NASA TECH BRIEF

Heat Treatment Stabilizes Welded Aluminum Jigs and Tool Structures

The problem:

In the production of welded aluminum jigs and tool structures, after welding and before machining, certain treatment is required to make each device most suitable for its intended use. Welding may introduce residual stresses in the aluminum that alter initial properties.

The solution:

Treatment processes, applied after welding but before machining, that impart above normal stability to welded aluminum jigs and tool structures.

How it's done:

Two basic categories of tools to be treated are established from intended use requirements:

(1) Tools that control critical dimensions, locations, or configurations exceeding a span of 36 inches. In this category rigidity and stability are of prime importance, strength is secondary, and good machine finishes are assumed to be not essential. These devices are partially annealed at 625°F for 1 hour, then furnace cooled before machining or setting critical locations. This treatment reduces the aluminum material to a near-annealed but very stable condition. On return to room temperature, ultimate strength is reduced by approximately 55%, yield strength by about 75%, while rigidity is unaffected. Due to temperature or to the size and configuration of the device, the structure must be amply supported to prevent sag.

(2) Tools in which less reduction in mechanical properties is important (ultimate strength reduced 13.3% and yield strength reduced 16.3%) and tools used in an autoclave to control a plane or surface of adhesive bonding area exceeding 22 inches by 52 inches. In this category, rigidity and stability remain important but machinability becomes of greater importance since a finer finish is required. These devices are heat aged at 375°F for 2 to 3 hours and air cooled before machining. On return to room temperature the material is left hard enough to obtain a 125 (rms) finish suitable for bonding surfaces.

Notes:

1. Weight saving will not be realized in these categories of tools if rigidity equal to that of a comparable steel tool is required.
2. Jigs or tool structures that do not fall in the above use requirements areas need no treatment, although material in the weld areas will be annealed and will exhibit less strength per unit area, requiring heavier material at these locations.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas 77058
   Reference: B66-10458

Patent status:

No patent action is contemplated by NASA.

Source: R. S. Mehnert
North American Aviation, Inc.
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