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Research Review on Earth Pipe Air Conditioning System

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Abstract - This paper introduces basic concepts of Earth Pipe Air Conditioning System that constitutes the process of selected the foremost effective maintenance approach The natural cooling of air using Earth's near constant clandestine temperature is possible using earth tube heat exchangers. Subterranean temperature of earth is always lower than the surface temperature and this phenomenon can be utilized to lower the air temperature for domestic, industrial or agricultural usage. The designed and installed earth pipe air cooling system consists of a tubular heat exchanger which is formed by the pipes and it is buried to the ground where drainage system is also fabricated. Heat exchanger is of multi pass type. Using drainage system the problem of humidification and unpleasant places is attempted to be solved. Ambient air is introduced in the heat exchanger using electric blower and PVC piping is provided for air outlet through pipes.

Key Words: Earth Pipe Air Conditioning System, Air Conditioning, Heat Exchange, PVC Pipe.

1. INTRODUCTION

The Energy consumption of buildings for heating and cooling purpose has significantly raised throughout the decades [1]. The most people feel comfortable when the temperature is between 20°C to 26°C and ratio is inside the vary of 40 to 70% .These condition are achieved through the use of air conditioning [2]. Air-conditioning systems have used in many parts of the world. With the improvement of standard of living, occupants require more comfortable and healthful indoor environment. The main factors influences the close environment mainly include temperature, humidity, air movement, ventilation and particle pollutants. Air-conditioning has become most for human man because it made human life comfortable but it is the largest energy consumer. Energy consumption of air-conditioning can be decreased by reducing the temperature of sink reservoir. The Several researchers have described the Earth-to-Air Heat Exchangers (EAHE) coupled with buildings as an effective passive energy source for building space conditioning. An earth-to-air heat exchanger system suitably meets heating and cooling energy loads of a building pipe. Its performance is based upon the seasonally varying inlet temperature, and the tunnel-wall temperature which further depends on the ground temperature. The performance of an EAHE system depends upon the temperature and moisture distribution in the ground, as well as on the surface conditions. The Piping systems are prevalent throughout our everyday world. Most of us think of piping systems as underground structures used to convey liquids of one sort or another [3].

2. AIR CONDITIONING

Air conditioners use refrigeration to chill indoor air, taking advantage of a remarkable physical law: When a liquid converts to a gas (in a process called phase conversion), it absorbs heat. Air conditioners also contain fans that move warm interior air over these cold, refrigerant-filled coils. Air conditioning is a resaving process that performs many functions simultaneously. It conditions air, transports it, and introduce into the conditioned space. It provides heating and cooling from its central plant or roof top units. It also controls and maintains the temperature, humidity, air movement, air cleanliness, sound level, and pressure discrepancy in a space within predetermined limits for the comfort and health of the occupants of the conditioned space or for the purpose of product processing [2]. Air-conditioning systems is the largest energy consumer that is the biggest challenge which arise now a days. This problem can be overcome by the use of ground coupled heat exchanger in air conditioning system. Basic refrigeration cycle can be seen in Fig. 1.

