



(11) **EP 1 951 020 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07/30/2008 Patent Bulletin 2008/31

(51) Int Cl.:
H05K 7/20 (2006.01)

(21) Application no.: **07001753.8**

(22) Filing date: **01/26/2007**

(84) Designated contracting states:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated extension states:
AL BA HR MK RS

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(54) **Housing for accommodating electrical or electronic devices**

(57) The housing (2) has two self-contained housing sections (3, 5), each of which defines a chamber (7, 9) that is suitable for accommodating electrical or electronic devices (11, 13), wherein the housing sections (3, 5) are arranged spaced apart from one another, so that a ventilation channel (15) is defined between a wall surface (8) of the first housing section (3) and an opposite wall surface (10) of the second housing section (5), which channel is connected to the environment via at least one inlet opening (17) for supplying cool air and at least one outlet opening (19) for dissipating heated air, wherein at least one of the wall surfaces (8, 10) defining the ventilation channel (15) comprises a heat sink (21, 23) consisting of heat-conducting material.

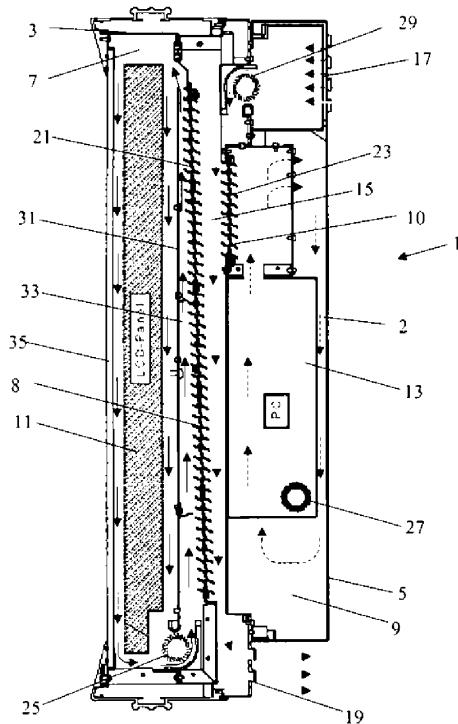


Fig. 1

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Printed by Jouve, 75001 PARIS (FR)

RESPONDENTS003124

CX-1983.00001

Description

[0001] The invention relates to a housing for accommodating electrical or electronic devices in general and, in particular, to a housing system for large-surface electrical or electronic assemblies that can be used in the outdoors.

[0002] Technical innovations have made it possible today to use large-surface display devices for displaying moving images on the basis of flat screens, for example via LCD technology. It is possible to use large-surface monitor systems in the outdoors, e.g. as advertising systems or as information systems in the public realm, for example at airports, train stations, and the like. The desired size of flat screen devices for such use is usually up to 80 inches (approximately 2 meters) in terms of screen diagonals. With the aid of new backlighting technologies, the brightness of the displays can be significantly increased, whereby such systems are also suitable for use in daylight.

[0003] The specifications are particularly high for outdoor use. On the one hand, the monitor systems must be adapted to the climatic conditions, i.e. they must work smoothly in a temperature range from 35°C to approximately + 40°C without damaging the electrical or electronic devices. Furthermore, all electrical and electronic components must be protected against dust and moisture. A further specification is that the monitor system must have a robust and vandalism-proof design in view of its installation or mounting in public rooms or squares. In addition, it must be possible to attach it flexibly and securely on all sides and, if an electrical or electronic assembly fails, it should be able to be replaced quickly and easily.

[0004] According to the current prior art, active cooling or heating systems, which exist in a large number of technologies, are used for such housing systems in the outdoors. These active cooling or heating systems are usually attached to the outside of the housing and cool or heat the portion of the housing to which they are attached. The problem with such active cooling or heating systems is that the cooling surfaces for heat exchange must be protected against solar radiation. For this reason, they are not suitable for flexible use in the outdoors.

[0005] Furthermore, standard heat exchangers that work according to the air/air principle have proven to be unsuitable due to the inflexible design of the cooling surface.

