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)

Definition statement

This place covers:

General methods or devices for heat treatment, e.g. hardening, annealing, heating, quenching or tempering.

Heat treatment adapted for particular articles, e.g. springs, pipes, drills, rollers or wires; furnaces therefor.

Heat treatment of cast-iron or of ferrous alloys.

Changing the physical properties of ferrous metals by deformation, by deformation combined or followed by heat treatment or by other methods.

Diffusion processes for extraction of non-metals, e.g. decarburising; furnaces therefor.

Process control or regulation for heat treatments.

The term "ferrous alloys" refers to alloys based essentially on iron.

Relationships with other classification places

- C22F provides for decarburization of non-ferrous metal and non-ferrous alloys to modify the physical structure thereof.
- Subclass C22B covers the decarburization of metalliferous material for purposes of refining.
- C22B covers general metallurgical or chemical processes for producing or recovering metals from metal compounds, ores, metalliferous waste or scrap metal and for refining metal.
- C23F 17/00 provides for surface treatment of metallic material involving at least one process provided for in class C23 and at least one process covered in C22F.
- When the method is intended for providing a particular use/product then the use/product is classified as well (see informative references for some of them).
- When the composition of the alloy is disclosed, either in the claims or the description, it is classified as well in C22C.
- Furnaces in general and details thereof are classified in F27B and F27D, respectively.

References

Limiting references

This place does not cover:

Chemical descaling	C23
Cementation by diffusion processes	C23C
Surface treatment of metallic material	C23F 17/00

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Apparatus for heat treatment of railway trains on the spot	E01B 31/18

Informative references

Attention is drawn to the following places, which may be of interest for search:

Mechanical metal-working	B21B, B21C, B21J
Working metallic powder, powder metallurgical apparatus or processes	B22F, C22C 1/04
Layered products	B32B
Changing the physical structure of non-ferrous metals or alloys	C22F
Electrolytic production or refining of metals	C25C
Single crystals or homogeneous polycrystalline material with defined structure; Production thereof	C30B
Furnaces	F27
Investigating or analysing material by determining their chemical or physical properties	G01N
Electric heating	H05B

Special rules of classification

- Looping references between C21D and C30B have been identified. Until this inconsistency is resolved in IPC, the current classification practice in CPC is as follows: C30B is considered as "informative reference".
- When classifying in C21D all essential features disclosed should be classified as invention.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Alloy	A composition of plural elements at least one of which is a free metal. It also includes material containing any combination of fibres, filaments, whiskers and particles, e.g. carbides, diamond, oxides, borides, nitrides, silicides, or other metal compounds, e.g. oxynitrides or sulfides embedded in a metallic matrix.
Cast iron	Ferrous alloy which solidifies with a eutectic, with a carbon content of 2.1-4 wt%.
Steel	Ferrous alloy with a carbon content of 0.2-2.1wt%.
Air hardening steel	Steel which does not require quenching from a high temperature to harden but which is hardened by cooling in air from above its critical temperature range.
Sub-critical annealing/Stress relief annealing	Heat treatment for relieving or dissipating stresses in weldments, heavily machined parts, castings, forgings by heating them, uniformly heated through, and air cooled/slow cooled with subsequent finishing or heat treatment.
Oil-hardening	Process of hardening a ferrous alloy by heating within or above the transformation range and quenching in oil.

