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# (54) ELECTRIC COMPRESSOR, AIR CONDITIONING SYSTEM, AND VEHICLE

(57) An electric compressor, an air conditioning system, and a vehicle. The electric compressor (100) comprises a housing assembly (1) and a compression mechanism (2). The housing assembly (1) comprises a first housing (11) and a support (12); two axial ends of the first housing (11) are respectively a first end (111) and a second end (112); the support (12) is disposed at the first end (111) of the first housing (11), so that an accommodation cavity (10) is formed between the support (12) and the first housing (11); an oil cavity (113) and a refrigerant discharge port (114) are formed on the first housing (11); the oil cavity (113) is disposed close to the second end (112) with respect to the first end (111); and an oil outlet (1131) of the oil cavity (113) is communicated with the refrigerant discharge port (114). The compression mechanism (2) is disposed in the accommodation cavity (10); a first silencing cavity (101) is formed between the compression mechanism (2) and the support (12); the compression mechanism (2) is provided with a first exhaust port (21); the first exhaust port (21) is communicated with the first silencing cavity (101); and the first silencing cavity (101) is communicated with an oil inlet (1132) of the oil cavity (113). According to the electric compressor, noise and vibration during operation can be reduced.

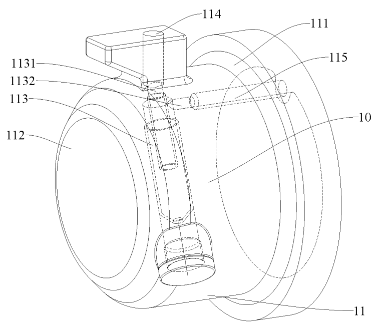



FIG. 1



Processed by Luminess, 75001 PARIS (FR)

# Description

## CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application is based on and claims priorities to Chinese patent applications Nos. 202210715848.7 and 202221588958.3 filed on June 22, 2022, the entire contents of which are incorporated herein by reference.

## FIELD

**[0002]** The present disclosure relates to the field of compressor technologies, and more particularly, to an electric compressor, an air conditioning system, and a vehicle.

## BACKGROUND

**[0003]** An electric compressor is a core component of a refrigeration device for a vehicle. The electric compressor generates vibration noise during its operation, which would affect vehicle noise and causes a subjective hearing issue. In the related art, a high-pressure refrigerant discharged from a compression mechanism of the electric compressor exits the electric compressor from a refrigerant discharge outlet after being subjected to a gas-liquid separation in an oil separation chamber. Exhaust airflow noise and pressure pulsations generated during the operation of the electric compressor are likely to stimulate resonance of various components of a thermal management system of the vehicle, which brings about problems of noise and vibration of the vehicle.

## SUMMARY

**[0004]** The present disclosure aims to solve at least one of the technical problems in the related art. To this end, embodiments of the present disclosure provide an electric compressor, which can mitigate noise and vibration generated during an operation of the electric compressor.

**[0005]** Embodiments of the present disclosure further provide an air conditioning system having the electric compressor as described above.

**[0006]** Embodiments of the present disclosure further provide a vehicle having air conditioning system as described above.

**[0007]** According to embodiments in a first aspect of the present disclosure, an electric compressor is provided. The electric compressor includes a housing assembly and a compression mechanism. The housing assembly includes a first housing and a support, and two axial ends of the first housing are a first end and a second end, respectively. The support is disposed at the first end of the first housing to form an accommodation chamber between the support and the first housing. The first housing has an oil separation chamber and a refrigerant discharge outlet. The oil separation chamber is located closer to the second end than the first end, and the oil separation chamber has an oil separation outlet in communication with the refrigerant discharge outlet. The compression mechanism is disposed in the accommodation chamber. A first silencing cavity is formed between the compression mechanism and the support. The compression mechanism has a first exhaust outlet in communication with the first silencing cavity, and the first silencing cavity is in communication with an oil separation inlet of the oil separation chamber.

**[0008]** In some embodiments, the second end of the first housing is closed, and the oil separation chamber is formed in an end housing part of the first housing at the second end.

**[0009]** In some embodiments, a first communication passage is formed in a side housing part of the first housing. The first silencing cavity and the oil separation inlet of the oil separation chamber are in communication with each other through the first communication passage.

**[0010]** Further, a first communication hole is formed at a connection between the first housing and the support, and the first communication passage is in communication with the first silencing cavity through the first communication hole. The first communication hole has a smaller flow area than the first communication passage.

**[0011]** Exemplarily, the first communication hole is formed at the support or at the first housing, or the first communication hole is defined by an insertion tube inserted into the first housing or the support.

**[0012]** Exemplarily, the first communication hole has a minimum flow area of S1, and the first silencing cavity has a volume of V1, where $0.06 \leq S1/V1 \leq 2.0$.

**[0013]** In some embodiments, the compression mechanism has a second silencing cavity in communication with the first silencing cavity.

**[0014]** Further, the second silencing cavity is spaced apart from the first silencing cavity in an axial direction of the compression mechanism. A second communication passage is formed at the compression mechanism. The second silencing cavity and the first silencing cavity are in communication with each other through the second communication passage.

**[0015]** Exemplarily, the second communication passage has a minimum flow area of S2; and the second silencing cavity has a volume of V2, where $0.08 \leq S2/V2 \leq 2.2$.

**[0016]** In some embodiments, a high-pressure cavity is formed between a wall of the accommodation chamber and the compression mechanism, and the first silencing cavity and the oil separation inlet of the oil separation chamber are in communication with each other through the high-pressure cavity.

**[0017]** Further, the compression mechanism has a second communication hole and a second silencing cavity in communication with the first silencing cavity, and the second silencing cavity and the high-pressure cavity being in communication with each other through the second communication hole.

**[0018]** Exemplarily, the compression mechanism is a rotary compression mechanism or a scroll compression mechanism.

**[0019]** According to embodiments in a second aspect of the present disclosure, an air conditioning system is provided. The air conditioning system includes the electric compressor according to any of the embodiments in the first aspect.

**[0020]** In a third aspect of the present disclosure, a vehicle is provided. The vehicle includes a vehicle body and the air conditioning system in the second aspect of the present disclosure. The air conditioning system is mounted at the vehicle body.

**[0021]** Additional aspects and advantages of the present disclosure will be provided at least in part in the following description, or will become apparent at least in part from the following description, or can be learned from practicing of the present disclosure.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0022]** The above and/or additional aspects and advantages of the present disclosure will become more apparent and more understandable from the following description of embodiments taken in conjunction with the accompanying drawings.

FIG. 1 is a perspective view of a first housing of an electric compressor according to some embodiments of the present disclosure.
FIG. 2 is a cross-sectional view of the electric compressor illustrated in FIG. 1.
FIG. 3 is an axial cross-sectional view of the electric compressor illustrated in FIG. 1.
FIG. 4 is a cross-sectional view of an electric compressor according to some embodiments of the present disclosure.
FIG. 5 is a cross-sectional view of an electric compressor according to some embodiments of the present disclosure.
FIG. 6 is a cross-sectional view of an electric compressor according to some embodiments of the present disclosure.
FIG. 7 is a cross-sectional view of an electric compressor according to some embodiments of the present disclosure.
FIG. 8 is a schematic view of a vehicle according to an embodiment of the present disclosure.
FIG. 9 is a relationship graph of S2/V2 versus pressure pulsation amplitude according to a first embodiment of the present disclosure.

**[0023]** Reference numerals of the accompanying drawings:
electric compressor 100; housing assembly 1; accommodation chamber 10; first silencing cavity 101; high-pressure cavity 102; first housing 11; first end 111; second end 112; oil separation chamber 113 oil separation outlet 1131; oil separation inlet 1132; exhaust tube 1133; refrigerant discharge outlet 114; first communication passage 115; support 12; gasket 13; compression mechanism 2; first exhaust outlet 21; second silencing cavity 22; second communication passage 23; second communication hole 24; first cylinder 251; second cylinder 252; first piston 261; second piston 262; partition 27; first bearing 281; second bearing 282; second exhaust outlet 283; silencer 29; first communication hole 3; drive shaft 4; air conditioning system 200; vehicle 300.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

**[0024]** Embodiments of the present disclosure will be described in detail below with reference to examples thereof as illustrated in the accompanying drawings, throughout which same or similar elements, or elements having same or similar functions, are denoted by same or similar reference numerals. The embodiments described below with reference to the drawings are illustrative only, and are intended to explain, rather than limit, the present disclosure.

