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(54) Title: ELECTRICAL HINGE CONNECTOR

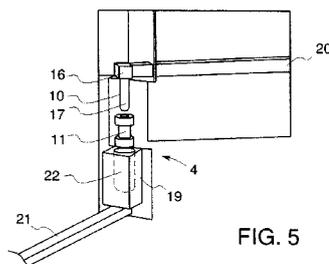


FIG. 5

(57) Abstract: A hinge (4) for an aircraft power distribution system unit (1) comprises a first hinge member (11) for connection to a first housing part (3) of the unit, and a second hinge member (10) for connection to a second housing part (2) of the unit. The first (11) and second (10) hinge members comprise an electrically conductive material and are connectable to one another to establish an electrical connection between the hinge members (10, 11) and to allow relative rotation between the hinge members.



WO 2011/018650 A1

236238

ELECTRICAL HINGE CONNECTOR

Field

The present invention relates to hinges that provide an electrical connection, in particular for use in aircraft electrical power systems. The invention further relates to electrical power distribution systems for aircraft.

Background

The factors governing the design of modern power distribution systems which are installed in aircraft include cost, weight and volume. To drive down the overall package size, design measures are taken which utilize every available surface and space. However general operation and maintenance access is required over the life of the part and therefore components are often mounted on a hinged door on the unit.

For primary power distribution, the components mounted on the door can require current feeds up to and in excess of 500A. Such large currents require cable feeds which are bulky, heavy and inherently inflexible. As an example, some cables need to be as thick as 15mm in diameter in order to carry the required current. As a result a great deal of space is required to accommodate the excess cable which brings with it additional weight, greater opening and closing forces to operate the door, and largely unpredictable wear and tear of the cable strands which are forced to act in a manner in which they are not mechanically designed to operate.

One solution that has been proposed to overcome the problem of the amount of volume required is to allocate space in the unit to accommodate the excess cable. This however does not reduce the resistance to flex in the cable. An additional solution in the prior art has been to transmit the power across the door hinge by multiple cables in a bundle. This enables increased flexibility and therefore reduces the force required to open and close the door, however using multiple 'thinner' cables increases weight through the increased cross-sectional area of insulation and bundle retention. This also

carries with it the risk of undetected faults if a wire breaks while others are connected in parallel.

The present invention provides a hinge for an aircraft power distribution system unit, the unit having a housing comprising first and second housing parts, the hinge comprising:

a first hinge member for connection to the first housing part of the unit, and

a second hinge member for connection to the second housing part of the unit,

the first and second hinge members comprising an electrically conductive material and being connectable to one another to establish an electrical connection between the hinge members and to allow relative rotation between the hinge members.

Advantageously, the present invention overcomes the problems associated with cable connections, because the hinge allows easy rotation of the door of the unit, requiring a low force to open and/or close the door of the unit, whilst providing an electrical connection to transmit power to the components mounted on the door within the unit. Thus, no wires are needed to transmit current from the main body of the unit to the door-mounted components. A reduction in the overall volume and weight of the aircraft power distribution system unit is made possible by the invention.

The second hinge member can be removably engagable in a cavity of the first hinge member, whereby the door of the unit can be easily plugged in and removed from the unit, without power cables restricting the motion of the door.

There follows a detailed description of embodiments of the invention by way of example only with reference to the accompanying drawings, in which:

Fig. 1 shows schematically a unit of an aircraft power distribution system according to the invention;

Fig. 2 shows first and second hinge members according to the invention;

Fig. 3 is a perspective view of a part of the hinge according to the invention;

Fig. 4 is a perspective view of a busbar connectable to the hinge part shown in Fig. 3;

Fig. 5 is a perspective view of a partially assembled hinge;

Fig. 6 shows an assembled hinge including the busbar shown in Fig. 4; and

Figs. 7 and 8 are perspective views of a unit of an aircraft power distribution system including the hinge according to the invention.

