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(71) Applicant *(for all designated States except US)*: **EMPIRE TECHNOLOGY DEVELOPMENT LLC** [US/US]; 2711 Centerville Road, Suite 400, Wilmington, DE 198008 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CHEN, Sung-wei** [US/SG]; 30 Mount Sophia, #14-01, The Cathay Residences, Singapore 228464 (SG). **CHAN, Colin** [SG/SG]; 7 Holt Road, #07-03, Sheares Ville, Singapore 249446 (SG).

(74) Agent: **ELLA CHEONG SPRUSON & FERGUSON (SINGAPORE) PTE LTD**; P O Box 1531, Robinson Road Post Office, Singapore 903031 (SG).

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(54) Title: BRINE DISPOSAL SYSTEM FOR A BRINE SOURCE

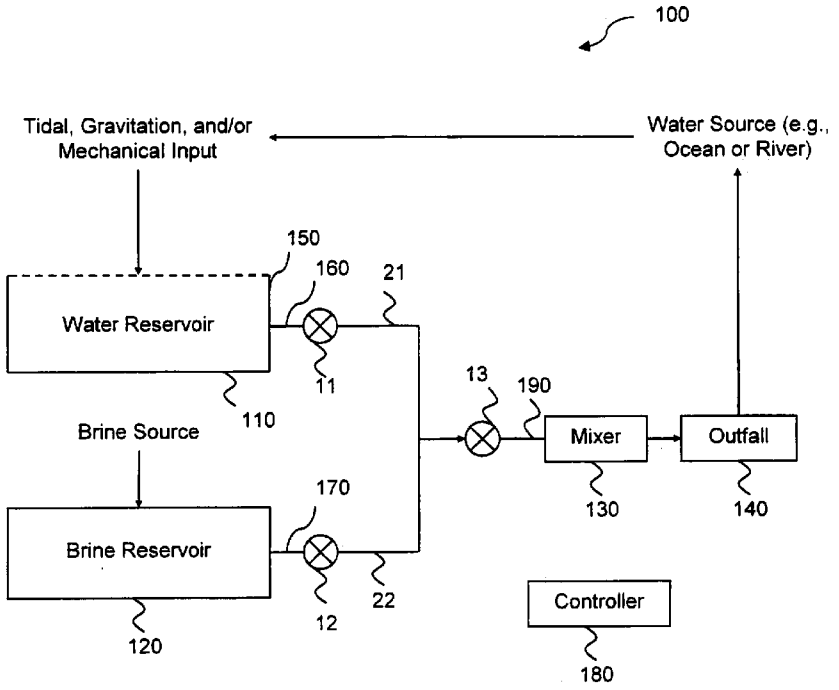

FIG. 1

(57) Abstract: Brine disposal systems are configured to receive brine from a brine source and to passively collect seawater from a nearby ocean during high tide using one or more tidal forces. Tidal movements during high tide, low tide, or both may be used to mix and thereby dilute the brine with the seawater. The mixture of seawater and brine is then passively discharged into the ocean during low tide using the tidal force, thereby minimizing the impacts on the marine ecosystem.

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BRINE DISPOSAL SYSTEM FOR A BRINE SOURCE

TECHNICAL FIELD

[0001] The present disclosure relates generally to a brine disposal system for a brine source.

BACKGROUND

[0002] Water desalination is the process of making fresh water by removing dissolved minerals (including but not limited to salt) from seawater, brackish water, or treated wastewater. Desalination technologies include reverse osmosis, distillation, electrodialysis, and vacuum freezing. Salt extracted from seawater during the desalination process comes out as concentrated brine whose salinity may be twice as high as that of seawater. Brine generated during the desalination process is often discharged directly into the ocean. The high-density desalination waste tends to fall on the sea floor near the brine outfall, creating a very salty layer that may negatively impact the flora, the marine life, and any related human activities in the region.

SUMMARY

[0003] One embodiment of the present disclosure may generally relate to a brine disposal system for a brine source. One example brine disposal system may include a water reservoir, a brine reservoir, and an outfall coupled to the water and the brine reservoirs. The water reservoir is located near a water source and stores water from the water source. The brine reservoir stores brine from the brine source. One or more tidal, gravitational, and mechanical forces cause the water to enter and exit the water reservoir, and the brine to exit from the brine reservoir. The outfall discharges a mixture of the water and the brine into an ocean.

[0004] Another embodiment of the present disclosure may generally relate to a plant. One example plant may include an equipment generating heat, a brine tank storing brine, and a water cooling system. The water cooling system may further include a cooling loop thermally coupled to the equipment, a pump in the cooling loop, a mixer coupling the brine tank to the cooling loop, and an outfall coupled to the cooling loop to discharge a mixture of the water and the brine into the water source. The pump is configured to circulate water from water source in the cooling loop, and the mixer is configured to mix the brine and the water.

[0005] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIGS. 1, 2, 3, and 4 are block diagrams of illustrative embodiments of brine disposal systems.

[0007] Fig. 5 is a block diagram of illustrative embodiment of a plant.

DETAILED DESCRIPTION

[0008] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. The illustrative embodiments described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the Figures, can be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are explicitly contemplated herein.

[0009] This disclosure is drawn, *inter alia*, to brine disposal techniques, systems and methods.

[0010] FIG. 1 is an illustrative embodiment of a brine disposal system 100. The brine disposal system 100 includes a water reservoir 110, a brine reservoir 120, an optional mixer 130, an outfall 140, and a controller 180.