**[0025]** Various embodiments or examples for implementing different structures of the present disclosure are provided below. In order to simplify the description of the present disclosure, components and arrangements of specific examples are described herein. These specific examples are merely for the purpose of illustration, rather than limiting the present disclosure. Further, the same reference numerals and/or reference letters may appear in different examples of the present disclosure for the purpose of simplicity and clarity, instead of indicating a relationship between different embodiments and/or the discussed arrangements. In addition, the present disclosure provides examples of various specific processes and materials. However, applications of other processes and/or the use of other materials are conceivable for those of ordinary skill in the art.

**[0026]** An electric compressor 100, an air conditioning system 200, and a vehicle 300 according to embodiments of the present disclosure will be described below with reference to the accompanying drawings.

**[0027]** As illustrated in FIG. 1 to FIG. 3, an electric compressor 100 according to embodiments of the present disclosure includes a housing assembly 1 and a compression mechanism 2. The compression mechanism 2 is configured to compress a low-pressure refrigerant into a high-pressure refrigerant.

**[0028]** The housing assembly 1 includes a first housing 11 and a support 12. Two axial ends of the first housing 11 are a first end 111 and a second end 112, respectively. The support 12 is disposed at the first end 111 of the first housing 11 to form an accommodation chamber 10 between the support 12 and the first housing 11. The first housing 11 has an oil separation chamber 113 and a refrigerant discharge outlet 114. That is, both the oil separation chamber 113 and the refrigerant discharge outlet 114 are integrally formed on the first housing 11.

**[0029]** The compression mechanism 2 is disposed in the accommodation chamber 10. A first silencing cavity 101 is formed between the compression mechanism 2 and the support 12. The compression mechanism 2 has a first exhaust outlet 21 in communication with the first silencing cavity 101. The first silencing cavity 101 is in communication with an oil separation inlet 1132 of the oil separation chamber 113. An oil separation outlet 1131 of the oil separation chamber 113 is in communication with the refrigerant discharge outlet 114. The oil separation chamber 113 is configured to separate a gas and a liquid in the high-pressure refrigerant from each other, and then the gas is discharged through the refrigerant discharge outlet 114.

**[0030]** For example, when the electric compressor 100 is powered for a normal operation, the low-pressure refrigerant may be sucked, and then compressed into the high-pressure refrigerant by the compression mechanism 2. The high-pressure refrigerant is then discharged into the first silencing cavity 101 through the first exhaust outlet 21 of the compression mechanism 2. The high-pressure refrigerant in the first silencing cavity 101 enters the oil separation chamber 113 through the oil separation inlet 1132 to undergo a gas-liquid separation. The separated gaseous refrigerant is finally discharged out of the housing assembly 1 through the refrigerant discharge outlet 114.

**[0031]** The oil separation chamber 113 is located closer to the second end 112 than the first end 111. That is, an axial distance between the oil separation chamber 113 and the second end 112 is smaller than that between the oil separation chamber 113 and the first end 111. Since the first silencing cavity 101 is formed by the compression mechanism 2 and the support 12 together, and the support 12 is located at the first end 111 of the first housing 11, the first silencing cavity 101 is closer to the first end 111 than the second end 112. That is, an axial distance between the first silencing cavity 101 and the first end 111 is smaller than that between the first silencing cavity 101 and the second end 112. Therefore, at the first housing 11, the first silencing cavity 101 is spaced apart from the oil separation chamber 113 by a predetermined axial distance. It should be noted that an axial direction of the first housing 11 is same as that of the compression mechanism 2.

**[0032]** With the electric compressor 100 according to the embodiments of the present disclosure, the oil separation chamber 113 is at a predetermined distance from the first silencing cavity 101, which can increase a flow distance of the high-pressure refrigerant flowing from the first silencing cavity 101 to the oil separation chamber 113, thereby mitigating flow noise and pressure pulsations of the high-pressure refrigerant. Therefore, operation noise and vibration of the electric compressor 100 can be mitigated. In addition, since the first silencing cavity 101 is formed between the compression mechanism 2 and the support 12, no additional silencing components need to be disposed outside the first housing 11 or the support 12, which can reduce input costs of arranging the silencing components, thereby improving a manufacturing efficiency considering that a mounting step of assembling the silencing component to the first housing 11 or the support 12 is eliminated. Further, the electric compressor 100 has a relatively compact overall structure, which is conducive to reducing a volume of and a space occupied by the electric compressor 100, improving versatility of the electric compressor 100. In addition, by arranging the compression mechanism 2 in the accommodation chamber 10, compactness of the electric compressor 100 can be further improved. In this way, a space in the electric compressor 100 can be efficiently utilized while the volume of the electric compressor 100 is limited, allowing the volume of and the space occupied by the electric compressor 100 to be further reduced.

**[0033]** In an exemplary embodiment of the present disclosure, as a core component of a refrigeration device for a vehicle, the electric compressor is subjected to strict control on its size and weight to ensure optimal key performance such as a vehicle range. Within limited dimensions, the compressor has a limited internal volume. Therefore, after space requirements for a compression component and a motor component are satisfied, a volume of a cavity available for refrigerant buffering and noise elimination is small. An exhaust solution provided in the present disclosure can provide an effective solution on how to utilize a limited volume to enhance a noise reduction effect.

**[0034]** In some embodiments, as illustrated in FIG. 1 to FIG. 3, the second end 112 of the first housing 11 is closed. The oil separation chamber 113 is formed in an end housing part of the first housing 11 at the second end 112. In such a structure, the oil separation chamber 113 and the first silencing cavity 101 are located at the second end 112 of the first housing 11 and the first end 111 of the first housing 11, respectively. A distance between the oil separation chamber 113 and the first silencing cavity 101 is relatively great, which can increase the flow distance of the high-pressure refrigerant flowing from the first silencing cavity 101 to the oil separation chamber 113, thereby better mitigating the flow noise and the pressure pulsations of the high-pressure refrigerant. Therefore, the operation noise and the vibration of the electric compressor 100 are further mitigated.

**[0035]** In addition, by designing the second end 112 of the first housing 11 in a closed form, a structure of the housing assembly 1 can be simplified, saving a cost and steps of closing the second end 112 by using other components. Further, by forming the oil separation chamber 113 in the end housing part of the first housing 11 at the second end 112, the oil separation chamber 113 can be prevented from occupying too much space of the accommodation chamber 10 to ensure a sufficient available volume of the accommodation chamber 10. In addition, problems such as interference between the oil separation chamber 113 and the compression mechanism

2 in the accommodation chamber 10 can be avoided, improving generality.

**[0036]** In some embodiments, as illustrated in FIG. 1 and FIG. 3, a first communication passage 115 is formed in a side housing part of the first housing 11. The first silencing cavity 101 and the oil separation inlet 1132 of the oil separation chamber 113 are in communication with each other through the first communication passage 115. Therefore, the high-pressure refrigerant in the first silencing cavity 101 flows into the first communication passage 115, and then flows into the oil separation chamber 113 through the oil separation inlet 1132. In this way, an exhaust efficiency can be improved. Also, the first silencing cavity 101 can be prevented from exhausting a gas towards the accommodation chamber 10 in a case where the accommodation chamber 10 has an oil pool, to avoid other adverse effects due to an unstable liquid level of the oil pool. In addition, with such a structure, the first communication passage 115 is formed at the inner side of of the first housing 11. Therefore, the first communication passage 115 is prevented from occupying the space of the accommodation chamber 10. Further, the first communication passage 115 has relatively high structural strength, which allows the first communication passage 115 to be less likely to be deformed under a pressure of the high-pressure refrigerant, improving reliability of the electric compressor 100.

**[0037]** A method for forming the first communication passage 115 at the first housing 11 is not limited. For example, the first communication passage 115 may be formed directly during casting or injection molding of the first housing 11. Or, for example, the first communication passage 115 may be formed by punching a hole in the first housing 11. In addition, it should be noted that the first communication passage 115 may extend along a straight line, a curve, or the like, and the present disclosure is not limited in this regard.

**[0038]** The number of the first communication passage 115 is not limited in the present disclosure. One first communication passage 115 may be formed, or a plurality of first communication passages 115 independently enabling the first silencing cavity 101 to be in communication with the oil separation chamber 113 may be formed. It should be noted that when the plurality of first communication passages 115 is formed, a total flow area of the plurality of first communication passages 115 can be set to be equal to a flow area of one first communication passage 115.

**[0039]** In some embodiments, as illustrated in FIG. 4 and FIG. 5, a first communication hole 3 is formed at a connection between the first housing 11 and the support 12. The first communication passage 115 is in communication with the first silencing cavity 101 through the first communication hole 3. The first communication hole 3 has a smaller flow area than the first communication passage 115. Therefore, since a refrigerant path from the first silencing cavity 101 to the oil separation chamber 113 has a variable flow area, the first communication passage 115 of a relatively great flow area may be used to ensure the exhaust efficiency, while the first communication hole 3 of a relatively small flow area may be used for a design of relevant dimensions to enhance the noise reduction effect. In addition, during a flow of the high-pressure refrigerant in the first silencing cavity 101 into the first communication passage 115 through the first communication hole 3, the flow area decreases and then increases, which is more conducive to mitigating the flow noise and the pressure pulsations of the high-pressure refrigerant in the first housing 11, further mitigating the operation noise and the vibration of the electric compressor 100.

