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(54) **COMBINED REFRIGERATOR AND AIR CONDITIONER UNIT SHARING SINGLE COMPRESSOR**

(57) A combined refrigerator and air conditioner unit sharing a single compressor comprises a compressor, a condenser, an air conditioner evaporator, a refrigerator evaporator, a four-way reversing valve, and a three-way valve. One end of the condenser, the air conditioner evaporator, and the refrigerator evaporator is arranged in parallel via the three-way valve, while the other end of these components is connected to the compressor through the four-way reversing valve. A first throttling valve is arranged between the air conditioner evaporator and the three-way valve, and second throttling valves are arranged respectively between the refrigerator evaporator and the three-way valve. By using a single compressor and condenser in combination with the four-way reversing valve, as well as the first and second throttling valves, this configuration enables the single compressor to simultaneously support the refrigeration functions of both the air conditioner and the refrigerator.

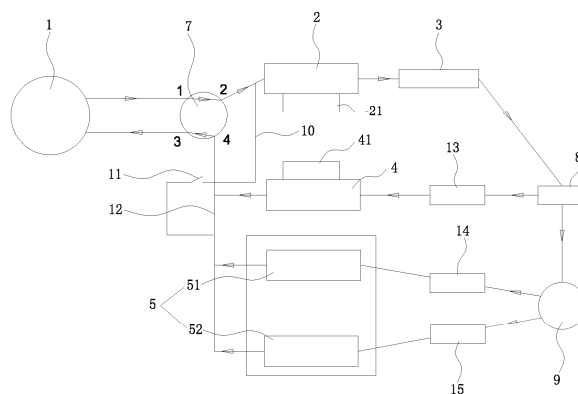


FIG. 1

Description

Field of the Invention

[0001] The present invention relates to the field of compressor-based refrigeration technology, and more specifically, to a combined refrigerator and air conditioner unit that utilizes a single compressor.

Background of the Invention

[0002] Currently, in daily life, refrigerators and air conditioners exist as separate household appliances, each requiring its own dedicated compressor for refrigeration. This arrangement not only demands a large amount of space for the appliances but also results in high energy consumption and heavy load, which is not conducive to energy conservation and emissions reduction.

[0003] Existing combined refrigerator-air conditioner units are generally designed for home use and often employ the cold air inside the refrigerator as an air conditioning source. For example, Chinese Patent No. CN 215597581 U discloses a combined air conditioner and refrigerator solution. However, although the air conditioner unit and the refrigerator unit are integrated to save space, the solution still uses two independent compressors to separately fulfill the refrigeration functions of the air conditioner and the refrigerator, which leads to substantial energy consumption.

[0004] In view of the above, the inventor has proposed the following technical solution.

Summary of the Invention

[0005] The objective of the present invention is to overcome the shortcomings of the prior art and provide a combined refrigerator and air conditioner unit that shares a single compressor.

[0006] To solve the above technical problems, the present invention adopts the following first technical solution:

[0007] First Technical Solution: A combined refrigerator and air conditioner unit sharing a single compressor, comprising: a compressor, a condenser, an air conditioner evaporator, a refrigerator evaporator, a four-way reversing valve, and a three-way valve. One end of the condenser, the air conditioner evaporator, and the refrigerator evaporator is arranged in parallel via the three-way valve, and the other end of the condenser, the air conditioner evaporator, and the refrigerator evaporator is connected to the compressor through the four-way reversing valve. A first throttling valve is provided between the air conditioner evaporator and the three-way valve, and a second throttling valve is provided between the refrigerator evaporator and the three-way valve.

[0008] Further, in the above technical solution, a second circuit is provided between the condenser and the four-way reversing valve to connect the refrigerator eva-

porator. A first switch is provided on this second circuit, and a second switch is provided between the refrigerator evaporator and the air conditioner evaporator as well as the four-way reversing valve.

[0009] Still further, the four-way reversing valve includes a first interface and a third interface connected to the compressor's inlet and outlet, respectively, a second interface connected to the condenser, and a fourth interface simultaneously connected to the air conditioner evaporator and the refrigerator evaporator. The second switch is located between the fourth interface and the evaporators, allowing the connection to the refrigerator evaporator to be cut off without interrupting the connection between the fourth interface and the air conditioner evaporator.