[0011] The system 100 is located near a water source. In an embodiment, the system 100 is near an ocean and the water reservoir 110 is a seawater reservoir that stores seawater from the ocean. The seawater reservoir 110 can be located in an intertidal zone, which is an area exposed to air during low tide and underwater during high tide. One or more tidal forces, such as those from the moon and the sun, cause seawater to enter the seawater reservoir 110 during high tide and to exit the seawater reservoir 110 during low tide. The seawater reservoir 110 may be partially or entirely man-made. The seawater reservoir 110 has walls and floor to contain the seawater. The seawater reservoir 110 may have an open

top and a wall 150 that faces the ocean. The height of the wall 150 may be lower than the high-tide sea level to allow the seawater to crest over the wall 150 and enter the seawater reservoir 110 during high tide. The seawater reservoir 110 may include a bottom outlet 160 that allows the seawater to exit the seawater reservoir 110 during low tide. In the example embodiment described above, the location and the construction configuration of the seawater reservoir 110 allow it to passively collect and discharge the seawater.

[0012] In another illustrative embodiment, the seawater reservoir does not collect the seawater on its own. Instead, one or more tidal pools located in the intertidal zone are used to collect the seawater over multiple high tides and the collected seawater is mechanically pumped into the seawater reservoir 110.

[0013] The brine reservoir 120 stores brine from a brine source, such as a desalination plant. The brine reservoir 120 may be located in the intertidal zone adjacent to the seawater reservoir 110 or it may be located outside of the intertidal zone elevated or not relative to the seawater reservoir. One or more tidal, gravitational, mechanical, and other forces cause the brine to exit from the brine reservoir 120 during low tide. The brine reservoir 120 may be partially or entirely man-made. The brine reservoir 120 has walls and floor to contain the brine, and an open or a closed top. The brine reservoir 120 may include a bottom outlet 170 that allows the brine to exit the brine reservoir 120 during low tide. In the example embodiment described above, the location and the construction configuration of the brine reservoir 120 allow it to passively discharge the brine.

[0014] In an embodiment, the optional mixer 130 is coupled to the seawater reservoir 110 and the brine reservoir 120. The mixer 130 mixes the seawater and the brine that exit from the seawater reservoir 110 and the brine reservoir 120, respectively, during low tide. The mixer 130 provides a mixture of seawater and brine whose salinity is lower than that of the brine received from the brine source. The mixer 130 may be of any type including but not limited to a static mixer or a powered mixer.

[0015] When the optional mixer 130 is present, the outfall 140 is coupled to the mixer 130. When the optional mixer 130 is not present, the outfall 140 is coupled to the seawater reservoir 110 and the brine reservoir 120. The outfall 140 discharges the mixture of seawater and brine from the mixer 130 into the ocean. The outfall 140 may be of any type including but not limited to a pipe or a tunnel.

[0016] The transfer of the seawater and the brine from the seawater reservoir 110 and the

brine reservoir 120, respectively, to the mixer 130 may be implemented using valves and pipes. In an illustrative embodiment, the brine disposal system 100 further includes valves 11 and 12 and pipes 21 and 22. The valve 11 is coupled to the outlet 160 of the seawater reservoir 110, and the valve 12 is coupled to the outlet 170 of the brine reservoir 120. The pipe 21 is coupled between the valve 11 and the mixer 130, and the pipe 22 is coupled between the valve 12 and the mixer 130. A controller 180 is configured to close the valves 11 and 12 for storing the seawater and the brine in the seawater reservoir 110 and the brine reservoir 120, respectively, and to open the valves 11 and 12 during low tide for allowing the seawater and the brine to exit the seawater reservoir 110 and the brine reservoir 120, respectively, by the one or more tidal forces.

[0017] Instead of valves 11 and 12, an illustrative embodiment of the brine disposal system 100 may include a valve 13. The valve 13 is coupled to an input 190 of the mixer 130. The pipe 21 is coupled between the outlet 160 of the seawater reservoir 110 and the valve 13, and the pipe 22 is coupled between the outlet 170 of the brine reservoir 120 and the valve 13. Controller 180 is configured to close the valve 13 for storing the seawater and the brine in the seawater reservoir 110 and the brine reservoir 120, respectively, and to open the valve 13 during low tide to allow the seawater and the brine to exit the seawater reservoir 110 and the brine reservoir 120, respectively, by the one or more tidal forces.

[0018] In an embodiment, the system 100 is located near a river and the water reservoir 110 is a freshwater reservoir that stores freshwater from the river. One or more gravitational, mechanical, and other forces cause freshwater to enter and exit the freshwater reservoir 110. One or more gravitational, mechanical, and other forces cause the brine to exit from the brine reservoir 120 during low tide. In an embodiment, the optional mixer 130 is coupled to the freshwater reservoir 110 and the brine reservoir 120. The mixer 130 mixes the freshwater and the brine that exit from the freshwater reservoir 110 and the brine reservoir 120, respectively. When the optional mixer 130 is present, the outfall 140 is coupled to the mixer 130. When the optional mixer 130 is not present, the outfall 140 is coupled to the freshwater reservoir 110 and the brine reservoir 120. The outfall 140 discharges the mixture of freshwater and brine from the mixer 130 into the river. The controller 180 is configured to operate the valves 11 and 12 or the valve 13 as described above but without any limitations imposed by the tides.

[0019] FIG. 2 is a block diagram of an illustrative embodiment of a brine disposal system 200. The brine disposal system 200 includes a reservoir 210, a mixer 230, a tidal port 240,

a controller 250, and a valve 14.