**[0040]** It should be noted that specific dimensions to be satisfied for matching the flow area of the first communication hole 3 and the flow area of the first communication passage 115 may be separately calculated by those skilled in the art based on specific requirements of different operation conditions. Therefore, the specific dimensions are not limited to the embodiments of the present disclosure.

**[0041]** A position and a shape of the first communication hole 3 are not limited in the present disclosure. For example, the first communication hole 3 may be formed at the support 12 or at the first housing 11, or the first communication hole 3 may be defined by an insertion tube inserted into the first housing 11 or the support 12. Therefore, the position of the first communication hole 3 is flexible. Based on structural needs of a device, the first communication hole 3 may be formed at the support 12 or at the first housing 11, or may be formed as a separate structure.

**[0042]** For example, in the embodiment shown in FIG. 4, the first communication hole 3 is formed at the support 12. A passageway is formed at a connection between the support 12 and the first communication passage 115, and the passageway has a smaller flow area than the first communication passage 115. The passageway serves as the first communication hole 3. Or, for example, in the embodiment shown in FIG. 5, the first communication hole 3 is formed at first housing 11. In this case, the first communication hole 3 may be formed as a passageway between the first communication passage 115 and the first silencing cavity 101. In addition, the first communication hole 3 has a smaller flow area than the first communication passage 115. Further, for example, a gasket 13 is disposed between the first housing 11 and the support 12. In this case, the first communication hole 3 may be an insertion tube disposed at the gasket 13 and corresponding to the first communication passage 115. The insertion tube may be inserted into the first communication passage 115, or into the first silencing cavity 101, or into both the first communication passage 115 and the first silencing cavity 101.

**[0043]** Exemplarily, the first communication hole 3 has a minimum flow area of S1, and the first silencing cavity 101 has a volume of V1, where $0.06 \le S1/V1 \le 2.0$. For example, a value of S1/V1 may be 0.06, 0.1, 0.5, 1, 1.5, 1.9, and 2.0. With such a structure, the noise reduction effect is relatively satisfactory.

**[0044]** It should be noted that when the plurality of first communication passages 115 is formed, the number of the first communication holes 3 may be same as that of the first communication passages 115, and thus a plurality of first communication holes 3 is formed. In this case, the plurality of first communication holes 3 has a total flow area of S1.

**[0045]** In some embodiments, as illustrated in FIG. 3, the compression mechanism 2 may further have a second silencing cavity 22 in communication with the first silencing cavity 101. Therefore, the high-pressure refrigerant compressed by the compression mechanism 2 is discharged into the first silencing cavity 101 and the second silencing cavity 22. With the second silencing cavity 22 in communication with the first silencing cavity 101, a total volume of silencing cavities in the electric compressor 100 can be increased. Therefore, the high-pressure refrigerant is accommodated in a relatively large space after being discharged into the first silencing cavity 101 and the second silencing cavity 22, which lowers the pressure of the high-pressure refrigerant, reducing a pressures exerted on inner walls of the first silencing cavity 101 and the second silencing cavity 22. In this way, the flow noise and the pressure pulsations due to the high-pressure refrigerant can be mitigated.

**[0046]** In addition, by forming the second silencing cavity 22 in the compression mechanism 2, an additional arrangement of other silencing components in the accommodation chamber 10 is removed, which can improve a space utilization rate of the accommodation chamber 10. Further, a satisfactory noise reduction effect and a satisfactory vibration reduction effect can be realized while the electric compressor 100 has a compact structure.

**[0047]** For example, as illustrated in FIG. 3, the second silencing cavity 22 is spaced apart from the first silencing cavity 101 in an axial direction of the compression mechanism 2. A second communication passage 23 is formed at the compression mechanism 2. The second silencing cavity 22 and the first silencing cavity 101 are in communication with each other through the second communication passage 23. Therefore, after the high-pressure refrigerant compressed by the compression mechanism 2 is discharged into the first silencing cavity 101, the high-pressure refrigerant enters the second silencing cavity 22 along the second communication passage 23. The high-pressure refrigerant entering the second silencing cavity 22 can flow back into the first silencing cavity 101 through the second communication passage 23. Thereafter, the high-pressure refrigerant enters the oil separation chamber 113 through the oil separation inlet 1132. The separated gaseous refrigerant is finally discharged out of the housing assembly 1 through the refrigerant discharge outlet 114.

**[0048]** With such a structure, since the second silencing cavity 22 is spaced apart from the first silencing cavity 101 in the axial direction of the compression mechanism 2, a predetermined axial distance is formed between the second silencing cavity 22 and the first silencing cavity 101. Therefore, the high-pressure refrigerant flows in the second communication passage 23 for a predetermined flow distance, which can better mitigate the flow noise and the pressure pulsations of the high-pressure refrigerant, mitigating the operation noise and the vibration of the electric compressor 100.

**[0049]** The present disclosure is not limited in this regard. For example, in other embodiments of the present disclosure, as illustrated in FIG. 7, the compression mechanism 2 may further have a second exhaust outlet 283. The second exhaust outlet 283 is configured to directly exhaust the gas towards the second silencing cavity 22, thereby improving the exhaust efficiency.

**[0050]** It should be understood that a flow space for the high-pressure refrigerant in the first silencing cavity 101 and the second silencing cavity 22 is greater than the flow area of the second communication passage 23. In this way, when the high-pressure refrigerant flows from the second silencing cavity 22 to the first silencing cavity 101 through the second communication passage 23, the flow noise and the pressure pulsations of the high-pressure refrigerant in the first housing 11 can be further mitigated, thereby further mitigating the operation noise and the vibration of the electric compressor 100.

**[0051]** The number of the second communication passage 23 is not limited in the present disclosure. One second communication passage 23 may be formed, or a plurality of second communication passages 23 independently enabling the first silencing cavity 101 to be in communication with the second silencing cavity 22 may be formed. It should be further noted that when the plurality of second communication passages 23 is formed, a total flow area of the plurality of second communication passages 23 is equal to a flow area of one second communication passage 23.

**[0052]** Exemplarily, as illustrated in FIG. 9, the second communication passage 23 has a minimum flow area of S2, and the second silencing cavity 22 has a volume of V2, where $0.08 \leq S2/V2 \leq 2.2$. For example, a value of S2/V2 may be 0.08, 0.1, 0.5, 1, 1.5, 1.9, and 2.2. With such a structure, the exhaust efficiency and the noise reduction effect can be balanced.

**[0053]** It should be noted that when the plurality of second communication passages 23 is formed, the plurality of second communication passages 23 has a total flow area of S2.

**[0054]** It was found through analysis and testing that, in a conventional design, due to the consideration of pressure losses, a large cavity and a flow passage of a large flow area are designed at an exhaust side of a compressor. However, this design is not an optimal scheme for pulsation attenuation and noise reduction of the refrigerant. For operation conditions and common noise issues of the electric compressor, if specific noise bands such as intractable low-frequency noise are encountered, a distribution ratio of "cavity-tube-cavity-tube" may be controlled based on an inherent topology of a flow passage of the compressor, for example, a ratio of a flow area of the flow passage to a cavity volume, which can alleviate a noise issue of the compressor, especially a low-frequency noise issue.

**[0055]** It was found that attenuation characteristics of fluid pulsations and attenuation characteristics of acoustic pulsations have obvious differences, and thus optimal attenuation of the fluid pulsations cannot be obtained only by relying on an acoustic plane wave transmission formula. An optimal ratio range for the flow area of each flow passage and a volume of a buffer cavity can be determined by combining with experimental testing through simulation.

**[0056]** When the electric compressor 100 is applied to the vehicle 300, an operation state of the electric compressor 100 would be affected by operation conditions of the vehicle 300. Since the attenuation characteristics of the fluid pulsations and the attenuation characteristics of the acoustic pulsations are significantly different, data illustrated in FIG. 9 are obtained by combining with experimental testing through simulation. FIG. 9 reveals that, when the vehicle is under an idle condition, the pressure pulsations have a relatively small amplitude within a range of $0.08 \leq S2/V2 \leq 0.8$, and thus optimal attenuation of the fluid pulsations and an optimal silencing effect are achieved. When the vehicle is under a low-speed refrigeration condition, the pressure pulsations have a relatively small amplitude within a range of $0.4 \leq S2/V2 \leq 0.8$, and thus the optimal attenuation of the fluid pulsations and the optimal silencing effect are achieved. However, when the vehicle is under a dehumidification condition, for example, a range between the above two ranges, i.e., a range of $0.08 \leq S2/V2 \leq 2.2$, and thus a relatively satisfactory effect of mitigating the pressure pulsations and the noise is achieved.

