US 20050160742A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2005/0160742 A1

(43) Pub. Date: Jul. 28, 2005

Naaman

(54) APPARATUS AND METHOD FOR EXCHANGING HEAT

(75) Inventor: **Chibbi Naaman**, Reut (IL)

Correspondence Address:
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314 (US)

(73) Assignee: **Global Micro Wire Technologies, Ltd.**, Even Yehuda (IL)

(21) Appl. No.: **10/506,616**

(22) PCT Filed: **Aug. 18, 2002**

(86) PCT No.: **PCT/IL02/00681**

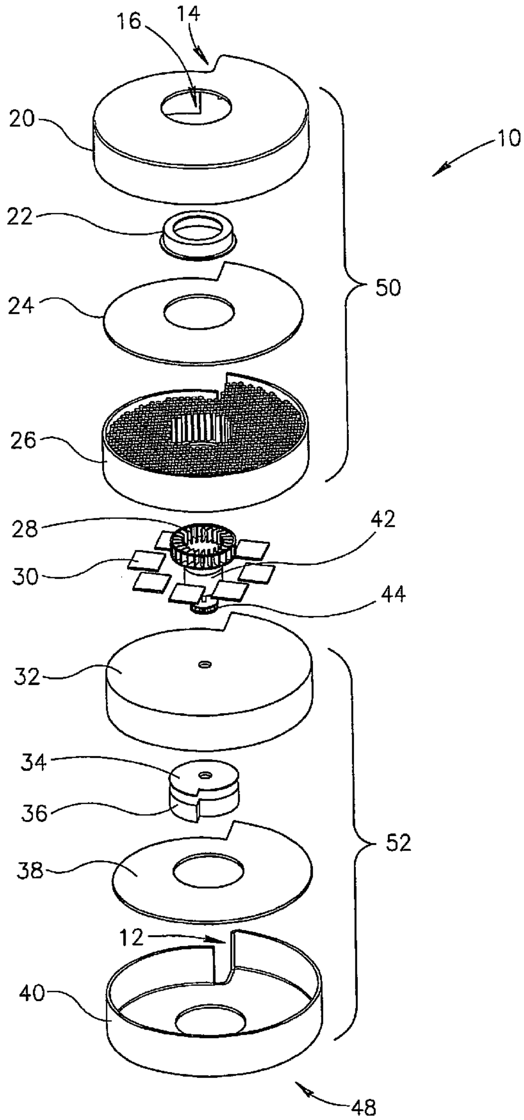
Publication Classification

(51) Int. Cl.^{7} **F25B 21/02**

(52) U.S. Cl. **62/3.2**

(57) **ABSTRACT**

An apparatus and method for exchanging heat including a conduit having a spiral shape for conditioned fluid to flow through, a heat sink compartment, and a chip layout. The chip layout includes a thermoelectric unit positioned between the conduit and the heat sink compartment such that a first surface of the chip layout is in contact with the fluid conduit and a second surface is in contact with the heat sink compartment.



