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(54) HERMETIC COMPRESSOR

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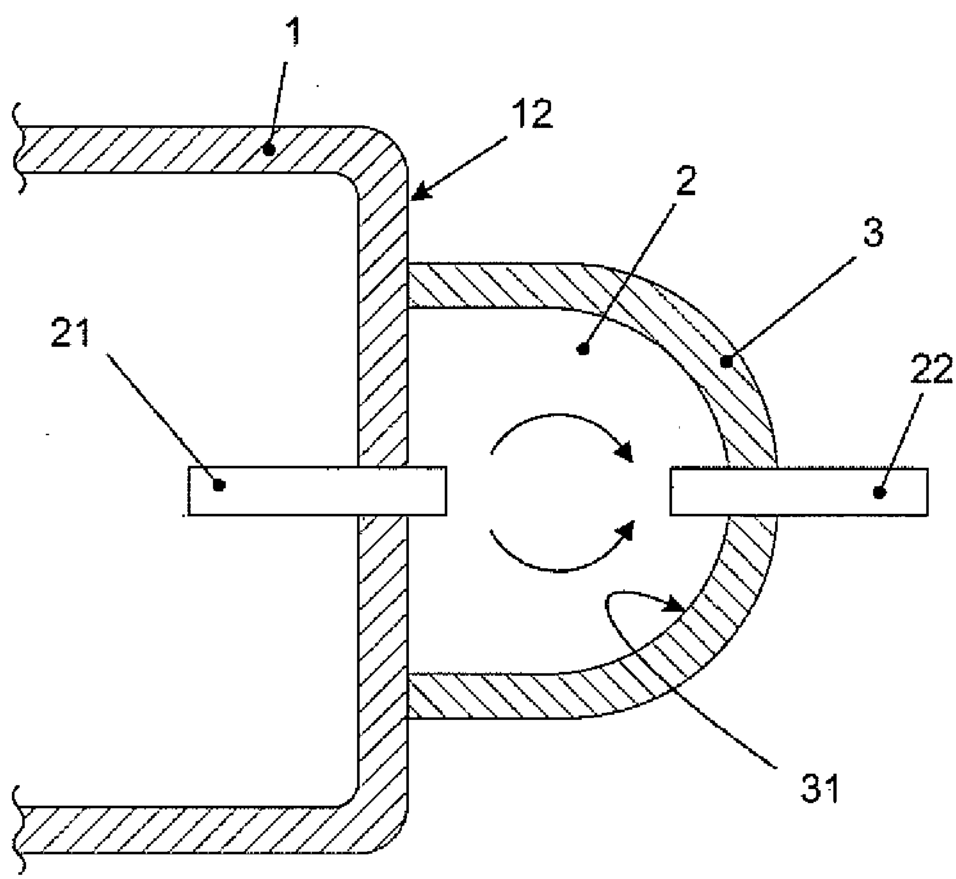
(57) **ABSTRACT**

It is disclosed a hermetic compressor, provided with at least one fluid expansion chamber, whose useful volume is narrowly defined between a section of one of the faces (inner or outer) of the airtight housing of the compressor and at least one wall section adjacently attached to one of the faces of the airtight housing of the compressor.



