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(54) **Fan heater**

(57) A wall mounted fan heater comprising safety elements including a thermal cut-out which is co-operable with a water impervious barrier which minimises the possibility of splashing water coming into contact with the at least one of the thermal cut out.

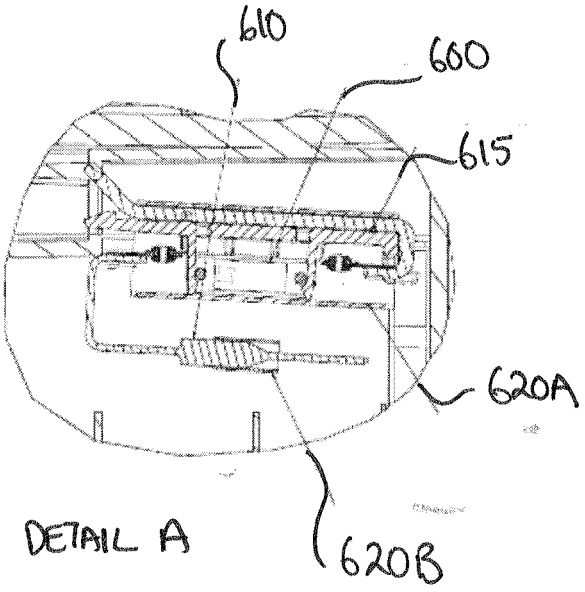

Figure 6

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Description

Field of the Invention

[0001] The present invention relates to fan heaters and in particular to fan heaters that are used for example in bathrooms. The invention more particularly relates to fan heaters of the type known as downflow heaters which are installed on bathroom walls and provide localised heating within the bathroom on demand.

Background

[0002] Fan heaters are well known. Such heaters typically employ an electrical heating elements which when coupled with a fan blower provides for the circulation of warm air about the environment where the heater is located. The power output of the heater is typically of the order of 1 kW to 2kW and their dimension typically is determined by their intended usage. For example it is known to provide portable self-standing fan heaters that may easily transported to a location where heat is required and then turned on when required.

[0003] It is also known to use fan heaters within a potentially wet environment such as bathrooms. Within such bathrooms building regulations have strict requirements as to the location of such heaters in that there is a desire to minimise the possibility of any electrically live parts coming into contact from water within the bathroom. When provided within a bathroom environment the heater is typically wall mounted. Different rating systems are available to advise the level of safety that is associated with a particular heater.

[0004] One well known system is the International Protection (IP) Code rating system which is commonly also called the Ingress Protection Rating as it is provides an indication of the protection provided against both intrusion of solid objects or water within electrical enclosures. It will be understood that a fan heater is an example of an electrical enclosure in that the electrical components for the heater are provided within an outer body housing. This rating system consists of the letters IP followed by two digits and an optional letter. Within the context of fan heaters for use in bathrooms or the like it is desirable that they conform with the IPX4 rating- which relates to the ability of the heater to operate in conditions of splashing water such that water splashing against the enclosure from any direction shall have no harmful effect.

[0005] There is therefore a desire to provide such IPX4 rated heaters within the bathroom environment. An easy way to do so is to locate the heater at a location where water cannot splash against the enclosure- either at a height or distance sufficiently great from the water source that the water could not accidentally come into contact with the heater. However there are difficulties in that many bathrooms are not sufficiently large to allow for installation of the heater in a location sufficiently far away from the water source. These known heaters typically included moulded or metal baffles behind which the electrical parts are mounted such that they are not in a direct path for incoming water. A further alternative is where the part is of such a size that the path to the electrical parts from an outer surface of the heater is too great for water to typically travel.

[0006] In both these arrangements the heaters require certain dimensions and it is desirable to provide IPX4 heaters that are smaller than these known dimensions.

Summary

[0007] These and other problems are provided by a wall mounted fan heater provided in accordance with the present teaching which comprises safety elements including a thermal cut-out which provides in the event that the product overheats, for the automatic switching off of the heater, and optionally a secondary thermal fuse link which operates to generate an open circuit within heater upon detection of abnormal overheating within the heater and **characterised in that** at least one of the thermal fuse link and thermal cut out are co-operable with a water impervious barrier minimises the possibility of splashing water coming into contact with the at least one of the thermal fuse link or thermal cut out.

