SECTION B — PERFORMING OPERATIONS; TRANSPORTING

B21 MECHANICAL METAL-WORKING WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING METAL

B21B **ROLLING OF METAL** (auxiliary operations used in connection with metal-working operations covered in B21, see B21C; bending by rolling B21D; manufacture of particular objects, e.g. screws, wheels, rings, barrels, balls, by rolling B21H; pressure welding by means of a rolling mill B23K 20/04)

Note(s)

In this subclass, the following terms or expressions are used with the meanings indicated:

- "rolling" means rolling operations in which plastic deformations occur;
- "continuous process" means a process employing a mill train designed to have the workpiece enter one pair of rolls before leaving the preceding pair.

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METAL ROLLING IN GENERAL
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1/00 **Metal rolling methods or mills for making semi-finished products of solid or profiled cross-section** (B21B 17/00-B21B 23/00 take precedence; with respect to composition of material to be rolled B21B 3/00; extending closed shapes of metal bands by simultaneous rolling at two or more zones B21B 5/00; metal-rolling stands as units B21B 13/00; continuous casting into moulds having walls formed by moving rolls B22D 11/06)**; Sequence of operations in milling trains; Layout of rolling-mill plant, e.g. grouping of stands; Succession of passes or of sectional pass alternations**

1/02 • for rolling heavy work, e.g. ingots, slabs, billets, in which the cross-sectional form is unimportant
1/04 • • in a continuous process
1/06 • • in a non-continuous process
1/08 • for rolling work of special cross-section, e.g. angle steel (rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects B21H 8/00) **[1, 2006.01]**
1/082 • • Piling sections having lateral edges specially adapted for interlocking with each other in order to build a wall **[2006.01]**
1/085 • • Rail sections **[2006.01]**
1/088 • • H- or I-sections **[2006.01]**
1/09 • • L-sections **[2006.01]**
1/092 • • T-sections **[2006.01]**
1/095 • • U- or channel sections **[2006.01]**
1/098 • • Z-sections **[2006.01]**
1/10 • • in a single two-high or universal rolling mill
1/12 • • in a continuous process
1/14 • • in a non-continuous process
1/16 • for rolling wire or material of like small cross-section
1/18 • • in a continuous process
1/20 • • in a non-continuous process
1/22 • for rolling bands or sheets of indefinite length (B21B 1/42 takes precedence)
1/24 • • in a continuous process
1/26 • • • by hot-rolling
1/28 • • • by cold-rolling
1/30 • • in a non-continuous process
1/32 • • • in reversing mills, e.g. with intermediate storage reels for accumulating work
1/34 • • • • by hot-rolling
1/36 • • • • by cold-rolling
1/38 • for rolling sheets of limited length, e.g. folded sheets, superimposed sheets (B21B 1/40 takes precedence; folding sheets before, or separating layers after, rolling B21B 47/00) **[2]**

1/40 • for rolling foils which present special problems, e.g. because of thinness
1/42 • for step-by-step or planetary rolling (making tubes by pilgrim-step rolling B21B 21/00)
1/46 • for rolling metal immediately subsequent to continuous casting (metal-rolling stands B21B 13/22; continuous casting B22D 11/00, e.g. into moulds with rolls B22D 11/06) **[3]**

3/00 Rolling materials of special alloys so far as the composition of the alloy requires or permits special rolling methods or sequences (altering special metallurgical properties of alloys, other than structure consolidation or mechanical properties resulting therefrom C21D, C22F)
3/02 • Rolling special iron alloys

5/00 Extending closed shapes of metal bands by rolling (manufacture of circular shapes, e.g. wheel rims, B21H 1/06)

9/00 Measures for carrying out rolling operations under special conditions, e.g. in vacuum or inert atmosphere to prevent oxidation of work; Special measures for removing fumes from rolling mills

11/00 Subsidising the rolling processes by subjecting rollers or work to vibrations

