

UNITED STATES PATENT OFFICE.

PAUL RICHARD KUEHNRIK, OF SHEFFIELD, ENGLAND.

STEEL.

1,277,431.

Specification of Letters Patent.

Patented Sept. 3, 1918.

No Drawing.

Application filed October 17, 1916. Serial No. 126,149.

To all whom it may concern:

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

This invention relates to steel, its object being to provide a substitute for high speed steel by the addition of cobalt to carbon-chromium steels. The use of cobalt is known both as an ingredient in various alloy steels and to improve the cutting and staying powers of the usual tungsten or molybdenum high speed steels. Carbon-chromium steels are also well-known, but even the best of them although superior in quality to the ordinary carbon steel, cannot be classed as high speed steel since tools made therefrom do not retain their cutting edges when worked at such a speed that they are raised to a red-heat. According to the present invention, however, such carbon-chromium steels are converted into high speed steel substitutes by the addition of cobalt.

In carrying out this invention the ingredients are selected and proportioned so that the resulting steel contains approximately from 1% to 6% of cobalt, 1.2% to 3.5% of carbon and 8% to 20% of chromium. Any steel alloy of these elements within these limits possesses the characteristic property of red-hardness of high speed steel, but the limits are approximate only.

A fair high speed steel substitute according to the present invention shows the following analysis:—

40	Carbon	1.50 per cent.
	Chromium.....	12.00 " "
	Cobalt	3.50 " "
	Silicon.....	.30 " "
	Manganese	.20 " "
45	Phosphorus	.02 " "
	Sulfur	.02 " "
	Iron	82.46 " "
		100.00

There may be added to steel according to the present invention small quantities, say up to about 1%, of any one or more of the other metals of the chromium group (chromium, molybdenum, tungsten and uranium) as defined by Mendeleeff, in order to enhance certain properties of the steel.

Steel according to the present invention melts at a lower temperature than tungsten high speed steel and is so fluid that it may easily be cast into tools. It may be annealed in the usual manner sufficiently soft to be easily machined and there is no difficulty in forging it.

The steel can be satisfactorily hardened at a much lower temperature than is necessary with the ordinary high speed steels, and thus it is easier to obtain more uniform hardening without risk of damaging fine cutting edges of tools.

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

1. A steel having substantially the following analysis:—carbon 1.50 per cent., chromium 12.00 per cent., cobalt 3.50 per cent., silicon .30 per cent., manganese .20 per cent., phosphorus .02 per cent., sulfur .02 per cent. and iron 82.46 per cent. substantially as described.

2. A steel containing approximately 1.2% to 3.5% of carbon, 8% to 20% of chromium and 1% to 6% of cobalt.

3. A steel containing approximately 1.2% to 3.5% of carbon, 8% to 20% of chromium, 1% to 6% of cobalt and a small quantity up to about 1% of other metal of the chromium group.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

PAUL RICHARD KUEHNRIK.

Witnesses:

C. E. MORTON,

F. HINNSWORTH.