[0020] The reservoir 210 receives brine from a brine source 220, which can be elevated relative to the reservoir 210. The valve 14 is coupled between the brine source 220 and the reservoir 210 for controlling the release of the brine and its rate. When controller 250 opens the valve 14, the brine source 220 releases the brine into the reservoir 210 by gravity. The brine source 220 may be of any type including but not limited to a brine reservoir coupled to store the brine from another brine source, such as a desalination plant. The brine reservoir 220 may be partially or entirely man-made. The brine reservoir 220 has walls and floor to contain the brine, and an open or a closed top.

[0021] In an embodiment, the reservoir 210 is located in an intertidal zone. One or more tidal forces causes seawater to enter the reservoir 210 and mix with the brine released from brine source 220, and the mixture of seawater and brine to exit from the reservoir 210. The reservoir 210 may be partially or entirely man-made. The reservoir 210 has walls and floor to contain the seawater and the brine, and an open or a closed top. Before high tide, the tidal port 240 remains closed so that the brine released from the brine source 220 is stored in the reservoir 210. During high tide, controller 250 opens the tidal port 240 so that the seawater may enter the reservoir 210 by the one or more tidal forces. The tidal movement mixes the seawater with the brine stored in the reservoir 210. After high tide, the tidal port 240 remains open for a period of time so that the mixture of seawater and brine may exit the reservoir 210 during low tide. In the example embodiment described above, the location and the construction configuration of the reservoir 210 allow it to passively collect the seawater and mix it with the brine, and to passively discharge the mixture of seawater and brine.

[0022] The mixer 230 is located in the reservoir 210 and further mixes the seawater and the brine. The mixer 230 may be of any type including but not limited to a static mixer or a powered mixer.

[0023] FIG. 3 is a block diagram of an illustrative embodiment of a brine disposal system 300. The brine disposal system 300 includes a reservoir 310, a mixer 330, a tidal port 340, a controller 350, and a valve 15.

[0024] The reservoir 310 receives brine from a brine source through the valve 15. When controller 350 opens the valve 15, the brine source releases the brine into the reservoir 310. The brine source may be of any type including but not limited to a desalination plant or a

brine reservoir coupled to store the brine from the desalination plant.

[0025] The reservoir 310 is located in an intertidal zone. One or more tidal forces causes seawater to enter the reservoir 310 and mix with the brine released from brine source, and the mixture of seawater and brine to exit from the reservoir 310. The reservoir 310 may be partially or entirely man-made. The reservoir 310 has walls and floor to contain the seawater and the brine. The reservoir 310 may have an open top and a wall 360 that faces the ocean. The height of the wall 360 may be lower than the high-tide sea level to allow the seawater to crest over the wall 360 and enter the reservoir 310 during high tide. Before high tide, the tidal port 340 remains closed so that the brine released from the brine source may be stored in the reservoir 310. During high tide, the one or more tidal forces cause the seawater to crest over wall 360 and mix with the brine. After high tide, the controller 350 opens the tidal port 340 for a period of time so that the mixture of seawater and brine may exit the reservoir 310 during low tide. The wall 360 of the reservoir 310 may be a height-adjustable wall for accommodating to variations in the high-tide sea level.

[0026] The tidal port 340 may be a sea door at or near the bottom of the reservoir 310. In an illustrated embodiment, the tidal port 340 is only opened for a period of time during low tide for releasing the mixture of seawater and brine. In another illustrated embodiment, the tidal port 340 may also be opened during high tide for gathering more seawater and allowing the tidal movements to further accelerate the mixing process.

[0027] The mixer 330 is located in the reservoir 310 and further mixes the seawater and the brine. The mixer 330 may be of any type including but not limited to a static mixer or a powered mixer.

[0028] FIG. 4 is a block diagram of an illustrative embodiment of a brine disposal system 400. The brine disposal system 400 includes a reservoir 410, a mixer 430, a tidal port 440, a controller 450, and a valve 16.

[0029] The reservoir 410 receives brine from a brine source through the valve 16. When controller 450 opens the valve 16, the brine source releases the brine into the reservoir 410. The brine source may be of any type including but not limited to desalination plant or a brine reservoir coupled to store the brine from the desalination plant.

[0030] The reservoir 410 is located in an intertidal zone. One or more tidal forces causes seawater to enter the reservoir 410 and mix with the brine released from brine source, and the mixture of seawater and brine to exit from the reservoir 410. The reservoir 410 may be

partially or entirely man-made. The reservoir 410 has walls and floor to contain the seawater and the brine, and an open or a closed top. Before high tide, the tidal port 440 remains closed so that the brine released from the brine source may be stored in the reservoir 410. The tidal port 440 may be a sea door at or near the bottom of the reservoir 410. After the brine is stored in the reservoir 410, the controller opens the tidal port 440 during high tide so that the one or more tidal forces may cause the seawater to enter the reservoir 410 through the tidal port 410 and mix with the brine. After high tide, the tidal port 440 remains open for a period of time so the mixture of seawater and brine may exit the reservoir 410 during low tide.

[0031] The mixer 430 is located in the reservoir 410 and further mixes the seawater and the brine. The mixer 430 may be of any type including but not limited to a static mixer or a powered mixer.

[0032] In the illustrative embodiments depicted in FIGs 1 to 4, the capacity of the reservoirs and how the brine from the brine source is released into the reservoir may be determined by the amount of brine to be discharged and the tidal period of the dilution tide. In an example embodiment, assume the tidal period of the dilution tide is about 12.5 hours. In an example embodiment, assume that the amount of brine generated by the brine source, such as by a desalination plant, during the tidal period is equal to "A" tons and has twice the salinity of seawater, a 1:1 dilution factor results in a diluted mixture having 1.5 times the salinity of seawater, and a 1:9 dilution factor results in a diluted mixture having 1.1 times the salinity of seawater.