13/00 Metal-rolling stands, i.e. an assembly composed of a stand frame, rolls, and accessories (B21B 17/00-B21B 23/00 take precedence; details, component parts, accessories, auxiliary means, procedures in connection with metal rolling, see the relevant groups)
13/02 • with axes of rolls arranged horizontally
13/04 • • Three-high arrangement
13/06 • with axes of rolls arranged vertically
13/08 • with differently-directed roll axes, e.g. for the so-called "universal" rolling process
13/10 • • all axes being arranged in one plane
13/12 • • axes being arranged in different planes
13/14 • having counter-pressure devices acting on rolls to inhibit deflection of same under load (counter-pressure devices as such B21B 29/00)
13/16 • with alternatively operative rolls
13/18 • for step-by-step or planetary rolling (methods B21B 1/42; making tubes by pilgrim-step rolling B21B 21/00)
13/20 • • for planetary rolling
13/22 • for rolling metal immediately subsequent to continuous casting (methods therefor B21B 1/46; continuous casting B22D 11/00, e.g. into moulds with rolls B22D 11/06)

15/00 Arrangements for performing additional metal-working operations specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills
15/02 • in which work is subjected to permanent internal twisting, e.g. for producing reinforcement bars for concrete

Rolling methods or mills specially designed for making or processing tubes

17/00 Tube-rolling by rollers of which the axes are arranged essentially perpendicular to the axis of the work, e.g. "axial" tube-rolling
17/02 • with mandrel (B21B 17/08 takes precedence) **[2]**
17/04 • • in a continuous process
17/06 • • in a discontinuous process
17/08 • with mandrel having one or more protrusions **[2]**
17/10 • • in a continuous process
17/12 • • in a discontinuous process
17/14 • without mandrel

19/00 Tube-rolling by rollers arranged outside the work and having their axes not perpendicular to the axis of the work (straightening by rollers B21D)
19/02 • the axes of the rollers being arranged essentially diagonally to the axis of the work, e.g. "cross" tube-rolling
19/04 • • Rolling basic material of solid, i.e. non-hollow, structure; Piercing
19/06 • • Rolling hollow basic material (B21B 19/04 takes precedence; separating work from mandrel B21C 45/00)
19/08 • • • Enlarging tube diameter
19/10 • • • Finishing, e.g. smoothing, sizing
19/12 • the axes of the rollers being arranged essentially parallel to the axis of the work
19/14 • • Rolling tubes by means of additional rollers arranged inside the tubes
19/16 • • Rolling tubes without additional rollers arranged inside the tubes

21/00 Pilgrim-step tube-rolling
21/02 • Rollers therefor
21/04 • Pilgrim-step feeding mechanisms (B21B 21/06 takes precedence)
21/06 • Devices for revolving work between the steps

23/00 Tube-rolling not restricted to methods provided for in only one of groups B21B 17/00-B21B 21/00, e.g. combined processes (B21B 25/00 takes precedence)

25/00 Mandrels for metal tube rolling mills, e.g. mandrels of the types used in the methods covered by group B21B 17/00; Accessories or auxiliary means therefor
25/02 • Guides, supports, or abutments for mandrels, e.g. carriages; Adjusting devices for mandrels
25/04 • Cooling or lubricating mandrels during operation **[2]**
25/06 • Interchanging mandrels

27/00 Rolls (shape of working surfaces required by special processes B21B 1/00)**; Lubricating, cooling or heating rolls while in use**
27/02 • Shape or construction of rolls (for rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects B21H 8/02)
27/03 • • Sleeved rolls **[5]**
27/05 • • • with deflectable sleeves **[5]**
27/06 • Lubricating, cooling, or heating rolls
27/08 • • internally
27/10 • • externally

28/00 Maintaining rolls or rolling equipment in effective condition (lubricating, cooling or heating rolls while in use B21B 27/06) **[2]**
28/02 • Maintaining rolls in effective condition, e.g. reconditioning **[2]**
28/04 • • while in use, e.g. polishing **[2]**

29/00 Counter-pressure devices acting on rolls to inhibit deflection of same under load, e.g. backing rolls

31/00 Rolling stand structures; Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames

31/02 • Rolling stand frames; Roll mountings
31/04 • • with tie rods, e.g. prestressed tie rods
31/06 • • Fastening stands or frames to foundation, e.g. to the sole plate (in general F16M)
31/07 • Adaptation of roll bearings (bearings in general F16C) **[2]**
31/08 • Interchanging rolls, roll mountings, or stand frames **[2]**
31/10 • • by horizontally displacing
31/12 • • by vertically displacing
31/14 • • by pivotally displacing
31/16 • Adjusting rolls (control devices B21B 37/00)
31/18 • • by moving rolls axially
31/20 • • by moving rolls perpendicularly to roll axis
31/22 • • • mechanically
31/24 • • • • by screws
31/26 • • • • Adjusting eccentrically-mounted roll bearings
31/28 • • • • by toggle-lever mechanisms
31/30 • • • • by wedges or their equivalent
31/32 • • • by liquid pressure

33/00 Safety devices not otherwise provided for (safety devices in general F16P)**; Breaker blocks; Devices for freeing jammed rolls [2]**

33/02 • Preventing fracture of rolls **[2]**

35/00 Drives for metal-rolling mills

35/02 • for continuously-operating mills (B21B 35/10, B21B 35/12 take precedence)
35/04 • • each stand having its own motor or motors
35/06 • for non-continuously-operating mills or for single stands (B21B 35/10, B21B 35/12 take precedence)
35/08 • • for reversing rolling mills
35/10 • Driving arrangements for rolls which have only a low-power drive; Driving arrangements for rolls which receive power from the shaft of another roll **[2]**
35/12 • Toothed-wheel gearings specially adapted for metal-rolling mills; Housings or mountings therefor
35/14 • Couplings, driving spindles, or spindle carriers specially adapted for or specially arranged in metal-rolling mills (couplings or shafts in general F16)

37/00 Control devices or methods specially adapted for metal-rolling mills or the work produced thereby (methods or devices for measuring specially adapted for metal-rolling mills B21B 38/00)

37/16 • Control of thickness, width, diameter or other transverse dimensions (B21B 37/58 takes precedence) **[6]**
37/18 • • Automatic gauge control **[6]**
37/20 • • • in tandem mills **[6]**
37/22 • • Lateral spread control; Width control, e.g. by edge rolling **[6]**
37/24 • • Automatic variation of thickness according to a predetermined programme **[6]**
37/26 • • • for obtaining one strip having successive lengths of different constant thickness **[6]**
37/28 • Control of flatness or profile during rolling of strip, sheets or plates **[6]**
37/30 • • using roll camber control **[6]**
37/32 • • • by cooling, heating or lubricating the rolls **[6]**
37/34 • • • by hydraulic expansion of the rolls **[6]**
37/36 • • • by radial displacement of the roll sleeve on a stationary roll beam by means of hydraulic supports **[6]**
37/38 • • using roll bending (B21B 37/42 takes precedence) **[6]**
37/40 • • using axial shifting of the rolls (B21B 37/42 takes precedence) **[6]**
37/42 • • using a combination of roll bending and axial shifting of the rolls **[6]**
37/44 • • using heating, lubricating or water-spray cooling of the product **[6]**
37/46 • Roll speed or drive motor control (B21B 37/52, B21B 37/60 take precedence) **[6]**
37/48 • Tension control; Compression control **[6]**
37/50 • • by looper control **[6]**
37/52 • • by drive motor control **[6]**
37/54 • • • including coiler drive control, e.g. reversing mills **[6]**
37/56 • Elongation control **[6]**
37/58 • Roll-force control; Roll-gap control **[6]**
37/60 • • by control of a motor which drives an adjusting screw **[6]**
37/62 • • by control of a hydraulic adjusting device **[6]**
37/64 • • Mill spring or roll spring compensation systems, e.g. control of prestressed mill stands **[6]**
37/66 • • Roll eccentricity compensation systems **[6]**
37/68 • Camber or steering control for strip, sheets or plates, e.g. preventing meandering **[6]**
37/70 • Length control (B21B 37/56 takes precedence) **[6]**
37/72 • Rear end control; Front end control **[6]**
37/74 • Temperature control, e.g. by cooling or heating the rolls or the product (B21B 37/32, B21B 37/44 take precedence) **[6]**
37/76 • • Cooling control on the run-out table **[6]**
37/78 • Control of tube rolling **[6]**

