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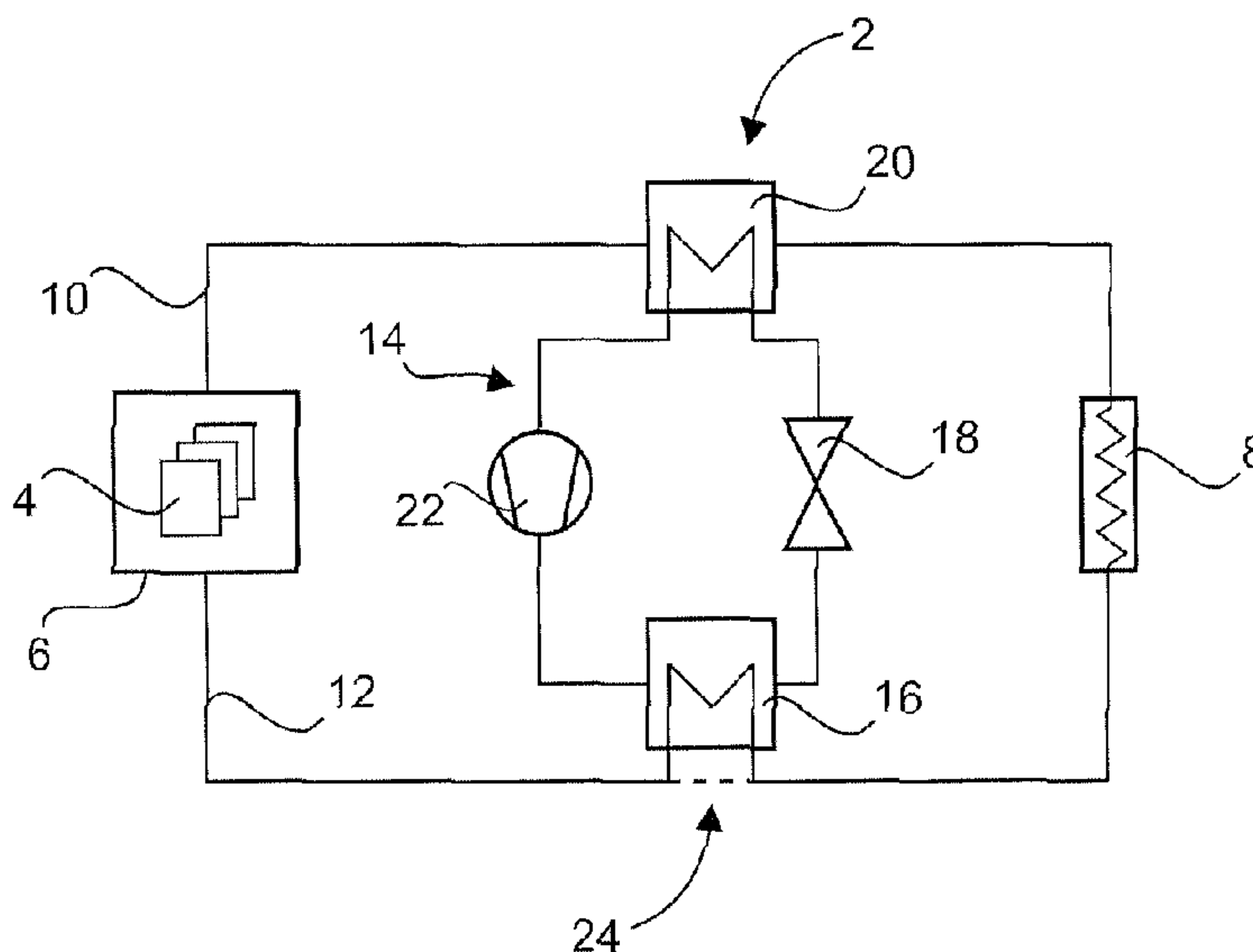
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CHALEUR DANS UN AVION

(54) Title: SYSTEM AND METHOD FOR COOLING AT LEAST ONE HEAT-PRODUCING DEVICE IN AN AIRCRAFT



(57) Abrégé/Abstract:

A system (2) for cooling at least one heat-producing device (4) in an aircraft has at least one coolant circuit. A coolant absorbs heat from the heat-producing device (4), and dissipates heat via a heat dissipation apparatus (8) to the area surrounding the aircraft. A temperature spreading apparatus (14) reduces the temperature of the coolant in an inlet (10) of the coolant circuit, and increases the heat dissipation temperature of the heat dissipation apparatus (8) in comparison to the temperature of the coolant in an outlet (12) of the coolant circuit. This makes it possible to avoid the normal ram-air channels or systems which consume precooled air in the prior art, which make avionics cooling or the like difficult, particularly when the aircraft is on the ground on hot days.

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A B S T R A C T

A system (2) for cooling at least one heat producing device (4) in an aircraft comprises at least one coolant circuit. A coolant absorbs heat from the heat producing
5 device (4) and dissipates heat, by way of a heat dissipation device (8), to the surroundings of the aircraft. A temperature spreading device (14) reduces the temperature of the coolant in a feed line (10) of the coolant circuit and increases the heat dissipation temperature of the heat dissipation device (8) relative to the temperature of the coolant in a return line (12) of the coolant circuit. In this manner
10 ram air ducts that are commonly used in the state of the art or systems that consume pre-cooled air can be avoided, which in particular when the aircraft is situated on the ground on hot days can render avionics cooling or the like difficult.

(Fig. 1)

15

System and method for cooling at least one heat-producing device in an aircraft

TECHNICAL FIELD

5 The invention relates to a system for cooling at least one heat producing device in an aircraft, to a method for cooling at least one heat producing device, to the use of a system for cooling at least one heat producing device in an aircraft, and to an aircraft comprising at least one heat producing device and at least one system for cooling the heat producing device.

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BACKGROUND TO THE INVENTION

In larger aircraft of a modern design, increasingly a multitude of devices are integrated which during normal operation of the aircraft produce a considerable amount of heat which must safely and reliably be removed from the aircraft and dissipated, for
15 example to the environment. For example, modern commercial aircraft comprise a multitude of different arithmetic units or other (power) electronics units, which are generally referred to as "avionics" and which are accommodated in an avionics compartment. In the state of the art avionics compartments in aircraft are cooled by means of various systems. Systems are known in which a coolant by way of a coolant
20 circuit absorbs heat from the avionics compartment and dissipates said heat to the environment by means of a skin-section heat exchanger. However, in this arrangement the situation when the aircraft is located on the ground on hot days is critical, because the temperature difference between the skin-section heat exchanger and the environment may be insufficient to carry out adequate heat dissipation.

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Furthermore, it is known, at least in flight, to cool components in the avionics compartment by blowing in air from the aircraft cabin, wherein air from the so-called “triangular region” underneath the cabin floor and near the fuselage wall could be removed and, after absorbing heat from the avionics devices, leaves the avionics
5 compartment in a heated state. However, this requires that the air conditioning system of the aircraft is already operative and, in particular during stops on the ground on hot days, the cabin has been cooled down to a predetermined temperature level. Accordingly, it may be required, during operation of an aircraft on a hot day, to first operate the air conditioning system before the avionics devices can be switched on.

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Furthermore, it is known for outside air to be used in order to dissipate heat from the interior of an aircraft to its environment. To this effect, by way of a so-called ram air duct, air that flows past the aircraft in flight is guided into the interior of the aircraft, is fed by way of a heat exchanger that thermally communicates with the coolant to be
15 cooled, and is discharged to the aircraft environment by way of an outlet opening. In this process the air flowing through the ram air duct absorbs heat to be dissipated. This principle is, for example, already used in aircraft air conditioning systems in order to cool hot compressed air that is later to flow into the aircraft cabin. Furthermore, this principle is used in cooling systems, as described for example in DE 4340317. The air
20 flowing through the ram air duct could, however, noticeably increase the aerodynamic resistance of the aircraft in flight. On the ground the ram air can be conveyed through the ram air duct by means of a fan.

SUMMARY OF THE INVENTION

25 It could thus be considered to be an object of the invention to propose a cooling system for cooling heat producing devices in an aircraft, which cooling system independently of an ambient temperature and independently of an air conditioning system makes possible reliable cooling of the heat producing devices.

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Likewise it could be considered an object of the invention to propose such a cooling system that is associated with as little complexity as possible, with the lowest possible energy requirement, the lightest possible weight, which cooling system in particular does not generate any additional aerodynamic resistance.

