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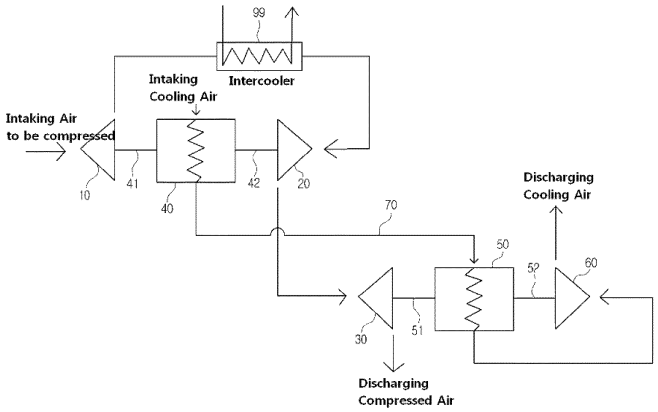
(54) TURBO COMPRESSOR SYSTEM HAVING AT LEAST TWO DRIVING MOTORS

(57) The present disclosure relates to a turbo compression system having two or more driving motors provided with a motor-cooling system for efficiently cooling two or more driving motors in the gearless type turbo compressor. An aspect of a turbo compression system having two or more driving motors according to the present disclosure comprises a first, second and third impeller provided separately; two or more driving motor rotating at least one among the first, second and third impeller; and a cooling impeller provided unitarily and simultaneously cooling the two or more driving motor. On the other hand, the turbo compression system having two or more driving motors further may comprise a fan motor rotating the cooling impeller and provided separately from the two or more driving motor.

【Fig. 1】



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Description

[FIELD]

[0001] The present disclosure relates to a turbo compression system having two or more driving motors, in detail, the turbo compression system having a motor-cooling system for efficiently cooling two or more driving motors in the gearless type turbo compressor.

[BACKGROUND]

[0002] This section provides background information related to the present disclosure which is not necessarily prior art.

[0003] Generally, a conventional turbo compressor is a device for compressing gases such as air or refrigerant. The conventional turbo compressor is characterized in that the discharge pressure thereof is very high.

[0004] US 6,398,517 discloses a two-stage turbo compression system having gearless type turbo compressor and US 7.044,718 discloses a three-stage turbo compression system having two turbo compressor which not only accomplishes three-stage compression by using two high-speed driving motors but also improves the compression efficiency by first-stage impeller coupled with the first driving motor and second-stage and third-stage impellers coupled with the second driving motor.

[0005] In the conventional turbo compression system, cooling system which cools high-speed driving motor has been installed and the three-stage turbo compression system having turbo compressor is equipped with two or more cooling impellers. That is, two or more cooling impellers, being respectively connected to separate cooling motors and rotating, may discharge heat out of the first and second driving motor which compress gases.

[0006] However, the conventional cooling system for the three-stage turbo compression system needs to be equipped with additional two or more cooling impellers and cooling motors for rotational driving of the cooling impellers. It caused some problems of making the structure of cooling system complicated, increasing product cost, and having space restraints for installing.

[0007] Meanwhile, in addition to that, it was disclosed that the system cools the driving motor by using some of compressed gases so as to improve cooling efficiency of the driving motor. But it also caused a problem of decrease of overall efficiency of turbo compression system.

[SUMMARY]

[0008] An object of the present disclosure is to provide a turbo compression system having two or more driving motors of which the excellent cooling efficiency may be maintained, and of which the configuration is simple.

[0009] An aspect of a turbo compression system having two or more driving motors according to the present disclosure comprises a first, second and third impeller provided separately; two or more driving motor rotating at least one among the first, second and third impeller; and a cooling impeller provided unitarily and simultaneously cooling the two or more driving motor.

[0010] The cooling impeller may be connected to a rotation shaft of one of the two or more driving motor and rotates.

[0011] The cooling impeller may be direct-connected to a rotation shaft of one of the two or more driving motor.

[0012] The cooling impeller may be provided with an axial flow type impeller.

[0013] The turbo compression system having two or more driving motors further may comprise a fan motor rotating the cooling impeller and provided separately from the two or more driving motor.

