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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 November 2008 (06.11.2008)

PCT

(10) International Publication Number
WO 2008/133445 A1

(51) International Patent Classification:
F04B 39/02 (2006.01)

(21) International Application Number:
PCT/KR2008/002353

(22) International Filing Date: 25 April 2008 (25.04.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10-2007-0040529 25 April 2007 (25.04.2007) KR

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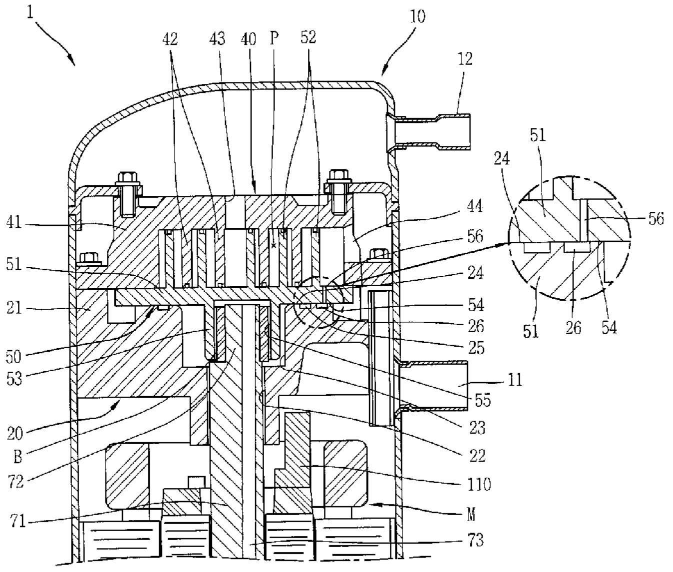
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM,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

(54) Title: COMPRESSOR AND OIL SUPPLYING STRUCTURE THEREFOR

[Fig. 1]



(57) Abstract: A compressor and an oil supplying structure therefor are provided. When a compressor is operated at a high speed or low speed, a predetermined amount of oil is supplied to compression pockets formed between a wrap of an orbiting scroll and a wrap of a fixed scroll. Pressure leakage between the wraps may be prevented, thereby enhancing a performance of the compressor. Further, since friction between the orbiting scroll and the fixed scroll may be prevented, abrasion of the components may be minimized.

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Description

COMPRESSOR AND OIL SUPPLYING STRUCTURE THEREFOR

Technical Field

[1] A compressor and an oil supplying structure therefor are disclosed herein.

Background Art

[2] Compressors are known. However, they suffer from various disadvantages.

Brief Description of the Drawings

[3] Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, and wherein:

[4] FIG. 1 is a sectional view of a compressor having an oil supplying structure according to an embodiment;

[5] FIG. 2 is a sectional view showing a modification of an oil hole of an oil supplying structure according to an embodiment;

[6] FIGS. 3 to 6 are sectional and planar views showing modifications of an oil hole of an oil supplying structure according to embodiments;

[7] FIG. 7 is a planar view showing an oil groove of an oil supplying structure according to an embodiment;

[8] FIG. 8 is a sectional view showing a compressor having an oil supplying structure according to an embodiment being operated;

[9] FIG. 9 is a sectional view of a compressor having an oil supplying structure according to another embodiment;

[10] FIG. 10 is a sectional view of a compressor having an oil supplying structure according to another embodiment;

[11] FIG. 11 is a planar view of a frame of the oil supplying structure of FIG. 10;

[12] FIG. 12 is a sectional view showing a modification of an oil passage of the oil supplying structure of FIG. 10;

[13] FIG. 13 is a sectional view showing an oil discharge passage of the oil supplying structure of FIG. 10;

[14] FIG. 14 is a sectional view showing an oil controlling portion of the oil supplying structure of FIG. 10;

[15] FIGS. 15 and 16 are sectional views, respectively, showing an operation state of the oil controlling portion of FIG. 14;

[16] FIG. 17 is a sectional view showing another embodiment of an oil controlling portion of the oil supplying structure of FIG. 10;

[17] FIGS. 18 and 19 are sectional views, respectively, showing an operation state of the

oil controlling portion of FIG 17; and

[18] FIGS. 20-22 are exemplary installations of a compressor having an oil supplying device according to embodiments disclosed herein.

Mode for the Invention

[19] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings.

[20] Generally, a compressor is a device for compressing gas by converting electric energy into kinetic energy. The compressor may include a driving force generating device that generates a driving force, and a compression device that compresses gas by receiving a driving force generated from the driving force generating device. Compressors are divided into several types, including a rotary compressor, a reciprocating compressor, and a scroll compressor, according to a compression mechanism for compressing gas.

[21] In a scroll compressor, a rotational force generated by a motor is transmitted to an orbiting scroll through a rotational shaft. The orbiting scroll performs an orbiting motion by being engaged with a fixed scroll, and a plurality of compression chambers or pockets are formed by a wrap of the fixed scroll and a wrap of the orbiting scroll. As the compression chambers move towards a center, a volume thereof is changed to suck, compress, and discharge gas. Oil contained in a casing is pumped along an oil passage disposed in the rotational shaft, and is supplied between a rear surface of the orbiting scroll and a bearing surface of a main frame that supports the rear surface of the orbiting scroll. Then, the oil returns to the lower surface of the casing.

[22] While the scroll compressor is operated, oil has to be sufficiently supplied into the compression pockets. Otherwise, friction is generated between the orbiting scroll and the fixed scroll generating abrasion therebetween. Also, an oil sealing performance between the fixed scroll and the orbiting scroll is lowered, thereby generating a pressure leakage between a high pressure side and a low pressure side. Accordingly, a reliability and a performance of the compressor are degraded.

[23] Hereinafter, a scroll compressor according to embodiments will be explained in detail with reference to the attached drawings. An oil supplying device according embodiments is disclosed in detail implemented in a scroll compressor. However, the oil supplying device according embodiments may be implemented in other types of compressors. Further, the oil separating device according to embodiments may be implemented in a high scroll compressors or a low side scroll compressor.

[24] FIG. 1 is a sectional view of a compressor having an oil feeding or supplying structure according to an embodiment. As shown in FIG. 1, the compressor 1 may include a casing 10, a main frame 20 and a sub frame 30 disposed in the casing 10 with

a predetermined gap therebetween, and a driving motor M disposed between the main frame20 and the sub frame 30. A suction pipe 11 and a discharge pipe 12 may be respectively, coupled to the casing 10, and oil may be contained in the casing 10.

[25] The main frame 20 may include a shaft insertion hole 22 formed in a frame body 21 and having a predetermined shape, that receives a rotational shaft 70, a boss insertion groove 23 which may extend from the shaft insertion hole 22 on an upper surface of the frame body 21 and having an inner diameter larger than that of the shaft insertion hole 22, a bearing surface 24 formed on an upper surface of the frame body 21, and an oil groove 25, which may have a ring shape and be formed at the bearing surface 24 with a predetermined width and depth.

[26] A fixed scroll 40 may be coupled to an inside of the casing 10 with a predetermined gap from the main frame 20. Also, an orbiting scroll 50 may be coupled between the fixed scroll 40 and the main frame 20 so as to perform an orbiting motion. An Oldham s ring 60 that prevents the orbiting scroll 50 from rotating on its axis may be coupled between the main frame 20 and the orbiting scroll 50.

[27] The fixed scroll 40 may include a body portion 41 having a predetermined shape, a wrap 42 formed on one surface of the body portion 41 in an involute curve having a predetermined height and thickness, a discharge hole 43 formed at a center of the body portion 41, and an inlet 44 formed at one side of the body portion 41.

[28] The orbiting scroll 50 may include a disc portion 51 having a predetermined thickness and area, a wrap 52 formed on one surface of the disc portion 51 in an involute curve having a predetermined thickness and height, and a boss portion 53 formed on another surface of the disc portion 51 with a predetermined height. A lower surface of the disc portion 51 may form a bearing surface 54, and a shaft insertion hole 55 having a predetermined outer diameter and depth may be formed in the boss portion 53.

[29] One or more oil hole 56 may be formed in the disc portion 51 of the orbiting scroll 50. The oil hole(s) 56 may be positioned at an inlet of a compression portion, which may include compression pockets or chambers formed by a wrap 42 of the fixed scroll 40 and a wrap 52 of the orbiting scroll 50. For example, the oil hole 56 may be disposed to be adjacent to an end of the wrap 52 protruding from the disc portion 51 of the orbiting scroll 50 on a same extending line. The oil hole 56 may be formed to contact the end of the wrap 52. Alternatively, the oil hole 56 may be disposed to be adjacent to the end of the wrap 52 so as to facilitate processing. An inner diameter of the oil hole 56 may be less than a thickness of the wrap 52 of the orbiting scroll 50. The oil hole 56 may be formed to be perpendicular to the disc portion 51, and may have a constant inner diameter. Or, as shown in FIG. 2, the oil hole 56 may be formed to be inclined from the disc portion 51. The oil hole 45 may have an inner diameter of,

for example, 2.0~3.5 mm.

