

**DEVICE FOR EXTRACTING WATER FROM THE AIR, AND SYSTEM  
AND MACHINE FOR THE PRODUCTION OF DRINKING WATER**

5       The present invention relates to a device for extracting water contained in the air. The invention also relates to a system for producing drinking water comprising the device for extracting water contained in the air. The invention also relates to a machine comprising the system for producing drinking water.

10       Different known machines for producing drinking water extract the water present in the air in vapor form by means of condensation. EP 0 597 716 and EP 0 891 523 propose such machines. The main performance criterion of these machines is the quantity of water produced per operating energy unit of the machine.

      There is still a need for a machine for producing water from the air with better performance.

15       To that end, the invention proposes a device for extracting water contained in the air by means of condensation, the device comprising:

- a fan for creating an air flow;
- a heat transfer fluid evaporator for condensing the water in the air flow created by the fan; and
- a compressor for compressing the heat transfer fluid evaporated by the evaporator, which compressor is placed in the air flow downstream of the evaporator.

      According to one alternative, the fan pushes the air flow onto the evaporator.

25       According to one alternative, the extraction device comprises a sealed pipe for the air flow created by the fan, the pipe channeling the air flow between the fan, the evaporator and the compressor.

      According to one alternative, the extraction device comprises:

- a heat transfer fluid condenser for condensing the fluid compressed by the compressor;
  - a heat exchange fluid inlet upstream of the evaporator;
  - a heat exchange fluid outlet downstream of the condenser;
- 30       the heat exchange fluid inlet and outlet being provided to be connected to a circuit returning the heat exchange fluid from the outlet toward the inlet.

      According to one alternative, the extraction device comprises:

- a condenser for condensing the fluid compressed by the compressor;
- a dehydrator for dehydrating the fluid condensed by the condenser downstream of the condenser;
- an expander for expanding the fluid dehydrated by the dehydrator;

- a pressure switch for determining the clogging of the dehydrator as a function of the pressure of the heat transfer fluid expanded by the expander.

According to one alternative, the extraction device is arranged in a block adapted to be installed interchangeably, in a system for producing drinking water  
5 from the air.

The invention also proposes a system for producing drinking water from the air, comprising:

- the preceding device for extracting water contained in the air,
- sensors for measuring the temperature and the hygrometric degree of the  
10 air outside the system,
- a control unit, controlling the extraction of water contained in the air as a function of temperature and hygrometry measurements provided by the sensors.

According to one alternative, the device for extracting water contained in the air comprises a heat transfer solenoid valve between the evaporator and the  
15 compressor, for selectively returning heat transfer fluid upstream of the evaporator, the solenoid valve being controlled to adjust temperature of the evaporator.

According to one alternative, the system has a filter, the filter comprising a portion for physical filtering of the air flow and a portion for sanitary treatment of the air flow, the sanitary treatment portion being chosen from among the group made up  
20 of the physical filter treated to avoid bacterial or microbial development, a plasma filter, and an ultraviolet light-emitting diode filter.

According to one alternative, the system also includes:

- a collection tub for collecting the extracted water, the collection tub collecting the extracted water by gravity;
  - 25 - a storage tub for storing the water collected by the collection tube;
  - a pump for pumping the water stored in the storage tub;
- the pump being provided for consumption of the stored water by a user, the actuating time of the pump determining a pumped volume of water;
- the control unit controlling the extraction of water contained in the air by the  
30 extraction device as a function of the volume of water pumped for consumption.

According to one alternative, the system also includes a refrigeration circuit for the water stored in the storage tub, the refrigeration circuit comprising:

- a heat exchanger outwardly wound on the storage tub for refrigeration of the stored water;
- 35 - the rest of the refrigeration circuit to provide the heat exchanger with the heat transfer fluid with a temperature lower than the stored water.

According to one alternative, the system also includes a set of filters for treating the stored water, the set of filters including at least one filter chosen from among the group made up of a sediment filter, a compressed activated carbon filter, and an ultrafiltration membrane, the set of filters filtering the water pumped by the  
 5 pump.

According to one alternative, the system also includes:

- a discharge circuit, in the storage tub, for the water filtered by the set of filters;
- a solenoid valve for switching the filtered water between the discharge  
 10 circuit and a consumption circuit for consumption of the filtered stored water by the user.

According to one alternative, the system includes an ultraviolet lamp, for the sanitary treatment of the water stored in the storage tub.

The invention also proposes a machine for producing drinking water from the  
 15 air, the machine including:

- the preceding system for producing drinking water from the air, divided heightwise into three parts, including a lower part including the storage tub, an intermediate part including the extraction device, and an upper part including the control unit;
- a structure including hollow plastic tubes for the passage of cables of the  
 20 system to the different parts of the machine.

According to one alternative, the machine includes a device for remotely transmitting information to centralized information storage on the server or a remote troubleshooting unit, the remote communication device including a remote  
 25 communication member chosen from among the group made up of a transmitting/receiving carrier current outlet, GPRS transmitter/receiver, WIFI transmitter/receiver.

The invention also proposes an assembly for remotely processing information on a machine for producing drinking water, the assembly including:

- the preceding machine, the control unit of which includes a member  
 30 collecting data on the operating and malfunction state of the machine;
- a device for remotely transmitting information, the device being outside the machine and provided to communicate by carrier current with the data collection member, the device including a modem for remotely sending data  
 35 collected by the collection member and received by the device;
- software for processing the data transmitted by the transmission device using the modem.

The invention also proposes a method for remotely processing information from a machine for producing drinking water using the preceding processing assembly, the method including:

- data collection on the operating and malfunction state of the machine by  
5 the data collection member of the machine;
- communication to the transmission device, via carrier current, of the data collected by the data collection member;
- remote data transmission by the transmission device via its modem, the data being processed by the processing software.

10 According to one alternative, the method also includes, after processing of the data transmitted remotely, the adaptation of the control from the machine by sending instructions to adapt the control from the machine to the transmission device for transmitting the information remotely.

15 Other features and advantages of the invention will appear upon reading the following detailed description of embodiments of the invention, provided only as an example and in reference to the drawings, which show:

- figure 1, an operating diagram of the device for extracting water contained in the air;
- figure 2, an operating diagram of the system for producing drinking  
20 water, with the fluid connections shown with wires;
- figure 3, an operating diagram of the cabling of the machine for producing drinking water, with the electrical and electronic cables shown with wires;
- figure 4, an operating flowchart of the system during forced operation and  
25 automatic operation.

The invention relates to a device for extracting water contained in the air by means of condensation.

In reference to figure 1, the device 30 for extracting water contained in the air comprises a fan 28. The fan 28 creates an air flow inside the device 30 for extracting  
30 water contained in the air flow. The air flow is shown by dotted lines in figure 1. The direction of the air flow is represented by solid arrows upstream and downstream of the air flow passing through the device 30.

The device 30 also comprises a heat transfer fluid evaporator 32. The evaporator 32 is a heat exchanger for exchanging the heat transfer fluid with the air  
35 flow. The heat transfer fluid in the evaporator 32 is at a temperature lower than that of the air flow downstream of the evaporator 32 to condense the water contained in

the air flow. The air flow cools in contact with the evaporator 32, the heat energy lost by the air flow being transmitted to the heat transfer fluid, which evaporates.

