The present invention concerns a compression device (1) suited to compress a gas, of the type comprising: a main body (30; 130, 230; 330) suited to define a compression chamber (2) provided with an inlet (32) for the gas; a liquid for compressing the gas, suited to be injected in the compression chamber (2) to create a mixture comprising the liquid and the gas; compression means (21, 22) arranged in the compression chamber (2) and suited to compress the mixture towards an outlet (50) of the compression chamber (2); separation means (7), arranged downstream of the outlet (50), suited to receive the mixture and to separate the liquid and the gas that are included in the mixture; connection means (51) suited to connect the outlet (50) to the separation means (7). Said connection means (51) comprise at least one connection channel made at least partially in said main body (30; 130, 230; 330).
VOLUMETRIC SCREW COMPRESSOR

FIELD OF APPLICATION OF THE INVENTION

[0001] The present invention is related to the technical field of the devices for the generation of compressed gas, preferably compressed air.

[0002] In particular, the present invention concerns the technical field of volumetric compressors.

[0003] In detail, the present invention concerns an oil-injected volumetric screw compressor.

DESCRIPTION OF THE STATE OF THE ART

[0004] The use of devices for the generation of compressed gas is known in several sectors, typically in the industrial field but also in other fields.

[0005] These compressed gas generation devices, hereinafter simply referred to as “compressors”, are based on the intake of a gas, typically air, and the treatment of the same to increase its pressure while it flows towards an outlet.

[0006] The compressors of the known type are constituted by the so-called oil-injected volumetric screw compressors.

[0007] Said compressors typically comprise a casing that defines a compression chamber provided with an intake duct and a delivery duct. Inside the compression chamber there are two helical rotors, a male (generally driving) rotor and a female (generally driven) rotor that mesh with each other. The compression chamber is fed with oil and the air to be compressed. The compression of the air-oil mixture takes place in the volume included between the toothings of the two rotors and the casing. During the rotation of the two rotors, the contact section included between the profile of the male rotor and that of the female rotor shifts. More particularly, said contact section shifts starting from the intake duct towards the delivery duct. In this way, the air-oil mixture included between the contact section and the delivery duct is compressed.

[0008] The air-oil mixture flowing out of the compression chamber is then subjected to a treatment to separate the oil from the compressed air.

[0009] The separated oil is then recovered in order to be re-used and re-introduced in the compression chamber.

[0010] The separation sector is thus arranged downstream of the compression chamber.

[0011] According to the known art, the separation sector typically comprises a tank. The oil particles are separated from the compressed air due to a mechanical effect. The air-oil mixture flowing out of the compression chamber is directed towards the tank through a channel, typically a pipe. Inside the tank the separated oil particles are deposited on the bottom of the tank, while the compressed air remains in the upper portion of the same.

[0012] On the one hand, the oil is collected from the bottom of the tank in order to recirculate it, as explained above, while on the other hand the compressed air is collected from the upper portion of the tank, further purified from any oil residues, and then made available to be let out at the desired pressure.

[0013] The screw compressors belonging to the state of the art, however, pose some drawbacks.

[0014] A drawback posed by the screw compressors of the known type lies in their construction complexity that is due to the need to channel the various flows along pre-determined paths, to feed oil and air into the compression chamber, to convey the oil-air mixture to the separation tank and to recirculate the oil.

[0015] First of all, this leads to a high production cost of the various parts making up the compressor and to considerable assembly time and costs.

[0016] Another drawback posed by said compressors and related to their construction complexity is constituted by their limited reliability which is due to the presence of several parts that may get damaged over time.

[0017] This construction complexity also leads to the need for complicated and costly operations for the maintenance and/or replacement of any damaged parts.

[0018] A further drawback of said compressors is constituted by their considerable overall dimensions, in particular due to the size of the oil-air mixture separation tank.

[0019] Another drawback of said compressors is represented by pressure drops along the channels of the oil, air and oil/air flows, which reduce the overall efficiency of the compressor.

[0020] The main object of the present invention is thus to solve or at least partially overcome the above mentioned problems that characterize the volumetric screw compressors known in the state of the art.

[0021] In particular, it is one object of the present invention to provide a volumetric screw compressor that is more efficient than the compressors of the known type.

[0022] It is another object of the present invention to provide a volumetric screw compressor having reduced size and weight compared to the compressors of the known type.

