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Title of invention:
HVAC system with powered subcooler

Applicant:
YORK INTERNATIONAL CORPORATION

Headword:
-

Relevant legal provisions:
EPC Art. 56

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"Inventive step (no)"

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Case Number: T 2359/10 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 24 May 2013

Appellant: (Applicant)
YORK INTERNATIONAL CORPORATION
631 South Richland Avenue
York
Pennsylvania 17403 (US)

Representative:
Wolff, Felix
Kutzenberger Wolff & Partner
Theodor-Heuss-Ring 23
D-50668 Köln (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 25 June 2010 refusing European patent application No. 06738137.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: U. Krause
Members: C. Donnelly
I. Beckedorf

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division, posted on 25 June 2010, refusing European Patent application No. EP-A-06 738 137.6.

In its decision the examining division held that the subject-matter of the independent claims according to the main request lacked an inventive step in view of a combination of EP-A-0 056 780 (D3) and common general knowledge whilst those of the auxiliary request lacked an inventive step in view of a combination of D3 and US2004/031278 A1 (D4).

II. The applicant (hereinafter "the appellant") filed a notice of appeal on 20 August 2010 and paid the fee the same day. The grounds of appeal were filed on 25 October 2010.

III. In a communication dated 20 March 2013, pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings, the Board informed the appellant of its provisional opinion. In particular, the Board indicated that the subject-matter of the independent claims according to the main and first auxiliary requests (corresponding to the main and auxiliary requests refused by the examining division) did not involve an inventive step in view of D3 in combination with either the skilled person's general knowledge or D4. The Board also pointed out that since the subject-matter of the independent method claims of the second and third auxiliary requests was identical to that of the independent method claim of the first auxiliary request, it too did not involve an inventive step.

IV. By letter of 15 May 2013 the appellant informed the Board that it would not attend oral proceedings. These were held as scheduled, in the absence of the appellant, on 24 May 2013 (Rule 115(2) EPC, Article 15(3) RPBA).

V. The appellant requested in the written proceedings that decision under appeal be set aside and that a patent granted on the basis of the main request or, alternatively, on the basis of one of the auxiliary requests 1 to 3, all filed with letter of 25 October 2010.

VI. Independent claim 1 of the main request reads:

"An HVAC system comprising:
a main circuit (100) comprising a main circuit evaporator (140), a main circuit expansion device (126), a main circuit condenser (190) and a main circuit compressor (110,112) connected in a closed refrigerant loop; a subcooler circuit (210,215) comprising a subcooler evaporator (222,224), subcooler expansion device (256,274), a subcooler condenser (260,272 and a subcooler compressor (250,270) connected in a closed refrigerant loop, the subcooler evaporator (222,224) being arranged and disposed to exchange heat between liquid refrigerant in the main circuit (100) and the refrigerant in the subcooler circuit (210,215) to cool the liquid refrigerant in the main circuit (100) prior to entering the main circuit evaporator (140); and wherein the operation of the subcooler circuit (210,215) provides an increased cooling capacity per unit of a (sic) mass flow of cooling fluid through the main circuit condenser (190) and subcooler

condenser (260,272) for the HVAC system with a predetermined design efficiency,
characterized in,
that the subcooler evaporator (222,224) is arranged and disposed to exchange heat between liquid refrigerant in the main circuit (100) and the refrigerant in the subcooler circuit (210,215 in a counter flow arrangement and that at least a portion of the cooling fluid in main circuit condenser (190) also flows through the condenser (260,272) for the subcooler."

