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D E C I S I O N
of 9 May 2000

Case Number: T 1203/97 - 3.2.3

Application Number: 90904972.8

Publication Number: 0462199

IPC: F24F 6/12, F24F 12/00

Language of the proceedings: EN

Title of invention:
Air conditioning unit

Patentee:
Recup Svenska AB

Opponent:
Recotech Heatex AB
Menerga Apparatebau GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - obvious combination of known features"

Decisions cited:
-

Catchword:
-



Case Number: T 1203/97 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 9 May 2000

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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 7 November 1997
revoking European patent No. 0 462 199 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: C. T. Wilson

Members: U. Krause
J. P. B. Seitz

Summary of Facts and Submissions

I. The present appeal is directed against the decision of the Opposition Division, dated 17 September 1997 and issued in writing on 7 November 1997, on the revocation of European Patent No. 0 462 199.

II. The patent was granted on 26 July 1995 with a single independent claim which reads as follows:

"1. Air conditioning unit, comprising

- a duct (12) for conveying supply air through the unit;
- a duct (26) for conveying exhaust air through the unit;
- a heat exchanger (16) in which the supply air duct and the exhaust air duct are linked with one another in heat-exchanging relationship and which comprises an exhaust air passage system including an exhaust air inlet at the top of the heat exchanger and an exhaust air outlet at the bottom of the heat exchanger, a substantially vertical section (15,15') of the exhaust air duct (26) following immediately after the exhaust air outlet; and
- a watering device (20) including means for supplying water to the exhaust air passage system at the exhaust air inlet and means (21) for collecting water draining off from the exhaust air outlet, the water collecting means (21) being adapted also to collect water flowing out of the

said vertical section of the exhaust air duct (26),
in which air conditioning unit
a substantially horizontal section (26A) of the exhaust air duct (26) located upstream of the heat exchanger (16) and a substantially horizontal further section (26B) of the exhaust air duct located downstream of said vertical section (15) of the exhaust air duct are disposed substantially in alignment with the bottom walls of said horizontal exhaust air duct sections (26A,26B) disposed approximately level with the exhaust air inlet of the heat exchanger (16) and with the upper end of said vertical exhaust air duct section (15,15'),

characterised in that

the heat exchanger is a plate heat exchanger, and a barrier (28) is disposed between the adjacent ends of the horizontal exhaust air duct sections (26A,26B) and provided with a damper (29) for controlled bypassing of exhaust air past the heat exchanger (15)."

III. Notice of opposition was filed by the Respondents I and II (Opponents I and II) who requested revocation of the patent on the grounds of lack of novelty and inventive activity (Article 100(a) EPC). In support of the oppositions, the following documents *inter alia* were cited by the appellants:

(D1) GB-A-2 160 963

(D2) WO 84/03756

(D3) Information sheet Hoval Systemtechnik Info-Blatt Nr. 2.1.01.00 Hoval LHW-30, dated 03/79, of Gustav

Ospelt Hovalwerk Aktiengesellschaft, Austrasse 70,
FL-9490 Vaduz/Liechtenstein

(D6) Lueger, Lexikon der Technik, Deutsche Verlags-
Anstalt Stuttgart, 4th edition 1970, vol. 16,
pages 562 to 564

IV. The Opposition Division held that the subject-matter of claim 1 was obvious in view of documents (D1) and (D3). Thus, the grounds for opposition mentioned in Article 100(a) together with 52(1) and 56 EPC prejudiced the maintenance of the patent.

V. The Appellant (proprietor of the patent) filed the notice of appeal on 17 December 1997. The appeal fee was paid on 19 December 1997 and the statement of the grounds of appeal was filed on 16 March 1998.

VI. The Appellant requests that the decision under appeal be set aside and the patent be maintained.

The Respondents I and II request that the appeal be dismissed.

