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METAL ALLOY

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1 Claim. (Cl. 75—126)

This invention relates to an alloy steel which is adapted among other purposes for the manufacture of valves, tubes, pipe lines, and equipment adapted for use in oil refineries and the like.

The principal objects of the invention are directed to the provision of an alloy steel which is not adversely affected when made into parts such as valves, pipe lines and other equipment that is subjected to elevated temperatures and pressures and to the action of various gases and acids which ordinarily very unfavorably affect ordinary steels.

The steel of this invention is characterized by an improved creep ratio, resistance to corrosion, fine grain, and improved impact properties. As special features, by reason of its composition, hydrogen-embrittlement and decarburization is practically eliminated.

According to present day practices in oil refineries, metal parts such as valves, pipe lines and equipment are frequently subjected to the action of various acids and gases such as hydrogen, propane, butane, ethane, methane, naphthionic and sulphonic acids, etc. The novel combination of elements constituting the alloy steel of this invention renders parts made therefrom peculiarly capable of withstanding the actions of these substances, at least to the extent that it is not easily, if at all, affected adversely thereby.

Ordinary steels when so subjected within the range of from 700 to 1000° F. have an inherent tendency towards decarburization and hydrogen-embrittleness. My novel alloy, hereinafter to be described, practically eliminates these objections.

Also the physical properties of the steel alloy of this invention are greatly improved in that the creep-rate at temperatures of from 900 to 1200° F. are improved by more than 25% as compared with the creep-rate of the steel disclosed in United States Letters Patent #1,915,065 issued to V. T. Malcolm on June 20, 1933. The steel of this invention, as to its ability to resist corrosion, is no less but slightly greater than that obtaining in connection with the prior art steel.

According to this invention, the steel alloy includes chromium and either tungsten or molybdenum, with vanadium as an important element. These are combined with sulphur, phosphorus, and silicon and it is believed that the tungsten-vanadium or molybdenum-vanadium elements are responsible in a large part for the ability of the steel of this invention to resist the various gases and acids above-mentioned which are encountered in present day oil refinery processes and its ability to overcome hydrogen-embrittlement and decarburization.

As stated, the steel also has a lower creep rate as well as fine grain and improved impact properties.

The composition of the alloy steel of this invention, more particularly the chromium, the tungsten or molybdenum, and the vanadium elements, may be varied within wide limits, but a composition within the range set forth in the following analysis will produce an alloy steel having the above characteristics and adapted to overcome the objections inherent in prior art steeel:

	Per cent
Carbon	Trace up to .50
Chromium	4.00 to 8.00
Tungsten	.75 to 2.00
Or molybdenum	.5 to 1.0
Sulphur, maximum	.05
Phosphorus, maximum	.05
Silicon	.3 to 2.0
Vanadium	.5 to 2.0
Iron	Substantial balance

A more specific analysis of the steel of this invention is as follows:

	Per cent
Carbon	.15
Chromium	6.00
Tungsten	1.00
Or molybdenum	.5
Sulphur	.05
Phosphorus	.05
Silicon	1.25
Vanadium	1.0
Iron	Substantial balance

From the above it will be noted that either tungsten or molybdenum chromium with the addition of vanadium form the important elements to provide the alloy of this invention and having the desired characteristics and properties.

While I have described the invention in great detail and with respect to the present preferred form thereof, it is not desired to be limited thereto since many changes and modifications may be made therein without departing from the spirit and scope of the invention.

What it is desired to claim and secure by Letters Patent of the United States is:

A new low-creep alloy steel containing chromium and carbon and silicon and which is resistant to the action of such corrosive elements as methane, propane, naphthionic acid, and sulphonic acid at high temoeratures in the neighborhood of 1200° F. comprising in combination, about 6% chromium, a maximum of .2% carbon, at least 1% and a maximum of 2% silicon, relatively small amounts of both sulphur and phosphorus, the maximum of each being .05%, more than .5% but not more than 2% of vanadium, at least .5% and a maximum of 2% of one of a group including tungsten and molybdenum, and the balance substantially all iron.

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