(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 October 2006 (19.10.2006)

PCT

(10) International Publication Number
WO 2006/109239 A1

(51) International Patent Classification:
F04B 39/12 (2006.01)

(21) International Application Number:
PCT/IB2006/051100

(22) International Filing Date: 11 April 2006 (11.04.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2005/01338 12 April 2005 (12.04.2005) TR

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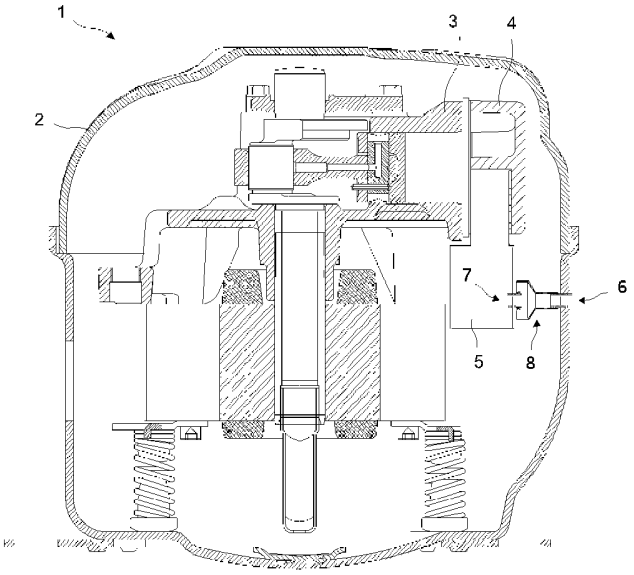
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** A COMPRESSOR



(57) **Abstract:** The present invention relates to a connecting pipe (8), providing the refrigerant fluid circulating in the cooling cycle in the compressors (1) to be delivered to the suction muffler (5) or the cylinder head (4) after it enters the compressor (1), attenuating both the radial and axial movements of the compressor (1) motor, preventing the transfer of motor vibrations to the shell (2) and providing for balancing of pressure within the inner volume of the shell (2). The connecting pipe (8) is produced of a material hard enough to withstand the high temperature environment within the shell (2) without failure.

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Description

A COMPRESSOR

[001] The present invention relates to a compressor, utilized in cooling devices, comprising a connecting pipe for delivering the refrigerant fluid to the suction muffler.

[002] In the hermetic compressors utilized preferably in cooling devices, a suction muffler made of plastic material is utilized for attenuating the noise generated by the refrigerant fluid and the refrigerant vapor coming from the evaporator with low pressure and temperature is delivered to the suction muffler or the suction volume in the cylinder head by the help of a flexible connecting pipe, without being mixed with the high temperature gases inside the compressor container. In these applications, the refrigerant fluid coming from the evaporator reaches the cylinder without being heated since it doesn't mix with the high temperature gases inside the compressor container; however, the pressure losses increase as it passes through the connection pipe and the power needed for starting the compressor also increases resulting in an adverse effect on the performance. In applications describing the delivery of the refrigerant fluid directly to the cylinder or the suction muffler via the connecting pipe, the vibrations of the motor crank, piston rod etc. components can be transferred to the container via the connecting pipe. The connecting pipes are supported by additional connection components to be able to function for a long term in a vibratory and high temperature environment, however these additional connection components make the assembly of the compressor harder, enough efficiency cannot be maintained due to the reason that the small size of the container or other geometric limitations. The connecting pipes joining the compressor inlet and the suction muffler should be produced of an elastic and leak-proof material since they have to function in an environment of high temperature like the compressor container and to attenuate the vibratory movements. In the production of connecting pipes, forming the connection of the vibratory components, bellow like elements are utilized for maintaining a certain flexibility but the desired end result cannot be achieved in the long term functioning and durability. The connecting pipes of bellow like structures, even though they provide the desired flexibility and leak-proofing, are deformed after a while under the conditions of the environment in which they function, and are rendered non-functional by being torn or punctured.

