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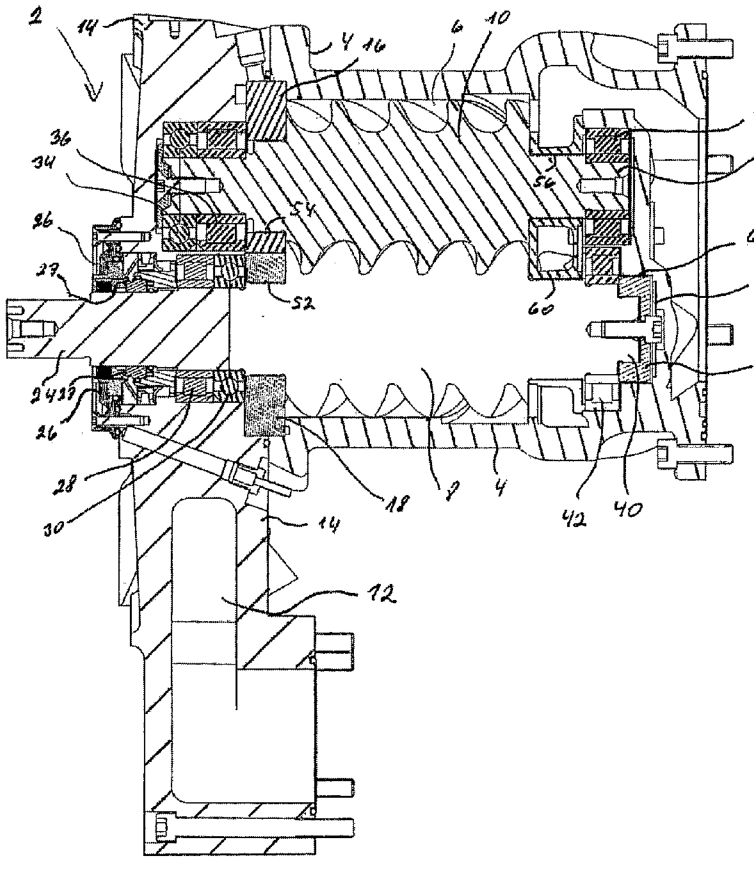
(54) **Title:** SCREW COMPRESSOR WITH INTEGRAL OIL CHANNELS



(57) Abstract: A method for lubricating a screw compressor and a screw compressor, comprising a compressor housing (4), which housing comprises a male (8) and a female (10) screw rotor and at least one oil inlet (12), from which oil is distributed to lubricate mechanical parts in conjunction with the compressor. The compressor housing (4) is connected to a bearing housing (14), where rotor endplates (16,18) comprise cutouts for discharge ports, which endplates are placed between the screw rotors (8,10) and the bearing housing (14), where oil at least at a first high pressure is distributed in integrated channels formed in the compressor components and where the longitudinal oil channels are formed in the compressor housing (4) along the screw rotors (8,10), and where oil channels mostly parallel to the rotational axes of the screw rotors can be formed at least in the bearing housing (14) and in the rotor endplates (16,18).

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SCREW COMPRESSOR WITH INTEGRAL OIL CHANNELS

Field of the Invention

The present invention relates to a screw compressor for gaseous refrigerants primarily, comprising a compressor housing, which housing comprises a male and a female screw rotor arranged in screw rotor bores in the compressor housing, which male and female rotors are co-rotatingly driveable and interact to compress the refrigerant, which compressor comprises at least one oil inlet, from which oil inlet oil is distributed to lubricate mechanical parts in conjunction with the compressor.

The present invention further relates to a method for lubricating a screw compressor, which screw compressor is used for gaseous refrigerants primarily, and which screw compressor comprises a compressor housing, which housing comprises male and female rotors which are co-rotatingly drivable and interact to compress the refrigerant, where pressurized oil is supplied to an oil inlet, from which oil inlet oil is distributed to lubricate mechanical parts in conjunction with the compressor.

Background of the Invention

US 6,409,490 describes a screw compressor, which screw compressor comprises guide bushings mounted within bores for the bearings to support the compressor rotor shafts. First bushings are provided at an inlet casing of the compressor and provide guidance for a slide stop, and second bushings are provided in an outlet casing of the compressor to provide guidance for a slide valve. The bushings are also mounted to the inlet and outlet casings to provide centring of two sections of the compressor rotor housing.

An unpublished Danish patent application PA 2005 01757 relates to a screw compressor and a method for operating the compressor for gaseous refrigerants primarily, which screw compressor comprises a compressor housing having a male and a female screw rotor arranged in screw rotor bores, where the male and female rotor are co-rotatingly drivable and interact to compress the refrigerant, and where the screw compressor comprises at least one slider, which slider is movable in relation to the male and the female rotor, and where movement of the slider controls the internal volume ratio of the screw compressor.

Object of the Invention

It is the object of the invention to secure oil distribution to moving parts in a screw compressor.

It is a further object of the invention to avoid pipework for distributing oil in relation to a screw compressor.

Description of the Invention

This object can be achieved with a compressor as described in the preamble of claim one where the compressor is modified such that the compressor housing is connected to a bearing housing, where rotor endplates comprise cutouts for discharge ports, which endplates are placed between the screw rotors and the bearing housing, where oil at least at a first high pressure is distributed in integrated channels formed in the compressor components and where the longitudinal oil channels are formed in the compressor housing along the screw rotors, and where oil channels mostly parallel to the rotational axes of the screw rotors can be formed at least in the bearing housing and in the rotor endplates.

