(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) EP 2 623 787 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.08.2013 Bulletin 2013/32

(51) Int Cl.:
F04C 18/02 (2006.01) *H01R 13/52* (2006.01)
H02K 5/22 (2006.01)

(21) Application number: **13152991.9**

(22) Date of filing: **29.01.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **02.02.2012 JP 2012021093**

(71) Applicant: **Kabushiki Kaisha Toyota Jidoshokki**
Kariya-shi,
Aichi 448-8671 (JP)

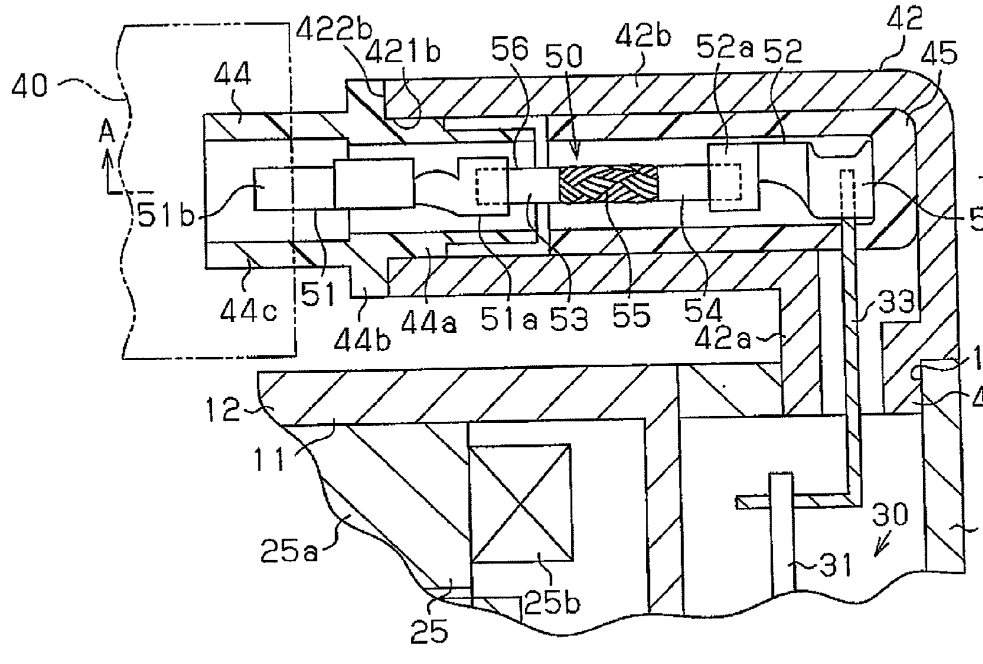
(72) Inventor: **Enami, Shingo**
Kariya-shi, Aichi 448-8671 (JP)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **Motor-driven compressor**

(57) A motor-driven compressor includes a wiring connection portion provided in a connector-receiving portion and adapted for supplying electricity from an external power source to a motor drive circuit. The wiring connection portion includes first and second terminals, each of which has a first end-connection portion at an end and a second end-connection portion at another end. The second end-connection portion of the first terminal is electrically connected to the external power source, while the second end-connection portion of the second terminal is electrically connected to a conductive member. The wiring connection portion further includes a coupling member coupling the first and second terminals. The coupling member includes a first metal plate connected to the first end-connection portion of the first terminal, a second metal plate connected to the first end-connection portion of the second terminal, and a wire mesh coupling the first and second metal plates.

Fig.1B



EP 2 623 787 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a motor-driven compressor including a compression portion, an electric motor, and a motor drive circuit, which are accommodated in a housing.

[0002] Conventionally, motor-driven compressors including a compression portion, an electric motor, and a motor drive circuit, which are accommodated in a housing, have been known. The compression portion is driven through rotation of a rotary shaft, which is rotated by the electric motor. The electric motor is driven by the motor drive circuit. For example, refer to Japanese Laid-Open Patent Publication No. 2009-74517. The motor drive circuit is driven by receiving electricity from an external power source. A tubular connector-receiving portion, which protrudes outward from the outer surface of the housing, is formed on the housing. A wiring connection portion is accommodated in the connector-receiving portion to supply electricity from the external power source to the motor drive circuit. A substrate on which electric parts such as a switching element are mounted is located in the motor drive circuit. A conductive member extending into the connector-receiving portion and connecting the substrate with the wiring connection portion is mounted on the substrate.

[0003] As shown in Fig. 5, a conventional wiring connection portion 80 is located in a connector-receiving portion 92, which is formed on an external surface of a housing (not shown). The wiring connection portion 80 is configured by a wire 81, a first terminal 82, which is provided at a first end of the wire 81 and electrically connected to an external power source 90, and a second terminal 83, which is provided at a second end of the wire 81 and electrically connected to the motor drive circuit (not shown). The wire 81 is formed by covering a lead portion 81a, which is formed by binding up a plurality of leads with an insulating coating 81b.

[0004] A swage portion 82a (first end-connection portion) is formed at a first end of the first terminal 82, while a connection portion 82b (second end-connection portion), which is electrically connected to the external power source 90, is formed at a second end of the first terminal 82. A swage portion 83a (first end-connection portion) is formed at a first end of the second terminal 83, while a connection portion 83b (second end-connection portion), which is electrically connected to a conductive member 91, is formed at a second end of the second terminal 83.

[0005] At the opposite ends of the wire 81, the lead portion 81a is exposed from the insulating coating 81b. The first end of the wire 81 and the first terminal 82 are connected by swaging the lead portion 81a exposed from the insulating coating 81b at the first end of the wire 81 by the swage portion 82a of the first terminal 82. Also, the second end of the wire 81 and the second terminal 83 are connected to each other by swaging the lead portion 81a exposed from the insulating coating 81b at the second end of the wire 81 by the swage portion 83a of the second terminal 83.

[0006] There is a need for the length in the direction in which the connector-receiving portion 92 extends to be shortened as required in accordance with the position and size of a space in the vehicle allotted for the motor-driven compressor. Therefore, it is also necessary to shorten the length of the wire 81 of the wiring connection portion 80 in accordance with the length of the connector-receiving portion 92.

