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(54) **LINEAR COMPRESSOR**

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(57) **ABSTRACT**

Disclosed herein is a linear compressor in which a bonding position of a muffler can be accurately determined when the muffler is bonded to a fixing plate so that a center axis of a discharge spring casing formed at the muffler accurately coincides with a center axis of an insertion hole formed at the fixing plate. This enables a discharge valve to be concentrically mounted to a cylinder, thereby eliminating the risk of slight leakage or malfunction of the discharge valve due to eccentric arrangement of the discharge valve and the cylinder.

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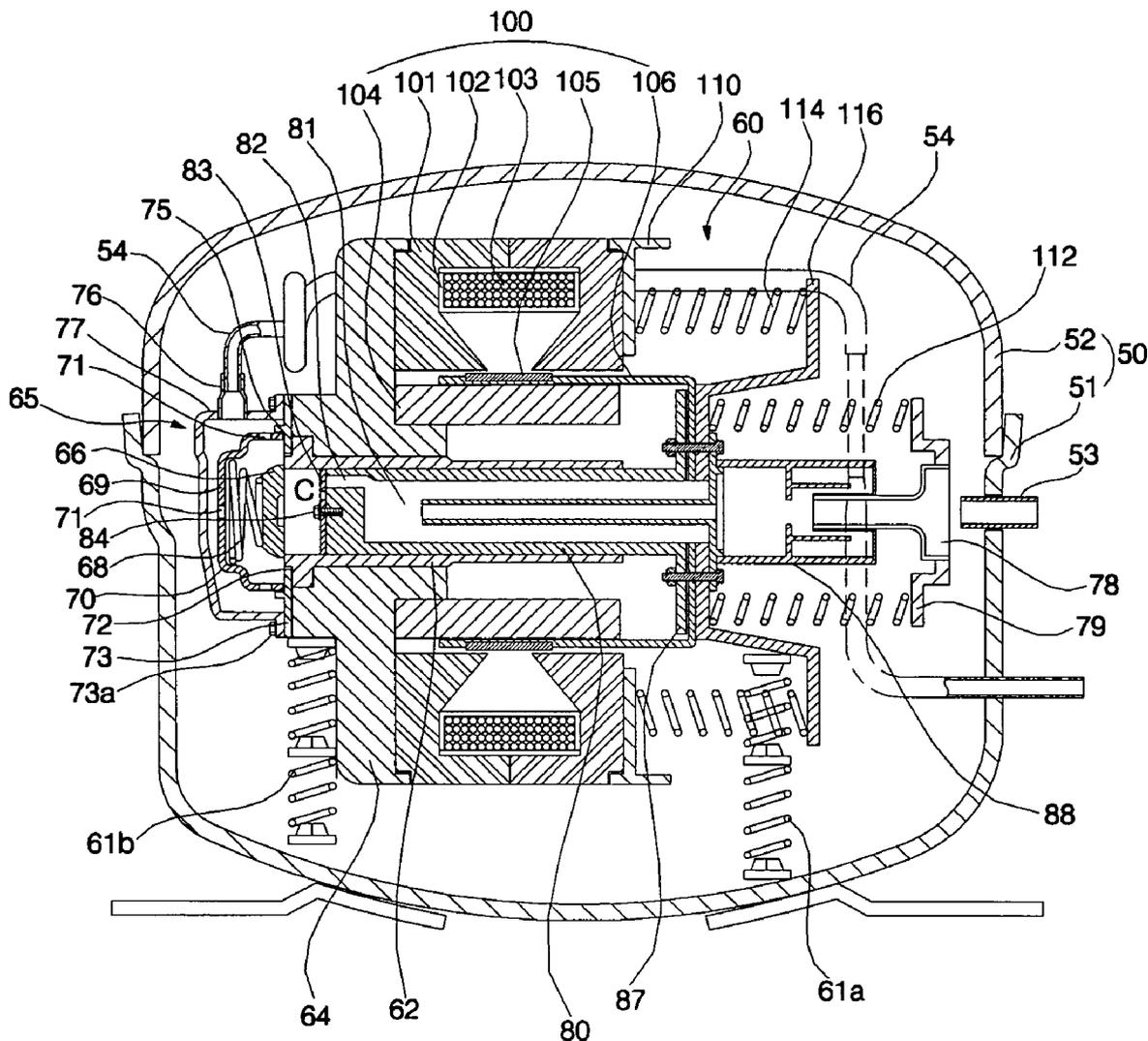


FIG. 1 (Prior Art)

