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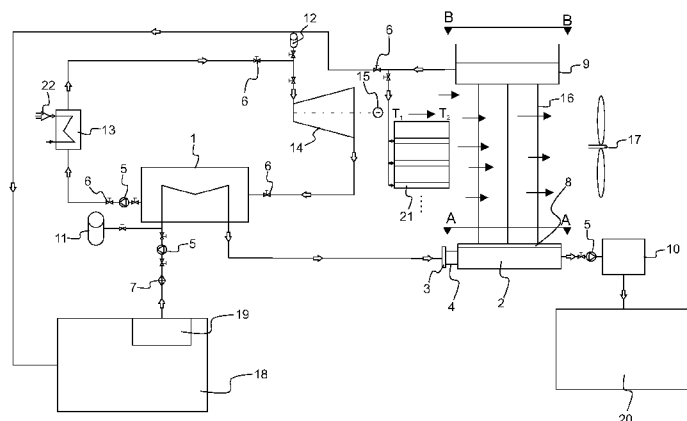
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(54) Title: AERIAL WATER GENERATION SYSTEM

Figure 1



(57) Abstract: The invention relates to an aerial water generation system for producing water from water taken from the sea (18) with the help of air. The inventive aerial water generation system is an integrated system. In addition to the production of water from the air, the electricity to be consumed by the system can also be supplied separately.

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AERIAL WATER GENERATION SYSTEM

Technical Field

The invention relates to an aerial water generation system for producing water
5 from water taken from the sea with the help of air. The inventive aerial water generation system is an integrated system. In addition to the production of water from the air, the electricity to be consumed by the system can also be supplied separately.

Prior Art

10 Effective use of water, one of the most critical elements of life in the world, is gaining importance day by day. With the non-stop increase in population and climate changes; both the rate of consumption and utilisation of water resources have been the subject of discussion. One of the studies that can bring solutions to these issues is the realisation of natural water production methods.

15 In the International patent document numbered WO2020095327A1 in the state of the art, an automatic atmospheric water generator for the production of high quality water for drinking and biomedical applications is disclosed.

In the Chinese patent document numbered CN115467392A in the state of the art, an energy-saving water generator is disclosed.

20 The Chinese utility model document numbered CN2333432Y in the state of the art discloses a device that uses low-temperature seawater in the deep sea as a condensing medium and collects the humidity of humid air condensed by a condenser into fresh water.

When the existing studies in the technique were examined, it was necessary to
25 develop a water generation system that provides water production with the help of

air over the water taken from the sea and allows the production of water from the air as well as the electricity to be consumed by the system.

Object of the Invention

5 The object of the present invention is to realise an aerial water generation system that enables the production of water from water taken from the sea with the help of air and allows the generation of electricity to be consumed by the system in addition to the production of water from the air.

10 A further object of the present invention is to realise an aerial water generation system for the production of potable water without the use of any fuel and electricity.

A further object of the present invention is to realise an air-to-water generation system in which water is produced by obtaining saturated gas vapour from seawater.

Detailed Description of the Invention

15 The aerial water generation system realised to achieve the object of the present invention is shown in the accompanying figures.

These figures are;

Figure 1: A schematic view of an aerial water generation system according to the invention.

20 **Figure 2:** A cross-sectional view of section A-A (as viewed from above) of a water trough I in the air water generation system according to the invention.

Figure 3: A cross-sectional view of the B-B section (viewed from above) of the water trough II in the air water production system of the invention.

Figure 4: The T-S diagram of the gas vapour mixture in the pool section in the inventive system.

The parts in the figures are numbered one by one and the corresponding definitions of these numbers are given below.

