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(54) **A COMPRESSOR**

VERDICHTER

COMPRESSEUR

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(56) References cited:
US-A- 4 236 879 **US-A- 5 795 140**

- **PATENT ABSTRACTS OF JAPAN vol. 007, no. 104 (M-212), 6 May 1983 (1983-05-06) & JP 58 025594 A (HITACHI SEISAKUSHO KK), 15 February 1983 (1983-02-15)**

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Description

[0001] This invention relates to a compressor, preferably used in refrigerators, wherein the lubrication of the movable parts is improved.

[0002] In compressors, preferably used in refrigerators, lubrication is necessary for the movable parts of the compressor not to be affected by friction forces and, for heat to be discharged. In compressors, the lubrication of the bearings is achieved usually by rotation of the crank at high revolutions. The lubrication is performed by sucking the lubricant oil inside the compressor casing via an oil suction pipe at the lower portion of the crank and by conducting it to the movable/heated parts. Although a lubrication process performed by utilizing several channels located on the crank improves the lubrication efficiency, lubrication problems are encountered particularly in variable speed compressors at low revolutions.

[0003] In one of the applications in the current state of the art, in the United States Patent Document US 2766929, a description is given of a crank wherein the oil sucked from the inside of the said crank is conducted to upper bearings via a helix channel formed in the main bearing.

[0004] In another application in the current state of the art, in the United States Patent Document US 6416296, a description is given of a channel formed to increase the oil film thickness at the section around the lower oil hole on the crank.

[0005] In another application in the current state of the art, in the United States Patent Document US 4236879, a description is given of a compressor wherein lubrication can be performed in different line and directions by utilizing more than one oil passage bores and channels.

[0006] The aim of the present invention is the realization of a compressor wherein, in different operating conditions, the lubrication of the movable parts is improved.

[0007] The compressor designed to fulfill the objectives of the present invention is illustrated in the attached figures where:

[0008] Fig.1 - is a schematic representation of a compressor.

[0009] Fig.2 - is a schematic representation of a crank comprising more than one channel with different helix angles.

[0010] Fig.3 - is a schematic representation of a crank comprising more than one channel with the same helix angle.

[0011] Fig.4 - is a schematic representation of a crank comprising two helix channels meeting at a junction.

[0012] Elements shown in figures are numbered as follows:

1. Compressor
2. Lower casing
3. Cylinder
4. Piston
5. Crank
6. Connecting rod
7. Piston pin
8. Cylinder head
9. Upper casing
10. Suction muffler
11. Balance weight
12. Oil suction pipe
13. Throwing pipe
14. Guiding member
15. Motor
16. Channel outlet opening
17. Channel
18. Channel inlet opening
19. Junction
20. Oil transfer pipe

[0013] In household appliances, preferably in cooling devices, the circulation of the refrigerant used to realize the cooling, is achieved by means of a compressor (1).

[0014] The compressor (1) comprises a motor (15), a lower casing (2) that carries the parts inside the said compressor (1), an upper casing (9) above the lower casing (2), a cylinder (3) between the lower (2) and upper casing (9), which is utilized to pump the refrigerant gas inside, a cylinder head (8) on the cylinder (3) the head of which provides the circulation of the gas sucked and pumped, a piston (4) whereby the refrigerant gas is compressed in the cylinder hole, a crank (5) which transmits the motion obtained from the motor (15), a connecting rod (6) which transmits the motion obtained from the crank (5) to the piston (4), a piston pin (7) that connects the piston(4) and the connecting rod (6), a balance weight (11) used to diminish the negative effect of eccentricities of gravitational centers of the components such as the crank (5), the connecting rod (6) and the piston (4) with respect to the rotation axis of the crank (5), a throwing pipe (13) fixed to the rotation axis of the crank (5) at an angle, wherein the oil that comes from the crank (5) and lubricates the bearings is flung to the upper casing (9) by the rotation of the said pipe together with the crank (5), a guiding member (14) which ensures that the oil flung by the throwing pipe (13) does not reach the cylinder block and obstruct mixing with the refrigerant but is routed onto the connecting rod (6), piston (4) and piston pin (7) and a suction muffler (10) preferably made of plastic material whereby the refrigerant gas reaches the cylinder block without being heated and the noise that might be generated by the refrigerant gas is prevented.