A unit 1 of an aircraft electrical power distribution system is shown in Fig. 1 comprising a first housing part 3 and a second housing part 2. The second housing part 2 comprises a door rotatably connected via a hinge 4 to the first housing part 3, the first housing part comprising a main body of the unit 1. Electrical current enters the unit 1 via a power input 8, which provides power to an electrical bus 7 for distributing current to electrical loads 12 provided within the unit. Power is also transmitted from the input 8 to an electrical bus 6 that is mounted on the door 2 of the unit. In the embodiment shown, the bus 6 on the door 2 is connected to the power input 8 via the bus 7 in the unit. The hinge 4 which connects the door 2 to the main body 3 of the unit 1 comprises electrically conductive material, whereby current can be conducted to the electrical bus 6. Further, one or more electrical devices 5 are mounted on the door 2, preferably on the interior side of the door, and draw power from the bus 6, the devices being connected to corresponding power outputs 9. Where cable is used for the power outputs 9, this can be achieved using thinner, more flexible wires than those needed for the power input. Alternatively, the power output could be transmitted across a second hinge not shown in Fig. 1.

Fig. 2 shows two components of the hinge 4 comprising a first hinge member 11 and a second hinge member 10, respectively comprising a receptacle 11 and a protrusion 17 for rotatable engagement in the receptacle. The receptacle 11 comprises a hyperboloid socket 11 having a circular cross-section and including a cylindrical cavity 13 for receiving the protrusion 17, the end portions 14 of the receptacle 11 having a greater thickness and hence an enhanced strength compared to a central part 15 of the receptacle. The second hinge member 10 can connect to the receptacle with a push-fit mechanism. In this regard, the internal structure of the hyperboloid socket 11 (not

shown) includes a series of wires extending along the periphery of the cylindrical cavity 13 between the end portions 14, the end portions being twisted with respect to one another about a longitudinal axis of the socket, whereby the wires form a constriction towards the middle of the socket. The protrusion 17 of the second hinge member is cylindrical and adapted for mating insertion in the cylindrical cavity 13 of the receptacle, the longitudinal axis of the protrusion 17 coinciding with the axis of rotation of the hinge. The cylindrical surface of the protrusion 17 and the internal structure of the cavity 13 provide a reliable surface contact over a large area between the first and second hinge members thereby providing a good electrical connection between the hinge members capable of carrying the high currents required by aircraft power distribution systems. Further, the internal constriction of the socket facilitates the fixture of the protrusion within the socket. At an end of the second hinge member 10 opposed to the protrusion, the second hinge member comprises a root portion 16 for connection to a busbar 18 shown in Fig. 4, which supplies power to the door-mounted electrical devices 5. Both the first and second hinge members 10, 11 are made from electrically conductive materials, such as metals.

Referring to Fig. 3, the receptacle 11 of the hinge is connected to the housing by means of a mount 19 and a conductor 21 feeds current to the receptacle 11 from the bus 7. The electrical connection between the conductor bar 21 and the receptacle can be provided by means of a subsidiary connector (not shown in the drawings), which can extend through the mount 19. The mount 19 itself preferably comprises an electrically insulating material, which advantageously insulates the unit housing from the electrical current.

Fig. 4 shows a busbar 18 which can be mounted on the door 2 of the unit and has the second hinge member 10 formed integrally therewith. In an alternative, the second hinge member is manufactured separately to the busbar 18 and is connected thereto by means of an electrically conductive joint. As shown in Fig. 6, the busbar 18 supplies power to the electrical devices 5 and ensures that the electrical devices 5 are firmly held in place on the inside of the door.

In Fig. 5, the hinge 4 is shown in a partially assembled or exploded view. The assembly of the hinge involves disposing the mount 19 on the main body of the unit 1. The receptacle 11 is inserted into a channel 22 in the mount 19 and the protrusion 17 of the second hinge member 10 is inserted into the cylindrical cavity 13 of the receptacle 11. The order in which these steps are carried out can be varied.