[0006] Therefore, the problem addressed by the present invention is to provide a housing for accommodating electrical or electronic devices that can be used in the outdoors, has a relatively simple structure, provides excellent dissipation of the heat generated by the electrical

devices, and promotes a long service life even under extreme conditions of the accommodated electrical equipment.

[0007] This problem is solved by the features of claim 1.

[0008] According to the invention, a housing having two self-contained housing sections is provided, each of which sections defines a chamber that is suitable for accommodating electrical or electronic devices, wherein the housing sections are arranged spaced apart from one another, so that a ventilation channel is defined between a wall surface of the first housing section and an opposite wall surface of the second housing section, which channel is connected to the environment via at least one inlet opening for supplying cool air and at least one outlet opening for dissipating heated air, wherein at least one of the wall surfaces defining the ventilation channel comprises a heat sink consisting of heat-conducting material. Due to the self-contained housing sections, it is ensured that neither dust nor moisture can penetrate into the electrical or electronic devices.

[0009] Advantageously, at least one heat sink is arranged in each of the two walls. Thus, depending on the positioning of the electrical or electronic devices, a dimensioning of the heat sinks is possible that only takes up a small portion of the wall surface or takes up the entire wall surface.

[0010] Particularly advantageously, a fan is arranged in the first and/or second chamber, which fan is suitable to produce a circulating air flow within the chamber. A circulating air flow ensures that the heat generated is evenly dissipated or that heat is supplied evenly, so that an optimized cooling or heating effect can be achieved.

[0011] Advantageously, at least one fan is arranged in the ventilation channel, which fan is suitable to steer an air flow from the inlet opening in the direction of the outlet opening. The arrangement of a fan in the ventilation channel ensures that the housing can be positioned in any spatial arrangement, i.e. a flow direction of cold air from bottom to top is not necessarily required.

[0012] Advantageously, the fan or each fan is configured as a roller fan. The roller fan ensures that the flow can occur evenly over a large surface area with a single fan.

[0013] Particularly advantageously, the fan or each fan is temperature-controlled. A known temperature control of the fan ensures that the fan consumes less power with lower required cooling capacity and thus saves electricity.

[0014] Preferably, the heat sink or each heat sink comprises a plurality of cooling ribs that are inclined in the direction of the respective air flow. The additional cooling surface of the cooling ribs increases the heat

absorption surface of the heat sink and thus the cooling capacity. In addition, the shape of the cooling ribs ensures that a certain amount of turbulence in the air flow that is guided along the heatsink contributes to a greater cooling effect without excessively slowing down the air flow.

[0015] Advantageously, the heat sink or each heat sink is configured as a molded part consisting of a pressed aluminum alloy. Due to its high thermal conductivity, aluminum is ideally suited as a material for the heat sink. However, it is of course possible to use other heat-conducting materials instead of aluminum. In addition, it is also possible to use casted or otherwise formed aluminum parts.

[0016] Particularly advantageously, a plate is arranged in the first chamber so as to be oblique with respect to the wall surface comprising the heat sink, so that a chamber section tapering in the direction of the air flow is defined between the plate and the wall surface. With this plate, the flow conditions of the resulting warm air can be controlled in a particular manner. Due to the particular arrangement with the tapering chamber section, the flow rate increases due to the Venturi effect.

[0017] Advantageously, at least one outer surface of the housing is configured as a transparent plate. Display devices such as flat screens (LCD, plasma, TFT, etc.) can thus be arranged in the housing sections. The transparent panel itself can consist of any transparent material such as glass, plexiglass, or the like.

[0018] According to the invention, a monitor system for the outdoors is also provided, wherein, in addition to the housing described above, the monitor system comprises a flat screen in the first chamber and a control unit in the second chamber. The control unit can be designed as a standard PC. The technology of the flat screen can be freely selected, e.g. LCD, OLED, or plasma.

[0019] Particularly advantageously, the flat screen in the first chamber is arranged such that a respective cavity is formed on both sides of the flat screen. The circulating air flow flows through these cavities and thus ensures a heat dissipation of the flat screen.

[0020] Preferably, a computer having an integrated fan is arranged in the second chamber, which computer generates an air circulation in the second chamber. The computer can be a commercially available PC having a standard housing in which its own fan provides the air circulation. The housing of the computer can be designed with suitable ventilation slits or holes that provide for circulation of the air flow throughout the chamber.