**[0057]** In some embodiments, as illustrated in FIG. 6 and FIG. 7, a high-pressure cavity 102 is formed between a wall of the accommodation chamber 10 and the compression mechanism 2. The first silencing cavity 101 and the oil separation inlet 1132 of the oil separation chamber 113 are in communication with each other through the high-pressure cavity 102. Therefore, the high-pressure refrigerant in the first silencing cavity 101 flows into the high-pressure cavity 102, and then flows into the oil separation chamber 113 through the oil separation inlet 1132. With such a structure, the high-pressure cavity 102 is formed by the wall of the accommodation chamber 10 and the compression mechanism 2 without additionally arranging in the first housing 11 a structure such as a communication tube between the oil separation inlet 1132 and the first silencing cavity 101, which can simplify the structure of the electric compressor 100. Further, no communication passage that enables the oil separation inlet 1132 to be in communication with the first silencing cavity 101 needs to be formed at the first housing 11, which lowers processing difficulty of the first housing 11 and input costs of arranging a communication structure and improves a manufacturing efficiency.

**[0058]** It should be understood that the high-pressure cavity 102 has a predetermined space to reduce the pressure of the high-pressure refrigerant flowing in the high-pressure cavity 102, mitigating the pressure pulsations generated by the high-pressure refrigerant. Also, a flow space for the high-pressure refrigerant in the first silencing cavity 101 and the high-pressure cavity 102 may be smaller than a flow space for the high-pressure cavity 102 to mitigate the flow noise and the pressure pulsations of the high-pressure refrigerant in the first housing 11, which can further mitigate the operation noise and the vibration of the electric compressor 100.

**[0059]** Further, in conjunction with FIG. 7, the compression mechanism 2 has a second communication hole 24 and a second silencing cavity 22 in communication with the first silencing cavity 101. The second silencing cavity 22 and the high-pressure cavity 102 are in communication with each other through the second communication hole 24. Therefore, the high-pressure refrigerant formed by the compression mechanism 2 is discharged into the first silencing cavity 101, and then enters the second silencing cavity 22. The high-pressure refrigerant in the first silencing cavity 101 may flow directly into the high-pressure cavity 102. The high-pressure refrigerant in the second silencing cavity 22 may flow into the high-pressure cavity 102 through the second communication hole 24. The high-pressure refrigerant in the high-pressure cavity 102 flows into the oil separation chamber 113 through the oil separation inlet 1132. In this process, the exhaust efficiency can be improved while ensuring the noise reduction effect when the high-pressure refrigerant flows from the second silencing cavity 22 to the high-pressure cavity 102 through the second communication hole 24.

**[0060]** In an exemplary embodiment of the present disclosure, as illustrated in FIG. 7, the compression mechanism 2 may further have the second exhaust outlet 283. The second exhaust outlet 283 is configured to directly exhaust the gas towards the second silencing cavity 22 to further improve the exhaust efficiency. In addition, the first silencing cavity 101 is in communication with the second silencing cavity 22 in such a manner that the high-pressure refrigerant flows between the first silencing cavity 101 and the second silencing cavity 22. In this way, the high-pressure refrigerant in the first silencing cavity 101 and the high-pressure refrigerant in the second silencing cavity 22 have balanced air pressures, which can avoid problems such as vibration of the electric compressor 100 due to a pressure difference between the first silencing cavity 101 and the second silencing cavity 22.

**[0061]** The number and a shape of the second communication hole 24 are not limited in the present disclosure. One second communication hole 24 may be formed, or a plurality of second communication holes 24 independently enabling the second silencing cavity

22 to be in communication with the high-pressure cavity 102 may be formed.

**[0062]** In an exemplary embodiment of the present disclosure, the oil separation chamber 113 has an oil return hole at a lower part of the oil separation chamber 113. The accommodation chamber 10 may have an oil pool. The oil return hole is in communication with the oil pool to facilitate an oil return. The oil pool is configured to supply a lubricant to the compression mechanism 2. Therefore, structural compactness of the electric compressor 100 can be improved.

**[0063]** It should be noted that a principle of the gas-liquid separation performed by the oil separation chamber 113 is not limited. For example, the oil separation inlet 1132 may extend in a tangential direction of the oil separation chamber 113. The refrigerant entering the oil separation chamber 113 from the oil separation inlet 1132 may flow in a circumferential direction to throw an oil liquid in the refrigerant from the refrigerant by a centrifugal force. The gaseous refrigerant without the oil liquid can be discharged through the oil separation outlet 1131, which generates a satisfactory result of the gas-liquid separation.

**[0064]** **In** this embodiment, an exhaust tube 1133 may further be disposed in the oil separation chamber 113. The refrigerant entering the oil separation chamber 113 may flow around the exhaust tube 1133 in a circumferential direction of the exhaust tube 1133 to achieve a more reliable gas-liquid separation. The separated gaseous refrigerant enters the exhaust tube 1133 and is then discharged from the oil separation outlet 1131 through the exhaust tube 1133.

**[0065]** The present disclosure is not limited in this regard. For example, a filtration structure such as a filter screen may also be disposed in the oil separation chamber 113 to filter out the oil liquid in the refrigerant. The gaseous refrigerant without the oil liquid may pass through the filtration structure and be discharged through the oil separation outlet 1131. Details thereof will be omitted herein.

**[0066]** **In** some exemplary embodiments, a type of the compression mechanism 2 is not limited. For example, the compression mechanism 2 may be a rotary compression mechanism or a scroll compression mechanism.

**[0067]** Therefore, compression mechanisms 2 of different types may be applied to different electric compressors 100. For example, when the electric compressor 100 is a rotary compressor, the compression mechanism 2 is the rotary compression mechanism. The compression mechanism 2 may include a cylinder, a piston, a slider, or the like. A drive shaft 4 of a motor is configured to drive the piston to roll inside the cylinder. When the electric compressor 100 is a scroll compressor, the compression mechanism 2 is the scroll compression mechanism. The compression mechanism 2 may include a static scroll disc and a moving scroll disc. The drive shaft is configured to drive the moving scroll disc to rotate.

**[0068]** It should be noted that a specific type of the electric compressor 100 is not limited. For example, the electric compressor 100 may be a horizontal compressor with a central axis extending in a traverse direction or in a direction slightly inclined to a horizontal line. Or, for example, the electric compressor 100 may be a vertical compressor with a central axis extending in a vertical direction or in a direction slightly inclined to a vertical line, and so on.

**[0069]** It should be noted that when the compression mechanism 2 is the rotary compression mechanism, the compression mechanism 2 may be a single-cylinder compression mechanism or a multi-cylinder compression mechanism. For example, in the example illustrated in FIG. 7, the compression mechanism 2 is a double-cylinder compression mechanism. The compression mechanism 2 includes a first bearing 281, a second bearing 282, a first cylinder 251, a second cylinder 252, a first piston 261, a second piston 262, a partition 27, and a silencer 29.

**[0070]** The first cylinder 251 and the second cylinder 252 are axially spaced apart from each other. The first cylinder 251 is located at a side of the second cylinder 252 close to the support 12. The partition 27 is sandwiched between the first cylinder 251 and the second cylinder 252. The first bearing 281 is disposed at a side of the first cylinder 251 away from the partition 27. The second bearing 282 is disposed at a side of the second cylinder 252 away from the partition 27.

**[0071]** A first compression cavity is formed between the first cylinder 251, the partition 27, and the first bearing 281. The first piston 261 is rollably adapted to a first compression space. The first bearing 281 has a first exhaust outlet 21 in communication with an exhaust cavity of the first compression space. The first silencing cavity 101 is formed between the first bearing 281 and the support 12. The first exhaust outlet 21 is in communication with the first silencing cavity 101.

**[0072]** A second compression cavity is formed between the second cylinder 252, the partition 27, and the second bearing 282. The second piston 262 is rollably adapted to a second compression space. The second bearing 282 has a second exhaust outlet 283 in communication with an exhaust cavity of the second compression space. The silencer 29 is disposed at a side of the second bearing 282 away from the second cylinder 252. The second silencing cavity 22 is formed between the second bearing 282 and the silencer 29. The second exhaust outlet 283 is in communication with the second silencing cavity 22. The silencer 29 has a second communication hole 24. The second silencing cavity 22 and the accommodation chamber 10 are in communication with each other through the second communication hole 24.