[0007] If the swaging of the lead portion 81a by the swage portion 82a of the first terminal 82 and the swaging of the lead portion 81a by the swage portion 83a of the second terminal 83 are performed using, for example, a swage tool while a machine such as a robot arm grasps the wire 81, the position of the swaging (connecting position) is shifted due to the flexibility of the wire 81, resulting in poor connecting operability. Therefore, generally, the swaging of the lead portion 81a by the swage portion 82a of the first terminal 82 and the swaging of the lead portion 81a by the swage portion 83a of the second terminal 83 are performed using the swage tool while an operator holds the wire 81 by hand. Accordingly, such manual operation by the operator allows the swage position to be adjusted finely, and the operability of the swaging is improved.

[0008] The shorter the length of the wire 81 becomes, however, the shorter the distance between the operator's hand and the swage tool becomes. Accordingly, such a connecting operation cannot be easily performed, and thus it becomes difficult to shorten the length of the entire wiring connection portion 80. As a result, the length in the direction in which the connector-receiving portion 92 extends cannot be shortened as necessary in accordance with the position and size of an allotted space in the vehicle.

[0009] Further, for example, dimensional tolerance exists between the connection portion 82b of the first terminal 82 and the external power source 90 or between the connection portion 83b of the second terminal 83 and the conductive member 91 when connecting the connection portion 82b of the first terminal 82 with the external power source 90 or the connection portion 83b of the second terminal 83 with the conductive member 91. Accordingly, there is a need for the dimensional tolerance to be absorbed between the connection portion 82b of the first terminal 82 and the external power source 90 or between the connection portion 83b of the second terminal 83 and the conductive member 91 when connecting the connection portion 82b of the first terminal 82 with the external power source 90 or the connection portion 83b of the second terminal 83 with the conductive member 91.

[0010] An object of the present invention is to provide a motor-driven compressor that can shorten the entire length of a wiring connection portion compared with a wiring connection portion using no wires and absorb dimensional tolerance between a first terminal and an external power source or between a second terminal and a conductive member.

SUMMARY OF THE INVENTION

[0011] To achieve the foregoing objective and in accordance with one aspect of the present invention, a motor-driven compressor is provided that includes a housing, a compression portion, an electric motor, a motor drive circuit, a connector-receiving portion, a wiring connection portion, and a conductive member. The compression portion, the electric motor, and the motor drive circuit are accommodated in the housing. The connector-receiving portion is provided on an outer surface of the housing. The wiring connection portion is provided in the connector-receiving portion and is adapted for supplying electricity from an external power source to the motor drive circuit. The conductive member is provided on the motor drive circuit and extends toward a space in the connector-receiving portion. The conductive member electrically connects the motor drive circuit and the wiring connection portion with each other. The wiring connection portion includes a first terminal, a second terminal and a coupling member for coupling the first terminal with the second terminal. The first terminal has a first end-connection portion at an end thereof and a second end-connection portion at the other end thereof. The second end-connection portion is electrically connected to the external power source. The second terminal has a first end-connection portion at an end thereof and a second end-connection portion at the other end thereof. The second end-connection portion is electrically connected to the conductive member. The coupling member has a first metal plate connected to the first end-connection portion of the first terminal, a second metal plate connected to the first end-connection portion of the second terminal, and a wire mesh coupling the first metal plate and the second metal plate with each other.

[0012] Other aspects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1A is a longitudinal cross-sectional view illustrating a motor-driven compressor according to one embodiment of the present invention;

Fig. 1B is a partially enlarged longitudinal cross-sectional view illustrating the connector-receiving portion and its surrounding in the motor-driven compressor shown in Fig. 1A;

Fig. 2 is a cross-sectional view taken along line A-A of Fig. 1B;

Fig. 3 is a view schematically showing the state where a first metal plate and a wire mesh are joined by resistance welding;

Fig. 4 is a partially enlarged longitudinal cross-sectional view illustrating a connector-receiving portion and its surrounding according to another embodiment of the present invention; and

Fig. 5 is a partially enlarged lateral cross-sectional view illustrating the connector-receiving portion of a conventional motor-driven compressor and its surroundings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] A motor-driven compressor according to one embodiment of the present invention will now be described with reference to Figs. 1-3. The motor-driven compressor of the present embodiment is mounted on vehicle, which is a hybrid automobile, and employed for a vehicle air conditioner.

[0015] As shown in Fig. 1A, a motor-driven compressor 10 includes a housing 11, which is made of metal (aluminum in the present embodiment). The housing 11 is formed by an intermediate housing member 12, a discharge housing member 13, and an inverter housing member 14. The intermediate housing member 12 constitutes an intermediate part of the housing 11 and is formed to be cylindrical with a closed end. The discharge housing member 13 is joined to the open end of the intermediate housing member 12. The inverter housing member 14 is joined to the closed end of the intermediate housing member 12. The intermediate housing member 12 and the discharge housing member 13 are fastened to each other by blots B1 with a gasket G in between. Also, the intermediate housing member 12 and the inverter housing member 14 are fastened to each other by bolts B2. An accommodation space 17 is defined between the intermediate housing member 12 and the inverter housing member 14.

[0016] A discharge chamber 15 is defined between the intermediate housing member 12 and the discharge housing member 13. A discharge port 16 is formed in an end face of the discharge housing member 13. The discharge chamber 15 is connected to an external refrigerant circuit (not shown) via the discharge port 16. A suction port (not shown) is formed at a position near the inverter housing 14 in the intermediate housing member 12. The space in the intermediate housing member 12 is connected to the external refrigerant circuit (not shown) via the suction port.

[0017] A rotary shaft 23 is rotationally supported in the intermediate housing member 12. The intermediate housing member 12 accommodates a compression portion 18 for compressing refrigerant and an electric motor 19 for driving the compression portion 18. The accommodation space 17 accommodates a motor drive circuit 30, which controls operation of the electric motor 19. Therefore, the compression portion 18, the electric motor 19, and the motor drive circuit 30 are accommodated in the housing 11 to be arranged in that order in the axial direction of the rotary shaft 23.

[0018] The compression portion 18 will now be described.

