(57) Abrégé/Abstract:
A steel composition for the production of railway and tram crossing point frog castings is disclosed which includes iron with, by weight, 0.15 to 0.2% of carbon, 1 - 1.8% of manganese, 1 - 1.6% of silicone, 1.5 - 2.5% of chrome, 2.3 - 3.5% of nickel, 0.4 - 0.7% of molybdenum and 0.0025 - 0.005% of boron. The composition has a higher wear and tear resistance and longer service life.
ABSTRACT

A steel composition for the production of railway and tram crossing point frog castings is disclosed which includes iron with, by weight, 0.15 to 0.2% of carbon, 1 - 1.8% of manganese, 1 - 1.6% of silicone, 1.5 - 2.5% of chrome, 2.3 - 3.5% of nickel, 0.4 - 0.7% of molybdenum and 0.0025 - 0.005% of boron. The composition has a higher wear and tear resistance and longer service life.
STEEL FOR RAILWAY AND TRAM POINT CROSSING FROG CASTINGS

Technical Area

The invention relates to the chemical composition of steel on the basis of chrome - nickel - molybdenum used especially for railway and tram crossing point frog castings to withstand higher axle and operational loads.

Actual Technical Conditions

The materials, which were known and used up to now for the production of railway and tram point crossing frog castings are for example pearlitic steel used under the trade name UIC 900A, cast austenitic steel super manganese alloy used under trade name 13Mn Super Special and the material chrome – nickel – molybdenum used under the trade name Lo8CrNiMo.

Steel used under the trade name UIC 900A contains iron with, by weight, 0,60 to 0,80% of carbon, 0,1 to 0,5% of silicon, 0,80 to 1,3% of manganese, maximally 0,04% of phosphorus and maximally 0,04% of sulphur. The disadvantages of the steel used under the trade name UIC 900A include lower resistance to wear and tear, lower strength and operation service life with respect to passed load, fast wear out, development of blanks, low notch toughness and fracture susceptibility.

Steel used under the trade name 13Mn Super Special contains iron with, by weight, 0,60 to 0,80% of carbon, 12,50 to 16,50% of manganese, maximally 0,6% of silicon, maximally 0,05% of phosphorusus, maximally 0,03% of sulphur and 1,80 % to 2,20% of molybdenum. The disadvantages of the steel used under the trade name 13 Mn Super Special include problematic weldability with high carbon steel of the UIC type and increased costs due to necessary repairs in operation as well as difficult detection of internal faults using ultra-sound. Taking into consideration predominant mechanisms of wear and tear of steel used under the trade name UIC 900A and 13 Mn Super Special, the steel represents material with limited possibilities for service life increase.

Steel used under the trade name Lo8CrNiMo contains iron with, by weight, of 0,11 to 0,15% of carbon, 0,50 to 0,80% of manganese, maximally 0,50% of silicon, 1,60% to 2,00% of chromium, 2,60 % to 3,00% of nickel, 0,40% to 0,50 % of molybdenum, maximally 0,003% of boron, maximally 0,045% of total content of aluminium in steel, maximally 0,13% of vanadium, maximally 0,05% of titaniumium, maximally 0,012%
nitrogen, maximally 0,015% phosphorus and maximally 0,012% of sulphur. Cast steel used under the trade name Lo8CrNiMo is suitable only for standard operation with an average operational load of 22,5 MT per axle.

**Summary of the Invention**

The above stated disadvantages of materials for production of railway and tram point crossing frogs are substantially eliminated by steel for the production of railway and tram point crossing frogs in accordance with the invention characterised by including iron with, by weight, of 0,15% to 0,20% of carbon, 1,00% to 1,80% of manganese, 1,00% to 1,60% of silicon, 1,50% to 2,50% of chrome, 2,50 to 3,50% of nickel, 0,40% to 0,70% of molybdenum and 0,0025% to 0,0005% of boron.

The above stated chemical composition in combination with a two-level thermal processing to bainitic structure with given parameters of sub-structure ensures a combination of mechanical properties leading to an increased resistance to typical operational wear and tear.

It concerns an increase of the yield point to at least 1100 Mpa and the strength limit at least to 1400 MPa, while the peak load value reaches minimally 20J and the fracture toughness reaches at least 100 MPa/m1/2.

Taking into consideration an increase in the operational load, like axle loads and passed tonns per year through the highly loaded components of switches, like frogs, the steel in accordance with the inventions provides a higher resistance to operational wear and tear with minimal maintenance.

**Detailed Description**

Example 1

Steel was prepared according to a preferred embodiment of the invention, containing iron together with, by weight, of 0,19% of carbon, 1,10% of manganese, 1,06% of silicon, 0,020% of phosphorus, 0,010% of sulphur, 1,97% of chrome, 2,96% of nickel, 0,03 % of titanium, 0,47% of molybdenum, 0,0031 of boron and 0,01% of total contents of aluminium in steel. Based on heat processing to a bainitic structure a yield strength of 1245 MPa, a strength limit of 1521 MPa, a peak load of 24,3 J and fracture toughness of 108,4 MPa/m1/2 was achieved.
Example 2

In another preferred embodiment, steel was prepared containing iron together with, by weight, of 0,20% of carbon, 1,54% of manganese, 1,06% of silicon, 0,020% of phosphorus, 0,010% of sulphur, 2,02% of chrome, 2,99% of nickel, 0,02 % of titanium, 0,49% of molybdenum, 0,0026 of boron and 0,04% of total contents of aluminium in steel. Based on heat processing to a bainitic structure a yield strength of 1169 MPa, a strength limit of 1420 MPa, peak load of 29,3 J and a fracture toughness of 110,2 MPa/m1/2 was achieved.

Example 3

In a further preferred embodiment, steel was prepared containing iron together with, by weight, 0,164% of carbon, 1,65% of manganese, 1,207% of silicon, 0,013% of phosphorus, 0,010% of sulphur, 1,71% of chrome, 2,89% of nickel, 0,0376 % of titanium, 0,479% of molybdenum, 0,0036 of boron and 0,015% of total contents of aluminium in steel. Based on heat processing to a bainitic structure a yield strength of 1147 MPa, a strength limit of 1457 MPa, a peak load of 21,3 J and a fracture toughness of 111,2 MPa/m1/2 was achieved.

**Industrial Applicability**

The steel according to the invention can be advantageously used mainly for railway and tram point crossing frog castings with high axle and operational loads.
CLAIMS:

1. Steel composition for the production of railway and tram point crossing frogs, comprising iron with, by weight, 0.15 to 0.20% of carbon, 1.00 to 1.80% of manganese, 1.00% to 1.60% of silicon, 1.50 to 2.50% of chrome, 2.50 up to 3.50% of nickel, 0.40 to 0.70% of molybdenum and 0.0025% to 0.005 of boron.

2. The steel composition according to claim 1, thermally processed to achieve a bainitic structure.

3. The steel composition according to claim 1 or 2, having a minimal yield strength of 1100 MPa and a minimal strength limit of 1400 MPa, while the minimal peak load reaches 20 J and the minimal fracture toughness reaches 100 MPa/m1/2.