This way all oil distribution in conjunction with the screw compressor can take place in integrated channels inside some of the compressor components. In the screw compressor there is no need for an oil outlet because the oil is contained in the discharge gas leaving the compressor. By using integrated oil channels, oil piping around the compressor, through which oil is supplied to different components, is avoided. The piping outside the compressor is vulnerable, expensive and complicated in construction particularly when using variable speed control, in which case it is difficult to avoid resonance throughout the entire speed range. During manufacture of the compressor there is always the risk that one or more pipes are connected wrongly, or that they are damaged during transport. By integrating the oil channels into different components these channels are perfectly and inherently produced, as the components can be mass-produced according to computer methods. Many of the oil channels can be formed internally in the rotor endplate, which endplates can comprise perimetrical channels to form a great part of the oil distribution system. This way most of the mechanical tooling has to take place inside the endplate. Only a small number of channels have to be formed in the compressor housing and in the bearing housing. However, especially in an area between the bearing housing and the endplates some channels can be formed to distribute oil to the front end of the compressor.

It is preferred that longitudinal oil channels can be formed in the compressor housing along the screw rotors, where oil channels mostly being perpendicular to the rotational axes of the screw rotors can be formed at least in the bearing housing and in the rotor endplates. Hereby is achieved that longitudinal oil channels are formed in longitudinal components such as the compressor housing. However, every cross-over channel, which is mostly perpendicular to the longitudinal channel, is as such formed in the rotor endplates mostly as circular channels or as channels in the bearing housing. This results in perfect oil distribution, which is integrated in the compressor components.

Preferably, the bearing housing comprises a first integrated oil channel leading towards a shaft seal, from which shaft seal oil returns through a second channel integrated in the bearing housing, which second channel is connected to a first channel in a first endplate, which first endplate comprises an integrated pressure reduction valve for generating oil supply at a second pressure slightly below the discharge pressure of the compressor. Hereby is achieved that oil at high pressure is led towards the shaft seal. This allows the shaft seal to be operated at an oil pressure nearly as high as the gas pressure. The shaft seal has to prevent refrigerant leaving the compressor along the shaft. The oil that leaves the shaft seal flows towards an area, where the pressure is slightly lower, and which lower pressure is regulated by a pressure reduction valve, and where the pressure reduction valve ensures that the oil pressure difference across the shaft seal is controlled and always relative to the discharge pressure of the compressor.

The outlet from the integrated pressure reduction valve can be formed as a second channel in the first endplate, which second channel can be connected to a first channel in the compressor housing, from which first channel oil is injected into the rotor housing for rotor lubrication, compression sealing and heat dissipation. Hereby is achieved that most of the oil can be sent to an inlet into the compressor housing for lubricating the rotors in relation to each other and in relation to the rotor housing. The oil injected into the compressor housing will be contained in the refrigerant probably as an oil mist, where the oil is transported along the screw rotors and furthermore the oil is contained in the refrigerant flowing through the discharge port.

A first pressure chamber can be formed between a rotating balance piston and the compressor housing at the suction end of the male screw rotor. The balance piston is placed at the end and around the suction end of the male screw rotor shaft, where the first pressure chamber is connected through a third longitudinal oil channel in the compressor housing and further through a fourth oil channel formed in one of the end-plates towards the oil pressure supply, where the oil pressure in the first pressure chamber forces the balance piston and the male rotor towards the pressure end of the male screw rotor. Hereby is achieved that the oil pressure forces the male rotor towards the discharge end. Hence, it is possible to compensate for forces acting in the opposite direction.

The pressure is dependent on the compressor discharge pressure, as the oil pressure is controlled by the compressor discharge pressure. This way the thrust force on the male rotor is automatically reduced.

From the first pressure chamber an oil film can be generated, which oil film flows along the end and around the balance piston to lubricate the male rotor bearings at the suction end of the rotors from where an oil film flows towards the bearing supporting the suction end of the female rotor. Hereby is achieved that the oil leaving the pressure chamber at the end of the male rotor flows further towards the bearings to lubricate the bearings at the suction end of both the male and the female rotors.

Oil of the second pressure can be connected to a magnetic valve through channels in the compressor housing, from where oil flows into a second pressure chamber formed behind a slider to force the slider forwards, which slider co-operates with the screw rotors and the discharge opening in the rotor endplates. Hence, it can be achieved that the oil distribution system also can be used as a hydraulic supply to operate a hydraulic slider. This slider operates against the discharge pressure of the compressor, and when the oil pressure, which operates against this pressure is automatically adjusted in relation to the discharge pressure, there will be achieved an efficient control of the slider simply because closing of the magnetic valve can lead to a reduction of the pressure such that the slider moves backwards and opening of the magnetic valve increases the pressure and the slider will be moved forward. It is also possible to turn the magnetic valve on and off i.e. by pulse width modulation to achieve slider adjustment into different positions.

The second pressure chamber can be connected through a bleed valve towards low pressure in the housing. Thus, it can be achieved that the pressure is reduced automatically as soon as the magnetic valve closes. This allows control of the magnetic valve for controlling the pressure in the chamber behind the slider at pressure levels depending on the outlet pressure and depending more or less on the compressor suction pressure.

The invention also concerns a method for lubricating a screw compressor as described in the preamble of claim 10, which method is modified such that oil is distributed in integrated channels formed at least in the compressor housing in a bearing housing and in rotor endplates. Thus, the lubrication system of a screw compressor can be achieved without pipe work as all channels are integrated in the different compressor components.