[30] As shown in FIGS. 3 and 4, the oil hole 56 may include a circular hole portion 56A formed on an upper surface of the disc portion 51 and having a predetermined inner diameter and length and a long recess portion 56B that communicates with the circular hole portion 56A. The long recess portion 56B may be formed on a lower surface of the disc portion 51 so as to have a cross-sectional area wider than that of the circular hole portion 56A. The long recess portion 56B may be disposed so that a longitudinal direction thereof extends toward a center of the disc portion 51.

[31] As shown in FIG. 5, the long recess portion 56B may be formed so as to be adjacent to an end of the wrap 52 of the orbiting scroll 50 formed on the upper surface of the disc portion 51 on a same extending line. Also, as shown in FIG. 6, the long recess portion 56B may be formed so as to be inclined from the end of the wrap 52. An oil groove 26 that communications with the oil hole 56 may be formed in the bearing surface 24 of the main frame 20 that supports a lower surface of the disc portion 51 of the orbiting scroll 50. As shown in FIG. 7, the oil groove 26 may be disposed at one side of an orbiting path of the oil hole 56 which is moved by the orbiting motion of the orbiting scroll 50. The oil groove 26 may have a square shape. However, the oil groove 26 may be formed to have various shapes besides a square shape, such as ring-shaped. Further, the oil groove 26 may have a depth of 3.5~4.5 mm.

[32] The wrap 52 of the orbiting scroll 50 may be engaged with the wrap 42 of the fixed scroll 40, and the boss portion 53 may be inserted into the boss insertion groove 23 of the main frame 20. The bearing surface of the disc portion 51 may be supported by the bearing surface 24 of the main frame 20.

[33] The ring-shaped oil groove 25 formed in the main frame 20 may serve as the oil groove 26. In such a case, the oil groove 26 need not be additionally formed in the main frame 20. When the orbiting scroll 50 performs an orbiting motion, the oil hole 56 of the orbiting scroll contacts the oil groove 25. A rotational shaft 70 that transmits a rotational force generated by the driving motor M to the orbiting scroll 50 may be coupled to the driving motor M. The rotational shaft 70 may include a shaft portion 71 having a predetermined length, an eccentric portion 72 extending from the shaft portion 71, and an oil passage 73 penetratingly formed in the shaft portion 71 and the eccentric portion 72. The shaft portion 71 of the rotational shaft 70 may be forcibly inserted into a rotor of the driving motor M, and may be penetratingly inserted into the main frame 20. Also, the eccentric portion 72 may be inserted into the shaft insert hole 55 of the boss portion 53 of the orbiting scroll 50. An end of the rotational shaft 70 may be submerged into oil contained in the casing 10. Unexplained reference numeral B denotes a bush, 100 denotes an oil feeder mounted on the rotational shaft 70, and 110 denotes a balance weight.

[34] Operation of the oil supplying structure for a compressor according to an embodiment will be explained herein below.

[35] When power is supplied to the compressor, the driving motor M is operated to generate a rotational force. As the rotational shaft 70 rotates by receiving the rotational force generated by the driving motor M, the orbiting scroll 50 coupled to the eccentric portion 72 orbits centering around the rotational shaft 70 due to the Oldham s ring 60. As the orbiting scroll 50 performs the orbiting motion, the wrap 52 of the orbiting scroll 50 engaged with the wrap 42 of the fixed scroll 40 form a plurality of compression pockets or chambers P which move towards a center of the orbiting scroll 50. As a volume of the compression pockets or chambers P is changed, gas is sucked, compressed, and then is discharged through the discharge hole 43 of the fixed scroll 40. Gas sucked into the casing 10 through the suction pipe 11 is sucked into the compression pockets or chambers P through a suction passage formed by the inlet 44 of the fixed scroll 40 and the orbiting scroll 50.

[36] As shown in FIG. 8, oil contained in the casing 10 is pumped by the oil passage 73 formed in the rotational shaft 70. Then, the oil is filled in the boss insertion groove 23. As the boss portion 53 of the orbiting scroll 50 performs a circular motion in the boss insertion groove 23, the oil filled in the boss insertion groove 23 is supplied between the bearing surface 54 of the disc portion 51 of the orbiting scroll and the bearing surface 24 of the main frame 20 to perform a lubricating operation. Some of the oil supplied between the bearing surface 54 of the disc portion 51 of the orbiting scroll and the bearing surface 24 of the main frame 20 is introduced into the compression portion formed by the wrap 52 of the orbiting scroll 50 and the wrap 42 of the fixed scroll 40, that is, the compression pockets or chambers P, through the oil hole 56 penetratingly formed at the disc portion 51 of the orbiting scroll 50. As a result, a pressure leakage between a high pressure compression pocket or chamber P and a low pressure compression pocket or chamber P may be prevented by an oil sealing. Also, friction generated at a contact surface between the orbiting scroll 50 and the fixed scroll 40 may be prevented. When the compressor is operated at a high speed or a low speed, as well as at a constant speed, oil is smoothly supplied to the compression portion. Further, when the oil hole 56 of the orbiting scroll 50 is formed at an inlet, an oil supplying performance to the compression pockets P through the oil hole 56 may be enhanced since gas sucked into the compression pockets P formed by the wrap 52 of the orbiting scroll 50 and the wrap 42 of the fixed scroll 40 flows.

[37] When the oil groove 26 that communicates with the oil hole 56 of the orbiting scroll is formed at the bearing surface 24 of the main frame 20, an amount of oil supplied to the compression pockets P through the oil hole 56 while the orbiting scroll 50 performs an orbiting motion may be increased. More specifically, while the orbiting scroll 50

performs the orbiting motion, some of the oil introduced between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be stored in the oil groove 26. As the orbiting scroll 50 performs the orbiting motion, the oil hole 56 performs a circular motion having an arbitrary point as a center point. At the time of the circular motion, the oil hole 56 communicates with the oil groove 26 formed in the bearing surface 24 of the main frame 20. Accordingly, oil filled in the oil groove 26 may be introduced into the oil hole 56, and then introduced into the compression pockets P. The oil groove 26 enhances an oil supplying performance to the compression pockets P. The oil supplying performance to the compression pockets P may be more enhanced when the compressor is operated at a low speed.

[38] With this embodiment, when the compressor is operated in a constant speed mode or in a variable-speed mode, oil may be smoothly supplied to the compression portion. That is, when the compressor is operated at a high speed or a low speed, oil may be smoothly supplied to the compression portion.

[39] FIG. 9 is a sectional view of a compressor having an oil supplying structure according to another embodiment. As shown, the compressor of FIG. 9 may include a casing 10, a main frame 20, a fixed scroll 40, an orbiting scroll 50, a rotational shaft 70, and a driving motor M, in which an oil passage 27 through which oil is supplied to a bearing surface 24 of the main frame 20 or a bearing surface 54 of the orbiting scroll 50 may be provided at one side of the main frame 20. The compressor of this embodiment has the same structure as the aforementioned compressor except for the main frame 20. The main frame 20 may include a shaft insertion hole 22 formed at a frame body 21 having a predetermined shape, that receives the rotational shaft 70, a boss insertion groove 23 extending from the shaft insertion hole 22 on an upper surface of the frame body 21 and having an inner diameter larger than that of the shaft insertion hole 22 and a predetermined depth, a bearing surface 24 formed on an upper surface of the frame body 21, and an oil groove 25, which may have a ring shape, formed in the bearing surface 24 with a predetermined width and depth. The oil passage 27 may be penetratingly formed in the boss insertion groove 23 and the bearing surface 24 of the main frame 20 so that oil stored in the boss insertion groove 23 may be introduced between a disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 that supports the disc portion 51.The oil passage 27 may be inclined from the bearing surface 24 of the main frame 20, and may be a linear hole.

[40] Operation of the oil supplying structure according to this embodiment will be explained herein below.

[41] While the compressor is operated, oil inside the casing 10 is pumped through an oil passage 73 formed in the rotational shaft 70 as the rotational shaft 70 rotates. The oil

may be filled in the boss insertion groove 23, and then supplied between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 as the boss portion 53 performs a circular motion in the boss insertion groove 23.

[42] An amount of oil supplied between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be increased since some of the oil filled in the boss insertion groove 23 may be supplied therebetween through the oil passage 27. Some of the oil supplied between the bearing surface 54 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be sucked into the compression pockets P together with gas.

[43] That is, as an amount of oil supplied between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be increased, an amount of oil discharged between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be increased. As a result, an amount of oil sucked to the compression portion (compression pockets or chambers P) together with gas may be increased.

