Review on Heat Tubes for Heating and Cooling

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Abstract- This review concerned with The main use of this technology is in residential buildings where the demand for hot (air or water) has a significant impact on energy bills. This generally means the situation in a large family, or the situation where the demand for hot water is increased or excessive due to frequent washing. Commercial applications include laundries, car washes, military laundry facilities and food establishments. This technology can also be used for heating purposes if the building is outside the grid, or if the usage energy is subject to frequent interruptions Solar heating systems are likely to be cost effective compared to water heating systems which are expensive to operate, and which require large quantities of hot water. Uncoated liquid collectors are commonly used to heat water in swimming pools. Because these collectors do not need to withstand high temperatures, they can use less expensive materials such as plastic or rubber. They also do not require anti-freezing since swimming pools are usually only used in warm climates and can be easily dried out during cold weather. While solar collectors are the most cost effective in temperate and sunny regions, they can be cost effective almost anywhere in the country so keep that in mind.
Keywords: heat pipe, heat tubs ,cooling, transfer.

I.INTRODUCTION

A heat tubes are a device used to change the temperature of fluids by passing them through tubes that enter another medium. Another high temperature medium is if we want to raise the temperature of the liquid or gas that is to be heated up. The liquid or gas to be cooled can also be cooled by passing it through tubes that pass through another medium with a low temperature. The process of transferring heat from one medium to another is called heat exchange. And the device in which the process takes place is called a heat exchanger. For example, an air conditioner is a heat exchanger that changes the room temperature by passing air through tubes carrying cold refrigerant gas (Freon), thus cooling the room air. Also, the car radiator is a coolant for engine water, Uncoated liquid collectors are commonly used to heat water in swimming pools. Because these collectors do not need to withstand high temperatures, they can use less expensive materials such as plastic or rubber. They also do not require anti-freezing since swimming pools are usually only used in warm climates and can be easily dried out during cold weather. While solar collectors are the most cost-effective in temperate and sunny regions, they can be cost-effective almost anywhere in the country so keep that in mind.

Thermally Evacuated Tube Collectors

Evacuated tube collector :Most of the evacuated tube collectors used in Central Europe use heat pipes for their core rather than passing a liquid directly through them. The direct flow is the most common in China. Evacuated heat tubes consist of several evacuated glass tubes, each of which has an absorbent plate embedded or welded to a heat tube. The heat is transferred from the hot end of the heat pipe to the transporting fluid (water or an anti-freeze mixture - usually propylene glycol) from a domestic hot water or heating system in a heat exchanger called a "manifold or manifold" heat exchanger, which is insulated and covered with metal sheets or plastic. To protect it from the elements, The vacuum surrounding the outside of the tube greatly reduces the heat load, conduction and heat loss to the outside, so it achieves greater efficiency than flat plate collectors, especially in cooler weather conditions. This feature is largely lost in hot climatic conditions, except in cases where very hot water is desirable, for example commercial process water. The high temperatures that may occur may require a special design to prevent overheating. Some vacuum tubes (glass-metallic) are made of a single layer of glass that fuses or fuses with the heat tube at the upper end and surrounds the heat pipe and absorber plate in a vacuum. Others (vitreous - vitreous) are made of a double layer of glass welded together at one or both ends within the space between the layers (such as a vacuum bottle or flask), where the absorber plate and the heat tube are present at normal atmospheric pressure. The glass-glass tubes have a very reliable vacuum seal, but the two layers of glass reduce the light that reaches the absorber plate. Moisture may enter the empty area of the tube and cause the absorption plate to corrode. Glass-metallic tubes allow more light to reach the absorber plate, and protect the absorber plate and heat pipe from corrosion even if they are made of different materials. The gaps between the pipes may allow snow to fall through the collector, which reduces production losses in some snowy conditions, although the decrease in heat emitted from the pipes can also prevent the effective dumping or dumping of the accumulated snow.

Pneumatic Heat Pipes:

For heating air they directly heat the air, and almost always they are used for heating purposes. It is also used for air preheating in industrial and commercial HVAC systems. They fall into two categories: coated and uncoated. Coated systems have a transparent top sheet as well as an insulated side and back panels to reduce heat loss to the surrounding atmosphere and absorption panels in modern panels can have an absorbance greater than (93%). The air usually passes along the front or back of the absorber when heat is removed directly from it, The heated air can then be distributed directly for some applications such as heating and drying purposes or it may be stored for later use. Uncoated systems, or exposed air systems, consist of an absorbing plate through which the air passes as it separates heat from the absorber plate. These systems are commonly used for preheating the air in commercial buildings. These technologies are among the most economical, efficient and reliable solar technologies available. And the recovery of coated solar panels to heat the air may be for a period of less than (9-15) years depending on the fuel being replaced.

