

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a scroll type fluid machine which injects oil into fluid working chambers, where refrigerant compression and other work are carried out, so as to seal the fluid working chambers.

2. Description of the Prior Art

It has been conventional practice, for example as disclosed in Japanese Patent Laid-Open Publication No. 88988/1991 and shown in Fig. 20, that a sealed casing D of high-pressure resistant cylinder type is internally provided with a stationary scroll A and a movable scroll B each having spiral ridges *a* and *b*, respectively, wherein a low-pressure gas taken in a spiral-peripheral portion via a suction tube L is compressed in fluid working chambers C defined between the spiral ridges *a* and *b*, and then the compressed high-pressure gas is released into the sealed casing D through a discharge hole H provided at the center of the stationary scroll A. Also, to seal and thereby keep hermetical the inside of the fluid working chambers C, which vary in pressure from low pressure range on the spiral periphery side to high-pressure range on the spiral center side, an oil injection tube J extending from an oil sump provided at a bottom of the sealed casing D under a high-pressure atmosphere is connected to a working chamber C falling within intermediate-pressure range on the way of compression process so as to enable an oil injection by differential pressure, so that oil films necessary for sealing can be formed to slidable contact surfaces between the spiral ridges *a* and *b*.

However, in the above-described arrangement, the high-pressure oil sump and the working chambers C are normally communicated with each other via the oil injection tube J and, as a result, oil is always injected into the working chambers C such that the quantity of injected oil is likely to result in an excessive one. To avoid this, the oil injection tube J is required to be a small-in-dia. capillary tube to restrict the flow rate of the oil, which causes high cost and moreover involves a complicated selection of the diameter of the capillary tube, for example. As a consequence, controlling the oil quantity becomes difficult, to a disadvantage.

A prior art that is also of interest is that disclosed in EP-A-0 217 349 since it discloses a scroll type fluid machine having all of the features disclosed in the pre-characterizing part of the accom-

panying Claim 1.

Of interest also is JP-A-59939 82 that teaches how a scroll type fluid machine can be provided with oil feed chambers and oil lines in the housing, which communicate with communicating means 102 provided in the end plate of a second scroll so as to be communicated with a working chamber and further to be intermittently communicated with an oil feed chamber as the second scroll revolves.

SUMMARY OF THE INVENTION

An object of the present invention is therefore to provide a scroll type fluid machine which is devised in the way that oil is injected into fluid working chambers so that it can perform proper oil injection without using any capillary tube.

Another object of the present invention is to provide a scroll type fluid machine which is devised in the way that oil is injected into fluid working chambers so that it can perform proper oil injection into the fluid working chambers while an axial force of a second scroll toward a first scroll can be prevented from becoming an excessive one.

In order to achieve the aforementioned object, there is provided a scroll type fluid machine in which within a sealed casing there are disposed a first scroll having an ending plate and a spiral ridge provided to a front side of the ending plate as well as a second scroll having an end plate and a spiral ridge provided to a front face of the end plate in such a way that the two spiral ridges are put in each other, a back face of the end plate of the second scroll being supported by a support member secured to the sealed casing, and in which between the spiral ridges of the first and second scrolls there are formed working chambers which move from a low-pressure range on a peripheral side to a high-pressure range on a center side as volumes of the working chambers are decreased due to revolution of the second scroll relative to the first scroll, the scroll type fluid machine characterized in that:

a back side chamber is formed between the back face of the end plate of the second scroll and the support member;

an annular member is disposed within the back side chamber so that the back face of the end plate of the second scroll makes sliding contact with an end face of the annular member, thereby defining a center side chamber inside the annular member within the back side chamber;

an oil feed chamber is provided to the end face of the annular member so as to open to the back face of the end plate of the second scroll;

an oil passage is provided to the annular member for introducing oil into the oil feed chamber;

and

communicating means is provided to the end plate of the second scroll so as to be communicated with the working chamber and further intermittently communicated with the oil feed chamber as the second scroll revolves.

With the above arrangement, high-pressure oil introduced into the oil feed chamber from the oil passage is injected into the working chamber when the oil feed chamber and the communicating means come to be communicated with each other as the second scroll revolves. Since it is not during the whole period of one revolution of the second scroll but during a partial period thereof that the oil feed chamber and the communicating means are communicated with each other, the resulting quantity of oil injected into the working chamber via the communicating means is a limited one and yet a period during which the communicating means is communicated with the oil feed chamber can be easily set by selecting the position at which the communicating means is open. Accordingly, it is easy to set the quantity of oil injected.

It is preferable that the communicating means is open to the inside of the working chamber falling under intermediate-pressure range.

With this arrangement, oil is not injected into the working chamber located in the low-pressure range but injected into the working chamber located in the intermediate-pressure range, and therefore the low-pressure gas in the working chamber located in the low-pressure range can be prevented from being heated to an excessive extent by the oil, suppressing any reduction in the volumetric efficiency.

Further, it is preferable that the oil feed chamber is provided by a ring-shaped groove provided to the annular member so as to surround the center of the end plate of the second scroll.

The above-described arrangement can ensure a more successful sliding characteristic between the annular member and the back face of the end plate of the second scroll by virtue of oil collected in the oil feed chamber formed by a ring-shaped groove.

Furthermore, it is preferable that a bottom of the back side chamber is provided with an oil sump for receiving oil fed to sliding part of a crank shaft which drives the second scroll, the oil sump being communicated with the oil passage of the annular member.

The arrangement also allows the bottom of the back side chamber of the support member to be effectively utilized, permitting a passage construction for oil injection to be simplified.

Moreover, it is preferable that the oil sump is disposed so as to be located below rotation range over which crank pin part of the crank shaft rotates,

and the support member is provided with a discharge hole for discharging oil which would gather in the rotation range of the crank pin part.

The arrangement further makes it possible to prevent the oil collected in the oil sump and the crank pin from interfering each other because any excessive oil can be discharged at the bottom of the sealed casing via the discharge hole, thus reducing any power loss due to stirring of oil.

Further, it is preferable that between the annular member and the support member there is provided an urging means for urging the annular member toward the back face of the end plate of the second scroll.

The arrangement also allows the annular member and the end plate of the second scroll to be put into successful close contact, which in turn contributes to successful oil delivery between the oil feed chamber and the communicating means.

Furthermore, it is preferable that the communicating means is open to an outer end portion of spiral space formed by the spiral ridge of the second scroll.

The arrangement further allows the oil having been fed to the outer end portion of the spiral space of the second scroll to be subsequently introduced into the working chamber, thus enabling a successful sealing and lubrication in the axial direction between the second scroll and the first scroll.

It is preferable that the oil passage for introducing oil to the oil feed chamber is communicated with the center side chamber, and the communicating means makes the center side chamber communicated with the high-pressure working chamber present in the high-pressure range and also makes the oil feed chamber intermittently communicated with the working chamber lower in pressure than the high-pressure working chamber with which the center side chamber is communicated.

With this arrangement, as the second scroll revolves, the center side chamber is communicated with working chambers high in pressure on the way of compression process, via the communicating means. This communication causes the gas, which has been compressed to an intermediate pressure within the working chamber, to partly flow into the center side chamber through the communicating means, so that the center side chamber is held at an intermediate pressure between low and high pressures. On the other hand, the oil feed chamber also is intermittently communicated with the working chamber being located on the peripheral side and falling under the low-pressure range of an earlier stage of the compression, via the communicating means, as the second scroll revolves. As a result of this communication, due to a pressure difference between the working chambers and the

oil feed chamber held at an intermediate pressure, the oil fed to the back side chamber after lubricating bearing parts is injected from the oil feed chamber into the working chambers via the communicating means. Yet also, since the injection of oil into the working chambers is effected intermittently only when the oil feed chamber is communicated with the working chamber, located in the low-pressure range on the peripheral side, via the communicating means, thus the quantity of oil fed to the working chambers will never become any excessive one.

