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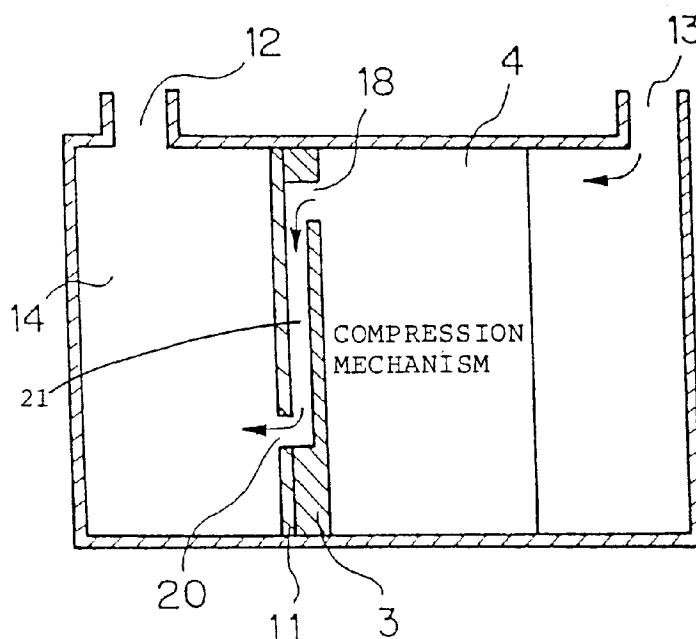
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(57) A quiet gas compressor from which pulsations leaking to outside are small. A rear side housing side plate 3 is provided with a silencing passage 21 from a first discharge opening 16 to a second discharge opening 20 of an oil separator 11. The silencing passage 21 is made small in passage cross-sectional area and long in passage length within such a limit that the silencing

passage 21 does not excessively raise the internal pressure inside a compression chamber 8. The upper surface of the silencing passage 21 is blocked by the oil separator 11. The cross-sectional area S1 of the second discharge opening 20 of the oil separator 11 is made small within such a limit that it does not excessively raise the internal pressure inside the compression chamber 8.

FIG. 2 A**EP 0 768 465 A1**

Description

This invention relates to a gas compressor suitable for use as a cooling medium compressor of an air conditioning unit for a vehicle, and particularly to a gas compressor having reduced discharge pulsation and consequently reduced noise.

Conventionally, in such a gas compressor, because a cooling medium gas is compressed and delivered by intake, compression and discharge processes, a peculiar pressure pulsation (hereinafter referred to as a pulsation) occurs in a discharge chamber and has been transmitted to outside the compressor through a discharge port. Also, noise accompanying the pulsation has been produced.

The causes of this will now be explained using a conventional gas compressor as an example.

Fig. 5 is a vertical sectional view of a conventional gas compressor, and Fig. 6 is a sectional view on the line A-A in Fig. 5.

This gas compressor has at its centre a cylinder 4 made up of a housing 1 having a substantially elliptical inner peripheral surface and a front side housing side plate 2 and a rear side housing side plate 3 to which front and rear end faces of the housing 1 are respectively fixed. A rotor 6 rotatably supported by a shaft 5 and vanes 7 fitted radially protrudably in the rotor 6 are disposed inside the cylinder 4. Two compression chambers 8 are formed in substantially symmetrical positions between the rotor 6 and the cylinder 4.

The housing 1 fixed to the front side housing side plate 2 and the rear side housing side plate 3 is mounted inside a rear housing 9. A front housing 10 is fixed to the outer end face of the front side housing side plate 2. An oil separator 11 for separating oil from the cooling medium gas is fixed to the outer end face of the rear side housing side plate 3. A cooling medium gas discharge port 12 is formed in the upper side of the rear housing 9 and a cooling medium gas intake port 13 is formed in the upper side of the front housing 10.

The discharge port 12 connects with a discharge chamber 14 formed by the rear side housing side plate 3 and the rear housing 9, and the intake port 13 connects with an intake chamber 15 formed by the front side housing side plate 2 and the front housing 10. A cylinder discharge opening 16 formed in the housing 1 for discharging compressed cooling medium gas and a reed valve 17 having one end able to open and close the discharge side of the cylinder discharge opening 16 and the other end fixed to the housing 1 are provided in each of two positions substantially symmetrical in the circumferential direction of the housing 1.

With this construction, cooling medium gas compressed in the compression chambers 8 passes through the cylinder discharge openings 16 and the reed valves 17 and then through a first discharge opening, not shown in the drawings, which passes through the rear side housing side plate 3. After that, the cooling medium gas is delivered into the discharge chamber 14 through a metal mesh oil extractor 19 fitted to the oil separator 11. At this time, oil contained in the cooling medium gas is extracted and cooling medium gas having thus had oil removed from it is sent through the discharge port 12 and through a hose not shown in the drawings to a condenser or the like.

The rotor 6 shown in Fig. 6 is fitted with five vanes 7, and these perform the processes of intake, compression and discharge of the cooling medium gas. Because the cylinder discharge openings 16 are disposed in substantially opposite positions in the housing 1, five gas pressure fluctuations per rotation of the rotor 6 occur at each one of the cylinder discharge openings 16 as the rotor 6 rotates. Also, because an odd number of vanes 7 are used, gas pressure fluctuations whose phase is different by 180° occur at the respective other, opposite cylinder discharge opening 16. Therefore, compounded gas pressure fluctuations, or pulsations, amounting to 10 per one rotation of the rotor 6 are emitted from the discharge port 12.

