

# CPC COOPERATIVE PATENT CLASSIFICATION

## C CHEMISTRY; METALLURGY

(NOTES omitted)

### METALLURGY

#### C21 METALLURGY OF IRON

#### C21D MODIFYING THE PHYSICAL STRUCTURE OF FERROUS METALS; GENERAL DEVICES FOR HEAT TREATMENT OF FERROUS OR NON-FERROUS METALS OR ALLOYS; MAKING METAL MALLEABLE BY DECARBURISATION, TEMPERING OR OTHER TREATMENTS (cementation by diffusion processes [C23C](#); surface treatment of metallic material involving at least one process provided for in class [C23](#) and at least one process covered by this subclass, [C23F 17/00](#); unidirectional solidification of eutectic materials or unidirectional demixing of eutectoid materials [C30B](#))

|             |   |             |   |
|-------------|---|-------------|---|
| <b>1/00</b> | <b>General methods or devices for heat treatment, e.g. annealing, hardening, quenching or tempering</b>   | 1/58        | . . Oils  |
| 1/02        | . Hardening articles or materials formed by forging or rolling, with no further heating beyond that required for the formation                            | 1/60        | . . Aqueous agents  |
| 1/04        | . with simultaneous application of supersonic waves, magnetic or electric fields  | 1/607       | . . Molten salts  |
| 1/06        | . Surface hardening   | 1/613       | . . Gases; Liquefied or solidified normally gaseous material  |
| 1/08        | . . with flames   | 1/62        | . Quenching devices   |
| 1/09        | . . by direct application of electrical or wave energy; by particle radiation   | 1/63        | . . for bath quenching  |
| 1/10        | . . . by electric induction   | 1/64        | . . . with circulating liquids  |
| 1/18        | . Hardening ( <a href="#">C21D 1/02</a> takes precedence); Quenching with or without subsequent tempering ( <a href="#">quenching devices C21D 1/62</a> ) | 1/667       | . . for spray quenching   |
| 1/185       | . . {from an intercritical temperature}   | 1/673       | . . for die quenching   |
| 1/19        | . . by interrupted quenching  | 1/68        | . Temporary coatings or embedding materials applied before or during heat treatment   |
| 1/20        | . . . Isothermal quenching, e.g. bainitic hardening   | 1/70        | . . while heating or quenching  |
| 1/22        | . . . Martempering  | 1/72        | . . during chemical change of surfaces  |
| 1/25        | . . Hardening, combined with annealing between 300 degrees Celsius and 600 degrees Celsius, i.e. heat refining ("Vergüten")                               | 1/74        | . Methods of treatment in inert gas, controlled atmosphere, vacuum or pulverulent material  |
| 1/26        | . Methods of annealing  | 1/76        | . . Adjusting the composition of the atmosphere   |
| 1/28        | . . Normalising   | 1/763       | . . . {using a catalyst}  |
| 1/30        | . . Stress-relieving  | 1/767       | . . with forced gas circulation; Reheating thereof  |
| 1/32        | . . Soft annealing, e.g. spheroidising  | 1/773       | . . under reduced pressure or vacuum  |
| 1/34        | . Methods of heating ( <a href="#">C21D 1/06</a> takes precedence)  | 1/78        | . Combined heat-treatments not provided for above   |
| 1/38        | . . Heating by cathodic discharges  | 1/785       | . . {Thermocycling}   |
| 1/40        | . . Direct resistance heating   | 1/82        | . Descaling by thermal stresses ( <a href="#">mechanically B21, B23</a> ; <a href="#">chemically C23</a> ; <a href="#">electrolytically C25F 1/00</a> ) |
| 1/42        | . . Induction heating   | 1/84        | . Controlled slow cooling ( <a href="#">cooling-beds for metal rolling B21B 43/00</a> )   |
| 1/44        | . . in heat-treatment baths   | <b>3/00</b> | <b>Diffusion processes for extraction of non-metals; Furnaces therefor (local protective coatings <a href="#">C21D 1/72</a>)</b>                        |
| 1/46        | . . . Salt baths  | 3/02        | . Extraction of non-metals  |
| 1/48        | . . . Metal baths   | 3/04        | . . Decarburising   |
| 1/50        | . . . Oil baths   | 3/06        | . . Extraction of hydrogen  |
| 1/52        | . . with flames   | 3/08        | . . Extraction of nitrogen  |
| 1/53        | . . Heating in fluidised beds   | 3/10        | . Furnaces therefor   |
| 1/54        | . Determining when the hardening temperature has been reached by measurement of magnetic or electrical properties   | <b>5/00</b> | <b>Heat treatments of cast-iron</b>   |
| 1/55        | . Hardenability tests, e.g. end-quench tests  | 5/02        | . improving the malleability of grey cast-iron  |
| 1/56        | . characterised by the quenching agents   | 5/04        | . of white cast-iron  |
|             |   | 5/06        | . . Malleabilising  |
|             |   | 5/08        | . . . with oxidation of carbon  |

