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(54) **Linear compressor**

(57) Disclosed herein is a linear compressor wherein a vibration absorbing unit is mounted at the outside of a compressor shell, whereby the number of elements inside the shell is reduced, resulting in a reduced compressor size. Also, the vibration absorbing unit is enclosed

by a protective cover to be protected from exterior shock or impurities, whereby damage or malfunction of elements is prevented, achieving improved durability and reliability of the compressor.

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a linear compressor and, more particularly, to a linear compressor wherein a vibration absorbing unit is mounted at the outside of a compressor shell and is enclosed by a protective cover, whereby the size of the shell can be reduced while achieving effective protection of the vibration absorbing unit from exterior force, resulting in improved durability and reliability of the compressor.

Description of the Related Art

[0002] Generally, a linear compressor is an apparatus to introduce, compress, and discharge fluid while linearly reciprocating a piston inside a cylinder using a linear driving force of a linear motor.

[0003] A conventional linear compressor comprises a compression unit having a piston and a cylinder mounted in a shell to compress fluid, and a linear motor having a stator and a mover to linearly reciprocate the piston in the cylinder.

[0004] The cylinder has a cylindrical structure opened at opposite ends thereof. Thereby, the piston is inserted into the cylinder through one of the open ends. At the other end of the cylinder is provided a discharge cover to discharge the fluid compressed by the piston there-through. A compression chamber is defined between the piston and the discharge cover.

[0005] Also, a discharge valve is elastically supported at the discharge cover to open or close the compression chamber.

[0006] The stator of the linear motor includes an outer core, an inner core inwardly spaced apart from the outer core to have a predetermined gap therebetween, a bobbin mounted in the outer core, and a coil wound around the bobbin. The mover of the linear motor includes a magnet to be linearly reciprocated using a magnetic force produced in the vicinity of the coil, and a magnet frame to transmit the linear reciprocating movement of the magnet to the piston.

[0007] The magnet is mounted to one side of the magnet frame, and the piston is fixed to the other side of the magnet frame.

[0008] In operation of the conventional linear compressor configured as stated above, if driving voltage is applied to the coil, a magnetic field is produced in the vicinity of the coil, causing the magnet to be linearly reciprocated while interacting with the magnetic field.

[0009] The linear reciprocating movement of the magnet is transmitted to the piston through the magnet frame, allowing the piston to be linearly reciprocated inside the cylinder.

[0010] Thereby, as the piston is linearly reciprocated

in the cylinder, fluid inside the cylinder is compressed, and the compressed fluid is discharged to the outside through the discharge unit.

[0011] However, the conventional linear compressor has a problem in that all elements thereof, including fluid compression elements, supporting elements, and vibration attenuating elements, are mounted in the shell, making it impossible to reduce the size of the linear compressor.

[0012] Meanwhile, when the vibration attenuating elements are mounted at the outside of the shell, they are subjected to damage and malfunction under the influence of exterior impurities or shock, resulting in deterioration of durability and reliability of the compressor.

SUMMARY OF THE INVENTION

[0013] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a linear compressor wherein a vibration absorbing unit is mounted at the outside of a compressor shell to be enclosed by a protective cover, whereby the size of the shell can be reduced while improved durability and reliability of the compressor.

[0014] In accordance with the present invention, the above and other objects can be accomplished by the provision of a linear compressor comprising: a shell formed with an inlet port and an outlet port; a linear motor mounted in the shell and adapted to generate a linear movement force; a cylinder mounted in the shell; a piston connected to the linear motor and adapted to compress fluid while being linearly reciprocated in the cylinder; a vibration absorbing unit mounted at the outside of the shell to absorb vibration; and a protector mounted around the vibration absorbing unit to protect the vibration absorbing unit.

[0015] Preferably, the protector may be a protective cover configured to enclose the vibration absorbing unit and coupled to the shell.

[0016] Preferably, the protective cover may have a cylindrical shape opened at one end thereof, the open end of the protective cover being coupled to the shell.

[0017] Preferably, the protective cover may be formed with a plurality of heat-discharge openings to discharge internal heat to the outside.

[0018] Preferably, the plurality of heat-discharge openings may be spaced apart from one another by a predetermined distance, and each may have a slit shape.