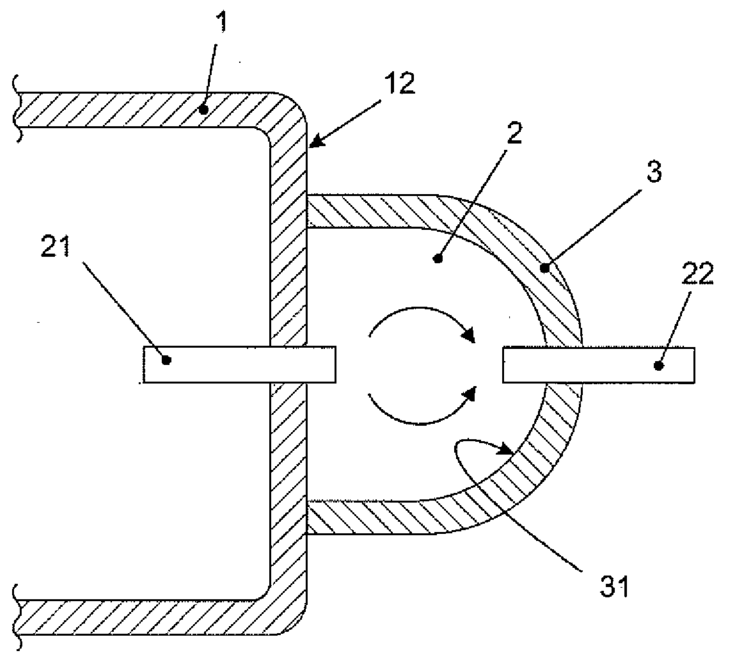


Figure 1A

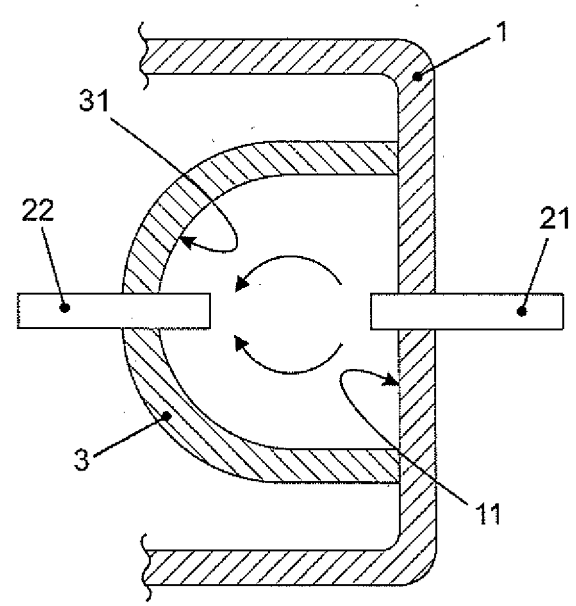


Figure 1B

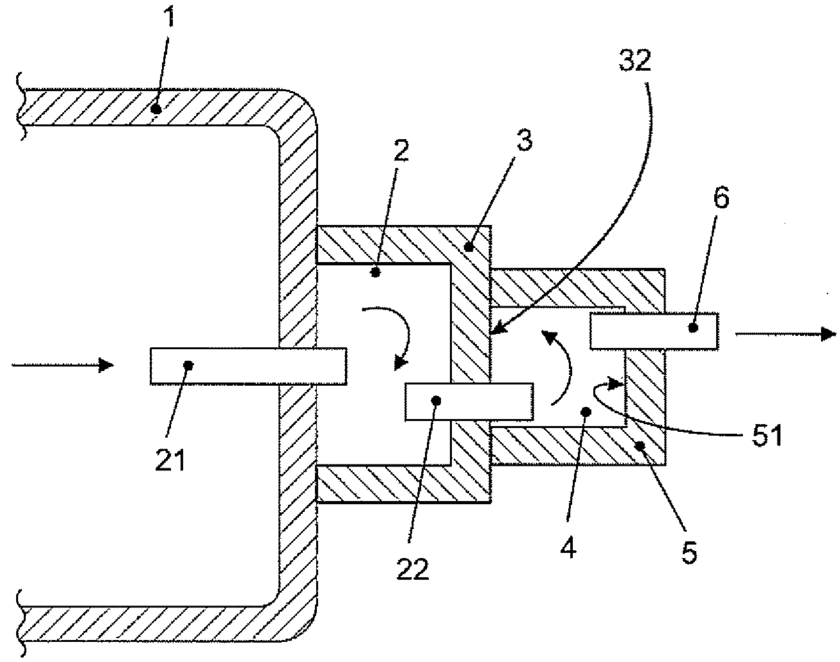


Figure 2A

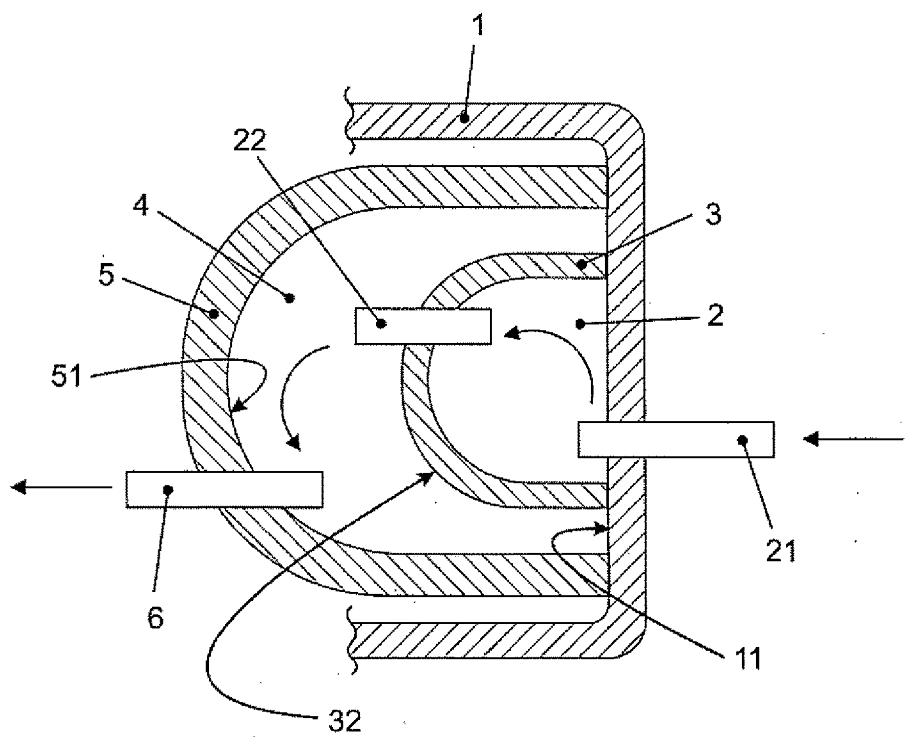


Figure 2B

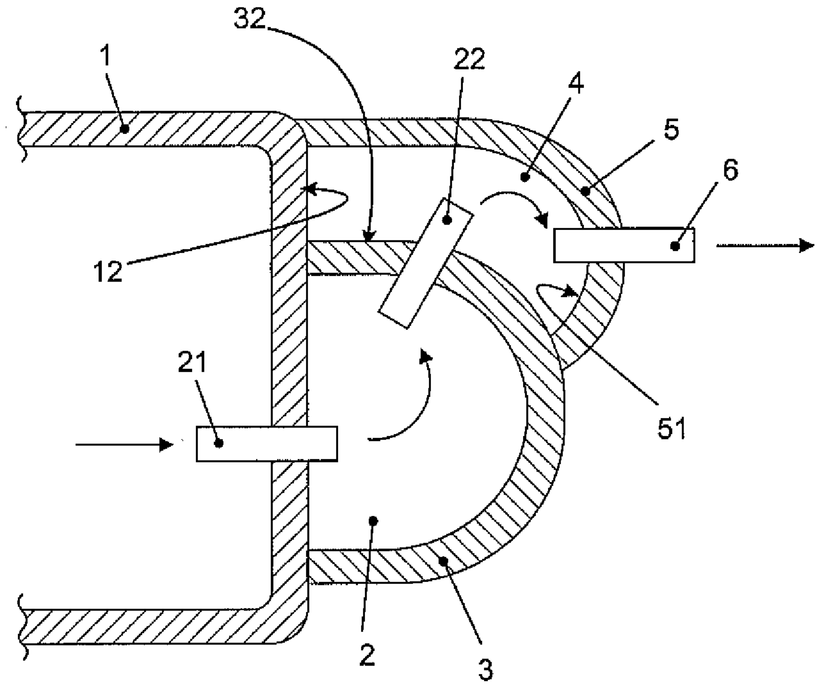


Figure 2C

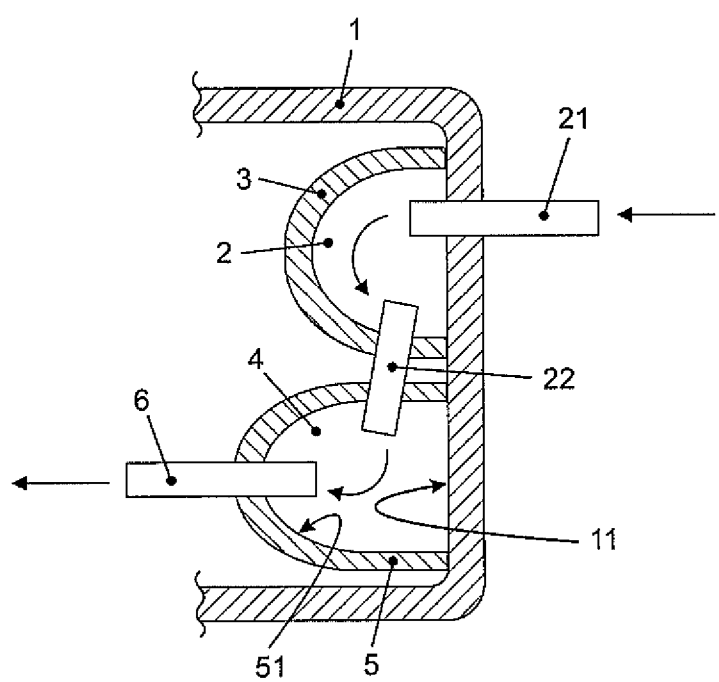


Figure 2D

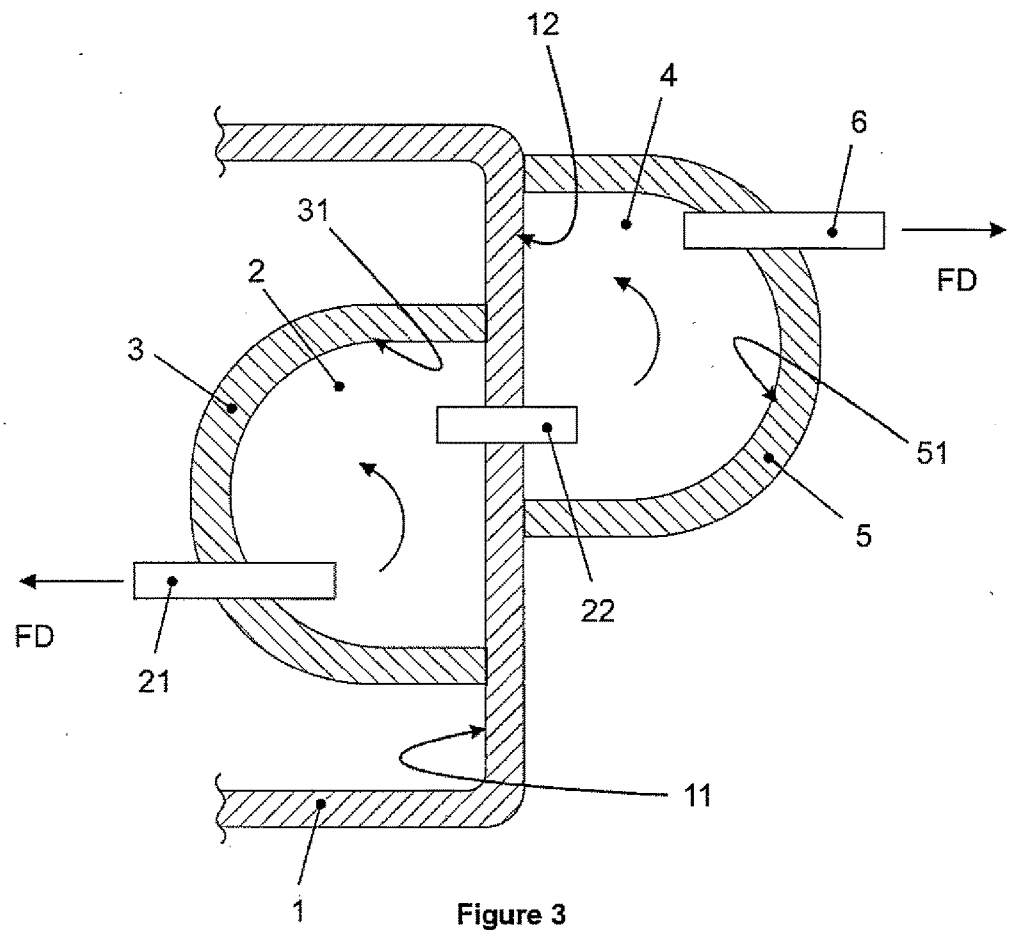


Figure 3

HERMETIC COMPRESSOR

FIELD OF THE INVENTION

[0001] The invention in question relates to a hermetic compressor, and, more particularly, a hermetic compressor provided with at least one fluid expansion chamber, that is, a pulsation attenuating chamber that can be used in the discharge line (discharge muffler) or in the suction line (suction muffler).

[0002] In accordance with the invention in question, the hermetic compressor disclosed herein is distinguished in that it comprises an airtight housing and at least an additional wall section, wherein the volume defined between the airtight housing and the additional wall section ends up defining said fluid expansion chamber.

BACKGROUND OF THE INVENTION

[0003] As is well known to those skilled in the art, hermetic compressors, especially those comprised of positive displacement compression mechanisms, include, among other components, discharge expansion chambers (also referred to as "discharge mufflers") and suction expansion chambers (also referred to as "suction muffler"). In general lines, the fluid expansion chambers have the general function of attenuating the pulsations of the useful fluid, being that the functional principles which governs the passive operation of the fluid expansion chambers are widely known to professionals and theoreticians in the area of acoustics, besides being particularly detailed in specialized technical literature.

[0004] The current state of the art comprises an infinity of models and constructions of fluid expansion chambers used in hermetic compressors.

[0005] There are, for example, constructions in which the volume of the discharge expansion chamber is defined by a hollow modular body arranged, in a non-anchored manner, within the airtight housing of the hermetic compressor. The fluid communication between the compression mechanism head, the hollow modular body and the discharge duct is performed by a rigid metal tubing.