[0019] The compression portion 18 includes a fixed scroll 20, which is fixed to the intermediate housing member 12, and an orbiting scroll 21, which is arranged to face the fixed scroll 20. Compression chambers 22, the volume of which is variable, are defined between the fixed scroll 20 and the orbiting scroll 21. A discharge passage 28, which connects the compression chambers 22 and the discharge chamber 15 to each other, is formed in the fixed scroll 20.
A discharge valve 29 is located at an end face of the fixed scroll 20.

[0020] Next, the electric motor 19 will be described.

[0021] The electric motor 19 includes a rotor 24, which rotates integrally with the rotary shaft 23, and a stator 25, which is fixed to the inner circumferential surface of the intermediate housing member 12 to surround the rotor 24. The rotor 24 includes a rotor core 24a, which is fixed to and rotates integrally with the rotary shaft 23, and permanent magnets 24b, which are provided on the circumferential surface of the rotor core 24a. The stator 25 is substantially annular. A stator core 25a is fixed to the inner circumferential surface of the intermediate housing member 12. A coil 25b is wound about each of teeth (not shown) of the stator core 25a.

[0022] The motor drive circuit 30 will now be described.

[0023] The motor drive circuit 30 includes a flat plate-like circuit board 31 and electrical components 32a to 32d mounted on the circuit board 31. The circuit board 31 is located in the accommodation space 17 and fixed to the inner surface of the inverter housing member 14. The circuit board 31 is arranged in the inverter housing member 14 to extend in a radial direction of the rotary shaft 23. The motor drive circuit 30 supplies electricity to the stator 25 of the electric motor 19 based on commands from an ECU for controlling the air conditioner (not shown). The circuit board 31 has a conductive member 33, which protrudes from the outer circumferential surface of the inverter housing member 14 and extends toward a connector-receiving portion 42.

[0024] As shown in Fig. 1B, the connector-receiving portion 42 is made of metal (aluminum in the present embodiment). The connector-receiving portion 42 includes a tubular first extended portion 42a and a tubular second extended portion 42b. The first extended portion 42a extends outward from the outer circumferential surface of the inverter housing member 14 in a radial direction of the rotary shaft 23. The second extended portion 42b is continuous with the first extended portion 42a and extends in the axial direction of the rotary shaft 23 and toward the electric motor 19. The first extended portion 42a has a connection portion 421 a, which is connected to a connection hole 141 formed in the inverter housing member 14. The connector-receiving portion 42 is connected to the inverter housing member 14 by joining the connection hole 141 and connection portion 421a to each other.

[0025] The length of the second extended portion 42b in a longitudinal direction is adjusted in accordance with the position and size of a space in a hybrid car allotted for the motor-driven compressor 10 according to the present embodiment. A connector housing 44, which is made of plastic, is attached to an opening 421b of the second extended portion 42b. The connector housing 44 is tubular and includes a fitting portion 44a, a contact portion 44b, and a main body 44c. The fitting portion 44a is fitted in the opening 421b. The contact portion 44b is continuous with the fitting portion 44a and contacts an open end 422b of the second extended portion 42b. The main body 44c is continuous with the contact portion 44b and is connected to an external power source 40.

[0026] Wiring connection portions 50 are accommodated in the second extended portion 42b and the connector housing 44 to supply electricity from the external power source 40 to the motor drive circuit 30. Each of the wiring connection portions 50 includes a first terminal 51 electrically connected to the external power source 40, a second terminal 52 electrically connected to the motor drive circuit 30 and a coupling member 56 coupling the first terminal 51 with the second terminal 52. The coupling member 56 includes a first metal plate 53, a second metal plate 54, and a wire mesh 55. The wire mesh 55 is configured by a woven metallic braid.

[0027] A first end-connection portion 51a is formed at a first end of the first terminal 51, while a second end-connection portion 51b, which is electrically connected to the external power source 40, is formed at a second end of the first terminal 51. Also, a first end-connection portion 52a is formed at a first end of the second terminal 52, while a second end-connection portion 52b, which is electrically connected to the conductive member 33, is formed at a second end of the second terminal 52. The first metal plate 53 and the second metal plate 54 are elongated boards. The first end of the first metal plate 53 and the first end-connection portion 51a of the first terminal 51 are joined to each other; that is, connected to each other by welding (in the present embodiment, resistance welding). The second end of the first metal plate 53 and the first end of the wire mesh 55 are joined to each other; that is connected to each other by welding (in the present embodiment, resistance welding). Also, the first end of the second metal plate 54 and the first end-connection portion 52a of the second terminal 52 are joined to each other by welding (in the present embodiment, resistance welding). The second end of the second metal plate 54 and the second end of the wire mesh 55 are joined to each other by welding (in the present embodiment, resistance welding). Accordingly, the wire mesh 55 couples the first metal plate 53 and the second metal plate 54 with each other. The first metal plate 53, the second metal plate 54 and the wire mesh 55 connect the first terminal 51 and the second terminal 52 with each other. The total length of the first metal plate 53, the second metal plate 54 and the wire mesh 55 added together is less than the length of the second extended portion 42b in the direction in which the second extended portion 42b extends.

[0028] As shown in Fig. 2, the motor-driven compressor 10 according to the present embodiment is provided with two wiring connection portions 50, which are arranged side by side. The second terminal 52, the second metal plate 54 and the wire mesh 55 of each wiring connection portion 50 are located in a plastic cluster block 45 having shape of a rectangular box accommodated in the second extended portion 42b. The inside of the cluster block 45 is sectioned into a first accommodation section 45a and a second accommodation section 45b. The first accommodation section 45a accommodates the second terminal 52, the second metal plate 54 and the wire mesh 55 of one of the wiring connection portions 50. The second accommodation section 45b accommodates the second terminal 52, the second metal plate 54 and the wire mesh 55 of the other one of the wiring connection portions 50. The cluster block 45 ensures insulation between i) the second terminal 52, the second metal plate 54 and the wire mesh 55 of one of the wiring connection portions 50 and ii) the second terminal 52, the second metal plate 54 and the wire mesh 55 of the other wiring connection portion 50. Further, the cluster block 45 ensures insulation between each of the wiring connection portions 50 and the connector-receiving portion 42. Therefore, in the present embodiment, the cluster block 45 functions as an insulating member.