The number of pulsations per second fluctuates over a wide range because the shaft 5 of the gas compressor is driven by being connected to an engine mounted in the vehicle. For example the engine speed fluctuates over a range of from about 1000rpm during idling to about 7000 to 8000rpm in the red range. That is, pulsation corresponding to the engine speed occurs and at the same time is the cause of noise which fluctuates greatly in frequency.

One known method of reducing this pulsation is to attach a muffler to the discharge port 12 of the gas compressor (see Japanese Utility Model publication No. S.52-16005).

However, with the conventional silencing technology mentioned above, the size of the gas compressor increases by the size of the muffler and its manufacturing cost also increases. Furthermore, there have been problems such as that it is not possible to eliminate sound leaking from the discharge chamber 14 to outside through the rear housing 9.

The present invention was made in view of the kinds of problem described above, and it is an object of the invention to accompany vehicle quietening having been taking place in recent years, to provide a gas compressor from which pulsations leaking to outside are small and which therefore is quiet, and which is small, lightweight and cheap to manufacture.

To achieve this object and other objects, this invention provides a gas compressor comprising a cylinder having a housing both open sides of which are blocked by a rear side housing side plate having a first discharge opening for a gas to pass through and a front side housing side plate, a rotating rotor supported inside the cylinder by a shaft, a compression chamber formed by an outer peripheral surface of the rotor and an inner peripheral surface of the cylinder,

an oil separator fixed to an outer end face of the rear side housing side plate and having a second discharge opening for discharging gas compressed in the compression chamber and separating oil from the gas, and a discharge chamber formed by the rear side housing side plate and a rear housing fixed to a peripheral surface of the rear side housing side plate, and characterised in that a silencing passage made small in passage cross-sectional area and long in passage length within such a limit that the silencing passage does not excessively raise the internal pressure of the compression chamber is provided from the first discharge opening in the rear side housing side plate to the second discharge opening in the oil separator.

Advantageously, the silencing passage is provided in the outer end face of the rear side housing side plate of the inner end face of the oil separator.

Also, this invention provides a gas compressor comprising a cylinder having a housing both open sides of which are blocked by a rear side housing side plate having a first discharge opening for a gas to pass through and a front side housing side plate, a rotating rotor supported inside the cylinder by a shaft, a compression chamber formed by an outer peripheral surface of the rotor and an inner peripheral surface of the cylinder, an oil separator fixed to an outer end face of the rear side housing side plate and having a second discharge opening for discharging gas compressed in the compression chamber and separating oil from the gas, and a discharge chamber formed by the rear side housing side plate and a rear housing fixed to a peripheral surface of the rear side housing side plate, and characterised in that the cross-sectional area of the second discharge opening in the oil separator is made small within such a limit that it does not excessively raise the internal pressure of the compression chamber.

Preferably, in the invention, the silencing passage is divided into a plurality of passages and the total cross-sectional area of the silencing passage is made small within such a limit that the silencing passage does not excessively raise the internal pressure of the compression chamber.

Preferably, in the invention, one or more cavities having a larger cross-sectional area than the passage cross-sectional area of the silencing passage are provided in the silencing passage.

Preferably, in the invention, the cross-sectional area of the second discharge opening in the oil separator is made small within such a limit that the silencing passage does not excessively raise the internal pressure of the compression chamber.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying diagrammatic figures, in which:

Fig. 1 is a simplified view of the construction of a gas compressor showing a first preferred embodiment of the invention;

Fig. 2 (A) is a simplified view of the construction of a gas compressor showing a second preferred embodiment of the invention;

Fig. 2 (B) is an external view of a rear side housing side plate shown in Fig. 2 (A);

Fig. 3 is a simplified view of the construction of a gas compressor showing a third preferred embodiment of the invention;

Figs. 4(A) through (F) are simplified views of the construction of a gas compressor showing a fourth preferred embodiment of the invention showing various forms of silencing passage;

Fig. 5 is a vertical sectional view of a conventional gas compressor; and

Fig. 6 is a sectional view on the line A-A in Fig. 5.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings.

In Fig. 1, which shows a first preferred embodiment of the invention, (and similarly hereinafter) a compressing mechanism is equivalent to a cylinder 4 comprising a front side housing side plate 2 and a rear side housing side plate 3 respectively blocking the front and rear ends of a housing 1 and containing a rotor 6 fitted with vanes 7. An oil separator 11 for separating oil from a cooling medium gas is fixed to the outer end face of the rear side housing side plate 3. Instead of a metal mesh oil extractor 19 fitted in the oil separator 11, one end of a, for example, copper pipe 25 made small in pipe cross-sectional area and long in pipe length within such a limit that it does not abnormally raise the pressure inside the compression chambers 8 is connected to a discharge opening 20 of the oil separator 11. The other end of the copper pipe 25 is open inside a discharge chamber 14.

The effect of this construction will now be explained.

When sound propagates through a narrow pipe, although the damping of the sound depends on the material of the pipe wall, even with a smooth metal pipe the amount of damping is greater than damping in air.

A coefficient α of this damping according to Kirchhof is:

(Exp. 1)

$$\alpha = 0.0102xf^{1/2}/(CxR) \quad [\text{nepers/m}]$$

$$= 0.0875xf^{1/2}(CxR) \quad [\text{dB/m}] \quad (1 \text{ neper} = 8.686\text{dB})$$

where C is the speed of sound [m/s] and R is the radius of the pipe.

