

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

INVALIDITY CLAIM CHART Invalidity of U.S. Patent No. 9,629,265 in view of Suzuki

U.S. Patent No. 7,042,722 (“Suzuki”) was filed on February 3, 2004, claims priority to February 3, 2004, and was issued on May 9, 2006. Suzuki therefore qualifies as prior art to the '265 patent under, at least, (pre-AIA) 35 U.S.C. § 102(a), (b) and/or (e). Suzuki anticipates and/or renders obvious (in combination with the knowledge of a person of ordinary skill in the art) the Asserted Claims of the '265 patent, at least as Dell understands Cloud Byte’s application of the Asserted Claims in an effort to show infringement.

To the extent Cloud Byte argues that any element below is not disclosed by Suzuki, a person of ordinary skill in the art would have found it obvious to combine the teachings of Suzuki with the background knowledge of a person of ordinary skill in the art and/or the additional references, and exemplary teachings, set forth in Dell’s Invalidity Contentions and accompanying charts and/or in Appendix D.

The chart below provides representative examples of where each element of each claim is found within Suzuki. Citations are meant to be exemplary, not exhaustive, and Dell reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Cloud Byte. Citations to figures, drawings, tables, and the like include reference to any accompanying or related text. All internal cross references are meant to incorporate the cross-referenced material as if fully set forth therein. Where Dell states that Suzuki “discloses” a limitation, that disclosure may be express, implicit, and/or inherent.

It is Dell’s position that Cloud Byte’s Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Dell’s statements below should not be treated as an admission, implication, or suggestion that Dell agrees with Cloud Byte regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Cloud Byte in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. Nothing in this chart is intended to suggest that Dell agrees with Cloud Byte’s application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

Cloud Byte has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Suzuki. Dell therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Cloud Byte makes any such contention. This chart is subject to all reservations, objections, and disclaimers in Dell’s Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
[1.pre] 1. An electronic device comprising:	<p>Dell takes no position in these Invalidity Contentions on whether the entirety of the preamble of this claim limitation. To the extent it is a limitation, Suzuki discloses, expressly and/or inherently, an electronic device.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p data-bbox="1207 324 1302 367"><i>FIG. 1</i></p> <p data-bbox="724 1055 1241 1086">Suzuki at Fig. 4 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at 1:13-15: The present invention relates generally to electronic equipment preferably used for disk array control devices or equivalents thereto.</p> <p>Suzuki at 1:17-25:</p>

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Asserted Claims	Suzuki
	<p>In electronic equipment such as for example a control unit for use in disk array apparatus or the like, a micro processing unit (MPU) or else is used to perform processing of a large amount of data at high speeds. Due to this, an increase in inside temperature rises, the rise of internal temperature is controlled using a cooling fan etc. (for example, patent documents 1).</p> <p>Suzuki at 1:47–51: The present invention has been made in view of the problems stated above, and its object is to provide an electronic equipment capable of performing effective cooling operations to thereby enable performance enhancement while increasing the reliability. Further objects of the present invention will become clear from the description of the embodiments described later.</p> <p>Suzuki at 1:52–2:2: In one preferred form of the invention, the duct member has a plurality of inflow ports connected to exhaust ports of the fans respectively, a plurality of outflow ports connected to the cooling air-use openings respectively, and a plurality of flow paths. A connection circuit board provided with an electrical connector, and provided in correspondence with each of the cooling air openings located in the one side space, and the connection circuit via the electrical connectors. A plurality of control modules each electrically connected to a substrate; a plurality of fan modules provided in the other side space, each having a built-in fan corresponding to each of the cooling air openings; A duct member that is located in the other side space and is provided between the connection circuit board and the fan modules, and connects the exhaust ports of the fans to the corresponding cooling air openings, respectively. Prepare.</p> <p>Suzuki at 2:64–67: In one form of the invention, each of the control modules is such that more than one electronic component acting as a heating body is disposed in close proximity to the cooling air-use openings.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

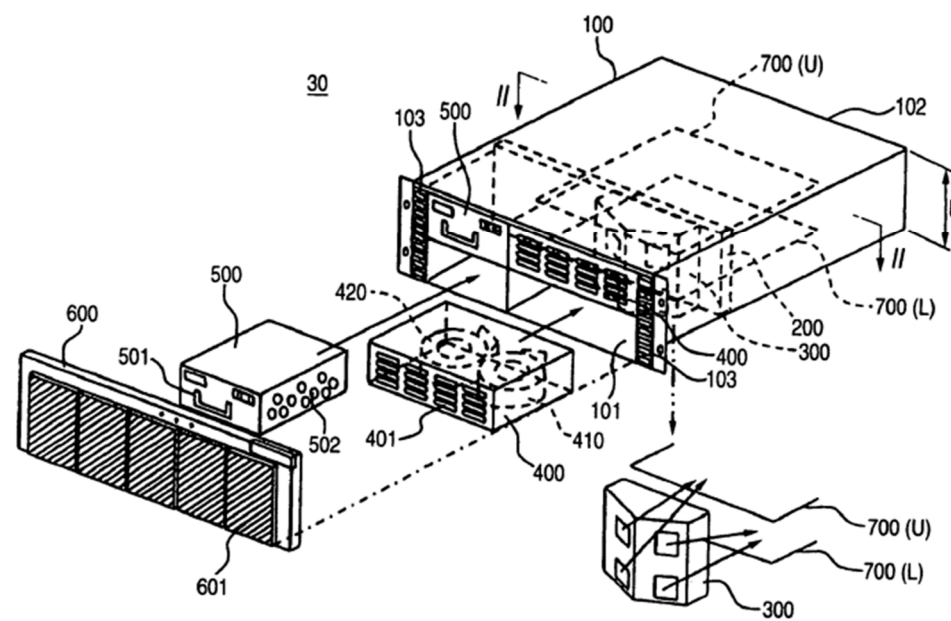
Asserted Claims	Suzuki
<p>[1.a] a housing comprising a front face and a rear face which are distanced from each other in a longitudinal direction;</p>	<p>Suzuki discloses, expressly and/or inherently, a housing comprising a front face and a rear face which are distanced from each other in a longitudinal direction.</p> <p><i>See, e.g.:</i> Suzuki at Fig. 1 and accompanying text:</p> <p style="text-align: center;">FIG. 1</p>  <p>Suzuki at Fig. 2 and accompanying text:</p>

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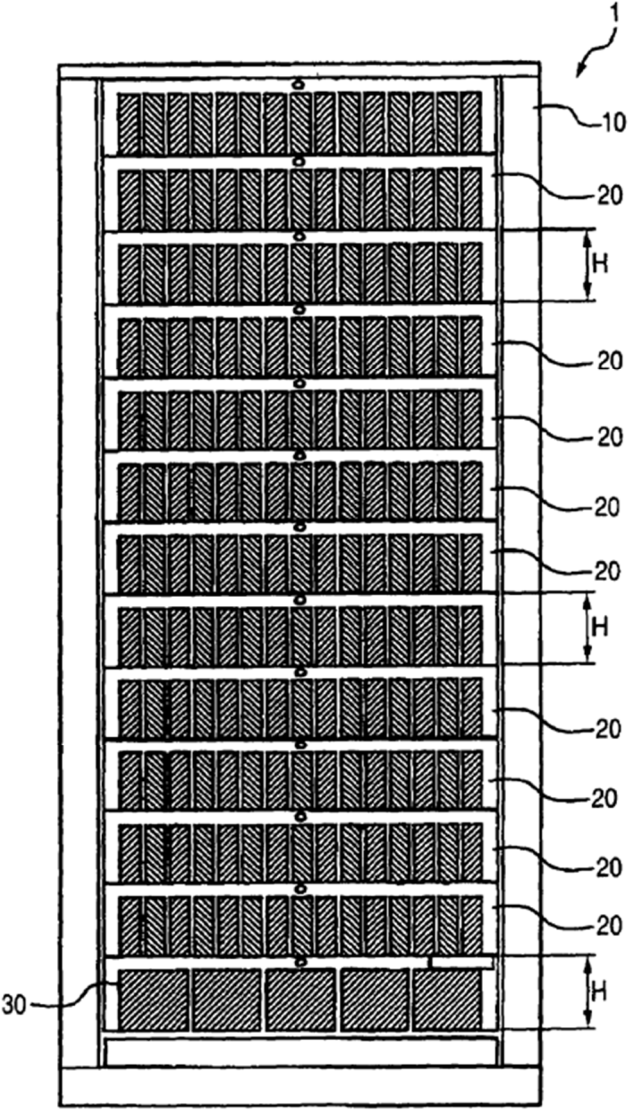
Asserted Claims	Suzuki
	 <p>The diagram shows a vertical cross-section of a multi-layered structure, labeled 1. It consists of a top layer 10, followed by a series of alternating layers. There are eight layers labeled 20, each separated by a thin white layer. The height of each layer 20 is indicated by a double-headed arrow labeled H. At the bottom, there is a layer labeled 30, also with a height H. The entire structure is enclosed in a frame.</p> <p>Suzuki at Fig. 4 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at Fig. 5 and accompanying text:</p>

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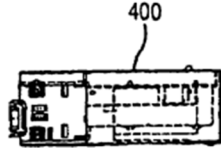
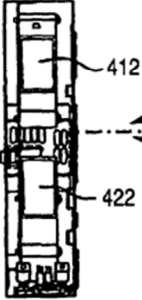
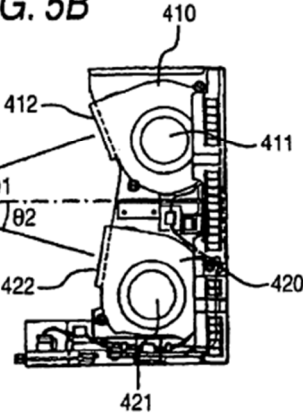
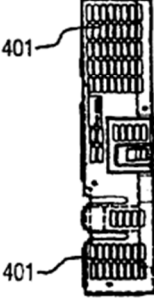
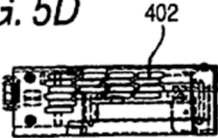
Asserted Claims	Suzuki
	<p data-bbox="1024 277 1157 321"><i>FIG. 5C</i></p>  <p data-bbox="831 570 961 613"><i>FIG. 5E</i></p>  <p data-bbox="1024 570 1157 613"><i>FIG. 5B</i></p>  <p data-bbox="1455 570 1585 613"><i>FIG. 5A</i></p>  <p data-bbox="1024 1036 1157 1079"><i>FIG. 5D</i></p>  <p data-bbox="730 1214 1262 1247">Suzuki at Fig. 10 and accompanying text:</p>

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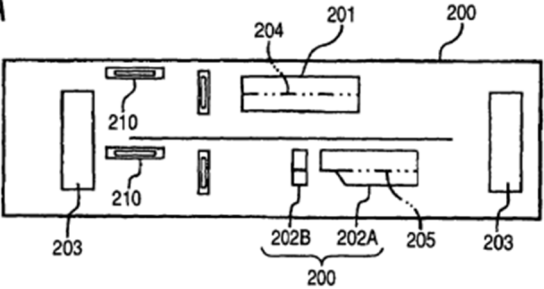
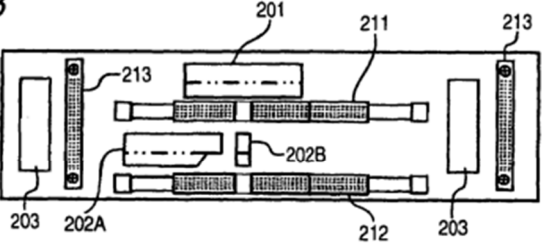
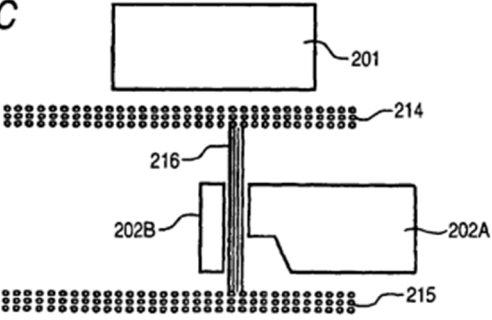
Asserted Claims	Suzuki
	<p>FIG. 10A</p>  <p>FIG. 10B</p>  <p>FIG. 10C</p>  <p>Suzuki at Fig. 11 and accompanying text:</p>

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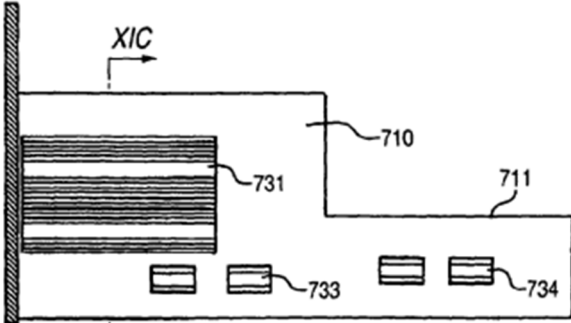
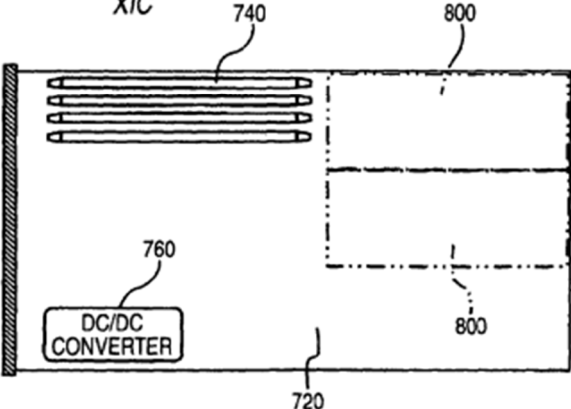
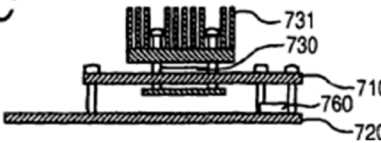
Asserted Claims	Suzuki
	<p>FIG. 11A</p>  <p>FIG. 11B</p>  <p>FIG. 11C</p>  <p>Suzuki at Fig. 13 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p>FIG. 13A</p> <p>FIG. 13B</p>

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Asserted Claims	Suzuki
	<p>The chassis 100 is made of a metallic material such as stainless steel or the like, which is formed for example into a hollow box-like shape. A front side opening 101 that is positioned on this side in the drawing and a rear side opening 102 that is placed rear side in the figure. The rear opening 102 is formed. The chassis 100 is configured to be disassembled by a fastening member such as a screw so that one side and the remaining three sides can be separated, for example. In addition, air intake holes 103 are formed on both sides of the front opening 101 of the chassis 100 so as to communicate with the front side ducts 104 formed in the front space of the chassis 100 so as to extend in the longitudinal direction.</p> <p>Suzuki at 5:4–13: Here, the chassis 100 is such that its height H and other sizes are determined in such a way as to enable accommodation into a dedicated rack 10 to be later described. The height H is designed to become less than or equal to 3U (about 133.35 mm) as defined according to the chassis height dimension H, the height dimension of each module mounted in the chassis 100 is also determined. Note that the shape, material, height dimension, and the like of the chassis 100 are examples, and the present invention is not limited to this.</p> <p>Suzuki at 5:14–23: The back board 200 is the one that holds each control module 700 while performing electrical connections between respective control modules 700 and with other modules. The back board 200 is positioned at a location near the front side opening 101 of the front portion of the chassis 100 in the longitudinal direction. The backboard 200 is formed in a substantially flat plate shape, and is provided with openings 201 to 203 for cooling air and electrical connectors 210 to 213 as described later.</p> <p>Suzuki at 5:24–46: By attaching the back board 200 to inside of the chassis 100, a rear side space and a front side space are partitioned within the chassis 100 respectively, wherein the former spans from the rear side opening 102 up to a rear face of the back board 200, which are each defined. Therefore, the space in the chassis 100 is divided into two by the back board 200, and the front space and the rear space are basically separated. However, in the present</p>

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Asserted Claims	Suzuki
	<p>invention, as described later, by forming predetermined cooling air openings 201 to 203 at predetermined positions, the front space and the rear space are partially communicated via the backboard 200. This enables efficient cooling. Thus, the backboard 200 forms a support function for supporting each control module 700, a connection function for electrically connecting each control module 700 and the like, and a space (front space and rear space) in the chassis 100. And a cooling function for flowing cooling air from the front space into the rear space.</p> <p>Suzuki at 5:47–6:3: The duct member 300 is for exhausting cooling winds as sent from respective fan modules 400 in a way that cooling winds are combined together per each control module 700. The duct member 300 is placed within the front side space in the chassis 100 and is ckboard 200 (the right side in FIG. 1) and each fan module 400. For example, the duct member 300 is formed in a box shape having a substantially pentagonal cross section from a plastic foam material, and the surface thereof is coated with a resin or the like so as not to generate dust or the like. Although details will be described later, a total of four inlets corresponding to the exhaust ports of the fan modules 400 are provided on the front surface of the duct member 300, and the control modules 700 are provided on the rear surface side of the duct member 300. A corresponding total of two outlets are provided. In the duct member 300, the cooling air from one of the two exhaust ports of each fan module 400 is guided to the upper control module 700, and the cooling air from the other exhaust port is guided to the lower control module 700. In order to guide to the above, a flow path connecting each inflow port and each outflow port is formed.</p> <p>Suzuki at 6:4–17: Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust por Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction</p>

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Asserted Claims	Suzuki
	<p>so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 6:43–63: Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 6:64-7:5: The decorating door 600 is for covering the front side opening 101 of the chassis 100 after having attached the duct member 300 and each fan module 400 and also each battery module 500 in the front side space of chassis 100. The decorating door 600 is detd to the chassis 100, and a plurality of louvers 601 are detachably attached to the decorative door 600. Each louver 601 has air permeability, and the outside air flows into the chassis 100 via each louver 601.</p> <p>Suzuki at 7:6–27: Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 is pontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively</p>

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Asserted Claims	Suzuki
	<p>fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 7:29–33: FIG. 2 is a front view of the disk array apparatus 1. The disk array apparatus 1 is constituted from a dedicated rack 10, a plurality of hard disk units 20 received within the rack 10, and a control unit 30 for control of operations, such as data access to each hard disk unit 20.</p> <p>Suzuki at 8:36–49: First, the cooling wind to be created by each fan module 400 will be discussed in detail. The fan module 400 is designed to take in the air streams coming respectively from two inlet paths—namely, air intake holes 401 in the front face of fan module 400, in the vicinity of each fan module 400 decreases due to the operation of each fan module 400, air flows into the battery module 500 from the vent hole 502 on the front surface of the battery module 500. It flows into each fan module 400 via the vent hole 502. Each fan 410, 420 of each fan module 400 sucks air from the intake ports 411, 421, and exhausts the sucked air from the exhaust ports 412, 422 by the rotational force of the fan blades.</p> <p>Suzuki at 9:59–10:10: Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked. When each intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100.</p>

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Asserted Claims	Suzuki
	<p>Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:35–40: An explanation will next be given of the structure of each fan module 400 with reference to FIGS. 5A to 5E. FIGS. 5A–5E are a set of projection drawings, wherein FIG. 5A is a front view, FIG. 5B is a top plan view, FIG. 5C is a right side view, FIG. 5D is a left side view, and FIG. 5E is a back view.</p> <p>Suzuki at 10:41–52: As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 11:9–18: As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flows into the battery module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 12:26–41: An explanation will next be given of a dividable structure of the duct member 300 with reference to FIGS. 9A to 9C. FIGS. 9A–9C show portions of projection drawings of the duct member 300, wherein FIG. 9A is a back view, FIG. 9B is a top plan view, and FI the duct member 300, the cooling air from the inlets 311 and 312 on one side is integrated and guided to the lower outlet 340, and the cooling air from the inlets 321 and 322 on the other side is integrated. The flow paths 350 and 360 are formed so as to be integrated into the upper outlet 330. Further, each of the flow paths 350 and 360 is formed in a shape in which the cooling air from each fan module 400 can easily flow so as to prevent backflow from the chassis 100.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that</p>

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Asserted Claims	Suzuki
	<p>generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p>
<p>[1.b] a plurality of fans which are arranged inside the housing close to the front face so as to cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing;</p>	<p>Suzuki discloses, expressly and/or inherently, a plurality of fans which are arranged inside the housing close to the front face so as to cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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Asserted Claims	Suzuki
<p>Suzuki at Fig. 4 and accompanying text:</p>	<p>FIG. 1</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at Fig. 5 and accompanying text:</p>

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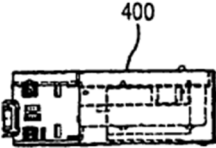
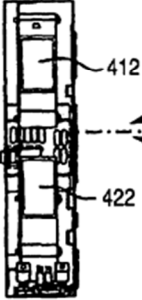
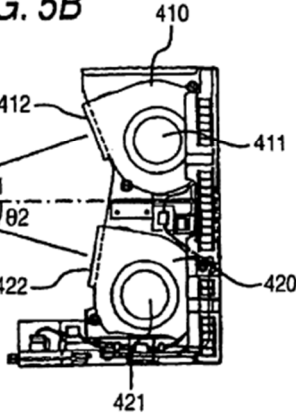
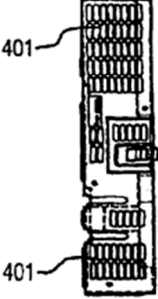
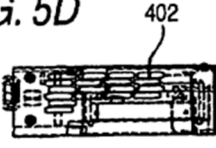
Asserted Claims	Suzuki
	<p data-bbox="1024 277 1157 321"><i>FIG. 5C</i></p>  <p data-bbox="831 565 961 609"><i>FIG. 5E</i></p>  <p data-bbox="1031 565 1161 609"><i>FIG. 5B</i></p>  <p data-bbox="1457 565 1587 609"><i>FIG. 5A</i></p>  <p data-bbox="1031 1036 1161 1079"><i>FIG. 5D</i></p>  <p data-bbox="730 1344 1262 1383">Suzuki at Fig. 13 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
<i>FIG. 13A</i>	
<i>FIG. 13B</i>	

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 1:52–2:2: In one preferred form of the invention, the duct member has a plurality of inflow ports connected to exhaust ports of the fans respectively, a plurality of outflow ports connected to the cooling air-use openings respectively, and a plurality of flow paths. A connection circuit board provided with an electrical connector, and provided in correspondence with each of the cooling air openings located in the one side space, and the connection circuit via the electrical connectors. A plurality of control modules each electrically connected to a substrate; a plurality of fan modules provided in the other side space, each having a built-in fan corresponding to each of the cooling air openings; A duct member that is located in the other side space and is provided between the connection circuit board and the fan modules, and connects the exhaust ports of the fans to the corresponding cooling air openings, respectively. Prepare.</p> <p>Suzuki at 2:3–12: In one preferred form of the invention, the duct member has a plurality of inflow ports connected to exhaust ports of the fans respectively, a plurality of outflow ports connected to the cooling air-use openings respectively, and a plurality of flow pathshat group the respective inlets and the respective outlets for each cooling air opening and communicate with each other, so that at least one of the flow paths can be divided and formed. It is composed of a plurality of divided bodies.</p> <p>Suzuki at 2:13–23: Respective ones of the flow paths may be communicably coupled together. For example, a confluence passage is provided within the duct member for coupling and communicating respective flow paths together to thereby permit cooling air streams or “winds” to w paths and merges the cooling air with each other, Cooling can be efficiently performed by effectively using the cooling air from all remaining normal fans.</p> <p>Suzuki at 6:4–17:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust ports. Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 8:36–49: The cooling wind exhausted from the fan 410, 420 of each fan module 400 flows into the duct member 300, resulting in separation into a cooling wind leading to the upper-side control module 700U and a cooling wind approaching the lower-side control module ir directed toward the upper control module 700U flows out from the upper outlet of the duct member 300 and flows into the upper control module 700U through the upper opening 201 of the backboard 200. Similarly, the cooling air toward the lower control module 700L flows out from the lower outlet of the duct member 300 and flows into the lower control module 700L through the lower opening 202 of the backboard 200.</p> <p>Suzuki at 10:53–62: As shown in FIG. 5B, each fan 410, 420 is arranged, for example, as a lateral flow type fan which sucks air from an inlet port 411, 421 in the axial direction and then exhausts the air from an exhaust port 412, 422 in the radial direction, respectively. I been. In this embodiment, a sirocco fan is used as the cross flow fan. By adopting a sirocco fan, it is possible to ensure a sufficient air volume while being relatively small, and to prevent backflow from within the chassis 100.</p> <p>Suzuki at 10:63–11:8: Also note that in this embodiment, each fan 410, 420 is designed to have the same structure while using a total of four identical fans for two fan modules 400. Sharing the</p>

