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(54) **LINEAR COMPRESSOR**

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(57) **ABSTRACT**

A linear compressor having a dynamic vibration-reducing unit, which is provided at a stopper, by which separation of a cylinder block is prevented, for eliminating vibration generated from a hermetically sealed container at a specific frequency band. The dynamic vibration-reducing unit comprises an elastic member disposed at the lower end of the stopper, and a mass member fixed to the bottom part of the elastic member. The elastic member is formed in the shape of a spiral plate. The elastic member is provided at the center part thereof with a through-hole, which corresponds to an opening of the stopper. The elastic member is provided symmetrically at both ends thereof with fixing parts for fixing the mass member. The mass member is formed in the shape of a plate. The mass member is provided at the center part thereof with a hollow part, which corresponds to the through-hole of the elastic member. Through the hollow part of the mass member are inserted supporting parts of the stopper frame. Both sides of the mass member are symmetrical to each other centering on the hollow part so that both ends of the mass member are fixed to the fixing parts of elastic member by means of welding or bolts.

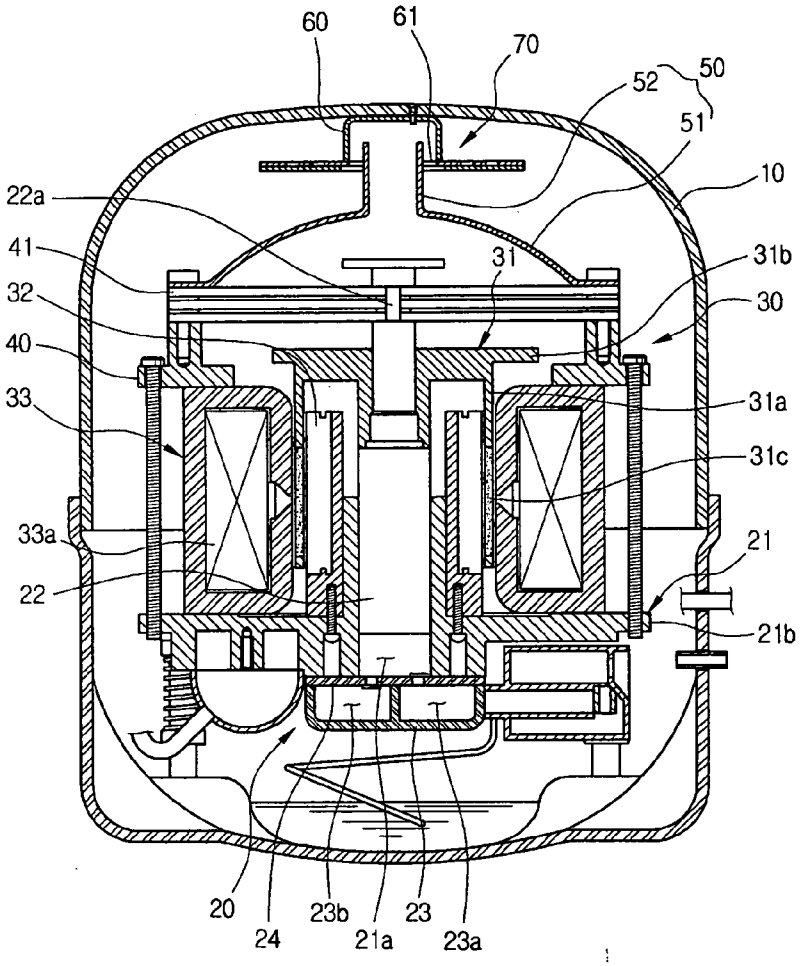

FIG 1

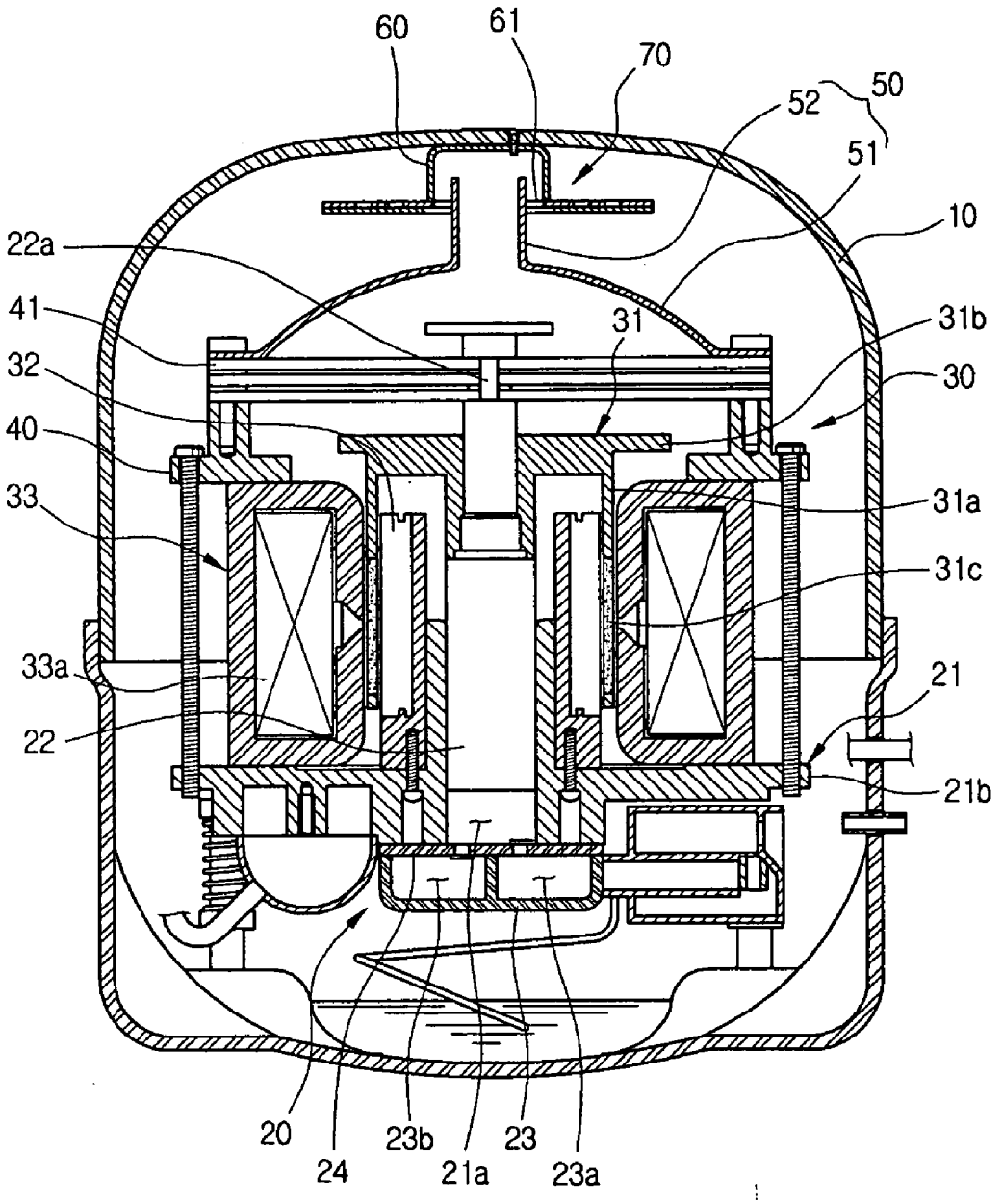
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FIG 2

