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(54) **Machine for producing hot or cold air or water by means of a refrigerant**

Maschine zum Heizen oder Kühlen von Luft oder Wasser mittels eines Kältemittels

Machine pour chauffer ou refroidir de l'air ou de l'eau au moyen d'un frigorigène

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(73) Proprietor: **DE' LONGHI S.p.A.**
**31100 Treviso (IT)**

(72) Inventor: **De' Longhi, Giuseppe**
**31100 Treviso (IT)**

(74) Representative: **Rapisardi, Mariacristina**
**Ufficio Brevetti Rapisardi S.r.l.,**
**Via Serbelloni, 12**
**20122 Milano (IT)**

(56) References cited:
**EP-A- 0 019 124**
**EP-A- 0 134 015**
**US-A- 2 715 317**
**US-A- 2 977 773**
**US-A- 4 420 947**
**US-A- 4 484 452**
**US-A- 4 546 616**
**US-A- 4 899 551**
**US-A- 5 052 472**
**US-A- 5 475 986**



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## Description

**[0001]** The present invention relates to a machine for producing hot or cold air or water for conditioning a room by means of a refrigerant.

**[0002]** Conventional air-water machines or unit, in the versions cold only or heat pump, for producing hot or cold air or water for conditioning an ambient generally comprise a compressor, two heat exchangers, an electric fan, a liquid separator, a liquid receiver, a cycle inverter valve (usually a four way valve), two refrigerator circuits that entail, among others, the use of two unidirectional valves or stop valves and two expansion members for the refrigerant.

**[0003]** In this manner it is possible to manage the internal fluidodynamic system of the machine in order to make it operate as a heat pump, for example during winter, or as a cooler, for example during summer, thereby varying the quantity of refrigerant inside the machine.

**[0004]** In other words, by inverting the direction of the refrigerant flow, it is possible, in winter, to use an exchanger as a condenser thereby producing heat, and to use the other exchanger as evaporator, while in summer the condenser is used as an evaporator and the evaporator is used as a condenser.

**[0005]** As the quantity of refrigerant used in the unit is different when producing heat with respect of when producing cold, i.e. the quantity is less in "winter" and greater in "summer", these machines must have a double and/or separate refrigeration circuits (liquid line-low pressure), operated separately by lamination members, stop or one way valves, leading to a refrigerant receiver.

**[0006]** Particularly documents US 5 475 986 and US 4 420 947 disclose a machine for producing hot or cold air or water according to the pre-characterizing portion of claim 1.

**[0007]** From the above, it is apparent that these machines have a rather complex construction and are therefore not entirely reliable. Furthermore, besides being very expensive, because of their complex construction, these conventional machines require a difficult maintenance and a great quantity of refrigerant which has to fill two separate circuits.

**[0008]** Also, in these conventional machines, the reversible refrigeration cycle is not optimally controlled and reacts slowly as the ambient temperature and humidity vary.

**[0009]** An aim of the present invention is to eliminate the above cited prior art drawbacks.

**[0010]** An object of the invention is to provide a machine for producing hot or cold air or water for conditioning a room by means of a refrigerant, having such an extremely simplified structure to be extremely reliable in operation.

**[0011]** A further object of the invention is to provide a machine for producing hot or cold air or water by means of a refrigerant, which, by having a simplified construction, accordingly has an easier maintenance and a smaller spare part supply requirement.

**[0012]** A further object of the invention is to provide a machine for producing hot or cold air or water by means of a refrigerant, which can operate with any type of gas and adapting to the gas virtually immediately.

**[0013]** A further object of the invention is to provide a machine for producing hot or cold air or water by means of a refrigerant, having a reduced cost and still operating better than conventional machines.

**[0014]** Still a further object of the invention is to improve the energetic effect (obtained hot or cold energy divided by spent energy) using smaller quantities of natural or artificial refrigerants thereby reducing their direct or indirect pollution.

**[0015]** The above aim and objects are achieved by a machine for producing hot or cold air or water according to the characterizing portion of claim 1.

**[0016]** Further characteristics and advantages of the invention will be more apparent by the following description of an embodiment of the invention, illustrated, by way of example in the enclosed drawings in which

FIG. 1 show an operation diagram of the machine according to the invention for producing heat, i.e. operating, for example, during winter;

FIG. 2 show the operation diagram of the machine of FIG. 1 when the machine operates for cooling the room, i.e. operating, for example, during summer;

FIG. 3 is a side schematic view of the container adapted to collect and release automatically the refrigerant to the one refrigeration circuit of the machine according to the invention;

FIG. 4 shows another embodiment of the container shown in FIG. 3, according to the invention;

FIGs. 5 and 6 show an open type rather than closed type of the circuit shown in FIGs. 1 and 2, with different positions of the container 11 and of valve 9.

**[0017]** With reference to the above figures, the machine, also known as "chiller", for producing hot or cold air or water by means of a refrigerant comprises, in a per se known manner, a compressor 2 wherein a refrigerant, of any type according to the needs, enters at low pressure and exits at high pressure to be fed, for example, to a four way valve 3.

**[0018]** The four way valve 3 operates as a cycle inverter valve switching the flow of refrigerant. from the conduit 4, as explained in detail later, in order to make the refrigeration cycle operate as a heat pump, returning from conduit 5 or, viceversa, as shown in FIG. 2, the inflow from conduit 5 and the return flow from conduit 4, in case of cooling of the ambient, i.e. during the "summer" operation.

**[0019]** Conduit 6 of the four way valve will be the in-

flow conduit while conduit 7 of the four way valve will be the return flow conduit of the refrigerant to the compressor.