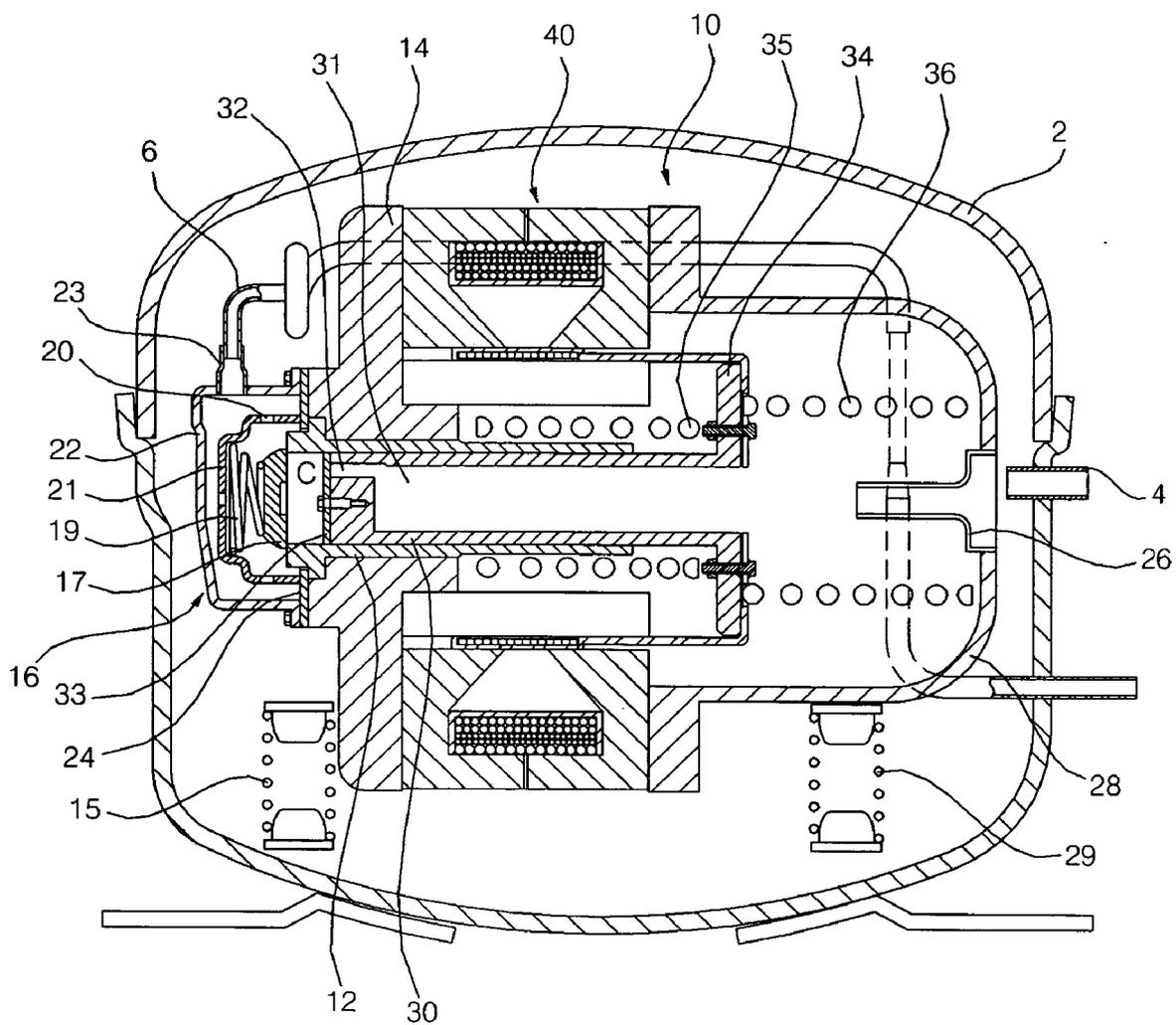


FIG. 2 (Prior Art)

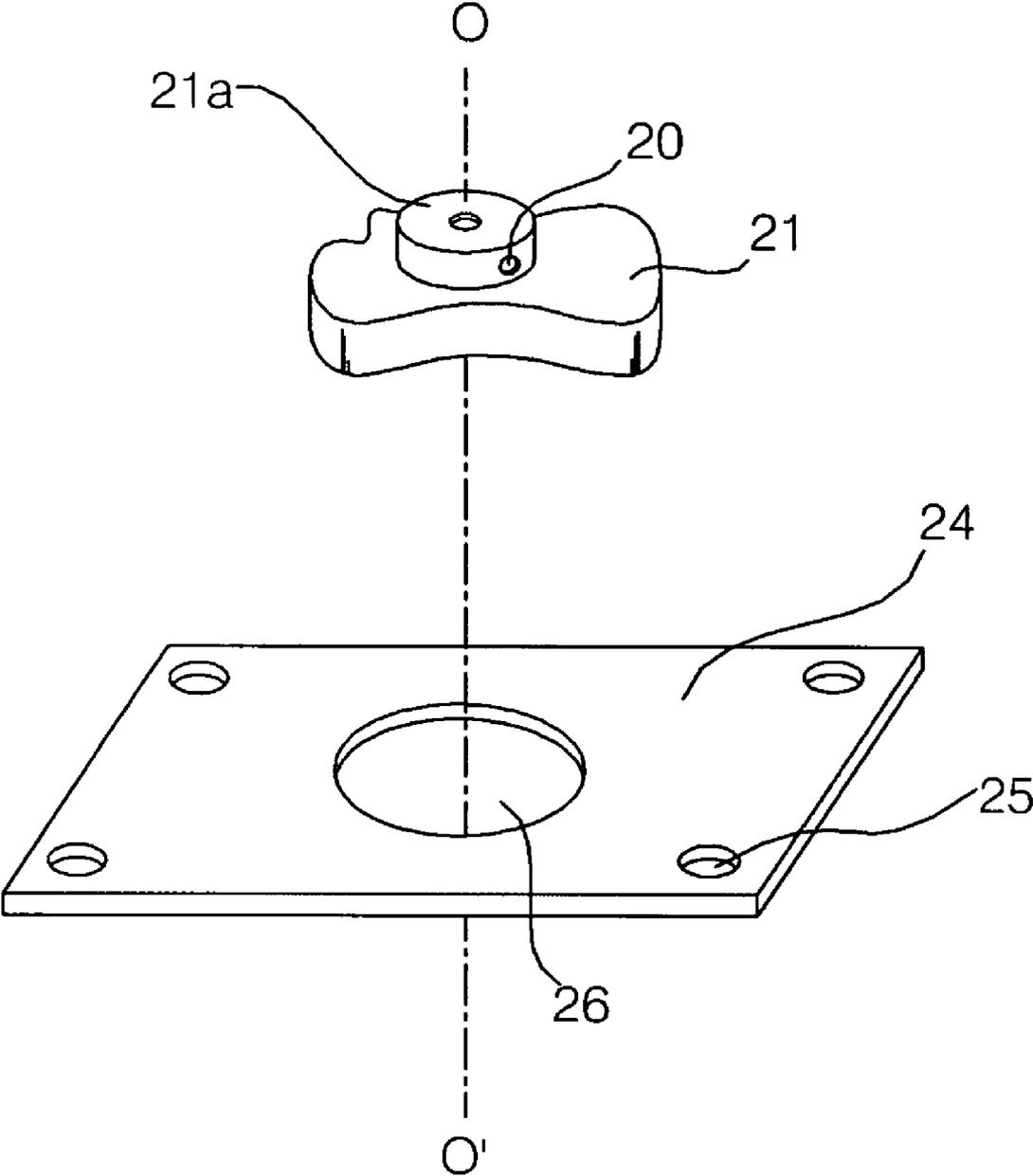


FIG. 3 (Prior Art)

