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(54) **GEOTHERMAL TRANSFER SYSTEM**

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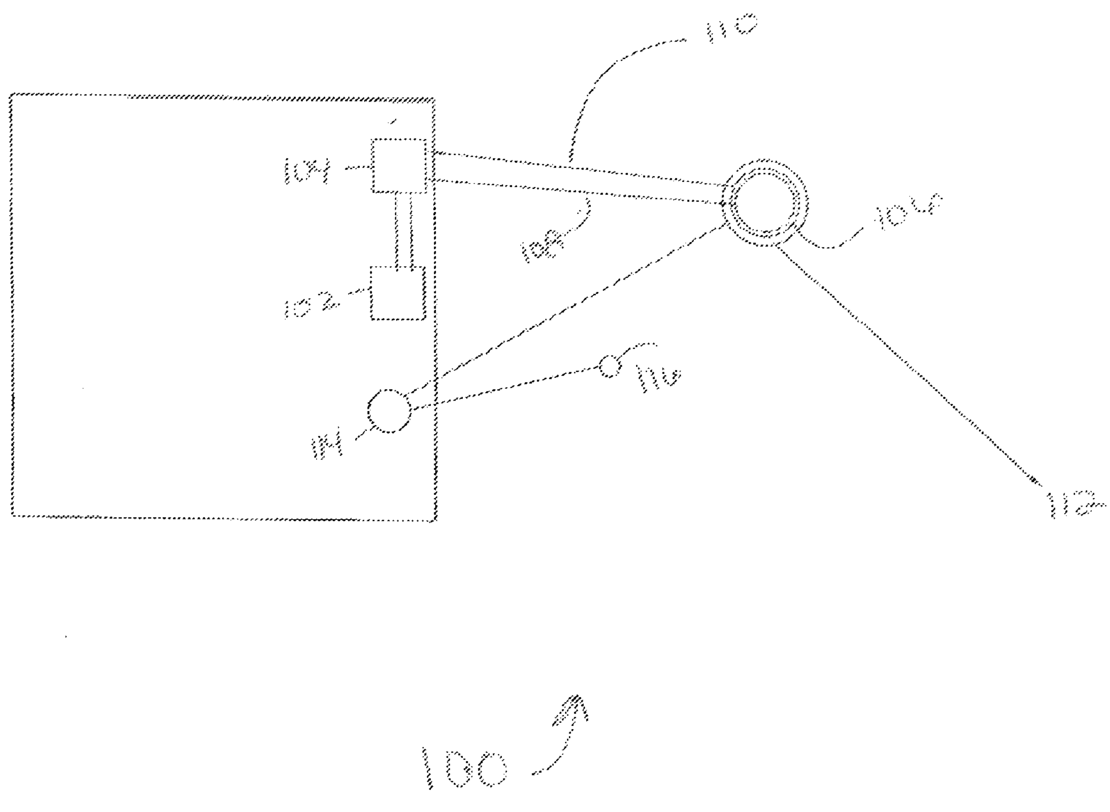
(57) **ABSTRACT**

Geothermal transfer systems and methods of transferring geothermal heat to residences are described herein. The geothermal transfer system generally includes an HVAC system in operable communication with a structure, the HVAC system adapted for circulating a heat transfer fluid therein, a housing adapted to contact the heat transfer fluid with water disposed therein, wherein the housing is disposed at a depth sufficient for geothermal transfer of heat between the water and the heat transfer fluid and adapted to refresh the water at a rate sufficient to maintain the geothermal transfer and a pump in fluid communication with the housing and adapted to transfer water from a water source to the housing.