[003] In the United States of America Patent no. US4160625, a direct suction system applied in hermetic compressors is described. In this system, the portion that forms the suction plenum of the cylinder head is directly connected to the compressor inlet by a connecting pipe and herewith the delivery of the refrigerant to the cylinder without heating up is intended. This connecting pipe, situated between the pipe exiting the

suction plenum of the cylinder head and the pipe forming the compressor inlet, being connected to the other metallic pipes by way of radial grooves and O-rings at opposite ends, serve to attenuate the motion of the compressor unit.

[004] In the United States of America Patent no. US5803717, a description is given of direct suction system comprising a flange positioned at a certain angle with the suction inlet channel at the entrance to the suction muffler, a telescopic tube having an orifice so as to entirely bear against this flange, and a helical spring used to keep the telescopic tube in place. The pressure inside the housing is balanced by way of the an opening formed between the telescopic tube situated inwards the compressor suction tube and the compressor suction tube.

[005] In the United States of America Patent no. US6155800, a direct suction system is described in which the suction muffler is taken outside the shell and the gas flowing out of the muffler is delivered to the suction plenum by way of a flexible pipe, contracting opening like a bellows.

[006] In the United States of America Patent no. US4793775, the suction pipe of the compressor is provided with a connecting pipe in the form of an axially deformable body which connects to the muffler intake. The connecting pipe denoted as a Suction Cup, has one end connected to the muffler intake formed like a plug, and the other end is pressed onto the wall of the casing so as to face the suction pipe of the compressor. In the case of oil accumulation in the connecting pipe, the oil is delivered again into the casing by lowering of the end pressing onto the casing.

[007] In the United States of America Patent no. US6390788, a direct suction system is described in which a coupling cap connects a suction muffler to the compressor suction pipe having a plug like projection at the top, firmly holding it in place in the suction muffler and a regularly formed surface at the bottom preventing it from going into the suction muffler. A helical spring is attached between this coupling cap and the compressor suction pipe, providing direct suction, equalizing of pressure and also the attenuation of the motor vibrations

[008] The aim of the present invention is the realization a compressor utilized in cooling devices, having a connecting pipe providing the delivery of the refrigerant fluid to the suction muffler and preventing the motor vibrations to be transferred to the shell.

[009] The compressor realized in order to attain above mentioned aim of the present invention is illustrated in the attached figures, where :

[010] Figure 1 – is the sectional view of a compressor.

[011] Figure 2 – is the perspective sectional view of a connecting pipe attached to a compressor outlet pipe and a muffler inlet pipe.

[012] Figure 3 – is the sectional view of a connecting pipe.

[013] Figure 4 – is the sectional view of a connecting pipe attached to a compressor outlet

pipe and a muffler inlet pipe.

[014] Elements shown in the figures are numbered as follows:

1. Compressor
2. Shell
3. Cylinder
4. Cylinder head
5. Suction muffler
6. Compressor inlet pipe
7. Muffler inlet pipe
8. Connecting pipe
9. Attenuation wall
10. Attenuation cavity
11. Passage surface
12. Inlet opening
13. Outlet opening
14. Stopper
15. Outlet opening side
16. Refrigerant fluid passage hole

[015] The compressor (1) comprises a shell (2) that safeguards the operational components within, a cylinder (3) which provides the pumping of the refrigerant fluid, a cylinder head (4) positioned on the cylinder (3) that directs the sucked and pumped refrigerant fluid, a suction muffler (5) which attenuates the noise generated by the refrigerant fluid, a compressor inlet pipe (6) allowing the entrance of the refrigerant fluid delivered from the evaporator in the cooling cycle and extending from the outside into the shell (2), a muffler inlet pipe (7) that allows the entrance of the refrigerant fluid into the suction muffler (5), and a connecting pipe (8) that connects the compressor inlet pipe (6) and the muffler inlet pipe (7) to each other and provides the refrigerant fluid delivered from the evaporator to reach the suction muffler (5).