**[0020]** The machine according to the invention comprises one reversible refrigeration cycle of either type closed or open (split system), globally designated by the reference numeral 8, adapted to provide a reversible refrigeration cycle for producing hot or cold air or water for conditioning an ambient.

**[0021]** The control of the reversible refrigeration cycle is effected by a variable expansion member adapted to vary the expansion in the reversible refrigeration circuit, namely an expansion valve 9 arranged in the refrigeration circuit and controlled by an electronic circuit 10 in order to control the refrigeration cycle more rapidly and optimally with respect to a double refrigeration circuit system of the prior art, as the internal and external temperature and humidity of the ambient vary.

**[0022]** The machine according to the invention also comprises collecting means for collecting a selected quantity of refrigerant from the refrigeration circuit and an automatic release means for automatically releasing a selected quantity of refrigerant inside the refrigeration circuit.

**[0023]** In particular, the refrigerant automatic collecting and release means comprise a container 11 connected to the refrigeration circuit through first and second conduits, respectively designated by reference numerals 12 and 13.

**[0024]** Container 11 is connected to the refrigeration circuit 8 in an area globally designated by reference numeral 14 and which is comprised between a first exchanger 15 and expansion valve 9.

**[0025]** Expansion valve 9 is associated with refrigeration circuit 8 in a position comprised between container 11 and a second heat exchanger 16.

**[0026]** More in detail, first conduit 12 is associated with second conduit 13 with its portion which is external to the container 11 and extends inside the container 11 down to its bottom 18.

**[0027]** Second conduit 13 is associated with the container at its upper portion 19 opposite to the bottom 18 and is connected to the refrigeration circuit in the area 14.

**[0028]** Area 14 of the refrigeration circuit is defined by a portion of a first pipe 20 associated with the first exchanger 15 and arranged coaxially around a portion of a second pipe 21 of the refrigeration circuit connected to the expansion valve 9 in order to form an annular chamber 22 which communicates with the second conduit 13.

**[0029]** In this manner, as explained in greater detail later, in the area 14, when freon or any other gas circulates in a direction going from the expansion valve 9 to the first exchanger 15, it generates a vacuum adapted to draw a selected quantity of refrigerant from container 11 into the first pipe 20.

**[0030]** In case of cycle inversion, i.e. when the refrigerant exits the first exchanger 15 in the direction of the expansion valve 9, the refrigerant is forced to enter the second conduit 13 and therefrom into the container 11 which is, at least in a first phase, at a lower pressure.

**[0031]** Then, a selected quantity of refrigerant will continue to flow into the container 11 by gravity.

**[0032]** The above will be better understood with reference to the above described drawings.

**[0033]** In particular, FIG. 1 shows the refrigeration circuit adapted to provide hot water or air for example during the winter season.

**[0034]** In this case, freon, or any other gas, exits conduit 4 and follows an anti-clockwise flow direction entering the first exchanger 15 which in this case operates as a condenser.

**[0035]** From condenser 15, the refrigerant enters first pipe 20, having a larger diameter with respect to second pipe 21, so that in area 14, where the two pipes are mutually coaxial and form the annular chamber 22, a selected quantity of refrigerant enters second conduit 13 and therefrom into the container 11 which, at least in a first phase, is at a lower pressure.

**[0036]** Then, during the working cycle, the refrigerant enters container 11 by gravity to fill it with a selected quantity equivalent to the quantity of refrigerant that is not required during the "winter" operation.

**[0037]** The valve 9 is automatically adjusted by means of the electronic circuit 10 in order to always provide a high efficiency of the machine with any type of refrigerant used in the machine.

**[0038]** Then, the refrigerant flows from the valve 9 to the second exchanger 16, which in this case operates as an evaporator, and then flows back through the conduit 5 into the compressor.

**[0039]** Viceversa, as illustrated in FIG. 2, when the refrigeration circuit operates for cooling the room, the refrigerant exits conduit 5 and enters the second exchanger 16, which in this case operates as a condenser, and then flows through the expansion valve 9, which is associated to a distributor 30 according to a first embodiment. Distributor 30 of the refrigerant has a fixed expansion member 32 (FIG. 3) which is bypassed by a bypass conduit 31 for the "winter"-"summer" reversing of the cycle.

**[0040]** According to a second embodiment of the invention, distributor 30 may not have the fixed expansion member 32 and the bypass conduit 31.

**[0041]** The expansion valve 9 will be regulated by the electronic circuit 10 and, passing in the area 14 of the refrigeration circuit, flowing out of the second pipe 21 a depression inside the annular chamber 22 will draw the selected quantity of refrigerant from the container 11 through the first conduit 12 and the second conduit 13.

**[0042]** First conduit 12 initially draws at first oil and then refrigerant liquid and then refrigerant gas, from container 11 , in order to ensure lubrication of the compressor.

**[0043]** Once the selected quantity of refrigerant is fed

into the refrigeration circuit, the refrigeration circuit can cool the ambient and therefore operate in the "summer" period with more refrigerant than in the "winter" period.

**[0044]** The refrigerant then enters the first exchanger 15, which in this case operates as an evaporator, and then flows back to the compressor 2 through the conduit 4.

**[0045]** FIG. 4 shows a different embodiment from that illustrated in FIG. 3 which however operates in the same manner.

**[0046]** In this case, the pipes connecting the first exchanger to the valve and to the container are still partially mutually coaxial but extend linearly rather than with a double bend, as in the embodiment illustrated in FIG. 3.