Detailed Description of the Invention

Fig. 1 shows a sectional view of a screw compressor 2 comprising a compressor housing 4, which compressor housing 4 comprises rotor borings 6 for screw rotors 8 and 10. An oil inlet is indicated by 12 in a bearing housing 14. Between the bearing housing 14 and the compressor housing 4 rotor endplates 16 and 18 are placed. The male rotor 8 has a driving shaft 24, which driving shaft 24 co-operates with a shaft sealing 26 placed in the bearing housing 14. The bearing housing 14 further comprises a roller bearing 28 and a ball bearing 30. The female rotor 10 has a shaft 32, which shaft 32 co-operates with the bearing housing 14 through a ball bearing 34 and a roller bearing 36. At the suction end of the male rotor the male rotor has a shaft 40, which shaft 40 is supported by a roller bearing 42. The female rotor 10 also has a shaft 44 at the suction side. The shaft 44 is supported through a roller bearing 46. The shaft 40 of the male rotor 8 co-operates with a balance piston 48 between which balance piston 48 and the housing a pressure chamber 50 is formed. Between the male rotor 8 and end plate 18 a labyrinth seal 52 is formed. Furthermore, a labyrinth seal is formed at the end plate 16 towards the female rotor 10, and at the suction end of the female rotor 10 labyrinth seal 56 is formed. Between the male rotor suction ends a labyrinth seal 60 is formed. The balance piston 48 also comprises a labyrinth seal 62 in the direction towards the housing.

During operation oil is supplied to several different positions in the screw compressor. Oil is supplied to the shaft seal 26 and 27 at relatively high pressure assuring that the oil is forced into the bearing to make the shaft seal tight to prevent refrigerant from entering. Furthermore, oil is supplied to all the mentioned bearings 28, 30, 42 and 46. These bearing are supplied with oil through labyrinth sealings 52, 54, 56 and 60. This assures that only a relatively small amount of oil flows through the bearings.

Fig. 2 shows a possible embodiment of a rotor bearing housing 100, which could be the bearing housing 14 in fig. 1. The bearing housing 100 has an opening 102 for the drive shaft 24 and for the shaft seal 26 the bearings 28 and 30 all seen in fig. 1. The bearing housing comprises a recess 104 for support of the shaft 32 and the bearings 34 and 36 from fig. 1. The housing 100 further comprises a first oil channel 106 connected to an oil inlet 105, which oil channel 106 leads oil towards the shaft seal 26 seen in fig. 1. A second oil channel 108 leads oil back from the shaft seal 26 in fig. 1 towards a pressure reduction valve, which is placed in the opening 110. From the pressure valve opening another oil channel 112 leads into another channel 114 from where oil is led into channels in the female rotor endplate 16 in fig. 1. The bearing housing 100 further comprises a recess 116 and 118 for the rotor endplate 16 and 18 in fig. 1.

Fig. 3 shows a sectional view of part of a compressor housing 202, which comprises a rotor boring 204. The compressor housing comprises a planar front 210, which planar front comprises an opening 216 into the rotor boring 204. Around the opening 216 is a recess 212 for support of the rotor endplate 16 shown in fig 1. Furthermore, fig. 3 shows an oil channel 206 leading to an oil inlet 208 injecting oil into the rotor mesh. An oil channel 230 is formed in the housing for leading oil towards the bearings at the suction side of the screw compressor.

Fig. 4 shows the compressor housing 202 seen from the discharge end showing the oil channel 206 in the end face 210. The end face comprises openings 216 and 218 for the screw rotors 8, 10 in fig. 1. A recess 212 and 214 is indicated around the openings 216 and 218 for supporting the rotor endplates 16 and 18 in fig 1.

Fig. 5 shows a sectional view of a female endplate 302, which female endplate is known as number 16 in fig. 1. At the side of the female end plate is seen a cutout 304, which cutout 304 is connected to the channel 206 indicated in fig. 4. The female end plate 302 has a discharge cutout 306. The female endplate 302 has a planar side 307 in which planar side 307 a channel 316 is indicated. Furthermore, an inlet 312 for oil is indicated. The oil inlet is connected to an opening 314 intended for a pressure reduction valve. The outlet from the pressure reduction valve is connected to a channel 316. A central rotor shaft opening 308 comprises a circular oil channel 310, which circular channel 310 is connected to a very small opening in the oil channel 318.

Fig. 6 shows a male rotor endplate 330, which is indicated as number 18 in fig. 1. An oil channel 332 is indicated, which oil channel communicates with the oil supply in the compressor housing. Another opening is indicated as 334, which opens towards an internal channel known as channel 338 in fig. 7. The male rotor endplate furthermore has a discharge opening 336 and a central opening 338 for a rotor shaft.

Fig. 7 shows a sectional view of fig.6. The sectional view is seen from lines B-B and thus shows channel 338, which has a very small opening 340 for supplying the inner bearing with oil. The oil channel 338 continues, and oil can leave the endplate through an opening 342.

Fig. 8 shows a sectional view of a compressor housing 400, which is identical to the compressor housing 4 seen from fig. 1. The compressor housing 400 has a boring 402 for the screw rotors, which are not shown in fig. 8. A slider boring 404 with an angle towards the compressor housing 400 is shown. The slider boring 404 ends in an opening 406, which opening has to co-operate with the end of a slider. An opening 408 is seen in the side of the housing, which opening 408 is for a magnetic valve, which valve is connected to line 410 towards an oil pressure source. The opening 406 is connected through an oil line 412 towards an opening 414 in the compressor housing, where oil is led towards the screw rotors where the pressure is relatively low. Another channel 416 for return oil is connected at 422 to return oil from the rotor bearings placed at the suction end of the compressor face.

