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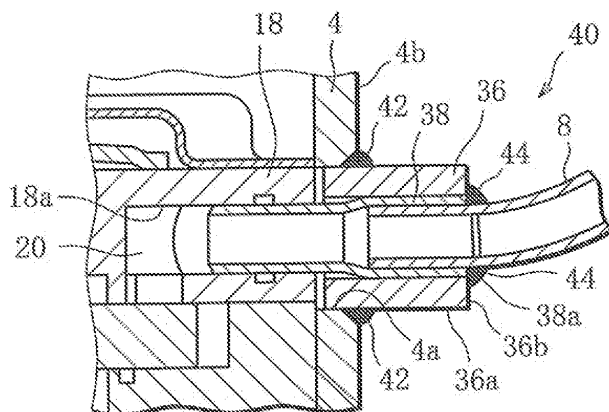
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(54) **SCROLL TYPE FLUID MACHINE**

(57) A scroll type fluid machine (1) includes piping (40). The piping (40) has a boss (36) fitted into a through hole (4a) from outside of a hermetic container (4) and forming a joint (42) in cooperation with the hermetic container (4) to seal up the through hole (4a), an internal pipe (38) inserted through the boss (36) into a scroll unit (12) and made of a copper-plated, iron-based material,

and an external pipe (8) inserted into the internal pipe (38) and projecting from the boss (36) to the outside of the hermetic container (4). The external pipe (8) is made of a copper-based material. The boss (36) is made of a copper-plated, iron-based material and has an iron-exposed region (48) where the iron-based material is exposed and where the joint (42) is formed.

FIG. 2



Description

Technical Field

[0001] The present invention relates to scroll type fluid machines, and more particularly, to a scroll type fluid machine suited for use in a refrigerating and air-conditioning system or in a heat pump water heater system.

Background Art

[0002] This type of scroll fluid machine, for example, a hermetic scroll compressor comprises a scroll unit accommodated in a hermetic container and driven by an electric motor to perform a series of processes including suction, compression and discharge of a refrigerant, and suction piping for supplying the refrigerant to the scroll unit from of the hermetic container.

[0003] The suction piping includes a suction pipe of copper, and a connection pipe and an outer pipe, both made of copper-plated steel.

[0004] The connection pipe has an outer end which is located outside of the hermetic container and into which the suction pipe is inserted, and an inner end which is located inside the hermetic container and connected to the scroll unit.

[0005] The outer pipe has an outer end into which the suction pipe and the connection pipe are inserted, an inner end fixed to the hermetic container.

[0006] Japanese Patent No. 3783346, for example, discloses a technique wherein the outer end of the connection pipe and the inner and outer ends of the outer pipe are enlarged in diameter by burring such that the copper-plated inner peripheral surface of the connection pipe fitted around the suction pipe and that of the outer pipe fitted around the connection pipe are partly exposed, to permit the exposed copper-plated portions to be simultaneously joined to the suction pipe by copper brazing.

[0007] The patent document also discloses a technique wherein, when the outer pipe is joined to the hermetic container by resistance welding, the copper coating plated on the inner peripheral surface of the outer pipe is caused to peel off in the vicinity of the inner end of the pipe due to the electric current flowing during the resistance welding, thus omitting the removal of the flux from inside the hermetic container, which is otherwise required after the outer pipe is brazed to the hermetic container, and thereby preventing corrosion attributable to the residual flux in the hermetic container.

[0008] In the conventional techniques disclosed in the patent document, however, the pipes are each obtained by first plating a metallic material with copper, and then cutting and forming the copper-plated material into shape. It is therefore essential that the connection pipe and the outer pipe should be subjected to burring in order to form burrs to be brazed to the suction pipe, which entails increase in the cost of working the suction piping.

[0009] Also, in the above conventional techniques, the copper coating plated on the inner peripheral surface of the outer pipe is made to peel off in the vicinity of the inner end of the pipe due to the current that is passed to join the outer pipe to the hermetic container by resistance welding. It is therefore necessary that, with the welding electrode immovably pressed against a portion to be welded, high current should be supplied to the welding portion, as stated in the patent document. This, however, entails increase in the consumption of electric power by the welding operation, and also since the cost of securing safety of the welding operation increases, a problem arises in that the cost of working the suction piping further increases.