[0021] Further details, features, and advantages of the present invention result from the following description with reference to the drawing.

[0022] Fig. 1 is a cross-sectional view of a preferred embodiment of a monitor system having the housing according to the present invention.

[0023] In Fig. 1, a preferred embodiment of the present invention is shown in a cross-sectional view. The monitor system 1 comprises a housing 2 which has a first self-contained housing section 3 and a second self-contained housing section 5. These two dust-proof and substantially watertight housing sections 3 and 5 each define a chamber 7 or 9. The chamber 7 comprises an LCD panel 11 in its interior, which is arranged in a stationary manner in the chamber 7 by means of suitable fastening means. In the second chamber 9, which is defined by the second self-contained housing section 5, a commercially available PC with its own housing is arranged, which serves as a control unit 13 for the monitor system 1.

[0024] The two housing sections 3 and 5 are arranged spaced apart from one another in such a way that a ventilation channel 15 is defined between a wall surface 8 of the first chamber 7 and an opposite wall surface 10 of the second chamber 9. The ventilation channel 15 is connected to the outside via an inlet opening 17 and an outlet opening 19 which are respectively formed in the housing 2. The inlet and outlet openings 17 and 19 can be located on the side or on the top and bottom of the housing 2.

[0025] In the illustrated preferred embodiment of the present invention, the wall surfaces 8, 10 defining the ventilation channel 15 each have a heat sink 21, 23. The first heat sink 21 extends over nearly the entire wall surface 8 of the first housing section 3 facing the ventilation channel 15. The second heat sink 23 is arranged in the upper region of the wall surface 10 of the second housing section 5 and is much smaller in area than the first heat sink 21.

[0026] An essential property of the heat sinks 21, 23 is their thermal conductivity. They are therefore made of a material that conducts heat very well, for example a casted aluminum alloy. In addition, it is necessary for an optimal heat exchange function that the heat sinks 21, 23 have the largest possible surface area. In the preferred embodiment of the present invention, this is achieved by a plurality of cooling ribs that are formed so as to be inclined in the direction of the respective air flows. This offers the particular advantage that the air turbulence caused by the cooling ribs is relatively large in the shape described herein and therefore ensures that the air flows circulate in the area of the cooling ribs without slowing down the air flow too much. The heat dissipation is consequently increased by the special shape and inclination of the cooling ribs. Of course, other shapes of the heat sink and cooling ribs are also possible.

[0027] As can be seen from Fig. 1, a fan 25, e.g. a roller fan, is also arranged in the first closed housing section 3. The fan 25 generates an air flow within the chamber 7 along the first heat sink 21. Similarly, the fan 27, which is arranged in the chamber 9 and is designed as an axial fan, generates an air flow that circulates within the chamber 9 and passes by the second heat sink 23. In the embodiment shown in FIG. 1, the fan 27 is arranged inside the housing of the control unit 13. The circulating air flow within the second chamber 9 is indicated by dashed arrows. It runs through the housing of the control unit 13 through an opening in the housing of the control unit 13 along the heat sink 23, then into the interstice between the outer wall surface of the second housing section 5 and the housing of the control unit 13, in order to then flow back into the housing of the control unit 13 via suitable openings.

[0028] In the ventilation channel 15, there is a fan 29 on one side, which is likewise designed as a roller fan, for example. It is configured so as to suck in the ambient air outside of the housing 2 via the inlet openings 17 and to give the air flow in the ventilation channel 15 such a direction and flow rate that it exits the housing 2 again at the outlet opening 19.

[0029] In addition to the LCD panel 11 and the fan 25, a plate 31 is also arranged in the chamber 7 so as to be oblique with respect to the first heat sink 21 and thus to the wall surface 8 of the chamber 7. This defines a tapering chamber section 33 through which the flow of air heated by the LCD panel 11 flows, being directed by the fan 25. Due to the tapering shape of the chamber section 33, the air flow is accelerated by the Venturi effect in the direction of the narrowing end, although the desired turbulence on the cooling ribs of the first heat sink 21 counteracts this to a certain extent.