The center side chamber formed on the back face of the end plate in the second scroll and the oil feed chamber are both partitioned from one portion of the inside of the sealed casing storing high pressure gas so as to be allowed to communicate with the working chambers via the communicating means provided to the end plate. Thus the center side chamber will never be subjected to high pressure, and therefore there is no possibility that the second scroll may be urged toward the first scroll strongly. As a consequence, the axial force of the second scroll toward the first scroll can be maintained as proper one.

Also, since the center side chamber is fed with a gas under compression process so as to be held at an intermediate pressure, the oil flowing into the back side chamber after lubricating bearing parts is sequentially fed to the working chambers from the oil feed chamber via the communicating means. As a result, whereas an eccentric shaft portion of the crank shaft eccentrically rotates within the center side chamber, power loss generated due to the stirring of oil within the center side chamber is yet suppressed to low level.

Further, it is preferable that the communicating means comprises at least one first communicating hole which makes the center side chamber communicated with the working chamber and at least one second communicating hole which makes the oil feed chamber intermittently communicated with the working chamber, as the second scroll revolves.

With the above-described arrangement, by providing the end plate of the second scroll with a first communicating hole and a second communicating hole independently, it is made possible to locate the first communicating hole at a proper position irrespectively of the second communicating hole. Therefore, the pressure of the center side chamber can be easily set to any intermediate pressure, thus enabling an optimum oil injection from the oil feed chamber to the working chambers to be achieved.

Furthermore, it is preferable that the communicating means comprises one communicating hole which makes the center side chamber and the oil

feed chamber alternately communicated with the working chamber, as the second scroll revolves.

With the arrangement, when the second scroll is provided with a single communicating hole, the single communicating hole can be used as both the aforementioned first and second communicating hole. Therefore, the machining of communicating holes can be much facilitated, allowing cost reduction.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Fig. 1 is a sectional view showing an embodiment of a scroll type fluid machine according to the present invention;

Fig. 2 is a main-part sectional view showing an embodiment of the invention;

Fig. 3 is a main-part sectional view showing an embodiment of the invention;

Fig. 4 is a main-part sectional view showing an embodiment of the invention;

Fig. 5 is a main-part sectional view showing an embodiment of the invention;

Fig. 6 is a sectional view showing an embodiment of a scroll type fluid machine according to the present invention;

Fig. 7 is a transverse sectional view of a compression element in the above embodiment;

Fig. 8 is an explanatory view showing an operating state of the same compression element;

Fig. 9 is a view showing both compression process through which gas taken in a suction chamber is increased in pressure with revolution angles of a second scroll and an angular range at which the communicating holes are communicated working chambers in the compression process;

Fig. 10 is a sectional view of a scroll type fluid machine showing another embodiment of the invention;

Fig. 11 is a transverse sectional view of a compression element in the above embodiment;

Fig. 12 is an explanatory view showing an operating state of the same compression element;

Fig. 13 is an explanatory view showing an operating state of the same compression element;

Fig. 14 is an explanatory view showing an operating state of the same compression element;

Fig. 15 is an explanatory view showing an operating state of the same compression element;

Fig. 16 is an explanatory view showing an operating state of the same compression element;

Fig. 17 is an explanatory view showing an operating state of the same compression element; Fig. 18 is an explanatory view showing an operating state of the same compression element; Fig. 19 is a view showing both compression process through which gas taken in a suction chamber is increased in pressure with revolution angles of a second scroll and an angular range at which the communicating holes are communicated with working chambers in the compression process; and Fig. 20 is a main-part sectional view of a prior-art scroll type compressor.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A scroll type fluid machine as shown in Fig. 1 is constructed as described below. A sealed casing 1 of high-pressure resistant cylinder type is internally provided with a stationary scroll 2 as a first scroll, which has a spiral ridge 22 and a peripheral wall 23 connected thereto protrusively provided to the front face of an end plate 21, as well as a movable scroll 3 as a second scroll, which has a spiral ridge 32 protrusively provided to the front face of an end plate 31. The stationary scroll 2 and the movable scroll 3 are supported by a support member 8 secured to the inside of the sealed casing 1. To a boss cylinder 33 protrusively provided to the lower side of the movable scroll 3 there is fitted a crank pin part 90 of a crank shaft 9 extending from a motor 13 having a stator 11 and a rotor 12 while between the movable scroll 3 and the support member 8 there is installed an Oldham's ring 18 for arresting the rotation of the movable scroll 3. The movable scroll 3 is driven by the motor 13 to orbit; a low-pressure gas taken in an inlet port 25 of a spiral peripheral part through a suction pipe 24 is compressed within fluid working chambers 4 defined between the spiral ridges; and the compressed high-pressure gas is released into the sealed casing 1 through a discharge hole 26 provided at the spiral center of the stationary scroll 2, so that the gas is taken out to external via a discharge pipe 19.

With the above-described arrangement, between the back face of the end plate 31 of the movable scroll 3 and the support member 8 there is formed a back side chamber 80, in which disposed is an annular member 5 which partitions the back face of the end plate 31 into center side and peripheral side, wherein a center side chamber is formed inside the annular member 5. To a contact surface of the annular member 5 with respect to the end plate 31 there is provided an oil feed chamber 6 formed by a ring groove surrounding the center of the end plate 31, while at the bottom

of the back side chamber 80 in the support member 8 there is provided an oil sump 81, the arrangement being such that the oil sump 81 functions to collect oil drawn up from an unshown bottom oil sump along a feed hole 91 within the crank shaft 9 by an unshown oil pump of volumetric type or the like provided to the lower end of the crank shaft 9 and then flowing out via the upper end of the crank shaft 9 and a notch groove 92 of the crank pin part 90, and the oil flowing out after lubricating a main bearing 93 or a pin bearing 94, and that the oil sump 81 and the oil feed chamber 6 are communicated with each other via an oil passage 51 axially formed in the cylinder member 5. The boss cylinder 33 of the movable scroll 3 and the crank pin part 90 contained therein is housed in the center side chamber inside the annular member 5.

Further, to the end plate 31 of the movable scroll 3 there is formed an oil communicating passage 7 as a communicating means given by a straight through hole which is intermittently communicated with the oil feed chamber 6 as the movable scroll 3 revolves or orbits, and an outlet portion of the oil communicating passage 7 is communicated with the working chamber 4 located in intermediate-pressure range on the way of compression process.

In addition, to a peripheral portion of the annular member 5 there is provided an annular groove, to which an O-ring 52 is installed, so that it is made possible to axially seal a low-pressure peripheral side chamber 15, which is defined at a back-face peripheral portion of the end plate 31 of the movable scroll 3 and which is communicated with an inlet port 25 via a through hole 34 provided to an end plate 31, and the back side chamber 80 from each other.

Furthermore, on the back face of the annular member 5 there is provided an annular spring seat, where an urging means 53 given by a spring 53a is installed, so that it is made possible to put a contact surface at the upper end of the annular member 5 into close contact with the end plate 31 of the movable scroll 3.

Also, the bottom of the back side chamber 80 is disposed below a rotation area of the crank pin part 90. In more detail, an oil sump 81 consisting of the bottom of the back side chamber 80 is formed by providing a concave groove recessed to such a low level that it will not interfere with the crank pin part 90 at any outward portion of a main bearing 93, while to the support member 8 defining the back side chamber 80 there is provided a discharge hole 82 which opens at an upper portion of the oil sump 81 for discharging oil which would be collected in the rotation area of the crank pin part 90 to the bottom oil sump not shown in figures

through internal space of the sealed casing 1.