[0006] There are, for example, constructions in which the volume of the discharge expansion chamber is integrally or partially defined in the compressor block itself. The fluid communication, between the compression mechanism head, the compressor block and the discharge duct, is performed by a rigid metal tubing.

[0007] There are, for example, as described in the patent document U.S. Pat. No. 4,782,858, constructions in which the volume of the discharge expansion chamber is integrally defined in the cap of the compression mechanism head. The fluid communication between the compression mechanism head and the discharge duct is performed by a rigid metal tubing.

[0008] There are, for example, as described in the patent document US 2009/162215, constructions in which the volume of the discharge expansion chamber is segmented in two, the first "sub volume" being defined integrally in the cap of the head and the second "sub volume" being defined between the cap of the head and the outer face of a segment of the compression cylinder block, the fluid communication between the two "sub-volumes" being defined in the arrangement itself, without the overall structure of the cylinder block being altered. The fluid communication between the compression mechanism head and the discharge duct is performed by a rigid metal tubing.

[0009] It is noted, however, that regardless of the model or construction of the known expansion chambers, they are always arranged within the airtight housing of the compressor, that is, they are arranged in the internal environment whose useful volume is shared with the compression mechanism, such as the electric motor, with the compressor block, among other components and systems.

[0010] In a general manner, the fact that an expansion chamber is arranged within the airtight housing generates at least three drawbacks, one from the thermal point of view, the other from the dimensional point of view, and the third relating to aspects of reliability.

[0011] With regard to the thermal point of view, it is noted that the discharge expansion chamber is arranged in an environment (within the airtight housing), whose temperature is lower than the temperature of the discharge fluid, that is, the temperature outside the discharge expansion chamber is less than its within temperature. Consequently, the internal environment of the housing of the compressor (suction fluid) suffers severe thermal exchange, after all, its temperature is pejoratively influenced by the temperature of the circulating discharge fluid through the discharge expansion chamber. As a consequence, there is an increase in the suction temperature of the compressor and, in this way, reducing the volumetric efficiency and, hence, the energy efficiency thereof.

[0012] As far as the dimensional point of view is concerned, it is noted that the discharge expansion chamber occupies a useful volume which could otherwise be suppressed in order to enable the miniaturization of the hermetic compressor housing, which currently is unlikely. Another benefit of reducing internal compressor volume is related to the application of high pressure useful refrigerants, such as CO_2, as well as flammable, wherein the compressors fall into the category of pressure vessel safety, and the internal volume defines the criticality of the damage. Thus, compressors with smaller internal volumes are advantageous for this type of application.

[0013] With regard to the reliability, it is noted that the reduction of the masses mounted in the discharge tube, which has a relative movement between the housing and the internal assembly of the compressor, especially the compressor block, when transporting the compressor, and also in the moments of on and off of the compressor. The elimination of these masses reduces the loads on the pipes, as well as avoids shocks of these volumes with the internal components and the housing of the compressor.

[0014] It is, therefore, based on the above-described scenario that the invention in question arises.

GOALS OF THE INVENTION

[0015] Thus, it is the primary goal of the invention in question to disclose a hermetic compressor, provided with at least one fluid expansion chamber, whose useful volume is narrowly defined between a section of one of the faces (inner or outer) of the airtight housing of the compressor and at least one wall section adjacently attached to one of the faces of the airtight housing of the compressor.

[0016] Accordingly, it is also a goal of the invention in question to provide a fluid expansion chamber less susceptible to thermal exchanges and which occupies less or no useful space within the airtight housing of the hermetic compressor.

[0017] It is also a goal of the invention in question that the fluid expansion chamber of the hermetic compressor now treated be less susceptible to problems and failures of transport and application of the compressor at the times of turning the compressor on and off.

[0018] Thus, it is one of the goals of the invention in question that the general concept of a fluid expansion chamber, whose useful volume is narrowly defined between a section of one of the faces (inner or outer) of the airtight housing of the compressor and at least a wall section adjacently attached to one of the faces of the airtight housing of the compressor can be used both as a discharge muffler and a suction muffler.

BRIEF DESCRIPTION OF THE INVENTION

[0019] The goals summarized above are fully achieved by the hermetic compressor disclosed herein, which comprises an airtight housing, at least one reciprocating compression mechanism arranged within the airtight housing and at least one fluid expansion chamber. Said fluid expansion chamber is formed between one of the faces of the airtight housing and the inner face of a first modular body, hermetically attached to one of the faces of the airtight housing and comprises at least one inlet path and at least one outlet path.