[0014] The two or more driving motor may include a first motor connecting with the first impeller and the second impeller at both sides of the first motor, and a second motor connecting with the third impeller at its one side and connecting with the cooling impeller at its the other side.

[0015] The turbo compression system having two or more driving motors further may comprise a cooling flow path connecting into the cooling impeller after passing through one and the other of the first motor and the second motor in sequence.

[0016] The turbo compression system having two or more driving motors further may comprise a cooling flow path passing through the first motor and the second motor separately, joining and then connecting into the cooling impeller.

[0017] The turbo compression system having two or more driving motors further may comprise the two or more driving motor including a first motor connecting with the first impeller and the second impeller at both sides of the first motor, and a second motor connecting with the third impeller at its one side; and a cooling flow path connecting into the cooling impeller after passing through one and the other of the first motor and the second motor in sequence.

[0018] The cooling impeller may be provided with an axial flow type impeller.

[0019] An aspect of a turbo compression system having two or more driving motors according to the present disclosure may have advantage to maintain the excellent cooling efficiency of the cooling system for cooling the two or more driving motors.

[0020] An aspect of a turbo compression system having two or more driving motors according to the present disclosure may also have advantage to make the structure of the cooling system simple and compact, to solve space restraints for installing, and to decrease the product cost of the cooling system.

[DRAWINGS]

[0021]

FIG. 1 is a view showing a turbo compression system having two or more driving motors according to the first embodiment of the present disclosure,

FIG. 2 is a view showing a turbo compression system having two or more driving motors according to the second embodiment of the present disclosure, and

FIG. 3 is a view showing a turbo compression system having two or more driving motors according to the third embodiment of the present disclosure.

[DETAILED DESCRIPTION]

[0022] Hereinafter, various embodiments of a turbo compression system according to the present disclosure will be described with reference to the accompanying drawings.

[0023] FIG. 1 is a view showing a turbo compression system having two or more driving motors according to the first embodiment of the present disclosure.

[0024] Referring to Figs. 1, a turbo compression system having two or more driving motors according to the first embodiment of the present disclosure comprises a first impeller 10, a second impeller 20, a third impeller 30, driving motors including a first motor 40 and a second motor 50, and a cooling impeller 60.

[0025] The first impeller 10 is connected to the rotation shaft 41 arranged at one side of the first motor 40 and rotates, and the second impeller 20 is connected to the rotation shaft 42 arranged at the other side of the first motor 40 and rotates.

[0026] In this case, an intercooler may be installed between the first impeller 10 and the second impeller 20.

[0027] Furthermore, the third impeller 20 is connected to the rotation shaft 51 arranged at one side of the second motor 50 and rotates.

[0028] Gas flowing in the first impeller 10 is compressed and discharged through the third impeller 30 passing through the second impeller 20.

[0029] The cooling impeller 60 is connected to the rotation shaft 52 arranged at the other side of the second motor 50 and rotates. In this case, the cooling impeller 60 rotates coaxially with the third impeller 30 connected to the second motor 50. Therefore, any separate driving device for the cooling impeller 60 is not needed by connecting the cooling impeller 60 to the rotation shaft 52 arranged at the other side of the second motor 50. Therefore it may decrease the product cost of the cooling system.

[0030] Furthermore, since the rotating velocity of the cooling impeller 60 is adjustable dependent on the rotating velocity of the second motor 50, any inverter for adjusting the rotating velocity of the cooling impeller 60 is not needed additionally. Therefore it may decrease the product cost of the cooling system and furthermore it may save the energy in partial-load operation.

[0031] In this case, the cooling impeller 60 is desirable to be provided with an axial flow type impeller because the rotating velocity of the second motor 50 is very high.

[0032] Meanwhile, since the first impeller 10 and the second impeller 20 are connected together with the first motor 40, the turbo compression system according to the present embodiment can be used as a low pressure compression system in itself and also the productivity can be increased.

[0033] Additionally, a turbo compression system having two or more driving motors according to the first embodiment of the present disclosure can cool plural driving motor by using one cooling impeller 60.

