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(54) Electrical connector assembly

(57) An assembly is disclosed for connecting a first array of electrical connectors to a second array of electrical connectors. A connector mount is provided, along with at least one corresponding connector locking element for engaging the connector mount, and a drive mechanism arranged to drive the connector mount towards a second array of electrical connectors, preferably by converting a rotational input into a linear drive, to engage and lock the electrical connectors in a locked position.

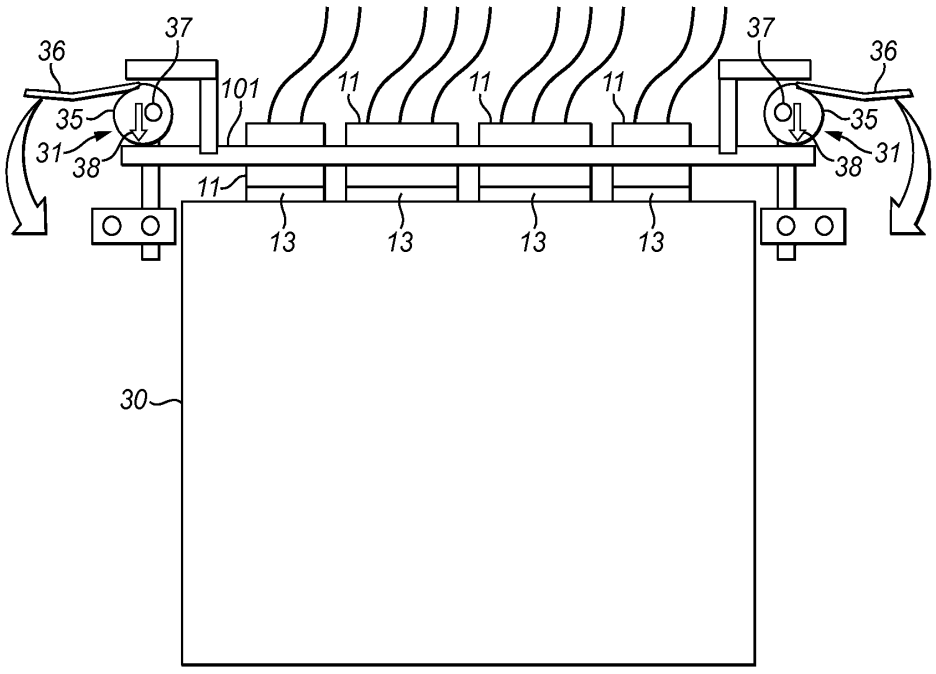

FIG. 3B

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to electrical connection equipment for use in an aircraft. In particular, the invention relates to an assembly for connecting an array of multiple electrical connectors to a second array of electrical connectors in a reliable and efficient manner.

BACKGROUND OF THE INVENTION

[0002] Modem aircraft include large numbers of items of electronic equipment, used for various functions, ranging from peripheral systems, such as passenger entertainment systems, through to system-critical avionics equipment, which may relate to navigation, auto pilot, engine management systems etc. Electronic equipment can be held in racks in aircraft and each piece of equipment may be connected to a number of connectors, which are mounted to a wiring harness to communicate electronic signals to and from the avionics equipment and on to other parts of the aircraft or its systems. The security of these connections is important and so each connector is generally secured using a multi-turn retaining nut, screw or bolt. Each piece of equipment may have a relatively large number of connectors to connect, for example, eight connectors, arranged as two rows of four. Each connector can be secured using one or more retaining bolts, and each bolt is to be tightened to a within narrow range of torque values using a specific tool, in order to ensure the security of the connection. Where multiple connectors are installed on the same piece of equipment, access to each retaining bolt can be difficult, due to the obstruction created by the wiring harness and/or adjacent connectors. Further, particularly in an aircraft environment, where forces due to vibration and acceleration can be significant, each individual connector can be subject to significant wear and stress, which can at least in part be transmitted through the wiring harness to the electrical connector.

[0003] Further, it can be very difficult for a maintenance technician or engineer to install the connectors correctly when protective gloves are being worn. This is particularly the case when maintenance procedures are being carried out in cold environments. Further, a technician must be particularly careful of which connector on the wiring harness is to be installed on each connector on each piece of equipment.

[0004] The result of these issues is that the time and care needed to uninstall and reinstall connectors onto a piece of equipment is relatively long, and requires significant skill and bespoke tooling, to ensure that the connectors are appropriately installed and appropriately secured, with the bolt tightened to the appropriate torque ranges.

[0005] Alternative configurations exist where the avionics equipment is held in equipment racks, with the aircraft harness connectors fixed into the equipment rack structure to align and hold them approximately. However, this approach is not useful where equipment cannot be racked. Accordingly, there is a need for an improved system for connecting multiple electrical connectors to a piece of electrical equipment.

SUMMARY OF THE INVENTION

[0006] A first aspect of the invention provides an assembly for connecting a first array of electrical connectors to a second array of electrical connectors, comprising: a connector mount, for receiving the first array of electrical connectors; and at least one connector locking element for retaining the connector mount to lock the first array of electrical connectors in engagement with the second array of electrical connectors; the connector locking element comprising a drive mechanism arranged to drive the connector mount and the first array of electrical connectors toward the second array of electrical connectors upon a first mechanical user input to the drive mechanism. Preferentially, the drive mechanism is also arranged to drive the connector mount and the first array of electrical connectors away from the second array of electrical connectors upon a second mechanical user input to the drive mechanism, different from the first mechanical user input.

[0007] The drive mechanism may be configured to convert a rotational user input into a linear driving motion. In this case, the drive mechanism may be rotatable and may have an eccentric surface able to push the connector mount or a connector locking element, in order to drive the connector mount and the first array of electrical connectors toward the second array of electrical connectors when the drive mechanism is rotated. Preferentially, the eccentric surface is also able to push the connector mount or a connector locking element, in order to drive the connector mount and the first array of electrical connectors away from the second array of electrical connectors when the drive mechanism is rotated in a different way, for example in the other direction or an opposite direction.

[0008] The connector locking elements may be attached to one of: a second electrical connector mount; electrical equipment; and a mounting area for mounting electrical equipment. In this way, the connector locking element or elements comprising the drive mechanism can be used to engage and lock together an array of electrical connectors to an array of corresponding electrical connectors, and retained in place by locking elements which are fixed relative to the corresponding connectors in numerous alternative configurations.

[0009] At least one of the connector locking elements may be movably mounted, so as to be movable into and out of engagement with the connector mount. This allows the connector mount to be advanced forward in a substantially linear direction without any obstruction by the connector locking elements. Subsequently the connector

locking elements can be moved into engagement with the connector mount to hold it in place and may be subsequently actuated by mechanical user input to drive the electrical connectors into full engagement with one another. The movement of the connector locking elements is preferably in a substantially lateral direction relative to a plane of the connector mount, so that the connector mount can be advanced in a direction substantially perpendicular to the plane of the connector mount to connect the connectors and then the connector locking elements can be moved into engagement in a direction substantially parallel to the plane of the connector mount, and/or perpendicularly to the direction in which the connector mount is advanced to join the electrical connectors.

[0010] At least one of the connector locking elements may comprise a shaft, the shaft being rotatably mounted at a first end and having the drive mechanism located at the second end, so that rotation of the shaft about its first end can move the drive mechanism into and/or out of engagement with the connector mount.

[0011] An axis of rotation of the drive mechanism may be substantially perpendicular to the direction of substantially linear motion of the connectors created by the drive mechanism. This allows a rapid creation of linear motion by rotation of the drive mechanism, and can include mechanisms such as a cam-based devices or other mechanisms as described herein.

[0012] The assembly may further comprise secondary locking means for maintaining the drive mechanism in a locked position. This helps to ensure security of the engagement of the connectors on the equipment.

[0013] The assembly may further comprise drive connection means connected to at least a first connector locking element and a second connector locking element of the assembly, so that a drive input to one of the first and second connector locking elements is transferred to the other of the first and second connector locking elements, to drive the first and second connector locking elements simultaneously. In this way, the connector locking elements being simultaneously driven means that the drive mechanisms of plural connector locking elements are driven simultaneously. This can ensure even application of drive to separate points on the connector mount, to ensure even, parallel and steady connection of all connectors mounted to the connector mount.

[0014] The first connector locking element may comprise a lever for a user to provide a drive input and the second connector locking element may preferably be driven by the first connector locking element, via the drive connection means.