Thus, as the machine is put into operation, high-pressure oil collected in the oil sump 81 and communicated with the inside of the sealed casing 1 via the feed hole 91 and the discharge hole 82 is elevated along the oil passage 51 so as to be introduced to the oil feed chamber 6 and, when the oil feed chamber 6 and the oil communicating passage 7 are communicated with each other as the movable scroll 3 revolves, the oil is injected into the fluid working chamber 4. In this arrangement, since it is not during the whole period of one revolution of the movable scroll 3 but during a partial short period thereof that the oil feed chamber 6 and the oil communicating passage 7 are communicated with each other, the resulting quantity of oil injected into the working chamber 4 via the oil communicating passage 7 is a limited one, preventing any excessive oil injection. Further, since a period during which the oil communicating passage 7 is kept communicated with the oil feed chamber 6 can be easily set by determining a position at which the oil communicating passage 7 opens, the quantity of oil injected into the working chamber 4 can be controlled simply and properly.

Also, since the oil from the oil communicating passage 7 is injected into the working chamber 4 located in the intermediate-pressure range, the low-pressure gas taken in from the inlet port 25 can be prevented from being excessively heated by the injected oil, suppressing any reduction in volumetric efficiency. Moreover, since the oil is injected directly into the working chamber 4, the machine is ensured for its sealing characteristic promptly even at its start-up.

Still further, since the oil feed chamber 6 is formed by an annular ring groove, the sliding characteristic between the annular member 5 and the back face of the end plate 31 of the movable scroll 3 can be improved.

Moreover, since the oil sump 81 is provided by making use of the bottom of the back side chamber 80 in the support member 8 so that the oil collected in the oil sump 81 is injected into the working chamber 4 via the oil passage 51 provided to the annular member 5, the construction for oil injection can be simplified.

Also since it is arranged that the oil collected in the oil sump 81, which is formed by lowering the bottom of the back side chamber 80, and the crank pin part 90 are prevented from interfering with each other and that any excessive oil is discharged into the bottom oil sump of the sealed casing 1 via the discharge hole 82, thus power loss due to the stirring of oil can be prevented.

Since the back face of the annular member 5 is arranged to be urged by the urging means 53, the annular member 5 and the end plate 31 of the

movable scroll 3 can be put into successful close contact with each other, ensuring a successful delivery of oil between the oil feed chamber 6 and the oil communicating passage 7. With the O-ring 52 further installed in addition to the above arrangement, the high-pressure back side chamber 80 and a low-pressure peripheral side chamber 15 can be successfully sealed from each other, and the working area of the high pressure made to act on the back face of the movable scroll 3 can be set at a proper level, thus allowing an upward thrust of the movable scroll 3 toward the stationary scroll 2 to be set at a proper level.

As shown in Fig. 2, an O-ring 53b may also be employed instead of the spring 53a as the urging means 53, and the urging means 53 formed by this O-ring 53b may be installed within the groove provided at the bottom of the back side chamber 80. In this case, since the bottom of the oil sump 81 is partitioned into inner peripheral side and outer peripheral side by the O-ring 53b that forms the urging means 53, thus the discharge hole 82 is comprised of a first discharge hole 82a, which is provided to the annular member 5, and a second discharge hole 82b, which is provided to the support member 8, so that the back side chamber 80 and the inside of the casing 1 are communicated with each other.

Further, whereas the oil communicating passage 7 is arranged so that its outlet directly opens to the working chamber 4 via the flat portion of the end plate 31 of the movable scroll 3, it may also be arranged, as shown in Fig. 3, that the outlet of the oil communicating passage 7 opens to a fitting groove 36 of a tip seal 35 installed at the tip of the spiral ridge 32 of the movable scroll 3. In this case, oil having been fed to the tip seal 35 is subsequently injected into the working chamber 4, thus ensuring a successful sealing in the axial direction between the end face of the spiral ridge 32 of the movable scroll 3 and the end plate 21 of the stationary scroll 2.

In the above-described embodiments, although the peripheral side chamber 15 on the spiral periphery of the movable scroll 3 is communicated with the inlet port 25 so as to be kept at low pressure while the oil communicating passage 7 is opened directly or indirectly through the fitting groove 36 of the tip seal 35 to the working chamber 4 without passing the way via the peripheral side chamber 15, yet it may also be arranged as shown in Fig. 4 that a first hole 71 forming the first half of the oil communicating passage 7 is arranged to open to the periphery of the movable scroll 3 so as to allow the oil feed chamber 6 and the peripheral side chamber 15 to be communicated with each other while the peripheral side chamber 15 and the working chamber 4 are com-

municated with each other by a second hole 72 forming the remaining second half so that the peripheral side chamber 15 is maintained at an intermediate pressure lower than the high pressure and higher than the pressure of the working chamber 4 in the low-pressure range, and that injected oil is delivered via the peripheral side chamber 15, thereby allowing the lubrication of the Oldham's ring 18 to be carried out at the same time. In addition, the first hole 71 forming the first half of the oil communicating passage 7 in Fig. 4 may be replaced with an oil groove 73 provided to the back face of the movable scroll 3, as shown in Fig. 5.

Further, in the embodiments described above, although oil is injected into the fluid working chamber 4 in the intermediate-pressure range for the sake of prevention of suction heating, yet oil may instead be injected at the inlet of the fluid working chamber 4 via the low-pressure inlet port 25. In this case, in connection with Fig. 1, the outlet of the oil communicating passage 7, for example, is arranged to open to the periphery of the end plate 31 of the movable scroll 3 or communicated with the through hole 34, while in connection with Fig. 4 or Fig. 5 the second hole 72 in the oil communicating passage 7 is formed into a straight through hole so as to be communicated with the inlet port 25; otherwise, without providing such second hole 72, there is opened a communicating hole at the bottom wall of the inlet port 25 in the stationary scroll 2, or the end plate 31 of the movable scroll 3 is reduced in outer diameter, so that the peripheral side chamber 15 and the inlet port 25 will be communicated with each other as the movable scroll 3 revolves.

According to these embodiments, it is possible to prevent any excessive oil injection into the fluid working chamber without using any capillary tube while the quantity of oil injected can be controlled simply and properly by adjusting the position at which the oil communicating passage opens.

According to these embodiments, it is also possible to prevent suction heating due to oil injection.

According to these embodiments, it is also possible to improve sliding characteristic between the annular member and the movable scroll.

According to these embodiments, it is also possible to simplify the passage construction for oil injection.

According to these embodiments, it is also possible not to cause power loss due to interference between the oil to be injected and the crank pin part.

According to these embodiments, it is also possible to accomplish a more successful delivery between the oil feed chamber and the oil communicating passage.

According to these embodiments, it is also possible to perform a successful sealing and lubrication in the axial direction between the movable scroll and the stationary scroll.

A scroll type fluid machine as shown in Fig. 6 and Fig. 7 is constructed as described below. At a lower portion within a sealed casing 101 there is provided a motor 111 having a stator and a rotor, while at an upper portion within the sealed casing 101 there is provided a compression element N composed of a first scroll 102, which has a spiral ridge 122 and a peripheral wall 123 connected thereto protrusively provided to an end plate 121, and a second scroll 103, which likewise has a spiral ridge 132 protrusively provided to an end plate 131, via a support member 104. The first scroll 102 is secured to the support member 104 with an elastic means 112, such as a plate spring. Between the spiral ridges 122 and 132 there are provided working chambers 105, which move with their volumes decreased from the periphery side to the center side as the second scroll 103 revolves with respect to the first scroll 102. The support member 104 is secured to the inner surface of the casing 101. Further, at an upper portion within the casing 101 there is provided a partition wall 113 so that the inside of the casing is partitioned into a chamber space 101a, and a space 101b for accommodating the compression element N, and there is formed a space 101c for accommodating the motor under the support member 104.