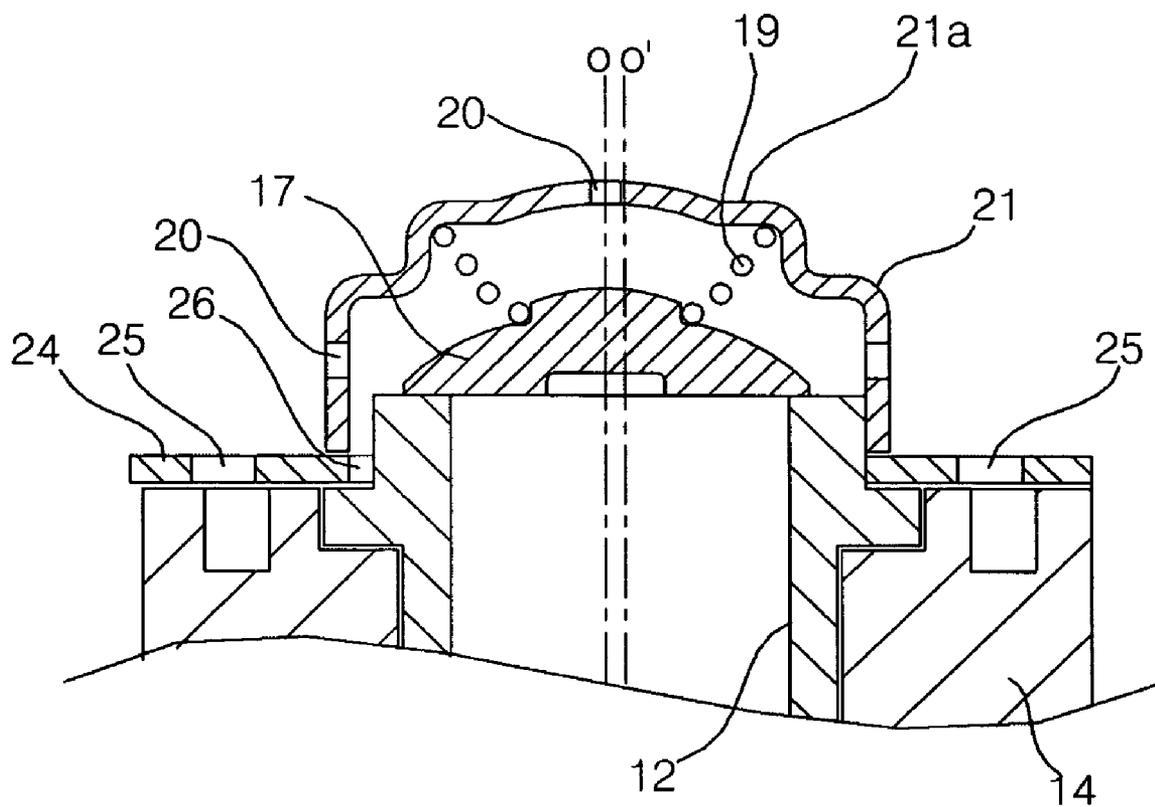


FIG. 4

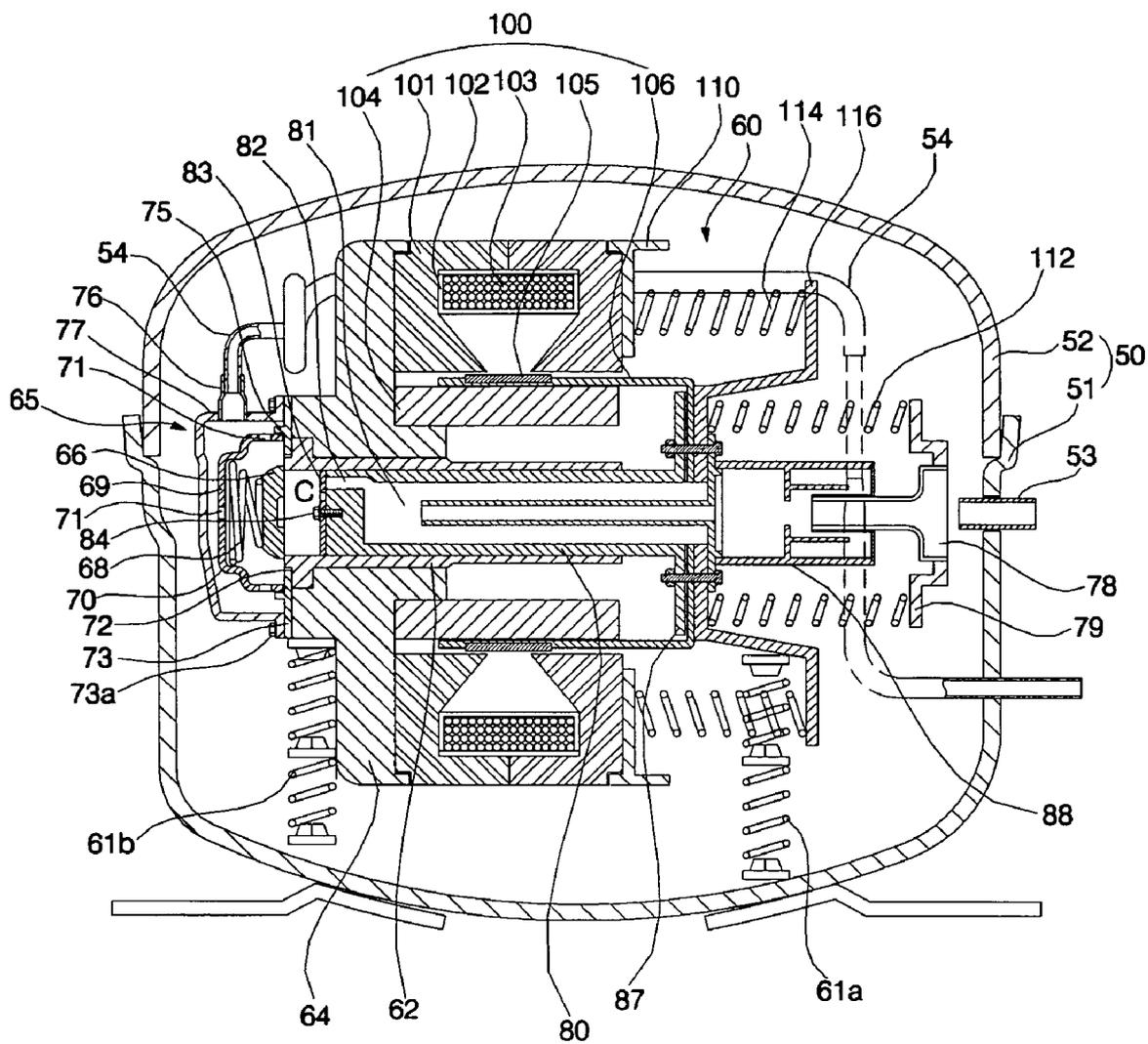


FIG. 5