**[0047]** Furthermore, the length of the coaxial portion of the pipes is greater and the second pipe 21 has a plurality of holes 30 in the area entering the first exchanger 15, allowing a better distribution of the refrigerant inside the exchanger.

**[0048]** The above described machine according to the invention has a further important advantage: it keeps the water, inside the hydraulic apparatus associated with the machine, at a constant temperature without requiring one or more water reservoirs or an inverter for the compressor.

**[0049]** In particular, this is achieved by modulating the pump of the hydraulic apparatus (not illustrated in the drawings) in order to vary the water capacity according to the users and at the same time to vary the quantity of refrigerant in the refrigeration circuit by modulating the expansion valve 9.

**[0050]** In particular, the modulation of the pump and of the expansion valve 9 by means, for example, of a PLC or of said electronic circuit 10, allows to keep the water temperature constant flowing out of the exchangers 15 or 16 during the operation of the refrigeration circuit both in winter (hot water) and in summer (cold water).

**[0051]** By means of the electronic circuit 10 or the PLC, it is possible to establish when and how to vary the water and refrigerant capacities by detecting the temperature of the water flowing out of the exchangers 15 and 16, and the temperature gap between the inlet and the outlet of the exchangers and the overheating temperature in the compressor 2 inlet in order to ensure that the refrigerant enter the compressor in the gaseous state.

**[0052]** It has been seen in practice that the machine according to the invention is particularly advantageous in that it can operate with any suitable type of natural and/or artificial refrigerant, it has an extremely simplified mechanical construction providing a greater reliability and less maintenance and has a lower cost.

**[0053]** The machine according to the invention may have numerous modifications and variations within the scope of the claims.

## Claims

1. Machine for producing hot or cold air or water for conditioning a room by means of a refrigerant, comprising one reversible refrigeration circuit (8) comprising one variable expansion member (9) for varying the expansion in said reversible refrigeration circuit (8) and for controlling the refrigeration cycle in a faster and optimized manner as the internal and external ambient temperature and humidity of the room to be conditioned vary,
**characterized in that** it comprises automatic collecting and release means comprising a container (11) connected to said refrigeration circuit (8) through first and second conduits (12, 13)
said container being connected to said refrigeration circuit (8) in its area comprised between a first exchanger (15) and said expansion valve (9), said expansion valve (9) being comprised between said container (11) and a second exchanger (16), said area (14) of said refrigeration circuit (8) having a portion in a first pipe (20) coaxially arranged around a portion of a second pipe (21) to form an annular chamber (22) communicating with said second conduit (13), whereby, when the refrigerant circulates in the direction going from the expansion valve (9) to the first exchanger (15), it generates an underpressure and draws a selected quantity of refrigerant from container (11) into the first pipe (20), and when the refrigerant circulates in the opposite direction a quantity thereof is forced to enter the second conduit (13) and therefrom the container (11).

2. Machine, according to claim 1, **characterized in that** said automatic collecting and release means are fit to collect and release a selected quantity of refrigerant from and into said refrigeration circuit (8).

3. Machine, according to claim 1 or 2, **characterized in that** said variable expansion member (9) is a expansion valve arranged in said refrigeration circuit (8) and controlled by an electronic circuit (10).

4. Machine, according to claim 1, **characterized in that** said first conduit (12) is connected to said second conduit (13) outside said container (11) and extends inside said container (11) down to the bottom (18) of said container (11).

5. Machine, according to claims 1 or 4, **characterized in that** said second conduit (13) is connected to said container (11) in its upper portion (19) opposite to said bottom (18).

6. Machine, according to one or more of the preceding claims, **characterized in that** said first and second exchanger(15, 16) alternatively operate as a con-

denser or an evaporator for producing hot or cold water or air according to the flow direction of the refrigerant established by switching a four way valve (3).

**7.** Machine, according to claim 1, **characterized in that** said container (11) alternatively operates in depression for releasing said refrigerant inside said refrigeration circuit (8) and initially in depression and then by gravity for collecting said refrigerant from said refrigeration circuit (8).

**8.** Machine, according to one or more of the preceding claims, **characterized in that** it comprises variation means for varying the water capacity of the hydraulic apparatus connected to said machine and the refrigerant capacity of said refrigeration circuit (8) for maintaining the water inside said hydraulic apparatus at a constant temperature.

**9.** Machine, according to claim 8, **characterized in that** said variation means comprises at least one modulated pump of the hydraulic apparatus and at least said expansion valve (9) in order to vary the capacity of the water in said hydraulic apparatus and the capacity of refrigerant inside said refrigeration circuit, according to the requirements.

**10.** Machine, according to claim 9, **characterized in that** said pump and said expansion valve (9) are modulated by means of a PLC or by said electronic circuit (10) for keeping the water temperature constant flowing out of the exchangers (15, 16) during the operation of the refrigeration circuit both in winter and in summer.

**11.** Machine, according to one or more of the preceding claims, **characterized in that** it comprises detecting means for establishing when and how to vary the water and refrigerant capacities by detecting the temperature of the water flowing out of the exchangers (15, 16), the temperature gap between the inlet and the outlet of the exchangers and the overheating temperature in the compressor (2) inlet in order to ensure that the refrigerant enter the compressor in the gaseous state.