To a boss cylinder 133 protrusively provided to the lower side of the second scroll 103 there is fitted an eccentric shaft portion 115 of a drive shaft 114 extending from the rotor while between the first scroll 102 and the second scroll 103 there is installed an Oldham's ring 116 for arresting rotation of the second scroll 103. By revolution of the second scroll 103 with the motor 111 driven, low-pressure gas taken in an inlet port 125 on the spiral periphery from a suction pipe 124 via the space 101b is compressed in the working chamber 105 and then the compressed high-pressure gas is released to the chamber space 101a of the casing 101 through a discharge hole 126 provided to the spiral center of the first scroll 102 while the same high-pressure gas is introduced into the space 101c, in which the motor is accommodated, via a discharge by-pass pipe 120. Thereafter the gas is taken out to external through a discharge pipe 300 connected to the casing 101.

Also, to a core portion of the drive shaft 114 there is provided a feed hole 117 extending in the axial direction and opening at both shaft ends of the drive shaft 114 while on the way of the feed hole 117 there is provided a branch hole 117a for feeding lubricating oil to a main bearing 118 installed between the drive shaft 114 and the support

member 104 so as to extend in the radial direction. Lubricating oil collected in an oil sump not shown in figures at the bottom of the casing 101 is drawn up by an oil pump (not shown) provided to the lower end of the drive shaft 114 through the feed hole 117. Thus the oil is released into the back side space of the end plate 131 after lubricating the main bearing 118 and an eccentric-shaft bearing 119.

In the scroll type fluid machine constructed as described above, in connection with the embodiment shown in the figure, a back side chamber 202 is defined on the back face of the end plate 131 of the second scroll 103 by the support member 104 independently of the space 101c, in which the motor is accommodated, of the casing 101, while an annular member 106 is installed on the back face of the end plate 131 of the second scroll 103 within the back side chamber 202.

Further, an O-ring 161 is installed between the outer peripheral face of the annular member 106 and the support member 104. Between the inner peripheral face of the annular member 106 and the outer peripheral face of the boss cylinder 133 there is provided a center side chamber 203 formed by defining the center side of the back side chamber 202 by the annular member 106. An annular groove 162 is formed to a contact surface of the annular member 106 with respect to the end plate 131, and within the groove 162 there is provided an oil feed chamber 204 partitioned from the center side chamber 203. Furthermore the oil feed chamber 204 and the center side chamber 203 are communicated with each other via an oil passage 163 formed in the axial direction of the annular member 106.

On the other hand, to the end plate 131 of the second scroll 103 there is provided communicating means 107 comprised of a first communicating hole 171, which makes the center side chamber 203 communicated with the working chamber 105 high in pressure on the way of compression process, and a second communicating hole 172, which makes the oil feed chamber 204 intermittently communicated with a working chamber 105 lower in pressure than the aforementioned working chamber 105 with which the center side chamber 203 is to be communicated, as the second scroll revolves. In this arrangement, at a stage of compression process when the pressure of the working chamber 105 reaches P_1 as shown in Fig. 9 as the second scroll 103 revolves, the first communicating hole 171 is opened so that the center side chamber 203 is communicated with the working chamber 105, whereby high-pressure gas within the working chamber 105 on the way of compression process is fed to the center side chamber 203, thus holding the center side chamber 203 at an intermediate

pressure. The first communicating hole 171 is kept communicated with the working chamber 105 up to a stage of compression process when the pressure of the working chamber 105 reaches P_2 as shown in Fig. 9, and thereafter closed. Accordingly, the working chamber 105 is communicated with the center side chamber 203 in a range X over which the working chamber 105 varies in pressure from P_1 to P_2 , thus holding the center side chamber 203 at an intermediate pressure P_m between the pressures P_1 and P_2 . While the first communicating hole 171 is communicated with the working chamber 105, the second communicating hole 172 is not so communicated simultaneously but communicated with another working chamber lower in pressure or otherwise closed. Then when pressure of the working chamber 105 in the low-pressure range at an earlier stage of the compression process reaches P_3 as shown in Fig. 9 as the second scroll 103 revolves, the second communicating hole 172 is opened so that the oil feed chamber 204 is communicated with the working chamber 105, whereby lubricating oil in the center side chamber 203 is injected from the oil feed chamber 204 into the working chamber 105 due to pressure difference between the oil feed chamber 204 and the working chamber 105, while when the pressure of the working chamber 105 reaches P_4 as shown in Fig. 9, the second communicating hole 172 is closed. Accordingly, lubricating oil is injected from the oil feed chamber 204 into the working chamber 105 in a range Y over which the pressure of the working chamber 105 varies from the above-noted P_3 to P_4 . In addition, although the first communicating hole 171 and the second communicating hole 172 are provided each one in number at positions displaced about 180° in Fig. 6 and Fig. 7, yet the positions where these communicating holes 171 and 172 are disposed are not particularly limited and besides they may be provided in any plural number instead of being provided one for each, as shown in Fig. 7. In Fig. 9, P_d is a discharge pressure, P_s is a suction pressure, and P_m is the intermediate pressure of the back side chamber 202.

It is to be noted that, in the embodiment shown in the figures, between the lower face of the annular member 106 and a bottom of the support member 104 there is provided a spring 164 for urging the annular member 106 toward the end plate 131, so that a contact surface of the annular member 106 is put into close contact with the lower face of the end plate 131 of the second scroll 103.

As the fluid machine constructed as described above goes into operation, the gas compressed to a high pressure within the working chamber 105 of the compression element N is discharged into the

chamber space 101a of the sealed casing 101 through the discharge hole 126, introduced to the motor-accommodating chamber 101c along the bypass pipe 120 connected to the sealed casing 101, and fed to external through the discharge pipe 300 while the oil collected in the unshown oil sump at the bottom of the sealed casing 101 is fed to the back side chamber 202 after lubricating the main bearing 118 and the eccentric-shaft bearing 119 via the feed hole 117 and the branch hole 117a by a feed pump.

Thus as the second scroll 103 revolves with the fluid machine in operation, the pressure of the working chamber 105 under compression process grows higher such that the first communicating hole 171 is opened to the center side chamber 203 in the range X in which the pressure varies from P_1 to P_2 as shown in Fig. 9 (state of Figs. 7 and 8), thus allowing the high-pressure gas in the working chamber 105 on the way of the compression process to be partly fed from the first communicating hole 171 to the center side chamber 203. Accordingly, the center side chamber 203 can be set at an intermediate pressure and the oil feed chamber 204 is communicated with the center side chamber 203 via the oil passage 163 so that the oil feed chamber 204 is also controlled at the same intermediate pressure as the center side chamber 203. Therefore, when the working chamber 105 in the low-pressure range at an earlier stage of the compression process is communicated with the oil feed chamber 204 via the second communicating hole 172 (state of Fig. 8), the lubricating oil in the center side chamber 203 can be injected from the oil feed chamber 204 and the second communicating hole 172 into the working chamber 105 via the oil passage 163 due to pressure difference between the oil feed chamber 204, which is kept at the intermediate pressure, and the working chamber 105.

Moreover, since the injection of oil into the working chamber 105 is effected intermittently only when the oil feed chamber 204 is communicated with the working chamber 105 in the low-pressure range via the second communicating hole 172, the resulting quantity of oil injected into the working chamber 105 is limited so that any excessive oil injection to the working chamber 105 can be prevented. Also, since the first communicating hole 171 and the second communicating hole 172 are provided independently of each other, it is possible to set the location of the first communicating hole 171 with respect to the working chamber 105 to a proper one irrespectively of the second communicating hole 172, allowing the pressure of the center side chamber 203 to be easily set to any intermediate pressure and thus ensuring an optimum oil injection from the oil feed chamber 204 into the working chamber 105 to be achieved.

Since the back side chamber 202 is fed with a high-pressure gas on the way of compression process so as to be set at an intermediate pressure between the above-noted P_1 and P_2 , the second scroll 103 is unlikely to be urged toward the first scroll 102 strongly, so that the axial force of the second scroll 103 toward the first scroll 102 can be held at proper level.