Fig. 6 shows the hinge assembled, including a plurality of electrical devices 5 mounted underneath the busbar 18. For example, one or more of the electrical devices 5 may comprise circuit breakers. The busbar 18 provides the input current to the circuit breakers 5, the output current from the circuit breakers 5 being significantly lower. Thus the output current can be carried by thin, flexible wires, which can be accommodated in the unit and do not offer an excessive resistance to the opening and closing of the door 2.

Figs 7 and 8 show an assembled unit 1 of an aircraft power distribution system. First and second busbars 18 are provided on the interior side of the door, connected respectively to first and second hinges 4. First and second conductors 21 feed current respectively to the first and second hinges 4. In Fig 7 the unit is shown in the closed position, while in Fig. 8, the door of the unit is open to allow access to the components within. The hinge 4 allows for 120 degrees of door rotation, which is typically required for maintenance access. In the example shown, each hinge is capable of carrying 200A of current, allowing for 400A to be conducted across a pair of hinges. The example shown is a DC system, although the hinge can also be used in a system that runs on AC power. The power output is not shown in Figs 7 and 8, but again can comprise wires or an output hinge. The size and quantity of the hinges can be varied depending on the specific mechanical and electrical design considerations at hand.

The first and second hinge members can be mounted in reverse to the way shown in the Figures. In other words, the receptacle 11 can be mounted on the door 2 and the protrusion 17 on the main body 3 of the unit 1. The mount 19 is then provided on the door 2 for receiving the receptacle 11. The first and second hinge members can be manufactured by moulding from plastics materials.

CLAIMS:

1. A hinge for an aircraft power distribution system unit, the unit having a housing comprising first and second housing parts, the hinge comprising:

a first hinge member for connection to the first housing part of the unit, and

a second hinge member for connection to the second housing part of the unit,

the first and second hinge members comprising an electrically conductive material and being connectable to one another to establish an electrical connection between the hinge members and to allow relative rotation between the hinge members.
2. A hinge according to claim 1, wherein the second hinge member is removably engagable in a cavity of the first hinge member.
3. A hinge according to claim 1 or 2, wherein the first hinge member comprises a receptacle and the second hinge member comprises a protrusion for engagement in the receptacle.
4. A hinge according to claim 3, wherein a longitudinal axis of the protrusion coincides with an axis of rotation of the hinge.
5. A hinge according to claim 3 or 4, wherein the receptacle comprises a hyperboloid socket.
6. A hinge according to any of claims 3 to 5, wherein the protrusion is cylindrical.
7. A hinge according to any of the preceding claims, wherein the first and/or second hinge member is connected to a busbar for distributing electrical power to one or more electrical components.
8. A hinge according to claim 7, wherein the first and/or second hinge member is formed integrally with the busbar.

9. A hinge according to any of the preceding claims, wherein the first and second hinge members are electrically insulated from the exterior of the unit.
10. A power distribution system unit for an aircraft having a housing comprising first and second housing parts rotatably connected to one another by a hinge according to claim 1.
11. A system according to claim 10, wherein the hinge is positioned inside the housing parts.
12. A system according to claim 10 or 11, wherein the first and second hinge members are connected to the first and second housing parts respectively.
13. A system according to any of claims 10 to 12, wherein the first housing part comprises a main body of the unit.
14. A system according to any of claims 10 to 13, wherein the second housing part comprises a door of the unit.
15. A system according to any of claims 10 to 14, wherein the first hinge member comprise a receptacle connected to the first housing part by a mount.