[0023] It is another object of the present invention to provide a volumetric screw compressor that is more reliable than the compressors of the known type.

[0024] It is another object of the present invention to provide a volumetric screw compressor having reduced production and/or maintenance times and/or costs compared to the compressors of the known type.

[0025] It is a further object of the present invention to provide a volumetric screw compressor that can be easily adapted to different power ranges and/or to different needs in terms of overall dimensions.

SUMMARY OF THE PRESENT INVENTION

[0026] The present invention is based on the general consideration that the problems found in the art can be at least partially resolved by providing a gas compression device that uses a compression liquid, wherein one or more of the gas and/or liquid conveying elements are integrated in a single block or main body.

[0027] According to a first embodiment, the subject of the present invention is thus a gas compression device of the type comprising:

[0028] a main body suited to define a compression chamber provided with an inlet for said gas;

[0029] a liquid for the compression of said gas, suited to be injected in said compression chamber in order to obtain a mixture comprising said liquid and said gas;

[0030] compression means arranged in said compression chamber and suited to compress said mixture towards an outlet of said compression chamber;

[0031] separation means arranged downstream of said outlet and suited to receive said mixture and separate said liquid from said gas included in said mixture;
[0032] connection means suited to connect said outlet to said separation means, wherein said connection means comprise at least one connection channel created at least partially in said main body.

[0033] The separation means are preferably housed at least partially in the main body.

[0034] According to a preferred embodiment of the invention, the connection channel is completely made in the main body.

[0035] The separation means preferably comprise an element suited to convey the mixture against a surface of the main body.

[0036] Advantageously, the device comprises a tank arranged downstream of the separation means so as to receive at least the separated liquid of the mixture.

[0037] According to a preferred embodiment of the invention, the tank is suited to be removably associated with the main body.

[0038] Preferably, the device comprises a liquid recirculation circuit running from the tank to the compression chamber.

[0039] According to an advantageous embodiment of the invention, the recirculation circuit comprises a channel for injecting the liquid in the compression chamber, wherein the injection channel is at least partially made in the main body.

[0040] A thermostatic valve is properly arranged along the liquid recirculation circuit.

[0041] According to a preferred embodiment of the invention, the thermostatic valve comprises a body carried out in a single piece with the main body.

[0042] Means for filtering the liquid are preferably arranged along the liquid recirculation circuit.

[0043] According to a preferred embodiment of the invention, the liquid filtering means comprise a filter that is accommodated in a supporting seat carried out in a single piece with the main body.

[0044] The device preferably comprises means for injecting the gas in the compression chamber.

[0045] Advantageously, the injection means comprise a gas intake valve.

[0046] In a preferred embodiment of the invention, the device comprises a valve body of the intake valve, wherein the valve body is carried out in a single piece with the main body.

[0047] The device preferably comprises conveying means arranged downstream of the separation means in order to convey the separated gas of the mixture to an oil separator filter.

[0048] According to a preferred embodiment of the invention, the conveying means comprise a gas ejection channel, wherein the ejection channel is at least partially made in the main body.

[0049] Advantageously, the device comprises a liquid recovery channel suited to convey the liquid recovered by the oil separator filter to the compression chamber.

[0050] Preferably, the liquid recovery channel is at least partially made in the main body.

[0051] More preferably, the device comprises a viewing element for the inspection of the liquid recovery channel.

[0052] In a preferred embodiment of the invention, the compression means comprise two helical screws meshing with each other.

[0053] The helical screws are advantageously arranged along respective longitudinal rotation axes that are substantially parallel to each other.

[0054] In a preferred embodiment of the invention, the hydraulic connection channel comprises at least one section aligned along a corresponding axis that intersects one of the rotation axes of the helical springs.

[0055] Advantageously, the device comprises canalization means suited to convey the liquid used to lubricate the moving parts of the device.

[0056] In a preferred embodiment of the invention the liquid conveying means convey the liquid to the sliding bearings of the helical screws.

[0057] The canalization means preferably comprise one or more channels made inside the main body.

[0058] The liquid is preferably constituted by oil.

[0059] The gas is preferably constituted by air.

