UNITED STATES PATENT OFFICE.

PAUL RICHARD KUEHNRICH, OF SHEFFIELD, ENGLAND.

ALLOY.

1,273,877. Specification of Letters Patent. Patented July 30, 1918.

No Drawing. Application filed June 17, 1916. Serial No. 104,212.

To all whom it may concern:

Be it known that I, PAUL RICHARD KUEHNRICH, steel manufacturer, subject of the King of England, residing at Sheffield, in England, have invented a certain new and useful Improved Alloy; and I declare the following to be a full, clear, and exact description of the same.

The object of this invention is to provide an improved alloy possessing the qualities and endurance almost exclusively associated heretofore with high speed tool steel. An alloy according to the present invention comprises a base of nickel, chromium and silicon, to which a substantial quantity of aluminium has been added. It is to the presence of this aluminium in the alloy that its peculiar properties are due, enabling it to be used as a substitute for high speed steel. The hardness of the alloy is determined by the amount of aluminium, but when excessive quantities of the latter are added the alloy becomes too brittle for use for high speed tools. The nickel may be partially replaced by cobalt.

In carrying out the present invention a base alloy of nickel, chromium and silicon is first melted. The proportion of chromium may vary from about 10% to 35% or possibly more, while the silicon content may also vary, 3% or even less giving satisfactory results but the amount of silicon may be considerably increased. When the base, which should preferably contain not less than ½% of carbon, is sufficiently molten there is added a substantial quantity of aluminium, about 6% of the whole, but the percentage of aluminium may vary from 3% to 20% according to the hardness required. When the aluminium has been melted and proper admixture has occurred the alloy is teemed.

The alloy thus made is cast into tools in metal or sand molds, the former being preferred. The castings are ready for use without any additional heat treatment, their cutting edges merely requiring to be ground. They are found to be excellent high speed tools.

Although the alloy according to this invention is mainly intended for the manufacture of high speed cutting tools it may be used for other purposes, such as the valves of internal combustion motors, where a metal is required to retain its hardness at high temperatures.

In making the alloy according to this invention, the chromium may be added in the form of the metal or the alloy known as ferro-chrome containing about 70% more or less of chromium, as the iron and carbon contained therein do not adversely affect the properties of the new alloy.

The following mixture has been found in practice to give excellent results:—

Ferro-chrome (containing about 70% chromium and 4% to 6% carbon)	8 lbs.
Nickel	21 lbs.
Silicon	1 lb. 11 ozs.
Aluminium	2 lbs. 8 ozs.

In the base alloy of nickel, chromium and silicon in about the relative proportions described the nickel may be partially replaced by cobalt.

What I claim and desire to secure by Letters Patent is:—

1. A metal alloy composed of nickel, approximately 10% to 35% of chromium, approximately 3% to 7% of silicon, and from 3% to 20% of aluminium.

2. A metal alloy composed of nickel, approximately 10% to 35% of chromium, approximately 5% of silicon, and approximately 6% of aluminium.

3. A metal alloy composed of nickel, approximately 10% to 35% of iron and chromium, approximately 3% to 7% of silicon, and from 3% to 20% of aluminium.

4. A metal alloy having the following approximate analysis:—

Nickel	63.26%
Iron	5.77%
Chromium	16.83%
Carbon	1.44%
Silicon	5.10%
Aluminium	7.60%
	100.00%

In testimony whereof I affix my signature in presence of two witnesses.

PAUL RICHARD KUEHNRICH.

Witnesses:
F. W. YOUNG,
F. HIMSWORTH.