[016] The connecting pipe (8) comprises an inlet opening (12) wherein the compressor inlet pipe (6) is attached to and allows the entry of the refrigerant fluid, and an outlet opening (13) that allows the refrigerant fluid to pass into the muffler inlet pipe (7). The connecting pipe (8) is assembled on the muffler inlet pipe (7) that is inserted into the outlet opening (13), so as to clasp it from the outside.

[017] The connecting pipe (8) extending from the compressor inlet pipe (6) towards the muffler inlet pipe (7), at the elevation of the muffler inlet pipe (7) end, has a width that allows the end of the muffler inlet pipe (7) to freely make a vibratory motion in the radial or axial directions, without touching anywhere. The diameter of the connecting pipe (8) decreases again behind the elevation of the muffler inlet pipe (7) end.

[018] The connecting pipe (8) comprises an outlet opening side (15), situated around the outlet opening (13), clasping the muffler inlet pipe (7) by touching on a thin circular line from its outer surface, a little behind the end of the muffler inlet pipe (7).

[019] In the preferred embodiment of the present invention, the outlet opening side (15), has a bended structure with resilient features, providing the attenuation of the muffler inlet pipe (7) vibrations.

[020] The connecting pipe (8) furthermore comprises an attenuation wall (9) forming a ridge-like surface on the side of the outlet of the refrigerant fluid, on which the outlet hole (13) and the outlet opening side (15) are situated, preferably forming a plane almost perpendicular to the axis of the muffler inlet pipe (7) and having a smaller wall thickness than itself for attaining a flexible feature, attenuating the vibrations of the muffler inlet pipe (7) in the radial direction, a preferably sloping passage plane (11) providing the passage to the wide diameter level around the end of the muffler inlet pipe (7) and attenuating the radial and axial vibrations, and an attenuation cavity (10) forming the inner volume around the end of the muffler inlet pipe (7), partially storing the refrigerant fluid, preventing its pressure from decreasing and allowing the end of the muffler inlet pipe (7) to freely make a vibratory motion in the radial or axial directions without touching anywhere.

[021] In one embodiment of the present invention, the diameter of the inlet and/or outlet openings (12,13) is greater than the outer diameter of the compressor and the muffler inlet pipes (6, 7) to allow for the insertion of the compressor and the muffler inlet pipes (6, 7) by contacting slightly. In this manner the connecting pipe (8), being joined on the compressor and the muffler inlet pipes (6, 7), can freely slide forwards and backwards in the axial direction and the motor vibrations are not transferred to the shell (2). Furthermore, as the refrigerant fluid flows through the connecting pipe (8), a little amount of the refrigerant fluid is allowed to seep into the shell (2) by way of inlet and outlet openings (12,13) to which the compressor and the muffler inlet pipes (6, 7) are spacedly mounted. Consequently balancing of pressure with the inner volume of the shell (2) is provided and the compressor (1) start-up gets easier.

[022] In the embodiment of the present invention explained above, the compressor (1) comprises one or more stoppers (14), preferably fixed to the compressor and/or the muffler inlet pipes (6, 7), preventing the disjointing of the connecting pipe (8) during the vibrations from the compressor and the muffler inlet pipes (6, 7) whereupon it is connected. During operation, the connecting pipe (8) can make a sliding movement on the compressor and the muffler inlet pipes (6, 7) towards both sides in the axial direction, in cases when the vibration level increases, moving more in any one direction or disjointing of the other end and getting freed from the compressor and the muffler inlet pipes (6, 7) is prevented by the stoppers (14).

[023] In another embodiment of the present invention, the connecting pipe (8) comprises one or more refrigerant fluid passage holes (16), situated on the attenuation wall (9), enhancing the attenuation of the vibrations by increasing the flexibility of the attenuation wall (9), and allowing limited passage of the refrigerant fluid into the inner volume of the shell (2) thus helping in balancing the pressure.