[0033] In one application, the release of high salinity brine into the brine reservoirs 120 and 220 or the reservoirs 310 and 410 is completed before each high tide. Under such circumstance, the brine reservoir 120 and the seawater reservoir 110 in FIG. 1 are each required to contain at least A tons of liquid for 1:1 dilution factor, or are respectively required to contain at least A tons and 9A tons of liquid for 1:9 dilution factor. The reservoirs 310 and 410 in FIGS. 3 and 4 are each required to contain at least 2A tons of liquid for 1:1 dilution factor, or at least 10A tons of liquid for 1:9 dilution factor.

[0034] In another application, the release of high salinity brine into the brine reservoirs 120 and 210 or the reservoirs 310 and 320 may also occur during high tide. By periodically opening the valves and modulating the release of the brine during high tide, the size of the reservoirs may be reduced.

[0035] Fig. 5 is a block diagram of an illustrative embodiment of a plant 500 which uses a once-through cooling system for brine disposal. The plant 500 includes a water cooling system 510, a brine tank 520 and one or more equipment 50. The plant 500 may be of any type including but not limited to a desalination plant, and the equipment 50 may be of any type including but not limited to desalination equipment that generate heat when extracting brine. The brine tank 520 is configured to store the brine generated by the equipment 50.

[0036] The water cooling system 510 includes a cooling loop 512, a pump 514, a mixer 530, an outfall 540, a valve 542, and a controller 550. The cooling loop 512 is thermally coupled to the equipment 50 for controlling the operational temperature of the equipment 50. The pump 514 is disposed in the cooling loop 512 for circulating water from a water source (e.g., seawater from an ocean or freshwater from a river) in the cooling loop 512. The brine tank 520 is coupled to valve 542, which is then coupled by the mixer 530 to the cooling loop 512 for mixing the brine and water. The mixing of the brine from the brine tank 520 and the water occurs as the pump 514 circulates the water in the cooling loop 512 and is further aided by the mixer 530. The outfall 540 is coupled to the cooling loop 512 for discharging the mixture of seawater and brine into the water source, thereby minimizing the impacts on the ecosystem. Controller 550 controls valve 542 to control the rate the brine is introduced into cooling loop 512.

[0037] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[0038] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions

containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation *is* explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean *at least* the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means *at least* two recitations, or *two or more* recitations). Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B."

[0039] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

We Claim:

1. A brine disposal system for a brine source, comprising:
   a water reservoir for storing water, the water reservoir being located near a water source so one or more tidal, gravitational, and mechanical forces cause the water to enter and exit the water reservoir;
   a brine reservoir for storing brine from the brine source, wherein one or more of tidal, gravitational, and mechanical forces cause the brine to exit from the brine reservoir; and
   an outfall coupled to the water and the brine reservoirs, the outfall discharging a mixture of the water and the brine into the water source.

2. The brine disposal system of claim 1, wherein:
   the water source is a river; and
   the water reservoir is a freshwater reservoir that stores freshwater from the river.

3. The brine disposal system of claim 1, wherein:
   the water source is an ocean;
   the water reservoir is a seawater reservoir, and the tidal forces cause seawater to enter the seawater reservoir during high tide and to exit from the seawater during low tide; and
   the brine reservoir is located in the intertidal zone so the one or more tidal forces cause the brine to exit from the brine reservoir during low tide.

4. The brine disposal system of claim 3, further comprising a mixer coupling the water and the brine reservoirs to the outfall, the mixer mixing the seawater and the brine as they exit the seawater and the brine reservoirs during low tide.

5. The brine disposal system of claim 3, further comprising:
   a first valve coupled to the brine reservoir;
   a first pipe coupled between the first valve and the mixer;
   a second valve coupled to the seawater reservoir;
   a second pipe coupled between the second valve and the mixer; and
   a controller configured to close the first valve to store the brine, to open the first valve during low tide to allow the brine to exit the brine reservoir, to close the second valve

to store the seawater and to open the second valve during low tide to allow the seawater to exit the seawater reservoir.

6. The brine disposal system of claim 5, wherein the seawater reservoir comprises a wall facing the ocean, wherein the tidal force causes the seawater to crest over the wall during high tide.

7. The brine disposal system of claim 3, further comprising:
a valve coupled to the mixer;
a first pipe coupling the seawater reservoir to the valve;
a second pipe coupling the brine reservoir to the valve; and
a controller configured to close the valve to store the seawater and the brine in the seawater and the brine reservoirs, respectively, and to open the valve during low tide to allow the seawater and the brine to exit the seawater and the brine reservoirs, respectively.

8. A brine disposal system for a brine source, comprising:
a reservoir for receiving seawater and brine, the reservoir being located in an intertidal zone;
a tidal port coupled to the reservoir, wherein one or more tidal forces cause the seawater to exit from the reservoir through the tidal port during low tide; and
a valve coupled between the brine source and the reservoir.

9. The brine disposal system of claim 8, wherein the brine source comprises a brine reservoir coupled to store the brine from another brine source.

10. The brine disposal system of claim 8, wherein the one or more tidal forces cause the seawater to enter the reservoir through the tidal port during high tide and to mix with the brine in the reservoir.

11. The brine disposal system of claim 8, wherein the brine reservoir is elevated relative to the seawater reservoir.

12. The brine disposal system of claim 8, further comprising a mixer in the reservoir for mixing

the seawater and the brine.

13. The brine disposal system of claim 8, further comprising a controller coupled to the valve to control release of the brine into the reservoir.