BRIEF DESCRIPTION OF THE DRAWINGS

[0060] Further advantages, objects and characteristics, as well as further embodiments of the present invention are defined in the claims and will be illustrated in the following description, with reference to the enclosed drawings; in the drawings, corresponding or equivalent characteristics and/or components of the present invention are identified by the same reference numbers. In particular:

[0061] FIG. 1 shows a schematic view of the operating principle of a compressor according to a first embodiment of the invention;

[0062] FIG. 2 shows a side view of a compressor according to a first embodiment of the invention;

[0063] FIG. 3 shows a plan view of the compressor shown in FIG. 2 in which some elements have been removed;

[0064] FIG. 4 shows an axonometric view of some parts of the compressor shown in FIG. 2;

[0065] FIG. 5 shows FIG. 4 from a different point of view;

[0066] FIG. 6 shows a partially exploded side view of FIG. 2 in which some elements have been removed;

[0067] FIG. 7 shows an enlarged detail of FIG. 4;

[0068] FIG. 8 shows a sectional view of FIG. 2 along line VIII-VIII in which some elements have been removed;

[0069] FIG. 9 shows a sectional view of FIG. 3 along line IX-IX;

[0070] FIG. 10 shows an axonometric view from below of the detail shown in FIG. 7;

[0071] FIG. 11 shows a plan view from below of the detail shown in FIG. 7;

[0072] FIG. 12 shows a sectional view of FIG. 3 along line XII-XII;

[0073] FIG. 13 shows a variant embodiment of the compressor shown in FIG. 4;

[0074] FIG. 14 shows an enlarged detail of FIG. 13;

[0075] FIG. 15 shows another variant embodiment of the compressor shown in FIG. 4;

[0076] FIG. 16 shows an enlarged detail of FIG. 15;

[0077] FIG. 17 shows a further variant embodiment of the compressor shown in FIG. 4;

[0078] FIG. 18 shows an enlarged detail of FIG. 17.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0079] Although the present invention is described below with reference to its embodiments illustrated in the drawings,
the present invention is not limited to the embodiments described below and illustrated in the drawings. On the contrary, the embodiments described below and illustrated in the drawings clarify some aspects of the present invention, the scope of which is defined in the claims.

[0080] The present invention can be applied in particular to the production of volumetric compressors used in various sectors, for example in the mining sector, in building construction or in the industrial sector. In particular, the present invention can be especially but not exclusively applied for the production of an oil-injected volumetric screw compressor powered by means of an electric motor. It should however be noted that the present invention is not limited to such application. On the contrary, the present invention can be conveniently applied in all the cases requiring the use of a volumetric screw compressor, for example an engine-driven or motor-driven compressor (internal compression engine/motor).

[0081] Here below is the description of some embodiments of the compressor according to the present invention; in the figures, similar or equivalent characteristics and/or component parts are identified by the same reference numbers.

[0082] FIG. 1 schematically shows the operating principle of a preferred embodiment of the oil-injected screw compressor according to the present invention, hereinafter simply referred to as the “compressor”.

[0083] The compressor 1 substantially carries out a compression treatment on an incoming gas flow Fi, typically air, with a compression liquid, typically oil, in order to obtain an outgoing flow of compressed gas Fo.

[0084] The oil-injected screw compressor 1 is a type of machinery of the volumetric rotary type. It is constituted by a compression chamber 2 containing two helical rotors, a male (generally driving) rotor and a female (generally driven) rotor that mesh with each other, as is explained in greater detail below. The compression of the gas-oil mixture takes place in the volume included between the toothing of the two rotors and the body that defines the compression chamber 2; during rotation, the contact section included between the profile of the male rotor and the profile of the female rotor shifts starting from an intake side towards a delivery side, so that the quantity of air contained therein is compressed due to the reduction in the available volume.

[0085] The compressor 1 comprises an air intake valve 3, provided with an opposite intake filter 4, suitied to convey the air into the compression chamber 2. The compressor 1 comprises an oil supply inlet 5 suited to convey the oil into the compression chamber 2.

[0086] Moving means 6 allow the driving rotor to rotate inside the compression chamber 2. The compressor 1 also comprises a separation sector 7 arranged downstream of the compression chamber 2, in which the compressed oil-air mixture is subjected to a separation treatment in order to provide, at the outlet, compressed air 8 on one side and oil 9 on the other side.

