

CPC**COOPERATIVE PATENT CLASSIFICATION****B21D**

WORKING OR PROCESSING OF SHEET METAL OR METAL TUBES, RODS OR PROFILES WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING (operations of the kind involved in the manufacture of such products B21B, B21C; working or processing of wire B21F; cutting or severing devices or machines in general B26; presses in general B30B)

NOTE

This subclass covers cutting or perforating of sheet metal or other stock material

This subclass does not cover the working of metal foils in a manner analogous to the working of paper, which is covered by classes B26, B31

Straightening; Restoring form; Bending; Corrugating; Flanging

B21D 1/00

Straightening, restoring form or removing local distortions of sheet metal or specific articles made therefrom ([B21D 3/00](#) takes precedence); **Stretching sheet metal combined with rolling** (working sheet metal of limited length by stretching [B21D 25/00](#); by localised hammering [B21D 31/06](#))

B21D 1/02

- . by rollers ([B21D 1/06](#) takes precedence)

B21D 1/05

- . Stretching combined with rolling

B21D 1/06

- . Removing local distortions

B21D 1/065

- .. {by hammering}

B21D 1/08

- .. of hollow bodies made from sheet metal (of substantially open bodies [B21D 1/10](#); {flattening hollow objects for transport and reforming [B21D 51/14](#)})

B21D 1/10

- .. of specific articles made from sheet metal, e.g. mudguards

B21D 1/12

- . Straightening vehicle body parts or bodies ([B21D 1/14](#) takes precedence)

B21D 1/14

- . Straightening frame structures

B21D 1/145

- .. {Clamps therefor}

B21D 3/00

Straightening or restoring form of metal rods, metal tubes, metal profiles, or specific articles made therefrom, whether or not in combination with sheet metal parts (straightening of well casings in situ E21B; {straightening rails or rail joints [E01B 31/08](#)})

B21D 3/005

- . {by eccentric turning members}

B21D 3/02

- . by rollers

B21D 3/04

- .. arranged on axes skew to the path of the work

B21D 3/045

- ... {Workpiece feed channels therefor}

- B21D 3/05 . . . arranged on axes rectangular to the path of the work
- B21D 3/06 . . . arranged inclined to a revolving flier rolling frame
- B21D 3/08 . . . which move in an orbit without rotating round the work
- B21D 3/10 . . . between rams and anvils or abutments
- B21D 3/12 . . . by stretching with or without twisting ([by twisting only B21D 11/14](#))
- B21D 3/14 . . . Recontouring
- B21D 3/16 . . . of specific articles made from metal rods, tubes, or profiles, e.g. crankshafts, by specially adapted methods or means
- B21D 5/00** **Bending sheet metal along straight lines, e.g. to form simple curves** ([B21D 11/06 to B21D 11/18 take precedence](#); [corrugating sheet metal B21D 13/00](#); as edge treatment [B21D 19/00](#))
- B21D 5/002 . . . {Positioning devices}
- B21D 5/004 . . . { with program control}
- B21D 5/006 . . . { combined with measuring of bends}
- B21D 5/008 . . . { combined with heating or cooling of the bends}
- B21D 5/01 . . . between rams and anvils or abutments
- B21D 5/015 . . . {for making tubes}
- B21D 5/02 . . . on press brakes without making use of clamping means
- B21D 5/0209 . . . {Tools therefor}
- B21D 5/0218 . . . { Length adjustment of the punch}
- B21D 5/0227 . . . { Length adjustment of the die}
- B21D 5/0236 . . . { Tool clamping}
- B21D 5/0245 . . . { Fluid operated}
- B21D 5/0254 . . . { Tool exchanging}
- B21D 5/0263 . . . { Die with two oscillating halves}
- B21D 5/0272 . . . {Deflection compensating means}
- B21D 5/0281 . . . {Workpiece supporting devices}
- B21D 5/029 . . . {with shearing devices}
- B21D 5/04 . . . on brakes making use of clamping means on one side of the work
- B21D 5/042 . . . { With a rotational movement of the bending blade}
- B21D 5/045 . . . { With a wiping movement of the bending blade}
- B21D 5/047 . . . { Length adjustment of the clamping means}
- B21D 5/06 . . . by drawing procedure making use of dies or forming-rollers, e.g. making profiles
- B21D 5/08 . . . making use of forming-rollers ([B21D 5/12 takes precedence](#))

- B21D 5/083 . . . {for obtaining profiles with changing cross-sectional configuration}
- B21D 5/086 . . . {for obtaining closed hollow profiles}
- B21D 5/10 . . for making tubes
- B21D 5/12 . . . making use of forming-rollers

- B21D 5/14 . by passing between rollers ([B21D 5/06](#) takes precedence)
- B21D 5/143 . . {making use of a mandrel}
- B21D 5/146 . . {one roll being covered with deformable material}

- B21D 5/16 . Folding; Pleating

B21D 7/00 **Bending rods, profiles, or tubes** ([B21D 11/02](#) to [B21D 11/18](#) take precedence; using mandrels or the like [B21D 9/00](#))