[0010] Furthermore, in the above technical solution, one end of the second circuit is connected between the refrigerator evaporator and the second switch, and the other end is connected between the condenser and the second interface. When the first switch is closed, the condenser can be directly connected to the refrigerator evaporator.

[0011] Further, in the above technical solution, an evaporator fan is provided on the air conditioner evaporator, and a condenser fan is provided on the condenser.

[0012] Further, in the above technical solution, the refrigerator evaporator includes at least a refrigeration evaporator and a freezer evaporator. One end of the refrigeration evaporator and the freezer evaporator is connected to the three-way valve through a solenoid valve. A second throttling valve and a third throttling valve are respectively provided between the solenoid valve and the refrigeration evaporator and between the solenoid valve and the freezer evaporator.

[0013] Further, in the above technical solution, a dryer filter is provided between the condenser and the three-way valve.

[0014] Second Technical Solution: To solve the aforementioned technical problems, the present invention adopts a second technical solution:

[0015] A combined refrigerator and air conditioner unit sharing a single compressor, comprising: a compressor, a condenser, an air conditioner evaporator, a refrigerator evaporator, a four-way reversing valve, and a three-way valve. One end of the condenser, the air conditioner evaporator, and the refrigerator evaporator is arranged in parallel via the three-way valve, and the other end of the condenser, the air conditioner evaporator, and the refrigerator evaporator is connected to the compressor through the four-way reversing valve. A first throttling valve is provided between the air conditioner evaporator and the three-way valve, and a second throttling valve is provided between the refrigerator evaporator and the three-way valve. During operation, the first and second interfaces of the four-way reversing valve are in communication, as are the third and fourth interfaces. The first switch is open, the second switch is closed, and the first, second, and third throttling valves are all open. Of course,

the first, second, and third throttling valves can each be controlled independently to open or close.

[0016] In this working mode, the gas pumped by the compressor flows through the first and second interfaces into the condenser. After the gas is cooled by the condenser, it is dried and filtered by the dryer filter, and then split by the three-way valve to the air conditioner evaporator and the solenoid valve. Ultimately, the gas enters the air conditioner evaporator and the refrigerator evaporator to achieve air conditioning and refrigeration functions. The gas, after exchanging heat, returns to the compressor via the fourth and third interfaces of the four-way reversing valve, thus forming a closed-loop gas circulation.

[0017] Compared with the prior art, by adopting the above technical solutions, the present invention offers the following beneficial effects: By using a single compressor and a condenser along with a four-way reversing valve, and controlling the first and second switches, the unit can achieve independent cooling and heating of the air conditioner evaporator and the refrigerator evaporator, or simultaneous cooling and heating, etc. This not only results in a more compact structure that saves space but also lowers energy consumption, conserves energy, and reduces emissions. It can adapt to various applications; for example, as a mobile combined air conditioner and refrigerator unit that can be used for outdoor activities like camping. In such scenarios, a portable power source or an electric vehicle can supply power to the device, making it more convenient and portable.

Brief Description of the Drawings

[0018]

Fig. 1 is a schematic diagram of Embodiment 1 of the present invention;

Fig. 2 is a schematic diagram of Embodiment 2 of the present invention;

Fig. 3 is a schematic diagram of Embodiment 3 of the present invention;

Fig. 4 is a schematic diagram of Embodiment 4 of the present invention.

Detailed Description of the Embodiments

[0019] The present invention will now be further described in conjunction with the specific embodiments and the accompanying drawings.

[0020] As shown in Figs. 1-4, the combined refrigerator and air conditioner unit sharing a single compressor includes: a compressor (1), a condenser (2), an air conditioner evaporator (4), a refrigerator evaporator (5), a four-way reversing valve (7), and a three-way valve (8), wherein one end of the condenser (2), the air conditioner

evaporator (4), and the refrigerator evaporator (5) is connected in parallel via the three-way valve (8), and the other end of the condenser (2), the air conditioner evaporator (4), and the refrigerator evaporator (5) is connected to the compressor (1) through the four-way reversing valve (7). A first throttling valve (13) is arranged between the air conditioner evaporator (4) and the three-way valve (8), and second throttling valves (14) are respectively arranged between the refrigerator evaporator (5) and the three-way valve (8).

