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Published:

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(54) Title: DEVICE FOR CONTROLLING AND DIRECTING AIR FLOW FOR CONDENSERS

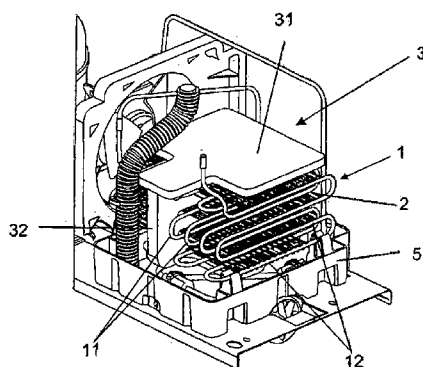


FIG. 4

(57) Abstract: The present invention relates to a device for controlling and directing air flow for condensers, more specifically a device that has been developed to allow the reduction of air flow through the condenser without impairing the performance of the same, and also to reduce the vibrations of the tubes of the condenser, hence resulting in decreased noise levels. Said controlling and directing device (3) comprises at least one body removably attachable to the condenser (1), said body comprised of at least two plates (31), (32) cooperating with each other, whereas one of the plates (32) is positioned between at least two vertical pipes (11), while the other plate (31) is located over the condenser (1), whereas the coupling of the device (3) to the condenser (1) creates at least two flow regions (4) adjacently delimited, above and on at least one side, by the at least two boards (31) (32).

"DEVICE FOR CONTROLLING AND DIRECTING AIR FLOW FOR CONDENSERS"

Field of the Invention

The present invention relates to a device for controlling and directing air flow for condensers, more specifically to a device that was developed to allow an air flow reduction through the condenser without impairing the performance of the same, and also to reduce the vibrations of the condenser tubes, hence resulting in lower noise levels.

Background of the Invention

As is well known on the art, the refrigerating cycle of the coolers equipment in general is basically composed of three main elements: compressor, evaporator and condenser, the condenser being the component responsible by cooling the hot compressed vapors from the compressor, making them go from the gaseous state to the liquid state.

Usually domestic refrigerators are provided of air cooled condensers, since the cooling gas loses absorbed heat throughout the system to the environment, wherein such cooling may be provided by natural circulation (by the existence of fins that increase the contact surface with the air) or in a forced manner through the use of a fan that acts as an air exhaust.

Currently refrigerators appliances that use condensers with forced circulation have such components installed on the compressor C housing – as, for example, the embodiment described on document MU8901406-5 – which allows a more compact installation. However, as may be better seen through the air flow scheme depicted on Figure 1, such an embodiment has the drawback of hindering the maintenance of a low condensation temperature to reduce energy consumption. In addition, with said arrangement of the components the heat transfer in the condenser 1 is not made uniformly, which causes high noise besides maintaining a region of the same showing low rate of heat transfer.

Another drawback observed in known similar machines refers to the vibration of the condenser which is kept in balance over the water tray, as its natural frequency is very close to the operating frequency of the fan motor V, which makes the capacitor vibrate generating high noise levels.

One of the solutions employed by the current technique to try to solve the problem of heat transfer was to increase the area of the condenser, resulting additionally in a significant increase in the manufacturing costs of the system.

It is therefore observed that the current state of the art lacks of solutions that maximize efficiency of condensation without, thereby raising the noise levels of the system as well as the manufacturing costs involved.

Objectives of the Invention

Therefore, it is an objective of this invention to provide a device for controlling and directing that allows altering the path of the air flow through the condenser of the cooling system.

Another objective of the invention is to provide a directing device that reduces the velocity of air that runs through the pipes constituents of the system condenser.

Accordingly, one of the objectives of this invention is to provide a better distribution of air flow over the entire surface of the condenser and, thereby, improve the efficiency of the system heat transfer.

Other objective among the objectives of the invention is to provide a device for controlling and directing air flow to help reduce the vibration of the condenser constituents tubes and consequently of the component as a whole during its operation.

In addition, it is an objective of this invention to provide a device that allows minimizing the noise levels coming from the operation of the cooling system.