[0034] That is, a cooling flow path 70 is provided so as to communicate the first motor 40 with the second motor 50 and the cooling impeller 60 activates the forced circulation flow of cooling air into the cooling flow path 70.

[0035] Therefore, cooling air flowing in one side of the cooling flow path 70 cools the first motor 40 passing through the first motor 40, and then cooling air is discharged outside through the cooling impeller 60 after passing through the cooling flow path 70 and cooling the second motor 50 in sequence.

[0036] FIG. 2 is a view showing a turbo compression system having two or more driving motors according to the second embodiment of the present disclosure.

[0037] Referring to Fig. 2, the three-stage turbo compression system according to the second embodiment of the present disclosure comprises a first impeller 10, a second impeller 20, a third impeller 30, driving motors including a first motor 40 and a second motor 50, and a cooling impeller 60.

[0038] The first impeller 10 is connected to the rotation shaft 41 arranged at one side of the first motor 40 and rotates, the second impeller 20 is connected to the rotation shaft 51 arranged at one side of the second motor 50 and rotates, and the third impeller 30 is connected to the rotation shaft 52 arranged at the other side of the second motor 50 and rotates. In this case, an intercooler may be installed between the second impeller 20 and the third impeller 30.

[0039] Gas flowing in the first impeller 10 is compressed and discharged through the third impeller 30 passing through the second impeller 20. In this case, an additional intercooler may be installed between the first impeller 10 and the second impeller 20.

[0040] The cooling impeller 60 is connected to the rotation shaft 42 arranged at the other side of the first motor 40 and rotates. In this case, the cooling impeller 60 rotates coaxially with the first impeller 10 connected to the first motor 40.

[0041] Therefore, any separate driving device for the cooling impeller 60 is not needed by connecting the cooling impeller 60 to the rotation shaft 42 arranged at the other side of the first motor 40. Therefore it may decrease the product cost of the cooling system.

[0042] Furthermore, since the rotating velocity of the cooling impeller 60 is adjustable dependent on the rotating velocity of the first motor 40, any inverter for adjusting

the rotating velocity of the cooling impeller 60 is not needed additionally. Therefore it may decrease the product cost of the cooling system and furthermore it may save the energy in partial-load operation.

[0043] In this case, the cooling impeller 60 is desirable to be provided with an axial flow type impeller because the rotating velocity of the first motor 40 is very high, and the cooling efficiency may get better in case the first impeller 10 and the cooling impeller 60 are provided together with the first motor 40 because the revolution per minute (RPM) of the first impeller is relatively low.

[0044] Additionally, a turbo compression system having two or more driving motors according to the first embodiment of the present disclosure can cool plural driving motor by using one cooling impeller 60.

[0045] That is, a first intake flow path 71 is provided with the first motor 40 for the intake of cooling air and a second intake flow path 72 is provided with the second motor 50 for the intake of cooling air, and then the first intake flow path 71 and the second intake flow path 72 are joined and connected to a branch flow path 73 connected to the cooling impeller 60.

[0046] Therefore, cooling air flowing into the first motor 40 by the cooling impeller 60 is discharged outside through the cooling impeller 60 after passing through the first intake flow path 71 and the branch flow path 73 in sequence, and cooling air flowing into the second motor 50 by the cooling impeller 60 is discharged outside through the cooling impeller 60 after passing through the second intake flow path 72 and the branch flow path 73 in sequence. That is, cooling air flowing into one side of the first intake flow path 71 cools the first motor 40 and then is discharge outside, and cooling air flowing into one side of the second intake flow path 72 cools the second motor 50 and then is discharge outside. the cooling efficiency may get better due to the separate intake structure as above.

[0047] FIG. 3 is a view showing a turbo compression system having two or more driving motors according to the third embodiment of the present disclosure.

[0048] Referring to Fig. 3, the turbo compression system having two or more driving motors according to the third embodiment of the present disclosure further comprises a fan motor 80 for rotating the cooling impeller 60, in addition to elements of the turbo compression system having two or more driving motors according to the first embodiment of the present disclosure as above-mentioned. Hereinafter, the explanation on the same elements as above mentioned will be omitted.