The evaporator 32 extracts water from the air flow by means of condensation of the water. The saturation vapor pressure of the water in the air lowers the temperature. Cold air can contain less water in gaseous form than hot air may contain. In this way, the air flow, by cooling, reaches the threshold temperature below which the quantity of water in gaseous form in the air exceeds the water threshold that the air can contain at that temperature. The dew point is reached, and the water exceeding the capacity threshold of the air condenses. Thus, part of the water initially contained in gaseous form in the air flow is in liquid form in contact with the evaporator 32.

The device 30 also comprises a compressor 34 for compressing the heat transfer fluid, said compressor being placed in the air flow downstream of the evaporator 32. After the evaporator 32, the air flow is cool (for example, with a temperature of approximately 11°C), and passes directly on the compressor 34 to cool it.

In this way, the compressor 34 is constantly cooled, when the device 30 is actuated. The air flow from which the water has been extracted evacuates the heat given off by the compressor 34 and can keep it at a temperature below 45°C. This arrangement avoids the problem of overheating of the compressor 34. In such a configuration, the compressor 34, continuously cooled, does not reach the threshold conditions for safe operation, for example 75°C. The operating time of the extraction device 30 can thus be increased, and the quantity of water extracted is higher. The device 30 is thus not subject to forced stops for safety reasons while the conditions for extracting water may be ideal. The device 30 can therefore concentrate the water extraction at the time when the conditions are ideal, thereby limiting the operating energy consumption of the compressor 32 and the fan 28.

Preferably, the compressor 34 is arranged downstream of the evaporator 32 for the heat transfer fluid. The compressor 34 comprises the heat transfer fluid evaporated by the evaporator 32 with the air flow. A heat transfer fluid circuit can then be provided to return the heat transfer fluid upstream of the evaporator 32. The heat transfer fluid then goes through a thermodynamic cycle.

The extraction device 30 therefore makes it possible to improve the quantity of water extracted per operating energy unit of the machine. Integrating this device 30 into a system or machine for producing water therefore makes it possible to obtain water production from the air with improved performance.

The fan 28 can be arranged upstream in the air flow in relation to the evaporator 32 and the compressor 34. The fan 28 pushes the air flow on the evaporator 32, rather than suctioning the air flow through the evaporator. Such an arrangement allows a greater passage of air on the evaporator 32, since, for the same  
 5 energy consumption, the fans pushing the air on the evaporator 32 have a better output in relation to the fans suctioning the air on the evaporator 32.

The device 30 can comprise a sealed pipe for the air flow created by the fan 28. The pipe channels the air flow between the fan 28, the evaporator 32, and the compressor 34. In this way, the extraction device 30 is an airtight compartment with  
 10 limited losses between the fan 28, the evaporator 32, and the compressor 34. All of the air flow passes over the evaporator 32, then over the compressor 32. This allows a gain for the extraction of water in the vicinity of 15 to 20% in relation to an extraction device not including a sealed pipe. In reference to table I later in this description, comparative tests were conducted between a traditional water production  
 15 system not having a sealed pipe and the system that is the subject-matter of the invention including a sealed pipe. Both systems are arranged in the same casing (trim box) of a water machine. The traditional system is not placed in a sealed pipe, while the system that is the subject-matter of the invention is placed in a sealed pipe as previously described. The only open portions of the sealed pipe correspond to the air  
 20 inlet and the air outlet. The outputs correspond to the production in  $\text{dm}^3/\text{h}$ .

The device 30 can comprise a condenser 36 for condensing the heat transfer fluid. The condenser 36 is placed downstream of the compressor 34 for the heat transfer fluid, i.e. the condenser 36 condenses the fluid compressed by the compressor 34.

25 The condenser 36 is preferably arranged downstream of the compressor 34 in the air flow, particularly in the sealed pipe of the device 30. The compressed heat transfer fluid, present in the condenser 36, cedes its heat to the air flow in outside contact with the condenser 36. The fluid, which may still be in gaseous form after the compressor 34, liquefies gradually as it advances in the tubes making up the  
 30 condenser 36. At its outlet, the heat transfer fluid is liquid and hot. The condenser 36 contributes to the thermodynamic cycle of the heat transfer fluid.

The device 30 may comprise, in addition to the condenser 36 for condensing the heat transfer fluid, a heat transfer fluid inlet and a heat transfer fluid outlet. The heat transfer fluid inlet is arranged upstream of the evaporator 32. The heat transfer  
 35 fluid outlet is arranged downstream of the condenser 36. The inlet and the outlet are provided to be connected to a circuit bringing the heat transfer fluid from the outlet

back toward the inlet, allowing the heat transfer fluid to go through a thermodynamic cycle.

The circuit may include a dehydrator 42, for dehydrating the fluid condensed by the condenser 36. The dehydrator is downstream of the condenser 36.

5       The circuit may include an expander for expanding the fluid dehydrated by the dehydrator 42. The expander 44 is upstream of the evaporator 32. The expander 44 provides a significant pressure drop for the heat transfer fluid. This pressure drop causes a temperature decrease to a value below that of the air flow that passes through the evaporator 32. Downstream of the expander 44, the heat transfer fluid  
10       reenters the evaporator 32, for example primarily in liquid form with 15 to 20% in vapor form. The expander 44 can be chosen from among the group made up of a thermostatic expander, an electronic expander, or a capillary expander.

      The electronic expander has the advantage of allowing a precise and optimal adjustment when it is associated with temperature probes and a regulator. The  
15       capillary expander has the advantage of a simple design (single tube with a diameter of 1.2 mm) with a limited price and implementation. The thermostatic expander has the advantage of regulating the fluid flow rate as a function of the thermal charge of the air. The thermostatic expander is preferred for the system for producing drinking water.

20       The dehydrator 42 is particularly useful during use of the thermostatic expander. In fact, it is preferable to have a so-called "liquid bottle" ("bouteille liquide" in French) reservoir with the thermostatic expander. The heat transfer fluid can then contain traces of moisture, due to the liquid bottle, which combine with oil, provided in the heat transfer fluid circuit to lubricate the compressor 34. This thus  
25       creates a very powerful acid that etches the protective sheath of the copper wires of the electric motor of the compressor 34. It is therefore preferable to trap the moisture in a porous and hydrophilic material. Furthermore, copper particles and other dusts may be introduced into the assembly and are thus trapped by the filtering sieve of the dehydrator 42. The "bottle dehydrator" has the advantage of bringing filtration,  
30       dehydration, and buffer volume for the heat transfer fluid into a single volume. In fact, the expander 44 is a regulating member that allows more or less heat transfer fluid to pass as a function of the temperature of the air, which causes the fluid flow rate to vary. This variation is absorbed by the volume of the bottle and ensures a supply of heat transfer fluid for the expander 44.

35       The circuit may include a pressure switch 48. The pressure switch 48 is preferably downstream of the expander 44 and upstream of the evaporator 32, in the low-pressure portion of the heat transfer fluid circuit. The pressure switch 48 makes

it possible to measure pressure drops of the fluid in the heat transfer fluid circuit. If the filters of the dehydrator 42 are clogged, the pressure of the heat transfer fluid decreases. The clogging of the dehydrator 42 is then determined as a function of the pressure of the heat transfer fluid.

5           In this way, when the pressure of the heat transfer fluid drops below a certain level, for example two bars, the control unit 80, informed by the pressure switch 48, can cut the compressor 34. Damage to the compressor 34 is limited and it is possible to indicate clogging of the dehydrator 42 filters. The lifetime of the compressor is improved.

