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
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.

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

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 {, blooms} billets, in which the cross-sectional form is unimportant {Rolling combined with forging or pressing}

2001/022 . . . {Blooms or billets}
2001/024 . . . {Forging or pressing (forging or pressing devices as units B21B 15/0035)}
2001/026 . . . {Rolling}
2001/028 . . . {Slabs}
1/04 . . . in a continuous process
1/06 . . . in a non-continuous process {, e.g. triplet mill, reversing mill}
1/08 . . . for rolling {structural sections, i.e.} 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)
1/0805 . . . {Flat bars, i.e. having a substantially rectangular cross-section}
2001/081 . . . {Roughening or texturing surfaces of structural sections, bars, rounds, wire rods}

1/0815 . . . {from flat-rolled products, e.g. by longitudinal shearing}
1/082 . . . Piling sections having lateral edges specially adapted for interlocking with each other in order to build a wall
1/085 . . . Rail sections
1/0855 . . . {Rerolling or processing worn or discarded rail sections}
1/088 . . . H- or I-sections
1/0883 . . . {using forging or pressing devices}
1/0886 . . . {using variable-width rolls}
1/09 . . . L-sections
1/092 . . . T-sections
1/095 . . . U- or channel sections
1/098 . . . Z-sections
1/10 . . . in a single two-high or universal rolling mill {stand (B21B 1/085 - B21B 1/098 take precedence)}
1/12 . . . in a continuous process {, i.e. without reversing stands (B21B 1/085 - B21B 1/098 take precedence)}
1/14 . . . in a non-continuous process {, i.e. at least one reversing stand (B21B 1/085 - B21B 1/098 take precedence)}
1/16 . . . for rolling {wire rods, bars, merchant bars, rounds} wire or material of like small cross-section
1/163 . . . (Rolling or cold-forming of concrete reinforcement bars or wire (reinforcement bars per se E04C 5/03); Rolls therefor)
1/166 . . . (Rolling wire into sections or flat ribbons)
1/18 . . . in a continuous process
1/20 . . . in a non-continuous process,(e.g. skew rolling, i.e. planetary cross rolling)
5/00 Extending closed shapes of metal bands by rolling
(manufacture of circular shapes, e.g. wheel rims, B21H 1/06)

2001/225 [by hot-rolling]

1/227 [Surface roughening or texturing]
1/2021/228 [skin pass rolling or temper rolling]

1/24 [by cold-rolling] in a continuous (or semi-continuous) process
(B21B 1/224 takes precedence)

1/26 by hot-rolling [, e.g. Steckel hot mill]

1/265 [and by compressing or pushing the material in rolling direction]

1/28 by cold-rolling [, e.g. Steckel cold mill]
1/30 in a non-continuous process (B21B 1/224 takes precedence)

1/32 in reversing (single stand) 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, [pack rolling]
(B21B 1/40 takes precedence; folding sheets before, or separating layers after, rolling B21B 47/00)

2001/383 [Cladded or coated products]
2001/386 [Plates]

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 17/00)

1/463 [in a continuous process, i.e. the cast not being cut before rolling]
1/466 [in a non-continuous process, i.e. the cast being cut before rolling]

3/00 Rolling materials of special alloys so far as the composition of the alloy requires or permits special rolling methods or sequences (Rolling of aluminium, copper, zinc or other non-ferrous metals) (altering special metallurgical properties of alloys, other than structure consolidation or mechanical properties resulting therefrom C21D, C22F)

2003/001 [Aluminium or its alloys]

3/003 [Rolling non-ferrous metals immediately subsequent to continuous casting, i.e. in-line rolling]

2003/005 [Copper or its alloys]
2003/006 [Powder metal alloys]
2003/008 [Zinc or its alloys]

3/02 Rolling special iron alloys [, e.g. stainless steel]

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 process by subjecting rollers or work to vibrations, [e.g. ultrasonic 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)

13/001 [Convertible or tiltable stands, e.g. from duo to universal stands, from horizontal to vertical stands]

2013/003 [Inactive rolling stands]

2013/005 [Cantilevered roll stands]

2013/006 [Multiple strand rolling mills; Mill stands with multiple caliber rolls]

13/008 [Skew rolling stands, e.g. for rolling rounds]

13/02 [with axes of rolls arranged horizontally]

2013/021 [Twin mills]