[0087] The separated oil 9 is recovered in order to be reintroduced in the compression chamber 2 through said supply inlet 5. The re-introduction of said oil 9 into the compression chamber 2 is conditional on its previous passage in a thermostatic valve 10 that allows the oil 9 to flow through it towards the supply inlet 5 only if its temperature is below a predetermined limit temperature. In fact, the oil inside the compression chamber 2 is subjected to a temperature increase. The thermostatic valve, therefore, allows only oil at the correct temperature to flow through it, while the oil at higher temperature is conveyed to an oil cooler 11 that lowers its temperature before it is re-introduced in the recirculation circuit.

[0088] Upstream of the oil supply inlet 5 there is preferably a filter 12 suitied to purify the oil from any impurities.

[0089] The separated compressed air 8 is first conveyed to an oil separator filter 13 that separates any oil residues present in the compressed air.

[0090] The recovered residual oil is re-introduced in the compression chamber 2. Along the re-introduction circuit provided for the recovered oil there is preferably an oil recovery viewing element 14 that allows the oil to be monitored.

[0091] The purified compressed air flowing out of the oil separator filter 13 passes through a minimum pressure valve 15. Said valve 15 allows the passage of air through it only when the pre-determined rated pressure has been reached.

[0092] The air flowing out of the minimum pressure valve is preferably directed towards a cooler 16 where it is cooled down. The cooled air is then conveyed to a usage tank 17, or alternatively directly to the user.

[0093] Part of the purified compressed air flowing out of the oil separator filter 13 is conveyed to the intake valve 3 through an appositive channel 58. The air conveyed through said channel 58 represents the feedback signal that signals to the intake valve 3 when the air passage must be closed or opened. In particular, if the air pressure in said channel 58 is lower than the pre-determined rated pressure of the compressor 1, the intake valve 3 is opened. If, on the contrary, the air pressure in said channel 58 is higher than or equal to the pre-determined rated pressure of the compressor, the intake valve 3 is closed.

[0094] Further elements, not specifically indicated, are preferably provided in the compressor 1, like for example valves for discharging oil from the separation sector 7, or safety valves, or valves for discharging the condensation present in the air tank 17 etc.

[0095] The compressor 1 is described here below with reference to Figures from 2 to 12, indicating the various parts mentioned above.

[0096] In the compressor 1 it is first of all possible to identify a main body 30, shown in particular in FIG. 7, inside which the compression chamber 2 is defined.

[0097] The main body 30 is preferably produced by means of a permanent mold casting process, preferably through a metallic material casting process. The metallic material preferably comprises aluminium. In variant embodiments of the invention, the main body 30 can advantageously be obtained by sand casting of a cast iron alloy.

[0098] On the underside of the main body 30 there is a tank 40 suitied to collect the air 8 and the oil 9 generated downstream of the separation means 7.

[0099] The oil tank 40 is preferably suitied to be connected to the main body 30 by means of screws, as shown in FIG. 6, in such a way as to obtain a removable structure.

[0100] The tank is advantageously provided with an oil discharge valve 80.