[44] With this embodiment, when the compressor is operated in a constant speed mode or in a variable-speed mode, oil may be smoothly supplied to the compression portion. That is, when the compressor is operated at a high speed or a low speed, oil may be smoothly supplied to the compression portion.

[45] FIG. 10 is a sectional view of a compressor having an oil supplying structure according to another embodiment. As shown, the compressor of FIG. 10 may include a casing 10, a main frame 20, a fixed scroll 40, an orbiting scroll 50, a rotational shaft 70, and a driving motor M. An oil hole 56 through which oil may be introduced to the compression portion while the orbiting scroll 50 performs an orbiting motion may be penetratingly formed at a disc portion 51 of the orbiting scroll 50, and an oil passage 27 through which oil may be supplied to the oil hole 56 may be penetratingly formed at one side of the main frame 20. The compressor of this embodiment has the same structure as the aforementioned compressors except for the main frame 20 and the orbiting scroll 50.

[46] That is, the orbiting scroll 50 may include a disc portion 51 having a predetermined thickness and area, a wrap 52 formed on one surface of the disc portion 51 in an involute curve having a predetermined thickness and height, and a boss portion 53 formed on another surface of the disc portion 51 with a predetermined height. A shaft insertion hole 55 having a predetermined outer diameter and depth may be formed in the boss portion 53.

[47] The oil hole 56 may be formed at the disc portion 51 of the orbiting scroll 50. The oil hole 56 may be positioned at an inlet of a compression portion formed by the wrap 42

of the fixed scroll 40 and the wrap 52 of the orbiting scroll 50. That is, the oil hole 56 may be disposed to be adjacent to an end of the wrap 52 protruding from the disc portion 51 of the orbiting scroll 50 on a same extending line. The oil hole 56 may be formed to contact the end of the wrap 52. However, the oil hole 56 may be disposed to be adjacent to the end of the wrap 52 so as to facilitate processing. A structure of the oil hole 56 of the orbiting scroll 50 of this embodiment is the same as the structure of the embodiment of FIG. 1.

[48] The main frame 20 may include a shaft insertion hole 22 formed at a frame body 21 and having a predetermined shape, that receives the rotational shaft 70, a boss insertion groove 23 extending from the shaft insertion hole 22 on an upper surface of the frame body 21, which may have an inner diameter larger than that of the shaft insertion hole 22, and having a predetermined depth, a bearing surface 24 formed on an upper surface of the frame body 21, and an oil groove 25, which may have a ring shape and be formed at the bearing surface 24 with a predetermined width and depth. The ring-shaped oil groove may not be provided according to a structure of the compressor.

[49] The oil passage 27 of the main frame 20 may be penetratingly formed at the boss insertion groove 23 and the bearing surface 24 of the main frame 20 so that oil stored in the boss insertion groove 23 may be introduced between a disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 that supports the disc portion 51. The oil groove 25, which may have a predetermined area and may communicate with the oil hole 56 may be formed at the bearing surface 24 of the main frame 20. The oil groove 26 may be disposed at one side of an orbiting path of the oil hole which is moved by an orbiting motion of the orbiting scroll 50. The oil passage 27 may communicate with the oil groove 26. The oil groove 26 may have the same shape as the oil groove of the embodiment of FIG. 1.

[50] As shown in FIG. 11, the oil passage 27 of the main frame 20 may be a linear hole penetratingly formed in the boss insertion groove 23 and the bearing surface that supports the disc portion 51 of the orbiting scroll 50. A longitudinal direction of the oil passage 27 may be inclined from a center of the boss insertion groove 23 of the main frame 20. The oil passage 27 may be formed with an inclination angle so that oil stored in the boss insertion groove 23 may be effectively discharged when the boss portion 53 of the orbiting scroll 50 performs a circular motion.

[51] As shown in FIG. 12, the oil passage 27 of the main frame 20 according to another embodiment may include a first through hole 27A that linearly penetrates an inner circumferential wall of the boss insertion groove 23 of the main frame 20 and an outer surface of the main frame 20 and a second through hole 27B that linearly penetrates the first through hole 27A and the bearing surface 24 of the main frame 20. A cover 27C that covers the first through hole 27A may be disposed on an outer surface of the

main frame of the first through hole 27A, thereby facilitating a processing of the oil passage 27.

[52] As shown in FIG. 13, an oil discharge passage 28 through which oil inside the boss insertion groove 23 may be discharged may be disposed at one side of the main frame 20. An inlet of the oil discharge passage 28 disposed on an inner circumferential wall of the boss insertion groove 23 may be positioned above an inlet of the oil passage 27 disposed on an inner circumferential wall of the boss insertion groove 23. The oil discharge passage 28 may include a first passage 28A that penetrates an inner circumferential wall of the boss insertion groove 23 and an outer circumferential surface of the main frame 20, and a second passage 28B disposed on the outer circumferential surface of the main frame 20 in a vertical direction so as to communicate with the first passage 28A. The oil discharge passage 28 may serve to discharge oil excessively contained at the boss insertion groove 23 to a lower surface of the casing 10.

[53] An oil controlling portion that controls an amount of oil introduced into the compression portion through the oil passage 27 may be disposed in the oil passage 27. As shown in FIG. 14, the oil controlling portion according to an embodiment may include a small pipe portion 27D, and an expanded pipe portion 27E having an inner diameter larger than that of the small pipe portion 27D. A supplementary path 27F through which oil flows may be formed at an inner edge of a stepped surface formed by a difference of inner diameters of the small pipe portion 27D and the expanded pipe 27E. A stopper 120 having a through hole 121 therein may be coupled to the expanded pipe portion 27E of the oil passage 27. An opening/closing ball 130 that opens and closes the through hole 121 of the stopper 120 may be inserted into the expanded pipe portion 27E. The opening/closing ball 130 may be moved according to a flow rate of oil inside the expanded pipe portion 27E. A spring 140 that elastically supports the opening/closing ball 130 may be inserted into the expanded pipe portion 27E.

[54] The stopper 120 may be formed to have a predetermined length and a circular sectional shape corresponding to a sectional surface of the expanded pipe portion 27E. The through hole 121 may be formed in the stopper 120, and a supporting surface that supports the spring 140 may be provided on an inner circumferential wall of the through hole 121.

[55] The opening/closing ball 130 may be spherical in shape. A maximum diameter of the opening/closing ball 130 may be smaller than an inner diameter of the expanded pipe portion 27E, but may be larger than an inner diameter of the through hole 121 of the stopper 120. The spring 140 may be a coil spring. In such a case, one side of the coil spring may be supported by the supporting surface of the stopper 120, and another side supported by the opening/closing ball 130.

[56] As shown in FIG. 15, when the compressor is operated at a low speed, the oil con-

trolling portion may be operated so that the oil contained in the boss insertion groove 23 of the main frame 20 may be supplied to the oil hole 56 of the orbiting scroll 50 via the small pipe portion 27D, the supplementary path 27F, the through hole 121 of the stopper, and the expanded pipe portion 27E. Since the boss portion 53 of the orbiting scroll 50 that performs a circular motion in the boss insertion groove 23 of the main frame 20 may have a slow rotational speed, a small amount of oil may be pumped to the oil passage 27. Accordingly, the opening/closing ball 130 may be supported by the stepped surface by an elastic force of the spring 140, thereby opening the through hole 121 of the stopper 120.

[57] As shown in FIG. 16, when the compressor is operated at a high speed, a large amount of oil may be pumped to the oil passage 27 from the boss insertion groove 23. By a flow pressure of the oil, the opening/closing ball 130 may be moved to close the through hole 121 of the stopper 120. Accordingly, the oil contained in the boss insertion groove 23 of the main frame 20 may be prevented from flowing to the oil hole 56 of the orbiting scroll 50 through the oil passage 27. The oil contained in the boss insertion groove 23 may be supplied to the oil hole 56 of the orbiting scroll through a space between the bearing surface 54 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20.

[58] The oil controlling portion may serve to smoothly supply oil to the compression portion when the compressor is rotated at a low speed, and to prevent oil from being excessively supplied to the compression portion when the compressor is rotated at a high speed. More specifically, when the compressor is rotated at a low speed, the oil controlling portion may be operated so that oil contained in the boss insertion groove 23 of the main frame 20 may be supplied to the oil hole 56 of the orbiting scroll through the oil passage 27. On the other hand, when the compressor is rotated at a high speed, the oil controlling portion may be operated so that the oil contained in the boss insertion groove 23 of the main frame 20 may not be supplied to the oil hole 56 of the orbiting scroll through the oil passage 27.

