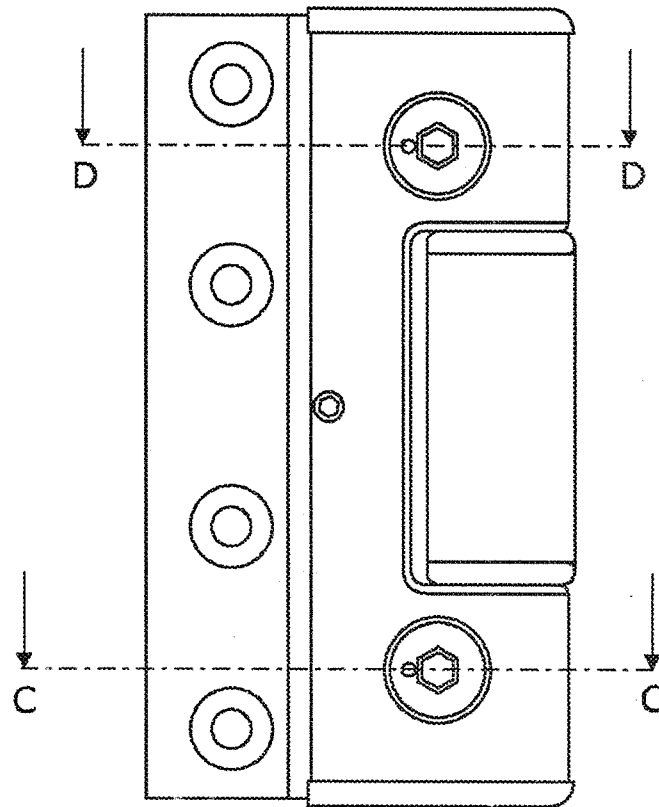


Fig. 5D

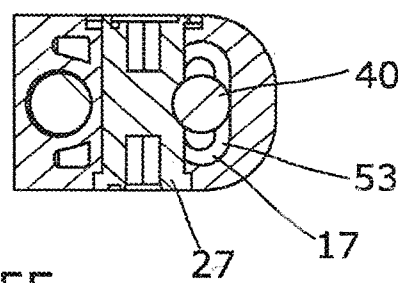


Fig. 5E

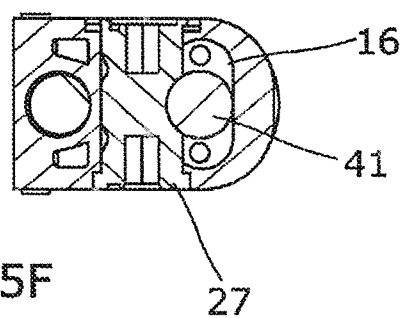


Fig. 5F