In the case of a square pipe, the above expression becomes:

(Exp.2)

$$\alpha = 2 \times 0.0102xf^{1/2}/(C \times D) \quad [\text{nepers/m}]$$

where C is the speed of sound [m/s] and D is the internal diameter or width. Thus, sound damping caused by a pipe is inversely proportional to the radius or internal diameter of the pipe and proportional to the length of the pipe. In results of numerous experiments, due to other factors damping was 10 to 15 percent greater than values calculated using Exp. 1.

In this preferred embodiment, for the reason mentioned above, copper pipes 25 were employed by trial and error and made small in pipe cross-sectional area and long in length within such a limit that the pipe did not abnormally raise the pressure inside the compression chambers 8. Here, as a supposition, the present inventors considered the open area of the reed valve 17 when fully open as a pipe cross-sectional area small within such a limit that the pipe does not abnormally raise the pressure inside the compression chambers 8 (and similarly hereinafter).

As a result, the pulsation at the discharge port 12 became extremely small. It was also confirmed that the amount of sound damping becomes greater the longer the pipe length is made.

Next, second preferred embodiment of the invention is shown in Figs. 2 (A) and (B).

Fig. 2 (A) is a simplified view of the construction of a gas compressor and Fig. 2 (B) is a view of the outer face of a rear side housing side plate 3.

The rear side housing side plate 3 is provided with a silencing passage 21 leading from a first discharge opening 18 to a second discharge opening 20 of an oil separator 11. The silencing passage 21 is made small in passage cross-sectional area and long in passage length within such a limit that the passage does not excessively raise the pressure inside a compression chamber 8. The upper surface of the silencing passage 21 is formed by the oil separator 11.

Also, the cross-sectional area S1 of the second discharge opening 20 of the oil separator 11 is made small within such a limit that it does not abnormally raise the pressure inside the compression chamber 8.

The effect of this will now be explained.

As described above with reference to Exp. 1 and Exp. 2, to dampen noise it is necessary to make the passage cross-sectional area small and make the passage length long. However, because there are various bolt holes in the rear side housing side plate 3, the silencing passage 21 was disposed snaking in a shape avoiding the bolt holes (not shown) as shown in Fig. 2 (B). The passage length of the silencing passage 21 in this preferred embodiment was made 15 centimetres by trial and error. As a result, it was possible to reduce the noise to a considerable degree.

A cover for blocking the upper side of the silencing passage 21 may be separately provided, but by utilising the oil separator 11 for this it is possible to reduce the number of parts.

Also, although the silencing passage 21 was disposed in the outer end face of the rear side housing side plate 3, the same results can be obtained by disposing the silencing passage 21 in the inner end face of the oil separator 11.

This preferred embodiment has merits such as that compared to the first preferred embodiment the number of parts is reduced because no copper pipe 25 is used, the assembly process is also the same as conventionally, the manufacturing cost does not increase significantly and the reliability and durability of the gas compressor are also the same as conventionally.

Now, when sound travels through a pipe, if there is a change in impedance such as a change in cross-section in the pipe or a hole connecting to the outside, some of the sound is reflected and as a result it is possible to reduce the propagation of specified frequencies. The amount of damping in this case is related to the ratio of change in cross-sectional area of the pipe. According to calculations based on acoustic impedance, when the ratio of change in cross-sectional area of the pipe S2/S1 is two the amount of damping is about 0.5dB, when it is three the amount of damping is about 2dB and when it is ten the amount of damping is about 5dB. Therefore, by making the cross-sectional area S of the second discharge opening 20 of the oil separator 11 small within such a limit that it does not abnormally raise the pressure inside the compression chambers 8 and by discharging the cooling medium gas into a discharge chamber 14 having a different cross-sectional area S2 it is possible to obtain a sound damping effect caused by the change in cross-sectional area S2/S1. The cross-sectional area of the discharge port 12 is the same as conventionally, but nev-

ertheless is amply small compared with the cross-sectional area S2. Since the volume of the discharge chamber 14 is large, a large change in cross-sectional area S2/S 1 can be provided and the sound damping effect is therefore also large.

By providing the silencing passage 21 in the rear side housing side plate 3 and making the cross-sectional area S1 of the second discharge opening 20 of the oil separator 11 small it was possible to obtain a damping effect of about 1/10 in pressure values at the opening of the discharge port 12 without any large design changes to the gas compressor. This is equivalent to damping of 20dB.

Next, a third preferred embodiment of the invention is shown in Fig. 3.

In Fig. 3, a rear side housing side plate 3 and an oil separator 11 are of the same construction as in the second preferred embodiment described above, but an auxiliary side plate 22 further provided with a silencing passage 21 is interposed between the rear side housing side plate 3 and the oil separator 11.

The effect of this is that it is possible to make the passage length of the silencing passage 21 longer than in the second preferred embodiment by the length by which the silencing passage 21 is extended by the auxiliary side plate 22 and it is thereby possible to reduce the noise even more. By superposing auxiliary side plates 22 in a plurality of stages, it is possible to make the passage length of the silencing passage 21 still longer. However, because there is the drawback that when the number of auxiliary side plates 22 increases the volume of the discharge chamber 14 decreases it is necessary to achieve a balance of these two considerations.