[0049] In the present embodiment, the cooling impeller 60 is not connected to the driving motor but connected to the fan motor 80 provided separately so as not to have a bad effect on the performance of the turbo compressor and so as to decrease the product cost by cooling plural driving motor by using one cooling impeller 60.

[0050] The descriptions as above mentioned have been given by the way of an example in limited embodiments for a clear understanding of the technical idea disclosed. It is not limited thereto, but applicable to the embodiments which can be deduced by those who have conventional knowledge in the field of the art that belongs to the technical idea disclosed below, in advance.

Claims

1. A turbo compression system having two or more driving motors, comprising:

   A first, second and third impeller provided separately;
   Two or more driving motor rotating at least one among the first, second and third impeller; and
   A cooling impeller provided unitarily and simultaneously cooling the two or more driving motor.

2. The turbo compression system having two or more driving motors as claimed in claim 1, wherein the cooling impeller is connected to a rotation shaft of one of the two or more driving motor and rotates.

3. The turbo compression system having two or more driving motors as claimed in claim 2, wherein the cooling impeller is direct-connected to a rotation shaft of one of the two or more driving motor.

4. The turbo compression system having two or more driving motors as claimed in claim 2, wherein the cooling impeller is provided with an axial flow type impeller.

5. The turbo compression system having two or more driving motors as claimed in claim 1, further comprises a fan motor rotating the cooling impeller and provided separately from the two or more driving motor.

6. The turbo compression system having two or more driving motors as claimed in claim 2, wherein the two or more driving motor includes a first motor connecting with the first impeller and the second impeller at both sides of the first motor, and a second motor connecting with the third impeller at its one side and connecting with the cooling impeller at its the other side.

7. The turbo compression system having two or more driving motors as claimed in claim 6, further comprises a cooling flow path connecting into the cooling impeller after passing through one and the other of the first motor and the second motor in sequence.

8. The turbo compression system having two or more driving motors as claimed in claim 6, further comprises a cooling flow path passing through the first motor and the second motor separately, joining and

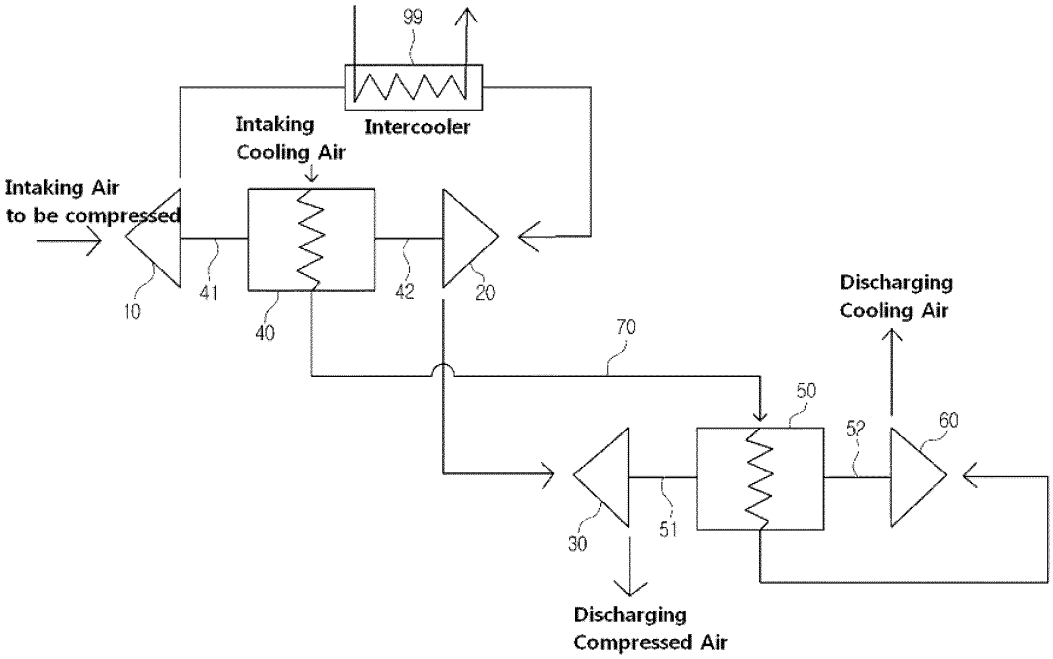
then connecting into the cooling impeller.