[0101] In the compression chamber 2 there are, arranged longitudinally along a main axis X, a first rotor 21 with helical toothings, or male rotor, and a second rotor 22 with helical toothings, or female rotor, which meshes with the first rotor 21. The two rotors 21 and 22 are arranged substantially parallel to each other and rotate along corresponding rotation axes substantially parallel to the main axis X of the compression chamber 2.
[0102] In the embodiment illustrated herein, the first rotor 21 is the driving rotor and is suited to be connected at one end 24 to the power means 6. The second rotor 22 is the driven rotor and is set rotating by the first rotor 21.
[0103] The power means 6 preferably comprises an electric motor directly connected to the end 24 of the first rotor 21.
[0104] In variant embodiments of the invention the power means may be of a different type, like for example a combustion engine, or they may be provided with an indirect, remote connection to a motor, for example through the interposition of a driving belt or gears.
[0105] The first rotor 21 preferably comprises four lobes suited to be engaged in seats provided in the second rotor 22. Said seats are five in the embodiment illustrated herein.
[0106] In variant embodiments of the invention, however, the number of lobes and/or seats of the two rotors 21, 22 may be different.
[0107] The top of the main body 30 is associated with the air intake valve 3 with the respective filter 4.
[0108] The air intake valve 3 comprises a valve body 31 that houses internal valve means, fixed to the valve body through suitable connection means, for example through screws.
[0109] The valve body 31 is preferably carried out in a single piece with the main body 30.
[0110] The air intake valve 3 communicates with the compression chamber 2 through an air intake channel 32. Said air intake channel 32 is preferably provided in the main body 30, as shown in FIG. 9.
[0111] Regarding the oil supply to the compression chamber 2, this is achieved through a recirculation circuit that draws the oil from the bottom of the tank 40 in order to reintroduce it in the compression chamber 2.
[0112] The oil present on the bottom of the tank 40 is drawn, due to the effect of pressure inside the tank 40, through a suction pipe 41, visible in FIG. 6, and then conveyed to the thermostatic valve 10.
[0113] If the oil temperature is correct, meaning below a limit temperature, the thermostatic valve 10 directs the oil flow directly to the oil filter 12 and from there to the compression chamber 2. If the oil temperature exceeds the limit temperature, the thermostatic valve 10, instead, directs the oil flow towards a cooler, not illustrated herein, through a duct connected to an opposite outlet 42.
[0114] The oil cooled by the cooler is reintroduced upstream of the thermostatic valve 10 through a duct connected to an opposite inlet 43.
[0115] The body 46 of the thermostatic valve 10 is preferably carried out in a single piece with the main body 30.
[0116] Also the supporting seat 55 of the oil filter 12 is preferably carried out in a single piece with the main body 30.
[0117] The oil flowing out of the oil filter 12 is conveyed to the compression chamber 2 through an oil injection channel 47, shown in FIG. 8.
[0118] The oil injection channel 47 is advantageously defined inside the main body 30.
[0119] As is known, in oil-injected screw compressors the oil performs also a lubricating function with regard to some parts of the compressor. In particular, the sliding elements, or bearings, that support the rotors 21, 22 need lubricating. For this purpose, the oil in the system is also properly channeled in such a way as to reach those parts. One of said lubrication channels 49, shown in FIG. 9, allows a minimum quantity of oil taken from the oil injection channel 47 to be conveyed to one end of the compression chamber, in the area where there are the bearings of the rotors 21, 22. Advantageously, said lubrication channel 49 is defined inside the main body 30.
[0120] The oil-air mixture is thrust from the compression chamber 2 towards an outlet opening 50 by the combined action of the two rotors 21 and 22, as shown in FIG. 9. The mixture is channeled from said outlet opening 50 towards the separation means 7.
[0121] According to the present invention, the canalization of the mixture takes place through a hydraulic connection channel 51. The hydraulic connection channel 51 is advantageously made in the main body 30.
[0122] The hydraulic connection channel 51 is substantially aligned along an inclined axis Y. Said axis Y of the hydraulic connection channel 51 intersects the main axis X of the compression chamber 2, as visible in FIG. 9, and thus intersects also the respective rotation axes of the first and second rotor 21 and 22.
[0123] The separation means 7, as illustrated in FIGS. 9, 10 and 11, are arranged under the compression chamber 2 and are preferably confined in a hollow portion 33 of the main body 30. In particular, the hollow portion 33 is defined by a side perimeter wall 34 of the main body 30. The side perimeter wall 34 is advantageously made in a single piece with the main body 30.
[0124] In this way the hydraulic connection channel 51 is advantageously carried out completely in the main body 30.
[0125] In particular, the separation means 7 comprise an injection element 52 suited to receive the pressurized mixture from the hydraulic connection channel 51 and to convey said mixture against the internal surface of the side perimeter wall 34.
[0126] The oil particles are separated from the compressed air due to a mechanical effect. The flow of the mixture is directed towards a given route, indicatively shown by the arrow D1 in FIG. 11. The special geometric configuration of the side wall 34 makes it possible to reduce the flow speed and thus to separate the oil particles from the air.
[0127] Following this separation, the oil falls downwards due to gravity and it is collected in the tank 40.
[0128] The compressed air separated from the oil, instead, remains in the upper portion 40a of the tank 40.
[0129] Advantageously, according to the present invention the separation means 7 are partially defined by the lower portion of the main body 30 and positioned in proximity to the compression chamber 2.
[0130] This makes it possible to reduce to a minimum the length of the hydraulic connection channel 51 between the compression chamber 2 and the separation means 7, more particularly between the outlet opening 50 and the injection element 52.
[0131] This advantageously makes it possible to reduce the pressure drops in the mixture to a minimum.
[0132] In other embodiments of the invention, the injection element may come in different shapes, and it may also be made in a single piece with the main body 30.
[0133] As already explained, the separated compressed air is in the upper portion 40a of the tank 40. The compressed air is drawn from said upper portion 40a through an ejection channel 60 in order to be conveyed to the oil separator filter 13. Said filter 13 allows the purification of the compressed air through the elimination of residual oil particles left therein after the separation step.
[0134] The first portion 60a of the air injection channel 60 is advantageously carried out inside the main body 30.
The oil separator filter 13 comprises a first outlet 61 for the purified compressed air and a second outlet 62 for the oil recovered after filtering, as can be seen in FIG. 12. The recovered oil is re-introduced in the compression chamber 2 through a suitable oil recovery channel 62. Advantageously, the oil recovery channel 62 is partially carried out inside the main body 30.