[0021] By using a single compressor (1) and condenser (2) along with the four-way reversing valve (7), first throttling valve (13), and second throttling valves (14), it is possible to satisfy the refrigeration functions of both the air conditioner and the refrigerator simultaneously. This leads to a more compact structure with reduced space occupation and lower energy consumption, fulfilling energy conservation and emissions reduction goals. It can be adapted to various scenarios. For example, as a portable combined air conditioner and refrigerator unit, it can be used during outdoor activities such as camping, powered by portable outdoor power supplies or electric vehicles, thus making it more convenient to use.

[0022] A second circuit (10) is provided between the condenser (2) and the four-way reversing valve (7) to connect the refrigerator evaporator (5). A first switch (11) is installed on the second circuit (10), and a second switch (12) is arranged between the refrigerator evaporator (5) and the air conditioner evaporator (4) as well as the four-way reversing valve (7). By adding the second circuit (10) along with the first switch (11) and second switch (12), and through the coordinated control of the four-way reversing valve (7) and these switches, it is possible to achieve multiple working modes for cooling and heating of the air conditioner evaporator (4) and the refrigerator evaporator (5), either independently or simultaneously. This provides a more compact structure that saves space, reduces energy consumption, and can be adapted to multiple scenarios, such as portable outdoor use.

[0023] The four-way reversing valve (7) includes a first interface and a third interface connected to the compressor (1) inlet and outlet, respectively, a second interface connected to the condenser (2), and a fourth interface connected simultaneously to the air conditioner evaporator (4) and the refrigerator evaporator (5). The second switch (12) is located between the fourth interface and the evaporators (4, 5), allowing the connection to the refrigerator evaporator (5) to be interrupted without blocking the connection to the air conditioner evaporator (4).

[0024] One end of the second circuit (10) is connected between the refrigerator evaporator (5) and the second switch (12), and the other end is connected between the condenser (2) and the second interface. When the first switch (11) is closed, the condenser (2) can be directly connected to the refrigerator evaporator (5).

[0025] An evaporator fan (41) is provided on the air conditioner evaporator (4), and a condenser fan (21) is

provided on the condenser (2).

[0026] The refrigerator evaporator (5) at least includes a refrigeration evaporator (51) and a freezer evaporator (52). One end of these evaporators (51, 52) is connected to the three-way valve (8) via a solenoid valve (9). Between the solenoid valve (9) and the refrigeration evaporator (51) and freezer evaporator (52), a second throttling valve (14) and a third throttling valve (15) are provided respectively. A dryer filter (3) is arranged between the condenser (2) and the three-way valve (8).

[0027] Referring to Fig. 1, Embodiment 1 shows the working mode for cooling both the air conditioner and the refrigerator. In this scenario, the first and second interfaces of the four-way reversing valve (7) communicate, as do the third and fourth interfaces. The first switch (11) is open, and the second switch (12) is closed. The first throttling valve (13), second throttling valve (14), and third throttling valve (15) are all open. Of course, each throttling valve can be independently controlled. Under this working mode, the gas pumped by the compressor (1) flows through the first and second interfaces into the condenser (2). After cooling in the condenser (2), the gas is dried and filtered by the dryer filter (3), then diverted by the three-way valve (8) to both the air conditioner evaporator (4) and the solenoid valve (9). Finally, it enters both the air conditioner evaporator (4) and the refrigerator evaporator (5), achieving air conditioning and refrigeration. The gas then returns to the compressor (1) through the fourth and third interfaces of the four-way reversing valve (7), forming a closed-loop cycle.

[0028] Referring to Fig. 2, Embodiment 2 shows the working mode for heating both the air conditioner and the refrigerator. In this scenario, the first interface of the four-way reversing valve (7) communicates with the fourth interface, and the third interface communicates with the second interface. The first switch (11) is open, the second switch (12) is closed, and all throttling valves (13, 14, 15) are open. Each throttling valve can be independently controlled. Under this mode, the hot gas from the compressor (1) flows through the first and fourth interfaces into the air conditioner and refrigerator evaporators (4, 5), thus providing heating. After heat exchange, the gas passes through the solenoid valve (9) and the three-way valve (8), is dried and filtered by the dryer filter (3), enters the condenser (2), and then returns to the compressor (1) through the second and third interfaces of the four-way reversing valve (7), forming a closed-loop cycle.

