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Miller

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[54] **ELECTRODYNAMIC LINEAR MOTOR OPERATED GAS COMPRESSOR**

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[73] Assignee: **Carrier Corporation,** Syracuse, N.Y.

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[52] **U.S. Cl.** **417/417,** 417/326, 417/363

[51] **Int. Cl.** **F04b 17/04**

[58] **Field of Search** 419/326, 363, 417, 418

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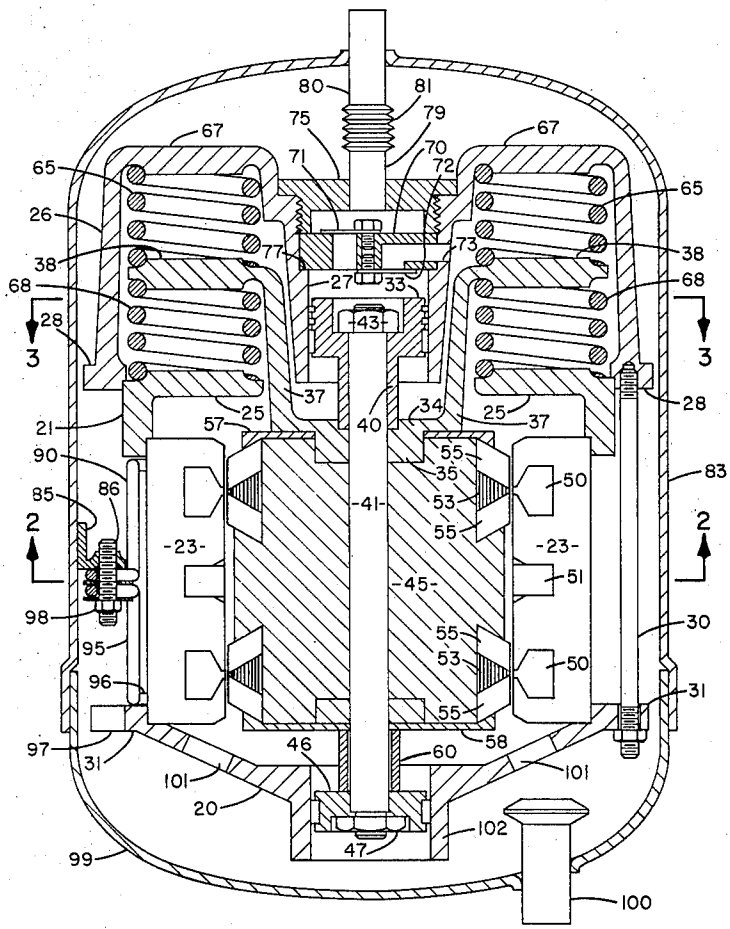
[57] **ABSTRACT**

The resilient armature centering mechanism surrounds the compressor cylinder rather than being positioned in axial series with the armature and cylinder structure. This arrangement results in a particularly compact structure for use as a hermetic refrigerator compressor.

