

CPC**COOPERATIVE PATENT CLASSIFICATION****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.

B21B 1/00

Metal-rolling methods or mills for making semi-finished products of solid or profiled cross-section ([B21B 17/00](#) to [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**

- [B21B 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}
- [B21B 2001/022](#) . . {Blooms or billets}
- [B21B 1/024](#) . . {Forging or pressing (forging or pressing devices as units [B21B 15/0035](#))}
- [B21B 1/026](#) . . {Rolling}
- [B21B 2001/028](#) . . {Slabs}
- [B21B 1/04](#) . . in a continuous process
- [B21B 1/06](#) . . in a non-continuous process, {e.g. triplet mill, reversing mill}
- [B21B 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](#))
- [B21B 1/0805](#) . . {Flat bars, i.e. having a substantially rectangular cross-section}
- [B21B 2001/081](#) . . {Roughening or texturing surfaces of structural sections, bars, rounds, wire rods}
- [B21B 1/0815](#) . . {from flat-rolled products, e.g. by longitudinal shearing}
- [B21B 1/082](#) . . Piling sections having lateral edges specially adapted for interlocking with each other in order to build a wall
- [B21B 1/085](#) . . Rail sections
- [B21B 1/0855](#) . . . {Rerolling or processing worn or discarded rail sections}
- [B21B 1/088](#) . . H- or I-sections
- [B21B 1/0883](#) . . . {using forging or pressing devices}
- [B21B 1/0886](#) . . . {using variable-width rolls}

- B21B 1/09 . . L-sections
- B21B 1/092 . . T-sections
- B21B 1/095 . . U-or channel sections
- B21B 1/098 . . Z-sections

WARNING

Groups [B21B 1/098](#) is not complete. See also other subgroups of [B21B 1/08](#)

- B21B 1/10 . . in a single two-high or universal rolling mill {stand ([B21B 1/085](#) to [B21B 1/098](#) take precedence)}
- B21B 1/12 . . in a continuous process, {i.e. without reversing stands ([B21B 1/085](#) to [B21B 1/098](#) take precedence)}
- B21B 1/14 . . in a non-continuous process, {i.e. at least one reversing stand ([B21B 1/085](#) to [B21B 1/098](#) take precedence)}
- B21B 1/16 . for rolling {wire rods, bars, merchant bars, rounds} wire or material of like small cross-section
- B21B 1/163 . . {Rolling or cold-forming of concrete reinforcement bars or wire (reinforcement bars per se [E04C 5/03](#)); Rolls therefor}
- B21B 1/166 . . {Rolling wire into sections or flat ribbons}
- B21B 1/18 . . in a continuous process
- B21B 1/20 . . in a non-continuous process, (e.g. skew rolling, i.e. planetary cross rolling)
- B21B 1/22 . for rolling {plates, strips,} bands or sheets of indefinite length ([B21B 1/42](#) takes precedence)
- B21B 2001/221 . . {by cold-rolling}
- B21B 1/222 . . {in a rolling-drawing process; in a multi-pass mill}
- B21B 1/224 . . {Edge rolling of flat products}
- B21B 2001/225 . . {by hot-rolling}
- B21B 1/227 . . {Surface roughening or texturing}
- B21B 2001/228 . . {skin pass rolling or temper rolling}
- B21B 1/24 . . in a continuous {or semi-continuous} process {([B21B 1/224](#) takes precedence)}
- B21B 1/26 . . . by hot-rolling, {e.g. Steckel hot mill}
- B21B 1/265 {and by compressing or pushing the material in rolling direction}
- B21B 1/28 . . . by cold-rolling, {e.g. Steckel cold mill}
- B21B 1/30 . . in a non-continuous process {([B21B 1/224](#) takes precedence)}
- B21B 1/32 . . . in reversing {single stand} mills, e.g. with intermediate storage reels for accumulating work
- B21B 1/34 by hot-rolling
- B21B 1/36 by cold-rolling
- B21B 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](#))
- B21B 2001/383 . . {Cladded or coated products}
- B21B 2001/386 . . {Plates}

- B21B 1/40 . for rolling foils which present special problems, e.g. because of thinness
- B21B 1/42 . for step-by-step or planetary rolling ([making tubes by pilgrim-step rolling B21B 21/00](#))
- B21B 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](#))
- B21B 1/463 . . {in a continuous process, i.e. the cast not being cut before rolling}
- B21B 1/466 . . {in a non-continuous process, i.e. the cast being cut before rolling}

