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NICKEL-CHROMIUM ALLOYS

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2 Claims. (Cl. 75—171)

This invention relates to improvements in nickel-chromium alloys.

In centrifuges which are used in the manufacture of glass wool, the metal from which the centrifuge is formed must be resistant to attacks by molten glass which is high in borax and soda ash. In addition it is desirable in centrifuges or rotors of this type to have a multiplicity of relatively small peripheral holes from which the molten glass is thrown by centrifugal force into the path of fiberizing jets. The alloy, therefore, must be readily machinable. A rotor of this type is disclosed in my pending patent application Ser. No. 167,091, filed Jan. 18, 1962, now Patent No. 3,227,536. Holes in centrifuges of this type are, of course, subject to wear, and it is highly desirable to be able to provide a centrifuge which can be used for a maximum number of hours before there is objectionable wear on the holes. Another problem with metal centrifuges is that in the larger sizes there is a problem of distortion in use.

It is a general object of the present invention to provide an improved nickel-chromium alloy which is particularly suitable for use in forming centrifuges of the above type.

A further object of the invention is to provide an alloy which is highly resistant to attack by the borax and soda ash present in molten glass.

A further object of the invention is to provide an improved alloy which makes it possible to form a distortion-free centrifuge in a diameter as large as 12".

A further object of the invention is to provide an improved alloy, particularly adapted for use in centrifuges, which permits said centrifuge to be operated at a temperature as high as 2200° F. for a period as long as 2 hours without major deformation.

With the above and other objects in view the invention consists of the improved nickel-chromium alloy as set forth in the claims.

Centrifuges formed by the alloy of the present invention have been found to stand up longer under the conditions encountered than centrifuges formed by the alloy of Patent No. 3,170,789, it being noted that the alloy of the present invention has substantially less nickel and substantially more chromium than the alloy of the prior patent, has substantially less tungsten, less iron, and less carbon. In addition, the alloy of the present invention contains molybdenum and cobalt in substantial quantities, which are not present in the alloy of the prior Patent No. 3,170,789. The presence of cobalt in the recited range results in high stress resistance at elevated temperatures, resistance to oxidation, and resistance to reducing atmospheres at temperatures in excess of 2100° F. such as are encountered in the use of centrifuges. The presence of molybdenum in the range recited results in a further enhancement of the desirable effects of the cobalt and permits the formation of a casting which is readily machinable. This machinability is particularly important because of the necessity of drilling a multiplicity of relatively small peripheral holes through which the molten glass is adapted to be thrown by centrifugal force. By having less nickel and more chromium than the alloy of the prior Patent No. 3,170,789 it is found that the integrity of the metal at elevated temperatures is improved and this further reduces the occurrence of creep and oxidation.

The nickel-chromium alloy of the present invention is composed of the following ingredients in the following ranges:

C	0.13–0.17
Mn	1.00–1.04
Fe	1.90–2.9
Si	0.84–1.14
W	3.13–4.13
Co	1.55–2.05
Cr	32.15–34.15
Ni	52–55
Mo	3.46–3.96

The preferred formula is as follows:

C	0.15
Mn	1.02
Fe	2.40
Si	0.99
W	3.63
Co	1.80
Cr	33.15
Ni	53.07
Mo	3.71

For preparation, any of the conventional procedures for nickel alloys may be followed.

Centrifuges manufactured by an alloy as above described were used in the manufacture of glass fibers and the centrifuges were found to stand up for an exceptionally long time against attacks by a molten glass batch which is high in borax and soda ash. The centrifuge was used for 100 hours before there was any noticeable wear on the small holes in its periphery. The centrifuge was also operated at a temperature of 2200° F. for a 2 hour period without any major deformation. This alloy was the only one tested which did not distort when used for a centrifuge with a diameter as large as 12".

The alloy of the present invention was found to have superior creep resistance and strength at elevated temperatures and is readily machinable. The alloy had a Rockwell test of 80–85 on a B scale.

Various changes and modifications may be made in the invention heretofore described as may be within the scope of the claims.

What I claim is:

1. An alloy consisting of the following ingredients in percentages by weight:

C	0.13–0.17
Mn	1.00–1.04
Fe	1.90–2.9
Si	0.84–1.14
W	3.13–4.13
Co	1.55–2.05
Cr	32.15–34.15
Ni	52–55
Mo	3.46–3.96

said alloy being characterized by resistance to corrosive attack by molten glass, having superior creep resistance, having strength at elevated temperatures, and imparting resistance to deformation to articles made therefrom.

2. An alloy as claimed in claim 1 in which the ingredients are in about the following percentages by weight:

C	0.15
Mn	1.02
Fe	2.40
Si	0.99
W	3.63
Co	1.80
Cr	33.15
Ni	53.07
Mo	3.71

References Cited

UNITED STATES PATENTS

3,170,789	2/1965	Woodward et al.	75—171
3,205,055	9/1965	Laurent et al.	75—171
3,316,074	4/1967	Laurent et al.	75—171
3,318,694	5/1967	Heitmann	75—171

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