WATER VAPOR DISTILLATION APPARATUS, METHOD AND SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a Continuation of U.S. patent application Ser. No. 15/468,870, filed Mar. 24, 2017 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 10,759,676 issued Sep. 1, 2020 (Attorney Docket No. U88), which is a Continuation of U.S. patent application Ser. No. 13/952,263, filed Jul. 26, 2013 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 9,604,858 issued Mar. 28, 2017 (Attorney Docket No. K95), which is a U.S. National Stage Application under 35 USC 371 of PCT Application Serial No. PCT/US12/46740, filed Jul. 13, 2012 and entitled Water Vapor Distillation Apparatus, Method and System (Attorney Docket No. I83WO), which claims priority to U.S. patent application Ser. No. 13/184,169, filed Jul. 15, 2011 and entitled Water Vapor Distillation Apparatus, Method and System now U.S. Pat. No. 8,505,323, issued Aug. 13, 2013 (Attorney Docket No. I83), each of which is hereby incorporated herein by reference in their entireties.

[0002] U.S. patent application Ser. No. 13/952,263, filed Jul. 26, 2013 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 9,604,858 issued Mar. 28, 2017 (Attorney Docket No. K95), also claims priority from U.S. Provisional Patent Application Ser. No. 61/819,919, filed May 6, 2013 and entitled Water Vapor Distillation Apparatus, Method and System (Attorney Docket No. K58), and U.S. Provisional Patent Application Ser. No. 61/676,597, filed Jul. 27, 2012 and entitled Water Vapor Distillation Apparatus, Method and System (Attorney Docket No. J50), both of which are hereby incorporated herein by reference in their entireties.

[0003] U.S. patent application Ser. No. 15/468,870, is a Continuation-in-Part of U.S. patent application Ser. No. 13/982,022, filed Jan. 9, 2014 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Publication No. 2014-0326592-A1 issued Nov. 6, 2014 (Attorney Docket No. K96), which is a U.S. National Stage Application under 35 USC 371 of PCT Application Serial No. PCT/US12/46740, filed Jul. 13, 2012 and entitled Water Vapor Distillation Apparatus, Method and System (Attorney Docket No. I83WO), which claims priority to U.S. patent application Ser. No. 13/184,169, filed Jul. 15, 2011 and entitled Water Vapor Distillation Apparatus, Method and System (Attorney Docket No. I83), each of which is hereby incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0004] The present invention relates to water distillation and more particularly, to a water vapor distillation apparatus, method, and system.

BACKGROUND INFORMATION

[0005] A dependable source of clean water eludes vast segments of humanity. For example, the Canadian International Development Agency reports that about 1.2 billion people lack access to safe drinking water. Published reports attribute millions and millions of deaths per year, mostly children, to water related diseases. Many water purification techniques are well known, including carbon filters, chlorination, pasteurization, and reverse osmosis. Many of these techniques are significantly affected by variations in the water quality and do not address a wide variety of common contaminants, such as bacteria, viruses, organics, arsenic, lead, mercury, and pesticides that may be found in water supplies in the developing world and elsewhere. Some of these systems require access to a supply of consumables, such as filters or chemicals. Moreover, some of these techniques are only well suited to centralized, large-scale water systems that require both a significant infrastructure and highly trained operators. The ability to produce reliable clean water without regard to the water source, on a smaller, decentralized scale, without the need for consumables and constant maintenance is very desirable, particularly in the developing world.

[0006] The use of vapor compression distillation to purify water is well known and may address many of these concerns. However, the poor financial resources, limited technical assets, and low population density that does not make it feasible to build centralized, large-scale water systems in much of the developing world, also limits the availability of adequate, affordable, and reliable power to operate vapor compression distillation systems, as well as hindering the ability to properly maintain such systems. In such circumstances, an improved vapor compression distillation system and associated components that increases efficiency and production capability, while decreasing the necessary power budget for system operation and the amount of system maintenance required may provide a solution.

SUMMARY

[0007] In accordance with one aspect of the present invention, a system for product water output is disclosed. The system includes a controller, a first conductivity sensor in communication with the controller, a first product valve downstream from the first conductivity sensor and in communication with the controller, a second product valve downstream from the first product valve and in communication with the controller, a second conductivity sensor downstream from the second product valve and in communication with the controller, and a divert valve downstream from the first conductivity sensor and upstream from the first product valve and in communication with the controller.

[0008] Some embodiments of this aspect of the present invention include one or more of the following: wherein the controller opens the divert valve and maintains the first product valve and second product valve in a closed position when the first conductivity sensor determines that the conductivity of product water is not within a first acceptable range; wherein the controller opens the first product valve and the second product valve when the first conductivity sensor determines that the conductivity of product water is within an acceptable range; wherein the second conductivity sensor determines the conductivity of the product water and the controller indicates a fault condition when the second conductivity sensor determines that the conductivity of product water is not within a second acceptable range; wherein the first acceptable range is lower than the second acceptable range; wherein the controller compares the conductivity from the first conductivity sensor and the second conductivity sensor and if the conductivity from the first conductivity sensor differs more than a threshold amount from the conductivity of the second conductivity sensor, a fault condition is indicated; wherein if it is determined that