

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.

Subclass index

METAL ROLLING IN GENERAL

General methods or apparatus.....	1/00, 11/00, 13/00, 15/00
Control or handling.....	35/00, 37/00, 38/00, 39/00, 41/00
Safety, cooling, maintenance.....	28/00, 33/00, 43/00
Details of rolling mills.....	27/00, 29/00, 31/00

METAL ROLLING UNDER SPECIAL CONDITIONS.....9/00

AUXILIARY OPERATIONS PERFORMED IN CONNECTION WITH METAL ROLLING.....15/00, 45/00, 47/00

ROLLING SPECIAL ALLOYS.....3/00

ROLLING TO PRODUCE PARTICULAR SHAPES

Tubes

rolling methods.....	17/00-23/00
mandrels, accessories.....	25/00

Extending closed shapes.....5/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

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	1/09	• • 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]
1/02	• 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]		

B21B

- 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

B21B

- 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 conveyers [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]**