[0030] A transparent plate 35 forms the outer wall surface of the first housing section 3. The transparent plate 35 is preferably made of shatterproof glass or glass-like plastic such as polymethyl methacrylate or the like in order to protect the electric or electronic devices against damage. The LCD panel is arranged inside the chamber 7 along with the plate 31 and the fan 25 in such a way that an even flow of air is generated along the long side faces of the LCD panel on both sides, respectively. As a result, the heat of the LCD panel is carried away and directed into the tapering chamber section 33 with the aid of the fan 25.

[0031] In the following, the functionality of the heat exchange function of the housing 2 according to the invention or of the monitor system 1 is described. In the two self-contained housing sections 3 and 5, which define the chambers 7 and 9, two independent streams of warm air circulate. The first stream of warm air

around the LCD panel 11 absorbs the dissipated heat of the LCD panel 11, which is approximately 100-500 W, depending on the size of the panel 11. By contrast, the dissipated heat of the PC 13 in the second housing section 5, including the power supply for the screen, is considerably lower, in a range between 50 and 100 W. The surface area of the second heat sink 23 is therefore also significantly smaller compared to the surface area of the first heat sink 21. The two air streams circulating in the respective chambers 7 and 9 transfer their heat to the heat sinks 21 and 23, respectively. The cool air flow accelerated by the fan 29 in the ventilation channel 15, which is indicated by dotted arrows in Fig. 1, absorbs the heat transported inwards by the two heat sinks 21 and 23 via the internal cooling ribs, heats up accordingly, and there exits the housing 2 again.

[0032] All of the fans 25, 27, 29 are temperature-controlled, and their flow rate thus depends on the streams of warm air to be transported, which run in the channels and chambers. The fans designed as roller fans have a throughput rate of up to 3,000 m³/h.

[0033] The plate 31, which is arranged between the first heat sink 21 and the back of the LCD panel 11, furthermore has the following effect: Because the monitor arrangement must also function smoothly even at very low temperatures, down to -35° C, a fogging of the large-surface LCD panel 11 must be prevented. The plate 31 ensures, among other things, that the air flow around the LCD panel 11 is as uniform as possible. In order to prevent freezing at very low temperatures, the control device 13 can be configured so as to only control the backlighting of the panel 11, for example.

[0034] By controlling the air flows via fans in the preferred embodiment of the present invention, it is possible for the monitor arrangement 1 according to the invention to be arranged at any location in the space and to be fully rotatable. It is also possible to arrange an LCD panel 11 on both sides of the monitor arrangement 1, wherein it should be noted that an appropriate size of the second heat sink 23 must then be chosen in order to compensate for the greater dissipated heat of the second panel. In addition, it is also possible to use a control unit derived from a small, portable computer instead of a commercially available PC 13. In this way, space can be saved and the heat output to be dissipated by the control unit 13 can be reduced to less than 20 W, for which reason the second heat sink 23 can also be omitted entirely, if desired.

[0035] It should be noted that the power supply of the LCD panel 11 is not shown in Fig. 1 in the preferred embodiment of the present invention. It is located next to the control unit 13 within the second housing section 5. As already mentioned, its dissipated heat is also

conducted to the second heat sink 23 via the air flow circulating in the second chamber 9.

[0036] This has created a monitor system that is simple in design, can be used in the outdoors, and in which, due to the arrangement of the heat sink and the ventilation channel inside the housing, the cooling effect cannot be limited from the outside. At the same time, it is possible to dissipate the entire generated heat output via two circuits that are isolated from one another.

