

Recent Trends in Applications of Heat Pipes

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Abstract— Heat pipes have been used for last 5 decades in many fields. Applications of heat pipes are increasing in number of sectors like heat transfer, renewable energy, instrumentation industry etc. Due to increasing use of heat pipes, in last few years there is a tremendous technical research and innovations taking place. New technologies in design, development and application of heat pipe are emerging. This paper provides overview of some newly developed technologies regarding heat pipes. Review on all these newly developed technologies is provided in this paper.

Key words: Heat Pipe, ETC

I. INTRODUCTION

Following the depletion of fossil fuels and environmental degradation need of efficient technical equipments is increasing. For heat transfer sector, efficient heat transfer equipments are provided by using different active and passive techniques like fins, pulsation etc. But for the engineering problems where very high heat transfer rates are required, Heat pipes can be an effective solution. Heat pipes are the efficient heat transfer devices that can be suitable for many applications in industry. There also new trends set up in the application of heat pipes.

II. HEAT PIPES

Heat pipes are simple heat transfer devices having huge capacity to transfer heat over long distances. Heat pipes can be constructed from millimeter to meter length range [1]. Due to their simplicity and compactness they are becoming more and more popular in mechanical as well as other engineering applications. Heat pipes are used in heat transfer related applications for many decades. Depending on their use and utilisation sector, they can operate over a wide range of temperatures with a high heat extraction capacity. Heat pipes are very useful in a number of engineering applications such as electronic cooling, spacecraft thermal control, transportation systems, powerplants, automotive industry, permafrost stabilization, medical-related applications, energy equipments, solar systems and production. Heat pipes and their applications in thermal management have been studied for decades. They constitute an efficient, compact tool to dissipate substantial amount of heat.

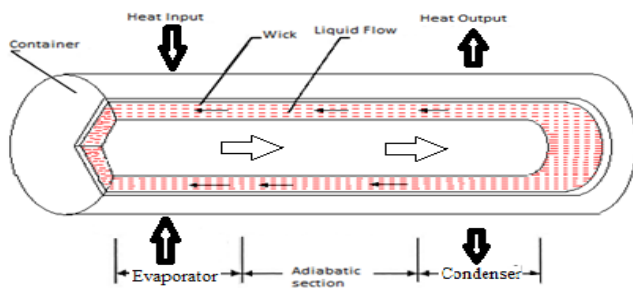


Fig 1: Construction and Operation Of Heat Pipe

III. STRUCTURAL CLASSIFICATION OF HEAT PIPES

According to their construction and structure heat pipes has many types some of them are listed below:

A. Loop pulsating heat pipes [2]:

These are loop type heat pipes with provision of pulsation. These heat pipes are very efficient and have more capacity to conduct heat.

B. Refrigerating heat pipes (RHP) [3]:

Refrigerating type heat pipes are the innovative structures of heat pipe and have faster rates of heat transfer.

C. Coil-inserted rotating heat pipe [4]:

These are rotating type of heat pipes and require external power and also has coil like structure.

IV. RECENT TRENDS IN APPLICATIONS OF HEAT PIPES

A. Cooling:

Heat pipes can be used as cooling circuits for different systems. Sarraf et al [5] invented a heat pipe assembly device for the cooling of fuel cell. Use of heat pipes for cooling fuel cell proved very efficient. Cooling of electronics equipments by using heat pipes is proved to be very efficient method in electronic cooling. By using heat pipe for electronic cooling reduces the fan and blower requirement and also reduces power consumption require for cooling.

Control of heat has become important consideration in the design of electronic equipments because of the recent trends in the electronic sector towards increased miniaturization of components and device heat dissipation. There is a huge need of the devices or systems capable of heat dissipation from electronic equipments and thermal management. The survey of US air force indicates that more than 50 percent electronic system failure is generally due to ill temperature control.[6] Hence by using efficient heat pipes this problem can be overcome.

B. Solar Water Heaters:

Evacuated Tube Heat Pipe Solar Collectors are the examples of application of heat pipes in solar water heater. Reheating water in the recirculation loop, rather than preheating cold water, requires a collector with a very low loss coefficient. This is currently available only with evacuated-tube solar collectors, as opposed to flat-plate solar collectors. Fig 2 shows the constructional details of the evacuated tube heat pipe solar collector. Newly developed heat pipes can be proved to be effective in domestic water heating.[7]

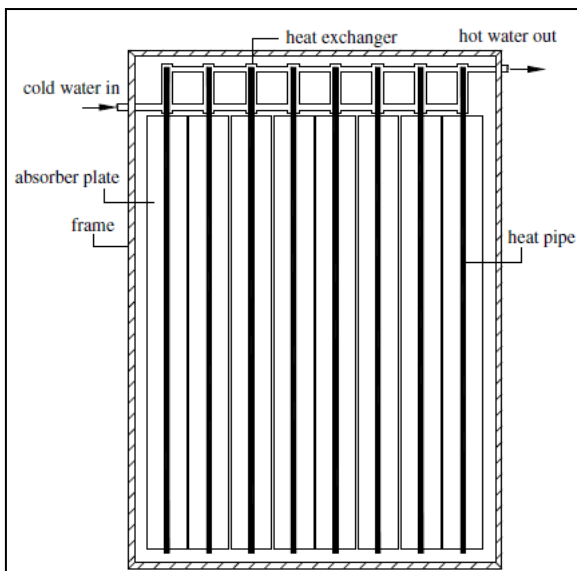


Fig. 2: Flat Plate Heat Pipe Solar Collector

C. Aerospace:

Use of heat pipes in for aerospace system is a new trend, Heat pipes has two applications in aerospace first one is to control temperature of satellite as well as to maintain isothermalization of effects of solar radiation on the mechanical structure of satellite.

And second one is to overcome distortion that may occur due to overheating of various components present in the satellite.[8]

V. CONCLUSIONS

It is observed that in last few years use of heat pipes in many industrial applications is increasing with more innovative technologies in heat pipes. Heat pipes are capable of fulfill needs of modern heat transfer equipments like high volume heat transfer rate, compactness, simple construction, good handling, less maintenance etc. Hence heat pipes have huge scope for application in various fields like electronics cooling, solar heat collectors and aerospace engineering.

Due to all above purpose heat pipes are the emerging technologies in the heat transfer of different applications.

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