

# United States Patent [19]

Harner et al.

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[54] THERMALLY STABLE SUPER INVAR AND ITS NAMED ARTICLE

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### Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 849,569, Apr. 8, 1986, abandoned.

[51] Int. Cl.<sup>4</sup> ..... C03C 27/02

[52] U.S. Cl. .... 428/630; 428/623; 428/433; 420/95

[58] Field of Search ..... 420/95; 148/336; 428/623, 630, 433

### [56] References Cited

#### U.S. PATENT DOCUMENTS

1,942,261 1/1934 Scott ..... 420/95  
2,062,335 12/1936 Scott ..... 420/95  
2,277,440 1/1941 Knochel ..... 420/95

#### OTHER PUBLICATIONS

B. S. Lement et al., *The Dimensional Behavior of Invar*, 43, Transactions of the American Society for Metals, pp. 1072-1097, 32nd Annual Convention (Publ'd 1951).

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### [57] ABSTRACT

A thermally stable Super Invar has a substantially suppressed martensitic transformation inception point as well as an average coefficient of thermal expansion substantially lower than Invar. The composition in weight percent consists essentially of

	w/o
C	0.02 Max.
Mn	0.4-0.8
Si	up to 0.25
Ni	32.0-33.2
Co	4.5-5.5

and the balance iron except for incidental amounts of other elements including up to 0.015 w/o P, 0.015 w/o S, 0.25 w/o Cr, 0.20 w/o Mo, 0.20 w/o Cu, as well as other incidental elements in amounts which do not undesirably affect the austenitic microstructure or otherwise detract from the desired properties of the alloy. The composition is particularly suited for the manufacture of precision optical articles as well as other articles where minimal expansion mismatch between a metal member and a nonmetal member is required at temperatures of  $-90^{\circ}\text{C}$ . ( $-130^{\circ}\text{F}$ .) and lower. Moreover, the composition does not sustain stress induced martensite transformation for cold reductions up to 75%.

23 Claims, 1 Drawing Sheet