- B21D 7/02 . over a stationary forming member; by use of a swinging forming member or abutment
- B21D 7/021 . . {Construction of forming members having more than one groove}
- B21D 7/022 . . over a stationary forming member only
- B21D 7/0225 . . . {using pulling members}
- B21D 7/024 . . by a swinging forming member
- B21D 7/025 . . . and pulling or pushing the ends of the work
- B21D 7/028 . . . and altering the profile at the same time, e.g. forming bumpers
- B21D 7/03 . . Apparatus with means to keep the profile in shape
- B21D 7/04 . over a movably-arranged forming member ([B21D 7/02](#) takes precedence)
- B21D 7/06 . in press brakes or between rams and anvils or abutments; Pliers with forming dies
- B21D 7/063 . . {Pliers with forming dies}
- B21D 7/066 . . {combined with oscillating members}
- B21D 7/08 . by passing between rollers or through a curved die
- B21D 7/085 . . {by passing through a curved die}
- B21D 7/10 . by abutting members and flexible bending means, e.g. with chains, ropes
- B21D 7/12 . with programme control
- B21D 7/14 . combined with measuring of bends or lengths
- B21D 7/16 . Auxiliary equipment, e.g. for heating or cooling of bends
- B21D 7/162 . . {Heating equipment}
- B21D 7/165 . . {Cooling equipment}
- B21D 7/167 . . {Greasing}

B21D 9/00 **Bending tubes using mandrels or the like** ([B21D 11/02](#) to [B21D 11/18](#) take precedence)

- B21D 9/01 . the mandrel being flexible and engaging the entire tube length
- B21D 9/03 . . and built-up from loose elements, e.g. series of balls
- B21D 9/04 . the mandrel being rigid
- B21D 9/05 . co-operating with forming members
- B21D 9/055 . . {Construction of forming members having more than one groove}
- B21D 9/07 . . with one or more swinging forming members engaging tube ends only
- B21D 9/073 . . . {with one swinging forming member}
- B21D 9/076 . . . {with more swinging forming members}
- B21D 9/08 . in press brakes or between rams and anvils or abutments; Pliers with forming dies
- B21D 9/085 . . {Pliers with forming dies}
- B21D 9/10 . by passing between rollers
- B21D 9/12 . by pushing over a curved mandrel; by pushing through a curved die
- B21D 9/125 . . {by pushing through a curved die}
- B21D 9/14 . Wrinkle-bending, i.e. bending by corrugating
- B21D 9/15 . using filling material of indefinite shape, e.g. sand, plastic material (filling of tubes with such material [B21D 9/16](#))
- B21D 9/16 . Auxiliary equipment, e.g. machines for filling tubes with sand
- B21D 9/165 . . {Machines for filling tubes with sand}
- B21D 9/18 . . for heating or cooling of bends
- B21D 11/00** **Bending not restricted to forms of material mentioned in only one of groups [B21D 5/00](#), [B21D 7/00](#), [B21D 9/00](#); Bending not provided for in groups [B21D 5/00](#) to [B21D 9/00](#)(corrugating or bending into wave form [B21D 13/00](#), [B21D 15/00](#); flanging [B21D 19/00](#)); Twisting**
- B21D 11/02 . Bending by stretching or pulling over a die (working sheet metal of limited length by stretching [B21D 25/00](#))
- B21D 11/06 . Bending into helical or spiral form; Forming a succession of return bends, e.g. serpentine form (making helically seamed tubing [B21C 37/12](#))
- B21D 11/07 . . Making serpentine-shaped articles by bending essentially in one plane
- B21D 11/08 . Bending by altering the thickness of part of the cross-section of the work ([B21D 11/06](#) takes precedence)
- B21D 11/085 . . {by locally stretching or upsetting}
- B21D 11/10 . Bending specially adapted to produce specific articles, e.g. leaf springs {(making or bending leaf springs [B21D 53/886](#))}
- B21D 11/12 . . the articles being reinforcements for concrete
- B21D 11/125 . . . {Bending wire nets}

- B21D 11/14 . Twisting
- B21D 11/15 . . Reinforcing rods for concrete
- B21D 11/16 . . Crankshafts
- B21D 11/18 . Joggling
- B21D 11/20 . Bending sheet metal, not otherwise provided for
- B21D 11/203 . . {Round bending}
- B21D 11/206 . . {Curving corrugated sheets}
- B21D 11/22 . Auxiliary equipment, e.g. positioning devices
- B21D 13/00** **Corrugating sheet metal, rods or profiles; Bending sheet metal, rods or profiles into wave form (tubes [B21D 15/00](#))**
- B21D 13/02 . by pressing
- B21D 13/04 . by rolling
- B21D 13/045 . . {the corrugations being parallel to the feeding movement}
- B21D 13/06 . by drawing
- B21D 13/08 . by combined methods
- B21D 13/10 . into a peculiar profiling shape
- B21D 15/00** **Corrugating tubes (wrinkle-bending using mandrels or the like [B21D 9/14](#))**
- B21D 15/02 . longitudinally
- B21D 15/03 . . by applying fluid pressure
- B21D 15/04 . transversely, e.g. helically
- B21D 15/06 . . annularly {(with thinning [B21C 37/205](#))}
- B21D 15/10 . . by applying fluid pressure
- B21D 15/105 . . . {by applying elastic material}
- B21D 15/12 . Bending tubes into wave form
- B21D 17/00** **Forming single grooves in sheet metal or tubular or hollow articles**
- B21D 17/02 . by pressing (grooving or notching of bolts, studs, or the like [B21K 1/54](#))
- B21D 17/025 . . {by pressing tubes axially}
- B21D 17/04 . by rolling

