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(54) AUXILIARY VOLUMETRIC PUMP FOR GENERATING A VACUUM

VOLUMETRISCHE HILFSPUMPE ZUR ERZEUGUNG VON VAKUUM

POMPE VOLUMÉTRIQUE AUXILIAIRE POUR GÉNÉRER UN VIDE

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EP 3 674 555 B1

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Description

[0001] This invention relates to an auxiliary volumetric pump for generating a vacuum.

[0002] The term volumetric auxiliary pump means a "booster" pump, generally called a "roots" pump or a rotary lobes pump, positioned upstream of a primary pump, for example of the rotary blade type, for generating a vacuum in systems in which it is necessary to manage high fluid flow rates and to speed up the emptying time of the system.

[0003] Currently, the most commonly used system for guaranteeing the correct operation of an auxiliary volumetric pump is determined by the control of the maximum current absorption value, as a function of the rotation speed of the pump and the operating pressure.

[0004] However, the control on the absorption of the electric current does not protect the pump against faults or malfunctions caused, for example, by abnormal pressure conditions, at the inlet and/or at the outlet of the pump.

[0005] WO2018/010970A1 discloses an auxiliary volumetric pump according to the preamble of claim 1.

[0006] In this context, the need has been felt of making an auxiliary pump for generating a vacuum comprising a casing, a rotary member housed in the casing and an electric motor for powering the rotary member.

[0007] The auxiliary pump comprises an intake duct, located downstream of a user device, and a discharge duct configured to define a delivery duct of a primary pump.

[0008] A device for detecting the pressure of the fluid entering the auxiliary pump, designed for emitting a signal for detecting the pressure of the fluid entering the auxiliary pump, is positioned in the intake duct.

[0009] A device for detecting the pressure of the fluid leaving the auxiliary pump, designed for emitting a signal for detecting the pressure of the fluid leaving the auxiliary pump, is positioned in the discharge duct.

[0010] A control unit is configured to receive and process the signal for detecting the pressure of the fluid entering and flowing out from the auxiliary pump and determining the pressure of the fluid in the intake duct and in the discharge duct and the pressure difference between the pressure value in the intake duct and in the discharge duct.

[0011] The control unit is configured for controlling the frequency of rotation and the absorption of the electric motor by the rotary member as a function of the pressure difference between the pressure value in the intake duct and in the discharge duct, if less than a pre-set permissible pressure difference.

[0012] Advantageously, this operating mode protects the electric motor of the auxiliary pump against malfunctions or faults since the current absorption is determined by the pressure difference between the pressure value in the intake duct and in the discharge duct, below the threshold value declared by the manufacturer of the aux-

iliary pump.

[0013] Further features and advantages of the invention are more apparent in the detailed description below, with reference to a preferred, non-limiting, embodiment of a volumetric auxiliary pump for generating a vacuum illustrated in a schematic view in Figure 1 which schematically illustrates a vacuum generating system.

[0014] The numeral 1 denotes an auxiliary volumetric pump for generating the vacuum according to the invention.

[0015] The auxiliary pump 1 comprises an intake duct 2 and a discharge duct 3. The intake duct 2 is located downstream of a user device 24, with reference to the direction of flow of the fluid.

[0016] The discharge duct 3 is configured to define a delivery duct of a primary pump 4.

[0017] The primary pump 4 is positioned downstream of the auxiliary pump 1, with reference to the direction of flow of the fluid.

[0018] A device for detecting the pressure 5 of the fluid entering the auxiliary pump 1, designed for emitting a signal for detecting the pressure 8 of the fluid entering the auxiliary pump 1, is positioned in the intake duct 2.

[0019] A device for detecting the pressure 6 of the fluid flowing out from the auxiliary pump 1, designed for emitting a signal for detecting the pressure 9 of the fluid flowing out of the auxiliary pump 1, is positioned in the discharge duct 3.

[0020] A control unit 7 is configured for receiving and processing the signal for measuring the pressure 8 of the fluid entering the auxiliary pump 1 and determining the pressure of the fluid in the intake duct 2.

[0021] The control unit 7 is configured for receiving and processing the signal for measuring the pressure 9 of the fluid flowing out from the auxiliary pump 1 and determining the pressure of the fluid in the discharge duct 3.

[0022] The control unit 7 is configured to receive and process the signals for detecting the pressure 8, 9 of the fluid entering and flowing out and determining the pressure difference between the pressure value in the intake duct 2 and in the discharge duct 3.