[0015] The drive mechanism may be a cam mechanism. This provides an efficient way for reliably translating rotational motion into a linear drive.

[0016] The cam mechanism may be configured with an over-centre locked position, configured to bias the cam mechanism to its locked position when it is in its locked position. This helps to ensure that the cam mechanism isn't accidently or undesirably opened or released without positive release input by a user.

[0017] The connector locking elements may comprise:

a rotatable drive mechanism having an axis of rotation and an axially projecting protrusion mounted eccentrically on the rotatable member; and

a follower member, having a slot for engagement with the protrusion, to convert rotation of the rotatable member to linear motion of the follower member.

[0018] This configuration provides an alternative mechanism for converting rotary motion to linear motion, and allows the provision of a different form of follower member, which can extend away from the connector mount to engage corresponding engagement points on all adjacent to the equipment to which the connectors are being connected.

[0019] The assembly may further comprise a fixed ramp and the follower member may comprise a ramp engagement portion arranged to be driven along the ramp when the follower member is moved to a disengaged position to move the follower member laterally. This means that simultaneously with the follower member being moved along its linear axis, the fixed ramp can drive at least a portion of the follower member, or a projecting portion connected to the follower member, perpendicularly to its axis of linear movement, to assist with its disengagement from corresponding engagement portions for holding the connector mount in its engaged position. This facilitates easier assembly and disassembly of the connector mount at the equipment before the drive mechanism is actuated for engagement, and after the drive mechanism is activated for disassembly.

[0020] The assembly may further comprise a detent for arresting rotational movement of the drive mechanism. This can provide a way of locking the drive mechanism in its fully engaged position to hold the connectors securely in place.

[0021] The detent may comprise a fixed element comprising an arcuate portion and a notch; and a lever of the connector locking element comprises a protrusion which is biased towards the notch to engage the notch and lock the drive mechanism.

[0022] A further aspect of the invention provides a connector locking arrangement for receiving and locking in the place a connector mount, comprising: at least one connector locking element for retaining the connector mount to lock the first array of electrical connectors in engagement with a second array of electrical connectors; the connector locking element comprising a drive mechanism arranged to drive the connector mount and the first array of electrical connectors toward the second array of electrical connectors upon mechanical user input to the drive mechanism.

[0023] A further aspect of the invention provides a connector mount for receiving a first array of electrical connectors, comprising:

at least one connector locking element for engaging an engagement portion of the connector mount to lock the first array of electrical connectors in engagement with a second array of electrical connectors;

the connector locking element comprising a drive mechanism arranged to drive the connector mount and the first array of electrical connectors toward the second array of electrical connectors upon mechanical user input to the drive mechanism.

[0024] As will become more apparent from the detailed description of the invention provided herein, the invention achieves the following advantages.

[0025] The invention removes the need to secure each of an array of connectors with its own individual retaining bolt(s), which has the following benefits:

- Each retaining bolt for separately secured connectors can take approximately 30 seconds to install i. e. 240 seconds in total. The drive mechanisms of the invention levers take approximately 10 seconds to operate and secure.

- Each retaining bolt for separately secured connectors can require the use of a hexagonal driver tool set to a specific torque setting. Several different torque settings may be required if there are different sizes of connector. With the solution of the present invention, no hexagonal driver is required and there is no time required for setting the torque value.

[0026] This also has the following benefits:

- The risk of over torqueing the retaining bolts is removed.

- The avionics equipment is generally installed in areas of the aircraft with low light levels and restricted access making the correct installation of the connector using a precision tool difficult, for example it can be difficult to position a hexagonal driver tool, difficult to identify the correct connectors, difficult to ensure the connector is correctly aligned. The assembly of the present invention simplifies the process by, for example, removing the need to identify each of a plurality of connectors.

- The aircraft harnesses connected to electrical connectors can make it very difficult to use a hexagonal driver to secure retaining bolts, for example by limiting the degree of rotation achievable, which can significantly increase the installation and removal times of equipment or connectors. The assembly of the present invention is free from interference with the connector harnesses.

[0027] The present invention permits the installation of all of the aircraft harness connectors onto a single mount at harness production time, which can have the following benefits:

- In some circumstances, it can be it is possible to install individual connectors incorrectly or accidentally onto adjacent equipment. With appropriate use of the present invention and chosen connector arrangements, it can be made impossible to install a single connector mount and connectors onto the wrong equipment.

- Avionics equipment may not capable of detecting and reporting that all of the connectors have not been correctly installed and therefore dedicated tests must be performed to ensure all connectors have been correctly installed. With all connectors mounted onto connector mount of the invention, the detection of one connector being installed correctly can provide confidence that all connectors of that connector mount have been installed and so can reduce the number of checks necessary before putting the aircraft into service.

[0028] The use of an assembly of the present invention further has the following advantages:

- The drive mechanism can be operated by a maintenance operator wearing protective gloves.

- The assembly can provide a simple visual indication of correct installation.

[0029] The present invention can improve the robustness of the installation by transmitting forces applied through the aircraft harness to the mounting mechanism and not to the electrical connectors.

[0030] The present invention can remove the need for individual connector retaining bolts, and individual backshells, which can reduce the number of parts required and operations required to assemble / disassemble the aircraft harness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1A to 1C show a connector mount of the present invention;

Figures 2A to 2D show how covers may be applied to the connector mount of figure 1;

Figures 3A to 3D show the connection and disconnection process for an assembly of the present invention;

Figure 4 shows detail of a connector locking element of the present invention;

Figures 5A to 5C show an alternative embodiment in accordance with the present invention;

Figures 6Aa and 6B show a side view illustrating operation of the embodiment of figures 5A to 5C;

Figure 7A and 7B show further detail of arrangements for use in the embodiment of figures 5A to 6B;

Figures 8A and 8B show a locking mechanism for use in the embodiments illustrated in figures 5A to 7B.

DETAILED DESCRIPTION OF EMBODIMENT(S)

[0032] Figure 1A shows a connector mount 10 of the present invention. Connector mount 10 comprises a mounting plate 101 and a plurality of connectors 11, which are mounted to mounting plate 101. Connectors 11 have a plurality of electrical wires 12 extending therefrom, which electrical wires can be connected to an electrical harness of a vehicle such as an aircraft. Connectors useful in the invention can include those specified in aerospace standard EN4165. The mounting plate 101 and connectors 11 can be manufactured as a single item in order to make it weigh less and to reduce the component count.

[0033] Figure 1B shows a top view of the connector mount 10 of figure 1A. It can be seen in this example that the connectors 11 are mounted in a two dimensional array, totalling 8 connectors, arranged in two rows of four. Arrays containing other numbers of connectors in each lateral direction are envisaged. The connector plate 101 comprises at each end an engagement portion 102 for engaging a locking element, to connect the connector mount 10 and its connectors 11 to a piece of equipment, or to corresponding electrical connectors. The engagement portion 102 comprises a notch 103, which is flanked either side by a protrusion 104. A connector locking element can therefore be received in the notch 103 and can engage the pair of protrusions 104 to lock the connector mount 10 in place with respect to a corresponding set of connectors arranged for connection to electrical connectors 11.

[0034] As illustrated in figure 1C, the connector mount 10 may further comprise a secondary engagement portion 105, arranged in a spaced configuration from the primary engagement portion 102, such that a connector locking element can be received in the gap 106 formed therebetween. This allows a connector locking element to drive against the primary engagement portion 102 to drive the connectors 11 into engagement with corresponding connectors, or alternatively against the secondary engagement portion 105 to drive the connector mount 10 away from, and out of engagement with, the corresponding connectors, to disengage connectors 11 therefrom.

[0035] Figures 2A to 2D show how covers can be assembled on the connector mount of figures 1A to 1D.

[0036] As shown in figure 2A, a central divider wall 107 may separate the 2 longitudinal rows of electrical connectors and can provide at least a degree of electromagnetic isolation between adjacent rows of connectors. As seen from above in figure 2B, the connector mount may further comprise a central outer wall portion 108 comprising a plurality of openings 109 into which wires 12 extending from the connectors 11 can be located, to enable them to pass from an interior space of the connector mount body to an exterior of the connector mount body.

[0037] As illustrated in figure 2C, side portions 110 can be provided to the connector mount, and may comprise openings 111, arranged to coincide with openings 109 so that the covers comprising the central divider wall 107, the central outer wall portion 108 and the side portions 110 constitute a back shell of the connector mount wherein a plurality of openings 111/109 is provided for the passage of wires 12, as illustrated in figure 2D. In this way, the enclosed back shell encloses the plural connectors 11 within the body of the connector mount 10. This can provide electromagnetic shielding to the full array of connectors by use of a single outer shell.