14. The brine disposal system of claim 8, wherein the seawater reservoir comprises a wall facing an ocean, wherein the one or more tidal forces cause the seawater to crest over the wall and to mix with the brine during high tide.

15. The brine disposal system of claim 14, wherein the wall comprises a height-adjustable wall.

16. The brine disposal system of claim 8, wherein the tidal port comprises a sea door at or near a bottom of the reservoir.

17. A plant, comprising:
equipment generating heat;
a brine tank storing brine; and
a water cooling system, comprising:
a cooling loop thermally coupled to the equipment;
a pump in the cooling loop, the pump circulating water from water source in the cooling loop;
a mixer coupling the brine tank to the cooling loop, the mixer mixing the brine and the water;
an outfall coupled to the cooling loop to discharge a mixture of the water and the brine into the water source.

18. The plant of claim 17, wherein:
the water source is an ocean or a river; and
the water is freshwater or seawater.

19. The plant of claim 17, wherein the water cooling system is a once-through cooling system.

20. The plant of claim 17, wherein the equipment comprises desalination equipment, and the brine tank stores brine from the desalination equipment.

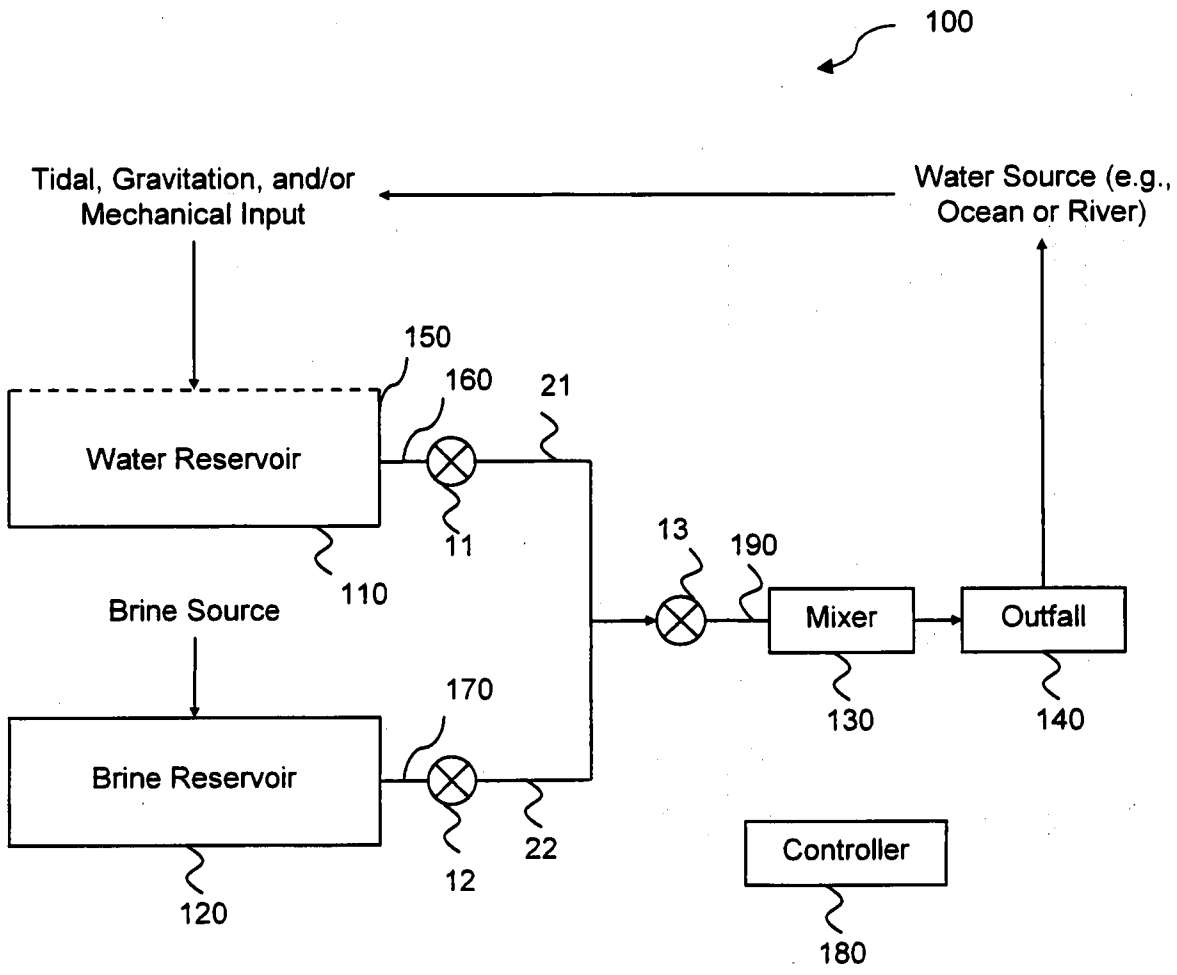
100
Tidal, Gravitation, and/or Mechanical Input
Water Source (e.g., Ocean or River)
150
160
21
Water Reservoir
11
110
13
190
Brine Source
Mixer
Outfall
130
140
170
Brine Reservoir
22
12
120
Controller
180