Fig. 9 shows a compressor housing 400 seen from the suction side of the rotors. A slider housing 404 comprises a slider opening 406. At the end face is indicated the opening 420, and the opening 426 of another oil channel 430 is leading oil towards the rotor bearings at the suction side.

Fig. 10 shows a principal diagram of the entire oil supply system used in a screw compressor system. An oil separator 502 receives refrigerant and oil coming from the compressor system, where oil flows into an oil reservoir 504 from where the oil is sent to an oil cooler 506 before being sent to an oil filter 508. Filtrated oil is distributed through channel 510 leading from the oil filter 508 where channel 510 is connected to a volume at the end of a balancing piston 514, which balancing piston 514 acts against pressure forces acting on the male rotor. By using the balancing piston 514 these acting forces are partly reduced. Oil leaves the volume at the end of the balancing piston through a labyrinth tightening 515 from where oil flows through a line 516 towards restriction means 518 towards a labyrinth tightening 520 and towards bearings 522. Oil leaving these bearings 522 is led towards the compressor housing to lubricate the rotors. From the filter 508 there is another line 512 leading towards a shaft seal 530 comprising flow restrictions 532. Oil flows from the shaft seal towards a lip seal 538 to which line 538 is connected towards a pressure regulation valve 539. The oil from line 538 furthermore flows towards restriction means 540, which lead towards another labyrinth seal 544 and towards the bearings 542.

CLAIMS

1. A screw compressor (2) primarily for gaseous refrigerants, which screw compressor comprises a compressor housing (4), which comprises a male (8) and a female screw rotor (10) arranged in screw rotor bores (6) in the compressor housing (4), which male (8) and female rotor (10) are co-rotatingly driveable and interact to compress the refrigerant, which compressor comprises at least one oil inlet (12), from which oil inlet (12) oil is distributed to lubricate mechanical parts in conjunction with the compressor where the compressor housing is connected to a bearing housing (14), where rotor endplates (16,18) comprise cutouts for discharge ports (20,22), which endplates (16,18) are placed between the screw rotors(8,10) and the bearing housing (14), **characterized in** that oil at least at a first high pressure is distributed in integrated channels formed in the compressor components, where longitudinal oil channels are formed in the compressor housing (4) along the screw rotors (8,10), where oil channels that are mostly not parallel to the rotational axes of the screw rotors (8,10) are formed at least in the bearing housing and in the endplates (16,18).

2. Screw compressor according to claim 1 characterized in that the bearing housing (14,100) comprises a first integrated oil channel (106) towards a shaft seal (26), from which shaft seal (26) oil returns through a second channel (108) integrated in the bearing housing (14,100), which second channel (108) comprises oil at a pressure level defined by an integrated pressure reduction valve (110) upstream connected to the first channel (106) for prioritizing the shaft seal lubrication.

3. Screw compressor according to claim 1or 2, **characterized in** that the outlet (112) from the integrated pressure reduction valve (110) is formed as a second channel (114) in the bearing housing (14) covered by the first endplate (16), which second channel (114) is connected to a first channel (206) in the compressor housing, from which first channel (206) oil is injected into the rotor housing (2,202)for rotor lubrication, compression sealing and heat dissipation.

4. Screw compressor according to one of claims 1-3, **characterized in** that a first pressure chamber (50) is formed between an balance piston (48) and the compressor

housing (4) at the suction end of the male screw rotor (8), which balance piston (48) is placed at the end and around the suction end of the male screw rotor axis (40), where the first pressure chamber (50) is connected through a third longitudinal oil channel (228, 230, 426) in the compressor housing (4,202,400) and further through a fourth oil channel formed in one of the rotor endplates (16,18) towards the oil pressure supply (106), where the oil pressure in the first pressure chamber (50) forces the balance piston (48) and the male rotor (8) towards the pressure end of the male screw rotor (8).

5. Screw compressor according to claim 4, **characterized in** that from the first pressure chamber (50) the clearance between the balance piston (48) and the boring in compressor housing generates a limited oil flow to lubricate the male rotor bearings (42) at the suction end (40) of the male rotor (8) from where the oil flows towards the bearing (46) supporting the suction end (44) of the female rotor (10).

6. Screw compressor according to claim 1-3, **characterized in** that oil from the oil supply (106) through channel (224) is distributed through channels (410) in the compressor housing (4,202,400) connected to a magnetic valve (408) from where oil flows into a second pressure chamber (406) formed behind a slide to force the slide forwards, which slide co-operates with the screw rotors (8,10) and the discharge opening(306,336) in the rotor endplates (16,18, 302,330).

7. Screw compressor according to claim 6, **characterized in** that the second pressure chamber (406) is connected through a clearance to form a bleed towards a channel (412) connected to a low pressure in the compressor housing (4,202,400).

8. Method for lubricating a screw compressor (2), which screw compressor primarily is used for gaseous refrigerants, which screw compressor comprises a compressor housing (4), comprising male (8) and female rotor (10) which are co-rotatingly driveable and interact to compress the refrigerant, where pressurized oil is supplied to an oil inlet, from which oil inlet oil is distributed to lubricate mechanical parts in conjunction with the compressor **characterized in** that oil is distributed in integrated channels formed at least in the compressor housing, in a bearing housing and in rotor endplates.