- B21B 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](#))

- B21B 2003/001 . {Aluminium or its alloys}
- B21B 3/003 . {Rolling non-ferrous metals immediately subsequent to continuous casting, i.e. in-line rolling}
- B21B 2003/005 . {Copper or its alloys}
- B21B 2003/006 . {Powder metal alloys}
- B21B 2003/008 . {Zinc or its alloys}
- B21B 3/02 . Rolling special iron alloys, {e.g. stainless steel}

- B21B 5/00** **Extending closed shapes of metal bands by rolling** ([manufacture of circular shapes, e.g. wheel rims, B21H 1/06](#))

- B21B 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**

- B21B 11/00** **Subsidising the rolling process by subjecting rollers or work to vibrations, {e.g. ultrasonic vibrations}**

- B21B 13/00** **Metal-rolling stands, i.e. an assembly composed of a stand frame, rolls, and accessories** ([B21B 17/00](#) to [B21B 23/00](#) take precedence; details, component parts, accessories, auxiliary means, procedures in connection with metal rolling, see the relevant groups)

- B21B 13/001 . {Convertible or tiltable stands, e.g. from duo to universal stands, from horizontal to vertical stands}
- B21B 2013/003 . {Inactive rolling stands}
- B21B 13/005 . {Cantilevered roll stands}
- B21B 2013/006 . {Multiple strand rolling mills; Mill stands with multiple caliber rolls}
- B21B 13/008 . {Skew rolling stands, e.g. for rolling rounds}
- B21B 13/02 . with axes of rolls arranged horizontally
- B21B 2013/021 . . {Twin mills}
- B21B 13/023 . . {the axis of the rolls being other than perpendicular to the direction of movement of the product, e.g. cross-rolling}
- B21B 2013/025 . . {Quarto, four-high stands}
- B21B 2013/026 . . {Quinto, five high-stands}

- B21B 2013/028 . . {Sixto, six-high stands}
- B21B 13/04 . . Three-high arrangement
- B21B 13/06 . with axes of rolls arranged vertically, {e.g. edgers}
- B21B 13/08 . with differently-directed roll axes, e.g. for the so-called "universal" rolling process
- B21B 13/10 . . all axes being arranged in one plane
- B21B 13/103 . . . {for rolling bars, rods or wire}
- B21B 2013/106 . . . {for sections, e.g. beams, rails}
- B21B 13/12 . . axes being arranged in different planes
- B21B 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](#))
- B21B 13/142 . . {by axially shifting the rolls, e.g. rolls with tapered ends or with a curved contour for continuously-variable crown CVC}
- B21B 13/145 . . {Lateral support devices for rolls acting mainly in a direction parallel to the movement of the product}
- B21B 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}
- B21B 13/16 . with alternatively operative rolls, {e.g. revolver stands, turret mills}
- B21B 13/18 . for step-by-step or planetary rolling; {pendulum mills} (methods [B21B 1/42](#); making tubes by pilgrim-step rolling [B21B 21/00](#))
- B21B 13/20 . . for planetary rolling
- B21B 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](#))

- B21B 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**
- B21B 15/0007 . {Cutting or shearing the product}
- B21B 2015/0014 . . {transversely to the rolling direction}
- B21B 2015/0021 . . {in the rolling direction}
- B21B 2015/0028 . {Drawing the rolled product}
- B21B 15/0035 . {Forging or pressing devices as units}
- B21B 15/0042 . . {Tool changers}
- B21B 15/005 . . {Lubricating, cooling or heating means}
- B21B 2015/0057 . {Coiling the rolled product}
- B21B 2015/0064 . {Uncoiling the rolled product}
- B21B 2015/0071 . {Levelling the rolled product}
- B21B 2015/0078 . {Extruding the rolled product}
- B21B 15/0085 . {Joining ends of material to continuous strip, bar or sheet}
- B21B 2015/0092 . {Welding in the rolling direction}
- B21B 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 ([control of tube rolling B21B 37/78](#))

