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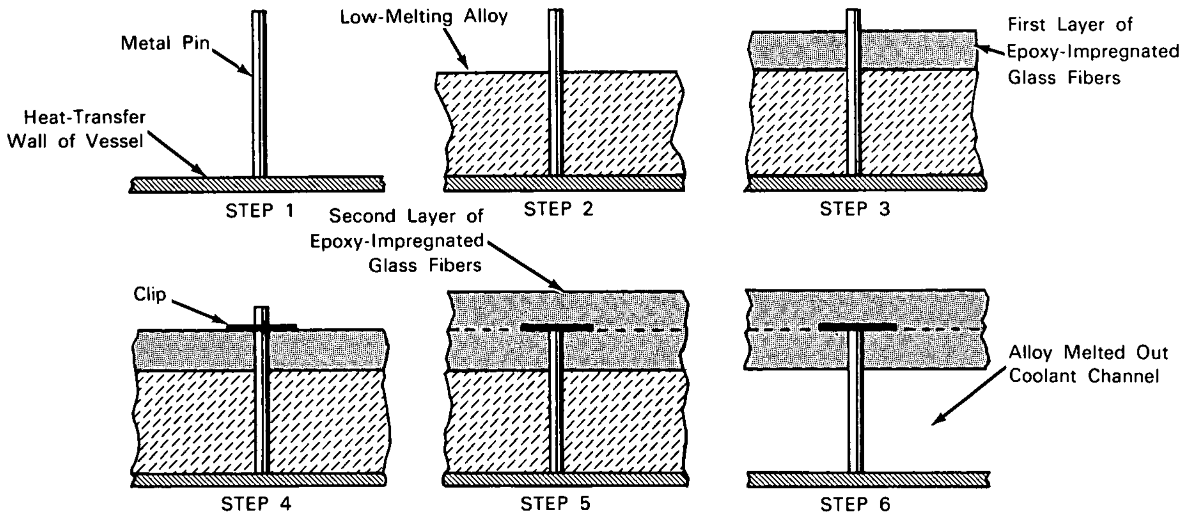
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

Integral Coolant Channels Simply Made by Melt-Out Method



The problem: To devise a simple method of making strong, lightweight, pressuretight fluid-coolant channels or jackets for maintaining inner-liner wall temperatures of pressure vessels, such as rocket thrust chambers, within tolerable limits. Methods that have been used for constructing jackets for continuous flow of coolants include welding or brazing of multiple tubes or channelized ribs which are mounted on the liner and externally wrapped with wire. These methods are costly and time-consuming and require the use of relatively heavy materials, which often do not permit the desired flexibility in design.

The solution: A method in which the integral coolant channel is built up on the pressure chamber liner using a temporary layer of a low-melting alloy that is melted out after layers of epoxy-impregnated glass fibers are wrapped around the alloy and cured in place. Pins bonded to the liner at the beginning of fabrication rigidly support the glass fiber wall around the resulting channel.

How it's done: A series of pins are cemented to the external surface of the liner or heat-transfer wall of the chamber. A suitable melt-out material, such as a tin-bismuth alloy, which melts at 281°F, is then deposited on the surface to a depth equal to the desired height of the coolant passage, leaving the upper extremities of the pins exposed. Glass fibers (impregnated with an epoxy-resin) are wound around the solidified melt-out material to a predetermined thickness, still leaving the upper ends of the pins exposed. Push-on-type head clips are fastened to the ends of the exposed pins, and the extreme ends of the pins are cut off. A second layer of epoxy-resin impregnated glass fibers is then wound over the first layer to a specified thickness enclosing the pins, the melt-out material, and the liner. Finally the structure is heated to melt

(continued overleaf)

out the low-melting alloy. The resin impregnant is cured to provide a gastight seal either during the melt-out operation or a later time. The resulting structure, providing integral cooling passages between the heat-transfer wall of the chamber and inner wall of the glass fiber envelope, is relatively strong, lightweight, and pressure tight.

Notes:

1. This method of fabrication is applicable to many types of pressure vessels, including rocket thrust chambers, combustion units, jacketed storage tanks, and heat exchangers.
2. For further information about this innovation inquiries may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B63-10497

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C. 20546.

Source: W. J. D. Escher (M-FS-91)