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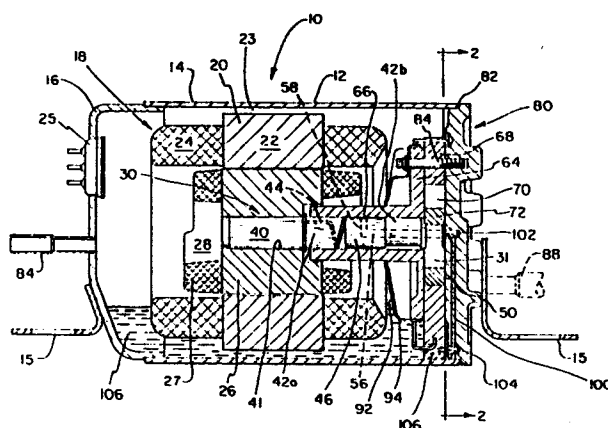
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⑤④ Compressor with an exposed outboard thrust plate.

⑤⑦ A rotary hermetic compressor including a bell shaped housing (12) and having an end wall (80) which also forms the end thrust plate for the compressor cylinder (68) and the crankshaft (30). The suction line (88) is connected directly to the end thrust plate (80) and the end thrust plate also includes oil passages (100, 102) for conducting oil from an oil sump (106) to an axial bore (56) in the crankshaft (30) for lubrication of the crankshaft bearings (64).



COMPRESSOR WITH AN EXPOSED OUTBOARD THRUST PLATE

This invention relates to hermetic compressors and in particular to the construction of an outboard thrust plate for a rotary hermetic compressor.

5 Conventional hermetic rotary compressors for compressing a compressible gas such as a refrigerant include a hermetically sealed housing shell within which are disposed an electric motor, a compressor cylinder or crankcase having a bore therein, and a
10 crankshaft which is rotatably driven by the motor for operating the working parts of the compressor. The crankshaft is generally journaled in one or more bearings which may be secured to either the housing or the compressor cylinder. In general when more
15 than one bearing is used for journalling the crankshaft, there is provided a main bearing and an outboard bearing and the cylinder is sandwiched between these two bearings. The outboard bearing also serves as an end plate for sealing off the cylinder bore which
20 forms the compression chamber. In some compressors only a single bearing is used and an end plate is provided whose only function is to provide a end wall for the compressor cylinder bore. One Example of such construction is shown in U.S. Patent No. 2,458,018.

25 One problem with such prior art compressors has been the attachment of the suction line of the compressor to the compression cylinder chamber. This is particularly true in compressors wherein the compressor shell or housing forms the pressurized or
30 high side of the system. In such compressors the suction line passes through the housing wall and leads directly into the compression chamber and

compressed refrigerant will be expelled from the compression chamber into the housing via a discharge valve. Since compressor housings tend to be somewhat flexible and since the connections of the suction line to both the cylinder and housing must be sealed, it is difficult to accommodate the relative movement between the housing shell and the compressor cylinder. In some compressors this problem has been addressed by welding the compression cylinder to the housing. The suction line is then pressed into the cylinder. In such structures the cylinder must be made relatively heavy to prevent distortion of the cylinder as the suction line is forced into the cylinder suction line aperture. Such heavy construction of the cylinder is undesirable as it adds weight and material cost to the compressor.

Due to the close tolerances to which hermetic rotary compressors must be built, proper lubrication of the working parts of the compressor is extremely important. In vertical crankshaft compressors the end portion of the compressor crankshaft generally includes an oil pump. The end portion of the crankshaft is disposed in the compressor oil sump which is conventionally located in a bottom portion of the housing. However, in horizontal axis compressors this pumping arrangement is not feasible and alternative lubricant pumping arrangements must be provided, thereby adding to the cost of the compressor.

