

Slide-In Cluster Block Assembly

FIELD OF INVENTION

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The present invention relates broadly to an assembly comprising a protector unit and a cluster block unit for connection to a hermetic terminal of a compressor, to a protector unit for connection to a hermetic terminal of a compressor, to a cluster block unit for connection to a hermetic terminal of a compressor, and to a method of electrically connecting a hermetic terminal of a compressor.

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BACKGROUND

The motor of a pump assembly in a refrigeration compressor gets its power supply via flexible lead wires terminated with a cluster block, which are attached to the hermetic terminals of the pump assembly. The free ends of the lead wires are then connected to the electrical accessories and the power supply.

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The cluster block comprises a number of receptacle pins corresponding to the number of lead wires, generally 3 wires. The 3 lead wires from the motor stator are terminated by crimping the wires onto their respective receptacle pins, which are housed inside the cluster block.

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Each receptacle pin has a spring back feature that enables the entry of the receptacle pin to open slightly for a corresponding hermetic terminal pin to slot in and subsequently exerts adequate pressure to secure the hermetic pin without permanent deformation. This will ensure adequate pressure by the receptacle pin to hold onto the hermetic terminal pin for proper conduction of electrical current. The receptacle pins are secured in the cluster block by locking features so as to prevent the receptacle pins from being pulled out of the cluster block.

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As each receptacle pin accepts a hermetic terminal pin, proper handling of the cluster block in order to ensure proper alignment with the receptacle pins is

important. Furthermore, as force needs to be exerted in order to push the cluster block and the receptacle pins against the hermetic terminal pins to secure the terminal pins, care must be exercised to prevent damages to the receptacle pins and the hermetic terminal pins or over-sliding of the cluster block. In addition, there
5 exists a problem associated with unintentional disengagement of the cluster block from the hermetic terminal pins during assembly of the device in which the compressor is used, such as a refrigerator, which may also damage the terminal pins, the cluster block or the compressor.

10 The present invention has been made in view of the above one or more challenges or problems.

SUMMARY

15 According to a first aspect of the present invention there is provided an assembly for connection to a hermetic terminal of a compressor, the assembly comprising a protector unit for attaching to the hermetic terminal of the compressor; and a cluster block unit for housing contact elements for connection to pins of the hermetic terminal; wherein the cluster block unit may be slidably moveable relative
20 to the protector unit to engage the contact elements with the pins of the hermetic terminal of the compressor when the protector unit is attached to the hermetic terminal.

 The protector unit and the cluster block unit may co-operate to lock the
25 cluster block unit when the cluster block unit is fully slid into the protector unit.

 The protector unit and the cluster block unit may co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and may be locked in 6 degrees of freedom.

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 The protector unit and the cluster block unit may co-operate to guide the contact elements for contacting the pins of the hermetic terminal during the sliding of the cluster block unit into the protector unit.

The assembly may further comprise the contact elements, and the contact elements may comprise biasing means co-operating with the cluster block unit to exert a pressing force for contacting the contact elements to the pins of the hermetic terminal when the cluster block unit is fully slid into the protector unit.

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The protector unit may further comprise one or more structural elements for facilitating fitting of the protector unit onto the hermetic terminal.

10 According to a second aspect of the present invention there is provided a protector unit for connection to a hermetic terminal of a compressor, the protector unit arranged such that a cluster block unit may be slidably moveable relative to the protector unit to engage contact elements in the cluster block unit with pins of the hermetic terminal of the compressor.

15 The protector unit may be arranged to co-operate with the cluster block unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

20 The protector unit may be arranged to co-operate with the cluster block unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and may be locked in 6 degrees of freedom.

25 The protector unit may be arranged to co-operate with the cluster block unit to guide the contact elements for contacting the pins of the hermetic terminal during the sliding of the cluster block unit into the protector unit.

The protector unit may further comprise one or more structural elements for facilitating fitting of the protector unit onto the hermetic terminal.

30 According to a third aspect of the present invention there is provided a cluster block unit for connection to a hermetic terminal of a compressor, the cluster block unit arranged such that the cluster block unit may be slidably moveable relative to a protector unit attached to the hermetic terminal to engage contact elements in the cluster block unit with pins of the hermetic terminal of the compressor.

The cluster block unit may be arranged to co-operate with the protector unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

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The cluster block unit may be arranged to co-operate with the protector unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and may be locked in 6 degrees of freedom.

