



(12) **DEMANDE DE BREVET CANADIEN**
CANADIAN PATENT APPLICATION

(13) **A1**

(22) Date de dépôt/Filing Date: 2019/10/11

(41) Mise à la disp. pub./Open to Public Insp.: 2021/04/11

(51) Cl.Int./Int.Cl. *C02F 1/16* (2006.01),
C02F 1/04 (2006.01), *F02G 5/02* (2006.01),
F24S 20/40 (2018.01), *H02K 7/18* (2006.01)

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(54) Titre : TURBINES DE COGENERATION POUR LA PRODUCTION D'ENERGIE ET LE DESSALEMENT DE L'EAU
DE MER

(54) Title: COGENERATION TURBINES FOR POWER AND DESALINATION OF SEA WATER

(57) **Abrégé/Abstract:**

By using the gas turbine and closed cycle gas/(air or nitrogen) turbine in cascade way we can get the required heat for the heat exchanger chamber (for adding heat) in the closed cycle gas turbine, by using the heat diverted with exhaust gases from the open cycle gas turbine. Also we can get the heat from nuclear plant instead the open cycle gas turbine if it is available. When we get the very hot air to the heat exchanger chamber (for cooling the air) after leave the turbine in the closed cycle gas/air turbine, we use the sea water in multi heat exchanger to cool the air and use the heat make desalination of the sea water, so at the end we can produce fresh water and electricity by the open and closed gas turbine same time.

Abstract

By using the gas turbine and closed cycle gas/(air or nitrogen) turbine in cascade way we can get the required heat for the heat exchanger chamber (for adding heat) in the closed cycle gas turbine, by using the heat diverted with exhaust gases from the open cycle gas turbine. Also we can get the heat from nuclear plant instead the open cycle gas turbine if it is available. When we get the very hot air to the heat exchanger chamber (for cooling the air) after leave the turbine in the closed cycle gas/air turbine, we use the sea water in multi heat exchanger to cool the air and use the heat make desalination of the sea water, so at the end we can produce fresh water and electricity by the open and closed gas turbine same time.

Cogeneration Turbines for Power and Desalination of Sea Water

Background of the innovation

There are several inventions about desalination. All of it focused on getting the heat just from the sun (solar energy). It wouldn't produce a good quantity of fresh water and not steady supplying of energy because the limited time of the heat source (nights and cloudy days effect).

In my innovation I offer to use the open cycle gas turbine as the source of the heat and submit it to the closed cycle gas/air turbine, which need the heat in one phase of the close cycle (heat exchanger B2, B3).

After the very hot air leave the turbine (B4) it need to cool down before go to the compressor (B1). That usually done by the draft air in the second heat exchanger.

I offer to use the sea water throw multi heat exchangers (B6, B7, B8) in a way to make desalination for the sea water and cooling down the air of the closed cycle before enter the compressor (B1).

By this way the cogeneration of open and closed cycle gas turbines can produce electricity together and the closed cycle turbine can produce fresh water from the sea water same time.

I added a way to use the solar heat in cooperation with the heat form the open cycle gas turbine in (B3) of the heat exchangers as a second source of heat which could save some energy for the open cycle gas turbine.

Description of the process.

In the open cycle gas turbine (A) air enter to compressor (A1), than to combustion chamber (A2), than very hot high pressured gases from (A2) hit the turbine (A3), leaving the turbine as very hot exhaust gases.

These gases enter the first heat exchanger (B2) and go throw iron pipes, which divided to 2, 3 or more pipes inside the heat exchanging chamber with insulation around each.

Pipes leave the chamber and back to be one pipe again going to (B3).

The warm compressed air (or nitrogen) coming from (B3) going to chamber (B2) throw cupper tube which divided inside the chamber to coil tubes each inside one of the iron pipes. The coil tubes should be in the middle of the iron pipes with no touch to the pipe wall.

At the end of the pipes the coil tubes back to be connected again form one pipe goes out of B2 and the very hot compressed air goes to the turbine (B4).

The air and the very hot gases going in posit direction to each other.

In the chamber (B3) it is similar in design to chamber (B2) except that the air coming from the compressor (B1) to (B3) and leave to (B2) as a compressed warm or hot air in copper pipes and the partially hot gases coming in the copper coil tubes from (B2) going in the middle of each pipe in the chamber (B3) and leave from the other side to reconnected in one tube going to the exhaust.

