A linear compressor comprising a linear motor. The linear motor comprises an outer core fixed to a cylinder block in such a fashion that it is spaced apart from a piston to surround it, a coil for producing a magnetic field by receiving electric power, and an inner core assembly fixed to an outer circumference of the piston. The inner core assembly has a hollow cylindrical shape, and includes an inner core, a magnet fixed to an outer circumference of the inner core 51, and a molded material obtained through injection molding for fixing the inner core and the magnet to each other.
FIG. 2
LINEAR MOTOR AND LINEAR COMPRESSOR HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 2004-36257, filed on May 21, 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 linear compressors, and, more particularly, to linear compressors having a linear motor for driving a piston, the linear motor comprising cores and a magnet.
[0004] 2. Description of the Related Art
[0005] Generally, in a refrigeration cycle wherein compression, condensation, expansion, and evaporation processes are continuously performed using a refrigerant, compressors serve to compress the refrigerant, and discharge it to the outside. One kind of such compressors is linear compressors wherein a linear motor, exhibiting a rectilinear motion, is used to reciprocate a piston for compressing a refrigerant.
[0006] Conventional linear compressors comprise a compressing unit for compressing a refrigerant, and a driving unit for providing power to the compressing unit. Both the compressing unit and the driving unit are installed inside a hermetic casing.
[0007] The compressing unit, for compressing the refrigerant, includes a cylinder block internally defining a compression chamber, and a piston reciprocating inside the compression chamber.
[0008] The driving unit is a linear motor, which is rectilinearly movable by receiving electric power. Such a linear motor includes an inner core surrounding the outside of the cylinder block, an outer core spaced apart from the inner core by a prescribed distance so that it surrounds the outer circumference of the inner core, the outer core having a coil wound therein, and a moving member fixed to the piston so that it is interposed between the inner and outer cores. The moving member is installed with a magnet for driving the moving member and the piston through electromagnetic interaction with the inner and outer cores.
[0009] The conventional linear compressors, however, have a problem in that the inner core and the magnet are installed to the cylinder block and the moving member, respectively, resulting in complexity in their overall assembling process, and deterioration of productivity.
[0010] Another problem of the conventional linear compressors is that there exists the need for an air gap, having a prescribed distance, between the inner and outer cores due to the moving member to be disposed therebetween, resulting in deterioration in efficiency of the linear motor. Especially, if the moving member is deformed by an exterior shock, it may prevent normal operation of the linear motor.

SUMMARY OF THE INVENTION

[0011] The present invention has been made in view of the above mentioned problems, and an aspect of the invention is to provide a linear compressor having a linear motor, which can achieve not only simplification in installation of an inner core and a magnet, but also minimization of an air gap between the inner core and an outer core, thereby being capable of improving a driving efficiency thereof.

[0012] In accordance with one aspect, the present invention provides a linear compressor comprising: a piston reciprocating inside a compression chamber for compressing a refrigerant; an outer core spaced apart from the piston to surround it, and having a coil wound therein for producing a magnetic field; and an inner core assembly fixed to an outer circumference of the piston, wherein the inner core assembly comprises: an inner core serving as a propagation passage of the magnetic field produced inside the outer core; and a permanent magnet for reciprocating the piston through electromagnetic interaction with the inner and outer cores.

[0013] The permanent magnet may be provided at an outer circumference of the inner core.

[0014] The inner core assembly may further include a molded material obtained through injection molding, the molded material serving to fix the inner core and the permanent magnet to each other.

[0015] The inner core assembly may further include an insulation member disposed between the inner core and the magnet for the electrical insulation therebetween.

[0016] The piston may have first and second support portions formed at the outer circumference thereof for axially supporting both ends of the inner core assembly, respectively.

[0017] The piston may be dividable into a first piston member formed with the first support portion, and a second piston member formed with the second support portion.

[0018] For the coupling of the first and second piston members, one of the piston members may be formed with a coupling protrusion, and the other one of the piston members may be formed with a coupling recess, into which the coupling protrusion will be inserted.