- 5/10 . . . . in gaseous agents
- 5/12 . . . . in solid agents
- 5/14 . . . Graphitising
- 5/16 . . . . Packing agents

**6/00 Heat treatment of ferrous alloys**

- 6/001 . {containing Ni ([C21D 6/004](#) takes precedence)}
- 6/002 . {containing Cr ([C21D 6/004](#) takes precedence)}
- 6/004 . {containing Cr and Ni}
- 6/005 . {containing Mn}
- 6/007 . {containing Co}
- 6/008 . {containing Si}
- 6/02 . Hardening by precipitation
- 6/04 . Hardening by cooling below 0 degrees Celsius

**7/00 Modifying the physical properties of iron or steel by deformation** ([apparatus for mechanical working of metal B21, B23, B24](#))

- 7/02 . by cold working
- 7/04 . . of the surface
- 7/06 . . . by shot-peening or the like
- 7/08 . . . by burnishing or the like
- 7/10 . . of the whole cross-section, e.g. of concrete reinforcing bars
- 7/105 . . . {of concrete reinforcing bars}
- 7/12 . . . by expanding tubular bodies
- 7/13 . by hot working

**8/00 Modifying the physical properties by deformation combined with, or followed by, heat treatment** ([hardening articles or materials formed by forging or rolling with no further heating beyond that required for the formation C21D 1/02](#))

- 8/005 . {of ferrous alloys ([C21D 8/02](#) - [C21D 8/12](#) take precedence)}
- 8/02 . during manufacturing of plates or strips ([C21D 8/12](#) takes precedence)

**NOTE**

In this group classification is made according to the most important feature in one subgroup only; for other features indexing codes of [C21D](#) are added

- 8/0205 . . {of ferrous alloys}
- 8/021 . . {involving a particular fabrication or treatment of ingot or slab}
- 8/0215 . . . {Rapid solidification; Thin strip casting}
- 8/0221 . . {characterised by the working steps}
- 8/0226 . . . {Hot rolling}
- 8/0231 . . . {Warm rolling}
- 8/0236 . . . {Cold rolling}
- 8/0242 . . . {Flattening; Dressing; Flexing}
- 8/0247 . . {characterised by the heat treatment}
- 8/0252 . . . {with application of tension}
- 8/0257 . . . {with diffusion of elements, e.g. decarburising, nitriding}
- 8/0263 . . . {following hot rolling}
- 8/0268 . . . {between cold rolling steps}
- 8/0273 . . . {Final recrystallisation annealing}
- 8/0278 . . {involving a particular surface treatment ([C21D 8/0294](#) takes precedence)}
- 8/0284 . . . {Application of a separating or insulating coating}
- 8/0289 . . . {Application of a tension-inducing coating}

- 8/0294 . . {involving a localised treatment}
- 8/04 . . to produce plates or strips for deep-drawing

**NOTE**

In this group classification is made according to the most important feature in one subgroup only; for other features indexing codes of [C21D](#) are added