[0015] The compressor (1) contains a preferably liquid fluid, which facilitates the motion of the operating parts and transfers the heat generated inside. In the preferred embodiment of the present invention, oil is utilized as the liquid fluid.

[0016] The crank (5) comprises an oil suction pipe (12) whereby the oil inside the lower casing (2) is conducted to the interior of the crank (5) by suction, an oil transfer pipe (20) transferring the oil to the throwing pipe (13) and to the upper portions of the crank (5), more than one channel (17), preferably in helical form, located at the outer surface, which are connected to each other at some point and wherein the oil proceeds upwards on the surface as a result of rotary motion, at least one channel inlet opening (18) for each channel (17) whereby the oil sucked from the oil suction pipe (12) is transferred to the channel (17), a channel outlet opening (16) which ensures that at least two of the channels (17) communicate with each other and with the oil transfer pipe (20) and that the oil is transferred to the inside of it and, a junction (19) where several channels (17) meet.

[0017] The crank (5), which transmits the rotary motion of the motor (15) to the piston (4) as linear motion by utilizing a connecting rod (6) mechanism, is a tight fit to the rotor and thus rotates as a consequence of the rotation of the rotor. The oil suction pipe (12) which preferably is a tight fit to the crank (5), provides the suction of the oil inside the lower casing (2) via the forces created as it rotates with the crank (5). Through the forces created during the rotation of the crank (5), it is achieved that the oil sticks to the surface of the crank (5) and thereby that an oil film (A) is formed in the crank (5). The thickness of the said oil film (A) at the level of the channel inlet opening (18), affects the amount of the oil transferred to the upper bearings and the starting of the lubrication at low revolutions. The oil sucked by the oil suction pipe (12) reaches the channel inlet opening (18) by passing through the crank (5) and diffuses through the channel inlet opening (18) into the channel (17). The oil that moves inside the channel (17) leaves the channel (17) through the channel outlet opening (16) and enters the oil transfer pipe (20) wherein it reaches the throwing pipe (13) that flings it into the compressor (1). In this way, it is achieved that the movable parts inside the compressor (1) are lubricated and thus, that the motion of the parts is facilitated as a result of the reduced friction and additionally, that the heat generated during the motion is transferred to the upper casing (9) via the oil that is flung to the said casing and consequently is discharged to the outside.

[0018] In one embodiment of the present invention, the crank (5) comprises two channel inlet openings (18) positioned approximately at the same distance to the inlet opening of the oil suction pipe (12), two channels (17), in the direction of the rotary motion of the crank (5), with different helix angles (α, β) and, communicating with each of the two channel inlet openings (18) and, a channel outlet opening (16) where the channels (17) meet and at the same time communicate with the oil transfer pipe (20); (Figure 2).

[0019] In another embodiment of the present invention, the crank (5) comprises two channel inlet openings (18) positioned approximately at the same distance to the inlet opening of the oil suction pipe (12), two channels (17), in the direction of the rotary motion of the crank (5), with the same helix angle (Φ) and, communicating with each of the two channel inlet openings (18), another channel (17) with a different helix angle (θ) from the helix angle (Φ) of the afore-mentioned channels (17) and a channel outlet opening (16) where this other channel (17) is connected to; (Figure 3).

[0020] In another embodiment of the present invention, the crank (5) comprises two channel inlet openings (18) positioned at the same or a different distance to the inlet opening of the oil suction pipe (12), two channels (17) with different helix angles (α, β) communicating with the channel inlet openings (18), a junction (19) where the said channels (17) meet and, a channel (17) that connects the junction (19) to the channel outlet opening (16); (Figure 4).

[0021] The channels (17) and the channel inlet opening (18) ensure that more amount of oil is transferred to the upper portions of the crank (5) and, by utilizing a throwing pipe (13), to the other movable parts. Moreover, by means of the channels (17) and the channel inlet openings (18) it is achieved that the hard-to-reach, movable and heated components are lubricated more easily.

[0022] By the embodiment in accordance with the present invention, it is accomplished that more amount of oil sucked from the oil film (A) in the crank (5) and that the lubrication can be performed at lower revolutions. Particularly in variable revolution compressors (1), proper operating is ensured at different revolutions. Furthermore, the oil flow rate is increased as a consequence of the improvement of the lubrication system according to the present invention and thereby, in addition to the ease of the motion obtained; extra means are provided to assist the discharge of the heat inside the compressor (1) to the surroundings. As a result of the discharge of the heat inside the compressor (1), the temperature of the inlet opening is decreased wherein, thermodynamically; the volumetric efficiency of the compressor (1) is increased.