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This object is met by a system for cooling at least one heat producing device in an aircraft, comprising at least one coolant circuit through which coolant flows in order to absorb heat from the heat producing device, wherein the coolant circuit comprises a feed line arranged upstream of the heat producing device, and a return line arranged
10 downstream of the heat producing device. The system according to the invention is characterized in that a heat dissipation device that thermally communicates with the return line of the coolant circuit for dissipating heat from the coolant circuit is provided, in that a temperature spreading device reduces the temperature of the coolant in the feed line of the coolant circuit and increases a heat dissipation
15 temperature of the heat dissipation device relative to the temperature of the coolant in the return line of the coolant circuit.

The type of heat dissipation device does not limit the invention. Instead, numerous types of heat dissipation devices are to be considered as being suitable, by means of
20 which heat can be dissipated to an environment. The use of heat transfer devices suggests itself, which heat transfer devices implement direct, indirect (recuperative), and/or semi-direct heat transfer.

The coolant can be of a liquid or gaseous nature. Any type of commonly used coolant
25 or special coolant can be used. The invention is not limited to the type of coolant.

Thus by means of the temperature spreading device the coolant is cooled down to a suitable temperature so that a distinct and adequate temperature difference to corresponding heat transfer means (cooling elements, heat exchangers and the like) on
30 the heat producing devices is produced in order to in an efficient manner absorb heat from the heat producing devices. At the same time, by means of the temperature

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spreading device, the heat dissipation temperature of a heat dissipation device is significantly increased relative to the temperature of the coolant in the return line, which means that even when the aircraft is situated on the ground on hot days in the sun an adequate temperature difference between the heat dissipation device and the
5 environment of the aircraft can be ensured.

This provides a further technical effect in that it is not necessary to have already started up an air conditioning system of the aircraft in order to be able to provide adequately cool air for cooling the heat producing devices. Instead, it is imaginable to
10 start up the temperature spreading device already shortly before starting up the heat producing devices so that in a relatively timely manner adequate cooling of the heat producing devices can be ensured even in the case of extreme temperatures within the aircraft. By means of the significant increase in temperature relative to the temperature of the coolant in the return line of the coolant circuit any type of heat
15 dissipation device, for example a heat exchanger or the like, can dissipate the heat absorbed by the coolant to the environment even in the case of extreme ambient temperatures.

The invention is not limited to the use of a single design of a temperature spreading
20 device; instead, any equipment, devices and systems can be used that are able to spread a temperature level between two coolant lines. Accordingly, compression cooling machines, absorption cooling machines, diffusion absorption cooling machines, adsorption cooling machines, cooling machines based on the Joule-Thomson effect, thermo-electrical cooling generators (Peltier elements) and the like
25 are imaginable. In addition, pure heat sinks or heat sources are imaginable in order to increase or decrease the temperature in a coolant line.

The design of the system according to the invention is not complex, involves low-cost technically mature components, and can be operated without active blowing of cooling air or the like from the aircraft to the outside.

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According to an advantageous improvement of the system according to the invention, the heat dissipation device is designed as a skin-section heat exchanger. The skin-section heat exchanger can in particular in flight ensure adequate heat transport to the environment.

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In order to improve the cooling performance with the aircraft situated on the ground, the skin-section heat exchanger can extend into an air duct pointing towards the aircraft interior, which air duct comprises at least one conveying device for conveying air from the environment or for conveying ram air. The extension of the skin-section heat exchanger into the air duct means that the skin-section heat exchanger can not only dissipate heat on the outside of the aircraft, but also comprises lamellae, ribs or other air-permeable structures towards the interior of the aircraft, which structures make it possible to dissipate heat to the ambient air. With the aircraft stationary on the ground, an air flow through the air duct can be enforced by operating the conveying device.

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In an advantageous improvement of the system according to the invention, on openings that are directed towards the surroundings the air duct comprises closing elements which during adequate flight speed of the aircraft can be closed in order to eliminate the additional aerodynamic resistance. The closing elements could, for example, be designed in the form of flaps or rotary-closure screens, wherein the drive is to be implemented by electric, pneumatic, or hydraulic actuators that are customary in this special field.

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In an advantageous improvement of the system according to the invention the coolant circuit is an open circulation system. This provides an advantage in that air can be used as a coolant. Since a certain air volume flow needs to be removed anyway from the cabin of the aircraft to the environment, at least part of this can be used as coolant for the system according to the invention.

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Furthermore, in a favorable embodiment the temperature spreading device comprises a first coolant medium circuit with a condenser and an evaporator. In this way, by means of mature technology, in a mechanically simple manner and economical manner adequate temperature spreading and consequently particularly efficient
5 cooling can be achieved by means of the system according to the invention.

According to an advantageous improvement of the system according to the invention, the condenser can be cooled with air from an additional air source, wherein the air source is situated in the interior of the aircraft and/or is implemented with the use of
10 ambient air and/or bleed air. In this manner still further improved temperature spreading is achieved. This suggests itself in those cases where air is used as a coolant, and in particular where the coolant circuit is open.

It is equally advantageous if the condenser is arranged at the return line of the coolant
15 circuit. In this manner at the same time the temperature reduction that can be achieved by the evaporator is improved, and consequently the overall efficiency of the system according to the invention is improved.

At the same the evaporator too can be arranged at the return line of the coolant circuit,
20 wherein in this case, however, the condenser is not to be arranged at the feed line of the coolant circuit, but instead could, for example, be directly connected to the heat dissipation device or to some other heat dissipating element.

According to an advantageous improvement of the system according to the invention,
25 the condenser can be connected to a heat exchanger that is subjected to air from an air source, wherein the air source is located in the interior of the aircraft, and/or is implemented by ambient air. Consequently, in this embodiment, too, the heat of the condenser can be dissipated by means of the heat exchanger to the through-flowing air from the air source.

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Furthermore, in an advantageous improvement of the system according to the invention, the temperature spreading device could comprise a first heat exchanger for cooling coolant from the return line of the coolant circuit with air from an air source, wherein the air source is situated in the interior of the aircraft, and/or is implemented
5 by ambient air. In this manner, at least in the case where the air conditioning system of the aircraft is already in operation, or in the case of adequately low ambient temperatures, reliable operation of the system according to the invention can be achieved, wherein the temperature spreading device should then in addition comprise further measures at least for cooling the coolant in the feed line.

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The object is furthermore met by a method for cooling at least one heat producing device, by the use of a system according to the invention for cooling at least one heat producing device in an aircraft, and by an aircraft comprising at least one heat producing device and at least one system for cooling a heat producing device in an
15 aircraft.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics, advantages and application options of the present invention are disclosed in the following description of the exemplary embodiments and of the
20 figures. All the described and/or illustrated characteristics per se and in any combination form the subject of the invention, even irrespective of their composition in the individual claims or their interrelationships. Furthermore, identical or similar components in the figures have the same reference characters.

25 Fig. 1 shows a diagrammatic view of a first exemplary embodiment of the system according to the invention.

Fig. 2 shows a diagrammatic view of a second exemplary embodiment of the system according to the invention.

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Fig. 3 shows a diagrammatic view of a third exemplary embodiment of the system according to the invention.

Fig. 4 shows a diagrammatic view of a fourth exemplary embodiment of the system
5 according to the invention.

Fig. 5 shows a diagrammatic view of a fifth exemplary embodiment of the system according to the invention.

10 Fig. 6 shows a diagrammatic view of a sixth exemplary embodiment of the system according to the invention.

Fig. 7 shows a diagrammatic view of a skin-section heat exchanger according to the invention.
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Fig. 8 shows a diagrammatic view of a method according to the invention.

Fig. 9 shows an aircraft comprising at least one system according to the invention.

20 DETAILED PRESENTATION OF EXEMPLARY EMBODIMENTS

In Fig. 1 a first exemplary embodiment of a system 2 according to the invention for cooling at least one heat producing device 4 in an aircraft is presented. As an example a space 6 is shown in which the heat producing devices 4 are accommodated. The design of this space 6, which can, for example, be an avionics compartment, does not
25 form part of the invention and accordingly is not described in detail. However, it should be pointed out that the heat producing devices 4 comprise suitable means with which heat can be dissipated to a coolant. These means can be of any design, for example heat exchangers, cooling elements or cooling fins around which air or the like flows.