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The cluster block unit may be arranged to co-operate with the protector unit to guide the contact elements for contacting the pins of the hermetic terminal during the sliding of the cluster block unit into the protector unit.

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The cluster block unit may further comprise the contact elements, and the contact elements may comprise biasing means co-operating with the cluster block unit to exert a pressing force for contacting the contact elements to the pins of the hermetic terminal when the cluster block unit is fully slid into the protector unit.

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According to a fourth aspect of the present invention there is provided a method of electrically connecting a hermetic terminal of a compressor, the method comprising the steps of attaching a protector unit to the hermetic terminal of the compressor; and sliding a cluster block unit relative to the protector unit to engage contact elements housed in the cluster block unit with pins of the hermetic terminal of the compressor.

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The protector unit and the cluster block unit may co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

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The protector unit and the cluster block unit may co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and locked in 6 degrees of freedom.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

FIGURE 1(a) shows an exploded view of a terminal protector, cluster block, receptacle pins and hermetic terminal according to one embodiment of the present invention.

FIGURE 1(b) shows a perspective view of an example of a compressor with which an embodiment of the present invention may be used.

FIGURES 2(a) and 2(b) show cross-sectional perspective and top views respectively of the terminal protector, cluster block, receptacle pins and hermetic terminal according to the embodiment of FIGURE 1(a), as assembled together in an operational environment.

FIGURES 3(a) and 3(b) show the perspective views of a cluster block according to one embodiment of the present invention.

FIGURE 4 shows a perspective view of a terminal protector according to one embodiment of the present invention.

FIGURE 5 shows a perspective view of receptacle pins housed within a see-through cluster block according to one embodiment of the present invention.

FIGURES 6(a)-6(c) show the perspective views of a receptacle pin according to one embodiment of the present invention.

FIGURES 7(a)-7(b) show the perspective views of a receptacle pin according to an alternate embodiment of the present invention.

FIGURES 8(a)-8(c) show cross-sectional views of a terminal protector, cluster block, receptacle pins and hermetic terminal according to one embodiment of the present invention, as assembled together in an operational environment.

5 FIGURE 9 shows a flow chart 900 illustrating a method of electrically connecting a hermetic terminal of a compressor according to an example embodiment.

10 **DETAILED DESCRIPTION**

Example embodiments of the present invention may provide an assembly of cluster block and receptacle pins specifically designed with an added terminal protector for connection to a reciprocating compressor. The assembly of cluster block and
15 receptacle pins of example embodiments enables the direct slot-in of the cluster block assembly into the hermetic terminal of a reciprocating compressor, which is subsequently locked into position. The receptacle pins enable a slot-in motion to engage and secure the hermetic terminal pins and exert sufficient pressure onto the terminal pins to ensure proper connections for the conduction of current. The terminal protector of
20 example embodiments is provided as a guide for the sliding motion of the cluster block assembly as it engages the hermetic terminal pins and also as a locking mechanism to secure the cluster block assembly in all 6 degrees of freedom to prevent movement.

FIGURE 1(a) shows an exploded view of a terminal protector 100, a cluster
25 block 102, receptacle pins 104 and a hermetic terminal 106 comprising terminal pins 108 according to embodiments of the present invention, which may be assembled onto a compressor, for example the compressor 110 as shown in FIGURE 1(b). FIGURES 2(a) and 2(b) show the cross-sectional perspective and top views respectively of the terminal protector 100, cluster block 102, receptacle pins 104 and
30 hermetic terminal 106 comprising terminal pins 108 according to the embodiment of FIGURE 1(a), as assembled together in an operational environment.

The terminal protector 100 and the cluster block 102 are generally made from glass fibre filled poly (butylene terephthalate) using a typical injection molding process

while the receptacle pins 104 are generally made from phosphor bronze using a typical stamping process. It should be appreciated that other materials and other manufacturing techniques known to those of skill in the art may also be used to produce the terminal protector 100, cluster block 102 and receptacle pins 104.

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FIGURES 3(a) and 3(b) show the perspective views of the cluster block 102 according to embodiments of the present invention. The cluster block 102 has a substantially Y-shaped structure 300 comprising symmetrical compartments 301a, 301b and a third compartment 301c. It should be appreciated that modifications may
10 be made to the shape and structure of the cluster block without departing from the spirit or scope of the invention as broadly described.