Instead of direct insulations to the pipes it's packed with materials can get very hot by solar heat and transfer it to the tube where the flow at the air. These materials could be (lava stones or coal).

The outside wall of the chamber made of glass on the top and the two sides to attract sun rays in morning time which could be directed in by reflector mirrors. These glasses panels could cover by insulators after sun set till sun rise again. The bottom of the chambers is iron and has stays to supports the pipes and the pipes has supports to support the coil tubes inside as in the drawing (B3).

After the air left the turbine (B4) it goes to multi heat exchanger to cool down which use sea water to absorb the heat from the air (B6, B8) then the cool air goes to the compressor (B1) to start the cycle again.

The chamber (B6) as in the drawing, has multi sets of coil tubes getting the very hot air from (B4) going throw several coil tubes in the chamber (B6) and leave from there to forming one tube has warm air going to (B8).

A pipe bring the partially warm sea water from (B8) feeding several atomizers on the wall of the chamber(B6) to atomize the water as drops dropping in the chamber on the top of the sets of tubes which have the hot air inside.

Most of the drops evaporate by pulling the heat out from the air in the pipes and evaporate in form of gases going up to the curved dome of the chamber (B6) and guided out throw pipe to outside of the chamber by suction fan to (B7). The rest of the drops fall and gathering in the bottom of (B6) and going throw pipe to rejoin the warm water coming from (B7 and B8) to the atomizers again.

In the chamber (B8) it has sets of coil tubes immersed in the sea water which filled up the chamber (B8) totally and coming to the chamber from the bottom drive from the sea by water pump to the chamber and leave from the top of the chamber after getting warm and extracting the rest of the heat in the air and go to (B6). The air leave the chamber cool going to the compressor (B1).

In (B7) the hot water vapour in form of gases coming to the chamber from the side wall above the level of the formed fresh water. The hot gases going up throw the sets of pipes hanged up horizontally in the chamber and carried in direct sea water pushed by water pump.

The warm sea water leave the chamber (B7) in one pipe after exchanging the heat and cooling the water vapour during its trip going up make lots of vapour condensed and drop by gravity in the basin bottom of the chamber as fresh water and pulled out.

What left of the vapour going out from the top side of the chamber in a pipe to join the hot water vapour pipe and going again to the chamber to repeat the cycle.

Drawing symbols list

1. A: open cycle gas turbine

A1: compressor

A2: combustion chamber

A3: turbine

A4: generator

2. B: closed cycle gas/air turbine

B1: compressor

B2: heat exchanger (for adding heat)

B3: preheating heat exchanger (for adding heat)

B4: turbine

B5: generator

B6: heat exchanger (for pulling out heat)

B7: heat exchanger (desalination of sea water)

B8: preheating heat exchanger (for pulling out heat)

The Embodiments Of The Invention In Which An Exclusive Property Or Privilege Is Claimed Are Defined As Follows:

1. In the cogeneration turbines comprising the open cycle gas turbine and close cycle gas/air turbine for power and desalination of sea water, Wherein said the very hot gases diverted from the open cycle gas turbine, said or heat from nuclear plant, said will directed to be used in the heat exchangers (B2 and B3) said in the drawing of the closed cycle gas air turbine, said as a source of heat to added into the air, said of the close cycle gas/air turbine.

Wherein said after very hot air leave the turbine (B4 in the drawing) said goes to heat exchangers (B6 and B8 as in the drawing), said to be cooled down by sea water in these heat exchangers (B6 and B8).

Wherein said sea water evaporate and it's vapour, said directed to (B7 in the drawing), said to be cooled down by sea water, said to condensate and forming fresh water.