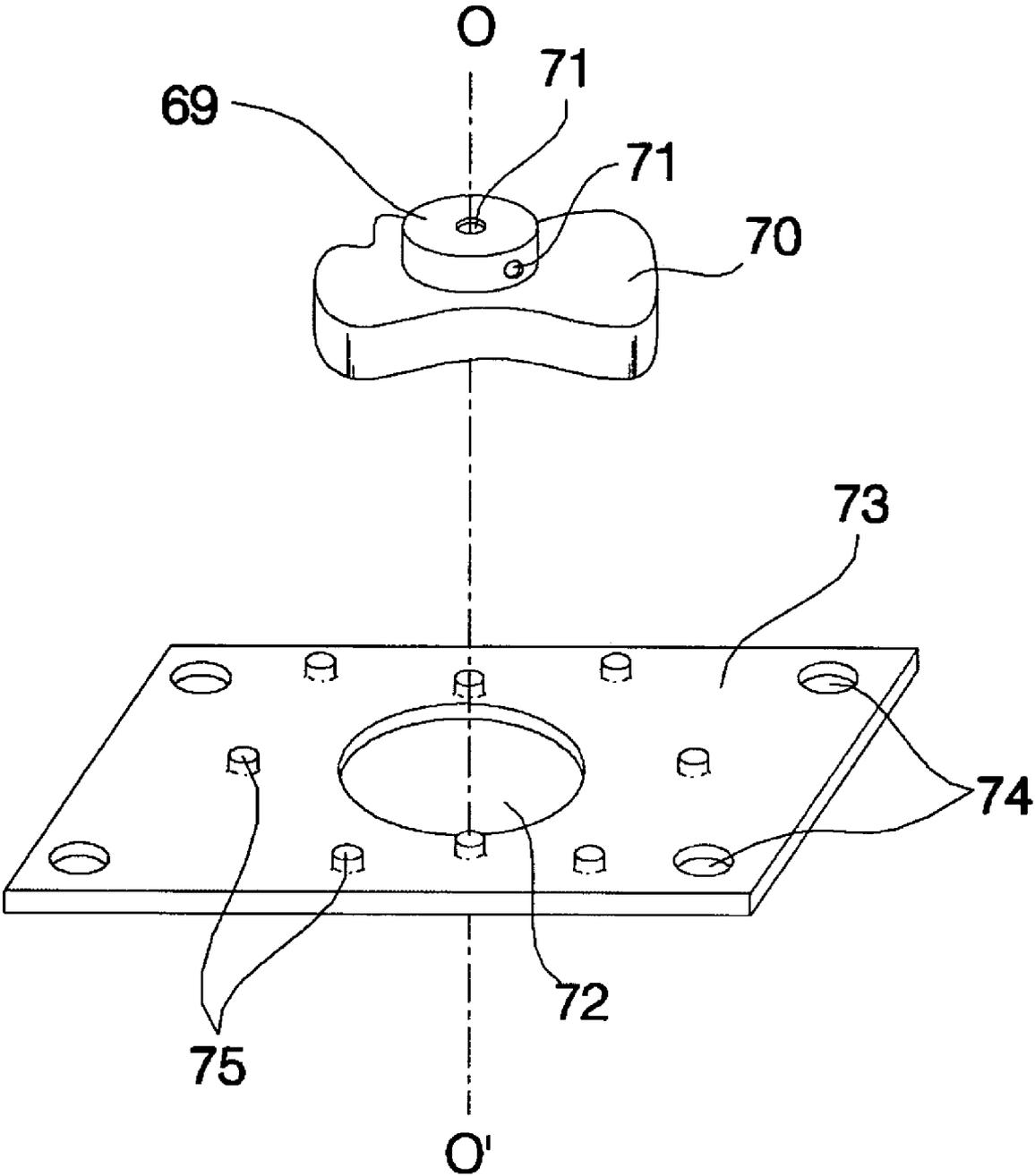


FIG. 6

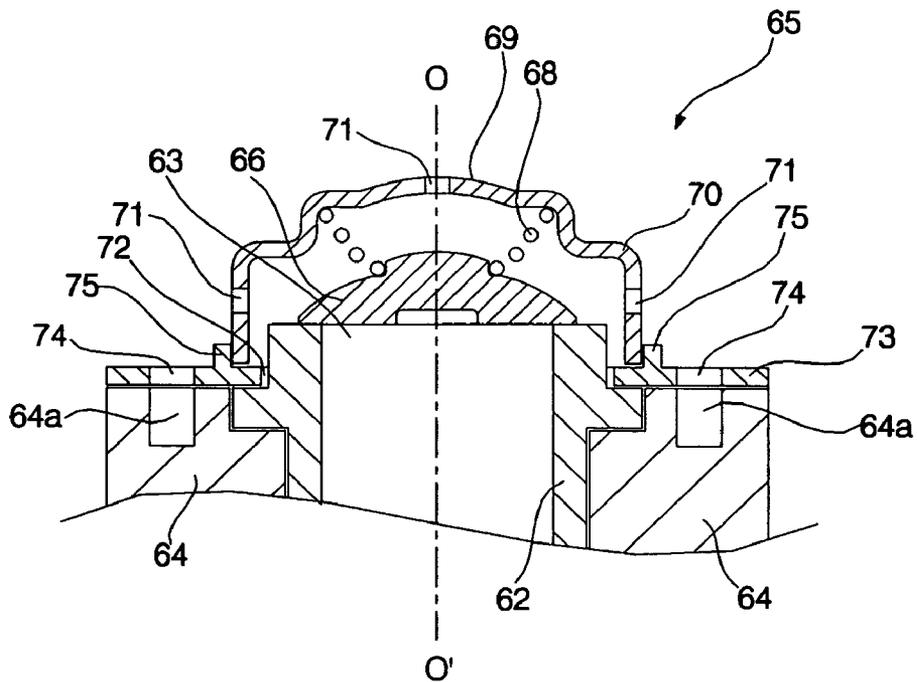
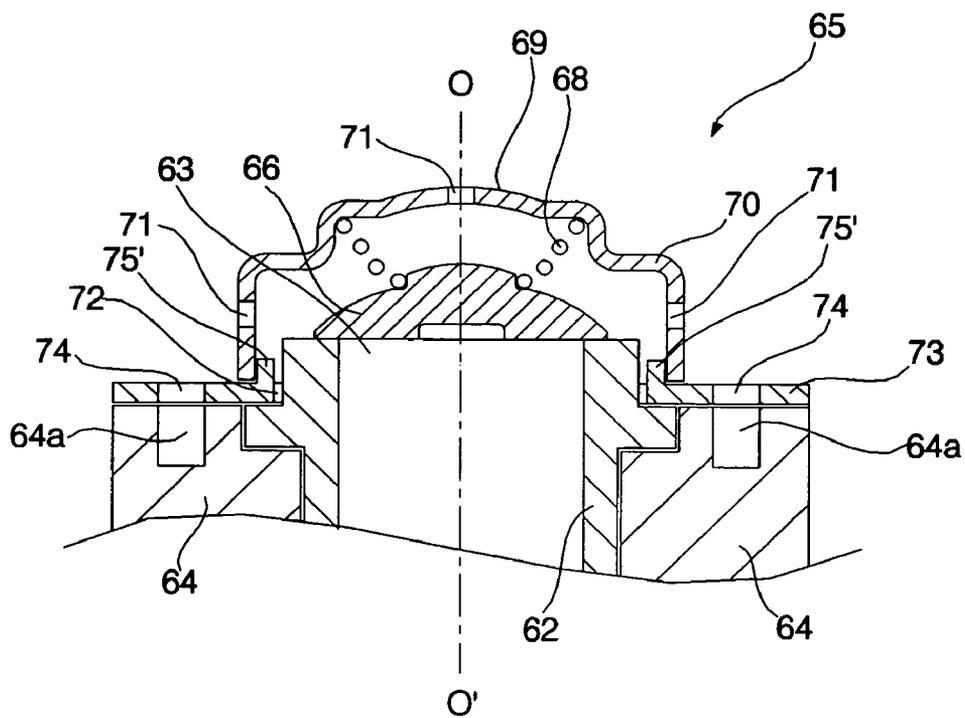