[0038] Figures 3A to 3D show how the connector mount 10 can be driven into, and locked in, engagement with a corresponding set of connectors 13 by connector locking elements 31.

[0039] Figure 3A shows an item of electronic equipment 30, which may be avionics equipment in an aircraft. The equipment 30 comprises a plurality of electrical connectors 13, for connecting the equipment to a wiring harness of a system or vehicle such as an aircraft. Either mounted to equipment 30, or provided adjacent to and in a fixed configuration relative to equipment 30, is a plurality of connector locking elements 31, in this embodiment a pair of connector locking elements 31 is shown. In the illustrated embodiment, each connector locking element comprises a shaft 32 which is rotatable about a pivot point 33 located adjacent a first end 34 of the shaft 32. At a second end, opposite the first end 34, of the shaft, is located a cam mechanism 35, for converting a rotational mechanical user input into a linear motion of the connector mount, when engaged with the connector mount. As can be seen in figure 3A, when the connector locking element 31 is rotated substantially about its first end 34, it can be placed into engagement with the engagement portions 102 of the connector mount 10, in this case by an arcuate movement, a part of which is also generally in a direction which is substantially parallel to the plane of the connector mount plate 101. A sliding motion could alternatively be provided, to allow the cam mechanism to be slid into engagement with the connector mount 10.

[0040] As is illustrated in figure 3B, once the connector locking elements 31 are engaged with the engagement

portions 102, a rotational input via a lever or levers 36 causes the cam mechanism 35 to rotate about a pivot point 37. Since the outer profile of the cam mechanism is non-circular, its rotation causes a linear drive to be transferred to the connector mount 10, via engagement portions 102, as illustrated by arrows 38.

[0041] If the cam mechanisms 31 are similarly configured and the levers 36 are simultaneously actuated, then the connector mount plate 101, carrying in connectors 11 will be advanced in a uniform manner, so that connectors 11 are all advanced together in a uniform manner. This allows the connectors 11 to be reliably and evenly connected to the equipment 30 via corresponding connectors 13, in a fast and efficient manner. Each cam mechanism 31 constitute therefore a drive mechanism arranged to drive the connector mount 10 and the array of electrical connectors 11 toward the corresponding array of electrical connectors 13, upon mechanical user input to the drive mechanism.

[0042] As can be seen in figure 3C, the complete rotation of the cam mechanism 35 results in full engagement of connectors 11 with corresponding connectors 13 and so by configuring the cam mechanisms with a linear stroke equal to or greater than the distance of motion required to engage the connectors 11 with corresponding connectors 13, the full engagement of the connectors can be driven in a controlled manner by the drive mechanisms.

[0043] Figure 3D illustrates how, by rotation of the cam mechanisms 35 in an opposite direction to that illustrated in figure 3B, the cam mechanism can exert a force in the direction of arrow 39, against secondary engagement portions 105, to lift the connector mount 10, and the connectors 11 mounted thereto, away from electrical equipment 30 and its corresponding connectors 13 in a similarly even and controlled manner. In this case, each cam mechanism 35 constitutes a drive mechanism arranged to drive the connector mount 10 and the array of electrical connectors 11 away from the corresponding array of electrical connectors 13, upon mechanical user input to the drive mechanism. Therefore, an appropriately configured drive mechanism can drive both engagement and disengagement of the connectors 11 mounted to the connector mount 10, in a controlled and even manner.

[0044] Figure 4 illustrates means by which the locking elements 31 can be configured to secure or lock the connector mount plate 101 and connectors 11 in place. A first means by which this can be achieved is with an over-centre cam arrangement. When the cam mechanism is fully rotated, by fully rotating lever 36 to its engaged position, a point of greatest radius 361 of the cam profile 360, relative to pivot 362, has moved past, and is located beyond, a contact point 363 between the cam mechanism and the connector mounting plate 101. By providing a degree of resilience in the connection of the electrical connectors 11 and 13 to one another, for example with resilient sealing means such as rubber seals in the connectors, then this elasticity can provide a degree of bias, which encourages the point of greatest radius 361 to be biased away from the plate 101 in a direction of arrow 364. This resilience may alternatively be provided in shafts 32 or in the plate 101 itself, or in engagement portions 102. This bias in the direction of arrow 364 imparts a moment on the cam mechanism in a direction of arrow 365, which maintains the connector locking element 31 in its closed or locked configuration as illustrated. Therefore, to disengage the connector locking element, a user must apply a force at lever 36 in a direction of arrow 366, to overcome the force in the direction of arrow 364 and disengage the connector locking element.

[0045] A secondary means which may further prevent the connector locking element from being inadvertently disengaged is to apply a secondary locking means, such as a mechanical locking means as exemplified by locking pin 40, to prevent lever 36 from being rotated in a direction of arrow 366 to disengage the connector locking element.

[0046] To ensure a smooth and even engagement of the connectors 11 on corresponding connectors 13, as illustrated in figure 3B, and disengagement as illustrated in figure 3D, it can be advantageous to ensure that the drive mechanisms, such as implemented by cam mechanisms 35, are simultaneously driven. To achieve this, a drive connection means can be provided to ensure that the mechanisms rotate simultaneously. In the embodiment shown in figures 3A to 3D, this can be achieved by providing the cam mechanisms in an orientation which is rotated by 90 degrees about the axis of the shafts 32 relative to that shown in the drawings, so that the axes about which the cam mechanism 35 rotate are parallel and coincident. Then, by providing a shaft connecting the two cam mechanisms, their simultaneous rotation about their respective axes can be ensured. An alternative form of drive mechanism and locking elements will now be described in relation to figures 5 to 8.

[0047] Figure 5A shows a piece of electrical equipment 30. An alternative form of engagement is provided. In this case, the connector locking element comprises a projecting portion 51 and a hook portion 52 extending substantially perpendicularly to the projecting portion 51, for engaging a notch 55a. In this case the connector locking element is provided on the connector mount 50, which again carries a plurality of connectors 11. Notch 55a is provided in a fixed configuration relative to the equipment 30. The notch 55a may be provided on the equipment or on a mounting portion adjacent the equipment.

[0048] The connector locking element further comprises a mechanism for converting a rotational input into a linear extension or retraction of the projecting portion 51 and its corresponding hook portion 52. The function of this mechanism is described later in relation to figures 6A and 6B.

[0049] Figure 5B shows a top view of the arrangement of figure 5A, viewed from the direction of arrow 501. Here, a shaft 53 is shown, for connecting a rotational movement of a first connector locking element 52a to a second connector locking element 52b. A lever 54 may be provided,

attached to either the shaft 53, or to one of the first and second connector locking elements 52a and 52b.

[0050] Simultaneous rotation of connector locking elements 52a and 52b is therefore ensured by their connection to shaft 53, and a single input can therefore advance or retract connector mount 50 and connectors 11 towards and away from electrical equipment 30 as shown by arrow 502 in figure 5a.

[0051] Therefore, rotation of lever 54 about shaft 53 from one side of shaft 53 shown in figure 5B, to the other as shown in figure 5C, can disengage the connectors 11 from the corresponding connectors 13 of electrical equipment 30. Conversely, rotation of the shaft in the other direction can engage the connectors. As can further be seen from figures 5B and 5C, a simple visual indication can be provided to a user that the lever and its connected mechanism are in the open/unlocked configuration, or in the closed/locked configuration, allowing a rapid and reliable check that the full array of connectors in the connector mount is correctly engaged and locked in place.

[0052] Figure 6A and 6B show how the connector locking elements 52 translate a rotational motion of the shaft 53 into a linear motion of the projecting portions 51.