1/5

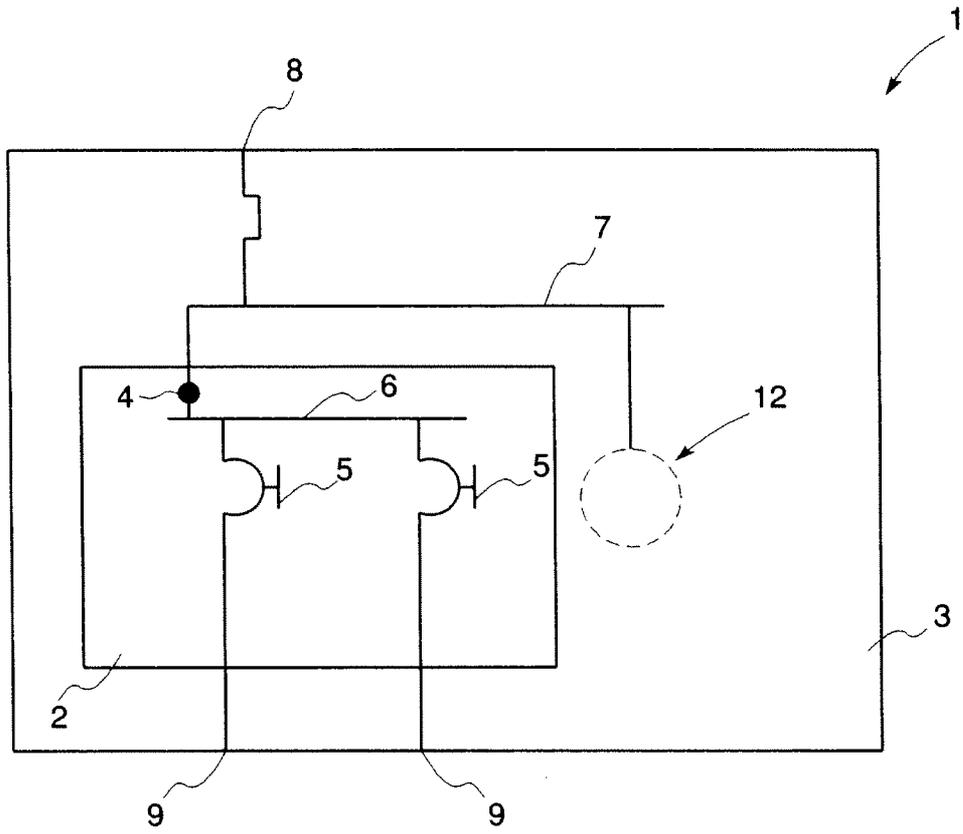


FIG. 1

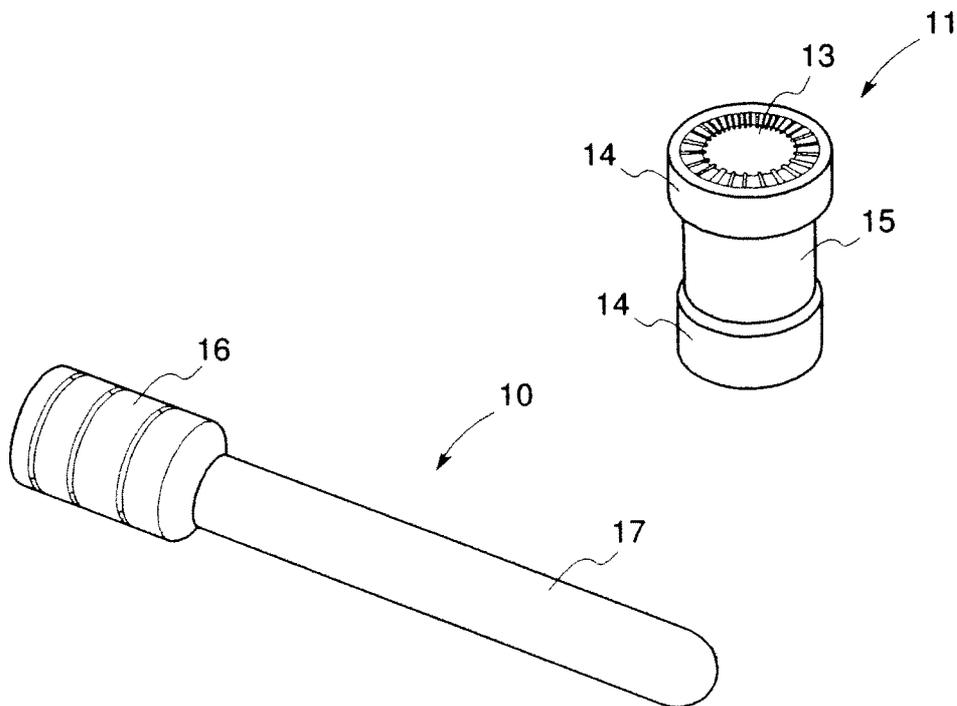


FIG. 2