[59] FIG. 17 is a sectional view of an oil controlling portion according to another embodiment. The oil controlling portion of this embodiment may include a stopper 150 having a through hole 151 therein, and fixedly coupled to an expanded pipe portion 27K of a vertical passage 27G of the oil passage 27, an opening/closing 160 disposed at the expanded pipe portion 27K and moving according to a flow rate of oil, that opens and closes the through hole 121 of the stopper, and a spring 170 coupled to the stopper 150 for elastically supporting the opening/closing ball 160.

[60] The oil passage 27 may include a slant passage 27H that penetrates an inner circumferential wall of the boss insertion groove 23 of the main frame 20 and the bearing surface 24 of the main frame 20, and a vertical passage 27G that penetrates the bearing

surface 24 of the main frame 20 and a lower surface of a body portion 21 of the main frame 20. The vertical passage 27G and the slant passage 27H may be connected to the bearing surface 24 of the main frame 20. A common hole 27M having a predetermined area and depth may be formed at the connection part. The common hole 27M may serve as the oil groove.

[61] The expanded pipe portion 27K may be formed at the vertical passage 27G. A stepped surface may be formed at a starting part of the expanded pipe portion 27K.

[62] The stopper 150 may be coupled to the expanded pipe portion 27K with a predetermined gap from the stepped surface. The opening/closing ball 160, which may be spherical in shape, may be disposed between the stopper 150 and the stepped surface.

[63] The spring 170 may be a coil spring. In such a case, one side of the coil spring may be supported by the stepped surface, and another side thereof supported by the opening/closing ball 160. The opening/closing ball 160 closes the through hole 151 of the stopper 150 by receiving an elastic force of the coil spring.

[64] As shown in FIG. 18, when the compressor is operated at a low speed, the oil controlling portion may be operated so that oil contained in the boss insertion groove 23 of the main frame 20 may be supplied to the oil hole 56 of the orbiting scroll through the slant passage 27H. Since a small amount of oil may be pumped to the slant passage 27H from the boss insertion groove 23, a pressure of oil inside the common hole 27M is low. Accordingly, the opening/closing ball 160 may block the vertical passage 27G by an elastic force of the spring 170.

[65] As shown in FIG. 19, when the compressor is operated at a high speed, a large amount of oil may be pumped to the slant passage 27H from the boss insertion groove 23. Accordingly, a pressure of oil inside the common hole 27M may be high thus to contract the spring 170. As a result, the vertical passage 27G may be opened by the opening/closing ball 160, and oil pumped to the slant passage 27H may be drained to a lower side of the main frame 20 through the vertical passage 27G. Since an amount of oil supplied to the oil hole 56 of the orbiting scroll may be controlled, oil may be prevented from being excessively introduced into the compression portion when the compressor is operated at a high speed.

[66] The oil controlling portion may be applied to the oil supplying structure of FIG. 9. When the compressor is operated at a high speed, oil may be prevented from being excessively supplied to the compression portion.

[67] Operation of the oil feeding structure for a compressor according to another embodiment will be explained hereinafter.

[68] While the compressor is operated, oil inside the casing 10 may be pumped through the oil passage 73 formed in the rotational shaft 70 as the rotational shaft 70 rotates. The oil may be filled in the boss insertion groove 23, and then supplied between the

bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 through the oil passage 27 of the main frame 20 as the boss portion 53 of the orbiting scroll 50 performs a circular motion in the boss insertion groove 23. The oil contained in the boss insertion groove 23 may be introduced between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 as the boss portion 53 of the orbiting scroll 50 rotates. The oil supplied between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be introduced into the compression portion formed by the wrap 52 of the orbiting scroll 50 and the wrap 42 of the fixed scroll, that is, the compression pockets P through the oil hole 56 of the orbiting scroll 50 as the orbiting scroll 50 performs an orbiting motion.

[69] When the oil groove 26 that communicates with the oil hole 56 of the orbiting scroll is formed at the bearing surface 24 of the main frame 20, a large amount of oil may be supplied to the compression portion through the oil hole 56 while the orbiting scroll 50 performs an orbiting motion. More specifically, while the orbiting scroll 50 is operated, some oil introduced between the bearing surface 54 of the disc portion 51 of the orbiting scroll 50 and the bearing surface 24 of the main frame 20 may be stored in the oil groove 26. As the orbiting scroll 50 performs the orbiting motion, the oil hole 56 formed in the disc portion 51 of the orbiting scroll 50 performs a circular motion having an arbitrary point as a center point. At the time of the circular motion, the oil hole 56 of the orbiting scroll 50 may communicate with the oil groove 26 formed at the bearing surface 24 of the main frame 20. Accordingly, oil filled in the oil groove 26 may be introduced into the oil hole 56, and then is introduced into the compression pockets P. The oil groove 26 may enhance an oil supplying performance to the compression pockets P. The oil supplying performance to the compression pockets P may be more enhanced when the compressor is operated at a low speed.

[70] With this embodiment, when the compressor is operated in a constant speed mode or in a variable-speed mode, oil may be smoothly supplied to the compression portion. That is, when the compressor is operated at a high speed or a low speed, oil may be smoothly supplied to the compression portion.

[71] When an oil controlling portion is provided in the oil passage 27 of the main frame 20, oil may be prevented from being excessively supplied to the compression pockets P formed by the wrap 52 of the orbiting scroll 50 and the wrap 42 of the fixed scroll while the compressor is operated at a high speed.

[72] The oil feeding structure for a compressor may further include an oil storing portion disposed outside the compression pockets P, and an oil passage penetratingly formed at the disc portion 51 of the orbiting scroll 50, to supply oil stored in the oil storing portion into the compression pockets P as the orbiting scroll 50 performs an orbiting

motion.

[73] As aforementioned, when the compressor according to embodiments is operated at a high speed, a predetermined amount of oil may be supplied to the compression pockets P formed by the wrap 52 of the orbiting scroll 50 and the wrap 42 of the fixed scroll 40. When the compressor is operated at a low speed, oil may also be smoothly supplied to the compression pockets P.

[74] Since a predetermined amount of oil may be supplied to the compression pockets P when the compressor is operated at a constant speed or a variable speed, a pressure leakage between the wrap of the orbiting scroll and the wrap of the fixed scroll may be prevented. Accordingly, a performance of the compressor may be enhanced. Further, since a friction between the orbiting scroll and the fixed scroll may be prevented, an abrasion therebetween may be minimized, enhancing a reliability of the compressor.

[75] The compressor and oil supplying structure therefor according to embodiments disclosed herein has numerous applications. Such applications may include, for example, air conditioning and refrigeration applications. One such exemplary application is shown in FIG. 20, in which compressor 710 having an oil supplying structure according to embodiments disclosed herein is installed in a refrigerator/ freezer 700. Installation and functionality of a compressor in a refrigerator is discussed in detail in U.S. Patent Nos. 7,082,776, 6,955,064, 7,114,345, 7,055,338 and 6,772,601, the entirety of which are incorporated herein by reference.

[76] Another such exemplary application is shown in FIG. 21, in which a compressor 810 having an oil supplying structure according to embodiments disclosed herein is installed in an outdoor unit of an air conditioner 800. Installation and functionality of a compressor in a refrigerator is discussed in detail in U.S. Patent Nos. 7,121,106, 6,868,681, 5,775,120, 6,374,492, 6,962,058, 6,951,628 and 5,947,373, the entirety of which are incorporated herein by reference.

[77] Another such exemplary application is shown in FIG. 22, in which a compressor 910 having an oil supplying structure according to embodiments disclosed herein is installed in a single, integrated air conditioning until 900. Installation and functionality of a compressor in a refrigerator is discussed in detail in U.S. Patent Nos. 7,032,404, 6,412,298, 7,036,331, 6,588,228, 6,182,460, and 5,775,123, the entirety of which are incorporated herein by reference.

[78] Embodiments disclosed herein provide an oil feeding or supplying structure for a compressor capable of smoothly supplying oil into a compression portion (compression pockets) formed by a wrap of a fixed scroll and a wrap of an orbiting scroll.

[79] In accordance with one embodiment disclosed herein, there is provided an oil feeding or supplying structure for a compressor that includes a fixed scroll, an orbiting scroll

engaged with the fixed scroll to form a compression portion and a frame having a bearing surface to support the orbiting scroll, and a boss insertion groove to insert a boss portion of the orbiting scroll. An oil hole through which oil may be introduced to the compression portion may be penetratingly formed at a disc portion of the orbiting scroll.

[80] According to another embodiment disclosed herein, there is provided an oil feeding or supplying structure for a compressor that includes a fixed scroll, an orbiting scroll engaged with the fixed scroll to form a compression portion and a frame having a bearing surface to support the orbiting scroll and a boss insertion groove to insert a boss portion of the orbiting scroll. An oil passage through which oil stored in the boss insertion groove may be introduced between a disc portion of the orbiting scroll and the bearing surface of the frame may be penetratingly formed at the boss insertion groove and the bearing surface of the frame.