[0019] Preferably, the linear compressor may further comprise:

a discharge cover provided in front of the outlet port and adapted to attenuate a flow rate of the fluid discharged through the outlet port; and a discharge pipe connected to the discharge cover to guide the fluid in the interior of the discharge cover to the outside.

[0020] Preferably, the protective cover may be perfo-

rated with a pipe hole for the penetration of the discharge pipe.

[0021] Preferably, the vibration absorbing unit may be coupled to the discharge cover.

[0022] Preferably, the vibration absorbing unit may include: a boss member connected to the discharge cover; a mass member outwardly spaced apart from the boss member; and a plurality of plate springs to connect the boss member to the mass member.

[0023] Preferably, the mass member may have a circular ring shape.

[0024] With the linear compressor according to the present invention configured as stated above, a vibration absorbing unit is mounted at the outside of a compressor shell. This has the effect of reducing the number of elements mounted in the shell as well as the size of the shell, resulting in a reduced compressor size.

[0025] Further, by enclosing the vibration absorbing unit with a protective cover to protect the vibration absorbing unit from exterior shock or impurities, there is no risk of damage or malfunction of elements, resulting in improved durability and reliability of the compressor.

[0026] Furthermore, by virtue of the plurality of heat-discharge openings formed at the protective cover, internal heat of the protective cover can be effectively discharged to the outside, preventing overheating of the compressor during operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] 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:

FIG. 1 is a longitudinal sectional view illustrating the interior structure of a linear compressor according to the present invention; and

FIG. 2 is a schematic side sectional view of the linear compressor of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Now, a preferred embodiment of the present invention will be described with reference to the accompanying drawings.

[0029] FIG. 1 is a longitudinal sectional view illustrating the interior structure of a linear compressor according to the present invention. FIG. 2 is a schematic side sectional view of the linear compressor of FIG. 1.

[0030] As shown in FIGS. 1 and 2, the linear compressor according to the present invention comprises a shell 50 having an inlet port 51 and an outlet port 52 formed at different locations thereof, a linear motor 60 mounted in the shell 50 to generate a linear movement force, a cylinder 70 mounted in the shell 50, a piston 71 connected to the linear motor 60 to be linearly reciprocated in the cylinder 70 to thereby compress fluid, a vibration absorb-

ing unit 80 mounted at the outside of the shell 50 to absorb vibration of the shell 50, and a protector configured to enclose the vibration absorbing unit 80 to protect the vibration absorbing unit 80 from exterior force.

[0031] A discharge unit assembly 90 is mounted in front of the outlet port 52 of the shell 50 so that the fluid, compressed in the cylinder 70, is discharged out of the cylinder 70 through the discharge unit assembly 90.

[0032] The shell 50 has a cylindrical shape, and is formed at front and rear surface thereof with the outlet port 52 and the inlet port 51, respectively. A suction pipe 53 is inserted through the inlet port 51 to introduce exterior fluid into the shell 50.

[0033] The linear motor 60 is generally divided into a stator and a mover. The stator includes an outer core 61 in the form of a stack, an inner core 62 also in the form of a stack, the inner core 62 being inwardly spaced apart from the outer core 61 to have a predetermined gap therebetween, and a coil 63 mounted in the outer core 61 to produce a magnetic field. The mover includes a magnet 64 located between the outer core 61 and the inner core 62 and adapted to be linearly moved using a magnetic force produced in the vicinity of the coil 63, and a magnet frame 65 connected to both the magnet 64 and the piston 71 to transmit the linear movement force of the magnet 64 to the piston 71.

[0034] The cylinder 70 is directly mounted to an inner wall surface of the shell 50. Specifically, the cylinder 70 is located in the shell 50 at the outlet port 52.

[0035] The cylinder 70 has a cylindrical structure opened at opposite ends thereof. A compression chamber C is defined in the cylinder 70 between the piston 71 and the discharge unit assembly 90.

[0036] A spring support 74 is coupled to a rear end of the piston 71, and main springs 75 are mounted between opposite surfaces of the spring support 74 and the shell 50 to elastically support the piston 71.