[0053] Figure 6A shows a side view of the drive mechanism of figure 5A, as if viewed from the left hand end of figure 5A. The projecting portion 51, and its corresponding hook portion 52 are engaged with the notch 55a in the receiving portion 55. An axial protrusion 61 is mounted to a rotatable element 60 of the drive mechanism, and engages with a slot 62 provided in a follower member connected to the projecting portion 51. It will therefore be apparent that rotation of element 60 about its central axis 63 (i.e. shaft 53) will be translated into linear motion of the follower member and its extension 51, in the direction of arrows 64. Therefore it will further be appreciated that, as illustrated in figure 6B, when the rotatable element 60 is rotated in a clockwise direction as illustrated by arrow 65, the projecting portion 51 will be driven in a direction of arrow 66, in a downward direction in the figure, relative to connector mounting plate 101, and the shaft 53 mounted thereto. This will move the connector mount 50 up, in a direction of arrow 67, relative to the notch 55a, which is fixed relative to electrical equipment 30, thus moving the connector mount away from electrical equipment 30 and disconnecting the electrical connectors 11. Since this motion is recreated on both sides of the connector mount 50, the rotation of shaft 53 can create a controlled and even movement of the connector mount 50 toward and away from equipment 30 to connect or disconnect electrical connectors 11 simultaneously. In this embodiment, each connector locking element 52a and 52b constitutes a drive mechanism arranged to drive the connector mount 50 and the array of electrical connectors 11 toward the corresponding array of electrical connectors 13, upon a first mechanical user input to the drive mechanism. Advantageously, these drive mechanisms are also arranged to drive the connector mount 10 and the array of electrical connectors 11 away from the corresponding array of electrical connectors 13, upon a second mechanical user input to the drive mechanism, different from the first mechanical user input.

[0054] Once the connectors have been disengaged, it can be further advantageous to disengage the projecting portions 51 and their hook portions 52 from the notches provided in receiver portions 55, to allow full removal of the connector mount from the vicinity of the equipment 30. In the absence of any mechanisms to carry this out, a technician would need to apply a lateral force to the projecting portion 51, to extract the hook portions from their corresponding notches 55a. This could be a difficult and fiddly operation, not well suited to the gloves which may be necessary in cold environments.

[0055] A mechanism which can assist with this motion is illustrated in figures 7A and 7B. In figure 7A, the rotatable element 60 can be seen with its axial protrusion 61 engaging with the slot 62 (not shown in Figure 7A) of a follower member 51a connected to the lower part 51c of the projecting portion 51. In this configuration, the connection between follower member 51a and the lower part 51c of the projecting portion 51 is provided with a pivot 70, such as a hinge. The follower member 51a therefore moves in a linear fashion up and down in figure 7A when driven by the rotatable member 60 as described in relation to figures 6A and 6B. The lower part 51c of the projecting portion 51, and an upwardly extending part 51b are able to pivot about pivot point 70.

[0056] As illustrated in figure 7B, a fixed ramp 72 is provided in fixed relation to the position of the rotatable member 60. When the follower member and projecting portion assembly is moved downwardly, in a direction of arrow 71, then fixed ramp 72 can engage a corresponding ramp or ramp engagement portion 73 provided to the upwardly extending part 51b of the projecting portion 51. Linear motion in a direction of arrow 71, can then be converted to a lateral motion of the upwardly extending part 51b of the projecting portion 51, which causes the lower part 51c of the projecting portion 51 to extend in the opposite direction by pivoting around pivot point 70. As will be appreciated from figures 7B and 5A, this lateral motion will act to disengage the protrusions 52 from the notches 55a in receiving elements 55, leaving the connector mount 50 free to be completely removed from the equipment 30. The desired lateral motion can be created by providing either one, or both of, the fixed ramp 72 and/or the movable ramp 73.

[0057] In this way, rotation of the shaft, or any rotational input to the connector locking element can be converted into both a linear movement of the projecting portion 51, and also a lateral movement, perpendicular to the direction of the linear movement, to simultaneously disengage the connectors and to subsequently disengage a protrusion 52 from the notch 55a in receiving element 55. According to a preferred embodiment, the follower member 51a, the upwardly extending part 51b, the ramp engagement portion 73, the lower part 51c and the protrusions 52 can be manufactured as a single formed and welded

part, comprising a flexible hinge 70.

[0058] Figures 8A and 8B show how a detent can be used to lock the arrangement shown in figures 5A to 7B in a locked configuration. Internal components, such as spring 82 and first part 541, are shown in the figures in dotted lines, but may in practice be at least partially concealed within the assembly. The lever 54 of figure 5B and 5C can comprise a first part 541 linked to the shaft 53, a second part 542, surrounding the first part 541, and able to translate on the first part 541 in a direction radial to the axis of rotation of the shaft 53. This second part 542 is biased toward the axis of rotation of the shaft 53, thanks to a tension spring 82.

[0059] The detent is provided by a wall portion 83, arranged in a plane perpendicular to the axis of rotation of the shaft 53, which has an arcuate section 83a and a notch 83b. An corner portion 81 of the second part 542, which may be considered a pin 81, is in contact with the border of the wall portion. It will be appreciated that while the portion 81 of the second part 542 is in contact with the arcuate section 83a, then the lever 54 is free to rotate about the axis of the shaft 53. However, as shown in figure 8B, when the portion 81 of the second part 542 is engaged with the notch 83b, the lever 54 will be prevented from rotating around the shaft 53 until portion 81 of the second part 542 is retracted away from the notch 83b by a user. This therefore prevents inadvertent disengagement of the electrical connectors from the electrical equipment when held in place by the connector mount of the present invention. Furthermore, while the biased portion 81 is in contact with the arcuate portion 83a, a portion of the first part 541 of the lever 54 is visible, close to the shaft 53. This portion can advantageously be coloured so as to flag that the detent is not locked. When the portion 81 is engaged with the notch 83b, this coloured portion of the first part 541 is surrounded by the second part 542 and is not yet visible.

[0060] Although the invention has been described above with reference to one or more preferred embodiments, it will be appreciated that various changes or modifications may be made without departing from the scope of the invention as defined in the appended claims.

Claims

1. An assembly (10, 50) for connecting a first array of electrical connectors (11) to a second array of electrical connectors (13), comprising:

   a connector mount (101), for receiving the first array of electrical connectors; and
   at least one connector locking element (31; 51) for retaining the connector mount to lock the first array of electrical connectors in engagement with the second array of electrical connectors;
   the connector locking element (31; 51) comprising a drive mechanism (35; 60, 61) arranged to drive the connector mount and the first array of electrical connectors toward the second array of electrical connectors upon a first mechanical user input to the drive mechanism.

2. An assembly (10, 50) according to claim 1, wherein the drive mechanism (35; 60, 61) is configured to convert a rotational user input into a linear driving motion.

3. An assembly (10, 50) according to claim 1 or claim 2, wherein the connector locking element or elements (31) are attached to at least one of: the connector mount (101), a second electrical connector mount; electrical equipment (30); and a mounting area for mounting electrical equipment.

4. An assembly (10) according to any of claims 1 to 3, wherein at least one of the connector locking elements (31) is movably mounted, preferably in a substantially lateral direction relative to a plane of the connector mount (101), so as to be movable into and/or out of engagement with the connector mount.

5. An assembly (10) according to claim 3, wherein at least one of the connector locking elements (31) comprises a shaft (32), the shaft being rotatably mounted at a first end (34) and having the drive mechanism (35) located at a second end, so that rotation of the shaft about its first end can move the drive mechanism into and/or out of engagement with the connector mount (101).

6. An assembly (10, 50) according to any of the preceding claims, wherein the drive mechanism (35; 60, 61) is rotatable about an axis of rotation (37, 362; 63) perpendicular to the direction of substantially linear motion created by the drive mechanism.

7. An assembly (10, 50) according to any of the preceding claims, further comprising secondary locking means (40, 81) for retaining the drive mechanism in a locked position.

8. An assembly (10, 50) according to any of the preceding claims, comprising drive connection means (53) connected to at least a first connector locking element (52a) and a second connector locking element (52b) of the assembly, so that a drive input to one of the first and second connector locking elements is transferred to the other of the first and second connector locking elements, to drive the first and second connector locking elements simultaneously.

9. An assembly (10, 50) according to claim 8, wherein the first connector locking element (52a) comprises a lever (541, 542) for a user to provide a drive input and the second connector locking element is driven

by the first connector locking element via the drive connection means (53).

10. An assembly (10, 50) according to any of the preceding claims, wherein the drive mechanism is a cam mechanism (35).

11. An assembly (10) according to any of the preceding claims, wherein the drive mechanism (35) is configured with an over-centre locked position, configured to bias the drive mechanism to its locked position, when in its locked position.

12. An assembly (50) according to any preceding claim, wherein the connector locking element comprises:

a rotatable drive mechanism, having an axis of rotation (63) and an axially projecting protrusion (61) mounted eccentrically on a rotatable member (60); and
a follower member (50; 51a), having a slot (62) for engagement with the protrusion, to convert rotation of the rotatable member to linear motion of the follower member.

