

**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](#)

**Guidance heading:** 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](#)**

**Guidance heading:** **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

**Guidance heading:** 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 ( <a href="#">B21D 53/261</a> takes precedence ) }
B21D 53/265	.. { parts of wheels ( <a href="#">B21D 53/28</a> , <a href="#">B21D 53/30</a> 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 { ( <a href="#">making keys by combined operations B23P 15/005</a> ) }
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 ( <a href="#">B21D 53/72</a> takes precedence; handle portions <a href="#">B21D 53/70</a> )
B21D 53/642	... { scissors }
B21D 53/645	... { safety razor blades }
B21D 53/647	... { mower blades }
B21D 53/66	.. spades ; shovels ( <a href="#">handle portions B21D 53/70</a> )
B21D 53/68	.. rakes, garden forks, or the like ( <a href="#">handle portions B21D 53/70</a> )
B21D 53/70	.. handle portions ( <a href="#">B21D 53/72</a> 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](#) )**