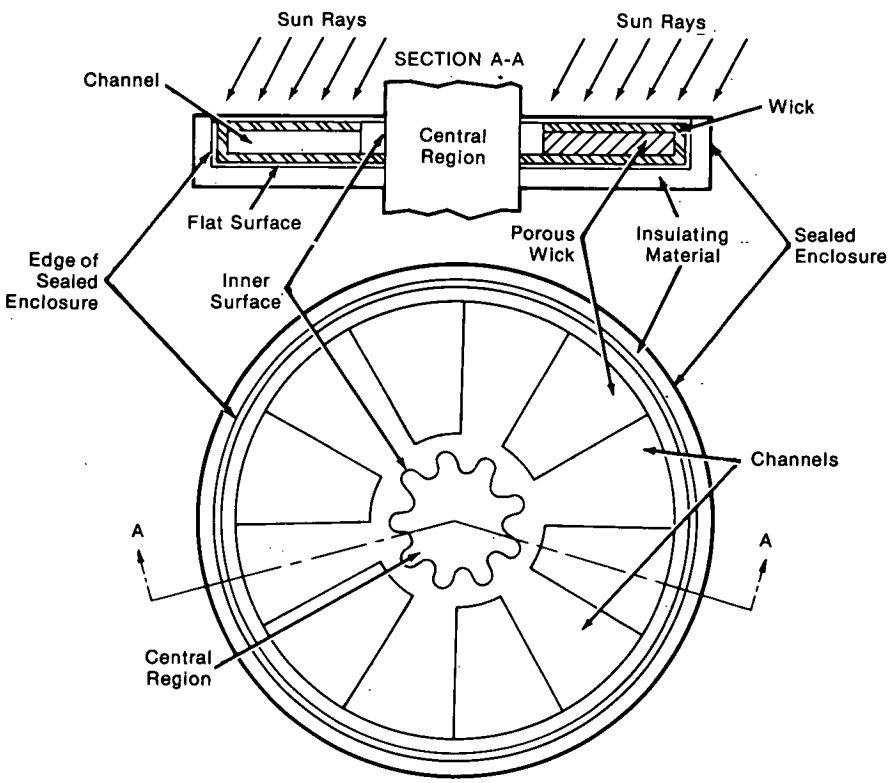
NASA TECH BRIEF

Langley Research Center

Flat Device for Heat Concentration or Dispersion



Heat Concentrator or Disperser Unit

The device illustrated provides a low-cost unit for efficiently transferring heat between, either to or from, a flat surface and a central point or region. It is based upon a vapor heat transfer principle and, therefore, extends the applicability of the heat pipe. Possible uses are varied, ranging from a solar heat concentrator or an electronic cooling device to geothermal power applications. The present intended application is as a solar heat collector to operate a newly developed type of air-conditioner.

The heat concentrator and disperser unit depends upon the transfer of a condensable vapor for the conductance of heat from one point to another. The concentration or dispersion of heat from a central region to a flat surface by the use of heat pipes is not practical, as it requires the incorporation of a complicated geometrical arrangement of a multiplicity of heat pipes.

The heat concentrator or disperser unit as shown consists of a sealed enclosure which, if necessary as for

(continued overleaf)

a solar heat concentrator, is partially encased in an insulating material. Heating or cooling is applied to one or both of the flat surfaces. In this application, Sun rays are used for heating, and they only strike one surface which is suitably treated and shielded against the loss of heat waves, thus allowing for a very efficient capture of the solar radiation. A wick of suitable material bears against the interior flat surfaces and against the edges of the sealed enclosure. A porous wick joins both the top and bottom surfaces of the wick and is shaped so as to leave the channels open to the free passage of vapor from the wick to heat the inner surface.

The porous wick, lying between and touching the wick, is appropriately designed so as to take the best advantage of the fluid dynamic properties of both the vapor and the liquid used. Thus, in the design of large-scale concentrators, the porous wick may consist of single or multiple radial segments. The inner surface is centrally located and is of suitable design so as to function either as a heating surface or as a heat sink, whichever mode a particular application may require. In the application as a solar heat concentrator, the central portion acts as a vapor-condensing surface. The volume contained within the inner surface permits the installation of fluid-type, thermal and mechanical, or thermionic devices.

In operation, a liquid having the desired physical properties for a particular application is sealed in the enclosure and saturates both wicks. The liquid and the amount are preselected in order to control the vapor pressure of the unit during operation.

In the illustrated application, Sun rays strike the exposed surface and heat the liquid in the wick to the vaporization point. Because a heat sink exists interior to the inner surface, it remains cooler than the vapor temperature of the fluid. Consequently, vapor condensation takes place on the inner surface and depletes the vapor about the central region. This causes a migration of warmed vapor from the wicks, and by a capillary action the wick returns the condensed vapor to repeat its cycle. Heat is therefore, in this instance, transferred by the vapor from the warmed surface to the cooler inner surface and the central region for utilization.

The vapor pressure is controlled by the type and quantity of liquid soaked in the wicks whether the unit is made to operate as a flat heat dispenser or as a heat concentrator. In use as a heat concentrator, the wick does not completely enclose the inner surface so as to allow that surface to collect and condense the heated vapor effectively.

The flat surfaces can be of any desired shape and not necessarily circular. Instead of the central region and the inner surface acting as heat sink, as in the illustration, this central region can be used as a heat source where the flat surfaces become heat dispersers. Heat from the flat surfaces can be dispersed either by radiation, convection, or conduction.

Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Langley Research Center
Mail Stop 139-A
Hampton, Virginia 23665
Reference: B74-10291

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Langley Research Center
Mail Stop 313
Hampton, Virginia 23665

Source: Renaldo V. Jenkins and Alexander P. Sabol
Langley Research Center
(LAR-11699)

Categories: 03 (Physical Sciences)
04 (Materials)
06 (Mechanics)