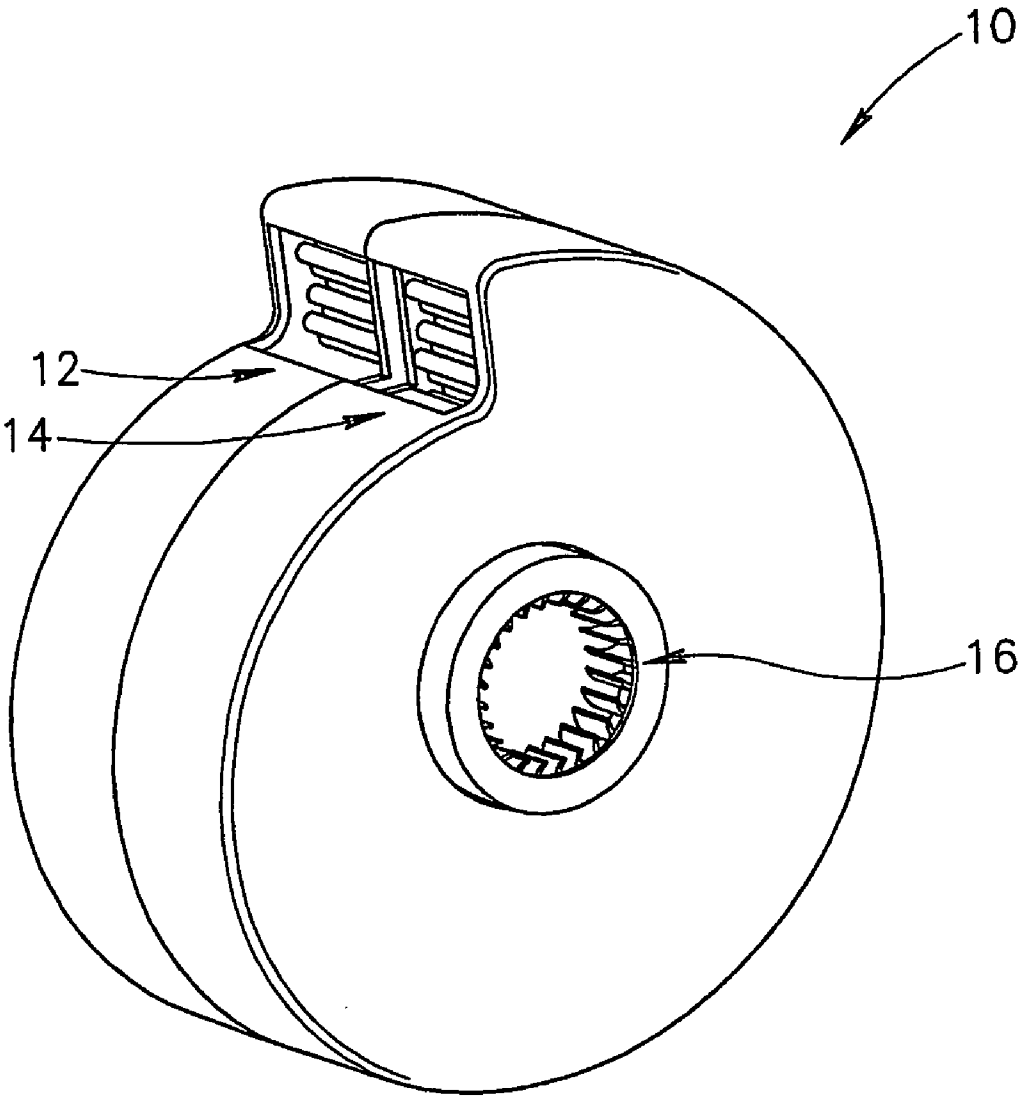


FIG.1A

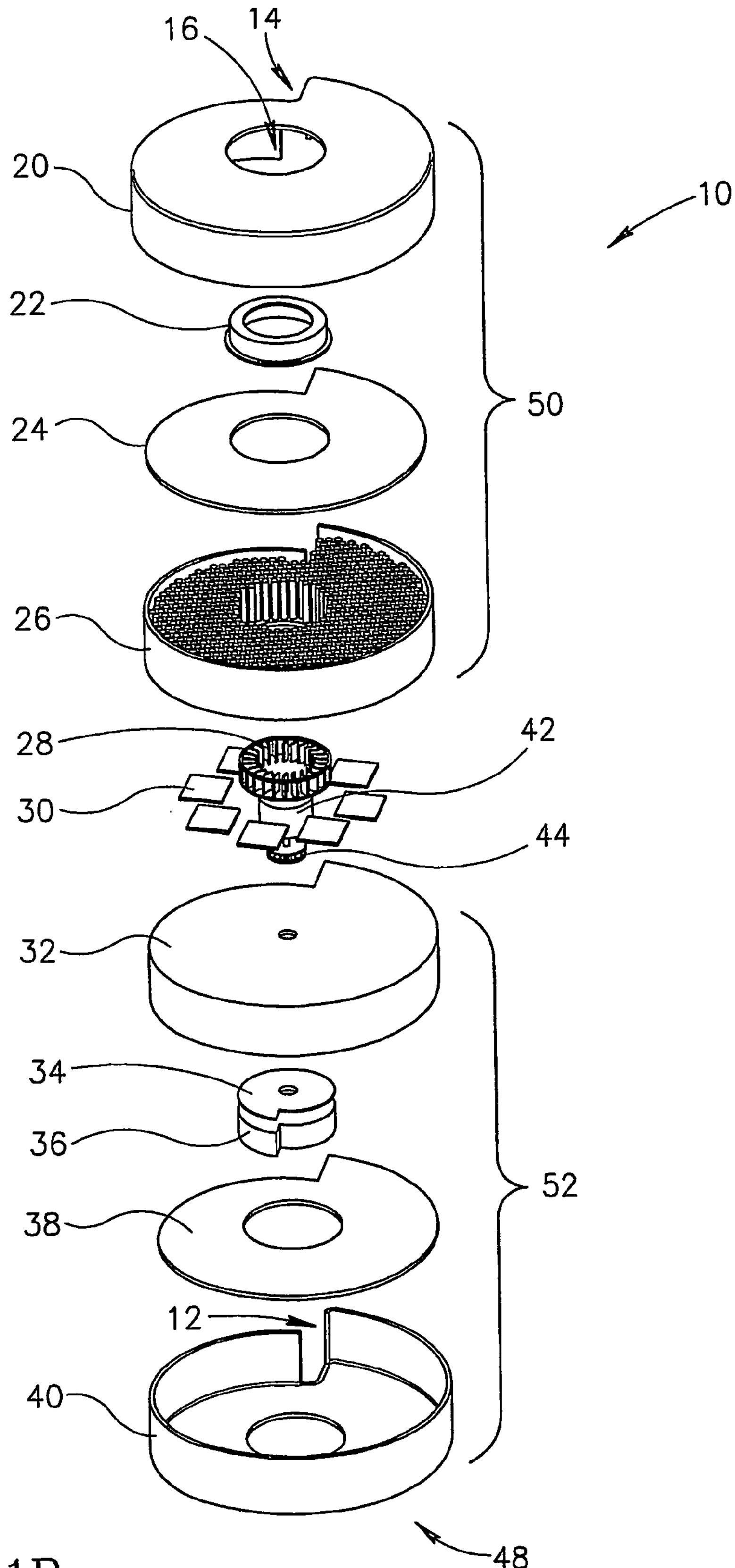


FIG.1B

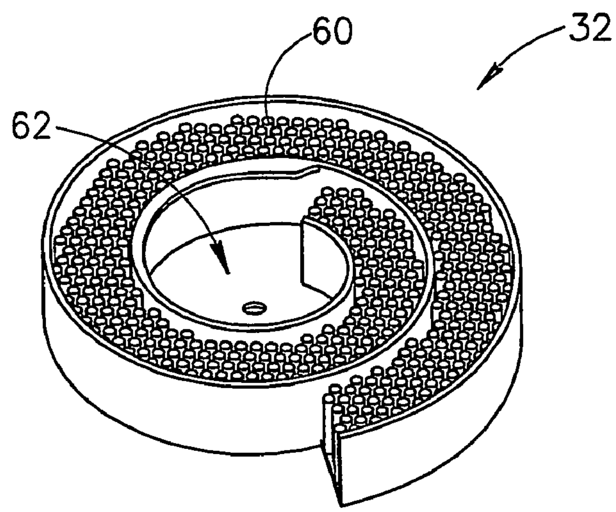


FIG.2A

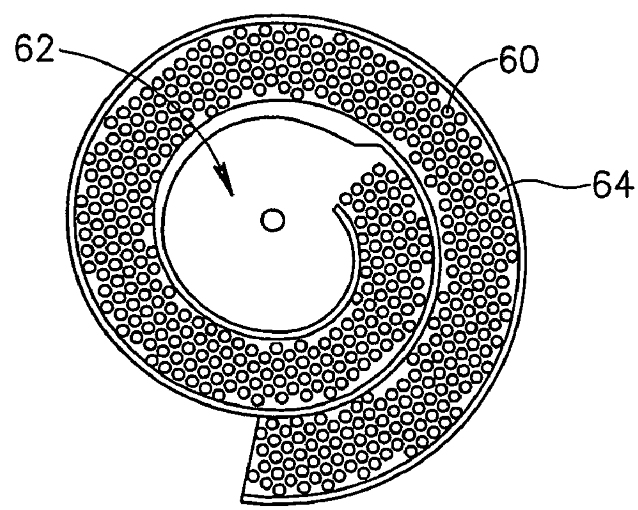


FIG.2B

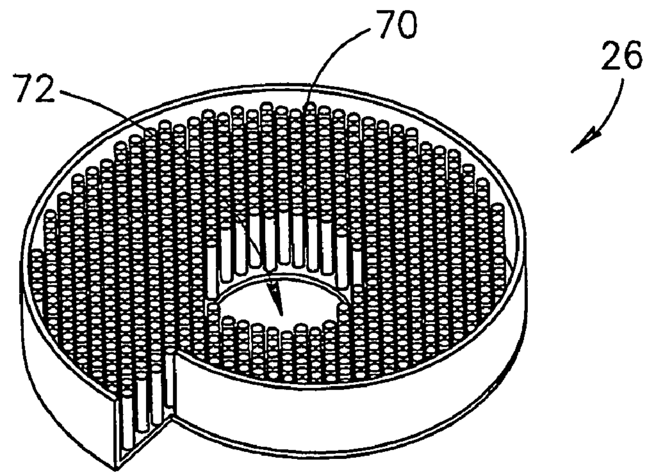


FIG.3A

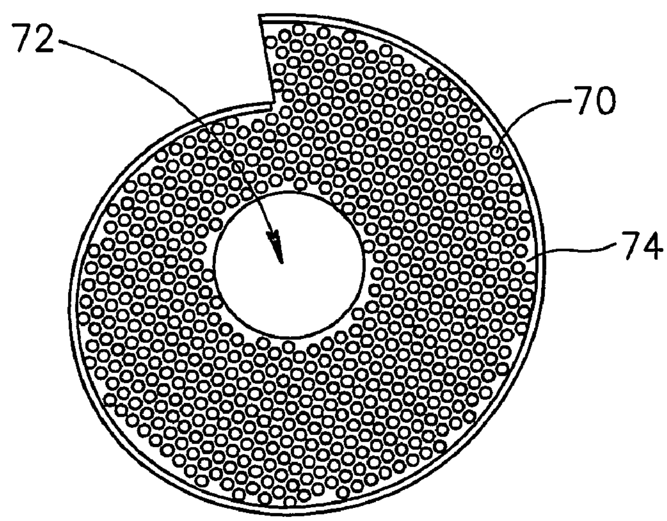


FIG.3B

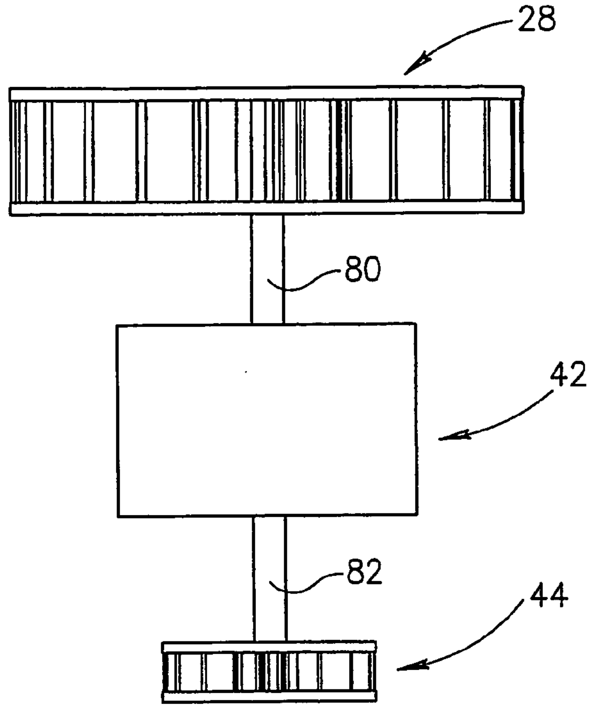


FIG.4

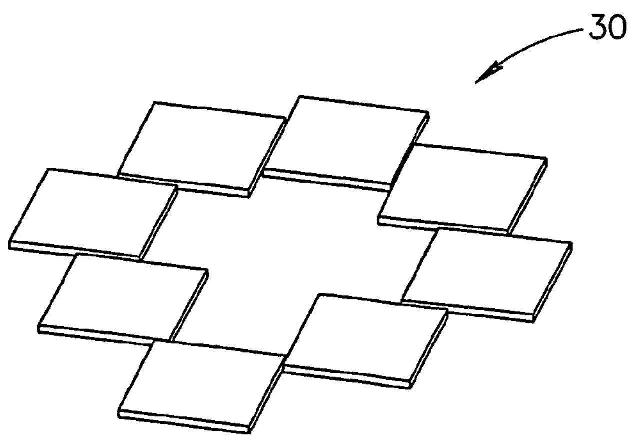


FIG.5

APPARATUS AND METHOD FOR EXCHANGING HEAT

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a heat-exchange apparatus, in general, and to a spiral shape heat-exchange apparatus, in particular.

[0003] 2. Discussion of the Related Art

[0004] Heat exchangers of different sizes and shapes are known in the art, such examples are plate type, shell and tube, and fin Heat exchangers. Common objectives considered for Heat exchangers construction are economy of manufacture, efficiency of heat transfer, safety and long service life. The basic construction of heat exchangers is aimed to optimize the heat exchange between a cool fluid and a hot fluid. Wherever fluids are mentioned, it could also include Air. Optimization of heat transfer within heat exchangers is a broad subject for scientists as well as engineers. Among the important parameters tested to reach optimization of heat exchangers are the temperature of the inlet fluids, the volume capacity of the fluids per time interval, the contact surface between the fluids, the fluid used, building materials of the heat exchanger, the temperature required for the outlet fluid and others. A change of value of one of the said parameters can have a significant influence on the operating performance of heat exchangers. Heat exchangers are commonly constructed as to have a bi-directional fluid flow in order to increase performance efficiency of the heating or cooling process. Thus, bi-directional heat exchangers provide a faster and usually energy saving manner of reaching a temperature requested of a desired fluid. Specifically, heat exchangers known in prior art, such as a shell and tube heat exchangers and others, include a first fluid that flows from one chamber to another chamber through bypass or cross-flow conduits, so as to exchange heat with a second fluid flowing in the passages of adjacent, heat-conductive conduits. Characteristically, a coolant fluid is the first fluid, the second fluid being atmospheric air. Alternatively, the second fluid is typically available in large quantities at substantially low cost, for use in bulk flow heat exchangers, such as water. Usually, the cooling or heating fluid flows within a U shape conduits. The U shape fluid flow provides more surface contact with the coolant fluid in order to permit additional heat to be absorbed. However, the U shape flow decreases the flow capacity of the fluid, subject to the U shape, which demands an 180° angel, turn of the fluid. Thus, a large capacity fluid flowing in a U shape conduit causes the eruption of friction forces that slow the fluids flow within conduit by causing turbulence flow and consequently, undesirable pressure within heat exchangers.

