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

3/06 . . arranged inclined to a revolving flier rolling frame
3/08 . . which move in an orbit without rotating round the work
3/10 . . between rams and anvils or abutments
3/12 . . by stretching with or without twisting (by twisting only B21D 11/14)
3/14 . . Recontouring
3/16 . . of specific articles made from metal rods, tubes, or profiles, e.g. crankshafts, by specially adapted methods or means

5/00 Bending sheet metal along straight lines, e.g. to form simple curves (B21D 11/06 - B21D 11/18 take precedence; corrugating sheet metal B21D 13/00; as edge treatment B21D 19/00)
5/002 . . [Positioning devices]
5/004 . . [with program control]
5/006 . . [combined with measuring of bends]
5/008 . . [combined with heating or cooling of the bends]
5/01 . . between rams and anvils or abutments
5/015 . . [for making tubes]
5/02 . . on press brakes without making use of clamping means
5/0209 . . [Tools therefor]
5/0218 . . . [Length adjustment of the punch]
5/0227 . . . [Length adjustment of the die]
5/0236 . . . [Tool clamping]
5/0245 . . . [Fluid operated]
5/0254 . . . [Tool exchanging]
5/0263 . . . [Die with two oscillating halves]
5/0272 . . . [Deflection compensating means]
5/0281 . . . [Workpiece supporting devices]
5/029 . . . [with shearing devices]
Straightening; Restoring form; Bending; Corrugating; Flanging

B21D

9/00 Bending tubes using mandrels or the like (B21D 11/02 - B21D 11/18 take precedence)

9/01 the mandrel being flexible and engaging the entire tube length
9/03 and built-up from loose elements, e.g. series of balls
9/04 the mandrel being rigid
9/05 co-operating with forming members
9/055 (Construction of forming members having more than one groove)

9/07 with one or more swinging forming members engaging tube ends only
9/073 (with one swinging forming member)
9/076 (with more swinging forming members)
9/08 in press brakes or between rams and anvils or abutments; Pliers with forming dies
9/085 (Pliers with forming dies)
9/10 by passing between rollers
9/12 by pushing over a curved mandrel; by pushing through a curved die
9/125 by pushing through a curved die
9/14 Wrinkle-bending, i.e. bending by corrugating
9/15 using filling material of indefinite shape, e.g. sand, plastic material (filling of tubes with such material B21D 9/16)
9/16 Auxiliary equipment, e.g. machines for filling tubes with sand
9/165 (Machines for filling tubes with sand)
9/18 for heating or cooling of bends

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 - B21D 9/00 (corrugating or bending into wave form B21D 13/00, B21D 15/00; flanging B21D 19/00); Twisting

11/02 Bending by stretching or pulling over a die (working sheet metal of limited length by stretching B21D 25/00)
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)
11/07 Making serpentine-shaped articles by bending essentially in one plane
11/08 Bending by altering the thickness of part of the cross-section of the work (B21D 11/06 takes precedence)
11/085 (by locally stretching or upsetting)
11/10 Bending specially adapted to produce specific articles, e.g. leaf springs (making or bending leaf springs B21D 53/886)
11/12 the articles being reinforcements for concrete
11/125 (Bending wire nets)
11/14 Twisting
11/15 Reinforcing rods for concrete
11/16 Crankshafts
11/18 Joggling
11/20 Bending sheet metal, not otherwise provided for
11/203 (Round bending)
11/206 (Curving corrugated sheets)
11/22 Auxiliary equipment, e.g. positioning devices

13/00 Corrugating sheet metal, rods or profiles; Bending sheet metal, rods or profiles into wave form (tubes B21D 15/00)

13/02 by pressing
13/04 by rolling
13/045 (the corrugations being parallel to the feeding movement)
13/06 by drawing
13/08 by combined methods
13/10 into a peculiar profiling shape

15/00 Corrugating tubes (wrinkle-bending using mandrels or the like B21D 9/14)
15/02 . longitudinally
15/03 . by applying fluid pressure
15/04 . transversely, e.g. helically
15/06 . annularly (with thinning B21C 37/205)
15/10 . by applying fluid pressure
15/105 . by applying elastic material
15/12 . Bending tubes into wave form