Independent claim 27 of the main request reads:

"A method for subcooling an HVAC system, comprising:

providing a main circuit (100) comprising a main circuit evaporator (140), a main circuit expansion device (126), a main circuit condenser (190) and a main circuit compressor (110,112) connected in a closed refrigerant loop; and a subcooler circuit (210,215) comprising a subcooler evaporator (222,224), a subcooler expansion device (256,274), a subcooler condenser (260,272 and a subcooler compressor (250,270) connected in a closed refrigerant loop;

subcooling refrigerant in the main circuit (100) with the subcooler evaporator (222,224) prior to the refrigerant in the main circuit entering the main circuit evaporator (140) to provide an increased cooling capacity per unit of airflow for the HVAC system with a predetermined design efficiency;

sensing one of an ambient air temperature or a refrigerant temperature;

activating or deactivating the compressor in at least one of the main circuit and the subcooler circuit in response to the sensed condition; and

activating or deactivating one or more fluid moving devices providing fluid flow to the main circuit condenser and subcooler condenser in response to the sensed condition

characterized by

directing the subcooling refrigerant and the refrigerant in the main circuit in the subcooler evaporator (222, 224) in a counterflow

and

condensing at least a portion of refrigerant in the subcooling circuit with air entering or exiting the main circuit condenser."

Claim 1 of the first auxiliary request comprises the additional feature:

"that the main circuit comprises a selective bypass with a bypass valve (310,320) for selectively bypassing the subcooler-evaporator in the main circuit."

The independent method claim 27 of the first auxiliary request comprises the additional step of:

"selectively bypassing the subcooler evaporator in the main circuit."

The independent method claims of the second and third auxiliary request are identical to the independent method claim of the first auxiliary request.

VII. *Appellant's case*

Main request

Contrary to the opinion of the examining division there are many other possibilities of configuring a heat exchanger besides counter and parallel flow designs. In particular, cross stream arrangements are often used and numerous other heat exchangers employ a combination these flow systems with or without direct contact of the media. Thus, in the present case, the skilled person had to make a selection out of a large number of different heat exchange designs.

First auxiliary request

The examination division's argument that there is no synergistic effect between the distinguishing features of counterflow in the subcooler heat exchanger and the selective bypass of this heat exchanger is incorrect.

The objective problem to be solved is one of providing an HVAC system which is energy optimised. This problem is solved by selecting a counter flow arrangement in combination with selectively allowing this heat exchanger to be bypassed. Thus, these two features contribute to the energy optimisation of the system.

Reasons for the decision

1. The appeal is admissible.

2. *Main Request*

2.1 The Board agrees with the examining division that EP-A-0 056 780 (D3) discloses the most relevant prior art.

2.2 This document describes an HVAC system (see page 11, lines 13 to page 14, line 5) comprising:
a main circuit comprising a main circuit evaporator (1), a main circuit expansion device (10), a main circuit condenser (6) and a main circuit compressor (5) connected in a closed refrigerant loop; a subcooler circuit comprising a subcooler evaporator (11), subcooler expansion device (14), a subcooler condenser (13) and a subcooler compressor (12) connected in a closed refrigerant loop, the subcooler evaporator (11) being arranged and disposed to exchange heat between liquid refrigerant in the main circuit and the refrigerant in the subcooler circuit to cool the liquid refrigerant in the main circuit prior to entering the main circuit evaporator (1); and wherein the operation of the subcooler circuit provides an increased cooling capacity per unit of mass flow of cooling fluid through the main circuit condenser (6) and subcooler condenser (13) for the HVAC system with a predetermined design efficiency, and
at least a portion of the cooling fluid in main circuit condenser (6) also flows through the condenser (13) for the subcooler (see page 13, lines 2 to 5 and page 13, line 29 to page 14, line 5).

Thus, the subject-matter of claim 1 differs from the apparatus disclosed in D3 in that the subcooler evaporator is arranged and disposed to exchange heat between liquid refrigerant in the main circuit and the refrigerant in the subcooler circuit in a counterflow arrangement.