13. An assembly (50) according to claim 12, further comprising a fixed ramp (72), wherein the follower member (51a) is connected to a projecting portion (51c) comprising a ramp engagement portion (73) arranged to be driven along the fixed ramp when the follower member is moved to a disengaged position, to move the projecting portion (51c) laterally.

14. An assembly (10, 50) according to any of the preceding claims, comprising a detent (83a, 83b) for arresting rotational movement of the drive mechanism (60,61).

15. An assembly (10, 50) according to claim 14, wherein:

the detent comprises a fixed element (83) comprising an arcuate portion (83a) and a notch (83b); and
wherein a lever (54) of the connector locking element comprises a protrusion (81) biased toward the notch to engage the notch and lock the drive mechanism.

16. A connector locking arrangement for receiving and locking in place the connector mount (101) recited in claim 1, comprising:

at least one connector locking element (31) for retaining the connector mount (101) to lock the first array of electrical connectors (11) in engagement with a second array of electrical connectors (13);
the connector locking element comprising a drive mechanism (35) arranged to drive the connector mount (101) and the first array of electrical connectors toward the second array of electrical connectors upon mechanical user input to the drive mechanism.

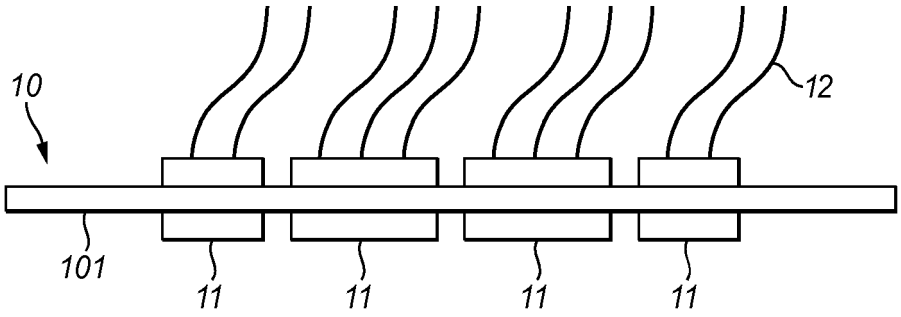

FIG. 1A

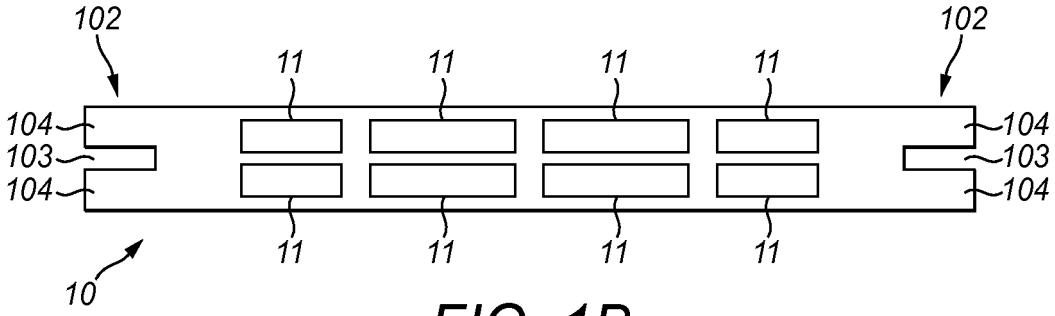

FIG. 1B

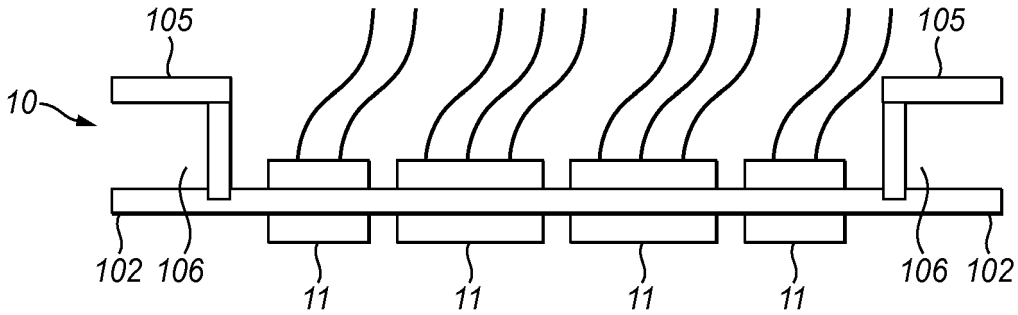

FIG. 1C

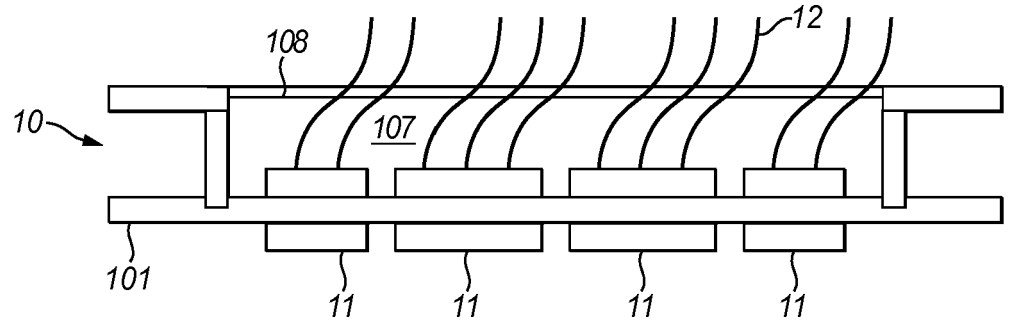

FIG. 2A

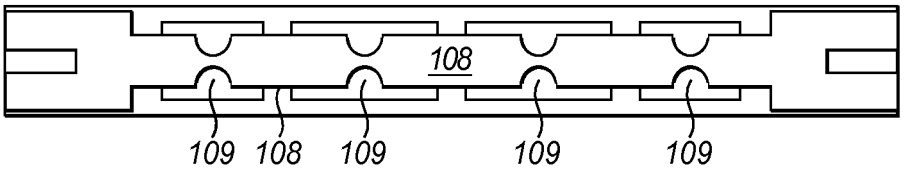

FIG. 2B

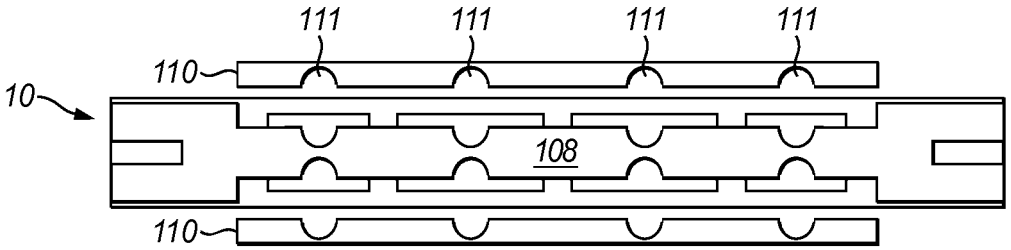

FIG. 2C

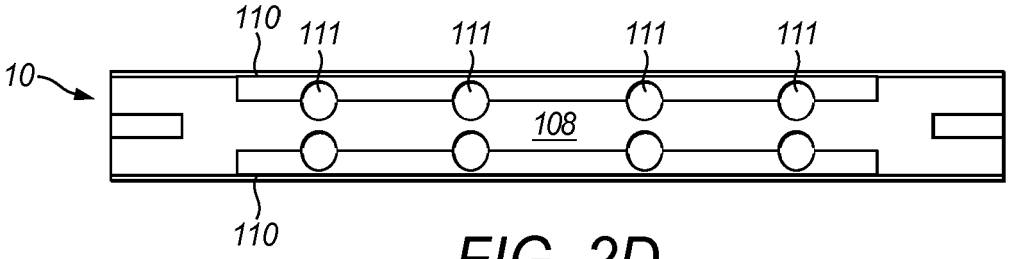

FIG. 2D

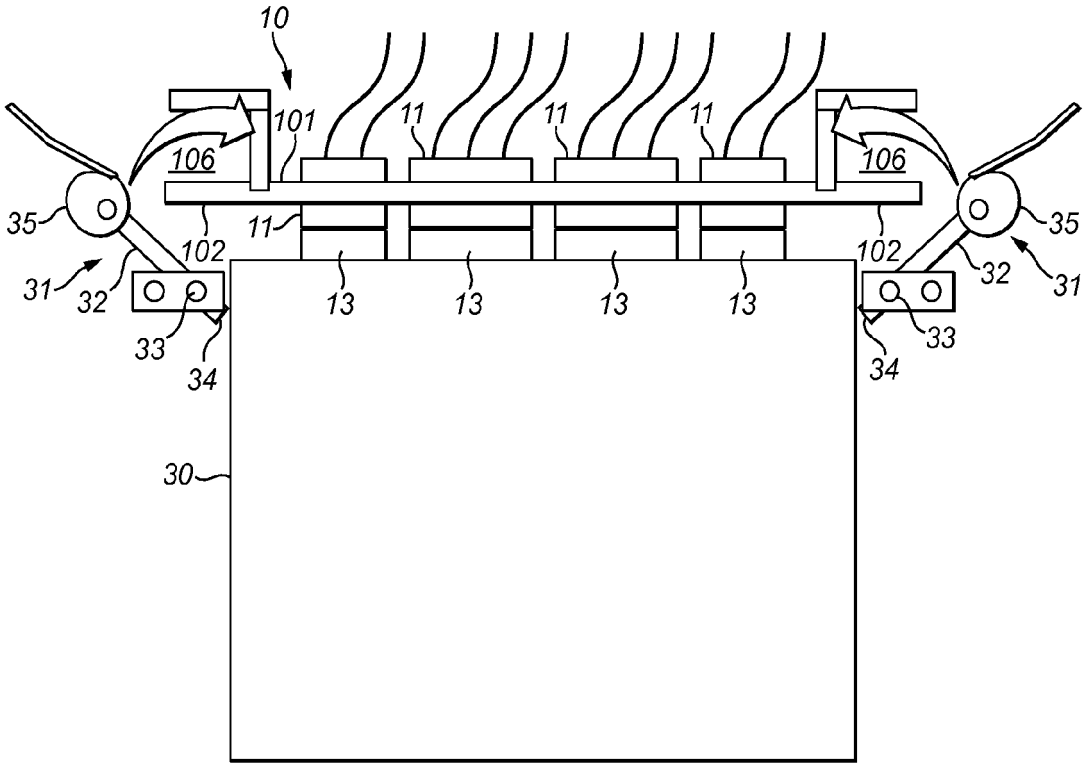
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FIG. 3A

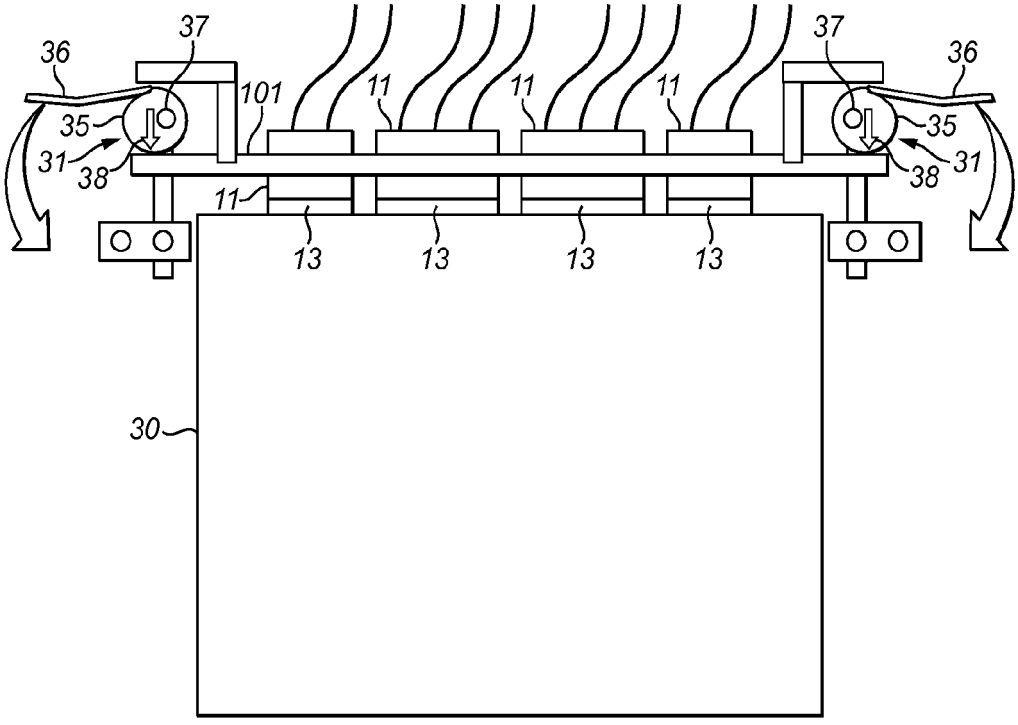
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FIG. 3B

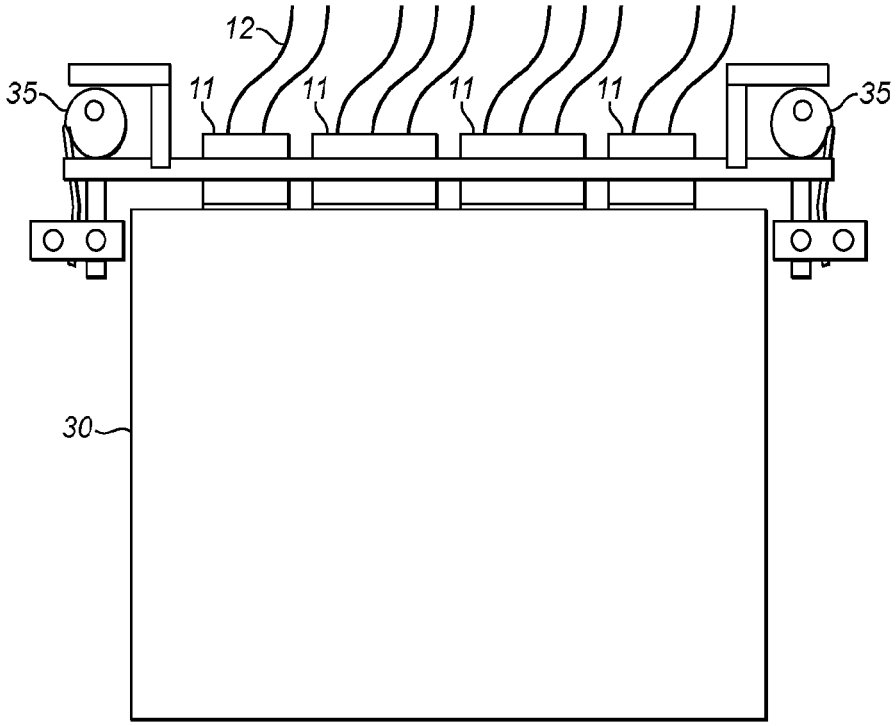
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FIG. 3C

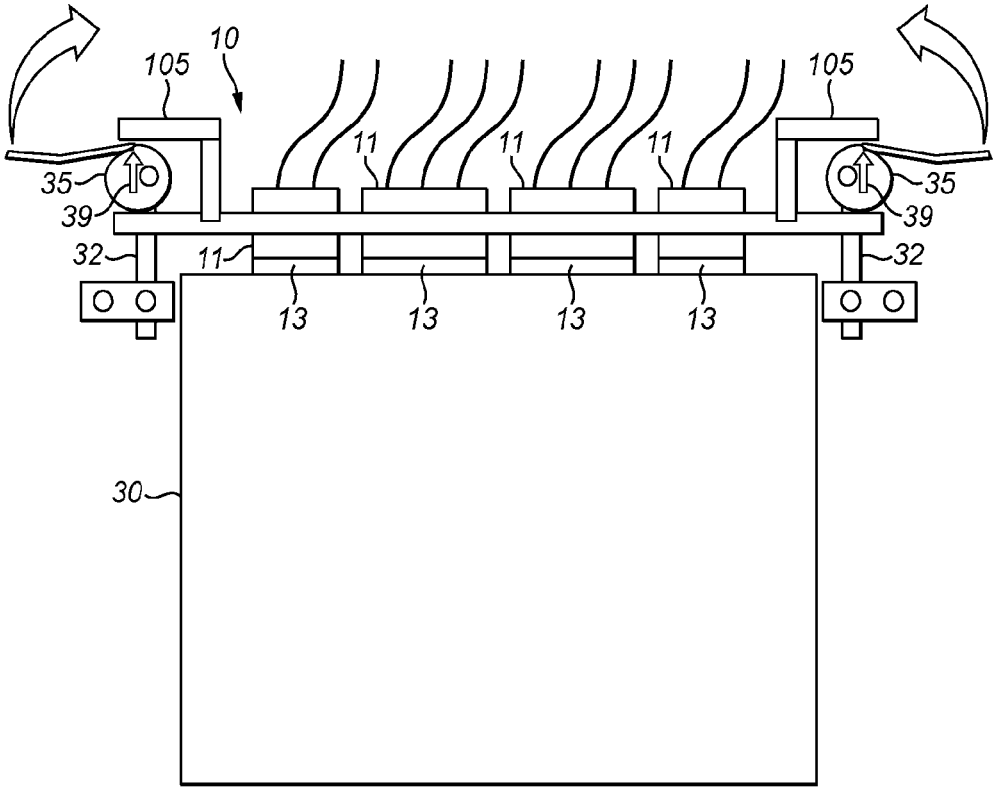
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FIG. 3D