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Asserted Claims	Suzuki
	<p data-bbox="724 256 1881 435">fans in this way is aimed at reduction of manufacturing costs. If the right and left fans 420 are opposite to each other, the fans can be arranged symmetrically. In that case, two types of fans with different rotation directions are required. As a result, manufacturing costs, component management costs, etc. increase. However, the present invention is not limited to this, and includes cases in which fans having different rotation directions are employed.</p> <p data-bbox="724 475 968 505">Suzuki at 11:9–18:</p> <p data-bbox="724 513 1881 727">As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flows into the fan module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p> <p data-bbox="724 768 984 797">Suzuki at 11:19–33:</p> <p data-bbox="724 805 1881 1130">The exhaust port 412, 422 of each fan 410, 420 is tilted by angle θ_1, θ_2 with respect to a center line respectively. More specifically, a cooling wind is exhausted from each fan 410, 420 in the form that it converges toward the center. Whereby, it is possible to reduce the size of the duct member 300 for separating the cooling air from each fan module 400 into a predetermined flow path can be reduced. Although it is possible to exhaust the cooling air from the fan module 400 substantially in parallel, in this case, the front shape of the duct member 300 that receives the cooling air also needs to be increased, and the size of the duct member 300 increases. . Since the fan module 400 according to the present invention exhausts the cooling air toward the center, the duct member 300 can be reduced in size.</p> <p data-bbox="724 1187 984 1216">Suzuki at 11:35–58:</p> <p data-bbox="724 1224 1881 1399">Next, an explanation will be given of the structure of the duct member 300 with reference to FIGS. 6A to 9C. First, refer to perspective views of FIGS. 6A–6B. FIG. 6A is a perspective view of the duct member 300 when looking at it from its front side, while FIG. 6B is a perspective view of the duct member 300 viewed from the rear side. As shown in FIG. 6A, the inlets 311, 312, 321, to which the exhaust ports 412, 422 of the fans 410, 420 are</p>

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Asserted Claims	Suzuki
	<p>respectively connected to the front side of the duct member 300 facing each fan module 400. 322 is formed. As shown in FIG. 6B, two outlets 330 and 340 corresponding to the openings 201 and 202 of the backboard 200 are formed on the rear side of the duct member 300. The upper outlet 330 corresponds to the upper opening 201 of the backboard 200, and the lower outlet 340 corresponds to the lower opening 202 of the backboard 200. The cooling air F410, F420 exhausted from the fans 410, 420 flows into the duct member 300 from the inlets 311, 312, 321, 322, respectively. Then, the cooling air FCU that has flowed out of the outlet 330 flows into the upper control module 700U through the upper opening 201 of the backboard 200, and the cooling air FCL that has flowed out of the outlet 340 flows into the lower opening of the backboard 200. It flows into the lower control module 700L via the unit 202.</p> <p>Suzuki at 12:11–16: Note here that a flow path system which is made up of the duct member 300's each inflow port 311, 312, 321, 322 and each flow path 350, 360 plus each outflow port 330, 340 is designed to have a shape which ensures that the cooling wind from each fan 410, cooling air is formed so as not to flow backward from the chassis 100 side.</p> <p>Suzuki at 12:17–25: As described above together with FIG. 5, since each fan 410, 420 of each fan module 400 is designed so that the direction of exhaust air faces the central direction, it is possible to form the duct member 300 to have a small size as shown in FIG. 8. Addit upper outlet 330 and the lower outlet 340 are formed so as to partially overlap each other on the rear surface of the duct member 300, which also contributes to downsizing of the duct member 300.</p> <p>Suzuki at 18:25–45: Based on FIG. 16, a control method of each fan module 400 will be explained. As has been stated supra, the control unit 30 in accordance with the invention employs two fan modules 400 each having two built-in fans 410, 420 and causes each fan module 400 te two control modules 700 are cooled by the respective fan modules 400. Further, the duct member 300 causes each one-side fan 410 of each fan module 400 to cool the lower control module</p>

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Asserted Claims	Suzuki
	<p>700, and each other fan 420 of each fan module 400 cools the upper control module 700. Yes. Therefore, even when any one of the fan modules 400 is stopped due to a failure or the like, redundancy is provided that the upper and lower control modules 700 can be cooled by the other normal fan module 400. Further, since the duct member 300 has a flow path shape and the like so that the cooling air from each fan module 400 can easily flow, the air blowing efficiency is high, and even when one fan module 400 stops operating, the remaining air remains. The other fan module 400 can secure an air volume of about 60 to 70%.</p> <p>Suzuki at 19:17–27: Since this embodiment is arranged as has been described above in detail, it offers the following effects and advantages. arranged above and below are provided, two control by the two fan modules 400 is normal. The module 700 can be effectively cooled, and even if one of the fan modules 400 stops operating, the remaining normal fan module 400 can continue to cool each control module 700. . Such a redundant configuration of the cooling air supply mechanism can ensure reliability when a failure occurs.</p> <p>Suzuki at 19:48–50: As each fan module 400 employs the fans 410, 420 with the same structure, it is possible to reduce parts management costs and manufacturing costs or the like.</p> <p>Suzuki at 19:51–56: Furthermore, since each fan 410, 420 is formed of a lateral flow type fan (e.g. sirocco fan) capable of sucking air from its axial direction and exhausting it in radial direction, it is possible to obtain a large amount of air flow while having a relativeack flow from within 100 can be prevented.</p> <p>Suzuki at 22:15–29: As has been stated in the first embodiment, for the purpose of causing the laterally disposed fans 410, 420 to cool down the upper and lower control modules 700 respectively, each flow path 350, 360 is substantially the same in its inflow side position</p>

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Asserted Claims	Suzuki
	<p>(i) is the same, the position on the outflow side (formation position of the outflow port) is divided into upper and lower parts, and is formed in a step. Accordingly, when viewed from the side surface in FIG. 17, the area where the flow paths 350 and 360 overlap decreases toward the downstream side, so the cooling air passage area of the merge passage 370 is set to be large with a relatively simple shape. For this purpose, it is preferable to form a confluence passage 370 upstream of the respective flow paths 350 and 360.</p> <p>Suzuki at 22:30–52: While each fan module 400 has two fans 410, 420, if either one fan within the same fan module 400 stops its operation due to malfunction or else, the above-stated embodiment experiences a decrease in amount of a cooling wind flowing in a flow path corresponding to the stopped fan is reduced. As described above, the flow paths 350 and 360 have a structure in which the cooling air easily flows and does not easily generate a reverse flow, and the fan drive voltage is increased when the fan is stopped. However, one of the fans stops. If you do, you may want to secure more flow. Therefore, in this embodiment, the flow paths 350 and 360 are communicated with each other by the merge passage 370 so that even when any one of the fans stops operating, the remaining normal fan can be backed up. ing. According to the applicant's experiment, when one fan is stopped, the temperature of the heating element (MPU 730, etc.) is reduced by about 5 degrees Celsius in this embodiment than in the embodiment described above. I was able to.</p> <p>Suzuki at 23:37–49: It should be noted that the present invention is not limited to the embodiments stated supra. It would readily occur to those skilled in the art that various additions and alterations or the like are available within the scope of the invention. For example, in the control unit, two fan modules each incorporating two fans are employed. However, the present invention is not limited to this. For example, n (n When a control module of ≥ 3) is mounted, a configuration may be adopted in which two or more fan modules incorporating n fans are provided. Further, the embodiment in which the flow paths in the duct member are merged and the embodiment in which the on-off valve is provided can be combined.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
<p>[1.c] a central processing unit (CPU) which is arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough;</p>	<p>Suzuki discloses, expressly and/or inherently, a central processing unit (CPU) which is arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough.</p> <p><i>See, e.g.:</i> Suzuki at Fig. 1 and accompanying text:</p> <p style="text-align: center;">FIG. 1</p> <p>Suzuki at Fig. 4 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at Fig. 13 and accompanying text:</p>

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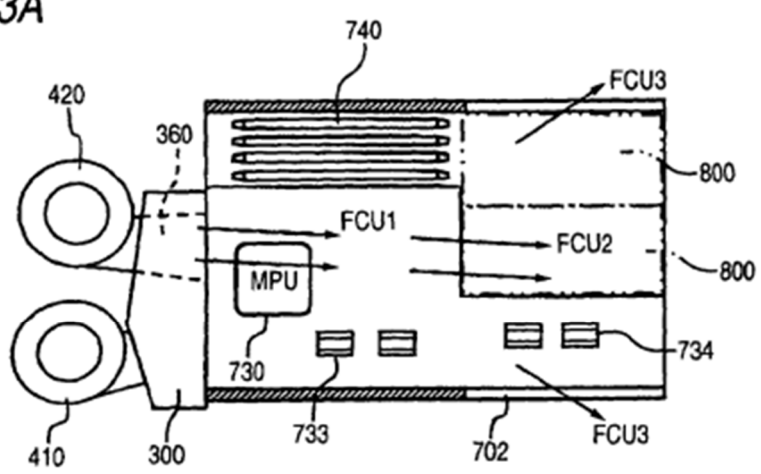
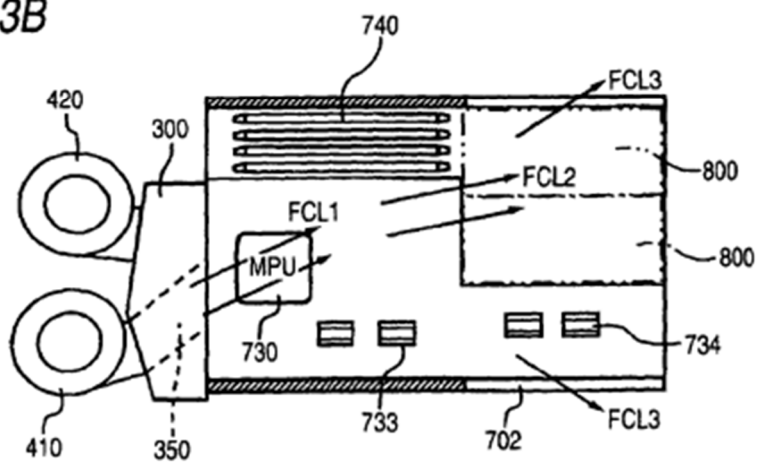
Asserted Claims	Suzuki
	<p>FIG. 13A</p>  <p>FIG. 13B</p>  <p>Suzuki at 1:17-25:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>In electronic equipment such as for example a control unit for use in disk array apparatus or the like, a micro processing unit (MPU) or else is used to perform processing of a large amount of data at high speeds. Due to this, an increase in inside temperature rises, the rise of internal temperature is controlled using a cooling fan etc. (for example, patent documents 1).</p> <p>Suzuki at 1:29–46:</p> <p>To attain the foregoing object, an electronic equipment in accordance with the invention comprises a housing, a connection-use circuit board which is provided to define within the housing a one side space and a remaining side space with a plurality of cooe improvements, it is necessary to improve the performance of the MPU and the like, but the performance improvement of the MPU causes an increase in the amount of heat generation and current consumption. In addition, there are many cases in which dimensional restrictions are imposed from the viewpoint of maintaining compatibility with mounting on conventional products and saving space. In other words, while high performance of data processing is required, increase in mechanical and physical dimensions is not allowed, and high performance and an increase in heat generation due to high performance must be resolved in a well-balanced space.</p> <p>Suzuki at 7:6–27:</p> <p>Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 is pontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished</p>

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Asserted Claims	Suzuki
	<p>from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 8:1–10: Each control module 700 is equipped with an MPU 730 and cache memory 740 and others, and is arranged to process a data write request and data read request in accordance with a command(s) as received from a host computer. A logic volume (logic unit) is set on a physical storage region, which is provided by the disk device 21 of each hard disk unit 20 with data being stored on this logic volume. By each hard disk unit 20, it is possible to perform data management in the architecture of redundant array of independent (inexpensive) disks, known as “RAID.”</p> <p>Suzuki at 8:64–9:17: Then, the flow of cooling wind will be discussed while looking at the upper-side control board 710 of upper-side control module 700U. A cooling wind FCU1 which has flown onto the upper-side control board 710 of upper-side control module 700U from the upper of the backboard 200. First, the MPU 730 provided in the vicinity of the upper opening 201 and the surrounding electronic components are cooled. Next, the cooling air deprived of heat from the MPU 730 reaches the intermediate portion of the upper control board 710 to become the cooling air FCU2, and cools the I / F module 800 and peripheral electronic components.</p> <p>Suzuki at 14:17–33: As shown in FIG. 11A, the upper-side control board 710 mounts thereon an MPU 730 being placed at a location near the front side to be attached to the back board 200 along with other electronic components 733, 734 and the like. A cutaway portion 711 for attaching each I / F module 800 is formed. Here, the heat sink 731 (see FIG. 11C) for cooling the MPU 730 and other electronic components (for example, IC and LSI) 733 and 734 are arranged along the direction of the cooling air flowing from the backboard 200 side. It is arranged in the longitudinal direction. However, it is not necessary that all the electronic</p>

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Asserted Claims	Suzuki
	<p>components are arranged along the flow of the cooling air, and main components that can affect the flow of the cooling air such as the heat sink 731 and the cache memory 740 are substantially parallel to the flow of the cooling air. By arrange positioning so that it may become, it can flow a cooling wind smoothly.</p> <p>Suzuki at 14:59–67: On the other hand, the DC/DC converter 760 is positioned adjacent to the back board 200 and is attached to the lower-side control circuit board 720. The first reason of this is that the DC/DC converter 760 is a heating element comparable to MPU 730 so thatively cooled by being arranged in the vicinity of the cooling air inlet. The second reason is to shorten the line length of the high voltage input inputted to the DC / DC converter 760.</p> <p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecacre loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 16:1–40: As shown in FIG. 13A, the cooling winds from respective other-side fans 420 of fan modules 400 are combined and mixed together within the flow path 360 of duct member 300 and then flow into the upper-side control module 700U from the upper-side outflow pospect to the longitudinal direction of the control module 700. The cooling air FCU1 that has flowed in cools the MPU 730 and the like disposed in the vicinity of the outlet 330, is</p>

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Asserted Claims	Suzuki
	<p>rectified by the heat sink 731 and the cache memory 740, and reaches the middle in the longitudinal direction of the upper control module 700U. The cooling air FCU2 that has reached the substantially middle part of the upper control module 700U cools the peripheral electronic components 734 and the like, and a part thereof goes straight as it is and is discharged to the outside from the vent hole 701 formed on the rear side of the control module 700U. Is done. The remaining cooling air FCU2 flows into the respective rear side ducts 105 through the respective vent holes 702 respectively formed on the both sides of the rear side of the upper control module 700U, and from the rear side ducts 105 to the outside.</p> <p>Suzuki at 16:24–41: As shown in FIG. 13B, the cooling winds from respective one-side fans 410 of the fan modules 400 are combined together within the flow path 350 of duct member 300 and then flow into the lower-side control module 700L from the lower-side outflow port 340. er flowing out from the lower outlet 340 is inclined in one direction with respect to the longitudinal direction of the lower control module 700L and flows into the lower control module 700L, and similarly cools the MPU 730 and the like. The flow is rectified. In the same manner as described above, a part of the cooling air FCL2 reaching the substantially middle portion of the lower control module 700L is discharged to the outside through the vent hole 701 of the lower control module 700L, and the rest is a side vent hole. It flows into the rear side duct 105 through 702 and is discharged to the outside.</p> <p>Suzuki at 20:24–28: Next, each control module 700 is disposed to mount the MPU 730 and DC/DC converter 760 serving as heating bodies at locations near the openings 201, 202 of back board 200, which are gateways of cooling winds. Thus it is possible to effectively cool down.</p> <p>Suzuki at 20:40–45: Furthermore, as respective parts including but not limited to the MPU 730 with heat sink 731 and the cache memory 740 plus the DC/DC converter 760 are laid out in parallel with</p>

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Asserted Claims	Suzuki
	<p>the long-side direction of the control module 700, it is possible to rectify module 700 is rectified. be able to.</p> <p>Suzuki at 22:30–52:</p> <p>While each fan module 400 has two fans 410, 420, if either one fan within the same fan module 400 stops its operation due to malfunction or else, the above-stated embodiment experiences a decrease in amount of a cooling wind flowing in a flow path corresponding the flow path corresponding to the stopped fan is reduced. As described above, the flow paths 350 and 360 have a structure in which the cooling air easily flows and does not easily generate a reverse flow, and the fan drive voltage is increased when the fan is stopped. However, one of the fans stops. If you do, you may want to secure more flow. Therefore, in this embodiment, the flow paths 350 and 360 are communicated with each other by the merge passage 370 so that even when any one of the fans stops operating, the remaining normal fan can be backed up. ing. According to the applicant's experiment, when one fan is stopped, the temperature of the heating element (MPU 730, etc.) is reduced by about 5 degrees Celsius in this embodiment than in the embodiment described above. I was able to.</p>
<p>[1.d] a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing; and</p>	<p>Suzuki discloses, expressly and/or inherently, a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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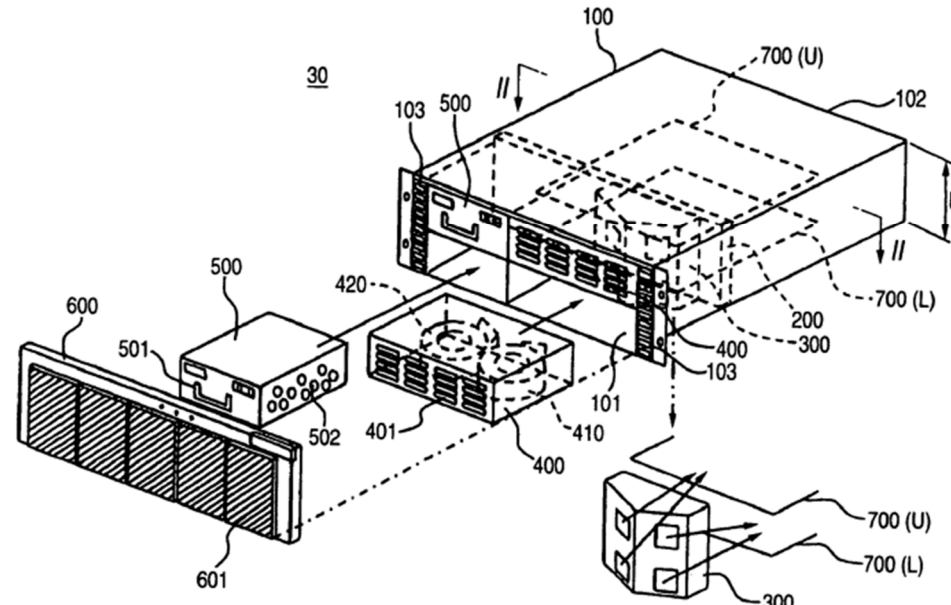
Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 1</p>  <p>Suzuki at Fig. 4 and accompanying text:</p>

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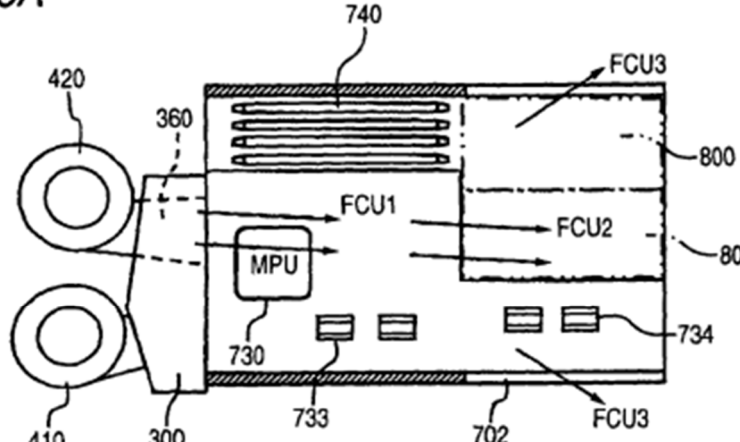
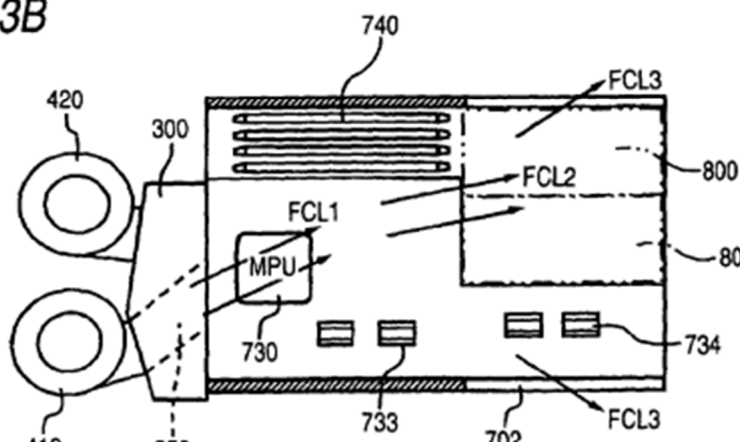
Asserted Claims	Suzuki
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Asserted Claims	Suzuki
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Asserted Claims	Suzuki
	<p>rectified by the heat sink 731 and the cache memory 740, and reaches the middle in the longitudinal direction of the upper control module 700U. The cooling air FCU2 that has reached the substantially middle part of the upper control module 700U cools the peripheral electronic components 734 and the like, and a part thereof goes straight as it is and is discharged to the outside from the vent hole 701 formed on the rear side of the control module 700U. Is done. The remaining cooling air FCU2 flows into the respective rear side ducts 105 through the respective vent holes 702 respectively formed on the both sides of the rear side of the upper control module 700U, and from the rear side ducts 105 to the outside.</p> <p>Suzuki at 16:24–41: As shown in FIG. 13B, the cooling winds from respective one-side fans 410 of the fan modules 400 are combined together within the flow path 350 of duct member 300 and then flow into the lower-side control module 700L from the lower-side outflow port 340. er flowing out from the lower outlet 340 is inclined in one direction with respect to the longitudinal direction of the lower control module 700L and flows into the lower control module 700L, and similarly cools the MPU 730 and the like. The flow is rectified. In the same manner as described above, a part of the cooling air FCL2 reaching the substantially middle portion of the lower control module 700L is discharged to the outside through the vent hole 701 of the lower control module 700L, and the rest is a side vent hole. It flows into the rear side duct 105 through 702 and is discharged to the outside.</p> <p>Suzuki at 20:24–28: Next, each control module 700 is disposed to mount the MPU 730 and DC/DC converter 760 serving as heating bodies at locations near the openings 201, 202 of back board 200, which are gateways of cooling winds. Thus it is possible to effectively cool down.</p> <p>Suzuki at 20:40–45: Furthermore, as respective parts including but not limited to the MPU 730 with heat sink 731 and the cache memory 740 plus the DC/DC converter 760 are laid out in parallel with</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>the long-side direction of the control module 700, it is possible to rectify module 700 is rectified. be able to.</p> <p>Suzuki at 22:30–52:</p> <p>While each fan module 400 has two fans 410, 420, if either one fan within the same fan module 400 stops its operation due to malfunction or else, the above-stated embodiment experiences a decrease in amount of a cooling wind flowing in a flow path corresponding the flow path corresponding to the stopped fan is reduced. As described above, the flow paths 350 and 360 have a structure in which the cooling air easily flows and does not easily generate a reverse flow, and the fan drive voltage is increased when the fan is stopped. However, one of the fans stops. If you do, you may want to secure more flow. Therefore, in this embodiment, the flow paths 350 and 360 are communicated with each other by the merge passage 370 so that even when any one of the fans stops operating, the remaining normal fan can be backed up. According to the applicant's experiment, when one fan is stopped, the temperature of the heating element (MPU 730, etc.) is reduced by about 5 degrees Celsius in this embodiment than in the embodiment described above. I was able to.</p>
<p>[1.e] a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing,</p>	<p>Suzuki discloses, expressly and/or inherently, a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 1</p> <p>Suzuki at Fig. 4 and accompanying text:</p>

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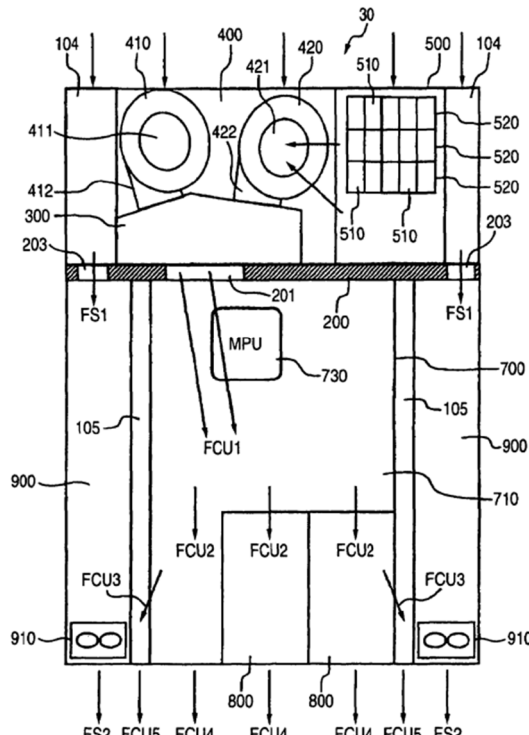
Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p>  <p>Suzuki at 2:61–63: In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p> <p>Suzuki at 3:1–5: In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a</p>