- 8/0405 . . . {of ferrous alloys}
- 8/041 . . . {involving a particular fabrication or treatment of ingot or slab}
- 8/0415 . . . . {Rapid solidification; Thin strip casting}
- 8/0421 . . . {characterised by the working steps}
- 8/0426 . . . . {Hot rolling}
- 8/0431 . . . . {Warm rolling}
- 8/0436 . . . . {Cold rolling}
- 8/0442 . . . . {Flattening; Dressing; Flexing}
- 8/0447 . . . {characterised by the heat treatment}
- 8/0452 . . . . {with application of tension}
- 8/0457 . . . . {with diffusion of elements, e.g. decarburising, nitriding}
- 8/0463 . . . . {following hot rolling}
- 8/0468 . . . . {between cold rolling steps}
- 8/0473 . . . . {Final recrystallisation annealing}
- 8/0478 . . . {involving a particular surface treatment ([C21D 8/0494](#) takes precedence)}
- 8/0484 . . . . {Application of a separating or insulating coating}
- 8/0489 . . . . {Application of a tension-inducing coating}
- 8/0494 . . . {involving a localised treatment}
- 8/06 . during manufacturing of rods or wires
- 8/065 . . {of ferrous alloys}
- 8/08 . . for concrete reinforcement
- 8/10 . during manufacturing of tubular bodies
- 8/105 . . {of ferrous alloys}
- 8/12 . during manufacturing of articles with special electromagnetic properties

**NOTE**

In this group classification is made according to the most important feature in one subgroup only; for other features indexing codes of [C21D](#) are added

- 8/1205 . . {involving a particular fabrication or treatment of ingot or slab}
- 8/1211 . . . {Rapid solidification; Thin strip casting}
- 8/1216 . . {the working step(s) being of interest}
- 8/1222 . . . {Hot rolling}
- 8/1227 . . . {Warm rolling}
- 8/1233 . . . {Cold rolling}
- 8/1238 . . . {Flattening; Dressing; Flexing}
- 8/1244 . . {the heat treatment(s) being of interest}
- 8/125 . . . {with application of tension}
- 8/1255 . . . {with diffusion of elements, e.g. decarburising, nitriding}
- 8/1261 . . . {following hot rolling}
- 8/1266 . . . {between cold rolling steps}
- 8/1272 . . . {Final recrystallisation annealing}
- 8/1277 . . {involving a particular surface treatment ([C21D 8/1294](#) takes precedence)}
- 8/1283 . . . {Application of a separating or insulating coating}