[0020] In accordance with the invention in question, the fluid expansion chamber may comprise a discharge fluid expansion chamber (discharge muffler) or a suction fluid expansion chamber (suction muffler).

[0021] Also in accordance with the invention in question, the fluid expansion chamber may be external (formed between the outer face of the airtight housing and the inner face of a first modular body hermetically attached to the outer face of the airtight housing) and/or internal (formed between the inner face of the airtight housing and the inner face of a first modular body hermetically attached to the inner face of the airtight housing).

[0022] Further, still in accordance with the invention in question, the inlet path and the outlet path of the fluid expansion chamber can be fluidly aligned or misaligned.

[0023] Optionally, the hermetic compressor disclosed herein further comprises at least one second fluid expansion chamber fluidly connected, in series, to the "main" fluid expansion chamber.

[0024] In one of the possible embodiments of such optional embodiment, the second fluid expansion chamber is internal, being arranged within the airtight housing and may be formed, at least partially, between the inner face of the airtight housing and the inner face of a second modular body or be formed, at least partially, between the outer face of the first modular body and the inner face of a second modular body.

[0025] In another of the possible embodiments of such optional embodiment, the second fluid expansion chamber is external, being arranged on the exterior of the airtight housing and may be formed, at least partially, between the outer face of the airtight housing and the inner face of a second modular body or be formed, at least partially, between the outer face of the first modular body and the inner face of a second modular body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The invention in question will be particularly detailed on the basis of the illustrative Figures listed below, which:

[0027] FIGS. **1**A and **1**B illustrate, in a schematic form, the most basic and simplified embodiments of the invention in question;

[0028] FIGS. **2**A, **2**B, **2**C and **2**D illustrate, in a schematic form, possible embodiments of the optional embodiment of the invention in question; and

[0029] FIG. **3** illustrates, in a schematic form, another possible embodiment of the optional embodiment of the invention in question.

DETAILED DESCRIPTION OF THE INVENTION

[0030] In accordance with the central goals of the invention in question, it is desired to "shift" the volume of a traditional fluid expansion chamber (discharge or suction), normally displaced within the airtight housing of a hermetic compressor, to the vicinity of said airtight housing, so that such volume becomes an integral part of the housing of the compressor.

[0031] Of course, such invention has the potential to optimize the internal volume of the compressor, in addition to reducing the emission of heat within the housing, promoting greater energy efficiency. In addition, such invention simplifies the overall manufacturing process of the compressor, after all, traditional brazing processes are replaced by faster and less expensive welding processes.

[0032] In a general manner, the hermetic compressor treated herein is a traditional hermetic compressor, and, of course, certain details not relevant for the understanding of the invention in question have been omitted and/or deleted. It is again emphasized that omission or deletion of these details (components that integrate the compression or the damping mechanisms, for example) does not prejudice the full understanding of the invention in question.

[0033] The invention in question, in its inventive core, is illustrated in FIGS. **1**A and **1**B.

[0034] As illustrated in these Figures, the hermetic compressor disclosed herein comprises an airtight housing and a fluid expansion chamber, being that the great inventive merit of the invention in question consists in the fact that said fluid expansion chamber—rather than being detached and conformed in itself, as it happens in the current state of the art—is formed between one of the faces of the airtight housing and the inner face of a first modular body hermetically attached to one of the faces of the airtight housing.

[0035] Specifically, as illustrated in FIG. **1**A, said fluid expansion chamber (**2**) is external to the airtight housing (**1**), being formed between the outer face (**12**) of the airtight housing (**1**) and the inner face (**31**) of the first modular body (**3**), which is, in turn, hermetically attached to the same outer face (**12**) of the airtight housing (**1**). It is further noted that, such as illustrated, said fluid expansion chamber (**2**) is a discharge fluid expansion chamber.

[0036] Specifically, as illustrated in FIG. **1**B, said fluid expansion chamber (**2**) is internal to the airtight housing (**1**), being formed between the inner face (**11**) of the airtight housing (**1**) and the inner face (**31**) of the first modular body (**3**), which is, in turn, hermetically attached to the same inner face (**11**) of the airtight housing (**1**). It is further noted that, such as illustrated, said fluid expansion chamber (**2**) is a suction fluid expansion chamber.

[0037] In both embodiments illustrated in FIGS. **1**A and **1**B, it is noted that the fluid expansion chamber (**2**) comprises at least one inlet path (**21**) and at least one outlet path (**22**).

