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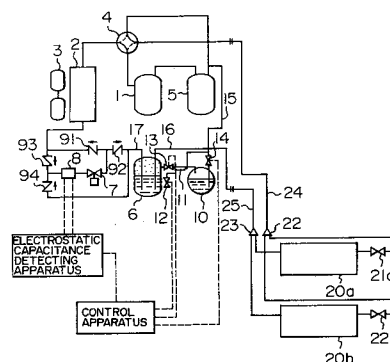
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01.03.95 Bulletin 95/09(71) Applicant: **HITACHI, LTD.**
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Patentanwälte v. Fünér, Ebbinghaus, Finck
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D-81541 München (DE)(54) **Refrigeration cycle and method of controlling the refrigeration composition ratio of the refrigeration cycle.**

(57) The composition of a refrigerant within the refrigeration cycle in which a non-azeotrope refrigerant is used is controlled to a predetermined composition. Further, the amount of the refrigerant is detected, and the composition and amount of the refrigerant within the refrigeration cycle are displayed, facilitating the maintenance of the refrigerant. The refrigeration cycle includes a compressor (1), a heat-source-side heat exchanger (2), use-side heat exchangers (20a,20b), and a pressure reducing apparatus (7,21a,21b), in which cycle a non-azeotrope refrigerant is used as a refrigerant. The refrigeration cycle further includes a sensor (8), disposed in a pipe portion where a liquid phase is formed, for detecting the composition of the non-azeotrope refrigerant circulating within the refrigeration cycle, and devices (5,6,10) for controlling the composition to a predetermined composition, a sensor for detecting the amount of refrigerant and a device for displaying the amount of the refrigerant. Since the composition of the refrigerant circulating within the refrigeration cycle

is detected and control appropriate for the detected composition is performed, it becomes possible to perform a stable operation even when the refrigerant leaks outside and the composition of the refrigerant varies.

FIG. 1

**EP 0 631 095 A3**



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EUROPEAN SEARCH REPORT

Application Number
EP 94 10 9583

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-5 186 012 (CZACHORSKI)	1,2	F25B49/02
Y	* column 3, line 49 - column 4, line 35 *	3-10,12,16	F25B1/00
A	* column 5, line 1 - column 10, line 24; figures 1-7 *	11,13	F25B45/00
Y	--- PATENT ABSTRACTS OF JAPAN vol. 17, no. 490 (M-1474) 6 September 1993 & JP-A-05 118 677 (EBARA) 14 May 1993 * abstract *	3,4,15	
Y	--- US-A-3 668 882 (SARSTEN)	5-8,15,16	
A	* the whole document *	14,17-20	
D,Y	--- JP-A-59 129 366 (...) * the whole document *	9	
Y	--- DE-A-34 06 588 (SIEMENS)	10,12	
A	* page 12, line 1 - page 13, line 13; figures 4,5 *	11,13	TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A	--- US-A-4 913 714 (OGURA) * column 2, line 57 - column 8, line 59; figures 1-9 *	11,13	F25B
A	--- US-A-5 062 275 (HIRATA) * column 2, line 62 - column 8, line 10; figures 1-20 *	18,19	
A	--- US-A-4 700 549 (BIAGINI) * column 2, line 40 - column 4, line 26; figure *	18	
A	--- US-A-4 624 112 (PROCTOR) * column 3, line 26 - column 6, line 51; figure *	20	
	--- -/--		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 January 1995	Examiner Boets, A
CATEGORY OF CITED DOCUMENTS 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 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			



CLAIMS INCURRING FEES

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

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees 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 claims:
- ☐ 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 requirement of unity of invention and relates to several inventions or groups of inventions, namely:

- claims 1-10,12,14-17: Compression refrigeration cycle with non-azeotropic refrigerant mixture and refrigerant composition detection
- claims 11,13 : Compression refrigeration cycle with non-azeotropic refrigerant mixture and variation of refrigerant composition
- claims 18-20 : Method of filling a non-azeotropic refrigerant mixture into a compression refrigeration cycle

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ 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 has 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:



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EUROPEAN SEARCH REPORT

Application Number
EP 94 10 9583

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
P,X A	WO-A-94 07095 (FRITZ EGGER) * page 1, line 16 - page 2, line 5 * * page 5, line 25 - page 6, line 13 * * page 8, line 12 - line 36 * * page 12, line 20 - page 14, line 23; figures 1-4 * --- A EP-A-0 196 051 (MATSUSHITA ELECTRIC INDUSTRIAL) --- A EP-A-0 518 394 (MATSUSHITA ELECTRIC INDUSTRIAL) --- A US-A-4 961 323 (KATSUNA) --- A US-A-5 056 329 (WILKINSON) --- A US-A-4 972 676 (SAKAI) -----	1,2 3-10,12, 16	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 January 1995	Examiner Boets, A
CATEGORY OF CITED DOCUMENTS 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 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			