

B22F

WORKING METALLIC POWDER; MANUFACTURE OF ARTICLES FROM METALLIC POWDER; MAKING METALLIC POWDER (processes or devices for granulating materials in general [B01J 2/00](#); making ceramics by compacting or sintering [C04B](#), e.g. [C04B 35/64](#); for the production of metals as such, see class [C22](#); reduction or decomposition of metal compounds in general [C22B](#); making alloys by powder metallurgy [C22C](#); electrolytic production of metal powder [C25C 5/00](#))

Definition statement

This place covers:

Special treatment of metallic powder, e.g. thermal, thermo-mechanical or chemical treatments, making agglomerates, mixing with lubricants or binders;

Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering or by the special shape of the product;

Manufacture of composite layers, workpieces, or articles, comprising metallic powder, by sintering the powder, with or without compacting;

Manufacture of articles from scrap or waste metal particles;

Making metallic powder or suspensions thereof using physical or chemical processes;

Powder metallurgical apparatus or equipment specifically adapted therefor, e.g. furnaces, retorts, sintering apparatus;

Metallic powders, per se, e.g. powder, mixture of powders or a mixture of a powder with a lubricating or binding agent

Relationships with other classification places

[B22F](#) covers the making of metallic powder including a metal powder with specific physical characteristics. When the metal is present only as impurity, or when the subject matter does not refer to the manufacturing process itself but only refers to the use of it (e.g. dental implants using metal powder are classified in [A61C 8/00](#)), it is classified in the other places of IPC.

[C22B 1/14](#) covers preliminary treatment of ores or scrap with organic or inorganic binders, e.g., agglomerating; briquetting, granulating; sintering.

[C22C 1/05](#); [C22C 1/10](#); [C22C 33/02](#); [C22C 47/14](#) cover the making of alloys by powder metallurgy using mixtures of metal powder with non-metallic powder, fibres or filaments.

[C22F](#) covers changing the physical structure of non-ferrous metals or alloys by heat treatment or by hot or cold working, including special physical methods, e.g. treatment with neutrons.

[C04B](#) covers preparing or treating powders of inorganic compounds in preparation to the manufacturing of ceramic products, e.g., [C04B 35/622](#). When the proportion of metal powder is present not like as impurity in the compounds, it is classified at [B22F](#).

[C08K](#) covers use of inorganic or non-macromolecular organic substances as compounding ingredients, including metals as inorganic ingredient, e.g., [C08K 5/56](#) organic compounds containing a metal-to-carbon bond. These compounds are not considered metal per se.

[B01J 2/00](#) covers chemical or physical processes or devices for granulating materials in general.

[B02C](#) covers crushing, grinding or milling in general

References

Limiting references

This place does not cover:

Non-ferrous alloys compositions made by powder metallurgy	C22C 1/04
Making alloys from mixtures of metal powder with non-metallic powder	C22C 1/05 , C22C 1/10
Alloys based on metal compounds	C22C 29/00
Non-ferrous alloys containing other metal compounds	C22C 32/00
Making ferrous alloys by powder metallurgy	C22C 33/02
Making alloys containing metallic or non-metallic fibres or filaments by powder metallurgy	C22C 47/14

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:

Making ceramics by compacting or sintering	C04B
Shaped ceramic products characterised by their composition	C04B 35/00
Burning or sintering process for ceramic compositions	C04B 35/64
Production or refining of metals; Pretreatment of raw materials	C22B
Sintering; Agglomerating for ores or scrap	C22B 1/16
Electrolytic production, recovery of refining of metal powder or metal masses	C25C 5/00

Informative references

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

Dental implants	A61C 8/00
Prostheses implantable into the body	A61F 2/02
Use of preparations for artificial teeth, for filling or for capping teeth	A61K 6/04
Materials for prostheses or for coating prostheses	A61L 27/04
Chemical or physical processes or devices for granulating materials in general	B01J 2/00
Catalysts comprising metals	B01J 23/00
Methods for preparing or activation of catalysts	B01J 37/00
Crushing, grinding or milling in general	B02C
Disposal of solid waste	B09B
Mechanical metal-working	B21C 23/00
Metal parts in the mould of a casting process	B22D 23/00
Soldering or unsoldering; Welding; Cladding or plating by soldering or welding	B23K
Abrasive tools	B24D
Cutting tools	B26D , B26F