2 Claims, 3 Drawing Figures



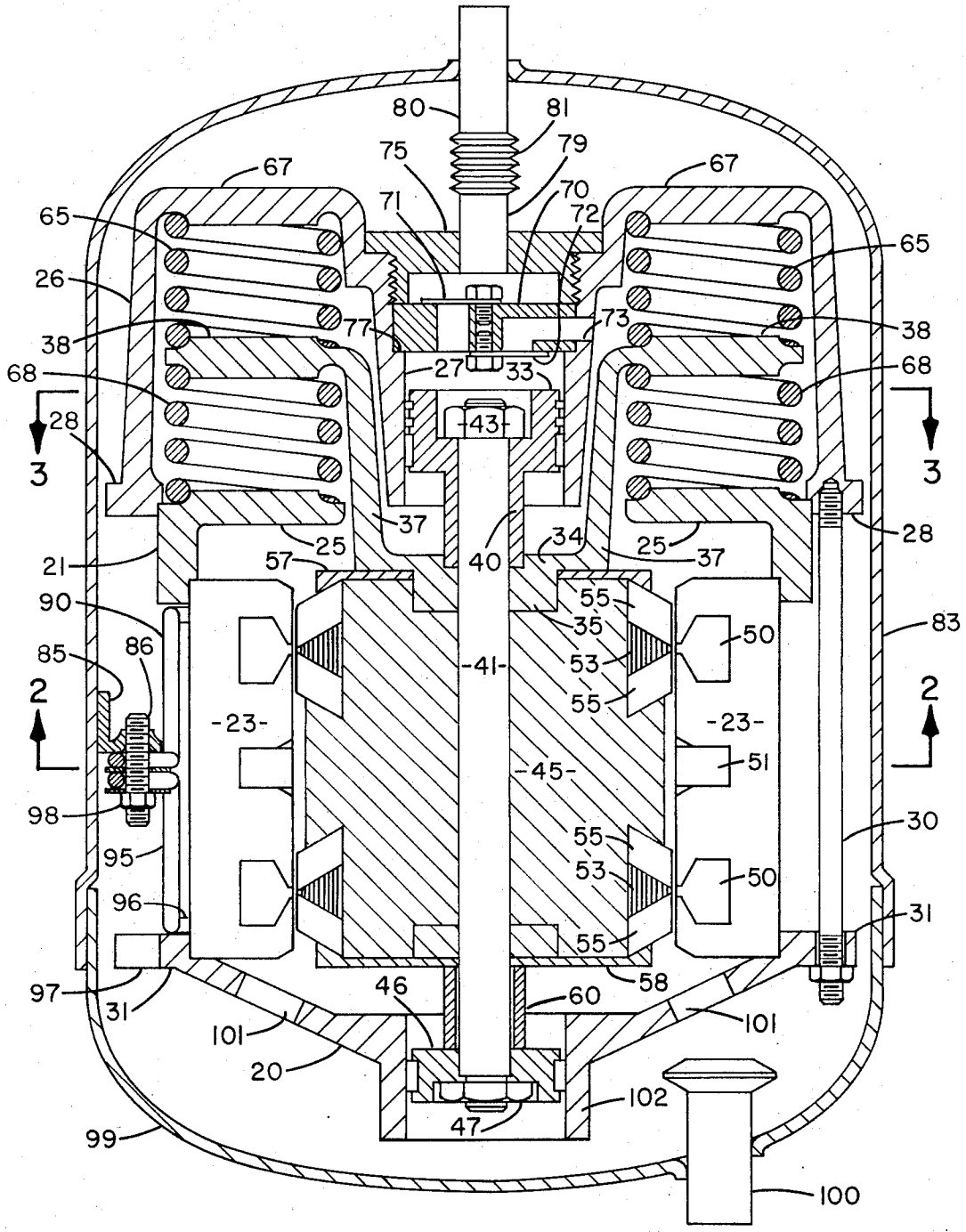

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FIG. 1

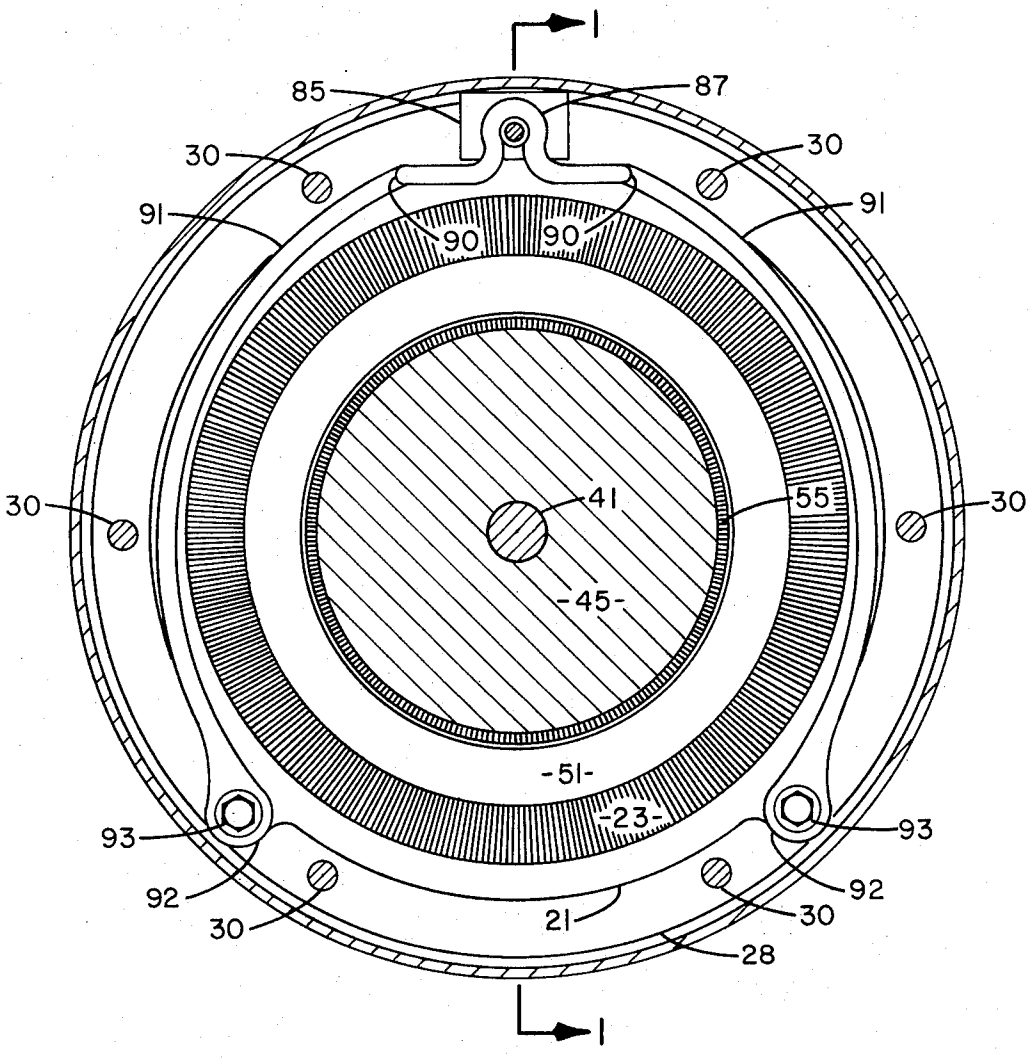

FIG. 2

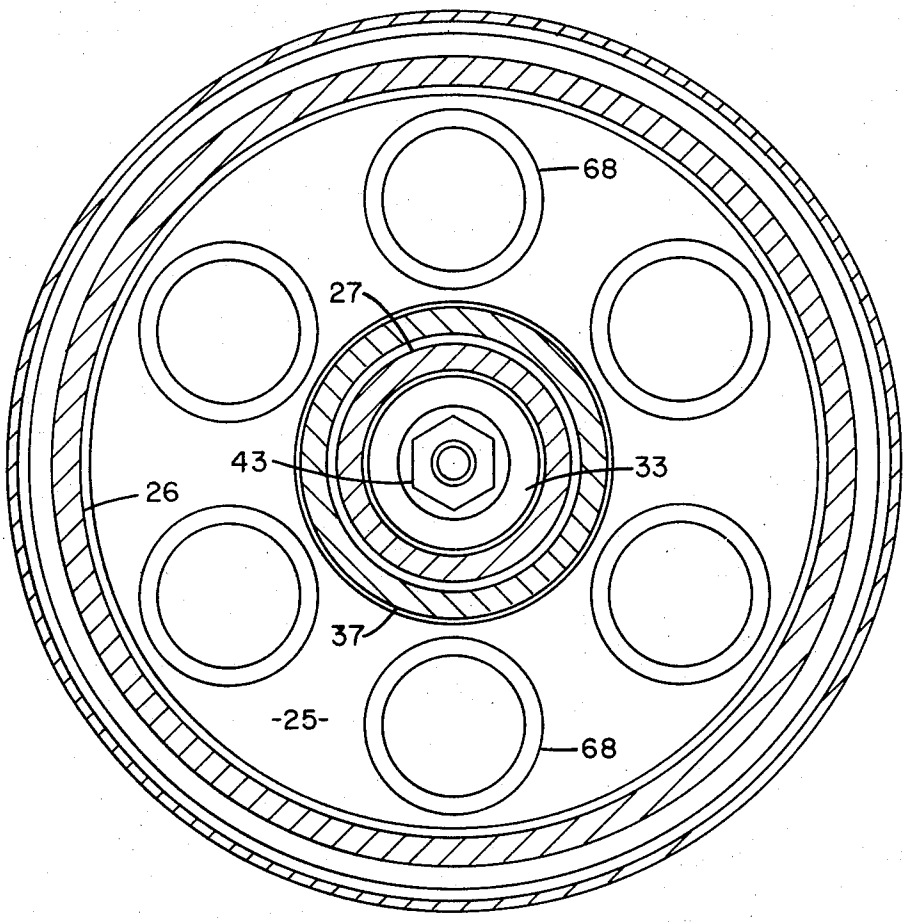

FIG. 3

ELECTRODYNAMIC LINEAR MOTOR OPERATED GAS COMPRESSOR

BACKGROUND OF THE INVENTION

Linear motor operated gas compressors of the type wherein the reciprocating armature is power operated in both directions form a null position, the resilient means, conventionally helical springs, for yieldingly urging the armature to null position, is arranged in axially spaced series relation with the armature and compressor cylinder. With such an arrangement, the machine is of substantial length, making it unsatisfactory for some uses such as, for example, a hermetic refrigerator compressor.

SUMMARY OF THE INVENTION

A cylinder structure is mounted on a frame member and includes a cylinder and a wall extending radially outwardly from the cylinder and spaced from the frame member in a direction axially of the cylinder. The cylinder is surrounded by a control member disposed intermediate the frame member and the wall of the cylinder structure. A piston in the cylinder and the control member are connected to the reciprocating armature. The control member is acted upon by resilient means, yieldingly opposing reciprocation of the armature from its null position. The resilient means may be in the form of springs arranged in a circular series above the cylinder and engaging opposite sides of the control member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of a gas compressor embodying the invention; the orientation of the view is indicated by the line 1-1 FIG. 2.