10           The circuit returning the heat transfer fluid can be arranged on the outside, independently of the extraction device 30. Such an arrangement of the circuit returning the fluid upstream makes it possible to have a device in the form of a compact block. The block is adapted to be installed interchangeably in a system for producing drinking water from the air. The block is thus independent from the rest of  
15 the system for producing drinking water and can be easily replaced or changed as needed for maintenance, for example.

          The circuit returning the heat transfer fluid can alternatively be included in the device 30. The heat transfer fluid inlet and outlet are then no longer necessary. The circuit may still include a dehydrator 42, an expander 44, a pressure switch 48 as  
20 previously described. The arrangement in the form of an interchangeable block to be installed in a system for producing drinking water, as previously described, is still possible.

          The system for producing drinking water is shown in figure 2 by an operating diagram. The system includes the extraction device 30 previously described. The  
25 system also includes sensors (shown in figure 3 by reference 86) for measuring the temperature and the hygrometric degree of the air outside the system. The hygrometry, or hygrometric degree, characterizes the humidity of the air, i.e. the quantity of water in gaseous form contained in the air. The temperature and hygrometry sensors 86 can be installed at the air flow inlet in the system.

30           The system also includes a control unit. Figure 3 shows the control unit 80. The control unit 80 controls the extraction of water contained in the air by the extraction device 30. The control to extract water contained in the air by the device 30 can be done as a function of temperature and hygrometry measurements provided by the sensors 86. Depending on the temperature (for example, at least 15°C) and  
35 depending on the degree of hygrometry (for example, at least 30%), the extraction device 30 is controlled to run by the control unit 80. Different operating values are described in more detail hereafter. The sensors 86 make it possible to determine the

extracted water output immediately. The control unit 80 maximally optimizes the output of the machine using information from the sensors 86. The control unit 80 thus determines the ideal dew point.

To create the ideal dew point, several pieces of information are taken into  
5 account. The ideal dew point is on average between 9°C and 12°C different from the air temperature at the inlet. If the temperature of the entering air on the evaporator 32 is 24°C, the ideal temperature must be comprised between 12°C and 15°C on the evaporator. For each reentering air temperature degree, the temperature degree on the evaporator 32 is calculated automatically. Different match values between the  
10 temperature of the entering air and the temperature of the evaporator 32 are described hereafter.

The control unit 80 controls the regulation of the temperature of the heat transfer fluid entering the evaporator 32 (the temperature of the evaporator 32), for example using a solenoid valve 40 of the device 30, between the evaporator 32 and  
15 the compressor 34. The solenoid valve 40 is thus downstream of the evaporator 32 and upstream of the compressor 34. The solenoid valve 40 makes it possible to selectively return the heat transfer fluid upstream of the evaporator 32, as shown in figure 1. When the temperature is too low relative to the ideal dew point, a small dose of hot heat transfer fluid is injected (for example in gas form having been  
20 evaporated by the evaporator 32) upstream of the evaporator 32 to raise the temperature.

It is preferable to extract water at a temperature above 0°C. As long as the temperature of the heat transfer fluid is above 0°C, the condensation, the extraction of water contained in the air, is optimal. Once it drops below 0°C, the condensed  
25 water freezes, decreasing the air flow rate through the evaporator 32. The temperature of the heat transfer fluid at the inlet of the evaporator 32 then further decreases, causing still more significant freezing of the extracted water.

Thus, when the ideal temperature, calculated by the control unit 80, of the heat transfer fluid is too low, for example close to 5°C, it is provided to stop the  
30 system.

A temperature sensor for the heat transfer fluid is preferably provided downstream of the evaporator 32 to allow the control unit 80 to have a control loop on the temperature of the heat transfer fluid.

The control unit 80 can control the extraction of water contained in the air as  
35 a function of the water consumption by the user. The control unit 80 then limits the water extraction to the quantity of water usually consumed by the user. The water consumption per person per day is estimated at 1.5 liters. The water consumption can

also be determined using different measurements available to the control unit 80, as described in the continuation of the description, for example. The energy consumption of the system is thereby optimized.

5 The air flow entering the extraction device 30 is preferably filtered. In fact, the higher the quality of the air, the higher the quality of the water extracted from the air. In reference to figure 1, the system includes a filter 46. The filter 46 preferably comprises two parts. A first part of the filter performs physical filtering. It makes it possible to prevent solid particles from entering the air flow. A second part of the filter performs a sanitary treatment of the air flow, fungicidal and bactericidal  
10 treatment of the air.

The part for sanitary treatment can be chosen from among the group made up of a physical filter treated to avoid bacterial or microbial development, a plasma filter, and an ultraviolet light-emitting diode filter. With the treatment of the air flow from which the water is extracted, the system can be an air treatment system.

15 In the case of the treated physical filter, the material of the filter is treated using a specific product that works to prevent any bacterial or microorganism development. It is possible to provide a pressure switch downstream of the filter to detect clogging of the filters. Thus, the abnormal pressure increase downstream of the filter can be caused by a reduced air passage due to a clogged filter. The pressure  
20 switch can also make it possible to detect a failure of the fan.

In the case of a plasma filter, electrical wires, for example made from copper, are attached to a frame. These electrical wires are called electrodes. On the bottom of the frame, a device with a negative conductive charge is attached, in honeycomb form. It is arranged such that all of the air suctioned by the fan 28 passes through.  
25 The electrodes have a particular arrangement so that they cover approximately 40% of the entire surface. The air that will pass through is thus completely treated. Between these electrodes, a large electrical field is created. This electrical field is powerful enough to create positive and negative ions in large quantities, which will create a plasma. The plasma is a neutral gaseous form, but with very strong  
30 bactericidal and germicidal action. Thus, the air that passes through is rid of all bacteria, spores, and germs before they can reach the water extracted from the air. A safety contact may be installed to cut the power supply of the entire system when the first part of the filter 46 is removed. This contact may be installed on a door providing access to the air filter to change it.

35 In the case of ultraviolet light-emitting diodes (UVLED), the UVLEDs are attached on a frame. Attached on the bottom of the frame is a radiant metal grating device. The radiation from the UVLED is thus diffused over an entire passage

section of the air flow. The air flow passing through that section is thus treated. The rays emitted by the UVLEDs are for example UV-C rays. UV-C rays are recognized for having very strong bactericidal and germicidal action. The air flow is rid of all bacteria, spores, and germs that could pollute the water to be extracted from the air.

- 5 The UVLEDs have the advantage of having a very long lifetime (approximately 20 years) compared with existing UV-C ray lamps. The upkeep of the system, replacement of the ultraviolet filter, is thus greatly reduced.

- The production of the device 30 with a sealed pipe and a fan 28 arranged upstream of the air flow makes it possible to maintain a slight air overpressure inside the pipe of the device 30. The air outside the pipe has a lower pressure than the air inside the pipe. Thus, even in the event of slight sealing defects of the pipe of the device 30, the air outside the device 30 can only enter the inside of the pipe by passing through the fan 28, and therefore through the filter 46 arranged upstream of the fan 46. The filter can also be arranged between the fan 28 and the evaporator 32.
- 10 15 All of the air from which the water is extracted thus undergoes sanitary treatment. In reference to figure 2, the system may comprise a collection tub 38 collecting the water extracted by gravity. The collection tub 38 can be arranged under the evaporator 32, in the device 30, to recover the stream of water extracted on the evaporator 32. The collection tub 38 can be slid like a drawer under the evaporator 32. The collection tub 38 can assume the form of a diamond point whereof the bottom contains a hole. The water extracted from the air is thus oriented toward the hole.
- 20

- The system can include a storage tub 60 for the water collected by the collection tub 38. The storage tub 60 is preferably situated just below the collection tub 38. This makes it possible to achieve gains in terms of the tube and to simplify assembly. For example, during serial manufacture, a specialized worker can prepare the system without having to perform the welds and connections.
- 25

- The system may include a pump 56 for pumping the water stored in the storage tub 60. The pumping of the water is then provided for consumption of the stored water by a user. The pump 56 can have a constant flow rate. In that case, it is possible to determine the volume of water pumped from the actuating duration of the pump. The volume of water pumped determines the quantity of water consumed. The consumption by the user can then be taken into account by the control unit 80. The control unit 80 can then control the extraction of water contained in the air by the extraction device 30 as a function of the volume of water pumped for consumption.
- 30 35
- The control to extract water as a function of consumption by the user is described in more detail hereafter.