B21D 19/00 **Flanging or other edge treatment, e.g. of tubes** (connecting by making use of folds [B21D 39/00](#); flaring-out tube ends [B21D 41/02](#))

- B21D 19/005 . {Edge deburring or smoothing}
- B21D 19/02 . by continuously-acting tools moving along the edge ([edge-curling B21D 19/12](#))
- B21D 19/04 .. shaped as rollers
- B21D 19/043 ... {for flanging edges of plates}
- B21D 19/046 ... {for flanging edges of tubular products}
- B21D 19/06 ... working inwardly
- B21D 19/08 . by single or successive action of pressing tools, e.g. vice jaws
- B21D 19/082 .. { for making negative angles}
- B21D 19/084 ... { with linear cams, e.g. aerial cams}
- B21D 19/086 ... { with rotary cams}
- B21D 19/088 .. { for flanging holes}
- B21D 19/10 .. working inwardly
- B21D 19/12 . Edge-curling
- B21D 19/14 .. Reinforcing edges, e.g. armouring same
- B21D 19/16 . Reverse flanging of tube ends

B21D 21/00 **Combined processes according to methods covered by groups [B21D 1/00](#) to [B21D 19/00](#)**

Stamping, Spinning, Deep-drawing; Working sheet metal of limited length by stretching; Punching

B21D 22/00 **Shaping without cutting, by stamping, spinning, or deep-drawing** (otherwise than using rigid devices or tools or yieldable or resilient pads [B21D 26/00](#))

- B21D 22/02 . Stamping using rigid devices or tools
- B21D 22/022 .. { by heating the blank or stamping associated with heat treatment (C21D takes precedence)}
- B21D 22/025 .. {for tubular articles}
- B21D 22/027 .. { for flattening the ends of corrugated sheets}
- B21D 22/04 .. for dimpling ([combined with perforating B21D 28/24](#))
- B21D 22/06 .. having relatively-movable die parts
- B21D 22/08 .. with die parts on rotating carriers
- B21D 22/10 . Stamping using yieldable or resilient pads
- B21D 22/105 .. {of tubular products}
- B21D 22/12 .. using enclosed flexible chambers

- B21D 22/125 . . . { of tubular products}
- B21D 22/14 . Spinning
- B21D 22/16 . . over shaping mandrels or formers
- B21D 22/18 . . using tools guided to produce the required profile
- B21D 22/185 . . . {making bombed objects}
- B21D 22/20 . Deep-drawing (special deep-drawing arrangements in, or in connection with, presses [B21D 24/00](#))
- B21D 22/201 . . {Work-pieces; preparation of the work-pieces, e.g. lubricating, coating}
- B21D 22/203 . . {of compound articles}
- B21D 22/205 . . {Hydro-mechanical deep-drawing}
- B21D 22/206 . . {articles from a strip in several steps, the articles being coherent with the strip during the operation}
- B21D 22/208 . . { by heating the blank or deep-drawing associated with heat treatment (C21D takes precedence)}
- B21D 22/21 . . without fixing the border of the blank
- B21D 22/22 . . with devices for holding the edge of the blanks ([B21D 22/24](#) to [B21D 22/30](#) take precedence; shaping over a die without external former [B21D 11/02](#))
- B21D 22/225 . . . {with members for radially pushing the blanks}
- B21D 22/24 . . involving two drawing operations having effects in opposite directions with respect to the blank
- B21D 22/26 . . for making peculiarly, e.g. irregularly, shaped articles
- B21D 22/28 . . of cylindrical articles using consecutive dies
- B21D 22/283 . . . { with ram and dies aligning means}
- B21D 22/286 . . . { with lubricating or cooling means}
- B21D 22/30 . . to finish articles formed by deep-drawing

B21D 24/00 Special deep-drawing arrangements in, or in connection with, presses

- B21D 24/005 . {Multi-stage presses}
- B21D 24/02 . Die-cushions
- B21D 24/04 . Blank holders; Mounting means therefor
- B21D 24/06 . . Mechanically spring-loaded blank holders
- B21D 24/08 . . Pneumatically or hydraulically loaded blank holders
- B21D 24/10 . Devices controlling or operating blank holders independently, or in conjunction with dies
- B21D 24/12 . . mechanically
- B21D 24/14 . . pneumatically or hydraulically
- B21D 24/16 . Additional equipment in association with the tools e.g. for shearing, for trimming