Next, a fourth preferred embodiment of the invention is shown in Figs. 4 (A) to (F).

Whereas in the second preferred embodiment described above a case wherein the gas compressor has one compression chamber 8 and the rear side housing side plate 3 has one first discharge opening 18 was discussed, Figs. 4 (A) to (F) show cases wherein the gas compressor has two compression chambers 8A, 8B and the rear side housing side plate 3 has two first discharge openings 18A, 18B corresponding with these compression chambers.

In Fig. 4(A), a case wherein cooling medium gas discharged through the two first discharge openings 18A, 18B passes through two silencing passages 21A, 21B and is discharged through two respective second discharge openings 20A, 20B is shown. In this case, pulsation components having a phase difference of half a wavelength arising in the two compression chambers 8A, 8B converge inside the discharge chamber 14. As in the case of the second preferred embodiment, the silencing passages 21A, 21B are preferably made small in passage cross-sectional area and long in passage length within such a limit that the passages do not excessively raise the pressure inside the compression chambers 8A, 8B (this point of making the silencing passages small in passage cross-sectional area and long in passage length also applies hereinafter).

In Fig. 4(B), a case wherein cooling medium gas discharged through two first discharge openings 18A, 18B passes through respective silencing passages 21A, 21B and converges inside the face of the rear side housing side plate 3 and then passes through a single silencing passage 21C and is discharged through a single second discharge opening 20 is shown. In this case, pulsation components having a phase difference of half a wavelength arising in the compression chambers 8A, 8B converge inside the face of the rear side housing side plate 3 and the peaks and troughs in the pulsations mutually interfere. That is, a cancelling-out effect caused by the phase difference can be expected. Experimental results obtained by the present inventors have confirmed that the cancelling-out effect of the phase difference at this time is greater when the passage lengths of the silencing passages 21A, 21B leading to the point of confluence are made the same (this point of making the passage lengths to the point of confluence the same also applies hereinafter).

In Fig. 4(C), a case wherein a cooling medium gas discharged through two first discharge openings 18A, 18B passes through respective silencing passages 21A, 21B and converges just before being discharged through a single second discharge opening 20 is shown. In this case, pulsation components having a phase difference of half a wavelength arising in the compression chambers 8A, 8B converge and the phases cancel each other out just before being discharged through the single second discharge opening 20 in the rear side housing side plate 3.

In Fig. 4(D), a case wherein cooling medium gas discharged through two first discharge openings 18A, 18B passes through respective silencing passages 21a, 21b each made up of a plurality of passages and converges just before being discharged through a single second discharge opening 20 is shown. That is, this case is equivalent to a case wherein the silencing passages 21A, 21B of Fig. 4(C) have each been divided up into a plurality of silencing passages 21a, 21b. This dividing up of silencing passages can also be applied to the passages shown in Fig. 4(A) and 4(B).

By dividing up the silencing passages it is possible to make the passage cross-sectional area per passage much smaller and a better damping effect according to Exp. 1 or Exp. 2 can be expected. Also, it is possible to provide an ample total passage cross-sectional area of the divided silencing passages and consequently it becomes unnecessary to consider rise in the internal pressure of the compression chambers 8. Besides being disposed in parallel as in this preferred embodiment, the divided silencing passages may alternatively be disposed individually away from each other.

In Fig. 4(E), a case wherein a plurality of cavities are provided in the silencing passages 21A, 21B is shown.

As mentioned above, when sound propagates along the inside of a pipe, when there is a change in the cross-section of the pipe it is possible to reduce the propagation of specified frequencies. Therefore, by providing silencing

passages 21A, 21B with a plurality of cavities 30 having a cross-sectional area S_4 different from the cross-sectional area S_3 of the silencing passages, in addition to the effects of making the passage cross-sectional area small and the passage length long in the preferred embodiments described above, it is possible to obtain a sound damping effect caused by the change in ratio of cross-sectional area S_4/S_3 . In this case, to provide the cavities 30 with a large cross-sectional area S_4 , the cavities 30 may be formed using both the rear side housing side plate 3 and the oil separator 11.

In Fig. 4(F), a case wherein pluralities of cavities 30 having a cross-sectional area S_4 different from the passage cross-sectional area S_3 of the silencing passages are provided in the pluralities of silencing passages 21a, 21b shown in Fig. 4(D) is shown. In this case, in addition to the effects of dividing up the silencing passages and making the passage cross-sectional area of each silencing passage small, it is possible to also obtain a sound damping effect caused by the change in ratio of cross-sectional area S_4/S_3 .

The passage cross-sectional area may be changed continuously in the passage length direction to form the cavities 30 (not shown).

Also, although aluminium was used as the material of the rear side housing side plate 3 and the oil separator 11 used in this preferred embodiment, the damping effect may be improved by changing this to another material.

Also, the number of compression chambers and first and second discharge openings is not limited to one or two, and the same effects of the invention can be obtained when there are more than this.

As described above, according to this invention, because a silencing passage made small in passage cross-sectional area and long in passage length is provided it is possible to dampen noise generated along with pulsations inside the silencing passage.

Also, according to this invention, because the cross-sectional area of the discharge opening of the oil separator is made small, the ratio of the cross-sectional area of the discharge chamber to the cross-sectional area of the discharge opening of the oil separator is larger than conventionally. As a result, it is possible to dampen noise generated along with pulsations by utilising the discharge chamber as a cavity.