Presses specially adapted for forming articles from material in particulate or plastic state	B30B 1/00
Layered products characterised by features of a layer formed of particles, e.g. chips, chopped fibres, powder	B32B 5/16
Printing	B41J , B41M
Chemical aspects of powdering or granulating of macromolecular substances	C08J 3/12
Metallic pigments or fillers	C09C 1/62
Compressing powdered coating material, e.g. by milling	C23C 24/06
Drilling tools	E21B 10/00 , E21B 11/00 , E21B 12/00
Parts of bearings; Use of special materials or surface treatments, e.g. for rust-proofing	F16C 33/12
Conductive material dispersed in non-conductive organic material	H01B 1/22
Magnets or magnetic bodies characterised by the magnetic materials therefore; Selection of materials for their magnetic properties in the form of particles, e.g. powder	H01F 1/20
Selection of the material for the legs of the junction comprising metals only	H01L 35/20
Elements or alloys used in electrodes	H01M 4/38
Printed circuits	H05K

Special rules of classification

in [B22F](#) EC codes are also used for deep-indexing in combination with Indexing Code. Combination of codes are made to address supplementary information concerning processes or compositions, process sequences or information linked to processes or compositions. Each of these combinations start with a specific Indexing Code:

[B22F 2998/00](#): supplementary information concerning processes or compositions relating to powder metallurgy

[B22F 2998/10](#): processes characterised by the sequence of their steps

[B22F 2999/00](#): aspects linked to processes or compositions used in powder metallurgy

Examples (see e.g. US2005281701):

[B22F 2998/00](#), [B22F 1/0014](#): in §36-39 additional information is given on an embodiment having a bimodal size distribution;

[B22F 2998/10](#), [B22F 1/0059](#), [B22F 3/004](#), [B22F 3/093](#), [B22F 3/02](#): from figure 4 it can be learned that a mould is filled with a mixture of metal powder and resin, vibration compacted and pressed

[B22F 2999/00](#), [B22F 3/004](#), [B22F 3/093](#), [B22F 2201/20](#): during the moulding and vibration compaction a vacuum is applied

Glossary of terms

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

Compacting	join or press firmly together.
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Metallic powder	covers powders which in addition to metals may contain a substantial proportion of non-metallic material.
Powder	includes particulate material of any geometrical shape, e.g. fibres, spheres, cubes, which are worked, obtained or behave in a manner similar to powder
Sintering	coalesce or cause to coalesce from powder into solid by heating.
Alloy	a composition of plural elements at least one of which is a free metal. Also includes material containing any combination of fibres, filaments, whiskers and particles, e.g. carbides, diamond, oxides, borides, nitrides or sulfides, embedded in a metallic matrix.
Furnace	covers kilns, ovens or retorts

Synonyms and Keywords

In patent documents the following words "apparatus", "equipment" and "device" are often used as synonyms.

In patent documents the following keywords "residue", "waste", "remains", "scrap", "rejects" and "shred" are often used.

In patent documents the following keywords "compacting" and "compressing" are often used.

B22F 1/00

Special treatment of metallic powder, e.g. to facilitate working, to improve properties {(treatment of powder by mechanical means, e.g. by grinding, milling, rolling [B22F 9/04](#))}; Metallic powders per se, e.g. mixtures of particles of different composition ([C04](#), [C08](#) take precedence; {amorphous powder [B22F 9/002](#)})

Definition statement

This place covers:

Metal particles per se as well as mixtures of metal particles with a lubricant, binding agent or organic material. Particles per se can have a specific size, size distribution, shape or structure. Treatment of metallic powder and coating thereof is also covered.

A special case, which is also covered by this subclass, concerns non-metallic or inorganic particles which have a metallic coating. Equally metal particles coated with non-metals or inorganic compounds are classified in subclass [B22F 1/00](#). [B22F 1/00](#) also covers powders containing a substantial proportion of non-metallic material. When the metal is present in a proportion significantly relevant so that it could not be seen as an impurity in the metallurgic process it must be classified in [B22F 1/00](#).

Relationships with other classification places

Compositions of metal and ceramic powder, e.g. cermets, are classified in [C22C](#).

References

Limiting references

This place does not cover:

Treatment of powder by mechanical means	B22F 9/04
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Informative references

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

Shot peening	C21D 7/06 , B24C 11/00
Ammunition shot	F42B 7/046

B22F 3/00

Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering; Apparatus specially adapted therefor {; Presses and furnaces}

Definition statement

This place covers:

Apart from the manufacturing of workpieces or articles from metallic powder, also the manufacturing of parts which are based on metallic fibres only (no matrix material) as well as processes starting from decomposable or reducible metal compounds.