[0005] Thermoelectric chips for heating and cooling based on the Peltier effect are known within the prior art. A thermoelectric layout is constructed of semi-conducting materials, such as bismuth telluride, that are electrically connected in parallel and/or series. When an electric current is connected to the circuit, a heat gradient is created, thus, heat is absorbed at the cold junction of the circuit and is transferred to the hot junction of the circuit. By inserting the hot and cold junctions within a heat exchanger, heat can be transferred from one fluid flow stream to another. Classically, a heat exchanger is filled with either gas or liquid fluid, resulting in the heating of one fluid and the cooling of the other fluid. The use of thermoelectric chips within heat exchangers in prior art is usually limited to particular uses, such as small capacity per time interval heat exchangers units or for delicate heat exchangers constructional conditions. The reasons for the limited use of thermoelectric chips are due to the fact that chips have a delicate construction and use electrical current for their operation. Using thermoelectric chips within rigid conditions can damage the construction of the chips consequently, decreasing the heat transfer capability of the heat exchanger. Due to the use of electric current to activate thermoelectric chips cooling or heating of explosive fluids can be hazardous. Nevertheless, the use of thermoelectric chips can provide efficient heat transfer when intelligently implemented within heat exchangers. There is a need in the art for a facility that will provide efficient performance of heat transfer in comparison to other heat exchangers of the same capacity. Furthermore, there is a need in the art to facilitate heat exchangers devices that are simple and can be easily optimized and minimizes energy loses due to mechanical flow of the fluids. Furthermore, there is a need in the prior art for a conditioning unit that will have a minimal size and weight that require minimal energy yet providing relatively large capacity of conditioning (e.g. of air). Thus, providing conditioning units for systems wherein reaching a minimal size, weight and energy consumption is vital. Said systems that require air conditioning units can be racing cars.

SUMMARY OF THE PRESENT INVENTION

[0006] The present invention provides a new and novel apparatus and method for fluid conditioning.

[0007] One aspect of the present invention regards an apparatus for exchanging heat, the apparatus comprising, a conduit having a spiral shape for conditioned fluid to flow through, a heat sink compartment that will be related below as the heat transfer unit of the coolant fluid compartment, a chip layout comprising a thermoelectric unit positioned between the conduit and the heat sink compartment such that one surface of the array is in contact with the fluid conduit and the second surface is in contact with the heat sink compartment. The heat sink compartment is a conduit having an inlet and an outlet for allowing a fluid to flow through. The apparatus may further comprise a motor and a first fan connected to the motor for driving the fluid to be conditioned through the spiral-shaped fluid conduit. The apparatus may further comprise a second fan for driving fluid through the heat sink compartment, the motor is a double-shaft motor having two opposite coaxial spinning shafts and the first and second fans are connected each to one of the two opposite shafts. The motor is located at the heat sink compartment. The fluid to be conditioned or driven through the heat sink could be air or water. The spiral shaped fluid conduit comprises a rounded thermally conductive base plate, the plate is in contact with one surface of the thermoelectric layout; and walls perpendicular to the plate, the walls forming a spiral path. The first fan is positioned at the center of the spiral path. The spiral path is provided with a plurality of pin fins perpendicularly protruding from the plate. The apparatus may be used as a fluid conditioner for directing conditioned fluid to a specific location through a conduit connected to the outlet of the spiral shaped conduit.

[0008] A second aspect of the present invention regards a heat exchange apparatus for use as a compact air-conditioning unit, the apparatus comprising a spiral-shaped conditioned-air compartment having a first inlet and a first outlet, a heat sink compartment having a second inlet and a second outlet, a thermoelectric array comprising a thermoelectric chip, positioned between the conditioned-air compartment and the heat sink compartment, such that when electric current is passed through the array a temperature gradient is formed between the conditioned air compartment and the heat sink compartment, a motor having two opposite coaxial spinning shafts; and two fans mounted each on one of the two opposite shafts such that one fan is mounted in the conditioned air compartment for driving ambient air through the first inlet, and the second fan is mounted in the heat sink compartment for driving ambient air through the second inlet. The conditioned air compartment comprises a first heat transfer unit fabricated from a thermal conductive material, the heat transfer unit comprises a base plate and perpendicular walls forming a spiral path and wherein the first inlet and the first outlet are located at the inner end and the outer end of the spiral path, respectively. The motor is mounted inside the heat sink compartment such that heat generated during operation of the motor is transferred to the air flowing through the heat sink compartment.

[0009] Yet, another aspect of the present invention regards a method for conditioning fluid by a heat exchange apparatus, the method comprising driving a first fluid to be heated or cooled through a first compartment of a heat exchange apparatus, the compartment comprises a spiral shape path, driving a second, coolant or heating, fluid through a second compartment of the heat exchange apparatus, activating a layout comprising a thermoelectric chip for forming a temperature gradient between two surfaces of the array, wherein one surface is in contact with the first compartment and the second surface is in contact with the second compartment. The motor serves for driving both the first fluid and the second fluid through the first and the second compartments, respectively. The motor is provided with two opposite coaxial spinning shafts and wherein a first and second fan, are mounted each on one of the two shafts such that the first fan draws the first fluid through the first compartment and the second fan draws the second fluid through the second compartment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

[0011] **FIG. 1A** is an overall view of heat exchangers in accordance with a preferred embodiment of the present invention;

[0012] **FIG. 1B** depicts the different components of the heat exchangers of a preferred embodiment of the present invention;

[0013] **FIG. 2A** is a perspective view of an open heat transfer unit of the conditioned fluid compartment within a heat exchanger of the preferred embodiment of the present invention;

[0014] **FIG. 2B** is a cross section through the heat transfer unit of the conditioned fluid compartment of **FIG. 2A**;