Furthermore, according to the invention, because the silencing passage is divided into a plurality of passages and the total passage cross-sectional area is made small, it is possible to form silencing passages having a much smaller passage cross-sectional area and it is possible to dampen sound more effectively in the silencing passages.

Also, according to the invention, because at least one cavity is formed in the silencing passage, it is possible to promote sound damping resulting from changes in cross-sectional area.

Furthermore, according to the invention, because the silencing passage is disposed in a rear side housing side plate or the like and the cross-sectional area of a discharge opening of an oil separator is made small, it is possible to obtain the effects of both sound damping caused by the silencing passage and sound damping resulting from the utilisation of the discharge chamber as a cavity. Also, because there are no additional parts, the gas compressor can be made lightweight and small.

A gas compressor according to the invention can be constructed without any large design changes and without changing the external appearance at all, and the same reliability of the gas compressor as conventionally can be maintained.

The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention.

Claims

1. A gas compressor comprising a cylinder (4) having a housing (1) both open sides of which are blocked by a rear side housing side plate (3) having a first discharge opening (18) for a gas to pass through and a front side housing side plate (2), a rotating rotor (6) supported inside the cylinder (4) by a shaft (5), a compression chamber (8) formed by an outer peripheral surface of the rotor (6) and an inner peripheral surface of the cylinder (4), an oil separator (11) fixed to an outer end face of the rear side housing side plate (3) and having a second discharge opening (20) for discharging gas compressed in the compression chamber (8) and separating oil from the gas, and a discharge chamber (14) formed by the rear side housing side plate (3) and a rear housing (9) fixed to a peripheral surface of the rear side housing side plate (3), and characterised in that a silencing passage (21) made small in passage cross-sectional area and long in passage length within such a limit that the silencing passage (21) does not excessively raise the internal pressure of the compression chamber (8) is provided from the first discharge opening (18) in the rear side housing side plate (3) to the second discharge opening (20) in the oil separator (11).
2. A gas compressor according to claim 1, wherein the silencing passage (21) is provided in the outer end face of the rear side housing side plate (3) or the inner end face of the oil separator (11).
3. A gas compressor comprising a cylinder (4) having a housing (1) both open sides of which are blocked by a rear

side housing side plate (3) having a first discharge opening (18) for a gas to pass through and a front side housing side plate (2), a rotating rotor (6) supported inside the cylinder (4) by a shaft (5), a compression chamber (8) formed by an outer peripheral surface of the rotor (6) and an inner peripheral surface of the cylinder (4), an oil separator (11) fixed to an outer end face of the rear side housing side plate (3) and having a second discharge opening (20) for discharging gas compressed in the compression chamber (8) and separating oil from the gas, and a discharge chamber (14) formed by the rear side housing side plate (3) and a rear housing (9) fixed to a peripheral surface of the rear side housing side plate (3), and characterised in that the cross-sectional area of the second discharge opening (20) in the oil separator (11) is made small within such a limit that it does not excessively raise the internal pressure of the compression chamber (8).

4. A gas compressor according to claim 1 or claim 2, wherein the silencing passage (21) is divided into a plurality of passages (21a, 21b) and the total cross-sectional area of the silencing passage (21) is made small within such a limit that the silencing passage (21) does not excessively raise the internal pressure of the compression chamber (8).
5. A gas compressor according to any one of claims 1, 2 or 4, wherein at least one cavity (30) having a larger cross-sectional area than the passage cross-sectional area of the silencing passage (21) is provided in the silencing passage (21).
6. A gas compressor according to any one of claims 1, 2, 4 or 5, wherein the cross-sectional area of the second discharge opening (20) in the oil separator (11) is made small within such a limit that it does not excessively raise the internal pressure of the compression chamber (8).
7. A gas compressor according to any one of claim 1, 2 or 4 to 6, wherein the gas compressor comprises a plurality of compression chambers (8) each having a respective first discharge opening (18A, 18B) in the rear side housing side plate (3) linked by a respective silencing passage (21A, 21B) to a single common second discharge opening (20).
8. A gas compressor according to any preceding claim, wherein the gas is a cooling medium gas.