Decarburization	Subjecting the steel to high temperatures and heat treating in a media containing air, oxygen or hydrogen to remove carbon at the surface.
Recrystallization	After all metal crystals have been dissolved by heating enough to lose its structural strength, the metal temperature then falls, allowing the crystals to re-form.
Spheroidizing	Heating the carbon steel to approximately 700 °C for over 30 hours to form spheroidite, to soften higher carbon steels and allow more formability.
Aging or ageing	A process in which the hardness or strength of a metal alloy having a constituent in supersaturated solid solution is increased over time as the constituent precipitates out as a secondary phase containing the constituent. When occurring at room temperature the process is termed "natural aging", while a process that occurs when subjecting the metal alloy to elevated temperature is termed "artificial aging". Aging for a longer time than that corresponding to maximum strength or hardness at the particular temperature is termed "over-ageing".
Hardening	The increase in resistance to deformation.
Precipitation hardening	As the quenched alloy ages, a new material precipitates out of the metallic crystal lattice, filling in abutting spaces, and increasing hardness.
Normalizing	A process of heating metallic material above its critical temperature and cooling in air thereby establishing a fine uniform grain size and improving the microstructural uniformity.
Quenching	The rapid cooling of metallic material either from elevated temperature to room temperature or cooling of metal to sub-ambient temperature, at a specific rate, with a given medium.
Tempering	Heating of a previously quenched or normalized metallic material to an elevated temperature, and then cooling under suitable conditions to obtain the desired mechanical properties.
Martempering	Heat treatment of steel involving austenitisation of steel followed by quenching in heat extracting medium (e.g. salt), at a rate fast enough to avoid the formation of ferrite, pearlite or bainite to a temperature slightly above the martensite start (Ms) point.
Austempering	Isothermal heat treatment applied to steel and cast iron, involves holding the metallic material at the quenching temperature for an extended period of time in order to produce a lower bainite microstructure for steels and a structure of acicular ferrite and high carbon, stabilized austenite known as ausferrite for cast-irons.
Case Hardening	Heat treatment or combination of heat treatments of surface hardening involving a change in the composition of the outer layer of an iron-base alloy in which the surface is made harder by inward diffusion of a gas or liquid followed by appropriate thermal treatment.

C21D 1/00

General methods or devices for heat treatment, e.g. annealing, hardening, quenching or tempering

Definition statement

This place covers:

Methods and devices for heat treatments: annealing, hardening or quenching of ferrous alloys.

Relationships with other classification places

Ferrous alloys are classified in C22C 38/00.

When the heat-treated alloy is intended for a particular use/product then the use/ product is classified as well in the appropriate subclass or subgroup.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Cooling-beds for metal rolling	B21B 43/00
Manufacture of metal sheets, bars, wires, rods, tubes or profiles, otherwise than by rolling	B21C
Forging	B21J
Machine tools; Metal-working not otherwise provided for	B23
Production of gases	C01, C10
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00
Coating material with metallic material, cementation (carburizing, nitriding, etc.); Chemical descaling	C23C
Processes for the electrolytic removal of materials from objects	C25F
Furnaces	F27
Heat exchange apparatus in which the heat-exchange media do not come into direct contact	F28D
Investigating or analysing material by determining their chemical or physical properties	G01N
Electric heating	H05B

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A case-hardened gear steel consisting of, by weight percent, Co: 16.3, Ni: 7.5, Cr: 3.5, Mo: 1.75, W: 0.2, C: 0.11, Ti: 0.03, V: 0.02 and the balance Fe, will be classified in this group in C21D 1/22 as well as in C22C 38/44 and C22C 38/52.

C21D 3/00

Diffusion processes for extraction of non-metals; Furnaces therefor (local protective coatings C21D 1/72)

Definition statement

This place covers:

Diffusion processes for extraction of non-metals and furnaces thereof.

Relationships with other classification places

- Ferrous alloys are classified in C22C 38/00.
- When the heat-treated alloy is intended for a particular use/product then the use/product is classified as well in the appropriate subclass or subgroup; C21D 9/00 should also be considered.

References

Limiting references

This place does not cover:

Local protective coatings	C21D 1/72

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wires, rods, tubes or profiles, otherwise than by rolling	B21C
Forging	B21J
Production of gases	C01, C10
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00
Coating material with metallic material, cementation (carburizing, nitriding, etc.); Chemical descaling	C23C
Processes for the electrolytic removal of materials from objects	C25F
Furnaces	F27

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.
- For example: a method for production of a surface-decarburized hot-rolled strip with the following composition C: 0.4-1.0%, Si: 0.1-0.5%, Mn: 0.3-1.2%, P: <0.02%, S: <0.008%, Al: 0.01-0.05%, Cr: 0.1-0.5%, Ni: 0.1-0.4%, Mo: <50.1%, balance Fe will be classified in C21D 3/04, as well as in C21D 1/74, in C22C 38/02, C22C 38/04, C22C 38/06 and C22C 38/40.
- In case of a method for manufacturing oriented silicon steel: (in wt %): C: 0.020-0.050%, Si: 2.6-3.6%, S: 0.015-0.025%, Al: 0.008-0.028%, N: 0.005-0.020%, Mn: 0.15-0.5%, Cu: 0.3-1.2%, balance Fe and inevitable impurities, involves smelting steel, refining molten steel, continuously casting steel to obtain slab, hot rolling, cold rolling, annealing and applying annealing separator

and insulation coating on slab, the classification in this group is: C21D 3/04, C21D 1/26, as well as C22C 38/001, C22C 38/02, C22C 38/04, C22C 38/06 and C22C 38/16.