[0008] Each of the two safety elements are desirably provided with a dedicated water impervious barrier. The barrier is dimensioned and mounted relative to its respective safety element to allow for maintenance of an air flow passed the barrier. The barrier is desirably at least provided between the safety element and a front portion of the heater such that the barrier serves to prevent splashes incident through a front surface of the heater from coming into contact with the safety elements.

[0009] Desirably the barrier is also an electrical insulator which has insulating properties of the insulator sufficient to ensure that direct contact between the insulator and the respective one of the thermal cut out or thermal fuse link may be effected without affecting the operation of the thermal cut out or thermal fuse link.

[0010] The barrier is desirably fabricated from a material which allows for use in the high temperatures that are generated within the internal cavity of the heater.

[0011] The barrier may be provided so as to cover all surfaces of the safety elements. In this way it may be considered as encapsulating the safety element. In a preferred arrangement the insulator is provided in a sleeve arrangement which can be passed over the respective one of the thermal cut out or thermal fuse link so as to cover the sides of the safety elements.

[0012] The barrier is desirably fabricated from high temperature silicon, PTFE, Fluorinated Ethylene Propylene (FEP), PolyVinylidene Fluoride (PVDF) or the like which are rated to withstand the normal operating conditions of the heater and will allow the conduction of heat through the sleeve onto the respective one of the thermal cut out or the thermal fuse link to allow them to function

[0013] These and other features of the invention will

be better understood with reference to exemplary arrangements thereof which are described with reference to the following drawings.

Brief Description Of The Drawings

[0014] The present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a schematic front view showing installation of a heater.
Figure 2 is a side view of the installed heater of Figure 1.
Figure 3 is section through the line Y-Y of Figure 1.
Figure 4 is another front view of the heater of Figure 1.
Figure 5 is a section through the line X-X of Figure 4.
Figure 6 is a detail view of portion A of Figure 5.

Detailed Description Of The Drawings

[0015] Exemplary arrangements of a fan heater provided in accordance with the present teaching will now be described with reference to Figures 1 to 6 of the accompanying drawings. It will be appreciated that these are provided to assist a person skilled in the art with an understanding of the present teaching but are not intended to limit the scope of the invention to that described which as will be appreciated is to be construed with reference to the claims which follow.

[0016] Figures 1 and 2 show an installed heater 100 within a room 110. The heater 100 is mounted to a wall 120 and is spaced away from the wall such that an air gap 121 is defined between a rear surface 101 of the heater 100 and the wall 120. A front surface 102 of the heater housing 103 is provided with a plurality of air vents 130 through which heated air 131 may operably be directed downwardly from the heater so as to increase the ambient temperature of the air in the room. The heater will typically incorporate a heating element of between 1 kW and 2kW output.

[0017] The heater of this arrangement is a downflow heater and is therefore mounted on the wall sufficiently high to allow the heated air that passes downwardly to escape into the room as opposed to be recirculated through the heater where overheating may occur.

[0018] In operation cold air will be drawn into the interior body of the heater from the rear of the heater, where it will be passed over a heating element and expelled out through the front vents 130. The device is typically manually operated and as shown in Figure 1 an indicator light 300 provided on the front surface 102 of the heater will provide a visual indicator of the operation status of the heater.

[0019] As shown in the section views of Figures 3 and 5, a heating element 400 is provided within an interior volume 401 of the heater. The heating element is desirably located adjacent to the front surface 102 of the heater and has a length substantially overlapping with the vents 130 provided in that front face. In this way air 410 that is drawn into the heater volume 401 will pass across the heater element 400 prior to exiting through the vents.

[0020] It is important for safety considerations that the heater will not overheat during operation. To ensure that this does not happen it is important that during operation of the heating element 400 that an air stream is constantly moving passed the element 400. If this was not happening then the temperature inside the volume 401 would increase.

[0021] To detect such increases in temperature, the heater comprises safety elements 405 which are provided in a lower portion 415 of the interior volume 401. The safety elements desirably include a thermal cut-out. In the event that the product overheats, the cut-out switches the heater off automatically. To bring the heater back into operation, one can remove the cause of overheating, then turn off the electrical supply to the heater for a few minutes. When the heater has cooled sufficiently it is possible to reconnect and switch on the heater.

[0022] A thermal fuse link may also be provided as an added safety feature. If the fuse link operates and opens circuit it is the result of abnormal overheating within the appliance and will typically require correction by a service engineer as opposed to user correction.