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Asserted Claims	Suzuki
	<p>thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11: In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure</p>

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Asserted Claims	Suzuki
	<p>occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p> <p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 8:27–35:</p> <p>A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 9:31–53:</p> <p>A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is</p>

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Asserted Claims	Suzuki
	<p>formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed.</p>

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Asserted Claims	Suzuki
	<p>This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converters a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board ample, , 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p> <p>Suzuki at 15:17–34:</p>

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Asserted Claims	Suzuki
	<p>Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecure loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p> <p>Suzuki at 17:4–24:</p>

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Asserted Claims	Suzuki
	<p>An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3:</p> <p>As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal Sand gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3) Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way,</p>

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Asserted Claims	Suzuki
	<p>it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67: When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about V1 = 8 V) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p> <p>Suzuki at 20:29–33: In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power concurrent consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p>
<p>[1.f] wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices</p>	<p>Suzuki discloses, expressly and/or inherently, wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units.</p> <p><i>See, e.g.:</i></p>

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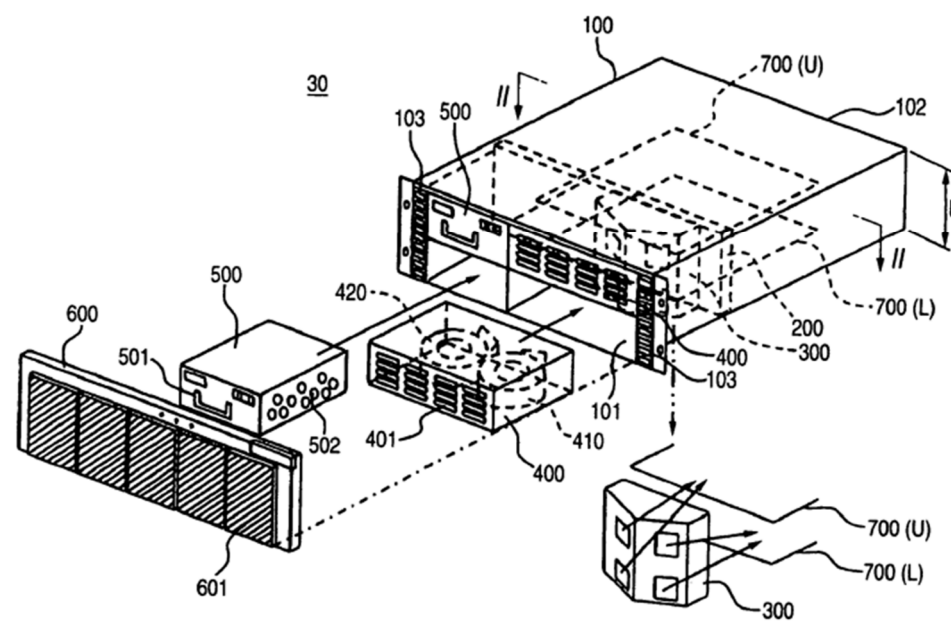
Asserted Claims	Suzuki
<p>passes into one of the power source units, and</p>	<p>Suzuki at Fig. 1 and accompanying text:</p> <p style="text-align: center;">FIG. 1</p>  <p>Suzuki at Fig. 4 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p data-bbox="1035 274 1121 311">FIG. 4</p>
	<p data-bbox="724 1195 966 1224">Suzuki at 2:61–63:</p>
	<p data-bbox="724 1242 1879 1308">In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p>
	<p data-bbox="724 1364 938 1388">Suzuki at 3:1–5:</p>

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Asserted Claims	Suzuki
	<p>In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11: In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by</p>

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Asserted Claims	Suzuki
	<p>the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p> <p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 7:6–27:</p> <p>Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 is control module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer.</p>

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Asserted Claims	Suzuki
	<p>In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 8:1–10: Each control module 700 is equipped with an MPU 730 and cache memory 740 and others, and is arranged to process a data write request and data read request in accordance with a command(s) as received from a host computer. A logic volume (logic unit) is set on a physical storage region, which is provided by the disk device 21 of each hard disk unit 20 with data being stored on this logic volume. By each hard disk unit 20, it is possible to perform data management in the architecture of redundant array of independent (inexpensive) disks, known as “RAID.”</p> <p>Suzuki at 8:11–20: Each control module 700 is responsive to a data write request, for writing into a certain logic volume the data that is temporarily stored in the cache memory 740. In addition, each control module 700 reads certain data out of a specified logic volume in response to a data read request and then transfers the data to a host computer. In the illustrative example, each control module 700 has two channels. Accordingly, an entirety of control unit 30 has four channels in total and is arranged to offer an ability to individually process data input/output requests from four host computers.</p> <p>Suzuki at 8:27–35: A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 9:31–53:</p>

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Asserted Claims	Suzuki
	<p>A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the</p>

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Asserted Claims	Suzuki
	<p>outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate with the 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an upper connector 211 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 14:17–33: As shown in FIG. 11A, the upper-side control board 710 mounts thereon an MPU 730 being placed at a location near the front side to be attached to the back board 200 along with other electronic components 733, 734 and the like. A cutaway portion 711 for attaching each I/F module 800 is formed. Here, the heat sink 731 (see FIG. 11C) for cooling the MPU 730 and other electronic components (for example, IC and LSI) 733 and 734 are arranged along the direction of the cooling air flowing from the backboard 200 side. It is arranged in the longitudinal direction. However, it is not necessary that all the electronic components are arranged along the flow of the cooling air, and main components that can affect the flow of the cooling air such as the heat sink 731 and the cache memory 740 are</p>

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Asserted Claims	Suzuki
	<p>substantially parallel to the flow of the cooling air. By arrange positioning so that it may become, it can flow a cooling wind smoothly.</p> <p>Suzuki at 14:34–41: As shown in FIG. 11B, the lower control board 720 is formed in a rectangular flat plate having a larger area than the upper control board 710, and the cache memory 740 and the DC / DC converter 760 are mounted thereon. Yes. Each I / F module 800 is attached to the rear side of the lower control board 720 in correspondence with the cutout portion 711 of the upper control board 710.</p> <p>Suzuki at 14:42–58: Here, the cache memory 740 is comprised of, for example, a double data rate synchronous dynamic random access memory (DDR-SDRAM) or the like, which is attached so that it is projected upwardly from a side edge on the other side of the upper-side control b is attached so as to be substantially parallel to the flow of the control module 700, that is, to be parallel to the longitudinal direction of the control module 700. In other words, by attaching the heat sink 731, other electronic components 733 and 734, the cache memory 740, and the DC / DC converter 760 substantially parallel to the longitudinal direction of the control module 700, Is rectified and flows toward the rear of the control module 700. In particular, the heat rectification effect of the cooling air is expected in the heat sink 731 located in the vicinity of the cooling air inlet.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converters a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board ample, , 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise</p>

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Asserted Claims	Suzuki
	<p>and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p> <p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecure loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:66–17:3:</p>

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Asserted Claims	Suzuki
	<p>As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p> <p>Suzuki at 17:4–24: An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24: An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal S and gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3)</p>

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Asserted Claims	Suzuki
	<p>Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23:</p> <p>A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67:</p> <p>When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about V1 = 8 V) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 20:29–33: In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:40–45: Furthermore, as respective parts including but not limited to the MPU 730 with heat sink 731 and the cache memory 740 plus the DC/DC converter 760 are laid out in parallel with the long-side direction of the control module 700, it is possible to rectify module 700 is rectified. be able to.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply module flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16:</p>

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Asserted Claims	Suzuki
	Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.
[1.g] wherein the plurality of power source units are each positioned not to be aligned linearly with the CPU in the longitudinal direction of the housing.	<p>Suzuki discloses, expressly and/or inherently, wherein the plurality of power source units are each positioned not to be aligned linearly with the CPU in the longitudinal direction of the housing.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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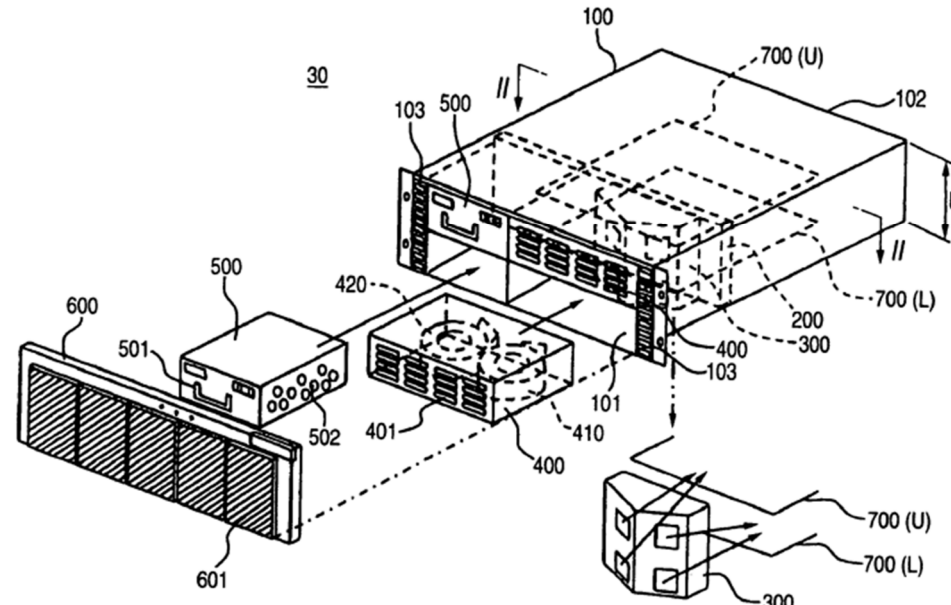
Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 1</p>  <p>Suzuki at Fig. 4 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at Fig. 13 and accompanying text:</p>

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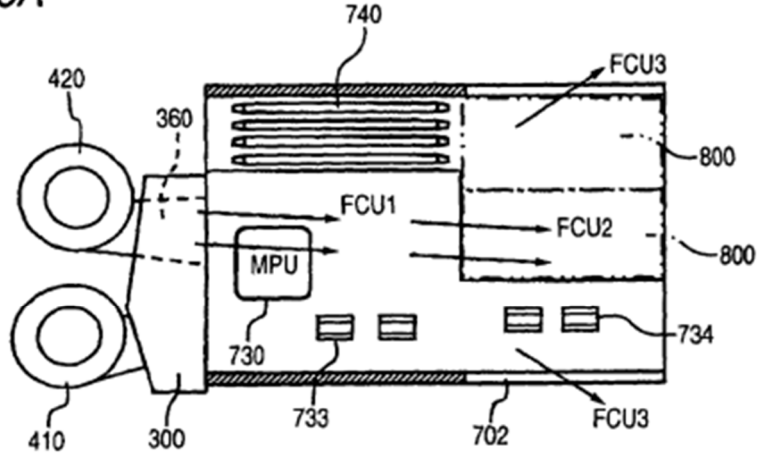
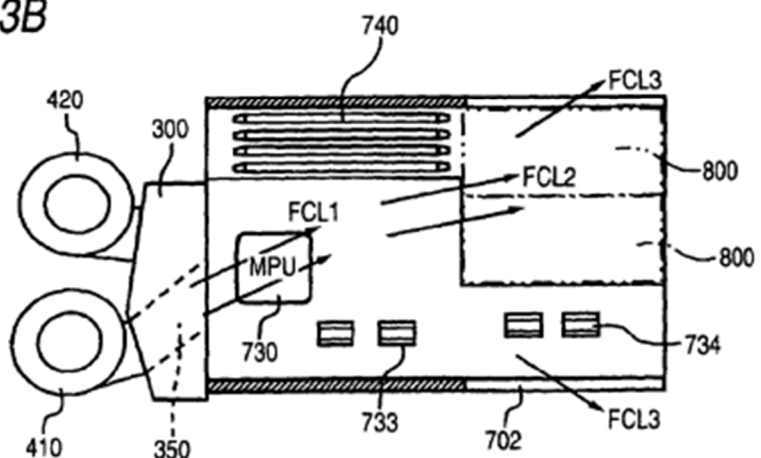
Asserted Claims	Suzuki
	<p>FIG. 13A</p>  <p>FIG. 13B</p>  <p>Suzuki at 1:17–25:</p>

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Asserted Claims	Suzuki
	<p>In electronic equipment such as for example a control unit for use in disk array apparatus or the like, a micro processing unit (MPU) or else is used to perform processing of a large amount of data at high speeds. Due to this, an increase in inside temperature rises, the rise of internal temperature is controlled using a cooling fan etc. (for example, patent documents 1).</p> <p>Suzuki at 1:29–46:</p> <p>To attain the foregoing object, an electronic equipment in accordance with the invention comprises a housing, a connection-use circuit board which is provided to define within the housing a one side space and a remaining side space with a plurality of cooe improvements, it is necessary to improve the performance of the MPU and the like, but the performance improvement of the MPU causes an increase in the amount of heat generation and current consumption. In addition, there are many cases in which dimensional restrictions are imposed from the viewpoint of maintaining compatibility with mounting on conventional products and saving space. In other words, while high performance of data processing is required, increase in mechanical and physical dimensions is not allowed, and high performance and an increase in heat generation due to high performance must be resolved in a well-balanced space.</p> <p>Suzuki at 2:61–63:</p> <p>In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p> <p>Suzuki at 3:1–5:</p> <p>In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11:</p>

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Asserted Claims	Suzuki
	<p>In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p>

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Asserted Claims	Suzuki
	<p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 7:6–27:</p> <p>Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 is pontril module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 8:1–10:</p>

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Asserted Claims	Suzuki
	<p>Each control module 700 is equipped with an MPU 730 and cache memory 740 and others, and is arranged to process a data write request and data read request in accordance with a command(s) as received from a host computer. A logic volume (logic unit) is set on a physical storage region, which is provided by the disk device 21 of each hard disk unit 20 with data being stored on this logic volume. By each hard disk unit 20, it is possible to perform data management in the architecture of redundant array of independent (inexpensive) disks, known as “RAID.”</p> <p>Suzuki at 8:27–35: A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 8:64–9:17: Then, the flow of cooling wind will be discussed while looking at the upper-side control board 710 of upper-side control module 700U. A cooling wind FCU1 which has flown onto the upper-side control board 710 of upper-side control module 700U from the uppe of the backboard 200 First, the MPU 730 provided in the vicinity of the upper opening 201 and the surrounding electronic components are cooled. Next, the cooling air deprived of heat from the MPU 730 reaches the intermediate portion of the upper control board 710 to become the cooling air FCU2, and cools the I / F module 800 and peripheral electronic components.</p> <p>Suzuki at 9:31–53: A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is</p>

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Asserted Claims	Suzuki
	<p>formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is</p>

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Asserted Claims	Suzuki
	<p>adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 14:17–33: As shown in FIG. 11A, the upper-side control board 710 mounts thereon an MPU 730 being placed at a location near the front side to be attached to the back board 200 along with other electronic components 733, 734 and the like. A cutaway portion 711 for atng each I / F module 800 is formed. Here, the heat sink 731 (see FIG. 11C) for cooling the MPU 730 and other electronic components (for example, IC and LSI) 733 and 734 are arranged along the direction of the cooling air flowing from the backboard 200 side. It is arranged in the longitudinal direction. However, it is not necessary that all the electronic components are arranged along the flow of the cooling air, and main components that can affect the flow of the cooling air such as the heat sink 731 and the cache memory 740 are substantially parallel to the flow of the cooling air. By arrange positioning so that it may become, it can flow a cooling wind smoothly.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 14:59–67: On the other hand, the DC/DC converter 760 is positioned adjacent to the back board 200 and is attached to the lower-side control circuit board 720. The first reason of this is that the DC/DC converter 760 is a heating element comparable to MPU 730 so that it is cooled by being arranged in the vicinity of the cooling air inlet. The second reason is to shorten the line length of the high voltage input inputted to the DC / DC converter 760.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converts a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board 720 (e.g., 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p> <p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and electric loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. A duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:1–40: As shown in FIG. 13A, the cooling winds from respective other-side fans 420 of fan modules 400 are combined and mixed together within the flow path 360 of duct member 300 and then flow into the upper-side control module 700U from the upper-side outflow prospect to the longitudinal direction of the control module 700. The cooling air FCU1 that has flowed in cools the MPU 730 and the like disposed in the vicinity of the outlet 330, is rectified by the heat sink 731 and the cache memory 740, and reaches the middle in the longitudinal direction of the upper control module 700U. The cooling air FCU2 that has reached the substantially middle part of the upper control module 700U cools the peripheral electronic components 734 and the like, and a part thereof goes straight as it is and is discharged to the outside from the vent hole 701 formed on the rear side of the control module 700U. Is done. The remaining cooling air FCU2 flows into the respective rear side ducts 105 through the respective vent holes 702 respectively formed on the both sides of the rear side of the upper control module 700U, and from the rear side ducts 105 to the outside.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 16:24–41:</p> <p>As shown in FIG. 13B, the cooling winds from respective one-side fans 410 of the fan modules 400 are combined together within the flow path 350 of duct member 300 and then flow into the lower-side control module 700L from the lower-side outflow port 340. er flowing out from the lower outlet 340 is inclined in one direction with respect to the longitudinal direction of the lower control module 700L and flows into the lower control module 700L, and similarly cools the MPU 730 and the like. The flow is rectified. In the same manner as described above, a part of the cooling air FCL2 reaching the substantially middle portion of the lower control module 700L is discharged to the outside through the vent hole 701 of the lower control module 700L, and the rest is a side vent hole. It flows into the rear side duct 105 through 702 and is discharged to the outside.</p> <p>Suzuki at 16:66–17:3:</p> <p>As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p> <p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the</p>

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Asserted Claims	Suzuki
	<p>electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24: An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal S and gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3) Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is</p>

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Asserted Claims	Suzuki
	<p>then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67:</p> <p>When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about V1 = 8 V) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p> <p>Suzuki at 20:24–28:</p> <p>Next, each control module 700 is disposed to mount the MPU 730 and DC/DC converter 760 serving as heating bodies at locations near the openings 201, 202 of back board 200, which are gateways of cooling winds. Thus it is possible to effectively cool down.</p> <p>Suzuki at 20:40–45:</p> <p>Furthermore, as respective parts including but not limited to the MPU 730 with heat sink 731 and the cache memory 740 plus the DC/DC converter 760 are laid out in parallel with the long-side direction of the control module 700, it is possible to rectify tdule 700 is rectified. be able to.</p> <p>Suzuki at 20:29–33:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p> <p>Suzuki at 22:30–52: While each fan module 400 has two fans 410, 420, if either one fan within the same fan module 400 stops its operation due to malfunction or else, the above-stated embodiment</p>

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Asserted Claims	Suzuki
	<p>experiences a decrease in amount of a cooling wind flowing in a flow path corresponding to the stopped fan is reduced. As described above, the flow paths 350 and 360 have a structure in which the cooling air easily flows and does not easily generate a reverse flow, and the fan drive voltage is increased when the fan is stopped. However, one of the fans stops. If you do, you may want to secure more flow. Therefore, in this embodiment, the flow paths 350 and 360 are communicated with each other by the merge passage 370 so that even when any one of the fans stops operating, the remaining normal fan can be backed up. ing. According to the applicant's experiment, when one fan is stopped, the temperature of the heating element (MPU 730, etc.) is reduced by about 5 degrees Celsius in this embodiment than in the embodiment described above.</p>
<p>2. The electronic device according to claim 1, wherein the plurality of power source units are each arranged to be pulled out from the rear face of the housing.</p>	<p>Suzuki discloses, expressly and/or inherently, the electronic device according to claim 1, wherein the plurality of power source units are each arranged to be pulled out from the rear face of the housing.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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Asserted Claims	Suzuki
<p>Suzuki at Fig. 4 and accompanying text:</p>	<p>FIG. 1</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at 2:61–63: In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p> <p>Suzuki at 3:1–5:</p>

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Asserted Claims	Suzuki
	<p>In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11: In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, The control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by</p>

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Asserted Claims	Suzuki
	<p>the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p> <p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 8:27–35:</p> <p>A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 9:31–53:</p> <p>A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side</p>

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Asserted Claims	Suzuki
	<p>ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery</p>

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Asserted Claims	Suzuki
	<p>module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converters a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board ample, , 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecure loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3:</p> <p>As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal Sand gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3) Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By</p>

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Asserted Claims	Suzuki
	<p>adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67: When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about $V1 = 8\text{ V}$) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p> <p>Suzuki at 20:29–33:</p>

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Asserted Claims	Suzuki
	<p>In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power concurrent consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p>
<p>3. The electronic device according to claim 1, wherein the plurality of power source units are each kept inside a power box, comprising a top</p>	<p>Suzuki discloses, expressly and/or inherently, the electronic device according to claim 1, wherein the plurality of power source units are each kept inside a power box, comprising a top board and a pair of side boards, and positioned close to each of side faces of the</p>

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Asserted Claims	Suzuki
<p>board and a pair of side boards, and positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.</p>	<p>housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>
	<p style="text-align: center;">FIG. 1</p>
	<p>Suzuki at Fig. 4 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at 2:61–63: In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p> <p>Suzuki at 3:1–5:</p>

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Asserted Claims	Suzuki
	<p>In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11: In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by</p>

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Asserted Claims	Suzuki
	<p>the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p> <p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 8:27–35:</p> <p>A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 9:31–53:</p> <p>A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side</p>

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Asserted Claims	Suzuki
	<p>ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery</p>

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Asserted Claims	Suzuki
	<p>module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converters a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board ample, , 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecure loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3:</p> <p>As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal Sand gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3) Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By</p>

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Asserted Claims	Suzuki
	<p>adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67: When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about $V1 = 8\text{ V}$) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p> <p>Suzuki at 20:29–33:</p>

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Asserted Claims	Suzuki
	<p>In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power concurrent consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p>
[4.a] 4. A cooling structure of an electronic device comprising a plurality of fans causing cooling air to flow downstream, a central processing	Suzuki discloses, expressly and/or inherently, a cooling structure of an electronic device comprising a plurality of fans causing cooling air to flow downstream, a central processing unit (CPU), a plurality of memory devices adjacent to the CPU, and a plurality of power

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Asserted Claims	Suzuki
unit (CPU), a plurality of memory devices adjacent to the CPU, and a plurality of power source units, all of which are arranged along a flowing direction of the cooling air corresponding to a longitudinal direction in a housing,	<p>source units, all of which are arranged along a flowing direction of the cooling air corresponding to a longitudinal direction in a housing.</p> <p><i>See claims 1.pre, 1.b, 1.c, 1.e.</i></p>
[4.b] wherein the CPU is arranged downstream of the plurality of fans and positioned to allow the cooling air to directly flow therethrough,	<p>Suzuki discloses, expressly and/or inherently, wherein the CPU is arranged downstream of the plurality of fans and positioned to allow the cooling air to directly flow therethrough.</p> <p><i>See claim 1.c.</i></p>
[4.c] wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units,	<p>Suzuki discloses, expressly and/or inherently, wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units.</p> <p><i>See claims 1.d, 1.f.</i></p>
[4.d] wherein the plurality of power source units are positioned opposite to each other and spaced out from each other in a width direction of the housing such that the plurality of power source units are positioned not to be aligned linearly with the CPU in the longitudinal direction.	<p>Suzuki discloses, expressly and/or inherently, wherein the plurality of power source units are positioned opposite to each other and spaced out from each other in a width direction of the housing such that the plurality of power source units are positioned not to be aligned linearly with the CPU in the longitudinal direction.</p> <p><i>See claims 1.e, 1.g.</i></p>