Moreover, since the center side chamber 203 is fed with a high-pressure gas on the way of compression process so as to be set at the aforementioned intermediate pressure, the lubricating oil flowing from the feed hole 117 into the center side chamber 203 after lubricating the bearing parts can be fed to the working chamber 105 successively from the oil feed chamber 204 and the second communicating hole 172 without being collected in the center side chamber 203 excessively. Accordingly, the center side chamber 203 can be prevented from being filled with oil, thus reducing power loss due to the stirring of oil within the center side chamber 203 even though the eccentric shaft portion 115 eccentrically rotates within the center side chamber 203.

Further in the embodiment of Figs. 6 and 7, since the oil feed chamber 204 is provided to the contact surface of the annular member 106 with the end plate 131 of the second scroll 103, the oil flowing into the oil feed chamber 204 serves for lubricating between the annular member 106 and the back face of the end plate 131 of the second scroll 103, thus gaining a successful sliding characteristic of the second scroll 103 with respect to the annular member 106.

Although the first communicating hole 171 and the second communicating hole 172 are provided to the end plate 131 independently of each other in the embodiment described above, it may also be arranged that one communicating hole 173 is provided to the end plate 131, as shown in Figs. 10 through 18, in which case the center side chamber 203 and the oil feed chamber 204 are alternately communicated with the working chamber 105 as the second scroll 103 revolves. Because the fluid machine as shown in Figs. 10 through 18 is the same in basic construction as the one shown in Figs. 6 through 8, the following description is made only upon their differences.

The communicating hole 173 is alternately opened to the center side chamber 203 or the oil feed chamber 204 while the second scroll 103 makes a 360° revolution, so that while opened to the center side chamber 203 it allows the high-pressure gas of the working chamber 105 on the way of compression process to be fed to the center side chamber 203 and while opened to the oil feed chamber 204 it allows lubricating oil of center side chamber 203 to be injected into a

working chamber 105 which is lower in pressure than the working chamber 105 and to which the center side chamber 203 is communicated.

In more detail, as the second scroll 103 revolves, the communicating hole 173 is opened to the center side chamber 203 at a stage of the compression process when the pressure of the working chamber 105 reaches, for example, P_5 as shown in Fig. 19 (state of Fig. 11), making the center side chamber 203 communicated with the working chamber 105 (state of Fig. 12), whereby the high-pressure gas of the working chamber 105 on the way of the compression process is partly fed to the center side chamber 203. The communicating hole 173 is communicated with the working chamber 105 up to a stage of the compression process when the pressure of the working chamber 105 reaches P_6 as shown in Fig. 19 (state of Figs. 13 and 14), and thereafter closed. Thus the center side chamber 203 and the oil feed chamber 204, which is communicated with the center side chamber 203 via the oil passage 163, are both maintained at an intermediate pressure between the above-noted pressures P_5 and P_6 . Further, the communicating hole 173 is opened to the oil feed chamber 204 at an earlier stage of the compression process when the working chamber 105 is located in the low-pressure range at an earlier stage of the compression process and its pressure reaches, for example, P_7 as shown in Fig. 19 (state of Fig. 15), making the oil feed chamber 204 communicated with the working chamber 105 (state of Fig. 16). Then lubricating oil of the center side chamber 203 is injected from the oil feed chamber 204 into the working chamber 105 due to pressure difference between the intermediate pressure of the oil feed chamber 204 and the pressure of the working chamber 105. The communicating hole 173 is kept communicated with the working chamber 105 up to a stage of compression process when the pressure of the working chamber 105 reaches, for example, P_8 as shown in Fig. 19 (state of Figs. 17 and 18), and thereafter closed to stop the oil injection into the working chamber 105. The pressure of the oil feed chamber 204 at this point becomes an intermediate pressure P_m between the aforementioned pressures P_8 and P_5 . In addition, in Fig. 19, P_d is the discharge pressure and P_s is the suction pressure.

As described above, even in the case of Figs. 10 through 19, the oil injection into the working chamber 105 is effected only when the oil feed chamber 204 is communicated with a working chamber 105 in the low-pressure range via the communicating hole 173, thus preventing any excessive oil injection into the working chamber 105 while the center side chamber 203 of the back side chamber 202 falls under the range from the inter-

mediate pressure between the pressures P_5 and P_6 to the intermediate pressure between the P_8 and P_5 , thus preventing the axial force of the second scroll 103 toward the first scroll 102 from becoming an excessively large one. Also the gas with a pressure of P_5 to P_6 on the way of compression process is fed to the center side chamber 203 so that the center side chamber 203 is set at the intermediate pressure. Therefore, the lubricating oil flowing into the center side chamber 203 after lubricating the bearing parts can be fed to the working chamber 105 successively from the oil feed chamber 204 and the communicating hole 173 without being collected excessively in the center side chamber 203, thus preventing the center side chamber 203 from being filled with the lubricating oil. Moreover, since only one communicating hole 173 is provided, the machining of communicating holes can be facilitated, allowing cost reduction as compared with when a plurality of communicating holes are provided. In addition, although the fluid machine as shown in Fig. 10 is so arranged that the chamber space 101a of the casing 101 and the space 101c for accommodating the motor are communicated with each other by a communicating means so that the space 101c is also maintained at high pressure with the discharge pipe 300 opened to the space 101c, yet such another construction may also be allowed that the inside of the casing 101 will not have high pressure.

Further, although in the embodiments described above the description has been made on a fluid machine in which the first scroll 102 is fixed and the second scroll 103 is revolutionary, yet another one may be allowed instead in which the first and second scrolls 102 and 103 are both adapted to revolve around the shaft axis.

The scroll type fluid machine of the present embodiment is constructed as described above. That is, on the back face of the end plate 131 of the second scroll 103 there is provided the back side chamber 202 partitioned from the internal space of the casing 101 while the annular member 106 is provided in the back side chamber 202 to thereby form the center side chamber 203 and the oil feed chamber 204, with the oil passage 163 provided between the center side chamber 203 and the oil feed chamber 204. Moreover, to the end plate 131 there is provided the communicating means that allows the center side chamber 203 to be communicated with the working chamber 105 high in pressure on the way of compression process and that also allows the oil feed chamber 204 to be intermittently communicated with a working chamber 105 lower in pressure than the working chamber 105 with which the center side chamber 203 is communicated, as the second scroll 103 revolves. Thus the center side chamber 203 is

communicated with the working chamber 105 high in pressure on the way of the compression process via the communicating means as the second scroll 103 revolves, whereby the center side chamber 203 can be set at an intermediate pressure. Also the oil feed chamber 204 is communicated with the working chamber 105 in the low-pressure range at an earlier stage of the compression process via the communicating means, whereby the oil fed to the back side chamber 202 after lubricating the bearing parts is reliably injected into the working chamber 105 from the oil feed chamber 204 via the communicating means, due to pressure difference between the working chamber 105 and the oil feed chamber 204, which is communicated with the center side chamber 203 via the oil passage 163. Yet such injection of oil into the working chamber 105 is effected intermittently only when the oil feed chamber 204 is communicated with a working chamber 105 located in the low-pressure range via the communicating means, whereby the resulting quantity of oil injected into the working chamber 105 is limited such that any excessive oil injection into the working chamber 105 can be prevented.

Further, the center side chamber 203 and the oil feed chamber 204 formed on the back face of the end plate 131 of the second scroll 103 is maintained at an intermediate pressure without being subjected to high pressure. Thus the second scroll 103 is unlikely to be pressed strongly toward the first scroll 102, preventing the axial force of the second scroll 103 toward the first scroll 102 from becoming an excessive one.

