DOE/R4/10077--T1

RAYFORD M. NORMAN SR.

DOE/R4/10077--T1

GRANT # DE-FG44-80R410077

DE84 000761

Final report April 30, 1981

The actual measurements and data following were very carefully gathered and documented. Efficiency calculations have been made based on quote from: Solar Heating and Cooling, Jan F. Kreider and Frank Kreith, Approximate solar impingement per day is 430 BTU per hour, per square foot. This diluted by atmosphere, pollution etc. to about 101-200 BTU per hour, per square foot striking a flat plate collector on the surface of the earth.

I am using the maximum of 200 BTU/HR/FT.Sq. as my reference.

My project collector is 17.94 foot square.

100 %	Efficiency	would	deliver	200	BTU/HR/FT SQ
70 %	"	"	"	140	" " " "
60 %	"	"	"	120	" " " "
50 %	"	"	"	100	" " " "
40 %	"	"	"	80	" " " "
30 %	"	"	"	60	" " " "

During the period from September 1, 1980 through September 5, 1980, Project collector delivered to storage an average of 114.46 BTU/HR/FT SQ. This calculates to an efficiency of 57%. Insolation conditions for this period were good.

During the period from October 30, 1980 through November 5, 1980, Project collector delivered to storage an average of 145.10 BTU/HR/FT SQ. This calculates to an efficiency of 72.9%. Insolation conditions were excellent.

During the period from February 26, 1981 through April 1, 1981, Project collector delivered to storage an average of 78.98 BTU/HR/FT SQ. This calculated to an efficiency of 39%.

The average for the three periods of documentation is 56.4% efficiency.

Continued

DISCLAIMER

CONCLUSION:

If indeed, Project collector has averaged delivery to storage an efficiency of 56.4%, I would deem the project to be a success. There remains much more testing and evaluating before we know for sure.

At this point I am convinced that the Heat-Pipe theory will make a substantial contribution to the worlds energy problem solution.

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Gentlemen:

I believe the following listed and documented aspects of my project merit serious consideration for patents. I am financially unable to persue this. I am hopeful that the D.O.E. can accomplish this end. I will appreciate your comments.

1- HEAT-PIPE COLLECTOR
2- HEAT-PIPE HEAT EXCHANGER
3- HEAT-PIPE HEAT EXCHANGER FREEZE PROOF
4- HEAT-PIPE TRANSFER FROM ROCK BED
5- HEAT-PIPE ATTIC VENTILATION
6- HEAT-PIPE INDCAND-HEAT
7- HEAT-PIPE COMMERCIAL HEAT RECLAIMER
8- HEAT-PIPE INDUSTRIAL HEAT RECLAIMER
9- HEAT-PIPE OIL PAN COOLER
10- HEAT-PIPE TRANSMISSION OIL COOLER
11- NOR-FLECTOR
12- AUTOMATIC SUN TRACKER
13- SINGLE STROKE VACUUM PUMP FOR HEAT PIPE MANUFACTURE

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HEAT-PIPE FLAT PLATE SOLAR COLLECTOR

Constructed as typical Solar Collector excepting that individual Heat-Pipes attached to collector surface transfers the collected energy via a phase change (steam) from collector surface into an attached jacket, that may contain any number of different transfer mediums. Air, Water, Oil, Wax, Vegetable oil or shortening, Any of the various phase change materials. Phase change materials may in fact, provide a double phase change, thus boosting over-all efficiency.

Imbedded in the transfer medium is the heat exchanger, transferring the heat from the medium into storage. I believe efficiencies of 70% to be easily attained.

CONCLUSION: I believe the Heat-Pipe concept offers tremendous new possibilities in the development and use of solar energy. In this report I would like to elaborate on just two fantastic ideas.

First, I have conducted limited experiments with recirculating a small amount of water (five gallons) in my project collector. I have attained extremely high temperatures. I believe that a single collector operating thusly, could power an absorption refrigeration unit that could produce enough ice in a cold water air conditioning system, in one collection day, to cool an office or home for several days. This would be super efficiency.

Secondly, As a passive heating unit, the Heat=Pipe offers exciting possibilities. One such possibility that I am exploring is a window unit that would be as easily installed as any window air conditioner. This unit will heat one or more rooms all day on sunny days and store enough energy to work well into the next day. Regulation of temperature could be attained by Opening-Closing vents within the storage compartment. Such a unit would be a Do-It-Yourselfer's dream. No plumbing, No Electricity, Not even a Plug-in.

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Heat-Pipe-Heat-Exchanger and method of Freeze-Proofing.

