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(54) Scroll compressor with bypass ports driven by a line fed permanent magnet sychronous type motor.

(57) A scroll compressor is provided with some capacity reduction technique such as a bypass port. The electric motor for driving the scroll compressor is not an induction motor, but rather a line fed permanent magnet synchronous motor is utilized. Such motors have a higher overall efficiency, and thus will be more efficient at reduced capacity operation.

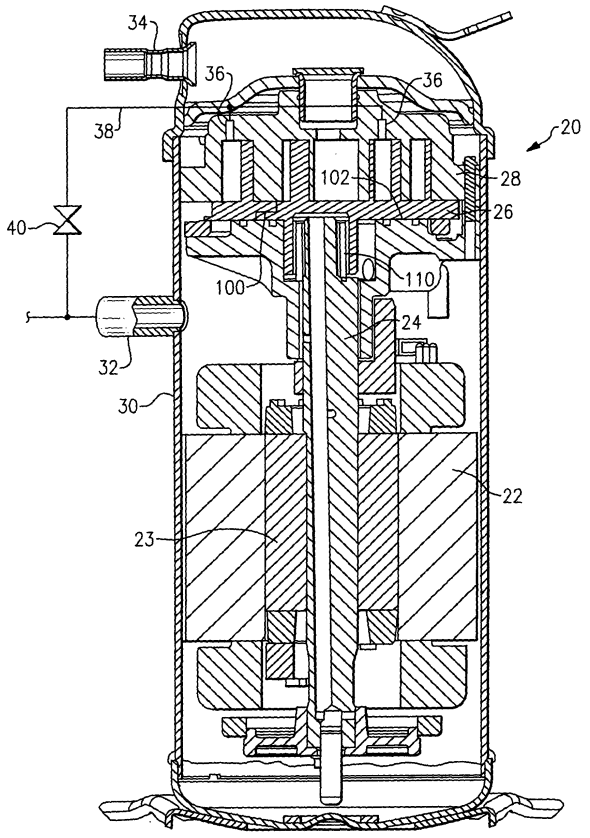

FIG.1

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Description

BACKGROUND OF THE INVENTION

[0001] This application relates to a scroll compressor having a line fed permanent magnet synchronous type motor, which has a relatively constant power curve as a load changes, and wherein the scroll compressor is provided with a function to reduce capacity.

[0002] Scroll compressors are becoming widely utilized in refrigerant compression applications. In a scroll compressor, a pair of scroll elements each have a base and a generally spiral wrap extending from the base. The wraps interfit to define compression chambers. An electric motor drives a shaft, and the shaft drives one of the two scroll members to rotate relative to the other through a non-rotation coupling.

[0003] There are many enhancements to the basic scroll compressor design. In one enhancement, partially or fully compressed refrigerant may be tapped back to a suction pressure to reduce the load on the compressor motor when there is a reduced capacity needed for a refrigerant system associated with the compressor. This is known as bypass or unloaded operation.

[0004] Other ways of reducing the capacity of the compressor, such as pulse width modulation to a back pressure chamber are also known. With all of these functions, the torque on the compressor motor is reduced.

[0005] In all known scroll compressor designs, an induction motor has been utilized. An induction motor has a peak efficiency at a certain load torque, above as well as below which the efficiency decreases. The value of reducing the capacity, which is to save energy, is somewhat lost due to the reduced efficiency.

SUMMARY OF THE INVENTION

[0006] In the disclosed embodiment of this invention, a scroll compressor having some way of reducing capacity is provided with a line fed permanent magnet synchronous type motor. The permanent magnet motor has a higher peak efficiency, and a flatter efficiency versus torque curve compared to the prior art induction motor.

[0007] These and other features of the present invention can be best understood from the following specification and drawings, the following of which is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Figure 1 is a scroll compressor incorporating the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0009] A scroll compressor 20 is illustrated in Figure 1. As shown, a motor stator 22 causes a motor rotor 23 to rotate. When rotor 23 rotates, a shaft 24 is driven to rotate. Shaft 24 causes an orbiting scroll 26 to orbit relative to a non-orbiting scroll 28, as known. The components as described at this point are housed within a shell 30. A suction port 32 receives a suction refrigerant from a refrigerant cycle, and delivers that refrigerant to compression chambers between the orbiting scroll 26 and non-orbiting scroll 28. A discharge tube 34 delivers a compressed refrigerant downstream into the refrigerant cycle.

[0010] Bypass ports 36 communicate with the compression chambers, and may return a partially or fully compressed refrigerant to the suction pressure, such as suction tube 32. As shown, a bypass line 38 incorporates a valve 40 to selectively communicate this refrigerant back to the suction port. However, any other way of communicating partially or fully compressed refrigerant back to the suction pressure may be utilized with this invention. Moreover, other ways of modulating the capacity of the compressor would come within the scope of this invention. As an example, scroll compressors are known wherein a biasing force is provided behind one of the two scroll compressors. Pulse width modulation techniques may be utilized to lower that biasing force under certain conditions such that the scroll members can come away from each other and reduce the capacity.

[0011] As shown in Figure 1, the scroll compressor includes a tap 100 extending through the orbiting scroll member 26 into a back pressure chamber 102. As known, this creates a biasing force holding the orbiting scroll member 26 in contact with the non-orbiting scroll member 28. In addition, the drive between the shaft 24 and the scroll compressor 26 is through a slider block arrangement 110. Such arrangements allow for radial movement of the orbiting scroll 26. Both the axial compliance and the radial compliance allow the reduction of capacity by allowing the wraps of the scroll members to move out of contact with each other. Techniques for providing this reduction in capacity are known. It is the use of a particular motor with such an ability to reduce capacity which is inventive here.