[0010] In the conventional techniques, moreover, the outer pipe is also subjected to burring so that the flow of high current may be concentrated at the welding portion. Because of the burr of the outer pipe, however, the outer pipe must be inserted from inside the hermetic container and also the welding must be performed on the inner side of the hermetic container. This lowers the assembling efficiency and welding efficiency of the suction piping, possibly entailing further increase in the cost of working the suction pipe.

Disclosure of the Invention

[0011] The present invention was created in view of the above circumstances, and an object thereof is to provide a scroll type fluid machine of which the piping can be worked at significantly low cost and also can be joined to a hermetic container by resistance welding.

[0012] To achieve the object, the present invention provides a scroll type fluid machine comprising: a hermetic container made of an iron-based material; a scroll unit accommodated in the hermetic container and driven by an electric motor to perform a series of processes from suction to discharge of a working fluid; and piping configured to allow the working fluid to flow from outside of the hermetic container to the scroll unit or vice versa through a through hole formed through the hermetic container, wherein the piping includes a boss fitted into the through hole from outside of the hermetic container and forming a joint in cooperation with the hermetic container to seal up the through hole, an internal pipe inserted through the boss into the scroll unit and made of a copper-plated, iron-based material, and an external pipe inserted into the internal pipe and projecting from the boss to the outside of the hermetic container, the external pipe being made of a copper-based material, and wherein the boss is made of a copper-plated, iron-based material and has an iron-exposed region where the iron-based material is exposed and where the joint is formed.

[0013] In the above scroll type fluid machine, it is unnecessary to carry out removal of flux from within the hermetic container, which is required in cases where the joint is formed by brazing, and thus it is possible to reliably prevent corrosion attributable to the residual flux in the

hermetic container.

[0014] Further, the boss has the iron-exposed region formed beforehand. Accordingly, during the welding operation, it is unnecessary to supply high current to the boss in order to remove the copper coating, so that the consumption of electric power by the welding operation can be reduced and safety enhanced, improving the assembling efficiency of the piping and also reducing the of working the piping.

[0015] Preferably, in the above scroll type fluid machine, the joint is formed at a junction between an outer surface of the hermetic container and an outer peripheral surface of the boss.

[0016] This structure permits the boss to be fitted from outside of the hermetic container and also allows the welding operation to be performed from the outer side of the hermetic container to form the joint, thus further improving the assembling efficiency of the piping and reducing the of working the piping.

[0017] Preferably, in the above scroll type fluid machine, each of the boss and the internal pipe is obtained by forming the iron-based material into shape and then subjecting the shaped material to a copper plating process, and an end face of the boss located opposite the joint is positioned substantially flush with an end face of the internal pipe located outside of the hermetic container.

[0018] In this case, the boss and the internal pipe be collectively joined, at their copper-plated end faces, to the copper-based external pipe by copper brazing, without the need to perform complicated working or machining on the boss and the internal pipe, making it possible to further reduce the of working the piping.

[0019] Preferably, in the above scroll type fluid machine, a region of the boss is masked prior to the copper plating process, to form the iron-exposed region.

[0020] The iron-exposed region of the boss can be formed with ease, whereby the of working the piping can be further cut down.

[0021] Preferably, in the above scroll type fluid machine, the boss is subjected to the copper plating process, and after the copper plating process, copper coating is removed from a region of the boss to form the iron-exposed region.

[0022] In this case, the welding range for forming the joint can be finely adjusted in accordance with a dimensional error of the boss fitted the through hole, making it possible to further reduce the of working the piping.

Brief Description of the Drawings

[0023]

FIG. 1 is a longitudinal sectional view of a principal part of a hermetic scroll compressor according to one embodiment of the present invention;
Fig. 2 is an enlarged longitudinal sectional view of suction piping shown in FIG. 1; and

FIG. 3 is a longitudinal sectional view showing details of a boss in FIG. 2.

Best Mode of Carrying out the Invention

[0024] An embodiment of the present invention will be described below with reference to the accompanying drawings.

[0025] FIG. 1 illustrates a principal part of a hermetic scroll compressor as an example of a scroll type fluid machine according to the embodiment.

[0026] The compressor 1 is incorporated into a refrigeration circuit of a refrigerating and air-conditioning system, heat pump hot water system or the like. The refrigeration circuit has a path through which a carbon dioxide refrigerant (hereinafter referred to as refrigerant) is circulated as a working fluid, and the compressor 1 sucks in the refrigerant from the path and discharges the compressed refrigerant into the path.