FIG. 7



LINEAR COMPRESSOR

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a linear compressor, and, more particularly, to a linear compressor in which a muffler is bonded to a fixing plate at a predetermined position, thereby preventing slight leakage or malfunction of a discharge valve.

[0003] 2. Description of the Related Art

[0004] Generally, a linear compressor is an apparatus to suction and compress fluid while linearly reciprocating a piston inside a cylinder using a linear driving force of a linear motor to thereby discharge the compressed fluid.

[0005] FIG. 1 is a longitudinal sectional view of a conventional linear compressor.

[0006] As shown in FIG. 1, the conventional linear compressor includes a hermetic container 2, and a linear compression unit 10 arranged in the hermetic container 2 to compress fluid, such as gaseous refrigerant (hereinafter, referred to as "fluid").

[0007] A suction pipe 4 is penetrated through the hermetic container 2 to introduce fluid from an external source into the hermetic container 2. Also, a loop pipe 6 is penetrated through the hermetic container 2 to discharge the compressed fluid from the linear compression unit 10 to the outside of the hermetic container 2.

[0008] The linear compression unit 10 includes a cylinder block 14 provided with a cylinder 12, a back cover 28 having a fluid suction pipe 26, a piston 30 inserted in the cylinder 12 to be linearly reciprocated inside the cylinder 12, and a linear motor 40 to generate a driving force required to linearly reciprocate the piston 30 inside the cylinder 12.

[0009] The cylinder block 14 is supported in a shock-absorbing manner inside the hermetic container 2 by means of a first damper 15.

[0010] A discharge assembly 16 is mounted at a front side of both the cylinder block 14 and the cylinder 12 to define a compression chamber C along with the piston 30 and the cylinder 12. The discharge assembly 16 serves to discharge the compressed fluid from the compression chamber C into the loop pipe 6.

[0011] The discharge assembly 16 includes a discharge valve 17 to open or close an end of the cylinder 12, a muffler 21 to elastically support the discharge valve 17 by means of a discharge spring 19, the muffler being formed with fluid discharge holes 20, a discharge plenum 22 to define a fluid channel between an inner wall thereof and an outer wall of the muffler 21, and a fixing plate 24 bonded to the muffler 21 and also bolted to one of the cylinder block 14 and the cylinder 12.

[0012] The discharge plenum 22 is provided with a fluid discharge pipe 23 that is connected to the loop pipe 6.

[0013] The fixing plate 24 serves to fix the discharge assembly 16 to one of the cylinder block 14 and the cylinder 12.

[0014] Meanwhile, the back cover 28 is supported in a shock-absorbing manner inside the hermetic container 2 by means of a second damper 29.

[0015] The piston 30 includes an elongated suction channel 31 longitudinally formed therein to allow fluid to be introduced into the piston 30, a suction port 32 formed at a front end of the piston 30 towards the compression chamber C, and a suction valve 33 provided at a front end surface of the piston 30 to open or close the suction port 32.

[0016] At a rear end of the piston 30 is formed a flange portion 34 for the connection of the linear motor 40.

[0017] The piston 30 further includes a first spring 35 interposed between the flange portion 34 and the cylinder block 14, and a second spring 36 interposed between the flange portion 34 and the back cover 28. With the first and second springs 35 and 36, the piston 30 is elastically supported between the cylinder block 14 and the back cover 28.

[0018] FIG. 2 is an exploded perspective view of the discharge assembly shown in FIG. 1. FIG. 3 is an enlarged sectional view illustrating an assembled state of the discharge assembly shown in FIG. 1.

[0019] The muffler 21 has a discharge spring casing 21a, which protrudes outward from the center of the muffler 21 to receive the discharge spring 19 therein.

[0020] The fixing plate 24 has a plurality of bolt holes 25 formed at corners thereof. As bolts are penetrated through the bolt holes 25, the fixing plate 24 is able to be fastened to one of the cylinder block 14 and the cylinder 12.

[0021] The fixing plate 24 further has an insertion hole 26 formed at the center thereof. The cylinder 12 is penetrated through the insertion hole 26 to be mounted to the fixing plate 24.

[0022] The discharge assembly 16 of the conventional linear compressor, however, has a problem in that, if a center axis O of the discharge spring casing 21a of the muffler 21 does not coincide with a center axis O' of the insertion hole 26 of the fixing plate 24 when the muffler 21 is bonded to the fixing plate 24, as shown in FIG. 3, the discharge valve 17 is eccentrically mounted relative to the cylinder 12, causing slight leakage of fluid between the cylinder 12 and the discharge valve 17 and malfunction of the discharge valve 17.

