

## SECTION B — PERFORMING OPERATIONS; TRANSPORTING

### B22 CASTING; POWDER METALLURGY

#### B22C FOUNDRY MOULDING (moulding refractory materials in general B28B)

##### Note(s)

This subclass covers:

- the making of moulds for casting metals or of other refractory moulds;
- selection or preparation of materials therefor;
- the necessary patterns, processes, machines, accessory devices or tools.

##### Subclass index

PATTERNS, MANUFACTURE THEREOF.....	7/00, 3/00
MOULDS, CORES, GENERAL MOULDING PROCESSES; COMPOSITIONS FOR MOULDS AND CORES.....	9/00, 1/00, 3/00
MOULDING MACHINES, PROCESSES INVOLVING THESE MACHINES.....	11/00-19/00
MOULDING PLANTS.....	25/00
TOOLS OR OTHER DEVICES.....	5/00, 21/00, 23/00

<p><b>1/00 Compositions of refractory mould or core materials; Grain structures thereof</b> (refractory materials in general C04B 35/00); <b>Chemical or physical features in the formation or manufacture of moulds [1, 2006.01]</b></p> <p>1/02 • characterised by additives for special purposes, e.g. indicators, breakdown additives [1, 2006.01]</p> <p>1/04 • • for protection of the casting, e.g. against decarbonisation [1, 2006.01]</p> <p>1/06 • • • for casting extremely oxidisable metals [1, 2006.01]</p> <p>1/08 • • for decreasing shrinkage of the mould, e.g. for investment casting [1, 2006.01]</p> <p>1/10 • • for influencing the hardening tendency of the mould material (influencing the hardening tendency of the binding agent only B22C 1/16) [1, 2006.01]</p> <p>1/12 • • for manufacturing permanent moulds or cores [1, 2006.01]</p> <p>1/14 • • for separating the pattern from the mould [1, 2006.01]</p> <p>1/16 • characterised by the use of binding agents; Mixtures of binding agents [1, 2006.01]</p> <p>1/18 • • of inorganic agents [1, 2006.01]</p> <p>1/20 • • of organic agents [1, 2006.01]</p> <p>1/22 • • • of resins or rosins [1, 2006.01]</p> <p>1/24 • • • of oily or fatty substances; of distillation residues therefrom [1, 2006.01]</p> <p>1/26 • • • of carbohydrates; of distillation residues therefrom [1, 2006.01]</p> <p><b>3/00 Selection of compositions for coating the surfaces of moulds, cores, or patterns [1, 2006.01]</b></p> <p>3/02 • specially adapted for vacuum-sealed moulding [6, 2006.01]</p>	<p><b>5/00 Machines or devices specially designed for dressing or handling the mould material so far as specially adapted for that purpose</b> (of general applicability, see the relevant places, e.g. for material with water-setting properties B28C) [1, 2006.01]</p> <p>5/02 • Dressing by centrifuging essentially or additionally [1, 2006.01]</p> <p>5/04 • by grinding, blending, mixing, kneading, or stirring [1, 2006.01]</p> <p>5/06 • by sieving or magnetic separating [1, 2006.01]</p> <p>5/08 • by sprinkling, cooling, or drying [1, 2006.01]</p> <p>5/10 • by dust separating [1, 2006.01]</p> <p>5/12 • for filling flasks (in combination with compacting B22C 15/20-B22C 15/28) [1, 2006.01]</p> <p>5/13 • • during vacuum-sealed moulding [6, 2006.01]</p> <p>5/14 • Equipment for storing or handling the dressed mould material, forming part of a plant for preparing such material [1, 2006.01]</p> <p>5/16 • • with conveyors or other equipment for feeding the material [1, 2006.01]</p> <p>5/18 • Plants for preparing mould materials [1, 2006.01]</p> <p><b>7/00 Patterns; Manufacture thereof so far as not provided for in other classes [1, 2006.01]</b></p> <p>7/02 • Lost patterns [1, 2006.01]</p> <p>7/04 • Pattern plates [1, 2006.01]</p> <p>7/05 • • for vacuum-sealed moulding [6, 2006.01]</p> <p>7/06 • Core boxes [1, 2006.01]</p> <p><b>9/00 Moulds or cores</b> (uniquely adapted to particular casting processes B22D); <b>Moulding processes</b> (processes involving the use of particular moulding machines, see the relevant groups for these machines) [1, 2006.01]</p> <p>9/02 • Sand moulds or like moulds for shaped castings [1, 2006.01]</p> <p>9/03 • • formed by vacuum-sealed moulding [6, 2006.01]</p>
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- 9/04 • • Use of lost patterns [1, 2006.01]
- 9/06 • Permanent moulds for shaped castings (moulds for ingots B22D 7/06) [1, 2006.01]
- 9/08 • Features with respect to supply of molten metal, e.g. ingates, circular gates, skim gates [1, 2006.01]
- 9/10 • Cores; Manufacture or installation of cores [1, 2006.01]
- 9/11 • • for vacuum-sealed moulding [6, 2006.01]
- 9/12 • Treating moulds or cores, e.g. drying, hardening [1, 2006.01]
- 9/14 • • Equipment or plant specially adapted for drying moulds or cores (B22C 13/08 takes precedence) [1, 2006.01]
- 9/16 • • • Movable drying equipment [1, 2006.01]
- 9/18 • Finishing [1, 2006.01]
- 9/20 • Stack moulds, i.e. arrangement of multiple moulds or flasks [1, 2006.01]
- 9/22 • Moulds for peculiarly-shaped castings [1, 2006.01]
- 9/24 • • for hollow articles [1, 2006.01]
- 9/26 • • • for ribbed tubes; for radiators [1, 2006.01]
- 9/28 • • for wheels, rolls, or rollers [1, 2006.01]
- 9/30 • • for chains [1, 2006.01]

