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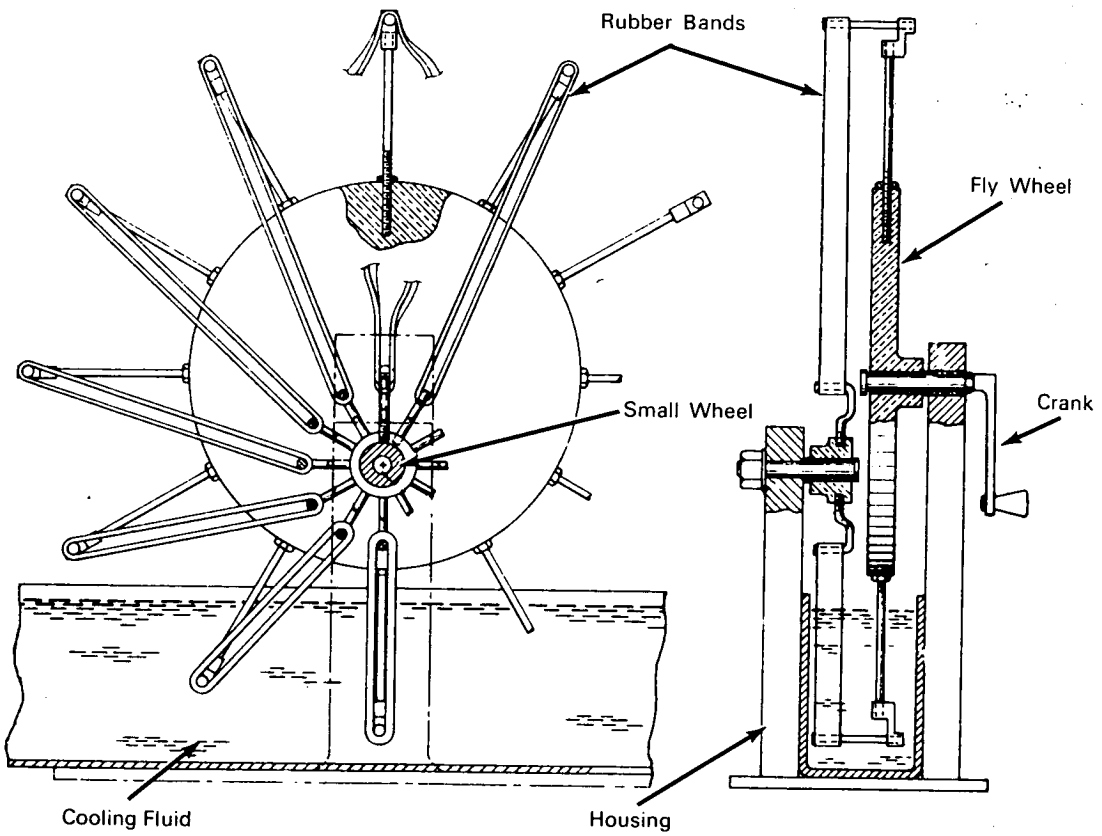
Brief B70-10270

NASA TECH BRIEF

Manually Operated Elastomer Heat Pump



In analytical test work on the stress behavior of various types of elastomers, it is frequently observed that the internal temperature of rubber rises when it is stretched. The heat evolved by stretching rubber corresponds to the work required for such extension, and therefore, human mechanical energy is converted to heat in an efficient manner. A prototype device, shown in the figure, consisting of a rotating mechanism, a frame with multiple wide bands of rubber and a fluid bath, was constructed in order to demonstrate the feasibility of a human operated device capable of cooling or producing heat, e.g., in an aerospace emergency. The mounting of the bands on each hook of the wheels provides a coupling means between the wheels, such that rotation of the large flywheel also causes the small wheel to rotate at the same radial speed. However, by reason of the fact that the axis of rotation of the small wheel is considerably offset from the fly-

(continued overleaf)

wheel, the rotation just described is accompanied by a distortional stretching and contraction of the wide bands during rotation; as a result, the multiple bands heat up the surrounding atmosphere in the zone of stretching, and cause cooling in the zone of contraction. The contraction cycle occurs in the fluid causing the fluid to be cooled.

This invention takes advantage of basic thermodynamic properties of natural rubber, which are summarized as follows: The increase in temperature of adiabatically stretched rubber is not a simple nonreversible conversion of mechanical energy into heat, as occurs for example, when a metal strip is bent. The phenomenon of heating and cooling of stretched natural rubber is a fully reversible process related not to friction or structural degradation but rather to the molecular chain structure of the rubber. This structure causes natural rubbers to behave ideally so that the heat evolved on stretching adiabatically is comparable to the work required to extend the rubber. Thus, with sufficiently large areas of rubber, preferably over 100 square inches, the present invention efficiently converts operator mechanical energy and work into heated air and cooled fluid. The flywheel and small wheel axis may be redesigned, if desired, to cause all the heating to occur in the fluid bath.

Note:

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

Technology Utilization Officer
NASA Pasadena Office
Pasadena, California 91103
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Patent status:

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