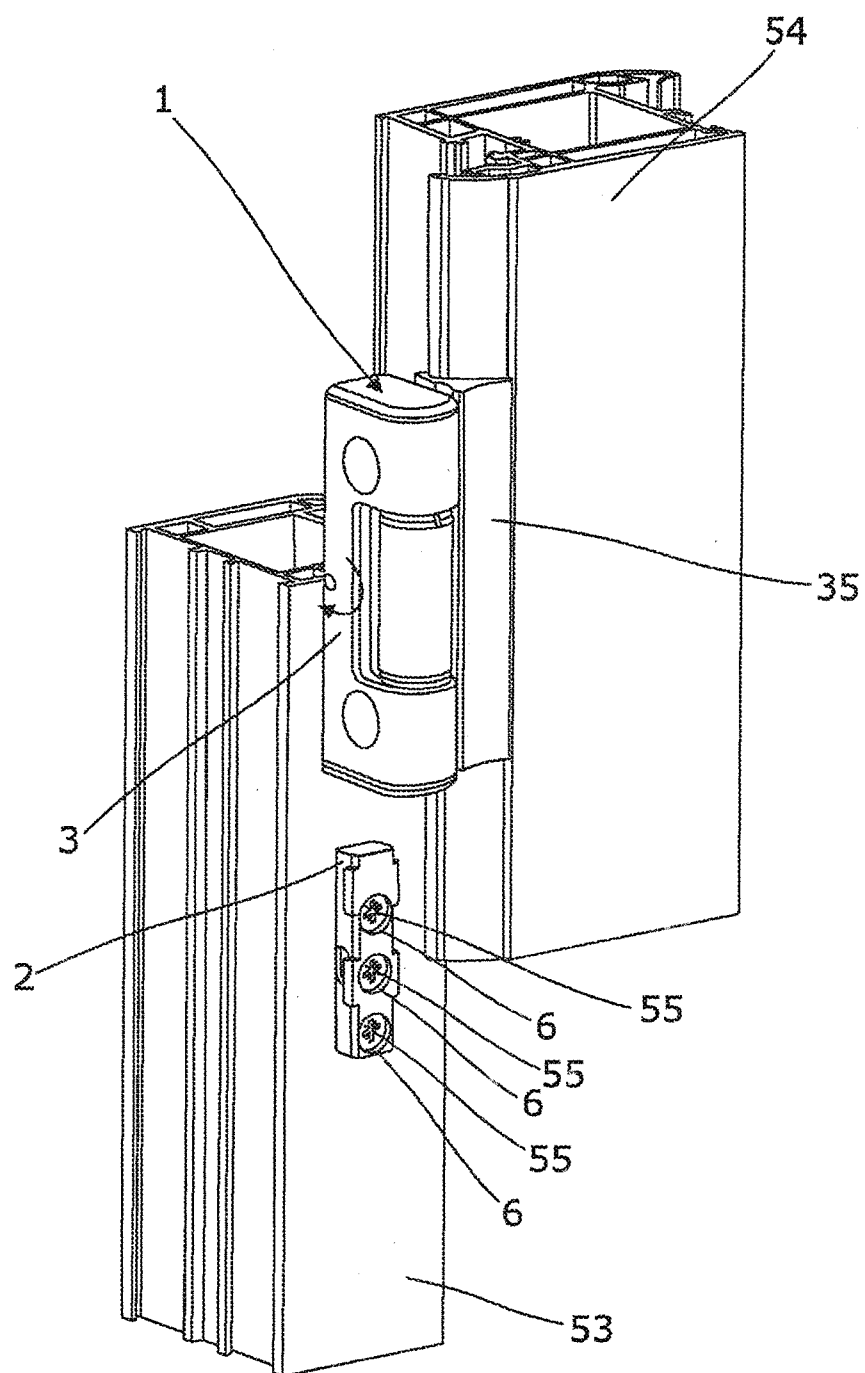


Fig. 6

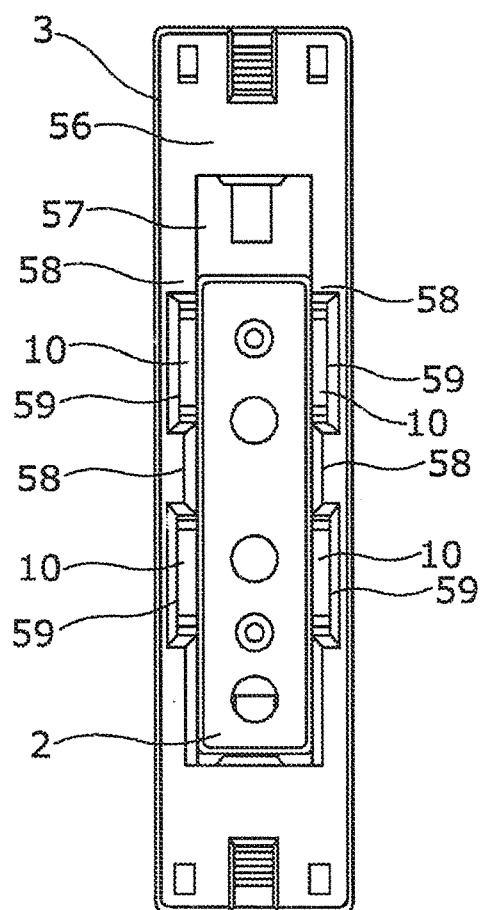


Fig. 7A

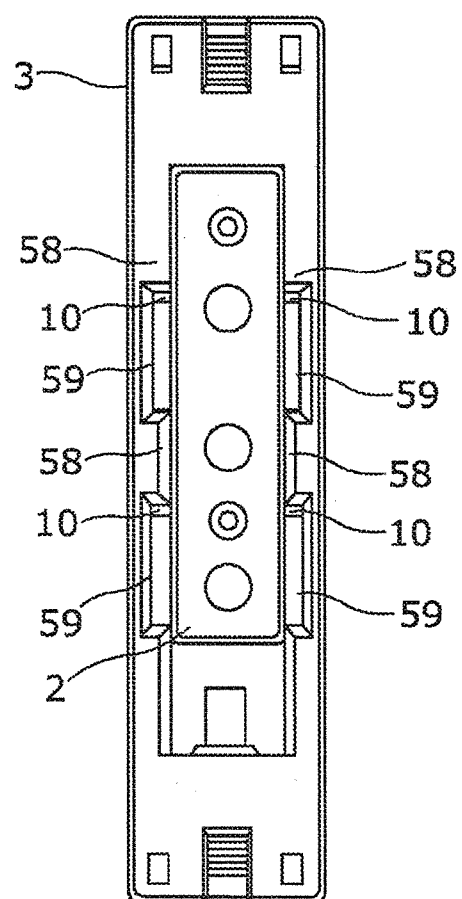


Fig. 7B

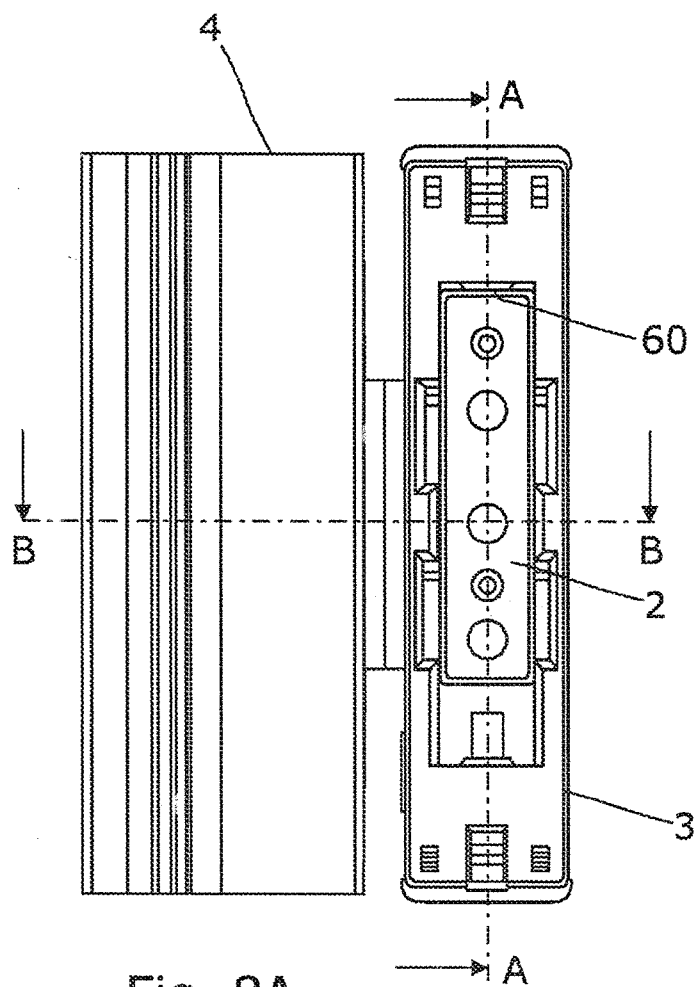