#### **Moulding machines for making moulds or cores**

##### **11/00 Moulding machines for making moulds or cores, characterised by the relative arrangement of their parts [1, 2006.01]**

- 11/02 • Machines in which the moulds are moved during a cycle of successive operations [1, 2006.01]
- 11/04 • • by a horizontal rotary table or carrier [1, 2006.01]
- 11/06 • • by a vertical rotary carrier [1, 2006.01]
- 11/08 • • by non-rotary conveying means, e.g. by travelling platforms [1, 2006.01]
- 11/10 • with one or more flasks forming part of the machine, from which only the sand moulds made by compacting are removed [1, 2006.01]
- 11/12 • Moulding machines able to travel [1, 2006.01]

##### **13/00 Moulding machines for making moulds or cores of particular shapes [1, 2006.01]**

- 13/02 • equipped with templates, e.g. for sweeping operation [1, 2006.01]
- 13/04 • • with rotary templates, e.g. arranged on a pillar [1, 2006.01]
- 13/06 • • with non-rotary template and rotary flask [1, 2006.01]
- 13/08 • for shell moulds or shell cores [1, 2006.01]
- 13/10 • for pipes or elongated hollow articles [1, 2006.01]
- 13/12 • for cores [1, 2006.01]
- 13/14 • • by sweeping, turning, or coating [1, 2006.01]
- 13/16 • • by pressing through a die [1, 2006.01]

##### **15/00 Moulding machines for making moulds or cores, characterised by the compacting mechanism; Accessories therefor [1, 2006.01]**

- 15/02 • Compacting by pressing devices only [1, 2006.01]
- 15/04 • • involving muscle power, e.g. hand-operated levers [1, 2006.01]
- 15/06 • • involving mechanical gearings, e.g. crank gears (B22C 15/04 takes precedence) [1, 2006.01]
- 15/08 • • involving pneumatic or hydraulic mechanisms [1, 2006.01]
- 15/10 • Compacting by jarring devices only [1, 2006.01]
- 15/12 • • involving mechanical gearings [1, 2006.01]

- 15/14 • • involving pneumatic or hydraulic mechanisms [1, 2006.01]
- 15/16 • • • the machine having special provision for reducing shock to its frame [1, 2006.01]
- 15/18 • • • • by means of separate shock-absorbers [1, 2006.01]
- 15/20 • Compacting by centrifugal forces only, e.g. in sand slingers [1, 2006.01]
- 15/23 • Compacting by gas pressure or vacuum [6, 2006.01]
- 15/24 • • involving blowing devices in which the mould material is supplied in the form of loose particles [1, 2006.01]
- 15/26 • • involving propulsion devices in which the mould material is supplied in the shape of a compacted column or the like [1, 2006.01]
- 15/264 • • Compacting after charge of the mould material [6, 2006.01]
- 15/268 • • • involving explosive combustion [6, 2006.01]
- 15/272 • • • involving the storage of gas under pressure [6, 2006.01]
- 15/276 • • • by vacuum, e.g. vacuum-sealed moulding processes [6, 2006.01]
- 15/28 • Compacting by different means acting simultaneously or successively, e.g. preliminary blowing and finally pressing [1, 2006.01]
- 15/30 • • by both pressing and jarring devices [1, 2006.01]
- 15/32 • • • involving mechanical gearing only [1, 2006.01]
- 15/34 • • • involving pneumatic or hydraulic mechanisms only [1, 2006.01]

##### **17/00 Moulding machines for making moulds or cores, characterised by the mechanism for separating the pattern from the mould or for turning over the flask or the pattern plate [1, 2006.01]**

- 17/02 • Moulding machines with pin lifting arrangement [1, 2006.01]
- 17/04 • Drop-plate moulding machines [1, 2006.01]
- 17/06 • Moulding machines using stripping plates; Stripping plates [1, 2006.01]
- 17/08 • Moulding machines with mechanisms to turn over the pattern plate or the mould around a horizontal axis [1, 2006.01]
- 17/10 • • Turning-over pattern plate and flask only (B22C 17/14 takes precedence) [1, 2006.01]
- 17/12 • • Turning-over pattern plate, flask, and compacting device as a unit (B22C 17/14 takes precedence) [1, 2006.01]
- 17/14 • • arranged to one side of the mould table, so-called roll-over table moulding machines [1, 2006.01]

##### **19/00 Components or accessories for moulding machines for making moulds or cores [1, 2006.01]**

- 19/01 • Devices for applying sealing coating [6, 2006.01]
- 19/02 • Mould tables [1, 2006.01]
- 19/04 • Controlling devices specially designed for moulding machines [1, 2006.01]
- 19/06 • Devices for rapping or loosening the pattern [1, 2006.01]