VII. In a communication issued on 30 July 1999 in preparation of oral proceedings the Board expressed the provisional opinion that the subject-matter of claim 1 would appear to be obvious in view of (D1) and (D3) since (D1) discloses an air conditioning unit as defined in the precharacterising portion of claim 1 for cooling supply air, (D3) teaches that the exhaust air may be bypassed around the heat exchanger of an air conditioning unit through a duct above the heat exchanger within the unit in order to regulate the amount of heat exchanged, and it would be questionable

whether the transfer of the teaching of (D3) to the air conditioning unit of (D1) exceeds the customary practice of the skilled person.

VIII. The appellant submitted essentially the following arguments:

Whilst (D1) discloses an air conditioning unit according to the precharacterising portion of claim 1, it is not a proper starting point because it only addresses the problem of achieving optimum cooling and completely fails to take the need for an adequate heat recovery during the cold season into consideration. The reference to the suitability of the cooling device as a recuperator on page 8, line 56, to page 9, line 4 of (D1) is recognized by the skilled person as being incorrect. Further, (D1) directs the skilled person away from using plate heat exchangers in evaporative cooling apparatus for two reasons: firstly, a plate heat exchanger has an effective surface area on the side of the primary stream which does not essentially differ in size from the effective surface area on the side of the secondary stream, and this would cause a prohibitively large volume of the heat exchanger. Secondly, as the air conditioning unit of (D3) includes only a single control damper flap there will always be, regardless of the position of the damper flap, an open path for the exhaust air due to the small resistance to flow of exhaust air through the plate heat exchanger. The particular arrangement of the plate heat exchangers shown in (D3), in which the supply and exhaust air passages are obliquely oriented, rather than horizontal and vertical, respectively, could not be used for an indirect evaporative cooler because no more than about half of the plate surfaces could be wetted by the watering device. Thus, the designs of the heat exchangers used in (D1) and (D3) are incompatible, and a skilled person faced with the problem of providing an air conditioning unit which is efficient both in

cooling and in heat recovery would therefore consider an arrangement of two separate heat exchangers, rather than a single heat exchanger for both purposes.

IX. The essential arguments of the Respondents can be summarised as follows:

Throughout the examination and opposition proceedings document (D1) has always been accepted by the Appellant as closest prior art. This is independent of the type of heat exchanger. The two distinguishing features, i.e. the use of a plate heat exchanger and the integrated damper for controlled bypassing of exhaust air past the heat exchanger, solve different problems. The plate heat exchanger provides an efficient and low-cost heat exchanger for both cooling and heating the supply air, and the controlled bypass provides a simple and efficient regulating means without increasing the dimensions of the unit. There is no relation between both aspects because the bypass can be used in combination with any type of heat exchanger, nor is there any non-obvious working interrelationship between both aspects. Furthermore, it can be derived from (D1), (D2) and (D6) that tube heat exchangers as well as plate heat exchangers are equally suitable for cooling and heating purposes. The choice of a particular type is dependent on the particular circumstances, for example size or cost of manufacture. (D1) does not teach away from the use of a plate heat exchanger because the drawback of this heat exchanger, as stated e.g. on page 1, lines 61 to 65, of (D1), is only relevant if compactness is decisive, and heat exchange surface ratios other than about 1:1 can also be realised with plate heat exchangers. Additional control flaps at the exhaust air inlet to the heat exchanger

are not necessary, regardless of the type of heat exchanger, because the substantially lower flow resistance in the open bypass will result in a more or less complete ending of the airflow through the heat exchanger. Since a plate heat exchanger is known from (D6) to have advantages as regards size and costs, a skilled person would consider replacing the tube heat exchanger of (D1) by a plate heat exchanger. (D3) then suggests the incorporation of the damper-controlled bypass as a solution to the second problem.

Starting from (D3), the problem could be seen in providing an improved cooling capacity of the unit, and the solution of incorporating a watering device for wetting the exhaust air passages is obvious in view of (D1). The fact that the supply and exhaust air passages of (D3) are obliquely oriented does not teach away from this solution because the heat exchange surfaces could be only partially wetted, or a different device, such as a spraying device, could be used for wetting the entire heat exchange surfaces.

