

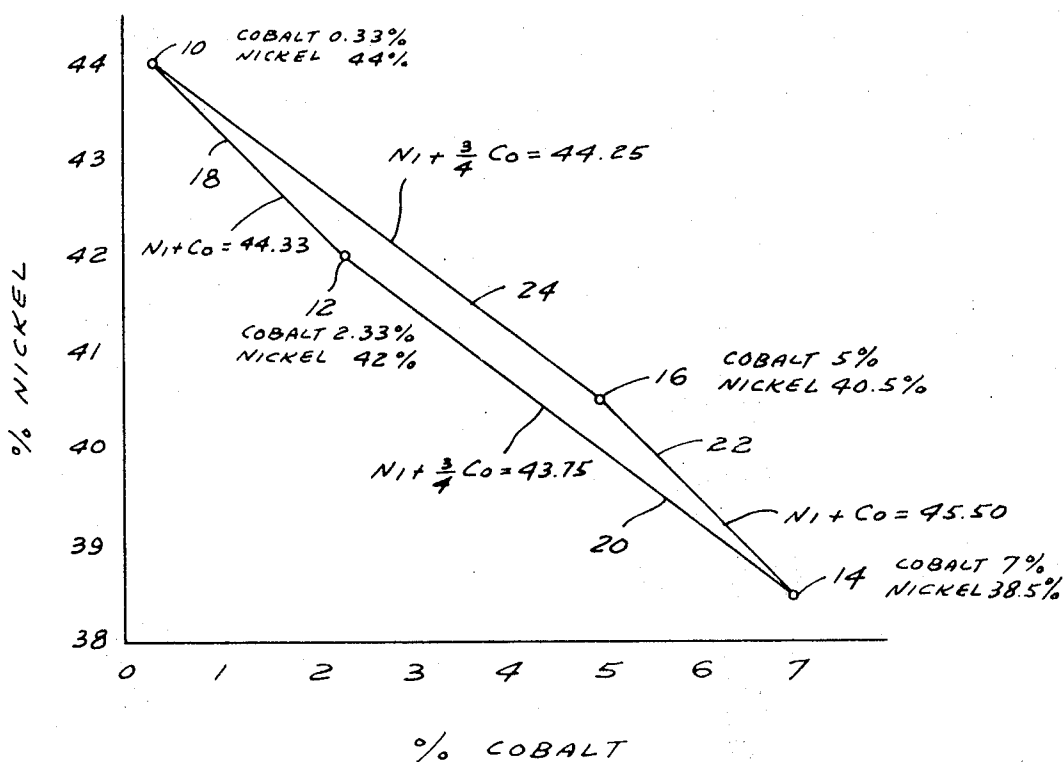
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SEALING ALLOY

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3,586,499 SEALING ALLOY

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5 Claims

ABSTRACT OF THE DISCLOSURE

An alloy used in metal to glass seals and the like containing as primary constituents, nickel, cobalt, and iron. In this alloy, the cobalt content falls within the range 0.33%–7% by weight, the nickel content falls within the range 38.5%–44%, the sum of the nickel plus cobalt content falls within the range 44.33%–45.5% and the sum of the nickel plus 75% of the cobalt content falls within the range 43.75%–44.25%.

BACKGROUND OF THE INVENTION

Individual glass fibers or strands are often formed into a bundle which serves as a light conduit. It is necessary, in forming such conduits and connecting them to various equipments, to seal the bundle at one or more points to a metal sleeve, disc or similar structure.

The individual glass fibers are assembled into a bundle and the bundle is disposed in a glass matrix. The matrix is peripherally coated with a glass frit and sealed to a metal member, such as a flange.

In our copending application Ser. No. 725,279 filed Apr. 30, 1968, now U.S. Pat. No. 3,516,824 granted June 23, 1970, we disclosed a new sealing alloy used as the metal member wherein the coefficients of thermal expansion of the fritted bundle and the alloy were sufficiently "matched" over a wide temperature range to avoid the creation both of tensile strains and excessive compressive strains. At the same time, proper characteristics for sealing, such as forming a secure hermetic bond, were retained. This disclosed alloy basically comprised, by weight percent, 34.5%–35.5% nickel, 10.5%–11.5% cobalt, 1%–2% chromium and the balance iron, and could also contain up to 1% by weight of certain minor constituents such as silicon, manganese and carbon.