Fig. 8A

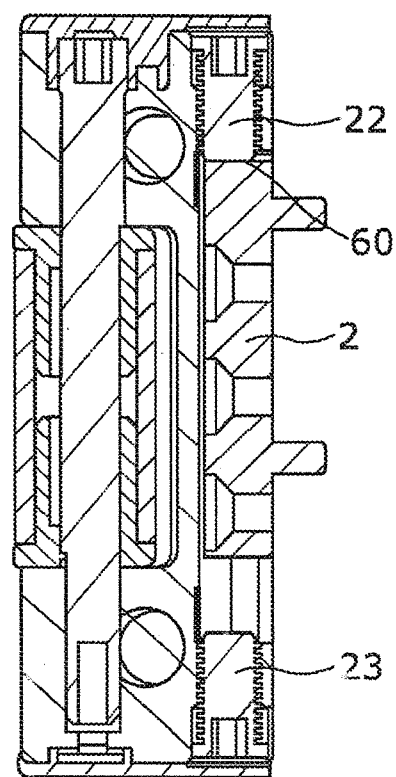


Fig. 8B

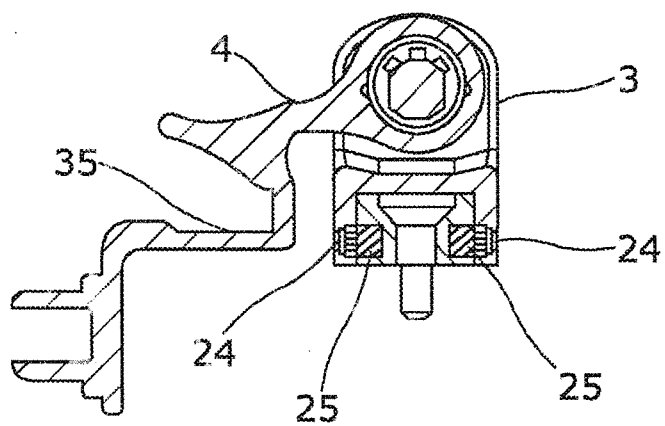


Fig. 8C

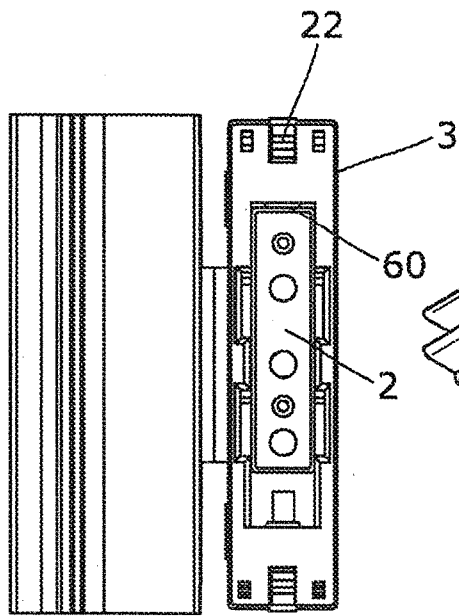