9. The turbo compression system having two or more driving motors as claimed in claim 5, further comprises:

the two or more driving motor including a first motor connecting with the first impeller and the second impeller at both sides of the first motor, and a second motor connecting with the third impeller at its one side; and
a cooling flow path connecting into the cooling impeller after passing through one and the other of the first motor and the second motor in sequence.

10. The turbo compression system having two or more driving motors as claimed in claim 9, wherein the cooling impeller is provided with an axial flow type impeller.

【Fig. 1】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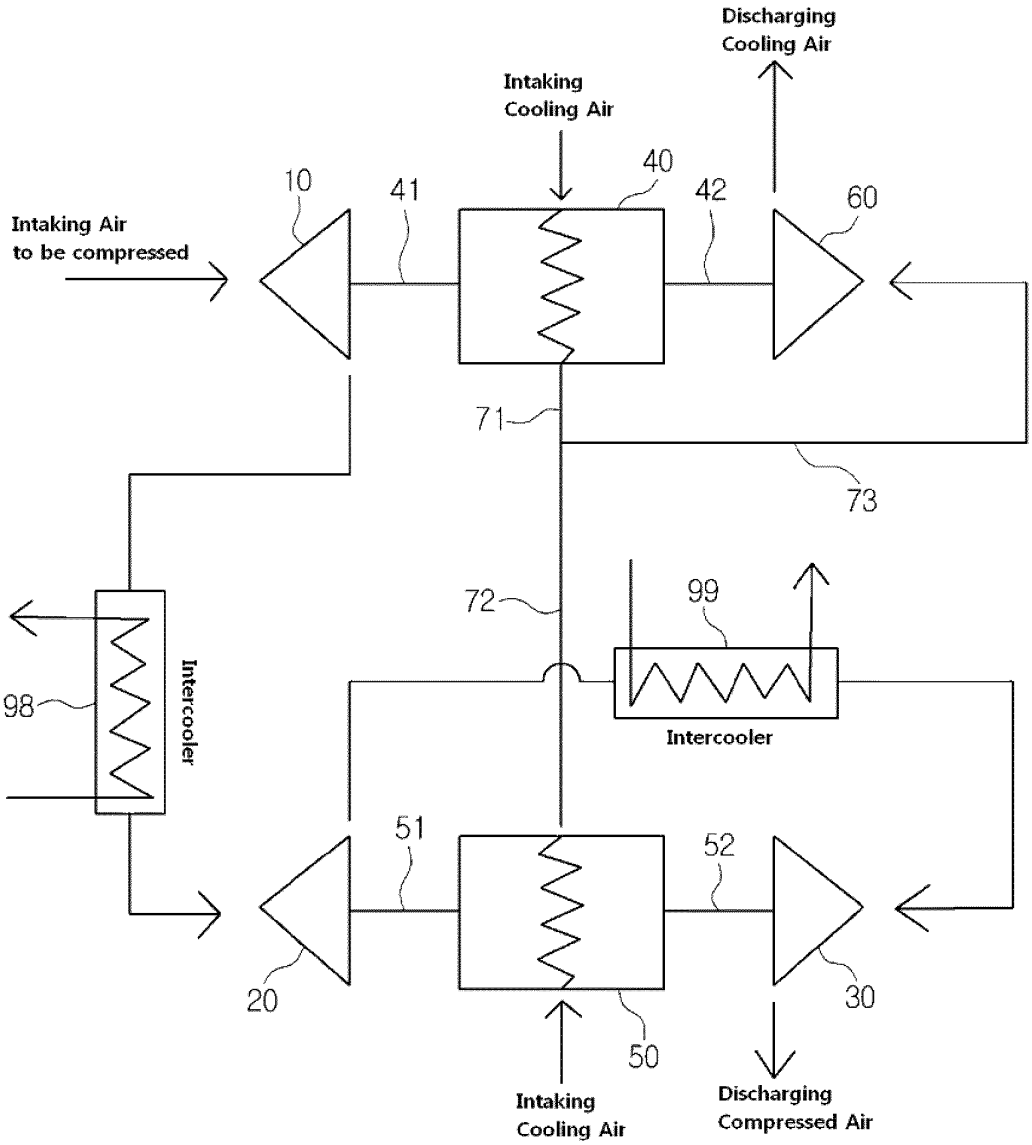
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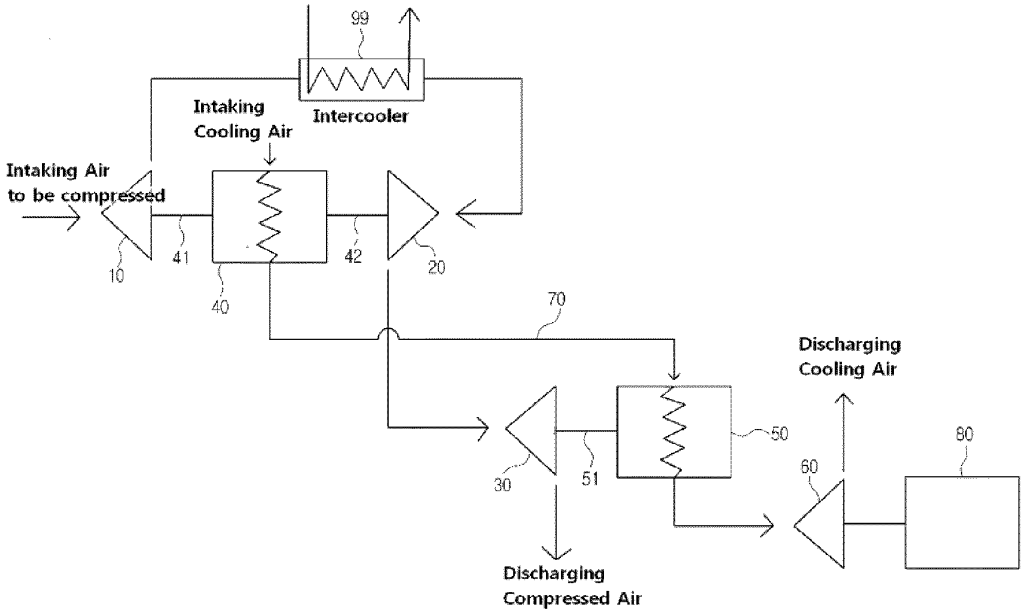
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2013/004618