[0037] The piston 71 is internally formed with a suction channel 72 into which the fluid from the suction pipe 53 is introduced. Also, a plurality of suction ports 73 are defined adjacent to a front end of the piston 71, and a suction valve 76 is mounted to the front end of the piston 71 to open or close the plurality of suction ports 73.

[0038] A muffler 54 is coupled behind the piston 71 to communicate with the suction pipe 53. The muffler 54 serves to attenuate suction noise of the fluid.

[0039] The discharge unit assembly 90 includes a discharge cover 91 mounted to an outer wall surface of the shell 50 and adapted to attenuate the flow rate of the fluid discharged from the outlet port 52, a discharge valve 92 located in the discharge cover 91 to come into close contact with the open end of the cylinder 70, the discharge valve 92 serving to open or close the compression chamber C, and a discharge spring 93 supported by the discharge cover 91 to elastically support the discharge valve 92.

[0040] The discharge cover 91 has a cap shape, and is coupled to the front surface of the shell 50. A discharge

pipe 94 is connected to a certain location of the discharge cover 91 to guide the fluid, discharged into the discharge cover 91, to the outside.

[0041] Meanwhile, the vibration absorbing unit 80 is mounted to the discharge cover 91. The vibration absorbing unit 80 includes a boss member 82 connected to the discharge cover 91 via connecting shaft 81, a mass member 83 radially spaced apart from the boss member 82 by a predetermined distance, and a plurality of plate springs 84 to connect the boss member 82 to the mass member 83.

[0042] The mass member 83 is a circular ring having a predetermined mass. The plurality of plate springs 84 are provided to connect front and rear surfaces of the boss member 82 to front and rear surfaces of the mass member 83, respectively.

[0043] Preferably, the plate springs 84 are fastened to the front and rear surfaces of the mass member 83 by means of bolts.

[0044] Meanwhile, the protector is provided around the vibration absorbing unit 80 to protect the vibration absorbing unit 80 from exterior impurities or shock. In the present invention, the protector is a protective cover 85 to enclose the vibration absorbing unit 80.

[0045] The protective cover 85 has a cylindrical shape opened at one end thereof. The open end of the protective cover 85 is coupled to the front surface of the shell 50.

[0046] In this case, preferably, the protective cover 85 is coupled to the front surface of the shell 50 by welding or using fasteners.

[0047] The protective cover 85 is perforated with a plurality of heat-discharge openings 87 to discharge internal heat of the protective cover 85 to the outside.

[0048] Here, the plurality of heat-discharge openings 87 are perforated at lateral locations of the cylindrical protective cover 85 to be spaced apart from one another by a predetermined distance. Specifically, each of the heat-discharge openings 87 has an elongated slit shape.

[0049] At a certain location of the protective cover 85 is also perforated a pipe hole 86 so that the discharge pipe 94 protrudes out of the protective cover 85 through the pipe hole 86.

[0050] Now, the operation of the linear compressor according to the present invention configured as stated above will be explained.

[0051] When the linear motor 60 is operated, the magnet 64 is linearly reciprocated while interacting with the magnetic field produced in the vicinity of the coil 63.

[0052] The reciprocating movement of the magnet 64 is transmitted to the piston 71 via the magnet frame 65, allowing the piston 71 to be continuously linearly reciprocated in the cylinder 70. Thereby, the piston 71 acts to compress the fluid, introduced into the compression chamber C of the cylinder 70, and discharge the compressed fluid into the discharge cover 91. The introduction, compression, and discharge of the fluid are continuously repeated so long as the piston 71 is linearly reciprocated.

[0053] More specifically, when the piston 71 is moved rearward, the suction valve 76 is opened, allowing the fluid, in the suction channel 72 of the piston 71, to be introduced into the compression chamber C of the cylinder 70 through the suction ports 73.

[0054] Then, if the piston 71 is moved forward toward the compression chamber C, the fluid, compressed in the compression chamber C, pushes the discharge valve 92 forward. Thereby, the discharge valve 92 is opened, and the compressed fluid is discharged to the outside by way of the discharge cover 91 and the discharge pipe 94.

[0055] Meanwhile, during the operation of the linear motor 60, the vibration absorbing unit 80 acts to absorb vibration transmitted thereto in an movement direction of the linear motor 60 and the piston 71.

