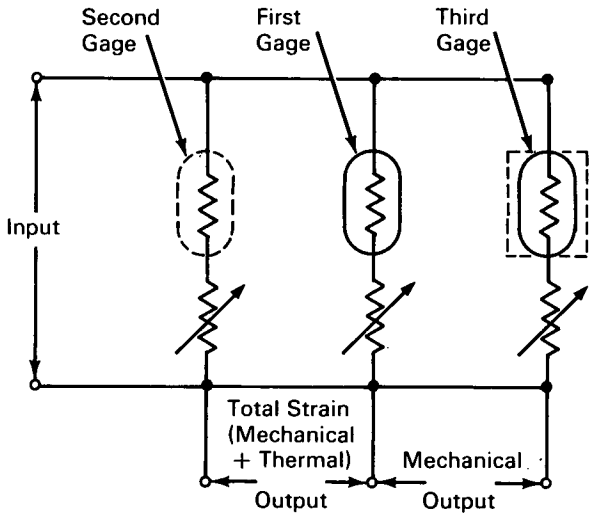
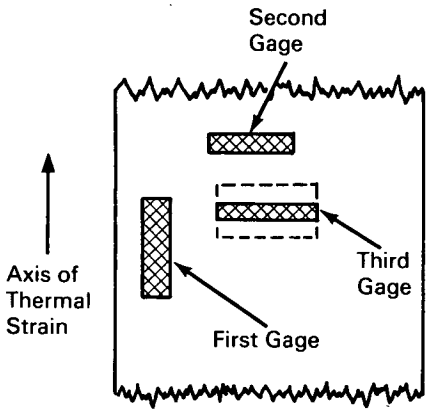
NASA TECH BRIEF

Strain Gage Network Distinguishes Between Thermal and Mechanical Deformations





The problem:

To measure the thermal coefficient of linear expansion of composite metal structures. Sampling methods are reliable only to the extent of the sample size and optical methods are prohibitively expensive.

The solution:

A strain gage network consisting of a test gage and two dummy gages arranged to distinguish thermally induced deformation from mechanical strain.

How it's done:

Three separate strain gages are mounted on the test specimen and wired into a double bridge configuration. Variable resistors are used in the legs of the bridges to balance the outputs. The first gage is bonded to the test specimen surface in such a way that it responds to both thermally and mechanically induced strains. The second gage is attached to the test specimen surface with a silicone grease and compensates for the electrical changes of the first gage as a function of temperature. The third gage is bonded to a strip of material identical to the test specimen and the strip is thermally attached to the test specimen surface. This gage compensates for both electrical changes of the first gage and thermal expansion in the material. This causes the output between the first and third gage to respond only to mechanical deformation induced thermally in the material strip by temperature gradients occurring in the test structure.

In operation, the output between the first and second gages indicates the total thermal and mechanical strain change in the test structure, while the output

(continued overleaf)

between the first and third gages indicates only the mechanical component. By subtracting the mechanical strain from the total strain, the true thermal strain acting on the test structure is determined.

Notes:

1. This design can be reduced to a single bridge configuration employing the first gage in conjunction with either the second or third depending upon the conditions of the test and whether thermal measurements alone or mechanical measurements alone are desired.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B66-10280

Patent status:

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

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