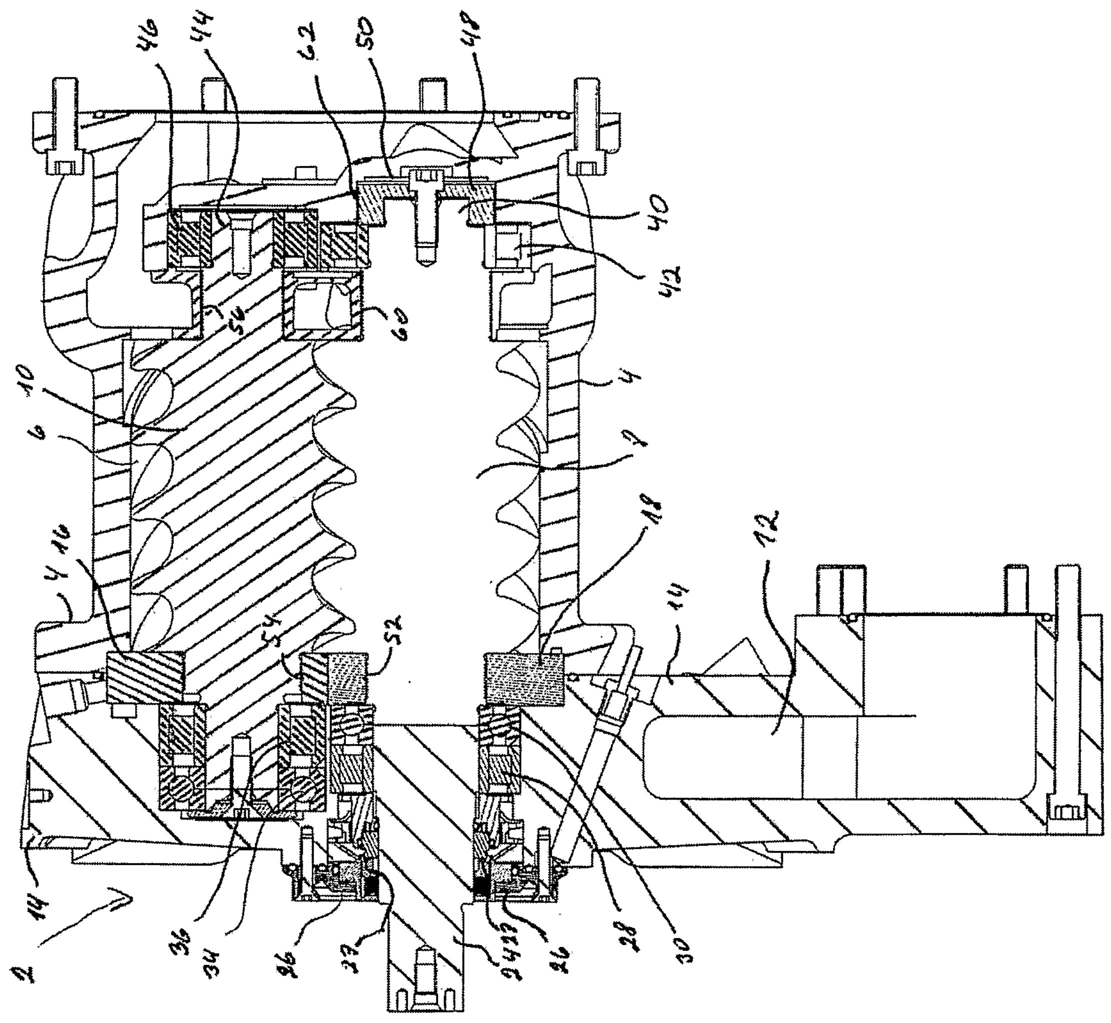

Fig. 1

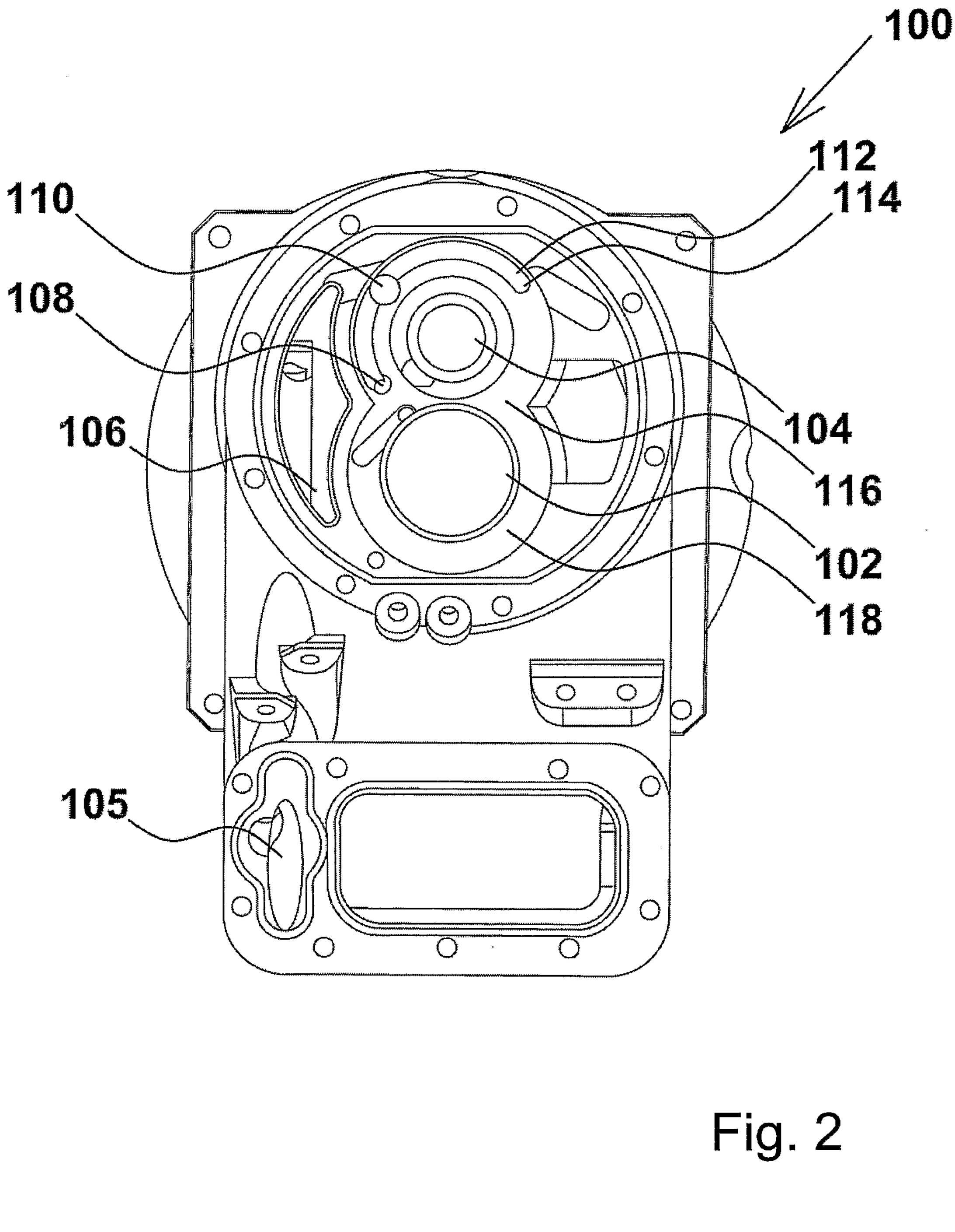

Fig. 2

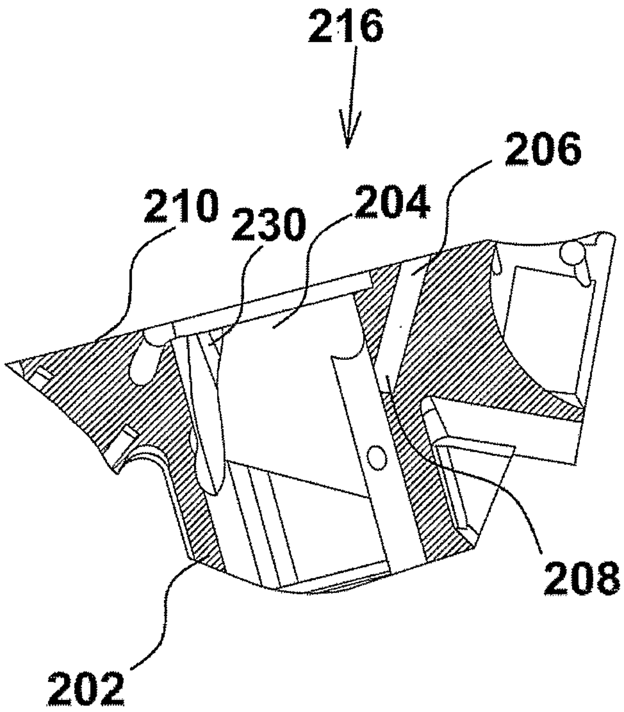

Fig. 3

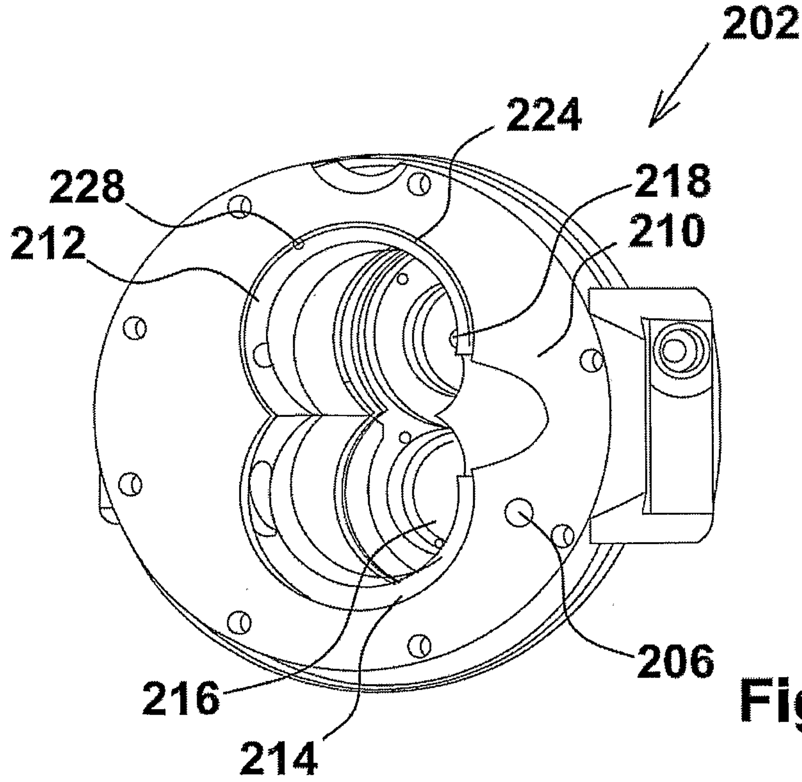