##### **21/00 Flasks; Accessories therefor (stripping plates B22C 17/06) [1, 2006.01]**

- 21/01 • for vacuum-sealed moulding [6, 2006.01]
- 21/02 • Sectional flasks, i.e. with divided, articulated, or interchangeable side sections [1, 2006.01]
- 21/04 • Upset frames; Bottom boards or mould boards (pattern plates B22C 7/04) [1, 2006.01]
- 21/06 • • Bottom boards or mould boards [1, 2006.01]

21/08	• Clamping equipment [1, 2006.01]	23/00	<b>Tools; Devices not mentioned before for moulding [1, 2006.01]</b>
21/10	• Guiding equipment [1, 2006.01]	23/02	• Devices for coating moulds or cores [1, 2006.01]
21/12	• Accessories [1, 2006.01]	25/00	<b>Foundry moulding plants</b> (for preparing mould materials B22C 5/18; in combination with casting plants B22D 47/02) [1, 2006.01]
21/14	• • for reinforcing or securing moulding materials or cores, e.g. gagers, chaplets, pins, bars [1, 2006.01]		

**B22D CASTING OF METALS; CASTING OF OTHER SUBSTANCES BY THE SAME PROCESSES OR DEVICES** (shaping of plastics or substances in a plastic state B29C; metallurgical processing, selection of substances to be added to metal C21, C22)

### Note(s)

In this subclass, any material to be cast is referred to as metal.

### Subclass index

PRELIMINARY TREATMENTS.....	1/00
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CONTROLLING OR SUPERVISING.....	46/00
CASTING PLANTS.....	47/00

**1/00 Treatment of fused masses in the ladle or the supply runners before casting** (features relating to gas injection, provided on closures of the sliding-gate type B22D 41/42, provided on pouring-nozzles B22D 41/58) [1, 2006.01]

**2/00 Arrangement of indicating or measuring devices, e.g. for temperature or viscosity of the fused mass** [3, 2006.01]

### Casting of pigs, i.e. metal castings suitable for subsequent melting; Similar casting

**3/00 Pig or like casting** (equipment for conveying molten metal B22D 35/00) [1, 2006.01]

3/02 • Moulding of beds [1, 2006.01]

**5/00 Machines or plants for pig or like casting** [1, 2006.01]

5/02 • with rotary casting tables [1, 2006.01]

5/04 • with endless casting conveyors [1, 2006.01]

### Casting of ingots, i.e. metal castings suitable for subsequent rolling or forging

**7/00 Casting ingots** (equipment for conveying molten metal B22D 35/00) [1, 2006.01]

7/02 • Casting compound ingots of two or more different metals in the molten state, i.e. integrally cast [1, 2006.01]

7/04 • Casting hollow ingots [1, 2006.01]

7/06 • Ingot moulds or their manufacture [1, 2006.01]

7/08 • • Divided ingot moulds [1, 2006.01]

7/10 • • Hot tops therefor [1, 2006.01]

7/12 • Accessories, e.g. for sintering, for preventing splashing [1, 2006.01]

**9/00 Machines or plants for casting ingots** [1, 2006.01]

**Particular casting processes; Machines or apparatus therefor****11/00 Continuous casting of metals, i.e. casting in indefinite lengths** (metal drawing, metal extruding B21C) [1, 2006.01]

- 11/01 • without moulds, e.g. on molten surfaces [2, 2006.01]
- 11/04 • into open-ended moulds (B22D 11/06, B22D 11/07 take precedence; plants for continuous casting, e.g. for upwardly drawing the strand, B22D 11/14) [1, 3, 2006.01]
- 11/041 • • for vertical casting (B22D 11/043, B22D 11/049-B22D 11/059 take precedence) [7, 2006.01]
- 11/043 • • Curved moulds (B22D 11/049-B22D 11/059 take precedence) [7, 2006.01]
- 11/045 • • for horizontal casting (B22D 11/049-B22D 11/059 take precedence) [7, 2006.01]
- 11/047 • • • Means for joining tundish to mould [7, 2006.01]
- 11/049 • • for direct chill casting, e.g. electromagnetic casting [7, 2006.01]
- 11/05 • • into moulds having adjustable walls [7, 2006.01]
- 11/051 • • into moulds having oscillating walls [7, 2006.01]
- 11/053 • • Means for oscillating the moulds [7, 2006.01]
- 11/055 • • Cooling the moulds [7, 2006.01]
- 11/057 • • Manufacturing or calibrating the moulds [7, 2006.01]
- 11/059 • • Mould materials or platings [7, 2006.01]
- 11/06 • into moulds with travelling walls, e.g. with rolls, plates, belts, caterpillars (B22D 11/07 takes precedence) [1, 3, 2006.01]
- 11/07 • Lubricating the moulds [3, 2006.01]
- 11/08 • Accessories for starting the casting procedure [1, 2006.01]
- 11/10 • Supplying or treating molten metal (B22D 41/00 takes precedence) [1, 7, 2006.01]
- 11/103 • • Distributing the molten metal, e.g. using runners, floats, distributors [7, 2006.01]
- 11/106 • • Shielding the molten jet [7, 2006.01]
- 11/108 • • Feeding additives, powders, or the like [7, 2006.01]
- 11/11 • • Treating the molten metal [7, 2006.01]
- 11/111 • • • by using protecting powders [7, 2006.01]
- 11/112 • • • by accelerated cooling [7, 2006.01]
- 11/113 • • • by vacuum treating [7, 2006.01]
- 11/114 • • • by using agitating or vibrating means (B22D 11/117 takes precedence) [7, 2006.01]
- 11/115 • • • • by using magnetic fields [7, 2006.01]
- 11/116 • • • Refining the metal [7, 2006.01]
- 11/117 • • • • by treating with gases (B22D 11/118, B22D 11/119 take precedence) [7, 2006.01]
- 11/118 • • • • by circulating the metal under, over or around weirs (B22D 11/119 takes precedence) [7, 2006.01]
- 11/119 • • • • by filtering [7, 2006.01]
- 11/12 • Accessories for subsequent treating or working cast stock *in situ* (rolling immediately subsequent to continuous casting B21B 1/46, B21B 13/22) [1, 3, 2006.01]
- 11/124 • • for cooling [2, 2006.01]
- 11/126 • • for cutting [2, 2006.01]
- 11/128 • • for removing [2, 2006.01]
- 11/14 • Plants for continuous casting, e.g. for upwardly drawing the strand [1, 2006.01]
- 11/16 • Controlling or regulating processes or operations [2, 2006.01]