[0027] The compressor 1 includes a hermetic container 2 made of an iron-based metallic material (iron-based material). The hermetic container 2 has a cylindrical barrel 4 opening at opposite ends, and an upper lid 6 and a lower lid, not shown, hermetically fitted in the upper and lower open ends, respectively, of the barrel 4, whereby the interior of the barrel 4 is hermetically sealed. A discharge pressure of the refrigerant prevails in the interior of the barrel 4. A suction pipe (external pipe) 8 is connected to an appropriate portion of the barrel 4 to introduce the refrigerant from the refrigeration circuit into the barrel 4. A discharge pipe 10 is connected to an appropriate portion of the upper lid 6 to discharge the compressed refrigerant from inside the hermetic container 2 to the refrigeration circuit. The suction and discharge pipes 8 and 10 are each a copper pipe made of a copper-based metallic material (copper-based material).

[0028] The barrel 4 accommodates a scroll unit 12 and an electrically driven motor (electric motor), not shown, arranged below the scroll unit 12 for driving the unit 12 through a rotary shaft 14.

[0029] The scroll unit 12 comprises a movable scroll 16 and a fixed scroll 18, and spiral wraps protrude integrally from respective end plates of the scrolls 16 and 18 toward each other.

[0030] The spiral wraps cooperate with each other to suck the refrigerant from the suction pipe 8 into a suction chamber 20 defined in the end plate of the fixed scroll 18, to form a compression chamber. Because of orbiting movement of the movable scroll 16 relative to the fixed scroll 18, the compression chamber moves toward the center of the spiral wraps, accompanying gradual decrease in the volume of the compression chamber, so that a series of processes including suction, compression, and discharge of the refrigerant is carried out.

[0031] The movable scroll 16 is prevented from rotating by a rotation-preventing pin, not shown, and thus makes an orbiting on a shaft frame 22 fixed to the barrel 4. To cause the movable scroll 16 to make an orbiting

motion, a boss 24 protrudes from the back surface of the end plate of the movable scroll 16, and an eccentric shaft 26 is formed integrally with the upper end of the rotary shaft 14 so as to face the boss 24. The boss 24 is supported by the eccentric shaft 26 with a bearing therebetween.

[0032] On the other hand, the fixed scroll 18 is fixed to the barrel 4 and serves as a partition separating the compression chamber from a refrigerant discharge chamber 28 defined on the back side of the end plate of the fixed scroll 18.

[0033] Specifically, a discharge hole 30 is formed through a central portion of the end plate of the fixed scroll 18 and is opened and closed by a discharge valve 32 attached to the fixed scroll 18 on the same side as the discharge chamber 28. The discharge valve 32 is covered with a cover 34. The cover 34 serves to set the compression chamber off from the discharge chamber 28 and also to suppress noise produced when the discharge valve 32 opens.

[0034] In the compressor 1 described above, as the rotary shaft 14 rotates, the movable scroll 16 orbits on the shaft frame 22 relative to the fixed scroll 18. Consequently, the refrigerant introduced into the suction chamber 20 from the suction pipe 8 is guided toward the center of the scroll unlit 12 while being compressed in the compression chamber, and the high-pressure refrigerant in the compression chamber is discharged from the discharge hole 30 into the interior of the hermetic container 2 and then delivered from the discharge chamber 28 to the outside of the compressor 1 through the discharge pipe 10.

[0035] As shown in the enlarged view of FIG. 2, the suction pipe 8 is joined to the barrel 4 by means of a suction boss (boss) 36 and also communicates with the suction chamber 20 via an inner pipe (internal pipe) 38. The suction pipe 8, the boss 36 and the inner pipe 38 constitute suction piping (piping) 40.

[0036] The boss 36 is inserted from outside of the barrel 4 into a through hole 4a formed through the barrel 4, and a joint 42 is formed at a junction between an outer surface 4b of the barrel 4 and an outer peripheral surface 36a of the boss 36 to seal up the through hole 4a.

[0037] The inner pipe 38 is inserted through the boss 36 and fitted and fixed in a suction hole 18a formed in the fixed scroll 18 and extending from the side surface of the end plate through to the suction chamber 20. The suction pipe 8 has an end portion fitted into the inner pipe 38 and projects from the boss 36 to the outside of the barrel 4.