The compartments 301a, 301b are hollow with central channels 305a, 305b running through the length of the compartments 301a, 301b. Similarly, the third
15 compartment 301c has a central channel running through its length. The respective compartments 301a, 301b have a projection extending outwards from one side of the respective compartments 301a, 301b, which comprise inner stoppers 302a, 302b to prevent the cluster block 102 from being dislodged in the x-direction 200 and outer stoppers 304a, 304b to prevent the cluster block 102 from over-sliding into
20 the hermetic terminal pins 108 when the cluster block 102 is engaged with the terminal protector 100 as shown in FIGURES 2(a)-2(b). The cluster block 102 further comprises arms 306a, 306b extending from the respective sides 308a, 308b of the respective compartments 301a, 301b to prevent the cluster block 102 from over-sliding into the hermetic terminal pins 108 when the cluster block 102 is engaged
25 with the terminal protector 100 as shown in FIGURES 2(a)-2(b). Each of the arms 306a, 306b further comprises an enlarged section towards the rear that prevents the cluster block 102 from being dislodged in the z-direction 202 when the cluster block 102 is engaged with the corresponding sections of the terminal protector 100 as shown in FIGURES 2(a)-2(b). The cluster block 102 further comprises slots 310a,
30 310b, 310c, corresponding to the number of hermetic terminal pins 108, which in this example is 3. The slots 310a, 310b, 310c allow spaces for the terminal pins 108 to slide into position, as shown in FIGURES 2(a)-2(b).

FIGURE 4 shows the perspective view of the terminal protector 100 according to example embodiments. The terminal protector 100 comprises three hemispheres 400 attached to the base circular structure 402, whereby the three hemispheres 400 are positioned to correspond to the configuration of the three hermetic terminal pins. Each hemisphere 400 has an aperture 404 through which a terminal pin 108 can pass through, as shown in FIGURES 2(a)-2(b). The terminal protector 100 further comprises symmetrically raised arms 406a, 406b disposed towards the front half of the base circular structure 402. The parallel inner side walls 408a, 408b of the respective arms 406a, 406b act to guide a cluster block as it is linearly slid into position. The respective arms 406a, 406b further comprise downward step stoppers 410a, 410b to prevent the cluster block 102 from over-sliding into the hermetic terminal pins 108 and latches 412a, 412b with a groove to prevent the cluster block 102 from being dislodged in the x-direction 200 and the z-direction 200 when the cluster block 102 is engaged with the terminal protector 100 as shown in FIGURES 2(a)-2(b). The latches 412a, 412b also act as release latches when the cluster block 102 is to be removed. A tool, for example a test pen, may be used to wedge in between the groove of latch features 412a, 412b and the arms 306a, 306b (FIGURE 3) when they are engaged together in order to push the latches 412a, 412b upwards to release the cluster block 102.

The terminal protector 100 of example embodiments further comprises the raised structure 414 disposed towards the rear half of the circular structure 402. The raised structure 414 comprises inner stoppers 416 on each side of the structure 414 to prevent the cluster block 102 from over-sliding into the hermetic terminal pins 108 and outer stoppers 418 on each side of the structure 414 to prevent the cluster block 102 from being dislodged in the x-direction 200 when the cluster block 102 is engaged with the terminal protector 100 as shown in FIGURES 2(a)-2(b). The structure 414 further comprises the fastener 420, which when coupled with the fasteners 422, securely fasten the terminal protector 100 to the hermetic terminal to ensure a tight fitting.

It should be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the shapes, sizes, features and configurations of the cluster block and the terminal protector depending on the configuration of the

compressor to which they are attached to without departing from the spirit or scope of the invention as broadly described.

FIGURE 5 shows the perspective view of receptacle pins 500a, 500b, 500c housed within the cluster block 502, shown as see-through, according to example
5 embodiments of the present invention. The respective receptacle pins 500a, 500b, 500c are positioned within the respective channels 504a, 504b, 504c of the respective compartments 506a, 506b, 506c of the cluster block 502. One end of the respective wires 508a, 508b, 508c are attached to the respective receptacle pins
10 500a, 500b, 500c with the other end of the wires then connected to the power supply.