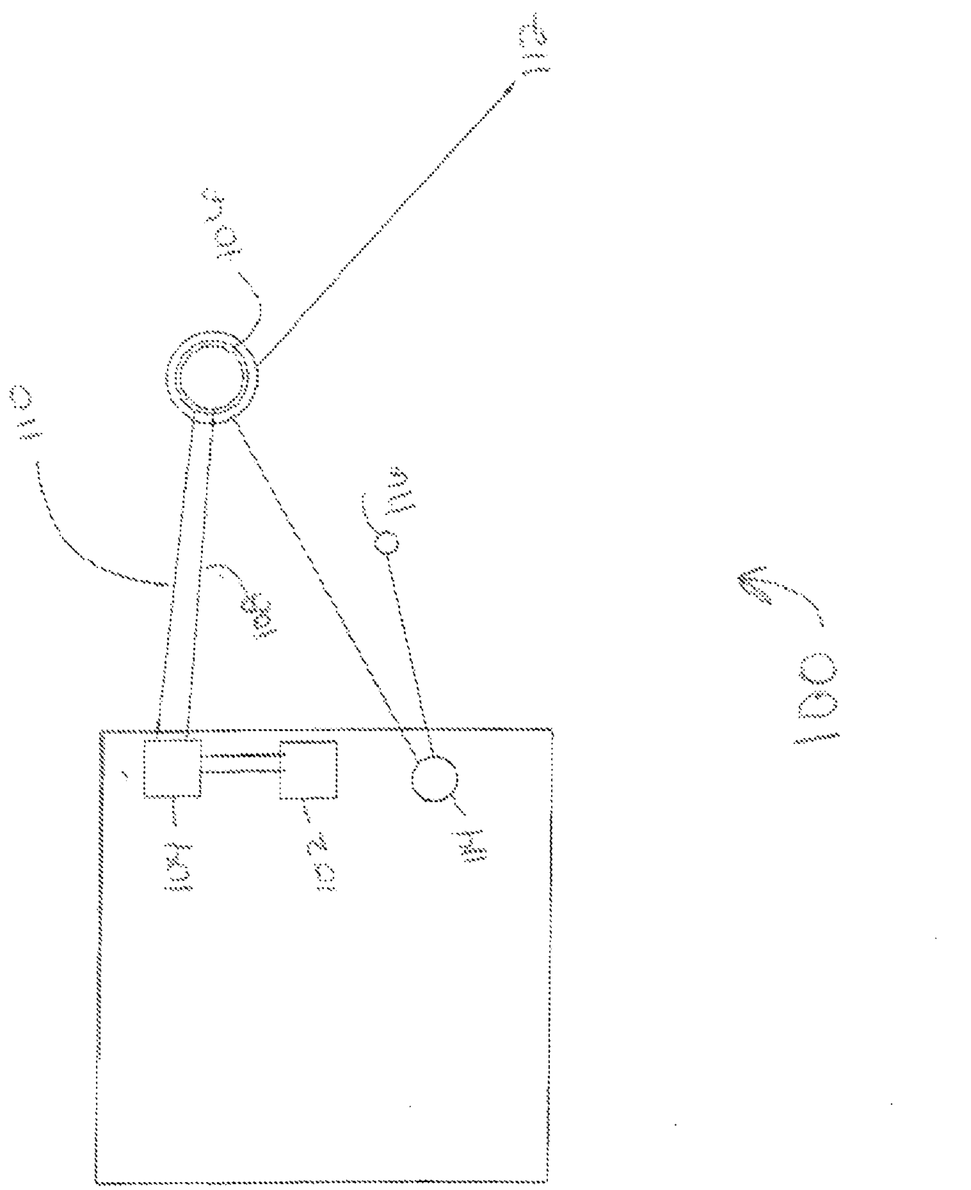


FIGURE 1

# GEOTHERMAL TRANSFER SYSTEM

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application claims the benefit of U.S. patent application Ser. No. 12/702,426, filed Feb. 9, 2010, which claims the benefit of U.S. Provisional patent application Ser. No. 61/150,908, filed Feb. 9, 2009.

## BRIEF DESCRIPTION OF DRAWINGS

**[0002]** FIG. **1** illustrates an embodiment of a geothermal transfer system.

## DETAILED DESCRIPTION

### Introduction and Definitions

**[0003]** A detailed description will now be provided. Each of the appended claims defines a separate invention, which for infringement purposes is recognized as including equivalents to the various elements or limitations specified in the claims. Depending on the context, all references below to the "invention" may in some cases refer to certain specific embodiments only. In other cases it will be recognized that references to the "invention" will refer to subject matter recited in one or more, but not necessarily all, of the claims. Each of the inventions will now be described in greater detail below, including specific embodiments, versions and examples, but the inventions are not limited to these embodiments, versions or examples, which are included to enable a person having ordinary skill in the art to make and use the inventions when the information in this patent is combined with available information and technology.