Certain glass to metal seals which are exposed to high vacuum at elevated temperatures as in some types of electron discharge tubes, require the same "match" and yet cannot use alloys containing chromium.

We have succeeded in developing a new sealing alloy which can be used in high vacuum and temperature environments. Our alloy comprises, by weight percent, 38.5%–44% nickel, 0.33%–7% cobalt and the balance iron, provided however, that the sum of the nickel plus cobalt content falls within the range 44.33%–45.5% and the sum of the nickel plus 75% of the cobalt content falls within the range 43.75%–44.25%. We sometimes find it desirable to add to this alloy up to 1% by weight of certain minor constituents such as silicon, manganese and carbon.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying graph illustrates the relationships between nickel and cobalt contents as employed in our invention.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Our alloy, which can be produced by air, vacuum melting or powder metallurgy techniques used to produce conventional nickel-iron sealing alloys, can have typical compositions as indicated in the table below:

Element	Percent by weight	
	Melt 1	Melt 2
Nickel.....	40.85	42.66
Cobalt.....	3.92	1.62
Manganese.....	0.23	0.24
Silicon.....	0.15	0.15
Carbon.....	0.024	0.031
Iron.....	Balance	Balance

The thermal expansion characteristics of our alloys are substantially the same as described in our aforesaid copending application.

As previously indicated, the nickel and cobalt contents of our alloy must be held within certain limits. These limits are represented by the shaded area shown in the graph. This shaded area is a quadrilateral having vertices at points 10, 12, 14 and 16. Point 10 represents a cobalt content of 0.33% and a nickel content of 44%. Point 12 represents a cobalt content of 2.33% and a nickel content of 42%. Points 10 and 12 are joined by a line 18 representing a constant sum of nickel plus cobalt content equal to 44.33%. Point 14 represents a cobalt content of 7% and a nickel content of 38.5%. Line 20 which interconnects points 12 and 14 represents a constant sum of nickel plus 75% of the cobalt content equal to 43.75%. Point 16 represents a cobalt content of 5% and a nickel content of 40.5%. Point 16 is joined to point 14 by line 22, which represents a constant sum of nickel plus cobalt content equal to 45.5%. Point 16 is joined to point 10 by line 24, which represents a constant sum of nickel plus 75% of the cobalt content equal to 44.25%. The desired expansivity characteristics of our alloy can only be maintained if the nickel and cobalt contents fall within this shaded area bounded by these points and interconnecting lines.

Our alloy remains as a stable single phase over a temperature range which extends from below -80° C. to its melting temperature (which is about 1500° C.).

As in conventional sealing alloys, we have found that, while minor constituents such as silicon, manganese and carbon can be eliminated without adverse effects in the seal itself, forgeability and other metallurgical working properties of the alloy are enhanced when these constituents are used, providing that the total content by weight is about 1% or less.

While we described our invention with particular reference to preferred embodiments, our protection is to be limited only by the claims which follow.

What is claimed is:

1. An alloy, as expressed in percent by weight, consisting essentially of:

nickel 38.5%–44%;

cobalt 0.33%–7%, the sum of the nickel and cobalt contents falling within the range 44.33%–45.50%, the sum of the nickel and 75% of the cobalt contents falling within the range 43.75%–44.25%; and

iron balance.

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2. An alloy as set forth in claim 1 containing up to 1% of the following minor constituents: silicon, manganese and carbon.

3. An alloy as set forth in claim 2 which, over a temperature range from below -80°C. to about 1500°C. , remains as a stable single phase. 5

4. An alloy as set forth in claim 3 containing 40.85% nickel; 3.92% cobalt; 0.23% manganese; 0.15% silicon; and 0.024% carbon.

5. An alloy as set forth in claim 3 containing 42.66% nickel; 1.62% cobalt; 0.24% manganese; 0.15% silicon; and 0.031% carbon. 10

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