Fig. 4

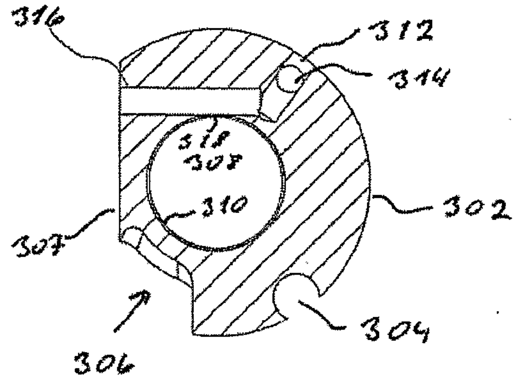

Fig. 5

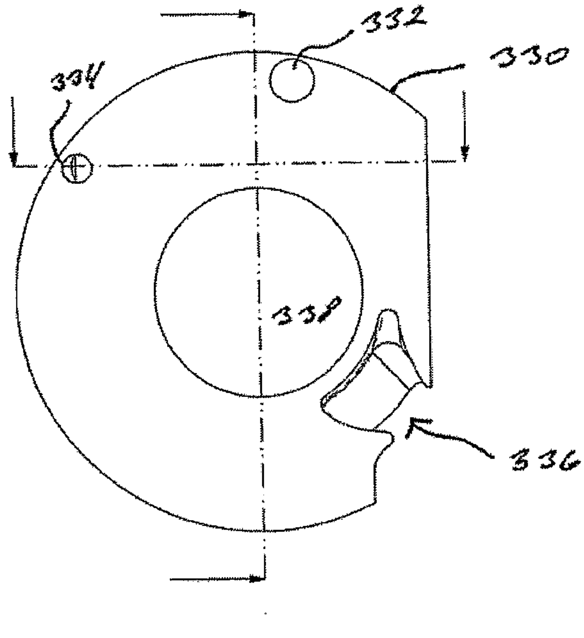

Fig. 6

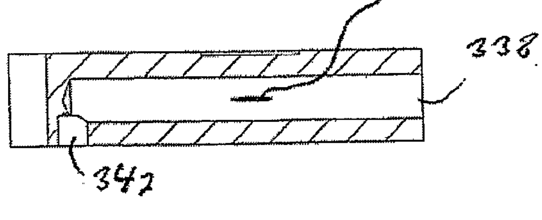

Fig. 7