2/5

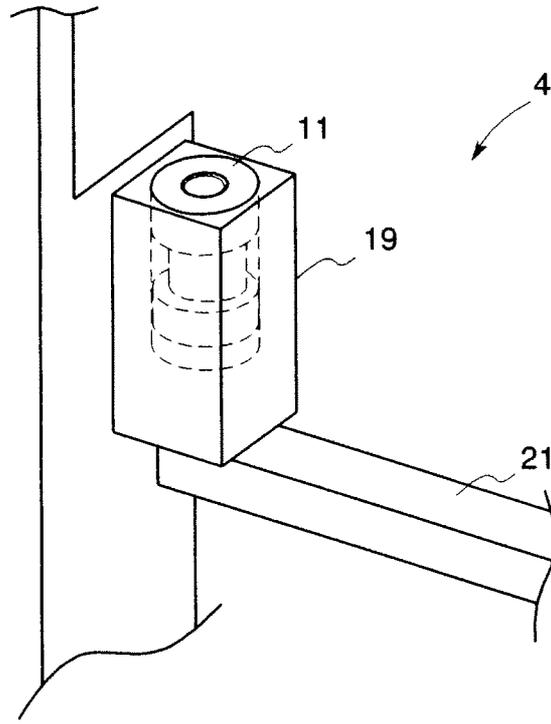


FIG. 3

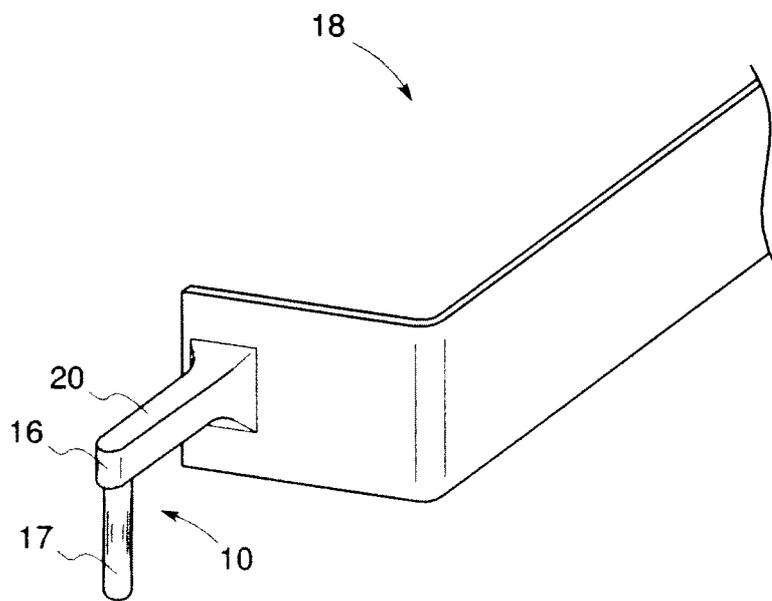