[0023] To function properly the safety devices should be proximal to the heater element to detect any overheat conditions. It is not essential that these be in a direct air path between an inlet and outlet of the heater, as long as they are close to that air path and particularly close to the heater element 400 to ensure that they can react quickly enough to enable a cut out of the heater element prior to serious damage being caused by an overheating.

[0024] It will be appreciated that the operation of these safety elements is important and it is necessary that they continue to operate despite any inadvertent splashing through the front vents or otherwise. In this exemplary heater the housing 103 is relatively small in dimensions and any water that inadvertently entered into the interior volume of the housing 103 could come into contact with the safety elements.

[0025] In the views of Figures 3 and 5, an exemplary mounting location for the safety elements is provided. Figure 6 shows a detailed view taken from Figure 5, showing an exemplary mounting arrangements for each of a thermal cut-out 600 which provides in the event that the product overheats, for the automatic switching off of the heater, and a secondary thermal fuse link 610 which operates to generate an open circuit within heater upon detection of abnormal overheating within the heater. While both operate independently of each other it is usual that they be mounted adjacent to one another and in this arrangement they are both mounted on a mounting arm 615 which also provides for an electrical path between the safety elements and the heater element 400 which they control.

[0026] The thermal cut out of this arrangement is of an

exemplary type which will reset automatically on detection of a dropping in ambient temperature. In such instances conventional regulations require for a secondary safety element which will require manual intervention to effect this reset of the safety element and allow re-energisation of the heater element. In this specific element this secondary element is provided by a fuse link. In embodiments where the primary safety element did not reset automatically the necessity for a secondary cut out could be obviated.

[0027] It will be appreciated that as the safety elements serve to detect the temperature within the interior volume 401 of the heater that it is desirable that they are provided adjacent to the heater element 400 itself. As the heater element 400 is located towards the front 102 of the fire it is potentially possible that splashed water could pass through the vents on the front surface through the heater element and into contact with the safety elements. Being electrical components exposure or contact to water could affect the performance of these elements and to ensure that the device will not overheat and become for example a fire hazard such performance cannot be compromised.

[0028] To address this problem, the present invention provides for at least one of the thermal fuse link and thermal cut out to be encapsulated in a water impervious barrier 620 which minimises the possibility of splashing water coming into contact with the at least one of the thermal fuse link or thermal cut out. In the arrangement of Figures 6 both are provided with this encapsulant but if it is possible to mount one or other of the two safety elements in a location where water could not contact then it may not be necessary to provide that encapsulant. Typically however it is necessary for both elements to be in the air flow and as such they both could potentially come into contact with water splashed through the front cover and therefore both will typically require at least partial covering.

[0029] It will be appreciated that the primary purposes of the barrier is to prevent ingress of water into the heater housing affecting the performance of the safety elements. Due to the close proximity of the barrier to the electrical parts it is desirable that the barrier is also formed from a material having electrical insulating properties sufficient that direct contact between the barrier and the respective one of the thermal cut out or thermal fuse link may be effected without affecting the operation of the thermal cut out or thermal fuse link, for example by providing a short. It will also be appreciated that in the event of splashing that it is most probable that such splashing will be directed from the front of the heater so it is not necessary for all surfaces of each of the two safety elements to be covered. What is necessary is that at least the frontwardly facing surfaces are protected by a water impervious barrier which will prevent water passing inwardly through the vents from coming into contact with the elements.

[0030] As each of the two elements are operating proximal to a heater element it is important that the water impervious barrier is fabricated from a material which allows for use in the high temperatures that are generated within the internal cavity of the heater. Typical materials include thermoplastic material such as polyolefin, fluoropolymer (such as Fluorinated Ethylene Propylene (FEP), PolyVinylidene Fluoride (PVDF), PTFE or Kynar), PVC, neoprene, silicone elastomer or Viton. Teflon tubing, and Convoluted tubing could also be used or indeed any like material which is rated to withstand the normal operating conditions of the heater and will allow the conduction of heat through the sleeve onto the respective one of the thermal cut out or the thermal fuse link to allow them to function

[0031] It will also be appreciated that such material are also electrical insulators which ensures that if intimate contact between the barrier and the safety elements is achieved that an electrical path between the two is not resultant.