[0038] The boss 36 and the inner pipe 38 are each made of a copper-plated, iron-based metallic material (copper-plated, iron-based material) and obtained by first forming the iron-based material into shape and then plating the shaped material with copper. An outer end face (boss end face) 36b of the boss 36 located outside of the barrel 4 opposite the joint 42 is positioned substantially flush with an outer end face (internal pipe end face) 38a

of the inner pipe 38 located outside of the barrel 4. The boss 36 and the inner pipe 38 are collectively joined, at their copper-plated outer end faces 36a and 38a along the entire circumference, to the suction pipe 8, which is a copper pipe, by copper brazing, thus forming a copper-brazed joint 44.

[0039] The boss 36 has a copper-plated region 46 plated with copper, an iron-exposed region 48 where the iron-based material is exposed to permit the joint 42 to be formed by resistance welding.

[0040] FIG. 3 shows in detail the copper-plated region 46 and iron-exposed region 48 of the boss 36.

[0041] The copper-plated region 46 covers at least the outer side of the boss 36 including the outer end face 36b, to permit the joint 44 to be formed by copper brazing.

[0042] On the other hand, the iron-exposed region 48 is located on the inner side of the boss 36 opposite the outer end face 36b and includes the inner end face 36c. The iron-exposed region 48 extends to the outer peripheral surface 36a of the boss 36 such that the iron-exposed region 48 of the outer peripheral surface 36a extends from the inner end face 38c by a predetermined distance L including at least the formation range of the joint 42.

[0043] The distance L is determined beforehand taking into account a length of the boss 36 by which the boss 36 is inserted into the through hole 4a and the formation or welding range of the joint 42. Specifically, prior to the copper plating process, the necessary region of the boss 36 is masked, and then the boss 36 is immersed in a copper plating solution, whereby the length L of the outer peripheral surface 36a, inclusive of the end face 36c, is prevented from being plated with copper, thus forming the iron-exposed region 48 where the joint 42 is to be formed.

[0044] Alternatively, the boss 36 may be immersed in its entirety in the copper plating solution, without masking the boss 36, and after the plating process, the copper coating may be removed from the necessary region including at least the formation range of the joint 42, to form the iron-exposed region 48.

[0045] As described above, according to the embodiment, the boss 36 is constituted by a copper-plated, iron-based pipe member having the iron-exposed region 48 where the iron-based material is exposed and where the joint 42 is to be formed. Accordingly, the inner pipe 38 and the suction pipe 8 can be joined to the boss 36 by copper brazing, while the joint 42 can be formed by resistance welding. It is therefore unnecessary to remove flux from inside the hermetic container 2, which is required in cases where the joint 42 is formed by brazing, thereby reliably preventing corrosion attributable to the residual flux in the hermetic container 2.

[0046] Further, the iron-exposed region 48 of the boss 36 formed beforehand. This makes it unnecessary to supply high current to the boss 36 during the welding operation to cause the copper coating to peel off. The consumption of electric power by the welding operation can therefore be reduced and safety enhanced, thus im-

proving the assembling efficiency of the suction piping 40 and reducing the cost of working the suction piping 40.

[0047] Also, the joint 42 is formed at the junction between the outer surface 4a of the barrel 4 and the outer peripheral surface 36a of the boss 36. Accordingly, with the boss 36 inserted from outside of the barrel 4, the welding operation be performed from the outer side of the barrel 4 to form the joint 42. This improves the assembling efficiency of the suction piping 40 and makes it possible to further reduce the cost of working the suction piping 40.

[0048] Further, after the iron-based material for the boss 36 and the inner pipe 38 is formed into shape, the shaped material is plated with copper, and the outer end face 36b of the boss 36 and the outer end face 38a of the inner pipe 38 are positioned so as to be substantially flush with each other. Accordingly, the boss 36 and the inner pipe 38 can be collectively joined, at their copper-plated outer end faces 36a and 38b, to the suction pipe 8 of copper by copper brazing, without the need for complicated working of the boss 36 and the inner pipe 38, whereby the cost of working the suction piping 40 can be further cut down.