[0015] **FIG. 3A** is a perspective view of an open heat transfer unit of the coolant fluid compartment within a heat exchanger of the preferred embodiment of the present invention;

[0016] **FIG. 3B** is a cross section through the heat transfer unit of the coolant fluid compartment of **FIG. 3A**;

[0017] **FIG. 4** is a profile view of a motor and rotate-ably mounted fans within a heat exchanger of the preferred embodiment of the present invention;

[0018] **FIG. 5** is a schematic illustration of a thermoelectric chips layout within a heat exchanger of the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] The present invention provides an innovated concept of operation for heat exchangers, a distinctive profile of construction of heat exchangers and exploitation of thermoelectric chips as heat transferring means. The present invention provides a heat exchanger that optimizes the heat transfer process, thus, providing a simple yet high capacity efficient heat exchanger. The present invention provides a heat exchanger having a spiral shaped conditioning compartment enabling the heat exchanger to be small and more efficient than previous heat exchangers. Furthermore, the heat exchanger of the present invention comprises a single motor unit for performing the inlet and outlet of conditioned and coolant fluids allowing a more compact and efficient heat exchanger. The use of the particular design enables a more efficient cooling/or heating while consuming less energy. The use of one motor in association with a spiral shape heat exchanger also results in a better heat exchange in high volume of conditioned fluid exchange. The present invention will be better understood during the depiction of the following drawings that illustrate the preferred embodiment of the present invention.

[0020] **FIG. 1A** presents the preferred embodiment of the present invention. The heat exchanger designated **10** presents a spiral exterior shape of the innovative heat exchanger **10**. The coolant fluid enters and leaves heat exchanger **10** through inlet **16** and outlet **14**, respectively. The conditioned fluid outlet is designated **12**. The inlet of the conditioned fluid that is placed on the same axis line of the coolant fluid inlet **16** is not shown in **FIG. 1A**. One skilled in the art can easily comprehend that, though, the preferred embodiment, depicted in view of the drawings, refers to conditioning air by a coolant that is air, it is by no means limited to the mentioned example. The fluids used within the heat exchanger **10** can be of any sort without any limitation of physical state of the fluid. Thus, the coolant or the fluid to be conditioned can be any physical state, liquid or gas, requested by a user.

[0021] **FIG. 1B** illustrates in a de-assembled manner the components that consist heat exchanger **10** according to the preferred embodiment of the present invention. One skilled in the art can foresee that the elements illustrated within **FIG. 1B** are presented in order to comprehend the present embodiment alone and do not limit the scope of the present invention. Heat exchanger **10** is comprised from a coolant fluid compartment **50** also referred to as a heat sink compartment, a conditioned fluid compartment **52**, a motor **42** and thermoelectric chips layout **30**. The coolant fluid compartment **50** is comprised from a coolant inlet **16**, a coolant cover **20**, a fan cover **22**, a sealing cover **24**, a heat transfer unit **26** and a fluid fan **28**. The coolant fluid outlet **14** is presented in **FIG. 1A** is viewed at the coolant cover **20** viewed in **FIG. 1B**. The coolant inlet **16** is in the central part of the coolant cover **20**. Heat transfer unit **26** and the coolant insertion section are described below in conjunction with **FIGS. 3A and 3B**. The coolant cover **20** covers the entire coolant fluid compartment **50**, thus, determining the size of the coolant fluid compartment **50**. The fluid fan **28** draws the coolant fluid to the coolant fluid compartment **50**. The coolant fluid enters the coolant fluid compartment **50** through the coolant inlet **16**. The fan cover **22** is positioned on the top part of the fluid fan **28** thus, fixing the position of fluid fan **28** and not allowing the coolant fluid to exit from the space between the coolant fluid cover **20** and the fluid fan **28**. The fluid fan **28** is positioned in the center part of the coolant fluid compartment **50**, a better view of the fluid fan's **28** position in relation to the coolant fluid compartment **50** is viewed in **FIG. 3B**. The fluid fan **28** relation to the motor **44** and to the suction fan **44** will be depicted in view of **FIG. 4** bellow. The sealing cover **24** prevents the exit of the coolant fluid from the coolant fluid compartment **50** other than the coolant outlet section **14** illustrated in **FIG. 1A**. The heat transfer unit **26** is positioned above the thermoelectric chips layout **30** and contains fins that aid efficient heat exchange toward the coolant fluid. Thus according to the preferred embodiment of the present invention the coolant (e.g. air) exchanges heat with the fins positioned within the heat transfer unit **26**. The fins **70** are depicted and illustrated more closely in **FIGS. 3A and 3B** below. The thermoelectric chips layout **30** is positioned under the coolant heat transfer unit **26** and over the conditioned heat transfer unit **32**. The terms "under" and "over" used within the depiction of the drawings are in accordance to the illustrations shown and by no means are limiting the scope of the present invention. The conditioned fluid compartment **52** is comprised from a conditioned fluid inlet **48**, a conditioned fluid compartment cover section **40**, a sealing cover **38**, an insulation cover for suction fan **36**, a suction fan cover **34**, a heat transfer unit **32** and a suction fan **44**. The thermoelectric chips layout **30** is positioned between the coolant heat transfer unit **26** and the conditioned fluid heat transfer unit **32**. The conditioned fluid enters the conditioned fluid compartment **52** through the conditioned fluid inlet **48**. The conditioned fluid chosen to illustrate the preferred embodiment of the present invention is air. The conditioned fluid inlet **48** is positioned in the central part of the conditioned fluid compartment cover section **40**. According to one preferred embodiment of the present invention the diameter of the conditioned fluid inlet is approximately 30% longer than the diameter of suction fan **44**. A better perspective of the conditioned fluid inlet **48** position is provided in **FIGS. 2A and 2B**. The conditioned fluid compartment cover section **40** covers the entire conditioned fluid compartment **52**, thus, determining the size of the conditioned fluid compartment **52**. The sealing cover **38** prevents the conditioned fluid to exit from the heat transfer unit **32** other than the coolant outlet section **12** illustrated in **FIG. 1A**. The insulation cover **36** for suction fan **44** prevents thermal exchange from the heat transfer unit **32** through the opening of the suction fan **44**. As can be viewed in **FIG. 1B** the heat transfer unit **32**, suction fan cover **34** as well as insulation cover **36** (not shown) include a hole enabling the positioning of the fan connecting pivot **82** depicted below in view of **FIG. 4**. The suction fan cover **34** besides sealing the exit of conditioned fluid from the heat transfer unit **32** also stabilizes the position of the suction fan **44** by eliminating mechanical stress from the motor assembly. The heat transfer unit **32** is positioned under the thermoelectric chips **30** and contains fins that aid efficient heat transfer from the conditioned fluid towards the coolant fluid. The fins **60** are depicted and illustrated more closely within **FIGS. 2A and 2B** below. The suction fan **44** sucks the fluid to be conditioned into the conditioned fluid compartment **52**. The suction fan **44** will be depicted in view of **FIG. 4** bellow. The thermoelectric chips layout **30** is positioned above the heat transfer unit **32** and under the coolant fluid compartment heat transfer unit **32**. The motor **42** is positioned according to the preferred embodiment within the center of heat transfer unit **26** within the coolant fluid compartment **50**. More specifically the motor **42** is positioned within the center of the inlet section **72** as viewed and depicted in regard to **FIG. 3A** below. The fluid fan **28** and the suction fan **44** are pivotally connected to the motor **42**. The motor's **42** position and the fact that the fluid fan **28** and the suction fan **44** are pivotally connected provide a unique construction of HE **10**. The motor **42** provides dual functionality within heat exchanger **10** as presented according to the preferred embodiment. The motor **42** is functioning as the driving force of the incoming coolant fluid at the coolant inlet **16** and is functioning as the driving force of the inserted fluid to be conditioned at the conditioned fluid inlet **48**. The dual functionality of the motor **42** saves space and enables to achieve optimization of the energy and efficient energy exploitation within the preferred embodiment as well as minimizing the energy consumption of heat exchanger **10**. The conditioned fluid compartment **52** is positioned on the opposite side of the coolant fluid compartment **50**.