**[0004]** Various terms as used herein are shown below. To the extent a term used in a claim is not defined below, it should be given the broadest definition skilled persons in the pertinent art have given that term as reflected in printed publications and issued patents at the time of filing. Further, unless otherwise specified, all compounds described herein may be substituted or unsubstituted and the listing of compounds includes derivatives thereof.

**[0005]** Further, various ranges and/or numerical limitations may be expressly stated below. It should be recognized that unless stated otherwise, it is intended that endpoints are to be interchangeable. Further, any ranges include iterative ranges of like magnitude falling within the expressly stated ranges or limitations.

**[0006]** In typical geothermal heat exchange/transfer systems, a working fluid, such as water carries heat between an internal heat exchanger in the user's location thereinafter referred to as a "structure") and a geothermal mass. Structures may include residential, commercial and agricultural structures, for example.

**[0007]** Heat exchange systems often are designed to have both a "heating mode" and a "cooling mode". During the heating mode, heat is transferred from the geothermal mass to the structure, providing heat energy to the user. During the cooling mode, heat is transferred from the structure to a geothermal mass, providing cooling energy to the user.

**[0008]** Conventional heat pumps generally rely upon heat exchange between the heat pump and a geothermal mass by pumping the working fluid to the geothermal mass, where thermal energy is transferred via a primary heat exchange coil, and back to the structure to be heated, where an internal heat exchanger extracts the heat from this working fluid, in heating mode. The now cooled working fluid is then pumped back to the earth to be reheated through the primary heat exchange coil in contact with the geothermal mass. In cooling mode, this working fluid transfers heat from internal exchanger to geothermal mass.

**[0009]** Since the ground temperature is relatively constant at about 50° F. at a depth below the frost line, the availability of heat is relatively constant. Generally, placing a geothermal loop heat exchange system to conduct thermal exchange in both water based heat pump and direct exchange heat pump systems incorporates several characteristics. First, thermal exchange is dependent upon total surface area of the geothermal loop tube exposed to the geothermal mass. Next, circulation of the working fluid or refrigerant requires a circulating pump or compressor. For a water based heat exchange system, a water pump circulates water constantly through the geothermal loop. Thus, due to the limitations of the circulating pump or compressor capacity, both types of systems are of limited length and diameter geothermal loop tube for conducting the heat exchange. A limited diameter geothermal loop tube restricts the available heat exchange surface area per unit length of the tube. Typical water based and direct exchange heat exchange systems use a horizontal, vertical or diagonal looping system. Horizontal looping requires extensive excavation of the geothermal mass. Thus, use of horizontal looping for a house or building with a small yard is not practical.

**[0010]** Vertical or diagonal looping, however, requires drilling several holes to a depth of approximately 50-100 feet underneath the ground for direct exchange systems, and 200-300 feet for water source systems. And these systems also still generally require a modest size of land to install the necessary equipment.

**[0011]** Therefore, both types of existing systems require high cost installation due to extensive drilling, land excavation and labor requirement, as well as requiring a relatively long period of time to install.

**[0012]** Thus, there is also a need for a geothermal heat exchange system and method that does not require extensive drilling or excavation to offset the prohibitively costly installation of conventional loop systems.

**[0013]** The present invention advantageously provides for geothermal heat exchange system and method that does not require high cost installation due to extensive drilling, land excavation, labor requirement, as well as a relatively long installation period.

**[0014]** In contrast to conventional systems requiring extensive area, the present invention utilizes a system capable of installation in a small footprint. As shown in FIG. **1**, the geothermal transfer system **100** of the present invention is generally integrated with conventional heating, ventilating and air conditioning (HVAC) components, such as heat pumps, air conditioners and furnaces, for example (designated collectively as **102** in FIG. **1**).