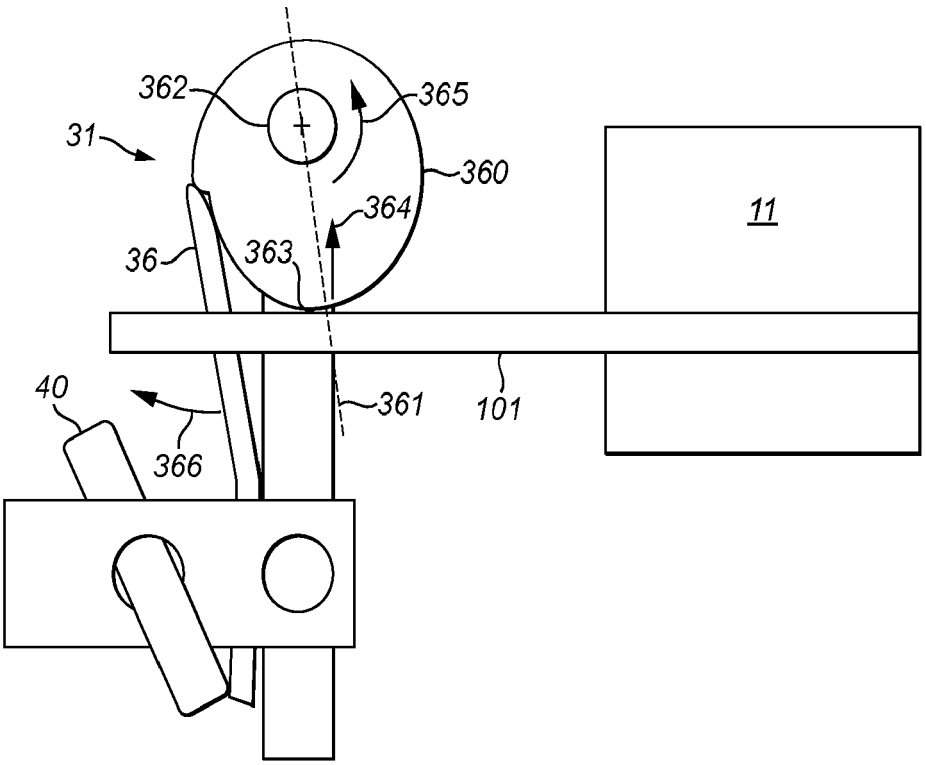

FIG. 4

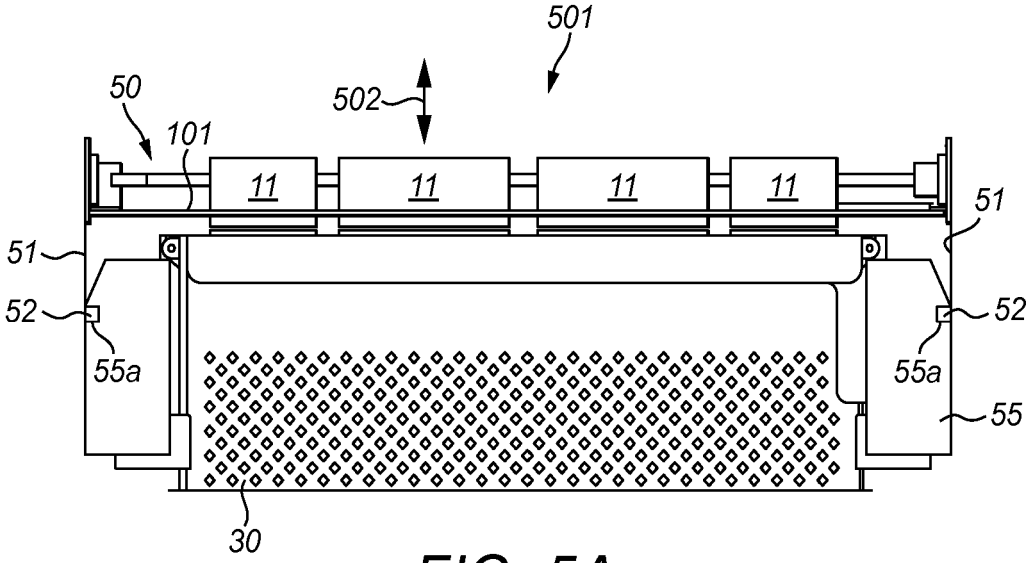

FIG. 5A

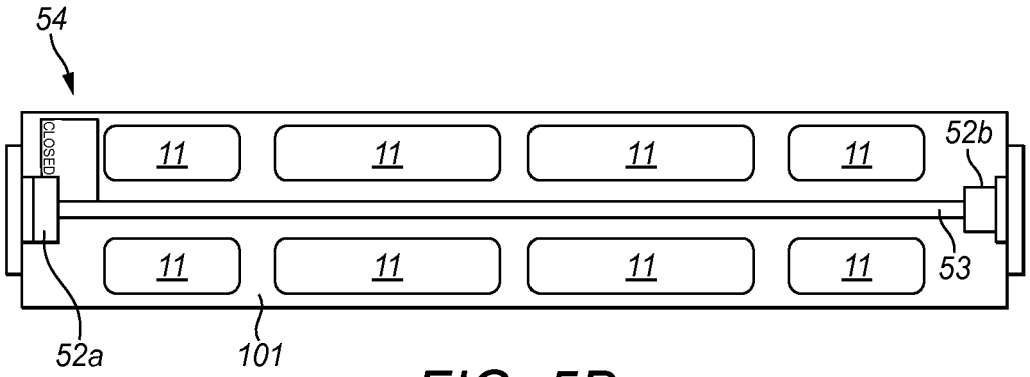

FIG. 5B

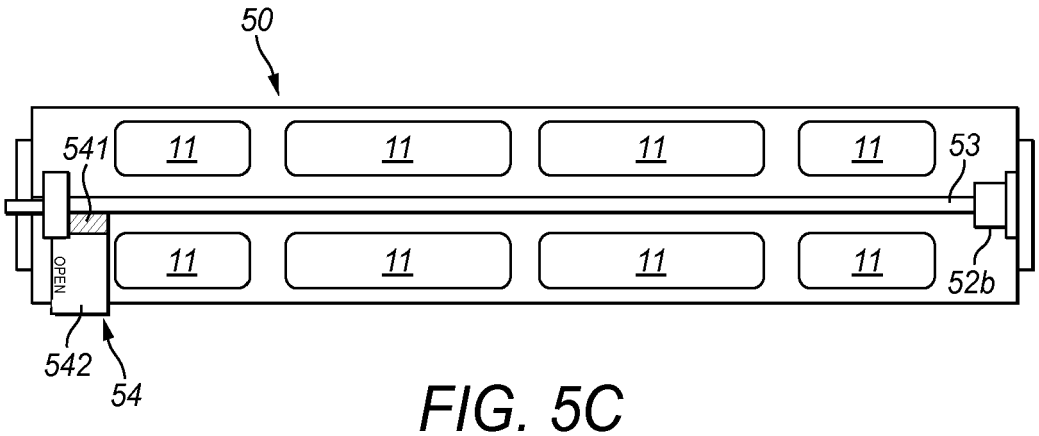

FIG. 5C

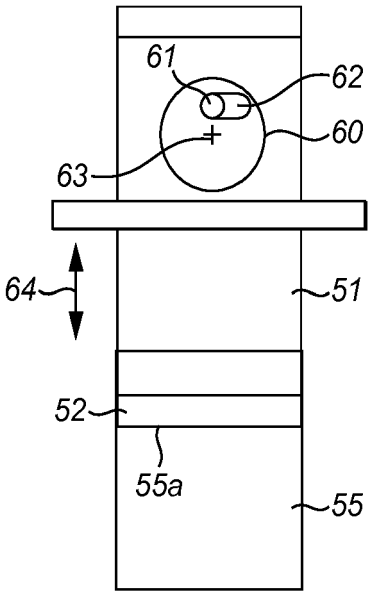

FIG. 6A

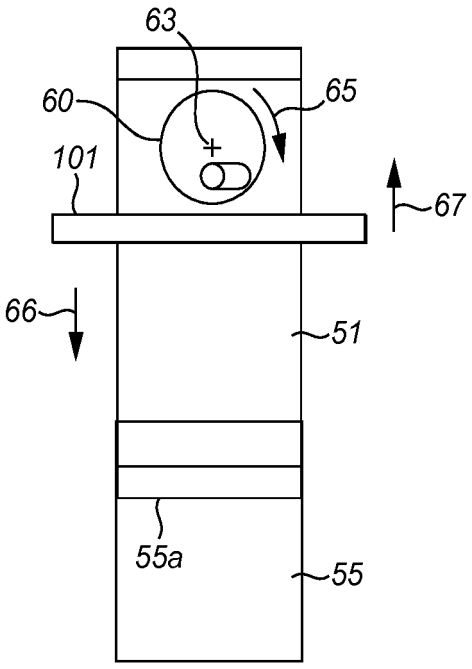

FIG. 6B

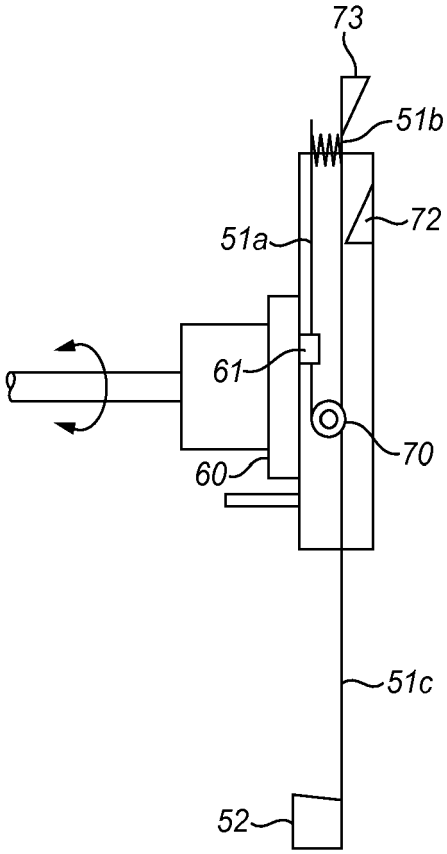

FIG. 7A

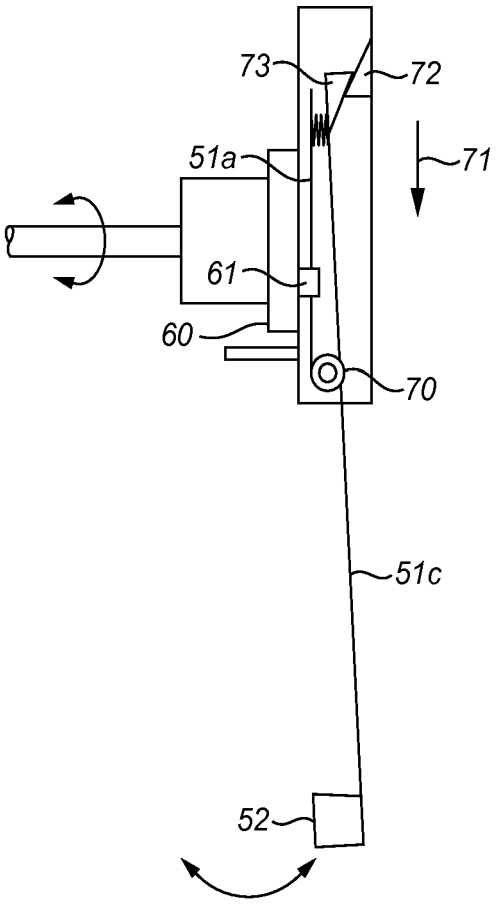

FIG. 7B

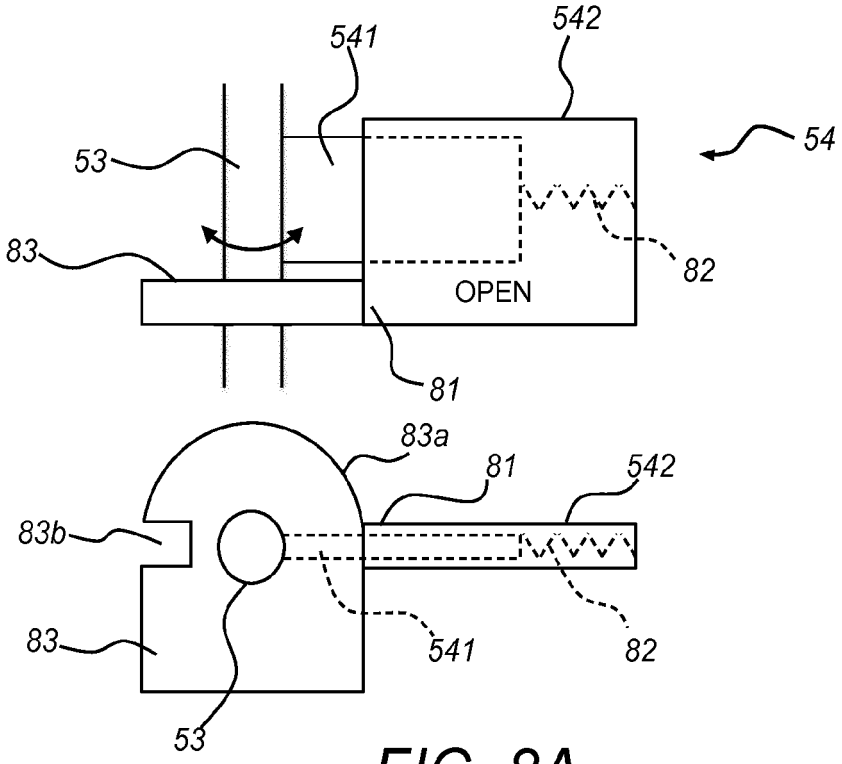