C21D 5/00

Heat treatments of cast-iron

Definition statement

This place covers:

Heat treatments of cast iron alloys i.e. ferrous alloy which solidifies with a eutectic, with Carbon 2.1%-4% by weight percent.

Relationships with other classification places

- Cast iron is classified in C22C 37/00.
- When the heat-treated cast iron alloy is intended for a particular use/product then the use/product is classified as well in the relevant group(s) in the appropriate subclass or subgroup; C21D 9/00 should also be considered.
- Making cast iron alloys are classified in C22C 33/08 – C22C 33/12.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Refining of metals	C22B
Making cast iron alloys	C22C 33/08 - C22C 33/12
Steels	C22C 38/00
Heat treatment of non-ferrous alloys	C22F

Special rules of classification

- If the cast-iron alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 37/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: Surface hardening cast iron parts by degraphitizing a surface layer part of a cast iron member and thereafter irradiating a laser beam or an electron beam on said surface will be classified in C21D 5/00, as well as in C21D 3/04 and C21D 1/09.

C21D 6/00

Heat treatment of ferrous alloys

Definition statement

This place covers:

Heat treatment of ferrous alloys: iron-based alloys and all types of steels such as low alloy steels, dual-phase steels, tool steels, spring steels, maraging steels, stainless steels, ferritic, austenitic, martensitic, bainitic or pearlitic.

Relationships with other classification places

When the alloy is produced by a specifically described method (such as in the examples or claims) then the method is classified as well in the appropriate areas such as B22F, C23C, B23K, C25D, C25B, B22D, B21J, B21B or B21C.

Ferrous alloys are classified in C22C 38/00.

When the alloy is intended for a particular use/product then the use/product is classified as well.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/3053 - B23K 35/3093, C21D 9/50
Layered products	B32B 1/00
Heat treating of non-ferrous alloys	C22F

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- Heat treatment of ferrous alloys/steels containing Ni (and no Cr) are classified in C21D 6/001 and C22C 38/08.
- Heat treatment of ferrous alloys/steels containing Cr (and no Ni) are classified in C21D 6/002 and C22C 38/18 - C22C 38/38.
- Heat treatment of ferrous alloys/steels containing Cr and Ni are classified in C21D 6/004 and C22C 38/40 - C22C 38/58.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.
- When classifying in group C21D 6/00, any aspect of the method for the heat treatment of ferrous alloys which is considered to represent information of interest for search may also be classified in groups C21D 1/02 - C21D 1/84. This can, for example, be the case when it is considered of interest to enable searching of heat treatment methods of ferrous alloys using a combination of classification symbols. Such non-obligatory classification should be given as "additional information".

For example: A case hardened gear steel having enhanced core fracture toughness includes by weight percent of about Co: 16.3, Ni: 7.5, Cr: 3.5, Mo: 1.75, W: 0.2, C: 0.11, Ti: 0.03, V: 0.02 and the balance Fe, characterized as a predominantly lath martensitic microstructure essentially free of topologically close-packed (TCP) phases and carburized to include fine M_2C carbides to provide a case hardness of at least about 62 HRC and a core toughness of at least about 50 ksi$\sqrt{in}$ will be classified in C21D 6/004; C21D 6/007; C21D 6/02; C21D 6/04, and also in C21D 1/22, C21D 1/25, C22C 38/44 and C22C 38/52.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Hardening by cooling below 0 degrees Celsius	Controlled cooling below 0° C in order to alter the material microstructure, and enhance its strength and wear properties.

C21D 7/00

Modifying the physical properties of iron or steel by deformation (apparatus for mechanical working of metal B21, B23, B24)

Definition statement

This place covers:

Cold working and hot working deformation process of iron and steel.

Relationships with other classification places

When the iron/steel alloy is produced by a specifically described method (such as in the examples or claims) then the method is classified as well in the appropriate areas such as B22F, C23C, B23K, C25D, C25B, B22D, B21J, B21B or B21C.