- 11/18 • • for pouring (B22D 11/20 takes precedence) [4, 2006.01]
- 11/20 • • for removing cast stock [4, 2006.01]
- 11/22 • • for cooling cast stock or mould [4, 2006.01]
- 13/00 Centrifugal casting; Casting by using centrifugal force [1, 2006.01]**
- 13/02 • of elongated solid or hollow bodies, e.g. pipes, in moulds rotating around their longitudinal axis [1, 2006.01]
- 13/04 • of shallow solid or hollow bodies, e.g. wheels or rings, in moulds rotating around their axis of symmetry [1, 2006.01]
- 13/06 • of solid or hollow bodies in moulds rotating around an axis arranged outside of the mould [1, 2006.01]
- 13/08 • in which a stationary mould is fed from a rotating mass of liquid metal [1, 2006.01]
- 13/10 • Accessories for centrifugal casting apparatus, e.g. moulds, linings therefor; Means for feeding molten metal, cleansing moulds or removing castings (making or lining moulds B22C) [1, 2006.01]
- 13/12 • Controlling, supervising, specially adapted to centrifugal casting, e.g. for safety reasons [3, 2006.01]
- 15/00 Casting using a mould or core of which a part significant to the process of high thermal conductivity, e.g. chill casting; Moulds or accessories specially adapted therefor** (continuous casting of metals into open-ended moulds for direct chill casting B22D 11/049) [1, 7, 2006.01]
- 15/02 • of cylinders, pistons, bearing shells or like thin-walled objects [1, 2006.01]
- 15/04 • Machines or apparatus for chill casting (B22D 15/02 takes precedence) [1, 2006.01]
- 17/00 Pressure die casting or injection die casting, i.e. casting in which the metal is forced into a mould under high pressure [1, 3, 2006.01]**
- 17/02 • Hot chamber machines, i.e. with heated press chamber in which metal is melted [1, 2006.01]
- 17/04 • • Plunger machines [1, 2006.01]
- 17/06 • • Air injection machines [1, 2006.01]
- 17/08 • Cold chamber machines, i.e. with unheated press chamber into which molten metal is ladled [1, 2006.01]
- 17/10 • • with horizontal press motion [1, 2006.01]
- 17/12 • • with vertical press motion [1, 2006.01]
- 17/14 • Machines with evacuated die cavity [1, 2006.01]
- 17/16 • specially adapted for casting slide fasteners or elements therefor [1, 2006.01]
- 17/18 • Machines built up from units providing for different combinations [1, 2006.01]
- 17/20 • Accessories; Details [1, 2006.01]
- 17/22 • • Dies (manufacture, see the appropriate class, e.g. B23P 15/24); Die plates; Die supports; Cooling equipment for dies; Accessories for loosening and ejecting castings from dies [1, 2006.01]
- 17/24 • • Accessories for locating and holding cores or inserts [1, 2006.01]
- 17/26 • • Mechanisms or devices for locking or opening dies [1, 2006.01]
- 17/28 • • Melting pots [1, 2006.01]
- 17/30 • • Accessories for supplying molten metal, e.g. in rations [1, 2006.01]
- 17/32 • • Controlling equipment [1, 2006.01]