Constructed as follows: Heat-Pipe is 1/2" copper tubing. The upper end is fed through an 1/2" to 1" adapter and extends through 7". A seven inch section of 1" copper pipe is slipped over this 1/2" section of Heat-Pipe into the 1" adapter and soldered. Another adapter is slipped over the upper end of the seven inch pipe and soldered. Now we have an envelope enclosing the end of Heat-Pipe. The adapters have a second 1/2" outlet, through which the potable water, from and to storage is circulated. The water has extremely close contact with the Heat-Pipe. Project collector has twenty-four of these assembliesin a line. Water from storage moves into the first one at the bottom adapter and out the top, proceeding to the top of next assembly and out the bottom, continueing in serpentine fashion through all twenty-four assemblies, and back to storage. Freeze-Proofing is accomplished simply by the addition of a three inch long 1/2" pipe soldered into 1/2" outlet of upper adapter, and capped. This forms a three inch air pocket, that absorbes the expansion of ice when frozen, thereby not rupturing the assembly. Repeated freezing and thawing has produced not one rupture in the system.

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HEAT-PIPE ATTIC VENTILATION

This concept is simply a number of Heat-Pipes extending from attic space through roof. Finned top section radiating attic heat to the outside. A large Pipe boiling at 80° very effectively removes the attic build-up. Tests indicate that a Pipe boiling at 130° may offer a better winter time solution. This concept is also exxcellent for steel buildings.

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HEAT-PIPE INDCAND-HEAT

Indcand-heat is transfer of light bulb heat via Heat-Pipe to heat water.

Spiral rap the base end of a section of tubing to snugly fit either the bottom or the top bell of a standard indcandescent bulb. The Pipe then extends vertically through and into a container. The heat from the bulb boils water in Heat-Pipe and thusly transfers energy to water in container. This concept could be especially useful in restaurants, hospitals, and other places that operate long hours. A 60 watt bulb will deliver about 108 BTU/Hr. Maximum temperature attained is 146°F. Illumination from bulb is not affected.

Light fixture designers could very easily design fixtures incorporating the Heat-Pipe system.

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INDUSTRIAL/COMMERCIAL HEAT RECLAIMER

This concept is simply to reclaim heat via a Heat-Pipe transfer system, adapted to the situation. Especially adaptable to laundry/laundramats, restaurants and many others.

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GRANT # DE-FG44-80R410077

HEAT-PIPE OIL COOLER

To remove heat from oil in engines and transmissions via Heat-Pipe transfer.

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NOR-FLECTOR

This concept is a tracking reflector mounted on front surface of heat-exchanger section of collector. The reflector consists of verticle ribs cut on 45° angle and covered with highly reflective foil. Sun-rays are reflected downward onto flat-plate surface, from early morning through the afternoon. The reflector's contribution to overall performance has not been determined, but should prove substantial.

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AUTOMATIC SUN TRACKER

This device is a cylinder with a pump like plunger that will respond to water pressure. A heat sensitive valve is attached to the west side of collector so that it is shaded by collector, until sun moves past. Heat from sun activates valve, pressurising the cylinder. As the collector turns, thus shading the valve, pressure is stopped. The proceedure continues as long as the collector and the sun alternately chase each other. During the night, a built-in seepage allows the spring loaded collector to return to its east facing position for a new start next day. On cloudy days the system just waits.

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SINGLE STROKE VACUUM PUMP FOR HEAT_PIPE MANUFACTURE

This concept is a cylinder with a pump-like plunger that will remove all air from cylinder when withdrawn. Cylinder is equipped with adapter stub that is easily and quickly attached to Heat-Pipe. One stroke of plunger removes air from Heat-Pipe, which is then pinched off and sealed. Controlled vacuum is accomplished by the insertion of a vacuum gage in the circuit.

I have found this simple instrument to work far better than a commercial refrigeration pump.

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HEAT-PIPE TRANSFER FROM ROCK BED

This concept envolves a number of Heat-Pipes imbedded in the storage medium and extending into an air plenum through which the household air is forced. Heat from storage medium is thusly transferred via the boiling and condensing in the Heat-Pipe.

For this project I have chosen seventy-two Heat-Pipes each twenty inches long. Each Pipe has a 28.968 inch vacuum, boiling at 80°. These Pipes are mounted verticle and bottom eight inches imbedded in storage medium. Two inches of rigid insulation seperates the storage medium from the air plenum sitting on top. Embedded Pipes going through this insulation end up in a twenty-four inch by twelve inch plenum that circulates the household air, thus heating it.

This method of transfer from storage eliminates a multitude of problems encountered, you simply move household air through your rockbed storage. Afew of the more important ones are, the actual air movement itself, The inherent dust problem, Spider webs, odors. Complete seperation of collector-storage-household air is attained. The efficiency is terrific.

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FINAL FINANCIAL REPORT

April 30, 1981.

Total disbursements through March 30, 1981 is $3320.00

Project fund balance is zero

I am retaining all bills and receipts, and banking records. Should you require copies I shall forward at your request.

1-0029

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GRANT # DE-FG44-80R410077

FINAL REPORT
APRIL 30, 1981

COMPLETION SCHEDULE	MAJOR EVENT & KEY ACTIVITY	DATE COMPLETED
January 1981	Completed all twenty-four of Heat-Pipes for project & tested same for two weeks.	Jan. 1981
February 1981	Assembled the project collector and mated it to storage. Started collecting data on February 26, 1981.	Feb. 1981
March 1981	Collected data all this month. Noted that the insolation conditions were very poor the entire month. Data and comments on following pages.	Mar. 1981