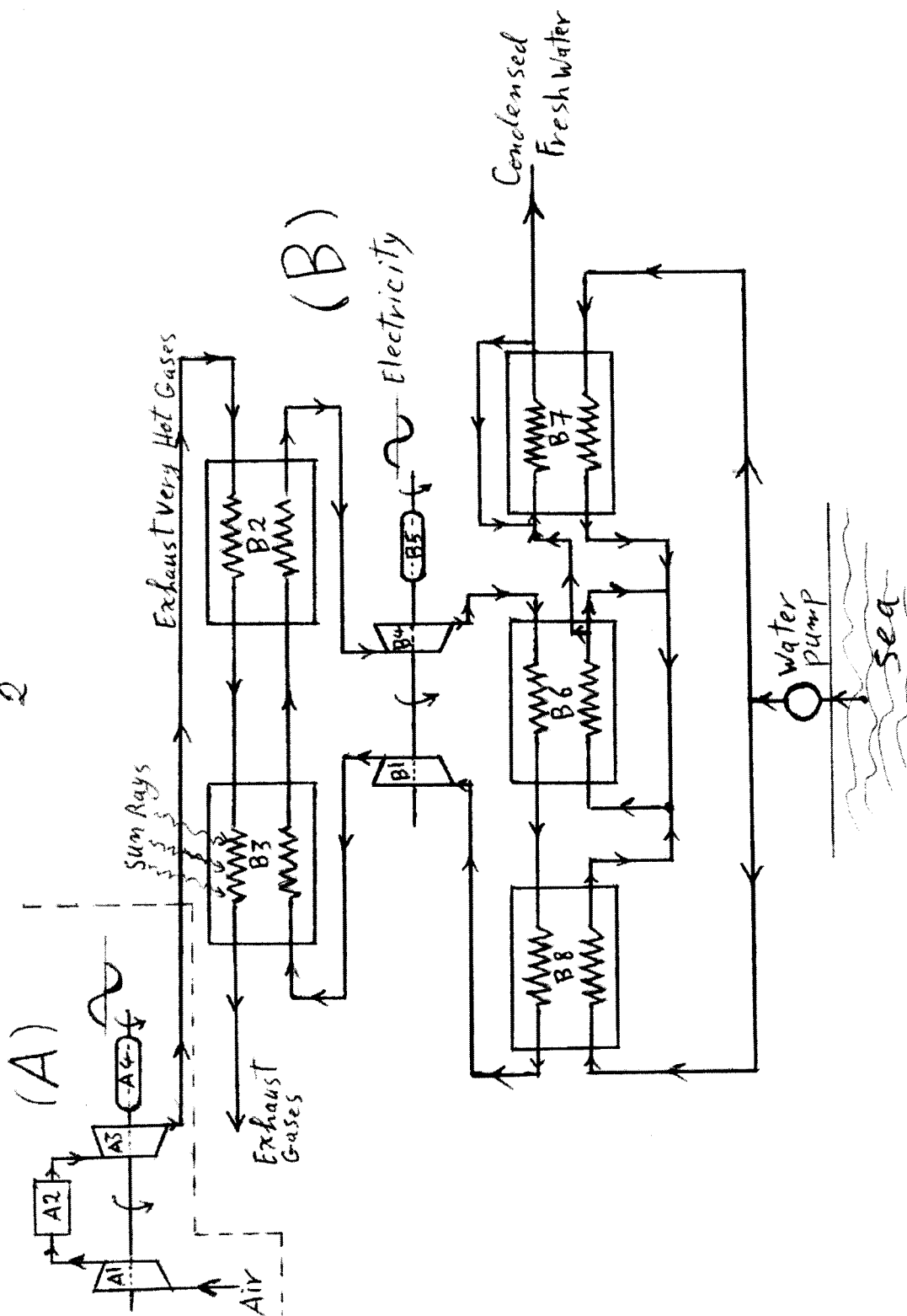
Wherein said the air cooled down in heat exchangers (B6 and B8 as in the drawing), said directed to the compressor (B1 as in the drawing), said to complete the cycle of the closed cycle gas/air turbine.