[0038] In the embodiment illustrated in FIG. **1**A, the inlet path (**21**) is related to a fluidic communication means (tube or mere through-hole, to give only two examples) which, bypassing the airtight housing (**1**), connects its internal environment to the volume of the fluid expansion chamber (**2**). The outlet path (**22**) is related to a fluid communication means (discharge duct tube, to give only one example) able to allow the connection between the hermetic compressor and the discharge line of an external system (not illustrated), such as, for example, a cooling system.

[0039] In the embodiment illustrated in FIG. **1**B, the inlet path (**21**) is related to a fluidic communication means (suction duct tube, to give only one example) which, bypassing the airtight housing (**1**), is able to allow the connection between the suction line of an external system (not illustrated), such as, for example, a cooling system and the hermetic compressor. The outlet path (**22**) is related to a fluidic communication means (tube or mere through-hole, to give only two examples) capable of connecting the volume of the fluid expansion chamber (**2**) to the internal environment of the compressor or to the cylinder of the compression mechanism (not illustrated).

[0040] In both embodiments illustrated in FIGS. **1**A and **1**B, in addition to the remaining embodiments described in the invention in question, the first modular body (**3**) is preferably made of metal alloy and attached to one of the faces (**11** and **12**) of the airtight housing (**1**), preferably by means of welding. Nothing prevents the modular body from being manufactured with other types of materials, such as polymeric, that the fixing is of alternative forms, such as, for example, glue.

[0041] Although the invention in question does not intentionally address thermal and acoustic issues, it is worth emphasizing that the general, dimensional and structural format of the first modular body (**3**), as well as the general features of the fastening medium, must respect the features of acoustics of each project. In this regard, it is most important to note that in any of the embodiments illustrated in FIGS. **1**A and **1**B, the inlet path (**21**) and the outlet path (**22**) of the fluid expansion chamber (**2**) can be arranged in a fluidly aligned manner or in a fluidly misaligned manner.

[0042] Optional embodiments of the invention in question, in accordance with the inventive core described above, are illustrated in FIGS. **2**A, **2**B, **2**C and **2**D.

[0043] In all these optional embodiments it is noted the existence of said fluid expansion chamber (**2**) (internal or external to the airtight housing (**1**), formed between one of the faces (**11** and **12**) of the airtight housing (**1**) and the inner face (**31**) of a first modular body (**3**) hermetically attached to one of the faces (**11** and **12**) of the airtight housing (**1**)) and the existence of at least one second fluid expansion chamber (**4**) fluidly connected, in series, to the fluid expansion chamber (**2**). The fluid expansion chambers (**2** and **4**) can conform a volume-in-series for discharge fluid or a volume-in-series for suction fluid.

[0044] In general lines, the formation of the second fluid expansion chamber (**4**) always has a second modular body (**5**), which, also in general lines, is substantially analogous to the first modular body (**3**).

[0045] The formatting of the second fluid expansion chamber (**4**), always employing the second modular body (**5**), can be varied, some examples being illustrated in cited FIGS. **2**A, **2**B, **2**C and **2**D.

[0046] As illustrated in FIG. **2**A, the fluid expansion chamber (**2**) and the second fluid expansion chamber (**4**) are both external and, preferably, dedicated to the discharge fluid. In this embodiment, the second fluid expansion chamber (**4**) is formed only between the outer face (**32**) of the first modular body (**3**) and the inner face (**51**) of a second modular body (**5**).

[0047] As illustrated in FIG. **2**B, the fluid expansion chamber (**2**) and the second fluid expansion chamber (**4**) are both internal and, preferably, dedicated to the suction fluid. In this embodiment, the second fluid expansion chamber (**4**) is formed between the outer face (**32**) of the first modular body (**3**), the inner face (**11**) of the airtight housing (**1**) and the inner face (**51**) of a second modular body (**5**).

[0048] As illustrated in FIG. **2**C, the fluid expansion chamber (**2**) and the second fluid expansion chamber (**4**) are both external and, preferably, dedicated to the discharge fluid. In this embodiment, the second fluid expansion chamber (**4**) is formed between the outer face (**32**) of the first modular body (**3**), the outer face (**12**) of the airtight housing (**1**) and the inner face (**51**) of a second modular body (**5**).

[0049] As illustrated in FIG. **2**D, the fluid expansion chamber (**2**) and the second fluid expansion chamber (**4**) are both internal and, preferably, dedicated to the suction fluid. In this embodiment, the second fluid expansion chamber (**4**) is formed only between the inner face (**11**) of the airtight housing (**1**) and the inner face (**51**) of a second modular body (**5**).

[0050] In these four embodiments, it is further noted that the fluid expansion chamber (**4**) comprises an outlet path (**6**), which is directed to a fluidic communication means (traditional tube, mere through-hole or through-tube, to give only three examples). In this sense, it is noted that the "inlet path" of said fluid expansion chamber (**4**) always ends up being defined by the outlet path (**22**) of the fluid expansion chamber (**2**).