Fig. 9A

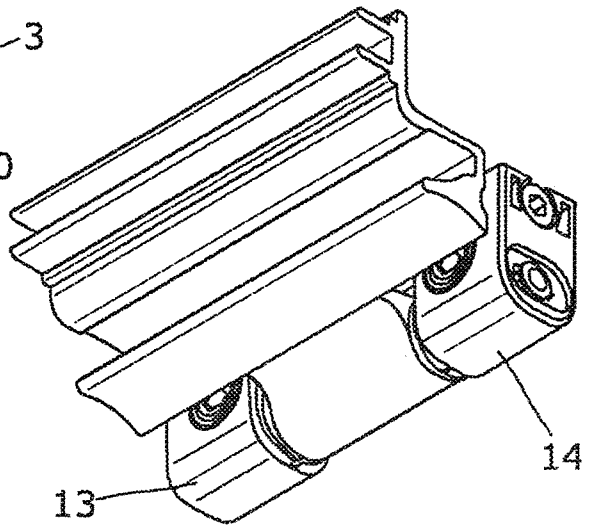


Fig. 9B

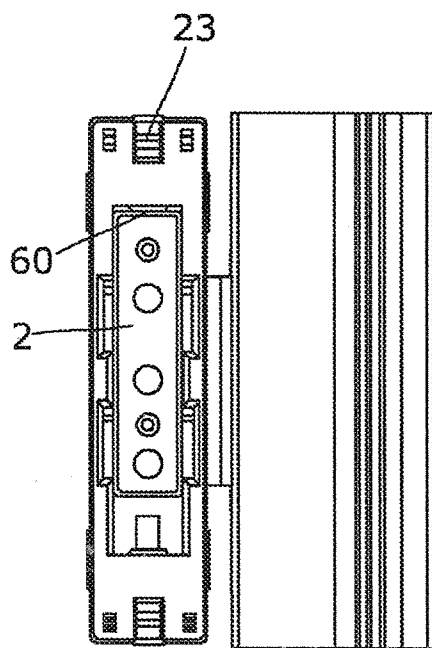


Fig. 10A

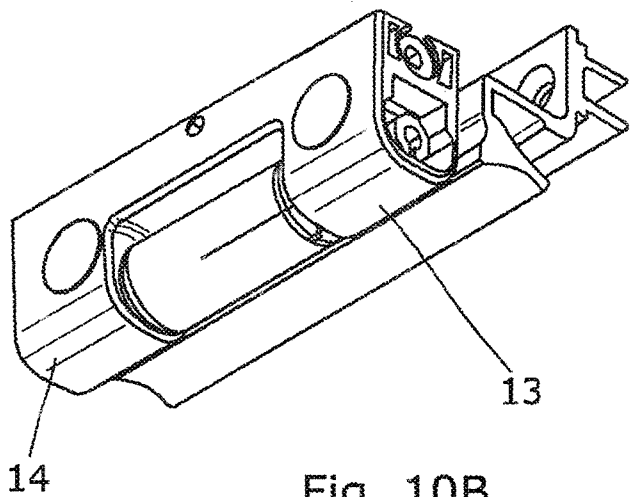


Fig. 10B