[0022] The preferred embodiment of heat exchanger **10** is a cooling apparatus; accordingly, the heat is transferred from the conditioned fluid to the coolant. The temperature gradient within heat exchanger **10** is formed by the Peltier effect performed by the thermoelectric chips layout **30**. The surface coverage of the thermoelectric chips layout **30** is further discussed in view of **FIG. 5**. The conditioned fluid enters the conditioned fluid compartment **52** and an the heat is transferred from the conditioned fluid to the fins **60 (FIG. 2B)** within the heat transfer unit **32** and the base of the heat transfer section **64 (FIG. 2B)**. The thermoelectric chips layout **30** by exploiting the Peltier effect indicates the direction of the heat flow from the conditioned fluid to the coolant. Thus, motivating and directing the heat transfer direction. Hence, the heat transfer within the preferred embodiment is directed from the conditioned fluid compartment **52** towards the coolant fluid compartment **50**. The said fins transfer the received heat to the coolant fluid compartment **50** through the thermoelectric chips layout **30** to the heat transfer unit **26** within the coolant fluid compartment **50**. An exchange of the heat within heat transfer unit **26** is performed from the fins **70 (FIG. 3B)** and heat transfer section base **74 (FIG. 3B)** to the coolant fluid within the heat transfer unit **26**. The coolant within the heat transfer unit **26** transfers the heat from the heat exchanger **10** at the outlet **14** shown in **FIG. 1A**.

[0023] **FIGS. 2A and 2B** present a layout of the heat transfer unit **32** within the conditioned fluid compartment **52**. Accordingly, **FIG. 2A** presents the spiral path that the conditioned fluid goes through within the conduit of heat transfer unit **32**. The fluid to be conditioned within the heat transfer unit **32** within the preferred embodiment of the present invention is drawn by means of fan **44** through the center of the heat transfer unit **32** at the conditioned fluid inlet **62**. The conditioned fluid exits the heat transfer unit **32** at the conditioned fluid outlet **12 (FIG. 1A)**. The suction fan **44 (FIG. 1B)** draws said fluid to the heat transfer unit **32** and the conditioned fluid flows through the heat transfer section conduit to the conditioned fluid outlet **12 (FIG. 1A)**. Due to the spiral shape of the conduit of the heat transfer unit **32**, as illustrated within **FIG. 2A**, the fluid flows through a long way, thus, enhancing the heat transfer rate from the conditioned fluid to the fins **60** the thermoelectric chips **30** to the fins **70** within the coolant fluid compartment **50**. The fins **60** within the heat transfer unit **32** improve the heat transfer from the conditioned fluid to the coolant by erupting the flow of the conditioned fluid. A temperature gradient within the heat transfer unit **32** exists between the conditioned fluid and the fins **60** due to the fact that the fin's **60** base are connected to the base of the heat transfer section **64 (FIG. 2B)**. The base of the heat transfer section **64** is in contact with the cool side of the thermoelectric chips layout **30 (FIG. 1B)**. The thermoelectric chips layout **30** using the Peltier effect creates a temperature gradient that according to the preferred embodiment enables exchange of heat from the heat transfer section base **64** to the heat transfer unit **26** within the coolant fluid compartment **50**. The heat transfer unit **26** is positioned in contact with the hot side of the thermoelectric chips layout **30 (FIG. 1B)**. The heat exchange within the heat transfer unit **26** provides the exchange of the heat by the coolant fluid within the heat transfer unit **26**. Consequently, the heat received from the conditioned fluid exits HE **10 (FIG. 1B)** with the coolant flow at the coolant outlet **14 (FIG. 1A)**. The heat gradient within the heat transfer unit **32** as well as heat transfer unit **26** varies along the progress of the conditioned fluid and the coolant fluid due to the exchange of heat executed along the flow of the fluid from its insertion to the conditioned fluid outlet **12 (FIG. 1A)** and the coolant outlet **14 (FIG. 1A)**. The spiral flow movement within heat exchanger **10 (FIG. 1B)** of the conditioned fluid within the heat transfer unit **32** facilitates improved exchange possibilities in comparison to other heat exchangers known in the art. The flow of the conditioned fluid in a spiral course minimizes the flow disturbances compared to known parallel heat exchangers, having the same capacity of conditioned fluid, same temperature difference of inlet and outlet of conditioned fluid. Furthermore, improved exchange of heat within the heat exchanger of the preferred embodiment is reached due to the use of the thermoelectric chips layout **30 (FIG. 1B)**. The thermoelectric chips layout **30** creates a temperature gradient between the coolant fluid compartment **50** and the conditioned fluid compartment **52**. The improved heat exchange capabilities of heat exchanger **10** of the preferred embodiment enables to provide a small size heat exchanger **10** for performing the conditioning of a required fluid capacity. The size of heat exchanger **10** provided in the preferred embodiment is considerable smaller and requires less energy consumption in comparison to usage for a commonly used shell and tube heat exchanger that provides the same capacity and conditioning of a given fluid with the same coolant. Furthermore, as illustrated in **FIG. 4** heat exchanger **10** includes only one motor **42** used for both the inlet and outlet of conditioned fluid and coolant fluid. The improved exchange offered within the preferred embodiment of the present invention along with the use of only one motor **42** for performing the inlet and the outlet of the conditioned and coolant fluids provide a compact heat exchanger unit that supplies conditioned fluid.