Ferrous alloys are classified in C22C 38/00.

When the iron/steel alloy is intended for a particular use/product then the use/product is classified as well.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods or profiles without essentially removing material; Punching	B21D
Forging	B21J
Apparatus for mechanical working of metal	B23, B24
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00

Special rules of classification

- References B21, B23 and B24 are non-limiting in groups C21D 1/82 and C21D 7/00, CPC will be updated once this inconsistency is resolved in IPC.
- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A high cleanliness spring steel useful in manufacturing a spring with SiO_2 -based inclusions being extremely controlled and excellent in fatigue properties is obtained by scalping -> patenting -> cold wire drawing working (wire drawing) -> oil tempering -> process equivalent to strain relieving annealing -> shot peening -> strain relieving annealing will be classified in C21D 7/04, C21D 7/06, as well as in C22C.

C21D 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)

Definition statement

This place covers:

Modifying the physical properties by deformation combined with, or followed by, heat treatment during manufacturing processes of plates or strips, plates or strips for deep drawing, rods or wires, tubular bodies or articles with special electromagnetic properties.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well.

Ferrous alloys are classified in C22C 38/00.

References

Limiting references

This place does not cover:

Hardening articles or materials formed by forging or rolling with no further heating beyond that required for the formation	C21D 1/02

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; Punching	B21D
Forging	B21J
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.
- When classifying in this main group, use of C21D orthogonal indexing symbols is mandatory.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Hot rolling	Rolling occurs in the austenite region of the phase diagram of the steel (above approximately 900ºC).

Warm rolling	Rolling occurs in the ferrite region of the phase diagram of the steel (approximately 600ºC to 800ºC).
Cold rolling	Rolling occurs below the ferrite region (below 600ºC).

C21D 8/005

{of ferrous alloys (C21D 8/02 - C21D 8/12 take precedence)}

Definition statement

This place covers:

Modifying the physical properties by deformation combined with, or followed by, heat treatment of ferrous alloys, during manufacturing of plates or strips.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well.

Ferrous alloys are classified in C22C 38/00.

References

Limiting references

This place does not cover:

Modifying the physical properties by deformation combined with, or followed by, heat treatment during manufacturing of plates, strips, rod, wires, tubular bodies or articles with special electromagnetic properties	C21D 8/02 - C21D 8/12

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; Punching	B21D
Forging	B21J
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A method of producing a surface-decarburised hot-rolled strip consisting of heating the strip from heat-treated steel: C: 0.4-1.0%, Si: 0.1-0.5%, Mn: 0.3-1.2%, P: <0.02%, S: <0.008%, Al: 0.01-0.05%, Cr: 0.1-0.5%, Ni: 0.1-0.4%, Mo: <50.1%, the remainder being iron and unavoidable impurities, heating it while wound as an open coil within austenitizing temperature limits, keeping it incandescent in a carbon-free atmosphere for at least 90 minutes, in which the atmosphere absorbs

carbon from the steel, and cooling at an accelerated rate is classified in: C21D 8/0257, C21D 1/74, C21D 3/04, C22C 38/02, C22C 38/04, C22C 38/06 and C22C 38/40.

C21D 8/04

to produce plates or strips for deep-drawing

Definition statement

This place covers:

Modifying the physical properties by deformation combined with, or followed by, heat treatment of ferrous alloys, during manufacturing of plates or strips for deep-drawing.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well.

Ferrous alloys are classified in C22C 38/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; punching	B21D
Forging	B21J
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A micro-alloyed low carbon steel strip C: 0.04-0.08, Mn: 0.15-2.0, Si: 0.06-0.60, P: 0.010 max, S: 0.010 max, Cr: 0.35 max, Ni: 0.20 max, Mo: 0.25 max, Cu: 0.20 max, Nb: 0.012-0.070, V: 0.02-0.03, Ti <= 0.11, Al: 0.025-0.050, N: 0.0115 max, balance Fe, for the production of finished pieces by cold pressing and shearing, obtained by hot rolling at temperature of the pre-strip temperature never lower than 900 DEG C in the steps preceding the final rolling, will be classified in C21D 8/0405, C21D 8/0415, C21D 1/42, C22C 38/02, C22C 38/04, C22C 38/06 and C22C 38/12.

