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WILHELM ROHN, OF HANAU-ON-THE-MAIN, GERMANY

NICKEL-CHROMIUM-IRON ALLOY AND ARTICLES MADE THEREFROM

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This invention relates to alloys composed of nickel as the main component, chromium, iron and, in some cases, tungsten, molybdenum, aluminium and cobalt. Alloys of this kind containing more than 0.05 per cent of carbon have been described as being a suitable material for forming parts of machines such as turbine blades or other parts exposed to similar strain. Now I have found by further experiments that by decreasing the carbon contents of such alloys the properties of the latter may be further improved in such a manner that the improved alloys can be substituted, in some cases, even for precious metals in the manufacture, for instance, of surgical instruments, dentures, elements of construction for artificial teeth or dentures such as palate plates, pins, clamps, single artificial teeth &c. substitutes for inner parts of man and animals and especially for injection cannulæ.

The alloys forming the object of the present invention are further capable of being drawn to seamless tubes and therefore are especially suited for making condenser tubes, as owing to the strength of the material and method of producing the same, tubes with very thin walls can be produced the strength of which is quite sufficient, so that the price of these tubes, in spite of the higher price of the material employed per kg. is hardly higher than that of the tubes made of the usual alloys, for which thicker walls are required.

By decreasing the carbon contents the anticorrosive properties of the well-known chromium-nickel alloys are considerably increased. Owing to the fact that in carbonaceous alloys two different structural elements having different dissolving tensions occur the attack by chemical agents is rather strong; on the contrary, chromium-nickel alloys practically free from carbon form homogeneous solid solutions and prove to be considerably more resistant. Furthermore these alloys free from carbon show extraordinarily high notched-bar impact values. For instance, it has been ascertained that the notched-bar impact value of a chromium-nickel alloy was increased by 30% of its value by reducing its carbon contents from 0.1% to 0.02%, its composition otherwise remaining unchanged. Furthermore these alloys have a great hardness and a great elasticity which properties may be still more increased by the incorporation of molybdenum, tungsten or cobalt in the pure or iron-containing chromium-nickel alloys. Injection cannulæ made of the said alloys do not get bent on sticking them in, owing to the high elasticity of the material, and do not break off when striking upon a hard matter, for instance, a bone owing to its high notched-bar impact value. Furthermore I have ascertained that the alloys forming the object of the present invention show an extremely high resistance to wear so that, for instance, the points of injection cannulæ are not blunt after having been stuck into pine wood more than one hundred times. Moreover the point of recrystallization of the alloys in question being at relatively high temperatures they may be sterilized, if required by heating to a dark red heat. The above cited favourable qualities together with a relatively low price of manufacture are not united in any of the alloys hitherto employed for the same purposes, nor in any pure metal.

Platinum is too expensive, nickel and argentan are too soft and therefore bend on being introduced, besides they are not sufficiently resistant toward chemical actions. Common steel in a hardened state possesses the required mechanical properties, but does not sufficiently resist chemical actions and therefore cannot be sterilized by heat. The so-called corrosion resistant and stainless or rustless steels are relatively brittle when hardened; therefore they easily break off and cannot be heated to a high temperature without danger to their hardness and anticorrosive properties. Finally the resistant steels are exceedingly stable against nitric acid, but not against sulfuric acid, chlorides, sulfates and other agents. Alloys composed according to the present invention are first to unite the advantageous qualities of all the other alloys mentioned above, the faults of the latter being entirely eliminated.

Of course the applicability of the alloys according to my invention is not confined to the above described purposes as they may be

advantageously used in any case when similar demands on chemical or mechanical or heat resistibility are made.

A preferred composition of an alloy made according to the present invention is nickel 60%, chromium 15%, iron 15%, molybdenum 3%, tungsten 3%, cobalt 3%, carbon less than 0.05%.

All the alloys claimed have the same desired characteristics, viz, anticorrosiveness, high notching tenacity, insensibleness to heat, capacity of being soldered.

I claim:—

1. An alloy for making injection cannulæ, surgical instruments, dentures, substitutes for inner parts of men and animals and the like, containing nickel 80 to 50%, chromium 10 to 40%, iron 1 to 40%, molybdenum 0.2 to 12% and carbon less than 0.05%.

2. An alloy for making injection cannulæ, surgical instruments, substitutes for inner parts of men and animals, dentures and the like, containing nickel 80 to 50%, chromium 10 to 40%, iron 1 to 40%, molybdenum 0.2 to 12%, tungsten 0.2 to 15%, and carbon less than 0.05%.

3. An alloy for making injection cannulæ, surgical instruments, dentures, substitutes for inner parts of men and animals and the like, containing nickel 80 to 50%, chromium 10 to 40%, iron 1 to 40%, molybdenum 0.2 to 12%, tungsten 0.2 to 15%, cobalt 2 to 20% and carbon less than 0.05%.

4. An alloy for making injection cannulæ, surgical instruments, dentures, substitutes for inner parts of men and animals and the like, containing nickel 80 to 50%, chromium 10 to 40%, iron 1 to 40%, molybdenum 0.2 to 12%, tungsten 0.2 to 15%, cobalt 2 to 20%, aluminum 0.5 to 6% and carbon less than 0.05%.

In testimony whereof I affix my signature.

WILHELM RÖHN.