- 18/00 Pressure casting; Vacuum casting** (B22D 17/00 takes precedence; treating the metal in the mould by using pressure or vacuum B22D 27/00) [3, 2006.01]
- 18/02 • Pressure casting making use of mechanical pressing devices, e.g. cast-forging (B22D 18/04 takes precedence) [3, 2006.01]
- 18/04 • Low pressure casting, i.e. making use of pressures up to a few bars to fill the mould [3, 2006.01]
- 18/06 • Vacuum casting, i.e. making use of vacuum to fill the mould [3, 2006.01]
- 18/08 • Controlling, supervising, e.g. for safety reasons [3, 2006.01]
- 19/00 Casting in, on, or around, objects which form part of the product** (B22D 23/04 takes precedence; aluminothermic welding B23K 23/00; coating by casting molten material on the substrate C23C 6/00) [1, 2006.01]
- 19/02 • for making reinforced articles (B22D 19/14 takes precedence) [1, 3, 2006.01]
- 19/04 • for joining parts [1, 2006.01]
- 19/06 • for manufacturing or repairing tools [1, 2006.01]
- 19/08 • for building up linings or coverings, e.g. of anti-frictional metal [1, 2006.01]
- 19/10 • Repairing defective or damaged objects by metal casting techniques (by other techniques B23P 6/04) [1, 2006.01]
- 19/12 • for making objects, e.g. hinges, with parts which are movable relatively to one another [1, 2006.01]
- 19/14 • the objects being filamentary or particulate in form (making alloys containing fibres or filaments by contacting the fibres or filaments with molten metal C22C 47/08) [3, 2006.01]
- 19/16 • for making compound objects cast of two or more different metals, e.g. for making rolls for rolling mills (casting compound ingots B22D 7/02) [3, 2006.01]
- 21/00 Casting non-ferrous metals or metallic compounds so far as their metallurgical properties are of importance for the casting procedure** (apparatus for vacuum casting B22D 18/00); **Selection of compositions therefor** [1, 2006.01]
- 21/02 • Casting exceedingly oxidisable non-ferrous metals, e.g. in inert atmosphere (use of inert atmosphere in casting metals in general B22D 23/00) [1, 2006.01]
- 21/04 • • Casting aluminium or magnesium [1, 2006.01]
- 21/06 • Casting non-ferrous metals with a high melting-point, e.g. metallic carbides (B22D 21/02 takes precedence) [1, 2006.01]
- 23/00 Casting processes not provided for in groups B22D 1/00-B22D 21/00** (making metallic powder by casting B22F 9/08; aluminothermic welding B23K 23/00; remelting metals C22B 9/16) [1, 2006.01]
- 23/02 • Top casting [1, 2006.01]
- 23/04 • Casting by dipping (hot-dipping or immersion processes for applying coating material in the molten state without affecting the shape C23C 2/00) [1, 2006.01]
- 23/06 • Melting-down metal, e.g. metal particles, in the mould [1, 2006.01]
- 23/10 • • Electroslag casting [5, 2006.01]
- 25/00 Special casting characterised by the nature of the product** (B22D 15/02, B22D 17/16, B22D 19/00 take precedence; casting stereotype plates B41D 3/00) [1, 2, 2006.01]
- 25/02 • by its peculiarity of shape; of works of art [1, 2006.01]
- 25/04 • • Casting metal electric battery plates or the like (manufacture thereof by multi-step processes H01M 4/82) [1, 2, 2006.01]
- 25/06 • by its physical properties (B22D 27/00 takes precedence) [1, 2006.01]
- 25/08 • • by uniform hardness (B22D 15/00 takes precedence) [1, 2006.01]
- 27/00 Treating the metal in the mould while it is molten or ductile** (B22D 7/12, B22D 11/10, B22D 18/00, B22D 43/00 take precedence) [1, 3, 2006.01]
- 27/02 • Use of electric or magnetic effects [1, 2006.01]
- 27/04 • Influencing the temperature of the metal, e.g. by heating or cooling the mould (cooling of open-ended moulds in continuous casting B22D 11/055) [1, 7, 2006.01]
- 27/06 • • Heating the top discard of ingots (hot tops for ingot moulds B22D 7/10) [1, 2006.01]
- 27/08 • Shaking, vibrating, or turning of moulds (B22D 11/051, B22D 11/053 take precedence) [1, 7, 2006.01]
- 27/09 • by using pressure [3, 2006.01]
- 27/11 • • making use of mechanical pressing devices [3, 2006.01]
- 27/13 • • making use of gas pressure [3, 2006.01]
- 27/15 • by using vacuum [3, 2006.01]
- 27/18 • Measures for using chemical processes for influencing the surface composition of castings, e.g. for increasing resistance to acid attack [1, 2006.01]
- 27/20 • Measures not previously mentioned for influencing the grain structure or texture; Selection of compositions therefor [1, 2006.01]
- Final measures after casting**
- 29/00 Removing castings from moulds, not restricted to casting processes covered by a single main group; Removing cores; Handling ingots** [1, 2, 2006.01]
- 29/02 • Vibratory apparatus specially designed for shaking out flasks [1, 2006.01]
- 29/04 • Handling or stripping castings or ingots (grippers in general, see the relevant subclasses, e.g. B66C) [1, 2006.01]
- 29/06 • • Strippers actuated by fluid pressure [1, 2006.01]
- 29/08 • • Strippers actuated mechanically [2, 2006.01]
- 30/00 Cooling castings, not restricted to casting processes covered by a single main group** (accessories for cooling cast stock in continuous casting of metals B22D 11/124; controlling or regulating processes or operations for cooling cast stock or mould in continuous casting of metals B22D 11/22; chill casting B22D 15/00) [5, 2006.01]
- 31/00 Cutting-off surplus material after casting, e.g. gates** (cleaning of castings by sand-blasting B24C) [1, 2006.01]
- Other equipment for casting [3]**
- 33/00 Equipment for handling moulds** [1, 2006.01]
- 33/02 • Turning or transposing moulds [1, 2006.01]
- 33/04 • Bringing together or separating moulds [1, 2006.01]
- 33/06 • Burdening or relieving moulds [1, 2006.01]