An additional consideration in constructing small hermetic rotary compressors for use with household appliances and the like is that the compressor size is desirably kept small. In one prior art

compressor disclosed in U.S. Patent No. 2,612,311,
 this has been achieved by combining the end plate of
 the compressor with the compressor housing end wall.
 However a problem with the disclosed arrangement is
 5 that the compressor suction tube extends through the
 sidewall of the casing. This is undesirable as
 pointed out above. Furthermore, in this construction
 the working parts of the compressor are partly
 submerged in lubricant. If a large amount of the
 10 lubricant in this system is circulated through the
 refrigerant system with the refrigerant, insufficient
 lubricant will be available in the sump for adequate
 lubrication of the working parts. It is therefore
 desired to provide a compressor wherein the compressor
 15 outboard thrust plate functions as the end wall of
 the compressor housing and as a means for attachment
 of the suction line. It is furthermore desired to
 provide such a compressor with an improved lubrication
 system. Lastly, it is desired to supply such a
 20 compressor wherein the outboard thrust plate serves
 as a bearing for the crankshaft.

An additional problem in hermetic rotary com-
 pressors is the provision of adequate cooling arrange-
 ments for the compressor since a great deal of heat
 25 is generated in the compressor which must be dissipated.
 When the working parts of a compressor are completely
 enclosed within the compressor housing, special
 arrangements must be provided for cooling the working
 parts. Generally this is accomplished by dripping or
 30 spraying lubricant over the working parts and then
 causing the lubricant to contact the housing shell
 whereby excess heat is dissipated through the housing

shell. Such arrangements are costly and it is therefore desired to provide an economical, compact compressor including an effective lubrication system wherein heat generated by the compressor is more readily dissipated and wherein the connection of the suction line to the compressor chamber is more easily accomplished.

The present invention overcomes the disadvantages of the above described hermetic rotary compressors by providing an improved hermetic rotary compressor therefor.

The hermetic rotary compressor of the present invention includes a bell shaped casing, an end portion of which forms the outboard or end thrust plate of the compressor. Thus, the hermetic rotary compressor includes an open ended shell member, an electric motor including a rotor and a stator, a rotatable horizontal or vertical crankshaft driven by the rotor and journaled in a main bearing, a compressor cylinder including a compression chamber and means driven by the crankshaft and disposed in the compression chamber for compressing a gas therein. A compressor outboard or end thrust plate is provided for supporting the compressor cylinder and forming an end wall of the housing, the end thrust plate being sealingly secured to the housing shell member. The end plate includes a suction aperture which communicates with the compression chamber of the cylinder. A suction tube is directly connected to the end plate in communication with the suction aperture. The end thrust plate also includes a crankshaft bearing. The end plate further includes a lubrication passage

whose lower end is disposed in the oil sump and whose upper end communicates with an axial bore of the crankshaft. The crankshaft includes a helical passageway in its outer surface which communicates with the axial crankshaft bore by means of a radial passage whereby lubricant is drawn upwardly through the end plate passage for lubricating the compressor bearings.

Thus the invention eliminates the need for the conventional prior art end wall member of the compressor housing and provides a compact compressor structure since the compressor outboard thrust plate forms part of the compressor housing. Secondly, the compressor lubrication system is substantially simplified since it comprises a very simple arrangement of passages in existing parts of the compressor such as the crankshaft and outboard thrust plate. Furthermore, since the compressor end thrust plate also forms part of the housing, cooling of the compressor is substantially improved over conventional cooling arrangements. Lastly, by eliminating the conventional prior art end shell portion of the housing, the compressor is more compact, economical and lower in weight.

The present invention, in one form thereof, comprises a rotary hermetic compressor including an open ended shell member, an electric motor including a rotor and stator. A rotatable crankshaft is secured to said rotor for driving the rotor. A bearing member is provided for journalling the crankshaft. A cylinder is provided including a compression chamber and a means driven by the crankshaft is disposed in the chamber for compressing gas

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It is an object of the present invention to provide a compact, economical construction of a hermetic compressor.

It is another object of the present invention to provide a hermetic compressor wherein the connection of the suction tube to the compressor is simplified.

It is a further object of the invention to provide a compressor having an exposed outboard thrust plate.

