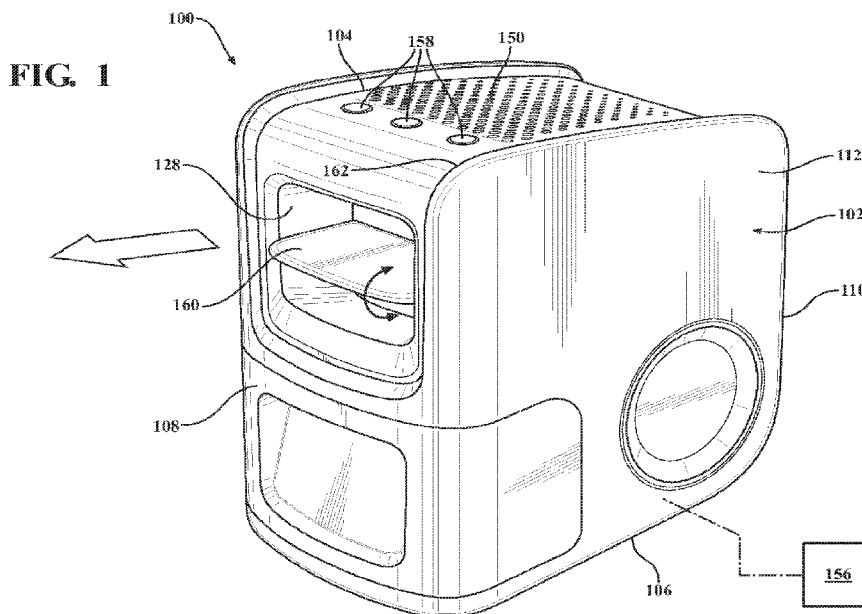




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(54) Title: PELTIER EFFECT DRIVEN AIR COOLER



(57) Abstract: According to these and other aspects of the disclosure, an air cooling device is provided. The air cooling device includes a housing that defines a compartment. A Peltier module at least partially divides the compartment into a first chamber and a second chamber. The Peltier module has a cooled surface located in the first chamber and a heated surface located in the second chamber. The housing defines a first opening fluidly connected to the first chamber. A first fan is located in first chamber and is configured to emit air from the first chamber that has been cooled by the cooled surface of the Peltier module through the first opening.



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GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 23/10277

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. F25B 21/04 (2023.01)

- ADD. F24F 1/02 (2023.01)

CPC - INV. F24F 5/0042, F25B 21/04

ADD. F24F 2221/12, F24F 2221/38, F24F 1/02

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

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

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- A	WO 2021/172882 A1 (LG Electronics Inc) 2 September 2021 (02.09.2021), entire document, especially Fig. 1-2, page 4 paragraph 6, 7, 8, 11, page 5 paragraph 3, 4, 7	1-3, 7-9 ----- 4-6, 10-11
A	CN 110671771 A (Tao) 10 January 2020 (10.01.2020), entire document	1-11
A	CN 102052737 A (Dong et al.) 11 May 2011 (11.05.2011), entire document	1-11
A	US 2021/0076849 A1 (Daikin Industries Ltd) 18 March 2021 (18.03.2021), entire document	1-11
A	WO 2006/030901 A1 (Japan Exlan Company Limited) 23 March 2006 (23.03.2006), entire document	1-11

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 23/10277

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-*- See Extra Sheet -*-

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-11

- Remark on Protest**
- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 23/10277

--- Continuation of Box No. III ---

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows:

The embodiments are directed to an air cooling device.

Group I: directed to a divider extending across the compartment in a horizontal direction such that the first chamber is located beneath the divider and the second chamber is located above the divider and above the first chamber, wherein the divider defines a slot, and wherein the Peltier module is located in the slot of the divider. (Fig. 1-4)

Group II: directed to a box located in the compartment and defining the first chamber, and wherein the second chamber is located outside of the box in the compartment. (Fig. 5)

Group III: directed to the housing having an outside wall extending annularly about an axis and defining the compartment, an inside wall having a tube shape and extending annularly about the axis at a location that is radially inward of the outside wall and defining a channel of the compartment along the axis, wherein the Peltier module is located in the channel along the axis and separates the channel into the first chamber and the second chamber. (Fig. 6-7)

The claims are deemed to correspond to the species listed above in the following manner:

Group I claims 1-11 (as directed to a divider extending across the compartment in a horizontal direction)

Group II claims 1-9, 12-15 (as directed to a box located in the compartment and defining the first chamber)

Group III claims 1-9, 16-20 (as directed to an outside wall and inside wall)

Claims considered as generic: 1-9

*Note: see Note below.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Common Technical Features

The features shared by the inventions of Group I-III are an air cooling device, comprising: a housing defining a compartment; a Peltier module at least partially dividing the compartment into a first chamber and a second chamber, wherein the Peltier module has a cooled surface located in the first chamber and a heated surface located in the second chamber; the housing defining a first opening fluidly connected to the first chamber; and a first fan located in first chamber and configured to emit air from the first chamber that has been cooled by the cooled surface of the Peltier module through the first opening.

However, these shared technical features do not represent a contribution over prior art, because the shared technical features are taught by WO 2021/172882 A1 to LG Electronics (hereinafter "LG").

LG discloses an air cooling device (See Fig. 1, the air cooling device is shown.), comprising: a housing (Fig. 1, case 11, page 4 paragraph 6) defining a compartment (See Fig. 1, a compartment is shown in the housing 11.); a Peltier module (Fig. 2, first thermoelectric element 15, first indoor heat exchanger 151, first outdoor heat exchange unit 152, page 5 paragraph 4) at least partially dividing the compartment into a first chamber (Fig. 2, first area S1, page 4 paragraph 11) and a second chamber (Fig. 2, second area S2, page 4 paragraph 11), wherein the Peltier module has a cooled surface (Fig. 2, indoor heat exchange surface 151a, page 5 paragraph 7) located in the first chamber and a heated surface (Fig. 2, outdoor heat exchange surface 152a, page 5 paragraph 7) located in the second chamber; the housing defining a first opening (Fig. 2, indoor discharge port 141, page 4 paragraph 6) fluidly connected to the first chamber; and a first fan (Fig. 2, blowing fan 143, page 4 paragraph 7) located in the first chamber and configured to emit air from the first chamber that has been cooled by the cooled surface of the Peltier module through the first opening ("When the indoor blower fan 143 operates, the bet air is introduced into the case 11 and heat exchange occurs, then cold or warm air may be supplied to the room through the indoor outlet 141.", page 4 paragraph 7) (Note: See Note below).

As the technical features were known in the art at the time of the invention, they cannot be considered a special technical features that would otherwise unify the groups.

Groups I-III therefore lack unity of invention under PCT Rule 13.