Summary of the Invention

The above objectives are achieved by a device for controlling and directing air flow for condensers comprised of pipes shaped so as to present a structure of several vertical pipes of bent tubes in a sinuous trajectory, the pipes being joined together by vertical means of transverse flaps.

In a preferred embodiment of the invention, said directing and control device comprises at least one body removably attached to the condenser, said body comprised of at least two plates cooperating with each other, with one plate being positioned between at least two vertical pipes, while the other plate is located over the condenser, whereas the device coupling to the condenser creates at least two adjacent flow regions defined, above and on at least one side, by at least two plates.

Preferably the at least two plates are arranged orthogonal to each other and comprise a T shaped body.

Also according to one of the preferred embodiments of the invention, at least two plates cooperate with one another by one of the following means: welding, fitting, interference or fixating elements.

The vertical plate will be preferably coupled between the vertical pipes of the condenser, and will present cavities for coupling the cross fins of the condenser.

The present invention therefore, includes means for reducing the velocity and directing the flow of air that crosses the tubes and transversal flaps of the condenser.

Brief Description of the Drawings

The present invention will be described in details based on the attached drawings, in which:

Figure 1 shows a schematic diagram of the air flow inside a housing of the compressor for refrigeration systems of the present state of the art;

Figures 2.1, 2.2, 2.3 and 2.4 show, in anterior and posterior perspectives, devices for directing and controlling air flow for condensers according to some preferred embodiments of the present invention;

Figure 3 shows an anterior view of the device for controlling and directing of the present invention;

Figure 4 shows a perspective view of a device according to the present invention, suitably coupled to a condenser;

Figure 5 shows the schematic diagram of air flow on the inside of a housing of a compressor for cooling systems using the device for controlling and directing air flow built accordingly to a preferred embodiment of the present invention;

Figure 6 shows a table comparing the measured levels of performance in a cooling system, with and without the use, of the device for controlling and directing air flow of the present invention; and

Figure 7 shows a set of test results among which factor I represents the degree of noise reduction achieved with the use of the device of the present invention.

Detailed Description of the Invention

The present invention will be described in details based on the attached drawings, to which will be allocated numerical references to facilitate its understanding.

The device for controlling and directing air flow of the present invention is intended primarily for use with condensers 1 comprising a pipe shaped so as to present a structure of several vertical pipes 11 of bent tubes in sinuous trajectory 12, and the vertical pipes 11 joined together by two transverse flaps 2.

As can be best seen in Figures 2.1 to 2.4 appended, said device 3 comprises a substantially T-shaped body, which is defined by two plates 31, 32 arranged orthogonally to each other, and one of these plates 32 is positioned between two vertical pipes 11, preferably in the central region of the condenser 1, while the other plate 31 is located over the condenser 1.

In Figure 3 it can be noted that the coupling device 3 at the condenser 1 ends up to divide the passage area of the air flow into two flow regions 4 adjacently defined, in the upper and central portions, by the device 3 and on the lower portion by the support element 5 of the condenser 1.

It should be noted that in the embodiment illustrated in the appended figures, the vertical plate 32 of the device 3 cooperates with the central axis of the horizontal plate 31, but other orthogonal placements are allowed between the plates 31 and 32 provided that it is possible the conformation of at least two regions 4 of the air flow passage.

Furthermore, the plates 31 and 32 may be supportive or cooperate through interference fit, or using any fixating elements, without thereby escaping the scope of protection claimed.

Preferably, the plate 32 which will be coupled between the vertical pipes of the condenser 11 must provide indentations or recesses 321 for allowing coupling of the two transverse fins 2.

On the other hand top plate 31 may have quadrangular surface or be provided with cutouts 311 for enabling the passage of any other components of the cooling system.

Thus, the presented device acts as a barrier that forces the air flow to traverse the entire longitudinal length of the condenser tubes thereby maximizing heat transfer obtained during the journey. This result is obtained by both inhibiting the possibility of the air flow to follow into the fan before it reaches the end of the pipes due to vertical plate 32, as well as the impossibility of air escape through the top of the condenser, which is blocked by plate top 31.