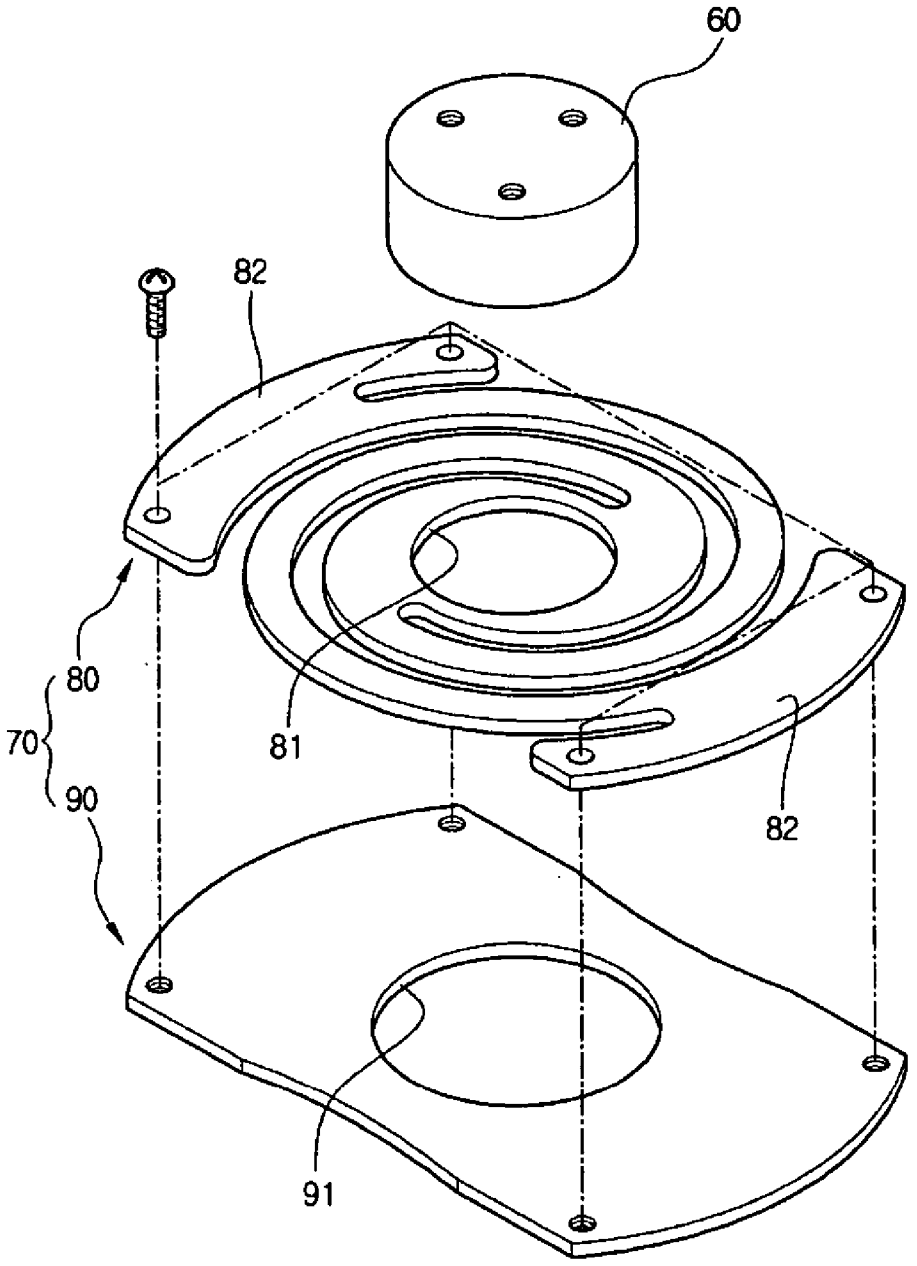