Claims

1. A housing (2) having two self-contained housing sections (3, 5), each of which defines a chamber (7, 9) that is suitable for accommodating electrical or electronic devices (11, 13), wherein the housing sections (3, 5) are arranged spaced apart from one another, so that a ventilation channel (15) is defined between a wall surface (8) of the first housing section (3) and an opposite wall surface (10) of the second housing section (5), which channel is connected to the environment via at least one inlet opening (17) for supplying cool air and at least one outlet opening (19) for dissipating heated air, wherein at least one of the wall surfaces (8, 10) defining the ventilation channel (15) comprises a heat sink (21, 23) consisting of heat-conducting material.
2. The housing (2) according to claim 1, **characterized in that** at least one heat sink (21, 23) is arranged in each of the two walls (8, 10).
3. The housing (2) according to claim 1 or 2, **characterized in that** a fan (25, 27) is arranged in the first and/or second chamber (7, 9), which fan is suitable to produce a circulating air flow within the chamber (7, 9).
4. The housing (2) according to any of the preceding claims, **characterized in that** at least one fan (29) is arranged in the ventilation channel (15), which fan is suitable to steer an air flow from the inlet opening (17) in the direction of the outlet opening (19).
5. The housing (2) according to claim 3 or 4, **characterized in that** the fan or each fan (25, 27, 29) is configured as a roller fan.
6. The housing (2) according to any of the claims 3 to 5, characterized in that the fan or each fan (25, 27, 29) is temperature-controlled.
7. The housing (2) according to any of the preceding claims, characterized in that the heat sink or each heat sink (21, 23) comprises a plurality of cooling ribs that are inclined in the direction of the respective air flow.
8. The housing (2) according to any of the preceding claims, **characterized in that** the heat sink or each heat sink (21, 23) is configured as a molded part consisting of a pressed aluminum alloy.
9. The housing (2) according to any of the preceding claims, **characterized in that** a plate (31) is arranged in the first chamber (7) so as to be oblique with respect to the wall surface (8) comprising the heat sink (21), so that a chamber section (33) tapering in the direction of the air flow is defined between the plate (31) and the wall surface (8).
10. The housing (2) according to any of the preceding claims, **characterized in that** at least one outer surface of the housing (2) is configured as a transparent plate (35).
11. A monitor system (1) for the outdoors, having a housing (2) according to any of the claims 1 to 10, wherein the monitor system comprises a flat screen (11) in the first chamber (7) and a control unit (13) in the second chamber (9).
12. The monitor system (1) for the outdoors according to claim 11, wherein the flat screen (11) in the first chamber (7) is arranged such that a respective cavity is formed on both sides of the flat screen.
13. The monitor system (1) for the outdoors according to claim 11 or 12, wherein a computer having an integrated fan (27) is arranged in the second chamber (9), which computer generates an air circulation in the second chamber (9).