[0029] The connector housing 44 accommodates the first terminals 51 and the first metal plates 53 of the wiring connection portions 50. A space in the connector housing 44 is sectioned into a first accommodation section 441 and a second accommodation section 442. The first accommodation section 441 accommodates the first terminal 51 and the first metal plate 53 of one of the wiring connection portions 50. The second accommodation section 442 accommodates the first terminal 51 and the first metal plate 53 of the other wiring connection portion 50. The connector housing 44 ensures insulation between i) the first terminal 51 and the first metal plate 53 of one of the wiring connection portions 50 and ii) the first terminal 51 and the first metal plate 53 of the other one of the wiring connection portions 50. Further, the connector housing 44 ensures insulation between each wiring connection portion 50 and the connector-receiving portion 42. Therefore, in the present embodiment, the connector housing 44 functions as an insulating member.

[0030] The second end-connection portions 52b of the second terminals 52 and the conductive members 33 are electrically connected to each other, and the second end-connection portions 51b of the first terminals 51 and the external power source 40 are electrically connected to each other, so that the external power source 40 and the motor drive circuit 30 are electrically connected to each other via the wiring connection portions 50 and the conductive members 33.

[0031] According to the above described motor-driven compressor 10, electricity from the external power source 40 is supplied to the motor drive circuit 30 via the wiring connection portions 50 and the conductive members 33. When the electricity is supplied to the electric motor 19 from the motor drive circuit 30, the rotor 24 is rotated. Accordingly, the rotary shaft 23 rotates. As the rotary shaft 23 rotates, the volume of each compression chamber 22 between the orbiting scroll 21 and the fixed scroll 20 is reduced in the compression portion 18. Then, refrigerant is drawn into the intermediate housing member 12 from the external refrigerant circuit via the suction port. The refrigerant taken into the intermediate housing member 12 is drawn into the compression chambers 22 in the intermediate housing member 12 via a suction passage 27 provided in the intermediate housing member 12 to be compressed. The refrigerant that has been compressed in the compression chambers 22 is discharged to the discharge chamber 15 via the discharge passage 28, while flexing the discharge valve 29. The refrigerant discharged to the discharge chamber 15 is conducted to the external refrigerant circuit via the discharge port 16 and then returned to the intermediate housing member 12.

[0032] Operation of the present embodiment will now be described.

[0033] For example, a case is considered where a machine such as a robot arm grasps the first metal plate 53 or the second metal plate 54 to connect the first end of the first metal plate 53 to the first end-connection portion 51a of the first terminal 51 or the first end of the second metal plate 54 is connected to the first end-connection portion 52a of the second terminal 52. In this case, since the first metal plate 53 and the second metal plate are more rigid than a wire used in a conventional motor-driven compressor, the likelihood of shifting of the connecting position of the first metal plate 53 and the second metal plate 54 with respect to the first end-connection portion 51a of the first terminal 51 or to the first end-connection portion 52a of the second terminal 52 is reduced. As a result, it is not necessary for an operator to perform connecting operation while holding the first metal plate 53 or the second metal plate 54 by hand. Even if the entire length of the first metal plate 53 and the second metal plate 54 is shortened, the operation of connecting the first end of the first metal plate 53 with the first end-connection portion 51a of the first terminal 51 or the first end of the second metal plate 54 with the first end-connection portion 52a of the second terminal 52 is facilitated.

[0034] According to the above described motor-driven compressor 10, the total length of the first metal plate 53, the second metal plate 54, and the wire mesh 55 is less than the length of the second extended portion 42b in the direction in which the second extended portion 42b extends. As a result, the length of the second extended portion 42b is shortened in accordance with the position and size of a space in a hybrid car allotted for the motor-driven compressor 10 according to the present embodiment. This facilitates mounting of the motor-driven compressor 10 on a hybrid car.

[0035] Further, the wire mesh 55 is flexible. Accordingly, the wire mesh 55 flexes when connecting the second end-connection portion 51b of the first terminal 51 with the external power source 40 or the second end-connection portion 52b of the second terminal 52 with the conductive member 33. The flexing of the wire mesh 55 absorbs the dimensional tolerance between the second end-connection portion 51b of the first terminal 51 and the external power source 40 or between the second end-connection portion 52b of the second terminal 52 and the conductive member 33.

[0036] Next, a method for welding the first metal plate 53 with the wire mesh 55 will be described.

[0037] As shown in Fig. 3, first, a part of the wire mesh 55 is brought into contact with a plane part 53a of the first metal plate 53, and then the first metal plate 53 and the wire mesh 55 are sandwiched by a pair of welding electrodes T1 and T2. Specifically, the welding electrode T1 is arranged at a part opposite to a part in contact with the first metal plate 53 in the wire mesh 55, and the welding electrode T2 is arranged on a surface opposite to the plane part 53a in the first metal plate 53. Then, current is supplied to flow between the welding electrodes T1 and T2.

[0038] The current from the welding electrode T1 flows into the welding electrode T2 through the wire mesh 55 and the first metal plate 53. Thereby, resistance heat is generated in the contacting part between the wire mesh 55 and the first metal plate 53. With this resistance heat, the part of the wire mesh 55 in contact with the first metal plate 53 and the part of the first metal plate 53 in contact with the wire mesh 55 are respectively heated to be melted. As the melted parts are cooled, the first metal plate 53 and the wire mesh 55 are joined with each other. Since the method for welding the second metal plate 54 with the wire mesh 55 is the same as the method for welding the first metal plate 53 with the wire mesh 55, the detailed explanation thereof is omitted.

[0039] The above described embodiment has the following advantages.