**[0073]** The second communication passage 23 penetrates the first bearing 281, the first cylinder 251, the partition 27, the second cylinder 252, and the second bearing 282 to enable the first silencing cavity 101 and the second silencing cavity 22 to be in communication with each other. Therefore, the compression mechanism 2 has a simple and compact structure.

**[0074]** An air conditioning system 200 according to embodiments of the present disclosure includes the electric compressor 100 according to any of the above-mentioned embodiments. Therefore, by adopting the above-mentioned electric compressor 100 having the compact structure, a volume of the air conditioning system 200 can be reduced. Also, exhaust noise and the vibration of the electric compressor 100 can be mitigated, mitigating the operation noise and the vibration of the entire air conditioning system 200.

**[0075]** It should be noted that exemplary application scenarios of the air conditioning system 200 according to the embodiments of the present disclosure are not limited, and the air conditioning system 200 may be for example applied in an indoor air conditioner, an indoor refrigerator, an in-vehicle air conditioner, or the like. When the application scenario is determined, other components of the air conditioning system 200 are conceivable for those skilled in the art. For example, when the air conditioning system 200 is applied in the indoor air conditioner or the indoor refrigerator, the air conditioning system 200 may further include an evaporator, a condenser, a throttling component, or the like. For example, when the air conditioning system 200 is applied in the in-vehicle air conditioner, the air conditioning system 200 may further include at least one of an in-vehicle condenser, an in-vehicle evaporator, an out-of-vehicle condenser, an out-of-vehicle evaporator, a throttling component, and the like. Details thereof will be omitted herein.

**[0076]** As illustrated in FIG. 8, a vehicle 300 according to embodiments of the present disclosure includes a vehicle body and the air conditioning system 200 according to any of the above-mentioned embodiments. The air conditioning system 200 is mounted at the vehicle body. Since the exhaust noise and the pressure pulsations of the electric compressor 100 included in the air conditioning system 200 according to any of the above-mentioned embodiments can be mitigated, applying the air conditioning system 200 in the vehicle 300 can ameliorate a problem of resonance of various components in a thermal management system of the vehicle 300 due to exhaust airflow noise and the pressure pulsations of the electric compressor 100, mitigating the noise and the vibration of the vehicle 300.

**[0077]** In addition, since the volume of the air conditioning system 200 can be reduced by adopting the above-mentioned electric compressor 100, the air conditioning system 200 can be arranged in the vehicle 300 more flexibly.

**[0078]** It should be noted that exemplary types of the vehicle 300 according to the embodiments of the present disclosure are not limited. For example, the vehicle 300 may be a new energy vehicle. The new energy vehicle may include a pure electric vehicle, a hybrid vehicle, or the like. Details thereof will be described herein. In addition, when the type of the vehicle 300 is determined, other components of the vehicle 300 are conceivable for those skilled in the art, and thus details thereof will be omitted herein.

**[0079]** An electric compressor 100 according to some exemplary embodiments of the present disclosure will be described below.

**[0080]** In some embodiments, as illustrated in FIG. 1 to FIG. 3, the example electric compressor 100 is a rotary electric compressor. The example electric compressor 100 includes the housing assembly 1 and a compression mechanism 2. The compression mechanism 2 is configured to compress a low-pressure refrigerant into a high-pressure refrigerant.

**[0081]** The housing assembly includes a first housing 11 and a support 12. Two axial ends of the first housing 11 are a first end 111 and a second end 112, respectively. The support 12 is disposed at the first end 111 of the first housing 11 and engaged with the first housing 11 to form the accommodation chamber 10. The second end 112 of the first housing 11 has an oil separation chamber 113 and a refrigerant discharge outlet 114. Further, an oil separation outlet 1131 of the oil separation chamber 113 is in communication with the refrigerant discharge outlet 114.

**[0082]** In addition, the compression mechanism 2 in this example is a rotary compression mechanism. The compression mechanism 2 is disposed in the accommodation chamber 10. A first silencing cavity 101 is formed between the compression mechanism 2 and the support 12. The first silencing cavity 101 is in communication with an oil separation inlet 1132 of the oil separation chamber 113 through a first communication passage 115.

**[0083]** A first exhaust outlet 21 of the compression mechanism 2 is in communication with a first silencing cavity 101. The compression mechanism 2 further has a second silencing cavity 22. The second silencing cavity 22 is spaced apart from the first silencing cavity 101 in the axial direction of the compression mechanism 2. The second silencing cavity 22 and the first silencing cavity 101 are in communication with each other through a second communication passage 23. Further, the compression mechanism 2 may further have a second exhaust outlet 283 in communication with the second silencing cavity 22.

**[0084]** As illustrated in FIG. 3, when the electric compressor 100 is powered for a normal operation, the low-pressure refrigerant is converted into the high-pressure refrigerant in the compression mechanism 2. After the high-pressure refrigerant is discharged into the first silencing cavity 101 and the second silencing cavity 22 through the first exhaust outlet 21 and the second exhaust outlet 283, respectively, the high-pressure refrigerant in the second silencing cavity 22 flows into the first silencing cavity 101 through the second communication passage 23, and then the high-pressure refrigerant in the first silencing cavity 101 enters the oil separation chamber 113 from the oil separation inlet 1132 through the first communication passage 115. The separated gaseous refrigerant is finally discharged out of the housing assembly 1 through the refrigerant discharge outlet 114.

**[0085]** Therefore, the flow noise and the pressure pulsations of the high-pressure refrigerant in the housing assembly 1 can be mitigated to mitigate the operation noise and the vibration of the electric compressor 100.

**[0086]** The embodiment illustrated in FIG. 4 and the above embodiments illustrated in FIG. 1 to FIG. 3 have the following differences. In some embodiments, as illustrated in FIG. 4, the first communication hole 3 is formed at a connection between the first housing 11 and the support 12. The first communication hole 3 is formed at the support 12. Further, the first communication passage 115 is in communication with the first silencing cavity 101 through the first communication hole 3, and the first communication hole 3 has a smaller flow area than a flow area of the first communication passage 115.

**[0087]** The embodiment illustrated in FIG. 5 and the above embodiment illustrated in FIG. 4 have the following difference. In some embodiments, as illustrated in FIG. 5, the first communication hole 3 is formed at the first housing 11.

**[0088]** The embodiment illustrated in FIG. 6 and the above embodiment illustrated in FIG. 4 have the following difference. In some embodiments, as illustrated in FIG. 6, the first housing 11 according to the present embodiment includes no first communication passage 115.

**[0089]** As illustrated in FIG. 6, the high-pressure cavity 102 is formed between the wall of the accommodation chamber 10 and the compression mechanism 2. The first silencing cavity 101 and the oil separation inlet 1132 of the oil separation chamber 113 are in communication with each other through the high-pressure cavity 102. As a result, the high-pressure refrigerant in the first silencing cavity 101 flows into the high-pressure cavity 102, and then flows into the oil separation chamber 113 through the oil separation inlet 1132.

**[0090]** The embodiment illustrated in FIG. 7 and the above embodiment illustrated in FIG. 6 have the following difference. In some embodiments, as illustrated in FIG. 7, the second silencing cavity 22 is also in communication with the high-pressure cavity 102 through the second communication hole 24. In this case, the high-pressure refrigerant in the second silencing cavity 22 can further flow to the high-pressure cavity 102 through the second communication hole 24, which improves the exhaust efficiency while ensuring the noise reduction effect.

**[0091]** In the description of the present disclosure, it should be understood that, the orientation or the position indicated by terms such as "center", "over", "vertical", "traverse", "horizontal", "inner", "outer", and "axial" should be construed to refer to the orientation and the position as shown in the drawings, and is only for the convenience of describing the present disclosure and simplifying the description, rather than indicating or implying that the pointed device or element must have a specific orientation, or be constructed and operated in a specific orientation, and therefore cannot be understood as a limitation of the present disclosure.

**[0092]** In addition, the terms "first" and "second" are only used for descriptive purposes, and cannot be understood as indicating or implying relative importance or implicitly indicating the number of indicated technical features. Therefore, the features associated with "first" and "second" may explicitly or implicitly include one or more of the features. In the description of the present disclosure, "plurality" means two or more, unless otherwise specifically defined.

**[0093]** In the present disclosure, unless otherwise clearly stipulated and limited, terms such as "install", "connect", "connect to", "fix" and the like should be understood in a broad sense. For example, it may be a fixed connection or a detachable connection or connection as one piece; direct connection or indirect connection through an intermediate; or internal communication of two components or the interaction relationship between two components. For those skilled in the art, the specific meaning of the above-mentioned terms in the present disclosure can be understood according to specific circumstances.

