

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, e.g. BY DECARBURISATION OR TEMPERING (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)

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

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

- 3/10 . Furnaces therefor
- 5/00 Heat treatments of cast-iron**
- 5/02 . improving the malleability of grey cast-iron
- 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}	9/46	. for sheet metals
8/1266	. . . {between cold rolling steps}	9/48	. . deep-drawing sheets
8/1272	. . . {Final recrystallisation annealing}	9/50	. for welded joints
8/1277	. . {involving a particular surface treatment (C21D 8/1294 takes precedence)}	9/505	. . {Cooling thereof}
8/1283	. . . {Application of a separating or insulating coating}	9/52	. for wires; for strips {; for rods of unlimited length}
8/1288	. . . {Application of a tension-inducing coating}	9/525	. . {for wire, for rods (C21D 9/54 takes precedence)}
8/1294	. . {involving a localized treatment}	9/54	. . Furnaces for treating strips or wire
9/00	Heat treatment, e.g. annealing, hardening, quenching or tempering, adapted for particular articles; Furnaces therefor	9/56	. . . Continuous furnaces for strip or wire
9/0006	. {Details, accessories not peculiar to any of the following furnaces (control devices C21D 11/00)}	9/561	. . . . {with a controlled atmosphere or vacuum}
9/0012	. . {Rolls; Roll arrangements}	9/562	. . . . {Details}
9/0018	. . {for charging, discharging or manipulation of charge}	9/563	. . . . . {Rolls; Drums; Roll arrangements}
9/0025	. . {Supports; Baskets; Containers; Covers}	9/564	. . . . . {Tension control}
9/0031	. {Rotary furnaces with horizontal or slightly inclined axis}	9/565	. . . . . {Sealing arrangements}
9/0037	. {Rotary furnaces with vertical axis; Furnaces with rotating floor}	9/567	. . . . with heating in fluidised beds
9/0043	. {Muffle furnaces; Retort furnaces}	9/573	. . . . with cooling
9/005	. {Furnaces in which the charge is moving up or down (for wire, strip C21D 9/54)}	9/5732	. . . . . {of wires; of rods}
9/0056	. {Furnaces through which the charge is moved in a horizontal straight path (C21D 9/0043 takes precedence)}	9/5735	. . . . . {Details}
9/0062	. {Heat-treating apparatus with a cooling or quenching zone}	9/5737	. . . . . {Rolls; Drums; Roll arrangements}
9/0068	. {for particular articles not mentioned below}	9/58	. . . . with heating by baths
9/0075	. {for rods of limited length (of unlimited length C21D 9/52)}	9/60	. . . . with induction heating
9/0081	. {for slabs; for billets}	9/62	. . . . with direct resistance heating
9/0087	. {for chains, for chain links}	9/63	. . . . the strip being supported by a cushion of gas
9/0093	. {for screws; for bolts}	9/64	. . . Patenting furnaces
9/02	. for springs	9/66	. . . Tower-type furnaces
9/04	. for rails	9/663	. . . Bell-type furnaces
9/06	. . with diminished tendency to become wavy	9/665	. . . . inverted or side-facing
9/08	. for tubular bodies or pipes	9/667	. . . . Multi-station furnaces
9/085	. . {Cooling or quenching}	9/67	. . . . . adapted for treating the charge in vacuum or special atmosphere
9/10	. . shotgun barrels	9/673	. . . . Details, accessories, or equipment peculiar to bell-type furnaces
9/12	. . barrels for ordnance	9/675	. . . . Arrangements of charging or discharging devices
9/14	. . wear-resistant or pressure-resistant pipes	9/677	. . . . Arrangements of heating devices
9/16	. for explosive shells	9/68	. . . Furnace coilers; Hot coilers (cold coilers B21C 47/00)
9/18	. for knives, scythes, scissors, or like hand cutting tools	9/70	. Furnaces for ingots, i.e. soaking pits
9/20	. for blades for skates	10/00	Modifying the physical properties by methods other than heat treatment or deformation
9/22	. for drills; for milling cutters; for machine cutting tools	10/005	. {by laser shock processing}
9/24	. for saw blades	11/00	Process control or regulation for heat treatments
9/26	. for needles; for teeth for card-clothing	11/005	. {for cooling}
9/28	. for plain shafts	2201/00	Treatment for obtaining particular effects
9/30	. for crankshafts; for camshafts	2201/01	. Shape memory effect
9/32	. for gear wheels, worm wheels, or the like	2201/02	. Superplasticity
9/34	. for tyres; for rims	2201/03	. Amorphous or microcrystalline structure
9/36	. for balls; for rollers	2201/04	. Single or very large crystals
9/38	. for roll bodies	2201/05	. Grain orientation
9/40	. for rings; for bearing races	2211/00	Microstructure comprising significant phases
9/42	. for armour plate	2211/001	. Austenite
9/44	. for equipment for lining mine shafts, e.g. segments, rings or props	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

- 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