C21D 8/06

during manufacturing of rods or wires

Definition statement

This place covers:

Modifying the physical properties by deformation combined with, or followed by, heat treatment of ferrous alloys, during manufacturing of rods or wires.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well.

Ferrous alloys are classified in C22C 38/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; Punching	B21D
Forging	B21J
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A method of producing a steel wire suitable for reinforcement bar consists of choosing a steel of composition in wt. percent: less than 0.22% C; less than 0.5% Si; less than 1.5% Mn; and 0.01-0.15% V or 0.01-0.15% Nb or 0.01-0.15% V+Nb in which the carbon equivalent is less than 0.45 %, where the steel wire is hot rolled from billet, quenched at the end of the hot rolling stand and finally wound on a bobbin will be classified in C21D 8/08, C21D 1/19 and C22C 38/12.

C21D 8/10

during manufacturing of tubular bodies

Definition statement

This place covers:

Modifying the physical properties by deformation combined with, or followed by, heat treatment of ferrous alloys, during manufacturing of tubular bodies.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well.

Ferrous alloys are classified in C22C 38/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B

Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; Punching	B21D
Forging	B21J
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All of the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: The manufacture of case-hardened steel pipe for machine structural components, involves making pipe from steel composition in mass percent, C: 0.1 - 0.25%, Si: 0.2 - 0.4%, Mn: 0.3 - 0.9%, P: at most 0.02%, S: 0.001 - 0.15%, Cr: 0.5 - 0.9%, Mo: 0.15 - 1%, Al: 0.01 - 0.1%, B: 0.0005 - 0.009%, N: less than 0.006%, and a remainder essentially of Fe, followed by subjecting the resulting steel tube to normalizing by soaking at a temperature of 880 - 980 DEG C followed by cooling at a cooling rate of at most 70 DEG C per minute, carrying out cold working of the normalized steel tube, and then annealing the cold worked steel tube at a temperature of 700 - 820 DEG C will be classified in: C21D 8/105, C21D 8/10, C21D 1/28, C21D 1/32, C21D 6/02, C21D 7/04 and C22C 38/00.

C21D 8/12

during manufacturing of articles with special electromagnetic properties

Definition statement

This place covers:

Modifying the physical properties by deformation combined with, or followed by, heat treatment of ferrous alloys, during manufacturing of articles with special electromagnetic properties.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well in the appropriate area such as H01F 1/00.

Ferrous alloys are classified in C22C 38/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rolling of metal	B21B
Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; Punching	B21D
Forging	B21J
Cast-iron alloys compositions	C22C 37/00

Ferrous alloys	C22C 38/00

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: The production of grain oriented magnetic sheet used for core of electrical transformer, involving a heating slab made of steel: Si: 3 - 3.3 %, Al: 0.012 - 0.028 %, C: 0.005 - 0.065 %, Cu: 0.01 - 0.1 %, Mn: 0.045 - 0.05 %, N: 0.0035 - 0.0055%, S: 0.015 - 0.023 %, Se: 0 - 0.018 %, Sn: 0.082 %, Fe balance at a temperature (T1), hot-rolling using rolling mill at a temperature (T2), heating at a temperature (T3)>(T2), cold-rolling, optionally annealing and performing primary recrystallization and secondary recrystallization will be classified in C21D 8/1211, C21D 8/1222, C21D 8/1255, C21D 8/1272, C21D 6/008, C22C 38/001, C22C 38/008, C22C 38/02, C22C 38/04 and C22C 38/16.

C21D 9/00

Heat treatment, e.g. annealing, hardening, quenching or tempering, adapted for particular articles; Furnaces therefor

Definition statement

This place covers:

Heat treatment, e.g. annealing, hardening, quenching or tempering, adapted for particular articles; furnaces therefore.

Relationships with other classification places

F27B provides for furnaces, kilns, ovens or retorts in general; open sintering or like apparatus.