[0023] The control unit 7 is configured for controlling the frequency of rotation and the absorption of the electric motor 21 by the rotary member 11 as a function of the pressure difference between the pressure value in the intake duct and in the discharge duct, if less than a pre-set permissible pressure difference.

[0024] The control unit 7 is configured for comparing the value of the pressure of the fluid in the discharge duct 3 with a threshold pressure value.

[0025] If the control unit 7 determines that the value of the pressure in the discharge duct 3 is greater than the threshold pressure value for a set period of time, the control unit 7 is configured to emit a first alarm signal 16.

[0026] This malfunction condition, that is to say, a pressure in the discharge duct 3 between the auxiliary pump 1 and the primary pump 4, may occur, for example, if the primary pump 4 is subject to a malfunction, the primary

pump 4 switched off.

[0027] The control unit 7 is configured for comparing the value of the pressure of the fluid in the discharge duct 3 with a control pressure value.

[0028] If the control unit 7 determines that the pressure value in the discharge duct 3 is less than the control pressure value, the control unit 7 does not take any action.

[0029] If the control unit 7 determines that the pressure value in the discharge duct 3 is greater than the control pressure value, the control unit 7 is configured for storing the value of the pressure determined by means of the signal for measuring the pressure 9 of the fluid flowing out from the auxiliary pump 1.

[0030] The control unit 7 is configured for continuously measuring the pressure values determined by means of the respective signals for measuring the pressure 9 of the fluid flowing out from the auxiliary pump 1.

[0031] The control unit 7 is configured to determine whether or not the new pressure values are within a range of pressure values defined by the pressure value stored in a respective time interval.

[0032] If the control unit 7 determines that the pressure values are within said range of pressure values, according to a respective time interval, the control unit 7 is configured to send a second alarm signal 17.

[0033] If the control unit 7 determines that the new pressure value is not within the range of pressure values, the control unit 7 is configured for storing the new pressure value and, after a predetermined period of time, the control unit 7 is configured for measuring a new pressure value determined by the detection signal of the pressure 9 of the fluid flowing out from the auxiliary pump 1 and determining again if the new pressure value is within said range of pressure values defined by the value of the last pressure value stored.

[0034] This sequence of operations is repeated until the pressure value, in the respective time interval, is shown to be within said range of pressure values and the control unit 7 sends a second alarm signal 17.

[0035] The auxiliary pump 1 comprises a device for measuring the frequency 20 of the electric motor and is configured for emitting a signal for measuring the frequency 22 of the electric motor 21.

[0036] If the control unit 7 determines that the value of the frequency of the electric motor 21 is less than the pre-set minimum frequency value for a pre-set period of time, the control unit 7 is configured to emit a third alarm signal 18.

[0037] The minimum frequency set is the frequency necessary to guarantee the circulation of lubricating liquid in the auxiliary pump 1.

[0038] This malfunction condition, that is to say, a minimum frequency which continues over time, may occur, for example, when the ratio of the flow rate between auxiliary pump 1 and primary pump 4 is too high, over-absorbing, the primary pump 4 switched off.

[0039] The auxiliary pump 1 comprises a casing 10 and a rotary member 11 housed in the casing 10.

[0040] An electric motor 21 powers the rotary member 11.

[0041] In the example illustrated, the rotary member 11 comprises at least a first lobe 12, rotating about its own axis 12a of rotation, and a second lobe 13, rotating about its own axis 13a of rotation.

[0042] The first lobe 12 and the second lobe 13 rotate in a synchronous fashion about the respective axes of rotation 12a, 13a for conveying the fluid from the intake duct 2 to the discharge duct 3.

[0043] A device 14 for measuring the temperature is positioned on the casing 10. More specifically, the device 14 for measuring the temperature is positioned on the casing 10 in a zone close to the discharge duct 3.

[0044] The temperature measuring device 14 is configured to measure the temperature of the casing 10 and to emit a warning signal 15 indicating that the temperature has been exceeded a maximum permitted temperature value.

[0045] For example, the temperature measuring device 14 comprises an electrical circuit equipped with a switch whose opening or closing is determined by the temperature of the casing 10 exceeding a maximum permitted temperature value.

[0046] The control unit 7 is configured to receive the warning signal 15 of the temperature measuring device 14 and, upon receiving it, to emit a fourth alarm signal 19.

