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## ALLOY STEEL

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8 Claims. (Cl. 75—125)

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This invention relates to alloy steel and an important object is to provide an alloy steel adapted for the manufacture of mechanical parts which are to operate under stress at temperatures up to 800° C. and require to have high creep resistance under such working conditions. The term "mechanical parts" is to be regarded as comprehensive and includes such objects as power plant, components or units thereof, and apparatus generally intended for operation in a range of temperature extending up to 800° C., and subjected during such operation to considerable stress.

The invention is based on the discovery that alloy steels containing carbon, nickel, chromium, molybdenum, copper and titanium in certain critical percentages possess creep resistance values, at temperatures up to 800° C., which have hitherto been regarded as unattainable.

Alloy steels containing the constituents above recited, but with much wider ranges prescribed for the permissible percentages of such constituents have been claimed to possess resistance to acids and other chemical agents and also to oxidation, scaling and corrosion at high temperatures, but it will be appreciated that the property of resistance to corrosion and scaling is by no means allied to, or to be confused with, resistance to creep.

According to this invention mechanical parts required for operation at temperatures up to 800° C., whilst subjected to considerable stress, are manufactured from steels lying within the following range of composition:

| | Per cent |
|---|---|
| Carbon | Up to 1.5 |
| Nickel | 15.0 to 25.0 |
| Chromium | 12.0 to 20.0 |
| Molybdenum | 2.0 to 6.0 |
| Copper | 2.0 to 6.0 |
| Titanium | 0.25 to 2.0 |
| Iron | Remainder |

Alloy steels of the above composition possess abnormally high creep resistance. In relation to this characteristic which is essential to the invention it is to be emphasized that the above limits of proportion of the several constituents of the alloy are critical. Furthermore, importance is to be attached to the inclusion of titanium as an essential constituent.

The preferred range of composition is as follows:

| | Per cent |
|---|---|
| C | Up to 0.3 |
| Ni | 16.0 to 18.0 |
| Cr | 12.0 to 16.0 |
| Mo | 3.0 to 4.5 |
| Cu | 3.0 to 4.5 |
| Ti | 0.25 to 1.0 |
| Fe | Remainder |

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The alloy may also contain silicon up to 2%, manganese up to 2% and vanadium up to 1%.

*Example*

A steel of the following analysis: C 0.08%, Si 0.28%, Mn 0.24%, Ni 16.93%, Cr 13.87%, Mo 4.31%, Cu 4.47%, Ti 0.51% and the remainder iron gave the following values at the temperatures stated:

| Time yield | 400° C. | 500° C. | 600° C. | 700° C. | 800° C. |
|---|---|---|---|---|---|
| Tons/sq. in | 20 | 18.5 | 15 | 6.5 | 2 |

From the above figures it will be seen that the steel of this example possesses abnormally high creep resistance at elevated temperatures and is therefore essentially suitable for use in the manufacture according to the invention.

I claim:

1. Alloy steel possessing high creep resistance when applied for the manufacture of mechanical parts to be operated under stress at temperatures up to 800° C., comprising the following constituents and critical percentages: Carbon up to 1.5%, nickel 15.0 to 25.0%, chromium 12.0 to 20.0%, molybdenum 2.0 to 6.0%, copper 2.0 to 6.0%, titanium 0.25 to 2.0% and iron the remainder.

2. Alloy steel possessing high creep resistance when applied for the manufacture of mechanical parts to be operated under stress at temperatures up to 800° C., comprising the following constituents and critical percentages: carbon up to 0.3%, nickel 16.0 to 18.0%, chromium 12.0 to 16.0%, molybdenum 3.0 to 4.5%, copper 3.0 to 4.5%, titanium 0.25 to 1.0%, and iron the remainder.

3. Alloy steel possessing high creep resistance when applied for the manufacture of mechanical parts to be operated under stress at temperatures up to 800° C., comprising the following constituents and critical percentages: carbon up to 1.5%, silicon up to 2.0%, manganese up to 2.0%, nickel 15.0 to 25.0%, chromium 12.0 to 20.0%, molybdenum 2.0 to 6.0%, copper 2.0 to 6.0%, titanium 0.25 to 2.0%, and iron the remainder.

4. Alloy steel possessing high creep resistance when applied for the manufacture of mechanical parts to be operated under stress at temperatures up to 800° C., comprising the following constituents and critical percentages: carbon up to 0.3%, silicon up to 2.0%, manganese up to 2.0%, nickel 16.0 to 18.0%, chromium 12.0 to 16.0%, molybdenum 3.0 to 4.5%, copper 3.0 to 4.5%, titanium 0.25 to 1.0%, and iron the remainder.

5. Alloy steel possessing high creep resistance when applied for the manufacture of mechanical parts to be operated under stress at temperatures up to 800° C., comprising the following constit-

uents and critical percentages: carbon 0.08%, silicon 0.28%, manganese 0.24%, nickel 16.93%, chromium 13.87%, molybdenum 4.31%, copper 4.47%, titanium 0.51% and iron the remainder.

6. Alloy steel according to claim 1 and containing vanadium up to 1.0% displacing an equivalent percentage of iron remainder.

7. The fabrication of apparatus required to operate under stress at high temperatures, that is up to 800° C., from an alloy steel comprising carbon up to 1.5%, nickel 15–25%, chromium 12–20%, molybdenum 2–6%, copper 2–6%, titanium 0.25–2% and the remainder iron.



8. A mechanical part required to operate under stress at high temperatures, that is, up to 800° C., and having high creep resistance under such conditions, said part consisting of alloy steel comprising carbon up to 1.5%, nickel 15–25%, chromium 12–20%, molybdenum 2–6%, copper 2–6%, titanium 0.25–2% and the remainder iron.

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