The oil recovery viewing element 14 is advantageously positioned along the oil recovery channel 62. Said viewing element 14 makes it possible to monitor the presence of oil inside the oil recovery channel 62 and thus inside the compressor 1.

The purified air flowing out of the oil separator filter 13 passes through the minimum pressure valve 15. The outgoing flow of compressed air F_u is available at the outlet of the minimum pressure valve 15. According to the present invention, the presence of a main body 30 provided with channels for the flow of oil and/or air and/or the air-oil mixture makes it possible to reduce to a minimum the length of the routes covered by said fluids and thus to reduce the pressure drops in the corresponding flows.

This increases the overall efficiency of the compressor 1 and reduces its dimensions. This results in a compact structure of the compressor 1.

Furthermore, such a type of canalization makes it possible to avoid the use of ducts to create the channels for the passage of the fluids, reducing to a minimum the moving parts of the compressor and also minimizing the risk of breakage and/or damage. This makes the compressor more reliable and reduces the time and costs required for the maintenance and/or production of the compressor.

Furthermore, said techniques for making the main body allow the compressor's production time and costs to be reduced.

A further advantage obtained through the present invention is the integration of several parts of the compressor in the main body 30. In particular, elements like the side air intake valve 3, the valve body 31 of the intake valve 3, the body 46 of the thermostatic valve 10, the supporting seat 55 of the oil filter 12 are advantageously carried out in a single piece with the main body 30.

This results in the compact structure of the compressor, its reduced size, its reduced overall weight and greater reliability due to the integration of said elements.

Said advantages with respect to the known art are at least partially obtained even if not all of the said elements are integrated in the main body, but only one or more of the same, as is explained below with reference to other embodiments of the invention.

As explained above, the tank 40 can be associated with the main body 30 of the compressor 1 through screws. Furthermore, the separation means 7 are substantially confined in the overall volume of the main body 30. Said characteristics make the tank 40 easy to replace to equip the compressor with a tank having a different shape and/or volume.

This makes it possible to customize the compressor based on the different characteristics required from time to time, which may vary according to the compressor power required or simply in order to adapt the external shape of the tank in case special sizes are needed or to satisfy specific aesthetic requirements.

Again, the tank may be configured so that it can be placed in a remote position with respect to the main body 30, and in this case a collection element may be provided that can be applied to the underside of the main body 30 downstream of the separation means 7, for example a funnel-shaped element that collects the separated oil and conveys it to the remote tank. A suitable suction unit will then be provided to bring the oil from the remote tank back to the compression chamber 2 so as to allow recirculation.

FIGS. 13 and 14 show a variant embodiment of the invention.

Said embodiment differs from the one previously described with reference to Figures from 2 to 12 in that the valve body 131 of the intake valve 3 constitutes a separate element that can be applied to the main body 130. The other elements, that is, the side perimeter wall 34 of the separation means 7, the valve body 46 of the thermostatic valve 10 and the supporting seat 55 of the oil filter 12 are advantageously carried out in a single piece with the main body 130.

FIGS. 15 and 16 show another variant embodiment of the invention.

Said embodiment differs from the one previously described with reference to FIGS. 13 and 14 in that the supporting seat of the oil filter 12, not illustrated herein, constitutes a separate element with respect to the main body 230. In a preferred embodiment of the invention, the supporting seat of the oil filter 12 can be applied directly to the main body 230 in an appropriate channel 231. In other embodiments of the invention the supporting seat of the oil filter 12 is suited to be connected to the main body 230 through a duct connected to the same channel 231. The other elements, that is, the side perimeter wall 34 of the separation means 7 and the body 46 of the thermostatic valve 10, are advantageously carried out in a single piece with the main body 230.

FIGS. 17 and 18 show a further variant embodiment of the invention.