## B22D

35/00	<b>Equipment for conveying molten metal into beds or moulds</b> (B22D 37/00-B22D 41/00 take precedence; specially adapted to particular processes or machines, <u>see</u> the relevant groups) [1, 2006.01]	41/24	• • • characterised by a rectilinearly movable plate (B22D 41/38-B22D 41/42 take precedence) [5, 2006.01]
35/02	• into beds [1, 2006.01]	41/26	• • • characterised by a rotatively movable plate (B22D 41/38-B22D 41/42 take precedence) [5, 2006.01]
35/04	• into moulds, e.g. base plates, runners [1, 2006.01]	41/28	• • • Plates therefor (B22D 41/38-B22D 41/42 take precedence) [5, 2006.01]
35/06	• Heating or cooling equipment [1, 2006.01]	41/30	• • • Manufacturing or repairing thereof [5, 2006.01]
37/00	<b>Controlling or regulating the pouring of molten metal from a casting melt-holding vessel</b> (B22D 39/00, B22D 41/00 take precedence; specially adapted to particular processes or machines, <u>see</u> the relevant groups of this subclass) [1, 3, 5, 2006.01]	41/32	• • • • characterised by the materials used therefor [5, 2006.01]
39/00	<b>Equipment for supplying molten metal in rations</b> (specially adapted to particular processes or machines, <u>see</u> the relevant groups of this subclass) [1, 2006.01]	41/34	• • • • Supporting, fixing or centering means therefor [5, 2006.01]
39/02	• having means for controlling the amount of molten metal by volume [3, 2006.01]	41/36	• • • • Treating the plates, e.g. lubricating, heating (ladles, cups or the like with heating means B22D 41/01) [5, 2006.01]
39/04	• having means for controlling the amount of molten metal by weight [3, 2006.01]	41/38	• • • Means for operating the sliding gate [5, 2006.01]
39/06	• having means for controlling the amount of molten metal by controlling the pressure above the molten metal [3, 2006.01]	41/40	• • • Means for pressing the plates together [5, 2006.01]
41/00	<b>Casting melt-holding vessels, e.g. ladles, tundishes, cups or the like</b> (B22D 39/00, B22D 43/00 take precedence) [1, 5, 2006.01]	41/42	• • • Features relating to gas injection [5, 2006.01]
41/005	• with heating or cooling means [5, 2006.01]	41/44	• • Consumable closure means, i.e. closure means being used only once [5, 2006.01]
41/01	• • Heating means [5, 2006.01]	41/46	• • • Refractory plugging masses [5, 2006.01]
41/015	• • • with external heating, i.e. the heat source not being a part of the ladle [5, 2006.01]	41/48	• • • Melttable closures [5, 2006.01]
41/02	• Linings [1, 2006.01]	41/50	• Pouring-nozzles [5, 2006.01]
41/04	• tiltable [1, 2006.01]	41/52	• • Manufacturing or repairing thereof [5, 2006.01]
41/05	• • Tea-pot spout ladles [5, 2006.01]	41/54	• • • characterised by the materials used therefor [5, 2006.01]
41/06	• Equipment for tilting [1, 2006.01]	41/56	• • Means for supporting, manipulating or changing a pouring-nozzle [5, 2006.01]
41/08	• for bottom pouring (B22D 41/14, B22D 41/50 take precedence) [1, 2006.01]	41/58	• • with gas injecting means [5, 2006.01]
41/12	• Travelling ladles or similar containers; Cars for ladles (casting cranes B66C) [1, 2006.01]	41/60	• • with heating or cooling means [5, 2006.01]
41/13	• • Ladle turrets [7, 2006.01]	41/62	• • with stirring or vibrating means [5, 2006.01]
41/14	• Closures [5, 2006.01]	43/00	<b>Mechanical cleaning, e.g. skimming of molten metals</b> [1, 2006.01]
41/16	• • stopper-rod type, i.e. a stopper-rod being positioned downwardly through the vessel and the metal therein, for selective registry with the pouring opening [5, 2006.01]	45/00	<b>Equipment for casting, not otherwise provided for</b> [1, 2006.01]
41/18	• • • Stopper-rods therefor [5, 2006.01]		
41/20	• • • Stopper-rod operating equipment [5, 2006.01]	46/00	<b>Controlling, supervising, not restricted to casting covered by a single main group, e.g. for safety reasons</b> [3, 2006.01]
41/22	• • sliding-gate type, i.e. having a fixed plate and a movable plate in sliding contact with each other for selective registry of their openings [5, 2006.01]	47/00	<b>Casting plants</b> [1, 2006.01]
		47/02	• for both moulding and casting [1, 2006.01]

## B22F WORKING METALLIC POWDER; MANUFACTURE OF ARTICLES FROM METALLIC POWDER; MAKING METALLIC POWDER (making alloys by powder metallurgy C22C); APPARATUS OR DEVICES SPECIALLY ADAPTED FOR METALLIC POWDER

### Note(s) [6]

1. This subclass covers the making of metallic powder only insofar as powder with specific physical characteristics is made.
2. In this subclass, the following terms or expressions are used with the meanings indicated:
  - "metallic powder" covers powders containing a substantial proportion of non-metallic material;
  - "powder" includes somewhat larger particles which are worked, obtained or behave in a manner similar to powder, e.g. fibres.