According to the present embodiment, the center side chamber 203 is fed with a high-pressure gas on the way of compression process so that the pressure of the center side chamber 203 is maintained at an intermediate pressure. Therefore the oil flowing into the back side chamber 202 after lubricating the bearing parts is fed to the working chamber 105 successively from the oil feed chamber 204 via the communicating means, so that the center side chamber 203 is prevented from being filled with oil and thus power loss due to the stirring of oil within the center side chamber 203 can be reduced even though the eccentric shaft portion of the drive shaft eccentrically rotates within the center side chamber 203.

Furthermore, to the end plate 131 of the second scroll 103 there is provided the first communicating hole 171 and the second communicating hole 172 independently of each other, allowing the first communicating hole 171 to be located at a proper position irrespectively of the second communicating hole 172. Therefore the pressure of the center side chamber 203 can be easily set to any intermediate pressure, ensuring an optimum oil injection from the oil feed chamber 204 into the

working chamber 105.

Also when one communicating hole 173 is provided to the end plate 131 of the second scroll 103, this one communicating hole 173 can be used as both the first communicating hole 171 and the second communicating hole 172, much facilitating the machining of communicating holes and allowing cost reduction.

Claims

1. A scroll type fluid machine in which within a sealed casing (1, 101) there are disposed a first scroll (2, 102) having an ending plate (21, 191) and a spiral ridge (22, 122) provided to a front side of the ending plate (21, 121) as well as a second scroll (3, 103) having an end plate (31, 131) and a spiral ridge (32, 132) provided to a front face of the end plate (31, 131) in such a way that the two spiral ridges (22, 122; 32, 132) are put in each other, a back face of the end plate (31, 131) of the second scroll (3, 103) being supported by a support member (8, 104) secured to the sealed casing (1, 101), and in which between the spiral ridges (22, 122; 32, 132) of the first and second scrolls (1, 101; 2, 102) there are formed working chambers (4, 105) which move from a low-pressure range on a peripheral side to a high-pressure range on a center side as volumes of the working chambers (4, 105) are decreased due to revolution of the second scroll (3, 103) relative to the first scroll (2, 102);

there being a back side chamber (80, 202) that is formed between the back face of the end plate (31, 131) of the second scroll (3, 103) and the support member (8, 104);

and communicating means (7, 71, 72, 171, 172, 173) that is provided to the end plate (31, 131) of the second scroll (3, 103) so as to be communicated with the working chamber (4, 105) and to be intermittently communicated with an oil feed chamber as the second scroll (3, 103) revolves;

characterized in that

an annular member (5, 106) is disposed within the back side chamber (80, 202) so that the back face of the end plate (31, 131) of the second scroll (3, 103) makes sliding contact with an end face of the annular member (5, 106), thereby defining a center side chamber (203) inside the annular member (5, 106) within the back side chamber (80, 202);

an oil feed chamber (6, 204) is provided to the end face of the annular member (5, 106) so as to open to the back face of the end plate (31, 131) of the second scroll (3, 103);

communicated with the working chamber 105 high in pressure on the way of the compression process via the communicating means as the second scroll 103 revolves, whereby the center side chamber 203 can be set at an intermediate pressure. Also the oil feed chamber 204 is communicated with the working chamber 105 in the low-pressure range at an earlier stage of the compression process via the communicating means, whereby the oil fed to the back side chamber 202 after lubricating the bearing parts is reliably injected into the working chamber 105 from the oil feed chamber 204 via the communicating means, due to pressure difference between the working chamber 105 and the oil feed chamber 204, which is communicated with the center side chamber 203 via the oil passage 163. Yet such injection of oil into the working chamber 105 is effected intermittently only when the oil feed chamber 204 is communicated with a working chamber 105 located in the low-pressure range via the communicating means, whereby the resulting quantity of oil injected into the working chamber 105 is limited such that any excessive oil injection into the working chamber 105 can be prevented.

Further, the center side chamber 203 and the oil feed chamber 204 formed on the back face of the end plate 131 of the second scroll 103 is maintained at an intermediate pressure without being subjected to high pressure. Thus the second scroll 103 is unlikely to be pressed strongly toward the first scroll 102, preventing the axial force of the second scroll 103 toward the first scroll 102 from becoming an excessive one.

According to the present embodiment, the center side chamber 203 is fed with a high-pressure gas on the way of compression process so that the pressure of the center side chamber 203 is maintained at an intermediate pressure. Therefore the oil flowing into the back side chamber 202 after lubricating the bearing parts is fed to the working chamber 105 successively from the oil feed chamber 204 via the communicating means, so that the center side chamber 203 is prevented from being filled with oil and thus power loss due to the stirring of oil within the center side chamber 203 can be reduced even though the eccentric shaft portion of the drive shaft eccentrically rotates within the center side chamber 203.

Furthermore, to the end plate 131 of the second scroll 103 there is provided the first communicating hole 171 and the second communicating hole 172 independently of each other, allowing the first communicating hole 171 to be located at a proper position irrespectively of the second communicating hole 172. Therefore the pressure of the center side chamber 203 can be easily set to any intermediate pressure, ensuring an optimum oil injection from the oil feed chamber 204 into the

working chamber 105.

Also when one communicating hole 173 is provided to the end plate 131 of the second scroll 103, this one communicating hole 173 can be used as both the first communicating hole 171 and the second communicating hole 172, much facilitating the machining of communicating holes and allowing cost reduction.

Claims

1. A scroll type fluid machine in which within a sealed casing (1, 101) there are disposed a first scroll (2, 102) having an ending plate (21, 191) and a spiral ridge (22, 122) provided to a front side of the ending plate (21, 121) as well as a second scroll (3, 103) having an end plate (31, 131) and a spiral ridge (32, 132) provided to a front face of the end plate (31, 131) in such a way that the two spiral ridges (22, 122; 32, 132) are put in each other, a back face of the end plate (31, 131) of the second scroll (3, 103) being supported by a support member (8, 104) secured to the sealed casing (1, 101), and in which between the spiral ridges (22, 122; 32, 132) of the first and second scrolls (1, 101; 2, 102) there are formed working chambers (4, 105) which move from a low-pressure range on a peripheral side to a high-pressure range on a center side as volumes of the working chambers (4, 105) are decreased due to revolution of the second scroll (3, 103) relative to the first scroll (2, 102);

there being a back side chamber (80, 202) that is formed between the back face of the end plate (31, 131) of the second scroll (3, 103) and the support member (8, 104);

and communicating means (7, 71, 72, 171, 172, 173) that is provided to the end plate (31, 131) of the second scroll (3, 103) so as to be communicated with the working chamber (4, 105) and to be intermittently communicated with an oil feed chamber as the second scroll (3, 103) revolves;

characterized in that

an annular member (5, 106) is disposed within the back side chamber (80, 202) so that the back face of the end plate (31, 131) of the second scroll (3, 103) makes sliding contact with an end face of the annular member (5, 106), thereby defining a center side chamber (203) inside the annular member (5, 106) within the back side chamber (80, 202);

an oil feed chamber (6, 204) is provided to the end face of the annular member (5, 106) so as to open to the back face of the end plate (31, 131) of the second scroll (3, 103);



an oil passage (51, 163) is provided to the annular member (5, 106) for introducing oil into the oil feed chamber (6, 204); and that

the oil feed chamber with which said communicating means (7, 71, 72, 171, 172, 173) to the end plate (31, 131) of the second scroll (3, 103) is associated is the oil feed chamber (6, 204) at the end face of the annular member (5, 106).