With the device of the present invention, the air enters the compressor housing (path indicated by arrows) flows through the entire length of the condenser and then flows toward the fan as can be seen in Figure 5 attached, using the entire surface of the condenser thus improving the heat transfer system.

Moreover, it is precisely the uniformity of heat transfer which helps to reduce the vibration of the condenser tubes 1 and hence of noise levels.

The device for controlling and directing the flow of air may be preferably produced in plastic material or EPS (expanded polystyrene), or other suitable material.

In order to demonstrate the technical solution obtained for the problems of acoustic and overall performance observed in the similar ones existing, various tests were performed with the device of the present invention suitably coupled to a condenser, whose results are shown in Figures 6 and 7. In general, it is achieved a reduction of the condensation temperature of 4 ° C and 1.2 dBA reduction in noise levels.

It is noteworthy that, although there have been shown preferred mounting of the present invention, it is understood that any omissions, constructive substitutions and alterations can be made by those skilled in the art, without departing from the spirit

and scope of protection required. It is also expressly foreseen that all combinations of elements that perform the same function in substantially the same way to achieve the same results are within the scope of the invention. Substitutions of elements of a type described by others are also fully intended and contemplated.

CLAIMS

1. Device (3) for controlling and directing air flow for condensers (1) comprising a pipe shaped so as to present a structure of several vertical pipes (11) of bent tubes into a sinuous trajectory (12), and the vertical pipes (11) joined together by transverse flaps (2), CHARACTERIZED in that

said controlling and directing device (3) comprises at least one body removably attachable to the condenser (1), said body comprised of at least two plates (31, 32) cooperating with each other, and one of the plates (32) is positioned between at least two vertical pipes (11), while the other plate (31) is located over the condenser (1), and that the coupling of the device (3) to the condenser (1) establishes at least two flow regions (4) adjacently delimited above and on at least one side by at least two plates (31, 32).

2. Device according to claim 1, CHARACTERIZED in that the at least two plates (31, 32) are arranged orthogonal to each other.

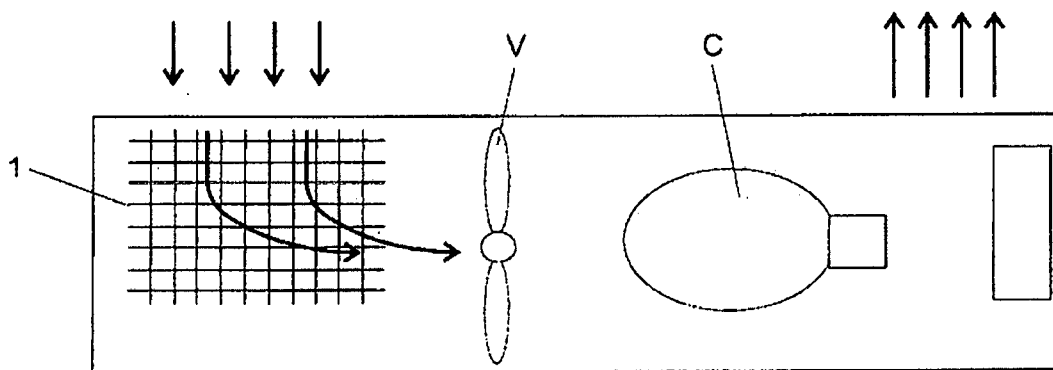
3. Device according to claim 1, CHARACTERIZED in that the at least two plates (31, 32) comprises a T shaped body.

4. Device according to claim 1, CHARACTERIZED in that the at least two plates (31, 32) cooperate with each other by one of the following methods: welding, fitting, interference or fixating elements.

5. Device according to claim 1, CHARACTERIZED in that the plate (32) is coupled between the vertical pipes (11) of the condenser.

6. Device according to claims 1 and 5, CHARACTERIZED in that the plate (32) presents cavities (321) for coupling the transverse flaps (2) of the condenser (1).

7. Device for controlling and directing of air flow for condensers, CHARACTERIZED in that it comprises means for reducing velocity and directing the air flow through the tubes (11, 12) and transverse flaps (2) of the condenser (1).