(1) Each of the wiring connection portions 50 is formed by the first terminal 51, the second terminal 52 the first metal plate 53, the second metal plate 54, and the wire mesh 55. Accordingly, the first metal plate 53 and the second metal plate 54 are more rigid than the wire used in the conventional motor-driven compressor. Therefore, the likelihood of shifting of the connecting positions of the first metal plate 53 and the second metal plate 54 with respect to the first end-connection portion 51a of the first terminal 51 or to the first end-connection portion 52a of the second terminal 52 can be reduced. Accordingly, even if the lengths of the first metal plate 53 and the second metal plate 54 are shortened, the first end-connection portion 51a of the first terminal 51 can be easily connected to the first metal plate 53 and the first end-connection portion 52a of the second terminal 52 can be easily connected to the second metal plate 54. As a result, the lengths of the first metal plate 53 and the second metal plate 54 can be shortened as much as possible; that is, the length of the entire wiring connection portion 50 can be easily shortened in comparison to a wiring connection portion in which a wire is used.
Further, the wire mesh 55 is flexible. Accordingly, the wire mesh 55 flexes when connecting the second end-connection portion 51b of the first terminal 51 with the external power source 40 or the second end-connection portion 52b of the second terminal 52 with the conductive member 33. Thereby, the dimensional tolerance between the second end-connection portion 51b of the first terminal 51 and the external power source 40 or between the second end-connection portion 52b of the second terminal 52 and the conductive member 33 can be absorbed. As a result, the second end-connection portion 51b of the first terminal 51 can be easily connected with the external power source 40 or the second end-connection portion 52b of the second terminal 52 can be easily connected with the conductive member 33.

(2) The connector-receiving portion 42 is made of metal, and the cluster block 45 and the connector housing 44 are located between the wiring connection portions 50 and the connector-receiving portion 42. In order to ensure the strength of the connector-receiving portion 42, it is preferred to form the connector-receiving portion 42 with metal. Further, the cluster block 45 and the connector housing 44 can ensure insulation between the wiring connection portions 50 and the connector-receiving portion 42. Since the positions of the wiring connection portions 50 are determined by the cluster block 45 and the connector housing 44 in the connector-receiving portion 42, movement of the wiring connection portions 50 in the connector-receiving portion 42 due to vibration of the running hybrid car is reduced.

(3) The cluster block 45 and the connector housing 44 ensure insulation between one of the wiring connection portions 50 and the other one of the wiring connection portions 50. Accordingly, for example, the wiring connection portions 50 are prevented from contacting each other to be conductive with each other due to vibration of the running hybrid car.

(4) The first metal plate 53 is provided between the wire mesh 55 and the first end-connection portion 51a of the first terminal 51 and the plane part 53a of the first metal plate 53 and a part of the wire mesh

55 are joined with each other according to resistance welding. Thereby, a current path (shown by an arrow E in Fig. 3) is formed by the welding electrode T1, the wire mesh 55, the first metal plate 53 and the welding electrode T2 in this order. Accordingly, the wire mesh 55 can be easily welded to the first metal plate 53. The same may be applied to the relationship between the second metal plate 54 and the wire mesh 55. Accordingly, the flexible wire mesh 55 can be easily provided at a part of each wiring connection portion 50.

[0040] The above described embodiment may be modified as follows.

[0041] The second extended portion 42b of the connector-receiving portion 42 is arranged to extend in the axial direction of the rotary shaft 23. The invention is not limited to this, and as shown in Fig. 4, for example, the second extended portion 42b of the connector-receiving portion 42 may be arranged to extend in the radial direction of the rotary shaft 23. That is, the direction in which the connector-receiving portion extends may be changed as necessary in accordance with the configurations such as the position and size of a space in the vehicle allotted for the motor-driven compressor.

[0042] The connector-receiving portion 42 may be simultaneously formed when the inverter housing member 14 is formed.

[0043] The connector-receiving portion 42 may be made of plastic, for example. In this case, the insulating member for ensuring the insulation between the wiring connection portions 50 and the connector-receiving portion may be omitted.

[0044] The first metal plate 53 and the first end-connection portion 51a of the first terminal 51 may be connected to each other by swaging, and the second metal plate 54 and the first end-connection portion 52a of the second terminal 52 may be connected to each other by swaging. Even in this case, when the first metal plate 53 is swaged to the first end-connection portion 51a of the first terminal 51 and the second metal plate 54 is swaged to the first end-connection portion 52a of the second terminal 52, the likelihood of shifting the swaging position, as in the case where a wire is used, can be reduced. Accordingly, it is possible to perform a swaging operation by the swage tool while a machine such as a robot arm grasps the first metal plate 53 or the second metal plate 54, for example. As a result, even if the lengths of the first metal plate 53 and the second metal plate 54 are shortened as much as possible, the swaging operation is not difficult. Accordingly, the length of the entire wiring connection portion 50 can be easily shortened in comparison to a wiring connection portion in which a wire is used.

[0045] The wiring connection portions 50 may be entirely accommodated in the cluster block 45 to ensure insulation between the wiring connection portions 50 and the connector-receiving portion 42. Alternatively, the connector housing 44 may accommodate the wiring connection portions 50 entirely to ensure insulation between the wiring connection portions 50 and the connector-receiving portion 42.

[0046] Although the wire mesh 55 is located in the cluster block 45, the wire mesh 55 may be located in the connector housing 44.

[0047] The two wiring connection portions 50 are provided side by side. However, for example, three wiring connection portions 50 may be arranged side by side. That is, the number of the wiring connection portions 50, which are arranged side by side, is not particularly limited.

[0048] The compression portion 18, the electric motor 19, and the motor drive circuit 30 are accommodated in the housing 11 to be arranged in that order in the axial direction of the rotary shaft 23. The present invention is not limited to this. For example, the electric motor 19, the compression portion 18, and the motor drive circuit 30 may be accommodated in the housing 11 to be arranged in that order in the axial direction of the rotary shaft 23.

[0049] The compression portion 18 is not limited to a type that is configured by the fixed scroll 20 and the orbiting scroll 21, but may be a piston type or a vane type.

[0050] Instead of a vehicle air conditioner, the present invention may be applied to other types of air conditioners.

[0051] The present invention is applied to the motor-driven compressor 10, which is mounted on a hybrid automobile and used in a vehicle air conditioner. However, instead of a hybrid automobile, the present invention may be applied to a motor-driven compressor that is used in a vehicle air conditioner mounted on an automobile driven only by gasoline or on an electric car.

[0052] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalence of the appended claims.

[0053] A motor-driven compressor includes a wiring connection portion provided in a connector-receiving portion and adapted for supplying electricity from an external power source to a motor drive circuit. The wiring connection portion includes first and second terminals, each of which has a first end-connection portion at an end and a second end-connection portion at another end. The second end-connection portion of the first terminal is electrically connected to the external power source, while the second end-connection portion of the second terminal is electrically connected to a conductive member. The wiring connection portion further includes a coupling member coupling the first and second terminals. The coupling member includes a first metal plate connected to the first end-connection portion of the first terminal, a second metal plate connected to the first end-connection portion of the second terminal, and a wire mesh coupling the first and second metal plates.