**Patentansprüche**

**1.** Maschine zum Erzeugen von heißer oder kalter Luft oder heißem oder kaltem Wassers zur Klimatisierung eines Raumes durch ein Kältemittel, bestehend aus einem umkehrbaren Kühlkreislauf (8) bestehend aus einer veränderlichen Expansionseinrichtung (9), um die Expansion in besagtem umkehrbaren Kühlkreislauf (8) zu verändern und um den Kühlzyklus auf eine schnellere und optimiertere Weise in dem Maße zu steuern, wie sich die innere und äußere Umgebungstemperatur und Luftfeuchte des zu klimatisierenden Raumes ändern, **gekennzeichnet dadurch, dass** sie automatische Aufnahme- und Abgabeeinrichtungen umfasst, bestehend aus einem, mit besagten Kühlkreislauf (8) durch erste und zweite Kühlkreisläufe (12,13) in Verbindung stehenden Behälter (11), wobei besagter Behälter mit besagtem Kühlkreislauf (8) in dessen Bereich zwischen einem ersten Austauscher (15) und besagtem Entspannungsventil (9) verbunden ist, und besagtes Entspannungsventil (9) sich zwischen besagtem Behälter (8) und einem zweiten Austauscher (16) befindet, und besagter Bereich (14) des besagten Kühlkreislaufs (8) Teil eines ersten Rohrs (20) ist, welches koaxial um einen Teil eines zweiten Rohres (21) angeordnet ist, um eine ringförmige Kammer (22) zu bilden, die mit besagtem zweiten Kreislauf (13) kommuniziert, wobei sie, wenn das Kühlmittel in Richtung vom Entspannungsventil (9) zum ersten Austauscher (15) zirkuliert, einen Unterdruck erzeugt und aus dem Behälter (11) eine ausgewählte Menge von Kühlmittel in das erste Rohr (20) zieht, und wenn das Kühlmittel in die Gegenrichtung zirkuliert, ein Teil davon in den zweiten Kreislauf (13) und das Rohr vom Behälter (11) hineingepresst wird.

**2.** Maschine nach Anspruch 1 **dadurch gekennzeichnet, dass** besagte automatische Aufnahme- und Abgabeeinrichtungen geeignet sind, eine ausgewählte Menge von Kühlmittel aus besagtem Kühlkreislauf (8) aufzunehmen und an ihn abzugeben.

**3.** Maschine nach Anspruch 1 oder 2 **dadurch gekennzeichnet, dass** besagte veränderliche Expansionseinrichtung (9) ein Entspannungsventil ist, welches in besagtem Kühlkreislauf (8) angeordnet ist und durch einen elektronischen Stromkreis (10) gesteuert wird.

**4.** Maschine nach Anspruch 1 **dadurch gekennzeichnet, dass** besagter erster Kreislauf (12) mit besagtem zweiten Kreislauf (13) außerhalb des besagten Behälters (11) verbunden ist und innerhalb des besagten Behälters (11) sich bis auf den Boden (18) des besagten Behälters (11) erstreckt.

**5.** Maschine nach den Ansprüchen 1 oder 4 **dadurch gekennzeichnet, dass** besagter zweiter Kreislauf (13) mit besagtem Behälter (11) in seinem Oberteil (19) gegenüber von besagtem Boden (18) verbunden ist.

**6.** Maschine nach einem oder mehreren der vorhergehenden Ansprüche **dadurch gekennzeichnet, dass** besagter erster und zweiter Austauscher (15,

16) wahlweise als Kondensator oder als Verdampfer arbeitet, um je nach Flussrichtung des Kühlmittels, die durch das Schalten eines Vier-Wege-Ventils (3) festgesetzt wird, heißes oder kaltes Wasser oder heiße oder kalte Luft zu erzeugen.

**7.** Maschine nach Anspruch 1 **dadurch gekennzeichnet, dass** besagter Behälter (11) wahlweise mit Unterdruck arbeitet, um besagtes Kühlmittel innerhalb des besagten Kühlkreislaufs (8) abzugeben, und am Anfang mit Unterdruck und dann durch Schwerkraft, um besagtes Kühlmittel aus besagtem Kühlkreislauf (8) aufzunehmen.

**8.** Maschine nach einem oder mehreren der vorhergehenden Ansprüche **dadurch gekennzeichnet, dass** sie eine Änderungseinrichtung zur Veränderung der Wasserkapazität der mit besagter Maschine verbundenen hydraulischen Baugruppe und der Kühlmittelkapazität des besagten Kühlkreislaufes (8) umfasst, um das Wasser innerhalb der besagten hydraulischen Baugruppe auf einer konstanten Temperatur zu halten.

**9.** Maschine nach Anspruch 8 **dadurch gekennzeichnet, dass** besagte Änderungseinrichtung zumindest eine abgestimmte Pumpe der hydraulischen Baugruppe und zumindest besagtes Entspannungsventil (9) umfasst, um die Kapazität des Wassers in besagter hydraulischer Baugruppe und die Kapazität des Kühlmittels innerhalb des besagten Kühlkreislaufs (8) je nach Anforderungen zu verändern.

**10.** Maschine nach Anspruch 9 **dadurch gekennzeichnet, dass** besagte Pumpe und besagtes Entspannungsventil (9) mittels eines PLC oder durch besagten elektronischen Stromkreis reguliert werden, um die Temperatur des Wassers, welches aus den Austauschern (15, 16) fließt, während des Betriebes des Kühlkreislaufes sowohl im Winter als auch im Sommer konstant zu halten.