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The system 2 according to the invention further comprises a heat dissipation device 8 which with a feed line 10 and a return line 12 of the space 6 or the heat producing device 4 forms a closed circulation system. In this circulation system a coolant circulates that flows from the feed line 10 to the heat producing devices 4 where it
5 absorbs heat, subsequently flows into the return line 12 to the heat dissipation device 8 where it dissipates heat to the environment of the aircraft, and subsequently again flows to the feed line 10 where it is again available for heat absorption.

Efficient heat dissipation by the heat dissipation device 8 to the environment, and
10 particularly efficient heat absorption from a heat producing device 4 by the coolant from the feed line 10 can be achieved only in those cases where there is a corresponding temperature gradient to the environment or to the coolant. In particular at high temperatures it can be difficult or entirely impossible to achieve a correspondingly high heat dissipation temperature in the heat dissipation device 8,
15 which makes possible a heat flow to the environment in the first place. Likewise without further equipment the temperature of the coolant in the feed line 10 would be so high that there is no adequate temperature difference for cooling the heat producing devices 4, and in turn as a result of this a very high volume flow of the coolant becomes necessary. If the temperature of the environment is too high, even the highest
20 coolant flow may not be sufficient to dissipate the heat.

For this reason the system 2 according to the invention comprises a temperature spreading device 14 which as an example is designed as a cooling medium circuit with a condenser 16, a flow control valve 18, an evaporator 20, and a compressor 22. This
25 cooling medium circuit, which is also referred to as a cold-vapor cooling machine, is able to increase the temperature of the coolant from the return line 12 by means of the condenser 16, and to lower said temperature by means of the evaporator 20. This means that the coolant from the return line 12, which has already absorbed heat, is heated still further so that the heat dissipation temperature in the heat dissipation
30 device 8 is clearly increased. This has the effect that the temperature gradient to the environment is adequate even on hot days, thus allowing efficient dissipation of heat.

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Likewise, the coolant flowing to the feed line 10 is cooled to a significantly lower temperature by the evaporator 20 so that, as a result of this, efficient absorption of heat from the heat producing device 4 can take place.

5 If it were to become necessary, for example due to a low ambient temperature, to increase to a lesser extent the temperature of the coolant flowing into the return line 12, in order to reduce heating of the coolant a bypass 24 can be arranged on the condenser 16 so that at least part of the coolant flowing into the return line 12 can flow directly to the heat dissipation device 8.

10

Fig. 2 shows a modification in the form of a system 26 according to the invention, wherein here again the temperature spreading device 14 is designed as a cooling medium circuit; however, in this embodiment the overarching coolant circuit is not closed. This implicitly means that in particular air is used as a coolant, which air is
15 taken from an air source and is again dissipated to the environment of the aircraft.

In addition, the system 26 according to the invention comprises an optional further air source 28, which introduces air into the return line 12 of the coolant circuit. As a result of this the temperature of the coolant from the return line 12 is reduced before
20 said coolant reaches the condenser 16. An optional bypass 24, shown in a dashed line in the illustration, serves to maintain the volume flow balance, and possibly for the exclusive use of air from the air source 28 for cooling the condenser 16, should this air be cooler than the temperature in the return line 12 of the coolant circuit.

25 If the aircraft is stationed on the ground on a hot day, it is not expected that ambient air automatically enters the aircraft in order to be used in the system 26 according to the invention. The system 26 according to the invention thus comprises, for example, two conveying devices 30 and 32 by means of which fresh air from the surroundings of the aircraft is channeled to the evaporator 20 in the direction of the feed line 10 and
30 is then conveyed from the aircraft to the outside. In this arrangement the conveying devices 30 and 32 are located on suitable air openings 34 and 36, which, for example,

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in flight can be closed by means of closing elements 38 and 40, and on the ground can be opened again.

Fig. 3 shows a further embodiment of the system 42 according to the invention, in which system 42 a liquid coolant, conveyed by means of a conveying device 62, could be used in a closed circulation system, wherein the closed circulation system comprises a heat dissipation device 44 which is, for example, implemented by combining a heat exchanger 46 and a fan 48 in a ram air duct 50.

10 In order to achieve an efficient spread of the temperature level between the heat dissipation device 44 and the feed line 10 a temperature spreading device 52 in the form of a cooling medium circuit is used, with the latter comprising an evaporator 54, a compressor 56, a condenser 58, and a flow control valve 60. However, in the figure, as an example the evaporator 54 is arranged between the feed line 10 and the return
15 line 12 so that consequently the temperature of the coolant flowing from the return line 12 to the feed line 10 is reduced. Since already upstream of the evaporator 54 a heat dissipation device 44 can dissipate heat from the return line 12, with the use of the cooling medium circuit 52 the temperature in the feed line 10 can be further reduced to a significant extent.

20 Furthermore, the condenser 58 is cooled in a ram air duct or from an additional air source 28, for example with the use of extraction air that also, for example, originates from the avionics compartment, from the cockpit, or from the cabin. As an alternative, the alternative air source 28 can be implemented by means of an inlet valve for
25 ambient air on the aircraft fuselage, or by means of bleed air from one or several engines 130.

Fig. 4 shows a further embodiment of the system 64 according to the invention, wherein in the aforesaid the coolant circuit can be constructed so as to be either closed
30 or open. A conveying device 66 conveys the coolant from the return line 12 to the

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feed line 10, where the coolant flows through an evaporator 68 of a temperature spreading device 70 that is implemented as a cooling medium circuit that also comprises a compressor 72, a condenser 74, and a flow control valve 76. As a result of this the temperature of the coolant in the feed line 10 is significantly reduced, which
5 results in improved heat absorption of the heat from the heat producing devices 4.

The condenser 74 of the cooling medium circuit 70 is cooled by means of a secondary cooling device 78, wherein the latter could, for example, comprise a conveying device 80, a heat exchanger 82, and a fan 84 in a ram air duct 86.

10

Such an arrangement is associated with a particular advantage in that the temperature spreading device 70 can be accommodated and operated in a pressurized region of the aircraft fuselage. In theory a temperature spreading device, for example the temperature spreading device 52 of Fig. 3, could partially or completely be
15 accommodated in a non-pressurized region of the aircraft, which could simplify the installation when compared to integration of the temperature spreading device 52 in the non-pressurized region. However, this could be unfavorable for maintenance purposes, because the cooling medium circuit would have to be interrupted for maintenance purposes.

20

If the system 64 according to the invention is operated as an open circuit, then the two conveying devices 30 and 32 shown in Fig. 2 could be arranged upstream of the feed line 10 and downstream of the return line 12. In this case it would also be possible to use air from the environment or from the interior of the aircraft as a coolant. If the
25 coolant circuit is designed so as to be closed, any suitable coolant can be used.

It is of course possible to use not only one single system 2, 26, 42 or 64 according to the invention in an aircraft; for reasons associated with redundancy, multiplication is also imaginable. For this reason Fig. 5 as an example shows a combination of two
30 systems 42 according to the invention according to Fig. 3, albeit without the ram air duct 50, the heat exchanger 46 arranged therein, and the fan 48. This embodiment of a

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system 88 according to the invention thus comprises two coolant circuits, each being cooled by a temperature spreading device 90 implemented as a cooling medium circuit. The two coolant circuits are thermally interconnected by valves 92 and 94 as well as / or by a heat exchanger 96.

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It should be pointed out that the illustration is symmetrical, i.e. the upper coolant circuit in the drawing plane is shown in a mirror-inverted manner relative to the lower coolant circuit.

10 If, for example, one of the two temperature spreading devices 90 were to fail, the return lines 12 of the two coolant circuits could be pneumatically interconnected by means of the valve 92, and the feed lines 10 of the two coolant circuits could be pneumatically interconnected by means of a valve 94. As an alternative or in addition to this, it is also possible for heat to be transferred by way of the heat exchanger 96
15 from one coolant circuit to the other coolant circuit. This ensures that, for example, two spaces 6 with several heat producing devices 4 in an aircraft, which spaces are positioned at locations that are situated apart from each other, can be cooled adequately, also on the ground, also if one of the temperature spreading devices 90 were to fail.