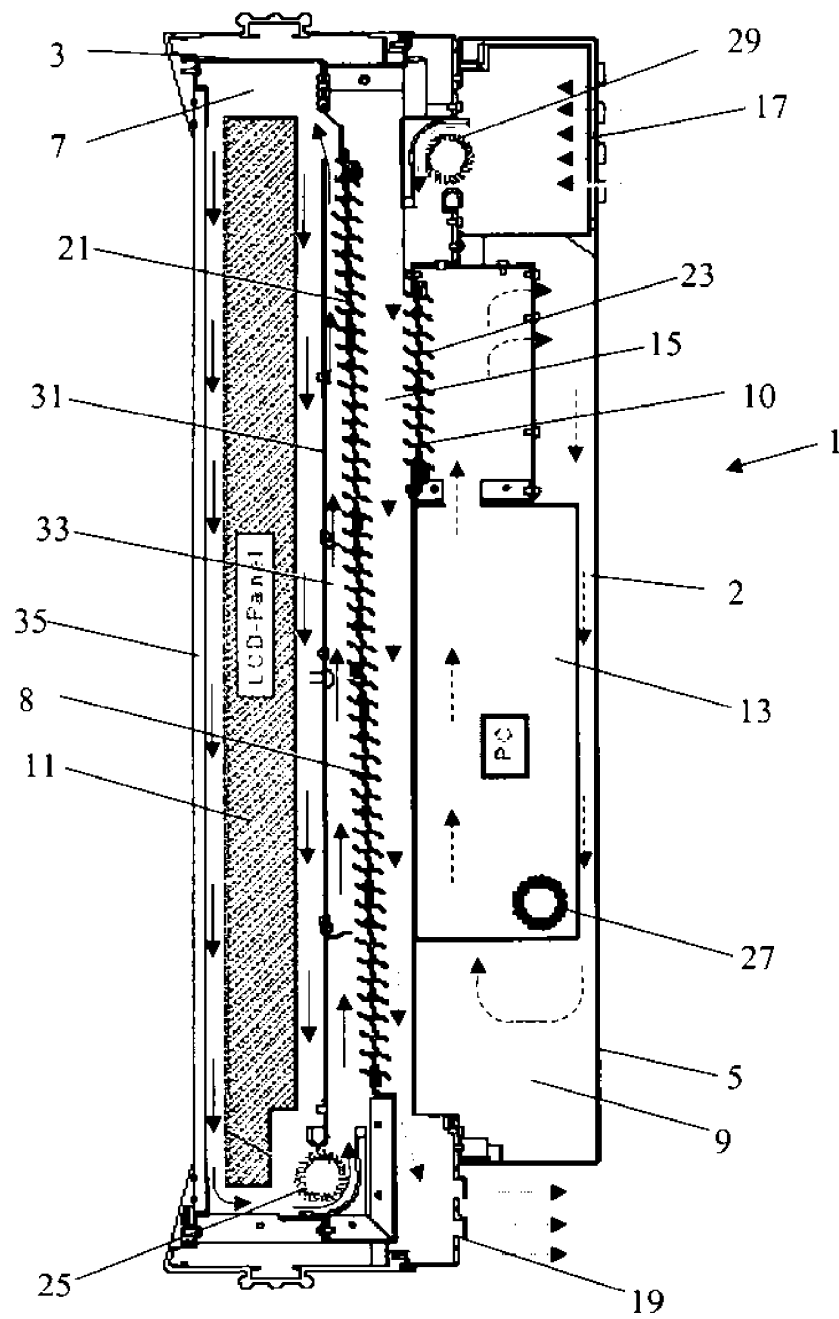


Fig. 1



European
Patent Office EUROPEAN SEARCH REPORT

Application no.
EP 07 00 1753

RELEVANT DOCUMENTS			
Category	Citation of document, with indication, where appropriate of the relevant passages	Relevant to claim no.	CLASSIFICATION OF APPLICATION (IPC)
A	GB 2 402 205 A (DENSITRON TECHNOLOGIES PLC [GB]) December 1, 2004 (2004-12-01) * the entire document *	1	INV. H05K7/20
A	WO 2006/098365 A (MATSUSHITA ELECTRIC IND CO LTD [JP]; YANAGAWA HIROTO; TAKEZAWA HIROAKI) September 21, 2006 (2006-09-21) * the entire document *	1	
E	FR 2 891 940 A (COTEP SA [FR]) April 13, 2007 (2007-04-13) * the entire document *	1	
			FIELDS SEARCHED (IPC)
			H05K
This search report was created for all patent claims.			
Search location The Hague		Date search completed June 11, 2008	Examiner Toussaint, François
<p>CATEGORIES OF THE CITED DOCUMENTS</p> <p>X: of special importance when considered alone Y: of special importance in conjunction with another publication of the same category A: technological background O: non-written disclosure P: intermediate document</p> <p>T: theories or principles underlying the invention E: older patent document that was not published until on or after the application date D: document cited in the application L: document cited for another reason &: member of the same patent family, matching document</p>			

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ATTACHMENT TO EUROPEAN SEARCH REPORT
FOR THE EUROPEAN PATENT APPLICATION NO.

EP 07 00 1753

This attachment lists the members of the patent families of the patent documents listed in the above-entitled European search report.

This information about the family members corresponds to the state of the file of the European Patent Office as of:
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Patent document listed in the search report		Date of publication	Member(s) of the patent family	Date of publication
GB 2402205	A	12/01/2004	NONE	
WO 2006098365	A	09/21/2006	NONE	
FR 2891940	A	04/13/2007	NONE	

For further details of this attachment, see the Official Bulletin of the European Patent Office, no. 12/82

RESPONDENTS003131

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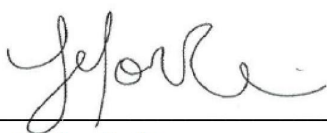
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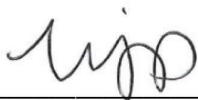
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