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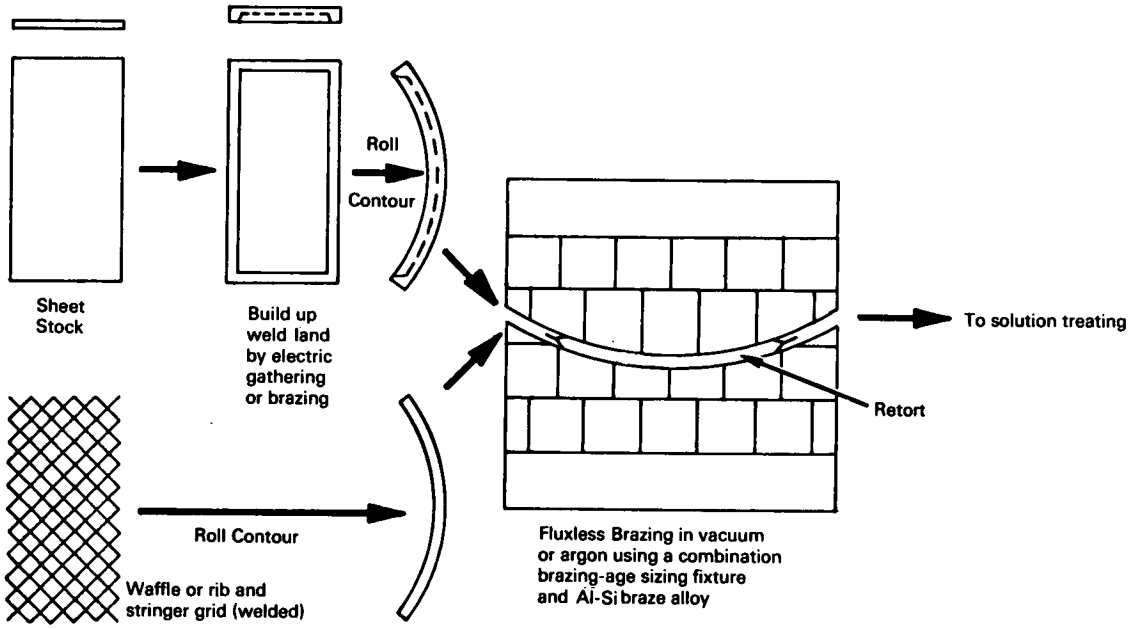
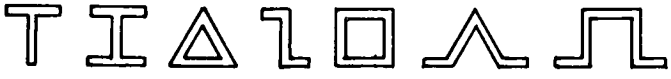
NASA TECH BRIEF

Preformed Stiffeners Used to Fabricate Structural Components for Pressurized Tanks





Cross sections of some typical stiffeners (extruded or formed from sheet metal clad with Al-Si braze alloy

The problem:

To develop a process for fabricating stiffened section components for pressurized tanks. The process should permit the use of stiffener cross-section designs which cannot be satisfactorily produced by other fabrication methods. Also, the cost of chemical milling is considerably greater than that of brazing stiffeners onto sheet metal stock.

The solution:

A fabrication process utilizing vacuum or argon brazing and diffusion bonding techniques to attach preformed stiffeners to sheet metal stock. A unique feature of the process is the inclusion of electric gathering of weld lands, or edges, and the fabrication of stiffened panels or gore segments by joining the stiffeners to sheet metal stock instead of machining or chemical milling from metal-plate stock.

(continued overleaf)

How it's done:

Although the following description emphasizes vacuum or argon fluxless brazing of aluminum tank structures, brazing or diffusion bonding of any metallic material is applicable.

As shown, the edges of a sheet metal blank are increased in thickness by electric gathering or by brazing with a high-fluidity, aluminum–silicon brazing alloy. Next, low-cost extruded sections or sections fabricated from brazing-alloy clad aluminum-strip stock are assembled into a grid. The grid is roll formed, and then brazed to roll-formed sheet metal stock. This assembly is then encased in a thin-gage, metal envelope. The envelope is then purged, evacuated, and sealed. When the envelope is evacuated, it collapses upon the encased assembly and compresses the surfaces to be joined. The brazing operation is performed in an age-forming fixture. Upon completion of the brazing operation, the assembly is solution-treated, and then age-sized in the forming fixture.

Notes:

1. The new fabrication process is an improvement over the previous method since the tank shell now consists of high integrity presized rolled sheet metal instead of plate stock chemically milled to size. Also, the sheet metal stock has higher notch toughness. Both the brazing and diffusion bonding processes produce high strength joints of exceptional ductility. These processes also permit the use of more structurally efficient extruded or formed stiffeners, which are either impossible or difficult to fabricate by machining or chemical milling.
2. A potential use of the fabrication process is the production of gore and quarter-panel sections of hydrogen and oxygen tanks for space vehicle boosters.
3. The process may be used to fabricate high-strength lightweight pressurized tanks for rail and truck transportation or storage purposes. Both cryogenic and noncryogenic fluids can be stored or pressurized in such tanks.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B66-10688

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: J. C. Lewis and E. S. Sherba
of North American Aviation, Inc.
under contract to
Marshall Space Flight Center
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