

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	<ul style="list-style-type: none"> of sheet metal by folding, e.g. connecting edges of a sheet to form a cylinder
B21D 39/021	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {for panels, e.g. vehicle doors}
B21D 39/023	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {using rollers}
B21D 39/025	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Hand tools}
B21D 39/026	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Reinforcing the connection by locally deforming}
B21D 39/028	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Reinforcing the connection otherwise than by deforming, e.g. welding}
B21D 39/03	<ul style="list-style-type: none"> of sheet metal otherwise than by folding
B21D 39/031	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Joining superposed plates by locally deforming without slitting or piercing}
B21D 39/032	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {by fitting a projecting part integral with one plate in a hole of the other plate}
B21D 39/034	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Joining superposed plates by piercing}
B21D 39/035	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Joining superposed plates by slitting}
B21D 39/037	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Interlocking butt joints}
B21D 39/038	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Perpendicular plate connections}
B21D 39/04	<ul style="list-style-type: none"> of tubes with tubes; of tubes with rods {(crimped pipe joints as such F16L 13/14)}
B21D 39/042	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {using explosives (by explosive welding B23K 20/08)}
B21D 39/044	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {perpendicular}
B21D 39/046	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {Connecting tubes to tube-like fittings}
B21D 39/048	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {using presses for radially crimping tubular elements}
B21D 39/06	<ul style="list-style-type: none"> of tubes in openings, e.g. rolling-in
B21D 39/063	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {for assembling ladders}
B21D 39/066	<ul style="list-style-type: none"> <ul style="list-style-type: none"> {using explosives}
B21D 39/08	<ul style="list-style-type: none"> Tube expanders
B21D 39/10	<ul style="list-style-type: none"> <ul style="list-style-type: none"> with rollers for expanding only
B21D 39/12	<ul style="list-style-type: none"> <ul style="list-style-type: none"> with rollers for expanding and flanging
B21D 39/14	<ul style="list-style-type: none"> <ul style="list-style-type: none"> with balls
B21D 39/16	<ul style="list-style-type: none"> <ul style="list-style-type: none"> with torque limiting devices
B21D 39/18	<ul style="list-style-type: none"> <ul style="list-style-type: none"> Rollers of special shape
B21D 39/20	<ul style="list-style-type: none"> <ul style="list-style-type: none"> with mandrels, e.g. expandable
B21D 39/203	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> {expandable by fluid or elastic material}
B21D 39/206	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> {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	<ul style="list-style-type: none"> 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 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](#))