13/023 [the axis of the rolls being other than perpendicular to the direction of movement of the product, e.g. cross-rolling]

2013/025 [Quarto, four-high stands]

2013/026 [Quinto, five high-stands]

2013/028 [Sixto, six-high stands]

13/04 [Three-high arrangement]

13/06 [with axes of rolls arranged vertically [, e.g. edgers]

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]

13/103 [for rolling bars, rods or wire]

2013/106 [for sections, e.g. beams, rails]

13/12 [axes being arranged in different planes]

13/14 [having counter-pressure devices acting on rolls to inhibit deflection of same under load; (Back-up rolls) (counter-pressure devices as such B21B 29/00)]

13/142 [by axially shifting the rolls, e.g. rolls with tapered ends or with a curved contour for continuously-variable crown CVC)

13/145 [Lateral support devices for rolls acting mainly in a direction parallel to the movement of the product]

13/147 [Cluster mills, e.g. Sendzimir mills, Rohn mills, i.e. each work roll being supported by two rolls only arranged symmetrically with respect to the plane passing through the working rolls]

13/16 [with alternatively operative rolls [, e.g revolver stands, turret mills]

13/18 [for step-by-step or planetary rolling; (pendulum mills ) (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, (i.e. in-line rolling of steel) (methods therefor B21B 1/46; continuous casting B22D 11/00, e.g. into moulds with rolls B22D 11/06)]
Rolling methods or mills specially designed for making or processing tubes (control of tube rolling B21B 37/78)

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, {i.e. the mandrel rod contacts the rolled tube over the rod length} (B21B 17/08 takes precedence)
17/04 . in a continuous process
17/06 . in a discontinuous process
17/08 . with mandrel having one or more protrusions {i.e. only the mandrel plugs contact the rolled tube; Press-piercing mills}
17/10 . in a continuous process
17/12 . in a discontinuous process {e.g. plug-rolling mills}
17/14 . without mandrel {e.g. stretch-reducing mills}

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 [Diescher mills, Stiefel disc piercers, Stiefel rotary piercers]
19/04 . Rolling basic material of solid, i.e. non-hollow, structure; Piercing {e.g. rotary piercing mills}
19/06 . Rolling hollow basic material, e.g. Assel mills (B21B 19/04 takes precedence; separating work from mandrel B21C 45/00)
19/08 . Enlarging tube diameter
19/10 . Finishing, e.g. smoothing, sizing {reeling}
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 {i.e. pilger mills}
21/005 . with reciprocating stand, e.g. driving the stand
21/02 . Rollers therefor
Rolling methods or mills specially designed for making or processing tubes

28/00 Maintaining rolls or rolling equipment in effective condition (lubricating, cooling or heating rolls while in use B21B 27/06)
28/02 . Maintaining rolls in effective condition, e.g. reconditioning
28/04 . . while in use, e.g. polishing [or grinding while the rolls are in their stands]

29/00 Counter-pressure devices acting on rolls to inhibit deflection of some under load, e.g. backing rolls [; Roll bending devices, e.g. hydraulic actuators acting on roll shaft ends (control devices responsive to roll bending B21B 37/38)]

31/00 Rolling stand structures; Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames
31/02 . Rolling stand frames [or housings]; Roll mountings [; Roll chocks]
2031/0201 . . [Integral tandem mill housings]
2031/0203 . . [Transverse shifting one housing]
2031/0205 . . [Shifting the stand in or against the rolling direction]
2031/0206 . . [Transverse shifting the stand]
31/08 . . with tie rods [in frameless stands], 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 [neck] bearings (bearings in general F16C)
2031/0702 . . [Bearing materials]
2031/0704 . . [Oil film bearings, e.g. "Morgoil" bearings]
2031/0706 . . [Cooling; Lubricating roller bearings]
2031/0708 . . [Sealing devices (sealings in general F16J)]
31/10 . . Interchanging rolls, roll mountings, or stand frames [e.g. using C-hooks; Replacing roll chocks on roll shafts]
31/16 . . by horizontally displacing [ ; i.e. horizontal roll changing]
31/13 . . . . . [Manipulators or carriages therefor]
31/106 . . . [Vertical displacement of rolls or roll chocks during horizontal roll changing]
31/12 . . by vertically displacing
31/14 . . by pivotally displacing
31/16 . . Adjusting [or positioning] rolls (control devices B21B 37/00)
31/18 . . by moving rolls axially
31/185 . . . [and by crossing rolls]
31/20 . . by moving rolls perpendicularly to roll axis
31/203 . . . . . [Balancing rolls]
2031/206 . . . . [Horizontal offset of work rolls]
31/22 . . mechanically [ ; e.g. by thrust blocks, inserts for removal]
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 [ ; e.g. hydromechanical adjusting]