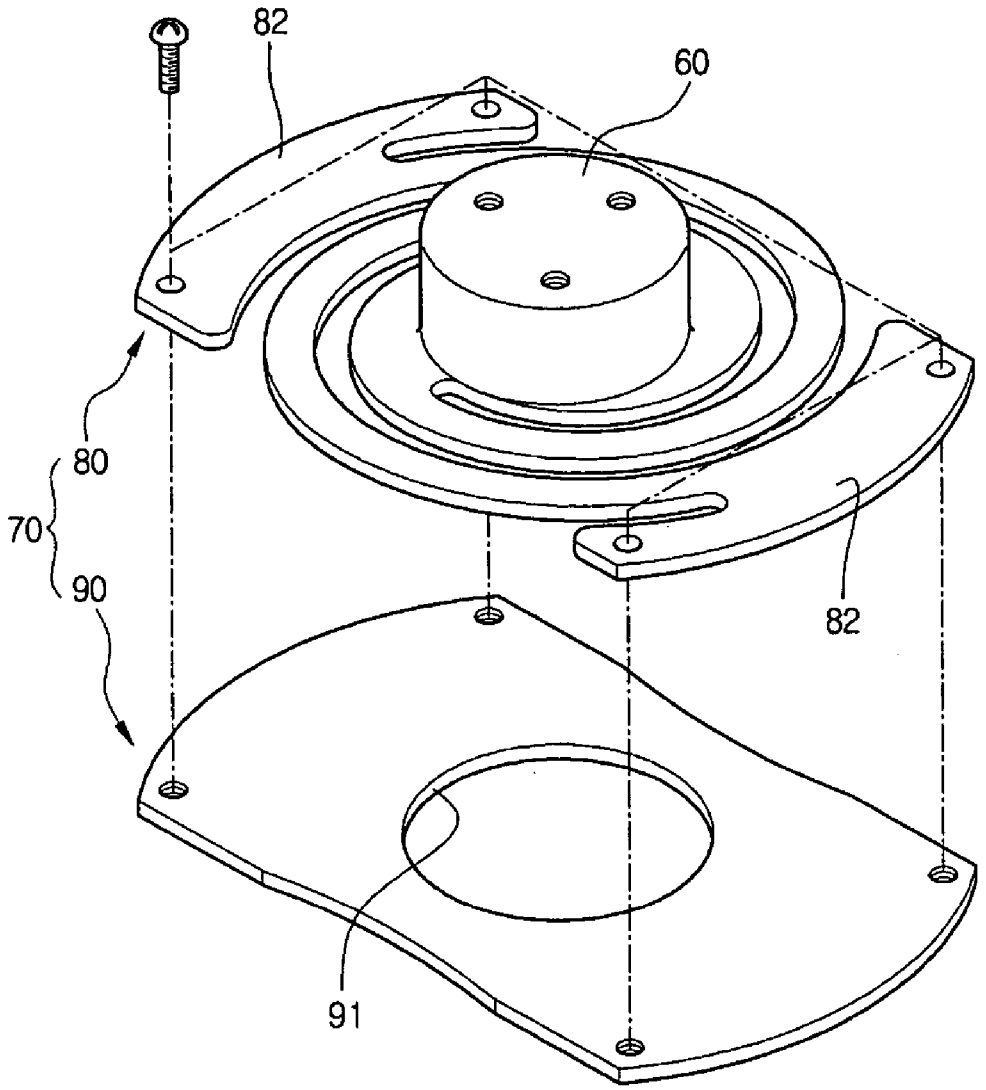