Reasons for the Decision

1. The appeal is admissible.
2. *Prior art*

Document (D3) is apparently produced for information of potential clients and carries the indication "Dat. 0379", indicating a printing date of March 1979, which is about 10 years before the priority date of the patent under consideration. Since the Appellant did not contest the validity of this document as prior art, the

Board accepts that (D3) was made available to the public before the priority date of the patent.

3. *Novelty*

It is not in dispute that (D1) discloses an air conditioning unit comprising a duct for conveying supply air (1) through the unit, a duct for conveying exhaust air (2) through the unit, a heat exchanger (3,12) in which the supply air duct and the exhaust air duct are linked with one another in heat exchanging relationship and which comprises an exhaust air passage system including, for example at the rightmost section 3 shown in figure 1, an exhaust air inlet at the top of the heat exchanger and an exhaust air outlet at the bottom of the heat exchanger, a substantially vertical section of the exhaust air duct following immediately after the exhaust outlet, and a watering device (13,16) including means for supplying water to the exhaust air passage system at the exhaust air inlet and means (4) for collecting water draining off from the exhaust air outlet, the water collecting means (4) being adapted also to collect water flowing out of the vertical section of the exhaust air duct, in which air conditioning unit a substantially horizontal section of the exhaust air duct located upstream of the heat exchanger (3,12) and a substantially horizontal further section of the exhaust duct located downstream of said vertical section of the exhaust air duct are disposed substantially in alignment, with the bottom walls of said horizontal exhaust air duct sections disposed approximately level with the exhaust air inlet of the heat exchanger (3,12) and with the upper end of said vertical exhaust air duct section.

The heat exchanger (3,12) is a tube heat exchanger including vertical tubes forming the exhaust air duct and comprising fins in the supply air duct on the outside of the tubes. Barriers are shown in figure 1 to divide the horizontal exhaust air duct above the heat exchanger into three sections, starting from the exhaust air inlet at the right side, one upstream of a first section of the heat exchanger, one downstream of a second section and upstream of a third section of the heat exchanger, and one downstream of the last section of the heat exchanger. However, it can be derived from page 4, lines 32 to 39, that the presence of a plurality of heat exchanger sections is one of the possible embodiments only, and that the exhaust air path could also include a single heat exchanger section or two such sections. This would reduce the number of barriers to one between the adjacent ends of the horizontal exhaust air duct sections.

The subject-matter of claim 1 therefore differs from the air conditioning unit of (D1) by the following features:

- (a) the heat exchanger is a plate heat exchanger; and
- (b) the barrier is provided with a damper for controlled bypassing of exhaust air past the heat exchanger.

(D2) discloses an air conditioning system including a supply air duct (1) in heat exchange with an exhaust air duct (2), and a moistening element (6) positioned in the exhaust air duct upstream of the heat exchanger (5) for cooling the exhaust air by vaporizing water injected through nozzles (7). All generally known heat

exchangers are said to be applicable. There is, therefore, no description of a plate heat exchanger and of the watering device and water collecting means of claim 1. Furthermore, only an external bypass for supply air is shown in figure 2.

(D3) discloses a ventilating device with heat recovery from an exhaust air stream to a supply air stream through two consecutive, obliquely oriented plate heat exchangers. The flow path of the exhaust air through the heat exchangers can be bypassed through an internal bypass located above the heat exchangers and including a controllable bypass flap. There is no description of any means for cooling the supply air.

(D6) provides general information on heat exchangers.

It can therefore be concluded that none of the relevant documents discloses an air conditioning unit comprising all the features defined in claim 1. The subject-matter of claim 1 is therefore novel. Since novelty was not disputed in the appeal proceedings, this issue requires no further argumentation.