17/00 Forming single grooves in sheet metal or tubular or hollow articles
17/02 . by pressing (grooving or notching of bolts, studs, or the like B21K 1/54)
17/025 . by pressing tubes axially
17/04 . by rolling

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

21/00 Combined processes according to methods covered by groups B21D 1/00 - B21D 19/00

Stamping, Spinning, Deep-drawing; Working sheet metal of limited length by stretching; Punching
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
22/02 . Stamping using rigid devices or tools
22/022 . (by heating the blank or stamping associated with heat treatment (C21D takes precedence))
22/025 . for tubular articles
22/027 . for flattening the ends of corrugated sheets
22/04 . for dimpling (combined with perforating B21D 28/24)
22/06 . having relatively-movable die parts
22/08 . with die parts on rotating carriers
22/10 . Stamping using yieldable or resilient pads
22/105 . (of tubular products)
22/12 . using enclosed flexible chambers
22/125 . (of tubular products)
22/14 . Spinning
22/16 . over shaping mandrels or formers
22/18 . using tools guided to produce the required profile
22/185 . (making bombed objects)
22/20 . Deep-drawing (special deep-drawing arrangements in, or in connection with, presses B21D 24/00)
22/201 . (Work-pieces; preparation of the work-pieces, e.g. lubricating, coating)
22/203 . (of compound articles)
22/205 . (Hydro-mechanical deep-drawing)
22/206 . (articles from a strip in several steps, the articles being coherent with the strip during the operation)
22/208 . (by heating the blank or deep-drawing associated with heat treatment (C21D takes precedence))
22/21 . without fixing the border of the blank
22/22 . with devices for holding the edge of the blanks (B21D 22/24 - B21D 22/30 take precedence; shaping over a die without external former B21D 11/02)
22/225 . (with members for radially pushing the blanks)
22/24 . involving two drawing operations having effects in opposite directions with respect to the blank
22/26 . for making peculiarly, e.g. irregularly, shaped articles
22/28 . of cylindrical articles using consecutive dies
22/283 . with ram and dies aligning means
22/286 . (with lubricating or cooling means)
22/30 . to finish articles formed by deep-drawing

24/00 Special deep-drawing arrangements in, or in connection with, presses
24/005 . (Multi-stage presses)
24/02 . Die-cushions
24/04 . Blank holders; Mounting means therefor
24/06 . Mechanically spring-loaded blank holders
24/08 . Pneumatically or hydraulically loaded blank holders
24/10 . Devices controlling or operating blank holders independently, or in conjunction with dies
24/12 . Mechanically
24/14 . Pneumatically or hydraulically
24/16 . Additional equipment in association with the tools, e.g. for shearing, for trimming

25/00 Working sheet metal of limited length by stretching, e.g. for straightening
25/02 . by pulling over a die
25/04 . Clamping arrangements

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)
26/02 . by applying fluid pressure
26/021 . Deforming sheet bodies
26/023 . including an additional treatment performed by fluid pressure, e.g. perforating
26/025 . Means for controlling the clamping or opening of the moulds
26/027 . Means for controlling fluid parameters, e.g. pressure or temperature
26/029 . Closing or sealing means
26/031 . Mould construction (B21D 26/025 - B21D 26/029 take precedence)
26/033 . Deforming tubular bodies (corrugating tubes by applying fluid pressure B21D 15/03, B21D 15/10)
26/035 . including an additional treatment performed by fluid pressure, e.g. perforating
26/037 . Forming branched tubes
Stamping, Spinning, Deep-drawing; Working sheet metal of limited length by stretching; Punching