[81] According to still another embodiment disclosed herein, there is provided an oil feeding structure for a compressor that includes a fixed scroll, an orbiting scroll engaged with the fixed scroll to form a compression portion, and a frame having a bearing surface to support the orbiting scroll and a boss insertion groove to insert a boss portion of the orbiting scroll. An oil hole through which oil may be introduced to the compression portion may be penetratingly formed at a disc portion of the orbiting scroll, and an oil passage through which oil may be supplied to the oil hole may be penetratingly formed at one side of the frame.

[82] Any reference in this specification to one embodiment, or example embodiment, etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[83] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

[1] An oil supplying structure for a scroll compressor, comprising:
a fixed scroll;
an orbiting scroll disposed adjacent to the fixed scroll to form a compression chamber therebetween; and
at least one oil hole formed in the orbiting scroll through which oil may be supplied into the compression chamber.

[2] The oil supplying structure of claim 1, wherein the at least one oil hole extends parallel to a central axis of rotation of a rotational shaft of the orbiting scroll.

[3] The oil supplying structure of claim 1, wherein the at least one oil hole extends at an angle to a central axis of rotation of a rotational shaft of the orbiting scroll.

[4] The oil supplying structure of claim 1, wherein an inner diameter of the oil hole is less than a diameter of a wrap of the orbiting scroll.

[5] The oil supply structure of claim 1, wherein an inner diameter of the at least one oil hole is 2.0~3.5mm.

[6] The oil supplying structure of claim 1, wherein the at least one oil hole comprises a hole formed extending through a disc portion of the orbiting scroll.

[7] The oil supply structure of claim 6, wherein the at least one oil hole further comprises an extending groove formed in one surface of the disc portion and extending a predetermined distance from the hole.

[8] The oil supplying structure of claim 7, wherein the extending groove extends in a substantially circumferential direction.

[9] The oil supplying structure of claim 7, wherein the extending groove extends toward a central axis of rotation of a rotational shaft of the orbiting scroll.

[10] The oil supplying structure of claim 7, wherein the extending groove extends at an angle to a line connecting the at least one oil hole and a central axis of rotation of a rotational shaft of the orbiting scroll.

[11] The oil supplying structure of claim 7, further comprising a main frame having a bearing surface on which the orbiting scroll is supported, wherein an oil groove is formed in the bearing surface of the main frame and wherein the extending groove is positioned adjacent to the oil groove formed in the main frame so as to be in fluid communication therewith.

[12] The oil supplying structure of claim 11, wherein the oil groove is one of a ring-shaped oil groove or a square oil groove.

[13] The oil supplying structure of claim 11, wherein the oil groove has an inner diameter of 3.5~4.5 mm.

[14] The oil supplying structure of claim 1, further comprising a main frame having a

bearing surface on which the orbiting scroll is supported, wherein an oil groove is formed in the bearing surface of the main frame and wherein the at least one oil hole is positioned adjacent to so as to be in fluid communication with the oil groove formed in the bearing surface of the main frame.

[15] The oil supplying structure of claim 14, wherein the oil groove is one of a ring-shaped oil groove or a square oil groove.

[16] The oil supplying structure of claim 14, wherein the oil groove has a depth of 3.5~4.5 mm.

[17] The oil supplying structure of claim 14, wherein the oil groove is in communication with the at least one oil hole continuously.

[18] The oil supplying structure of claim 14, wherein the oil groove is in fluid communication with at least one oil hole periodically.

[19] The oil supplying structure of claim 1, further comprising a main frame having a bearing surface on which the orbiting scroll is mounted, wherein at least one oil passage is formed in the main frame which is in fluid communication with the at least one oil hole formed in the orbiting scroll.

[20] The oil supplying structure of claim 19, wherein the at least one oil passage formed in the main frame extends diagonal to a central axis of rotation of a rotational shaft of the orbiting scroll.

[21] The oil supplying structure of claim 19, wherein the at least one oil passage formed in the main frame extends from a first end to a second end opening into an oil groove formed in the bearing surface of the main frame.

[22] The oil supply structure of claim 21, further comprising an oil controlling device positioned in the at least one oil passage formed in the main frame.

[23] The oil supplying structure of claim 21, wherein the oil groove formed in the main frame is one of a ring-shaped oil groove or a square oil groove.

[24] The oil supplying structure of claim 21, wherein the oil groove has a depth of 3.5~4.5 mm.

[25] The oil supplying structure of claim 1, wherein the at least one oil hole has a constant inner diameter.

[26] The oil supplying structure of claim 1, further comprising a main frame having a bearing surface on which the orbiting scroll is supported, wherein an oil groove is formed in the bearing surface of the main frame and wherein the oil groove formed in the bearing surface of the main frame is positioned to one side of an orbiting path of the at least one oil hole.

[27] The oil supplying structure of claim 25, wherein the oil groove formed in the bearing surface of the main frame is one of a ring shaped oil groove or a square oil groove.

[28] A scroll compressor comprising the oil supplying structure of claim 1.

[29] An oil supplying structure for a scroll compressor, comprising:
a fixed scroll;
an orbiting scroll disposed adjacent to the fixed scroll to form a compression chamber therebetween; and
a main frame having a bearing surface on which the orbiting scroll is supported, and a boss insertion groove into which a boss portion of the orbiting scroll is inserted, wherein at least one oil passage is formed in the main frame through which oil stored in the boss insertion groove is introduced between a disc portion of the orbiting scroll and the bearing surface of the main frame.

[30] The oil supplying structure of claim 29, wherein the at least one oil passage extends from the boss insertion groove to the bearing surface of the main frame.

[31] The oil supplying structure of claim 29, wherein the at least one central axis of the oil passage extends at an angle to a central axis of rotation of a rotational shaft of the orbiting scroll.

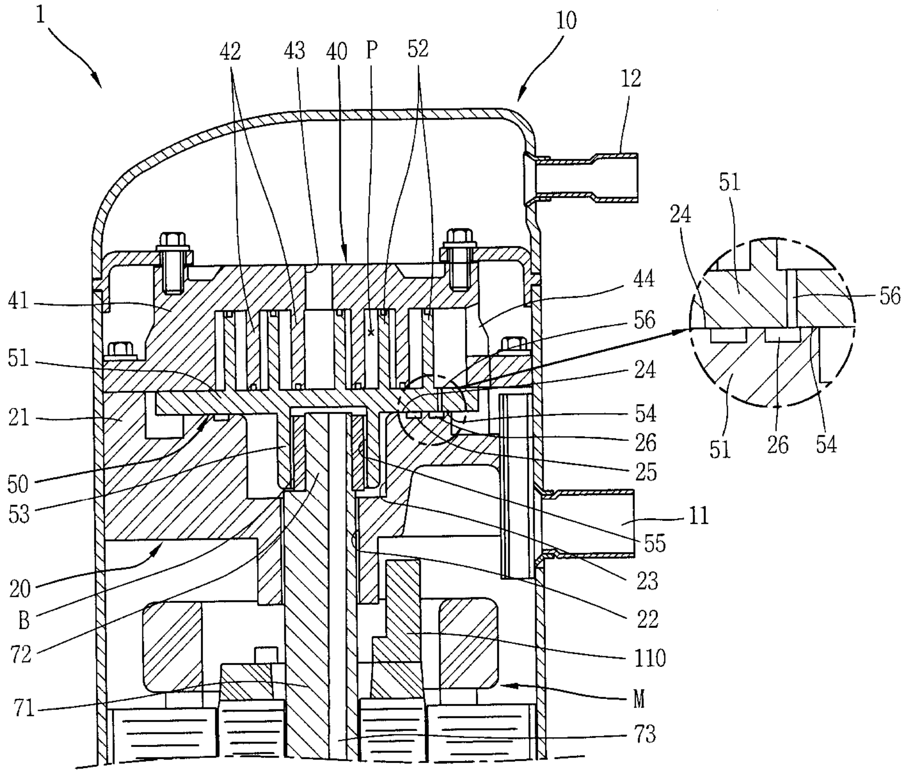
[32] The oil supplying structure of claim 29, further comprising an oil controlling device positioned in the at least one oil passage formed in the main frame.

[33] A method of supplying oil to a compression chamber of a scroll compressor comprising a fixed scroll and an orbiting scroll disposed adjacent to the fixed scroll to form the compression chamber, the method comprising:
providing at least one oil hole formed in the orbiting scroll through which oil may be supplied into the compression chamber; and
positioning the at least one hole adjacent an oil passage formed in a bearing surface of a main frame that supports the orbiting scroll such that upon rotation of the orbiting scroll the at least one oil hole communicates with the oil passage to inject oil one of continuously or periodically into the compression chamber.