4. *Inventive activity*

4.1 According to established case law of the Boards of Appeal (see for example the unpublished decisions T 606/89 of 18 September 1990, T 506/95 of 5 February 1997 and T 989/93 of 16 April 1997) the closest prior art for the purpose of objectively assessing inventive activity is generally that which corresponds to a similar use or purpose and relates to the same or a similar technical problem as the claimed invention. In the present case the patent relates to an air

conditioning unit designed for cooling the supply air and for ventilation purposes, see col. 1, line 39, and col. 2, line 29 of the patent. (D1) discloses an air conditioning unit which is primarily designed to cool the supply air, but which is likewise suitable for heat recovery used in ventilation, as mentioned on page 8, line 56, to page 9, line 4. (D3) is concerned with ventilation and heat recovery only. Thus, (D1) is more appropriate as closest prior art than (D3).

- 4.2. As outlined above the subject-matter of claim 1 is distinguished from the air conditioning unit disclosed in (D1) by the features that (a) the heat exchanger is a plate heat exchanger, and (b) the barrier is provided with a damper for controlled bypassing of exhaust air past the heat exchanger.

Since a plate heat exchanger is an efficient and low-cost heat exchanger, and the controlled bypass is effective to regulate the heat recovery from the exhaust air to the supply air, the objective technical problem underlying the invention defined in claim 1 can be seen in providing an efficient and low-cost air conditioning unit with regulated heat recovery. The second aspect of this problem, i.e. the regulated heat recovery, appears to have no direct relation to the first aspect, i.e. the efficiency and low cost of the heat exchanger, because the regulation of the heat recovery by the controlled bypass can be carried out with any type of heat exchanger. Only an indirect relation between both aspects could be seen in the fact that according to (D6), page 564, first paragraph of the left-hand column, a plate heat exchanger is an efficient type of heat exchanger for low pressure applications, such as heat recovery.

4.3 On page 1, lines 19 to 35, of (D1), prior art air conditioning units using the principle of indirect evaporative cooling in combination with plate heat exchangers are discussed. Later on this page (lines 61 to 65) these known air conditioning units are qualified as being prohibitively large, the reason being that the effective surface area on the side of the primary stream does not essentially differ in size from the effective surface area on the side of the secondary stream. This can be accepted because the design principle of plate heat exchangers, a plate as a heat exchanging wall between the two streams, results in an area ratio of the heat exchanging surfaces of about 1:1, whereas the difference in heat exchange coefficients experienced in indirect evaporative cooling would normally require correspondingly different heat exchange surface areas.

The skilled person will therefore conclude from this discussion that plate heat exchangers should be disregarded in indirect evaporative cooling applications if compactness of the air conditioning unit is decisive. This does not apply, however, to conditions where cost or efficiency are of major concern, as in the first aspect of the problem underlying the invention defined in claim 1. Indeed, the known advantages of plate heat exchangers over tube heat exchangers in terms of cost of manufacture, as evident from (D6), page 564, left-hand column, first paragraph, will encourage the skilled person to consider the use of a plate heat exchanger in indirect evaporative cooling applications under these conditions.

4.4. At the end of the description on page 8, line 56, to

page 9, line 4, of (D1) it is pointed out that the particular heat exchanger of this document is extremely suitable for use as a recuperator in winter time because of its high efficiency also under conditions of heat recovery. The Appellant argues that this statement is recognized by the skilled person as being incorrect, because the skilled person is aware that an air to air heat exchanger, such as a recuperator, should have about equal heat exchanging surface areas to operate efficiently, whereas in the heat exchanger of (D1) these areas differ by a factor of 3 to 10. This argument can be accepted as far as the particular suitability is concerned, because it is consistent with the earlier explanations in (D1) of the reasons why, in indirect evaporative cooling, a heat exchange surface area ratio of 3:1 to 10:1 is preferable (page 3, lines 10 to 26). It can therefore be concluded that the skilled reader of (D1) will recognize that the efficiency of the air conditioning unit in a heat recovery mode of operation could be increased by using a heat exchanger having a surface area ratio of about 1:1, such as the plate heat exchanger mentioned on page 1.

