

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

WORKING OR PROCESSING OF SHEET METAL OR METAL TUBES, RODS OR PROFILES WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING METAL ([working or processing of wire B21F](#))

NOTES

1. This subclass covers cutting or perforating of sheet metal or other stock material
2. 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 . Jogging
 - 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
- 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 70/80](#))}
- 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 placed 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)