[024] In the cooling cycle, the refrigerant fluid received from the evaporator reaches the connecting pipe (8) by passing through the compressor inlet pipe (6) on the shell (2). A small amount of the refrigerant fluid inside the connecting pipe (8) seeps through the refrigerant fluid passage holes (16) or between the compressor inlet pipe (6) and the inlet opening (12) and/or the muffler inlet pipe (7) and the outlet opening (13), mixing partly with the gases inside the shell (2) thus providing to balance the pressure. The refrigerant fluid reaches the suction muffler (5) by passing through the connecting pipe (8). As the refrigerant fluid passes through the connecting pipe (8), it is partly stored in the attenuation volume (10) and the decrease of pressure is prevented until it reaches the suction muffler (5). By way of the connecting pipe (8) being able to make a sliding movement in the axial direction on the muffler inlet pipe (7) and/or the compressor inlet pipe (6), the transfer of the motor vibrations to the shell (2) and the increase in the noise level are prevented. The flexible structure of the outlet opening side (15) clasping the muffler inlet pipe (7) on the side of the outlet opening (13), attenuates the radially directed movement of the muffler inlet pipe (7). The part of the muffler inlet pipe (7) extending into the attenuation volume (10) can move freely without bumping into anywhere and any harm to the connecting pipe (8) is thus prevented.

[025] The connecting pipe (8) is so structured that it attenuates the movement of the compressor (1) motor in both radial and axial directions, prevents the transfer of the motor vibrations to the shell (2) and helps in balancing the pressure. The connecting pipe (8) is preferably produced of hardened rubber or plastic, almost rigid and hard enough to perform for a long time without being impaired within the high temperature environment of the shell (2), with a low thermal conductivity, allowing for easy injection process and simplified assembly.

Claims

[001] A compressor (1) comprising a shell (2) that safeguards the operational components within, a suction muffler (5) which attenuates the noise generated by the refrigerant fluid, a compressor inlet pipe (6) extending from outside into the shell (2), allowing the entrance of the refrigerant fluid delivered from the evaporator in the cooling cycle, a muffler inlet pipe (7) that allows the entrance of the refrigerant fluid into the suction muffler (5), and characterized by a conn ecting pipe (8) having an inlet opening (12) wherein the compressor inlet pipe (6) is attached to, and an outlet opening (13) that allows the refrigerant fluid to pass into the muffler inlet pipe (7), assembled on the muffler inlet pipe (7) that is inserted into the outlet opening (13), so as to clasp it from the outside and having a width that allows the end of the muffler inlet pipe (7) to freely make a vibratory motion in the radial or axial directions without contacting other components, and its diameter decreasing again behind the level of the muffler inlet pipe (7) end.

[002] A compressor (1) as in Claim 1, characterized by a connecting pipe (8), having an attenuation cavity (10), forming the inner volume of the wide diameter area around the end of the muffler inlet pipe (7), inside which the muffler inlet pipe (7) can freely make vibratory movements in the radial or axial directions.

[003] A compressor (1) as in Claim 1 or 2, characterized by a connecting pipe (8) comprising an outlet opening side (15), situated around the outlet opening (13), clasping the muffler inlet pipe (7) by touching on a thin circular line from its outer surface, a little behind the end of the muffler inlet pipe (7).

[004] A compressor (1) as in Claim 3, characterized by a connecting pipe (8) comprising an outlet opening side (15), having a bended structure with resilient features, providing for the attenuation of the muffler inlet pipe (7) vibrations.

[005] A compressor (1) as in any one of the above claims, characterized by a connecting pipe (8) comprising an attenuation wall (9) forming a ridge-like surface on the side of the outlet of the refrigerant fluid, on which the outlet hole (13) and the outlet opening side (15) are situated, providing the attenuation of the muffler inlet pipe (7) vibrations in the radial direction.

[006] A compressor (1) as in Claim 5, characterized by a connecting pipe (8) comprising an attenuation wall (9) forming an almost perpendicular plane to the axis of the muffler inlet pipe (7).

[007] A compressor (1) as in Claim 5 or 6, characterized by a connecting pipe (8) comprising an attenuation wall (9) having a smaller wall thickness than itself.