2. A scroll type fluid machine as claimed in Claim 1, wherein the communicating means (7) is open to the inside of the working chamber (4) falling under intermediate-pressure range.
3. A scroll type fluid machine as claimed in claim 1, wherein the oil feed chamber (6, 204) is provided by a ring-shaped groove provided to the annular member (5, 106) so as to surround the center of the end plate (31, 131) of the second scroll (3, 103).
4. A scroll type fluid machine as claimed in claim 2, wherein the oil feed chamber (6) is provided by a ring-shaped groove provided to the annular member (5) so as to surround the center of the end plate (31) of the second scroll (3).
5. A scroll type fluid machine as claimed in claim 1, wherein a bottom of the back side chamber (80) is provided with an oil sump (81) for receiving oil fed to sliding part of a crank shaft (9) which drives the second scroll (3), the oil sump (81) being communicated with the oil passage (51) of the annular member (5).
6. A scroll type fluid machine as claimed in claim 5, wherein the oil sump (81) is disposed so as to be located below rotation range over which crank pin part (90) of the crank shaft (9) rotates, and wherein the support member (8) is provided with a discharge hole (82) for discharging oil which would gather in the rotation range of the crank pin part (90).
7. A scroll type fluid machine as claimed in claim 1, wherein between the annular member (5, 106) and the support member (8, 104) there is provided an urging means (53, 164) for urging the annular member (5, 106) toward the back face of the end plate (31, 131) of the second scroll (3, 103).
8. A scroll type fluid machine as claimed in claim 1, wherein the communicating means (71, 72) is open to an outer end portion of spiral space formed by the spiral ridge (32) of the second scroll (3).

9. A scroll type fluid machine as claimed in claim 1, wherein the oil passage (163) for introducing oil to the oil feed chamber (204) is communicated with the center side chamber (203), and wherein the communicating means (171, 172) makes the center side chamber (203) communicated with the high-pressure working chamber (105) present in the high-pressure range and also makes the oil feed chamber (204) intermittently communicated with the working chamber (105) lower in pressure than the high-pressure working chamber (105) with which the center side chamber (203) is communicated.

10. A scroll type fluid machine as claimed in claim 9, wherein the communicating means (171, 172) comprises at least one first communicating hole (171) which makes the center side chamber (203) communicated with the working chamber (105) and at least one second communicating hole (172) which makes the oil feed chamber (204) intermittently communicated with the working chamber (105), as the second scroll (103) revolves.

11. A scroll type fluid machine as claimed in claim 9, wherein the communicating means (173) comprises one communicating hole (173) which makes the center side chamber (203) and the oil feed chamber (204) alternately communicated with the working chamber (105), as the second scroll (103) revolves.

12. A scroll type fluid machine as claimed in claim 1, wherein the communicating means (7) opens to a fitting groove (36) for a tip seal (35) installed at a tip of the spiral ridge (32) of the second scroll (3).

Patentansprüche

1. Strömungsmaschine vom Spiraltyp, bei welcher innerhalb eines abgedichteten Gehäuses (1, 101) eine erste Spiralscheibe (2, 102) mit einer Abschlußplatte (21, 121) und einer an einer Vorderseite der Abschlußplatte (21, 121) vorgesehenen spiralförmigen Erhebung (22, 122), sowie eine zweite Spiralscheibe (3, 103) mit einer Endplatte (31, 131) und einer an einer Vorderseite der Endplatte (31, 131) vorgesehenen spiralförmigen Erhebung (32, 132) auf eine solche Weise angeordnet sind, daß die beiden spiralförmigen Erhebungen (22, 122; 32, 132) ineinander gesteckt sind, wobei eine Rückseite der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) von einem am abgedichteten Gehäuse (1, 101) befestigten



- Halteelement (8, 104) gehalten wird, und bei welcher zwischen den spiralförmigen Erhebungen (22, 122; 32, 132) der ersten und zweiten Spiralscheibe (2, 102; 3, 103) Arbeitskammern (4, 105) gebildet werden, die sich von einem Niederdruckbereich auf einer Umfangsseite in einen Hochdruckbereich auf einer Zentrumsseite bewegen, während Volumina der Arbeitskammern (4, 105) infolge einer Drehung der zweiten Spiralscheibe (3, 103) relativ zur ersten Spiralscheibe (2, 102) verkleinert werden; wobei eine rückseitige Kammer (80, 202) vorhanden ist, die zwischen der Rückseite der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) und dem Halteelement (8, 104) ausgebildet ist;
- sowie eine Verbindungseinrichtung (7, 71, 72, 171, 172, 173), die in der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) vorgesehen ist, so daß sie mit der Arbeitskammer (4, 105) in Verbindung steht und intermittierend mit einer Ölzufuhrkammer in Verbindung steht, während sich die zweite Spiralscheibe (3, 103) dreht;
- dadurch gekennzeichnet, daß ein Ringelement (5, 106) innerhalb der rückseitigen Kammer (80, 202) angeordnet ist, so daß die Rückseite der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) in Gleitberührung mit einer Stirnfläche des Ringelements (5, 106) steht, wodurch eine zentrumsseitige Kammer (203) innerhalb des Ringelements (5, 106) innerhalb der rückseitigen Kammer (80, 202) begrenzt wird;
- eine Ölzufuhrkammer (6, 204) an der Stirnfläche des Ringelements (5, 106) vorgesehen ist, so daß sie sich zur Rückseite der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) hin öffnet;
- ein Öldurchlaß (51, 163) im Ringelement (5, 106) vorgesehen ist, um Öl in die Ölzufuhrkammer (6, 204) zuzuführen; und daß die Ölzufuhrkammer, mit welcher die besagte Verbindungseinrichtung (7, 71, 72, 171, 172, 173) in der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) verbunden ist, die Ölzufuhrkammer (6, 204) an der Stirnfläche des Ringelements (5, 106) ist.
2. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß die Verbindungseinrichtung (7) zum Inneren der unter den Zwischendruckbereich fallenden Arbeitskammer (4) hin offen ist.
 3. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß die Ölzufuhrkammer (6, 204) durch eine ringförmige

ge Nut geschaffen wird, die so im Ringelement (5, 106) vorgesehen ist, daß sie das Zentrum der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) umgibt.

4. Strömungsmaschine vom Spiraltyp nach Anspruch 2, dadurch gekennzeichnet, daß die Ölzufuhrkammer (6) durch eine ringförmige Nut geschaffen wird, die so im Ringelement (5) vorgesehen ist, daß sie das Zentrum der Endplatte (31) der zweiten Spiralscheibe (3) umgibt.
5. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß ein Boden der rückseitigen Kammer (80) mit einem Ölsumpf (81) zur Aufnahme von Öl versehen ist, das einem gleitenden Teil einer Kurbelwelle (9) zugeführt wird, welche die zweite Spiralscheibe (3) antreibt, wobei der Ölsumpf (81) mit dem Öldurchlaß (51) des Ringelements (5) in Verbindung steht.
6. Strömungsmaschine vom Spiraltyp nach Anspruch 5, dadurch gekennzeichnet, daß der Ölsumpf (81) so angeordnet ist, daß er unterhalb eines Drehbereichs angeordnet ist, über den sich ein Kurbelzapfenteil (90) der Kurbelwelle (9) dreht, und daß das Halteelement (8) mit einer Abgabeöffnung (82) zur Abgabe von Öl versehen ist, welches sich im Drehbereich des Kurbelzapfenteils (90) ansammeln würde.
7. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß zwischen dem Ringelement (5, 106) und dem Halteelement (8, 104) eine Druckeinrichtung (53, 164) vorgesehen ist, um das Ringelement (5, 106) gegen die Rückseite der Endplatte (31, 131) der zweiten Spiralscheibe (3, 103) zu drücken.
8. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß die Verbindungseinrichtung (71, 72) zu einem äußeren Endteil eines von der spiralförmigen Erhebung (32) der zweiten Spiralscheibe (3) gebildeten Spiralraums hin offen ist.
9. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß der Öldurchlaß (163) zum Zuführen von Öl in die Ölzufuhrkammer (204) mit der zentrumsseitigen Kammer (203) in Verbindung steht, und daß die Verbindungseinrichtung (171, 172) die zentrumsseitige Kammer (203) mit der im Hochdruckbereich liegenden Hochdruck-Arbeitskammer (105) verbindet und auch die Öl-



zuführkammer (204) intermittierend mit der Arbeitskammer (105) verbindet, die einen niedrigeren Druck als die Hochdruck-Arbeitskammer (105) aufweist, mit der die zentrumsseitige Kammer (103) in Verbindung steht.