Said embodiment differs from the one previously described with reference to FIGS. 15 and 16 in that the body of the thermostatic valve, not illustrated herein, constitutes a separate element that can be applied to the main body 330. The side perimeter wall 34 of the separation means 7 is advantageously made in a single piece with the main body 330.

The above clearly shows, therefore, that the compressor that is the subject of the invention achieves all the set objects, and in particular achieves the object to provide a volumetric screw compressor having reduced size and weight compared to the compressors of the known type, though ensuring higher reliability and efficiency.

While the present invention has been described with reference to the particular embodiments shown in the figures, it should be noted that the present invention is not limited to the specific embodiments illustrated and described herein; on the contrary, further variants of the embodiments described herein fall within the scope of the present invention, which is defined in the claims.

1) Gas compression device (1), comprising:

a main body (30; 130; 230; 330) suited to define a compression chamber (2) provided with an inlet (32) for gas, said main body being a single block,
a compression liquid for the gas, suited to be injected in the compression chamber (2) in order to obtain a mixture comprising said compression liquid and the gas; compression means (21, 22) arranged in the compression chamber (2) and suited to compress the mixture towards an outlet (50) of the compression chamber (2); separation means (7) arranged downstream of the outlet (50) and suited to receive the mixture and separate said compression liquid from the gas included in the mixture; a connection channel (51) suited to directly connect the outlet (50) to said separation means (7); wherein said connection channel (51) is completely made in said main body (30, 130, 230, 330).

2) Device according to claim 1, wherein:
said separation means (7) are at least partially housed in said main body (30, 130, 230, 330).

3) Device (1) according to claim 1 wherein:
said separation means (7) comprise an element (52) suited to convey said mixture against a surface of said main body (30, 130, 230, 330).

4) Device (1) according to claim 1 further comprising:
a tank (40) arranged downstream of said separation means (7) in order to receive at least a separated compression liquid of the mixture.

5) Device (1) according to claim 4, wherein:
said tank (40) can be removable associated with said main body (30, 130, 230, 330).

6) Device (1) according to claim 4 further comprising:
a circuit recirculating said compression liquid from said tank (40) to the compression chamber (2).

7) Device (1) according to claim 6, wherein:
said recirculation circuit comprises an injection channel (47) for injecting said compression liquid in the compression chamber (2), the injection channel (47) being at least partially carried out in said main body (30, 130, 230, 330).

8) Device (1) according to claim 6 further comprising:
a thermostatic valve (10) arranged along said recirculation circuit of said compression liquid.

9) Device (1) according to claim 8, wherein:
said thermostatic valve (10) comprises a body (46) carried out in a single piece with said main body (30, 130, 230).

10) Device (1) according to claim 6 further comprising:
means (12) for filtering said compression liquid are arranged along said circuit.

11) Device (1) according to claim 10, wherein:
said means for filtering comprise a filter (12) that is housed in a supporting seat (55) carried out in a single piece with the main body (30, 130).

12) Device (1) according to claim 1 further comprising:
injection means (3) for injecting the gas in the compression chamber (2).

13) Device (1) according to claim 12, wherein:
said injection means (3) comprise an intake valve (3) for the gas.

14) Device (1) according to claim 13, further comprising:
a valve body (31) of the intake valve (3), said valve body (31) being carried out in a single piece with said main body (30).

15) Device (1) according to claim 1 further comprising:
conveying means (60), arranged downstream of said separation means (7), for conveying a separated gas of the mixture to an oil separator filter (13).

16) Device (1) according to claim 1 further comprising:
canализация means (49) for conveying said compression liquid for lubricating moving parts of said gas compressor device (1).

17) Device (1) according to claim 16, wherein:
said canализация means comprise one or more channels (49) made inside said main body (30, 130, 230, 330).

18) Device (1) according to claim 1 wherein:
said compression means comprise two helical screws (21, 22) meshing with each other.

19) A gas compressor comprising:
a main body:
a compression chamber formed in said main body having an inlet and an outlet;
compression means, placed within said compression chamber, for compressing a mixture of a gas and a compression liquid, said compression means moving the mixture to the outlet of said compression chamber;
a separator, whereby the gas and the compression liquid are separated; and
a connection channel completely made within said main body coupled to the outlet of said compression chamber and said separator,
whereby the gas compressor has a reduced size and weight with improved reliability.

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