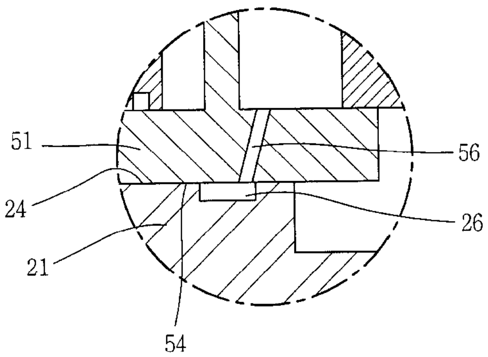
[34] The method of claim 33, wherein the positioning comprises positioning the at least one hole adjacent the oil passage formed in the bearing surface of the main frame that supports the orbiting scroll such that upon rotation of the orbiting scroll the at least one hole communicates with the oil passage to inject oil continuously into the compression chamber.

[35] The method of claim 33, wherein the positioning comprises positioning the at least one oil hole adjacent the oil passage formed in the bearing surface of the main frame that supports the orbiting scroll such that upon rotation of the orbiting scroll the at least one oil hole communicates with the oil passage to inject oil periodically into the compression chamber.

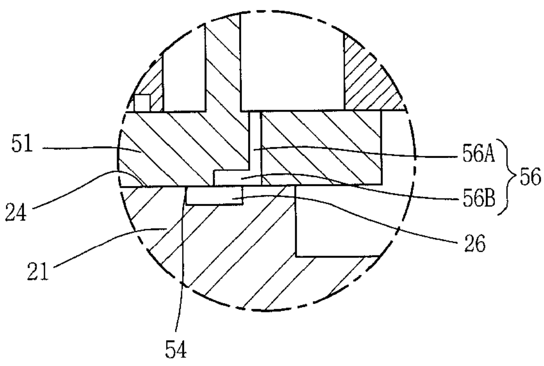
[Fig. 1]



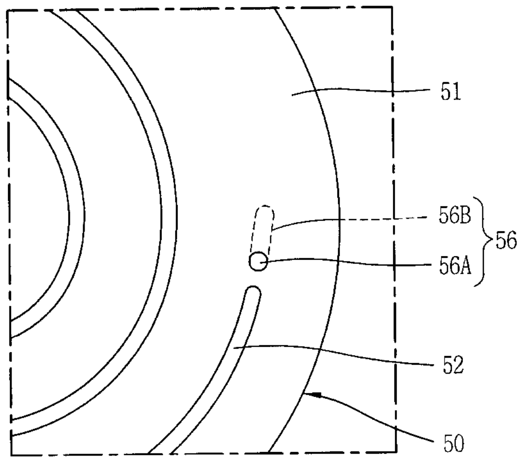
[Fig. 2]



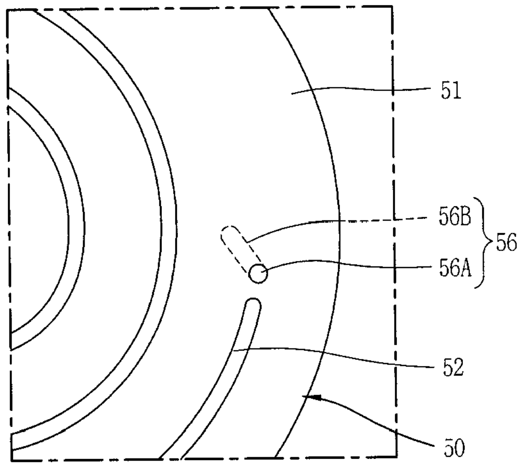
[Fig. 3]



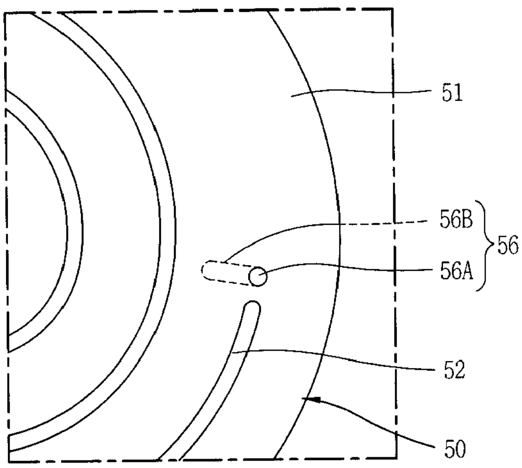
[Fig. 4]



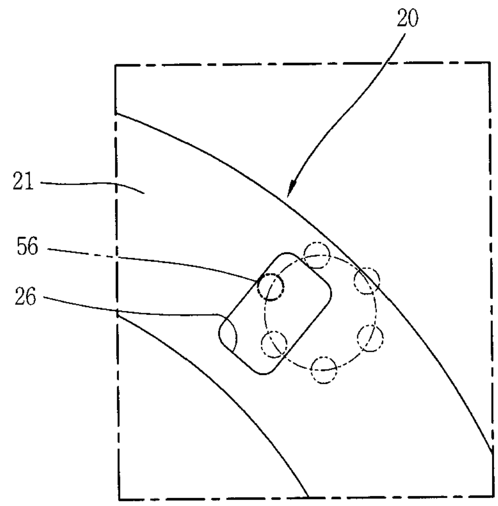
[Fig. 5]



[Fig. 6]