[0024] **FIGS. 3A and 3B** illustrate the heat transfer unit **26** within the coolant fluid compartment **50 (FIG. 1B)**. The heat transfer unit **26** includes the inlet section **72**, the outlet section **14 (FIG. 1A)**, fins **70** and the heat transfer section base **74 (FIG. 3B)**. The inlet section **72** is positioned within the preferred embodiment in the center of the heat transfer unit **26** as viewed in **FIG. 3B**. The heat transfer unit **26** includes fins **70** that improve the heat exchange to the heat transfer section base **74** that is positioned above the thermoelectric chips layer **30 (FIG. 1B)**. Similar to the function of fins **60** within the heat transfer unit **32 (FIG. 2A)** depicted above, the fins **70 (FIG. 3A)** enable efficient exchange of heat within the preferred embodiment from the conditioned fluid to the coolant fluid. The temperature gradient exists from the conditioned fluid within the heat transfer unit **32 (FIG. 2A)** within the conditioned fluid compartment **52** through the fins **60 (FIG. 2A)**, the heat transfer section base **64 (FIG. 2B)**, the thermoelectric chips layout **30 (FIG. 5)**, the heat transfer section base **74 (FIG. 3B)** within the coolant fluid compartment **50**, the fins **70 (FIG. 3A)** and the coolant fluid. The said temperature gradient is different and is subject to the temperature of the fluids, conditioned and coolant, at every point along their course within heat exchanger **10 (FIG. 1A)** of the preferred embodiment. Nevertheless, the said temperature gradient, initiated by the Paltier effect by the thermoelectric chips layout **30**, motivation derives a rapid and efficient heat transfer from one fluid to the other within the preferred embodiment of the present invention. The coolant, within the coolant fluid compartment **50**, according to the preferred embodiment, transports the heat received from the conditioned fluid, within the conditioned fluid compartment **52**, by means of exchange through the fins **60, 70 (FIG. 2A, FIG. 3A**, respectably), the heat transfer section base **64, 74 (FIG. 2A, FIG. 3A** respectably) and the thermoelectric chips layout **30**. The outlet **14 (FIG. 1A)** is the place the coolant leaves the heat exchanger transferring heat from the conditioned fluid. The thermal calculation (i.e. the heat capacity for transferring from conditioned fluid) for supplying required conditioned fluid capacity at a particular temperature is based on the coolant capacity. The thermal calculation according to the preferred embodiment takes into account the heat transferring of the heat of motor **42** positioned within the coolant fluid compartment **50**.

[0025] **FIG. 4** illustrates the motor **42**, a fluid fan **28**, a suction fan **44**, a fluid fan connecting pivot **80** and the suction fan connecting pivot **82**. The motor **42** is positioned within the preferred embodiment in the center axis of the heat exchanger **10 (FIG. 1B)** as depicted in view of **FIG. 1B**. The fluid fan **28** and the suction fan **44** are rotate-ably connected to the motor **42**. The fluid fan **28** within the preferred embodiment is a blower that draws coolant fluid (e.g. air) into heat exchanger **10**. The suction fan **44** inserts the conditioned fluid to the heat exchanger **10**. According, to the different functions of the said fans, the fluid fan **28** within the heat exchanger **10** is larger and includes more blades than the suction fan **44**. Nevertheless, the different functions of the said fans does not prevent the economical and well operating pivotally connected operation on the same axis of fluid fan **28** and suction fan **44** within the preferred embodiment. The operating of fluid fan **28** and suction fan **44** provides an easily achieved optimized operation of heat exchanger **10**, excludes the need for an additional apparatus to insert fluid and saves space within heat exchanger **10**. Thus, the heat exchanger of the preferred embodiment has a smaller size and better capabilities in comparison to heat exchangers known in the art.

[**0026**] **FIG. 5** illustrates the thermoelectric chips layout **30** within the preferred embodiment of the present invention. Accordingly, the thermoelectric chips layout **30** is positioned in a way that covers most of the surface area at the base of heat transfer sections of the conditioned fluid compartment **52** and the coolant fluid compartment **50**. The surface covered by the thermoelectric chips layout **30** and the heat gradient created by the thermoelectric chips layout **30** increase the heat exchange between the conditioned fluid and the coolant fluid as described above relating to **FIG. 2A** and **FIG. 3A**. Consequently, providing an efficient operation of the HE of the preferred embodiment.