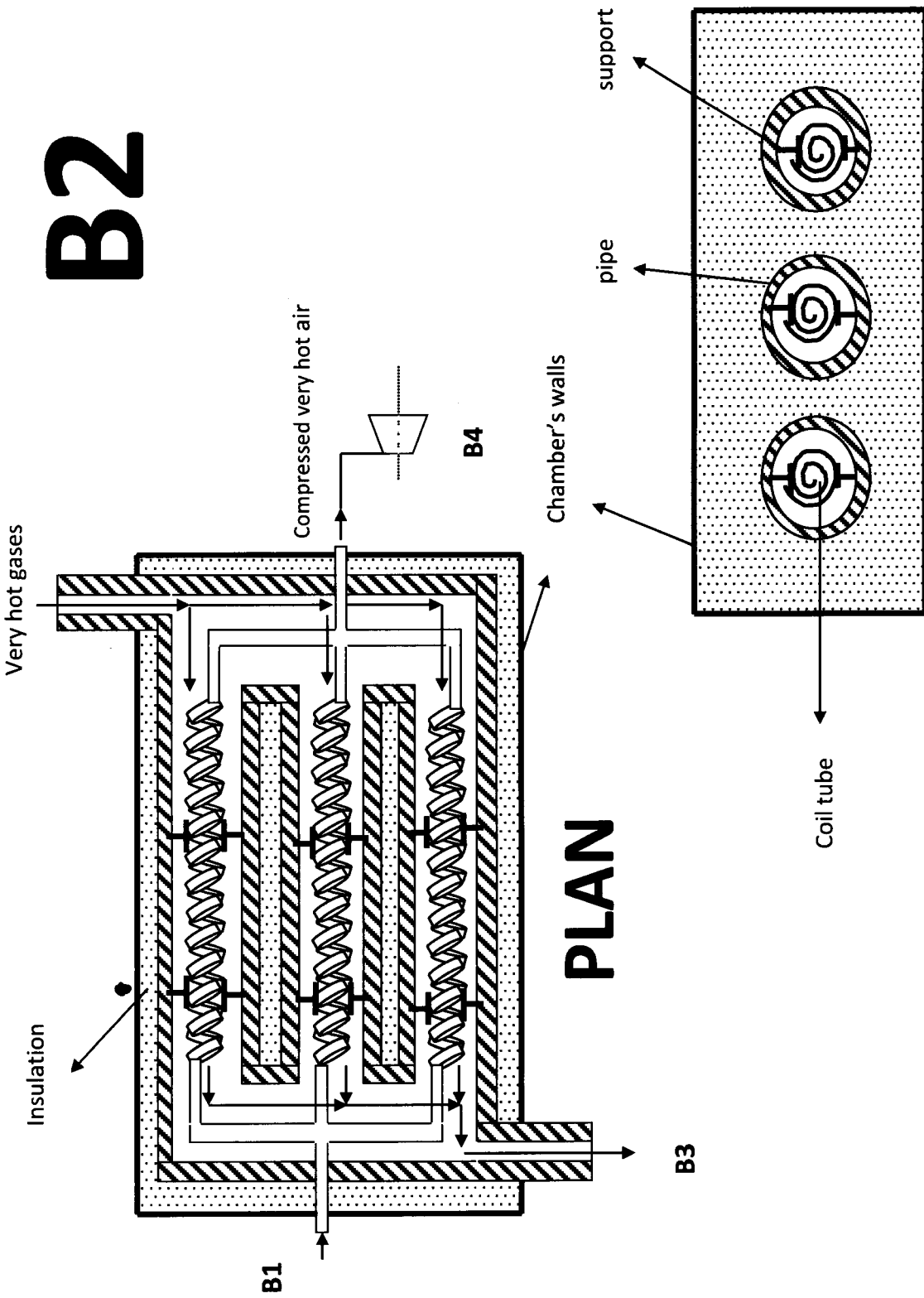
2. The cogeneration turbines for power and desalination of sea water in claim 1, wherein said the very hot gases produced by the open cycle gas turbine, said directed to be used in the heat exchanger (B2) said to give the heat needed to the air of the close cycle gas turbine.
3. The cogeneration turbines for power and desalination of sea water in claim 2, wherein said the heat exchanger of (B2) is an insulated chamber, said comprising multi pipes, said each pipe has very hot gases, said goes from the open cycle gas turbine throw the chamber of (B2) and out to (B3), said the air goes from (B3) to the pipes of the chamber of (B2), said inside cupper coil tube inside each pipe, said then out as a very hot compressed air going to the turbine (B4).
4. The cogeneration turbines for power and desalination of sea water in claim 1, wherein said the hot gases leave (B2) goes to (B3) chamber, said which is preheating heat exchanger, said it goes in coil tubes each inside one pipe of the multi pipes of the chamber (B3).
Wherein said the air which coming from the compressor (B1) to the chamber (B3), said air

goes in the pipes in the opposite direction of the hot gases in the coil tubes, said which going from (B3) to exhaust, said the air in the pipes goes to coil tubes in (B2).