[Fig. 7]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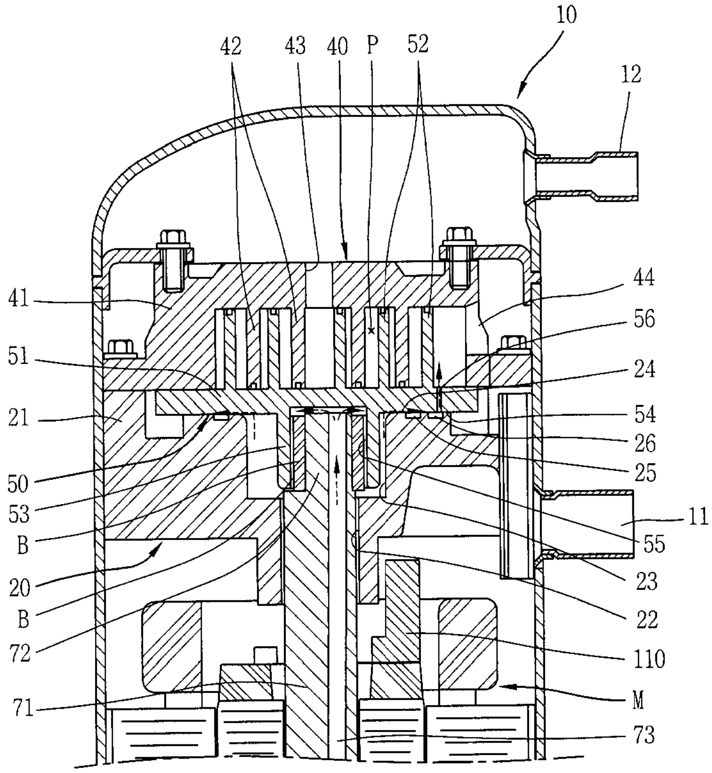
[Fig. 8]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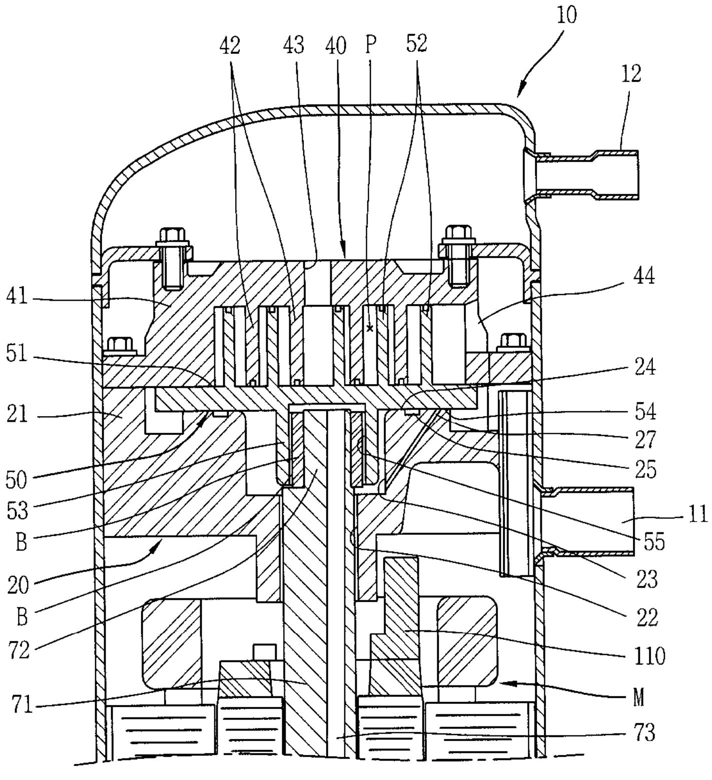
[Fig. 9]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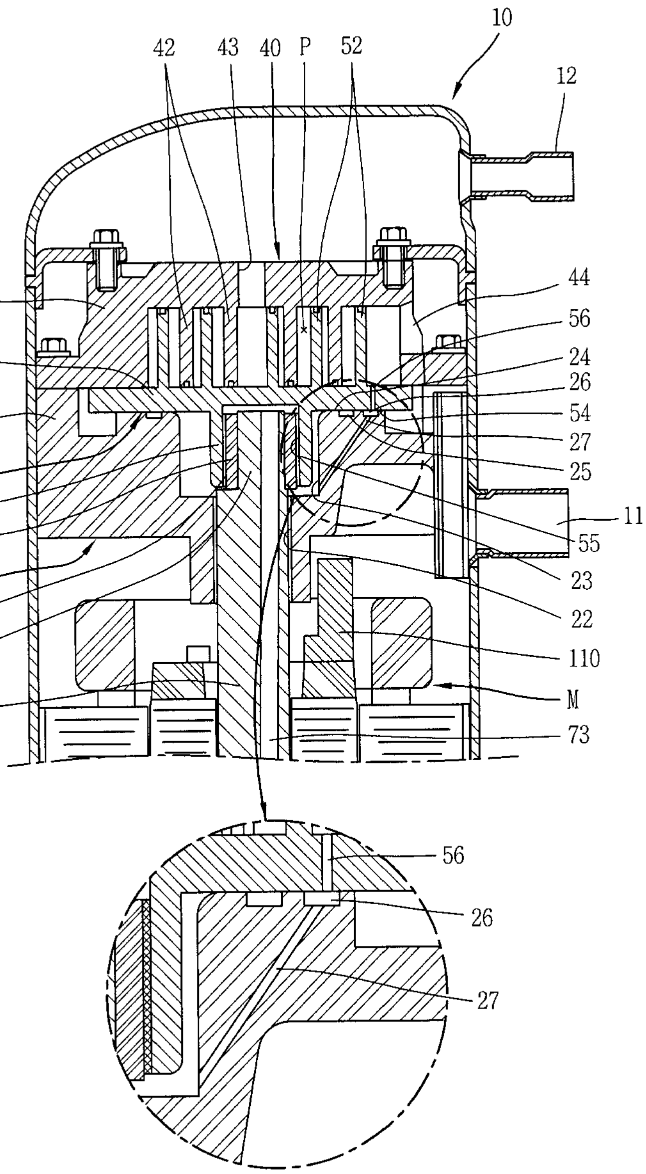
[Fig. 10]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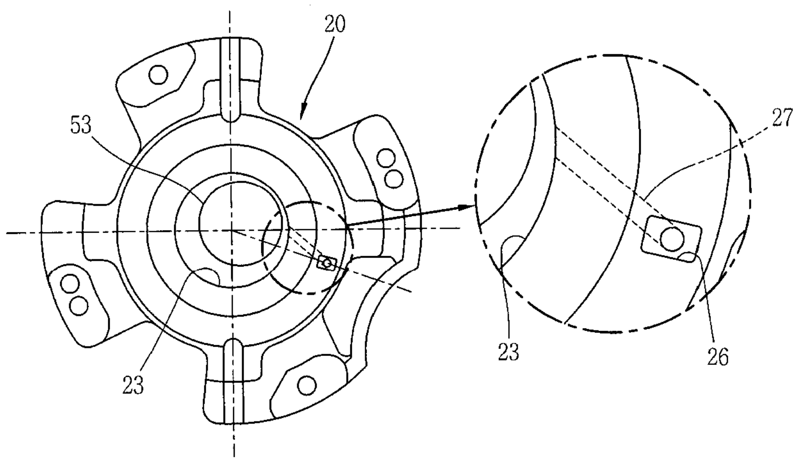
[Fig. 11]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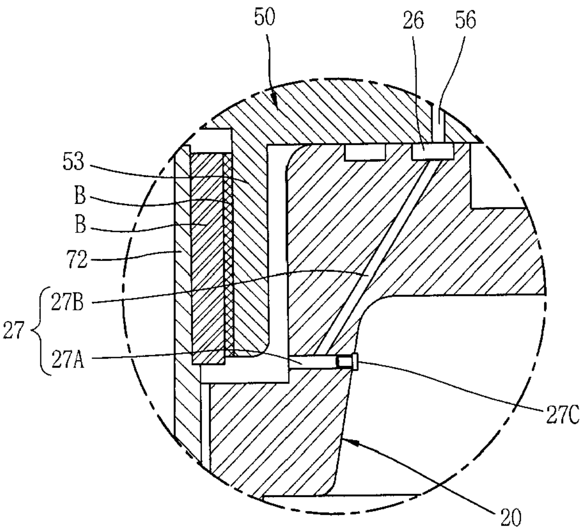
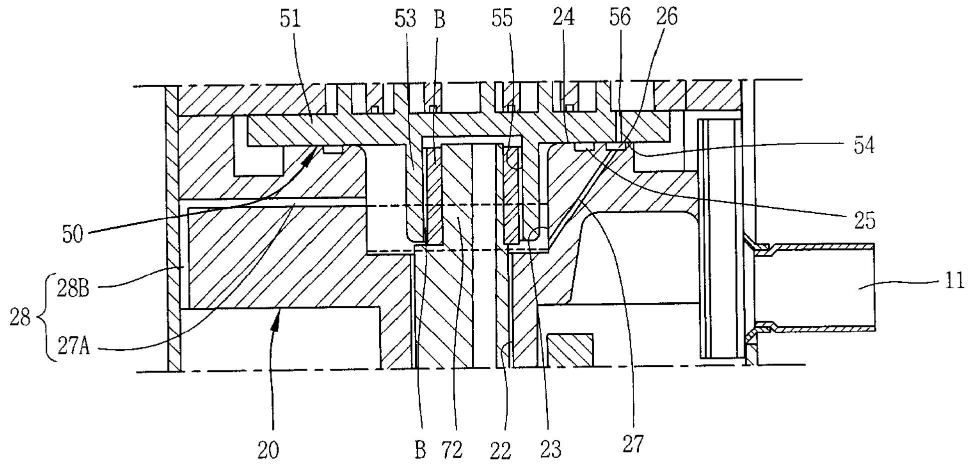
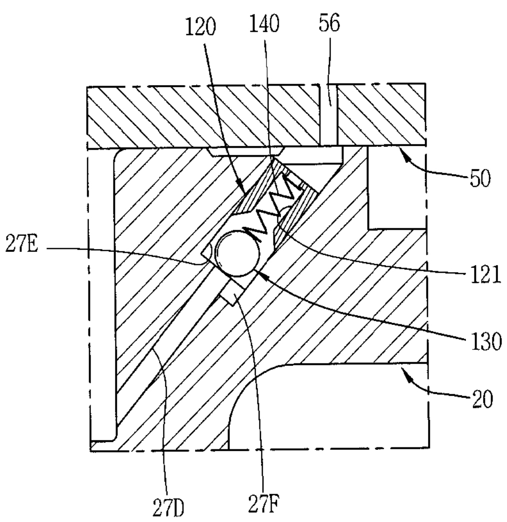
[Fig. 12]



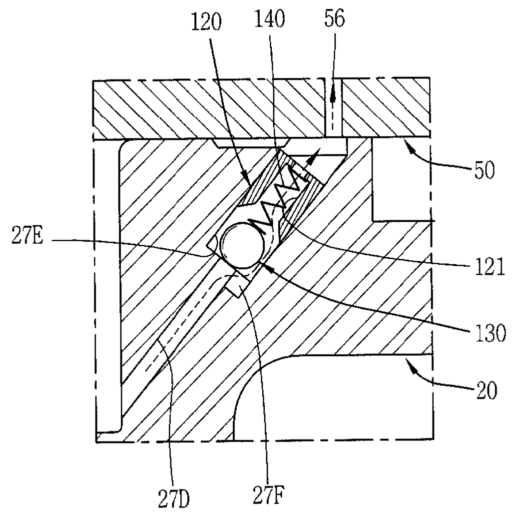
[Fig. 13]



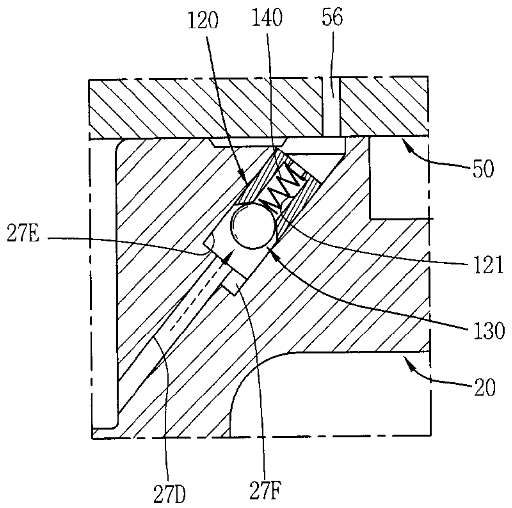
[Fig. 14]