[0047] This condition of malfunction, that is to say, an over-temperature of the auxiliary pump 1, may occur, for example, if the ambient temperature in which the auxiliary pump 1 is positioned is high, the level or viscosity of the oil is high, the clearances of the rotary member 11 are too high, the suction filter of the auxiliary pump 1 is dirty or due to overloading of the auxiliary pump 1.

[0048] A display device 23 is configured to receive the first, second, third and fourth alarm signals 16, 17, 18, 19 emitted by the control unit 7 and make it visible to an operator.

[0049] Preferably, the display device 23 makes available the alarm signals by means of a warning light.

[0050] Lastly, it should be noted that, in order to protect the auxiliary pump 1 from malfunctions or faults, the control unit 7 is configured for controlling the switching off of the auxiliary pump 1, that is to say, for controlling the interruption of the electric motor 21 for powering the rotary member 11 upon the emission of at least one of the above-mentioned alarm signals 16, 17, 18, 19.

Claims

1. An auxiliary volumetric pump for generating a vacuum comprising a casing (10), a rotary member (11) housed in the casing (10) and an electric motor (21) for powering the rotary member (11); the auxiliary pump (1) comprising an intake duct (2), located downstream of a user device (24), and a discharge duct (3) configured to define a delivery duct of a pri-

mary pump (4);

a device for detecting the pressure (5) of the fluid entering the auxiliary pump (1), designed for emitting a signal for detecting the pressure (8) of the fluid entering the auxiliary pump (1), is positioned in the intake duct (2); the auxiliary volumetric pump **characterised by** further comprising

a device for detecting the pressure (6) of the fluid flowing out from the auxiliary pump (1), designed for emitting a signal for detecting the pressure (9) of the fluid flowing out of the auxiliary pump (1), is positioned in the discharge duct (3);

a control unit (7) is configured to receive and process the signal for detecting the pressure (8, 9) of the fluid entering and flowing out from the auxiliary pump (1) and determining the pressure of the fluid in the intake duct (2) and in the discharge duct (3) and the pressure difference between the pressure value in the intake duct (2) and in the discharge duct (3);

the control unit (7) is configured for controlling the frequency of rotation and the absorption of the electric motor (21) by the rotary member (11) as a function of the pressure difference between the pressure value in the intake duct (2) and in the discharge duct (3), if less than a pre-set permissible pressure difference.

2. The pump according to independent claim 1, **characterised in that** the control unit (7) is configured for comparing the value of the pressure of the fluid in the discharge duct (3) with a pre-set threshold pressure value; the control unit (7) being configured to determine whether the value of the pressure in the discharge duct (3) is greater than the threshold pressure value set for a set period of time and, if this is the case, to emit a first alarm signal (16).
3. The pump according to claim 1 or 2, **characterised in that** the control unit (7) is configured for continuously comparing each value of the pressure of the fluid detected in the discharge duct (3) with a pre-set control pressure value; the control unit (7) being configured to determine whether the value of the pressure in the discharge duct (3) is less than a pre-set control pressure value and, if the value of the pressure in the discharge duct (3) is greater than the control pressure value, the control unit (7) being configured to store this pressure value and, after a pre-determined period of time, the control unit (7) being configured to determine if a new pressure value measured in the discharge duct (3) is within or not a range of pressure values defined by the previous pressure value stored; if the new pressure value is within the range of pressure values, the control unit (7) being configured to send a second alarm signal (17); if the new pressure value is not within the range of pressure values, the control unit (7) being configured to repeat the sequence of operations until a

new pressure value is within the range of pressure values.