- B21B 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**
- B21B 17/02 . with mandrel, {i.e. the mandrel rod contacts the rolled tube over the rod length} ([B21B 17/08 takes precedence](#))
- B21B 17/04 . . in a continuous process
- B21B 17/06 . . in a discontinuous process
- B21B 17/08 . with mandrel having one or more protrusions, {i.e. only the mandrel plugs contact the rolled tube; Press-piercing mills}
- B21B 17/10 . . in a continuous process
- B21B 17/12 . . in a discontinuous process, {e.g. plug-rolling mills}
- B21B 17/14 . without mandrel, {e.g. stretch-reducing mills}
- B21B 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](#))
- B21B 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}
- B21B 19/04 . . Rolling basic material of solid, i.e. non-hollow, structure; Piercing, {e.g. rotary piercing mills}
- B21B 19/06 . . Rolling hollow basic material, {e.g. Assel mills} ([B21B 19/04 takes precedence](#); [separating work from mandrel B21C 45/00](#))
- B21B 19/08 . . . Enlarging tube diameter
- B21B 19/10 . . . Finishing, e.g. smoothing, sizing, {reeling}
- B21B 19/12 . the axes of the rollers being arranged essentially parallel to the axis of the work
- B21B 19/14 . . Rolling tubes by means of additional rollers arranged inside the tubes
- B21B 19/16 . . Rolling tubes without additional rollers arranged inside the tubes
- B21B 21/00** **Pilgrim-step tube-rolling, {i.e. pilger mills}**
- B21B 21/005 . {with reciprocating stand, e.g. driving the stand}
- B21B 21/02 . Rollers therefor
- B21B 21/04 . Pilgrim-step feeding mechanisms ([B21B 21/06 takes precedence](#))
- B21B 21/045 . . {for reciprocating stands}
- B21B 21/06 . Devices for revolving work between the steps
- B21B 21/065 . . {for reciprocating stands}
- B21B 23/00** **Tube-rolling not restricted to methods provided for in only one of groups [B21B 17/00](#), [B21B 19/00](#), [B21B 21/00](#), e.g. combined processes {planetary tube rolling, auxiliary arrangements, e.g. lubricating, special tube blanks, continuous casting combined with tube rolling} ([B21B 25/00 takes precedence](#))**
- B21B 2023/005 . {Roughening or texturing surfaces of tubes}

- B21B 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; {Construction of, or alloys for, mandrels or plugs}**
- [B21B 25/02](#) . Guides, supports, or abutments for mandrels, e.g. carriages {or steadiers}; Adjusting devices for mandrels
- [B21B 25/04](#) . Cooling or lubricating mandrels during operation
- [B21B 25/06](#) . Interchanging mandrels, {fixing plugs on mandrel rods or cooling during interchanging mandrels (separating tubes from mandrels [B21C 45/00](#))}
- B21B 27/00** **Rolls, {roll alloys or roll fabrication} (shape of working surfaces required by special processes [B21B 1/00](#)); Lubricating, cooling or heating rolls while in use**
- [B21B 27/005](#) . {Rolls with a roughened or textured surface; Methods for making same}
- [B21B 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](#) {; [B21B 27/005](#) takes precedence})
- [B21B 27/021](#) . . {Rolls for sheets or strips}
- [B21B 2027/022](#) . . . {Rolls having tapered ends}
- [B21B 27/024](#) . . {Rolls for bars, rods, rounds, tubes, wire or the like}
- [B21B 27/025](#) . . . {Skew rolls}
- [B21B 27/027](#) . . {Vertical rolls}
- [B21B 27/028](#) . . {Variable-width rolls}
- [B21B 27/03](#) . . Sleeved rolls {([B21B 27/028](#) takes precedence)}
- [B21B 27/032](#) . . . {Rolls for sheets or strips}
- [B21B 27/035](#) . . . {Rolls for bars, rods, rounds, tubes, wire or the like}
- [B21B 27/037](#) {Skew rolls}
- [B21B 27/05](#) . . . with deflectable sleeves
- [B21B 27/055](#) {with sleeves radially deflectable on a stationary beam by means of hydraulic supports (in general [F16C 13/00](#); for paper-making machines [D21G 1/00](#); regulating devices therefor [B21B 37/36](#))}
- [B21B 27/06](#) . Lubricating, cooling or heating rolls
- [B21B 27/08](#) . . internally
- [B21B 2027/083](#) . . . {cooling internally}
- [B21B 2027/086](#) . . . {heating internally}
- [B21B 27/10](#) . . externally
- [B21B 2027/103](#) . . . {cooling externally}
- [B21B 27/106](#) . . . {Heating the rolls}
- B21B 28/00** **Maintaining rolls or rolling equipment in effective condition (lubricating, cooling or heating rolls while in use [B21B 27/06](#))**
- [B21B 28/02](#) . Maintaining rolls in effective condition, e.g. reconditioning
- [B21B 28/04](#) . . while in use, e.g. polishing {or grinding while the rolls are in their stands}