10. Strömungsmaschine vom Spiraltyp nach Anspruch 9, dadurch gekennzeichnet, daß die Verbindungseinrichtung (171, 172) mindestens eine erste Verbindungsöffnung (171) umfaßt, welche die zentrumsseitige Kammer (203) mit der Arbeitskammer (105) verbindet, sowie mindestens eine zweite Verbindungsöffnung (172), welche die Ölzuführkammer (204) intermittierend mit der Arbeitskammer (105) verbindet, während sich die zweite Spiralscheibe (103) dreht.

11. Strömungsmaschine vom Spiraltyp nach Anspruch 9, dadurch gekennzeichnet, daß die Verbindungseinrichtung (173) eine Verbindungsöffnung (173) umfaßt, welche die zentrumsseitige Kammer (203) und die Ölzuführkammer (204) abwechselnd mit der Arbeitskammer (105) verbindet, während sich die zweite Spiralscheibe (103) dreht.

12. Strömungsmaschine vom Spiraltyp nach Anspruch 1, dadurch gekennzeichnet, daß sich die Verbindungseinrichtung (7) in eine Paßnut (36) für eine an einem vorderen Ende der spiralförmigen Erhebung (32) der zweiten Spiralscheibe (3) angebrachte Kopfdichtung (35) öffnet.

Revendications

1. Machine à fluide du type à volute, dans laquelle sont disposées, dans un carter étanche (1, 101), une première volute (2, 102) ayant une plaque d'extrémité (21, 191) et une nervure spiralée (22, 122) disposée à une face avant de la plaque d'extrémité (21, 121) et une seconde volute (3, 103) ayant une plaque d'extrémité (31, 131) et une nervure spiralée (32, 132) placée sur une face avant de la plaque d'extrémité (31, 131) de manière que les deux nervures spiralées (22, 122 ; 32, 132) soient placées l'une dans l'autre, une face arrière de la plaque d'extrémité (31, 131) de la seconde volute (3, 103) étant supportée par un organe (8, 104) de support fixé au carter étanche (1, 101), et dans laquelle, entre les nervures spiralées (22, 122 ; 32, 132) de la première et de la seconde volute (1, 101 ; 2, 102), des chambres de travail (4, 105) sont formées et se déplacent d'une plage à basse pression d'un côté périphérique à une plage à haute pression du côté

central lorsque les volumes des chambres de travail (4, 105) diminuent à cause de la rotation de la seconde volute (3, 103) par rapport à la première volute (2, 102),

une chambre arrière (80, 202) étant formée entre la face arrière de la plaque d'extrémité (31, 131) de la seconde volute (3, 103) et l'organe de support (8, 104), et

un dispositif (7, 71, 72, 171, 172 et 173) de communication associé à la plaque d'extrémité (31, 131) de la seconde volute (3, 103) afin qu'il communique avec la chambre de travail (4, 105) et communique par intermittence avec une chambre d'alimentation en huile lorsque la seconde volute (3, 103) tourne,

caractérisée en ce que

un organe annulaire (5, 106) est disposé dans la chambre arrière (80, 202) afin que la face arrière de la plaque d'extrémité (31, 131) de la seconde volute (3, 103) soit en contact glissant avec une face d'extrémité de l'organe annulaire (5, 106), délimitant ainsi une chambre du côté central (203) à l'intérieur de l'organe annulaire (5, 106) dans la chambre arrière (80, 202),

une chambre (6, 204) d'alimentation en huile est placée à la face d'extrémité de l'organe annulaire (5, 106) afin qu'elle débouche à la face arrière de la plaque d'extrémité (31, 131) de la seconde volute (3, 103),

un passage d'huile (51, 163) est formé vers l'organe annulaire (5, 106) pour l'introduction d'huile dans la chambre (6, 204) d'alimentation en huile, et

la chambre d'alimentation en huile à laquelle est associé le dispositif de communication (7, 71, 72, 171, 172 et 173) vers la plaque d'extrémité (31, 131) de la seconde volute (3, 103) constitue la chambre d'alimentation en huile (6, 204) à la face d'extrémité de l'organe annulaire (5, 106).

2. Machine à fluide du type à volute selon la revendication 1, dans laquelle le dispositif (7) de communication débouche à l'intérieur de la chambre de travail (4) et se trouve dans une plage à pression intermédiaire.

3. Machine à fluide du type à volute selon la revendication 1, dans laquelle la chambre (6, 204) d'alimentation en huile est formée par une gorge annulaire placée sur l'organe annulaire (5, 106) afin qu'elle entoure le centre de la plaque d'extrémité (31, 131) de la seconde volute (3, 103).

4. Machine selon la revendication 2, caractérisée en ce que la chambre (6) d'alimentation en



huile est formée par une gorge annulaire (5) afin qu'elle entoure le centre de la plaque d'extrémité (31) de la seconde volute (3).

5. Machine selon la revendication 1, dans laquelle la partie inférieure de la chambre arrière (80) a un puisard (81) destiné à recevoir l'huile transmise à la partie de coulisement d'un vilebrequin (9) qui entraîne la seconde volute (3), le puisard (81) d'huile communiquant avec le passage (51) d'huile d'un organe annulaire (5). 5
6. Machine selon la revendication 5, dans laquelle le puisard (81) d'huile est disposé afin qu'il se trouve au-dessous de la plage de rotation dans laquelle tourne la partie de maneton (90) du vilebrequin (9), et l'organe de support (8) a un trou (82) d'évacuation de l'huile qui pourrait se rassembler dans la plage de rotation de la partie (90) de maneton. 10
7. Machine selon la revendication 1, dans laquelle un dispositif (53, 164) de rappel de l'organe annulaire (5, 106) vers la face arrière de la plaque d'extrémité (31, 131) de la seconde volute (3, 103) est placé entre l'organe annulaire (5, 106) et l'organe de support (8, 104). 15
8. Machine selon la revendication 1, dans laquelle le dispositif de communication (71, 72) débouche vers une partie d'extrémité externe de l'espace spiralé formé par la nervure spiralée (32) de la seconde volute (3). 20
9. Machine selon la revendication 1, dans laquelle le passage d'huile (163) destiné à introduire l'huile dans la chambre (204) d'alimentation en huile communique avec la chambre du côté central (203), et le dispositif de communication (171, 172) fait communiquer la chambre du côté central (203) avec la chambre de travail à haute pression (105) présente dans la plage à haute pression et fait aussi communiquer par intermittence la chambre d'alimentation en huile (204) avec la chambre de travail (105) à une pression inférieure à celle de la chambre de travail à haute pression (105) avec laquelle communique la chambre du côté central (203). 25
10. Machine selon la revendication 9, dans laquelle le dispositif de communication (171, 172) comprend au moins un premier trou (171) de communication qui fait communiquer la chambre du côté central (203) avec la chambre de travail (105) et au moins un second trou de communication (172) qui fait communiquer par intermittence la chambre d'alimentation en huile (204) avec la chambre de travail (105) lors- 30

que la seconde volute (103) tourne.

11. Machine selon la revendication 9, dans laquelle le dispositif de communication (173) comporte un trou (173) de communication qui fait communiquer en alternance la chambre du côté central (203) et la chambre d'alimentation en huile (204) avec la chambre de travail (105) lorsque la seconde volute (103) tourne. 35
12. Machine selon la revendication 1, dans laquelle le dispositif de communication (7) débouche dans une gorge (36) de montage d'un joint (35) d'étanchéité de bout placé au bout de la nervure spiralée (32) de la seconde volute (3). 40