4. The pump according to any one of the preceding claims, **characterised in that** it comprises a device for measuring the frequency (20) of the electric motor, designed for emitting a signal for measuring the frequency (22) of the electric motor (21); the control unit (7) is configured to determine whether the value of the frequency of the electric motor (21) is less than the pre-set minimum frequency value for a pre-set period of time and, if this is the case, to emit a third alarm signal (18).
5. The pump according to any one of the preceding claims, **characterised in that** it comprises a device for measuring the temperature (14) positioned on the surface of the casing (10), in particular in an area of the casing (10) close to the discharge duct (3) configured for measuring the temperature of the casing (10) and for emitting a warning signal (15) that the temperature has exceeded a maximum permitted temperature value; the control unit (7) being configured to receive the warning signal (15) of the temperature measuring device (14) and, upon receiving it, to emit a fourth alarm signal (19).
6. The pump according to any one of the preceding claims, **characterised in that** it comprises a display device (23) configured to receive the first, second, third and fourth alarm signals (16, 17, 18, 19) emitted by the control unit (7) and make it visible to an operator; preferably, the display device (23) makes available the alarm signals (16, 17, 18, 19) by means of a warning light.
7. The pump according to any one of the preceding claims, **characterised in that** the control unit (7) is configured to control the switching off of the auxiliary pump (1), in particular for controlling the interruption of the electric motor (21) powering the rotary member (11), upon the emitting of at least one of the first, second, third and fourth alarm signals (16, 17, 18, 19).
8. A plant for generating a vacuum comprising the auxiliary pump according to any one of claims 1 to 7 and a primary pump (4) located downstream of the auxiliary pump (1), with reference to the direction of flow of the fluid; the intake duct (2) of the auxiliary pump (1) being located downstream of a user device (24), with reference to the direction of flow of the fluid.

55 Patentansprüche

1. Volumetrische Hilfspumpe zur Erzeugung von Vakuum, umfassend ein Gehäuse (10), ein Drehglied

- (11), das in dem Gehäuse (10) untergebracht ist, und einen Elektromotor (21) zum Antreiben des Drehglieds (11); wobei die Hilfspumpe (1) einen Einlasskanal (2), der sich stromabwärts einer Benutzer-
 vorrichtung (24) befindet, und einen Auslasskanal (3), der konfiguriert ist, um einen Förderkanal einer Primärpumpe (4) zu definieren, umfasst;
 eine Vorrichtung zum Erfassen des Drucks (5) des in die Hilfspumpe (1) eintretenden Fluids, die zum Ausgeben eines Signals zum Erfassen des Drucks (8) des in die Hilfspumpe (1) eintretenden Fluids ausgelegt ist, ist im Einlasskanal (2) positioniert; die volumetrische Hilfspumpe ist **dadurch gekennzeichnet, dass** sie ferner eine Vorrichtung zum Erfassen des Drucks (6) des aus der Hilfspumpe (1) austretenden Fluids umfasst, die zum Ausgeben eines Signals zum Erfassen des Drucks (9) des aus der Hilfspumpe (1) austretenden Fluids ausgelegt und im Auslasskanal (3) positioniert ist;
 eine Steuereinheit (7), die konfiguriert ist, um das Signal zum Erfassen des Drucks (8, 9) des in die Hilfspumpe (1) eintretenden und aus dieser austretenden Fluids zu empfangen und zu verarbeiten und den Druck des Fluids im Einlasskanal (2) und im Auslasskanal (3) und die Druckdifferenz zwischen dem Druckwert im Ansaugkanal (2) und im Auslasskanal (3) zu bestimmen;