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Fig. 6 diagrammatically shows a generalized advantageous embodiment of the system 98 according to the invention, which embodiment can relate to all the above-described embodiments. A temperature spreading device 100, which can be implemented in any desired manner, is integrated in a coolant circuit that is connected to a special form of
25 a heat dissipation device 8 in the form of a skin-section heat exchanger 102. The skin-section heat exchanger 102 comprises not only flow ducts 103 that for convective heat dissipation to the environment are thermally connected to an outer skin area 104, through which flow ducts 103 coolant or cooling media flow, but also a ram air duct 108 as illustrated in Fig. 7. The ram air duct 108, which comprises a first opening 110
30 and a second opening 112, is located between the outer skin 104 of the skin-section heat exchanger 102 and the aircraft interior, which in the diagram is designated by

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reference character 106. Through the first opening 110 air can flow into the ram air duct 108, and through the opening 112 said air can leave said ram air duct 108 again. Heat dissipation elements 114, which as an example are designed as cooling ribs, extend from the skin-section heat exchanger 102 to the ram air duct 108, around
5 which heat dissipation elements 114 air flowing through the flow duct 108 flows. In this manner the efficiency of heat transfer to the environment can be improved.

To achieve an adequate airflow for absorbing the heat of the skin-section heat exchanger 102 when the aircraft is situated on the ground, in addition a fan 116 is
10 arranged in the ram air duct 108. Accordingly, the skin-section heat exchanger 102 is not limited to heat transfer by convection on the outer skin 104.

In order to reduce the aerodynamic resistance during flight phases with adequately high flight speed and adequately good heat transfer through the outer skin 104, the
15 openings 110 and 112 can be closed by mechanically driven closing elements 118.

In a method according to the invention according to Fig. 8 at first heat from heat producing devices is absorbed 120 by means of a coolant flowing into a return line of a coolant circuit, and subsequently the temperature of the coolant in the return line is
20 increased 122. By means of a heat dissipation device heat from the coolant whose temperature has been increased is dissipated 124, and subsequently the temperature of the coolant flowing into a feed line of the coolant circuit is reduced 126.

Finally, Fig. 9 shows an aircraft 128 that is equipped with at least one system
25 according to the invention for cooling at least one heat producing device.

In addition, it should be pointed out that “comprising” does not exclude other elements or steps, and “a” or “one” does not exclude a plural number. Furthermore, it should be pointed out that characteristics or steps which have been described with
30 reference to one of the above exemplary embodiments can also be used in combination with other characteristics or steps of other exemplary embodiments

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described above. Reference characters in the claims are not to be interpreted as limitations.

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LIST OF REFERENCE CHARACTERS

	2	System according to the invention
	4	Heat producing device
5	6	Space
	8	Heat dissipation device
	10	Feed line
	12	Return line
	14	Temperature spreading device
10	16	Condenser
	18	Flow control valve
	20	Evaporator
	22	Compressor
	24	Bypass
15	26	System according to the invention
	28	Additional air source
	30	Conveying device
	32	Conveying device
	34	Opening
20	36	Opening
	38	Closing element
	40	Closing element
	42	System according to the invention
	44	Heat dissipation device
25	46	Heat exchanger
	48	Fan
	50	Ram air duct
	52	Temperature spreading device
	54	Evaporator
30	56	Compressor
	58	Condenser

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	60	Flow control valve
	62	Conveying device
	64	System according to the invention
	66	Conveying device
5	68	Evaporator
	70	Temperature spreading device
	72	Compressor
	74	Condenser
	76	Flow control valve
10	78	Secondary cooling device
	80	Conveying device
	82	Heat exchanger
	84	Fan
	86	Ram air duct
15	88	System according to the invention
	90	Temperature spreading device
	92	Valve
	94	Valve
	96	Heat exchanger
20	98	System according to the invention
	100	Temperature spreading device
	102	Skin-section heat exchanger
	103	Flow ducts
	104	Outer skin
25	106	Aircraft interior
	108	Ram air duct
	110	Opening
	112	Opening
	114	Cooling fins
30	116	Fan
	118	Closing element

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	120	Heat absorption
	122	Increase in the temperature of the coolant
	124	Heat dissipation
	126	Decrease in the temperature of the coolant
5	128	Aircraft
	130	Engine

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A system for cooling at least one heat producing device in an aircraft, comprising at least one coolant circuit through which a coolant flows in order to absorb heat from the heat producing device,
wherein the coolant circuit comprises a feed line arranged upstream of the heat producing device, and a return line arranged downstream of the heat producing device,
characterized by a heat dissipation device, which thermally communicates with the return line of the coolant circuit, for dissipating heat from the coolant circuit, and
by a temperature spreading device, which is in thermal communication with both the return line and the feed line, for reducing the temperature of the coolant in the feed line of the coolant circuit and for simultaneously increasing a heat dissipation temperature of the heat dissipation device relative to the temperature of the coolant in the return line of the coolant circuit.
2. The system of claim 1, further comprising a skin-section heat exchanger, arranged on an outer skin of the aircraft, with flow ducts as a heat dissipation device, which flow ducts are thermally connected to the outer skin.
3. The system of claim 2, further comprising an air duct which is delimited by the skin-section heat exchanger towards the outside of the aircraft, with heat dissipation elements that extend into the air duct, and around which heat dissipation elements air can flow.
4. The system of claim 3, further comprising at least one closing element for opening or closing at least one opening of the air duct.

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5. The system of any one of claims 1 to 4, wherein the coolant circuit is an open circulation system.
6. The system of any one of claims 1 to 5, further comprising at least one conveying device for conveying the coolant in the coolant circuit.
7. The system of any one of claims 1 to 6, wherein the temperature spreading device comprises a cooling medium circuit with a condenser and an evaporator.
8. The system of claim 7, wherein the condenser is arranged at the return line of the coolant circuit.
9. The system of claim 7, wherein the evaporator is arranged at the feed line and/or at the return line of the coolant circuit.
10. The system of claim 9, wherein the heat dissipation device has been implemented by the condenser that is designed to be cooled by means of air from an additional air source, wherein the additional air source provides air from the interior of the aircraft and/or from the surroundings and/or by means of bleed air.
11. The system of claim 10, wherein the condenser is connected to a heat exchanger that is designed to be cooled by air from the interior of the aircraft and/or by ambient air and/or by bleed air.
12. The system of any one of claims 1 to 11, comprising two coolant circuits whose feed lines are thermally interconnected by way of a heat exchanger.

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13. The system of claim 12, wherein the feed lines and the return lines of the two coolant circuits communicate with each other in a switchable manner by way of valves.

14. A method for cooling at least one system for cooling at least one heat producing device in an aircraft, comprising the steps of:

- absorbing heat from the heat producing device by means of a coolant flowing into a return line of a coolant circuit;
- increasing the temperature of the coolant in the return line;
- by means of a dissipation device, dissipating heat from the coolant whose temperature has been increased;
- reducing the temperature of the coolant flowing into a feed line of the coolant circuit.

15. An aircraft, comprising at least one space with at least one heat dissipating device and at least one system for cooling the heat producing device, comprising
at least one coolant circuit, through which a coolant flows, for absorbing heat from the heat producing device,

wherein the coolant circuit comprises a feed line located upstream of the heat producing device, and a return line that is arranged downstream of the heat producing device,

characterized by a heat dissipation device, which thermally communicates with the return line of the coolant circuit, for dissipating heat from the coolant circuit, and

by a temperature spreading device, which is in thermal communication with both the return line and the feed line, for reducing the temperature of the coolant in the feed line of the coolant circuit and for simultaneously increasing a heat dissipation temperature of the heat dissipation device relative to the temperature of the coolant in the return line of the coolant circuit.