38/00 Methods or devices for measuring specially adapted for metal-rolling mills, e.g. position detection, inspection of the product [6]

38/02 • for measuring flatness or profile of strips **[6]**
38/04 • for measuring thickness, width, diameter or other transverse dimensions of the product **[6]**
38/06 • for measuring tension or compression **[6]**
38/08 • for measuring roll-force **[6]**
38/10 • for measuring roll-gap, e.g. pass indicators **[6]**
38/12 • for measuring roll camber **[6]**

39/00 Arrangements for moving, supporting, or positioning work, or controlling its movement, combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (guiding, conveying, or accumulating easily-flexible work in loops or curves B21B 41/00; specially associated with cooling-beds B21B 43/00; conveying or transporting in general B65G)

39/02 • Feeding or supporting work; Braking or tensioning arrangements
39/04 • • Lifting or lowering work for conveying purposes, e.g. tilting tables arranged immediately in front of or behind the pass (turn-over or like manipulating means as such B21B 39/20)
39/06 • • Pushing or forcing work into pass
39/08 • • Braking or tensioning arrangements
39/10 • • Arrangement or installation of feeding rollers in rolling stands

39/12 • • Arrangement or installation of roller tables in relation to a roll stand
39/14 • Guiding, positioning or aligning work (B21B 43/12 takes precedence; guides in which work is subjected to permanent internal twisting B21B 15/02)
39/16 • • immediately before entering or after leaving the pass
39/18 • • Switches for directing work in metal-rolling mills or trains
39/20 • Revolving, turning-over, or like manipulation of work (guides in which work is subjected to permanent internal twisting B21B 15/02)
39/22 • • by tipping, e.g. by lifting one side by levers or wedges (B21B 39/26, B21B 39/28 take precedence)
39/24 • • by tongs or grippers
39/26 • • by members, e.g. grooved, engaging opposite sides of the work and moved relatively to each other to revolve the work
39/28 • • by means of guide members shaped to revolve the work during its passage
39/30 • • by lodging it in a rotating ring manipulator or ring segment manipulator
39/32 • • Devices specially adapted for turning sheets
39/34 • Arrangements or constructional combinations specifically designed to perform functions covered by more than one of groups B21B 39/02, B21B 39/14, B21B 39/20

41/00 Guiding, conveying, or accumulating easily-flexible work, e.g. wire, sheet metal bands, in loops or curves; Loop lifters
41/02 • Returning work to repeat the pass or passes
41/04 • • above or underneath the rolling stand or rolls
41/06 • in which the direction of movement of the work is turned through approximately 180°
41/08 • without overall change in the general direction of movement of the work
41/10 • • Loop deflectors
41/12 • Arrangements of interest only with respect to provision for indicating or controlling operations

43/00 Cooling beds, whether stationary or moving; Means specially associated with cooling beds, e.g. for braking work or for transferring it to or from the bed (conveying means in general B65G)
43/02 • Cooling beds comprising rakes or bars (B21B 43/10 takes precedence) **[2]**
43/04 • Cooling beds comprising rolls or worms
43/06 • Cooling beds comprising carriages (B21B 43/08 takes precedence)
43/08 • Cooling beds comprising revolving drums or recycling chains
43/10 • Cooling beds with other work-shifting elements projecting through the bed
43/12 • Devices for positioning workpieces "flushed", i.e. with all their axial ends arranged in line on cooling beds or on co-operating conveyors **[2]**

45/00 Devices for surface treatment of work, specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (B21B 15/00 takes precedence; technical features of scaling-off devices B21C 43/00)
45/02 • for lubricating, cooling, or cleaning
45/04 • for de-scaling
45/06 • • of strip material (B21B 45/08 takes precedence)
45/08 • • hydraulically

47/00 Auxiliary arrangements, devices or methods in connection with rolling of multi-layer sheets of metal (soaking pits C21D 9/70) **[2]**
47/02 • for folding sheets before rolling
47/04 • for separating layers after rolling

99/00 Subject matter not provided for in other groups of this subclass [2006.01]