The system can include a refrigeration circuit for refrigerating water stored in the storage tub 60. The refrigerating circuit then comprises a heat exchanger 64 wound outwardly around the storage tub 60 to refrigerate the stored water. Preferably, the heat exchanger 64 assumes the form of a copper coil. The heat  
 5 exchange fluid then cannot be in contact with the water of the storage tub 60, preventing problems of pollution of the extracted watering in case of leaks.

The rest 66 of the refrigeration circuit provides the heat exchanger 64 with the heat exchange fluid at a temperature lower than the stored water.

According to one embodiment of the refrigeration circuit, the storage tub 60  
 10 is surrounded by the copper coil in which the cooling fluid passes. The cooling of the water to the temperature desired by the user can be steered by a temperature probe provided in the storage tub 60.

To guarantee an exceptional water quality, it is preferable to filter and treat the water found in the storage tub 60. The system can therefore include a set 70 of  
 15 treatment filters for the stored water. The set 70 of filters preferably includes one of the filters chosen from among the group made up of a sediment filter 72, a compressed activated carbon filter 74, and an ultrafiltration membrane 76. The sediment filter 72 preferably has a nominal filtration rating of 0.5 microns. The ultrafiltration member 76 preferably has a nominal filtration rating of 0.01  $\mu\text{m}$ .

Also preferably, the set 70 of filters includes all three filters from the  
 20 preceding group. Known systems use a filtration system equipped with an osmosis membrane. The osmosis membrane can create complications over time. To make 1 liter of osmosed water, 2 liters of water are rejected. In general, in household facilities, that water is rejected to the sewer. In traditional water machines, those 2  
 25 liters return to a first tub, which recovers the condensed water. If bacterial development were to occur, the wastewater from the membrane that returns to the first tub would pollute the pure water that had just been extracted. It is therefore preferable to adopt filters not using the osmosis membrane.

It is possible to complete the filtration with a fourth filter to remineralize the  
 30 water. That filter can be associated with vitamins or medicines.

The pump 56 can cause the filtration of the water of the storage tub 60. The sets 70 of filters is then arranged downstream of the pump 56, as shown in figure 2.

The system can include a discharge circuit, in the storage tub 60, for the water filtered by the set 70 of filters. The filtered water is discharged in the storage  
 35 tub 60. The stored water is then kept drinkable. The water can be filtered at regular intervals to maintain a water quality for consumption by users. For example, the filtration may take place every hour, for 15 minutes. The water in the tub is thus

regenerated 24 times over the course of the day. A solenoid valve 78 is preferably then provided for switching the filtered water between the discharge circuit and a consumption circuit for the filtered stored water to be consumed by the user. The consumed water is thus pumped by the pump 56, then filtered by the set 30 of filters, and lastly switched by the solenoid valve 78, according to demand by the user, into the consumption circuit to be consumed by the user. The duration of the simultaneous activation of the solenoid valve 78 and the pump 56 makes it possible to deduce the volume of water consumed by the user. The consumed volume of water can alternately be counted by a water meter located just before a faucet and after the switching solenoid valve 78. When the solenoid valve 78 is not activated, the water pumped by the pump 56 returns, is discharged, into the storage tub 60.

The control unit 80 can control the pumping of the water stored in the storage tub 60, just after the extraction device 30 is started. The water that has just been extracted is then treated immediately.

The control unit 80 may control pumping of the water only when a minimum water level is reached in the storage tub 60, for example 2 liters. This makes it possible to prevent the pump 56 from running when empty. The case where the minimum water level is met can be determined using a level sensor described hereafter.

Preferably, the filters 72, 74, 76 connect independently of one another without requiring the disconnection of the pumped water circuit connector. The set 70 of filters may include a head with only one water inlet and only one water outlet. The head of the set 70 of filters includes connectors for replacing each filter independently.

The bottom of the storage tub 60 may be slightly sloped to lead the water toward the filtration suction, preventing part of the stored water from stagnating.

The system may include an ultraviolet lamp for sanitary treatment of the water stored in the storage tub 60. Preferably, the ultraviolet lamp 58 is arranged close to the discharge of the pumped water into the storage tub 60. In this way, after the water has been filtered, it returns to the tub by falling or pouring directly on the ultraviolet lamp 58. The entire volume of water treated by the filters is treated by ultraviolet radiation, preventing antibacterial or microorganism development.

Using a pump 56 with a constant flow rate or a pump 56 associated with a flow meter makes it possible to determine the quantity of stored water that has gone through the set 70 of filters and/or the ultraviolet lamp 58. Such a determination of the treated water quantity allows better maintenance of the system, in particular at

the end of life of the water treatment members, by notifying the user or by sending information to the maintenance department for the system.

The ultraviolet lamp 58 is preferably replaced by a UVLED assembly having a longer lifetime, thereby limiting the maintenance costs of the system.

5       The system can include a level sensor 68 for the water stored in the storage tub 60. The level sensor 68 can be chosen from among electronic level sensors and membrane level sensors. Preferably, the level sensor is a membrane level sensor for reliable precision of the stored water level. The information on the available water quantity is based on the pressure of the water. For example, when one liter of water  
10 causes a pressure of 1.67 mbars, if the sensor reads 4.17 mbars, the level is 2.5 liters. The measurement is reliable and precise, and makes it possible to inform the user to within a centiliter.

15       In the system, the level sensor 68 is preferably at the bottom of the storage tub 60, spaced away from the water intake for pumping of the water, to limit measurement errors.

20       The system may comprise an overflow sensor 62 for the storage tub 60. Preferably, the overflow sensor 62 is a blade sensor. The blade sensor can be integrated into a tube at the apex of the storage tub 60. The tube integrating the overflow sensor 62 can also serve as exhaust, when the storage tub 60 is filled with extracted water. This pipe may be equipped with a T.

25       The level sensor 68 and/or the overflow sensor 62 make it possible to determine the quantity of water stored in the storage tub 60. As a function of that quantity of water, the control unit 80 can control or stop the extraction of water contained in the air. The level and overflow sensors 62 and 68 can trigger a sound  
alarm and/or stop the operation of the extraction of water contained in the air. The overflow sensors 62 allows redundancy of the level sensor, which is useful in the event of a malfunction of the level sensor 68 and thereby limits maintenance costs.

30       In the event a refrigeration circuit is used for refrigerating the stored water, it is preferable only to store a minimal quantity of water in the storage tub 60. The energy costs of the system for refrigerating the stored water are then limited. Preferably, the quantity of stored water is set by the control unit 80 as a function of the measurements of the quantity of water consumed by the user.

35       The system can be arranged in a machine divided heightwise into three parts. Each part comprises a plate for arranging the different members of the system. This makes it possible, during manufacture, to mount each plate separately, to then assemble them, representing very significant time savings during manufacturing.