[0029] Referring to Fig. 3, Embodiment 3 shows the working mode for air conditioner cooling and refrigerator heating. In this scenario, the first and second interfaces of the four-way reversing valve (7) communicate, as do the third and fourth interfaces. The first switch (11) is closed, the second switch (12) is open, and the throttling valves (13, 14, 15) are all open. Each can be independently controlled. Under this mode, gas from the compressor (1) partly enters the condenser (2) through the first and fourth interfaces and partly enters the refrigerator evaporator

(5) through the second circuit (10). After cooling in the condenser (2) and drying and filtering, the gas enters the air conditioner evaporator (4) from the three-way valve (8). The gas that flowed into the refrigerator evaporator (5) via the solenoid valve (9) also joins and is diverted to the air conditioner evaporator (4), thus achieving air conditioner cooling. Finally, the gas returns to the compressor (1) via the fourth and third interfaces of the four-way reversing valve (7), completing the closed-loop cycle.

[0030] Referring to Fig. 4, Embodiment 4 shows the working mode for air conditioner heating and refrigerator cooling. In this scenario, the first interface of the four-way reversing valve (7) communicates with the fourth interface, and the third interface communicates with the second interface. The first switch (11) is closed, the second switch (12) is open, and all throttling valves (13, 14, 15) are open. Each can be independently controlled. Under this mode, hot gas from the compressor (1) flows through the first and fourth interfaces into the air conditioner evaporator (4) for heating. After heat exchange, the gas returns to the compressor (1) through the three-way valve (8) and dryer filter (3), passes through the condenser (2), and then re-enters the compressor (1) via the second and third interfaces of the four-way reversing valve (7). Meanwhile, the gas directed through the solenoid valve (9) flows to the refrigerator evaporator (5) for cooling, and then returns to the compressor (1) through the second circuit (10) and the four-way reversing valve (7), thus forming a closed-loop cycle.

[0031] In summary, through the coordinated control of the four-way reversing valve (7), the first switch (11), and the second switch (12), the present invention can achieve multiple working modes for a single compressor (1) and a single condenser (2) servicing both air conditioning and refrigeration functions. This significantly reduces energy consumption, not only saving household electricity but also facilitating portable outdoor use. It greatly expands the applicability of the equipment.

[0032] Of course, the above description only details specific embodiments of the present invention and should not be construed as limiting the scope of the invention. Any equivalent changes or modifications made based on the described structure, characteristics, and principles within the scope of the appended claims should be included within the scope of the present invention.

Claims

1. A combined refrigerator and air conditioner unit sharing a single compressor, comprising:

a compressor (1), a condenser (2), an air conditioner evaporator (4), a refrigerator evaporator (5), a four-way reversing valve (7), and a three-way valve (8),