Claims

1. A motor-driven compressor, comprising:

a housing (11);
a compression portion (18), an electric motor (19), and a motor drive circuit (30), which are accommodated in the housing (11);
a connector-receiving portion (42) provided on an outer surface of the housing (11); and
a wiring connection portion (50) provided in the connector-receiving portion (42), the wiring connection portion (50) being adapted for supplying electricity from an external power source (40) to the motor drive circuit (30); and
a conductive member (33) provided in the motor drive circuit (30), the conductive member (33) extending into a space in the connector-receiving portion (42) and electrically connecting the motor drive circuit (30) and the wiring connection portion (50) with each other,
the motor-driven compressor being **characterized in that**
the wiring connection portion (50) includes
a first terminal (51) having a first end-connection portion (51 a) at an end thereof and a second end-connection portion (51 b) at another end thereof, the second end-connection portion (51 b) being electrically connected to the external power source (40),
a second terminal (52) having a first end-connection portion (52a) at an end thereof and a second end-connection portion (52b) at another end thereof, the second end-connection portion (52b) being electrically connected to the conductive member (33), and
a coupling member (56), which couples the first terminal (51) with the second terminal (52), and wherein the coupling member (56) includes
a first metal plate (53) connected to the first end-connection portion (51 a) of the first terminal (51),
a second metal plate (54) connected to the first end-connection portion (51 a) of the second terminal (52), and
a wire mesh (55) connecting the first metal plate (53) and the second metal plate (54) with each other.

2. The motor-driven compressor according to claim 1, wherein
the connector-receiving portion (42) is formed of metal, and
the motor-driven compressor further comprises an insulating member (44, 45) located between the wiring connection portion (50) and the connector-receiving portion (42), which insulating member (44, 45) determines a position of the wiring connection portion (50) in the connector-receiving portion (42).

3. The motor-driven compressor according to claim 1 or 2, wherein the housing (11) accommodates a rotary shaft (23) having an axial direction, and wherein the connector-receiving portion (42) extends in the axial direction of the rotary shaft (23) and toward the electric motor (19).

4. The motor-driven compressor according to claim 3, wherein the compression portion (18), the electric motor (19), and the motor drive circuit (30) are accommodated in the housing (11) to be arranged in that order in the axial direction of the rotary shaft (23).

Fig.1A

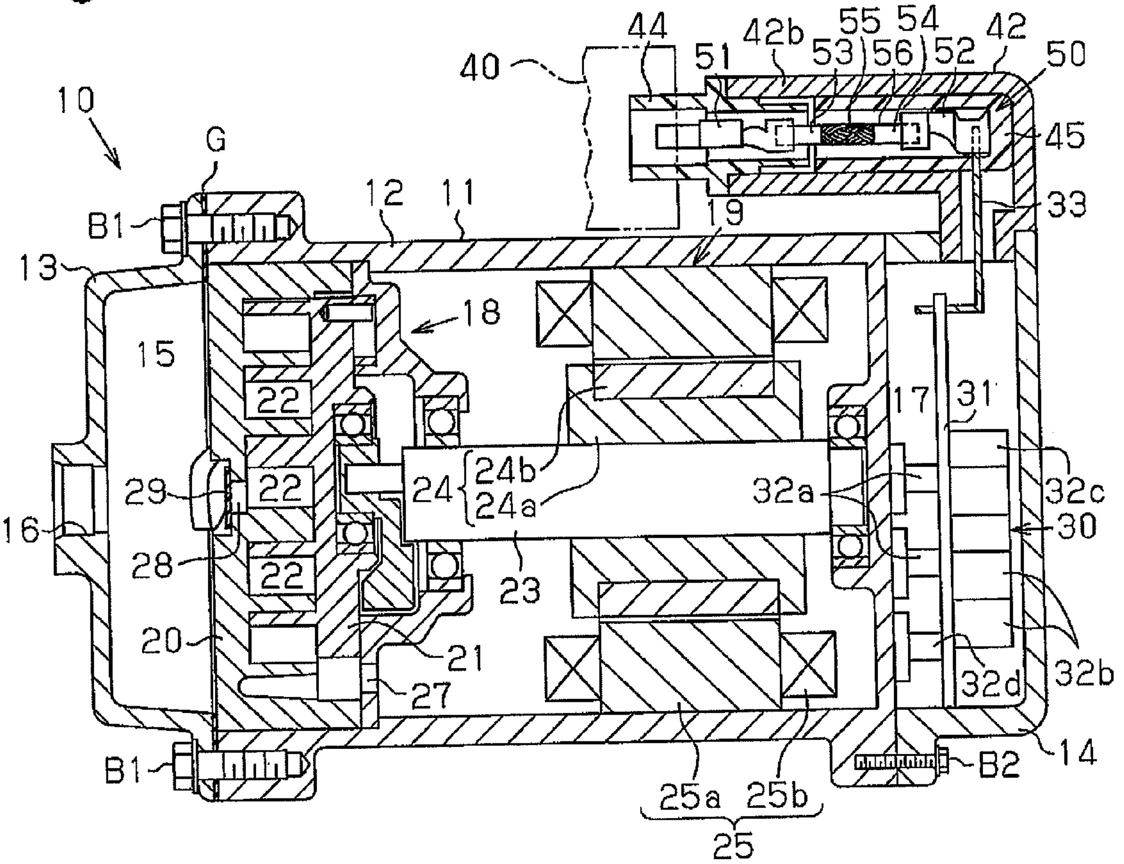

10
G
B1
13
15
16
29
28
20
22
22
22
12
11
18
24
24b
24a
23
21
27
B1
40
44
51
42b
53
55
54
56
52
42
50
45
33
19
17
31
32a
32c
30
32b
32d
14
B2
25a
25b
25