- | | |
|----|------------------------|
| 5 | 1. Condenser I |
| | 2. Condenser II |
| | 3. Main collector |
| | 4. Auxiliary collector |
| | 5. Pump |
| 10 | 6. Valve |
| | 7. Non-return valve |
| | 8. Trough I |
| | 9. Trough II |
| | 10. Field |
| 15 | 11. Reservoir I |
| | 12. Reservoir II |
| | 13. Heater |
| | 14. Turbine |
| | 15. Alternator |
| 20 | 16. Condenser pipes |
| | 17. Aspirator |
| | 18. Sea |
| | 19. Filter |
| | 20. Dam lake |
| 25 | 21. Pool |
| | 22. Axial compressor |

T₁: Gas vapour mixture pool inlet temperature

T₂: Gas vapour mixture pool outlet temperature

T_{DP}: Dew point temperature

The invention relates to a water generation system for producing water from water taken from the sea (18) with the help of air, comprising

- 5 - a non-return valve (7) which ensures that the water taken from the sea (18) is carried in one direction,
- a main collector (3) for collecting the water from a condenser I (1),
- an auxiliary collector (4) connected to the main collector (3),
- the condenser I (1) to which the water received through the non-return
10 valve (7) is transmitted with the help of a pump (5) and which condenses the received water,
- a condenser II (2) to which the water from the condenser I (1) is transmitted and which condenses the water again,
- condenser tubes (16) positioned vertically on the condenser II (2),
- a water trough II (9) through which the water passing through the
15 condenser pipes (16) is transmitted,
- a water trough I (8) positioned above the condenser II (2) and into which the water particles formed on the condenser tubes (16) are filled,
- a field (10) through which water in the water trough I (8) is conveyed and which enables the conveyed water to be enriched with minerals,
- 20 - an aspirator (17) positioned to draw air over the condenser tubes (16,) causing droplets to form on the condenser tubes (16).

In order to generate the electricity required for the system, the system according to the invention further comprises;

- 25 - a heater (13) connected to the condenser I (1) for heating the fluid passing through it,
- an axial compressor (22) connected to the heater (13), which heats the fluid liquid in the heater (13) using atmospheric air,
- turbine (14) connected to the heater (13) and producing work,

- alternator (15) connected to the turbine (14) and generating alternating current.

In the system according to the invention, the pump (5) is positioned between the check valve (7) and the condenser I (1), the condenser I (1) and the heater (13) and the water trough I (8) and the field (10). They provide water pumping in these sections.

In addition, the refrigerants required for the operation of the inventive system are filled into a reservoir I (11) and a reservoir II (12) to be used for initial start-up. In the system, the reservoir I (11) is positioned at the inlet of condenser I (1) and the reservoir II (12) is positioned at the inlet of turbine (14). There are also valves (6) in the system to control the water flow. The valves (6) are located at the inlet and outlet of the pumps (5) positioned between the non-return valve (7) and the condenser I (1), between the condenser I (1) and the heater (13) and between the water trough I (8) and the field (10) to control the flow in these areas.

In the aerial water generation system according to the invention, water is taken into the system from approximately 1000 m depth of the sea (18). The water taken from the sea (18) is first passed through a strainer (19) in order to prevent pollution that may occur during the water intake from the sea (18). The temperature of the water at this depth is +4 °C. The water is taken into the system firstly by non-return valve (7) and then by pump (5) through pipes with insulated outer walls and enters into condenser I (1). The water taken from the sea (18) and the ammonia or refrigerants (R134a etc.) in the condenser I (1) are cooled and condensed. The refrigerant coming out of the condenser I (1) is transmitted to the heater (13) with the help of a pump (5). The fluid entering the heater (13) is heated here by the temperature of the air of the axial compressor (22). The heating described herein is provided by an axial compressor (22). The compression ratio of the axial compressor (22) used is about 1.50. Thanks to the axial compressor (22), the efficiency is increased by 4.5 % in hot weather and by 10 % in cold weather compared to the existing systems in the art.

Then, the turbine (14) expands and does work and turns the alternator (15) connected to the shaft of the turbine (14). Alternating current is generated by the alternator (15). The exhaust gas from the turbine (14) enters the condenser I (1). Here it is cooled and condensed with cold water from the sea (18). The condensed
5 liquid is pumped back into the system with the help of a pump (5). In this way, the energy required for the water generation system will be obtained.