26/039 . . . Means for controlling the clamping or opening of the moulds
26/041 . . . Means for controlling fluid parameters, e.g. pressure or temperature
26/043 . . . Means for controlling the axial pusher
26/045 . . . Closing or sealing means
26/047 . . . Mould construction
(B21D 26/037 - B21D 26/045 take precedence)
26/049 . . . Deforming bodies having a closed end
26/051 . . . Deforming double-walled bodies
26/053 . . . characterised by the material of the blanks
26/055 . . . Blanks having super-plastic properties
26/057 . . . Tailored blanks
26/059 . . . Layered blanks
26/06 . . . by shock waves
26/08 . . . generated by explosives, e.g. chemical explosives
26/10 . . . generated by evaporation, e.g. of wire, of liquids
26/12 . . . initiated by spark discharge
26/14 . . . applying magnetic forces
28/00 Shaping by press-cutting; Perforating
28/002 . . . [Drive of the tools (B21D 28/007 and B21D 28/20 take precedence)]
28/005 . . . [Adjustment of the punch stroke for compensating wear]
28/007 . . . [Explosive cutting or perforating]
28/02 . . . Punching blanks or articles with or without obtaining scrap (cutting nails or pins from strips or sheet material B21G 3/26); Notching
28/04 . . . Centering the work; Positioning the tools
28/06 . . . Making more than one part out of the same blank; Scrapless working
28/08 . . . Zig-zag sequence working
28/10 . . . Incompletely punching in such a manner that the parts are still coherent with the work
28/12 . . . Punching using rotatable carriers
28/125 . . . [with multi-tools]
28/14 . . . Dies (ejecting or stripping-off devices arranged in punching machines or tools B21D 45/00)
28/145 . . . [with means for slug retention, e.g. a groove]
28/16 . . . Shoulder or burr prevention [, e.g. fine-blanking]
28/18 . . . Yieldable, e.g. rubber, punching pads
28/20 . . . Applications of drives [for reducing noise or wear]
28/22 . . . Notching the peripheries of circular blanks, e.g. laminations for dynamo-electric machines
28/24 . . . Perforating, i.e. punching holes
28/243 . . . [in profiles]
28/246 . . . [Selection of punches]
28/26 . . . in sheets or flat parts
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]
28/28 . . . in tubes or other hollow bodies
28/285 . . . [punching outwards]
28/30 . . . in annular parts, e.g. rings
28/32 . . . in other articles of special shape
28/325 . . . [using cam or wedge mechanisms, e.g. aerial cams]
28/34 . . . Perforating tools; Die holders
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 B21E, 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

39/02 . of sheet metal by folding, e.g. connecting edges of a sheet to form a cylinder

39/021 . {for panels, e.g. vehicle doors}

39/023 . . {using rollers}

39/025 . . {Hand tools}

39/026 . . {Reinforcing the connection by locally deforming}

39/028 . . {Reinforcing the connection otherwise than by deforming, e.g. welding}

39/03 . of sheet metal otherwise than by folding

39/031 . . {Joining superposed plates by locally deforming without slitting or piercing}

39/032 . . . {by fitting a projecting part integral with one plate in a hole of the other plate}

39/034 . . . {Joining superposed plates by piercing}

39/035 . . . {Joining superposed plates by slitting}

39/037 . . . {Interlocking butt joints}

39/038 . . . {Perpendicular plate connections}

39/04 . . of tubes with tubes; of tubes with rods (crimped pipe joints as such F16L 13/14)

39/042 . . . {using explosives (by explosive welding B23K 2008)}

39/044 . . . {perpendicular}

39/046 . . . {Connecting tubes to tube-like fittings}

39/048 . . . {using presses for radially crimping tubular elements}

39/06 . . of tubes in openings, e.g. rolling-in

39/063 . . . {for assembling ladders}

39/066 . . . {using explosives}

39/08 . . Tube expanders

39/10 . . with rollers for expanding only

39/12 . . with rollers for expanding and flanging

39/14 . . with balls

39/16 . . with torque limiting devices

39/18 . . Rollers of special shape

39/20 . . with mandrels, e.g. expandable

39/203 . . . {expandable by fluid or elastic material}

39/206 . . . . {by axially compressing the elastic material}

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

41/02 . . Enlarging

41/021 . . . {by means of tube-flaring hand tools}

41/023 . . . {comprising rolling elements}

41/025 . . . {by means of impact-type swaging hand tools}

41/026 . . . {by means of mandrels}

41/028 . . . {expandable mandrels}

41/04 . . Reducing; Closing

41/045 . . . {Closing}

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)

43/003 . . {Positioning devices (B21D 28/04 and B21D 28/265 take precedence; stops B21D 43/26; centering moving strips B21D 43/023)}

43/006 . . {Feeding elongated articles, such as tubes, bars, or profiles}

43/02 . . Advancing work in relation to the stroke of the die or tool

43/021 . . . {Control or correction devices in association with moving strips}

43/022 . . . . {Loop-control}

43/023 . . . . {Centering devices, e.g. edge guiding}

43/025 . . . . {Fault detection, e.g. misfeed detection}

43/026 . . . . {Combination of two or more feeding devices provided for in B21D 43/04 - B21D 43/18}