**11.** Maschine nach einem oder mehreren der vorhergehenden Ansprüche **dadurch gekennzeichnet, dass** sie Messeinrichtungen zur Festlegung, wann und wie die Wasser- und Kühlmittelkapazitäten verändert werden sollen, umfasst, um durch das Messen der Temperatur des Wassers, welches aus den Austauschern (15, 16) fließt, des Temperaturgefälles zwischen der Einlass- und der Auslassöffnung der Austauscher und der Überhitzungstemperatur in der Einlassöffnung des Kompressors (2) sicherzustellen, dass das Kühlmittel im gasförmigen Zustand in den Kompressor gelangt.

**Revendications**

**1.** Machine pour produire soit de l'air soit de l'eau chauds ou froids pour le conditionnement d'un local au moyen d'un réfrigérant, comprenant un circuit de réfrigération réversible(8) se composant d'un membre à détente (9) pour varier la détente dans ledit circuit de réfrigération réversible (8) ainsi que pour commander le cycle de réfrigération d'une façon plus rapide et optimisée compte tenu de la variation à laquelle sont soumises la température ambiante interne et externe outre à l'humidité du local à conditionner, **caractérisée en ce qu'**elle comprend des moyens automatiques de ramassage et de relâchement constitués d'un récipient (11) relié audit circuit de réfrigération (8) par des premières et des deuxièmes conduites (12,13) ledit récipient étant relié audit circuit de réfrigération (8) dans sa zone comprise entre un premier échangeur (15) et ledit détendeur (9), ledit détendeur (9) étant compris entre ledit récipient (11) et un deuxième échangeur (16), ladite zone (14) dudit circuit de réfrigération (8) ayant une portion dans un premier tuyau (20) placé d'une façon coaxiale autour d'une portion d'un deuxième tuyau (21) en vue de former une chambre annulaire (22) communiquant avec ladite deuxième conduite (13), par laquelle, lorsque le réfrigérant circule dans le sens allant du détendeur (9) au premier échangeur (15), il engendre une pression souterraine et transfuse une quantité sélectionnée de réfrigérant du récipient (11) dans le premier tuyau (20), et lorsque le réfrigérant circule dans le sens opposé, une quantité de ce même réfrigérant est forcée à entrer dans la deuxième conduite (13) d'où elle coule dans le récipient (11).

**2.** Machine, selon la revendication 1, **caractérisée en ce que** ledit ramassage automatique et lesdits moyens de relâchement sont en état de ramasser et de relâcher une quantité sélectionnée de réfrigérant dudit circuit de réfrigération (8)et à l'intérieur de ce dernier.

**3.** Machine, selon la revendication 1 ou 2, **caractérisée en ce que** ledit membre de détente variable (9) est un détendeur placé dans ledit circuit de réfrigération (8) et commandé par un circuit électronique (10).

**4.** Machine, selon la revendication 1, **caractérisée en ce que** ladite première conduite (12) et reliée à ladite deuxième conduite (13) hors dudit récipient (11) et qu'elle s'étend à l'intérieur dudit récipient (11) jusqu'au fond (18) dudit récipient (11).

**5.** Machine, selon la revendication 1 ou 4, **caractérisée en ce que** ladite deuxième conduite (13) est reliée audit récipient (11) dans sa portion supérieu-

re (19) vis-à-vis dudit fond (18).

**6.** Machine, selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce que** lesdits premier et deuxième échangeur (15,16) fonctionnent alternativement en tant qu'un condenseur ou un évaporateur pour produire soit de l'eau soit de l'air chauds ou froids selon la direction d'écoulement du réfrigérant établie en commutant une soupape à quatre voies (3).

**7.** Machine, selon la revendication 1, **caractérisée en ce que** ledit récipient (11) fonctionne alternativement en dépression afin de relâcher ledit réfrigérant dans ledit circuit de réfrigération (8) au début en dépression, et ensuite par gravité en vue de ramasser ledit réfrigérant dudit circuit de réfrigération (8).

**8.** Machine, selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des moyens de variation pour varier la capacité hydrique de l'appareil hydraulique relié à ladite machine ainsi que la capacité réfrigérante dudit circuit de réfrigération (8) pour maintenir l'eau à l'intérieur dudit appareil hydraulique à une température constante.

**9.** Machine, selon la revendication 8, **caractérisée en ce que** lesdits moyens de variation comprennent au moins une pompe modulée de l'appareil hydraulique et au moins ledit détendeur (9) afin de varier la capacité de l'eau dans ledit appareil hydraulique ainsi que la capacité du réfrigérant à l'intérieur dudit circuit de réfrigération, selon le besoin.

**10.** Machine, selon la revendication 9, **caractérisée en ce que** ladite pompe et ledit détendeur (9) sont modulés soit par un PLC soit par ledit circuit électronique (10) de sorte que la température de l'eau coulant hors des échangeurs (15,16) se maintienne constante pendant le fonctionnement du circuit de réfrigération aussi bien en hiver qu'en été.

**11.** Machine, selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des moyens de détection pour établir quand et comment varier les capacités de l'eau et du réfrigérant en détectant la température de l'eau coulant hors des échangeurs (15,16), l'écartement thermique entre l'entrée et la sortie des échangeurs ainsi que la température de surchauffe à l'entrée du compresseur (2) pour garantir que le réfrigérant entre dans le compresseur à l'état gazeux.