**[0094]** In the present disclosure, unless expressly stipulated and defined otherwise, the first feature "on" or "under" the second feature may mean that the first feature is in direct contact with the second feature, or the first and second features are in indirect contact through an intermediate. Moreover, the first feature "above" the second feature may mean that the first feature is directly above or obliquely above the second feature, or simply mean that the level of the first feature is higher than that of the second feature. The first feature "below" the second feature may mean that the first feature is directly below or obliquely below the second feature, or simply mean that the level of the first feature is smaller than that of the second feature.

**[0095]** Reference throughout this specification to "an embodiment", "some embodiments", "an example", "a specific example", or "some examples" means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. The appearances of the above phrases in various places throughout this specification are not necessarily referring to the same embodiment or example. Further, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples. In addition, different embodiments or examples and features of different embodiments or examples described in the specification may be combined by those skilled in the art without mutual contradiction.

**[0096]** Although embodiments of the present disclosure have been illustrated and described, it is conceivable for those skilled in the art that various changes, modifications, replacements, and variations can be made to these embodiments without departing from the principles and spirit of the present disclosure. The scope of the present disclosure shall be defined by the claims as appended and their equivalents.

## Claims

1. An electric compressor, comprising:

   a housing assembly comprising a first housing and a support, two axial ends of the first housing respectively being a first end and a second end, the support being disposed at the first end of the first housing to form an accommodation chamber between the support and the first housing, the first housing having an oil separation chamber and a refrigerant discharge outlet, the oil separation chamber being located closer to the second end than the first end, and the oil separation chamber having an oil separation outlet in communication with the refrigerant discharge outlet; and
   a compression mechanism disposed in the accommodation chamber, a first silencing cavity being formed between the compression mechanism and the support, the compression mechanism having a first exhaust outlet in communication with the first silencing cavity, and the first silencing cavity being in communication with an oil separation inlet of the oil separation chamber.

2. The electric compressor according to claim 1, wherein:

   the second end of the first housing is closed; and
   the oil separation chamber is formed in an end housing part of the first housing at the second end.

3. The electric compressor according to claim 1 or 2, wherein a first communication passage is formed in a side housing part of the first housing, the first silencing cavity and the oil separation inlet of the oil separation chamber being in communication with each other through the first communication passage.

4. The electric compressor according to claim 3, wherein a first communication hole is formed at a connection between the first housing and the support, the first communication passage being in communication with the first silencing cavity through the first communication hole, and the first communication hole having a smaller flow area than the first communication passage.

5. The electric compressor according to claim 4, wherein:

   the first communication hole is formed at the support or at the first housing; or
   the first communication hole is defined by an insertion tube inserted into the first housing or the support.

6. The electric compressor according to claim 4 or 5, wherein:

   the first communication hole has a minimum flow area of S1; and
   the first silencing cavity has a volume of V1, wherein $0.06 \leq S1/V1 \leq 2.0$.

7. The electric compressor according to any one of claims 1 to 6, wherein the compression mechanism has a second silencing cavity in communication with the first silencing cavity.

8. The electric compressor according to claim 7, wherein:

   the second silencing cavity is spaced apart from the first silencing cavity in an axial direction of the compression mechanism;
   a second communication passage is formed at the compression mechanism; and
   the second silencing cavity and the first silencing cavity are in communication with each other through the second communication passage.

9. The electric compressor according to claim 8, wherein:

   the second communication passage has a minimum flow area of S2; and
   the second silencing cavity has a volume of V2, wherein $0.08 \leq S2/V2 \leq 2.2$.

10. The electric compressor according to any one of claims 1 to 9, wherein a high-pressure cavity is formed between a wall of the accommodation chamber and the compression mechanism, the first silencing cavity and the oil separation inlet of the oil separation chamber being in communication with each other through the high-pressure cavity.

11. The electric compressor according to claim 10, wherein the compression mechanism has a second silencing cavity in communication with the first silencing cavity, and the compression mechanism has a second communication hole, the second silencing cavity and the high-pressure cavity being in communication with each other through the second communication hole.

12. The electric compressor according to any one of claims 1 to 11, wherein the compression mechanism

is a rotary compression mechanism or a scroll compression mechanism.

**13.** An air conditioning system, comprising the electric compressor according to any one of claims 1 to 12.

**14.** A vehicle, comprising:

a vehicle body; and
the air conditioning system according to claim 13, the air conditioning system being mounted at the vehicle body.

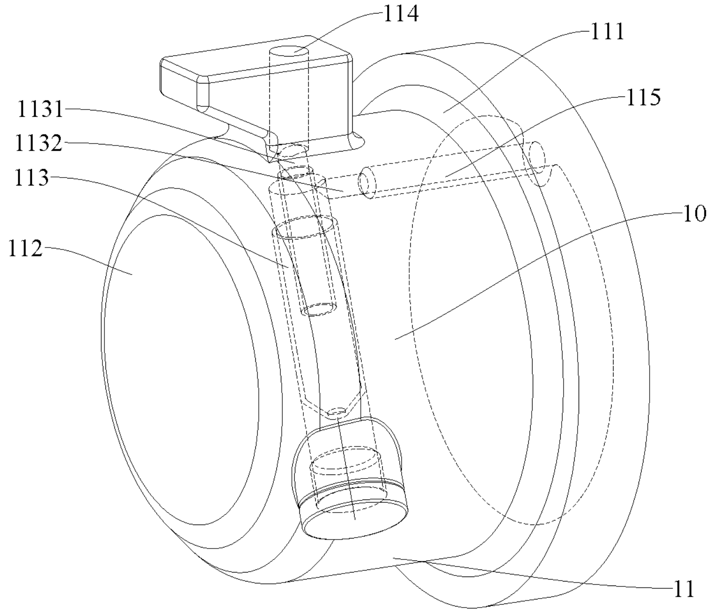
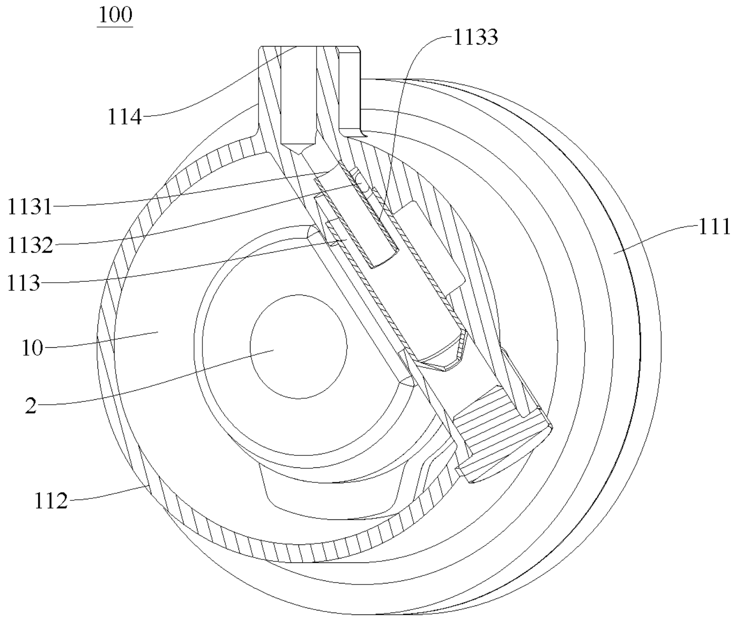

114
111
1131
115
1132
113
10
112
11

FIG. 1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111
1132
113
10
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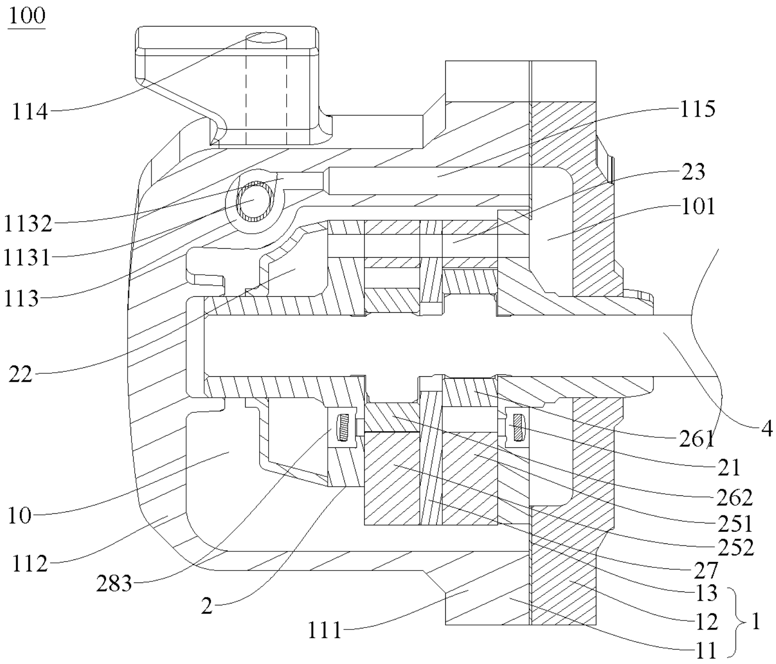
112

