Can You Imagine . . .

. . . porous metal wicks that cool heat-generating Pentium® micro-processors in portable computers.

HEAT PIPES KEEP CHIPS FROM BLOWING THEIR COOL

Manufacturers of portable computers deal with a hot issue when it comes to chip cooling. To prevent chip damage, heat-pipe technology helps them redirect away the heat that the microprocessor generates. But this technology does not work well when users tip and turn their computers.

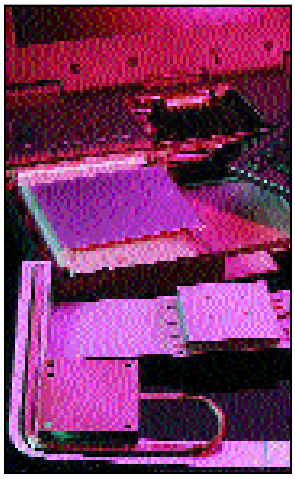
Thermacore, Inc. (Lancaster, PA), developed heat pipes that, unlike traditional heat pipes, allow users to tip and turn portable computers without degrading performance. These devices use porous metal wicks, the key to their capabilities. Thermacore developed the heat pipes through SBIR contracts—including several from BMDO—to cool laser mirrors, electronic devices, and batteries.

THERMACORE PRODUCES 7,000 HEAT PIPES PER DAY FOR PENTIUM® CHIP-BASED PORTABLE COMPUTERS.

Thermacore's heat pipes help the Pentium® chip (which has greater cooling requirements because it has over 3 million transistors[1]) find relief from the heat inside portable computers. For example, the company supplies devices to manufacturers for installation in 120- and 133-megahertz Pentium chip-based computers to prevent overheating. Alternative methods of cooling, such as electrically powered fans, are large and have high energy requirements that make them impractical for portable computers. Thermacore's compact, lightweight heat pipes do not interfere with the computer's portability. Also, since they use no electricity, the heat pipes conserve the precious energy essential for battery-powered portables.

To meet market demand, Thermacore enhanced the capabilities of its manufacturing division, Thermal Products. This division now produces 7,000 heat pipes per day (a rate based on existing and expected orders) to cool high-end Pentium-based portable computers. According to Yale Eastman, chairman of DTX, Thermacore's parent company, "In 1997, Thermacore expects to manufacture over 2 million heat pipes for this thermal management application."

Developing prototypes for desktop and workstation computer markets, Thermacore's heat pipe technologies provide the cooling improvement needed for increased computer speeds. "Faster chip speeds and microprocessor-intensive software create higher levels of heat in desktop and workstation computers," adds Eastman. "Our heat pipes are more reliable than other technologies and could provide all the cooling necessary to prevent chip damage."



■ Thermacore's heat pipes cool today's high-end processors in portable computers without using fans or extremely large or heavy heat sinks.

ABOUT THE TECHNOLOGY

Thermacore's passive heat pipes use porous metal wicks that move the heat-transfer liquid quickly and efficiently, using capillary action. Like kerosene in lantern wicks, the heat-pipe liquid moves against the force of gravity, making these devices ideal for any cooling need where the system moves. Other heat pipes lose their effectiveness when turned upside down because their wicks will not work against gravity.

Heating one end of the pipe causes evaporation of a liquid inside, absorbing heat. The vapor then flows to the opposite end of the pipe. At this cooler end, it condenses back into a liquid, thereby releasing heat. To repeat the cycle, the wick absorbs the condensed liquid and transports it back to the hot end. Capillary action, the same action that pulls kerosene through the wick in a kerosene lantern, moves the liquid along the wick.

[1]Intel Microprocessor Quick Reference Guide. 1996. World Wide Web at http://www.intel.com/pressroom/quickref.htm.