B21D 25/00 Working sheet metal of limited length by stretching, e.g. for straightening

B21D 25/02 . by pulling over a die

B21D 25/04 . Clamping arrangements

B21D 26/00 **Shaping without cutting otherwise than using rigid devices or tools or yieldable or resilient pads, i.e. applying fluid pressure or magnetic forces** ([stamping using resilient pads B21D 22/10](#))

B21D 26/02 . by applying fluid pressure M2010.12

B21D 26/021 . . Deforming sheet bodies

B21D 26/023 . . . including an additional treatment performed by fluid pressure, e.g. perforating

B21D 26/025 . . . Means for controlling the clamping or opening of the moulds

B21D 26/027 . . . Means for controlling fluid parameters, e.g. pressure or temperature

B21D 26/029 . . . Closing or sealing means

B21D 26/031 . . . Mould construction ([B21D 26/025](#) - [B21D 26/029](#) take precedence)

B21D 26/033 . . Deforming tubular bodies ([corrugating tubes by applying fluid pressure B21D 15/03](#), [B21D 15/10](#))

B21D 26/035 . . . including an additional treatment performed by fluid pressure, e.g. perforating

B21D 26/037 . . . Forming branched tubes

B21D 26/039 . . . Means for controlling the clamping or opening of the moulds

B21D 26/041 . . . Means for controlling fluid parameters, e.g. pressure or temperature

B21D 26/043 . . . Means for controlling the axial pusher

B21D 26/045 . . . Closing or sealing means

B21D 26/047 . . . Mould construction ([B21D 26/037](#) - [B21D 26/045](#) take precedence)

B21D 26/049 . . . Deforming bodies having a closed end

B21D 26/051 . . . Deforming double-walled bodies

B21D 26/053 . . characterised by the material of the blanks

B21D 26/055 . . . Blanks having super-plastic properties

B21D 26/057 . . . Tailored blanks

B21D 26/059 . . . Layered blanks

B21D 26/06 . . by shock waves

B21D 26/08 . . . generated by explosives, e.g. chemical explosives

B21D 26/10 . . . generated by evaporation, e.g. of wire, of liquids

B21D 26/12 . . . initiated by spark discharge

B21D 26/14 . applying magnetic forces

B21D 28/00 **Shaping by press-cutting; Perforating**

B21D 28/002 . {Drive of the tools ([B21D 28/007](#) and [B21D 28/20](#) take precedence)}

B21D 28/005 . . { Adjustment of the punch stroke for compensating wear}

B21D 28/007 . {Explosive cutting or perforating}

- B21D 28/02 . Punching blanks or articles with or without obtaining scrap ([cutting nails or pins from strips or sheet material B21G 3/26](#)); Notching
- B21D 28/04 . . Centering the work; Positioning the tools
- B21D 28/06 . . Making more than one part out of the same blank; Scrapless working
- B21D 28/08 . . . Zig-zag sequence working
- B21D 28/10 . . Incompletely punching in such a manner that the parts are still coherent with the work
- B21D 28/12 . . Punching using rotatable carriers
- B21D 28/125 . . . { [with multi-tools](#) }
- B21D 28/14 . . Dies ([ejecting or stripping-off devices arranged in punching machines or tools B21D 45/00](#))
- B21D 28/145 . . . { [with means for slug retention, e.g. a groove](#) }
- B21D 28/16 . . Shoulder or burr prevention { [, e.g. fine-blanking](#) }
- B21D 28/18 . . Yieldable, e.g. rubber, punching pads
- B21D 28/20 . . Applications of drives { [for reducing noise or wear](#) }
- B21D 28/22 . . Notching the peripheries of circular blanks, e.g. laminations for dynamo-electric machines

- B21D 28/24 . Perforating, i.e. punching holes
- B21D 28/243 . . { [in profiles](#) }
- B21D 28/246 . . { [Selection of punches](#) }
- B21D 28/26 . . in sheets or flat parts
- B21D 28/265 . . . { [with relative movement of sheet and tools enabling the punching of holes in predetermined locations of the sheet, e.g. holes punching with template](#) }
- B21D 28/28 . . in tubes or other hollow bodies
- B21D 28/285 . . . { [punching outwards](#) }
- B21D 28/30 . . in annular parts, e.g. rims
- B21D 28/32 . . in other articles of special shape
- B21D 28/325 . . . { [using cam or wedge mechanisms, e.g. aerial cams](#) }
- B21D 28/34 . . Perforating tools; Die holders
- B21D 28/343 . . . { [Draw punches](#) }
- B21D 28/346 . . . { [length adjustable perforating tools](#) }
- B21D 28/36 . . using rotatable work or tool holders

