

Title (en)

SPRING STEEL HAVING SUPERIOR FATIGUE LIFE, AND MANUFACTURING METHOD FOR SAME

Title (de)

FEDERSTAHL MIT VERBESSERTER ERMÜDUNGSLEBENSDAUER UND VERFAHREN ZU SEINER HERSTELLUNG

Title (fr)

ACIER À RESSORT PRÉSENTANT UNE DURÉE DE VIE EN FATIGUE SUPÉRIEURE, ET SON PROCÉDÉ DE FABRICATION

Publication

EP 3831970 A1 20210609 (EN)

Application

EP 19841872 A 20190719

Priority

- CN 201810842312 A 20180727
- CN 2019096726 W 20190719

Abstract (en)

A spring steel having a superior fatigue life, and a manufacturing method for the same. The chemical components thereof are as follows in weight percentage: C: 0.52-0.62%, Si: 1.20-1.45%, Mn: 0.25-0.75%, Cr: 0.30-0.80%, V: 0.01-0.15%, Nb: 0.001-0.05%, N: 0.001-0.009%, O: 0.0005-0.0040%, P: $\leq 0.015\%$, S: $\leq 0.015\%$, and Al: $\leq 0.0045\%$, with the remainder being Fe and incidental impurities, wherein the following condition is also met $0.02 \leq (2Nb+V)/(20N+C) \leq 0.40$. The spring steel of the present invention has a microstructure of tempered troostite + tempered sorbite, a prior austenite grain size less than 80 μm , a size of alloy nitride and carbide precipitates being 5-60 nm, and a maximum width of single-grain inclusions being less than 30 μm . The spring steel has a handling strength greater than 2020 MPa, superior ductility and toughness (the reduction of area $\geq 40\%$), and a fatigue life $\geq 800,000$ times, thereby meeting application requirements of high-stress springs in industries, such as automobiles, machinery, and the like.

IPC 8 full level

C22C 38/00 (2006.01); **B21B 1/16** (2006.01); **B21C 1/00** (2006.01); **B21C 37/04** (2006.01); **B22D 11/00** (2006.01); **C21C 7/10** (2006.01); **C21D 1/25** (2006.01); **C21D 1/58** (2006.01); **C21D 1/60** (2006.01); **C21D 7/06** (2006.01); **C21D 8/06** (2006.01); **C21D 9/02** (2006.01); **C21D 9/52** (2006.01); **C22C 38/02** (2006.01); **C22C 38/04** (2006.01); **C22C 38/24** (2006.01); **C22C 38/26** (2006.01)

CPC (source: CN EP KR US)

B21C 1/003 (2013.01 - EP); **B22D 11/1206** (2013.01 - EP); **B22D 11/20** (2013.01 - EP); **C21C 7/072** (2013.01 - EP); **C21C 7/10** (2013.01 - CN EP KR); **C21D 1/25** (2013.01 - EP); **C21D 1/58** (2013.01 - EP); **C21D 1/60** (2013.01 - EP); **C21D 7/06** (2013.01 - KR); **C21D 8/06** (2013.01 - EP); **C21D 8/065** (2013.01 - CN KR US); **C21D 9/02** (2013.01 - EP KR US); **C21D 9/525** (2013.01 - EP); **C21D 9/5737** (2013.01 - US); **C22C 38/001** (2013.01 - EP KR); **C22C 38/002** (2013.01 - EP US); **C22C 38/02** (2013.01 - CN EP US); **C22C 38/04** (2013.01 - CN EP); **C22C 38/06** (2013.01 - US); **C22C 38/24** (2013.01 - CN EP KR US); **C22C 38/26** (2013.01 - CN EP KR US); **C22C 38/60** (2013.01 - KR); **C21D 9/562** (2013.01 - US); **C21D 2211/001** (2013.01 - US); **C22C 38/04** (2013.01 - US)

Cited by

CN112792122A

Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated extension state (EPC)

BA ME

DOCDB simple family (publication)

EP 3831970 A1 20210609; **EP 3831970 A4 20210609**; **EP 3831970 B1 20230510**; CN 110760748 A 20200207; CN 110760748 B 20210514; JP 2021530623 A 20211111; JP 7110480 B2 20220801; KR 20210036916 A 20210405; US 2021164078 A1 20210603; WO 2020020066 A1 20200130

DOCDB simple family (application)

EP 19841872 A 20190719; CN 201810842312 A 20180727; CN 2019096726 W 20190719; JP 2021503062 A 20190719; KR 20217001643 A 20190719; US 201917261457 A 20190719