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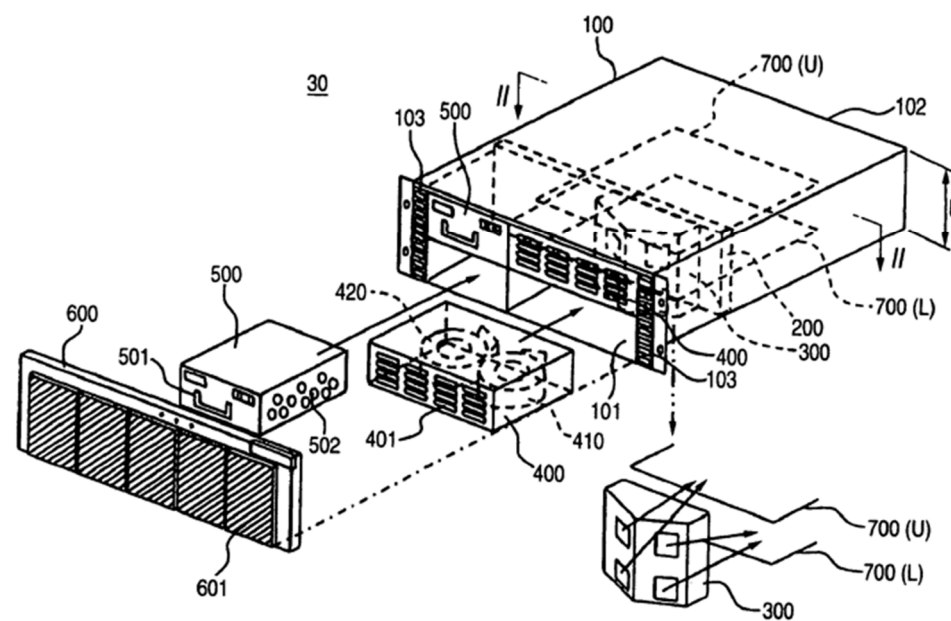
Asserted Claims	Suzuki
<p>5. The electronic device according to claim 1, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.</p>	<p>Suzuki discloses, expressly and/or inherently, the electronic device according to claim 1, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p> <p style="text-align: center;">FIG. 1</p> 

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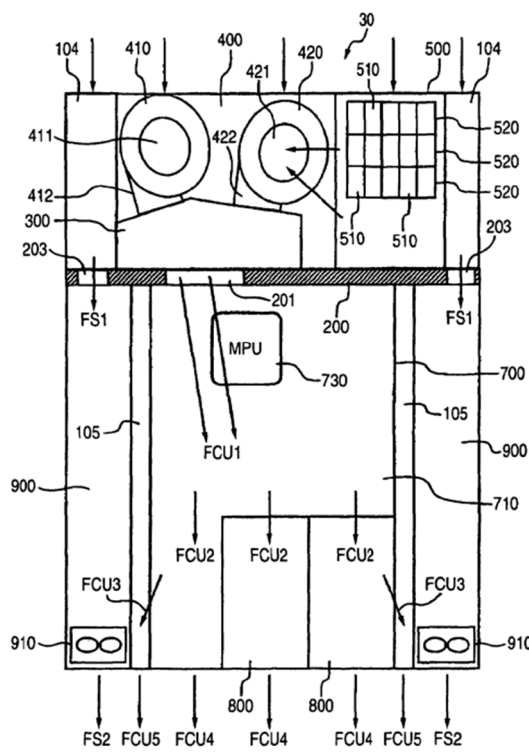
Asserted Claims	Suzuki
	<p data-bbox="730 261 1241 293">Suzuki at Fig. 4 and accompanying text:</p> <div data-bbox="798 329 1323 1136"> <p data-bbox="1035 329 1106 362"><i>FIG. 4</i></p>  </div> <p data-bbox="730 1203 968 1235">Suzuki at 1:13-15:</p> <p data-bbox="730 1240 1850 1305">The present invention relates generally to electronic equipment preferably used for disk array control devices or equivalents thereto.</p> <p data-bbox="730 1349 968 1382">Suzuki at 1:17-25:</p>

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Asserted Claims	Suzuki
	<p>In electronic equipment such as for example a control unit for use in disk array apparatus or the like, a micro processing unit (MPU) or else is used to perform processing of a large amount of data at high speeds. Due to this, an increase in inside temperature rises, the rise of internal temperature is controlled using a cooling fan etc. (for example, patent documents 1).</p> <p>Suzuki at 1:29–46: To attain the foregoing object, an electronic equipment in accordance with the invention comprises a housing, a connection-use circuit board which is provided to define within the housing a one side space and a remaining side space with a plurality of cooe improvements, it is necessary to improve the performance of the MPU and the like, but the performance improvement of the MPU causes an increase in the amount of heat generation and current consumption. In addition, there are many cases in which dimensional restrictions are imposed from the viewpoint of maintaining compatibility with mounting on conventional products and saving space. In other words, while high performance of data processing is required, increase in mechanical and physical dimensions is not allowed, and high performance and an increase in heat generation due to high performance must be resolved in a well-balanced space.</p> <p>Suzuki at 1:47–51: The present invention has been made in view of the problems stated above, and its object is to provide an electronic equipment capable of performing effective cooling operations to thereby enable performance enhancement while increasing the reliability. Further objects of the present invention will become clear from the description of the embodiments described later.</p> <p>Suzuki at 1:52–2:2: In one preferred form of the invention, the duct member has a plurality of inflow ports connected to exhaust ports of the fans respectively, a plurality of outflow ports connected to the cooling air-use openings respectively, and a plurality of flow paths. A connection circuit board provided with an electrical connector, and provided in correspondence with each of the cooling air openings located in the one side space, and the connection circuit</p>

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Asserted Claims	Suzuki
	<p>via the electrical connectors. A plurality of control modules each electrically connected to a substrate; a plurality of fan modules provided in the other side space, each having a built-in fan corresponding to each of the cooling air openings; A duct member that is located in the other side space and is provided between the connection circuit board and the fan modules, and connects the exhaust ports of the fans to the corresponding cooling air openings, respectively. Prepare.</p> <p>Suzuki at 2:3–12: In one preferred form of the invention, the duct member has a plurality of inflow ports connected to exhaust ports of the fans respectively, a plurality of outflow ports connected to the cooling air-use openings respectively, and a plurality of flow pathshat group the respective inlets and the respective outlets for each cooling air opening and communicate with each other, so that at least one of the flow paths can be divided and formed. It is composed of a plurality of divided bodies.</p> <p>Suzuki at 2:13–23: Respective ones of the flow paths may be communicably coupled together. For example, a confluence passage is provided within the duct member for coupling and communicating respective flow paths together to thereby permit cooling air streams or “winds” to w paths and merges the cooling air with each other, Cooling can be efficiently performed by effectively using the cooling air from all remaining normal fans.</p> <p>Suzuki at 2:24–28: Preferably, a flow path system made up of each inflow port and each flow path plus each outflow port of the duct member is formed to have a shape which causes a cooling wind to hardly flow back from each exhaust port toward each inflow port.d the respective inlets. It is preferable.</p> <p>Suzuki at 2:29–54: Furthermore, an open/close valve is provided at each inflow port for allowing a cooling wind from each fan to flow into inside of each flow path and for avoiding reverse flow thereof. The open/close valve may be made of a material having flexibility. Exame, a</p>

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Asserted Claims	Suzuki
	<p>lightweight valve formed from a flexible polymer material (such as rubber) into a film shape or a thin plate shape can be exemplified. The on-off valve opens by the wind pressure of the cooling air exhausted from the fan, and allows the cooling air to flow into the flow path. When the fan stops, the on-off valve closes due to its own weight or pressure difference and covers the inlet. Thereby, it is possible to prevent the backflow from occurring when the fan is stopped. When the on-off valve is formed from a flexible material into a flat film, a protection mechanism is provided so that when the on-off valve is closed, the shape of the on-off valve changes and does not come out of the inlet. preferable. As such a defense mechanism, for example, a mechanism in which a stopper member for restricting the closing position of the on-off valve is provided at the inlet is conceivable. For example, it is preferable that the stopper member be formed in a small area so that it can support at least the substantially central portion of the on-off valve and the flow path area of the inflow port does not decrease.</p> <p>Suzuki at 2:55–60: In accordance with one preferred form of the invention, each fan of each fan module is arranged as a sirocco fan for performing air intake from an axial direction and air exhaust in a radial direction, wherein an exhaust port of each fan is disposed to fa</p> <p>Suzuki at 2:61–63: In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p> <p>Suzuki at 3:1–5: In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11:</p>

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Asserted Claims	Suzuki
	<p>In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:17–19: In one aspect of the present invention, at least one of the cooling air openings of the connection circuit board is formed of a plurality of openings.</p> <p>Suzuki at 3:20–23: In one form of the invention, the plurality of openings are provided for reducing the length of a wiring pattern of the connection-use circuit board.</p> <p>Suzuki at 3:24–31: In one form of the invention, the equipment further comprises a battery module disposed adjacent to each fan module within the remaining side space of the housing. The battery module has a plurality of communicating holes formed in each of a first side face respectively formed on the second side surface facing the outside, and external air is supplied from the communication holes on the second side surface to the fan module via the communication holes on the first side surface.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30</p>

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Asserted Claims	Suzuki
	<p>includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 4:56–5:3: The chassis 100 is made of a metallic material such as stainless steel or the like, which is formed for example into a hollow box-like shape. A front side opening 101 that is positioned on this side in the drawing and a rear side opening 102 that is placed rear side in the figure. The rear opening 102 is formed. The chassis 100 is configured to be disassembled by a fastening member such as a screw so that one side and the remaining three sides can be separated, for example. In addition, air intake holes 103 are formed on both sides of the front opening 101 of the chassis 100 so as to communicate with the front side ducts 104 formed in the front space of the chassis 100 so as to extend in the longitudinal direction.</p> <p>Suzuki at 5:4–13: Here, the chassis 100 is such that its height H and other sizes are determined in such a way as to enable accommodation into a dedicated rack 10 to be later described. The height H is designed to become less than or equal to 3U (about 133.35 mm) as defined according to the chassis height dimension H, the height dimension of each module mounted in the chassis 100 is also determined. Note that the shape, material, height dimension, and the like of the chassis 100 are examples, and the present invention is not limited to this.</p> <p>Suzuki at 5:14–23: The back board 200 is the one that holds each control module 700 while performing electrical connections between respective control modules 700 and with other modules. The back board 200 is positioned at a location near the front side opening 101 of the front portion of the chassis 100 in the longitudinal direction. The backboard 200 is formed in a substantially flat plate shape, and is provided with openings 201 to 203 for cooling air and electrical connectors 210 to 213 as described later.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 5:24–46: By attaching the back board 200 to inside of the chassis 100, a rear side space and a front side space are partitioned within the chassis 100 respectively, wherein the former spans from the rear side opening 102 up to a rear face of the back board 200, wh are each defined. Therefore, the space in the chassis 100 is divided into two by the back board 200, and the front space and the rear space are basically separated. However, in the present invention, as described later, by forming predetermined cooling air openings 201 to 203 at predetermined positions, the front space and the rear space are partially communicated via the backboard 200. This enables efficient cooling. Thus, the backboard 200 forms a support function for supporting each control module 700, a connection function for electrically connecting each control module 700 and the like, and a space (front space and rear space) in the chassis 100. And a cooling function for flowing cooling air from the front space into the rear space.</p> <p>Suzuki at 5:47–6:3: The duct member 300 is for exhausting cooling winds as sent from respective fan modules 400 in a way that cooling winds are combined together per each control module 700. The duct member 300 is placed within the front side space in the chassis 100 and is ckboard 200 (the right side in FIG. 1) and each fan module 400. For example, the duct member 300 is formed in a box shape having a substantially pentagonal cross section from a plastic foam material, and the surface thereof is coated with a resin or the like so as not to generate dust or the like. Although details will be described later, a total of four inlets corresponding to the exhaust ports of the fan modules 400 are provided on the front surface of the duct member 300, and the control modules 700 are provided on the rear surface side of the duct member 300. A corresponding total of two outlets are provided. In the duct member 300, the cooling air from one of the two exhaust ports of each fan module 400 is guided to the upper control module 700, and the cooling air from the other exhaust port is guided to the lower control module 700. In order to guide to the above, a flow path connecting each inflow port and each outflow port is formed.</p> <p>Suzuki at 6:4–17:</p>

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Asserted Claims	Suzuki
	<p>Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust ports. Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 6:18–30: A cooling wind to be exhausted from one exhaust port (the left side exhaust port in FIG. 1) of the two exhaust ports of each fan module 400 is arranged to flow into the rear side space of the chassis 100 from the duct member 300 through the upper side cooling opening 700 attached to the upper side of the chassis 100 is cooled by flowing into the rear space of the chassis 100 through the chassis 100. Similarly, the cooling air exhausted from the other exhaust port of each fan module 400 flows from the duct member 300 into the rear space of the chassis 100 through the cooling air opening 202 on the lower side of the backboard 200. The control module 700 attached to the lower side in the chassis 100 is cooled.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p>

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Asserted Claims	Suzuki
	<p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 6:64-7:5: The decorating door 600 is for covering the front side opening 101 of the chassis 100 after having attached the duct member 300 and each fan module 400 and also each battery module 500 in the front side space of chassis 100. The decorating door 600 is detd to the chassis 100, and a plurality of louvers 601 are detachably attached to the decorative door 600. Each louver 601 has air permeability, and the outside air flows into the chassis 100 via each louver 601.</p> <p>Suzuki at 7:6–27: Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 is pontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on</p>

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Asserted Claims	Suzuki
	<p>the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 7:29–33: FIG. 2 is a front view of the disk array apparatus 1. The disk array apparatus 1 is constituted from a dedicated rack 10, a plurality of hard disk units 20 received within the rack 10, and a control unit 30 for control of operations, such as data access t access to each hard disk unit 20.</p> <p>Suzuki at 7:35–45: Each hard disk unit 20 and control unit 30 respectively have height values H being set at the above-noted value of 3U. The dedicated rack 10 has a lateral width value of about 19 inches, for example. Each hard disk unit 20 and control unit 30 received wit the dedicated rack 10 is the same. The depth dimensions of the hard disk units 20 and the control unit 30 are also set to the same value. Therefore, each hard disk unit 20 and the control unit 30 have the same outer dimensions and exhibit a sense of unity in appearance. Further, if the wiring problem or the like is not taken into consideration, the modules 20 and 30 can be freely arranged in the dedicated rack 10.</p> <p>Suzuki at 7:47–58: FIG. 3 is a diagram schematically showing a configuration of the disk array apparatus 1 for explanation of an overview of the control architecture thereof. Each control module 700 is connected from upper-level I/Fs 750 via wiring lines L1 to host computer, via a wiring L1 from the host I / F 750 so that bidirectional data communication is possible. In addition, each control module 700 is connected from the lower I / F 810 of the I / F module 800 to the disk device 21 of each hard disk unit 20 that is a lower device via wirings L21 to L24. As the host computer, for example, a personal computer, a workstation, a main frame, or the like can be used.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 7:59–67: A local area network (LAN) or storage area network (SAN) or the like may be used as the wiring lines L1 for connection between the host computers and the control modules 700. In the case of using the SAN, high-speed data communications are performed in ac protocol is performed. For example, the control module 700 and each hard disk unit 20 are directly connected by wires L21 to L24. In addition, the above is an illustration and this invention is not limited to these.</p> <p>Suzuki at 8:1–10: Each control module 700 is equipped with an MPU 730 and cache memory 740 and others, and is arranged to process a data write request and data read request in accordance with a command(s) as received from a host computer. A logic volume (logic unit) is set on a physical storage region, which is provided by the disk device 21 of each hard disk unit 20 with data being stored on this logic volume. By each hard disk unit 20, it is possible to perform data management in the architecture of redundant array of independent (inexpensive) disks, known as “RAID.”</p> <p>Suzuki at 8:11–20: Each control module 700 is responsive to a data write request, for writing into a certain logic volume the data that is temporarily stored in the cache memory 740. In addition, each control module 700 reads certain data out of a specified logic volume in response to a data read request and then transfers the data to a host computer. In the illustrative example, each control module 700 has two channels. Accordingly, an entirety of control unit 30 has four channels in total and is arranged to offer an ability to individually process data input/output requests from four host computers.</p> <p>Suzuki at 8:22–26: Next, based on FIG. 4, an explanation will be given of an entire overview of a cooling structure of the control unit 30 in accordance with the present invention. FIG. 4 is a schematic diagram of the control unit 30 when looking at it from an arrow-indicatfrom the direction indicated by arrows AA in FIG.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 8:27–35: A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 8:36–49: First, the cooling wind to be created by each fan module 400 will be discussed in detail. The fan module 400 is designed to take in the air streams coming respectively from two inlet paths—namely, air intake holes 401 in the front face of fan module 400, in the vicinity of each fan module 400 decreases due to the operation of each fan module 400, air flows into the battery module 500 from the vent hole 502 on the front surface of the battery module 500. It flows into each fan module 400 via the vent hole 502. Each fan 410, 420 of each fan module 400 sucks air from the intake ports 411, 421, and exhausts the sucked air from the exhaust ports 412, 422 by the rotational force of the fan blades.</p> <p>Suzuki at 8:36–49: The cooling wind exhausted from the fan 410, 420 of each fan module 400 flows into the duct member 300, resulting in separation into a cooling wind leading to the upper-side control module 700U and a cooling wind approaching the lower-side control module ir directed toward the upper control module 700U flows out from the upper outlet of the duct member 300 and flows into the upper control module 700U through the upper opening 201 of the backboard 200. Similarly, the cooling air toward the lower control module 700L flows out from the lower outlet of the duct member 300 and flows into the lower control module 700L through the lower opening 202 of the backboard 200.</p> <p>Suzuki at 8:50–63: Each control module 700 is structured from two spaced-apart control circuit boards 710 and 720, which are disposed at upper and lower locations respectively. Due to this, the</p>

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Asserted Claims	Suzuki
	<p>cooling wind that has flown into inside of each control module 700 through the ockboard 200 cools the upper cooling air FCU that cools the upper control substrate 710 and the lower control substrate 720. Separated from the cooling air FCL, each control board is cooled. FIG. 4 shows the state of cooling air and the like flowing on the upper control board 710 of the upper control module 700U. The upper control module 700U and the lower control module 700L are slightly different in the flow of cooling air, but the basic structure of cooling is not changed. Similarly, the upper control board 710 and the lower control board 720 in the same control module also have slightly different flow of cooling air, but there is no change in the flow of rough cooling air.</p> <p>Suzuki at 8:64–9:17: Then, the flow of cooling wind will be discussed while looking at the upper-side control board 710 of upper-side control module 700U. A cooling wind FCU1 which has flown onto the upper-side control board 710 of upper-side control module 700U from the uppe of the backboard 200 First, the MPU 730 provided in the vicinity of the upper opening 201 and the surrounding electronic components are cooled. Next, the cooling air deprived of heat from the MPU 730 reaches the intermediate portion of the upper control board 710 to become the cooling air FCU2, and cools the I / F module 800 and peripheral electronic components.</p> <p>Suzuki at 9:31–53: A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control</p>

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Asserted Claims	Suzuki
	<p>board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:54–58: The same goes with the flow of a cooling wind on or above the lower-side control circuit board 720. In this way, each control board 710, 720 within control module 700 is arranged to be cooled down by the cooling wind being forcibly sent from each fan modu</p> <p>Suzuki at 9:59–10:10: Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:11–14: The discussion above is an outline of cooling winds flowing within the chassis 100. Details of the cooling winds and each module relating thereto will be described later in greater detail.</p> <p>Suzuki at 10:16–33: An explanation will next be given of the structure of each battery module 500 with reference to FIG. 4. Each battery module 500 is arranged by parallel connection of three</p>

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Asserted Claims	Suzuki
	<p>battery units 520, each of which has a series connection of five batteries 510. The series. The three battery units 520 are controlled to be charged evenly. Here, if the temperature of each battery 510 is different, the battery is deteriorated due to the temperature difference. In addition, when the difference in wiring length between the batteries 510 and between the battery units 520 is large, the difference in impedance also increases, so that uniform charging cannot be performed. Therefore, in this embodiment, as shown in FIG. 4, the three battery units 520 are arranged adjacent to each other so as to be parallel to the backboard 200. Thereby, the temperature difference and wiring length difference of each battery 510 are reduced, and uniform charging can be performed.</p> <p>Suzuki at 10:35–40: An explanation will next be given of the structure of each fan module 400 with reference to FIGS. 5A to 5E. FIGS. 5A–5E are a set of projection drawings, wherein FIG. 5A is a front view, FIG. 5B is a top plan view, FIG. 5C is a right side view, FIG. 5D is FIG. 5D is a left side view. FIG. 5 and FIG. 5 (e) are rear views.</p> <p>Suzuki at 10:41–52: As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 10:53–62: As shown in FIG. 5B, each fan 410, 420 is arranged, for example, as a lateral flow type fan which sucks air from an inlet port 411, 421 in the axial direction and then exhausts the air from an exhaust port 412, 422 in the radial direction, respectively. In this embodiment, a sirocco fan is used as the cross flow fan. By adopting a sirocco fan, it is</p>

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Asserted Claims	Suzuki
	<p>possible to ensure a sufficient air volume while being relatively small, and to prevent backflow from within the chassis 100.</p> <p>Suzuki at 10:63–11:8: Also note that in this embodiment, each fan 410, 420 is designed to have the same structure while using a total of four identical fans for two fan modules 400. Sharing the fans in this way is aimed at reduction of manufacturing costs. If the right and left 420 are opposite to each other, the fans can be arranged symmetrically. In that case, two types of fans with different rotation directions are required. As a result, manufacturing costs, component management costs, etc. increase. However, the present invention is not limited to this, and includes cases in which fans having different rotation directions are employed.</p> <p>Suzuki at 11:9–18: As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flows to the battery module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p> <p>Suzuki at 11:19–33: The exhaust port 412, 422 of each fan 410, 420 is tilted by angle θ_1, θ_2 with respect to a center line respectively. More specifically, a cooling wind is exhausted from each fan 410, 420 in the form that it converges toward the center. Whereby, it is possible of the duct member 300 for separating the cooling air from each fan module 400 into a predetermined flow path can be reduced. Although it is possible to exhaust the cooling air from the fan module 400 substantially in parallel, in this case, the front shape of the duct member 300 that receives the cooling air also needs to be increased, and the size of the duct member 300 increases. . Since the fan module 400 according to the present invention exhausts the cooling air toward the center, the duct member 300 can be reduced in size.</p> <p>Suzuki at 11:35–58:</p>

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Asserted Claims	Suzuki
	<p>Next, an explanation will be given of the structure of the duct member 300 with reference to FIGS. 6A to 9C. First, refer to perspective views of FIGS. 6A–6B. FIG. 6A is a perspective view of the duct member 300 when looking at it from its front side, whe. 6B is a perspective view of the duct member 300 viewed from the rear side. As shown in FIG. 6A, the inlets 311, 312, 321, to which the exhaust ports 412, 422 of the fans 410, 420 are respectively connected to the front side of the duct member 300 facing each fan module 400. 322 is formed. As shown in FIG. 6B, two outlets 330 and 340 corresponding to the openings 201 and 202 of the backboard 200 are formed on the rear side of the duct member 300. The upper outlet 330 corresponds to the upper opening 201 of the backboard 200, and the lower outlet 340 corresponds to the lower opening 202 of the backboard 200. The cooling air F410, F420 exhausted from the fans 410, 420 flows into the duct member 300 from the inlets 311, 312, 321, 322, respectively. Then, the cooling air FCU that has flowed out of the outlet 330 flows into the upper control module 700U through the upper opening 201 of the backboard 200, and the cooling air FCL that has flowed out of the outlet 340 flows into the lower opening of the backboard 200. It flows into the lower control module 700L via the unit 202.</p> <p>Suzuki at 11:59–12:10: As shown in FIG. 7, the inflow ports 311, 312 on one side (right side in FIG. 7) to which one-side fans 410 of each fan module 400 are connected are coupled to the upstream side of the lower-side flow path 350 respectively and integrated together. The dowlower flow path 350 is connected to the lower outlet 340. On the other hand, the inlets 321 and 322 on the other side to which the fan 420 on the other side is connected are connected and integrated on the upstream side of the upper flow path 360, respectively. The downstream side of the upper flow path 360 is connected to the upper outlet port 330. Accordingly, in each fan module 400, one fan 410 cools the lower control module 700L, and the other fan 420 cools the upper control module 700U. Even when one of them stops operation due to a failure or the like, the remaining fan module 400 can send cooling air to both the upper and lower control modules 700.</p> <p>Suzuki at 12:11–16:</p>