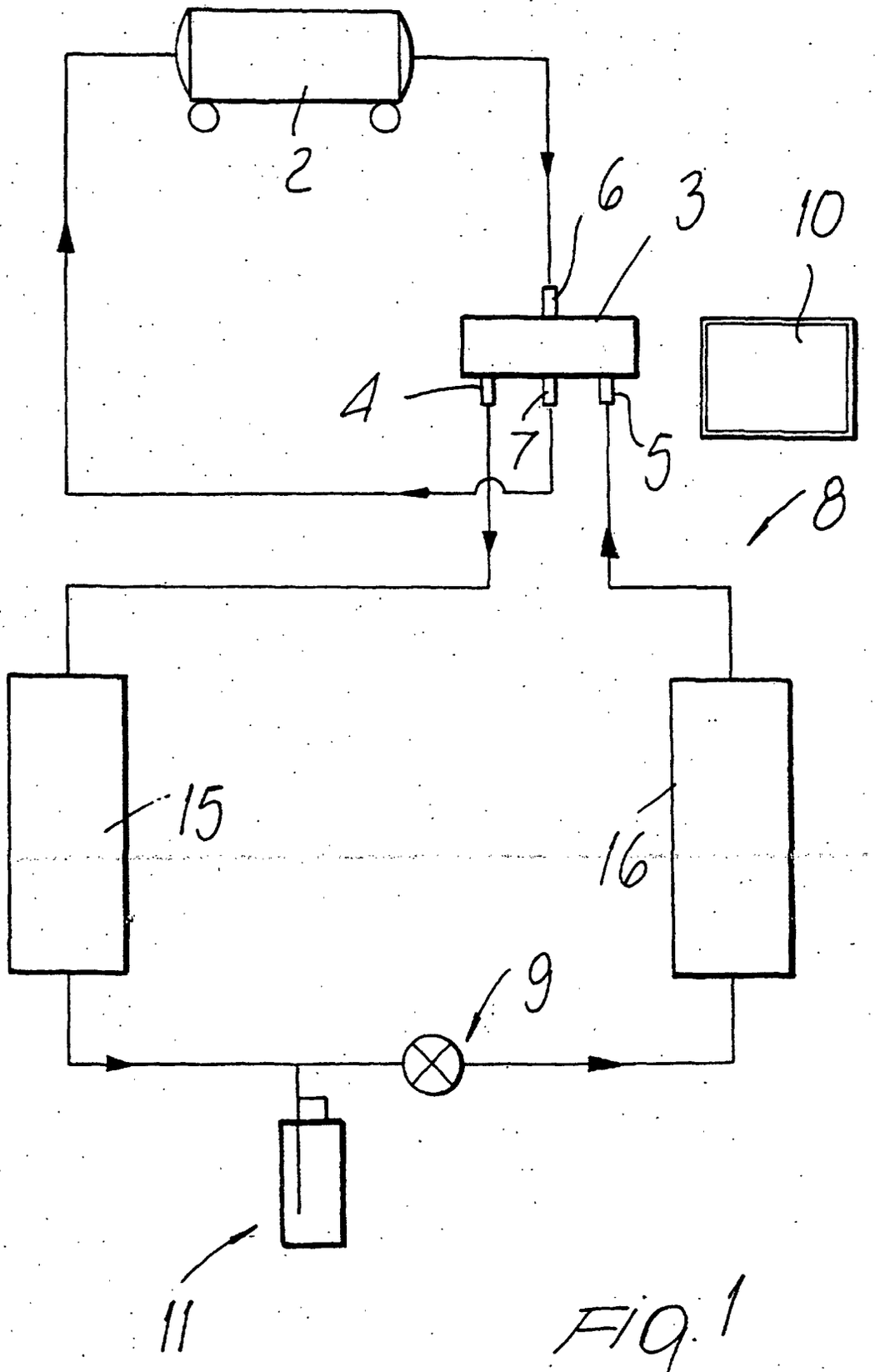


FIG. 1

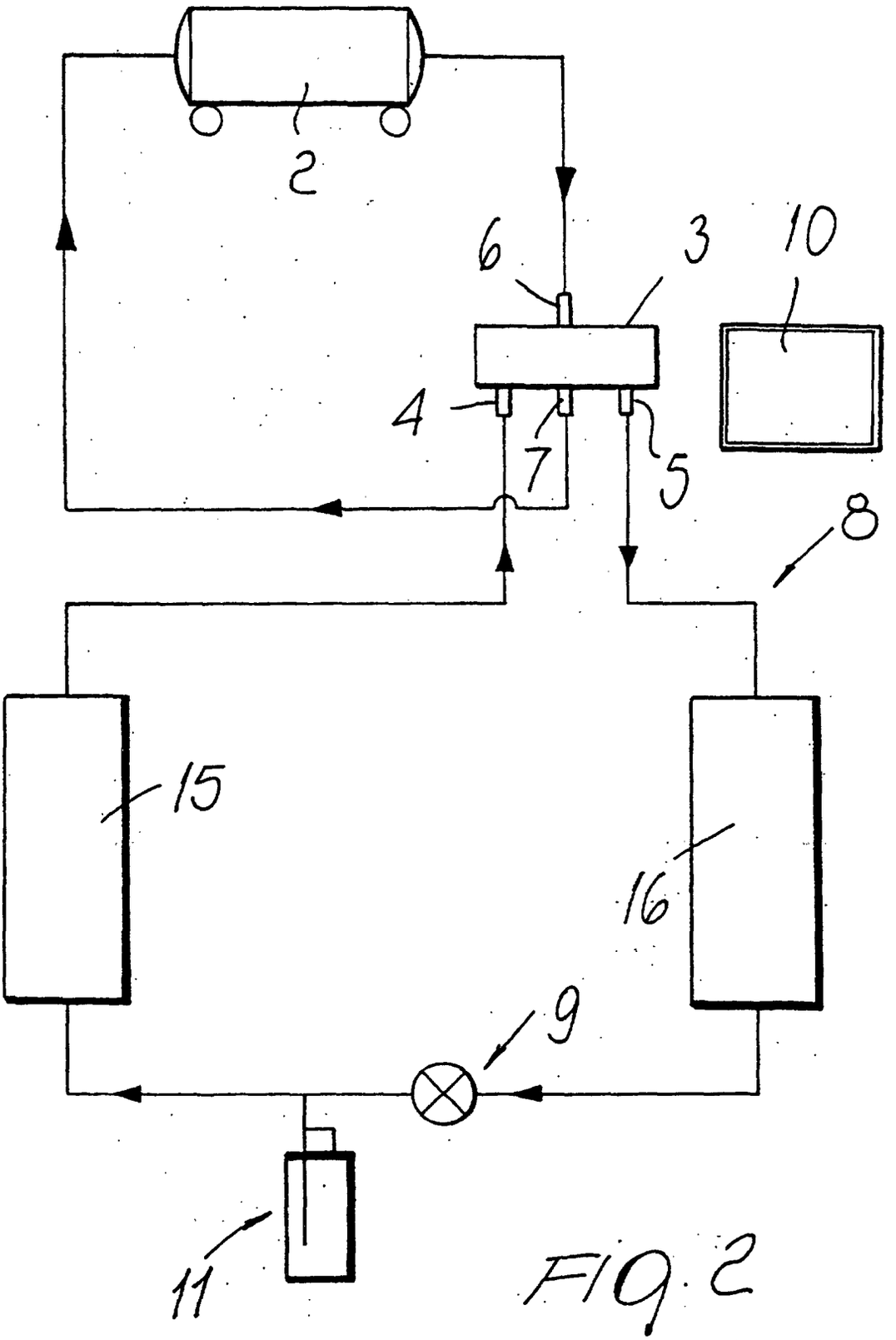


FIG. 2