Fig.1B

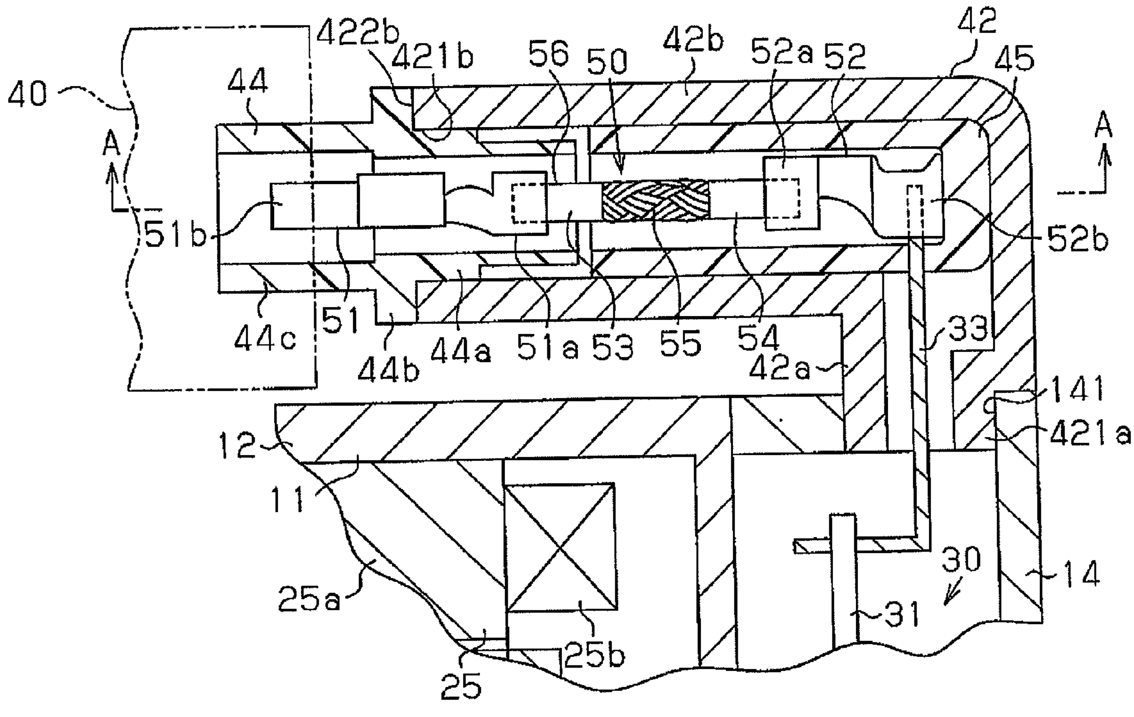

40
A
44
51b
44c
51
44b
44a
422b
421b
56
51a
53
50
55
42b
54
52a
52
42
45
A
52b
33
42a
141
421a
12
11
25a
25
25b
31
30
14

Fig.2

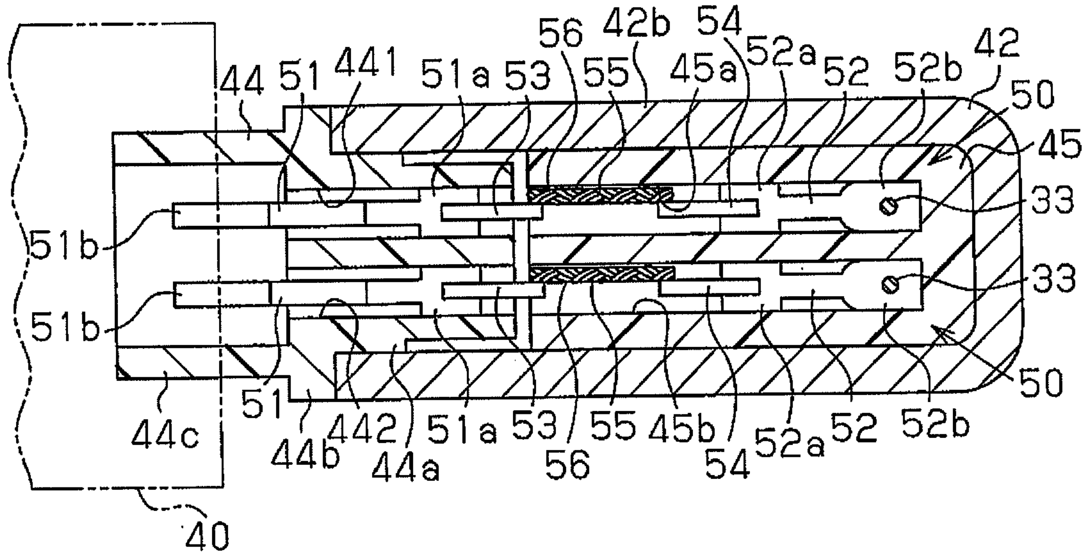

56
42b
54
52a
52
52b
42
50
45
44
51
441
51a
53
55
45a
33
33
51b
51b
50
51
44c
44b
442
44a
51a
53
56
55
45b
54
52a
52
52b
40