 die Steuereinheit (7) ist konfiguriert, um die Drehfrequenz und die Absorption des Elektromotors (21) durch das Drehglied (11) als Funktion der Druckdifferenz zwischen dem Druckwert im Einlasskanal (2) und im Auslasskanal (3) zu steuern, wenn weniger als eine voreingestellte zulässige Druckdifferenz vorliegt.
2. Pumpe nach unabhängigem Anspruch 1, **dadurch gekennzeichnet, dass** die Steuereinheit (7) zum Vergleichen des Druckwerts des Fluids im Auslasskanal (3) mit einem voreingestellten Schwellendruckwert konfiguriert ist; wobei die Steuereinheit (7) so konfiguriert ist, dass sie bestimmt, ob der Wert des Drucks im Auslasskanal (3) größer als der für einen festgelegten Zeitraum eingestellte Schwellendruckwert ist, und, falls dies der Fall ist, ein erstes Alarmsignal (16) ausgibt.
 3. Pumpe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Steuereinheit (7) zum kontinuierlichen Vergleichen eines jeden Wertes des im Auslasskanal (3) erfassten Fluiddrucks mit einem voreingestellten Steuerdruckwert konfiguriert ist; wobei die Steuereinheit (7) konfiguriert ist, um zu bestimmen, ob der Wert des Drucks im Auslasskanal (3) kleiner als ein voreingestellter Steuerdruckwert ist und ob der Wert des Drucks im Auslasskanal (3) größer als der Steuerdruckwert ist, wobei die Steuereinheit (7) konfiguriert ist, um diesen Druckwert zu speichern, und die Steuereinheit (7) nach einer vor-
- bestimmten Zeitdauer konfiguriert ist, um zu bestimmen, ob ein neuer in dem Auslasskanal (3) gemessener Druckwert innerhalb eines Bereichs von Druckwerten liegt oder nicht, der durch den zuvor gespeicherten Druckwert definiert ist; wenn der neue Druckwert innerhalb des Bereichs der Druckwerte liegt, ist die Steuereinheit (7) so konfiguriert, dass sie ein zweites Alarmsignal (17) aussendet; wenn der neue Druckwert nicht innerhalb des Bereichs der Druckwerte liegt, ist die Steuereinheit (7) so konfiguriert, dass sie die Abfolge der Vorgänge wiederholt, bis ein neuer Druckwert innerhalb des Bereichs der Druckwerte liegt.
4. Pumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Vorrichtung zum Messen der Frequenz (20) des Elektromotors umfasst, die zum Ausgeben eines Signals zum Messen der Frequenz (22) des Elektromotors (21) ausgelegt ist; die Steuereinheit (7) ist konfiguriert, um zu bestimmen, ob der Wert der Frequenz des Elektromotors (21) für einen voreingestellten Zeitraum kleiner als der voreingestellte minimale Frequenzwert ist, und, falls dies der Fall ist, ein drittes Alarmsignal (18) auszugeben.
 5. Pumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Vorrichtung zum Messen der Temperatur (14) umfasst, die auf der Oberfläche des Gehäuses (10) positioniert ist, insbesondere in einem Bereich des Gehäuses (10) in der Nähe des Auslasskanals (3), die zum Messen der Temperatur des Gehäuses (10) und zum Ausgeben eines Warnsignals (15) konfiguriert ist, dass die Temperatur einen maximal zulässigen Temperaturwert überschritten hat; wobei die Steuereinheit (7) so konfiguriert ist, dass sie das Warnsignal (15) der Temperaturmessvorrichtung (14) empfängt und bei dessen Empfang ein viertes Alarmsignal (19) ausgibt.
 6. Pumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Anzeigevorrichtung (23) umfasst, die konfiguriert ist, um die ersten, zweiten, dritten und vierten Alarmsignale (16, 17, 18, 19) zu empfangen, die von der Steuereinheit (7) ausgegeben werden und für einen Bediener sichtbar zu machen; vorzugsweise stellt die Anzeigevorrichtung (23) die Alarmsignale (16, 17, 18, 19) mittels einer Warnleuchte zur Verfügung.
 7. Pumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Steuereinheit (7) konfiguriert ist, um das Abschalten der Hilfspumpe (1) zu steuern, insbesondere um die Unterbrechung des Elektromotors (21) zu steuern, der das Drehglied (11) nach Ausgeben mindestens eines der ersten, zweiten, dritten und vierten Alarmsignale (16,

