

# UNITED STATES PATENT OFFICE

2,011,976

## COBALT-TUNGSTEN-IRON ALLOY

Werner Köster, Dortmund, Germany, assignor to  
Vereinigte Stahlwerke Aktiengesellschaft, Dusseldorf, Germany

No Drawing. Application January 28, 1932,  
Serial No. 589,535. In Germany February 18,  
1931

2 Claims. (Cl. 148—13)

This invention relates to a process of treating cobalt-tungsten-iron alloys and to alloys thus treated.

Exhaustive experiments have demonstrated that alloys containing about 40 to 85% of cobalt, about 5 to 40% of tungsten and the balance substantially iron, if they contain carbon in amounts not exceeding 0.3% are very well adapted to be precipitation hardened by a special heat treatment, namely by heating the cast or rolled alloys to a temperature between about 1000° C. and the melting point of the alloy, followed by quenching in the air, water or oil, and then heating the quenched alloys at temperatures between 500 and 900° C. By this treatment, the mechanical properties of the alloys are very considerably improved by comparison with what they were prior to the heat treatment and particularly good hardness values ensue, if the alloys contain iron in addition to cobalt and tungsten in the proportions mentioned. A further improvement in the quality of the alloys occurs on the tungsten content being increased to above 10%. Moreover, the alloys may contain up to 15% of other additions such as molybdenum, manganese, nickel, copper, aluminium, vanadium or titanium, without affecting the scope of the invention such small additions are comprised by the term in the claims: "the balance consisting substantially of iron".

The following examples serve to illustrate more clearly the nature of the present invention:—

1. An alloy containing 41% of cobalt, 22% of tungsten, 35% of iron, 1.5% of vanadium and 0.08% of carbon gave, after quenching from 1300° C., a hardness of 402 Brinell units, and a

hardness of 720 Brinell units after being annealed at 700° C. for an hour.

2. An alloy of: cobalt 45%, tungsten 38%, iron 17% and carbon 0.1%, gave a hardness of 328 Brinell units after quenching from 1300° C. and a hardness of 554 Brinell units after annealing at 800° C. for an hour.

3. An alloy of: cobalt 56%, tungsten 26%, chromium 13%, iron 4.5%, vanadium 0.6% and carbon 0.06%, gave a hardness of 315 Brinell units after quenching from 1200° C. and a hardness of 545 Brinell units after annealing at 800° C. for an hour.

I claim:—

1. The process which consists in forming an alloy comprising about 40 to 85% cobalt, about 5 to 40% of tungsten and the balance constituting a substantial portion of the alloy consisting substantially of iron, said alloy containing carbon in amounts not exceeding 0.3%, subjecting said alloy to a precipitation hardening by heating the alloy to a temperature between about 1000° C. and the melting point of the alloy, rapidly cooling from this temperature and annealing at temperatures between 500 and 900° C.

2. An alloy comprising about 40 to 85% cobalt, 5 to 40% tungsten and as balance constituting a substantial portion of the alloy consisting substantially of iron, said alloy containing carbon in amounts not exceeding 0.3% and being hardened by precipitation hardening to such an extent that its hardness has been raised by at least 200 to 300 Brinell units.

WERNER KÖSTER.