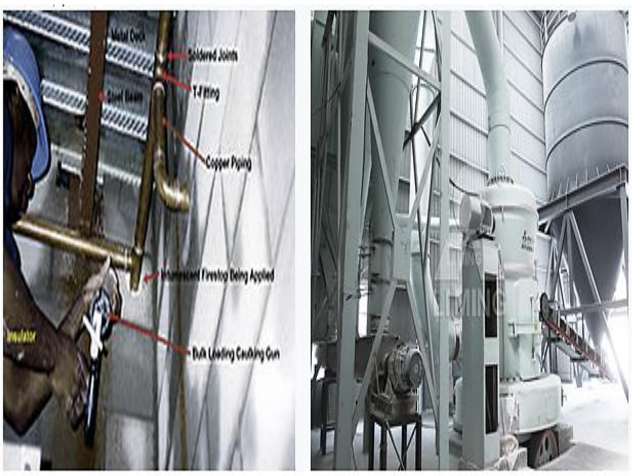

Fig.1. Thermal Systems in Buildings

Fig.2. Thermal Systems in Companies

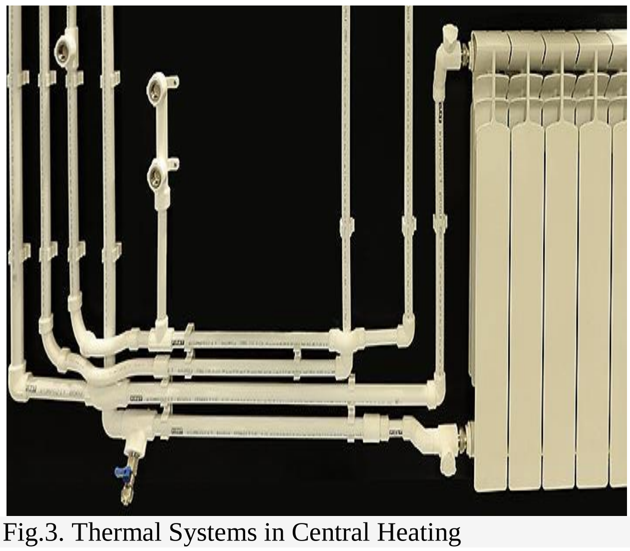

Fig.3. Thermal Systems in Central Heating

How to Operate:

A normal heat pipe consists of a tube made of a material that is compatible with a working fluid, such as copper for water, or aluminum for heat pipes operating on ammonia. Usually, a pump is used to remove air from the empty heat pipe. The heat pipe is partially filled with a working fluid, then the mass of the working fluid is chosen so that the heat pipe contains both the liquid and the vapor within the operating temperature range. Below the operating temperature, the liquid is very cold and cannot evaporate into gas. Above the operating temperature, all the liquid has turned into a gas, and the ambient temperature is too high for any of the gas to condense. In other words, whether the temperature is too high or too low, thermal conductivity remains possible through the walls of the heat pipe, but with a much lower thermal transfer rate. The heat pipe must contain a saturated liquid and its vapor (gas phase) to be able to transfer heat. The saturated liquid evaporates and moves to the condenser, where it is cooled down and returned to the saturated liquid. In a standard heat tube: the condensate liquid is returned to the evaporator using a filament-shaped structure that affects the capillary tube property on the liquid phase of the working fluid. The structures used in heat pipes can be pressed metal powder capillary tubes, which are grooved by a longitudinal drill string parallel to the tube axis. When the condenser is placed over the evaporator within a gravitational field, the fluid can return to the gravitational effect. In this case, the heat pipe is a thermosiphon (thermosiphon or thermal manifold). Finally, rotating heat tubes use centrifugal forces to return the liquid from the condenser to the evaporator.

Heat pipes do not have moving mechanical parts and usually do not require any maintenance, but non-condensable gases that diffuse through the tube walls, resulting from the breakdown of the working fluid or when impurities remain in the material, can reduce the pipe's efficiency in transferring heat.

Heat pipes are distinguished from many other heat dissipation methods by their greater efficiency in transferring heat. A pipe of one inch diameter and two feet long can move 3.7 Kelvin (12,500 Kelvin per hour) at 1800 K (980 K) with a minimum of 10 Kelvin between the ends. Some heat pipes showed a heat flux exceeding 23 K, which is four times the heat flux across the surface of the sun

Materials used in heat pipes and working fluids:

Heat tubes have a jacket, a capillary tube, and a working fluid. Heat pipes are designed for long-term operation without repair, so the tube wall, capillary tube and working fluid must be compatible. Some working fluid / substance pairs that appear to be compatible are not actually the same. For example, if water is present in an aluminum housing, large quantities of non-condensable gas form within a few hours or a few days, preventing the heat pipe from functioning normally. Since heat pipes were rediscovered by George Grover in 1963, lengthy life determination tests have been conducted to identify compatible jacket / fluid pairs, some of which have lasted for decades. In a tube life determination test, the tubes are operated for extended periods of time, and problems such as non-condensable gas generation, material transfer, and

wear are monitored. The most commonly used pairs of casings (and capillary tubes) with fluids include:
Copper housing with a water-acting fluid to cool the electronics. This is by far the most popular type.
Copper or steel housing with refrigerant as the operating fluid in energy recovery applications in heating, ventilation, and air conditioning (HVAC) systems.
Aluminum housing with ammonia fluid for thermal control of spacecraft.
A sheath of super alloys with alkaline metals (cesium, potassium, sodium) acts as a working fluid for heat pipes that operate at elevated temperatures, most commonly used for calibrating core temperature gauges.
There are other pairs as stainless steel (stainless steel) with any of (nitrogen, oxygen, hydrogen, helium) as operating fluid at temperatures below 100 K, heat pipes copper / methanol to cool the electronics when the application requires the work of the heat pipe under the allowed range Water, aluminum / ethane heating tubes for thermal control of spacecraft in an environment where ammonia freezes, heating tubes (thermoset / lithium housing as operating fluid) for applications requiring high temperatures (above 1150 ° C)
The different types of heat pipes:
In addition to the conventional constant thermal conductivity type, there are a number of other types of heat pipes:
Steam chambers (planar heat pipes), which are used to divert heat flux and heat stabilize surfaces.
Variable conductivity heating tubes, which use a non-condensable gas to change the effective thermal conductivity of the heat pipe when the heat capacity or heat drain conditions change.
Variable pressure heat pipes, which are heat pipes of variable conductivity in which the heat storage area can be changed, or the mass of the non-condensable gas can be changed, to give more accurate temperature control.
Bipolar heat tubes (diode), which have high thermal conductivity in the direct direction and low in the reverse direction.
Thermal siphons (thermosiphons), which are heat tubes in which the liquid is returned to the evaporator with the forces of gravity / acceleration.
Rotary heat tubes, in which the liquid is returned to the evaporator by centrifugal forces.

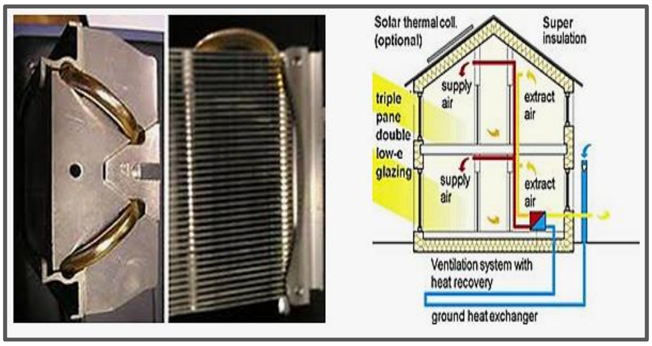

Fig.4. Heat exchange system

Closed circuit system:
The air from inside the house itself is pumped into a U-shaped circle with a diameter of the pipe, with 30-50 m (100-500 feet) of tubes in place, which are subject to temperature tests close to the ground temperature. Then we distribute it by duct work throughout the home or facility itself. This system can be more efficient (when the temperature is greatest) than an open system, because it cools and then re-cools the same air.
Open system:
The outside air is drawn through a tube that filters the air. The tube that performs the cooling is usually 30 m (100 feet) long and is in the form of a long straight tube in the house. Usually this system is associated with the energy-saving ventilation system and is approximately 80-95% effective as the closed system in addition to it ensures the entry of air Pure and moderate in temperature.
Combination system:
This system can be constructed with the use of valves regulated to allow the system to be opened or closed during operation. This depends on the amount of ventilation required. Single inlet heat exchangers provide the possibility of improving the air in the indoor environment more than conventional systems by increasing the amounts of outside air entering the vacuum and this system usually uses one or more boxes through which heat is transferred so that the Indoor temperatures instead of completely losing them.
Use water instead of air:
Instead of using air in heat exchangers through the ground, it is possible to use water also in these exchangers, and this system is completely similar to a geothermal heat pump tubing system, which is placed in the soil in a horizontal or vertical sometimes to the same depth that the double heat exchanger is placed in the ground. This system uses approximately twice the length of pipes with a diameter of 35 mm. Usually the liquid used is a saline solution. This system does not need a point to drain the water and it is a safe system because it reduces the problems caused by the formation of mold.

II.CONCLUSIONS

This system is usually used as an alternative or support application for central heating or air conditioning systems. Since there is no need for an air compressor, chemicals or combustion processes only, there is a need for a pump that moves the air. These systems are used for total or partial cooling or heating operations or for ventilation purposes of the building. Using this system can make the building meet the conditions and standards of sustainable buildings, In the case of heating or cooling liquids such as water, for example, they are used in residential, industrial or agricultural uses. If the building air passes through a heat exchanger for ventilation processes but retains the thermal energy for this air, then it is called a ground tube (it is also called a cooling or floor heating pipe)

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