Claims

1. A compressor (1) used in household appliances, preferably in refrigerators that comprises; a motor (15); and a crank (5), which transmits the motion obtained from the motor (15) and the crank (5) comprising; an oil suction pipe (12) whereby the oil is conducted to the interior of the crank (5) by suction so that the movable parts and the bearings that the said parts contact with while moving are lubricated during operating; an oil transfer pipe (20) transferring the oil to the upper portions of the crank (5); more than one channel (17) located at the outer surface, which are connected to each other at some point and wherein the oil proceeds upwards on the surface as a result of rotary motion; at least one channel inlet opening (18) for each channel (17) whereby the oil sucked from the oil suction pipe (12) is transferred to each channel (17); **characterised by** a junction (19) where at least two channels (17) meet and; a channel outlet opening (16) which communicates

with the oil transfer pipe (20) and ensures that the oil is transferred from each channel (17) to the inside of the oil transfer pipe (20).

2. A compressor (1) as described in Claim 1 wherein the channels (17) directly communicate with the oil transfer pipe (20) at their intersection point.

3. A compressor (1) as described in Claims 1 or 2 wherein the crank (5) comprises at least two channels (17), in the direction of the rotary motion of the crank (5), with different helix angles (α, β) and, communicating with each of the two channel inlet openings (18) positioned approximately at the same distance to the inlet opening of the oil suction pipe (12) and also communicating with each other and with the oil transfer pipe (20) at channel outlet opening (16).

4. A compressor (1) as described in Claims 1 or 2 wherein the crank (5) comprises two channels (17), in the direction of the rotary motion of the crank (5), with the same helix angle (Φ) and, communicating with each of the two channel inlet openings (18) positioned approximately at the same distance to the inlet opening of the oil suction pipe (12), another channel (17) with a different helix angle (θ) from the helix angle (Φ) of the afore-mentioned channels (17) and at least two channels (17) which connect this other channel (17) to the channel outlet opening (16).

5. A compressor (1) as described in Claim 2 wherein the crank (5) comprises at least two channels (17) in the direction of the rotary motion of the crank (5), with different helix angles (α, β), communicating with each of the two channel inlet openings (18) positioned at the same and/or a different distance to the inlet opening of the oil suction pipe (12) and, which reach the channel outlet opening (16) as one channel (17) after meeting at a junction (19).

Patentansprüche

1. Kompressor (1) zur Verwendung in Haushaltsgeräten, vorzugsweise in Kühlschränken, umfassend: einen Motor (15); und eine Kurbelwelle (5), die die vom Motor (15) erzeugte Bewegung überträgt, wobei die Kurbelwelle (5) Folgendes umfasst: eine Ölansaugleitung (12), durch die mittels Ansaugen Öl ins Innere der Kurbelwelle (5) geleitet wird, damit die beweglichen Teile und die Lager, mit denen die beweglichen Teile während ihrer Bewegung in Kontakt gelangen, während des Betriebs geschmiert werden; eine Ölübertragungsleitung (20), die das Öl an die oberen Abschnitte der Kurbelwelle (5) überträgt; mehrere Kanäle (17), die an der Außenfläche angeordnet sind, und die an einem Punkt miteinander verbunden sind, und in denen das Öl aufgrund einer Drehbewegung an der Fläche nach oben fließt; mindestens eine Kanaleinlassöffnung (18) für jeden Kanal (17), durch die Öl, das von der Ölansaugleitung (12) angesaugt wird, in den jeweiligen Kanal (17) geleitet wird; **gekennzeichnet durch** ein Anschlussstück (19), an dem sich mindestens zwei Kanäle (17) vereinigen; und eine Kanalauslassöffnung (16), die mit der Ölübertragungsleitung (20) in Verbindung steht, und die sicherstellt, dass das Öl von den einzelnen Kanälen (17) in das Innere der Ölübertragungsleitung (20) geleitet wird.

2. Kompressor (1) nach Anspruch 1, wobei die Kanäle (17) an ihrer Schnittstelle zur Ölübertragungsleitung (20) direkt mit dieser in Verbindung stehen.