FIG 3



LINEAR COMPRESSOR

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 2004-15797, filed on Mar. 9, 2004 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a linear compressor, and, more particularly, to a linear compressor that is capable of eliminating vibration transmitted to a hermetically sealed container due to reciprocating movement of a piston, which is generated at a specific frequency band.

[0004] 2. Description of the Related Art

[0005] Generally, a linear compressor is used to compress a coolant of a cooling unit, such as a refrigerator or an air conditioner. The linear compressor is provided with a linear motor, which is linearly reciprocated, as a driving unit for moving a piston forward and backward.

[0006] The linear compressor comprises: a cylinder block having a compression chamber defined therein; a piston disposed in the compression chamber of the cylinder block such that the piston is moved forward and backward; a cylinder head having an inlet chamber defined therein for introducing a coolant and an outlet chamber defined therein for discharging the coolant; and a valve unit disposed between the cylinder block and the cylinder head for controlling the introduction and discharge of the coolant.

[0007] The linear motor, as the driving unit for moving the piston forward and backward, comprises: a moving member having one side connected to the piston and the other side where a cylindrical permanent magnet surrounding the cylinder block is mounted; an inner stator fixedly disposed at the inside of the moving member; and an outer stator fixedly disposed at the outside of the moving member.

[0008] In the conventional linear compressor with the above-stated construction, there is generated a magnetic field between the outer stator and the inner stator when alternating current is supplied to the outer stator. Since the current supplied to the outer stator is the alternating current, the polarity of the magnetic field is periodically altered. Consequently, the moving member with the permanent magnet is vertically moved forward and backward. At the same time, the piston connected to the moving member is moved forward and backward in the compression chamber so that the coolant is compressed. At this time, vibration generated at a specific frequency band due to the reciprocating movement of the piston is transmitted to the hermetically sealed container, with the result that the hermetically sealed container is vibrated. Such vibration of the hermetically sealed container is a major cause of a compressor noise.

SUMMARY OF THE INVENTION

[0009] Therefore, it is an aspect of the invention to provide a linear compressor having a dynamic vibration-reducing unit for eliminating vibration generated from a hermetically sealed container at a specific frequency band.

[0010] In accordance with one aspect, the present invention provides a linear compressor comprising: a hermetically sealed container having an airtight space defined therein; a cylinder block disposed in the hermetically sealed container, the cylinder block having a compression chamber defined therein; a stopper frame fixed to the cylinder block; a stopper disposed in the hermetically sealed container for supporting the stopper frame; and a dynamic vibration-reducing unit disposed at the stopper for eliminating vibration generated from the hermetically sealed container at a specific frequency band.

[0011] Preferably, the dynamic vibration-reducing unit comprises: an elastic member fixed to the stopper; and a mass member fixed to the elastic member.

[0012] Preferably, one end of the stopper is fixed to the hermetically sealed container, and the stopper is provided at the other end thereof with an opening, through which the stopper frame is inserted, and the elastic member is provided with a through-hole, through which the stopper frame is inserted, the through-hole corresponding to the opening of the stopper.

[0013] Preferably, the elastic member is formed in the shape of a spiral plate, the through-hole being formed at the center part of the elastic member.

[0014] Preferably, the mass member is formed in the shape of a plate, and the mass member is provided with a hollow part corresponding to the opening of the stopper.

[0015] Preferably, both sides of the mass member are symmetrical to each other centering on the hollow part.

[0016] Preferably, the elastic member is integrally formed with the stopper such that the elastic member is extended from one end of the stopper.

[0017] Preferably, elastic coefficient of the elastic member and mass of the mass member are set so that a specific frequency transmitted to the hermetically sealed container and an oscillation frequency of the dynamic vibration-reducing unit correspond to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above aspects, and other features and advantages of the present invention will become more apparent after reading the following detailed description when taken in conjunction with the drawings, in which:

[0019] **FIG. 1** is a cross-sectional view illustrating the entire structure of a linear compressor according to the present invention;

[0020] **FIG. 2** is a perspective view illustrating a dynamic vibration-reducing unit provided at the linear compressor according to a preferred embodiment of the present invention; and

[0021] **FIG. 3** is a perspective view illustrating a dynamic vibration-reducing unit provided at the linear compressor according to another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] Preferred embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

[0023] **FIG. 1** is a cross-sectional view illustrating the entire structure of a linear compressor according to the present invention. As illustrated in **FIG. 1**, the linear compressor comprises: a hermetically sealed container **10** having an airtight space defined therein; a compressing unit **20** for compressing a coolant introduced thereinto and discharging the compressed coolant; and a driving unit for driving the compressing unit **20**.

[0024] The compressing unit **20** comprises: a cylinder block **21** having a compression chamber **21***a* where the coolant is compressed; a piston **22** disposed in the compression chamber **21***a* such that the piston **22** is reciprocated; and a cylinder head **23** having an inlet chamber **23***a* and an outlet chamber **23***b*. Between the cylinder block **21** and the cylinder head **23** is disposed a valve unit **24** for controlling the introduction of the coolant.