PRIOR ART
FIG. 1

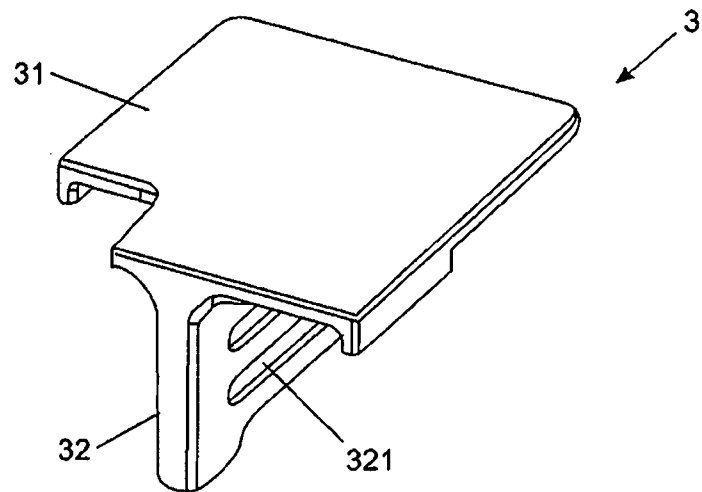


FIG. 2.1

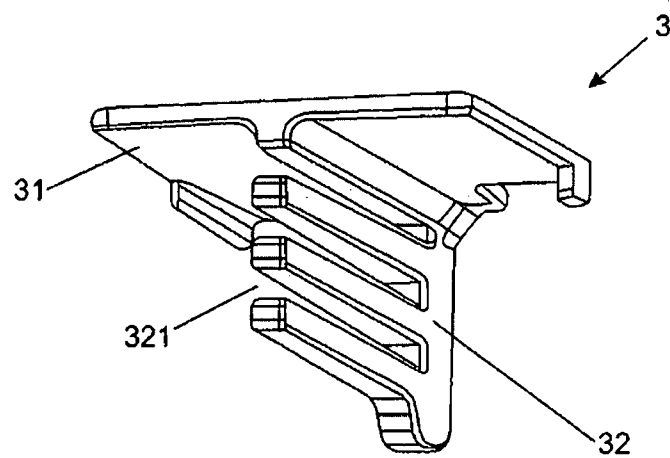


FIG. 2.2

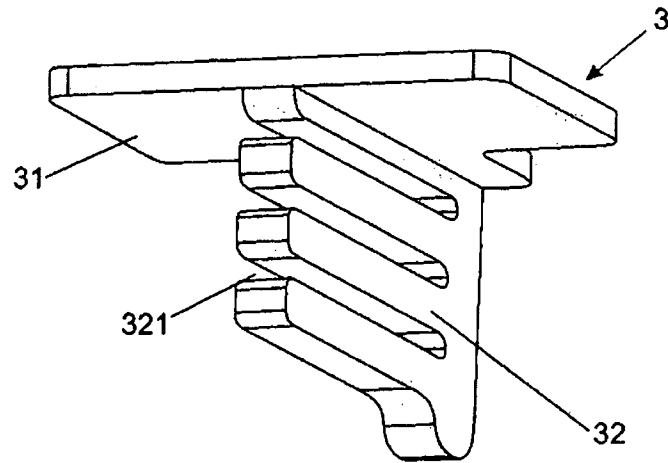


FIG. 2.3

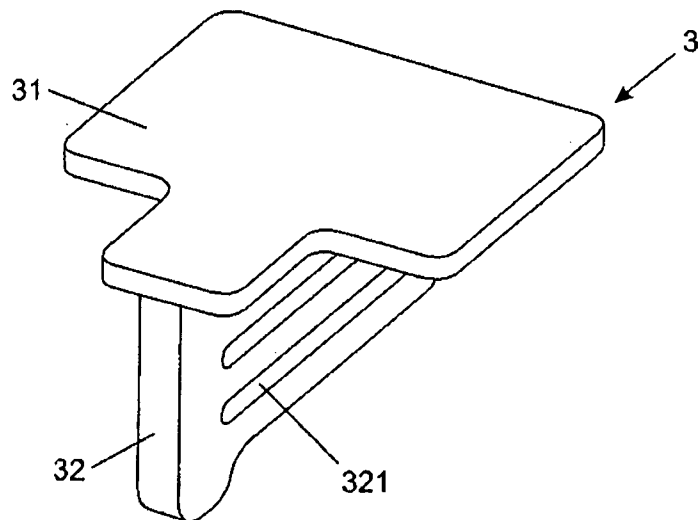


FIG. 2.4

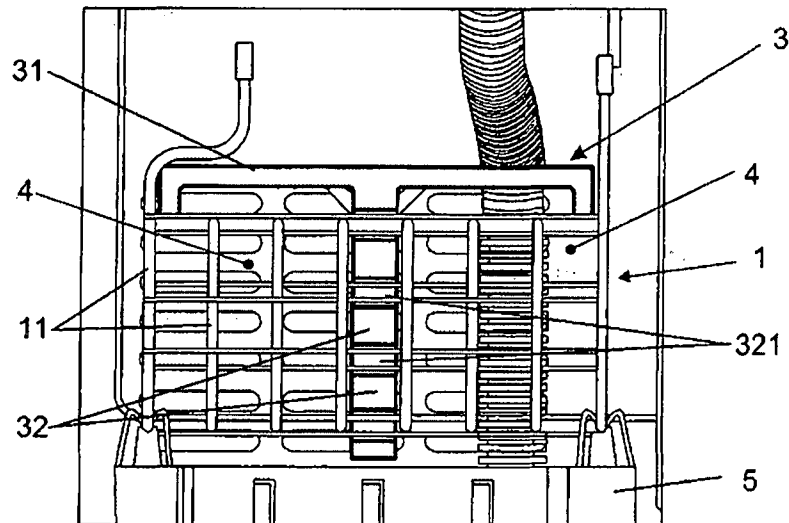


FIG. 3

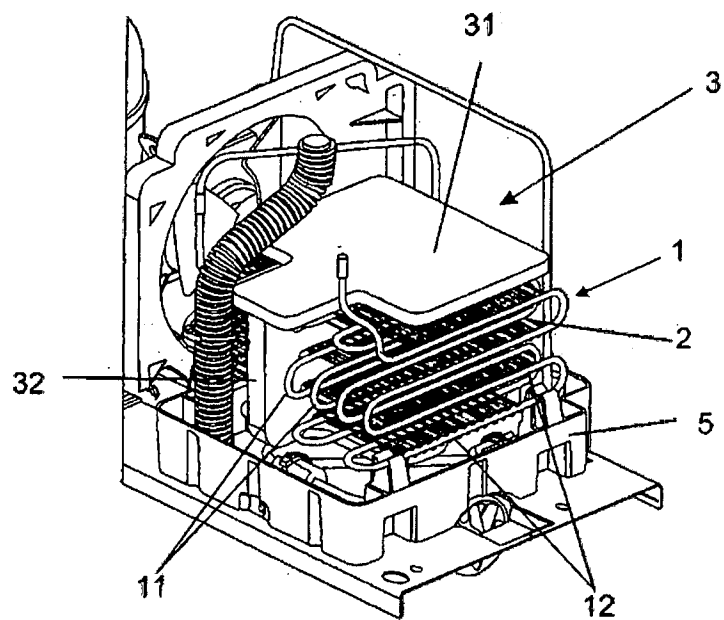


FIG. 4

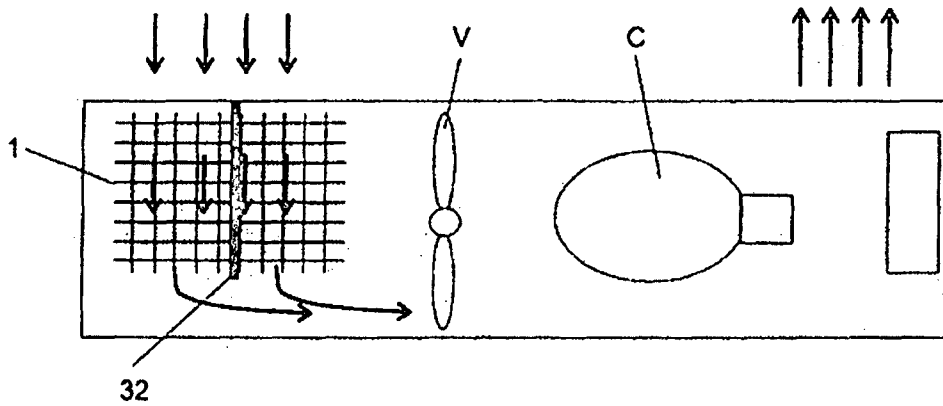


FIG. 5

Variable	With the device	Without the device
Freezer	-21,7	-20,6
Inner compartment	-4,9	-5,8
Comp. dome	66,5	74,0
Comp. discharge	77,8	83,7
Exit cond.	53,3	57,6
Heat removal exit	52,7	56,0
Evaporator inlet	-26,3	-25,8
Evaporator inlet/ discharge sensor	-26,8	-26,4

FIG. 6

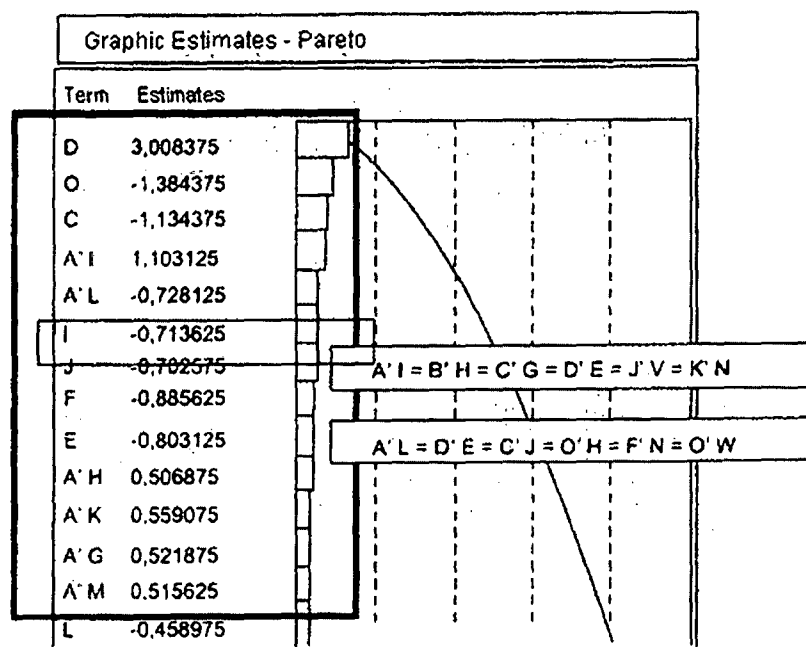


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2013/000293

A. CLASSIFICATION OF SUBJECT MATTER
INV. F25D23/00
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25D

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2003 287342 A (TOSHIBA CORP) 10 October 2003 (2003-10-10) abstract; figures 4,6 paragraphs [0039], [0041] -----	1-6
X	KR 2007 0065512 A (LG ELECTRONICS INC [KR]) 25 June 2007 (2007-06-25) abstract; figures 1-3 -----	1-6



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

"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

12 November 2013

Date of mailing of the international search report

22/11/2013

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/BR2013/000293

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.: 7
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:
see FURTHER INFORMATION sheet PCT/ISA/210
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:

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 an 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.:

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 7

Claim 7 does not meet the requirements of Article 6 PCT because the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved (see "means for reducing velocity and directing the air flow through the tubes (11, 12) and transverse flaps (2) of the condenser (1)"), which merely amounts to a statement of the underlying problem, without providing the constructional features necessary for achieving this result.

It is therefore impossible to determine the scope of claim 7 and carry out a meaningful search for said claim.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/BR2013/000293

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2003287342 A	10-10-2003	NONE	

KR 20070065512 A	25-06-2007	NONE	