- B21D 31/00** **Other methods for working sheet metal, metal tubes, metal profiles** ([deforming one surface of tubes helically by rolling B21H 3/00](#); [upsetting B21J 5/08](#); [working metal by removing material therefrom B23](#); [embossing B44B](#))

- B21D 31/005 . { [Incremental shaping or bending, e.g. stepwise moving a shaping tool along the surface of the workpiece \(B21D 22/14 takes precedence\)](#) }

- B21D 31/02 . Stabbing or piercing, e.g. for making sieves ([dimpling B21D 22/04](#); [perforating by punching B21D 28/24](#))

- B21D 31/04 . Expanding other than provided for in groups [B21D 1/00](#) to [B21D 28/00](#), e.g. for

- making expanded metal ([B21D 47/00](#) takes precedence; enlarging tube ends [B21D 41/02](#))
- B21D 31/043 . . {Making use of slitting discs or punch cutters}
- B21D 31/046 . . {making use of rotating cutters}
- B21D 31/06 . Deforming sheet metal, tubes or profiles by sequential impacts, e.g. hammering, beating, peen forming ([forging hammers B21J 7/00](#))
- B21D 33/00** **Special measures in connection with working metal foils, e.g. gold foils** ([cutting or perforating of metal foil analogous to paper B26](#))
- B21D 35/00** **Combined processes according to { or processes combined with} methods covered by groups [B21D 1/00](#) to [B21D 31/00](#)**([B21D 21/00](#) takes precedence)
- B21D 35/001 . { Shaping combined with punching, e.g. stamping and perforating}
- B21D 35/002 . { Processes combined with methods covered by groups [B21D 1/00](#) to [B21D 31/00](#)}
- B21D 35/003 . . { Simultaneous forming, e.g. making more than one part per stroke ([B21D 26/06](#) takes precedence)}
- B21D 35/005 . . { characterized by the material of the blank or the workpiece ([B21D 26/053](#) takes precedence)}
- B21D 35/006 . . . { Blanks having varying thickness, e.g. tailored blanks}
- B21D 35/007 . . . { Layered blanks ([B21D 22/203](#) takes precedence; joining superposed plates [B21D 39/031](#), [B21D 39/034](#), [B21D 39/035](#))}
- B21D 35/008 . . { involving vibration, e.g. ultrasonic}
- B21D 37/00** **Tools as parts of machines covered by this subclass** (forms or constructions of tools uniquely adapted for particular operations, see the relevant groups for the operations)
- B21D 37/01 . Selection of materials
- B21D 37/02 . Die constructions enabling assembly of the die parts in different ways ([B21D 37/06](#) takes precedence)
- B21D 37/04 . Movable or exchangeable mountings for tools
- B21D 37/06 . . Pivotaly-arranged tools, e.g. disengageable ([die sets with dies pivoted to one another B21D 37/12](#))
- B21D 37/08 . Dies with different parts for several steps in a process
- B21D 37/10 . Die sets; Pillar guides
- B21D 37/12 . . Particular guiding equipment, {e.g. pliers}; Special arrangements for interconnection or co-operation of dies
- B21D 37/14 . Particular arrangements for handling and holding in place complete dies
- B21D 37/142 . . {Spotting presses}
- B21D 37/145 . . {Die storage magazines}

- B21D 37/147 . . { Tool exchange carts}
- B21D 37/16 . Heating or cooling
- B21D 37/18 . Lubricating, { e.g. lubricating tool and workpiece simultaneously (lubricating workpieces for deep-drawing [B21D 22/201](#))}
- B21D 37/20 . Making tools by operations not covered by a single other subclass
- B21D 37/205 . . {Making cutting tools}

- B21D 39/00** **Application of procedures in order to connect objects or parts, e.g. coating with sheet metal otherwise than by plating** ({ joining mitred profiles [B21D 53/745](#);} riveting [B21J](#); uniting components by forging or pressing to form integral members [B21K 25/00](#); welding [B23K](#); press-fitting, force-fitting, or shrinking in general [B23P 11/00](#), [B21D 19/00](#); by adhesives [F16B 11/00](#); { Connections as such [F16L](#), [F16B](#)}); **Tube expanders**

- B21D 39/02 . of sheet metal by folding, e.g. connecting edges of a sheet to form a cylinder
- B21D 39/021 . . {for panels, e.g. vehicle doors}
- B21D 39/023 . . . { using rollers}
- B21D 39/025 . . {Hand tools}
- B21D 39/026 . . { Reinforcing the connection by locally deforming}
- B21D 39/028 . . { Reinforcing the connection otherwise than by deforming, e.g. welding}

- B21D 39/03 . of sheet metal otherwise than by folding
- B21D 39/031 . . {Joining superposed plates by locally deforming without slitting or piercing}
- B21D 39/032 . . . {by fitting a projecting part integral with one plate in a hole of the other plate}
- B21D 39/034 . . {Joining superposed plates by piercing}
- B21D 39/035 . . {Joining superposed plates by slitting}
- B21D 39/037 . . {Interlocking butt joints}
- B21D 39/038 . . {Perpendicular plate connections}