[**0027**] Follows is an example of one particular embodiment of the present invention used for conditioning air and using air as the coolant fluid. Motor **42** is a 12V DC brushless motor manufactured by Kollmorgen having the following example characteristics: I_{max}=7 A; motor length 28 mm; Diameter 44 mm; about 11,700 R.P.M. The fluid fan **28** has a diameter of 76 mm and **28** blades and the suction fan **44** has a diameter of 32 mm and about 10 blades. The fluid fan connecting pivot **80** length is 16 mm and the suction fan connecting pivot **82** length is 18.90 mm. The heat transfer unit **32** within the conditioned fluid compartment **52** and the heat transfer unit **26** within the coolant fluid compartment **50** are fabricated from an aluminum based alloy material containing zinc. The dimensions of the heat transfer unit **32** (as can be understood by viewing **FIG. 2B**) are as follows: length 192 mm (upper part of base of the heat transfer section **64** to the lowest edge), width 180 mm, length of the conditioned fluid inlet **62**, 73 mm (upper part of the inlet to lower part of the inlet) and the width is 52 mm. The dimensions of the heat transfer unit **26** (as can be understood by viewing **FIG. 3B**) are as follows: length 192 mm (upper part of base of the heat transfer section **64** to the lowest edge), width 180 mm. The thickness of the base of the heat transfer section **64** is 8 mm. The fins, designated **60** and **70** within heat transfer unit **32** and heat transfer unit **26** (**FIG. 2A** and **FIG. 3A**, respectively), are 32 mm high. The said fins are distributed all over the heat transfer sections base and the distance between two neighboring fins ranges between 5 and 6 mm. The sidewall of the heat transfer unit **26** and the sidewall and the inner spiral walls of the conduit of the heat transfer unit **32** have a width of 3 mm. The thermoelectric chips layout **30** (**FIG. 5**) is combined from eight chips manufactured by Thermonamic Electronics (Xiamen Co. Ltd.) from China, Catalog No. TEC1-12704. The dimensions of a single chip is as follows 40×40×4.7 having I_{max}=3.9 amp.; V_{max}=15 volts; Q_{max}=33.4 Watt. The said chips within the particular embodiment are connected as follows, each couple of chips connected in series and the 3 pairs connected in parallel. The coolant air influx within the particular embodiment is constant 140 CFM. The conditioned air inlet maximum influx is 18 CFM. The pressure within the heat transfer unit **32** at 0 CFM is 10" H_2O and 2" H_2O at 18 CFM. The results received within the operation of the said particular embodiment are as follows, the inlet air at 30° Celsius and 50% RH (relative-humidity) at the conditioned air inlet, the conditioned air outlet provides 17 Celsius, at 16-17 CFM. The person skilled in the art will appreciate that the above example is exemplary and tat the dimensions and measurements supplied are in no way limiting and serve merely to better describe the invention and enable a person skilled in the art to make and use the invention. Other like dimensions and measurements can be used to accomplish the objectives of the present invention.

[**0028**] The person skilled in the art will appreciate that what has been shown is not limited to the description above. Many modifications and other embodiments of the invention will be appreciated by those skilled in the art to which this invention pertains. It will be apparent that the present invention is not limited to the specific embodiments disclosed and those modifications and other embodiments are intended to be included within the scope of the invention. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation. The scope of the present invention is clearly defined by the claims that follow.

1. An apparatus for exchanging heat, the apparatus comprising:

at least one conduit having a spiral shape for conditioned fluid to flow through;

at least one heat sink compartment;

a chip layout comprising at least one thermoelectric unit positioned between the at least one conduit and the at least one heat sink compartment such that a first surface of the chip layout is in contact with the fluid conduit and a second surface is in contact with the heat sink compartment.

2. The apparatus of claim 1 wherein the at least one heat sink compartment is a conduit having an inlet and an outlet for allowing the fluid to flow through.

3. The apparatus of claim 1 further comprising a motor and a first fan connected to the motor for driving the fluid to be conditioned through the spiral-shaped fluid conduit.

4. The apparatus of claim 3 further comprising a second fan for driving fluid through the heat sink compartment, wherein the motor is a double-shaft motor having two opposite coaxial spinning shafts and the first and second fans are connected each to one of the two opposite shafts.

5. The apparatus of claim 4 wherein the motor is located at the heat sink compartment.

6. The apparatus of claim 1 wherein the fluid to be conditioned is air.

7. The apparatus of claim 1 wherein the fluid driven through the heat sink is air.

8. The apparatus of claim 1 wherein the fluid driven through the heat sink is water.

9. The apparatus according to claim 1 wherein the spiral shaped fluid conduit comprises a rounded thermally conductive base plate, wherein the plate is in contact with one surface of the thermoelectric layout; and further comprising:

walls perpendicular to the plate, the walls forming a spiral path.

10. The apparatus of claim 9 wherein the first fan is positioned at a center of the spiral path.

11. The apparatus of claim 9 wherein the spiral path is provided with a plurality of pin fins perpendicularly protruding from the plate.

12. The apparatus of claim 9 wherein the heat sink comprises a thermally conductive base plate and a plurality of thermally conductive pin fins perpendicular to the plate and wherein dimensions of said plate are substantially the same as dimensions of the rounded plate of the spiral fluid conduit.

13. The apparatus according to claim 1 for use as a fluid conditioner for directing conditioned fluid to a specific location through a conduit connected to the outlet of the spiral shaped conduit.

14. A heat exchange apparatus for use as a compact air-conditioning unit, the apparatus comprising:

a spiral-shaped conditioned-air compartment having a first inlet and a first outlet;

a heat sink compartment having a second inlet and a second outlet;

a thermoelectric array comprising at least one thermoelectric chip, positioned between the conditioned-air compartment and the heat sink compartment, such that when electric current is passed through the array a temperature gradient is formed between the conditioned-air compartment and the heat sink compartment;

a motor having two opposite coaxial spinning shafts; and

first and second fans mounted each on one of the two opposite shafts such that the first fan is mounted in the conditioned air compartment for driving ambient air through the first inlet, and the second fan is mounted in the heat sink compartment for driving ambient air through the second inlet.

15. The apparatus of claim 14 wherein the conditioned air compartment comprises a first heat transfer unit fabricated from a thermal conductive material, the heat transfer unit comprises a base plate and perpendicular walls forming a spiral path and wherein the first inlet and the first outlet are located at the inner end and the outer end of the spiral path, respectively.

16. The apparatus of claim 14 wherein the motor is mounted inside the heat sink compartment such that heat generated during operation of the motor is transferred to the air flowing through the heat sink compartment.

17. A method for conditioning fluid by a heat exchange apparatus, the method comprising:

driving a first fluid to be heated or cooled through a first compartment of a heat exchange apparatus, the compartment comprising a spiral shape path;

driving a second, coolant or heating, fluid through a second compartment of the heat exchange apparatus;

activating a layout comprising at least one thermoelectric chip for forming a temperature gradient between first and second surfaces of the layout, wherein the first surface is in contact with the first compartment and the second surface is in contact with the second compartment.

18. The method of claim 17 wherein one motor serves for driving both the first fluid and the second fluid through the first and the second compartments, respectively.

19. The method of claim 18 wherein the motor is provided with two opposite coaxial spinning shafts and wherein a first fan and a second fan are mounted each on one of the two shafts such that the first fan draws the first fluid through the first compartment and the second fan draws the second fluid through the second compartment.

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