[0051] The constructive details described (and omitted) with respect to the fluid expansion chamber (**2**) (possibility of structural and dimensional variation, and preferred form of fixation by welding, for example) are similarly observed in the fluid expansion chamber (**4**).

[0052] In contrast to the optional embodiments illustrated in FIGS. **2**A, **2**B, **2**C and **2**D, the optional embodiment illustrated in FIG. **3** provides for the use of two fluid expansion chambers, fluidly connected, in series, one of these chambers being internally arranged (in relation to the housing of the compressor) and the other of these chambers externally arranged (in relation to the housing of the compressor).

[0053] Thus, as arbitrarily defined in FIG. **3**, there is provided a hermetic compressor comprising an airtight housing (**1**), a first fluid expansion chamber (**2**) and a second fluid expansion chamber (**4**), such chambers being fluidly connected, in series, defining a volume-in-series for discharge fluid (it may of course also define a volume-in-series for suction fluid).

[0054] In particular, the first fluid expansion chamber (**2**) is specially formed only between the inner face (**11**) of the airtight housing (**1**) and the inner face (**31**) of a first modular body (**3**) hermetically attached to the inner face (**11**) of the airtight housing (**1**), while the second fluid expansion chamber (**4**) is specially formed only between the outer face (**12**) of the airtight housing (**1**) and the inner face (**31**) of a first modular body (**3**) hermetically attached to the outer face (**12**) of the airtight housing (**1**). The fluid connection between the volumes occurs in an analogous manner to the constructions and options illustrated in FIGS. **2**A, **2**B, **2**C and **2**D.

[0055] It is important to emphasize that the above description has the sole purpose of describing by way of example the particular embodiment of the utility model in question. Therefore, it is clear that modifications, variations and constructive combinations of the elements performing the same function, in substantially the same manner, to achieve the same results, remaining within the scope of protection delimited by the appended claims.

1. Hermetic compressor, comprising:
- an airtight housing;
- at least one reciprocating compression mechanism (not illustrated) arranged within the airtight housing; and
- at least one fluid expansion chamber;
- said hermetic compressor being especially characterized in that said fluid expansion chamber is formed between one of the faces of the airtight housing and the inner face of a first modular body is hermetically attached to one of the faces of the airtight housing; and
- said fluid expansion chamber comprises at least one inlet path and at least one outlet path.

2. Hermetic compressor, according to claim **1**, characterized in that the fluid expansion chamber comprises a discharge fluid expansion chamber.

3. Hermetic compressor, according to claim **1**, characterized in that the fluid expansion chamber comprises a suction fluid expansion chamber.

4. Hermetic compressor, according to claim **1**, characterized in that the fluid expansion chamber is external, being formed between the outer face of the airtight housing and the inner face of a first modular body hermetically attached to the outer face of the airtight housing.

5. Hermetic compressor, according to claim **1**, characterized in that the fluid expansion chamber is internal, being formed between the inner face of the airtight housing and the inner face of a first modular body hermetically attached to the inner face of the airtight housing.

6. Hermetic compressor, according to claim **1**, characterized in that the inlet path and the outlet path of the fluid expansion chamber are fluidly aligned.

7. Hermetic compressor, according to claim **1**, characterized in that the inlet path and the outlet path of the fluid expansion chamber are fluidly misaligned.

8. Hermetic compressor, according to claim **1**, characterized in that it further comprises at least one second fluid expansion chamber fluidly connected, in series, to the fluid expansion chamber.

9. Hermetic compressor, according to claim **8**, characterized in that said second fluid expansion chamber is internal, being arranged within the airtight housing.

10. Hermetic compressor, according to claim **9**, characterized in that said second fluid expansion chamber is formed, at least partially, between the inner face of the airtight housing and the inner face of a second modular body.

11. Hermetic compressor, according to claim **9**, characterized in that said second fluid expansion chamber is formed, at least partially, between the outer face of the first modular body and the inner face of a second modular body.

12. Hermetic compressor, according to claim **8**, characterized in that said second fluid expansion chamber is external, being arranged on the outside of the airtight housing.

13. Hermetic compressor, according to claim **12**, characterized in that said second fluid expansion chamber is formed, at least partially, between the outer face of the airtight housing and the inner face of a second modular body.

14. Hermetic compressor, according to claim **12**, characterized in that said second fluid expansion chamber is formed, at least partially, between the outer face of the first modular body and the inner face of a second modular body.

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