[0032] While it is possible to provide the barrier 620 only to the front of each of the two safety elements, in the preferred arrangement of Figures 6 the barrier is provided in a sleeve arrangement which can be passed over the respective one of the thermal cut out or thermal fuse link so as to cover the sides of the safety elements 600, 610. By use of a protective sleeve it is possible to ensure that all surfaces are covered and that the orientation of the safety elements within the housing is not restricted by their respective orientation relative to their protective barriers. It is desirable that such a sleeve has properties including impervious to water, non-electrically conductive, desirably having a thin wall section- less than 1 mm being optimal. It is further preferable that it is flame-retardant having properties conforming with UL 224 VW-1 as a minimum. It is useful for such a material to be both flexible and have good dielectric strength, minimum 500 volts/mil , typical 2.5kV/1 minute and higher.

[0033] In the arrangements of Figures 6, the sleeve is formed from a flexible material that can be cut to the desired length to ensure adequate coverage along the longitudinal axis of each of the two safety elements. In the arrangement shown in Figure 6, the sleeve 620A for the thermal cut out 600 is shown in a partially finished position in that it has not been slid fully over the cut out 600. In contrast the fuse link 610 is completely covered by its dedicated sleeve 620B.

[0034] To ensure the maintenance of the protective covering the sleeve may be secured using for example a silicon or other adhesive to either the mounting arm or the actual safety element. The sleeve could also be used as a template defining a volume between an inner region of the sleeve and an outer region of the safety element which could be filled with a water impervious material such as silicon to provide a secondary barrier. The sleeve could also or alternatively be formed from a shrinkable material that would deform so as to adopt the outer dimensions of the element that it serves to protect. In a further alternative arrangement a water barrier is provided around at least one of the thermal cut out or fuse link

by effecting painting of the respective electrical element with a water impervious paint such as a latex based paint. This could be achieved by either manual painting or a dipping arrangement for the fuse link. Such an arrangement may not be optimal for the cut out because of the moving parts required for operation of this particular device. In such an arrangement the barrier would be applied to the safety element in a liquid form which would then dry or cure to form a solid membrane about the surface of the safety element.

[0035] It will be appreciated that an exemplary arrangement of a wall mounted fan heater comprising safety elements including a thermal cut-out and a secondary thermal fuse link which are co-operable with a water impervious barrier which minimises the possibility of splashing water coming into contact with the at least one of the thermal fuse link or thermal cut out has been described but that modifications can be made without departing from the scope of the invention. Furthermore the dimensions and geometry of the illustrated exemplary arrangement described herein are not to be construed as limiting.

[0036] The words comprises/comprising when used in this specification are to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers , steps, components or groups thereof.

Claims

1. A wall mounted fan heater having an air path defined between and inlet and an outlet, the heater comprising safety elements including a thermal cut-out provided within an interior volume of the heater between the inlet and outlet and **characterised in that** the heater further comprises a water impervious barrier provided adjacent to the thermal cut out to minimise water received into the interior volume of the heater coming into contact with the thermal cut out.

2. The heater of claim 1 wherein the safety elements further comprises a thermal fuse link, the thermal fuse link having an associated water impervious barrier provided adjacent thereto to minimise water received into the interior volume of the heater coming into contact with the thermal fuse link.

3. The heater of claim 1 or 2 wherein the safety elements are provided within the air path between the inlet and outlet

4. The heater of claim 2 wherein each of the two safety elements are provided with a dedicated water impervious barrier.

5. The heater of any preceding claim wherein the barrier is dimensioned and mounted relative to its respective safety element to allow for maintenance of an air flow passed the barrier.

6. The heater of any preceding claim wherein the barrier is at least provided between its safety element and a front portion of the heater such that the barrier serves to prevent splashes incident through a front surface of the heater from coming into contact with the safety elements.

7. The heater of any preceding claim wherein the barrier is also an electrical insulator which has insulating properties sufficient to ensure that direct contact between the barrier and the respective one of the thermal cut out or thermal fuse link may be effected without affecting the operation of the thermal cut out or thermal fuse link.

8. The heater of any preceding claim wherein the barrier is fabricated from a high temperature silicon, PTFE, Fluorinated Ethylene Propylene (FEP), PolyVinylidene Fluoride (PVDF) or the like which are rated to withstand the normal operating conditions of the heater and will allow the conduction of heat through the barrier onto the respective one of the thermal cut out or the thermal fuse link to allow them to function

9. The heater of any preceding claim wherein the barrier is dimensioned and provided relative to the safety elements so as to cover all surfaces of the safety elements.