FIG. 4

3/5

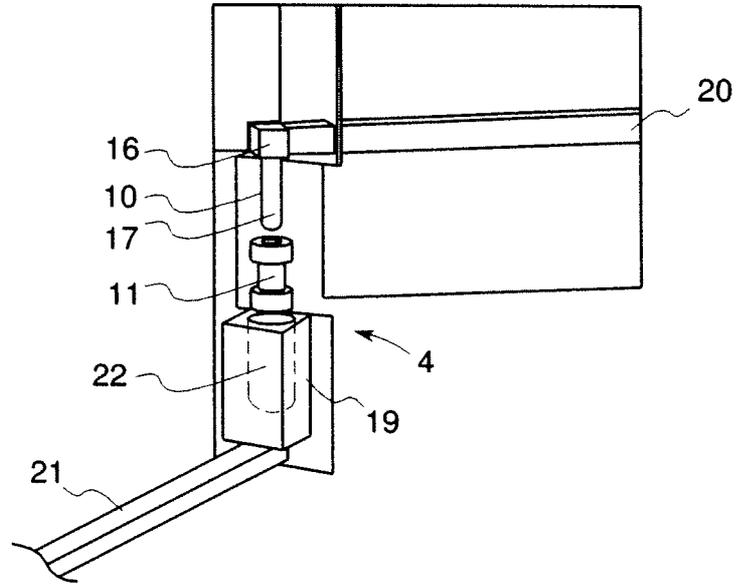


FIG. 5

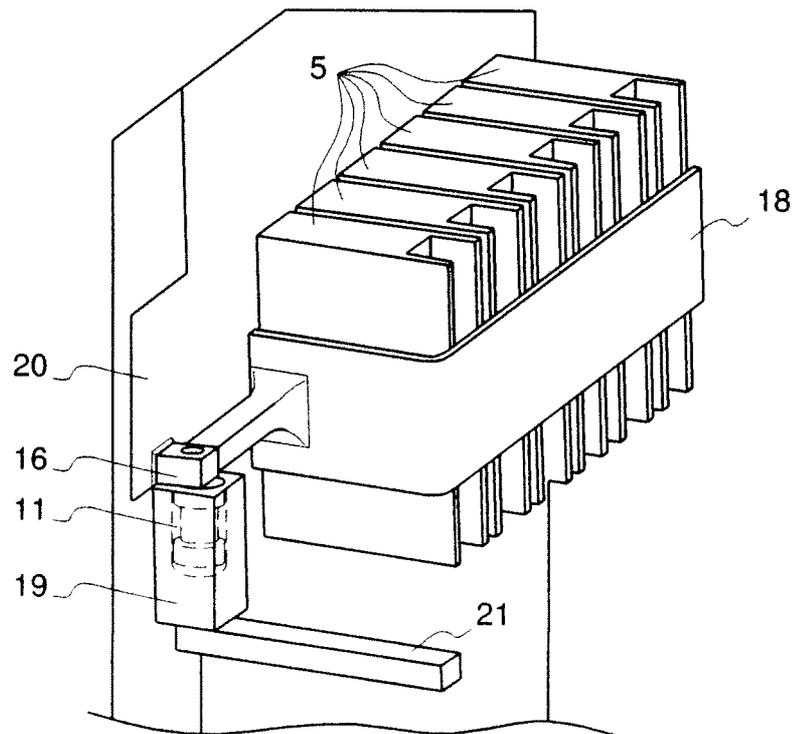