[0049] Moreover, the iron-exposed region 48 is formed by masking the necessary region of the boss 36 prior to the copper plating process. Thus, the iron-exposed region 48 of the boss 36 can be formed with ease, making it possible to further reduce the cost of working the suction piping 40.

[0050] Alternatively, following the copper plating process, the iron-exposed region 48 is formed by removing the copper coating. In this case, the welding range for forming the joint 42 can be finely adjusted in accordance with a dimensional error of the boss 36 fitted into the through hole 4a, whereby the cost of working the suction piping 40 can be cut down.

[0051] While the embodiment of the present invention has been described above, it is to be noted that the present invention is not limited to the foregoing embodiment alone and may be modified in various ways without departing from the spirit and scope of the invention.

[0052] For example, although in the above description of the embodiment, the suction piping 40 is mentioned as piping, the piping is not limited to the suction piping and may be various types of piping including the discharge pipe connected to the hermetic container.

[0053] Also, in the foregoing embodiment, the present invention is applied to the hermetic scroll compressor incorporated in the refrigeration circuit of a refrigerating and air-conditioning system or heat pump water heater system using carbon dioxide as the refrigerant. The present invention can equally be applied to various other machines using different kinds of working fluid and having different applications, such as non-hermetic type compressors and scroll type fluid machines serving as expansion devices.

Claims

1. A scroll type fluid machine comprising:

a hermetic container made of an iron-based material;
a scroll unit accommodated in the hermetic container and driven by an electric motor to perform a series of processes from suction to discharge of a working fluid; and
piping configured to allow the working fluid to flow from of the hermetic container to the scroll unit or vice versa through a through hole formed through the hermetic container,

wherein the piping includes a boss fitted into the through hole from outside of the hermetic container and forming a joint if cooperation with the hermetic container to seal up the through hole, an internal pipe inserted through the boss into the scroll unit and made of a copper-plated, iron-based material, and an external pipe inserted into the internal pipe and projecting from the boss to the outside of the hermetic container, the external pipe being made of a copper-based material, and
the boss is made of a copper-plated, iron-based material and an iron-exposed region where the iron-based material is exposed and where the joint is formed.

2. The scroll type fluid machine according to claim 1, wherein the joint is formed at a junction between an outer surface of the hermetic container and an outer peripheral surface of the boss.

3. The scroll type fluid machine according to claim 1 or 2, wherein: each of the boss and the internal pipe is obtained by forming the iron-based material into shape and then subjecting the shaped material to a copper plating process, and an end of the boss located opposite the joint is positioned substantially flush with an end face of the internal pipe located outside of the hermetic container.

4. The scroll type fluid machine according to claim 3, wherein a region of the boss is masked prior to the copper plating process, to form the iron-exposed region.

5. The scroll type fluid machine according to claim 3, wherein the boss is subjected to the copper plating process, and after the copper plating process, copper coating is removed from a region of the boss to form the iron-exposed region.