B21B 29/00	Counter-pressure devices acting on rolls to inhibit deflection of same 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)}
B21B 31/00	Rolling stand structures; Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames
B21B 31/02	. Rolling stand frames {or housings}; Roll mountings; {Roll chocks}
B21B 2031/021	. . {Integral tandem mill housings}
B21B 2031/023	. . {Transverse shifting one housing}
B21B 2031/025	. . {Shifting the stand in or against the rolling direction}
B21B 2031/026	. . {Transverse shifting the stand}
B21B 31/028	. . {Prestressing of rolls or roll mountings in stand frames}
B21B 31/04	. . with tie rods {in frameless stands}, e.g. prestressed tie rods
B21B 31/06	. . Fastening stands or frames to foundation, e.g. to the sole plate (in general F16M)
B21B 31/07	. Adaptation of roll {neck} bearings (bearings in general F16C)
B21B 2031/072	. . {Bearing materials}
B21B 31/074	. . {Oil film bearings, e.g. "Morgoil" bearings}
B21B 31/076	. . {Cooling; Lubricating roller bearings}
B21B 31/078	. . {Sealing devices (Sealings in general F16J 15/00)}
B21B 31/08	. Interchanging rolls, roll mountings, or stand frames, {e.g. using C-hooks; Replacing roll chocks on roll shafts}
B21B 31/10	. . by horizontally displacing, {i.e. horizontal roll changing}
B21B 31/103	. . . {Manipulators or carriages therefor}
B21B 31/106	. . . {Vertical displacement of rolls or roll chocks during horizontal roll changing}
B21B 31/12	. . by vertically displacing
B21B 31/14	. . by pivotally displacing
B21B 31/16	. Adjusting {or positioning} rolls (control devices B21B 37/00)
B21B 31/18	. . by moving rolls axially
B21B 31/185	. . . {and by crossing rolls}
B21B 31/20	. . by moving rolls perpendicularly to roll axis
B21B 31/203	. . . {Balancing rolls}
B21B 2031/206	. . . {Horizontal offset of work rolls}
B21B 31/22	. . . mechanically, {e.g. by thrust blocks, inserts for removal}
B21B 31/24	. . . . by screws
B21B 31/26	. . . . Adjusting eccentrically-mounted roll bearings
B21B 31/28	. . . . by toggle-lever mechanisms
B21B 31/30	. . . . by wedges or their equivalent
B21B 31/32	. . . by liquid pressure, {e.g. hydromechanical adjusting}
B21B 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}

- B21B 2033/005 . {Cobble-freeing}
- B21B 33/02 . Preventing fracture of rolls

- B21B 35/00** **Drives for metal-rolling mills, {e.g. hydraulic drives}**
- B21B 2035/005 . {Hydraulic drive motors}
- B21B 35/02 . for continuously-operating mills ([B21B 35/10](#), [B21B 35/12](#) take precedence)
- B21B 35/025 . . {for stretch-reducing of tubes}
- B21B 35/04 . . each stand having its own motor or motors
- B21B 35/06 . for non-continuously-operating mills or for single stands ([B21B 35/10](#), [B21B 35/12](#) take precedence)
- B21B 35/08 . . for reversing rolling mills
- B21B 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
- B21B 2035/103 . . {Fluid-driven rolls or rollers}
- B21B 2035/106 . . {Non-driven or idler rolls or rollers}
- B21B 35/12 . Toothed-wheel gearings specially adapted for metal-rolling mills; Housings or mountings therefor
- B21B 35/14 . Couplings, driving spindles, or spindle carriers specially adapted for, or specially arranged in, metal-rolling mills ([couplings or shafts in general F16](#))
- B21B 35/141 . . {Rigid spindle couplings, e.g. coupling boxes placed on roll necks ([rigid couplings in general F16D 1/00](#))}
- B21B 35/142 . . {Yielding spindle couplings; Universal joints for spindles ([yielding couplings in general F16D 3/00](#))}
- B21B 35/143 . . . {having slidably-interengaging teeth, e.g. gear-type couplings ([universal joints with the coupling parts having slidably-interengaging teeth, in general, F16D 3/18](#))}
- B21B 35/144 {Wobbler couplings}
- B21B 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](#))}
- B21B 35/146 {Tongue and slipper joints ([tongue and slipper joints in general F16D 3/265](#))}
- B21B 35/147 . . {Lubrication of spindle couplings}
- B21B 35/148 . . {Spindle carriers or balancers}
- B21B 2035/149 . . {Measuring devices for spindles or couplings}