10. The heater of any preceding claim wherein the barrier is provided in a sleeve arrangement which can be passed over the respective one of the thermal cut out or thermal fuse link so as to cover the sides of the safety elements.

11. The heater of claim 1 wherein the water impervious barrier is operably provided in a liquid form which cures to form a solid seal about its respective safety device.

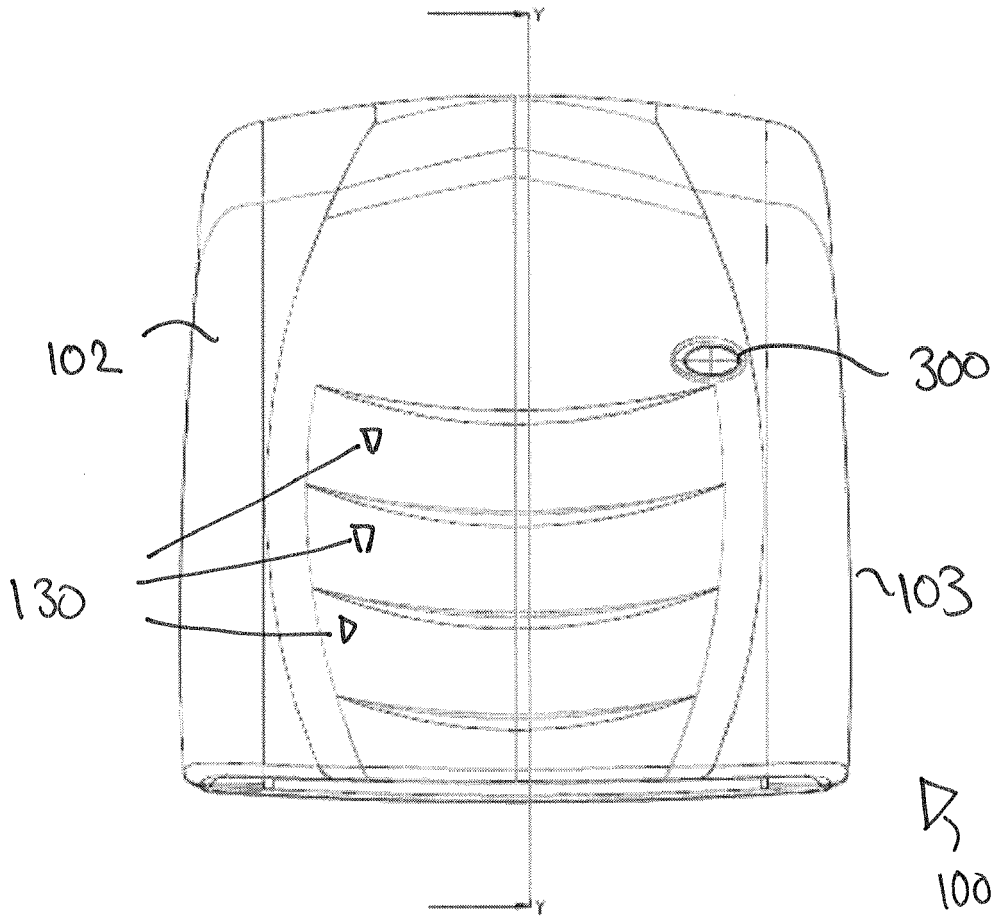

Figure 1