Fig.3

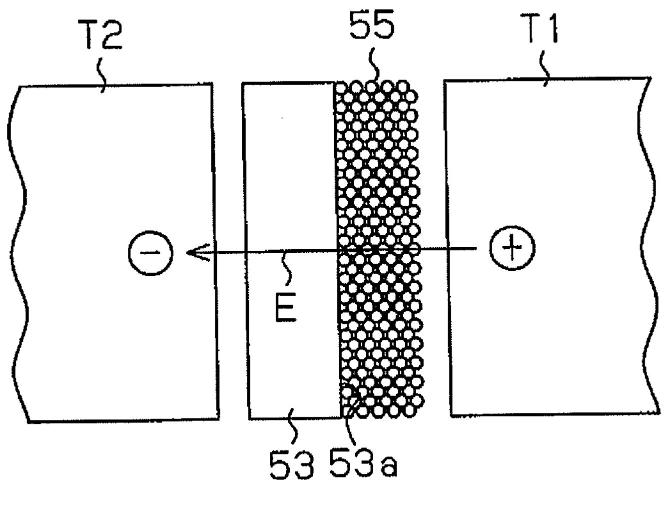

T2
55
T1
E
53
53a

Fig.4

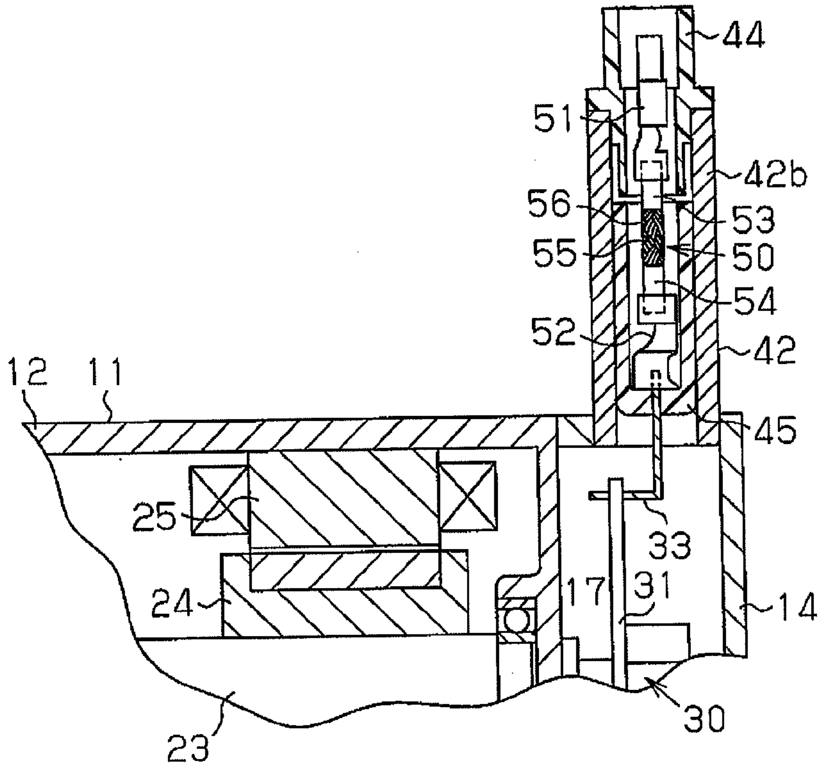
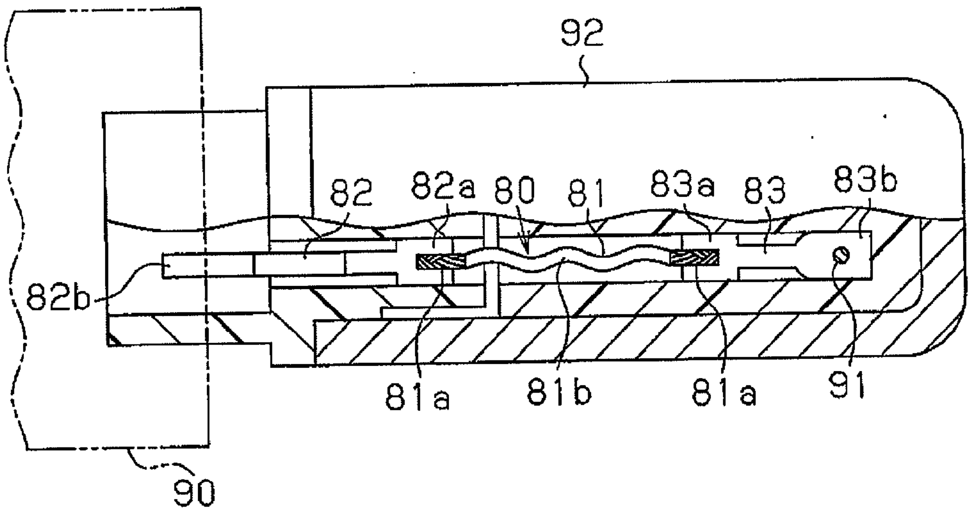

44
51
42b
56
53
55
50
54
52
42
12
11
45
25
33
17
31
24
14
30
23

Fig.5


92
82
82a
80
81
83a
83
83b
82b
81a
81b
81a
91
90

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 15 2991

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 964 788 A (ITAMERI-KINTER TERRY [US] ET AL) 23 October 1990 (1990-10-23) * figures 1,2 * * column 4, line 21 - column 5, line 57 * -----	1,2	INV. F04C18/02 H01R13/52 H02K5/22
A	US 3 160 460 A (ANDREW WYZENBEEK) 8 December 1964 (1964-12-08) * figure 7 * * column 2, line 28 - line 67 * * column 3, line 36 - line 53 * * column 4, line 10 - line 46 * -----	1,3	
A	US 4 966 559 A (WISNER RONALD R [US]) 30 October 1990 (1990-10-30) * figures 1,2 * * column 5, line 3 - column 6, line 43 * * column 7, line 10 - line 19 * -----	1,3	
A	EP 1 505 697 A1 (TOYOTA JIDOSHOKKI KK [JP]) 9 February 2005 (2005-02-09) * figures 1,2A,2B * * paragraph [0019] - paragraph [0034] * -----	1-3	TECHNICAL FIELDS SEARCHED (IPC) F04C H01R H02K
A	EP 2 299 118 A2 (TOYOTA JIDOSHOKKI KK [JP]) 23 March 2011 (2011-03-23) * figures 1,2 * * paragraph [0012] - paragraph [0025] * -----	1-4	

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	17 April 2013	Durante, Andrea

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 15 2991

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

17-04-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4964788 A	23-10-1990	BR 9004622 A	19-11-1991
		CA 2023760 A1	22-09-1991
		EP 0447607 A2	25-09-1991
		JP H0612940 B2	16-02-1994
		JP H03273844 A	05-12-1991
		US 4964788 A	23-10-1990
US 3160460 A	08-12-1964	NONE	
US 4966559 A	30-10-1990	CA 2016487 A1	12-04-1991
		US 4966559 A	30-10-1990
EP 1505697 A1	09-02-2005	DE 602004004212 T2	18-10-2007
		EP 1505697 A1	09-02-2005
		JP 4151510 B2	17-09-2008
		JP 2005056806 A	03-03-2005
		US 2005061535 A1	24-03-2005
EP 2299118 A2	23-03-2011	CN 102011729 A	13-04-2011
		EP 2299118 A2	23-03-2011
		JP 4998527 B2	15-08-2012
		JP 2011058388 A	24-03-2011
		US 2011058973 A1	10-03-2011

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 2009074517 A **[0002]**