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Asserted Claims	Suzuki
	<p>Note here that a flow path system which is made up of the duct member 300's each inflow port 311, 312, 321, 322 and each flow path 350, 360 plus each outflow port 330, 340 is designed to have a shape which ensures that the cooling wind from each fan 410, cooling air is formed so as not to flow backward from the chassis 100 side.</p> <p>Suzuki at 12:17–25: As described above together with FIG. 5, since each fan 410, 420 of each fan module 400 is designed so that the direction of exhaust air faces the central direction, it is possible to form the duct member 300 to have a small size as shown in FIG. 8. Addit upper outlet 330 and the lower outlet 340 are formed so as to partially overlap each other on the rear surface of the duct member 300, which also contributes to downsizing of the duct member 300.</p> <p>Suzuki at 12:26–41: An explanation will next be given of a dividable structure of the duct member 300 with reference to FIGS. 9A to 9C. FIGS. 9A–9C show portions of projection drawings of the duct member 300, wherein FIG. 9A is a back view, FIG. 9B is a top plan view, and FI the duct member 300, the cooling air from the inlets 311 and 312 on one side is integrated and guided to the lower outlet 340, and the cooling air from the inlets 321 and 322 on the other side is integrated. The flow paths 350 and 360 are formed so as to be integrated into the upper outlet 330. Further, each of the flow paths 350 and 360 is formed in a shape in which the cooling air from each fan module 400 can easily flow so as to prevent backflow from the chassis 100.</p> <p>Suzuki at 12:42–61: Accordingly the flow path 350, 360 is relatively complicated in shape. In view of this, the duct member 300 is arranged to have a laterally two-dividable structure. More specifically, the duct member 300 is structured from a one-side divided body 300R shon on the right side in FIG. 9 and the other-side divided body 300L shown on the left side. The flow paths 350 and 360 are formed by joining the divided bodies 300R and 300L in an airtight manner (not necessarily having a strict airtightness). Thereby, even the complicated-shaped flow paths 350 and 360 can be easily formed. 9 illustrates the case where the duct member 300 is divided into two in the left-right direction (horizontal width direction). However, the</p>

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Asserted Claims	Suzuki
	<p>present invention is not limited to this, and the duct member 300 may be divided in other directions such as the up-down direction. You may divide segment or 4 divisions. However, as the number of divisions increases, the part management cost, the assembly cost, and the like increase.</p> <p>Suzuki at 12:63–13:16: An explanation will next be given of a detailed structure of the back board 200 based on FIGS. 10A to 10C. FIG. 10A is a front view, FIG. 10B is a back view, and FIG. 10C is an enlarged diagram of part of FIG. 10A. The back board 200 is formed for example, a substantially flat printed board, and a rectangular upper opening 201 corresponding to the upper control module 700U is formed in the lateral direction (left-right direction) on the upper side of the backboard 200. A rectangular lower opening 202 corresponding to the lower control module 700L is formed on the lower side of the backboard 200 in the left-right direction. More specifically, the lower opening 202 is composed of two openings, a large opening 202A having a large area and a small opening 202B formed in a small area. The whole is referred to as a lower opening 202. Here, the upper opening 201 and the lower opening 202 are formed in parallel so as to be slightly shifted in the left-right direction, and the area of each opening 201, 202 is substantially the same so that the difference between the upper and lower airflows does not increase. It is set to be the same.</p> <p>Suzuki at 13:17–13:28: Additionally, a wind direction adjustment plate 204 is provided at the upper side opening 202; another wind direction adjuster plate 205 is provided at the lower side opening 202. These wind plates 204, 205 are each used to change the direction of a cooliard to the lower side, and guides sufficient cooling air to the lower control board 720 located on the lower side in each control module 700. belongs to. The wind direction plates 204 and 205 do not need to be provided on the backboard 200, and may be provided at the outlets 330 and 340 of the duct member 300.</p> <p>Suzuki at 13:29–34:</p>

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Asserted Claims	Suzuki
	<p>Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 13:47–61: As shown in FIG. 10C, a pad group 214 to which the upper-side connector 211 is attached and a pad group 215 to which the lower-side connector 212 is attached are such that predetermined terminals are connected together via a wiring pattern. Here, a wiringarge opening 202A and the small opening 202B constituting the lower opening 202, a wiring pattern 216 for connecting predetermined terminals of the pad groups 214 and 215 is formed. . For example, the wiring pattern 216 is formed so that each control module 700 performs high-speed data communication through a fiber channel or the like. That is, the wiring pattern 216 formed in the gap between the large opening 202A and the small opening 202B is used for transmitting an electrical signal with a shorter wiring length.</p> <p>Suzuki at 13:62–14:5: Since it is required in order to stably perform high-speed signal transmission that the wiring length be minimized to maximally reduce the influences of the impedance and stray capacitance or noise or else, the lower-side opening 202 is divided into the l for such signal transmission is used. In order to shorten the wiring length, the lower opening 202 is divided into a large opening 202A and a small opening 202B. In the figure, only the wiring</p>

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Asserted Claims	Suzuki
	<p>pattern 216 is shown, but the upper pad group 214 and the lower pad group 215 are connected by another wiring pattern (not shown) as necessary.</p> <p>Suzuki at 14:7–16: An explanation will be given of the structure of each control module 700 with reference to FIGS. 11A–11C and 12. First, refer to FIGS. 11A–C showing an arrangement of each control circuit board 710, 720 within the control module 700. FIG. 11A is a plan view of the upper control board 710, FIG. 11 (b) is a plan view of the lower control board 720, and FIG. 11 (c) is an arrow with the control boards 710 and 720 assembled vertically. It is sectional drawing seen from the BB direction.</p> <p>Suzuki at 14:17–33: As shown in FIG. 11A, the upper-side control board 710 mounts thereon an MPU 730 being placed at a location near the front side to be attached to the back board 200 along with other electronic components 733, 734 and the like. A cutaway portion 711 for attaching each I / F module 800 is formed. Here, the heat sink 731 (see FIG. 11C) for cooling the MPU 730 and other electronic components (for example, IC and LSI) 733 and 734 are arranged along the direction of the cooling air flowing from the backboard 200 side. It is arranged in the longitudinal direction. However, it is not necessary that all the electronic components are arranged along the flow of the cooling air, and main components that can affect the flow of the cooling air such as the heat sink 731 and the cache memory 740 are substantially parallel to the flow of the cooling air. By arranging positioning so that it may become, it can flow a cooling wind smoothly.</p> <p>Suzuki at 14:34–41: As shown in FIG. 11B, the lower control board 720 is formed in a rectangular flat plate having a larger area than the upper control board 710, and the cache memory 740 and the DC / DC converter 760 are mounted thereon. Yes. Each I / F module 800 is attached to the rear side of the lower control board 720 in correspondence with the cutout portion 711 of the upper control board 710.</p> <p>Suzuki at 14:42–58:</p>

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	<p>Here, the cache memory 740 is comprised of, for example, a double data rate synchronous dynamic random access memory (DDR-SDRAM) or the like, which is attached so that it is projected upwardly from a side edge on the other side of the upper-side control b is attached so as to be substantially parallel to the flow of the control module 700, that is, to be parallel to the longitudinal direction of the control module 700. In other words, by attaching the heat sink 731, other electronic components 733 and 734, the cache memory 740, and the DC / DC converter 760 substantially parallel to the longitudinal direction of the control module 700, Is rectified and flows toward the rear of the control module 700. In particular, the heat rectification effect of the cooling air is expected in the heat sink 731 located in the vicinity of the cooling air inlet.</p> <p>Suzuki at 14:59–67: On the other hand, the DC/DC converter 760 is positioned adjacent to the back board 200 and is attached to the lower-side control circuit board 720. The first reason of this is that the DC/DC converter 760 is a heating element comparable to MPU 730 so thatatively cooled by being arranged in the vicinity of the cooling air inlet. The second reason is to shorten the line length of the high voltage input inputted to the DC / DC converter 760.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converters a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board ample, , 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p>

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	<p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elec are loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:42–47: Two upper-level I/F units 750 each of which is connectable to a host computer are provided on the rear side of each control module 700 in such a manner as to underlie each I/F module 800. Provided on the rear side of each I/F module 800 are lower-level I/d disk unit 20 is provided.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p>

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	<p>Suzuki at 15:56–60: Also note that each I/F 750 is disposed in conformity with the flow of a cooling wind within the control module 700 in such a manner as to lie on the other side (left side) when looking down the control module 700 from its upper direction.</p> <p>Suzuki at 15:61–67: Next, an explanation will be given about a cooling air stream or “wind” which flows on or above each control module 700U, 700L with reference to FIGS. 13A–13B. FIG. 13A shows a cooling wind which flows above the upper-side control module 700U, and FIG. 13B shows a cooling wind flowing above the lower-side control module 700L.</p> <p>Suzuki at 16:1–40: As shown in FIG. 13A, the cooling winds from respective other-side fans 420 of fan modules 400 are combined and mixed together within the flow path 360 of duct member 300 and then flow into the upper-side control module 700U from the upper-side outflow pospect to the longitudinal direction of the control module 700. The cooling air FCU1 that has flowed in cools the MPU 730 and the like disposed in the vicinity of the outlet 330, is rectified by the heat sink 731 and the cache memory 740, and reaches the middle in the longitudinal direction of the upper control module 700U. The cooling air FCU2 that has reached the substantially middle part of the upper control module 700U cools the peripheral electronic components 734 and the like, and a part thereof goes straight as it is and is discharged to the outside from the vent hole 701 formed on the rear side of the control module 700U. Is done. The remaining cooling air FCU2 flows into the respective rear side ducts 105 through the respective vent holes 702 respectively formed on the both sides of the rear side of the upper control module 700U, and from the rear side ducts 105 to the outside.</p> <p>Suzuki at 16:24–41: As shown in FIG. 13B, the cooling winds from respective one-side fans 410 of the fan modules 400 are combined together within the flow path 350 of duct member 300 and then flow into the lower-side control module 700L from the lower-side outflow port 340. er</p>

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	<p>flowing out from the lower outlet 340 is inclined in one direction with respect to the longitudinal direction of the lower control module 700L and flows into the lower control module 700L, and similarly cools the MPU 730 and the like. The flow is rectified. In the same manner as described above, a part of the cooling air FCL2 reaching the substantially middle portion of the lower control module 700L is discharged to the outside through the vent hole 701 of the lower control module 700L, and the rest is a side vent hole. It flows into the rear side duct 105 through 702 and is discharged to the outside.</p> <p>Suzuki at 16:44–53: An explanation will next be given of a circuit for preventing a rush current occurring in active line or “hot” insertion events. Each control module 700 in accordance with this invention is arranged to offer hot plug/unplug capabilities to thereby permit users to perform maintenance works or the like while the disk array apparatus 1 is made active. Accordingly, each control module 700 is required to prevent rush currents in hot insertion events. For use as the rush prevention circuit, it comprises a circuit shown in FIG. 14A or 14B.</p> <p>Suzuki at 16:54–65: FIG. 14A shows one example of the rush prevention circuit. This circuit uses a PMOSFET 1001 to suppress a rush current with respect to an electrostatic capacitor C between 54V and ground (GND) at the time of hot insertion of a controller. Note here that PMOSFET refers to a P-channel metal oxide semiconductor field effect transistor. The PMOSFET is such that when a negative voltage is applied to its gate terminal G, a resistance value between a source terminal S and drain terminal D changes due to a potential difference between the gate terminal G and source terminal S, thereby making it possible to control the value of a source-drain current.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p>

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	<p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3:</p> <p>As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal S and gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3) Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost</p>

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	<p>zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67: When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about V1 = 8 V) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p> <p>Suzuki at 20:29–33:</p>

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Asserted Claims	Suzuki
	<p>In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power concurrent consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p>
<p>6. The electronic device according to claim 1, wherein the cooling air flows through a heat sink, attached onto the CPU, and further flows downstream</p>	<p>Suzuki discloses, expressly and/or inherently, the electronic device according to claim 1, wherein the cooling air flows through a heat sink, attached onto the CPU, and further flows downstream via a relatively large space formed between the plurality of power source units.</p>

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Asserted Claims	Suzuki
<p>via a relatively large space formed between the plurality of power source units.</p>	<p>See, e.g.:</p> <p>Suzuki at Fig. 1 and accompanying text:</p> <div data-bbox="745 550 1692 1255"> <p style="text-align: center;">FIG. 1</p> </div> <p>Suzuki at Fig. 4 and accompanying text:</p>

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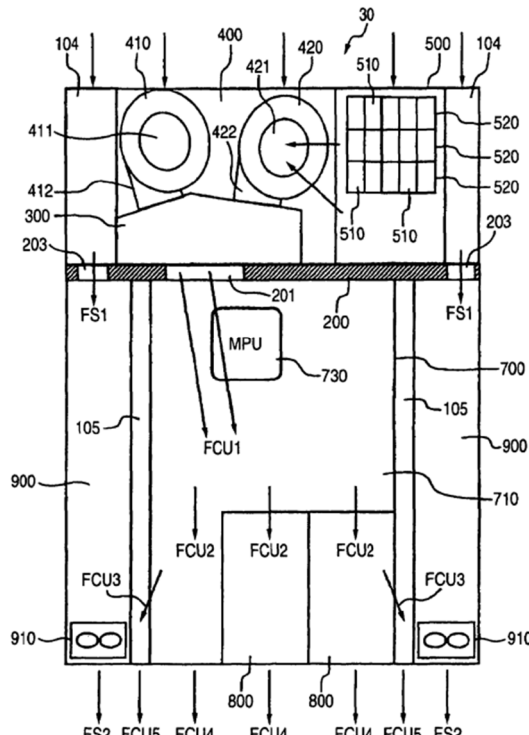
Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p>  <p>Suzuki at 2:61–63: In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p> <p>Suzuki at 3:1–5:</p>

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Asserted Claims	Suzuki
	<p>In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11: In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the like, it is possible to continue cooling of the two control modules 700 can be continued by</p>

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Asserted Claims	Suzuki
	<p>the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p> <p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 8:27–35:</p> <p>A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 9:31–53:</p> <p>A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery</p>

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Asserted Claims	Suzuki
	<p>module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converters a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board ample, , 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecure loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3:</p> <p>As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24:</p> <p>An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal Sand gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3) Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By</p>

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Asserted Claims	Suzuki
	<p>adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67: When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about V1 = 8 V) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p> <p>Suzuki at 20:29–33:</p>

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Asserted Claims	Suzuki
	<p>In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p>

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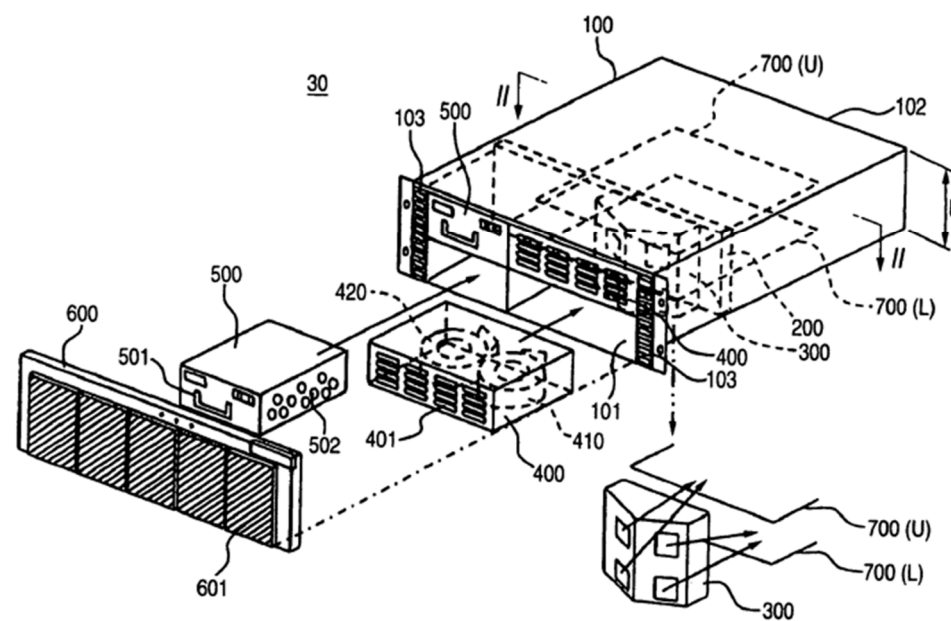
Asserted Claims	Suzuki
<p>7. The cooling structure of an electronic device according to claim 4, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.</p>	<p>Suzuki discloses, expressly and/or inherently, the cooling structure of an electronic device according to claim 4, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p> <p style="text-align: center;">FIG. 1</p> 

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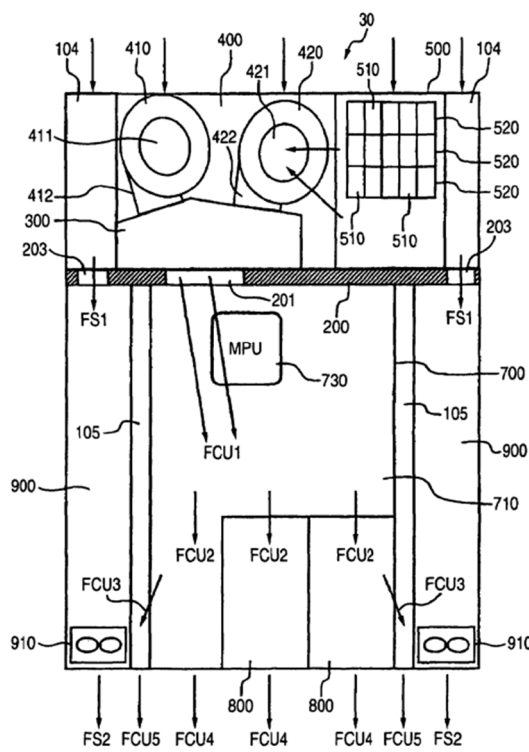
Asserted Claims	Suzuki
	<p data-bbox="730 261 1241 293">Suzuki at Fig. 4 and accompanying text:</p> <div data-bbox="798 329 1323 1136"> <p data-bbox="1035 329 1106 362"><i>FIG. 4</i></p>  </div> <p data-bbox="730 1247 968 1279">Suzuki at 2:61–63:</p> <p data-bbox="730 1292 1871 1360">In one form of the invention, when any one of the fan modules stops its operation, control is made to cause the remaining fan module to increase in air blow power.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 3:1–5: In one form of the invention, the equipment further comprises a power supply module disposed adjacent to each control module within the one side space of the housing, and a thermal insulating ventilation path formed between the power supply module and each control module.</p> <p>Suzuki at 3:6–11: In one form of the invention, the power supply module includes an air inlet fan. A communicating hole is formed on a downstream side of the thermal insulating ventilation path, for causing a cooling air which cools down each control module to escape toward ventilation path. A communication hole for exhausting the gas is formed.</p> <p>Suzuki at 3:12–19: In one form of the invention, the control module includes a converter circuit for converting a high voltage input being supplied from the power supply module into a low voltage output, wherein the converter circuit is disposed near the cooling air-use opening air opening.</p> <p>Suzuki at 3:46–55: FIG. 1 is an exploded perspective view showing an overview of the control unit 30. The control unit 30 is a device which controls an operation of disk array apparatus 1 as will be described later. The control unit 30 is generally made up of a chassis 100, the control unit 30 includes a chassis 100, a backboard 200, a duct member 300, two fan modules 400, two battery modules 500, a decorative door 600, and two controls. A module 700, two interface modules (hereinafter abbreviated as I / F modules; see FIG. 4) 800, and two power supply modules 900 are roughly configured.</p> <p>Suzuki at 6:31–42: In this way, since each fan module 400 is arranged so that two exhaust ports drain out the cooling winds for separate control modules 700 respectively, even in cases where either one of the fan modules 400 becomes inoperative due to occurrence of an obstruction or the</p>

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Asserted Claims	Suzuki
	<p>like, it is possible to continue cooling of the two control modules 700 can be continued by the remaining normal fan modules 400. By adopting such a redundant configuration, a fail-safe function during cooling is ensured. Further, as will be described later, when a failure occurs, the blowing power is increased by increasing the drive voltage to the normal fan module 400.</p> <p>Suzuki at 6:43–63:</p> <p>Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 8:27–35:</p> <p>A rough flow of a cooling air stream or “wind” within the chassis 100 of control unit 30 will be explained with reference to FIG. 4. The cooling wind that flows within the chassis 100 is generally dividable into two kinds. One of them is a cooling wind who fan modules 400. The other one is cooling air generated by the intake fan 910 built in a total of two power supply modules 900 disposed on both sides of the rear space of the chassis 100.</p> <p>Suzuki at 9:31–53:</p>

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Asserted Claims	Suzuki
	<p>A cooling wind FCU3 which is part of the cooling wind FCU2 that has reached the intermediate portion of the upper-side control board 710 flows into respective rear side ducts 105 from the both sides of the upper-side control board 710, which ducts are forflow. Each of these rear side ducts 105 is located in the rear space of the chassis 100 and is formed between each control module 700 and each power supply module 900. Each rear side duct 105 is formed so that only a part on the downstream side thereof communicates with each control module 700. Thereby, each rear side duct 105 exhibits a heat insulating effect from the upstream region to the middle flow region, and prevents heat from each power supply module 900 from being transmitted to each control board 710 and 720. Cooling air that has cooled the electronic components and the like of the upper control board 710 is exhausted to the outside as indicated by the exhaust FCU 4 from a vent formed in the rear surface of the control module 700. Further, the cooling air FCU3 flowing into the rear side duct 105 from the control module 700 is discharged to the outside as indicated by the exhaust FCU5.</p> <p>Suzuki at 9:59–10:10:</p> <p>Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:41–52:</p> <p>As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the</p>

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Asserted Claims	Suzuki
	<p>outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate with 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an upper connector 211 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 15:1–33: More specifically, the DC/DC converter 760 is the one that converts a high-voltage input (e.g., DC 54V), which is input from the power supply module 900 through the wiring pattern of the back board 200 and the wiring pattern of lower-side control board 720, to a low-voltage (e.g., 3.3V DC) and supplied to each predetermined part. Therefore, when the DC / DC converter 760 is mounted on the lower control board 720 away from the back board 200, the distance from the back board 200 to the DC / DC converter 760 becomes longer, and the upper side of the lower control board 720 becomes higher. The distance through which the voltage current flows increases, which is not preferable from the viewpoint of noise</p>