- 8/1288 . . . {Application of a tension-inducing coating}
- 8/1294 . . {involving a localized treatment}
- 9/00 Heat treatment, e.g. annealing, hardening, quenching or tempering, adapted for particular articles; Furnaces therefor**
- 9/0006 . {Details, accessories not peculiar to any of the following furnaces (control devices [C21D 11/00](#))}
- 9/0012 . . {Rolls; Roll arrangements}
- 9/0018 . . {for charging, discharging or manipulation of charge}
- 9/0025 . . {Supports; Baskets; Containers; Covers}
- 9/0031 . {Rotary furnaces with horizontal or slightly inclined axis}
- 9/0037 . {Rotary furnaces with vertical axis; Furnaces with rotating floor}
- 9/0043 . {Muffle furnaces; Retort furnaces}
- 9/005 . {Furnaces in which the charge is moving up or down (for wire, strip [C21D 9/54](#))}
- 9/0056 . {Furnaces through which the charge is moved in a horizontal straight path ([C21D 9/0043](#) takes precedence)}
- 9/0062 . {Heat-treating apparatus with a cooling or quenching zone}
- 9/0068 . {for particular articles not mentioned below}
- 9/0075 . {for rods of limited length (of unlimited length [C21D 9/52](#))}
- 9/0081 . {for slabs; for billets}
- 9/0087 . {for chains, for chain links}
- 9/0093 . {for screws; for bolts}
- 9/02 . for springs
- 9/04 . for rails
- 9/06 . . with diminished tendency to become wavy
- 9/08 . for tubular bodies or pipes
- 9/085 . . {Cooling or quenching}
- 9/10 . . shotgun barrels
- 9/12 . . barrels for ordnance
- 9/14 . . wear-resistant or pressure-resistant pipes
- 9/16 . for explosive shells
- 9/18 . for knives, scythes, scissors, or like hand cutting tools
- 9/20 . for blades for skates
- 9/22 . for drills; for milling cutters; for machine cutting tools
- 9/24 . for saw blades
- 9/26 . for needles; for teeth for card-clothing
- 9/28 . for plain shafts
- 9/30 . for crankshafts; for camshafts
- 9/32 . for gear wheels, worm wheels, or the like
- 9/34 . for tyres; for rims
- 9/36 . for balls; for rollers
- 9/38 . for roll bodies
- 9/40 . for rings; for bearing races
- 9/42 . for armour plate
- 9/44 . for equipment for lining mine shafts, e.g. segments, rings or props
- 9/46 . for sheet metals
- 9/48 . . deep-drawing sheets
- 9/50 . for welded joints
- 9/505 . . {Cooling thereof}
- 9/52 . for wires; for strips {; for rods of unlimited length}
- 9/525 . . {for wire, for rods ([C21D 9/54](#) takes precedence)}
- 9/54 . . Furnaces for treating strips or wire
- 9/56 . . . Continuous furnaces for strip or wire
- 9/561 . . . . {with a controlled atmosphere or vacuum}
- 9/562 . . . . {Details}
- 9/563 . . . . . {Rolls; Drums; Roll arrangements}
- 9/564 . . . . . {Tension control}
- 9/565 . . . . . {Sealing arrangements}
- 9/567 . . . . with heating in fluidised beds
- 9/573 . . . . with cooling
- 9/5732 . . . . . {of wires; of rods}
- 9/5735 . . . . . {Details}
- 9/5737 . . . . . . {Rolls; Drums; Roll arrangements}
- 9/58 . . . . with heating by baths
- 9/60 . . . . with induction heating
- 9/62 . . . . with direct resistance heating
- 9/63 . . . . the strip being supported by a cushion of gas
- 9/64 . . . Patenting furnaces
- 9/66 . . . Tower-type furnaces
- 9/663 . . . Bell-type furnaces
- 9/665 . . . . inverted or side-facing
- 9/667 . . . . Multi-station furnaces
- 9/67 . . . . . adapted for treating the charge in vacuum or special atmosphere
- 9/673 . . . . Details, accessories, or equipment peculiar to bell-type furnaces
- 9/675 . . . . Arrangements of charging or discharging devices
- 9/677 . . . . Arrangements of heating devices
- 9/68 . . . Furnace coilers; Hot coilers ([cold coilers B21C 47/00](#))
- 9/70 . Furnaces for ingots, i.e. soaking pits
- 10/00 Modifying the physical properties by methods other than heat treatment or deformation**
- 10/005 . {by laser shock processing}
- 11/00 Process control or regulation for heat treatments**
- 11/005 . {for cooling}
- 2201/00 Treatment for obtaining particular effects**
- 2201/01 . Shape memory effect
- 2201/02 . Superplasticity
- 2201/03 . Amorphous or microcrystalline structure
- 2201/04 . Single or very large crystals
- 2201/05 . Grain orientation
- 2211/00 Microstructure comprising significant phases**
- 2211/001 . Austenite
- 2211/002 . Bainite
- 2211/003 . Cementite
- 2211/004 . Dispersions; Precipitations
- 2211/005 . Ferrite
- 2211/006 . Graphite
- 2211/007 . Ledeburite
- 2211/008 . Martensite
- 2211/009 . Pearlite
- 2221/00 Treating localised areas of an article**
- 2221/01 . End parts (e.g. leading, trailing end)
- 2221/02 . Edge parts
- 2221/10 . Differential treatment of inner with respect to outer regions, e.g. core and periphery, respectively
- 2241/00 Treatments in a special environment**

## C21D

- 2241/01 . under pressure
- 2241/02 . . Hot isostatic pressing
- 2241/03 . in zero gravity (e.g. in space)

### **2251/00 Treating composite or clad material**

- 2251/02 . Clad material
- 2251/04 . Welded or brazed overlays

### **2261/00 Machining or cutting being involved**

### **2281/00 Making use of special physico-chemical means**

- 2281/01 . Seed crystals being used
- 2281/02 . temperature gradient