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3,425,828

PRODUCTION OF COBALT STRIP AND THE LIKE
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U.S. Cl. 75—214 4 Claims
Int. Cl. B22f 1/00**ABSTRACT OF THE DISCLOSURE**

The addition of between 2 percent to 4 percent by weight of iron powder to cobalt powder whereby the resulting mechanical mixture of powders is more readily cold formable than a similar cobalt powder without the added iron.

This invention relates, in general, to the production of cobalt strip, foil, and the like, but has reference more particularly to the production of such strip, foil, and the like, by cold forming.

It has heretofore been proposed, as in the Faulkner Patent No. 3,091,022, to provide a cold-formable predominantly cobalt alloy by changing the crystalline structure of the cobalt, which, at room temperature, has an hexagonal close-packed crystal structure, to a face-centered cubic crystalline structure. This is accomplished by incorporating in or adding to the cobalt at least one of the elements carbon, iron and nickel, in a predetermined amount. Although commercially available cobalt may contain a small amount of nickel, iron, carbon or other impurities which cannot be avoided during refinement of the metal, these metals or elements are not present in sufficient amounts nor in the proper proportions required to retain a face-centered cubic structure at room temperature.

The predominantly cobalt alloy in the aforesaid Faulkner patent is made by melting under standard furnacing procedures, preferably by vacuum melting, and the alloy may then be hot-worked, or may be cold-worked by well-known methods to produce sheet, tubing, wire, strip, etc.

It has also been proposed, as described in an article entitled "Properties and Applications of Cobalt Strip" by Fraser, Evans and Mackiw, on pages 80-84 of the July 1964 issue of Metal Progress, to produce ductile cobalt strip by compacting cobalt powder of high purity (99.92%). The powder is rolled into a continuous coil of green strip which is then sintered and hot rolled, and the densified cobalt strip is cold-rolled to the desired gauge or thickness. The hot rolling is performed at 1750° F. In the cold rolling, the strip is cold rolled to nearly the density of solid cobalt and finally, it is annealed in bell furnaces at temperatures up to 1700° F. for 1 hour. The finished cobalt strip consists of combined hexagonal close-packed and face-centered cubic structures, the mixture of these depending on the actual annealing temperature.

I have found that I can produce a cold-formable predominantly cobalt product without changing the hexagonal close-packed crystal structure of the cobalt, and with a minimum of annealing of the cold-formed product by utilizing, to form the product, a mixture of cobalt powder and iron powder, with the iron powder comprising from about 2% to about 4% by weight of the mixture.

In general, the powders in the mixture should be of a size of minus 150 mesh, but preferably not smaller than 500 mesh.

The mixture of powders is compacted by cold pressure or by cold rolling into a flat plate or sheet, or into a continuous coil, which is then sintered, if necessary, to agglomerate the particles of powder into a workable mass.

After sintering, the cold pressing or cold-rolling is con-

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tinued until strip or foil of the desired gauge or thickness is obtained.

Hot rolling may be used to increase the readiness with which the strip is reduced to smaller gauges.

The strip or foil may be used as such, or may be formed into tubing, wire, etc.

The maximum effect, for the purposes of this invention, is obtained by using from about 3% to about 3½% by weight of iron powder in the mixture.

Studies using X-ray diffraction show that the structure of both the sintered material as well as the finished strip or coil is overwhelmingly hexagonal close-packed, and no evidence of a face-centered cubic structure has been found.

Microscopic examination establishes that there is little or no solid solution of the iron in the cobalt, and that in the finished strip or foil, the iron is found in long stringers and not in solid solution in the crystals of cobalt. The formation of a face-centered cubic crystalline structure, such as is found in the product of the Faulkner patent and in the product of the Metal Progress article referred to above, requires the solid solubility of the iron in the cobalt in Faulkner's invention, or repeated annealing of the cobalt strip in the Metal Progress method.

I have thus produced a cobalt strip or foil by a cold-forming method, which strip or foil is characterized by the essentially hexagonal closed-packed crystal structure of the cobalt, and by the presence of a small amount of iron in the form of long stringers, and substantially none of which is in solid solution in the cobalt.

Having thus described my invention, I claim:

1. The method of producing a cold-formable predominantly cobalt product having an hexagonal close-packed crystal structure of the cobalt which comprises: providing a mechanical mixture consisting of cobalt powder and iron powder, with the iron powder forming from about 2% to about 4% by weight of the mixture, both powders being of a size of minus 150 mesh but not smaller than about 500 mesh, and then compacting the mixture into strip or foil, whereby the addition of the iron powder to the mixture permits compacting with a minimum of annealing.

2. The method as recited in claim 1 wherein the mixture of powders is compacted by cold pressure into a flat plate, sheet or continuous coil.

3. The method, as recited in claim 2, wherein hot rolling is used to increase the speed with which the strip or foil is reduced to smaller gauges, but without annealing of the strip or foil.

4. The method, as recited in claim 1, wherein the iron powder forms from about 3% to about 3.5% by weight of the mixture.

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