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Asserted Claims	Suzuki
	<p>and the like. Therefore, in the present invention, the length of the high voltage input line is shortened by mounting the DC / DC converter 760 on the backboard 200 side.</p> <p>Suzuki at 15:17–34: Additionally, an arrangement is also conceivable which causes a prespecified low voltage to output from each power supply module 900 by way of example; however, in this case, the length of a power supply line increases, which leads to the MPU 730 and elecure loads increases. Accordingly, there is a possibility that a voltage drop or the like on the power supply line may occur although it varies depending on the power consumption. Therefore, in the present invention, the DC / DC converter 760 is mounted in each control module 700 to shorten the power supply line. Further, by arranging the DC / DC converter 760 in the vicinity of the load, it is possible to cope with an increase in current consumption, and therefore it is possible to follow the performance improvement of the MPU 730. Further, by increasing the input voltage to, for example, about 54V, it is possible to input a low current and reduce the number of power supply pins of the connector.</p> <p>Suzuki at 15:35–41: FIG. 12 is a back view of the control unit 30. Power supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively. A great number of ventilation holes 701 are formed on the rear side of each conA large number of vent holes 801 are also formed on the rear side of each I / F module 800.</p> <p>Suzuki at 15:48–54: On the other hand, ventilation holes 901 and a power supply connector 902 to which commercial power of AC 100V or the like is input for example along with a power switch 903 and a handle 704 are provided on the rear side of each power supply module 900. Ade duct 105 is formed between each power supply module 900 and each control module 700.</p> <p>Suzuki at 16:66–17:3:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>As shown in FIG. 14A, the PMOSFET 1001 is provided at a portion of a power supply line 1000 of 54V extending from the back board 200. A transistor 1003 is provided between the gate terminal G of PMOSFET 1001 and a ground line 1002.</p> <p>Suzuki at 17:4–24: An operation of the circuit shown in FIG. 14A will be explained. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of back board 200 and then mate them together. At this time, the source terminal S and gate terminal G of PMOSFET 1001 are at the same potential level. (2) Next, set the transistor 1003 being connected to the gate terminal G of PMOSFET 1001 in a turn-on state. When applying a negative voltage to the gate terminal G, this terminal gradually decreases in potential. (3) With such a potential decrease of the gate terminal G, the resistance value between the source terminal S and drain terminal D also decreases gradually, causing the capacitor C to be charged up. (4) At a point whereat the resistance value between the source terminal S and drain terminal D becomes almost zero, let the gate terminal G stay at a fixed potential level. With such an operation, it is possible to prevent any rush current relative to the electrostatic capacitor C lying between the power line 1000 and ground line 1002, which are coupled to inputs of the DC/DC converter 760 respectively.</p> <p>Suzuki at 16:66–17:3: As shown in FIG. 14B, the NMOSFET 1010 is provided partway on a ground line 1002 connected to the DC/DC converter 760. An IC 1011 for hot swap use is provided between the gate terminal G of NMOSFET 1010 and the power line 1000.</p> <p>Suzuki at 17:4–24: An operation of the circuit shown in FIG. 14A is as follows. (1) First, insert the terminals of control module 700 into the connector 211 (or 212) of backboard 200 and then mate them together. At this time, the source terminal Sand gate terminal G of NMOSFET 1010 are at the same potential level. (2) Next, the hot swap IC 1011 causes a positive voltage being applied to the gate terminal G of NMOSFET 1010 to increase gradually. (3)</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Whereby, the resistance value between the source terminal S and drain terminal D gradually decreases, permitting the capacitor C to be charged up. (4) At a point at which the resistance value between the source terminal S and drain terminal D becomes almost zero, the hot swap IC 1011 retains the potential of gate terminal G at a constant level. By adjustment of the operation of NMOSFET 1010 provided to ground line 1002 in this way, it is possible to preclude any rush current relative to the electrostatic capacitor C between the power line 1000 and ground line 1002, which are input to the DC/DC converter 760.</p> <p>Suzuki at 18:5–23: A voltage monitor circuit 1020 is provided between the power supply line 1000 of 54V and the ground line 1002 which are coupled to inputs of the DC/DC converter 760 respectively, for monitoring to determine whether an obstruction occurs at the input voltage stop DC/DC converter 760. In case an obstruction occurs at the input voltage(s) to DC/DC converter 760, this obstruction is detected by the voltage monitor circuit 1020; then, an obstruction detection signal is output as a current signal from voltage monitor circuit 1020. This current signal from voltage monitor circuit 1020 is input to a photo-coupler 1030 and is then converted by photocoupler 1030 into a voltage signal. This obstruction detection signal thus converted to the voltage signal is input to a voltage obstruction signal receiving circuit 1040. Note here that the photocoupler 1030 is provided because a reference voltage (54V) of the voltage monitor circuit 1020 and a reference voltage (Vcc) of voltage obstruction signal receiver circuit 1040 differ from each other.</p> <p>Suzuki at 18:57–67: When the power supply of the control unit 30 turns on (YES at step S1), determine whether two fan modules 400 are connected to the control unit 30 (at step S2). In case two fan modules 400 are connected together (YES at S2), use a drive voltage V1 (for ex with a normal driving voltage V1 (for example, about $V1 = 8\text{ V}$) (S3). When the power is turned off (S5: YES), the operation of each fan module 400 is stopped (S6). The operation of the fan module 400 may be delayed, and the operation of the fan module 400 may be stopped after a predetermined time has elapsed since the power was turned off.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 20:29–33: In addition, since the DC/DC converter 760 is mounted at a specified position near the backboard 200 side, it is possible to shorten the wiring length of a high-voltage input line from the power supply module 900 on the lower-side control board 720.</p> <p>Suzuki at 20:34–39: Additionally, as the DC/DC converter 760 is mounted within each control module 700 on which respective electronic parts acting as loads are mounted, it is possible to prevent any voltage drop at the power supply line 1000 and enlargement of the power consumption is reduced. Can be accommodated.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p> <p>Suzuki at 21:12–16: Additionally, as the rear side duct 105 is provided between each control module 700 and each power supply module 900, it is possible to avoid transmission of the heat within the power supply module 900 toward the inside of control module 700.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
[8.pre] 8. The electronic device according to claim 1, wherein	<p>Dell takes no position in these Invalidity Contentions on whether the entirety of the preamble of this claim limitation. Suzuki discloses, expressly and/or inherently, the electronic device according to claim 1.</p> <p><i>See claim 1.</i></p>
[8.a] the plurality of fans are arranged in a direction normal to the longitudinal direction,	<p>Suzuki discloses, expressly and/or inherently, the plurality of fans are arranged in a direction normal to the longitudinal direction.</p> <p><i>See claim 1.b.</i></p>
[8.b] the central processing unit is positioned in a first row,	<p>Suzuki discloses, expressly and/or inherently, the central processing unit is positioned in a first row.</p> <p><i>See claim 1.c.</i></p>
[8.c] the first row extending parallel to the direction,	<p>Suzuki discloses, expressly and/or inherently, the first row extending parallel to the direction.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

[illegible]

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

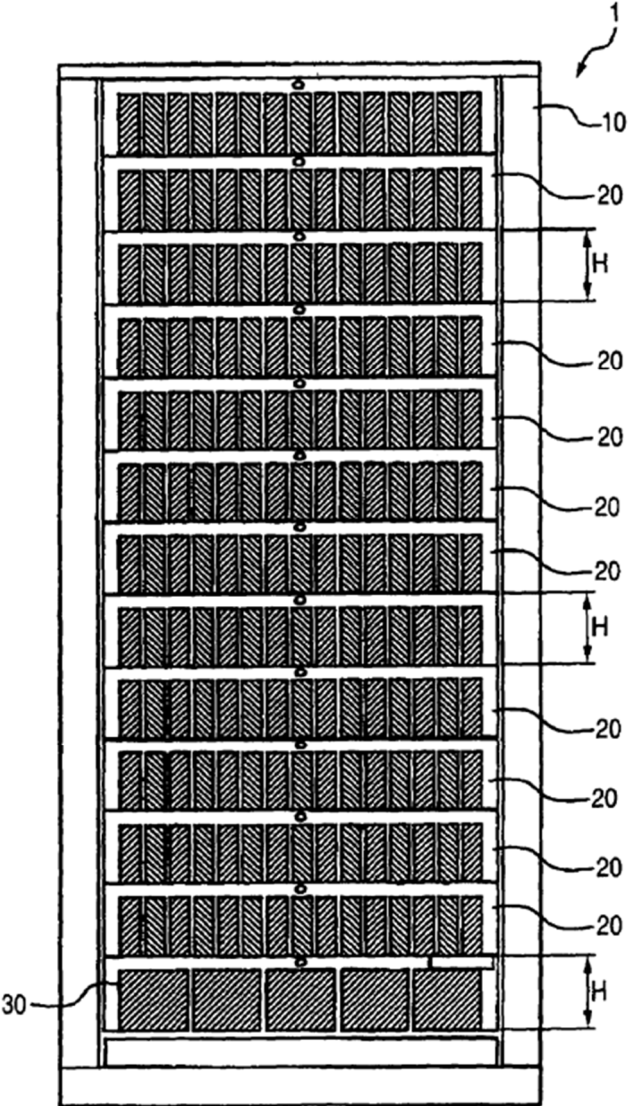
Asserted Claims	Suzuki
	

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p data-bbox="730 261 1241 293">Suzuki at Fig. 4 and accompanying text:</p> <div data-bbox="798 329 1325 1133" data-label="Diagram"> <p data-bbox="1035 329 1108 362"><i>FIG. 4</i></p> </div> <p data-bbox="730 1203 1241 1235">Suzuki at Fig. 5 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

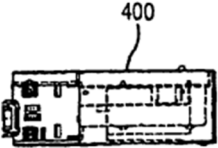
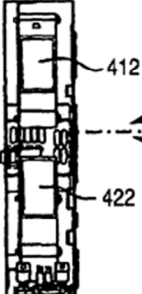
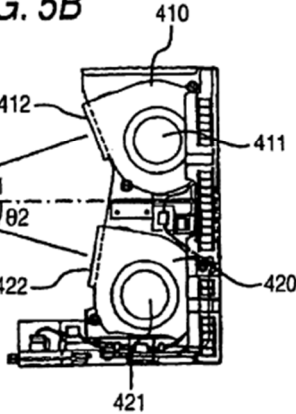
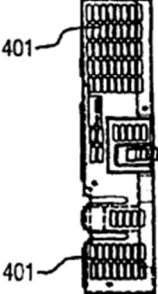
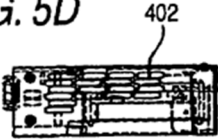
Asserted Claims	Suzuki
	<p data-bbox="1024 277 1157 321"><i>FIG. 5C</i></p>  <p data-bbox="831 570 963 613"><i>FIG. 5E</i></p>  <p data-bbox="1024 570 1157 613"><i>FIG. 5B</i></p>  <p data-bbox="1455 570 1587 613"><i>FIG. 5A</i></p>  <p data-bbox="1024 1036 1157 1079"><i>FIG. 5D</i></p>  <p data-bbox="726 1211 1260 1247">Suzuki at Fig. 10 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

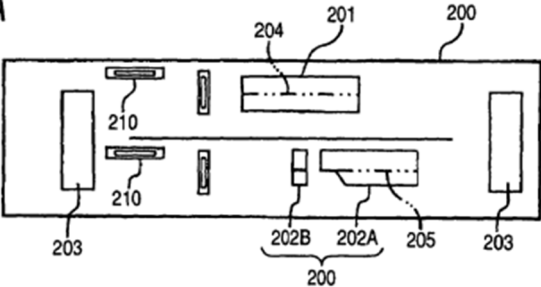
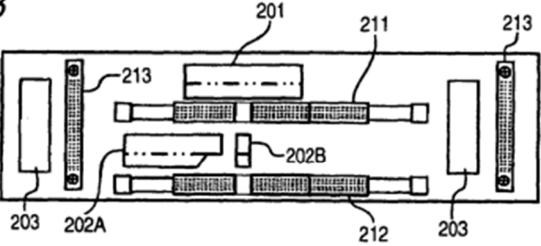
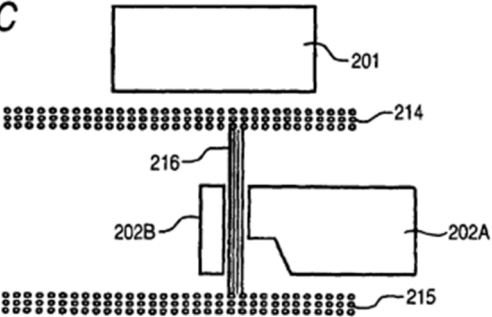
Asserted Claims	Suzuki
	<p>FIG. 10A</p>  <p>FIG. 10B</p>  <p>FIG. 10C</p>  <p>Suzuki at Fig. 11 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

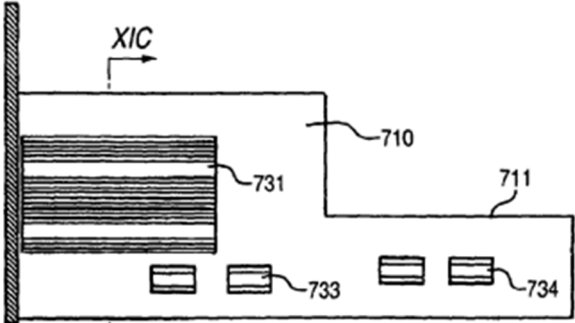
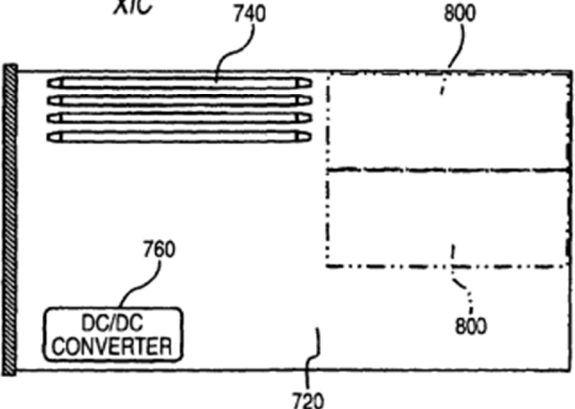
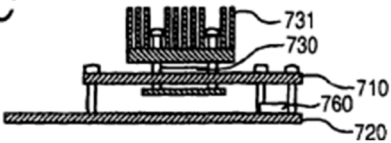
Asserted Claims	Suzuki
	<p>FIG. 11A</p>  <p>FIG. 11B</p>  <p>FIG. 11C</p>  <p>Suzuki at Fig. 13 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

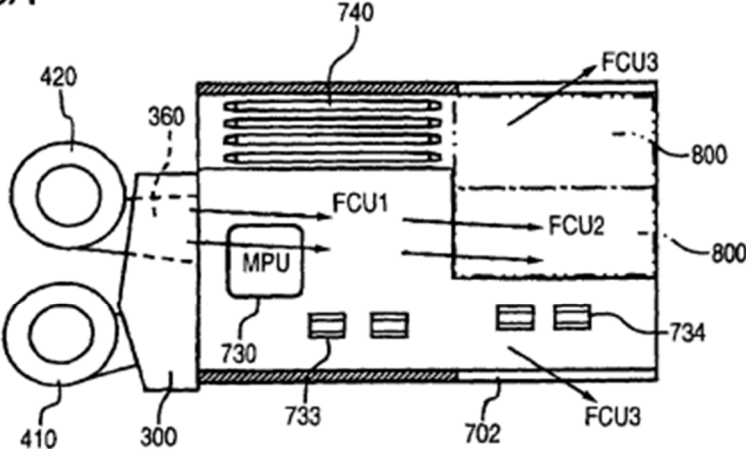
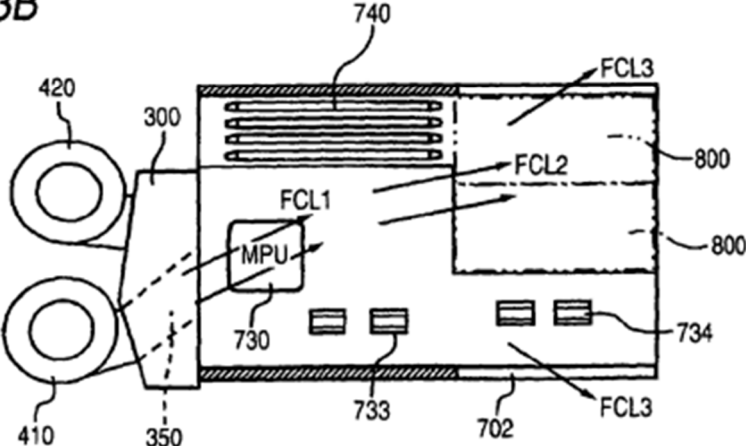
Asserted Claims	Suzuki
	<p data-bbox="791 272 947 321">FIG. 13A</p>  <p data-bbox="791 865 947 912">FIG. 13B</p>  <p data-bbox="730 1351 980 1375">Suzuki at 4:56-5:3:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>The chassis 100 is made of a metallic material such as stainless steel or the like, which is formed for example into a hollow box-like shape. A front side opening 101 that is positioned on this side in the drawing and a rear side opening 102 that is placed rear side in the figure. The rear opening 102 is formed. The chassis 100 is configured to be disassembled by a fastening member such as a screw so that one side and the remaining three sides can be separated, for example. In addition, air intake holes 103 are formed on both sides of the front opening 101 of the chassis 100 so as to communicate with the front side ducts 104 formed in the front space of the chassis 100 so as to extend in the longitudinal direction.</p> <p>Suzuki at 5:4–13: Here, the chassis 100 is such that its height H and other sizes are determined in such a way as to enable accommodation into a dedicated rack 10 to be later described. The height H is designed to become less than or equal to 3U (about 133.35 mm) as defined according to the chassis height dimension H, the height dimension of each module mounted in the chassis 100 is also determined. Note that the shape, material, height dimension, and the like of the chassis 100 are examples, and the present invention is not limited to this.</p> <p>Suzuki at 5:14–23: The back board 200 is the one that holds each control module 700 while performing electrical connections between respective control modules 700 and with other modules. The back board 200 is positioned at a location near the front side opening 101 of the front portion of the chassis 100 in the longitudinal direction. The backboard 200 is formed in a substantially flat plate shape, and is provided with openings 201 to 203 for cooling air and electrical connectors 210 to 213 as described later.</p> <p>Suzuki at 5:24–46: By attaching the back board 200 to inside of the chassis 100, a rear side space and a front side space are partitioned within the chassis 100 respectively, wherein the former spans from the rear side opening 102 up to a rear face of the back board 200, which are each defined. Therefore, the space in the chassis 100 is divided into two by the back board 200, and the front space and the rear space are basically separated. However, in the present</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>invention, as described later, by forming predetermined cooling air openings 201 to 203 at predetermined positions, the front space and the rear space are partially communicated via the backboard 200. This enables efficient cooling. Thus, the backboard 200 forms a support function for supporting each control module 700, a connection function for electrically connecting each control module 700 and the like, and a space (front space and rear space) in the chassis 100. And a cooling function for flowing cooling air from the front space into the rear space.</p> <p>Suzuki at 5:47–6:3: The duct member 300 is for exhausting cooling winds as sent from respective fan modules 400 in a way that cooling winds are combined together per each control module 700. The duct member 300 is placed within the front side space in the chassis 100 and is ckboard 200 (the right side in FIG. 1) and each fan module 400. For example, the duct member 300 is formed in a box shape having a substantially pentagonal cross section from a plastic foam material, and the surface thereof is coated with a resin or the like so as not to generate dust or the like. Although details will be described later, a total of four inlets corresponding to the exhaust ports of the fan modules 400 are provided on the front surface of the duct member 300, and the control modules 700 are provided on the rear surface side of the duct member 300. A corresponding total of two outlets are provided. In the duct member 300, the cooling air from one of the two exhaust ports of each fan module 400 is guided to the upper control module 700, and the cooling air from the other exhaust port is guided to the lower control module 700. In order to guide to the above, a flow path connecting each inflow port and each outflow port is formed.</p> <p>Suzuki at 6:4–17: Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust por Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 6:43–63: Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 6:64-7:5: The decorating door 600 is for covering the front side opening 101 of the chassis 100 after having attached the duct member 300 and each fan module 400 and also each battery module 500 in the front side space of chassis 100. The decorating door 600 is detd to the chassis 100, and a plurality of louvers 601 are detachably attached to the decorative door 600. Each louver 601 has air permeability, and the outside air flows into the chassis 100 via each louver 601.</p> <p>Suzuki at 7:6–27: Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 isontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 7:29–33: FIG. 2 is a front view of the disk array apparatus 1. The disk array apparatus 1 is constituted from a dedicated rack 10, a plurality of hard disk units 20 received within the rack 10, and a control unit 30 for control of operations, such as data access to each hard disk unit 20.</p> <p>Suzuki at 8:36–49: First, the cooling wind to be created by each fan module 400 will be discussed in detail. The fan module 400 is designed to take in the air streams coming respectively from two inlet paths—namely, air intake holes 401 in the front face of fan module 400, in the vicinity of each fan module 400 decreases due to the operation of each fan module 400, air flows into the battery module 500 from the vent hole 502 on the front surface of the battery module 500. It flows into each fan module 400 via the vent hole 502. Each fan 410, 420 of each fan module 400 sucks air from the intake ports 411, 421, and exhausts the sucked air from the exhaust ports 412, 422 by the rotational force of the fan blades.</p> <p>Suzuki at 9:59–10:10: Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked. When each intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:35–40: An explanation will next be given of the structure of each fan module 400 with reference to FIGS. 5A to 5E. FIGS. 5A–5E are a set of projection drawings, wherein FIG. 5A is a front view, FIG. 5B is a top plan view, FIG. 5C is a right side view, FIG. 5D is FIG. 5D is a left side view. FIG. 5 and FIG. 5 (e) are rear views.</p> <p>Suzuki at 10:41–52: As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 11:9–18: As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flowsttery module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 12:26–41: An explanation will next be given of a dividable structure of the duct member 300 with reference to FIGS. 9A to 9C. FIGS. 9A–9C show portions of projection drawings of the duct member 300, wherein FIG. 9A is a back view, FIG. 9B is a top plan view, and FI the duct member 300, the cooling air from the inlets 311 and 312 on one side is integrated and guided to the lower outlet 340, and the cooling air from the inlets 321 and 322 on the other side is integrated. The flow paths 350 and 360 are formed so as to be integrated into the upper outlet 330. Further, each of the flow paths 350 and 360 is formed in a shape in which the cooling air from each fan module 400 can easily flow so as to prevent backflow from the chassis 100.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p>
<p>[8.d] the plurality of power source units are each positioned in a second row.</p>	<p>Suzuki discloses, expressly and/or inherently, the plurality of power source units are each positioned in a second row.</p> <p><i>See claim 1.e.</i></p>
<p>[8.e] the second row extending parallel to the direction,</p>	<p>Suzuki discloses, expressly and/or inherently, the second row extending parallel to the direction.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

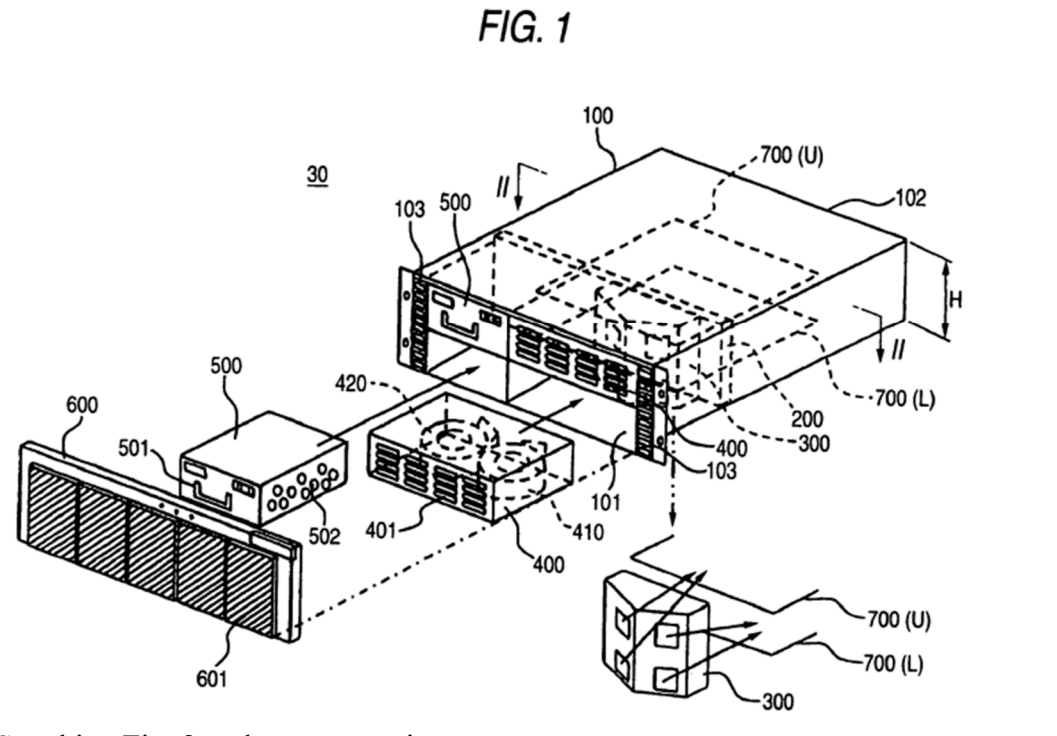
Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 1</p>  <p>Suzuki at Fig. 2 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidation Claim Chart for the '265 Patent

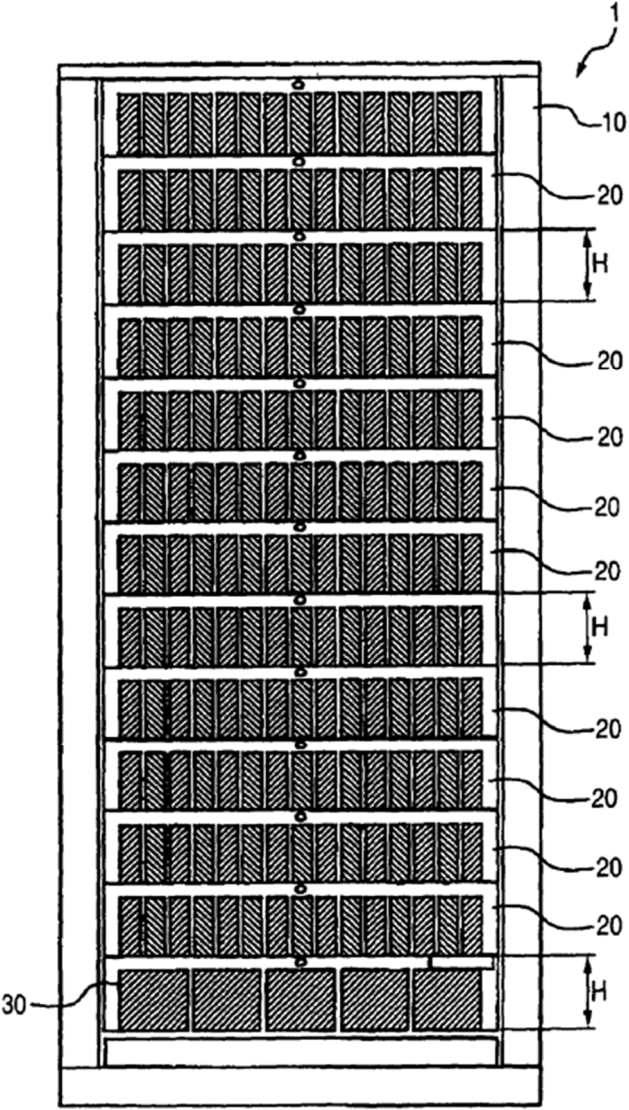
Asserted Claims	Suzuki
	 <p>The diagram shows a vertical cross-section of a multi-layered structure, labeled 1. It consists of a top layer 10, followed by a series of alternating layers. There are eight layers labeled 20, each separated by a thin white layer. The height of each layer 20 is indicated by a vertical double-headed arrow labeled H. At the bottom, there is a layer labeled 30, also with a height H. The entire structure is enclosed in a frame.</p> <p>Suzuki at Fig. 4 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