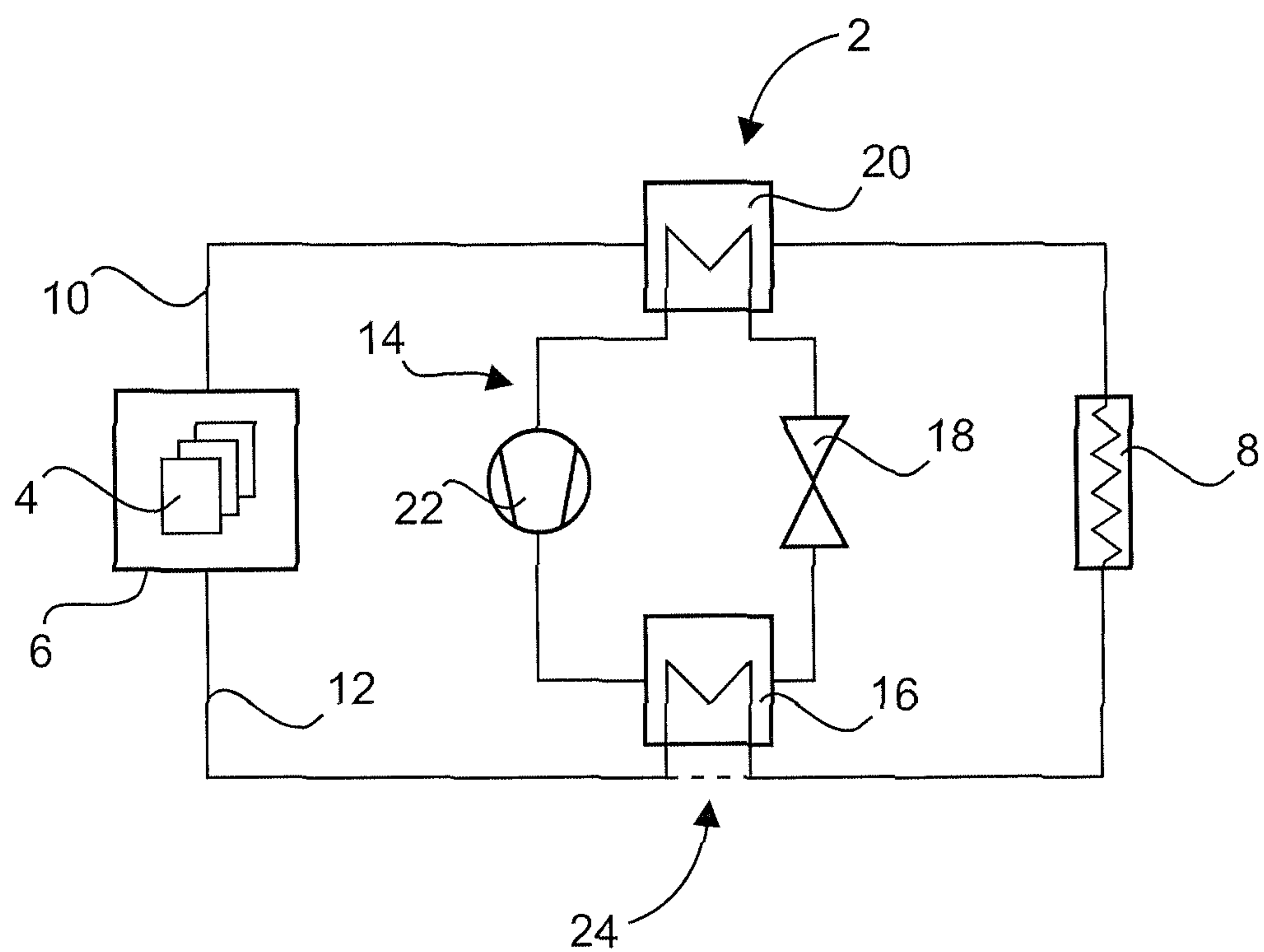


Fig. 1

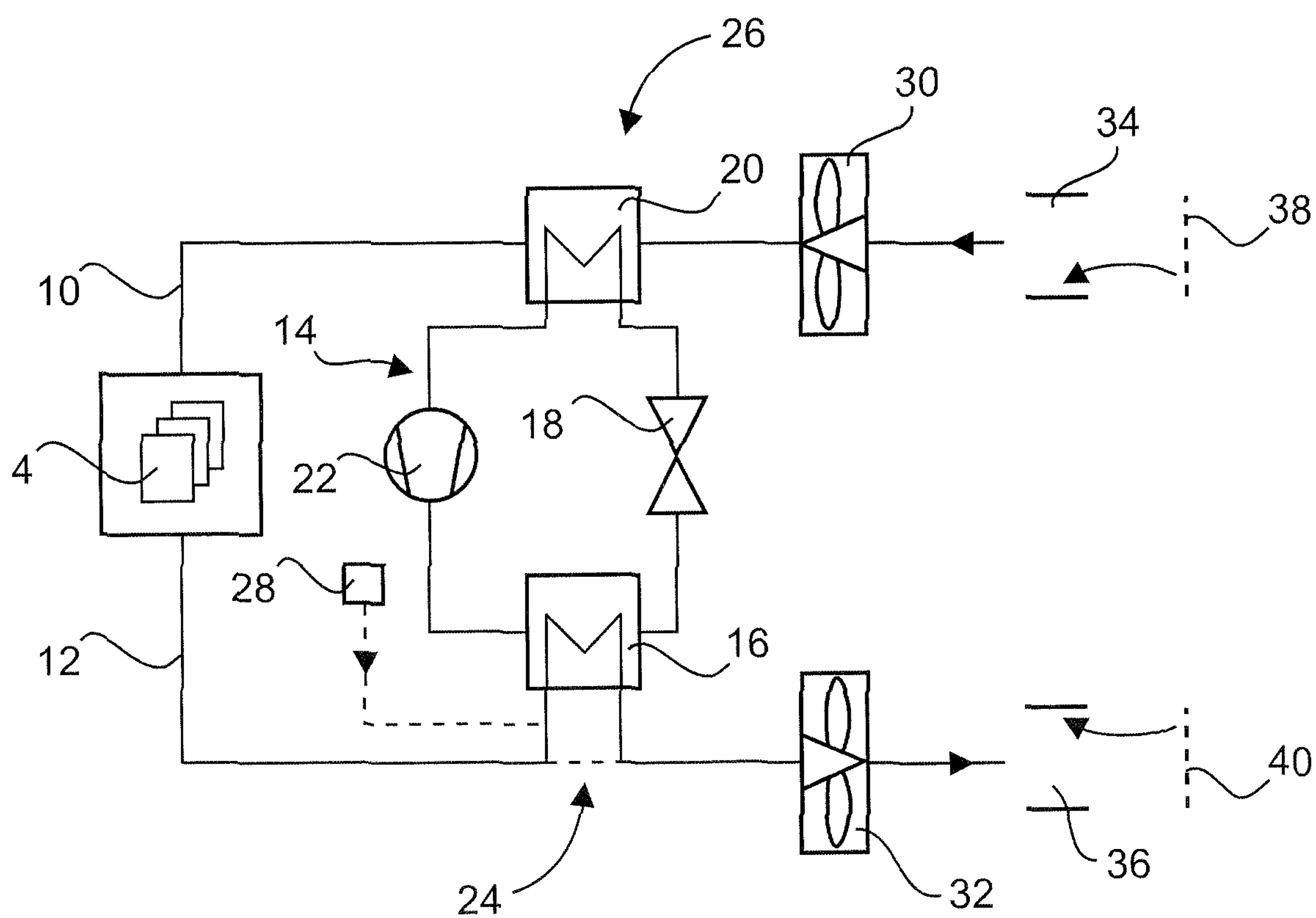


Fig. 2