- wherein one end of the condenser (2), the air conditioner evaporator (4), and the refrigerator evaporator (5) is arranged in parallel via the three-way valve (8), and the other end of the condenser (2), the air conditioner evaporator (4), and the refrigerator evaporator (5) is connected to the compressor (1) through the four-way reversing valve (7);
 a first throttling valve (13) is provided between the air conditioner evaporator (4) and the three-way valve (8), and a second throttling valve (14) is provided between the refrigerator evaporator (5) and the three-way valve (8).
2. The combined refrigerator and air conditioner unit sharing a single compressor according to claim 1, wherein a second circuit (10) is provided between the condenser (2) and the four-way reversing valve (7) to connect the refrigerator evaporator (5), a first switch (11) is arranged on the second circuit (10), and a second switch (12) is arranged between the refrigerator evaporator (5) and the air conditioner evaporator (4) as well as the four-way reversing valve (7).
 3. The combined refrigerator and air conditioner unit sharing a single compressor according to claim 2, wherein the four-way reversing valve (7) comprises a first interface and a third interface connected to the inlet and outlet of the compressor (1) respectively, a second interface connected to the condenser (2), and a fourth interface connected simultaneously to the air conditioner evaporator (4) and the refrigerator evaporator (5), the second switch (12) being located between the fourth interface and the evaporators, so as to disconnect the refrigerator evaporator (5) from the fourth interface without interrupting the connection between the fourth interface and the air conditioner evaporator (4).
 4. The combined refrigerator and air conditioner unit sharing a single compressor according to claim 2, wherein one end of the second circuit (10) is connected between the refrigerator evaporator (5) and the second switch (12), and the other end is connected between the condenser (2) and the second interface; when the first switch (11) is closed, the condenser (2) can be directly connected to the refrigerator evaporator (5).
 5. The combined refrigerator and air conditioner unit sharing a single compressor according to claim 1, wherein an evaporator fan (41) is provided on the air conditioner evaporator (4), and a condenser fan (21) is provided on the condenser (2).
 6. The combined refrigerator and air conditioner unit sharing a single compressor according to claim 1, wherein the refrigerator evaporator (5) includes at least a refrigeration evaporator (51) and a freezer evaporator (52), one end of the refrigeration evaporator (51) and the freezer evaporator (52) being connected to the three-way valve (8) via a solenoid valve (9), and a second throttling valve (14) and a third throttling valve (15) being respectively arranged between the solenoid valve (9) and the refrigeration evaporator (51) and between the solenoid valve (9) and the freezer evaporator (52).
 7. The combined refrigerator and air conditioner unit sharing a single compressor according to claim 1, wherein a dryer filter (3) is provided between the condenser (2) and the three-way valve (8).
 8. A combined refrigerator and air conditioner unit sharing a single compressor, comprising:
 - a compressor (1), a condenser (2), an air conditioner evaporator (4), a refrigerator evaporator (5), a four-way reversing valve (7), and a three-way valve (8),
 - wherein one end of the condenser (2), the air conditioner evaporator (4), and the refrigerator evaporator (5) is arranged in parallel via the three-way valve (8), and the other end of the condenser (2), the air conditioner evaporator (4), and the refrigerator evaporator (5) is connected to the compressor (1) through the four-way reversing valve (7);
 - a first throttling valve (13) is provided between the air conditioner evaporator (4) and the three-way valve (8), and a second throttling valve (14) is provided between the refrigerator evaporator (5) and the three-way valve (8);
 - during operation, the first interface of the four-way reversing valve (7) communicates with the second interface, and the third interface communicates with the fourth interface, the first switch (11) is open, the second switch (12) is closed, and the first throttling valve (13), the second throttling valve (14), and the third throttling valve (15) are all open (of course, the first throttling valve (13), the second throttling valve (14), and the third throttling valve (15) can each be independently controlled to open or close;
 - in the operating mode, gas pumped from the compressor (1) enters the condenser (2) through the first and second interfaces, after being cooled by the condenser (2), the gas is dried and filtered by the dryer filter (3), then split by the three-way valve (8) to flow to the air conditioner evaporator (4) and the solenoid valve (9), and finally enters the air conditioner evaporator (4) and the refrigerator evaporator (5), thereby achieving air conditioning and refrigeration; the gas after heat exchange returns

to the compressor (1) via the fourth and third interfaces of the four-way reversing valve (7), thus realizing a closed-loop circulation of the gas flow.

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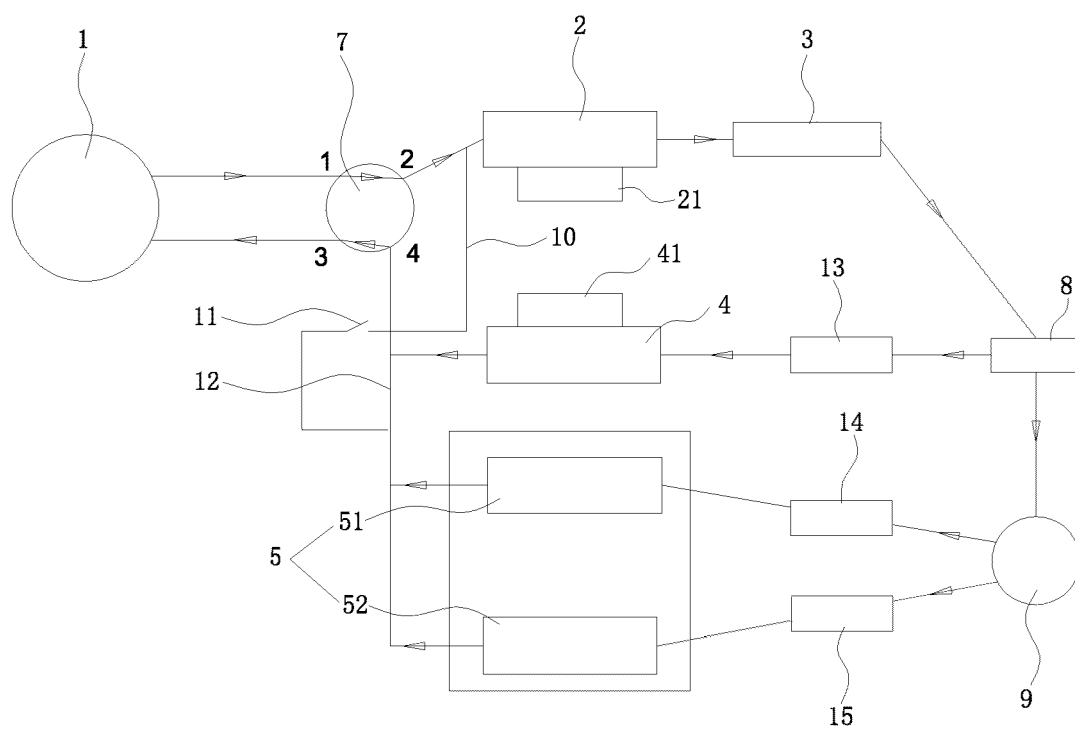