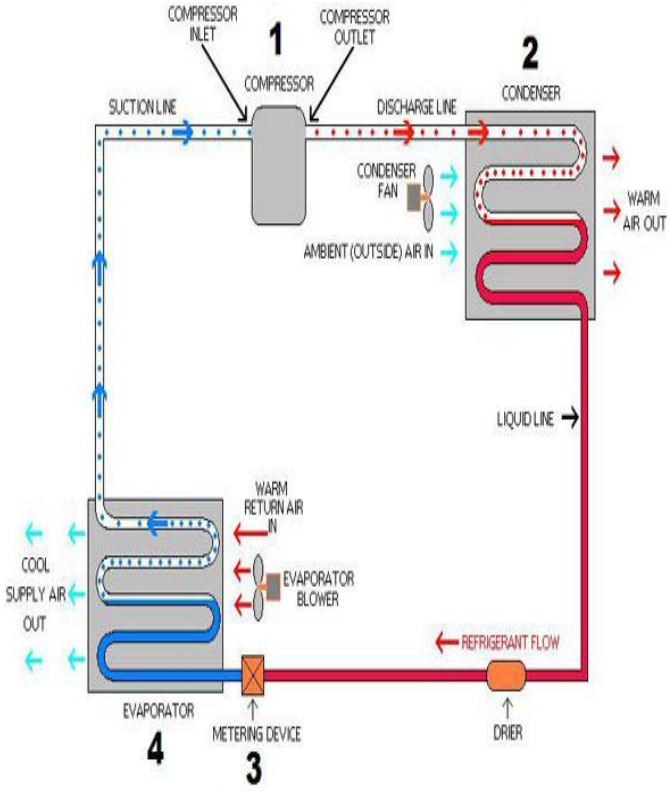

Fig: 1 Air Conditioning Circuit

Most of the air is cooled air conditioning and refrigeration systems square measure designed in order that the refrigerant will condense at a temperature regarding twenty five to thirty degrees on top of outside close air temperature. Once the recent refrigerant vapor discharged from the mechanical device travels through the condenser, the cool air flowing through the condenser coil absorbs enough heat from the vapor to cause it to condense [7].

2.1 Types of Air Conditioning Systems

The Heating, ventilation and air conditioning designer will recommend different types of air conditioning systems for various applications. The most commonly used are described in this article [4].

2.1.1 Window Air Conditioner

Window air Conditioner is the most commonly used air conditioner for single rooms. In this air conditioner system all the components, namely the compressor, condenser and expansion valve or coil, evaporator and cooling coil are enclosed in a single box. This unit is fitted in a slot made in the wall of the room, or more commonly a window sill use this type of air Conditioner.

2.1.2. Split Air Conditioner

The split cooling system includes of two parts: the outside unit and therefore the indoor unit. The outside unit, fitted outside the space, homes elements just like the mechanical device, condenser and growth valve. The indoor unit includes the evaporator or cooling coil and therefore the cooling fan. For this unit you don't have to create any find time for the wall of the space. Further, gift day split units have aesthetic attractiveness and don't take up the maximum amount house as a window unit. A split cooling system will be wont to cool one or two rooms.

2.1.3. Packaged Air Conditioner

An HVAC designer can recommend this kind of cooling system if you wish to chill quite 2 rooms or a bigger house at your home or workplace. There are two potential arrangements with the package unit. Within the initial one, all the elements, particularly the mechanical device, condenser (which may be air cooled or water cooled); enlargement valve and evaporator are housed in a very single box. The cooled air is thrown by the high capability blower, and it flows through the ducts ordered through numerous rooms. With in the second arrangement, the mechanical device and condenser are housed in one casing. The gas passes through individual units, comprised of the enlargement valve and cooling coil, placed in numerous rooms.

2.1.4. Central Air Conditioning System

Central air-con is employed for cooling huge buildings, houses, offices, entire hotels, gyms, motion picture theatres, factories etc. If the total building is to be air conditioned, HVAC engineers realize that golf shot individual units in every of the rooms is extremely pricy creating this a more robust choice. A central air-con system is comprised of an enormous mechanical device that has the capability to provide many loads of air-con. Cooling huge halls, malls, Brobdingnagian areas, galleries etc is typically solely possible with central acquisition units [6].

3. Literature Review

There are many ways for estimating soil thermal conduction which may be applied to boreholes. These embody soil and

rock identification, experimental testing of drill cuttings, in place probes, and inverse heat conductivity models.

3.1 Soil and Rock Identification

One technique to determine the soil thermal properties is described by the IGSHPA Soil and Rock Classification manual. The manual contains procedures to determine the type of soil and the type of rock encountered at a project location. The procedure begins by classifying the soil by visual inspection.