[0056] More specifically, the vibration transmitted in the movement direction of the piston 71 is absorbed by the plate springs 84. In addition, by virtue of the mass member 83 provided in the vibration absorbing unit 80, a characteristic frequency of the linear compressor is reduced, resulting in attenuation in the vibration of the linear compressor.

[0057] In the present invention, furthermore, since the protective cover 85 is mounted to enclose the vibration absorbing unit 80, the vibration absorbing unit 80 is able to be safely protected from exterior impurities or shock.

[0058] As is apparent from the above description, the linear compressor according to the present invention configured as stated above has the following effects.

[0059] Firstly, according to the present invention, a vibration absorbing unit is mounted at the outside of a compressor shell. This reduces the number of elements mounted in the shell, and consequently, the size of the shell, achieving a reduced compressor size.

[0060] Secondly, according to the present invention, the vibration absorbing unit is enclosed by a protective cover to be protected from exterior shock or impurities. Thereby, the vibration absorbing unit is free from damage or malfunction, resulting in improved durability and reliability of the compressor.

[0061] Thirdly, the protective cover is provided with a plurality of heat-discharge openings to discharge internal heat to the outside. Thereby, the linear compressor of the present invention has no risk of overheating during operation thereof.

[0062] 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.

Claims

1. A linear compressor comprising:

a shell (50) formed with an inlet port (51) and an

- outlet port (52);
 a linear motor (60) mounted in the shell (50) and adapted to generate a linear movement force;
 a cylinder (70) mounted in the shell (50);
 a piston (71) connected to the linear motor (60) and adapted to compress fluid while being linearly reciprocated in the cylinder (70);
 a vibration absorbing unit (80) mounted at the outside of the shell (50) to absorb vibration; and
 a protector mounted around the vibration absorbing unit (80) to protect the vibration absorbing unit (80).
2. The compressor as set forth in claim 1, wherein the protector is a protective cover (85) configured to enclose the vibration absorbing unit (80) and coupled to the shell (50).
3. The compressor as set forth in claim 2, wherein the protective cover (85) has a cylindrical shape opened at one end thereof, the open end of the protective cover being coupled to the shell (50).
4. The compressor as set forth in claim 2, wherein the protective cover (85) is formed with a plurality of heat-discharge openings (87) to discharge internal heat to the outside.
5. The compressor as set forth in claim 4, wherein the plurality of heat-discharge openings (87) are spaced apart from one another by a predetermined distance, and each has a slit shape.
6. The compressor as set forth in claim 5, further comprising:
 a discharge cover (91) provided in front of the discharge port (52) and adapted to attenuate a flow rate of the fluid discharged through the discharge port (52); and
 a discharge pipe (94) connected to the discharge cover (91) to guide the fluid in the interior of the discharge cover (91) to the outside.
7. The compressor as set forth in claim 6, wherein the protective cover (85) is perforated with a pipe hole (86) for the penetration of the discharge pipe (4).
8. The compressor as set forth in claim 6, wherein the vibration absorbing unit (80) is coupled to the discharge cover (91).
9. The compressor as set forth in claim 8, wherein the vibration absorbing unit (80) includes:
 a boss member (82) connected to the discharge cover (91);
 a mass member (83) outwardly spaced apart
- from the boss member (82); and
 a plurality of plate springs (84) to connect the boss member (82) to the mass member (83).
10. The compressor as set forth in claim 9, wherein the mass member (83) has a circular ring shape.