- B21B 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](#))**
- B21B 2037/002 . {Mass flow control}
- B21B 37/005 . {Control of time interval or spacing between workpieces}
- B21B 37/007 . {Control for preventing or reducing vibration, chatter or chatter marks ([B21B 37/66](#) takes precedence)}
- B21B 37/16 . Control of thickness, width, diameter or other transverse dimensions ([B21B 37/58](#) takes precedence)
- B21B 37/165 . . {responsive mainly to the measured thickness of the product}

B21B 37/18	. . Automatic gauge control
B21B 37/20	. . . in tandem mills
B21B 37/22	. . Lateral spread control; Width control, e.g. by edge rolling
B21B 37/24	. . Automatic variation of thickness according to a predetermined programme
B21B 37/26	. . . for obtaining one strip having successive lengths of different constant thickness
B21B 37/28	. Control of flatness or profile during rolling of strip, sheets or plates
B21B 37/30	. . using roll camber control
B21B 37/32	. . . by cooling, heating or lubricating the rolls
B21B 37/34	. . . by hydraulic expansion of the rolls
B21B 37/36	. . . by radial displacement of the roll sleeve on a stationary roll beam by means of hydraulic supports
B21B 37/38	. . using roll bending (B21B 37/42 takes precedence)
B21B 37/40	. . using axial shifting of the rolls (B21B 37/42 takes precedence)
B21B 37/42	. . using a combination of roll bending and axial shifting of the rolls
B21B 37/44	. . using heating, lubricating or water-spray cooling of the product
B21B 37/46	. Roll speed or drive motor control (B21B 37/52 , B21B 37/60 take precedence)
B21B 37/48	. Tension control; Compression control
B21B 37/50	. . by looper control
B21B 37/52	. . by drive motor control
B21B 37/54	. . . including coiler drive control, e.g. reversing mills
B21B 37/56	. Elongation control
B21B 37/58	. Roll-force control; Roll-gap control (B21B 38/105 takes precedence)
B21B 37/60	. . by control of a motor which drives an adjusting screw
B21B 37/62	. . by control of a hydraulic adjusting device
B21B 37/64	. . Mill spring or roll spring compensation systems, e.g. control of prestressed mill stands
B21B 37/66	. . Roll eccentricity compensation systems
B21B 37/68	. Camber or steering control for strip, sheets or plates, e.g. preventing meandering
B21B 37/70	. Length control (B21B 37/56 takes precedence)
B21B 37/72	. Rear end control; Front end control
B21B 37/74	. Temperature control, e.g. by cooling or heating the rolls or the product (B21B 37/32 , B21B 37/44 take precedence)
B21B 37/76	. . Cooling control on the run-out table
B21B 37/78	. Control of tube rolling
B21B 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)}
B21B 2038/002	. {Measuring axial forces of rolls}
B21B 2038/004	. {Measuring scale thickness}
B21B 38/006	. {for measuring temperature}
B21B 38/008	. {Monitoring or detecting vibration, chatter or chatter marks}

- B21B 38/02 . for measuring flatness or profile of strips
- B21B 38/04 . for measuring thickness, width, diameter or other transverse dimensions of the product
- B21B 38/06 . for measuring tension or compression
- B21B 38/08 . for measuring roll-force
- B21B 38/10 . for measuring roll-gap, e.g. pass indicators
- B21B 38/105 . . {Calibrating or presetting roll-gap}
- B21B 38/12 . for measuring roll camber