A still further object of the invention is to provide a simplified lubrication arrangement for a compressor.

An additional object of the present invention is to provide an effectively cooled hermetic compressor.

The above mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be better understood by reference to the following description of an embodiment of the invention, taken in conjunction with accompanying drawings, wherein:

Fig. 1 is an elevational view, in cross-section, of a preferred embodiment of the hermetic compressor of the present invention;

Fig. 2 is a cross-sectional view of the hermetic compressor taken along line 2-2 of Fig. 1;

Fig. 3 is an elevational view of the crankshaft of the compressor of Fig. 1;

Fig. 4 is an end view of the crankshaft taken from the right hand side of Fig. 3.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

The exemplifications set out herein illustrate a preferred embodiment of the invention, in one form

thereof, and such exemplifications are not to be construed as limiting the scope of the disclosure or the scope of the invention in any manner.

Referring to Fig. 1 there is shown a compressor assembly 10 including a housing bell or shell 12 having a cylindrical portion 14 and an end bell portion 16. Cylindrical portion 14 and end bell portion 16 are sealingly secured to each other such as by welding. A pair of mounting brackets 15 is provided for mounting the compressor. An electric motor 18 is disposed inside housing bell 12 and includes a stator 20 having a stack of stator laminations 22 and stator windings 24. Stator 20 is secured to housing shell 12 in any convenient manner such as by an interference fit. Stator 20 includes two flat portions on its circumference whereby clearance is provided between a portion of stator lamination stack 22 at 23 and housing shell 12 as shown in Fig. 1. An electrical connector 25 is secured to shell end portion 16 for connection to a source of electrical supply. The rotor of the electric motor 26 is provided with a counterweight 28 for balancing the rotor and crankshaft 30 which includes an eccentric portion 31. Crankshaft 30, as best seen in Fig. 3, also includes a portion 40 which is secured inside a bore 41 of rotor 26 such as by press fitting or the like. Crankshaft 30 also includes two bearing portions 42a and 42b and an undercut portion 46. Bearing portion 42a is provided with a helical passageway in its outer surface for lubrication purposes as further explained hereinafter.

While in the illustrated preferred embodiment an

undercut portion 46 is provided in crankshaft 30,
 this undercut portion 46 could be eliminated so that
 helical passageway 44 could be extended to run the
 length of portions 42a and 46. Crankshaft 30 also
 5 includes an end thrust bearing surface 50 on eccentric
 31. Eccentric 31 is provided with an oil groove 52.
 Bearing portion 42b is provided with an oil groove
 54. Crankshaft 30 also includes an axial bore 56
 which communicates with a radial oil passage 58 in
 10 portion 46.

Referring further to Fig. 1, a bearing 64 is
 provided for journalling crankshaft 30. Undercut
 portion 46 of crankshaft 30 forms an annular chamber
 66 with bearing 64 whereby a continuous lubrication
 15 circuit is provided from axial bore 56 through radial
 passage 58 and annular chamber 66 to helical passageway
 44.

Compressor 10 also includes a compressor cylinder
 68 having an axial bore which forms a compression
 20 chamber 70 therein. A roller 72 surrounds eccentric
 31 inside compression chamber 70 and cooperates with
 a sliding vane (not shown) in a conventional manner
 for compressing a compressible gas such as a refrigerant
 in the compression chamber as the crankshaft 30 is
 25 rotatingly driven by rotor 26 of motor 18.

Continuing now with Figs. 1 and 2, the compressor
 is provided with an end plate 80 which is sealingly
 secured to housing valve 12 by suitable means such as
 by or the like welding as shown at circumferential
 30 weld 82. End plate 80 is secured to bearing 64 by
 means of five bolts 84 which are engaged in threaded
 apertures 86 of end plate 80. Compressor cylinder 68

is sandwiched between bearing 64 and end plate 80 whereby the axial bore in cylinder 68 is provided with end walls to provide sealed compressor chamber 70. A suction tube 88 is secured to end plate 80 by
5 any suitable method such as by press fitting into aperture 90, or by a suitable connector. In operation, refrigerant or another suitable gas flows through suction tube 88 and aperture 90 into compression chamber 70 to be compressed therein by means of the
10 operation of roller 72 and the sliding vane (not shown), whereafter the compressed gas is discharged via a discharge valve (not shown) into discharge muffler 94. From discharge muffler 94 the gas passes through apertures 92 into the compressor housing.
15 The compressed refrigerant will flow out of housing 10 through discharge tube 84 to the condenser of a refrigeration circuit in a conventional manner.