43/027 . . . . {Combined feeding and ejecting devices}

43/028 . . . . {Tools travelling with material, e.g. flying punching machines}

43/04 . . . by means in mechanical engagement with the work

43/05 . . . specially adapted for multi-stage presses (B21D 43/145 takes precedence)

43/052 . . . . . {Devices having a cross bar}

43/055 . . . . . {Devices comprising a pair of longitudinally and laterally movable parallel transfer bars}

43/057 . . . . . {Devices for exchanging transfer bars or grippers; Idle stages, e.g. exchangeable}

43/06 . . . . . by positive or negative engaging parts cooperating with corresponding parts of the sheet or the like to be processed, e.g. carrier bolts or grooved section in the carriers

43/08 . . . . . by rollers (B21D 43/145 takes precedence)

43/09 . . . . . by one or more pairs of rollers for feeding sheet or strip material

43/10 . . . . by grippers (B21D 43/055, B21D 43/057, B21D 43/145 takes precedence)

43/105 . . . . . {Manipulators, i.e. mechanical arms carrying a gripper element having several degrees of freedom}

43/11 . . . . . for feeding sheet or strip material

43/12 . . . . by chains or belts (B21D 43/145 takes precedence)

43/13 . . . by linearly moving tables

43/14 . . by turning devices, e.g. turn-tables

43/145 . . . . {Turnover devices, i.e. by turning about a substantially horizontal axis}
the manufacture of finished or semi-finished articles
profiles according to any of groups

45/00

Ejecting or stripping-off devices arranged in machines or tools dealt with in this subclass

45/003 . [in punching machines or punching tools]
45/006 . [Stripping-off devices]
45/02 . Ejecting devices
45/04 . interrelated with motion of tool
45/06 . Stripping-off devices
45/065 . [for deep-drawn cans, e.g. using stripping fingers]
45/08 . interrelated with motion of tool
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

47/00

Making rigid structural elements or units, e.g. honeycomb structures

47/005 . [Making gratings]
47/01 . beams or pillars
47/02 . by expanding
47/04 . composite sheet metal profiles

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)

49/005 . [Hollow objects]

51/00

Making hollow objects (from thick-walled or non-uniform tubes B21K 21/00)

51/02 . characterised by the structure of the objects

NOTE

Making hollow objects characterised both by their structure and by their use is classified only in group B21D 51/16

51/04 . built-up objects, e.g. objects with rigidly-attached bottom or cover
51/06 . folded objects
51/08 . ball-shaped objects
51/10 . conically or cylindrically shaped objects
51/12 . objects with corrugated walls
51/14 . Flattening hollow objects for transport or storage; Re-forming same (making tubes from doubled flat material B21C 37/14)
51/16 . characterised by the use of the objects (making heat exchangers B21D 53/02)

51/18 . vessels, e.g. tubs, vats, tanks, sinks, or the like
51/20 . barrels
51/22 . pots, e.g. for cooking
51/24 . high-pressure containers, e.g. boilers, bottles
51/26 . cans or tins; Closing same in a permanent manner (making outlet arrangements B21D 51/38; welding or soldering B23K)

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)]
51/2615 . [Edge treatment of cans or tins]
51/2623 . [Curling]
51/263 . [Flanging]
51/2638 . [Necking]
51/2646 . [Of particular non-cylindrical shape, e.g. conical, rectangular, polygonal, bulged]
51/2653 . [Methods or machines for closing cans by applying caps or bottoms]
51/2661 . [Sealing or closing means thereof]
51/2669 . [Transforming the shape of formed can bodies; Forming can bodies from flattened tubular blanks; Flattening can bodies]
51/2676 . [Cans or tins having longitudinal or helical seams]
51/2684 . [Cans or tins having circumferential side seams]
51/2692 . [Manipulating, e.g. feeding and positioning devices; Control systems]
51/28 . Folding the longitudinal seam
51/30 . Folding the circumferential seam
51/32 . by rolling
51/34 . by pressing
51/36 . collapsible or like thin-walled tubes, e.g. for toothpaste
51/365 . [involving fixing closure members to the tubes, e.g. nozzles]
51/38 . Making inlet or outlet arrangements of cans, tins, baths, bottles, or other vessels; Making can ends; Making closures
51/383 . [scoring lines, tear strips or pulling tabs]
51/386 . [on the side-wall of containers]
51/40 . Making outlet openings, e.g. bung holes
51/42 . Making or attaching spouts
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)
51/443 . [easily removable closures, e.g. by means of tear strips]
51/446 . [Feeding or removal of material]
51/46 . Placing sealings or sealing material (moulding plastic sealing material into closure members B29C 70/80)
51/48 . Making crown caps
51/50 . Making screw caps
51/52 . boxes, cigarette cases, or the like
51/54 . cartridge cases, e.g. for ammunition, for letter carriers in pneumatic-tube plants