FIG. 1

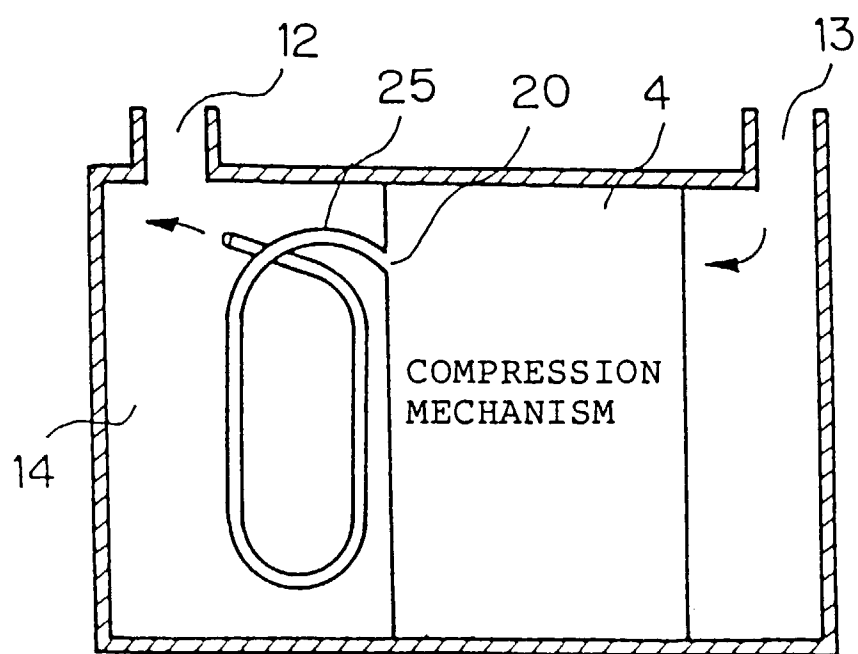


FIG. 2 A

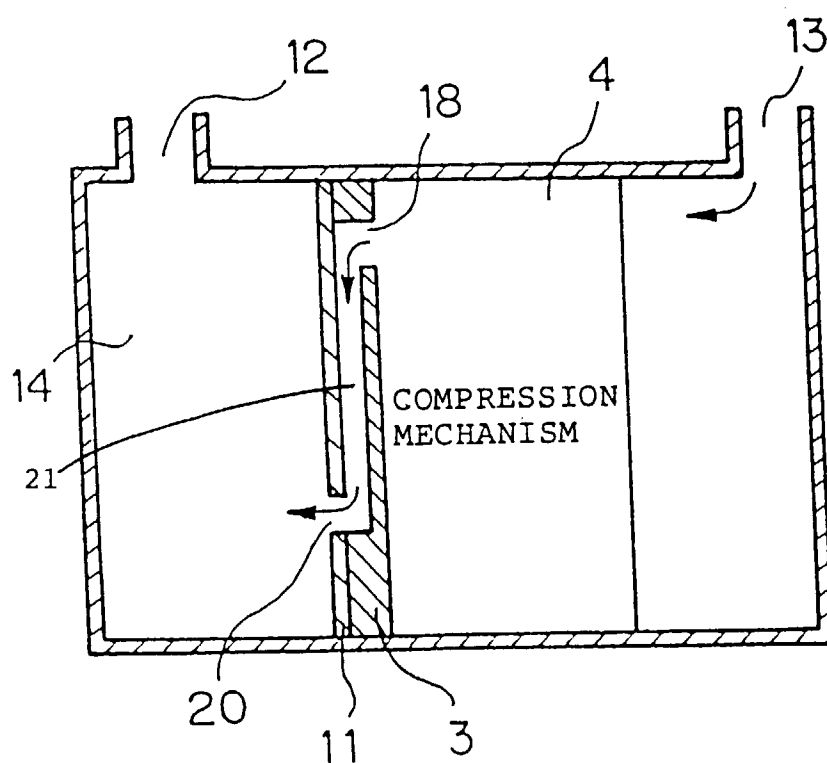


FIG. 2 B

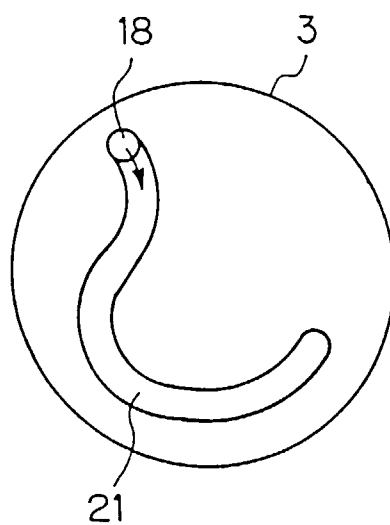


FIG. 3

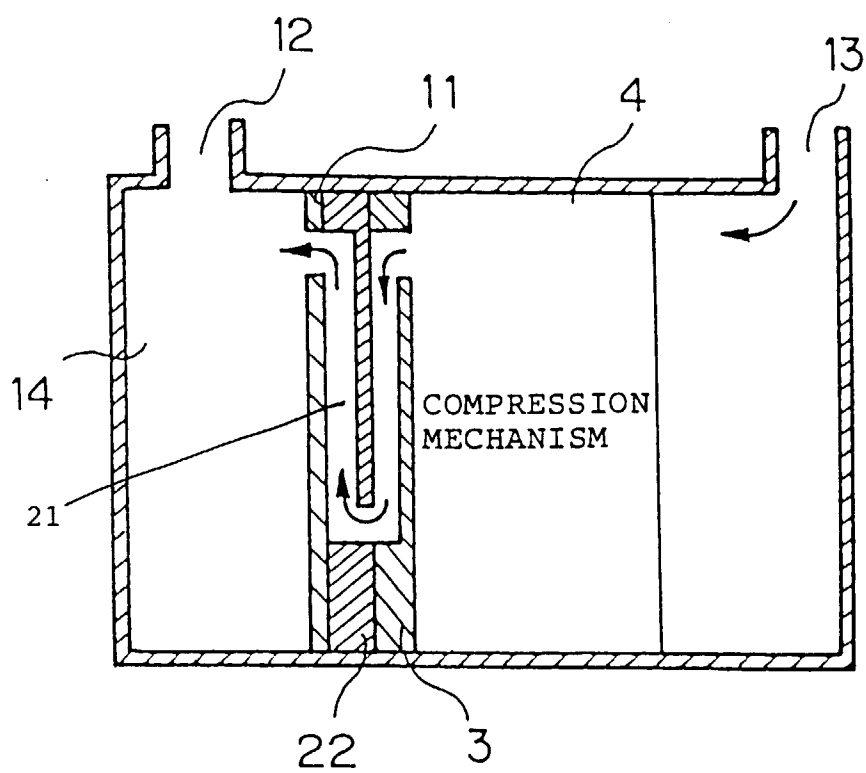


FIG. 4 A

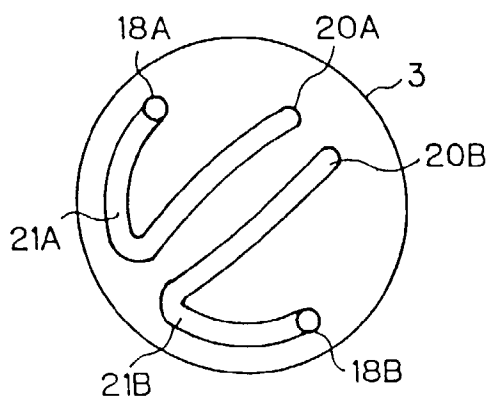


FIG. 4 B

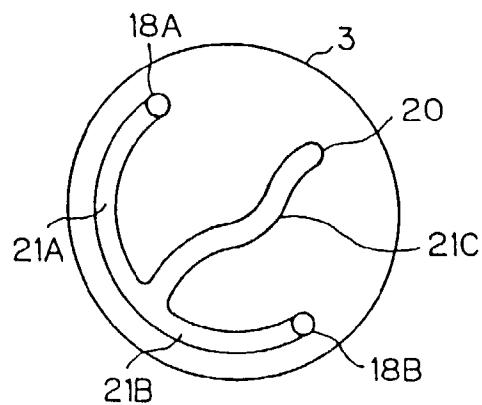


FIG. 4 C

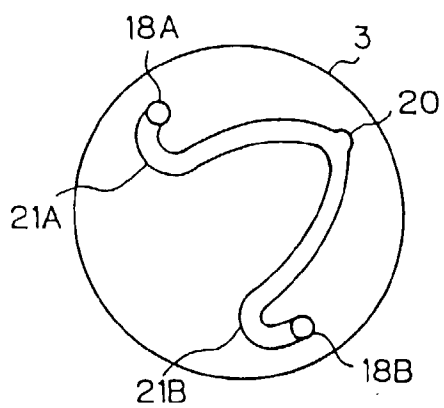


FIG. 4 D

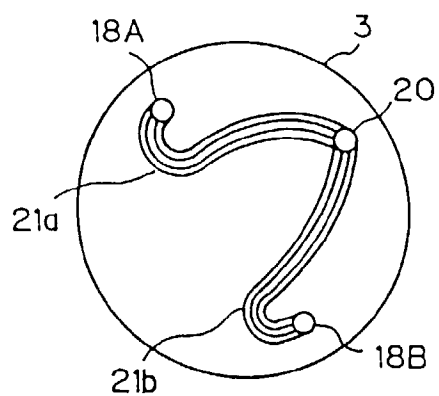


FIG. 4 E