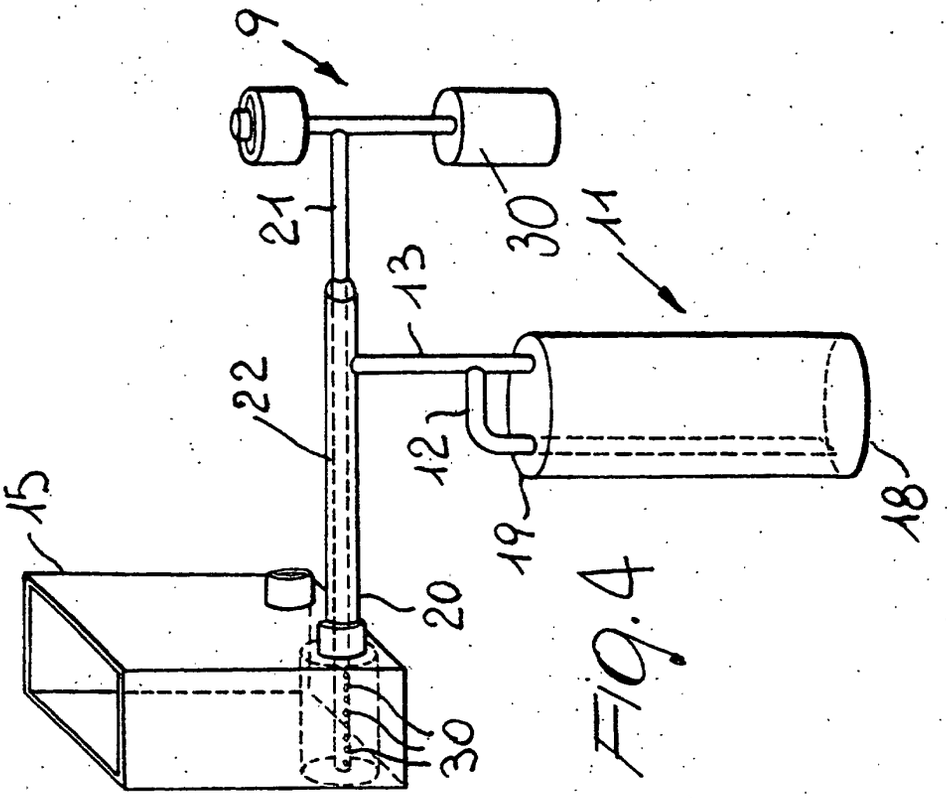
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FIG. 4