1/00	<b>Special treatment of metallic powder, e.g. to facilitate working, to improve properties; Metallic powders</b>	<b>per se, e.g. mixtures of particles of different composition</b> [1, 2006.01]
1/02		• comprising coating of the powder [2, 2006.01]

- 3/00 Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering; Apparatus specially adapted therefor [1, 2006.01, 2021.01]**
- 3/02 • Compacting only [1, 2006.01]
- 3/03 • • Press-moulding apparatus therefor [6, 2006.01]
- 3/035 • • • with one or more of the parts thereof being pivotally mounted [6, 2006.01]
- 3/04 • • by applying fluid pressure [1, 2006.01]
- 3/06 • • by centrifugal forces [1, 2006.01]
- 3/08 • • by explosive forces [1, 2006.01]
- 3/087 • • using high energy impulses, e.g. magnetic field impulses [6, 2006.01]
- 3/093 • • using vibration [6, 2006.01]
- 3/10 • Sintering only [1, 2006.01]
- 3/105 • • by using electric current, laser radiation or plasma (B22F 3/11 takes precedence) [6, 2006.01]
- 3/11 • • Making porous workpieces or articles [6, 2006.01]
- 3/115 • by spraying molten metal, i.e. spray sintering, spray casting [6, 2006.01]
- 3/12 • Both compacting and sintering (by forging B22F 3/17) [1, 6, 2006.01]
- 3/14 • • simultaneously [1, 2006.01]
- 3/15 • • • Hot isostatic pressing [6, 2006.01]
- 3/16 • • in successive or repeated steps [1, 2006.01]
- 3/17 • by forging [6, 2006.01]
- 3/18 • by using pressure rollers [1, 6, 2006.01]
- 3/20 • by extruding [1, 2006.01]
- 3/22 • for producing castings from a slip [1, 2006.01]
- 3/23 • involving a self-propagating high-temperature synthesis or reaction sintering step [6, 2006.01]
- 3/24 • After-treatment of workpieces or articles [1, 2006.01]
- 3/26 • • Impregnating [1, 2006.01]
- 5/00 Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product [1, 2006.01]**
- 5/02 • of piston rings [1, 2006.01]
- 5/04 • of turbine blades [1, 2006.01]
- 5/06 • of threaded articles, e.g. nuts [1, 2006.01]
- 5/08 • of toothed articles, e.g. gear wheels; of cam discs [1, 2006.01]
- 5/10 • of articles with cavities or holes, not otherwise provided for in the preceding subgroups [6, 2006.01]
- 5/12 • of tubes or wires [6, 2006.01]
- 7/00 Manufacture of composite layers, workpieces, or articles, comprising metallic powder, by sintering the powder, with or without compacting [1, 2006.01]**
- 7/02 • of composite layers [1, 2006.01]
- 7/04 • • with one or more layers not made from powder, e.g. made from solid metal [1, 2006.01]
- 7/06 • of composite workpieces or articles from parts, e.g. to form tipped tools [1, 2006.01]
- 7/08 • • with one or more parts not made from powder [1, 2006.01]
- 8/00 Manufacture of articles from scrap or waste metal particles [6, 2006.01]**
- 9/00 Making metallic powder or suspensions thereof; Apparatus or devices specially adapted therefor [1, 2006.01]**
- 9/02 • using physical processes [3, 2006.01]
- 9/04 • • starting from solid material, e.g. by crushing, grinding or milling [3, 2006.01]
- 9/06 • • starting from liquid material [3, 2006.01]
- 9/08 • • • by casting, e.g. through sieves or in water, by atomising or spraying (using electric discharge B22F 9/14) [3, 2006.01]
- 9/10 • • • • using centrifugal force [3, 2006.01]
- 9/12 • • starting from gaseous material [3, 2006.01]
- 9/14 • • using electric discharge [3, 2006.01]
- 9/16 • using chemical processes [3, 2006.01]
- 9/18 • • with reduction of metal compounds [3, 2006.01]
- 9/20 • • • starting from solid metal compounds [3, 2006.01]
- 9/22 • • • • using gaseous reductors [3, 2006.01]
- 9/24 • • • starting from liquid metal compounds, e.g. solutions [3, 2006.01]
- 9/26 • • • • using gaseous reductors [3, 2006.01]
- 9/28 • • • starting from gaseous metal compounds [3, 2006.01]
- 9/30 • • with decomposition of metal compounds, e.g. by pyrolysis [3, 2006.01]
- 10/00 Additive manufacturing of workpieces or articles from metallic powder (apparatus or devices therefor B22F 12/00) [2021.01]**
- 10/10 • Formation of a green body [2021.01]
- 10/12 • • by photopolymerisation, e.g. stereolithography [SLA] or digital light processing [DLP] [2021.01]
- 10/14 • • by jetting of binder onto a bed of metal powder [2021.01]
- 10/16 • • by embedding the binder within the powder bed [2021.01]
- 10/18 • • by mixing binder with metal in filament form, e.g. fused filament fabrication [FFF] [2021.01]
- 10/20 • Direct sintering or melting [2021.01]
- 10/22 • • Direct deposition of molten metal [2021.01]
- 10/25 • • Direct deposition of metal particles, e.g. direct metal deposition [DMD] or laser engineered net shaping [LENS] [2021.01]
- 10/28 • • Powder bed fusion, e.g. selective laser melting [SLM] or electron beam melting [EBM] [2021.01]
- 10/30 • Process control [2021.01]
- 10/31 • • Calibration of process steps or apparatus settings, e.g. before or during manufacturing [2021.01]
- 10/32 • • of the atmosphere, e.g. composition or pressure in a building chamber [2021.01]
- 10/322 • • • of the gas flow, e.g. rate or direction [2021.01]
- 10/34 • • of powder characteristics, e.g. density, oxidation or flowability [2021.01]
- 10/36 • • of energy beam parameters [2021.01]
- 10/362 • • • for preheating [2021.01]
- 10/364 • • • for post-heating, e.g. remelting [2021.01]
- 10/366 • • • Scanning parameters, e.g. hatch distance or scanning strategy [2021.01]
- 10/368 • • • Temperature or temperature gradient, e.g. temperature of the melt pool [2021.01]
- 10/37 • • of powder bed aspects, e.g. density [2021.01]
- 10/38 • • to achieve specific product aspects, e.g. surface smoothness, density, porosity or hollow structures [2021.01]
- 10/39 • • Traceability, e.g. incorporating identifier into a workpiece or article [2021.01]
- 10/40 • Structures for supporting workpieces or articles during manufacture and removed afterwards [2021.01]
- 10/43 • • characterised by material [2021.01]
- 10/47 • • characterised by structural features [2021.01]