As shown in Figure 1, there are covered and completely isolated pools (21) in the system. Pools (21) are isolated from the outside. The level control in the pools (21) is provided by floats. The atmospheric air sucked by the aspirator (17) enters
10 the pool (21) from one end of the pool (21) and exits from the other end. The temperature of the gas vapour mixture will be T_1 at the inlet side and the temperature of the gas vapour mixture will be T_2 at the outlet side. The gas vapour mixture will drag the vapour on the liquid as it passes through the pool (21). In this case, the liquid will produce vapour. Here, the atmospheric air also reduces
15 the temperature of the liquid and the gas vapour mixture. Thus, the gas vapour mixture output will be saturated gas vapour mixture. Therefore, the temperature of the mixture has decreased. T_2 temperature will be cooled and saturated. With this method, the gas vapour mixture becomes saturated by completing each other. The saturated gas vapour mixture is sent to the condenser pipes (16) in a closed
20 manner so that it does not come into contact with atmospheric air.

The process of adiabatic saturation of the gas vapour mixture in the pool (21) section is described below.

Since there is a loss of liquid due to continuous evaporation in the pool (21), the pool (21) is continuously fed with sea water. Part of the energy required for
25 evaporation is supplied from the gas vapour mixture and part from the liquid mass in the pool (21). Therefore, the outlet temperature T_2 of the mixture is always smaller than the inlet temperature T_1 .

The gas-vapour mixture is transferred to the condenser tubes (16) in contact with the vapour liquid in the elongated pool (21), which is insulated from the outside. The mixture enters the pool (21) (adiabatic saturator) at temperature T_1 and in an unsaturated state and exits therefrom at temperature T_2 and in a saturated state.

- 5 The temperature T_2 here is called adiabatic saturation temperature. As can be seen in Figure 4, the adiabatic saturation temperature (T_2) is greater than the dew point temperature (T_{DP}) at constant pressure.

- Normally, water production in atmospheric air can be achieved without the use of a pool (21). It depends entirely on the relative humidity of the air. The higher the
10 relative humidity, the higher the amount of water obtained. The water production efficiency was tried to be increased by adding the pool (21) system.

- If the water in the pools (21) runs continuously, salt will accumulate. The bottom of the pools (21) may be designed in such a way that this salt can be easily collected. Afterwards, these salts accumulated in the pools (21) can be cleaned
15 and the system can continue its operation.

- At the same time, the cold sea water (18) from the condenser I (1) enters the main collector (3) of the air to water production system. This main collector (3) is divided into the auxiliary collectors (4). The auxiliary collectors (4) enter the vertical condenser pipes (16) with baffles. With the help of an aspirator (17)
20 standing perpendicular to the condenser pipes (16), moist pool air (21) is drawn to the pipe surfaces. When the water vapours in the air reach the dew point, water droplets are formed on the surfaces of the condenser pipes (16) in the form of perspiration. The speed of the aspirator (17) is below 5 m/s. These water droplets fall downwards from the surfaces of the condenser tubes (16) into the water
25 trough I (8). The water in the water trough I (8) is sent to the field (10) by means of a pump (5). In the field (10), the water is enriched by meeting the minerals in the field (10) with the downward flow. The water, which has a drinking consistency, is then discharged into the city dam lake (20). From the dam, it is

distributed to the city network. The necessary minerals are added to this water according to the need, that is, according to the drinking or usage water status.

The sea water (18) coming out of the condenser pipes (16) heats up and fills the water trough II (9). From here, it returns to the sea (18) by its own gravity. Thus,
5 the system is fully operational. The system works with the Rankine cycle principle.

When installing the system according to the invention, the aspirator (17) should operate from the sea (18) towards the land. In this way, since the environment is more humid, it will cause both heat transfer and more water condensation.

10 Normally liquids are in equilibrium with their vapour pressures. When the vapour on it is removed by some means, it will produce vapour again. A heat is needed to produce the vapour. This heat will be from the liquid itself. This means the following. The liquid will cool down.