53/00

Making other particular articles (making wire fabrics B21F; making chains or chain parts B21L)
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)
53/022 . . (Making the fins)
53/025 . . {Louvered fins}
53/027 . . [by helically or spirally winding elongated elements]
53/04 . . of sheet metal
53/045 . . [by inflating partially united plates]
53/06 . . of metal tubes
53/08 . . of both metal tubes and sheet metal (connecting tubes in openings B21D 39/06)
53/085 . . [with fins places on zig-zag tubes or parallel tubes]
53/10 . . parts of bearings; sleeves; valve seats or the like
53/12 . . cages for bearings
53/14 . . belts, e.g. machine-gun belts
53/16 . . rings, e.g. barrel hoops
53/18 . . of hollow or C-shaped cross-section, e.g. for curtains, for eyelets
53/20 . . washers, e.g. for sealing
53/22 . . with means for preventing rotation
53/24 . . nuts or like thread-engaging members
53/26 . . wheels or the like
53/261 . . {pulleys}
53/262 . . [with inscriptions or the like, e.g. printing wheels]
53/264 . . [wheels out of a single piece (B21D 53/261 takes precedence)]
53/265 . . [parts of wheels (B21D 53/28, B21D 53/30 take precedence)]
53/267 . . [blower wheels, i.e. wheels provided with fan elements]
53/268 . . [wheels having spokes]
53/28 . . gear wheels
53/30 . . wheel rims
53/32 . . wheel covers
53/34 . . brake drums
53/36 . . clips, clamps, or like fastening or attaching devices, e.g. for electric installation
53/38 . . locksmith's goods, e.g. handles
53/40 . . hinges, e.g. door hinge plates
53/42 . . keys { (making keys by combined operations B23P 15/005) }
53/44 . . fancy goods, e.g. jewellery products
53/46 . . haberdashery, e.g. buckles, combs; pronged fasteners, e.g. staples
53/48 . . buttons, e.g. press-buttons, snap fasteners
53/50 . . metal slide-fastener parts
53/52 . . fastener elements; Attaching such elements so far as this procedure is combined with the process for making the elements
53/54 . . slides
53/56 . . stops
53/58 . . end-pieces for laces or ropes
53/60 . . cutlery wares; garden tools or the like
53/62 . . spoons; table forks
53/64 . . knives; scissors; cutting blades (B21D 53/72 takes precedence; handle portions B21D 53/70)
53/642 . . {scissors}
53/645 . . {safety razor blades}
53/647 . . {mower blades}
53/66 . . spades; shovels (handle portions B21D 53/70)
53/68 . . rakes, garden forks, or the like (handle portions B21D 53/70)
53/70 . . handle portions (B21D 53/72 takes precedence)
53/72 . . sickles; scythes
53/74 . . frames for openings, e.g. for windows, doors, handbags
53/745 . . [Joining mitred profiles comprising punching the profiles on a corner-angle connecting piece]
53/76 . . writing or drawing instruments, e.g. writing pens, erasing pens
53/78 . . propeller blades; turbine blades
53/80 . . dustproof covers; safety covers
53/82 . . perforated music sheets; pattern sheets, e.g. for control purposes, stencils
53/84 . . other parts for engines, e.g. connecting-rods
53/845 . . [Making camshafts]
53/86 . . other parts for bicycles or motorcycles
53/88 . . other parts for vehicles, e.g. cowlings, mudguards
53/883 . . [reflector]
53/886 . . [leaf springs]
53/90 . . axle-housings
53/92 . . other parts for aircraft
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)