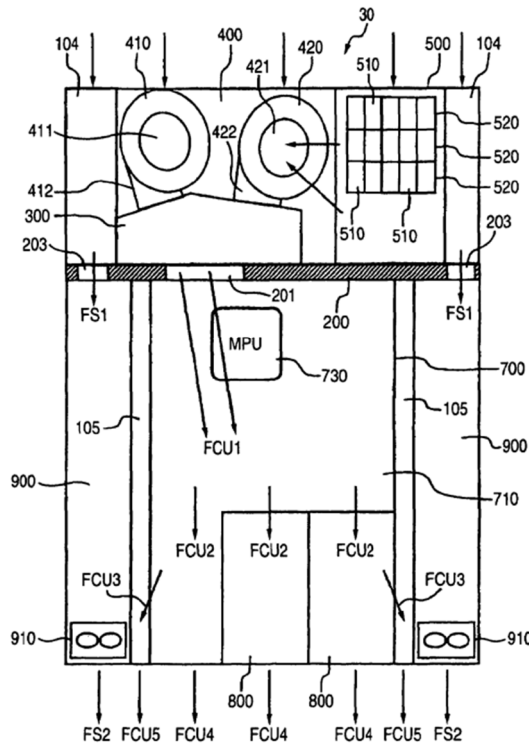
Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p>  <p>Suzuki at Fig. 5 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

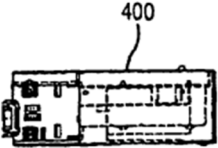
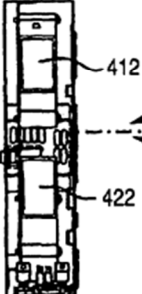
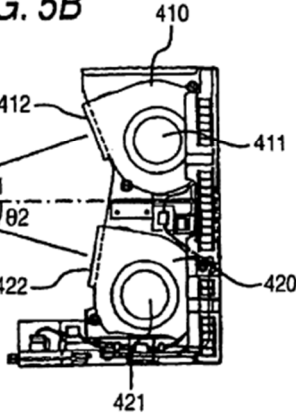
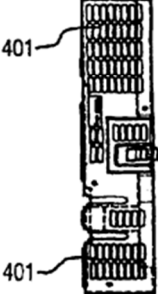
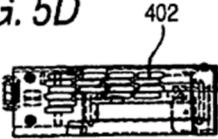
Asserted Claims	Suzuki
	<p data-bbox="1024 277 1157 321"><i>FIG. 5C</i></p>  <p data-bbox="831 570 961 613"><i>FIG. 5E</i></p>  <p data-bbox="1024 570 1157 613"><i>FIG. 5B</i></p>  <p data-bbox="1455 570 1585 613"><i>FIG. 5A</i></p>  <p data-bbox="1024 1036 1157 1079"><i>FIG. 5D</i></p>  <p data-bbox="726 1211 1260 1247">Suzuki at Fig. 10 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

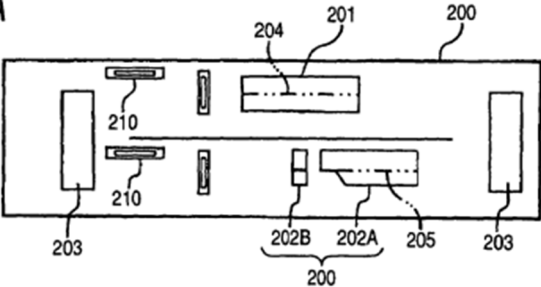
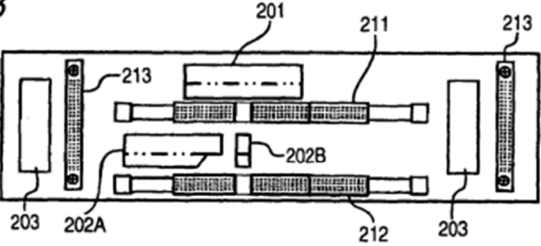
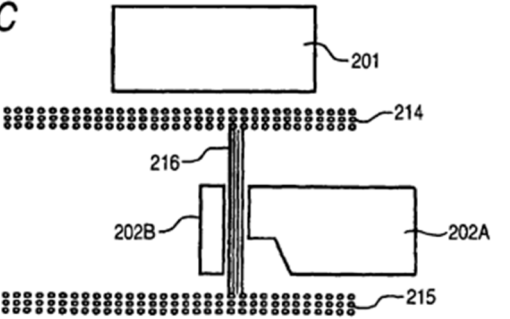
Asserted Claims	Suzuki
	<p>FIG. 10A</p>  <p>FIG. 10B</p>  <p>FIG. 10C</p>  <p>Suzuki at Fig. 11 and accompanying text:</p>

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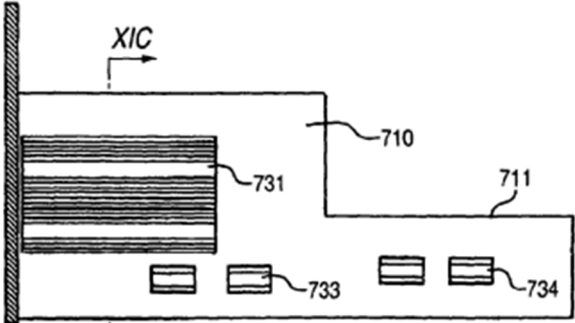
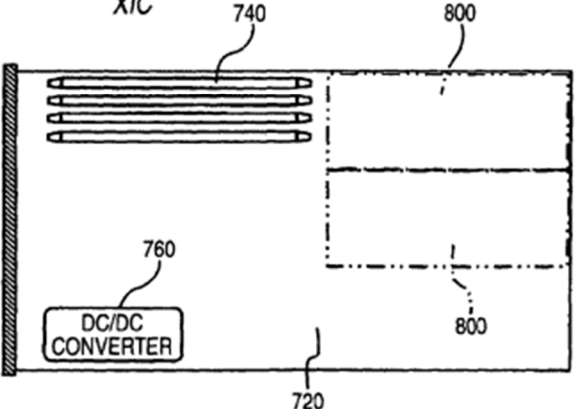
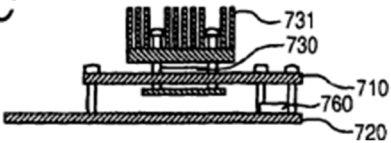
Asserted Claims	Suzuki
	<p>FIG. 11A</p>  <p>FIG. 11B</p>  <p>FIG. 11C</p>  <p>Suzuki at Fig. 13 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p>FIG. 13A</p> <p>FIG. 13B</p>
	Suzuki at 4:56–5:3:

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Asserted Claims	Suzuki
	<p>The chassis 100 is made of a metallic material such as stainless steel or the like, which is formed for example into a hollow box-like shape. A front side opening 101 that is positioned on this side in the drawing and a rear side opening 102 that is placed rear side in the figure. The rear opening 102 is formed. The chassis 100 is configured to be disassembled by a fastening member such as a screw so that one side and the remaining three sides can be separated, for example. In addition, air intake holes 103 are formed on both sides of the front opening 101 of the chassis 100 so as to communicate with the front side ducts 104 formed in the front space of the chassis 100 so as to extend in the longitudinal direction.</p> <p>Suzuki at 5:4–13: Here, the chassis 100 is such that its height H and other sizes are determined in such a way as to enable accommodation into a dedicated rack 10 to be later described. The height H is designed to become less than or equal to 3U (about 133.35 mm) as defined according to the chassis height dimension H, the height dimension of each module mounted in the chassis 100 is also determined. Note that the shape, material, height dimension, and the like of the chassis 100 are examples, and the present invention is not limited to this.</p> <p>Suzuki at 5:14–23: The back board 200 is the one that holds each control module 700 while performing electrical connections between respective control modules 700 and with other modules. The back board 200 is positioned at a location near the front side opening 101 of the front portion of the chassis 100 in the longitudinal direction. The backboard 200 is formed in a substantially flat plate shape, and is provided with openings 201 to 203 for cooling air and electrical connectors 210 to 213 as described later.</p> <p>Suzuki at 5:24–46: By attaching the back board 200 to inside of the chassis 100, a rear side space and a front side space are partitioned within the chassis 100 respectively, wherein the former spans from the rear side opening 102 up to a rear face of the back board 200, which are each defined. Therefore, the space in the chassis 100 is divided into two by the back board 200, and the front space and the rear space are basically separated. However, in the present</p>

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Asserted Claims	Suzuki
	<p>invention, as described later, by forming predetermined cooling air openings 201 to 203 at predetermined positions, the front space and the rear space are partially communicated via the backboard 200. This enables efficient cooling. Thus, the backboard 200 forms a support function for supporting each control module 700, a connection function for electrically connecting each control module 700 and the like, and a space (front space and rear space) in the chassis 100. And a cooling function for flowing cooling air from the front space into the rear space.</p> <p>Suzuki at 5:47–6:3: The duct member 300 is for exhausting cooling winds as sent from respective fan modules 400 in a way that cooling winds are combined together per each control module 700. The duct member 300 is placed within the front side space in the chassis 100 and is ckboard 200 (the right side in FIG. 1) and each fan module 400. For example, the duct member 300 is formed in a box shape having a substantially pentagonal cross section from a plastic foam material, and the surface thereof is coated with a resin or the like so as not to generate dust or the like. Although details will be described later, a total of four inlets corresponding to the exhaust ports of the fan modules 400 are provided on the front surface of the duct member 300, and the control modules 700 are provided on the rear surface side of the duct member 300. A corresponding total of two outlets are provided. In the duct member 300, the cooling air from one of the two exhaust ports of each fan module 400 is guided to the upper control module 700, and the cooling air from the other exhaust port is guided to the lower control module 700. In order to guide to the above, a flow path connecting each inflow port and each outflow port is formed.</p> <p>Suzuki at 6:4–17: Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust por Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction</p>

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Asserted Claims	Suzuki
	<p>so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 6:43–63: Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 6:64-7:5: The decorating door 600 is for covering the front side opening 101 of the chassis 100 after having attached the duct member 300 and each fan module 400 and also each battery module 500 in the front side space of chassis 100. The decorating door 600 is detd to the chassis 100, and a plurality of louvers 601 are detachably attached to the decorative door 600. Each louver 601 has air permeability, and the outside air flows into the chassis 100 via each louver 601.</p> <p>Suzuki at 7:6–27: Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 isontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively</p>

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Asserted Claims	Suzuki
	<p>fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 7:29–33: FIG. 2 is a front view of the disk array apparatus 1. The disk array apparatus 1 is constituted from a dedicated rack 10, a plurality of hard disk units 20 received within the rack 10, and a control unit 30 for control of operations, such as data access to each hard disk unit 20.</p> <p>Suzuki at 8:36–49: First, the cooling wind to be created by each fan module 400 will be discussed in detail. The fan module 400 is designed to take in the air streams coming respectively from two inlet paths—namely, air intake holes 401 in the front face of fan module 400, in the vicinity of each fan module 400 decreases due to the operation of each fan module 400, air flows into the battery module 500 from the vent hole 502 on the front surface of the battery module 500. It flows into each fan module 400 via the vent hole 502. Each fan 410, 420 of each fan module 400 sucks air from the intake ports 411, 421, and exhausts the sucked air from the exhaust ports 412, 422 by the rotational force of the fan blades.</p> <p>Suzuki at 9:59–10:10: Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked. When each inlet fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100.</p>

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Asserted Claims	Suzuki
	<p>Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:35–40: An explanation will next be given of the structure of each fan module 400 with reference to FIGS. 5A to 5E. FIGS. 5A–5E are a set of projection drawings, wherein FIG. 5A is a front view, FIG. 5B is a top plan view, FIG. 5C is a right side view, FIG. 5D is FIG. 5D is a left side view. FIG. 5 and FIG. 5 (e) are rear views.</p> <p>Suzuki at 10:41–52: As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 11:9–18: As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flowsttery module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p>

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Asserted Claims	Suzuki
	<p>Suzuki at 12:26–41: An explanation will next be given of a dividable structure of the duct member 300 with reference to FIGS. 9A to 9C. FIGS. 9A–9C show portions of projection drawings of the duct member 300, wherein FIG. 9A is a back view, FIG. 9B is a top plan view, and FIG. 9C is a side view of the duct member 300, the cooling air from the inlets 311 and 312 on one side is integrated and guided to the lower outlet 340, and the cooling air from the inlets 321 and 322 on the other side is integrated. The flow paths 350 and 360 are formed so as to be integrated into the upper outlet 330. Further, each of the flow paths 350 and 360 is formed in a shape in which the cooling air from each fan module 400 can easily flow so as to prevent backflow from the chassis 100.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate with the power supply module 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an upper connector 211 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that</p>

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Asserted Claims	Suzuki
	generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.
[8.f] the second row being positioned farther from a longitudinal center of the housing than the first row,	<p>Suzuki discloses, expressly and/or inherently, the second row being positioned farther from a longitudinal center of the housing than the first row.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 1</p>
	<p>Suzuki at Fig. 2 and accompanying text:</p>

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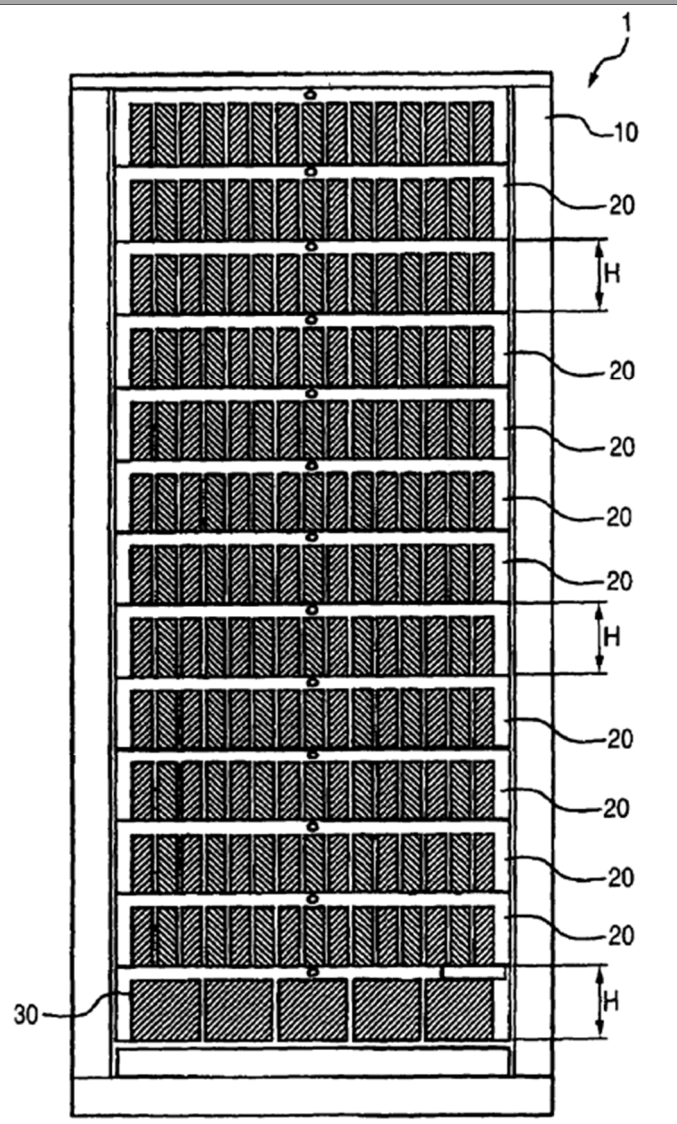
Asserted Claims	Suzuki
	 <p>Suzuki at Fig. 4 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 4</p> <p>Suzuki at Fig. 5 and accompanying text:</p>

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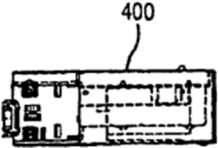
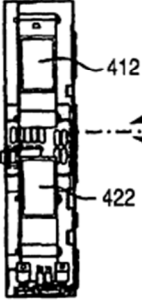
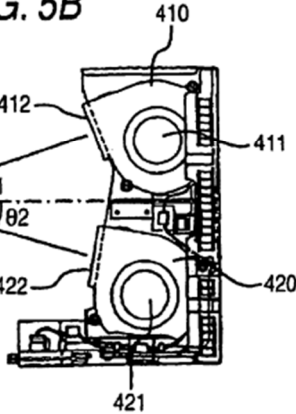
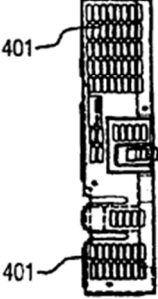
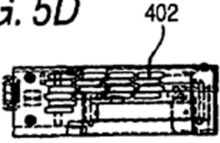
Asserted Claims	Suzuki
	<p data-bbox="1024 277 1157 321"><i>FIG. 5C</i></p>  <p data-bbox="831 565 963 609"><i>FIG. 5E</i></p>  <p data-bbox="1024 565 1157 609"><i>FIG. 5B</i></p>  <p data-bbox="1455 565 1587 609"><i>FIG. 5A</i></p>  <p data-bbox="1024 1036 1157 1079"><i>FIG. 5D</i></p>  <p data-bbox="726 1211 1260 1248">Suzuki at Fig. 10 and accompanying text:</p>

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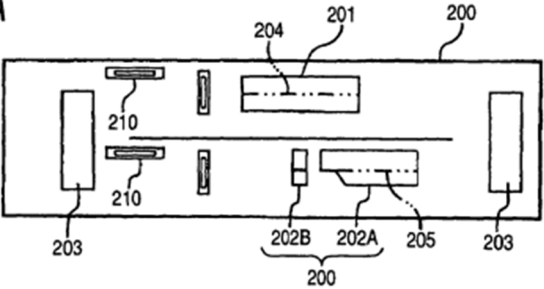
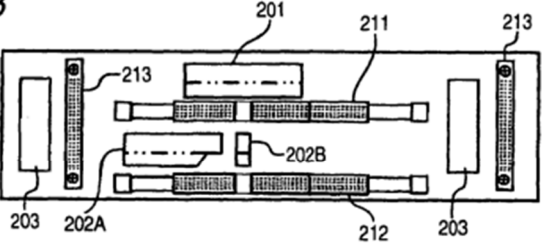
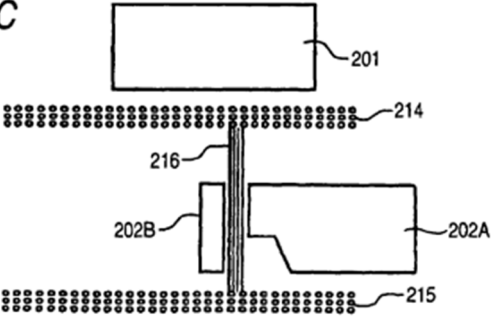
Asserted Claims	Suzuki
	<p>FIG. 10A</p>  <p>FIG. 10B</p>  <p>FIG. 10C</p>  <p>Suzuki at Fig. 11 and accompanying text:</p>

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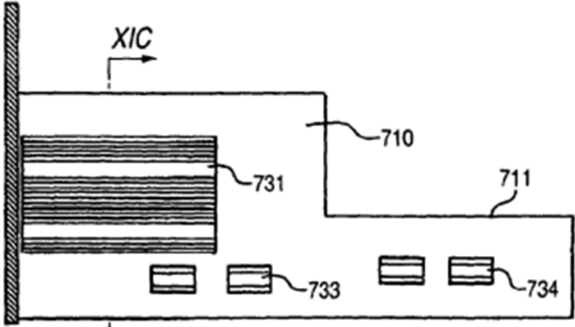
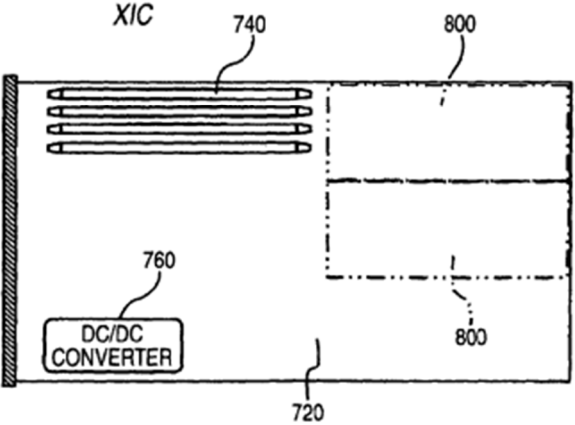
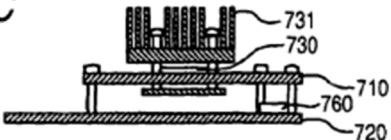
Asserted Claims	Suzuki
	<p>FIG. 11A</p>  <p>FIG. 11B</p>  <p>FIG. 11C</p>  <p>Suzuki at Fig. 13 and accompanying text:</p>

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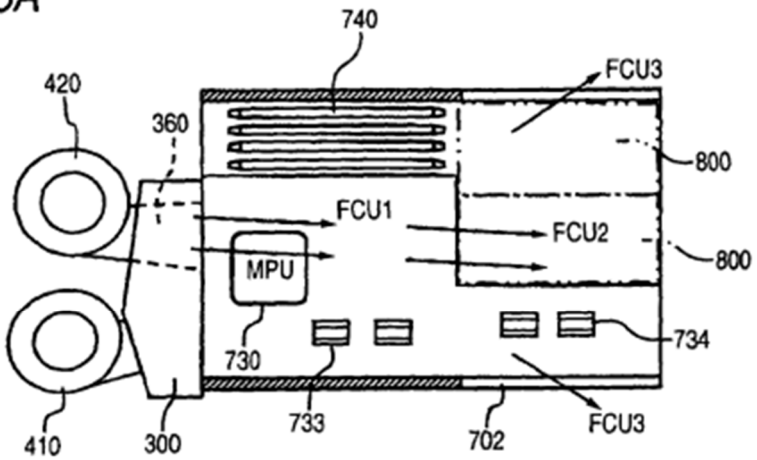
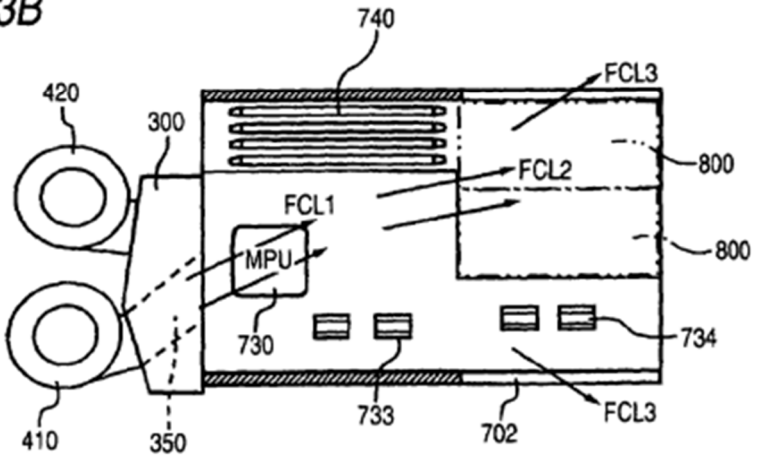
Asserted Claims	Suzuki
	<p data-bbox="787 272 947 315">FIG. 13A</p>  <p data-bbox="787 863 949 907">FIG. 13B</p> 