FIG. 2 is a view taken on line 2—2 FIG. 1.

FIG. 3 is a view taken on line 3—3 FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The compressor unit consists of spaced apart frame end members **20, 21.** These members are formed with aligned circular shoulders to receive the ends of an annular stator member **23.**

The upper frame member **21,** referring to FIG. **1,** is formed with an annular flange **25** extending radially inwardly in axial spaced relation to the stator **23.**

A cylinder structure is mounted upon the end member **21** and consists of an outer wall **26** and an inner wall **27.** These walls are arranged in concentrically spaced apart relation. The lower end portion of the outer wall **26** is formed with an annular flange **28** formed with a circular shoulder engaging the end member **21.** The flange **28** is formed with threaded apertures to receive tie bolts **30** which extend through the flange **31** of the lower end member **20,** and threaded into flange **28.** The bolts **30** serve to clamp the cylinder structure against the frame end member **21,** and to clamp the stator **23** between the end members **20, 21.**

The inner wall **27** forms the cylinder portion having a cylinder bore in which there is mounted for reciprocation a piston **33.** A control member, acted upon by the resilient positioning means, consists of a cup-shaped member having a bottom wall **34** formed with a hub **35.** The periphery of bottom wall **34** merges with an upstanding circular flange **37** terminating in a radial flange **38.**

The piston **33** is formed with a tubular projection **40,** the lower end of which is positioned in a circular recess formed in the wall **34** of the control member. A piston rod **41** is provided at its upper end with a nut **43.** The piston rod extends through the piston **33,** the bottom wall **34** of the control member, through an armature **45,** and terminates in a circular member **46,** to which it is secured by a nut **47** threaded on the lower end of the piston rod, as shown in FIG. **1.**

The stator **23** is provided with coils **50, 51.** The armature **45** is formed of solid, ferrous material and is provided with short circuiting rings **53** of conductive material located in groups of laminations **55.** The outer groups **55** at the upper end of the armature are retained by a washer like member **57,** clamped between the upper end of the armature and the control member. A similar washer member **58** is clamped between the armature and a spacer sleeve **60** engaged by the nut **47.**

In the coil arrangement illustrated in FIG. **1,** the coils **50** are connected to a source of alternating current and the coil **51** is connected to a DC supply. When the coils are so energized, they effect axial reciprocation of the armature **45** and accordingly, the piston **33.** It will be understood by those familiar with the linear motor art that other forms of coil arrangements may be employed. The electrical operating functions of the device form no part of this invention.