2.3 D3 also discloses a method for subcooling an HVAC system, comprising:

providing a main circuit comprising a main circuit evaporator (1), a main circuit expansion device (10), a main circuit condenser (6) and a main circuit compressor (5) connected in a closed refrigerant loop; and a subcooler circuit comprising a subcooler evaporator (11), a subcooler expansion device (14), a subcooler condenser (13) and a subcooler compressor (12) connected in a closed refrigerant loop;

subcooling refrigerant in the main circuit with the subcooler evaporator (11) prior to the refrigerant in the main circuit entering the main circuit evaporator (1) to provide an increased cooling capacity per unit of airflow for the HVAC system with a predetermined design efficiency

condensing at least a portion of refrigerant in the subcooling circuit with fluid entering or exiting the main circuit condenser

2.4 The features of:

(i) - sensing one of an ambient air temperature or a refrigerant temperature;

(ii) - activating or deactivating the compressor in at least one of the main circuit and the subcooler circuit in response to the sensed condition; and

(iii) - activating or deactivating one or more fluid moving devices providing fluid flow to the main circuit condenser and subcooler condenser in response to the sensed condition; and

(iv) - air is used as the fluid entering or exiting the main circuit condenser for condensing at least a portion of refrigerant in the subcooling circuit

are not explicitly described in D3. However, the appellant has not contested the examining division's conclusion in paragraph 3.3. of its decision, that D3 discloses these features. The Board is also of the view that since features (i) to (iii) merely describe the standard way of controlling any HVAC system that they must be present in the apparatus disclosed in D3 as part of the control circuit ("Steuerteil" 18 - see for example page 14, lines 7 to 18). As regards feature (iv), claim 8 as well as the passage from page 13, line 25 to page 4, line 5 of D3 specify that the condensers are cooled by a "medium" for taking up the available heat ("Nutzwärme aufnehmenden Medium"; "Nutzwärme abtransportierenden Medium"). The skilled person knows that this general reference to a "medium" can only mean "water or air" since, in a domestic

heating context as is the case in D3, these are the only two available cooling media.

2.5 Thus, the subject-matter of claim 27 only further differs therefrom by the step of:

directing the subcooling refrigerant and the refrigerant in the main circuit in the subcooler evaporator in a counterflow;

2.6 The skilled person is well aware of the advantages of using counterflow in a heat-exchanger. In particular, it is known that, especially in comparison with parallel flow exchangers, such an arrangement ensures a more uniform temperature difference between the fluids and consequently a more uniform rate of heat transfer throughout the exchanger. For the skilled person faced with the problem of optimising the energy efficiency of the heat exchanger 11 in D3 the selection of a counterflow model would therefore be a matter of routine design procedure. Furthermore, the application of this feature in a similar apparatus is explicitly described in US2004/0031278 (D4), page 2, paragraph [0019], right-hand column, lines 3 to 7.

2.7 The appellant's argument that the selection of a counterflow arrangement is inventive since there are many different types of possible configuration to choose from is not convincing particularly since it has not been demonstrated that anything other than the expected effect is obtained.

2.8 Thus, the subject-matter of claims 1 and 27 of the main request does not meet the requirements of Article 56 EPC since it does not involve an inventive step.

3. *First auxiliary request*

3.1 The provision of bypasses in heat exchange systems is also standard practice and is explicitly mentioned in D4 (see page 2, paragraph [0019], right-hand column, line 3).

3.2 The appellant has argued that the distinguishing features of the independent claims of the first auxiliary request both contribute to solving the problem of optimising the energy efficiency of a HVAC system and such a combination would not be obvious for the skilled person. The Board does not accept this since both of these features are conventional *per se* as is their use in combination to improve the energy efficiency of heat exchange systems as illustrated for example by the disclosure of D4, page 2, paragraph [0019], right-hand column, line 3 to 7.

3.3 Thus, the subject-matter of claims 1 and 27 of the first auxiliary request also does not meet the requirements of Article 56 EPC since it does not involve an inventive step.

4. *Second and third auxiliary requests*

4.1 The subject-matter of the independent method claims of these requests is identical to the independent method claim of the first auxiliary request and therefore also does not involve an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

Registrar: Chairman:

C. Spira U. Krause