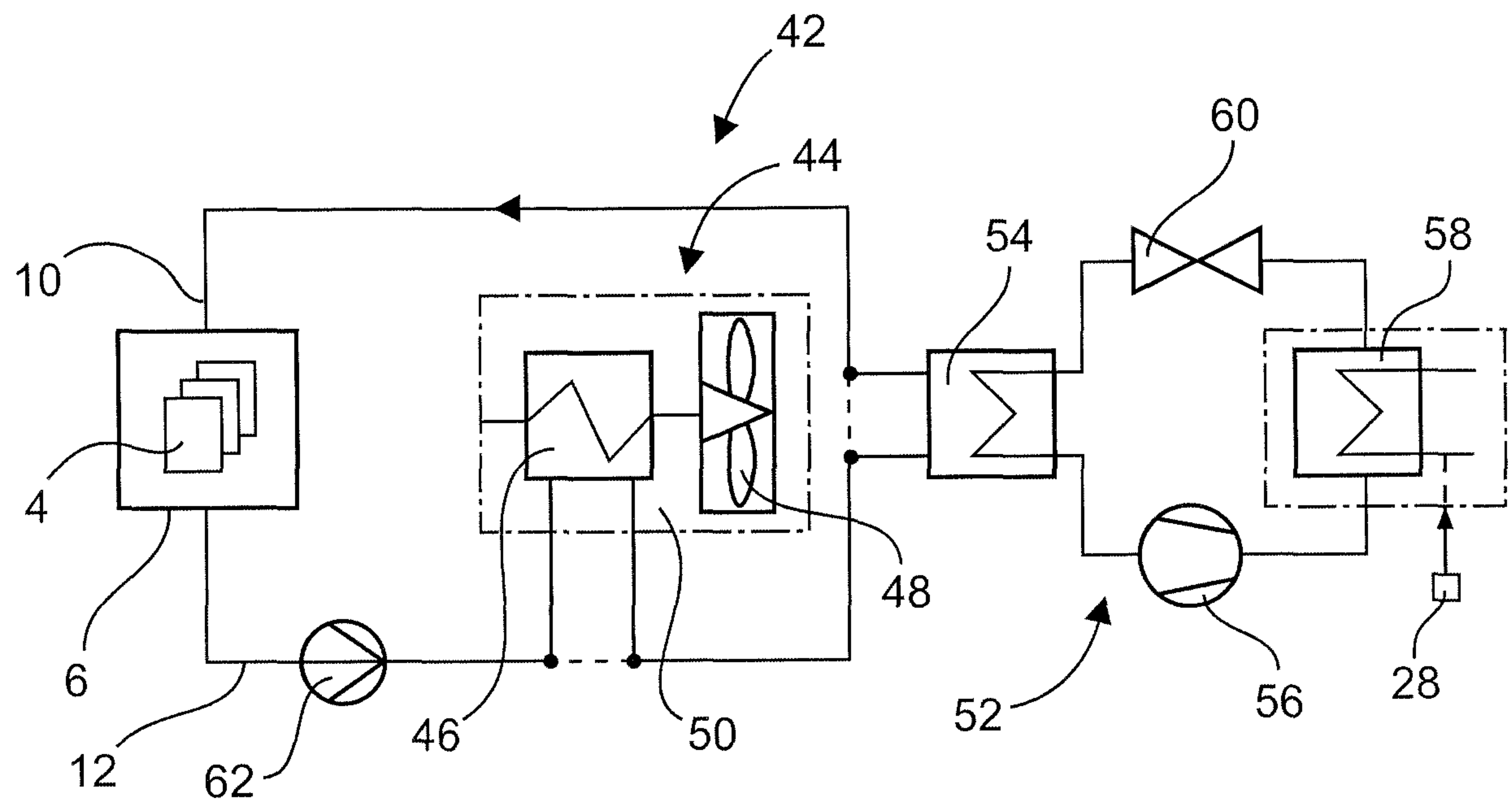


Fig. 3

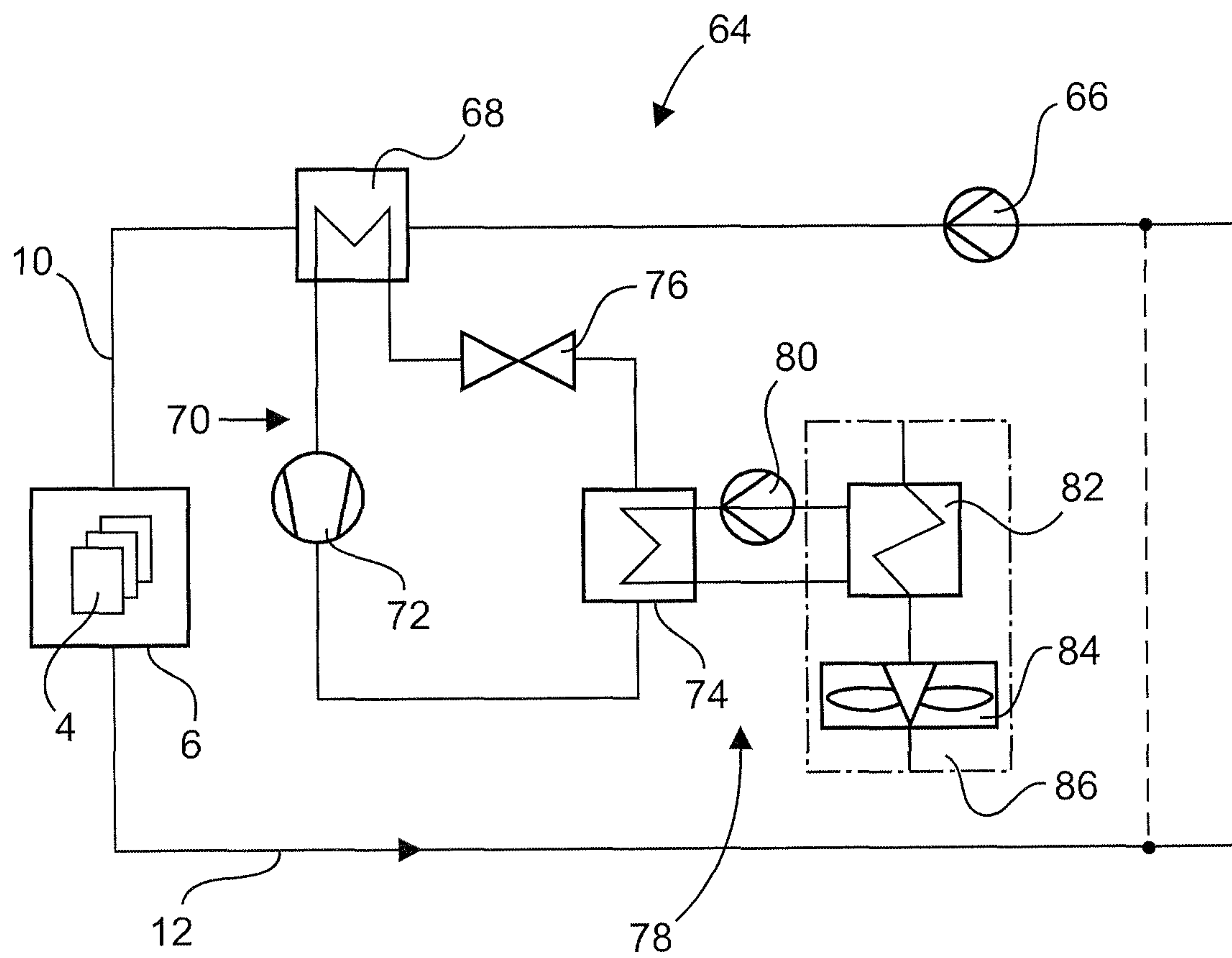


Fig. 4

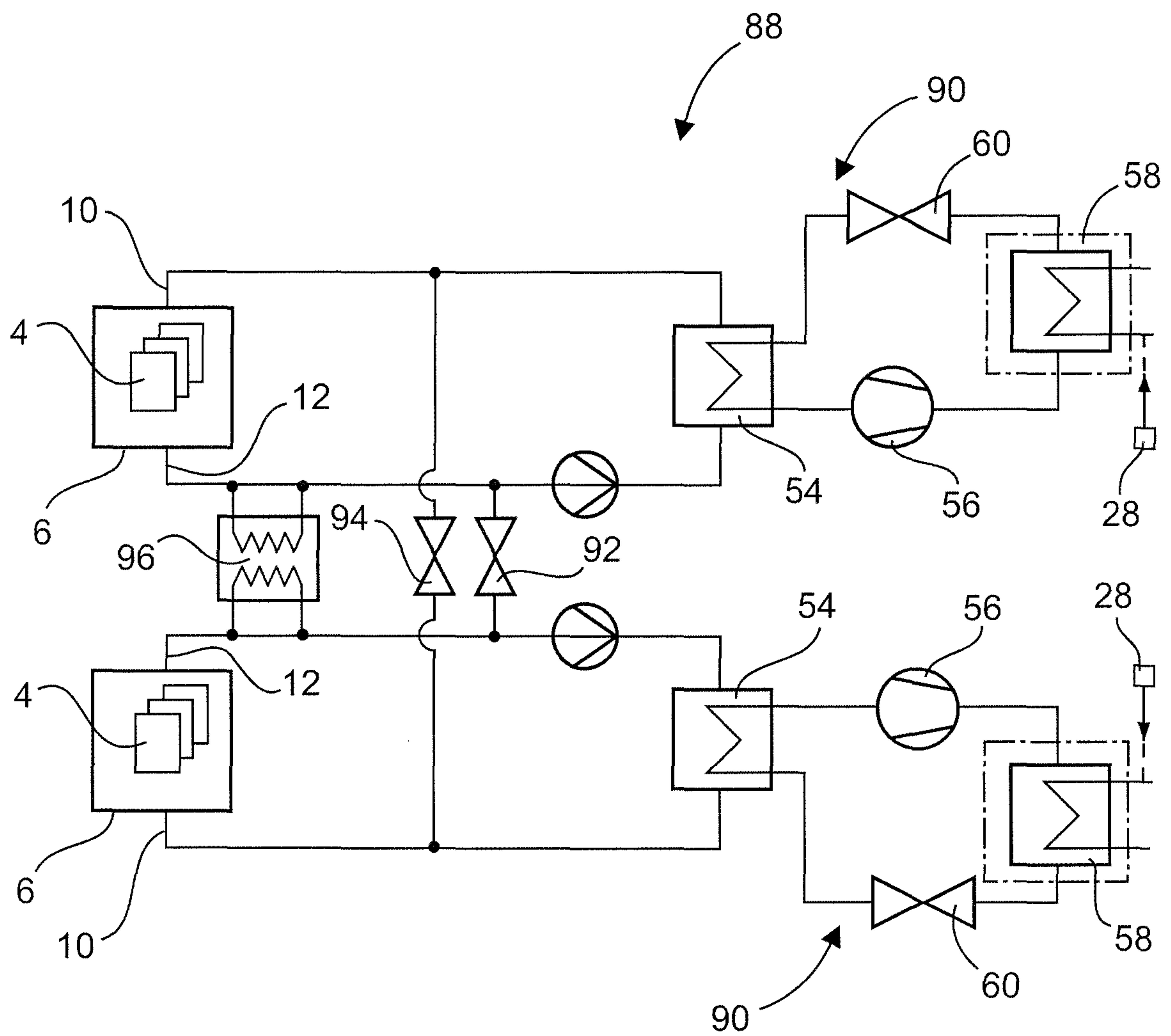