FIG. 6

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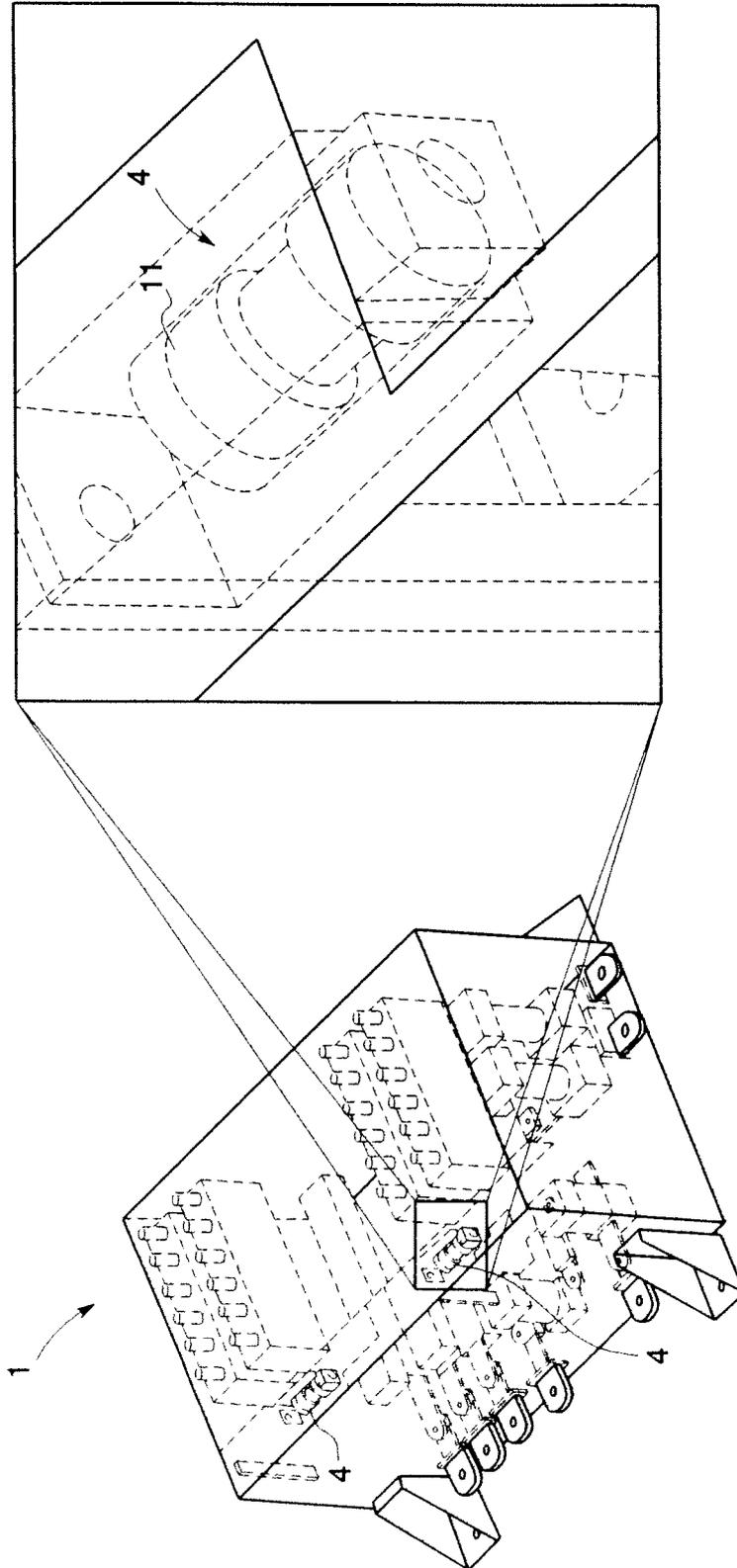