FIG. 2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101
1132
1131
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261
21
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252
27
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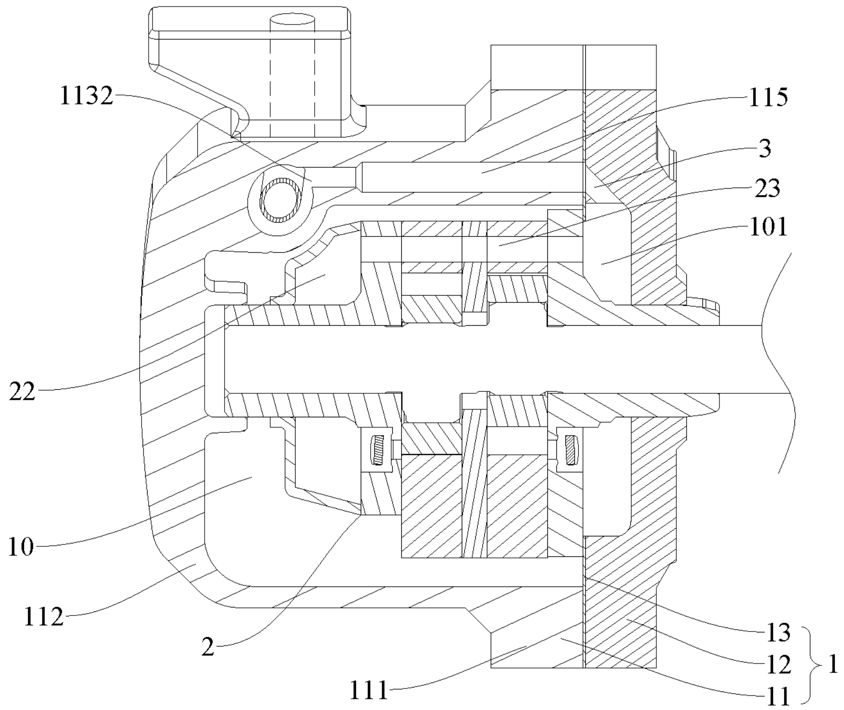
2
13
12
1
11
111

FIG. 3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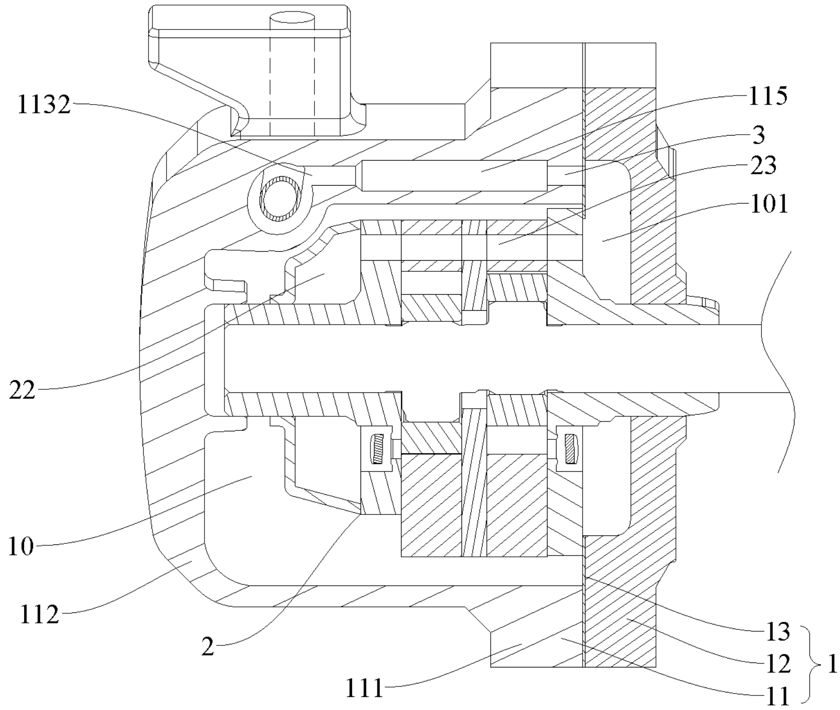
115
3
23
101
22
10
112
2
13
12
1
11
111

FIG. 4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101
22
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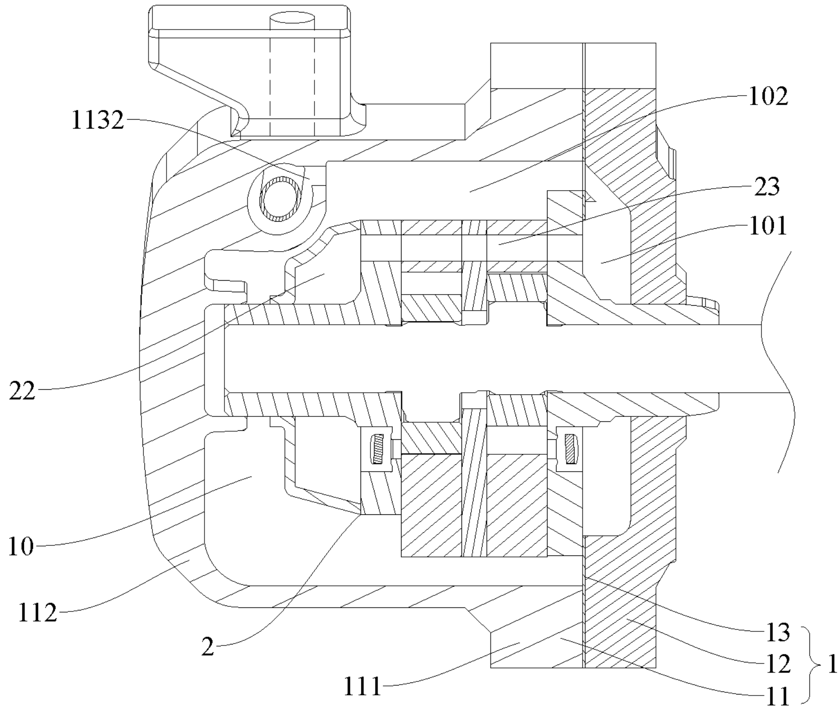
112
2
111
13
12
11
1

FIG. 5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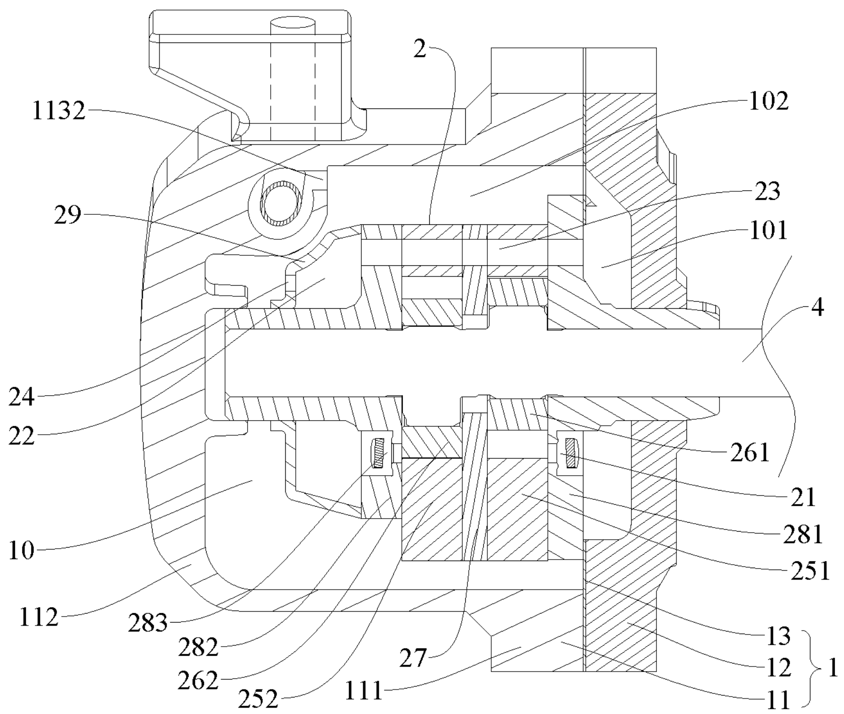
111
13
12
11
1