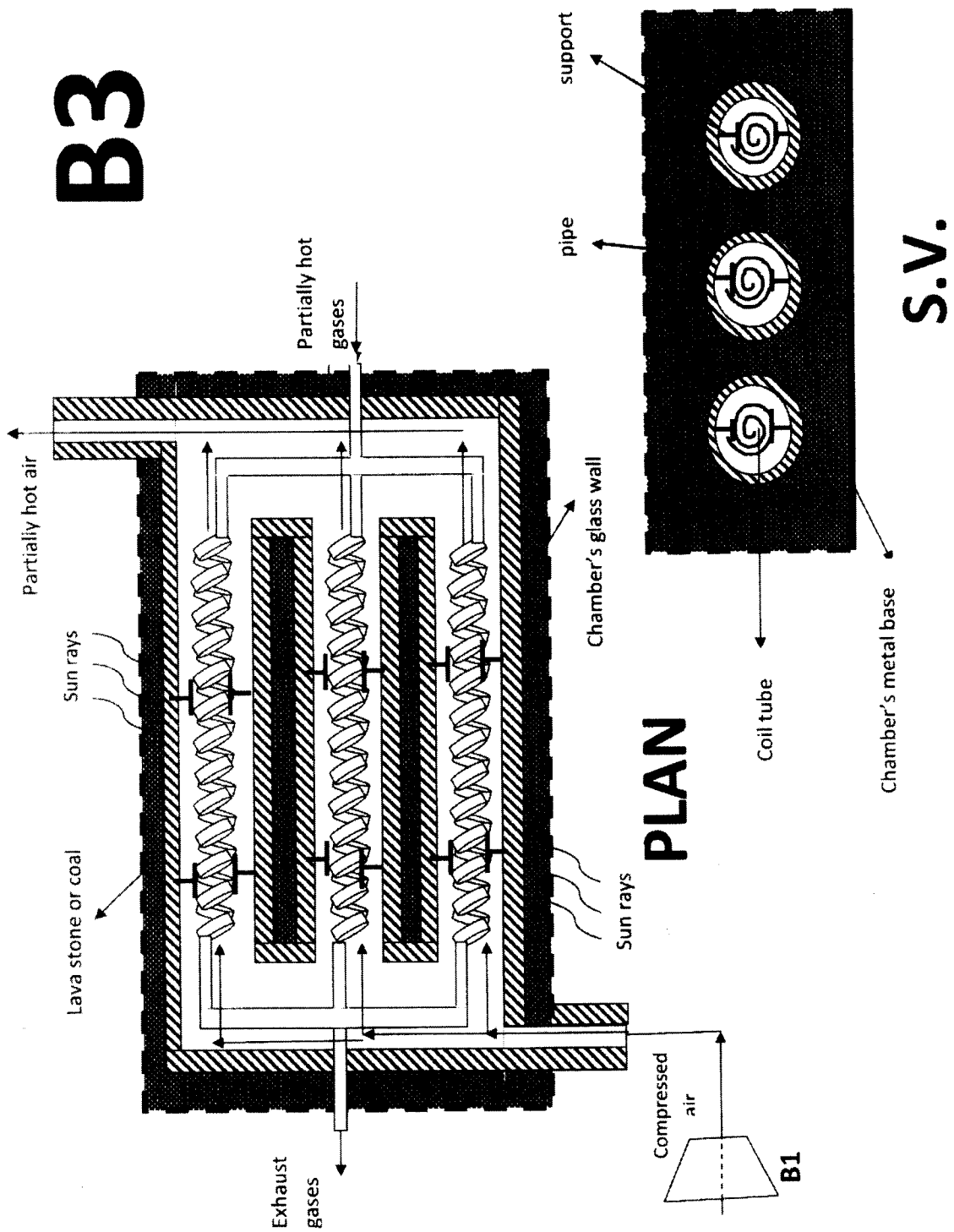
5. The cogeneration turbines for power and desalination of sea water in claim 4, wherein said instead of the insulations around the pipes like (B2), said the chamber (B3) packed around the pipes with materials can transfer the solar heat to the pipes of the air in (B3), said the walls and the top of the chamber B3 are glasses, said get the sun light directed to the chamber throw the glasses by set of mirrors, said to add more heat to the air in the pipes, said by using the solar heat.
6. The cogeneration turbines for power and desalination of sea water in claim 1, wherein said in heat exchanger (B6) very hot air coming from (B4) throw pipes inside the chamber (B6), said cooled down by warm sea water, said coming from (B8) and leave (B6) to recycle and enter again (B6).
7. The cogeneration turbines for power and desalination of sea water in claim 6, wherein said the sea water in the chamber (B6) atomized by atomizers on the walls of the chamber (B6), said fall down on the very hot air pipes, said part of the water evaporate up, said collected from the dome of (B6), said the vapour gases pulled out of (B6) by suction fan, said directed to (B7).
8. The cogeneration turbines for power and desalination of sea water in claim 1, wherein said the hot air from (B6) goes into chamber (B8) throw set of coil tubes and, said the cooled air goes out of (B8) to compressor (B1), said chamber (B8) comprising sets of coil tubes, said which air go throw it, said the tubes immersed in the sea water, said pumped directly from the sea by a pump to the bottom of the chamber (B8) and, said leave from the top of the chamber (B8) to (B6).
9. The cogeneration turbines for power and desalination of sea water in claim 1, wherein said heat exchanger (B7) comprising sets of pipes carrying the sea water, said pumped directly from the sea by a pump, said leaving (B7) to (B8).
10. The cogeneration turbines for power and desalination of sea water in claim 9, wherein said hot water vapour as goes into chamber (B7) from the side walls below the sets of tubes of sea water, said the vapour rising up throw the pipes, said most of the vapour should condensed and falling down as fresh water, said in the bottom of (B7), said collected out of (B7), said the rest of the vapour redirected into the bottom of the chamber (B7) again.