33/00 Safety devices not otherwise provided for (safety devices in general F16P; Breaker blocks; Devices for freeing jammed rolls [for handling cobbles; Overload safety devices]
2033/005 . . . [Cobble-freeing]
33/02 . Preventing fracture of rolls

35/00 Drives for metal-rolling mills [ , e.g. hydraulic drives]
2035/005 . . [Hydraulic drive motors]
35/02 . for continuously-operating mills (B21B 35/10, B21B 35/12 take precedence)
35/025 . . . . . [for stretch-reducing of tubes]
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
2035/103 . . . [Fluid-driven rolls or rollers]
2035/106 . . . . . [Non-driven or idler rolls or rollers]
35/12 . . Toothed-wheel gearing 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)
35/141 . . . [Rigid spindle couplings, e.g. coupling boxes placed on roll necks (rigid couplings in general F16D 1/00)]
35/142 . . . [Yielding spindle couplings; Universal joints for spindles (yielding couplings in general F16D 3/00)]
35/143 . . . [having slidable-interengaging teeth, e.g. gear-type couplings (universal joints with the coupling parts having slidable-interengaging teeth, in general, F16D 3/18)]
35/144 . . . . . . . [Wobbler couplings]
35/145 . . . . . . [Hooke's joints or the like with each coupling part pivoted with respect to an intermediate member (Hooke's joints in general F16D 3/26)]
35/146 . . . . . . . [Tongue and slipper joints (tongue and slipper joints in general F16D 3/265)]
35/147 . . . . . [Lubrication of spindle couplings]
35/148 . . . . . [Spindle carriers or balancers]
2035/149 . . . [Measuring devices for spindles or couplings]

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)
2037/002 . . . [Mass flow control]
37/005 . . [Control of time interval or spacing between workpieces]
37/007 . . [Control for preventing or reducing vibration, chatter or chatter marks (B21B 37/66 takes precedence)]
37/16 . . Control of thickness, width, diameter or other transverse dimensions (B21B 37/58 takes precedence)
37/165 . . . [responsive mainly to the measured thickness of the product]
37/18 . . . Automatic gauge control
37/20 . . . . . in tandem mills
Rolling methods or mills specially designed for making or processing tubes

37/22 . . Lateral spread control; Width control, e.g. by edge rolling
37/24 . . Automatic variation of thickness according to a predetermined programme
37/26 . . . for obtaining one strip having successive lengths of different constant thickness
37/28 . . Control of flatness or profile during rolling of strip, sheets or plates
37/30 . . using roll camber control
37/32 . . . by cooling, heating or lubricating the rolls
37/34 . . . by hydraulic expansion of the rolls
37/36 . . . by radial displacement of the roll sleeve on a stationary roll beam by means of hydraulic supports
37/38 . . using roll bending (B21B 37/42 takes precedence)
37/40 . . using axial shifting of the rolls (B21B 37/42 takes precedence)
37/42 . . using a combination of roll bending and axial shifting of the rolls
37/44 . . using heating, lubricating or water-spray cooling of the product
37/46 . . Roll speed or drive motor control (B21B 37/52, B21B 37/60 take precedence)
37/48 . . Tension control; Compression control
37/50 . . . by looper control
37/52 . . . by drive motor control
37/54 . . . including coiler drive control, e.g. reversing mills
37/56 . . Elongation control
37/58 . . Roll-force control; Roll-gap control (B21B 38/105 takes precedence)
37/60 . . by control of a motor which drives an adjusting screw
37/62 . . . by control of a hydraulic adjusting device
37/64 . . . Mill spring or roll spring compensation systems, e.g. control of prestressed mill stands
37/66 . . Roll eccentricity compensation systems
37/68 . . Camber or steering control for strip, sheets or plates, e.g. preventing meandering
37/70 . . Length control (B21B 37/56 takes precedence)
37/72 . . Rear end control; Front end control
37/74 . . Temperature control, e.g. by cooling or heating the rolls or the product (B21B 37/32, B21B 37/44 take precedence)
37/76 . . Cooling control on the run-out table
37/78 . . Control of tube rolling