In reference to figure 3, the machine is preferably arranged as follows:

- an upper part with a plate on which the control unit 80 is installed (the control unit 80 may include printed circuits as well as a power supply board and a control circuit);

- an intermediate part including the device 30 and the rest 66 of the refrigeration circuit for refrigerating the stored water;

- a lower part including a plate on which the storage tub 60, the heat exchanger 64 and the filtration members (the set 70 of filters and the ultraviolet lamp 58, the pump 56, the solenoid valve 78) are installed.

Such an arrangement of the system is advantageous. The storage tub 60 is situated in the lower part, thus the heat given off by all of the equipment rises in the machine and has no impact on the refrigeration of the water. The rest 66 of the refrigeration circuit then operates consuming little operating energy. Furthermore, leaks of water stored in the storage tub 60 cannot flow over the rest of the equipment, limiting damage to the system.

The structure and the machine may include hollow plastic tubes, preferably made from polyvinyl chloride (PVC). PVC tubes are generally used for flows or circulation of water in houses. The material of such tubes can be chosen from among the group consisting of polypropylene or natural materials, such as bamboo. It has the advantage of being easy for anyone to use, being cut to the desired size simply by using a traditional metal saw or with specialized tube cutting, and of being strong and light. The inside of these tubes is hollow, allowing the passage of all electrical cables. They thereby insulate the electrical cabling of each plate.

Furthermore, PVC tubes exist in different forms, such as T's or sleeves making it easier to place the plates that will make up the machine. It is thus possible to arrange tube sleeves between each plate, to gradually set up the machine, plate by plate. The structure of the machine can thus be made up of four tubes situated at the four corners of the rectangular plates. This makes it possible, while isolating them, to differentiate between the traditional electrical cables and the electronic cables. The electrical cables are conveyed to the upper plate by one of the four tubes and the electronic cables by another. At each stage, a T makes it possible to direct the cables toward the upper plate. In this way, the cables are prepared and protected all throughout mounting of the machine. When the last upper plate is placed, the cables are ready to be connected to the control unit 80.

The polyvinyl chloride (PVC) hollow tube structure for the passage of the cables of the system to the different parts of the machine thus makes it possible to run the cables of the system while isolating them from the fluid circuits of the system.

The machine may comprise, on the upper part thereof in a front surface, a liquid crystal display (LCD) 82 communicating information on the operation of the machine to the user. The outside temperature and humidity measurements may be indicated to the user. The possible water extraction percentage may also be indicated,  
 5 for example on a scale of 0 to 100%. In this way, the user has an accurate indication of whether the machine is effective.

The indications on the quantity of stored water can also be indicated to the user with the temperature of the stored water. Each important element, or member, of the machine is monitored: the pump, the compressor, the operation of the solenoid  
 10 valves, and the status of the filters. Several diagnostics can be determined for each part.

Regarding the mechanical part: the compressor 34, the compressor of the rest  
 66 of the refrigerating circuit, the pump 56 for pumping the stored water, and the fan 28, different failures may be determined using current and/or power voltage sensors  
 15 for each of these members, a pressure sensor (high and low) in the heat transfer fluid circuit and the refrigeration circuit for the stored water, an air pressure sensor downstream of the filter 46. It is then possible to determine the following failures:

- DCE 001: no power, no current measurements for the compressor 28, in the case where the power supply current of the compressor 34 is not  
 20 measured whereas the compressor 34 is in its operating range;
- DCE 002: abnormal intensity measured, in the case where the values recorded during normal operation for the voltage and intensity increase abnormally;
- DCE 003: the calibrated value of the low pressure sensor of the heat  
 25 transfer fluid circuit is abnormal, when the pressure measured goes below a calibrated value threshold;
- DCE 004: the calibrated value of the high pressure sensor of the heat transfer fluid circuit is abnormal, when the pressure measured goes below a calibrated value threshold;
- DCF 005: no power, no current measurements for the compressor of the  
 30 rest 66 of the refrigeration circuit;
- DCF 006: abnormal intensity measured for the compressor of the rest 66 of the refrigeration circuit;
- DCF 007: the calibrated value of the low pressure sensor of the  
 35 refrigeration circuit for the stored water is abnormal, when the pressure measured goes below a calibrated value threshold;

- DCF 008: the calibrated value of the high pressure sensor of the refrigeration circuit for the stored water is abnormal, when the pressure measured goes above a calibrated value threshold;
- 5     - DP 009: the pump 56 is stopped whereas it is in its operating range, when its power supply current is not measured even though the pump 56 should operate;
- DP 010: the pump 56 is abnormally stopped, when the user presses on the outside button to obtain water and the pump is not triggered and the flow meter does not record the passage of water;
- 10    - DP 011: the filtration pump is abnormally stopped, when the flow meter does not record the passage of water for more than two hours even though the storage tub is three quarters full;
- DP 012: the filters are clogged or the pump has a problem, when the flow meter records a low passage of water below a calibrated flow rate threshold;
- 15    - DV 013: the motor of the fan is abnormally stopped, when its power supply current is not measured even though the fan should operate;
- DV 014: the air pressure is too high, the suctioned air experiences difficulty passing through the air filter, it is definitely plugged or clogged, when the air pressure is too high upstream of the filter and exceeds the calibrated high pressure values, it is also possible to provide for stopping the compressor and the fan in that case.
- 20

Regarding the water treatment and storage part, different failures may be determined:

- 25     - DN 015: The water level sensor 62 is defective, when the hygrometry level and the temperature of the air are favorable to water production, the compressor 34 operates as well as the fan 28, but the water storage reservoir 60 no longer fills;
- DN 016: The water level sensor 62 is defective, when the device for extracting water from the air is operating with a hygrometry level and an air temperature favorable to water production whereas the capacity of the reservoir 60 is not modified after 4 hours of operation;
- 30
- DN 017: The level sensor is defective or incorrect information is stored in the memory, when the capacity display values of the reservoir 60 are abnormal and do not correspond to base values (which may be related to overvoltage problems or electrical power line disturbances);
- 35

- DT 018: the UV lamp is no longer connected or the lamp was broken, when the power supply current for the lamp is not measured by an *ad hoc* sensor and the pump 56 is operating;
- DT 019: the UV lamp needs to be changed or the entire machine requires maintenance, when the usage duration (for example, 7,600 hours) of the UV lamp approaches the lifetime of the UV lamp, which may for example be 8,000 hours;
- DT 020: the cartridges need to be changed, when the quantity of water filtered by the filtration cartridges approaches the maximum quantity (such as 900 liters of water filtered for a maximum use provided at 1000 liters of water).

All of this information and all of the associated diagnostics can be recorded and stored over a 30 day loop. When one of the elements, or members, breaks down, the information may be displayed for the user on the LCD screen 82. Different light-emitting diodes may be provided close to the LCD screen 82, as indicators of the operation or malfunction of the various members of the machine. It is possible to provide for canceling the diagnostic display by actuating the buttons on the front surface of the machine in a certain manner, and on the condition that the displayed problem has been resolved.

The machine may include a device 88 for transmitting information remotely. Information may be sent to the maintenance department by carrier currents via the electrical network powering the system or via modem integrated into the system and via the telephone network. The machine may be queried remotely to verify its proper operation simply by means of an electrical outlet. Any type of information can thus be collected in a centralized manner, such as the water consumption, electrical consumption, the number of liters of water manufactured, as well as error messages, or the operation of the various devices of the system during an abnormal length of time. The information may be transmitted to a centralized information storage area on a server or a remote troubleshooting unit. The information remotely stored can then serve to provide remote troubleshooting services. The user can thus be notified by telephone that an intervention must be done on the machine and/or may be given the address of a retailer selling consumables for the machine.