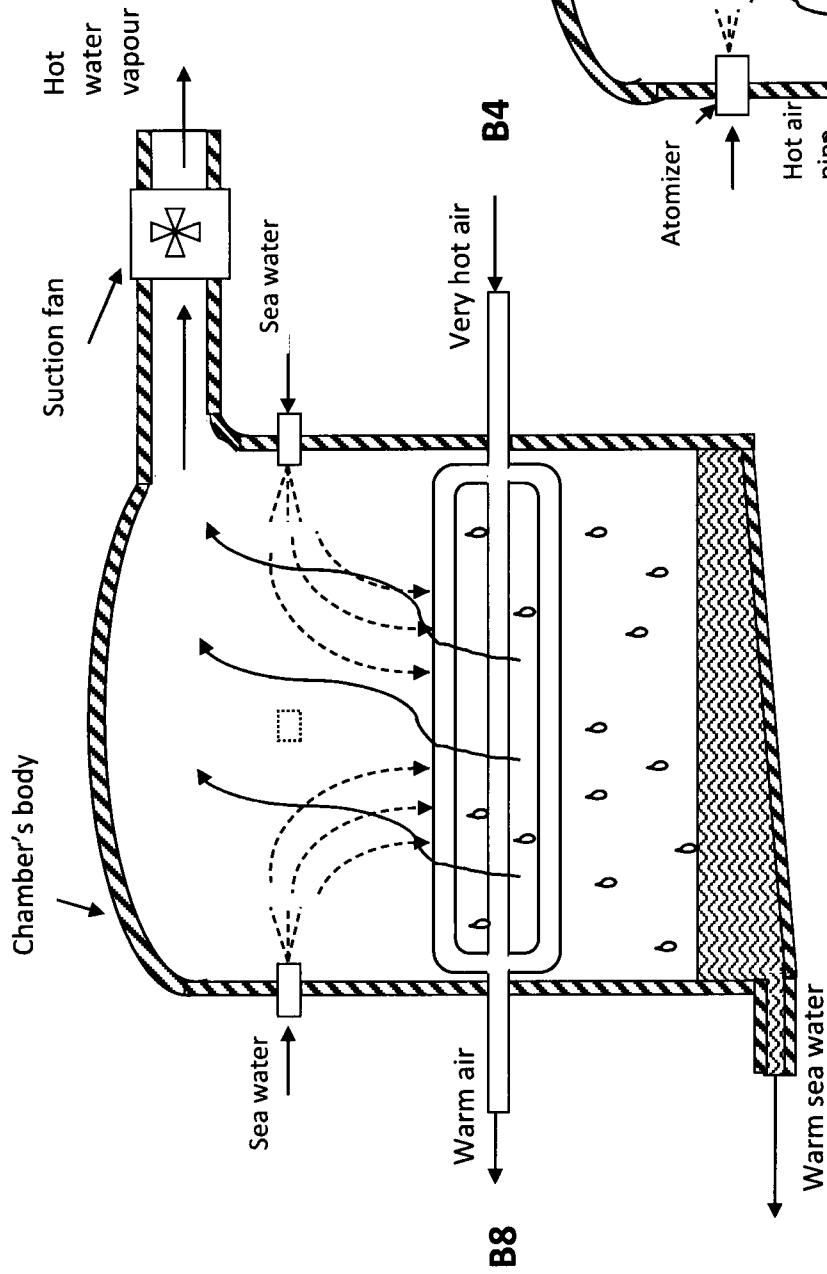
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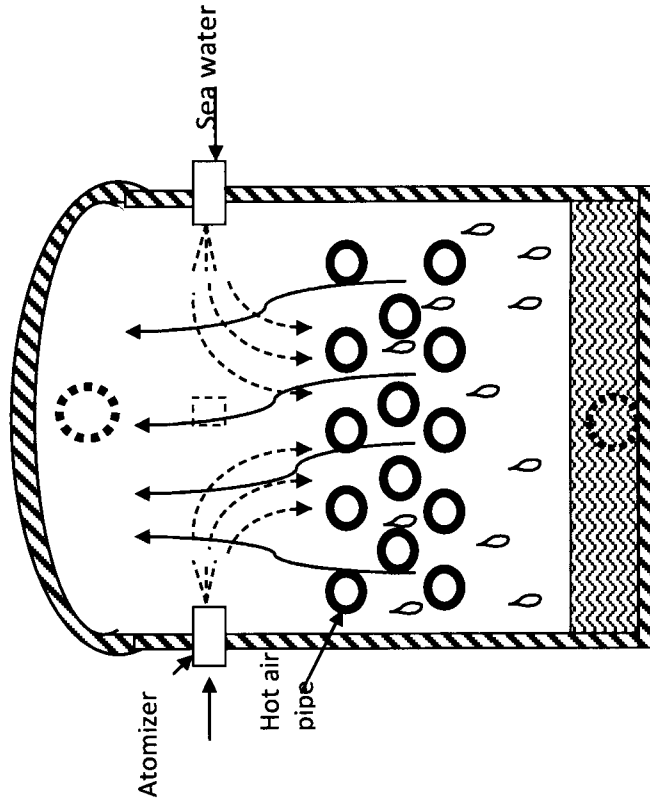