CLAIMS

1. A water generation system for generating water using the water taken from the sea (18) with the help of air, characterized by comprising
 - a non-return valve (7) which ensures that the water taken from the sea (18) is carried in one direction,
 - a main collector (3) for collecting the water from a condenser I (1),
 - the condenser I (1) to which the water received through the non-return valve (7) is transmitted with the help of a pump (5) and which condenses the received water,
 - a condenser II (2) to which the water from the condenser I (1) is transmitted and which condenses the water again,
 - condenser tubes (16) positioned vertically on the condenser II (2),
 - a water trough I (8) positioned above the condenser II (2) and into which the water particles formed on the condenser tubes (16) are filled,
 - an aspirator (17) positioned to draw air over the condenser tubes (16,) causing droplets to form on the condenser tubes (16).
2. A water generation system for generating water using the water taken from the sea (18) with the help of air according the to claim 1, characterized by comprising an auxiliary collector (4) connected to the main collector (3).
3. A water generation system for generating water using the water taken from the sea (18) with the help of air according the to claim 2, characterized by comprising a water trough II (9) through which the water passing through the condenser pipes (16) is transmitted.
4. A water generation system for generating water using the water taken from the sea (18) with the help of air according the to claim 2, characterized by comprising a field (10) through which water in the water trough I (8) is conveyed and which enables the conveyed water to be enriched with minerals.

5. A water generation system for generating water using the water taken from the sea (18) with the help of air according any of the preceding claims, characterized by comprising

- 5 - a heater (13) connected to the condenser I (1) for heating the fluid passing through it,
- an axial compressor (22) connected to the heater (13), which heats the fluid liquid in the heater (13) using atmospheric air,
- turbine (14) connected to the heater (13) and producing work,
- 10 - alternator (15) connected to the turbine (14) and generating alternating current.