SUMMARY OF THE INVENTION

[0023] Therefore, the present invention has been made in view of the above problem, and it is an object of the present invention to provide a linear compressor capable of preventing slight leakage and malfunction of a discharge valve.

[0024] In accordance with a first aspect of the present invention, the above and other objects can be accomplished by the provision of a linear compressor comprising: a discharge valve to open or close an end of a cylinder, i.e. a compression chamber; a discharge spring to elastically support the discharge valve; a muffler having a discharge spring casing to receive the discharge spring therein; a fixing plate bonded to the muffler and having an insertion hole for the insertion of the cylinder, the fixing plate being mounted to the cylinder; and assembly positioners to guide an assem-

bling position of the muffler so that centers of the discharge spring casing and the insertion hole coincide with each other when the muffler is bonded to the fixing plate.

[0025] Preferably, the discharge spring casing may protrude from the muffler to define a cylindrical space therein.

[0026] Preferably, the fixing plate may be bonded to the muffler by brazing.

[0027] Preferably, the assembly positioners may be a plurality of bosses formed at a surface of the fixing plate along an outer contour of the muffler.

[0028] Preferably, the assembly positioners may be a plurality of bosses formed at a surface of the fixing plate along an inner wall contour of the muffler.

[0029] In accordance with a first aspect of the present invention, the above and other objects can be accomplished by the provision of a linear compressor comprising: a cylinder block having a cylinder; a piston disposed to be linearly reciprocated inside the cylinder and having a fluid suction channel defined therein; a linear motor mounted on the cylinder block to linearly reciprocate the piston; a suction valve to open or close the suction channel of the piston; and a discharge assembly to define a compression chamber with the piston and adapted to discharge compressed fluid, wherein the discharge assembly includes: a discharge valve to open or close the compression chamber; a discharge spring to elastically support the discharge valve; a muffler having a discharge spring casing to receive the discharge spring therein and discharge holes; a fixing plate bonded to the muffler and having an insertion hole for the insertion of the cylinder, the fixing plate being mounted to one of the cylinder and the cylinder block; and assembly positioners to guide an assembling position of the muffler so that centers of the discharge spring casing and the insertion hole coincide with each other when the muffler is bonded to the fixing plate.

[0030] Preferably, the discharge spring casing may protrude from the muffler to have a cylindrical shape.

[0031] Preferably, the fixing plate may be bonded to the muffler by brazing.

[0032] Preferably, the assembly positioners may be a plurality of bosses formed at a surface of the fixing plate along an outer contour of the muffler.

[0033] Preferably, the assembly positioners may be a plurality of bosses formed at a surface of the fixing plate along an inner wall contour of the muffler.

[0034] The linear compressor of the present invention configured as stated above has the following advantages.

[0035] Firstly, according to the present invention, a bonding position of the muffler can be accurately determined when the muffler is bonded to the fixing plate so that a center axis of the discharge spring casing formed at the muffler accurately coincides with a center axis of the insertion hole formed at the fixing plate. This enables the discharge valve to be concentrically mounted to the cylinder, thereby eliminating the risk of slight leakage or malfunction of the discharge valve due to eccentric arrangement of the discharge valve and the cylinder.

[0036] Secondly, according to the linear compressor of the present invention, the plurality of bosses is formed at the surface of the fixing plate along the outer contour of the muffler. This enables the muffler to be accurately positioned and bonded to the fixing plate with a simplified and inexpensive structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0038] **FIG. 1** is a longitudinal sectional view of a conventional linear compressor;

[0039] **FIG. 2** is an exploded perspective view illustrating a discharge assembly shown in **FIG. 1**;

[0040] **FIG. 3** is an enlarged sectional view illustrating an assembled state of the discharge assembly shown in **FIG. 1**;

[0041] **FIG. 4** is a longitudinal sectional view of a linear compressor according to an embodiment of the present invention;

[0042] **FIG. 5** is an exploded perspective view illustrating a discharge assembly shown in **FIG. 4**;

[0043] **FIG. 6** is an enlarged sectional view illustrating an assembled state of the discharge assembly shown in **FIG. 4**; and

[0044] **FIG. 7** is an enlarged sectional view of a linear compressor according to another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0045] Now, preferred embodiments of a linear compressor according to the present invention will be described with reference to the accompanying drawings.

[0046] **FIG. 4** is a longitudinal sectional view of a linear compressor according to an embodiment of the present invention.

[0047] As shown in **FIG. 4**, the linear compressor according to the present embodiment comprises a hermetic container **50**, and a linear compression unit **60**.

[0048] The hermetic container **50** includes a lower shell **51**, and an upper shell **52** to cover an upper side of the lower shell **51**. A suction pipe **53** is penetrated through the hermetic container **50** to introduce fluid, such as gaseous refrigerant (hereinafter, referred to as "fluid"), into the hermetic container **50**. Also, a loop pipe **54** is penetrated through the hermetic container **50** to discharge the fluid, that is compressed while passing through the linear compression unit **60**, to the outside of the hermetic container **50**.

[0049] The linear compression unit **60** is supported in the hermetic container **50** in a shock-absorbing manner by means of first and second dampers **61a** and **61b** arranged in the hermetic container **50**. For this, a rear portion of the linear compression unit **60** is disposed on the first damper **61a**, and a front portion of the linear compression unit **60** is disposed on the second damper **61b**. The linear compression unit **60** includes a cylinder block **64** having a cylinder **62**, a

back cover **79** having a suction pipe **78**, a piston **80** inserted in the cylinder **62** to be linearly reciprocated inside the cylinder **62**, and a linear motor **100** to generate a driving force required to linearly reciprocate the piston **80** inside the cylinder **62**.

[0050] A discharge assembly **65** is mounted at a front side of the cylinder **62** to define a compression chamber C between the discharge assembly **65** and the piston **80**. If fluid inside the compression chamber C is compressed beyond a predetermined pressure, the compressed fluid is discharged into the loop pipe **54** by way of the discharge assembly **65**.