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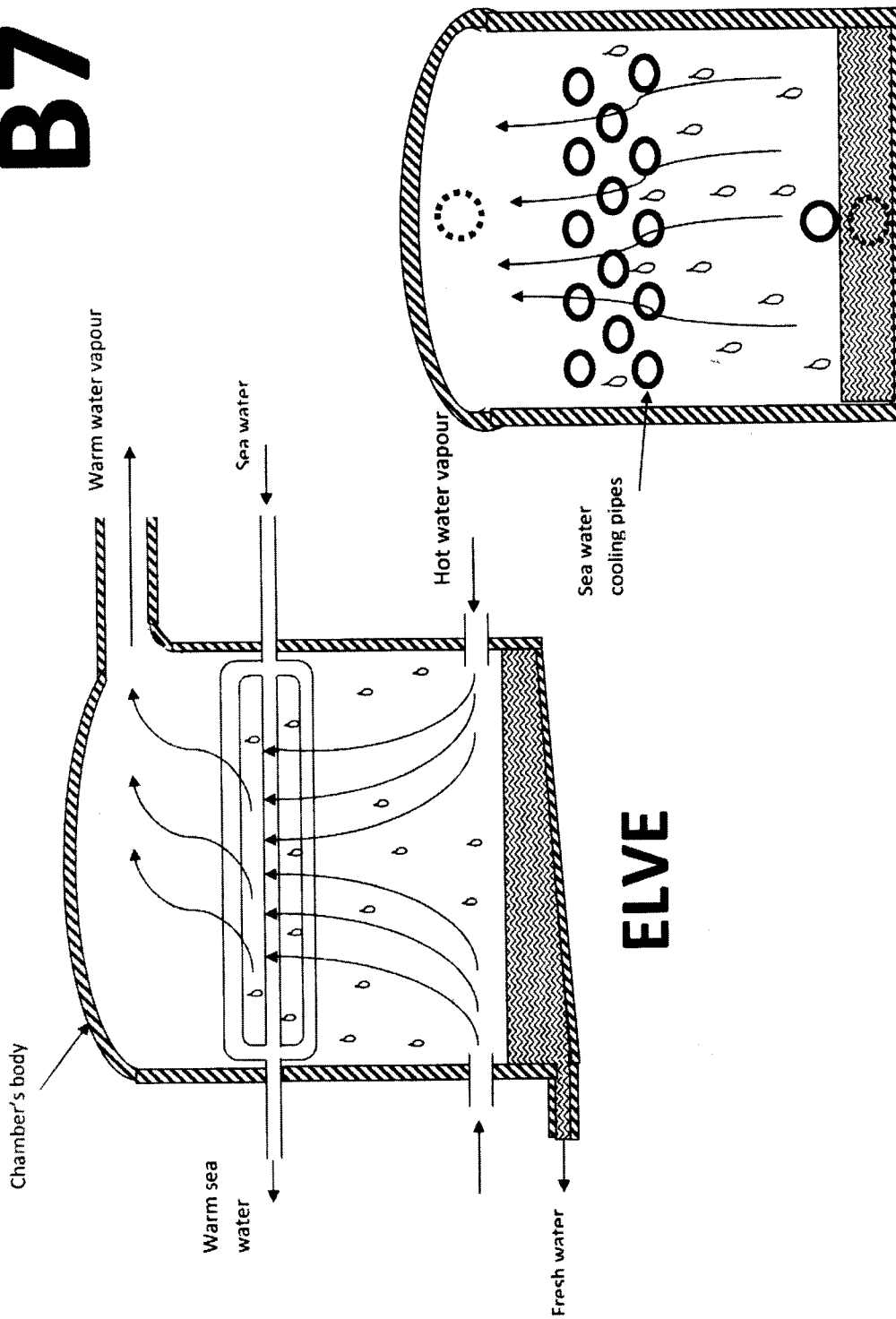