References**Informative references**

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

Mechanical metal-working without essentially removing material; Punching metal	B21D
Forging; Hammering; Pressing; Forge Furnaces	B21J
Making forged or pressed products	B21K
Presses in general	B30B
Furnaces, Kilns, Ovens, or retorts in general; Open sintering or like apparatus	F27B

Special rules of classification

Although [B22F 3/12](#) specifies processes including both compacting and sintering, this group is mainly used for information concerning the container or model used during the compacting and sintering. For the compacting and sintering step, the more detailed subgroups under [B22F 3/02](#) (compacting) and/or [B22F 3/10](#) (sintering) are applied.

B22F 3/03

Press-moulding apparatus therefor

Definition statement

This place covers:

Press apparatuses specially adapted for metal powder pressing.

References

Informative references

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

Presses in general	B30B
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Special rules of classification

Methods or special apparatuses for the filling of the moulds with powder are classified in [B22F 3/003](#).

B22F 3/08

by explosive forces {(generating shock waves in general [G10K 15/043](#))}

Definition statement

This place covers:

Processes in which compacting is accomplished through the use of shock waves or explosive forces, including processes that utilize a time-related detonating effect

References

Informative references

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

Application of shock-waves for chemical reactions or for modifying structures in general	B01J 3/08
Generating shock-waves in general	G10K 15/043

Special rules of classification

- Flyer impact effect: [B22F 3/087](#)
- Compression in the presence of a magnetic field: [B22F 3/087](#) and/or with Indexing Code [B22F 2202/05](#)

B22F 3/093

using vibrations {or friction}

Definition statement

This place covers:

Compaction aided by vibrations or friction.

B22F 3/105

by using electric current {other than for infra-red radiant energy}, laser radiation or plasma ([B22F 3/11](#) takes precedence){; by ultrasonic bonding ([B22F 3/115](#) takes precedence)}

Definition statement

This place covers:

All sintering processes involving EM-wave energy: electric current, plasma, laser, microwave, etc and ultra-sonic bonding.

References

Limiting references

This place does not cover:

Selective sintering processes, e.g. stereolithography	B22F 3/1055
Stereolithographic techniques for making dental prostheses	A61C 13/0013
Selective sintering of ceramic or cementitious material	B28B 1/00
Rapid manufacturing and prototyping of 3D objects by additive depositing, agglomerating or laminating of plastics material	B29C 64/00

Informative references

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

Laser welding and relative movement between laser beam and workpiece	B23K 26/08
Selective printing	B41J 2/00

B22F 3/115

by spraying molten metal, i.e. spray sintering, spray casting

Definition statement

This place covers:

(hot) spraying of molten metal wherein the sprayed material forms the product (i.e. not as a coating process).

References

Limiting references

This place does not cover:

Cold spraying of metal	C23C 24/04
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Informative references

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

Adding compound dispersions to the spray	C22C 1/1042
Thermal spraying fibre reinforced material	C22C 47/16

Special rules of classification

These documents are also classified in [C23C 4/123](#) (spraying molten metal) and [C23C 4/185](#) (separation of coating from substrate) as well as [B22D 23/003](#) (moulding by spraying metal on a surface).

B22F 3/24**After-treatment of workpieces or articles {(B22F 3/1146 takes precedence)}****Definition statement***This place covers:*

Chemical or thermal after-treatments and mechanical treatments only in as far as material is removed from the surface, such as making recesses or grooves, honing, polishing, milling, grinding, carving etc.

Special rules of classification

The after-treatment is further specified by means of an Indexing Code.

B22F 3/26**Impregnating {(making ferrous alloys by impregnation C22C 33/0242)}****References****Limiting references***This place does not cover:*

Porous articles or workpieces formed by impregnation remaining porous	B22F 3/114
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Apparatus for impregnation	B05C 3/109
Impregnating a ceramic preform with molten metal	C04B 41/51
Non-ferrous alloys obtained by impregnation of a powder metallurgy product	C22C 1/0475
Making ferrous alloys by impregnation	C22C 33/0242

B22F 5/00**Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product****Definition statement***This place covers:*

Processes in which a defined geometrical configuration of a final product is specified, and also moulds, turbine components other than blades, engine parts different from piston rings, flat products and articles to be fractured or separated into parts.