FIG. 1

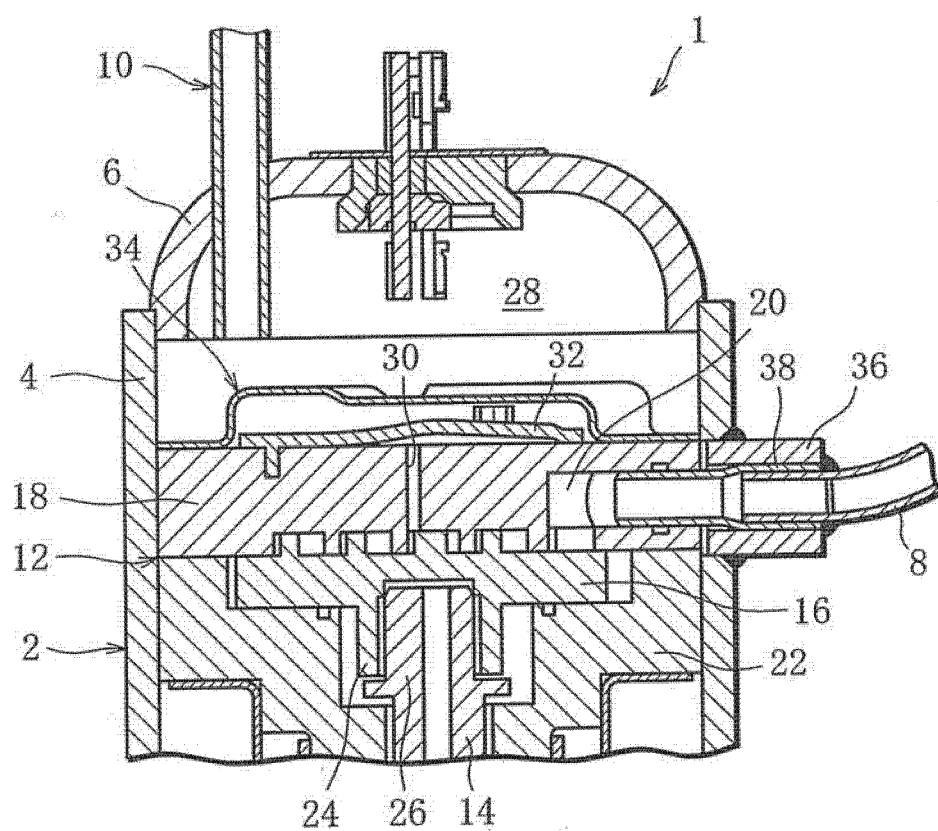


FIG. 2

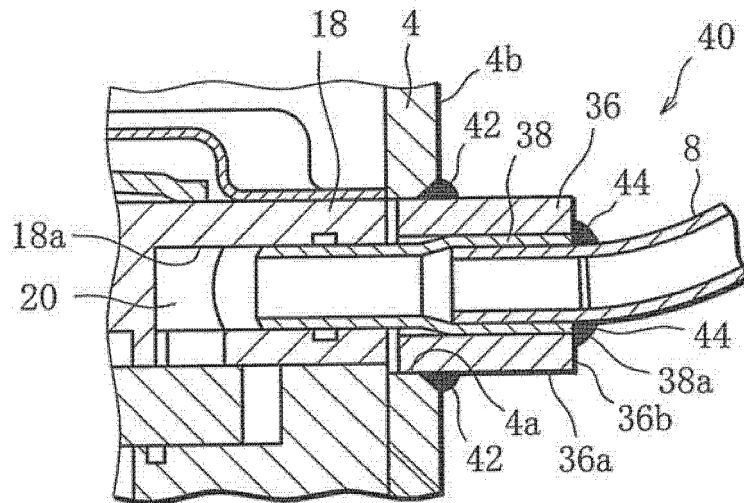
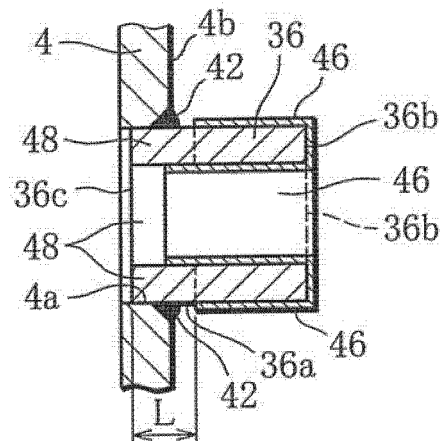


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/065434

A. CLASSIFICATION OF SUBJECT MATTER

F04C18/02 (2006.01) i, F04B39/12 (2006.01) i, F04C29/12 (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)

F04C18/02, F04B39/12, F04C29/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2005-48682 A (Matsushita Electric Industrial Co., Ltd.), 24 February, 2005 (24.02.05), Par. Nos. [0002] to [0005]; Figs. 6 to 7 & CN 1584336 A	1-5
Y	JP 2004-225614 A (Mitsubishi Electric Corp.), 12 August, 2004 (12.08.04), Par. Nos. [0020] to [0030]; Figs. 1 to 3 (Family: none)	1-5
Y	JP 11-13671 A (Matsushita Electric Industrial Co., Ltd.), 19 January, 1999 (19.01.99), Par. No. [0003]; Fig. 5 & US 6158995 A	1-5

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

* Special categories of cited documents:

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Date of the actual completion of the international search
05 November, 2008 (05.11.08)Date of mailing of the international search report
18 November, 2008 (18.11.08)Name and mailing address of the ISA/
Japanese Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/065434

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002-155861 A (Matsushita Electric Industrial Co., Ltd.), 31 May, 2002 (31.05.02), Figs. 3 to 4 (Family: none)	1-5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 3783346 B [0006]