- B21D 39/04 . of tubes with tubes; of tubes with rods {(crimped pipe joints as such [F16L 13/14](#))}
- B21D 39/042 . . {using explosives (by explosive welding [B23K 20/08](#))}
- B21D 39/044 . . {perpendicular}
- B21D 39/046 . . {Connecting tubes to tube-like fittings}
- B21D 39/048 . . {using presses for radially crimping tubular elements}

- B21D 39/06 . of tubes in openings, e.g. rolling-in
- B21D 39/063 . . {for assembling ladders}
- B21D 39/066 . . {using explosives}

- B21D 39/08 . Tube expanders
- B21D 39/10 . . with rollers for expanding only
- B21D 39/12 . . with rollers for expanding and flanging
- B21D 39/14 . . with balls
- B21D 39/16 . . with torque limiting devices

- B21D 39/18 . . . Rollers of special shape
- B21D 39/20 . . . with mandrels, e.g. expandable
- B21D 39/203 . . . {expandable by fluid or elastic material}
- B21D 39/206 { by axially compressing the elastic material}

B21D 41/00 **Application of procedures in order to alter the diameter of tube ends** ([B21D 39/00](#) takes precedence; { plastic tubes [B29C 57/08](#)})

- B21D 41/02 . Enlarging
- B21D 41/021 . . {by means of tube-flaring hand tools}
- B21D 41/023 . . . {comprising rolling elements}
- B21D 41/025 . . {by means of impact-type swaging hand tools}
- B21D 41/026 . . { by means of mandrels}
- B21D 41/028 . . . { expandable mandrels}
- B21D 41/04 . Reducing; Closing
- B21D 41/045 . . {Closing}

B21D 43/00 **Feeding, positioning or storing devices combined with, or arranged in, or specially adapted for use in connection with, apparatus for working or processing sheet metal, metal tubes or metal profiles; Associations therewith of cutting devices** (cutting devices associated with the tool, [see the relevant group for the tool](#))

- B21D 43/003 . {Positioning devices ([B21D 28/04](#) and [B21D 28/265](#) take precedence; stops [B21D 43/26](#); centering moving strips [B21D 43/023](#))}
- B21D 43/006 . {Feeding elongated articles, such as tubes, bars, or profiles}
- B21D 43/02 . Advancing work in relation to the stroke of the die or tool
- B21D 43/021 . . {Control or correction devices in association with moving strips}
- B21D 43/022 . . . {Loop-control}
- B21D 43/023 . . . {Centering devices, e.g. edge guiding}
- B21D 43/025 . . {Fault detection, e.g. misfeed detection}
- B21D 43/026 . . {Combination of two or more feeding devices provided for in [B21D 43/04](#) to [B21D 43/18](#)}
- B21D 43/027 . . {Combined feeding and ejecting devices}
- B21D 43/028 . . {Tools travelling with material, e.g. flying punching machines}
- B21D 43/04 . . by means in mechanical engagement with the work
- B21D 43/05 . . . specially adapted for multi-stage presses {([B21D 43/145](#) takes precedence)}
- B21D 43/052 { Devices having a cross bar}
- B21D 43/055 {Devices comprising a pair of longitudinally and laterally movable parallel transfer bars}
- B21D 43/057 {Devices for exchanging transfer bars or grippers; Idle stages, e.g. exchangeable}
- B21D 43/06 . . . by positive or negative engaging parts co-operating with corresponding parts of the sheet or the like to be processed, e.g. carrier bolts or grooved section in the

- carriers
- B21D 43/08 . . . by rollers {(B21D 43/145 takes precedence)}
- B21D 43/09 by one or more pairs of rollers for feeding sheet or strip material
- B21D 43/10 . . . by grippers {(B21D 43/055, B21D 43/057, B21D 43/145 take precedence)}
- B21D 43/105 {Manipulators, i.e. mechanical arms carrying a gripper element having several degrees of freedom}
- B21D 43/11 for feeding sheet or strip material
- B21D 43/12 . . . by chains or belts {(B21D 43/145 takes precedence)}
- B21D 43/13 . . . by linearly moving tables
- B21D 43/14 . . . by turning devices, e.g. turn-tables
- B21D 43/145 {Turnover devices, i.e. by turning about a substantially horizontal axis}
- B21D 43/16 . . by gravity, e.g. chutes
- B21D 43/18 . . by means in pneumatic or magnetic engagement with the work
- B21D 43/20 . Storage arrangements; Piling or unpling (in general B65G, {B65H})
- B21D 43/22 . . Devices for piling sheets
- B21D 43/24 . . Devices for removing sheets from a stack
- B21D 43/26 . Stops
- B21D 43/28 . Associations of cutting devices therewith
- B21D 43/282 . . {Discharging crop ends or the like}
- B21D 43/285 . . {Devices for handling elongated articles, e.g. bars, tubes or profiles (B21D 43/282, B21D 43/287 take precedence)}
- B21D 43/287 . . {Devices for handling sheet or strip material (B21D 43/282 takes precedence)}