- B21B 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](#))**
- B21B 39/002 . {Piling, unpling, unscrambling}
- B21B 39/004 . {Transverse moving}
- B21B 39/006 . {Pinch roll sets}
- B21B 39/008 . {Rollers for roller conveyers (roller-ways in general [B65G 13/00](#), [B21B 39/00](#))}
- B21B 39/02 . Feeding or supporting work; Braking or tensioning arrangements, {e.g. threading arrangements}
- B21B 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](#))
- B21B 39/06 . . Pushing or forcing work into pass
- B21B 39/08 . . Braking or tensioning arrangements
- B21B 39/082 . . . {Bridle devices}
- B21B 39/084 . . . {Looper devices}
- B21B 39/086 . . . {Braking devices}
- B21B 39/088 . . . {Bumpers, stopping devices}
- B21B 39/10 . . Arrangement or installation of feeding rollers in rolling stands
- B21B 39/12 . . Arrangement or installation of roller tables in relation to a roll stand
- B21B 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](#))
- B21B 39/16 . . immediately before entering or after leaving the pass
- B21B 39/165 . . . {Guides or guide rollers for rods, bars, rounds, tubes ([B21B 39/28](#) takes precedence); Aligning guides}
- B21B 39/18 . . Switches for directing work in metal-rolling mills or trains
- B21B 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](#))
- B21B 39/22 . . by tipping, e.g. by lifting one side by levers or wedges ([B21B 39/26](#), [B21B 39/28](#) take precedence)
- B21B 39/223 . . . {Side-guard manipulators}
- B21B 39/226 . . . {Tiltable ingot chairs}
- B21B 39/24 . . by tongs or grippers

- B21B 39/26
 - . . by members, e.g. grooved, engaging opposite sides of the work and moved relatively to each other to revolve the work
- B21B 39/28
 - . . by means of guide members shaped to revolve the work during its passage
- B21B 39/30
 - . . by lodging it in a rotating ring manipulator or ring segment manipulator
- B21B 39/32
 - . . Devices specially adapted for turning sheets
- B21B 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](#)

- B21B 41/00**
Guiding, conveying, or accumulating easily-flexible work, e.g. wire, sheet metal bands, in loops or curves; Loop lifters
- B21B 41/02
 - . Returning work to repeat the pass or passes {within the same stand}
- B21B 41/04
 - . . above or underneath the rolling stand or rolls
- B21B 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}
- B21B 41/08
 - . without overall change in the general direction of movement of the work
- B21B 41/10
 - . . Loop deflectors {(B21B 39/084 takes precedence)}
- B21B 41/12
 - . Arrangements of interest only with respect to provision for indicating or controlling operations

- B21B 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](#))
- B21B 43/003
 - . {Transfer to bed}
- B21B 43/006
 - . {Transfer from bed}
- B21B 43/02
 - . Cooling beds comprising rakes {racks, walking beams} or bars ([B21B 43/10](#) takes precedence)
- B21B 43/04
 - . Cooling beds comprising rolls or worms
- B21B 43/06
 - . Cooling beds comprising carriages ([B21B 43/08](#) takes precedence)
- B21B 43/08
 - . Cooling beds comprising revolving drums or recycling chains {or discs}
- B21B 43/10
 - . Cooling beds with other work-shifting elements projecting through the bed
- B21B 43/12
 - . Devices for positioning workpieces "flushed", i.e. with all their axial ends arranged in line on cooling beds or on co-operating conveyers, {e.g. before cutting}

- B21B 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 1/227](#) and [B21B 27/005](#)} take precedence; technical features of scaling-off devices [B21C 43/00](#))
- B21B 45/002
 - . {Increasing friction between work and working rolls by using friction increasing substance}
- B21B 45/004
 - . {Heating the product}
- B21B 2045/006
 - . . {in vacuum or in inert atmosphere}
- B21B 45/008
 - . {Heat shields}
- B21B 45/02
 - . for lubricating, cooling, or cleaning {(in particular in combination with forging or pressing devices [B21B 15/005](#), control of flatness or profile using lubricating or cooling [B21B 37/44](#))}