FIG. 1

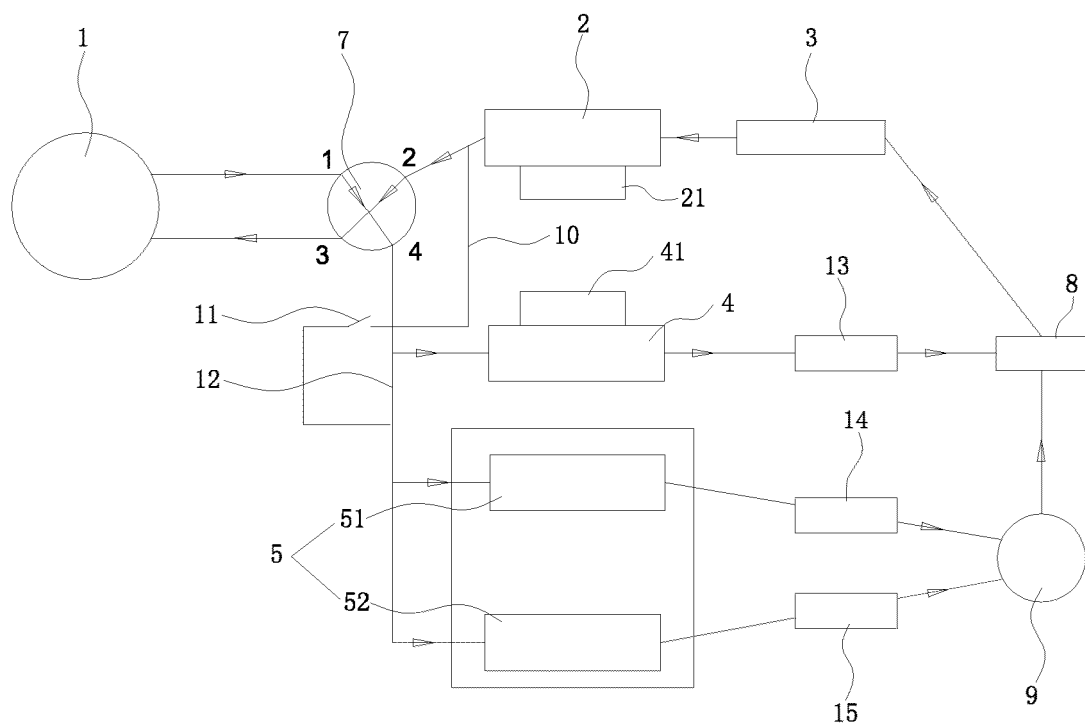


FIG. 2

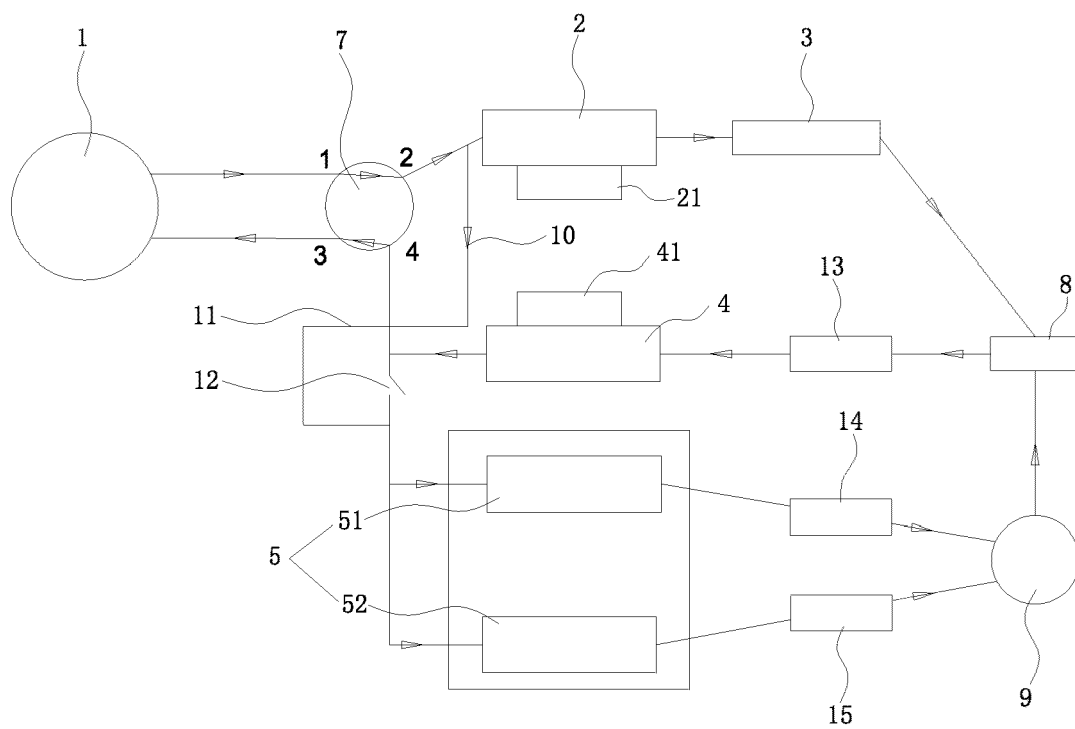


FIG. 3

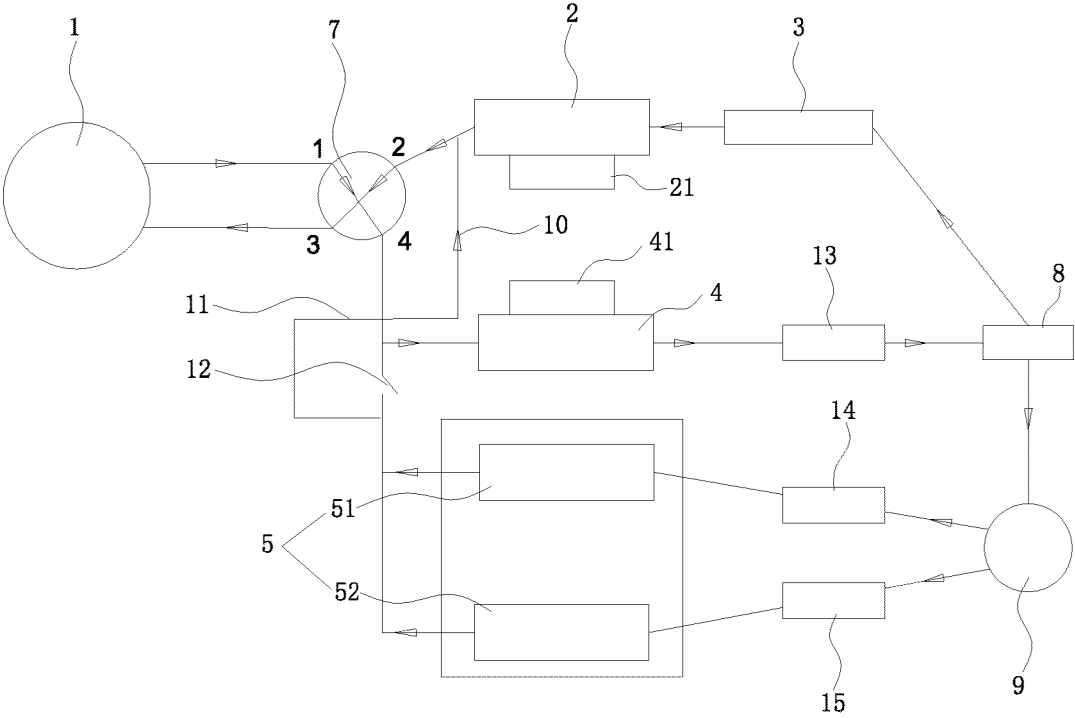


FIG. 4



EUROPEAN SEARCH REPORT

Application Number

EP 25 20 5308

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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