[0012] Any other capacity modulation technique would come within the scope of this invention.

[0013] This invention relates to the use of a permanent magnet synchronous motor for any scroll compressor having the ability to reduce its capacity. Such motors have a high peak efficiency, and a flatter efficiency versus torque curve. Thus, when the capacity is reduced, the motor 22/23 will still operate more efficiently than the prior art which utilize an induction motor.

[0014] While an embodiment of this invention has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the

scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

Claims

1. A scroll compressor comprising:

a first scroll member having a base and a generally spiral wrap extending from said base;
a second scroll member having a base and a generally spiral wrap extending from its base, said generally spiral wraps interfitting to define compression chambers; and
an electric motor operable to drive a rotary shaft to in turn cause said second scroll member to orbit relative to said first scroll member, said electric motor being a permanent magnet synchronous motor, wherein said permanent magnet synchronous motor is a line fed motor, running directly from the mains without requirement of frequency inverter.

2. Scroll compressor as set forth in Claim 1, wherein a capacity reduction feature being incorporated into the scroll compressor to allow the reduction of capacity provided by the scroll compressor under certain conditions.

3. The scroll compressor as set forth in Claim 1, 2 or 3, wherein bypass ports are provided to reduce the capacity of the scroll compressor.

4. The scroll compressor as set forth in Claim 1, 2 or 3, wherein said second scroll member and said first scroll member are held together, but are movable away from each other in an axial direction.

5. The scroll compressor as set forth in Claim 1, 2, 3 or 4, wherein the wraps of said first and second scroll member are held together but are capable of moving radially away from each other.

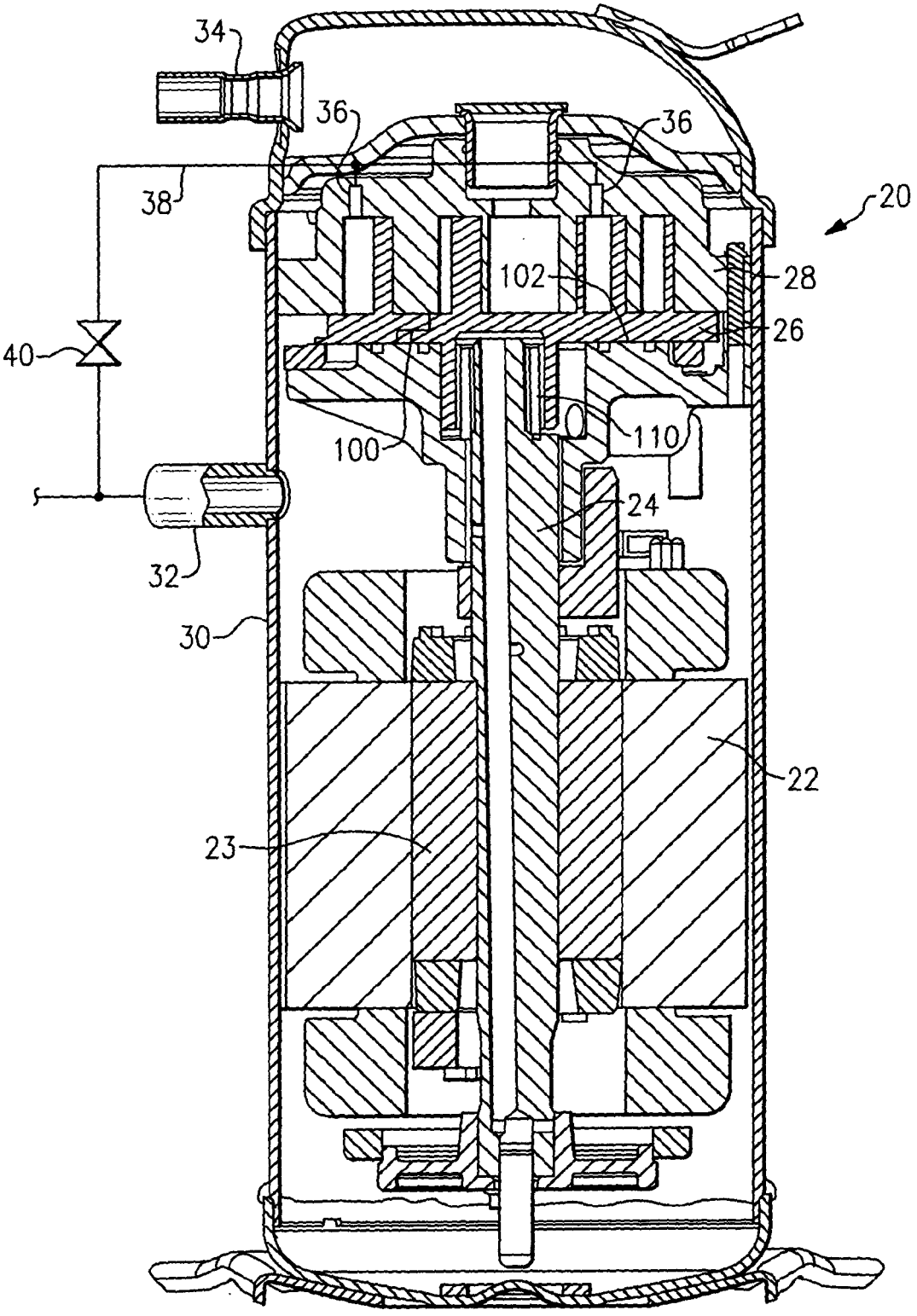

FIG.1