WATER VAPOR DISTILLATION APPARATUS, METHOD AND SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a Continuation Application of U.S. patent application Ser. No. 16/017,458, filed Jun. 25, 2018 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 10,946,302, issued Mar. 16, 2021 (Attorney Docket No. X68), which is a Continuation Application of U.S. patent application Ser. No. 14/080,176, filed Nov. 14, 2013 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 10,005,001, issued Jun. 26, 2018 (Attorney Docket No. L36), is a Continuation Application of U.S. patent application Ser. No. 13/311,227, filed Dec. 5, 2011 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 8,584,472, issued Nov. 19, 2013 (Attorney Docket No. J14), which is a Continuation Application of U.S. patent application Ser. No. 12/135,035, filed Jun. 6, 2008 and entitled Water Vapor Distillation Apparatus, Method and System, now U.S. Pat. No. 8,069,676, issued Dec. 6, 2011 (Attorney Docket No. G01), which claims priority from U.S. Provisional Patent Application 60/933,525, filed Jun. 7, 2007 (Attorney Docket No. DEKA-014XX), each of which is hereby incorporated herein by reference in their entireties.

[0002] U.S. application Ser. No. 12/135,035 is also a Continuation-In-Part of patent application Ser. No. 11/480,294 filed Jun. 30, 2006 and entitled Pressurized Vapor Cycle Liquid Distillation, now U.S. Pat. No. 8,366,883, issued Feb. 5, 2013 (Attorney Docket No. E41), which is hereby incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0003] The present invention relates to water distillation and more particularly, to a water vapor distillation apparatus, method, and system.

BACKGROUND INFORMATION

[0004] 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.

[0005] 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

[0006] In accordance with one aspect of the present invention, a fluid vapor distillation apparatus is disclosed. The apparatus includes a source fluid input, and an evaporator condenser apparatus. The evaporator condenser apparatus includes a substantially cylindrical housing and a plurality of tubes in the housing. The source fluid input is fluidly connected to the evaporator condenser and the evaporator condenser transforms source fluid into steam and transforms compressed steam into product fluid. Also included in the fluid vapor distillation apparatus is a heat exchanger fluidly connected to the source fluid input and a product fluid output. The heat exchanger includes an outer tube and at least one inner tube. Also included in the fluid vapor distillation apparatus is a regenerative blower fluidly connected to the evaporator condenser. The regenerative blower compresses steam, and the compressed steam flows to the evaporative condenser where compressed steam is transformed into product fluid.

[0007] Some embodiments of this aspect of the present invention include one or more of the following: where the heat exchanger is disposed about the housing of the evaporator condenser; where the heat exchanger further includes wherein the outer tube is a source fluid flow path and the at least one inner tube is a product fluid flow path; where the heat exchanger further includes at least three inner tubes; where the at least three inner tubes are twined to form a substantially helical shape; where the heat exchanger further includes two ends, and at each end a connector is attached, whereby the connectors form a connection to the evaporator condenser; where the evaporator condenser tubes further include packing inside the tubes; where the packing is a rod; where the evaporator condenser further includes a steam chest fluidly connected to the plurality of tubes; and where the regenerative blower further comprising an impeller assembly driven by a magnetic drive coupling.

[0008] In accordance with another aspect of the present invention, a water vapor distillation system is disclosed. The water vapor distillation system includes a source fluid input, and an evaporator condenser apparatus. The evaporator condenser apparatus includes a substantially cylindrical housing and a plurality of tubes in the housing. The source fluid input is fluidly connected to the evaporator condenser and the evaporator condenser transforms source fluid into steam and transforms compressed steam into product fluid. Also included in the fluid vapor distillation apparatus is a heat exchanger fluidly connected to the source fluid input and a product fluid output. The heat exchanger includes an outer tube and at least one inner tube. Also included in the