F27D provides for details or accessories of furnaces, kilns, ovens or retorts, in which they are occurring in more than one kind of furnace.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Manufacture of metal sheets, bars, wire, rods, tubes or profiles, otherwise than by rolling	B21C
Vehicle parts	B62
Cast-iron alloys compositions	C22C 37/00
Ferrous alloys	C22C 38/00
Surface treatment of metallic material	C23, C23F
Cementation by diffusion processes	C23C
Electrolytic production or refining of metals	C25C
Single crystals or homogeneous polycrystalline material with defined structure; Production thereof	C30B
Steam turbines, turbine rotors; Blades, turbine blades	F01D, F01D 5/00
Valve guides/valve seat inserts	F01L
Gas turbine plants	F02C

Bearings, shafts/crankshafts	F16C 13/00, F16C 23/00, F16C 29/00, F16C 33/00
Springs	F16F
Sliding member	F16J, F16K
Furnaces	F27B, F27D

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- For example: a heat treatment method of manufacturing high carbon bearing steel having excellent abrasion resistance and fatigue resistance, a steel wire rod for high carbon bearing steel subjected to the heat treatment, a manufacturing method of the steel wire rod, high carbon bearing steel manufactured by the heat treatment and a soaking method of a steel bloom used for manufacturing the steel wire rod. The heat treatment method of bearings includes the steps of: quenching a bearing-shaped steel part containing, by weight, 0.5% to 1.20% carbon and 1.0% to 2.0% silicon; and partitioning the quenched steel part at a temperature ranging from Ms - 100 degrees C to Ms for at least 10 minutes, where Ms represents a temperature at which formation of martensite will start, will be classified in C21D 9/0075 (rod of limited length), C21D 9/38, C21D 9/40, C21D 1/19, C21D 1/32, C22C 38/02, C22C 38/04 and C22C 38/34.
- Similarly, a rod of unlimited length, respectively a large gauge high strength steel rod having a diameter of not less than 9 mm, is produced from high carbon steel containing, by weight percent, from 0.65 to 0.90% carbon and from 0.15 to 1.5% chromium capable of being drawn without subsequent heat treatment will be classified in C21D 9/525, C21D 8/06 and C22C 38/18.
- The case-hardened gear steel (example group C21D 1/00- C21D 1/84) consisting of, by weight percent, Co: 16.3, Ni: 7.5, Cr: 3.5, Mo: 1.75, W: 0.2, C: 0.11, Ti: 0.03, and V: 0.02 and the balance Fe, classified in C21D 1/22 as well as in C22C 38/44, C22C 38/52, C21D 1/25 and C21D 9/32.
- The method for production of a surface-decarburized hot-rolled strip with specific disclosed composition (example group C21D 3/00 - C21D 3/10) will be classified in C21D 3/04, C21D 1/74, C21D 9/46, C21D 9/48 and the corresponding subgroups of C22C 38/00.

C21D 10/00

Modifying the physical properties by methods other than heat treatment or deformation

Definition statement

This place covers:

Modifying the physical properties by laser shock processing, ultrasonic treatment and other methods other than heat treatment or deformation.

Relationships with other classification places

When the alloy is intended for a particular use/product then the use/product is classified as well in the appropriate area such as H01F 1/00.

Ferrous alloys are classified in C22C 38/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Modifying the physical properties by heat treatment or deformation	C21D 1/00- C21D 7/04, C21D 7/08- C21D 9/70
Modifying the physical properties of iron and steel by deformation	C21D 7/06
Abrasive or related blasting with particulate material	B24C
Alloys	C22C

Special rules of classification

- If the ferrous alloy composition is disclosed, it should be classified in the appropriate subgroups of C22C 38/00.
- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A steel tube with excellent steam oxidation resistance and a method for producing the steel tube by shot peening the inner surface of the steel tube will be classified in C21D 10/005 as well as in C21D 7/06, the corresponding C22C 38/00 subgroups and in B24C 1/00.

C21D 11/00

Process control or regulation for heat treatments

Definition statement

This place covers:

Control and regulation of heat treatments.

Relationships with other classification places

When classifying in this group, the disclosed heat treatments and/or furnaces should also be classified in C21D in the corresponding group and, for furnaces, in F27 too.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Controlling or regulating in general	G05

Special rules of classification

- All the disclosed heat treatments (in the claims, description, examples, figures or diagrams) are classified.

For example: A metal processing system for forming and heat treating of metal casing comprises process control temperature station upstream from heat treatment station and having temperature sensing device, with a controlled cooling, is classified in C21D 1/84, C21D 9/0068 and in C21D 11/005.