B21B 45/0203	. . {Cooling}
B21B 45/0206	. . . {Coolants}
B21B 45/0209	. . . {Cooling devices, e.g. using gaseous coolants}
B21B 2045/0212	. . . . {using gaseous coolants}
B21B 45/0215	. . . . {using liquid coolants, e.g. for sections, for tubes}
B21B 45/0218	. . . . . {for strips, sheets, or plates (B21B 45/023 , B21B 45/0233 take precedence)}
B21B 2045/0221	. . . . . {for structural sections, e.g. H-beams}
B21B 45/0224	. . . . . {for wire, rods, rounds, bars (B21B 45/023 , B21B 45/0233 take precedence)}
B21B 2045/0227	. . . . . {for tubes}
B21B 45/023	. . . . . {by immersion in a bath}
B21B 45/0233	. . . . . {Spray nozzles, Nozzle headers; Spray systems}
B21B 2045/0236	. . {Laying heads for overlapping rings on cooling conveyer}
B21B 45/0239	. . {Lubricating}
B21B 45/0242	. . . {Lubricants}
B21B 45/0245	. . . {Lubricating devices}
B21B 45/0248	. . . . {using liquid lubricants, e.g. for sections, for tubes}
B21B 45/0251	. . . . . {for strips, sheets, or plates}
B21B 2045/0254	. . . . . {for structural sections, e.g. H-beams}
B21B 45/0257	. . . . . {for wire, rods, rounds, bars}
B21B 2045/026	. . . . . {for tubes}
B21B 45/0263	. . . . {using solid lubricants}
B21B 45/0266	. . {Measuring or controlling thickness of liquid films}
B21B 45/0269	. . {Cleaning}
B21B 45/0272	. . . {Cleaning compositions}
B21B 45/0275	. . . {Cleaning devices}
B21B 45/0278	. . . . {removing liquids}
B21B 45/0281	. . . . . {removing coolants}
B21B 45/0284	. . . . . {removing lubricants}
B21B 45/0287	. . . . {removing solid particles, e.g. dust, rust}
B21B 45/029	. . . {Liquid recovering devices}
B21B 45/0293	. . . . {Recovering coolants}
B21B 45/0296	. . . . {Recovering lubricants}
B21B 45/04	. for de-scaling, {e.g. by brushing (descaling of rod or wire B21C 43/04)}
B21B 45/06	. . of strip material (B21B 45/08 takes precedence)
B21B 45/08	. . hydraulically
B21B 47/00	Auxiliary arrangements, devices or methods in connection with rolling of multi-layer sheets of metal (soaking pits C21D 9/70)
B21B 47/02	. for folding sheets before rolling

B21B 47/04 . for separating layers after rolling

B21B 99/00 Subject matter not provided for in other groups of this subclass

B21B 2201/00 Special rolling modes

- B21B 2201/02 . Austenitic rolling
- B21B 2201/04 . Ferritic rolling
- B21B 2201/06 . Thermomechanical rolling
- B21B 2201/08 . Batch rolling
- B21B 2201/10 . Endless rolling
- B21B 2201/12 . Isothermic rolling
- B21B 2201/14 . Soft reduction
- B21B 2201/16 . Two-phase or mixed-phase rolling
- B21B 2201/18 . Vertical rolling pass lines

Equipment codes

B21B 2203/00 Auxiliary arrangements, devices or methods in combination with rolling mills or rolling methods

- B21B 2203/02 . Backlash elimination
- B21B 2203/04 . Brakes
- B21B 2203/06 . Cassettes
- B21B 2203/08 . Clutches
- B21B 2203/10 . Counterweights
- B21B 2203/12 . Covers or shieldings
- B21B 2203/14 . Dummy bars or slabs
- B21B 2203/16 . Eccentrics
- B21B 2203/18 . Rolls or rollers
- B21B 2203/182 . . Fluid driven rolls or rollers
- B21B 2203/185 . . Reversible rolls for changing grooves
- B21B 2203/187 . . Tilting rolls
- B21B 2203/20 . Flywheels
- B21B 2203/22 . Hinged chocks
- B21B 2203/24 . Hydrostatic bearings or guides
- B21B 2203/26 . Motors, drives
- B21B 2203/28 . Mounting or dismounting bearing and chock as a unit
- B21B 2203/30 . Quick or bayonet couplings
- B21B 2203/32 . Roll changing stools
- B21B 2203/34 . Rotational position or alignment
- B21B 2203/36 . Spacers
- B21B 2203/38 . Strain gauges

- B21B 2203/40 . Torsion bars or shafts
- B21B 2203/42 . Turntables
- B21B 2203/44 . Vibration dampers

B21B 2205/00 Particular shaped rolled products

- B21B 2205/02 . Tailored blanks
- B21B 2205/04 . Taper- or wedge-shaped profiles