FIG. 7

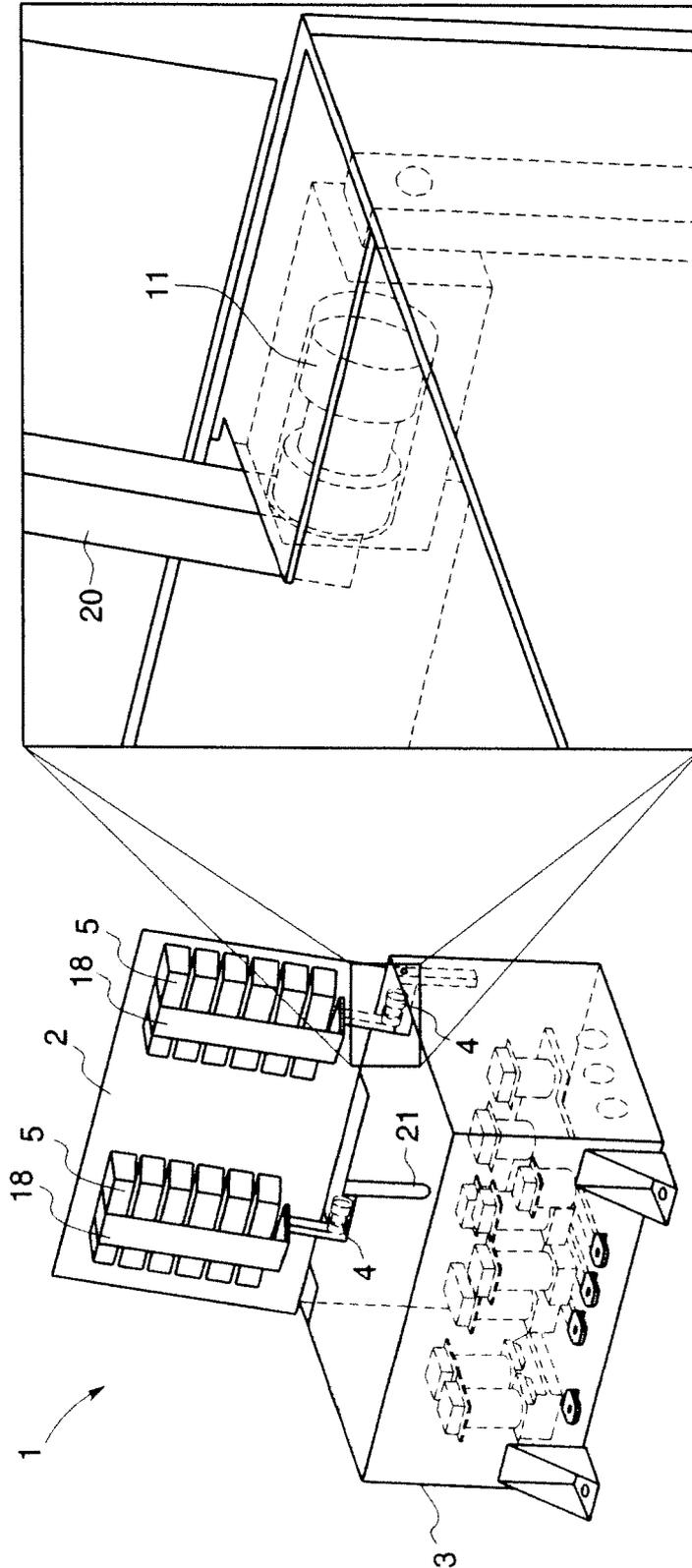


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2010/051304

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H01R13/04 H01R13/11 H01R25/14 H01R35/04 H02G3/18
 H05K7/14
 ADD.
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 H01R H02J B64D H05K H02G

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 94/03947 A2 (ATLANTIQUE ISOLANTS THERMIQUES [FR]; FRADIN LOUIS MAURICE [FR] ATLANTI) 17 February 1994 (1994-02-17) figure 11	1-4,6-8
X	GB 812 878 A (HACKBRIDGE AND HEWITTIC ELECTR; JOHN ROBERT WINTER; JACK ARTHUR WEST) 6 May 1959 (1959-05-06) the whole document	1-4,6,7
Y	US 2008/076270 A1 (JAO CHIA W [TW] ET AL JAO CHIA WEI [TW] ET AL) 27 March 2008 (2008-03-27) figure 1	1-15
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier document but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
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Date of the actual completion of the international search 14 October 2010	Date of mailing of the international search report 21/10/2010
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Salojärvi, Kristiina
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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2010/051304

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2010/051304

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