



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
09.07.2008 Bulletin 2008/28

(51) Int Cl.:
F24F 11/00 (2006.01) F25B 49/02 (2006.01)

(43) Date of publication A2:
23.04.2008 Bulletin 2008/17

(21) Application number: **07076044.2**

(22) Date of filing: **27.06.2005**

(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 MC NL PL PT RO SE SI SK TR

(30) Priority: **11.08.2004 US 916223**
11.08.2004 US 916222
17.05.2005 US 130569
17.05.2005 US 130562
17.05.2005 US 130871
17.05.2005 US 130601

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
05790996.2 / 1 781 996

(71) Applicant: **Kates, Lawrence**
Corona del Mar, CA 92625 (US)

(72) Inventor: **Kates, Lawrence**
Corona del Mar, CA 92625 (US)

(74) Representative: **Fox-Male, Nicholas Vincent**
Humbert et al
Potter Clarkson LLP
Park View House
58 The Ropewalk
Nottingham NG1 5DD (GB)

(54) **Method and apparatus for monitoring refrigerating-cycle systems**

(57) A real-time monitoring system that monitors various aspects of the operation of a refrigerant-cycle system is described. In one embodiment, the system includes a processor that measures power provided to the refrigerant-cycle system and that gathers data from one or more sensors and uses the sensor data to calculate a figure of merit related to the efficiency of the system. In one embodiment, the sensors include one or more of the following sensors: a suction line temperature sensor, a suction line pressure sensor, a suction line flow sensor, a hot gas line temperature sensor, a hot gas line pressure sensor, a hot gas line flow sensor, a liquid line temperature

sensor, a liquid line pressure sensor, a liquid line flow sensor. In one embodiment, the sensors include one or more of an evaporator air temperature input sensor, an evaporator air temperature output sensor, an evaporator airflow sensor, an evaporator air humidity sensor, and a differential pressure sensor. In one embodiment, the sensors include one or more of a condenser air temperature input sensor, a condenser air temperature output sensor, and a condenser air flow sensor, an evaporator air humidity sensor. In one embodiment, the sensors include one or more of an ambient air sensor and an ambient humidity sensor.

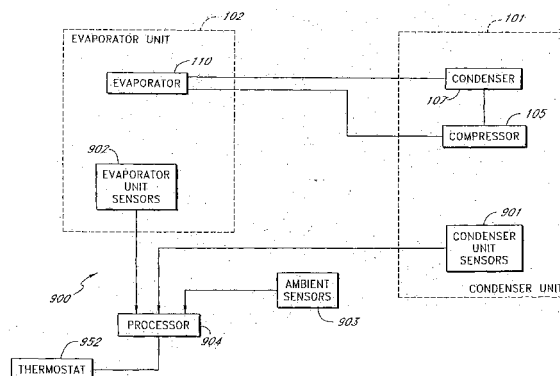


FIG. 9A



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 07 6044

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 596 507 A (JONES ET AL) 21 January 1997 (1997-01-21) * the whole document *	1-9	INV. F24F11/00 F25B49/02
X	WO 2004/049088 A (RADAR HVAC-REFRIGERATION INC; WIEBE, DAVID; SMITH, PHILIP; JOHNSON, LA) 10 June 2004 (2004-06-10) * the whole document *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			G01D F24F H04L G08C G05B F25B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 March 2008	Examiner Valenza, Davide
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

19

EPO FORM 1503 03 82 (P04C01)



European Patent
Office

Application Number
EP 07 07 6044

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
see additional sheet(s)
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-9

Monitoring system for monitoring a condenser unit in a refrigerant-cycle system, comprising a first temperature sensor to measure condenser input refrigerant temperature, a second temperature sensor to measure condenser output refrigerant temperature, one or more ambient sensors, an electrical sensor to sense electrical power provided to a compressor, and a processing system to calculate a performance criteria of the condenser unit.

2. claim: 10

System for electrical load control comprising a remote monitoring system, and a thermostat and a data interface provided to said thermostat.

3. claim: 11

System for electrical load control comprising a remote monitoring system, a cooling system comprising an evaporator unit, and a data interface provided to said evaporator unit.

4. claim: 12

System for electrical load control comprising a remote monitoring system, a cooling system condenser unit, a compressor provided to said condenser unit, a data interface provided to said condenser unit.

5. claim: 13

System for electrical load control comprising a remote monitoring system, a cooling system comprising, an evaporator unit, a condenser unit, a thermostat, and one or more data interface devices provided to said cooling system.

6. claim: 14

Monitoring system for monitoring an evaporator of a refrigerant-cycle system, comprising a first temperature sensor, a second temperature sensor, one or more ambient sensors, an air flow sensor, and a processing system to calculate a performance criteria of the evaporator unit.



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

7. claim: 15

Monitoring system for monitoring an evaporator of a refrigerant-cycle system, comprising means for measuring one or more inputs to said evaporator, means for measuring one or more outputs from said evaporator, programmed data parameters related to said evaporator, and a processing system to calculate one or more performance criteria of the evaporator unit.

8. claim: 16

Monitoring system for monitoring a condenser of a refrigerant-cycle system, comprising means for measuring one or more inputs to said condenser, means for measuring one or more outputs from said condenser, programmed data parameters related to said evaporator, and a processing system to calculate one or more performance criteria of the condenser unit.

9. claim: 17

Monitoring system for monitoring an air filter in a forced-air heating or cooling system, comprising means for holding a filter element, means for measuring a pressure drop across the filter element, means for sending data to a processing system, and a processing system configured to calculate one or more performance criteria of the filter.

10. claim: 18

Monitoring system for monitoring an air filter in a forced-air heating or cooling system, comprising means for holding a filter element, means for measuring a light transmission through the filter element, means for sending data to a processing system, and a processing system configured to calculate one or more performance criteria of the filter.

11. claim: 19

Monitoring system for monitoring an air filter in a forced-air heating or cooling system, comprising a light source, a light sensor, and a processing system configured to calculate a performance criteria of the filter.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 07 6044

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-03-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5596507	A	21-01-1997	NONE	

WO 2004049088	A	10-06-2004	AU 2003283169 A1	18-06-2004
			CA 2506791 A1	10-06-2004