3. Kompressor (1) nach Anspruch 1 oder 2, wobei die Kurbelwelle (5) mindestens zwei Kanäle (17) in Richtung der Drehbewegung der Kurbelwelle (5) umfasst, die unterschiedliche Steigungswinkel (α, β) aufweisen und in Verbindung mit den zwei Kanaleinlassöffnungen (18) stehen, welche annähernd in demselben Abstand zur Einlassöffnung der Ölansaugleitung (12) angeordnet sind, und die außerdem miteinander in Verbindung stehen, und an der Kanalauslassöffnung (16) auch mit der Ölübertragungsleitung (20) in Verbindung stehen.

4. Kompressor (1) nach Anspruch 1 oder 2, wobei die Kurbelwelle (5) zwei Kanäle (17) umfasst, die denselben Steigungswinkel (φ) aufweisen und in Verbindung mit den zwei Kanaleinlassöffnungen (18) stehen, welche annähernd in demselben Abstand zur Einlassöffnung der Ölansaugleitung (12) angeordnet sind, einen weiteren Kanal (17) mit einem anderen Steigungswinkel (θ) als dem Steigungswinkel (φ) der genannten Kanäle (17), und mindestens zwei Kanäle (17), die diesen Kanal (17) mit der Kanalauslassöffnung (16) verbinden.

5. Kompressor (1) nach Anspruch 2, wobei die Kurbelwelle (5) mindestens zwei Kanäle (17) in Richtung der Drehbewegung der Kurbelwelle (5) umfasst, die unterschiedliche Steigungswinkel (α, β) aufweisen und in Verbindung mit den zwei Kanaleinlassöffnungen (18) stehen, welche annähernd in demselben Abstand und/oder einem unterschiedlichen Abstand zur Einlassöffnung der Ölansaugleitung (12) angeordnet sind, und die die Kanalauslassöffnung (16) als ein Kanal (17) erreichen, nachdem sie sich an einem Anschlussstück (19) vereinigt haben.

Revendications

1. Un compresseur (1) utilisé dans les appareils ménagers, de préférence dans les réfrigérateurs, qui

comprend un moteur (15) ; et un arbre de transmission (5), qui transmet le mouvement obtenu du moteur (15), ledit arbre de transmission (5) comprenant à son tour un tuyau d'aspiration d'huile (12), par lequel l'huile est transmise à l'intérieur de l'arbre de transmission (5) par l'effet de l'aspiration pour que les pièces mobiles et les roulements avec lesquels sont en contact lesdites parties durant le mouvement soient lubrifiés au cours de l'opération ; un tuyau de transfert d'huile (20) pour transférer l'huile aux parties supérieures de l'arbre de transmission (5) ; plusieurs canaux (17), situés à la surface extérieure, lesquels étant reliés les uns aux autres à un point et dans lesquels l'huile s'étant élevée sur la surface suite aux mouvements rotatifs ; au moins un canal d'ouverture d'entrée (18) pour chacun des canaux (17), par lequel l'huile aspirée par le tuyau d'aspiration d'huile (12) est transférée à chacun des canaux (17) ; **caractérisé par** une jonction (19) où au moins deux canaux (17) se réunissent ; et un canal d'ouverture de sortie (16) qui communique avec le tuyau de transfert d'huile (20) et qui permet le transfert de l'huile à partir de chacun des canaux (17) vers l'intérieur du tuyau de transfert d'huile (20).

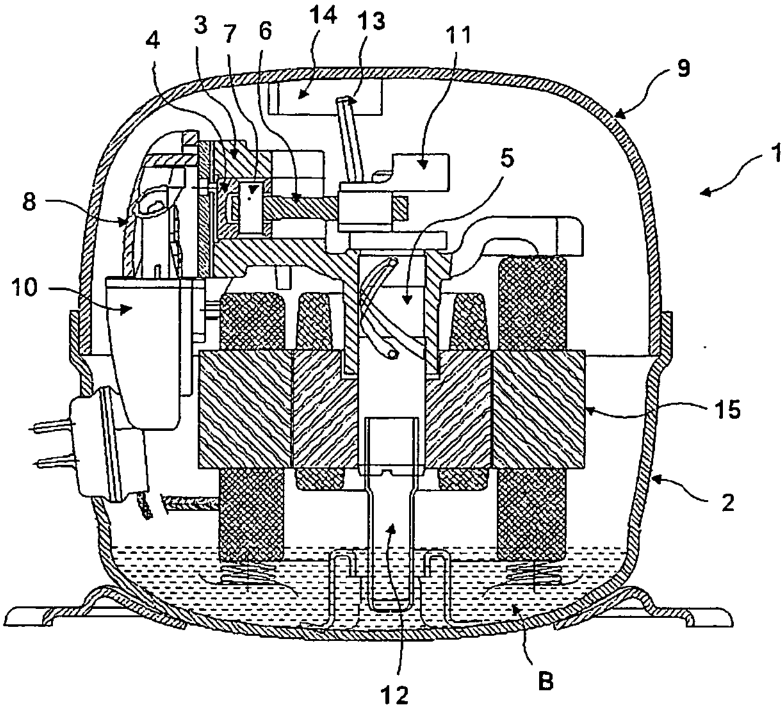
2. Un compresseur (1) selon la Revendication 1, dans lequel les canaux (17) communiquent directement avec le tuyau de transfert d'huile (20) à leur point d'intersection.