FIGURES 6(a)-6(c) show the perspective views of a receptacle pin 600 according to embodiments of the present invention. The receptacle pin 600 comprises the elastic tongues 601 and 603 with an opening 604 in between them
15 which allows a hermetic terminal pin to slide in. The tongue 601 comprises a fold back flap 602 with a slit 606 formed therein, which can exert an inward force when the flap 602 is pressed against a surface while the tongue 603 comprises a spring-back flap 605 which prevents the receptacle pin 600 from being pulled out when housed within a cluster block. The receptacle pin 600 further comprises a slot 608,
20 which when coupled with the slit 606, help to guide the receptacle pin 600 while it is being inserted into the cluster block.

FIGURES 7(a)-7(b) show the perspective views of a receptacle pin 700 according to alternate embodiments of the present invention. The receptacle pin 700
25 comprises the elastic tongues 702 and 704 with an opening 706 in between them which allows a hermetic terminal pin to slide in. The tongues 702 and 704 comprise fold back flaps 703 and 705 respectively, which can exert an inward force when the flaps 703 and 705 are pressed against a surface. The elastic tongues 702 and 704 also lock the receptacle pin 700 to the cluster block it is housed in, thus preventing
30 the receptacle pin 700 from being pulled out. The receptacle pin 700 further comprises a slot 710, which when coupled together with the slit 708 formed on the flap 703, help to guide the receptacle pin 700 while it is being inserted into the cluster block.

FIGURES 8(a)-8(c) show respectively the cross-sectional top view along the section A-A of FIGURE 8(c), the cross-sectional side view along the section B-B of FIGURE 8(c) and the cross-sectional side view along the section C-C of FIGURE 8(b) of the terminal protector 800, cluster block 802, receptacle pins 804a, 804b, 804c and hermetic terminal 806 according to example embodiments of the present invention, as assembled together in an operational environment. The hermetic terminal pins 807 pass through the aperture e.g. 808 of the hemisphere e.g. 809 of the terminal protector 800. The hermetic terminal pins 807 are held and secured between the respective elastic tongues 810a and 812a, 810b and 812b, 810c and 812c of the respective receptacle pins 804a, 804b, 804c housed within the respective compartments 803a, 803b, 803c of the cluster block 802. The elastic tongues 810a and 812a, 810b and 812b, 810c and 812c can exert an inward force to secure the hermetic terminal pins 807 and/or prevent the receptacle pins 804a, 804b, 804c from being pulled out of the cluster block 802, depending on the configurations of the elastic tongues 810a and 812a, 810b and 812b, 810c and 812c. The receptacle pins 804a, 804b, 804c have slits 814 to guide the receptacle pins 804a, 804b, 804c along the rail 816 provided in the cluster block 802 while they are being inserted into the cluster block 802. A pair of stoppers 818 is provided in the cluster block 802 corresponding to each of the receptacle pins 804a, 804b, 804c to prevent over-sliding during insertion.

Example embodiments of the present invention utilise the terminal protector to guide the sliding action of the cluster block assembly comprising the cluster block and the receptacle pins and lock the cluster block assembly in place once the receptacle pins have engaged the hermetic terminal pins. This locks the cluster block assembly in all 6 degrees of freedom, thus preventing it from being dislodged from the terminal pins.

In order to secure the cluster block assembly to the hermetic terminal pins, the terminal protector is first fitted over the hermetic terminal. Example embodiments provide fasteners on the terminal protector which promote tight fitting of the terminal protector onto the hermetic terminal when they are engaged. In addition to being used as a guide for the sliding action of the cluster block assembly, the terminal protector of example embodiments also helps to minimize the possibility of short circuit among the terminal pins.

The receptacle pins of example embodiments are inserted into the cluster block in the configuration similar to that of FIGURE 5. The cluster block assembly comprising the cluster block and the receptacle pins is next aligned with the terminal protector to ensure proper attachment before locking onto the terminal pins. The alignment is performed by contiguously matching the outer walls of the cluster block and the inner walls of the raised arms of the terminal protector.

The terminal protector of example embodiments comprises stoppers to prevent over-sliding of the cluster block assembly into the terminal pins as the assembly is slid into position for the receptacle pins to engage the terminal pins. In addition, the terminal protector and the cluster block of example embodiments comprise stoppers to prevent the cluster block from being dislodged from the terminal protector after they have been interlocked. The cluster block assembly may be removed from the terminal protector by maneuvering the latches of the terminal protector to release the cluster block assembly in circumstances where access to the pump assembly within the compressor is required.