17, 18, 19) antreibt.

8. Anlage zur Erzeugung von Vakuum, umfassend die Hilfspumpe nach einem der Ansprüche 1 bis 7 und eine Primärpumpe (4), die stromabwärts der Hilfspumpe (1), in Bezug auf die Strömungsrichtung des Fluids angeordnet ist; wobei der Einlasskanal (2) der Hilfspumpe (1) stromabwärts einer Benutzervorrichtung (24) in Bezug auf die Strömungsrichtung des Fluids angeordnet ist.

Revendications

1. Pompe volumétrique auxiliaire pour générer un vide comprenant un carter (10), un élément rotatif (11) logé dans le carter (10) et un moteur électrique (21) pour alimenter l'élément rotatif (11) ; la pompe auxiliaire (1) comprenant un conduit d'admission (2), situé en aval d'un dispositif utilisateur (24), et un conduit d'évacuation (3) configuré pour définir un conduit de refoulement d'une pompe primaire (4); un dispositif pour détecter la pression (5) du fluide entrant dans la pompe auxiliaire (1), conçu pour émettre un signal pour détecter la pression (8) du fluide entrant dans la pompe auxiliaire (1), est positionné dans le conduit d'admission (2) ; la pompe volumétrique auxiliaire **caractérisée en ce qu'**elle comprend en outre un dispositif pour détecter la pression (6) du fluide s'écoulant de la pompe auxiliaire (1), conçu pour émettre un signal pour détecter la pression (9) du fluide s'écoulant de la pompe auxiliaire (1) et positionné dans le conduit d'évacuation (3) ; une unité de commande (7) configurée pour recevoir et traiter le signal pour détecter la pression (8, 9) du fluide entrant et sortant de la pompe auxiliaire (1) et déterminer la pression du fluide dans le conduit d'admission (2) et dans le conduit d'évacuation (3) et la différence de pression entre la valeur de pression dans le conduit d'admission (2) et dans le conduit d'évacuation (3) ; l'unité de commande (7) est configurée pour commander la fréquence de rotation et l'absorption du moteur électrique (21) par l'organe rotatif (11) en fonction de la différence de pression entre la valeur de pression dans le conduit d'admission (2) et dans le conduit d'évacuation (3), si elle est inférieure à une différence de pression admissible prédéfinie.
2. Pompe selon la revendication indépendante 1, **caractérisée en ce que** l'unité de commande (7) est configurée pour comparer la valeur de la pression du fluide dans le conduit d'évacuation (3) avec une valeur de pression de seuil prédéfinie ; l'unité de commande (7) étant configurée pour déterminer si la valeur de la pression dans le conduit d'évacuation (3) est supérieure à la valeur de pression de seuil

définie pendant une période de temps définie et, le cas échéant, pour émettre un premier signal d'alarme (16).

3. Pompe selon la revendication 1 ou 2, **caractérisée en ce que** l'unité de commande (7) est configurée pour comparer en continu chaque valeur de la pression du fluide détectée dans le conduit d'évacuation (3) avec une valeur de pression de commande prédéfinie ; l'unité de commande (7) étant configurée pour déterminer si la valeur de la pression dans le conduit d'évacuation (3) est inférieure à une valeur de pression de commande prédéfinie et, si la valeur de la pression dans le conduit d'évacuation (3) est supérieure à la valeur de pression de commande, l'unité de commande (7) étant configurée pour enregistrer cette valeur de pression et, après une période de temps prédéterminée, l'unité de commande (7) étant configurée pour déterminer si une nouvelle valeur de pression mesurée dans le conduit d'évacuation (3) se trouve ou non dans une plage de valeurs de pression définie par la valeur de pression précédente enregistrée ; si la nouvelle valeur de pression est dans la plage de valeurs de pression, l'unité de commande (7) étant configurée pour envoyer un second signal d'alarme (17) ; si la nouvelle valeur de pression n'est pas dans la plage de valeurs de pression, l'unité de commande (7) étant configurée pour répéter la séquence d'opérations jusqu'à ce qu'une nouvelle valeur de pression soit dans la plage de valeurs de pression.
4. Pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**elle comprend un dispositif de mesure de la fréquence (20) du moteur électrique, conçu pour émettre un signal de mesure de la fréquence (22) du moteur électrique (21) ; l'unité de commande (7) est configurée pour déterminer si la valeur de la fréquence du moteur électrique (21) est inférieure à la valeur de fréquence minimale prédéfinie pendant une période de temps prédéfinie et, si tel est le cas, pour émettre un troisième signal d'alarme (18).
5. Pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**elle comprend un dispositif de mesure de la température (14) positionné sur la surface du carter (10), en particulier dans une zone du carter (10) proche du conduit d'évacuation (3) configuré pour mesurer la température du carter (10) et pour émettre un signal d'avertissement (15) que la température a dépassé une valeur de température maximale autorisée ; l'unité de commande (7) étant configurée pour recevoir le signal d'avertissement (15) du dispositif de mesure de la température (14) et, à sa réception, pour émettre un quatrième signal d'alarme (19) .

6. Pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend un dispositif d'affichage (23) configuré pour recevoir les premier, deuxième, troisième et quatrième signaux d'alarme (16, 17, 18, 19) émis par l'unité de commande (7) et les rendre visibles pour un opérateur ; de préférence, le dispositif d'affichage (23) rend disponibles les signaux d'alarme (16, 17, 18, 19) au moyen d'un voyant lumineux.
7. Pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'unité de commande (7) est configurée pour commander l'arrêt de la pompe auxiliaire (1), notamment pour commander l'interruption du moteur électrique (21) alimentant l'organe rotatif (11), lors de l'émission d'au moins un des premier, deuxième, troisième et quatrième signaux d'alarme (16, 17, 18, 19).
8. Installation de génération de vide comprenant la pompe auxiliaire selon l'une quelconque des revendications 1 à 7 et une pompe primaire (4) située en aval de la pompe auxiliaire (1), par rapport au sens d'écoulement du fluide ; le conduit d'admission (2) de la pompe auxiliaire (1) étant situé en aval d'un dispositif utilisateur (24), par rapport au sens d'écoulement du fluide.