[0051] The discharge assembly **65** includes a discharge valve **66** to open or close the compression chamber C, especially, a front end **63** of the cylinder **62**, a discharge spring **68** to elastically support the discharge valve **66**, a muffler **70** having a discharge spring casing **69** to receive the discharge spring **68** therein, a fixing plate **73** bonded to the muffler **70** and formed with an insertion hole **72** for the penetration of the cylinder **62**, assembly positioners **75** to guide an assembling position of the muffler **70** so that centers of the discharge spring casing **69** and the insertion hole **72** coincide with each other when the muffler **70** is bonded to the fixing plate **73**, and a discharge plenum **77** provided with a fluid discharge pipe **76** connected to the loop pipe **54**.

[0052] The discharge spring casing **69** protrudes from the muffler **70** to define a cylindrical space therein.

[0053] The muffler **70** defines an interior space to allow the front end **63** of the cylinder **62** to be partially inserted into the space and to receive the discharge valve **66**.

[0054] A plurality of discharge holes **71** are formed at the muffler **70** to discharge the fluid, that is compressed in the compression chamber C to thereby be introduced into the interior space of the muffler **70**, to the loop pipe **54**.

[0055] The muffler **70** is a discharge muffler to attenuate operational noise generated upon opening or closing of the discharge valve **66**. The muffler **70** is spaced apart from the discharge plenum **77** to define a predetermined space therebetween to attenuate noise when the compressed fluid, discharged through the discharge holes **71** of the muffler **70**, passes through the discharge plenum **77**.

[0056] The fixing plate **73** serves to affix the discharge assembly **65** to the cylinder block **64** or the cylinder **62**. The fixing plate **73** is fastened to the cylinder block **64** or the cylinder **62** by means of fasteners.

[0057] The insertion hole **72**, formed at the fixing plate **73** having a flat plate shape, has a diameter slightly larger than an outer diameter of the front end **63** of the cylinder **62** to allow part of the front end **63** of the cylinder **62** to be easily inserted into the insertion hole **72**.

[0058] Meanwhile, the back cover **79** is fastened to a motor cover **110**, which will be described hereinafter, by means of bolts, etc.

[0059] The piston **80** includes a fluid suction channel **81** longitudinally formed therein to allow the fluid to be introduced into the piston **80**, a suction port **82** centrally formed toward a front end of the piston **80** to have a diameter smaller than that of the fluid suction channel **81**, and a

suction valve **83** mounted at a front end surface of the piston **80** to open or close the suction port **82**.

[0060] The suction valve **83** is an elastic member fastened to the front end surface of the piston **80** by means of a bolt **84**. The suction valve **83** opens or closes the suction port **82** using a pressure difference between the compression chamber C and the suction port **82**.

[0061] The piston **80** further includes a flange **87** formed at a rear end thereof for the connection of the linear motor **100**. A suction muffler **88** is mounted behind the flange **87** to guide the fluid, introduced through the suction pipe **78** of the back cover **79**, into the fluid suction channel **81** of the piston **80**, and to attenuate noise generated upon opening or closing of both the suction valve **83** and the discharge valve **66**.

[0062] The linear motor **100** includes an outer stator core **101** mounted to the cylinder block **64**, a bobbin **102** mounted in the outer stator core **101**, a coil **103** wound around the bobbin **102**, an inner stator core **104** mounted to the cylinder block **64** to have a predetermined gap with the outer stator core **101**, a magnet **105** interposed between the outer stator core **101** and the inner stator core **104** to be linearly reciprocated using a magnetic force generated in the vicinity of the coil **103**, and a magnet frame **106** to support the magnet **105** mounted thereon. The magnet frame **106** is coupled to the flange **87** of the piston **80** to transmit a linear movement force to the piston **80**.

[0063] Meanwhile, the linear compressor further comprises the motor cover **110** to cover a part of the linear motor **100**, a spring support **116** fastened to the flange **87** of the piston **80** by means of bolts, etc., a first spring **112** interposed between the spring support **116** and the back cover **79**, and a second spring **114** interposed between the spring support **116** and the motor cover **110**.

[0064] The motor cover **110** is positioned on a side of the outer stator core **101** to cover one surface of the outer stator core **101**.

[0065] Considering operation of the linear compressor according to the embodiment of the present invention configured as stated above, initially, the piston **80** is linearly reciprocated inside the cylinder **62** upon driving of the linear motor **100**.

[0066] By virtue of a pressure difference generated during linear reciprocation of the piston **80**, the fluid inside the hermetic container **50** passes through the suction pipe **78** of the back cover **79**, the suction muffler **88**, and the fluid suction channel **81** and the suction port **82** of the piston **80** in this sequence, thereby being introduced into the compression chamber C.

[0067] The fluid, introduced into the compression chamber C, is compressed by the piston **80**, and then, is introduced into the muffler **70**. Thereby, the fluid is discharged to the outside by passing through the discharge holes **71** of the muffler **70**, the space defined between the muffler **70** and the discharge plenum **77**, the discharge pipe **76**, and the loop pipe **54** in this sequence.

[0068] Meanwhile, the linear compressor as stated above is designed to minimize noise, transmitted to the discharge assembly **65**, in the space between the muffler **70** and the discharge plenum **77** of the discharge assembly **65**.

[0069] FIG. 5 is an exploded perspective view illustrating the discharge assembly shown in FIG. 4. FIG. 6 is an enlarged sectional view illustrating an assembled state of the discharge assembly shown in FIG. 4.

[0070] The fixing plate 73 has a plurality of bolt holes 74 formed at corners thereof. As bolts 73a are fastened through the bolt holes 74, the fixing plate 73 is fastened to the cylinder block 64 or the cylinder 62.

[0071] The fixing plate 73 is also bonded to the muffler 70 by brazing.

[0072] The assembly positioners 75 are a plurality of bosses, which are formed at a surface of the fixing plate 73 to be distributed along an outer contour of the muffler 70.

[0073] The plurality of bosses 75 protrude from the fixing plate 73 between the insertion hole 72 and the fastening holes 74.

[0074] In the case of the discharge assembly 65 configured as stated above, if the muffler 70 is positioned inside the plurality of bosses 75 to come into close contact with the fixing plate 73, the muffler 70 is fixed in position by means of the plurality of bosses 75 so as not to move in all directions. In this case, a center axis O of the discharge spring casing 69 of the muffler 70 coincides with a center axis O' of the insertion hole 72 of the fixing plate 73. Then, as a contact region between the muffler 70 and the fixing plate 73 is brazed, the muffler 70 is fixedly bonded to the fixing plate 73.