Referring further to Figs. 1 and 2, end plate 80 also includes a radial passage 100 and two axial
20 passages 102 and 104. Axial passage 102 is aligned with axial bore 56. Axial passage 104 communicates with oil sump 106 in the bottom portion of housing bell 12 by means of an axial passage 106 in cylinder 68. Therefore, in operation, as crankshaft 30 is
25 rotated by motor 18, oil is drawn upwardly from sump 106, due to the suction pressure generated by the rotation of helical oil groove 44 in crankshaft 30. Oil flows through axial passage 104, radial passage 100, axial passage 102, axial bore 56, and radial
30 passage 58 to annular chamber 66, whereby the bearings of crankshaft 30 will be lubricated.

End thrust plate 80 is preferably constructed of a weldable material such as steel whereby the end plate will not be distorted as suction tube 88 is forced into suction aperture 90 or as end plate 80 is welded to housing bell 12. The thrust bearing surface 50 of crankshaft 30 bears against the end thrust plate 80 for bearing support thereby.

It should also be noted that, since compressor cylinder 68 is in intimate contact with end plate 80, and since end plate 80 is exposed to the ambient air, cooling of the compressor is substantially improved over conventional designs.

In conclusion therefore, what has been provided is a compact, economical construction of a rotary compressor wherein the conventional end plate for the compressor also serves as the end wall of the compressor housing. It should also be understood that while a horizontal crankshaft compressor has been illustrated, the exposed end thrust plate arrangement could also be used in a vertical axis compressor, although the lubrication arrangement provided therein would need to be rearranged from the arrangements disclosed for the horizontal crankshaft arrangement.

It should also be understood that, while in the preferred embodiment disclosed herein only a single sleeve bearing 64 has been provided, end plate 68 could be provided with a sleeve bearing portion and crankshaft 30 could be provided with an extension to be journaled in the sleeve bearing portion of end plate 80.

While this invention has been described as having a preferred design it will be understood that

it is capable of further modification. This application
 is therefore intended to cover any variations, uses,
 or adaptations of the invention following the general
 principles thereof and including such departures from
 the present disclosure as come within known or
 customary practice in the art to which this invention
 5 pertains and fall within the limits of the appended
 claims.

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CLAIMS

1. A rotary hermetic compressor comprising: an open ended shell member (12); an electric motor (18) including a rotor (26) and a stator (20); a rotatable
5 crankshaft (30) secured to said rotor (26) and driven thereby; a bearing member (64) for journalling said crankshaft (30); a cylinder (68) including a compression chamber (70); means (72) driven by said crankshaft (30) and disposed in said chamber (70) for
10 compressing a gas therein characterized by end plate means (80) sealingly secured to said shell member (12) for closing the open end of said shell member (12), said end plate means (80) supporting said cylinder (68) and including a thrust bearing surface
15 for supporting a rotating end surface (50) of said crankshaft (30).

2. The compressor according to Claim 1 including an oil sump (106) and a lubrication conduit comprising a vertical passage (100) in said end plate
20 (80) which extends into said oil sump (106) and axial bore (56) in said crankshaft (30), and a helical passageway (44) in the outer surface of said crankshaft, said passage (100), said bore (56), and said helical passageway (44) connected in series
25 relationship, whereby, upon rotation of said crankshaft (30), oil is pumped upwardly through said lubrication conduit for lubrication of said crankshaft bearing (64).