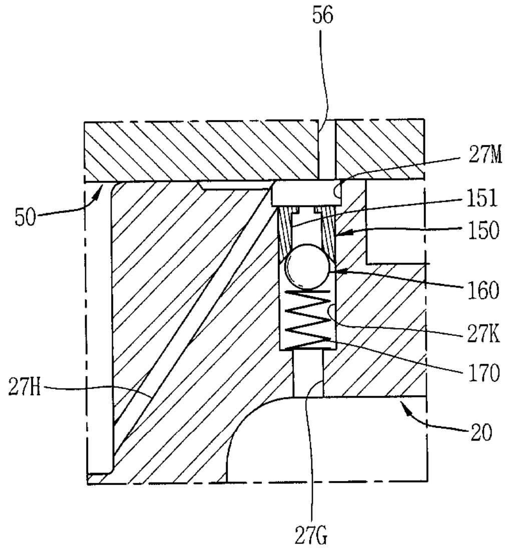
[Fig. 15]



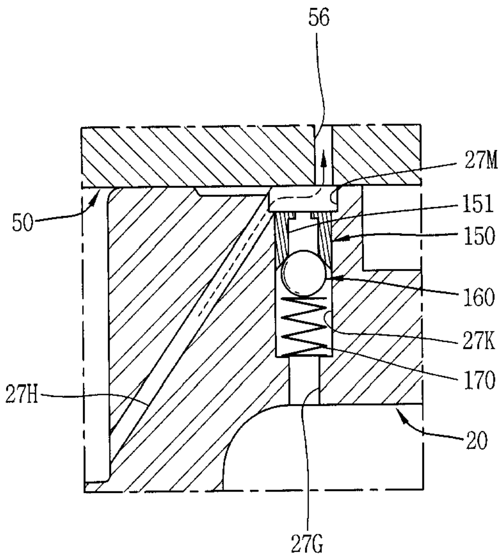
[Fig. 16]



[Fig. 17]



[Fig. 18]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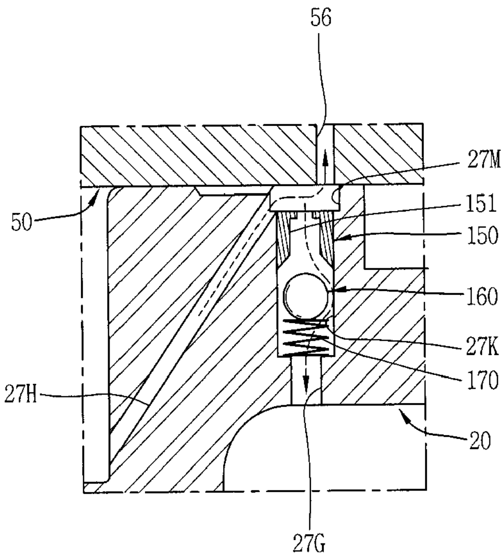
[Fig. 19]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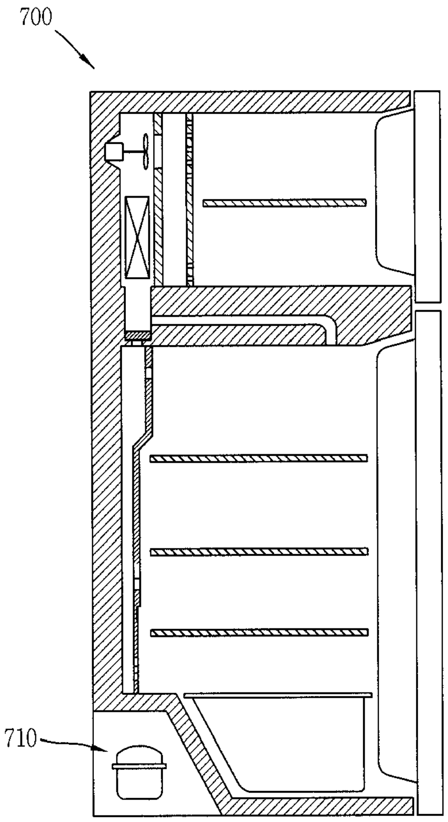
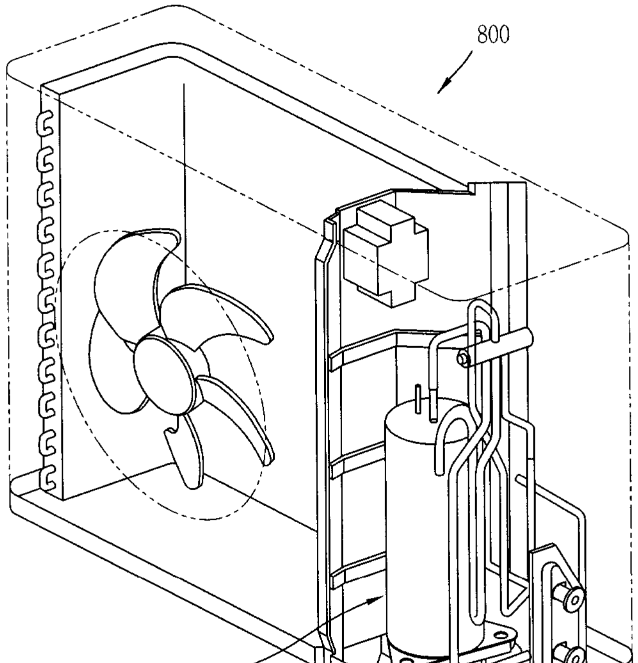
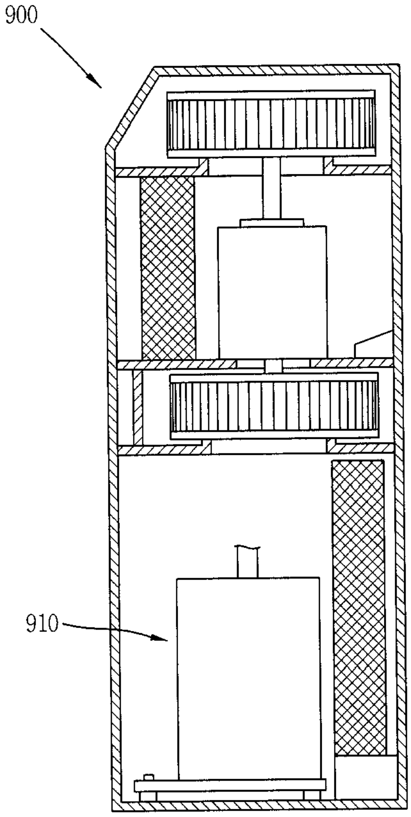
[Fig. 20]



[Fig. 21]



[Fig. 22]



INTERNATIONAL SEARCH REPORT

International application No. **PCT/KR2008/002353**

A. CLASSIFICATION OF SUBJECT MATTER

F04B 39/02(2006.01)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)

IPC8 : F04B 39/00, F04B 39/02, F04B 39/04, F04B 39/06, F04B 39/08, F04B 39/10, F04B 39/12, F04B 39/14, F04B 39/16

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 since 1975
Japanese Utility models and applications for Utility models since 1975

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

eKIPASS(KIPO internal) & keyword : "scroll", "compressor", "oil"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2001-0057497 A (LG ELECTRONICS INC.) 04 July 2001 See Figures 2 and 3.	1,3,4,6,25,28
Y		2,14,15,17-21,23,27, 29-31,33-35
A		5,7-13,16,22,24,26,32
X	JP 03-160178 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 10 July 1991 See Figures 1 and 2.	1,3,4,6,25,28
Y		2,14,15,17-21,23,27, 29-31,33-35
A		5,7-13,16,24,26,32
X	KR 10-2005-0062998 A (LG ELECTRONICS INC.) 28 June 2005 See Figures 4 and 5.	29,30
Y		1-4,6,14,15,17-21,23, 25,27,28,31,33-35
A		5,7-13,16,22,24,26,32

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 AUGUST 2008 (12.08.2008)	**12 AUGUST 2008 (12.08.2008)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
LEE, JUNG HYE
Telephone No. 82-42-481-8437

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/002353

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-2001-0057497 A	04.07.2001	NONE	
JP 03-160178 A	10.07.1991	JP 2558896 B2	27.11.1996
		KR 10-1991-0010072	28.06.1991
		KR 97-0008005 B1	20.05.1997
		US 5133651 A	28.07.1992
KR 10-2005-0062998 A	28.06.2005	NONE	