FIG. 1

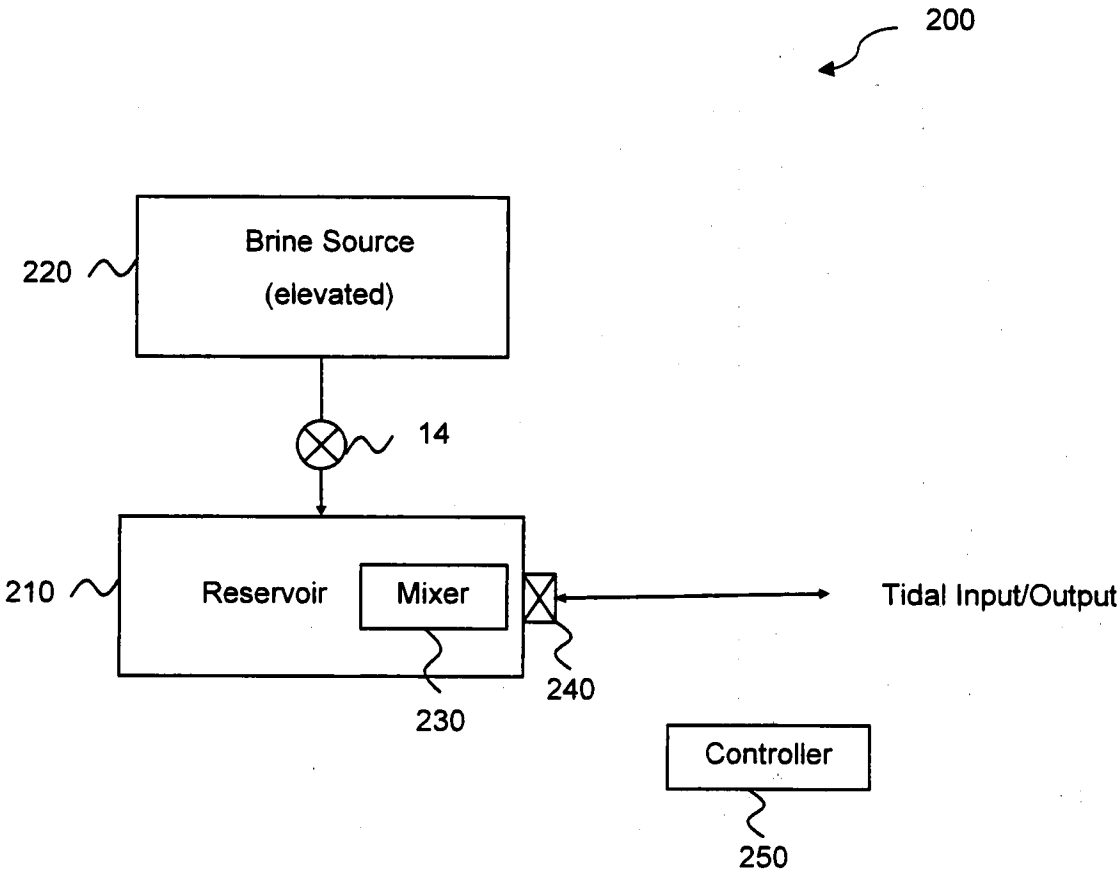
200
Brine Source
(elevated)
220
14
210
Reservoir
Mixer
Tidal Input/Output
230
240
Controller
250

FIG. 2

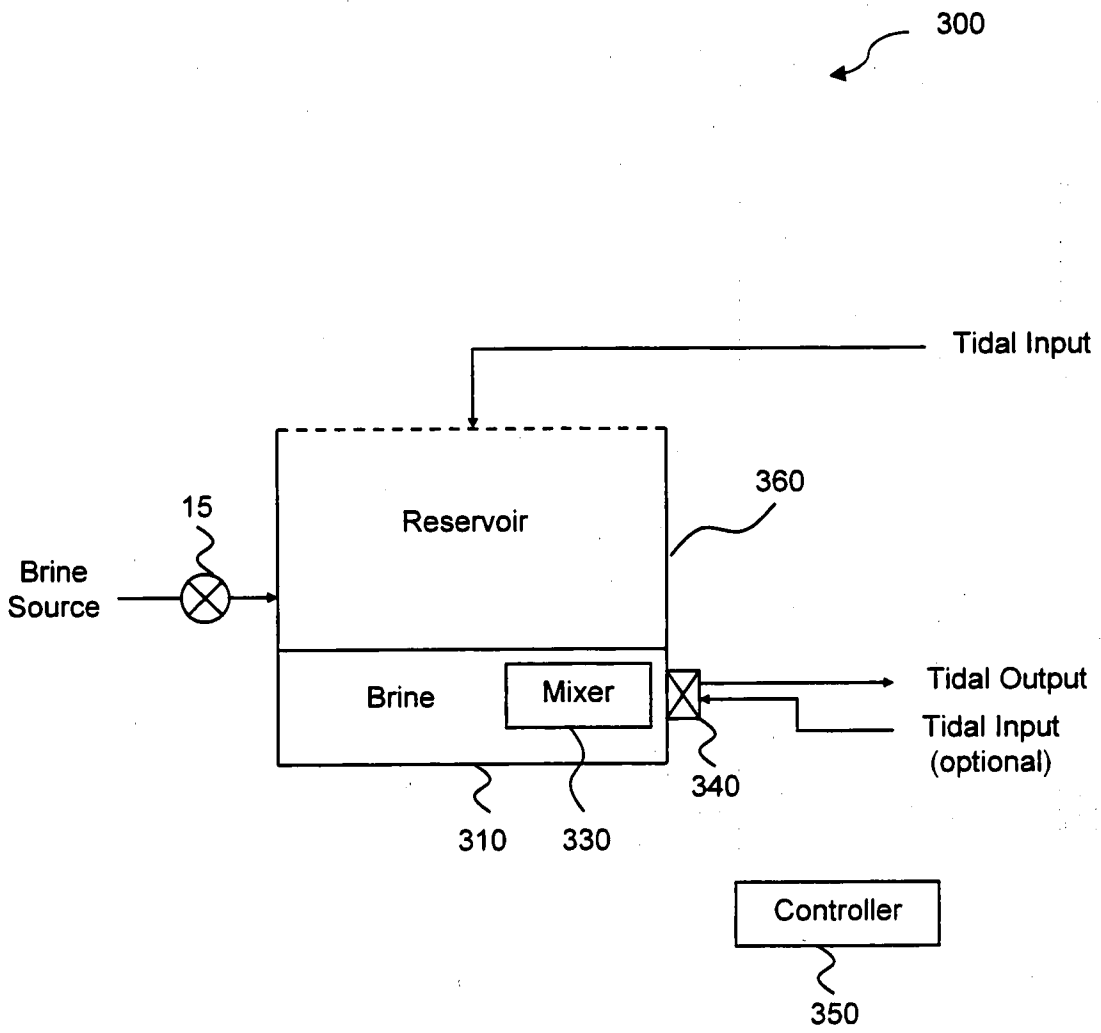
300
Tidal Input
360
15
Reservoir
Brine
Source
Brine
Mixer
Tidal Output
Tidal Input
(optional)
340
310
330
Controller
350