The next few steps can be followed by the flow chart depicted of the Soil and Rock Classification. Once the soil type has been determined, the reference manual offers the values shown in Table 1 for the different types of soil

Table 1 Soil Thermal Properties

Thermal Texture	Thermal Conductivity		Thermal Diffusivity	
	W/m -°K	Btu/hr -ft-°F	cm2 /sec	ft2 /day
Sand(or Gravel)	0.77	0.44	0.0045	0.42
Silt	1.67	0.96	-	-
Clay	1.11	0.64	0.0054	0.50
Loam	0.91	0.52	0.0049	0.46
Saturated Sand	2.50	1.44	0.0093	0.86
Saturate Silt or Clay	1.67	0.96	0.0066	0.61

Table: 1 Soil Thermal Properties

Alternatively, if the underlying ground at the site also contains various rock formations, it is then necessary to classify the rock type(s) into eight different categories based upon several different elements. The eight categories are termed Petrologic groups. The thermal conductivity values for each rock type. Even though the rock identification procedures are somewhat complicated, the designer is still

3.2 Earth to air heat exchange through buried pipes

The Earth tubes are very low technology, sustainable passive cooling systems used mostly to preheat a dwelling's air intake. Air is either cooled or heated by circulating underground in horizontally and vertical buried pipes at a specified depth [5].

Mainly air is sucked by means of a fan or a passive system providing adequate pressure difference from the ambient temperature which enters the building through the buried pipes. Due to underground properties the air temperature at the buried pipe outlet maintains moderate values all around the year. Temperature fluctuates with a time lag (from some days to a couple of months) relative to the depth considered. Temperature values remain usually in the comfort level range (15-27 °C).

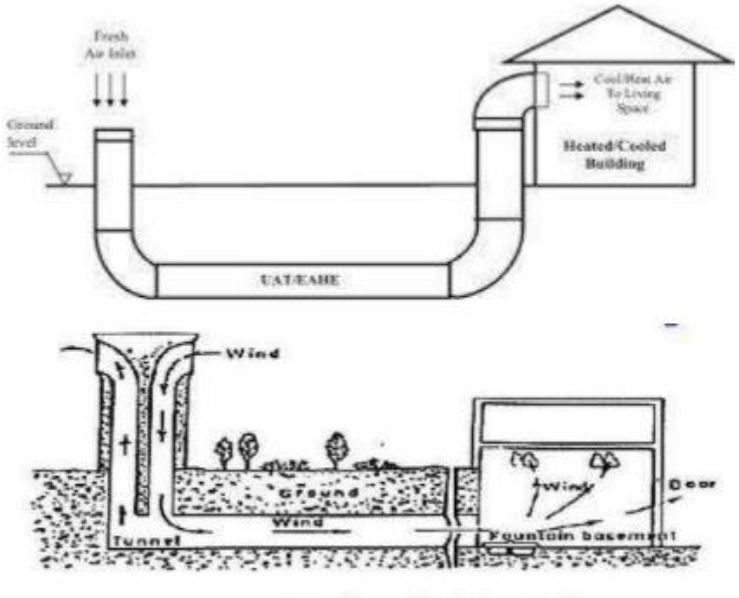

Fig-2: Earth to air heat exchange through buried pipes

The effectiveness of a buried pipe system is mainly related to the following parameters:

- Ground temperature at depth of the installed exchanger
- Thermal diffusivity of soil in ground

- Pipe length and width
- Inlet air temperature
- Thermal conductivity of buried pipes

4. CONCLUSIONS

This paper highlights the review and critiques of Earth Pipe Air Conditioning System. On the basis of literature review, the findings show the importance of Air Conditioning System in terms of cost effectiveness and power consumers. The Earth Pipe Air Conditioning System not only improves the Air Conditioning System but also significantly reduce the needed maintenance in today's highly competitive world, and thereby reducing concerned cost. A multi pass earth pipe air conditioned system was installed and study its performance in cooling mode. EPAC was able to reduce the temperature of hot ambient air by 10 to 12 degree Celsius.

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