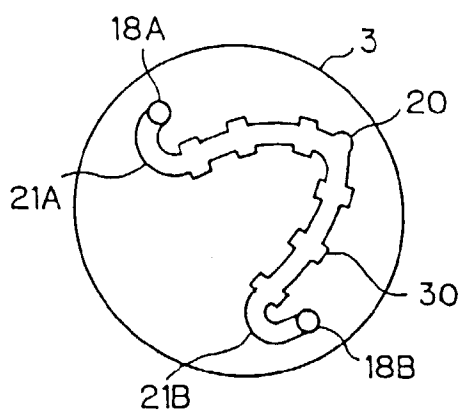


FIG. 4 F

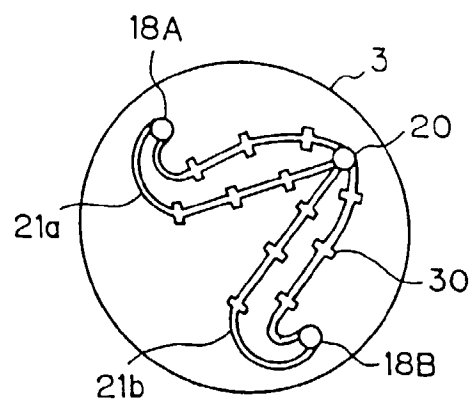


FIG. 5 PRIOR ART

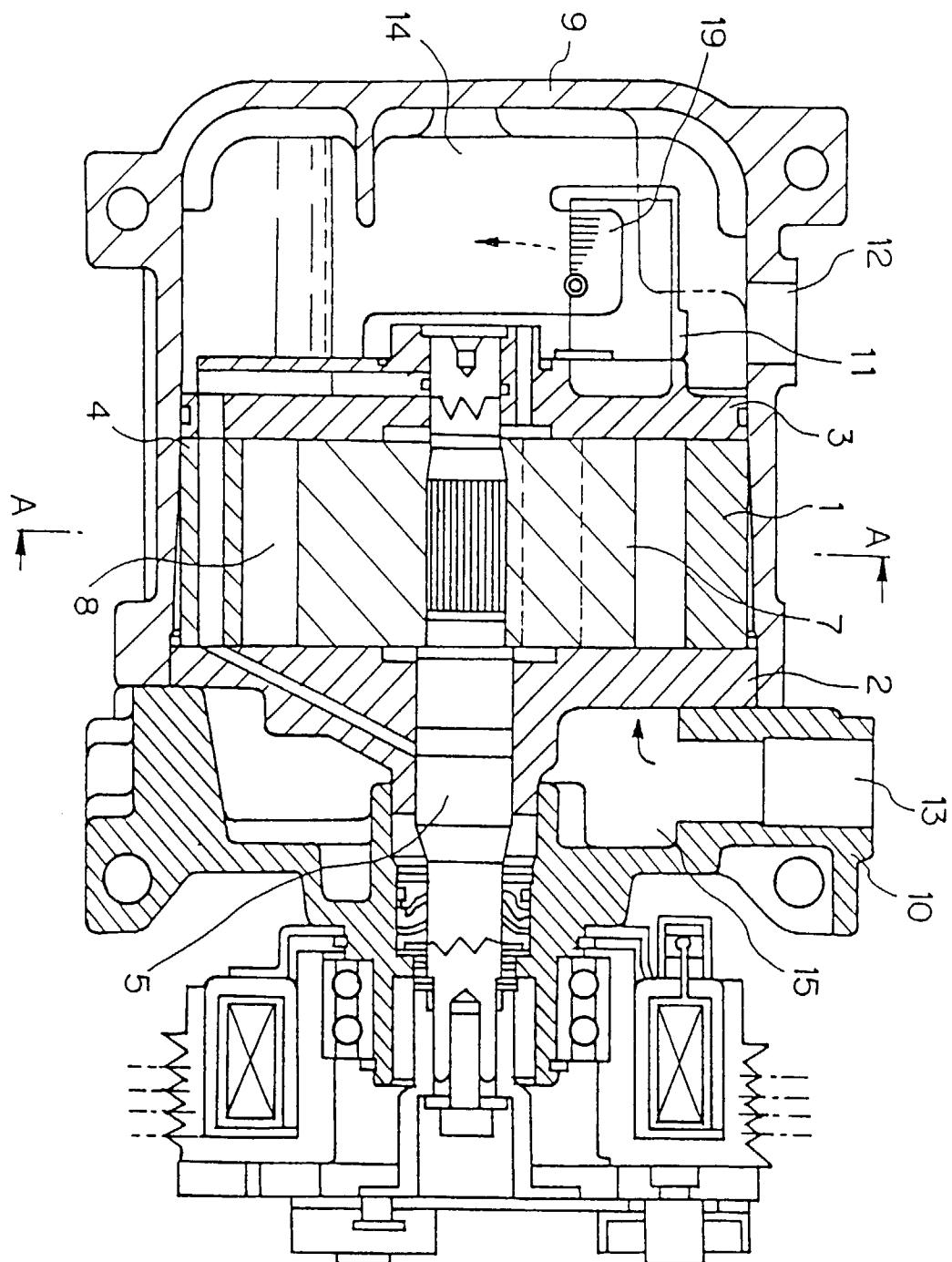
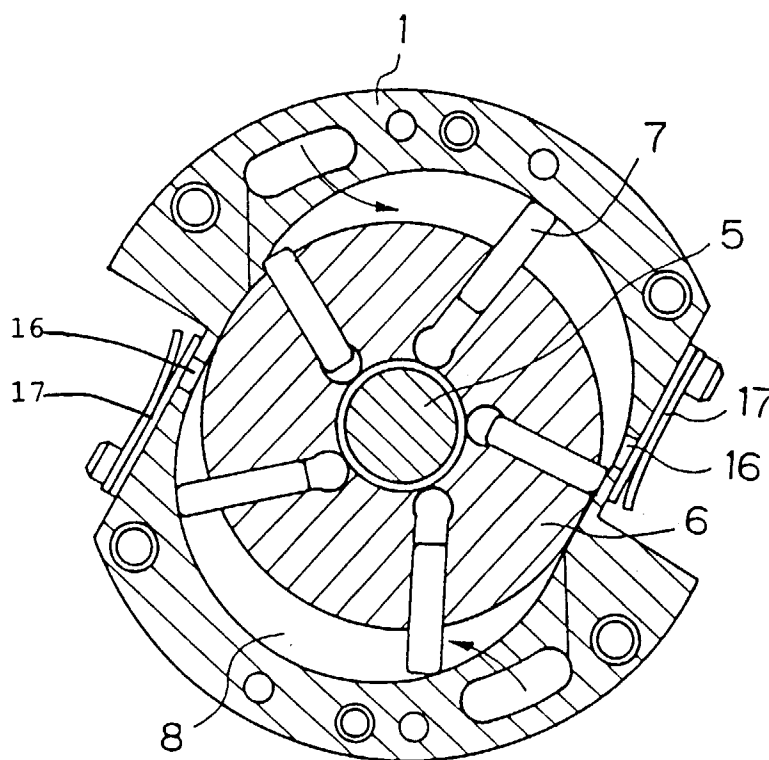


FIG. 6
PRIOR ART





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 7357

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-A-44 21 771 (KABUSHIKI KAISHA TOYODA JIDOSHOKKI SEISAKUSHO) * the whole document *	1,3,8	F04C29/06
A	GB-A-1 180 079 (VEB NILES PRESSLUFTWERKZEUGE) * the whole document *	1	
A	BE-A-402 771 (ROBERT BOSCH AKTIENGESELLSCHAFT) * the whole document *	1	
A	DE-U-91 13 962 (WILMS) * the whole document *	5	
A	DE-A-39 03 054 (DIESEL KIKI CO. LTD.) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F04C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 January 1997	Examiner Dimitroulas, P
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