A circular series of helical compression springs **65** is arranged between the cylinder structure walls **26, 27** and are interposed between the annular flange **38** of the control member and an annular end wall **67** connecting the walls **26, 27.** A like series of springs **68** are arranged between the flange **25** of the frame end piece **21** and the flange **38** of the control member. These springs, as will be apparent, function to yieldingly oppose reciprocation of the armature **45** and piston **33.** The springs **65, 68** are formed and dimensioned to effect reciprocation of the armature **45** in resonance. The cylinder portion **27** of the cylinder structure is provided with a valve plate **70** containing a discharge valve **71** and an intake valve **72** communicating with an intake passage **73.** A cylinder head **75** is attached to the upper end of the cylinder by threaded connection. The head **75** is formed with a cylindrical flange abutting against the valve plate **70** forcing the valve plate against a shoulder **77** formed in the cylinder bore. The compressed gas discharged through the valve **71** passes through a conduit **79** connected to a discharge passage **80** by a flexible connection **81.**

The compressor structure is yieldingly supported within a casing **83.** A bracket **85** is fixedly attached to the inner surface of the casing **83** as by welding. A stud **86** is fixed to the bracket. The compressor is supported by a pair of spring members formed of resilient rods. These rods are formed intermediate their ends with a loop **87** mounted on the stud **86.** One spring member is formed adjacent the loop **87,** see FIG. **2,** and with upwardly extending leg portions **90,** the upper ends of which merge with arcuate extensions **91** provided at their ends with apertured terminals **92.** Screws **93** extend through the terminals **92** and are threaded into radially extending bores formed on the flange **21.**

The other spring member is formed with depending leg portions **95** similar to the leg portions **90** and the legs **95** in like manner terminate in arcuate portions **96** attached to the inner surface of flange **31** of the lower end member **20.** The flange **31** is formed with a notch

97 for the admission of a tool to tighten the nut **98** on stud **86.** Subsequently, the end closure **99** is hermetically sealed to the casing **83.**

Gas is conveyed to the interior of the casing **83** through a conduit **100.** If the end member **20** is formed solid, it is provided with openings **101** for the passage of the gas upwardly between the stator **23** and the armature **45** and about springs **65, 68** to the inlet passage **73.** When the compressor unit is employed in a refrigeration system, the passage of the refrigerant vapor in contact with the stator and armature and springs **65, 68** effects cooling of those components.

The lower end member **20** is formed with a cylindrical hub **102** in which the member **46** is mounted for reciprocation. The piston **33** and member **46** serve to maintain the armature **45** in concentrically spaced relation to the stator **23.**

I claim:

1. An electrodynamic linear motor operated gas compressor comprising a stator formed with a passage extending axially therethrough, a first end member positioned on one end of said stator, a second end member positioned on the opposite end of said stator, means operable to clamp said end members against said stator, a cylinder structure including inner and outer concentrically spaced apart walls, connecting means connecting like ends of said inner and outer walls, the opposite end of said other wall being attached to said first end member, said inner wall forming a cylinder portion having a cylinder bore and including intake and exhaust valve assemblies, an armature arranged for reciprocation in the passage in said stator, a piston fixed to said armature for reciprocation in said cylinder bore, a control member fixed to said armature and having a wall portion extending axially therefrom and encircling said inner wall and terminating in a radially outwardly extending resilient means between said radial flange and said connecting means in a second resilient means intermediate said first member and said radial flange, said resilient means yieldingly opposing reciprocation of said armature having means slidably engaging said second end member and serving in conjunction with said piston to maintain said armature in spaced concentric relation to said stator, and electrical driving coils mounted in said stator member and operable when energized to effect reciprocation of said armature.

2. A gas compressor as set forth in claim **1** wherein the clamping means clamping the end members to the stator are disposed externally.

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