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FIG. 8A

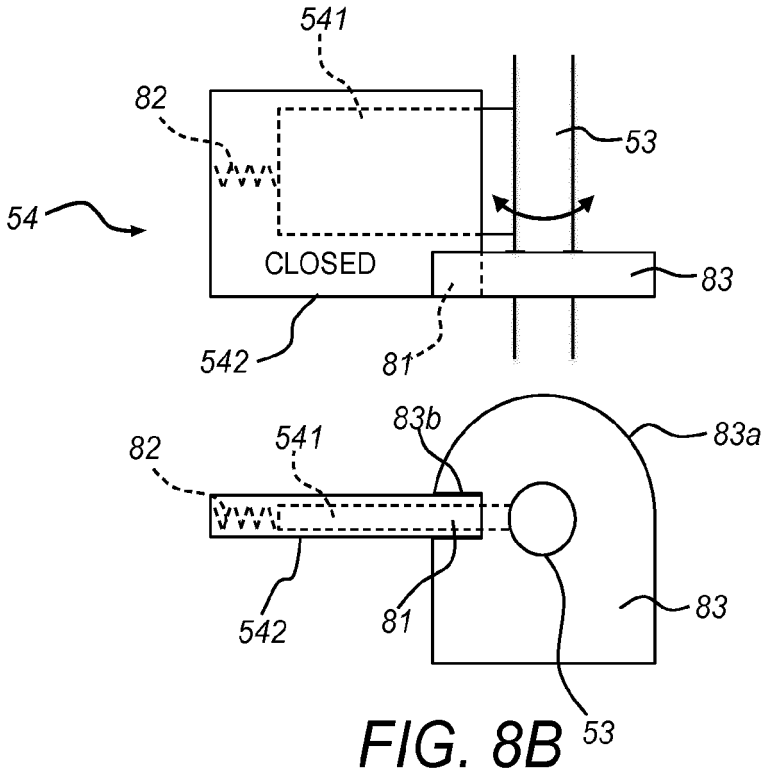
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FIG. 8B

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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 5758

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 March 2015	Salojärvi, Kristiina

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