[0019] In accordance with another aspect, the present invention provides a linear motor comprising: an outer core spaced apart from an output shaft to surround it, and serving to drive the output shaft, the outer core having a coil wound therein for producing a magnetic field; and an inner core assembly fixed to an outer circumference of the output shaft, wherein the inner core assembly comprises: an inner core serving as a propagation passage of the magnetic field produced inside the outer core; and a permanent magnet for reciprocating the output shaft through electromagnetic interaction with the inner and outer cores.

[0020] The inner core assembly may further include a molded material obtained through injection molding, the molded material serving to fix the inner core and the permanent magnet to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The above aspect, 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:

[0022] FIG. 1 is a sectional view illustrating the general structure of a linear compressor in accordance with the present invention;

[0023] FIG. 2 is a sectional view illustrating an inner core assembly of the linear compressor in accordance with the present invention; and

[0024] FIG. 3 is an exploded perspective view illustrating the coupling relationship between the inner core assembly and a piston of the linear compressor in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] A preferred embodiment of the present invention will now be described in detail with reference to the annexed drawings.

[0026] Referring to FIG. 1 illustrating a linear compressor in accordance with the present invention, it comprises, inside a hermetic casing 10, a compressing unit 20 for compressing a refrigerant, and a driving unit 40 for driving the compressing unit 20.

[0027] The compressing unit 20 includes a cylinder block 21 defining a compression chamber 21a, and a piston 30 reciprocating inside the compression chamber 21a. Coupled to one side of the cylinder block 21 is a cylinder head 22, which defines a suction chamber 22a and a discharge chamber 22b.

[0028] The driving unit 40 is a linear motor, which includes an outer core 41 fixed to the cylinder block 21 in such a manner that it is spaced apart form the piston 30 by a prescribed distance to surround it, a coil 42 adapted to produce a magnetic field by receiving electric power, and an inner core assembly 50 fixed to the outer circumference of the piston 30. The outer core 41 is formed by circumferentially stacking a plurality of metal sheets, and the coil 42 is annularly wound inside the outer core 41.

[0029] Referring to FIG. 2, the inner core assembly 50 has a hollow cylindrical shape, and is fixed to the outer circumference of the piston 30. Such an inner core assembly 50 includes an inner core 51, and a magnet 52. The inner core 51 is formed by circumferentially stacking metal sheets, and serves as a propagation passage of the magnetic field produced inside the outer core 41. The magnet 52 is fixed to the outer circumference of the inner core 51 so that it vertically reciprocates through electromagnetic interaction with the inner and outer cores 51 and 41.

[0030] That is, the inner core 51 and the magnet 52 of the inner core assembly 50 are integrally fixed to each other by making use of a molded material 53 obtained by injection molding.

[0031] In this case, for the electrical insulation between the inner core 51 and the magnet 52, an insulating member 54, such as an insulating sheet, insulating film, etc. is fitted therebetween.

[0032] Meanwhile, in order to fix the inner core assembly 50 to the piston 30, the piston 30 is formed with first and second supporting portions 31a and 32a, which radially and outwardly extend from the outer circumference of the piston 30. These supporting portions 31a and 32a are provided in a pair, and serve to support upper and lower ends of the inner core assembly 50.

[0033] Referring to FIG. 3, in order to assure that the inner core assembly 50 is mounted between the supporting portions 31a and 32a, the piston 30 is divided into a first piston member 31 formed with the first supporting portion 31a, and a second piston member 32 formed with the second supporting portion 32a. The first and second piston members 31 and 32 are coupled to each other after the inner core assembly 50 is fitted around one of the first and second piston members 31 or 32.

[0034] For the firm coupling of the first and second piston members 31 and 32, at an upper end of the second piston member 32 is formed an upwardly-protruding coupling protrusion 32b, and at a lower end of the first piston member 31 is formed a coupling recess 31b, into which the coupling protrusion 32b will be inserted.