**[0015]** The HVAC components **102** are generally in communication with a fluid circulation system **104**. The fluid circulation system is generally adapted to circulate a heat transfer fluid therethrough and to transfer the heat transfer fluid from the fluid circulation system **104** to and from a housing **106**, as discussed above. While in one or more embodiments, the housing **106** is disposed below the frost line, it is contemplated that the housing can be disposed at any location sufficient to geothermally transfer heat between the heat transfer fluid and the water disposed within the housing **106**, which may or may not be below the frost line.

**[0016]** In one or more embodiments, the heat transfer fluid is a conventional heat transfer fluid, such as glycol, a refrigerant or freon, for example. A feed line **108** connects the fluid circulation system **104** to the housing **106** and is adapted to transfer the heat transfer fluid from the fluid circulation system **104** to the housing **106**. A return line **110** connects the housing **106** to the fluid circulation system **104** and is adapted to transfer the heat transfer fluid from the housing **106** to the fluid circulation system **104**.

**[0017]** The heat transfer fluid generally flows through coils (not shown) disposed within the housing. The housing **106** may be of any size and shape appropriate to contain sufficient water to heat and or cool the heat transfer fluid. For example, the housing **106** may be formed of a coiled pipe and may be sized based on a desired load. The pipe **106** may be formed of a material, such as metal (e.g., copper) or a plastic (e.g., polypropylene, polyethylene or combinations thereof).

**[0018]** The housing **106** further contains water in contact with the geothermal mass. The water provides the geothermal heating and cooling capabilities. The water may be supplied by any source, such as naturally occurring bodies of water, such as lakes or rivers, wells or municipal water sources, for example. When the water is supplied by a well, the geothermal transfer system **100** may further include a well pump **114** operably connected to the housing **106**. The well pump **114** is then in further communication with a well **116** located outside of the geothermal transfer system **100**. It is contemplated that the well pump **114** may be adapted to pump water to a cistern (not shown) including the pipe **106**. The cistern may discharge to systems utilizing water in the case of overflow.

**[0019]** Unlike in traditional geothermal systems which expend significant amounts of energy due to the long underground passages required, the ability of the embodiments described herein to carefully control the water temperature in the housing **106** results in significantly decreased energy accumulation in the system and the surrounding earth. The water temperature may be controlled by supply of water to the housing **106** and discharge of such. Such control may be by known methods, such as automatically or manually operated valves, which may or may not be in operable communication with a sensor, for example.

**[0020]** Further, in contrast to conventional systems, utilizing water to transfer heat from the geothermal mass to the HVAC unit, the present invention eliminates contact of water with the HVAC components, thereby minimizing deposits on the HVAC components resulting from such contact. Furthermore, use of the water as described herein does not pollute or harm the water quality, allowing for reuse of water in subsequent applications. For example, the housing **106** may optionally discharge **112** to systems utilizing water, such as an irrigation system, a pond, a storm sewer, a secondary recharge well or combinations thereof, for example.

**[0021]** It has been observed that the geothermal transfer systems described herein may efficiently transfer heat geothermally in small scale applications, such as residential environments, for example.

**[0022]** It has further been observed that the embodiments described herein result in increased HVAC efficiency over conventional systems. For example, it has been observed that up to 90% of the HVAC system can run on 1 to 2 stages rather than the 2 to 3 stages utilized in conventional geothermal HVAC systems.

**[0023]** While the foregoing is directed to embodiments of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof and the scope thereof is determined by the claims that follow.

What is claimed is:

**1**. A geothermal transfer system comprising:

an HVAC system in operable communication with a structure, the HVAC system adapted for circulating a heat transfer fluid therein;

a housing adapted to contact the heat transfer fluid with water disposed therein, wherein the housing is disposed at a depth sufficient for geothermal transfer of heat between the water and the heat transfer fluid and adapted to refresh the water at a rate sufficient to maintain the geothermal transfer; and

a pump in fluid communication with the housing and adapted to transfer water from a water source to the housing.

**2**. The system of claim **1**, wherein the structure comprises a residence.

**3**. The system of claim **1**, wherein the heat transfer fluid is absent water.

**4**. The system of claim **1**, wherein the housing comprises coils.

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