- 4.5. It follows that, in an air conditioning unit operating both in an indirect evaporative cooling mode and in a heat recovery mode, a plate heat exchanger would be preferable under cost and efficiency considerations, whereas a heat exchanger having a higher heat exchange surface area ratio would be better if compactness of the air conditioning unit is critical. In view of aspect (a) of the underlying problem, i.e. providing an efficient and low-cost air conditioning unit, the skilled person will therefore consider, on the basis of the teaching of (D1), replacing the heat exchanger of

(D1) by a plate heat exchanger.

4.6. Thus, the choice of a plate heat exchanger is obvious in view of (D1) and the general knowledge of a skilled person reflected in (D6). The fact therefore that it appears that a suggestion towards the use of plate heat exchangers cannot be provided by (D3), showing a particular oblique orientation of the plate heat exchangers, because, as correctly pointed out by the Appellant, the oblique plates could only be partially wetted by a watering device as claimed in the patent and as disclosed in (D1), which would make this arrangement unsuitable, is irrelevant, this document only being of interest for aspect (b) of the underlying problem. The further argument of the Appellant, that a skilled person faced with the problem of providing an air conditioning unit which is efficient both in cooling and in heat recovery modes would consider an arrangement of two separate heat exchangers, one for each operating mode, is not convincing. In fact, the skilled person will tend to avoid the additional expense caused by this solution, especially as an efficient heat exchanger for both operating modes is suggested by (D1), as outlined above. (D2), in particular the embodiment shown in figure 4, operating in both modes, provides additional evidence for the use of a single heat exchanger used for both operating modes.

4.7. Concerning aspect (b) of the problem, i.e. the regulated heat recovery, the skilled person will take (D3) into consideration because this document is concerned with heat recovery in ventilation units and, in connection with the advantages listed on page 1, expressly refers to a regulation of this heat recovery.

As derivable from the figure on page 2 of (D3) in combination with the text on page 2, left column, first paragraph, this regulation is effected by opening or closing a bypass damper flap in a bypass duct disposed between substantially horizontal sections of the exhaust air duct upstream and downstream of the heat exchangers. The location of the bypass flap in (D3) corresponds to the location of the barriers, or the single barrier in the case of only one or two heat exchanger sections as referred to on page 4, lines 32 to 39, of (D1), separating the horizontal exhaust air duct sections above the heat exchangers, because this barrier likewise separates the exhaust air duct sections upstream and downstream of the heat exchanger(s). The skilled person will therefore conclude that a regulation of the heat recovery in (D1) could be obtained by integrating a bypass damper flap in the barrier separating the exhaust air duct sections above the heat exchanger(s) so as to control the bypass of exhaust air past the heat exchanger(s).

- 4.8. The Appellant argues that the skilled person would not consider combining the bypass control of (D3) with the indirect evaporative cooling of (D1) because the damper of (D3) cannot close the flow path through the heat exchangers, and there is therefore always an open path for the exhaust air through the heat exchangers, even if the bypass is open. This argument is not convincing. In fact, no basis can be found either in the patent or in the available prior art for an operation of the bypass control in the cooling mode. Rather, as in (D3), the bypass control concerns the heat recovery mode and therefore does not affect the operation of the apparatus in indirect evaporative cooling mode in which the bypass damper flap will normally be closed. The

fact that (D3) has no additional means to close the flow path of the exhaust air through the heat exchangers, if the bypass is open, demonstrates that, in the heat recovery mode, this open path can be accepted. This is technically plausible because the resistance to air flow through the heat exchangers is far higher than the resistance to air flow through the open damper, and the amount of exhaust air flowing through the heat exchangers is, therefore, negligible compared with the amount of exhaust air flowing through the open bypass.

- 4.9 To summarise, the Board considers that the solution to the technical problem underlying the invention as defined in independent claim 1 does not involve an inventive activity and, therefore, cannot form a basis for maintaining the patent. Dependent claims 2 to 5 fall together with claim 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

A. Counillon

C. T. Wilson