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Asserted Claims	Suzuki
	<p>Suzuki at 4:56–5:3: The chassis 100 is made of a metallic material such as stainless steel or the like, which is formed for example into a hollow box-like shape. A front side opening 101 that is positioned on this side in the drawing and a rear side opening 102 that is placed rear side in the figure. The rear opening 102 is formed. The chassis 100 is configured to be disassembled by a fastening member such as a screw so that one side and the remaining three sides can be separated, for example. In addition, air intake holes 103 are formed on both sides of the front opening 101 of the chassis 100 so as to communicate with the front side ducts 104 formed in the front space of the chassis 100 so as to extend in the longitudinal direction.</p> <p>Suzuki at 5:4–13: Here, the chassis 100 is such that its height H and other sizes are determined in such a way as to enable accommodation into a dedicated rack 10 to be later described. The height H is designed to become less than or equal to 3U (about 133.35 mm) as defined according to the chassis height dimension H, the height dimension of each module mounted in the chassis 100 is also determined. Note that the shape, material, height dimension, and the like of the chassis 100 are examples, and the present invention is not limited to this.</p> <p>Suzuki at 5:14–23: The back board 200 is the one that holds each control module 700 while performing electrical connections between respective control modules 700 and with other modules. The back board 200 is positioned at a location near the front side opening 101 of the chassis 100 in the longitudinal direction. The backboard 200 is formed in a substantially flat plate shape, and is provided with openings 201 to 203 for cooling air and electrical connectors 210 to 213 as described later.</p> <p>Suzuki at 5:24–46: By attaching the back board 200 to inside of the chassis 100, a rear side space and a front side space are partitioned within the chassis 100 respectively, wherein the former spans from the rear side opening 102 up to a rear face of the back board 200, which are each defined. Therefore, the space in the chassis 100 is divided into two by the back board 200,</p>

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Asserted Claims	Suzuki
	<p>and the front space and the rear space are basically separated. However, in the present invention, as described later, by forming predetermined cooling air openings 201 to 203 at predetermined positions, the front space and the rear space are partially communicated via the backboard 200. This enables efficient cooling. Thus, the backboard 200 forms a support function for supporting each control module 700, a connection function for electrically connecting each control module 700 and the like, and a space (front space and rear space) in the chassis 100. And a cooling function for flowing cooling air from the front space into the rear space.</p> <p>Suzuki at 5:47–6:3: The duct member 300 is for exhausting cooling winds as sent from respective fan modules 400 in a way that cooling winds are combined together per each control module 700. The duct member 300 is placed within the front side space in the chassis 100 and is ckboard 200 (the right side in FIG. 1) and each fan module 400. For example, the duct member 300 is formed in a box shape having a substantially pentagonal cross section from a plastic foam material, and the surface thereof is coated with a resin or the like so as not to generate dust or the like. Although details will be described later, a total of four inlets corresponding to the exhaust ports of the fan modules 400 are provided on the front surface of the duct member 300, and the control modules 700 are provided on the rear surface side of the duct member 300. A corresponding total of two outlets are provided. In the duct member 300, the cooling air from one of the two exhaust ports of each fan module 400 is guided to the upper control module 700, and the cooling air from the other exhaust port is guided to the lower control module 700. In order to guide to the above, a flow path connecting each inflow port and each outflow port is formed.</p> <p>Suzuki at 6:4–17: Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust por Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and</p>

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Asserted Claims	Suzuki
	<p>exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 6:43–63: Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 6:64-7:5: The decorating door 600 is for covering the front side opening 101 of the chassis 100 after having attached the duct member 300 and each fan module 400 and also each battery module 500 in the front side space of chassis 100. The decorating door 600 is detd to the chassis 100, and a plurality of louvers 601 are detachably attached to the decorative door 600. Each louver 601 has air permeability, and the outside air flows into the chassis 100 via each louver 601.</p> <p>Suzuki at 7:6–27: Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 isontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical</p>

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Asserted Claims	Suzuki
	<p>direction. Terminals formed at the front end of each control module 700 are respectively fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 7:29–33: FIG. 2 is a front view of the disk array apparatus 1. The disk array apparatus 1 is constituted from a dedicated rack 10, a plurality of hard disk units 20 received within the rack 10, and a control unit 30 for control of operations, such as data access to each hard disk unit 20.</p> <p>Suzuki at 8:36–49: First, the cooling wind to be created by each fan module 400 will be discussed in detail. The fan module 400 is designed to take in the air streams coming respectively from two inlet paths—namely, air intake holes 401 in the front face of fan module 400, in the vicinity of each fan module 400 decreases due to the operation of each fan module 400, air flows into the battery module 500 from the vent hole 502 on the front surface of the battery module 500. It flows into each fan module 400 via the vent hole 502. Each fan 410, 420 of each fan module 400 sucks air from the intake ports 411, 421, and exhausts the sucked air from the exhaust ports 412, 422 by the rotational force of the fan blades.</p> <p>Suzuki at 9:59–10:10: Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked h intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>from the air intake holes 103 formed on both sides of the front surface of the chassis 100. Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:35–40: An explanation will next be given of the structure of each fan module 400 with reference to FIGS. 5A to 5E. FIGS. 5A–5E are a set of projection drawings, wherein FIG. 5A is a front view, FIG. 5B is a top plan view, FIG. 5C is a right side view, FIG. 5D is FIG. 5D is a left side view. FIG. 5 and FIG. 5 (e) are rear views.</p> <p>Suzuki at 10:41–52: As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 11:9–18: As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flows into the battery module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 12:26–41: An explanation will next be given of a dividable structure of the duct member 300 with reference to FIGS. 9A to 9C. FIGS. 9A–9C show portions of projection drawings of the duct member 300, wherein FIG. 9A is a back view, FIG. 9B is a top plan view, and FI the duct member 300, the cooling air from the inlets 311 and 312 on one side is integrated and guided to the lower outlet 340, and the cooling air from the inlets 321 and 322 on the other side is integrated. The flow paths 350 and 360 are formed so as to be integrated into the upper outlet 330. Further, each of the flow paths 350 and 360 is formed in a shape in which the cooling air from each fan module 400 can easily flow so as to prevent backflow from the chassis 100.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate le 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an 1 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply modul flow into the</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.</p>
<p>[8.g] and the second row being positioned farther from the plurality of fans than the first row.</p>	<p>Suzuki discloses, expressly and/or inherently, and the second row being positioned farther from the plurality of fans than the first row.</p> <p><i>See, e.g.:</i></p> <p>Suzuki at Fig. 1 and accompanying text:</p>

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Asserted Claims	Suzuki
	<p style="text-align: center;">FIG. 1</p> <p style="text-align: center;">Suzuki at Fig. 2 and accompanying text:</p>

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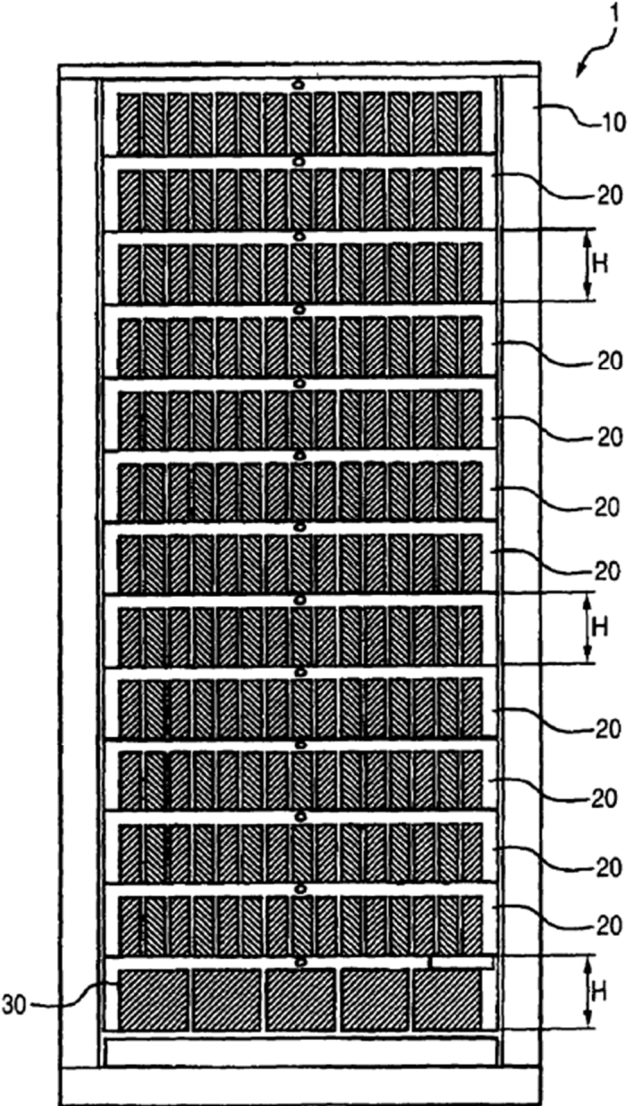
Asserted Claims	Suzuki
	

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at Fig. 4 and accompanying text:</p> <p style="text-align: center;">FIG. 4</p> <p>Suzuki at Fig. 5 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

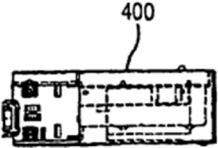
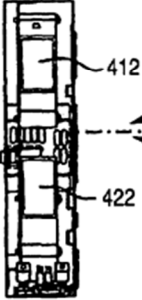
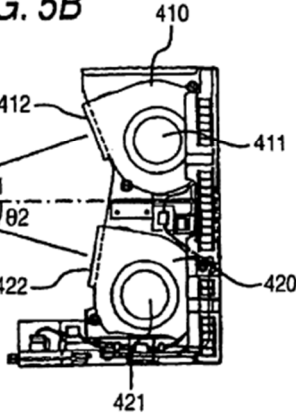
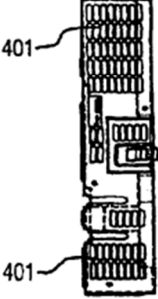
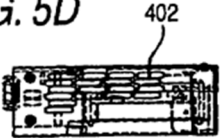
Asserted Claims	Suzuki
	<p data-bbox="1024 277 1157 321"><i>FIG. 5C</i></p>  <p data-bbox="831 565 961 609"><i>FIG. 5E</i></p>  <p data-bbox="1024 565 1157 609"><i>FIG. 5B</i></p>  <p data-bbox="1455 565 1585 609"><i>FIG. 5A</i></p>  <p data-bbox="1024 1036 1157 1079"><i>FIG. 5D</i></p>  <p data-bbox="730 1211 1262 1247">Suzuki at Fig. 10 and accompanying text:</p>

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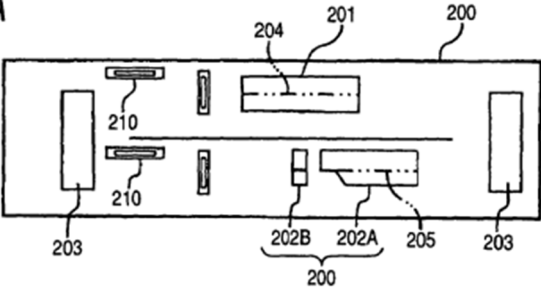
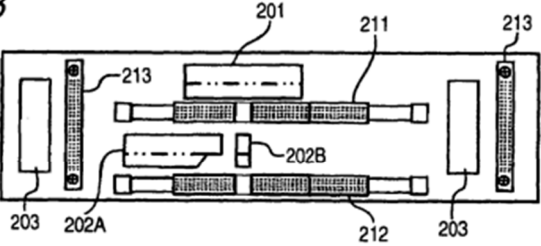
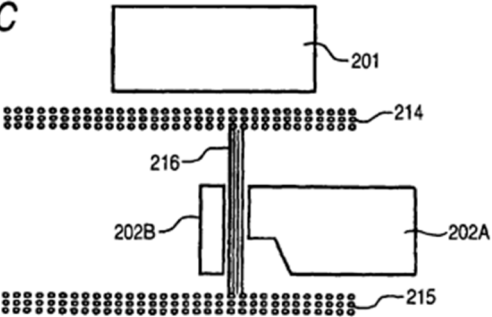
Asserted Claims	Suzuki
	<p>FIG. 10A</p>  <p>FIG. 10B</p>  <p>FIG. 10C</p>  <p>Suzuki at Fig. 11 and accompanying text:</p>

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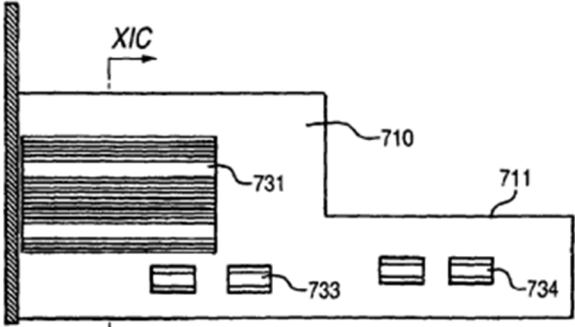
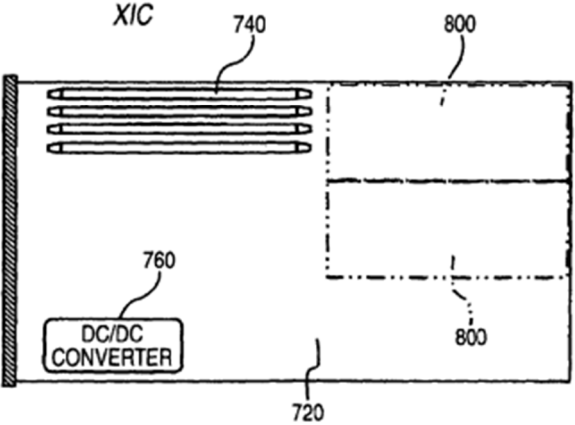
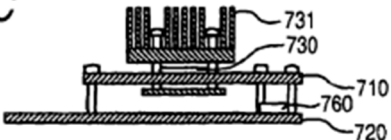
Asserted Claims	Suzuki
	<p>FIG. 11A</p>  <p>FIG. 11B</p>  <p>FIG. 11C</p>  <p>Suzuki at Fig. 13 and accompanying text:</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
FIG. 13A	
FIG. 13B	

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Asserted Claims	Suzuki
	<p>The chassis 100 is made of a metallic material such as stainless steel or the like, which is formed for example into a hollow box-like shape. A front side opening 101 that is positioned on this side in the drawing and a rear side opening 102 that is placed rear side in the figure. The rear opening 102 is formed. The chassis 100 is configured to be disassembled by a fastening member such as a screw so that one side and the remaining three sides can be separated, for example. In addition, air intake holes 103 are formed on both sides of the front opening 101 of the chassis 100 so as to communicate with the front side ducts 104 formed in the front space of the chassis 100 so as to extend in the longitudinal direction.</p> <p>Suzuki at 5:4–13: Here, the chassis 100 is such that its height H and other sizes are determined in such a way as to enable accommodation into a dedicated rack 10 to be later described. The height H is designed to become less than or equal to 3U (about 133.35 mm) as defined according to the chassis height dimension H, the height dimension of each module mounted in the chassis 100 is also determined. Note that the shape, material, height dimension, and the like of the chassis 100 are examples, and the present invention is not limited to this.</p> <p>Suzuki at 5:14–23: The back board 200 is the one that holds each control module 700 while performing electrical connections between respective control modules 700 and with other modules. The back board 200 is positioned at a location near the front side opening 101 of the front portion of the chassis 100 in the longitudinal direction. The backboard 200 is formed in a substantially flat plate shape, and is provided with openings 201 to 203 for cooling air and electrical connectors 210 to 213 as described later.</p> <p>Suzuki at 5:24–46: By attaching the back board 200 to inside of the chassis 100, a rear side space and a front side space are partitioned within the chassis 100 respectively, wherein the former spans from the rear side opening 102 up to a rear face of the back board 200, which are each defined. Therefore, the space in the chassis 100 is divided into two by the back board 200, and the front space and the rear space are basically separated. However, in the present</p>

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Asserted Claims	Suzuki
	<p>invention, as described later, by forming predetermined cooling air openings 201 to 203 at predetermined positions, the front space and the rear space are partially communicated via the backboard 200. This enables efficient cooling. Thus, the backboard 200 forms a support function for supporting each control module 700, a connection function for electrically connecting each control module 700 and the like, and a space (front space and rear space) in the chassis 100. And a cooling function for flowing cooling air from the front space into the rear space.</p> <p>Suzuki at 5:47–6:3: The duct member 300 is for exhausting cooling winds as sent from respective fan modules 400 in a way that cooling winds are combined together per each control module 700. The duct member 300 is placed within the front side space in the chassis 100 and is ckboard 200 (the right side in FIG. 1) and each fan module 400. For example, the duct member 300 is formed in a box shape having a substantially pentagonal cross section from a plastic foam material, and the surface thereof is coated with a resin or the like so as not to generate dust or the like. Although details will be described later, a total of four inlets corresponding to the exhaust ports of the fan modules 400 are provided on the front surface of the duct member 300, and the control modules 700 are provided on the rear surface side of the duct member 300. A corresponding total of two outlets are provided. In the duct member 300, the cooling air from one of the two exhaust ports of each fan module 400 is guided to the upper control module 700, and the cooling air from the other exhaust port is guided to the lower control module 700. In order to guide to the above, a flow path connecting each inflow port and each outflow port is formed.</p> <p>Suzuki at 6:4–17: Each fan module 400 is the one that creates a cooling wind for cooling each control module 700 within the chassis 100. Each fan module 400 is made up of a pair of horizontally neighboring fans (preferably, sirocco fans) and has two independent exhaust por Each fan module 400 has an air intake hole 401 formed on the front surface and a side surface adjacent to the battery module 500 (only the air intake hole on the front side is shown). Each fan module 400 sucks outside air from the axial direction by each fan and exhausts it in the radial direction. Each fan module 400 is stacked in the vertical direction</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>so as to be inserted into the front space of the chassis 100 and detachably attached to the front surface side of the duct member 300.</p> <p>Suzuki at 6:43–63: Each battery module 500 is the one that supplies emergency-use electric power in power failure events. Ventilation holes 502 are formed in the front face of each battery module 500 and in a side face opposing each fan module 400 (only the side-face vent h. As will be described later, each battery module 500 contains a plurality of batteries, and when power to the disk array device 1 is cut off due to a power failure or the like, the data on the cache memory is transferred to a predetermined disk. Power is supplied to the drive until the planned outage is automatically completed. Thereby, data loss at the time of a power failure can be prevented. Since the built-in battery deteriorates over time, each battery module 500 is provided with its front surface exposed to the front opening of the chassis 100 so that the periodic replacement of each battery module 500 can be easily performed. In addition, a handle 501 for the user to hold is provided on the front surface of each battery module 500. The user can easily replace the battery module 500 with a new one by gripping the handle 501 and pulling out the battery module 500.</p> <p>Suzuki at 6:64-7:5: The decorating door 600 is for covering the front side opening 101 of the chassis 100 after having attached the duct member 300 and each fan module 400 and also each battery module 500 in the front side space of chassis 100. The decorating door 600 is detd to the chassis 100, and a plurality of louvers 601 are detachably attached to the decorative door 600. Each louver 601 has air permeability, and the outside air flows into the chassis 100 via each louver 601.</p> <p>Suzuki at 7:6–27: Each control module 700 is to control an operation of the disk array apparatus 1 and is arranged to include two control circuit boards 710 and 720 each mounting thereon a micro processing unit (MPU) and a cache memory or else. Each control module 700 is pontrol module 700 is located in the rear space in the chassis 100 and is spaced apart in the vertical direction. Terminals formed at the front end of each control module 700 are respectively</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>fitted to connectors provided on the rear surface side of the backboard 200, whereby each control module 700 is formed on the backboard 200. They are electrically connected to each other through the wired lines. Each control module 700 is mechanically supported on the backboard 200. Each control module 700 shares cache memory with each other, thereby increasing the cache capacity and speeding up data access from the host computer. In the following description, when the upper and lower control modules are distinguished from each other, the upper control module 700 is referred to as an upper control module 700U, and the lower control module 700 is referred to as a lower control module 700L.</p> <p>Suzuki at 7:29–33: FIG. 2 is a front view of the disk array apparatus 1. The disk array apparatus 1 is constituted from a dedicated rack 10, a plurality of hard disk units 20 received within the rack 10, and a control unit 30 for control of operations, such as data access to each hard disk unit 20.</p> <p>Suzuki at 8:36–49: First, the cooling wind to be created by each fan module 400 will be discussed in detail. The fan module 400 is designed to take in the air streams coming respectively from two inlet paths—namely, air intake holes 401 in the front face of fan module 400, in the vicinity of each fan module 400 decreases due to the operation of each fan module 400, air flows into the battery module 500 from the vent hole 502 on the front surface of the battery module 500. It flows into each fan module 400 via the vent hole 502. Each fan 410, 420 of each fan module 400 sucks air from the intake ports 411, 421, and exhausts the sucked air from the exhaust ports 412, 422 by the rotational force of the fan blades.</p> <p>Suzuki at 9:59–10:10: Next, an explanation will be given of the flow of other cooling winds. Each power supply module 900 is arranged to have built-in air inlet fans 910 on its rear side so that activation of these respective inlet fans 910 causes the outside air to be sucked. When each intake fan 910 is activated, air flows into the front side ducts 104 formed on both sides of the chassis 100 from the air intake holes 103 formed on both sides of the front surface of the chassis 100.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Each front side duct 104 is configured as a dedicated duct for cooling the power supply module 900. The air that has flowed into the front side ducts 104 flows into the power supply modules 900 through the side openings 203 of the backboard 200 as cooling air indicated by reference numeral FS1. The cooling air FS1 flowing into each power supply module 900 cools the inside of each power supply module 900 and is discharged to the outside as exhaust FS2 by each intake fan 910.</p> <p>Suzuki at 10:35–40: An explanation will next be given of the structure of each fan module 400 with reference to FIGS. 5A to 5E. FIGS. 5A–5E are a set of projection drawings, wherein FIG. 5A is a front view, FIG. 5B is a top plan view, FIG. 5C is a right side view, FIG. 5D is FIG. 5D is a left side view. FIG. 5 and FIG. 5 (e) are rear views.</p> <p>Suzuki at 10:41–52: As shown in FIG. 5A, the front part of the fan module 400 is exposed to the front-side opening of the chassis 100, with air intake holes 401 formed therein for intake of the outside air. In addition, as shown in FIG. 5D, air intake holes 402 for intake of the battery module 500 is formed on the side surface of the fan module 400 adjacent to the battery module 500 side. As shown in FIG. 5C, the other side surface of the fan module 400 is adjacent to the front side duct 104 of the chassis 100, so that no air intake hole is formed. This is because each front side duct 104 is a dedicated duct for taking outside air into the power supply module 900.</p> <p>Suzuki at 11:9–18: As previously stated, there are provided to the air inlet port 411, 421 of each fan 410, 420 both an air stream which flows into the fan module 40 from the air intake ports 401 being formed in the front face of fan module 400 and an air stream which flowsttery module 500 is supplied from the battery module 500 and the air intake hole 402 on the side surface of the fan module 400 from 502. In this way, a sufficient air volume can be secured by constructing two types of intake systems.</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	<p>Suzuki at 12:26–41: An explanation will next be given of a dividable structure of the duct member 300 with reference to FIGS. 9A to 9C. FIGS. 9A–9C show portions of projection drawings of the duct member 300, wherein FIG. 9A is a back view, FIG. 9B is a top plan view, and FIG. 9C is a side view of the duct member 300, the cooling air from the inlets 311 and 312 on one side is integrated and guided to the lower outlet 340, and the cooling air from the inlets 321 and 322 on the other side is integrated. The flow paths 350 and 360 are formed so as to be integrated into the upper outlet 330. Further, each of the flow paths 350 and 360 is formed in a shape in which the cooling air from each fan module 400 can easily flow so as to prevent backflow from the chassis 100.</p> <p>Suzuki at 13:29–34: Rectangular side openings 203 which extend in the up/down direction are respectively formed on both of the right and left sides of the back board 200. Each side opening 203 is the one that causes each front side duct 104 of the chassis 100 to communicate with the power supply module 900.</p> <p>Suzuki at 13:35–46: As shown in FIG. 10A, connectors 210 are provided on the front face of the back board 200 at positions corresponding to the battery modules 500, respectively. In addition, as shown in FIG. 10B, there are provided on the rear face of the back board 200 an upper connector 211 connected to a terminal of the upper control module 700U and a lower connector 212 connected to a terminal of the lower control module 700L. And side connectors 213 connected to the respective power supply modules 900 are provided. The backboard 200 is formed with a wiring pattern for electrically connecting the connectors as necessary.</p> <p>Suzuki at 20:63–21:11: Next, the front side ducts 104 are provided on the front side of the back board 200 so that these reside on the both sides within the chassis 100 respectively, for causing the cooling wind from each front side duct 104 to flow into each power supply module 900, the cooling structure of each control module 700 and each power supply module 900 can be separated. That is, in each power supply module 900 that</p>

Exhibit D7 – Suzuki Invalidity Claim Chart for the '265 Patent

Asserted Claims	Suzuki
	generates a large amount of heat but has little function deterioration due to heat generation, the intake fan 910 sucks cooling air from the dedicated front side duct 104 and cools it. In each control module 700 that has a possibility of function deterioration, cooling is performed by forcibly sending cooling air from each fan module 400 through the duct member 300.