FIG. 3

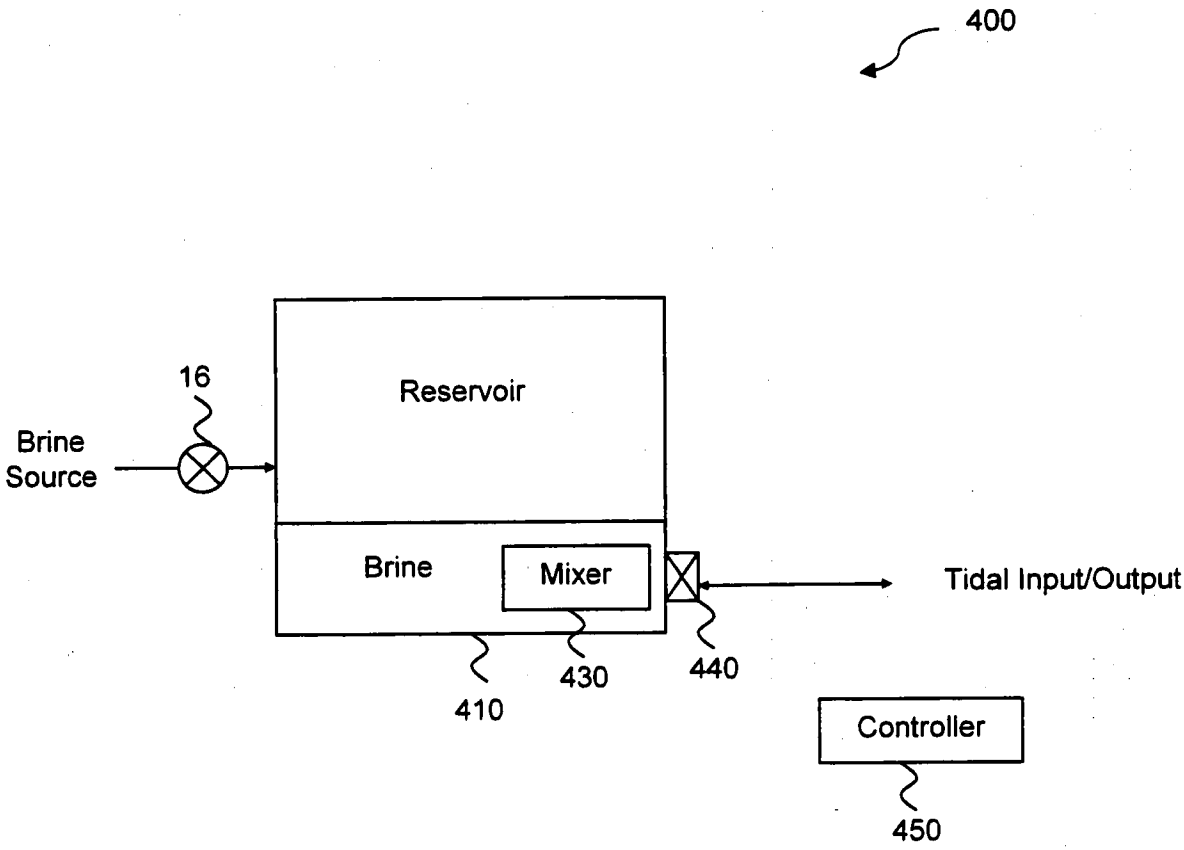
400
16
Reservoir
Brine Source
Brine
Mixer
Tidal Input/Output
410
430
440
Controller
450