Fig. 5

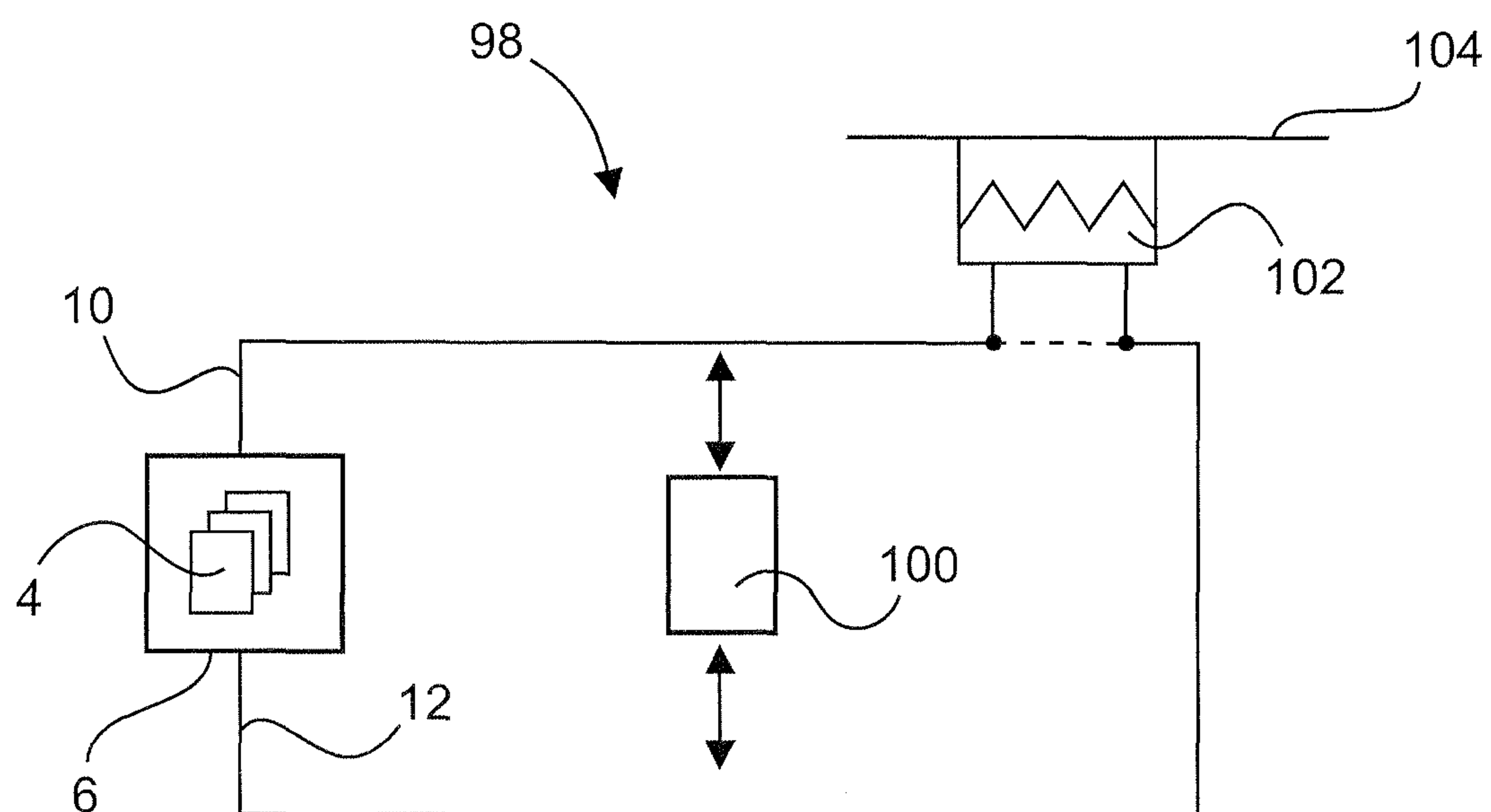


Fig. 6

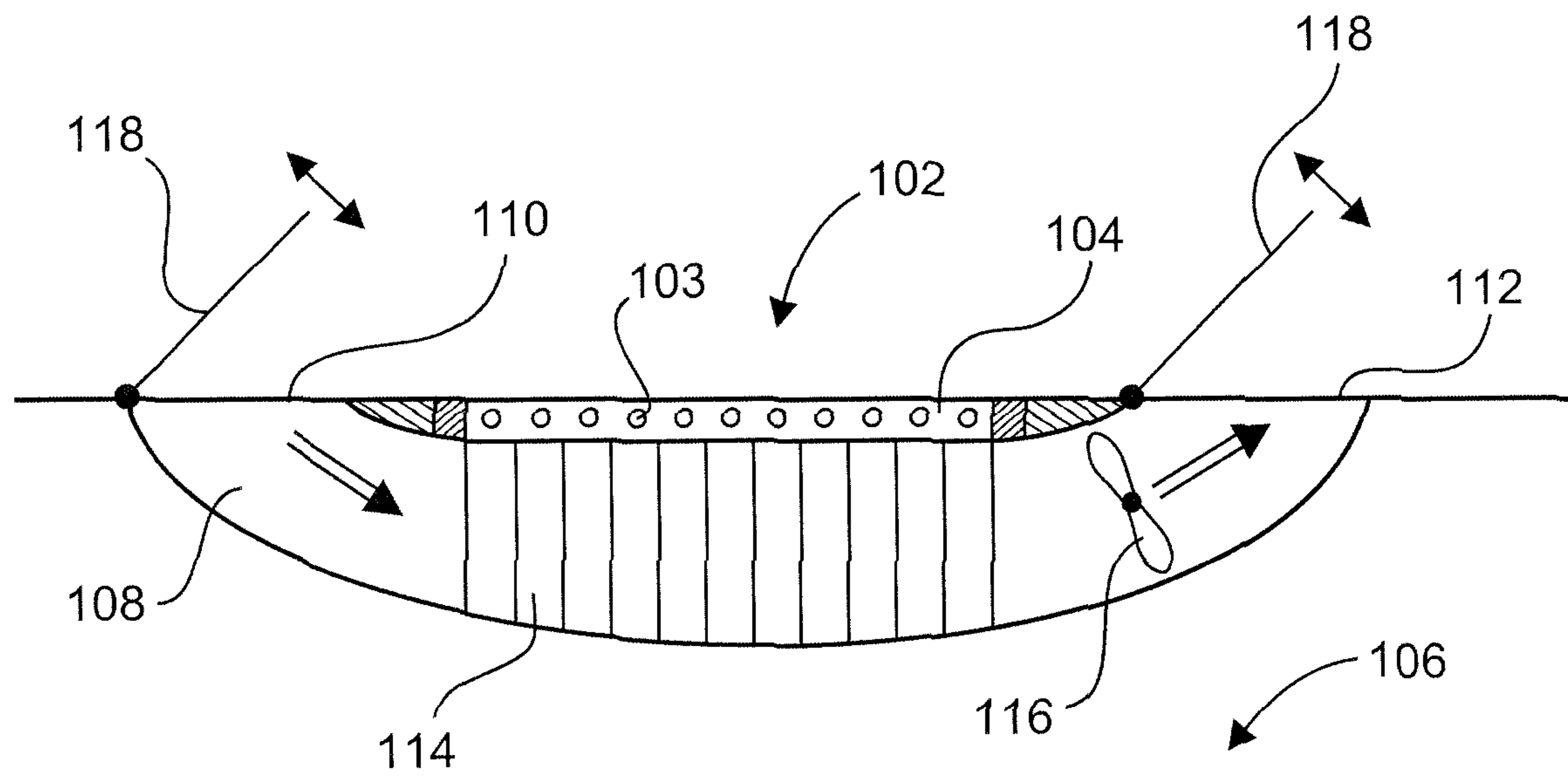