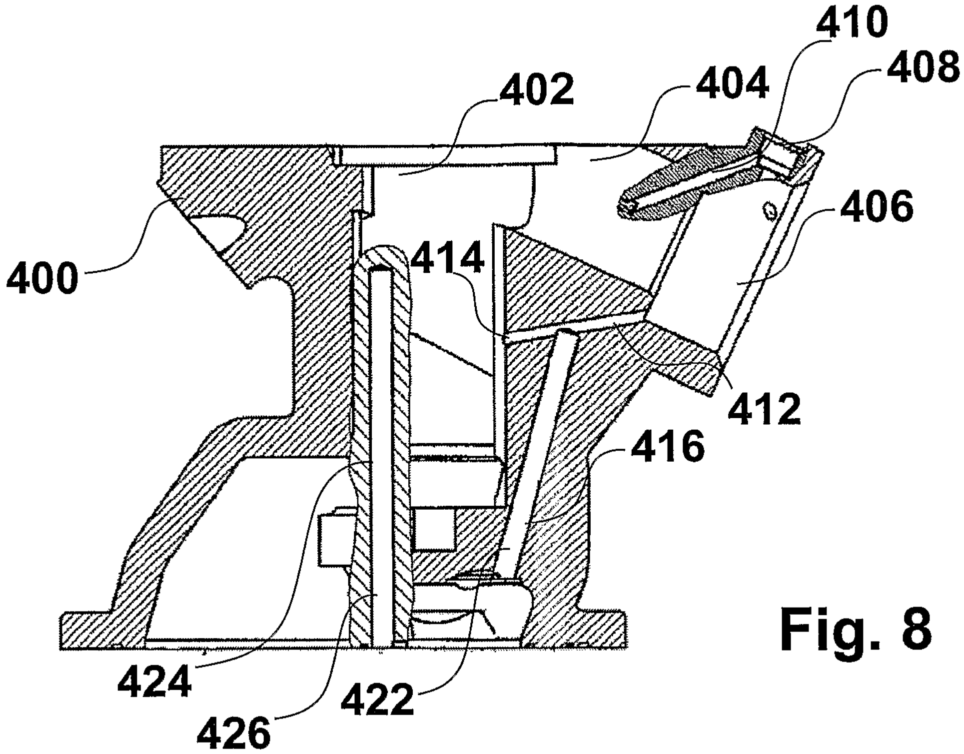
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Fig. 8

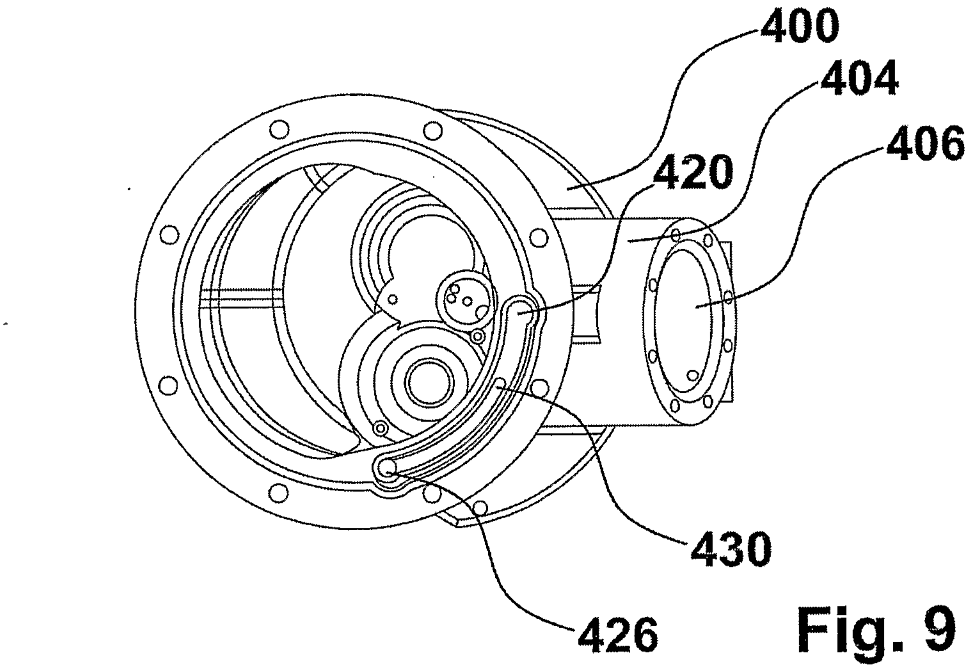
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Fig. 9