[0025] The driving unit **30** comprises: a moving member **31**, which is reciprocated along with the piston **22**; an inner stator **32** disposed at the inside of the moving member **31**; and an outer stator **33** disposed at the outside of the moving member **31**. Preferably, the driving unit **30** is a liner motor.

[0026] The moving member **31** is formed in the shape of a cylinder. The moving member **31** comprises: a cylindrical part **31***a* for surrounding the upper outside of the cylinder block **21**; and a fixing part **31***b* disposed at the same axis as a connection shaft **22***a* provided at the upper end of the piston **22** so that the fixing part **31***b* is vertically moved forward and backward along with the piston **22**. To the cylindrical part **31***a* is integrally attached a permanent magnet **31***c*, which electro-magnetically cooperates with the stators **32** and **33** so that the moving member **31** is moved forward and backward.

[0027] The inner stator **32** and the outer stator **33** are disposed at the inner and outer sides of the cylindrical part **31***a* of the moving member **31**, respectively. The inner stator **32** is formed in the shape of a cylinder, and fixed to the outer surface of the cylinder block **21** for guiding the vertical reciprocating movement of the moving member **31** and smoothing the flow of magnetic flux through the permanent magnet **31***c* of the moving member **31** from the outer stator **33**. On the outer stator **33** is wound an exciting coil **33***a* for moving the moving member **31** forward and backward by means of its electro-magnetic cooperation with the permanent magnet **31***c* of the moving member **31**. The lower end of the outer stator **33** is supported by means of a supporting part **21***b* extended outward from the lower end of the cylinder block **21**, and the upper end of the outer stator **33** is supported by means of an additional fixing frame **40**.

[0028] On the fixing frame **40**, by which the outer stator **33** is fixed, are successively disposed a plate spring **41**, which is formed of a plurality of stacked plates so that the movement power of the piston is increased by means of the elasticity of the stacked plates; and a stopper frame **50** for preventing separation of the cylinder block **21**. The stopper frame **50** is supported by means of a stopper **60**, which is fixed to the inner upper side of the hermetically sealed container **10**.

[0029] The stopper frame **50** comprises: a plurality of extension parts **51**, which are extended from the fixing frame **40** in the shape of a bow; and supporting parts **52** bent from the extended ends of the extension parts **51** toward the stopper **60**.

[0030] The stopper **60** is formed in the shape of a cylinder. The upper end of the stopper **60** is fixed to the inner surface of the hermetically sealed container **10**. The stopper **60** is provided at the lower end thereof with an opening **61**, through which the supporting parts **52** of the stopper frame **50** are inserted. The stopper **60** is provided with a dynamic vibration-reducing unit **70** for eliminating vibration generated from the hermetically sealed container at a specific frequency band. The dynamic vibration-reducing unit **70** will hereinafter be described with reference to **FIG. 2**.

[0031] Referring to **FIG. 2**, the dynamic vibration-reducing unit **70** comprises: an elastic member **80** disposed at the lower end of the stopper **60**; and a mass member **90** fixed to the bottom part of the elastic member **80**.

[0032] The elastic member **80** is formed in the shape of a spiral plate. The elastic member **80** is provided at the center part thereof with a through-hole **81**, which corresponds to the opening **61** of the stopper **60**. The supporting parts **52** of the stopper frame **50** are inserted through the through-hole **81** of the elastic member **80**. The elastic member **80** is provided symmetrically at both ends thereof with fixing parts **82** for fixing the mass member **90**.

[0033] The mass member **90** is formed in the shape of a plate. The mass member **90** is provided at the center part thereof with a hollow part **91**, which corresponds to the opening **61** of the stopper **60**. Both sides of the mass member **90** are symmetrical to each other centering on the hollow part **91** so that both ends of the mass member **90** are fixed to the fixing parts of the elastic member **80** by means of welding or bolts.