Fig. 7

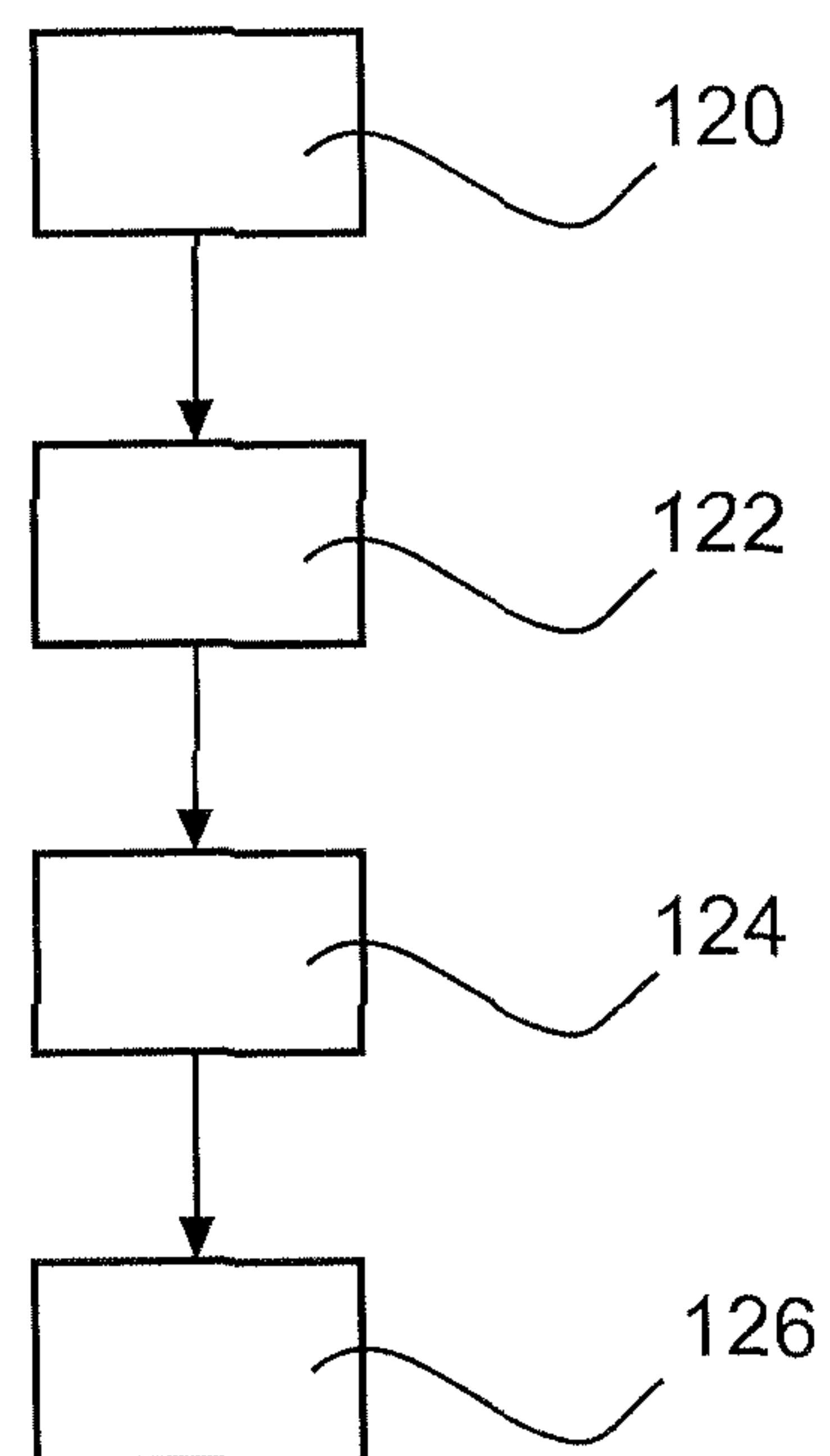
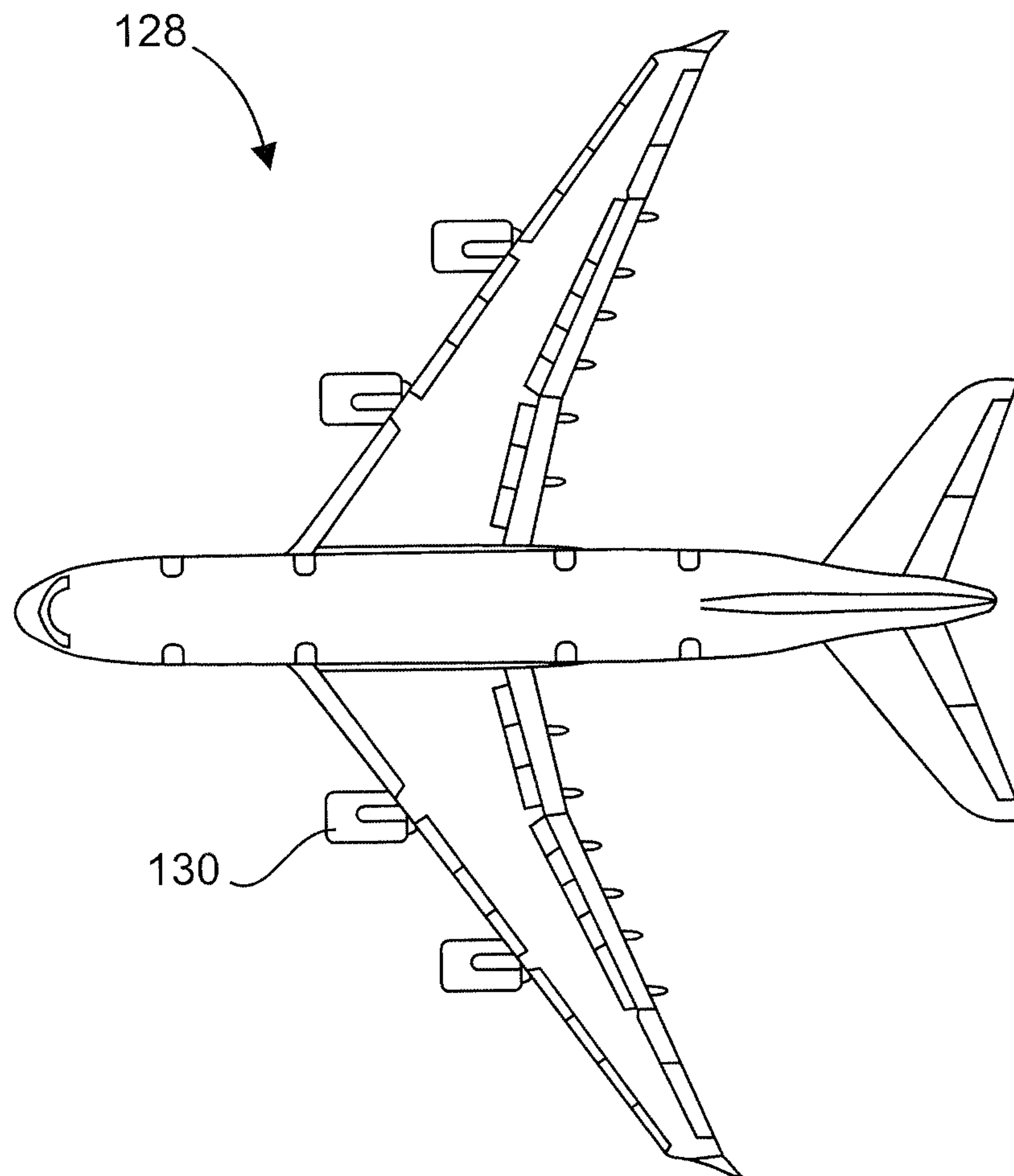


Fig. 8

**Fig. 9**