[0035] In this case, the coupling protrusion 32b is press-fitted into the coupling recess 31b. For this, preferably, the diameter of the coupling protrusion 32b is slightly larger than the diameter of the coupling recess 31b, and the top of the coupling protrusion 32b is conically tapered for securing smooth initial insertion thereof.

[0036] Now, the operation and effects of the linear compressor according to the present invention will be explained.

[0037] First, if electric power is applied to the coil 42, a magnetic field is produced inside the outer core 41, and is propagated toward the inner core 51. Thereby, the magnet 52, located between the inner and outer cores 51 and 41, vertically reciprocates through electromagnetic interaction with the magnetic field propagating from the outer core 41 toward the inner core 51. Here, since the magnet 52 and the inner core 51 together constitute the inner core assembly 50, and the inner core assembly 50 is fixed to the outer circumference of the piston 30, the piston 30 vertically reciprocates along with the magnet 52, thereby compressing the refrigerant inside the compression chamber 21a.

[0038] In the present invention, the magnet 52 and the inner core 51 are integrally molded to form the inner core assembly 50 through injection molding. This has an effect of minimizing an air gap between the inner and outer cores 51 and 41, resulting in improvement in driving efficiency of the linear motor.

[0039] As apparent from the above description, the present invention provides a linear compressor wherein an inner core and a magnet are integrally molded to form an inner core assembly through injection molding, and the inner core assembly is fixed to the outer circumference of a piston.

[0040] Such a configuration has an effect of eliminating the need for a moving member, which is used in conventional compressors, and consequently can minimize an air gap between the inner core and an outer core, resulting in improvement in output efficiency of a linear motor as well as driving efficiency of the compressor.

[0041] Further, according to the present invention, installation of the inner core and the magnet is completed as the inner core assembly, obtained through injection molding, is fixed to the piston, resulting in ease in their assembly, and improvement of productivity.
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 piston reciprocating inside a compression chamber for compressing a refrigerant;
   an outer core spaced apart from the piston to surround it, and having a coil wound therein for producing a magnetic field; and
   an inner core assembly fixed to an outer circumference of the piston,
   wherein the inner core assembly includes:
   an inner core serving as a propagation passage of the magnetic field produced inside the outer core; and
   a permanent magnet for reciprocating the piston through electromagnetic interaction with the inner and outer cores.
2. The compressor according to claim 1, wherein the permanent magnet is provided at an outer circumference of the inner core.
3. The compressor according to claim 1, wherein the inner core assembly further includes a molded material obtained through injection molding, the molded material serving to fix the inner core and the permanent magnet to each other.
4. The compressor according to claim 3, wherein the inner core assembly further includes an insulation member disposed between the inner core and the magnet for the electrical insulation therebetween.
5. The compressor according to claim 1, wherein the piston has first and second support portions formed at the outer circumference thereof for axially supporting both ends of the inner core assembly, respectively.
6. The compressor according to claim 5, wherein the piston is dividable into a first piston member formed with the first support portion, and a second piston member formed with the second support portion.
7. The compressor according to claim 6, wherein, for the coupling of the first and second piston members, one of the piston members is formed with a coupling protrusion, and the other one of the piston members is formed with a coupling recess, into which the coupling protrusion will be inserted.
8. A linear motor comprising:
   an outer core spaced apart from an output shaft to surround it, and serving to drive the output shaft, the outer core having a coil wound therein for producing a magnetic field; and
   an inner core assembly fixed to an outer circumference of the output shaft,
   wherein the inner core assembly includes:
   an inner core serving as a propagation passage of the magnetic field produced inside the outer core; and
   a permanent magnet for reciprocating the output shaft through electromagnetic interaction with the inner and outer cores.
9. The motor according to claim 8, wherein the inner core assembly further includes a molded material obtained through injection molding, the molded material serving to fix the inner core and the permanent magnet to each other.

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