[008] A compressor (1) as in any one of the Claims 5 to 7, characterized by a connecting pipe (8) having one or more refrigerant fluid passage holes (16),

situated on the attenuation wall (9), enhancing the attenuation of the vibrations by increasing the flexibility of the attenuation wall (9), allowing a limited passage of the refrigerant fluid into the inner volume of the shell (2) thus helping in balancing the pressure.

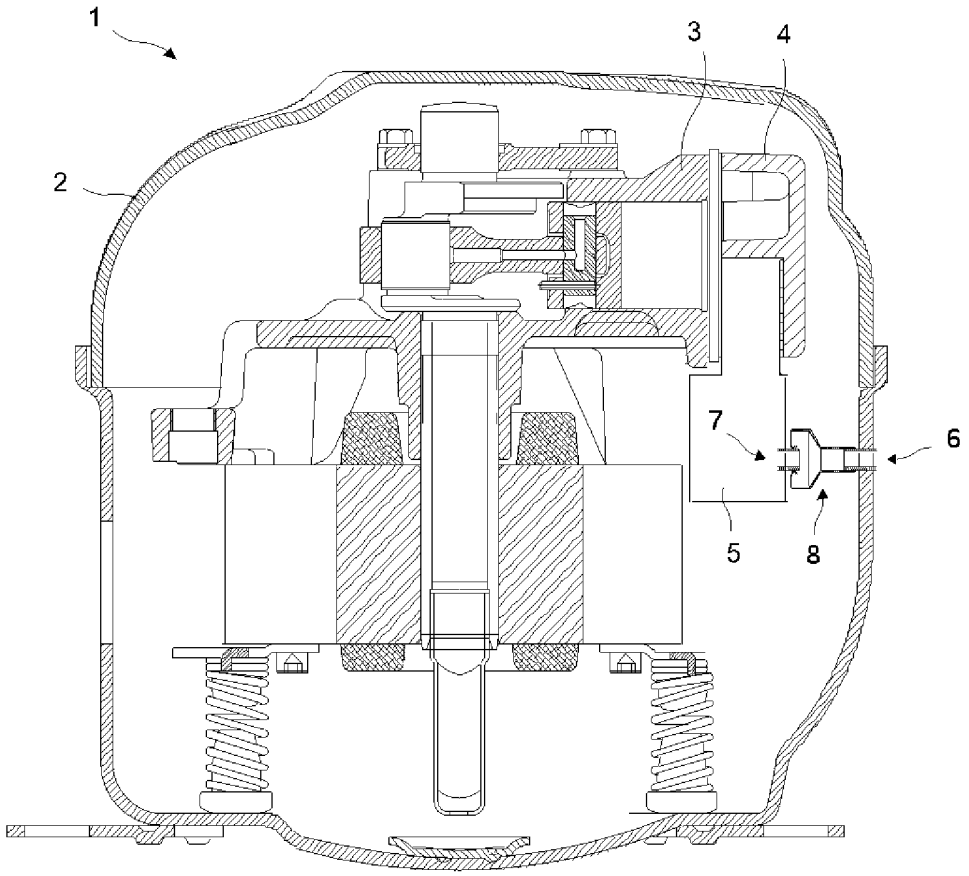
[009] A compressor (1) as in any one of the above claims, characterized by a connecting pipe (8) having a passage plane (11) that provide for passing to the wider diameter level around the end of the muffler inlet pipe (7) and attenuating the radial and axial vibrations.

[010] A compressor (1) as in any one of the above claims, characterized by a connecting pipe (8) having inlet and/or outlet openings (12,13) with a diameter greater than the outer diameter of the compressor and the muffler inlet pipes (6, 7) to allow for the insertion of the compressor and the muffler inlet pipes (6, 7) by contacting slightly.