B21B 2261/00 Product parameters

- B21B 2261/02 . Transverse dimensions
- B21B 2261/04 . . Thickness, gauge
 - B21B 2261/043 . . . Blanks with variable thickness in the rolling direction
 - B21B 2261/046 . . . Different thickness in width direction
 - B21B 2261/05 . . . Different constant thicknesses in one rolled product
- B21B 2261/06 . . Width
 - B21B 2261/065 . . . Blanks with variable width
- B21B 2261/08 . . Diameter
- B21B 2261/10 . . Cross-sectional area
- B21B 2261/12 . Length
- B21B 2261/14 . Roughness
- B21B 2261/18 . Weight
- B21B 2261/20 . Temperature
 - B21B 2261/21 . . Temperature profile
- B21B 2261/22 . Hardness

B21B 2263/00 Shape of product

- B21B 2263/02 . Profile, e.g. of plate, hot strip, sections
- B21B 2263/04 . Flatness
 - B21B 2263/06 . . Edge waves
 - B21B 2263/08 . . Centre buckles
- B21B 2263/10 . Lateral spread defects
 - B21B 2263/12 . . Dog bone
- B21B 2263/16 . Alligatoring
- B21B 2263/20 . End shape; fish tail; tongue
- B21B 2263/30 . Shape in top view

B21B 2265/00 Forming parameters

- B21B 2265/02 . Tension
 - B21B 2265/04 . . Front or inlet tension
 - B21B 2265/06 . . Interstand tension
 - B21B 2265/08 . . Back or outlet tension

- B21B 2265/10 . Compression, e.g. longitudinal compression
- B21B 2265/12 . Rolling load or rolling pressure; roll force
- B21B 2265/14 . Reduction rate
- B21B 2265/16 . . Extension
- B21B 2265/18 . Elongation
- B21B 2265/20 . Slip
- B21B 2265/22 . Pass schedule
- B21B 2265/24 . asymmetric rolling

B21B 2267/00**Roll parameters**

- B21B 2267/02 . Roll dimensions
- B21B 2267/06 . . Roll diameter
- B21B 2267/065 . . . Top and bottom roll have different diameters; Asymmetrical rolling
- B21B 2267/08 . . Roll eccentricity
- B21B 2267/10 . Roughness of roll surface
- B21B 2267/12 . Roll temperature
- B21B 2267/18 . Roll crown; roll profile
- B21B 2267/19 . . Thermal crown
- B21B 2267/20 . . Ground camber or profile
- B21B 2267/22 . . Hydraulic expansion of rolls
- B21B 2267/24 . Roll wear
- B21B 2267/26 . Hardness of the roll surface
- B21B 2267/28 . Elastic moduli of rolls

B21B 2269/00**Roll bending or shifting**

- B21B 2269/02 . Roll bending; vertical bending of rolls
- B21B 2269/04 . . Work roll bending
- B21B 2269/06 . . Intermediate roll bending
- B21B 2269/08 . . Back-up roll bending
- B21B 2269/10 . Horizontal bending of rolls
- B21B 2269/12 . Axial shifting the rolls
- B21B 2269/14 . . Work rolls
- B21B 2269/16 . . Intermediate rolls
- B21B 2269/18 . . Back-up rolls

B21B 2271/00**Mill stand parameters**

- B21B 2271/02 . Roll gap, screw-down position, draft position
- B21B 2271/025 . . Tapered roll gap
- B21B 2271/04 . . Screw-down speed, draft speed
- B21B 2271/06 . Mill spring

B21B 2273/00

B21B 2273/02

B21B 2273/04

B21B 2273/06

B21B 2273/08

B21B 2273/10

B21B 2273/12

B21B 2273/14

B21B 2273/16

B21B 2273/18

B21B 2273/20

B21B 2273/22

B21B 2273/24

Path parameters

- . Vertical deviation, e.g. slack, looper height
- . Lateral deviation, meandering, camber of product
- . Threading
 - . Threading-in or before threading-in
 - . Threading-out or after threading-out
- . End of product
 - . Front end or leading end
 - . Tail or rear end
- . Presence of product
- . Track of product
- . Aligning on rolling axis, e.g. of roll calibers
- . Web positioning

B21B 2275/00

B21B 2275/02

B21B 2275/04

B21B 2275/05

B21B 2275/06

B21B 2275/08

B21B 2275/10

B21B 2275/12

Mill drive parameters

- . Speed
 - . Roll speed
 - . Speed difference between top and bottom rolls
 - . Product speed
 - . Coiler speed
- . Motor power; motor current
 - . Roll torque