3. Un compresseur (1) selon la Revendication 1 ou 2, dans lequel l'arbre de transmission (5) comprend au moins deux canaux (17) à différents angles d'hélice (α, β) dans la direction du mouvement rotatif de l'arbre de transmission (5), et communiquant avec chacun des deux canaux d'ouverture d'entrée (18) situés approximativement à même distance à l'ouverture d'entrée du tuyau d'aspiration d'huile (12) et se communiquant également l'un avec l'autre et avec le tuyau de transfert d'huile (20) au canal d'ouverture de sortie (16).

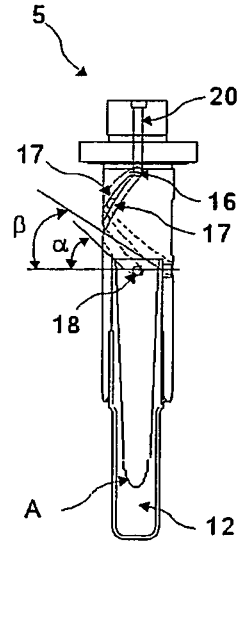
4. Un compresseur (1) selon la Revendication 1 ou 2, dans lequel l'arbre de transmission (5) comprend au moins deux canaux (17) à mêmes angles d'hélice (Φ) dans la direction du mouvement rotatif de l'arbre de transmission (5), et communiquant avec chacun des deux canaux d'ouverture d'entrée (18) situés approximativement à même distance à l'ouverture d'entrée du tuyau d'aspiration d'huile (12), un autre canal (17) à un angle d'hélice (θ) différent de l'angle d'hélice (Φ) des canaux susmentionnés (17) et au moins deux canaux (17) qui relient cet autre canal (17) au canal d'ouverture de sortie (16).

5. Un compresseur (1) selon la Revendication 2, dans lequel l'arbre de transmission (5) comprend au moins deux canaux (17) à différents angles d'hélice (α, β) dans la direction du mouvement rotatif de l'arbre de transmission (5), et communiquant avec chacun des deux canaux d'ouverture d'entrée (18) situés à même et/ou différente distance à l'ouverture d'entrée du tuyau d'aspiration d'huile (12) et atteignant le canal d'ouverture de sortie (16) pour devenir un seul canal (17) après la rencontre à la jonction (19).

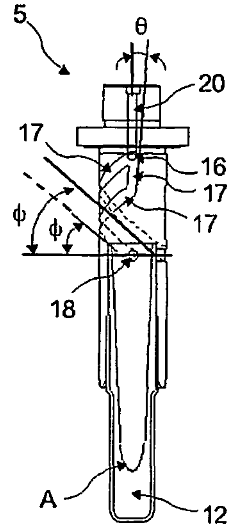
[Fig. 001]



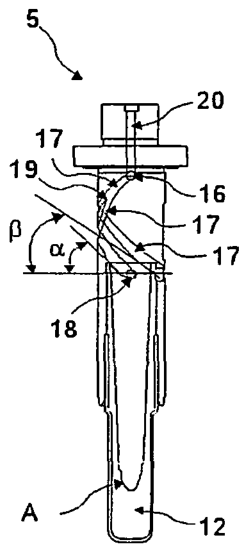
[Fig. 002]



[Fig. 003]



[Fig. 004]



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2766929 A **[0003]**
- US 6416296 B **[0004]**
- US 4236879 A **[0005]**