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- 10/50 • Treatment of workpieces or articles during build-up, e.g. treatments applied to fused layers during build-up [2021.01]
- 10/60 • Treatment of workpieces or articles after build-up [2021.01]
- 10/62 • • by chemical means [2021.01]
- 10/64 • • by thermal means (control of energy beam parameters for post heating B22F 10/364) [2021.01]
- 10/66 • • by mechanical means [2021.01]
- 10/68 • • Cleaning or washing [2021.01]
- 10/70 • Recycling [2021.01]
- 10/73 • • of powder [2021.01]
- 10/77 • • of gas [2021.01]
- 10/80 • Data acquisition or data processing [2021.01]
- 10/85 • • for controlling or regulating additive manufacturing processes [2021.01]
  
- 12/00 **Apparatus or devices specially adapted for additive manufacturing; Auxiliary means for additive manufacturing; Combinations of additive manufacturing apparatus or devices with other processing apparatus or devices [2021.01]**
- 12/10 • Auxiliary heating means [2021.01]
- 12/13 • • to preheat the material [2021.01]
- 12/17 • • to heat the build chamber or platform [2021.01]
- 12/20 • Cooling means [2021.01]
- 12/30 • Platforms or substrates [2021.01]
- 12/33 • • translatory in the deposition plane [2021.01]
- 12/37 • • Rotatable [2021.01]
- 12/40 • Radiation means [2021.01]
- 12/41 • • characterised by the type, e.g. laser or electron beam [2021.01]
- 12/42 • • • Light-emitting diodes [LED] [2021.01]
  
- 12/43 • • • pulsed; frequency modulated [2021.01]
- 12/44 • • characterised by the configuration of the radiation means [2021.01]
- 12/45 • • • Two or more [2021.01]
- 12/46 • • with translatory movement [2021.01]
- 12/47 • • • parallel to the deposition plane [2021.01]
- 12/48 • • • in height, e.g. perpendicular to the deposition plane [2021.01]
- 12/49 • • Scanners [2021.01]
- 12/50 • Means for feeding of material, e.g. heads [2021.01]
- 12/52 • • Hoppers [2021.01]
- 12/53 • • Nozzles [2021.01]
- 12/55 • • Two or more means for feeding material [2021.01]
- 12/57 • • Metering means [2021.01]
- 12/58 • • for changing the material composition, e.g. by mixing [2021.01]
- 12/60 • Planarisation devices; Compression devices [2021.01]
- 12/63 • • Rollers [2021.01]
- 12/67 • • Blades [2021.01]
- 12/70 • Gas flow means [2021.01]
- 12/80 • Plants, production lines or modules [2021.01]
- 12/82 • • Combination of additive manufacturing apparatus or devices with other processing apparatus or devices [2021.01]
- 12/84 • • • Parallel processing within single device [2021.01]
- 12/86 • • • Serial processing with multiple devices grouped [2021.01]
- 12/88 • • Handling of additively manufactured products, e.g. by robots [2021.01]
- 12/90 • Means for process control, e.g. cameras or sensors [2021.01]