Figure 1

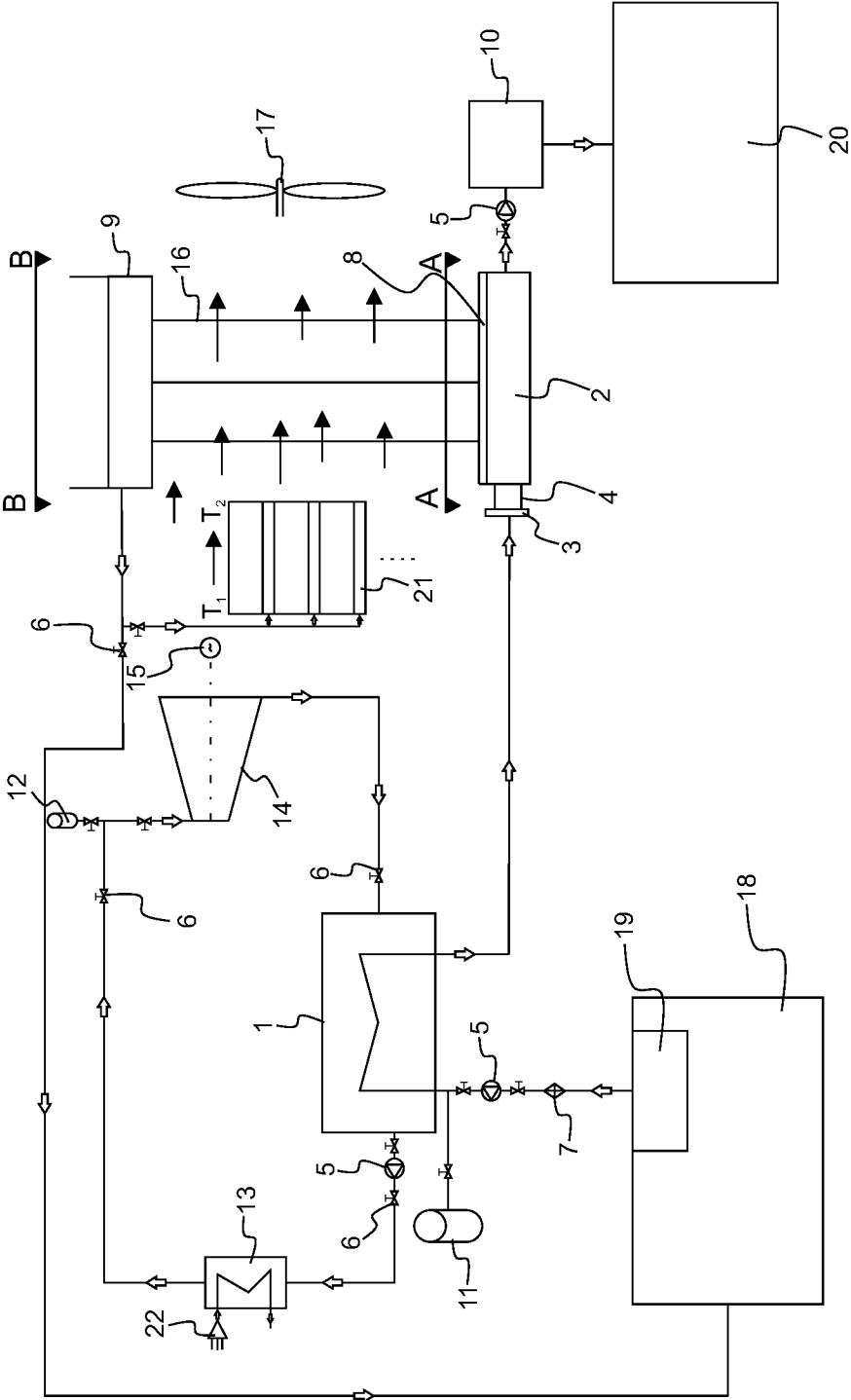


Figure 2

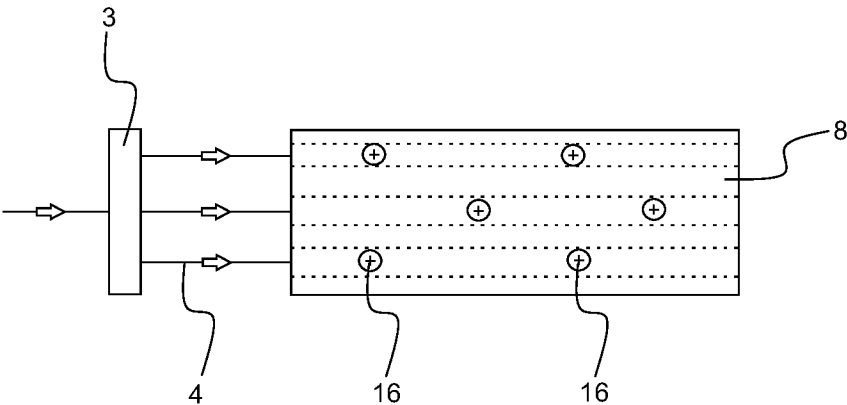
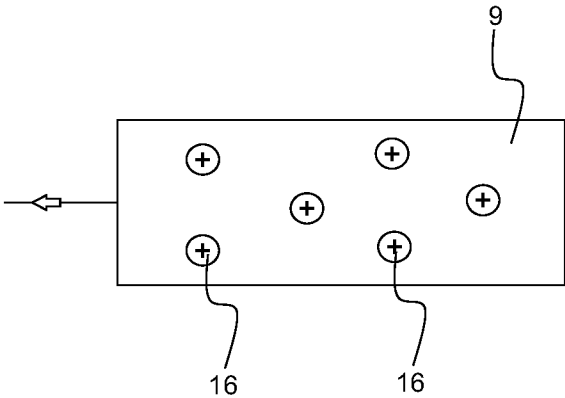
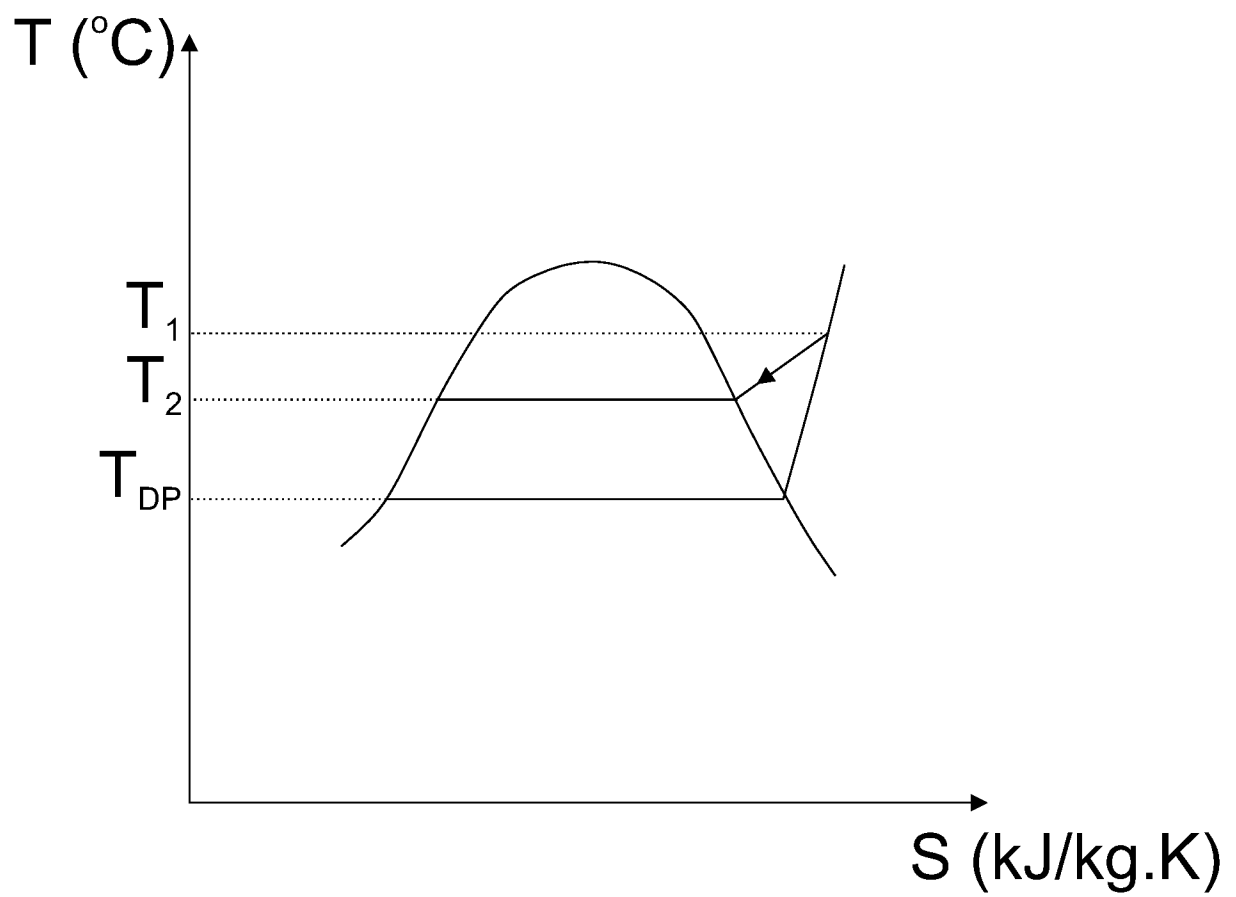


Figure 3



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Figure 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/TR2024/050812

A. CLASSIFICATION OF SUBJECT MATTER**E03B 3/00**(2006.01)i; **E03B 3/28**(2006.01)i; **B01D 5/00**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E03B; B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2023105476 A1 (CIRRUS REHOS RENEWABLE POWER AND WATER PTY LTD [ZA]) 15 June 2023 (2023-06-15) References 104, 122, 124, 150, 152, 154	1-5
X	WO 2007133771 A2 (MERRITT THOMAS [US]) 22 November 2007 (2007-11-22) Whole document	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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