FIG. 4

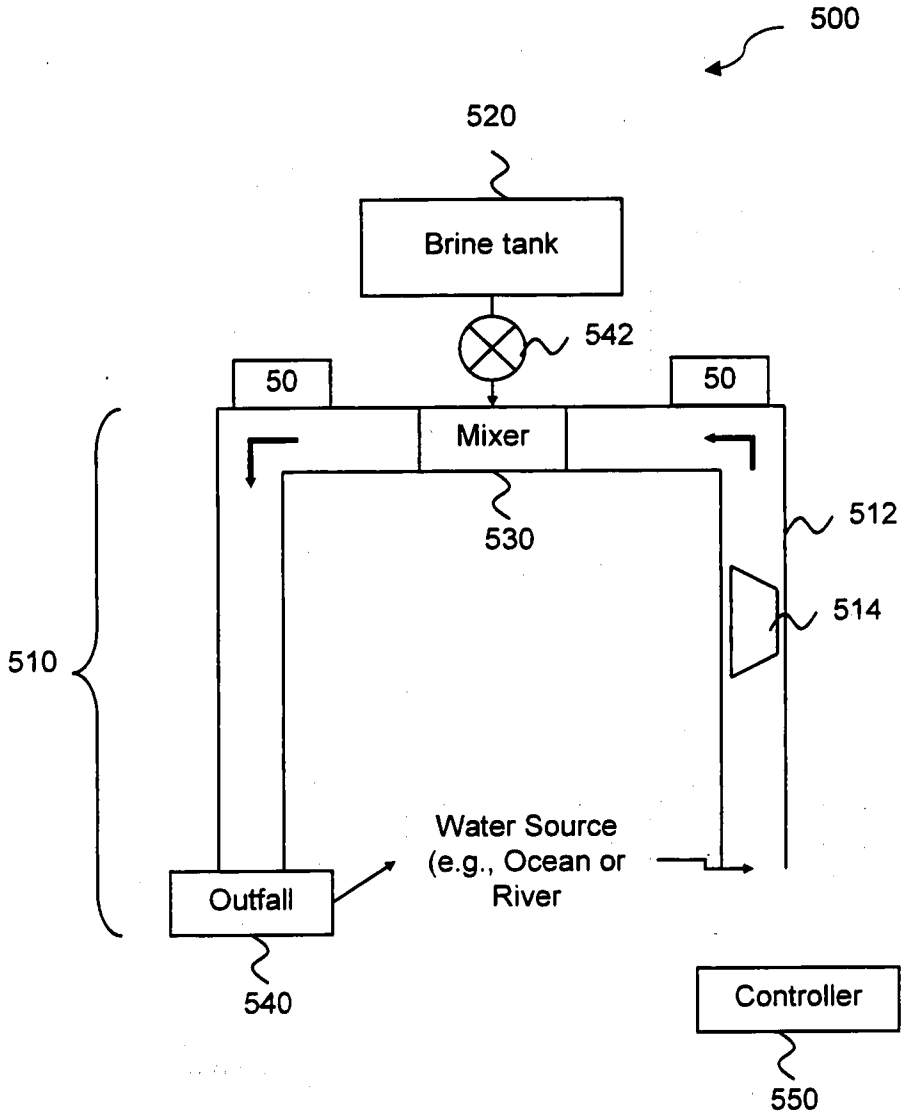
500
520
Brine tank
542
50
50
Mixer
530
512
514
510
Water Source
(e.g., Ocean or
River
Outfall
540
Controller
550

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2010/000302

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

C02F 1/00 (2006.01) *E02B 3/00* (2006.01) *C02F 103/08* (2006.01)

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)

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: IPC & EC: C02F 103/08, 1/00, E02B/-- and keywords (brin+, salt_water?, brackish_water?, discharg+, dispos+, dump+, outfall?, realeas+, diffus+, effluent+, tid, pump, mechanical+, forc+, wave+, gravit+, reservoir+, ditch+, pit+, stor+ and simialr terms); Google Scholar: keywords (desalination, brine, tidal, wave, mix, sea, ocean, water, reservoir, ditch)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	US 2008/0053907 A1 (GORDON) 6 March 2008	
X	Abstract; para 0004-0005; para 0008-0009; para 0012-0013; examples 1-5; figs. 1, 3-5	1-2
Y		17-20
A		3-16
	NL 1035015 C2 (KLIMREK I E B V [NL]) 13 August 2009. English abstract retrieved from EPODOC.	
X	Abstract; figs. 1-2	1-2
Y		17-20
A		3-16
	ES 2311320 A1 (PORCAR ORTI JAVIER [ES]) 1 February 2009. English abstract retrieved from EPODOC.	
X	Abstract; fig. 1	1-2
Y		17-20
A		3-16

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 October 2010	25 OCT 2010
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **HATINDER SHARMA** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6225 6151

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2010/000302

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6390870 B1 (HUGHES et al.) 21 May 2002 Abstract; col 2, lines 32-37; col 3, line 23 to col 4, line 10; figs. 1-2	17-20
A	JOSE L. PEREZ TALAVERA et al., 'Identification of the Mixing Processes in Brine Discharges Carried Out in Barraco Del Toro Beach, South of Gran Canaria (Canary Islands)', European Conference of Desalination and the Environment: Water Shortage, Lemesos, Cyprus, May 2001, pages 277-286 Page 1, line 25 to page 286, line 12	1-20
A	US 2010/0116726 A1 (DWEK et al.) 13 May 2010 Abstract; fig. 1	1-20
A	US 4335576 A (HOPFE) 22 June 1982 Abstract; col 1, lines 15-33; col 3, line 54 to col 5, line 6; fig. 3	1-20
	For Y indication: For claims 17-20 US 6390870 B1 can be combined with any one of the US 2008/0053907 A1 or NL 1035015 C2 or ES 2311320 A1.	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SG2010/000302

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2008053907	AU	2005235622	BR	PI0509446	CA	2562501
		CN	101094959	EP	1766144	KR	20070009715
		MX	PA06012268	NI	200600252	NO	20065274
		RU	2006141275	SG	136951	US	2005236327
		US	7153423	US	2007000835	US	7306724
		US	2009114603	US	7547392	WO	2005102943
		ZA	200609485				
NL	1035015	NONE					
ES	2311320	NONE					
US	6390870	NONE					
US	4335576	GB	2031527	US	4204406	ZA	7904524
US	2010116726	EP	2142423	GB	2448309	WO	2008119995

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX