

UNITED STATES PATENT OFFICE

RALPH P. DE VRIES, OF NEWTONVILLE, NEW YORK, ASSIGNOR TO LUDLUM STEEL COMPANY, OF WATERVLIET, NEW YORK, A CORPORATION OF NEW JERSEY

STABLE SURFACE ALLOY STEEL

No Drawing. Application filed January 20, 1926. Serial No. 82,607.

This invention relates to alloys of steel, and more particularly to such alloys as are known to the trade as stable-surface alloy steels.

The main objects of my invention are to provide an alloy steel of new composition which will be resistant to scaling action at high temperatures ranging from a low red heat to temperatures as high as 1800° F., and which will be resistant in varying degrees to rusting acids, and corroding agents of various kinds. This steel may be readily forged and rolled, and when it has been thus forged and rolled, it will have good strength and fair ductility.

The invention is especially useful where steels are to be used for internal combustion engine poppet valves, electrical resistance heating elements, carburizing boxes, and for other purposes wherein metal is desired which will resist scaling, particularly at high temperatures.

An alloy steel containing as its essential elements carbon and silicon within the ranges of my present invention, with iron as the balance of the alloy, has fairly good resistance to scaling and towards action of corroding agents of various kinds. When such an alloy however, contains percentages of silicon, which run above 2½% to 3% it becomes decidedly inferior with regard to its physical strength and ductility. When much higher percentages of silicon than 2½ to 3% are used, the alloy becomes useless for most structural and engineering purposes.

I have discovered that copper may be added to such an alloy in substantial amounts and that when so added it produces a steel having the desired qualities of strength and ductility, as well as resistance to scaling at high temperatures. Such steels containing percentages of silicon as high as 6% may then be readily forged, rolled or worked, in any manner desired, and have when thus forged or rolled, the desired characteristics mentioned above.

An alloy steel made in accordance with my invention contains from 2.0% to 7.0% of silicon and from 0.50% to 6.0% of copper.

Alloys of my invention when made with the

lower ranges of silicon and copper within ranges above specified, will be resistant to scaling at low red heats. To obtain good resistance to scaling, the alloy should contain at least 3.0% of silicon, and to obtain maximum resistance to scaling percentages of silicon should be in the upper portion of the silicon range.

Alloys of this composition can be melted practically carbon free, but for some purposes may contain carbon as high as 1.0%. The usual amount of manganese found in tool and structural steels may be present, or slightly greater amounts up to 1.5% may be used. Impurities and metalloids, such as sulphur, phosphorous, etc., will be kept as low as possible. Typical examples of this alloy may be noted as having the following composition, the iron "balance" including the manganese, impurities and metalloids mentioned above:

Carbon	Copper	Silicon	Iron
0.25%	3.5%	3.5%	Balance
0.30%	1.5%	5.2%	Balance

It is a well known fact that silicon in the highest proportions herein mentioned ordinarily makes a very coarse grain alloy of very little strength. The copper in the present alloy overcomes this objection. It produces an alloy which can be forged, and which has good strength. For still further refining the grain, titanium may be added in amounts running from as low as 0.1% up to 5.0%. Where it is desired to impart greater strength to the alloy which is to be subjected to high temperatures, I may add tungsten or molybdenum in percentages 0.5% to 5.0%.

Alloy steels made in accordance with my invention can be readily hardened by heating above their critical ranges and then cooling in water, oil, or air as desired. For many purposes for which this alloy steel is adapted, it will be desirable to vary the physical properties by heat treatment which may consist of hardening as mentioned and drawing the steel by re-heating after such hardening.

I claim—

1. A ferrous alloy consisting of from over 2% to 7% of silicon, from over 0.5% to 6% of copper, up to 1.5% manganese and the balance iron.
2. An alloy steel consisting of from more than 2% to 7% of silicon, from 0.5% to 6% of copper and the balance iron with the usual manganese.
3. In an alloy steel composed of from over 2% to 7% of silicon, copper in sufficient quantity between the proportions of 0.5% and 6% to render the product malleable both hot and cold and the balance iron with the usual manganese.
4. An alloy steel composed of from 2.5% to 7% of silicon, copper in sufficient quantity between the proportions of 0.5% and 6% to render the product malleable both hot and cold and the balance iron with manganese up to 1.5%.

In testimony whereof I have signed my name to this specification.

RALPH P. DE VRIES.

25

30

35

40

45

50

55

60

65