38/00 Methods or devices for measuring, (detecting or monitoring) specially adapted for metal-rolling mills, e.g. position detection, inspection of the product (control devices or methods B21B 37/00)

2038/002 [Measuring axial forces of rolls]
2038/004 [Measuring scale thickness]
38/006 [for measuring temperature]
38/008 [Monitoring or detecting vibration, chatter or chatter marks]
38/02 . . for measuring flatness or profile of strips
38/04 . . for measuring thickness, width, diameter or other transverse dimensions of the product
38/06 . . for measuring tension or compression
38/08 . . for measuring roll-force
38/10 . . for measuring roll-gap, e.g. pass indicators
38/105 . . (Calibrating or presetting roll-gap)

38/12 . . for measuring roll camber

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)

39/002 [Piling, unpiling, unscrambling]
39/004 [Transverse moving]
39/006 [Pinch roll sets]
39/008 [Rollers for roller conveyors (roller-ways in general B65G 13/00, B21B 39/00)]
39/012 . . Feeding or supporting work; Braking or tensioning arrangements, e.g. threading arrangements
39/014 . . 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)
39/016 . . Pushing or forcing work into pass
39/018 . . Braking or tensioning arrangements
39/02 . . Feeding or supporting work; Braking or tensioning arrangements, e.g. threading arrangements
39/02 . . . [Bridle devices]
39/028 . . . [Looper devices]
39/028 . . . [Braking devices]
39/028 . . . [Bumpers, stopping devices]
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
39/165 . . . [Guides or guide rollers for rods, bars, rounds, tubes (B21B 39/28 takes precedence); Aligning guides]
39/18 . . Switches for directing work in metal-rolling mills or trains
39/20 . . Revolving, turning-over, or like manipulation of work, e.g. revolving in trio stands (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)
39/223 . . . [Side-guard manipulators]
39/226 . . . [Tiltable ingot chairs]
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
Rolling methods or mills specially designed for making or processing tubes

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 {within the same stand}
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 degrees, e.g. repeaters, i.e. from one stand to another
41/08 . without overall change in the general direction of movement of the work
41/10 . . Loop deflectors (B21B 39/084 takes precedence)
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)

43/003 . {Transfer to bed}
43/006 . {Transfer from bed}
43/02 . Cooling beds comprising rakes {racks, walking beams} or bars (B21B 43/10 takes precedence)
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 {or discs}
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 {, e.g. before cutting}

45/00 Devices for surface {or other} treatment of work, specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (B21B 15/00, B21B 1/22 and B21B 27/005) take precedence; technical features of scaling-off devices (B21C 43/00)

45/002 . {Increasing friction between work and working rolls by using friction increasing substance}
45/004 {Heating the product)
2045/006 . . . . {in vacuum or in inert atmosphere}
45/008 {Heat shields)
45/02 . for lubricating, cooling, or cleaning {in particular in combination with forging or pressing devices (B21B 15/0005, control of flatness or profile using lubricating or cooling (B21B 37/44)}
45/0203 . . . . {Cooling}
45/0206 . . . . {Coolants}
45/0209 . . . . {Cooling devices, e.g. using gaseous coolants}
2045/0212 . . . . . {using gaseous coolants}
45/0215 . . . . . . . . {using liquid coolants, e.g. for sections, for tubes}
45/0218 . . . . . . . . . {for strips, sheets, or plates (B21B 45/023, B21B 45/0233 take precedence)}
2045/0221 . . . . . . . . . . {for structural sections, e.g. H-beams}
45/0224 . . . . . . . . {for wire, rods, rounds, bars (B21B 45/023, B21B 45/0233 take precedence)}
2045/0227 . . . . . . . . . . {for tubes}
45/023 . . . . . . . . . . . . {by immersion in a bath}
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<td>2261/02</td>
<td>. Transverse dimensions</td>
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<td>. Blanks with variable thickness in the rolling direction</td>
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<td>. Different constant thicknesses in one rolled product</td>
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<td>. Roll crown; roll profile</td>
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<td>. Aligning on rolling axis, e.g. of roll calibers</td>
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