The machine may thus include transmitting and collecting carrier current outlets. The machine may also include a GPRS (*General Packet Radio Service*) system, collecting and transmitting information. It is also possible to consider using a Wi-Fi (*Wireless Fidelity*) connection to transmit the information. Alternatively, data

may be recovered from the machine manually using a Universal Serial Bus (USB) port, for connecting to a computer or a removable data storage medium.

At the machine, the information may be collected by a "data collection" card querying the various members of the machine, for example every 10 seconds. The  
5 "data collection" card is a data collection member. This information or data, correctly received, is immediately communicated to the remote information transmission device 88.

According to one embodiment, the device 88 may be outside the machine, to be placed as close as possible to a telephone jack belonging to the user of the  
10 machine. The device 88 becomes an information receiving system from the "data collection" card integrated into the control unit 80 of the machine. In such an embodiment, the communication of the collected data between the control unit and a receiving system can be done by carrier current on the user's household network (for example, 220 V network). The data frames are stored, with the date and time of  
15 reception, by the receiving system. The receiving system may be made up of an LCD touchscreen and a modem integration medium.

The receiving medium, via its integrated modem, can be connected to the telephone line of the machine's user, thereby allowing transmission of the operating log of the machine, i.e. data collected by the "data collection" card and received by  
20 the receiving system, to a remote troubleshooting unit or a manufacturer of the machine. This transmission of the operating log may be done automatically during a malfunction over a long period of time, for example three days. Preferably, the transmission of information may take place only in case of malfunction. In this way, when a malfunction occurs, the remote troubleshooting unit recovers all of the data  
25 stored by the receiving system. Processing software for processing the data thus received can be provided, for example making it possible to archive the data, print it, or make a graph from it.

According to one preferred embodiment, the receiving system communicates with the control unit 80 of the machine to adapt the control of the machine to the  
30 detected malfunction. The adaptation of the control of the machine may for example include modifying the water production, forced operation or automatic operation, modification of the desired water temperature threshold. According to such an embodiment, during a malfunction, the receiving system sends the data it has stored to the remote troubleshooting unit and receives an appointment (date and time) in  
35 return, when the receiving system must call the remote troubleshooting unit back to obtain orders for adapting the control of the machine to resolve the problem.

After a malfunction has been detected and in the event no useful intervention can be done remotely by the remote troubleshooting unit, a direct intervention on the machine and information for the user of the machine can be provided. The user can thus be notified by telephone that an intervention must be done on the machine  
5 and/or may be given the address of a retailer for consumables for the machine.

The "data collection" card, the receiving system, and the software for the remote troubleshooting unit can form a processing unit for remotely processing information from the machine. This remote information processing assembly makes it possible to reduce intervention times to perform a support operation or to  
10 determine what type of breakdown must be resolved before sending a technician to the site. This in particular makes it possible to save maintenance costs by ensuring that technicians go to the intervention site with the defective part and make it possible to be prepared for the type of breakdown detected. The remote information processing assembly of the machine also advantageously makes it possible to avoid  
15 travel by a technician when the machine is not broken, but rather is not being used correctly by the user. In fact, such cases of needless travel may represent up to 60% of a technician's intervention travel. The proposed assembly also makes it possible to determine in advance what possible breakdowns may occur in the future. In this way, it is possible to anticipate potential breakdowns and intervene while the user does not  
20 yet know that the occurrence of a problem on the machine is imminent. The proposed assembly also makes it possible to improve the speed of the intervention, which is particularly useful to resolve problems on master parts of the machine, such as the compressor.

Figure 3 shows one possibility for cabling of the machine with the control  
25 unit 80. The control unit 80 is thus connected to various devices or members of the machine making it possible to centralize information for the user, on the LCD screen 82, or for a maintenance center via the information transmission device, allowing operation of the system under remote monitoring.

The fan 28 can be chosen from among three types of fans: the centrifugal fan,  
30 the helical fan, and the tangential fan.

The centrifugal fan has the advantages of a high dynamic pressure, which is necessary to maintain a constant air flow rate through the device 30 (the air filter and the exchangers: the evaporator 32 and the condenser 36), a reasonable noise level, an acceptable price, and a good lifetime.

35 The tangential fan has the advantages of a long lifetime and dynamic pressure.

The helical fan has the advantages of a small bulk, a wide variety of prices and availability. It can thus easily be chosen to push the air to the inside of the device or suction the air inside the device. The helical fan is preferred for the embodiment of the extraction device 30.

5        The evaporator 32 can be made up of four rows of tubes whereof the diameter is  $\frac{3}{8}$  of an inch, or 0.9525 cm. The evaporator 32 preferably includes fins to increase the heat exchange surfaces between the air flow and the heat exchange fluid. A maximum amount of air is thus in contact with the cold walls, and dehumidification is optimized.

10        The pitch of the fins may be 1.6 mm. The heat transfer fluid may be distributed in three locations. The cold heat transfer fluid is thus distributed in the same manner in the top, middle, and lower parts. In this way, the entire surface of the whole evaporator 32 is cooled at the same time. The circulation of the fluid is provided countercurrent to the air. The fluid outlet can be formed in the top part to  
15        prevent liquid from the compressor 34 from returning into the evaporator 32. To improve the industrialization of the machine, it is possible to assemble the evaporator 32 and the condenser 36 on the same plate.

      The compressor 34 can be chosen to strike a compromise between the desired power to sufficiently cool the air flow at the evaporator 32 and preventing it from  
20        cooling too much. The compressor 34 can be chosen from the group consisting of a piston compressor, a scroll compressor, and a rotary compressor.

      The piston compressor is the most common. It is cost-effective, quiet, and has a small bulk heightwise. The scroll compressor or spiral compressor has the advantages of a high output, a variable speed, and therefore a variable flow rate of  
25        the heat transfer fluid. The rotary compressor has the advantage of being affordable, having an average output, variable speed and flow rate, and a small bulk widthwise. The rotary compressor is preferred due to its good output, in addition to its affordable price. Lastly, the available powers for this type of compressor correspond to the subtle balance to be struck at the evaporator 32, to come as close as possible to the  
30        dew point, not too hot and not too cold. Its bulk corresponds to limited space, allowing easier implementation of the system in the machine. It is also mechanically strong.

      The condenser 36 may be made up of three rows of copper tubes whereof the diameter is  $\frac{3}{8}$  of an inch, or 0.9525 cm. Preferably, the circulation of the heat  
35        transfer fluid is done countercurrent to the air flow. The heat transfer fluid inlet is then in the top part of the condenser 36, and the output is in the lower part of the condenser 36.

The heat dissipated at the condenser is that captured by the evaporator plus the heat from the mechanical work of the compressor.

The diameter of the tube corresponds to the power of the compressor 34 and ensures a suitable circulation speed of the fluid and the oil all along the travel of the  
 5 heat transfer fluid. The condenser 36 preferably includes fins to increase the exchange surface between the fluid and the air. The fins are preferably made from aluminum. The pitch of the fins may be 1.6 mm. The tighter the pitch, the greater the heat exchange.