[0075] After the muffler 70 is bonded to the fixing plate 73, the discharge spring 68 is inserted in the discharge spring casing 69 of the muffler 70, and the discharge valve 66 is connected to the discharge spring 68. In succession, if the front end 63 of the cylinder 62 is partially inserted into the insertion hole 72 of the fixing plate 73, the discharge valve 66 is accurately concentric with the cylinder 62.

[0076] Reference numeral 64a denotes fastening holes formed in the cylinder block 64 to allow the fixing plate 73 to be fastened to the cylinder block 64 by means of the bolts 73a.

[0077] FIG. 7 is an enlarged sectional view of a linear compressor according to another embodiment of the present invention.

[0078] As shown in FIG. 7, the linear compressor according to the present embodiment is configured such that a plurality of bosses 75' are formed at the surface of the fixing plate 73 to be distributed along an inner wall contour of the muffler 70. Other configuration and operation of the present embodiment are identical to those of the above-described embodiment, and thus, a detailed description thereof will be omitted.

[0079] Admittedly, the assembly positioners 75 may be modified without being limited to the above-described configurations. For example, a rib, having the same outer or inner wall contour as the muffler 70, may be provided to allow part of the muffler 70 to be inserted inside or outside the rib.

[0080] As is apparent from the above description, the present invention provides a linear compressor having the following effects.

[0081] Firstly, according to the present invention, a bonding position of a muffler can be accurately determined when the muffler is bonded to a fixing plate so that a center axis of a discharge spring casing formed at the muffler accurately coincides with a center axis of an insertion hole formed at the fixing plate. This enables a discharge valve to be concentrically mounted to a cylinder, thereby eliminating the risk of slight leakage or malfunction of the discharge valve due to eccentric arrangement of the discharge valve and the cylinder.

[0082] Secondly, according to the linear compressor of the present invention, a plurality of bosses is formed at a surface of the fixing plate along an outer contour of the muffler. This enables the muffler to be accurately positioned and bonded to the fixing plate with a simplified and inexpensive structure.

[0083] Although the preferred embodiments of the present 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 discharge valve to open or close an end of a cylinder;

a discharge spring to elastically support the discharge valve;

a muffler having a discharge spring casing to receive the discharge spring therein;

a fixing plate bonded to the muffler and having an insertion hole for the insertion of the cylinder, the fixing plate being mounted to the cylinder; and

assembly positioners to guide an assembling position of the muffler so that centers of the discharge spring casing and the insertion hole coincide with each other when the muffler is bonded to the fixing plate.

2. The compressor as set forth in claim 1, wherein the discharge spring casing protrudes from the muffler to define a cylindrical space therein.

3. The compressor as set forth in claim 1, wherein the muffler internally defines a space to allow the cylinder to be partially inserted into the space and to receive the discharge valve.

4. The compressor as set forth in claim 1, wherein the fixing plate is bonded to the muffler by brazing.

5. The compressor as set forth in claim 1, wherein the fixing plate has fastening holes so as to be fastened to the cylinder by means of fasteners.

6. The compressor as set forth in claim 5, wherein the assembly positioners protrude from the fixing plate between the insertion hole and the fastening holes.

7. The compressor as set forth in claim 1, wherein the assembly positioners are a plurality of bosses formed at a surface of the fixing plate along an outer contour of the muffler.

8. The compressor as set forth in claim 1, wherein the assembly positioners are a plurality of bosses formed at a surface of the fixing plate along an inner wall contour of the muffler.

9. A linear compressor comprising:
 a cylinder block having a cylinder;
 a piston disposed to be linearly reciprocated inside the cylinder and having a fluid suction channel defined therein;
 a linear motor mounted on the cylinder block to linearly reciprocate the piston;
 a suction valve to open or close the suction channel of the piston; and
 a discharge assembly to define a compression chamber with the piston and adapted to discharge compressed fluid,

wherein the discharge assembly includes:
 a discharge valve to open or close the compression chamber;
 a discharge spring to elastically support the discharge valve;
 a muffler having a discharge spring casing to receive the discharge spring therein and discharge holes;
 a fixing plate bonded to the muffler and having an insertion hole for the insertion of the cylinder, the fixing plate being mounted to one of the cylinder and the cylinder block; and

assembly positioners to guide an assembling position of the muffler so that centers of the discharge spring casing and the insertion hole coincide with each other when the muffler is bonded to the fixing plate.

10. The compressor as set forth in claim 9, wherein the muffler internally defines a space to allow the cylinder to be partially inserted into the space and to receive the discharge valve.

11. The compressor as set forth in claim 9, wherein the discharge spring casing protrudes from the muffler to define a cylindrical space therein.

12. The compressor as set forth in claim 9, wherein the fixing plate is bonded to the muffler by brazing.

13. The compressor as set forth in claim 9, wherein the fixing plate has fastening holes so as to be fastened to the cylinder by means of fasteners.

14. The compressor as set forth in claim 11, wherein the assembly positioners protrude from the fixing plate between the insertion hole and the fastening holes.

15. The compressor as set forth in claim 9, wherein the assembly positioners are a plurality of bosses formed at a surface of the fixing plate along an outer contour of the muffler.

16. The compressor as set forth in claim 9, wherein the assembly positioners are a plurality of bosses formed at a surface of the fixing plate along an inner wall contour of the muffler.

17. The compressor as set forth in claim 9, wherein the discharge assembly further includes a discharge plenum to define a predetermined space with the muffler.

18. The compressor as set forth in claim 9, wherein the discharge assembly further includes a fluid discharge pipe mounted on the discharge plenum.

19. The compressor as set forth in claim 9, wherein the linear motor includes:

- an outer stator core mounted to the cylinder block;
- a bobbin mounted in the outer stator core;
- a coil wound around the bobbin;
- an inner stator core mounted to the cylinder block to have a predetermined gap with the outer stator core;
- a magnet interposed between the outer stator core and the inner stator core; and
- a magnet frame to support the magnet mounted thereon, the magnet frame being coupled to the piston.

20. The compressor as set forth in claim 9, further comprising:

- a back cover having a suction pipe;
- a motor cover configured to cover a part of the linear motor; and
- a spring support fastened to the piston by means of fasteners, such as bolts, and adapted to support a first spring interposed between the back cover and the spring support and a second spring interposed between the motor cover and the spring support.

* * * * *