FIG. 6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101
4
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112
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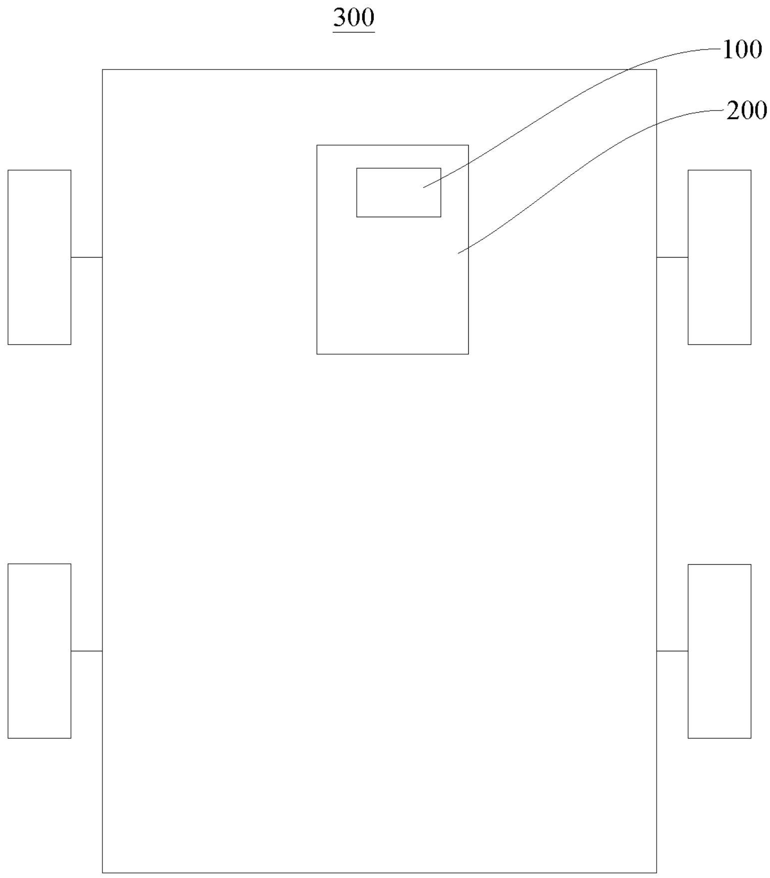
12
27
1
262
111
11
252

FIG. 7


300
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200

FIG. 8

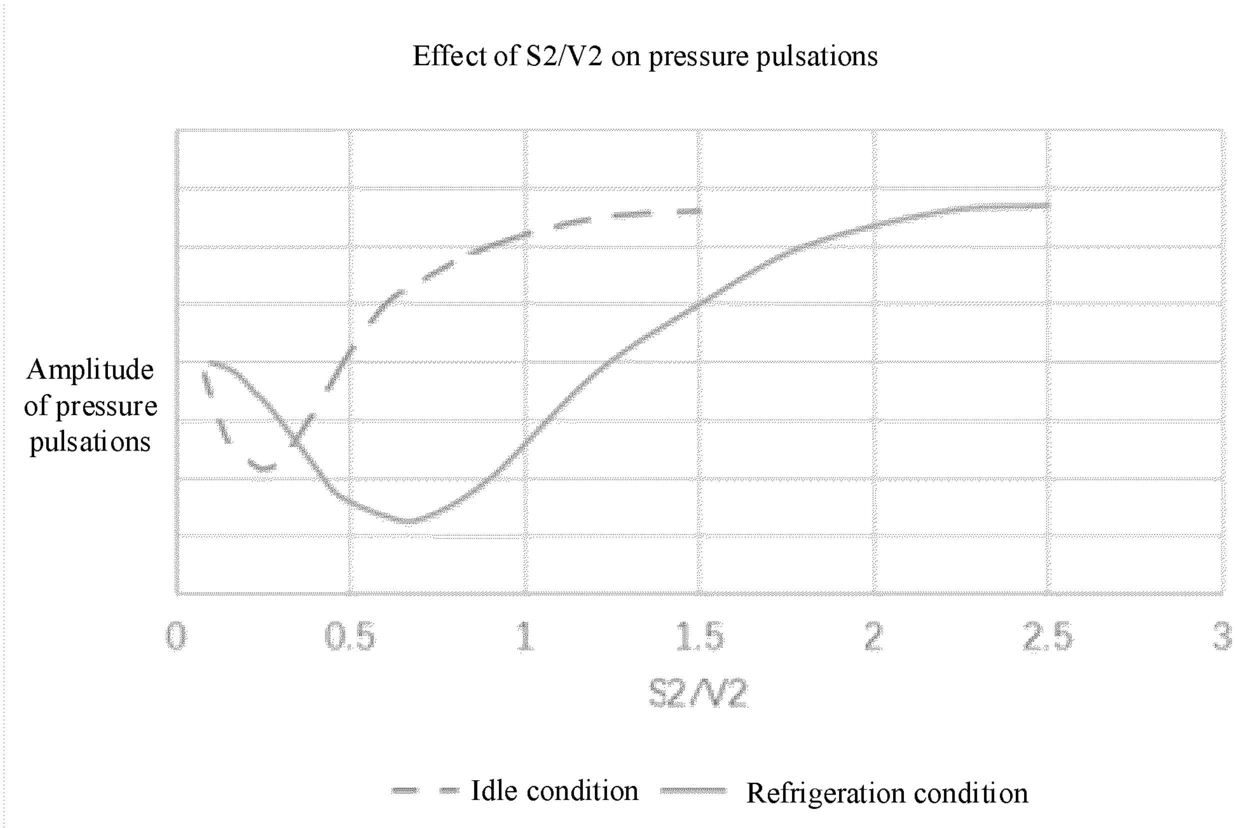
Effect of S2/V2 on pressure pulsations
Amplitude of pressure pulsations
0
0.5
1
1.5
2
2.5
3
S2/V2
Idle condition
Refrigeration condition

FIG. 9

# INTERNATIONAL SEARCH REPORT

International application No. **PCT/CN2023/081744**

**A. CLASSIFICATION OF SUBJECT MATTER**

F04C23/02(2006.01)i;F04C29/06(2006.01)i;F04C29/02(2006.01)i;F04C18/356(2006.01)i

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC：F04C

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

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

CNTXT, ENTXT, ENTXTC, VEN: 消音, 消音腔, 旋风, 油分, 油分腔, 油气分离, gas, oil, silencer, separat+, sound muffling, rotat+,

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| PX | CN 218325275 U (ANHUI WELLING AUTO PARTS CO., LTD. et al.) 17 January 2023 (2023-01-17)<br>claims 1-14 | 1-14 |
| X | CN 110259685 A (GUANGDONG WEILING AUTOMOBILE PARTS CO., LTD.) 20 September 2019 (2019-09-20)<br>description, paragraphs 60-116, and figures 3, 4 and 13 | 1-14 |
| X | CN 110259686 A (GUANGDONG WEILING AUTOMOBILE PARTS CO., LTD.) 20 September 2019 (2019-09-20)<br>description, paragraphs 65-144, and figures 16 and 21-23 | 1-14 |
| A | CN 106837802 A (GUANGDONG MEIZHI COMPRESSOR CO., LTD.) 13 June 2017 (2017-06-13)<br>entire document | 1-14 |
| A | CN 110259689 A (GUANGDONG WEILING AUTOMOBILE PARTS CO., LTD.) 20 September 2019 (2019-09-20)<br>entire document | 1-14 |

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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- "D" document cited by the applicant in the international application
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| **16 May 2023** | **18 June 2023** |

| Name and mailing address of the ISA/CN | Authorized officer |
|---|---|
| **China National Intellectual Property Administration (ISA/CN)**<br>**China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** | Telephone No. |

Form PCT/ISA/210 (second sheet) (July 2022)

**INTERNATIONAL SEARCH REPORT**

International application No.
**PCT/CN2023/081744**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 2020217316 A1 (LG ELECTRONICS INC.) 09 July 2020 (2020-07-09)<br>entire document | 1-14 |

Form PCT/ISA/210 (second sheet) (July 2022)

**INTERNATIONAL SEARCH REPORT**
**Information on patent family members**

International application No.
**PCT/CN2023/081744**

| Patent document cited in search report | Publication date (day/month/year) | Patent family member(s) | Publication date (day/month/year) |
|---|---|---|---|
| CN 218325275 U | 17 January 2023 | None | |
| CN 110259685 A | 20 September 2019 | None | |
| CN 110259686 A | 20 September 2019 | None | |
| CN 106837802 A | 13 June 2017 | None | |
| CN 110259689 A | 20 September 2019 | None | |
| US 2020217316 A1 | 09 July 2020 | EP 3677782 A1 | 08 July 2020 |
| | | KR 20200085559 A | 15 July 2020 |
| | | US 11225969 B2 | 18 January 2022 |

Form PCT/ISA/210 (patent family annex) (July 2022)

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- CN 202210715848 **[0001]**
- CN 202221588958 **[0001]**