B21D 45/00 Ejecting or stripping-off devices arranged in machines or tools dealt with in this subclass

- B21D 45/003 . {in punching machines or punching tools}
- B21D 45/006 . . {Stripping-off devices}
- B21D 45/02 . Ejecting devices
- B21D 45/04 . . interrelated with motion of tool
- B21D 45/06 . Stripping-off devices
- B21D 45/065 . . { for deep-drawn cans; e.g. using stripping fingers}
- B21D 45/08 . . interrelated with motion of tool
- B21D 45/10 . Combined ejecting and stripping-off devices

Processing sheet metal or metal tubes, or processing metal profiles according to any of groups B21D 1/00 - B21D 45/00, in the manufacture of finished or semi-finished articles

B21D 47/00 **Making rigid structural elements or units, e.g. honeycomb structures**

- B21D 47/005 . {Making gratings}
- B21D 47/01 . beams or pillars
- B21D 47/02 . . by expanding
- B21D 47/04 . composite sheet metal profiles

B21D 49/00 **Sheathing or stiffening objects** (by winding wire or tape thereon [B65H 54/00](#), [B65H 81/00](#); specially adapted for manufacturing conductors or cables [H01B 13/26](#))

- B21D 49/005 . {Hollow objects}

B21D 51/00 **Making hollow objects** (from thick-walled or non uniform tubes [B21K 21/00](#))

- B21D 51/02 . characterised by the structure of the objects {([B21D 51/26](#) takes precedence)}

NOTE

Making hollow objects characterised both by their structure and by their use is classified only in group [B21D 51/16](#)

- B21D 51/04 . . built-up objects, e.g. objects with rigidly-attached bottom or cover
- B21D 51/06 . . folded objects
- B21D 51/08 . . ball-shaped objects
- B21D 51/10 . . conically or cylindrically shaped objects
- B21D 51/12 . . objects with corrugated walls
- B21D 51/14 . . Flattening hollow objects for transport or storage; Re-forming same (making tubes from doubled flat material [B21C 37/14](#))
- B21D 51/16 . characterised by the use of the objects (making heat exchangers [B21D 53/02](#))
- B21D 51/18 . . vessels, e.g. tubs, vats, tanks, sinks, or the like
- B21D 51/20 . . . barrels
- B21D 51/22 . . . pots, e.g. for cooking
- B21D 51/24 . . high-pressure containers, e.g. boilers, bottles
- B21D 51/26 . . cans or tins; Closing same in a permanent manner (making outlet arrangements [B21D 51/38](#); welding or soldering [B23K](#))
- B21D 51/2607 . . . { Locally embossing the walls of formed can bodies ([B44B 5/00](#), [B44C 1/24](#), [B44C 3/085](#) take precedence; bulging [B21D 51/2646](#))}
- B21D 51/2615 . . . {Edge treatment of cans or tins}
- B21D 51/2623 { Curling}
- B21D 51/263 { Flanging}
- B21D 51/2638 { Necking}
- B21D 51/2646 . . . {Of particular non cylindrical shape, e.g. conical, rectangular, polygonal, bulged}

- B21D 51/2653 . . . {Methods or machines for closing cans by applying caps or bottoms}
- B21D 51/2661 {Sealing or closing means therefor}
- B21D 51/2669 . . . {Transforming the shape of formed can bodies; Forming can bodies from flattened tubular blanks; Flattening can bodies}
- B21D 51/2676 . . . {Cans or tins having longitudinal or helical seams}
- B21D 51/2684 . . . {Cans or tins having circumferential side seams}
- B21D 51/2692 . . . {Manipulating, e.g. feeding and positioning devices; Control systems}
- B21D 51/28 . . . Folding the longitudinal seam
- B21D 51/30 . . . Folding the circumferential seam
- B21D 51/32 by rolling
- B21D 51/34 by pressing
- B21D 51/36 . . . collapsible or like thin-walled tubes, e.g. for toothpaste
- B21D 51/365 . . . {involving fixing closure members to the tubes, e.g. nozzles}
- B21D 51/38 . . . Making inlet or outlet arrangements of cans, tins, baths, bottles, or other vessels; Making can ends; Making closures
- B21D 51/383 . . . { scoring lines, tear strips or pulling tabs}
- B21D 51/386 {on the side-wall of containers}
- B21D 51/40 . . . Making outlet openings, e.g. bung holes
- B21D 51/42 Making or attaching spouts
- B21D 51/44 . . . Making closures, e.g. caps (folded of thin metal foils in the way of making paper caps [B31D 5/00](#); making closures in conjunction with applying same [B67B](#))
- B21D 51/443 {easily removable closures, e.g. by means of tear strips}
- B21D 51/446 {Feeding or removal of material}
- B21D 51/46 Placing sealings or sealing material {(moulding plastic sealing material into closure members [B29C 67/18E2](#))}
- B21D 51/48 Making crown caps
- B21D 51/50 Making screw caps
- B21D 51/52 . . . boxes, cigarette cases, or the like
- B21D 51/54 . . . cartridge cases, e.g. for ammunition, for letter carriers in pneumatic-tube plants