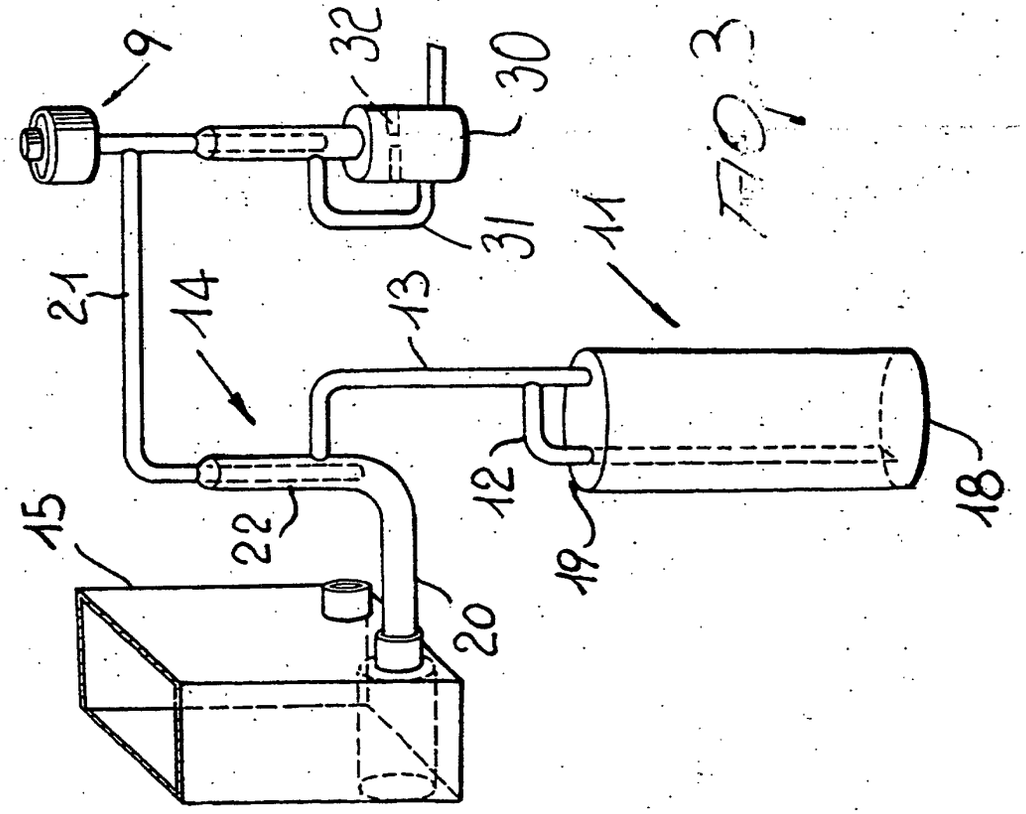
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FIG. 3

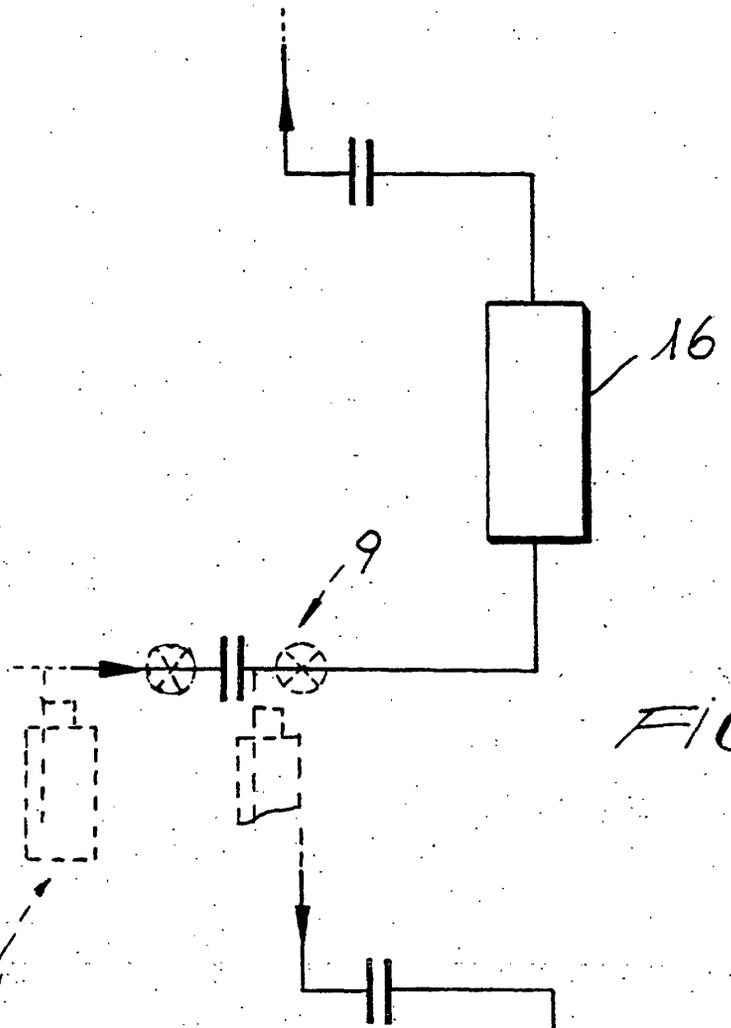


FIG. 5

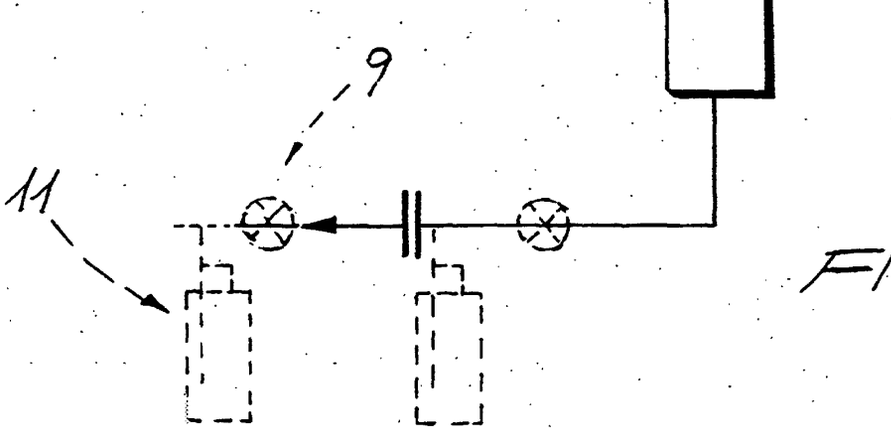


FIG. 6