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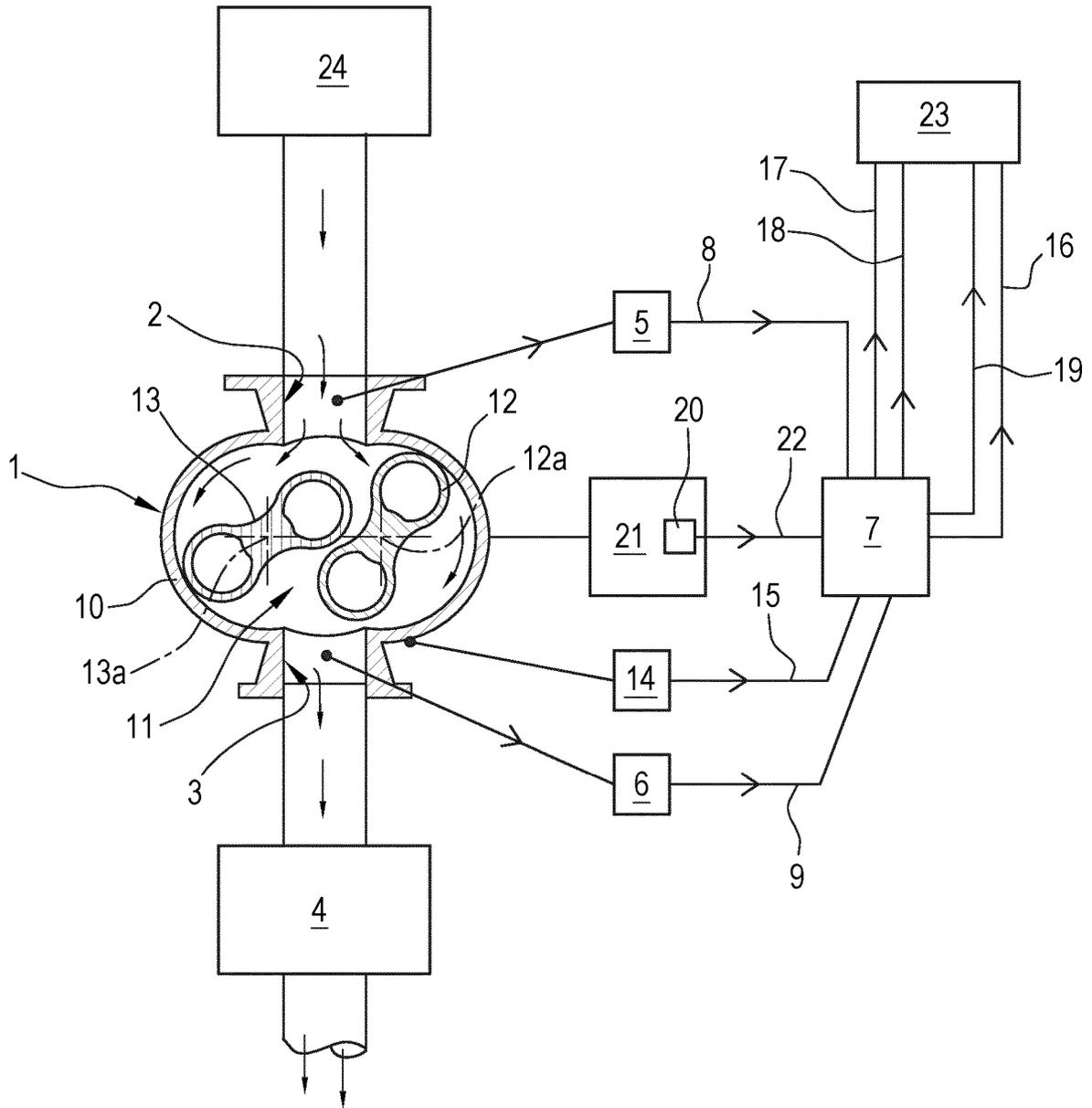
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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