- B21D 53/00** **Making other particular articles** (making wire fabrics [B21F](#); making chains or chain parts [B21L](#))

- B21D 53/02 . . . heat exchangers { or parts thereof}, e.g. radiators, condensers { fins, headers}(making finned or ribbed tubes by fixing strip material or the like to tubes [B21C 37/22](#))
- B21D 53/022 . . . { Making the fins}
- B21D 53/025 . . . { Louvered fins}
- B21D 53/027 . . . {by helically or spirally winding elongated elements}
- B21D 53/04 . . . of sheet metal
- B21D 53/045 . . . {by inflating partially united plates}
- B21D 53/06 . . . of metal tubes
- B21D 53/08 . . . of both metal tubes and sheet metal (connecting tubes in openings [B21D 39/06](#))
- B21D 53/085 . . . {with fins places on zig-zag tubes or parallel tubes}

- B21D 53/10 . parts of bearings; sleeves; valve seats or the like
- B21D 53/12 . . cages for bearings
- B21D 53/14 . belts, e.g. machine-gun belts
- B21D 53/16 . rings, e.g. barrel hoops
- B21D 53/18 . . of hollow or C-shaped cross-section, e.g. for curtains, for eyelets
- B21D 53/20 . . washers, e.g. for sealing
- B21D 53/22 . . . with means for preventing rotation
- B21D 53/24 . nuts or like thread-engaging members
- B21D 53/26 . wheels or the like
- B21D 53/261 . . { pulleys}
- B21D 53/262 . . {with inscriptions or the like, e.g. printing wheels}
- B21D 53/264 . . { wheels out of a single piece (B21D 53/261 takes precedence)}
- B21D 53/265 . . { parts of wheels (B21D 53/28, B21D 53/30 take precedence)}
- B21D 53/267 . . { blower wheels, i.e. wheels provided with fan elements}
- B21D 53/268 . . { wheels having spokes}
- B21D 53/28 . . gear wheels
- B21D 53/30 . . wheel rims
- B21D 53/32 . . wheel covers
- B21D 53/34 . . brake drums
- B21D 53/36 . clips, clamps, or like fastening or attaching devices, e.g. for electric installation
- B21D 53/38 . locksmith`s goods, e.g. handles
- B21D 53/40 . . hinges, e.g. door hinge plates
- B21D 53/42 . . keys {(making keys by combined operations B23P 15/005)}
- B21D 53/44 . fancy goods, e.g. jewellery products
- B21D 53/46 . haberdashery, e.g. buckles, combs; pronged fasteners, e.g. staples
- B21D 53/48 . . buttons, e.g. press-buttons, snap fasteners
- B21D 53/50 . . metal slide-fastener parts
- B21D 53/52 . . . fastener elements; Attaching such elements so far as this procedure is combined with the process for making the elements
- B21D 53/54 . . . slides
- B21D 53/56 . . . stops
- B21D 53/58 . end-pieces for laces or ropes
- B21D 53/60 . cutlery wares; garden tools or the like
- B21D 53/62 . . spoons; table forks
- B21D 53/64 . . knives; scissors; cutting blades (B21D 53/72 takes precedence; handle portions B21D 53/70)

B21D 53/642	... { scissors}
B21D 53/645	... { safety razor blades}
B21D 53/647	... { mower blades}
B21D 53/66	.. spades; shovels (handle portions B21D 53/70)
B21D 53/68	.. rakes, garden forks, or the like (handle portions B21D 53/70)
B21D 53/70	.. handle portions (B21D 53/72 takes precedence)
B21D 53/72	.. sickles; scythes
B21D 53/74	. frames for openings, e.g. for windows, doors, handbags
B21D 53/745	.. {Joining mitred profiles comprising punching the profiles on a corner-angle connecting piece}
B21D 53/76	. writing or drawing instruments, e.g. writing pens, erasing pens
B21D 53/78	. propeller blades; turbine blades
B21D 53/80	. dustproof covers; safety covers
B21D 53/82	. perforated music sheets; pattern sheets, e.g. for control purposes, stencils
B21D 53/84	. other parts for engines, e.g. connecting-rods
B21D 53/845	.. {Making camshafts}
B21D 53/86	. other parts for bicycles or motorcycles
B21D 53/88	. other parts for vehicles, e.g. cowlings, mudguards
B21D 53/883	.. {reflectors}
B21D 53/886	.. {leaf springs}
B21D 53/90	.. axle-housings
B21D 53/92	. other parts for aircraft
B21D 55/00	Safety devices protecting the machine or the operator, specially adapted for apparatus or machines dealt with in this subclass (for presses in general B30B ; safety devices in general F16P)