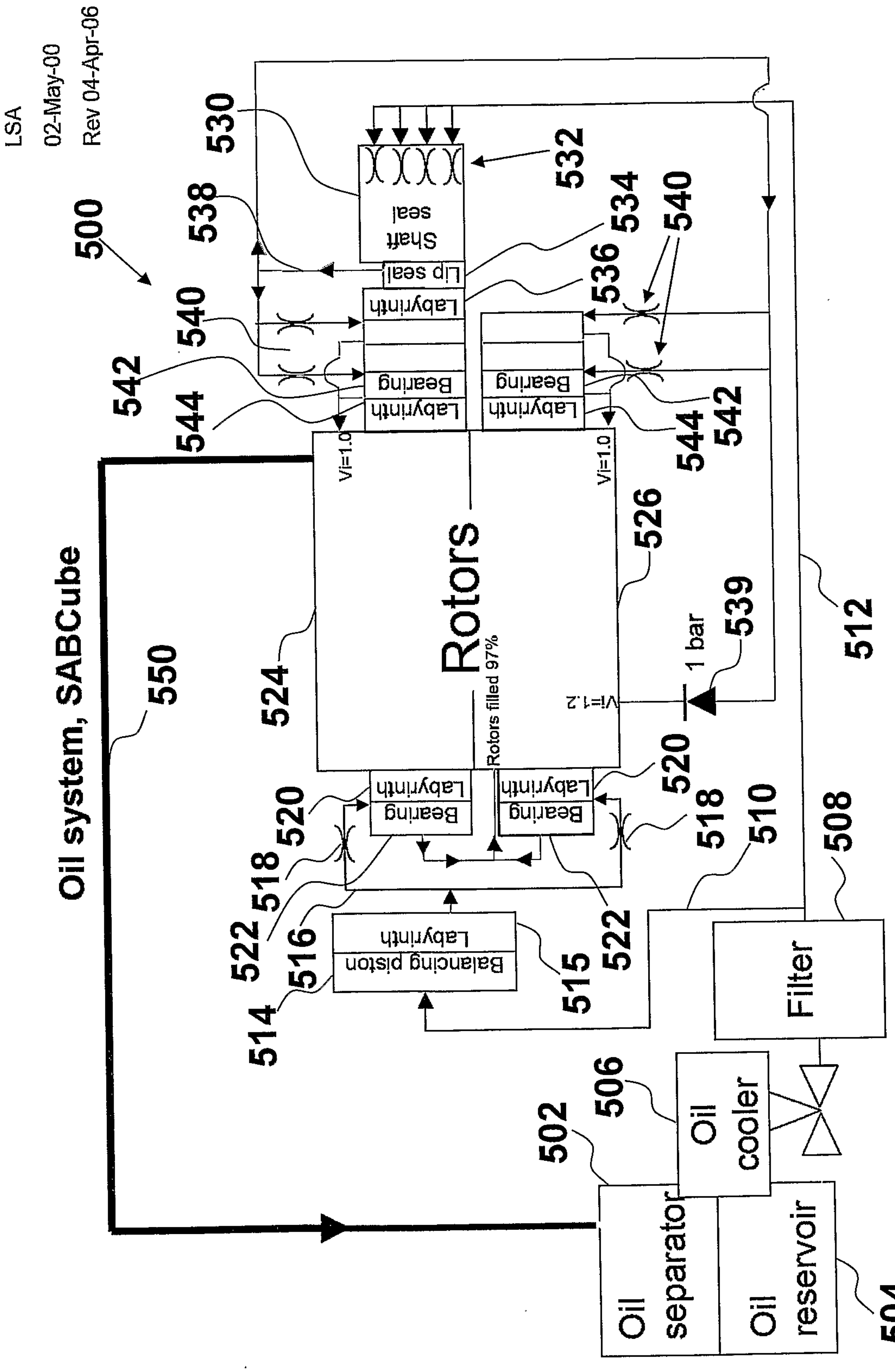
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Fig. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2007/000207

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04C18/16 F04C29/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04C F25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 58 082086 A (EBARA MFG) 17 May 1983 (1983-05-17) abstract; figure 4	1,8
X	JP 58 082087 A (EBARA MFG) 17 May 1983 (1983-05-17) abstract; figure 4	1,8
A	GB 665 565 A (LJUNGSTROMS ANGTURBIN AB) 23 January 1952 (1952-01-23) claim 1; figures 1,2	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
6 August 2007	13/08/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Descoubes, Pierre

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Information on patent family members

International application No
PCT/DK2007/000207

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 58082086	A	17-05-1983	NONE		
JP 58082087	A	17-05-1983	JP	1047637 B	16-10-1989
			JP	1564785 C	12-06-1990
GB 665565	A	23-01-1952	NONE		