3. The compressor of Claim 1 wherein said
30 compressor further includes a suction tube (88) secured to said end plate (80), said end plate including a suction aperture (90) communicating with said compression chamber (70).

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4. The compressor according to Claim 2 wherein
said end plate is comprised of weldable material.

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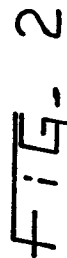
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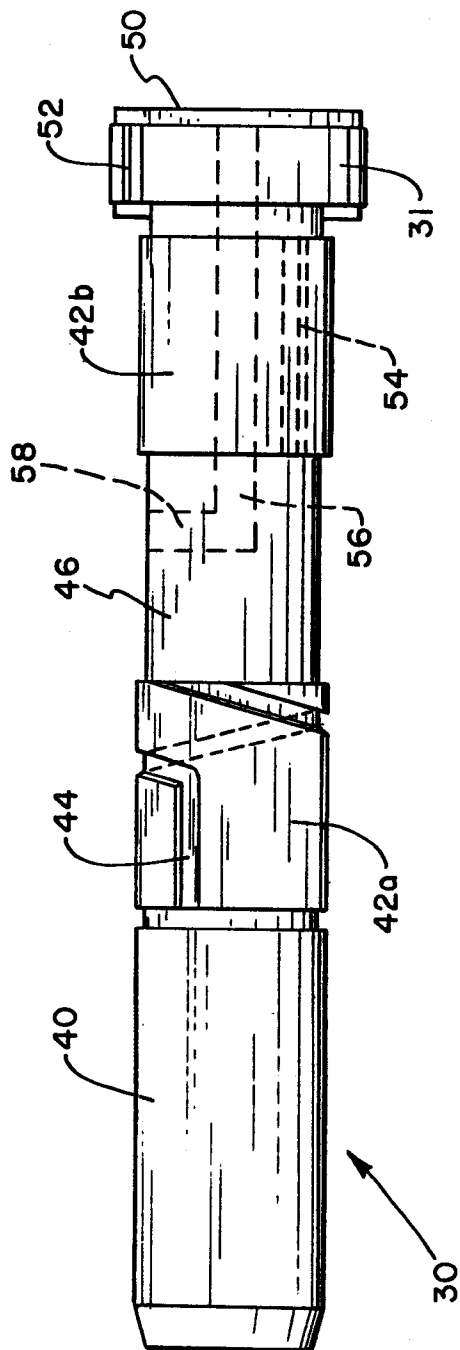


FIG. 3

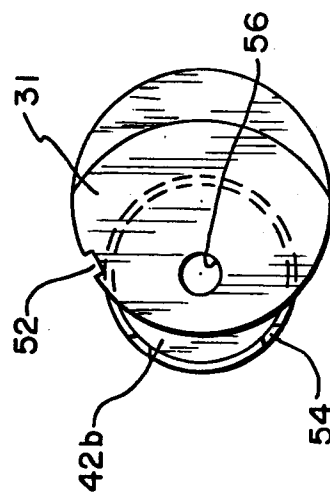


FIG. 4



European Patent
Office

EUROPEAN SEARCH REPORT

0227880

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86108252.7
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US - A - 1 925 166 (R.L.ALEXANDER) * Totality; especially claim; fig. 1 *	1,3,4	F 04 C 29/02 F 25 B 31/02
Y	--	2	F 04 C 23/00 F 04 C 27/00
Y	DE - A - 1 403 016 (BROWN, BOVERI) * Totality *	2	
A	-- US - A - 2 598 216 (BOUSKY) * Totality; especially fig. 1 *	1	
A	-- DE - B - 1 057 282 (GENERAL ELECTRIC) * Totality *	1	
A	-- DE - C - 822 393 (SIEMENS) * Totality; especially claim 1; fig. 2 *	1,4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 04 B 39/00 F 04 C 18/00 F 04 C 23/00 F 04 C 27/00 F 04 C 29/00 F 25 B 31/00
D,A	-- US - A - 2 612 311 (LELAND) * Totality *	1	

The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 09-04-1987	Examiner WERDECKER
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	