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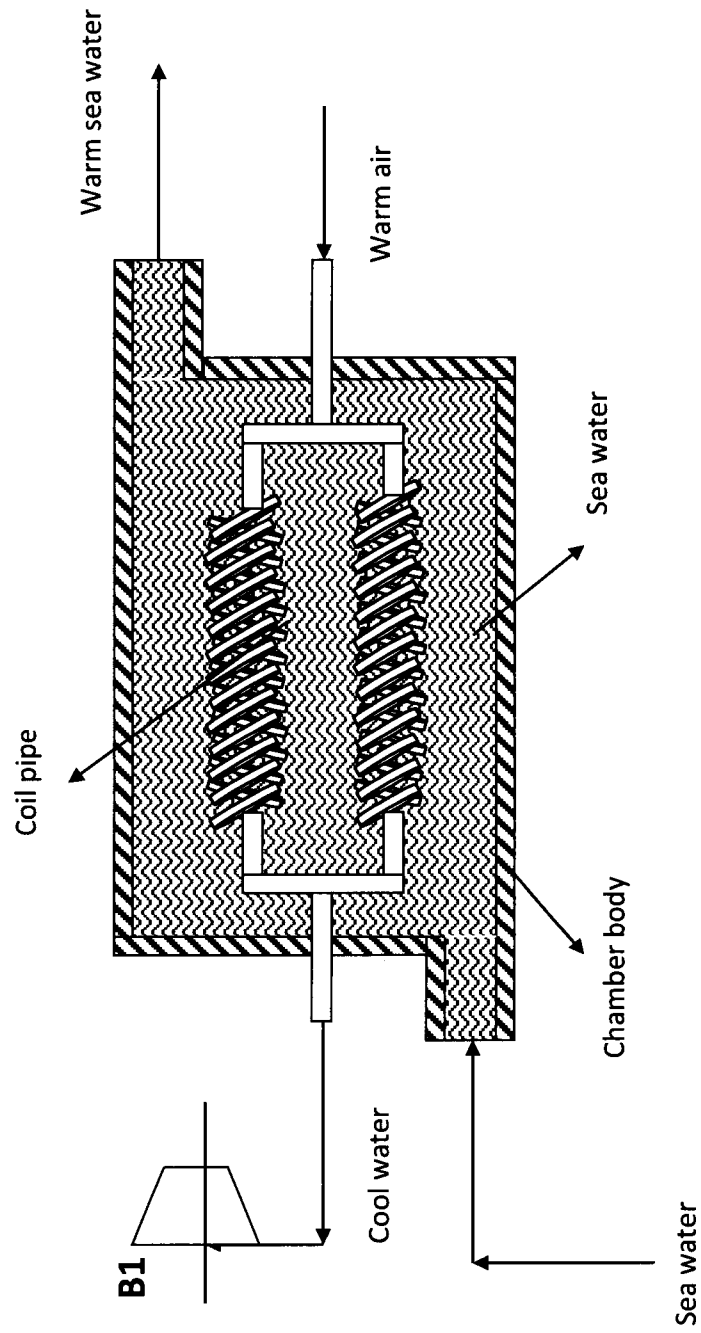
B6

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B7



B8



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