Example embodiments of the present invention advantageously provide a terminal protector that guides the cluster block assembly as it is maneuvered to slide into position to engage the hermetic terminal pins. The terminal protector and the cluster block assembly comprise stoppers to secure the cluster block assembly onto the terminal protector which in turn is secured to the hermetic terminal. This prevents any movement of the terminal protector and the cluster block assembly to ensure stable operation of the compressor.

Figure 9 shows a flow chart 900 illustrating a method of electrically connecting a hermetic terminal of a compressor according to an example embodiment. At step 902, a protector unit is attached to the hermetic terminal of the compressor. At step 904, a cluster block unit is slid relative to the protector unit to engage contact elements housed in the cluster block unit with pins of the hermetic terminal of the compressor.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific

embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. An assembly for connection to a hermetic terminal of a compressor, the assembly comprising:

5 a protector unit for attaching to the hermetic terminal of the compressor; and
a cluster block unit for housing contact elements for connection to pins of the hermetic terminal;

wherein the cluster block unit is slidably moveable relative to the protector unit to engage the contact elements with the pins of the hermetic terminal of the
10 compressor when the protector unit is attached to the hermetic terminal.

2. The assembly as claimed in claim 1, wherein the protector unit and the cluster block unit co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

3. The assembly as claimed in claim 2, wherein the protector unit and the cluster block unit co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and locked in 6 degrees of freedom.

4. The assembly as claimed in any one of the preceding claims, wherein the protector unit and the cluster block unit co-operate to guide the contact elements for contacting the pins of the hermetic terminal during the sliding of the cluster block unit into the protector unit.

5. The assembly as claimed in any one of the preceding claims, further comprising the contact elements, and the contact elements comprise biasing means co-operating with the cluster block unit to exert a pressing force for contacting the contact elements to the pins of the hermetic terminal when the cluster block unit is fully slid into the protector unit.

6. The assembly as claimed in any one of the preceding claims, wherein the protector unit further comprises one or more structural elements for facilitating fitting of the protector unit onto the hermetic terminal.

7. A protector unit for connection to a hermetic terminal of a compressor, the protector unit arranged such that a cluster block unit is slidably moveable relative to the protector unit to engage contact elements in the cluster block unit with pins of the hermetic terminal of the compressor.

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8. The protector unit as claimed in claim 7, wherein the protector unit is arranged to co-operate with the cluster block unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

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9. The protector unit as claimed in claim 8, wherein the protector unit is arranged to co-operate with the cluster block unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and locked in 6 degrees of freedom.

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10. The protector unit as claimed in any one of claims 7-9, wherein the protector unit is arranged to co-operate with the cluster block unit to guide the contact elements for contacting the pins of the hermetic terminal during the sliding of the cluster block unit into the protector unit.

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11. The protector unit as claimed in any one of claims 7-10, wherein the protector unit further comprises one or more structural elements for facilitating fitting of the protector unit onto the hermetic terminal.

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12. A cluster block unit for connection to a hermetic terminal of a compressor, the cluster block unit arranged such that the cluster block unit is slidably moveable relative to a protector unit attached to the hermetic terminal to engage contact elements in the cluster block unit with pins of the hermetic terminal of the compressor.

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13. The cluster block unit as claimed in claim 12, wherein the cluster block unit is arranged to co-operate with the protector unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

14. The cluster block unit as claimed in claim 13, wherein the cluster block unit is arranged to co-operate with the protector unit to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and locked in 6 degrees of freedom.

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15. The cluster block unit as claimed in any one of claims 12-14, wherein the cluster block unit is arranged to co-operate with the protector unit to guide the contact elements for contacting the pins of the hermetic terminal during the sliding of the cluster block unit into the protector unit.

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16. The cluster block unit as claimed in any one of claims 12-15, further comprising the contact elements, and the contact elements comprise biasing means co-operating with the cluster block unit to exert a pressing force for contacting the contact elements to the pins of the hermetic terminal when the cluster block unit is fully slid into the protector unit.

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17. A method of electrically connecting a hermetic terminal of a compressor, the method comprising the steps of:

attaching a protector unit to the hermetic terminal of the compressor; and

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sliding a cluster block unit relative to the protector unit to engage contact elements housed in the cluster block unit with pins of the hermetic terminal of the compressor.

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18. The method as claimed in claim 17, wherein the protector unit and the cluster block unit co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit.

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19. The method as claimed in claim 18, wherein the protector unit and the cluster block unit co-operate to lock the cluster block unit when the cluster block unit is fully slid into the protector unit and locked in 6 degrees of freedom.