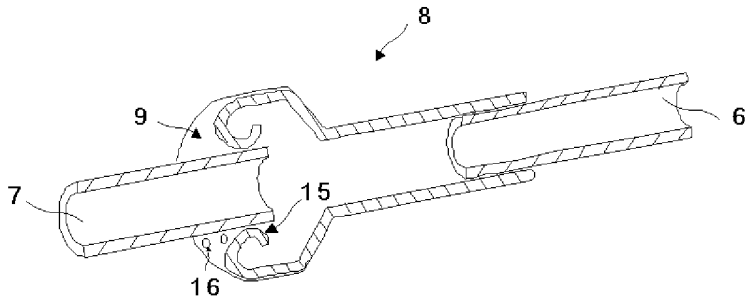
[011] A compressor (1) as in any one of the above claims, characterized by one or more stoppers (14), preventing the disjointing of the connecting pipe (8) from the compressor and the muffler inlet pipes (6, 7) upon which it is attached during the vibrations.

[012] A compressor (1) as in any one of the above claims, characterized by a connecting pipe (8) produced of an almost rigid, hardened rubber material or plastic material conforming to the injection process.

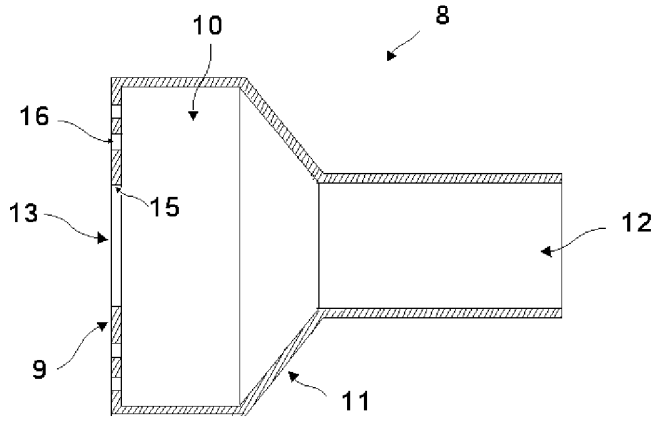
[Fig. 001]



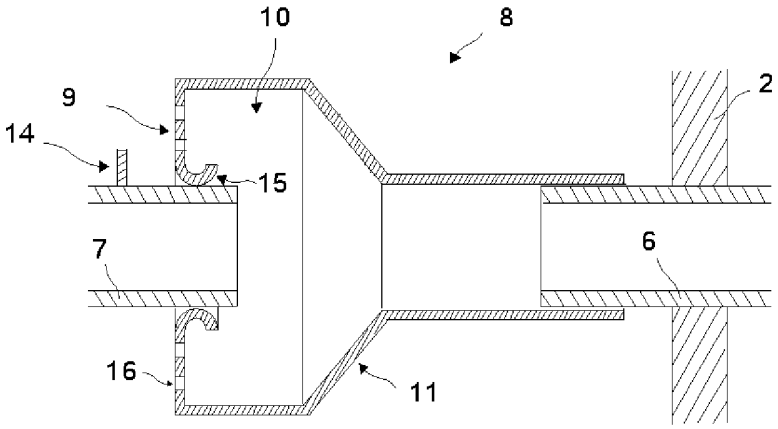
[Fig. 002]



[Fig. 003]



[Fig. 004]



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/051100

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04B39/12

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)
F04B

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 practical, search terms used)
EPO-Internal, PAJ, 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	PATENT ABSTRACTS OF JAPAN vol. 015, no. 222 (M-1121), 6 June 1991 (1991-06-06) -& JP 03 064680 A (MITSUBISHI ELECTRIC CORP), 20 March 1991 (1991-03-20)	1-5,9,10
A	abstract; figures 1,2	6,7,12
A	US 5 988 990 A (LEE ET AL) 23 November 1999 (1999-11-23) abstract column 3, line 62 - column 4, line 64 figures 4-7	1,8
A	US 4 160 625 A (DYHR ET AL) 10 July 1979 (1979-07-10) cited in the application column 3, line 15 - column 4, line 64 figures	1

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 July 2006	24/07/2006

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/051100

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 016, no. 141 (M-1232), 9 April 1992 (1992-04-09) -& JP 04 001480 A (MATSUSHITA REFRIG CO LTD), 6 January 1992 (1992-01-06) abstract; figures	1
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Information on patent family members

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