FIG. 1

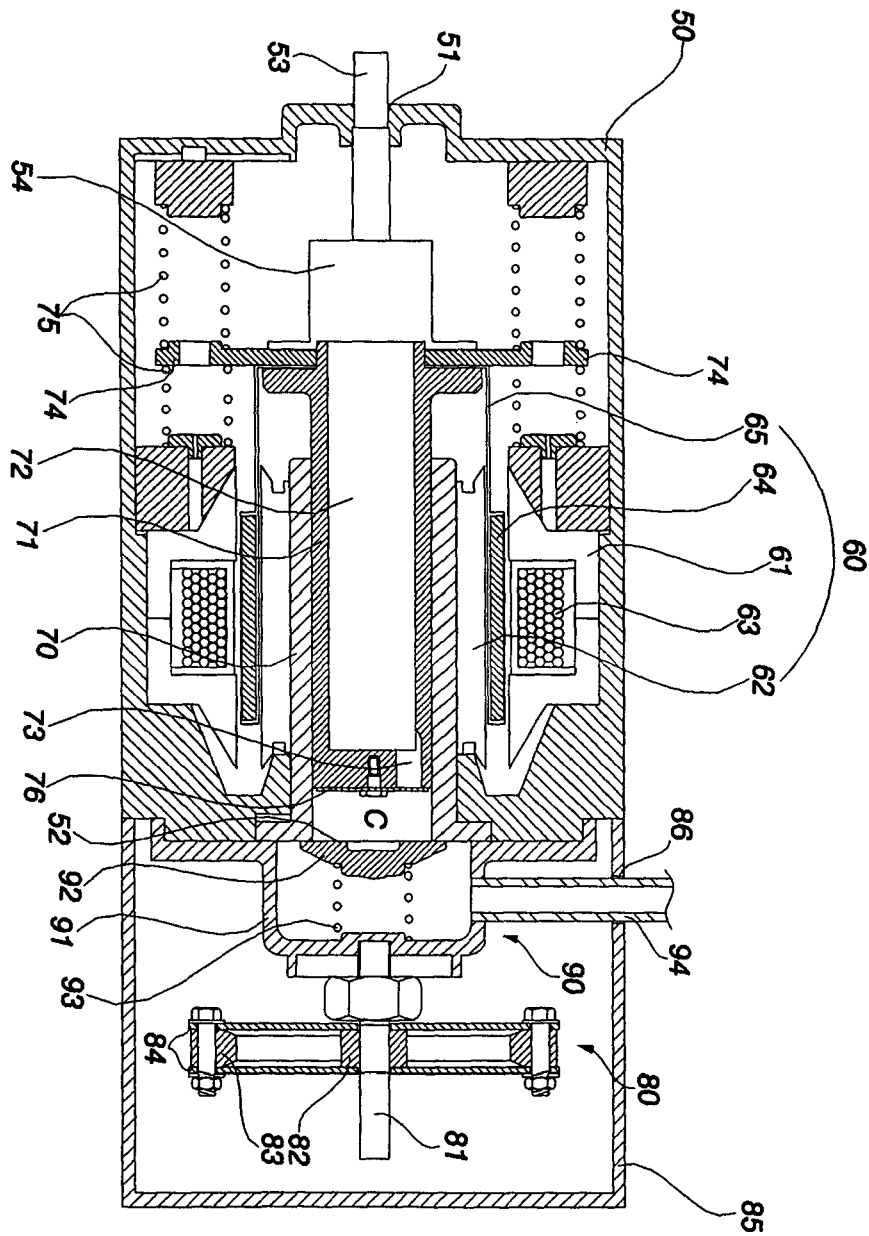
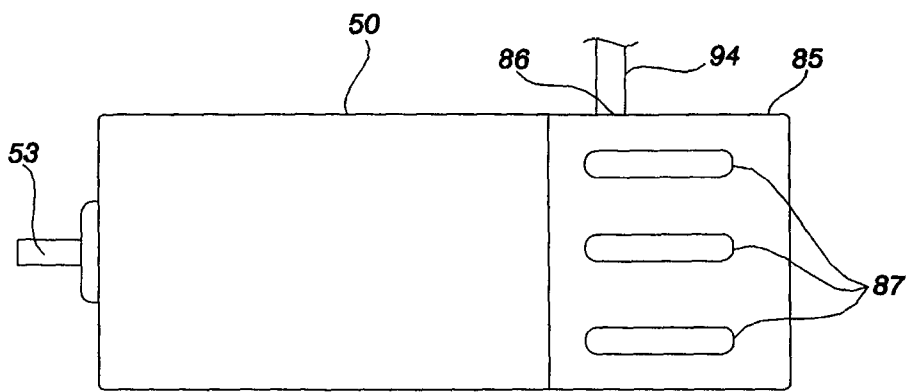


FIG. 2





European Patent
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EUROPEAN SEARCH REPORT

Application Number
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Place of search Munich		Date of completion of the search 22 March 2006	Examiner Gnüchtel, F
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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