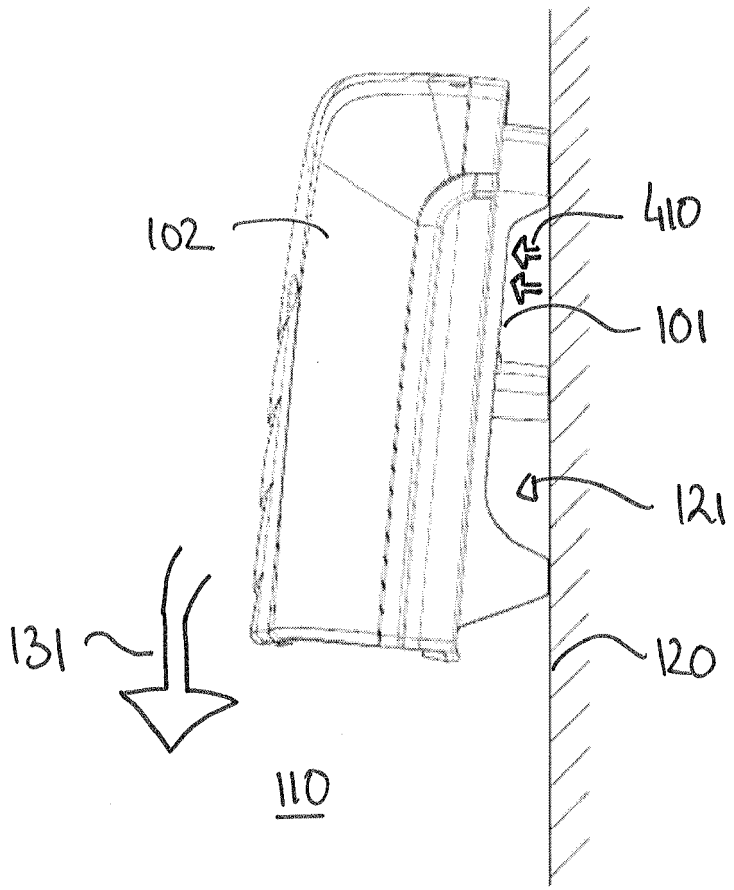

Figure 2

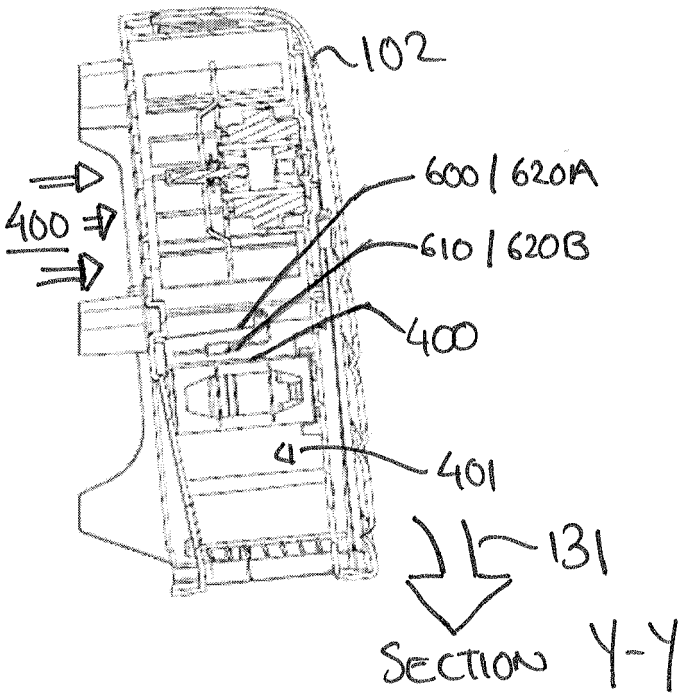

Figure 3

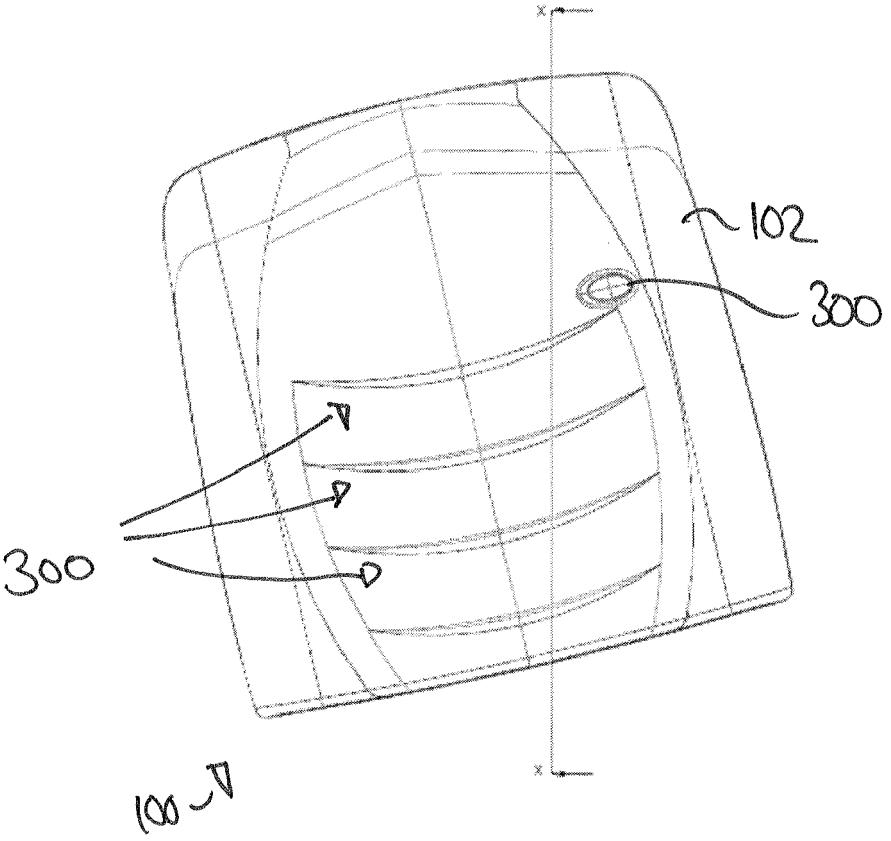

Figure 4

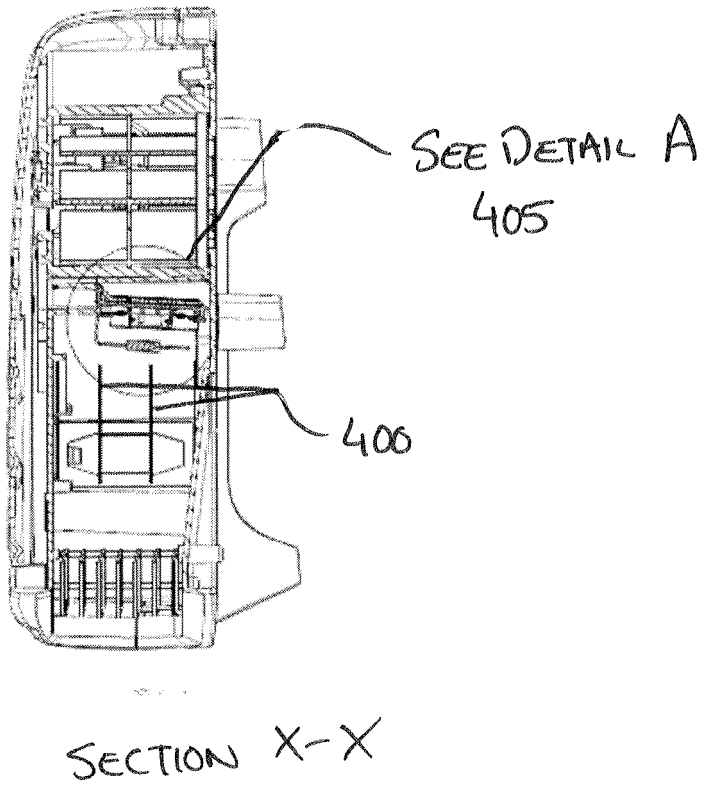

Figure 5

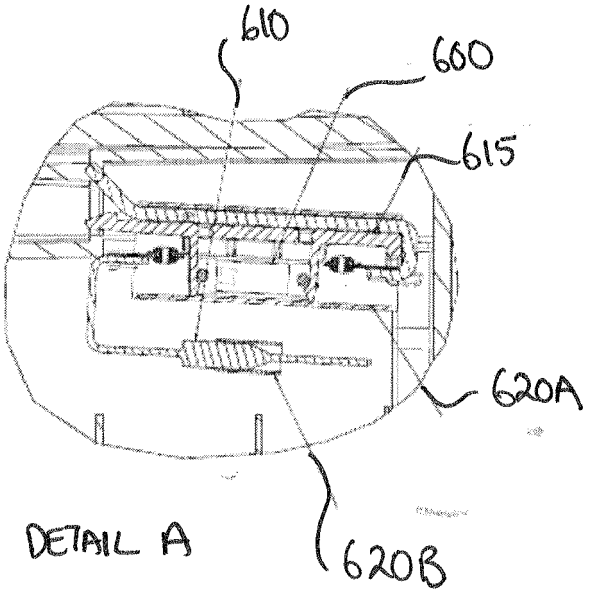

Figure 6