A. CLASSIFICATION OF SUBJECT MATTER

A61F 2/82(2006.01)i, A61F 2/06(2006.01)i, A61F 2/07(2013.01)i

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)

A61F 2/82; F04D 25/16; F04D 27/00; F04D 29/58; F04D 25/06; F04D 17/12; F04D 25/08; A61F 2/06; A61F 2/07

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: turbo, turbine, compression, motor, impeller, blade, blade, fan, cooling, cooling, direct, serial, axial

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2003-0026202 A (HITACHI, LTD.) 31 March 2003 See abstract; claim 1; figure 2.	1-10
A	KR 10-1123655 B1 (LEE, Heon Seok) 20 March 2012 See abstract; claim 1; figure 1.	1-10
A	KR 10-0530757 B1 (SAMSUNG TECHWIN CO.,LTD.) 23 November 2005 See abstract; claim 1; figures 1-3.	1-10
A	KR 10-0253250 B1 (LG ELECTRONICS INC.) 01 May 2000 See abstract; claim 1; figure 1.	1-10
A	JP 2010-185443 A (NIHON DENSAN KK.) 26 August 2010 See abstract; claim 1; figure 1.	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 AUGUST 2013 (06.08.2013)	**07 AUGUST 2013 (07.08.2013)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2013/004618

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Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6398517 B **[0004]**
- US 7044718 B **[0004]**