B22F 5/04**of turbine blades****References****Informative references**

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

Making turbine blades (by machining)from one piece from several pieces	B23P 15/02 , B23P 15/04
Turbine blades	F01D 5/00

B22F 5/06**of threaded articles, e.g. nuts****References****Informative references**

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

Making screw-threaded elements (e.g. nuts, bolts)	B21K 1/56
Screw bolts	F16B 35/00

B22F 5/08**of toothed articles, e.g. gear wheels; of cam discs****References****Informative references**

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

Gear wheels by stamping	B21D 53/28
Gear wheels by rolling	B21H 5/00
Gear wheels forged or pressed	B21K 1/30
Coupling members, e.g. clutch systems	B21K 1/762
Making gears or toothed racks	B23F
Making gear wheels by "other" processes	B23P 15/14
Mechanically actuated clutches	F16D 23/025
Toothed gearings	F16H 1/00 , F16H 3/00

B22F 7/00

Manufacture of composite layers, workpieces, or articles, comprising metallic powder, by sintering the powder, with or without compacting {wherein at least one part is obtained by sintering or compression (application of coating layers by use of metal powders, see [C23C](#))}

Definition statement

This place covers:

Manufacture of composite parts (limited geometry) and layers ("infinite"), including porous layers or parts, comprising metallic powder, by sintering the powder, with or without compacting

References**Limiting references**

This place does not cover:

Coatings applied by use of metal powder (not involving compression and/or sintering)	C23C
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Informative references

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

Layered products characterised by the non-homogeneity or physical structure of a layer, comprising fibres or filaments formed of particles foamed or porous material combinations thereof in at least 2 layers	B32B 5/02 - B32B 5/12 , B32B 5/16 , B32B 5/18 - B32B 5/20 , B32B 5/22 - B32B 5/26 , B32B 5/30 , B32B 5/32
Layered products characterised by the relation between layers	B32B 7/00
Layered products, essential comprising metal	B32B 15/00 - B32B 15/20
Methods or apparatus for laminating	B32B 37/00 - B32B 37/30

B22F 7/06

of composite workpieces or articles from parts, e.g. to form tipped tools {([B22F 7/002](#) takes precedence)}

References**Informative references**

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

Tools for cutting or boring with bits of special material or diamond bits	B23B 27/14 , B23B 27/20
Connecting cutting edges by brazing	B23K 31/025
Making cutting tools	B23P 15/28
Tools for grinding, with metallic binder	B24D 3/06 - B24D 3/10
Hand cutting tools	B26
Earth or rock drilling bits, with diamond insertswith button type inserts	E21B , E21B 10/46 , E21B 10/56

B22F 7/062**{involving the connection or repairing of preformed parts}****Definition statement***This place covers:*

Only connecting (i.e not co-forming or in-situ forming) or repairing.

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

Repairing methods or devices for turbine blades	F01D 5/005
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B22F 8/00**Manufacture of articles from scrap or waste metal particles****Glossary of terms***In this place, the following terms or expressions are used with the meaning indicated:*

Scrap, waste	swarf, residue, remains, rejects, shred
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B22F 9/00**Making metallic powder or suspensions thereof****References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Granulation of slag	C21B 3/06
Granulation of ores or scrap	C22B 1/14

B22F 9/008**{Rapid solidification processing}****Definition statement***This place covers:*

Solidification by means of quenching rates above 104 C/s.

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

Processes or devices for granulating materials, in general	B01J 2/00
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Metallic powder obtained by crushing, pulverising, disintegrating in general; milling grain	B02C
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B22F 9/06

starting from liquid material

Definition statement

This place covers:

Only starting from melts.

B22F 9/12

starting from gaseous material

Definition statement

This place covers:

Processes employing a gaseous precursor of the powder, plasma, or the evaporation of metal.

B22F 9/16

using chemical processes

Definition statement

This place covers:

Including the recovery of one metal from a mixture/solution containing multiple metals.

References**Informative references**

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

By hydrogen absorption / desorption	B22F 9/023
Electrolytic production, recovery or refining of metal powders	C25C 5/00

B22F 9/20

starting from solid metal compounds

Relationships with other classification places

Direct reduction of iron ores: [C21B 13/00](#)

General processes of reducing to metals: [C22B 5/00](#)

Dry reduction processes for obtaining specific non-ferrous metals: [C22B](#)

References***Informative references***

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

Controlled atmosphere, or pulverulent material; Adjusting the composition of the atmosphere	C21D 1/74 - C21D 1/773
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B22F 9/305**{of metal carbonyls}****References*****Limiting references***

This place does not cover:

Manufacturing of iron from iron carbonyl	C21B 15/04
General method of reducing metals from metal carbonyls	C22B 5/20