[0034] As illustrated in **FIG. 3**, the elastic member **80** may be integrally formed with the stopper **60** such that the elastic member **80** is extended outward from the opening **61** of the stopper **60**. To the bottom part of the elastic member **80** is fixed the mass member **90** by means of welding or bolts.

[0035] Now, the operation of the linear compressor with the above-stated construction according to the present invention will be described.

[0036] When alternating current is supplied to the coil **33***a* of the outer stator **33**, there is generated a magnetic field between the outer stator **33** and the inner stator **32**. Since the current supplied to the outer stator is alternating current, the polarity of the magnetic field is periodically altered. Consequently, the moving member **31** with the permanent magnet **31***c* and the piston **22** connected to the moving member **31** are moved forward and backward in the compression chamber **21***a* at the same frequency as the supplied current so that the coolant is compressed. At this time, vibration generated at a specific frequency band due to the reciprocating movement of the piston **22** is transmitted to the hermetically sealed container **10**. The vibration generated at the specific frequency band is eliminated by means of the dynamic vibration-reducing unit **70** provided at the stopper **60**.

[0037] Specifically, elastic coefficient of the elastic member **80** and mass of the mass member **80** are set so that the specific frequency at which the hermetically sealed container **10** is vibrated and the inherent oscillation frequency of the dynamic vibration-reducing unit **70** correspond to each other. Consequently, the mass member **80** of the dynamic vibration-reducing unit **70** is moved relative to the piston **22**

while the mass member **80** has a phase opposite to the phase of the piston **22**, whereby the vibration generated from the hermetically sealed container **10** at the specific frequency band is eliminated.

[**0038**] As apparent from the above description, the present invention provides a linear compressor having a dynamic vibration-reducing unit disposed at a stopper, which is provided for preventing separation of a cylinder block. The dynamic vibration-reducing unit comprises an elastic member and a mass member.

[**0039**] Consequently, vibration transmitted to a hermetically sealed container due to the reciprocating movement of a piston, which is generated at a specific frequency band, is eliminated by means of the mass member, which is moved relative to the piston while the mass member has a phase opposite to the phase of the piston, whereby the compressor is operated quietly.

[**0040**] Furthermore, the dynamic vibration-reducing unit is integrally formed with the stopper, whereby the number of parts of the linear compressor is reduced, and spatial applicability of the inside of the compressor is improved.

[**0041**] Although the preferred embodiments of the invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A linear compressor comprising:

a hermetically sealed container having an airtight space defined therein;

a cylinder block disposed in the hermetically sealed container, the cylinder block having a compression chamber defined therein;

a stopper frame fixed to the cylinder block;

a stopper disposed in the hermetically sealed container for supporting the stopper frame; and

a dynamic vibration-reducing unit disposed at the stopper for eliminating vibration generated from the hermetically sealed container at a specific frequency band.

2. The compressor according to claim 1, wherein the dynamic vibration-reducing unit comprises:

an elastic member fixed to the stopper; and

a mass member fixed to the elastic member.

3. The compressor according to claim 2, wherein one end of the stopper is fixed to the hermetically sealed container, and the stopper is provided at the other end thereof with an opening, through which the stopper frame is inserted, and

wherein the elastic member is provided with a through-hole, through which the stopper frame is inserted, the through-hole corresponding to the opening of the stopper.

4. The compressor according to claim 3, wherein the elastic member is formed in the shape of a spiral plate, the through-hole being formed at the center part of the elastic member.

5. The compressor according to claim 2, wherein the mass member is formed in the shape of a plate, and the mass member is provided with a hollow part corresponding to the opening of the stopper.

6. The compressor according to claim 5, wherein both sides of the mass member are symmetrical to each other centering on the hollow part.

7. The compressor according to claim 2, wherein the elastic member is integrally formed with the stopper such that the elastic member is extended from one end of the stopper.

8. The compressor according to claim 2, wherein elastic coefficient of the elastic member and mass of the mass member are set so that a specific frequency transmitted to the hermetically sealed container and an oscillation frequency of the dynamic vibration-reducing unit correspond to each other.

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