The different members along the travel of the heat transfer fluid may be  
 10 connected to each other by copper tubes with a diameter of 1/4 inch, or 0.635 cm, for the high-pressure (HP) part of the travel, and 3/8 of an inch, or 0.9525 cm, over the low pressure (BP) part of the travel. Pressure taps may also be provided on that travel: one HP pressure tap and two BP taps on that travel (one for the heat transfer fluid charge and one for the pressure switch 48).

15 The heat transfer fluid is preferably the R407C fluid. In that case, the heat transfer fluid charge is preferably 650 g.

According to one embodiment the refrigeration circuit, refrigeration circuit includes one of the following features, alone or combined with others:

- a compressor with a cooling capacity of 300 W, rotary, 220 V AC 50 Hz,  
 20 R134A;
- a grid-type static condenser;
- a dehydrator made from weld copper;
- a capillary expander with a diameter of 1.2 mm made from copper, and 1.5 m long;
- 25 - a copper static evaporator with a diameter of one quarter inch, or 0.65 cm, wound around the cylindrical storage tub 60 made from stainless steel, the evaporator being 5 m long;
- a polyurethane foam insulation, 13 mm thick wound in two plies;
- a charge of 170 g of R134A as refrigerant;
- 30 - a pressure switch, at the low pressure level of the refrigeration circuit, for the charge and monitoring the evaporation pressure and temperature.

According to one embodiment of the storage tub 60, it is round, it has a diameter of 15 cm, it is 22 cm high, and it has a capacity of 10 m. The bottom of the tub is slightly sloped to lead the water toward the suction of the filtration and prevent  
 35 part of the water from stagnating. It is made from stainless steel. A flat rectangular shape, forming a flat section, has been received over the entire height and a width of 4 cm. This part is pierced in several locations, for example six piercings, each

equipped with a nut and a locknut to seal them. These piercings are made with a diameter of 10 mm with a central piercing having a diameter of 20 mm:

- A copper thimble is welded on the first hole. It makes it possible to receive a temperature probe for the storage water. This probe is connected to the electronic circuit of the control unit 80 to transmit temperature information.

- The second hole, which is located next to the first (approximately 2 cm), is equipped with a brass connector of 3/4 inches, or 1.905 cm, to connect a 1/4 inch, or 0.65 cm, pipe, which is connected on the suction of the pump 56.

- The third hole at the center of the flat section receives a quartz tube, in which the ultraviolet lamp 58 is inserted. The tube and its lamp 58 penetrate inside the tub and soak in the storage water.

- The fourth piercing is located just above the third, approximately 10 cm. This piercing makes it possible to receive the discharge circuit of the pump water. It is preferable to situate it just above the ultraviolet lamp 58 so as to obtain maximum efficiency in the treatment of the water. The water then systematically falls on the ultraviolet lamp 58. It is therefore treated against antibacterial or microorganism developments.

- Still on the flat section of the storage tub 60, the fifth hole is located on top, close to the apex. It is equipped with a brass connector measuring 3/4 inches, or 1.905 cm, to connect a 1/4 inch, or 0.65 cm, pipe, making it possible to install the overflow sensor 62.

- The sixth piercing is located at the bottom left of the tub and spaced away from the second by approximately 10 cm. It receives the membrane level sensor 68.

The system may include forced operation and automatic operation modes. In reference to figure 3, the system may include a user interface 84, for example comprising buttons, to select the forced operation or automatic operation mode. The user interface 84 can also make it possible to control the solenoid valve 78 and/or the pump 56, for example via the control unit 80, for water consumption by the user. The user interface 84 can also allow the user to obtain sequential information on the operating state of the machine, the water consumption, or the water extraction performance recorded by the control unit 80 over time.

Figure 4 shows a flowchart of the operation of the system in forced operation and automatic operation modes. The system whereof the flowchart is shown in figure 4 comprises a 12 liter storage tub 60.

During forced operation, the control unit 80 only orders a stop when the storage tub 60 is full.

During automatic operation, the control unit 80 optimizes the extraction of water contained in the air. A minimum stored water reserve can then be provided, for example one third of the volume of the storage tub 60, as shown by figure 4. When the minimum reserve is achieved, the control unit 80 orders the extraction of water  
 5 contained in the air if the outside temperature and hygrometry conditions are favorable to the extraction of water contained in the air. The extraction of water is continued until an extraction maximum is reached, determined as a function of the daily consumption by the user or set at the maximum capacity of the storage tub 60, as shown by figure 4.

10 Preferably, the control unit 80 delays the extraction of water contained in the air until nighttime, for example until midnight. For instance, if the conditions for making water are good, the water level is below the minimum threshold and it is 9 p.m. or later, the manufacture of water is delayed until midnight.

The delay can also be calculated as a function of the user's consumption. For  
 15 example, if the quantity of water in the storage tub 60 is greater than the user's daily consumption, the control unit 80 may delay the extraction of water until nighttime.

This delay of the extraction of water contained in the air makes it possible to maximally optimize the output of the system. In fact, the hygrometry level is higher at night than during the day. The system then fills the storage tub more quickly, and  
 20 therefore consumes less energy. Furthermore, the energy cost may be less expensive during those periods. The optimization is thus also economical.

The control unit 80 can order the opening of a solenoid valve for connecting to the tap water grid, in the case where the system cannot produce water. The control to open a solenoid valve may be subjected to a signal confirming the presence of  
 25 water in the tap water grid, for example by measuring using a pressure switch calibrated at 2 bars.

The control unit 80 can control the operation of the extraction device 30 for a minimum amount of time. Thus, if, just after starting the operation of the extraction device 30, the conditions are no longer favorable, the control unit 80 controls the  
 30 operation for a period of three minutes, for example. This makes it possible to avoid a series of starts and stops of the device 30 that are too close together in time. Likewise, when the stop of the device 30 has been controlled by the control unit 80, the software can be maintained for a minimum period of time, for example three minutes.

35 The system can have threshold operating conditions, below which the control unit 80 stops the extraction of water. For example, for an outside temperature of 15°C with a hygrometry level of 40%, for an outside temperature of 20°C with a

hygrometry level 29%, for an outside temperature of 25°C with a hygrometry level of 22%, for an outside temperature of 30°C with a hygrometry level of 16%, for an outside temperature of 35°C with a hygrometry level of 11.5%.

5 The control unit 80 controls the temperature of the heat transfer fluid entering the evaporator 32 as a function of the temperature of the air entering the device 30. It is thus possible to define a control curve of the evaporator 32 as a function of the temperature of the entering air. Such a curve for example includes the following points: for an entering temperature of 15°C, a control temperature of 5°C; for an entering temperature of 20°C, a control temperature of 9.5°C; for an entering temperature of 25°C, a control temperature of 30°C; for an entering temperature of 30°C, a control temperature of 15.5°C; for entering temperature of 35°C, a committee temperature of 18°C.

15 The machine may include the device 88 for transmitting information remotely. The machine may also include a system for storing all of the information of the system such as:

- the number of liters of water manufactured per day,
- the temperature of the outside air and the hygrometry level,
- the cumulative number of liters of water manufactured and consumed,
- the pressure values of the compressor,
- 20 - the values of the pressure switch of the air filter,
- the operating time of the pump with the number of liters of filtered water to determine the replacement of the filters for treating water,
- the operating time of the UV lamps to determine when they must be changed,
- 25 - the occurrence of each power outage,
- the triggering of diagnostics, 12 diagnostic values for example being possible.

This information may be recorded at least three times per day on a 30 day loop. However, it may be preferable to keep the information on the occurrence of power outages or diagnostic triggering.

**TABLE**

|                           | Inlet air temperature 25° |                  | Inlet air temperature 30° |                  | Inlet air temperature 35° |                  | Progression of the output |
|---------------------------|---------------------------|------------------|---------------------------|------------------|---------------------------|------------------|---------------------------|
|                           | Traditional system        | Inventive system | Traditional system        | Inventive system | Traditional system        | Inventive system |                           |
| Hygrometry level 40%      | 0.45                      | 0.56             | 0.49                      | 0.53             | 0.65                      | 0.79             | 18.05%                    |
| Hygrometry level 50%      | 0.52                      | 0.61             | 0.78                      | 0.91             | 0.92                      | 1.1              | 17.85%                    |
| Hygrometry level 60%      | 0.754                     | 0.904            | 0.94                      | 1.1              | 1.05                      | 1.1              | 13.89%                    |
| Hygrometry level 70%      | 0.972                     | 1.17             | 1.14                      | 1.24             | 1.27                      | 1.52             | 16.28%                    |
| Hygrometry level 80%      | 1.21                      | 1.37             | 1.34                      | 1.54             | 1.52                      | 1.83             | 16.18%                    |
| Progression of the output | 19.05%                    |                  | 13.11%                    |                  | 17.19%                    |                  | 16.45%                    |

5 Table I: Output progression between the inventive system and a traditional system

**CLAIMS**

1. A device (30) for extracting water contained in the air by means of condensation, the device (30) comprising:
  - 5           - a fan (28) for creating an air flow;
  - a heat transfer fluid evaporator (32) for condensing the water in the air flow created by the fan (28); and
  - a compressor (34) for compressing the heat transfer fluid evaporated by the evaporator (32), which compressor (34) is placed in the air flow downstream
  - 10          of the evaporator (32).
  
2. The device according to claim 1, wherein the fan (28) pushes the air flow onto the evaporator (32).
  
- 15   3. The device according to claim 1 or 2, comprising a sealed pipe for the air flow created by the fan (28), the pipe channeling the air flow between the fan (28), the evaporator (32) and the compressor (34).
  
4. The device according to one of claims 1 to 3, comprising:
  - 20           - a heat exchange fluid condenser (36) for condensing the fluid compressed by the compressor (34);
  - a heat exchange fluid inlet upstream of the evaporator (32);
  - a heat exchange fluid outlet downstream of the condenser (36);
  - the heat exchange fluid inlet and outlet being provided to be connected to a
  - 25          circuit (42, 44, 48) returning the heat exchange fluid from the outlet toward the inlet.
  
5. The device according to one of claims 1 to 3, comprising:
  - a condenser (36) for condensing the fluid compressed by the compressor (34);
  - 30           - a dehydrator (42) for dehydrating the fluid condensed by the condenser (36) downstream of the condenser (36);
  - an expander (44) for expanding the fluid dehydrated by the dehydrator (42);
  - a pressure switch (48) for determining the clogging of the dehydrator (42)
  - 35          as a function of the pressure of the heat transfer fluid expanded by the expander (44).

6. The device according to one of claims 1 to 5, the device being arranged in a block adapted to be installed interchangeably, in a system for producing drinking water from the air.

5 7. A system for producing drinking water from the air, comprising:

- a device (30) for extracting water contained in the air according to one of claims 1 to 6,
- sensors (86) for measuring the temperature and the hygrometric degree of the air outside the system,
- 10 - a control unit (80), controlling the extraction of water contained in the air as a function of temperature and hygrometry measurements provided by the sensors (86).

15 8. The system according to claim 7, the device (30) for extracting water contained in the air comprising a heat transfer solenoid valve (40) between the evaporator (32) and the compressor (34), for selectively returning heat transfer fluid upstream of the evaporator (32), the solenoid valve (40) being controlled to adjust temperature of the evaporator (32).

20 9. The system according to claim 7 or 8, including a filter (46), the filter (46) comprising a portion for physical filtering of the air flow and a portion for sanitary treatment of the air flow, the sanitary treatment portion being chosen from among the group made up of the physical filter treated to avoid bacterial or microbial development, a plasma filter, and an ultraviolet light-emitting diode filter.

25

10. The system according to one of claims 7 to 9, also including:

- a collection tub (38) for collecting the extracted water, the collection tub (38) collecting the extracted water by gravity;
- a storage tub (60) for storing the water collected by the collection tube (38);
- 30 - a pump (56) for pumping the water stored in the storage tub (60);  
the pump (56) being provided for consumption of the stored water by a user, the actuating time of the pump (56) determining a pumped volume of water;  
the control unit (80) controlling the extraction of water contained in the air by  
35 the extraction device (30) as a function of the volume of water pumped for consumption.

**11.** The system according to claim 10, also including a refrigeration circuit (64, 66) for the water stored in the storage tub (60), the refrigeration circuit comprising:

- a heat exchanger (64) outwardly wound on the storage tub (60) for refrigeration of the stored water;
- 5        - the rest (66) of the refrigeration circuit to provide the heat exchanger (64) with the heat transfer fluid with a temperature lower than the stored water.

**12.** The system according to claim 10 or 11, also including a set of filters (70) for treating the stored water, the set of filters (70) including at least one filter chosen  
10        from among the group made up of a sediment filter (72), a compressed activated carbon filter (74), and an ultrafiltration membrane (76), the set (70) of filters filtering the water pumped by the pump (56).

**13.** The system according to claim 12, also including:

- 15        - a discharge circuit, in the storage tub (60), for the water filtered by the set (70) of filters;
- a solenoid valve (78) for switching the filtered water between the discharge circuit and a consumption circuit for consumption of the filtered stored water by the user.

20

**14.** The system according to one of claims 10 to 13, the system including an ultraviolet lamp (58), for the sanitary treatment of the water stored in the storage tub (60).

25        **15.** A machine for producing drinking water from the air, the machine including:

- the system for producing drinking water from the air according to one of claims 10 to 14, divided heightwise into three parts, including a lower part including the storage tub (60), an intermediate part including the extraction device (30), and an upper part including the control unit (80);
- 30        - a structure including hollow plastic tubes for the passage of cables of the system to the different parts of the machine.

**16.** The machine according to claim 15, including a device (88) for remotely transmitting information to centralized information storage on the server or a remote  
35        troubleshooting unit, the remote communication device (88) including a remote communication member chosen from among the group made up of a

transmitting/receiving carrier current outlet, GPRS transmitter/receiver, WIFI transmitter/receiver.

- 5     **17.** An assembly for remotely processing information on a machine for producing drinking water, the assembly including:
- the machine according to claim 15, the control unit of which includes a member collecting data on the operating and malfunction state of the machine;
  - a device for remotely transmitting information, the device being outside the machine and provided to communicate by carrier current with the data collection member, the device including a modem for remotely sending data collected by the collection member and received by the device;
  - software for processing the data transmitted by the transmission device using the modem.
- 10
- 15     **18.** A method for remotely processing information from a machine for producing drinking water using the preceding processing assembly according to claim 17, the method including:
- data collection on the operating and malfunction state of the machine by the data collection member of the machine;
  - communication to the transmission device, via carrier current, of the data collected by the data collection member;
  - remote data transmission by the transmission device via its modem, the data being processed by the processing software.
- 20
- 25     **19.** The processing method according to claim 18, the method also including, after processing of the data transmitted remotely, the adaptation of the control from the machine by sending instructions to adapt the control from the machine to the transmission device for transmitting the information remotely.