# SECTION B — PERFORMING OPERATIONS; TRANSPORTING

## B21 MECHANICAL METAL-WORKING WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING METAL

### B21D WORKING OR PROCESSING OF SHEET METAL OR METAL TUBES, RODS OR PROFILES WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING (working or processing of wire B21F)

**Note(s)**

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.

**Subclass index**


TREATMENT CHARACTERISED BY FUNCTION
- Straightening....1/00, 3/00, 25/00
- Bending....11/00
  - of sheets....5/00, 13/00
  - of rods....7/00, 13/00
  - of tubes....9/00, 15/00
- Twisting....11/00
- Corrugating or grooving or bending into waves....13/00, 15/00, 17/00
- Punching, stamping, deep- drawing, spinning, high-energy forming....22/00-28/00

EDGE TREATMENT; CONNECTION OF PARTS....19/00, 41/00, 39/00
OTHER METHODS....25/00, 31/00, 41/00
COMBINED PROCESSES....21/00, 35/00
HANDLING....43/00, 45/00
OTHER AUXILIARY OPERATIONS....33/00
TOOLS....37/00
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SPECIAL TREATMENT FOR THE MANUFACTURE OF SPECIFIED ARTICLES....47/00-53/00


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**Straightening; Restoring form; Bending; Corrugating; Flanging**

**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 [2]**

1/02 • by rollers (B21D 1/06 takes precedence)
1/05 • Stretching combined with rolling **[2]**
1/06 • Removing local distortions
1/08 • • of hollow bodies made from sheet metal (of substantially open bodies B21D 1/10)
1/10 • • of specific articles made from sheet metal, e.g. mudguards
1/12 • Straightening vehicle body parts or bodies (B21D 1/14 takes precedence)
1/14 • Straightening frame structures

**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**

3/02 • by rollers
3/04 • • arranged on axes skew to the path of the work
3/05 • • arranged on axes rectangular to the path of the work **[2]**
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
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)

5/01 • between rams and anvils or abutments
5/02 • on press brakes without making use of clamping means
5/04 • on brakes making use of clamping means on one side of the work
5/06 • by drawing procedure making use of dies or forming-rollers, e.g. making profiles

5/08 • • making use of forming-rollers (B21D 5/12 takes precedence)
5/10 • • for making tubes
5/12 • • • making use of forming-rollers
5/14 • by passing between rollers (B21D 5/06 takes precedence)
5/16 • Folding; Pleating

**7/00 Bending rods, profiles, or tubes** (B21D 11/02-B21D 11/18 take precedence; using mandrels or the like B21D 9/00)
7/02 • over a stationary forming member; by use of a swinging forming member or abutment **[2]**
7/022 • • over a stationary forming member only **[2]**
7/024 • • by a swinging forming member
7/025 • • • and pulling or pushing the ends of the work
7/028 • • • and altering the profile at the same time, e.g. forming bumpers
7/03 • • Apparatus with means to keep the profile in shape
7/04 • over a movably-arranged forming member (B21D 7/02 takes precedence)
7/06 • in press brakes or between rams and anvils or abutments; Pliers with forming dies
7/08 • by passing between rollers or through a curved die
7/10 • by abutting members and flexible bending means, e.g. with chains, ropes
7/12 • with programme control
7/14 • combined with measuring of bends or lengths
7/16 • Auxiliary equipment, e.g. for heating or cooling of bends

**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 **[2]**
9/05 • co-operating with forming members
9/07 • • with one or more swinging forming members engaging tube ends only
9/08 • in press brakes or between rams and anvils or abutments; Pliers with forming dies
9/10 • by passing between rollers
9/12 • by pushing over a curved mandrel; by pushing through a curved die
9/14 • Wrinkle-bending, i.e. bending by corrugating
9/15 • using filling material of indefinite shape, e.g. sand, plastic material **[2]**
9/16 • Auxiliary equipment, e.g. 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; Twisting [2]**
11/02 • Bending by stretching or pulling over a die
11/06 • Bending into helical or spiral form; Forming a succession of return bends, e.g. serpentine form
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)
11/10 • Bending specially adapted to produce specific articles, e.g. leaf springs
11/12 • • the articles being reinforcements for concrete
11/14 • Twisting
11/15 • • Reinforcing rods for concrete
11/16 • • Crankshafts
11/18 • Joggling
11/20 • Bending sheet metal, not otherwise provided for
11/22 • Auxiliary equipment, e.g. positioning devices

**13/00 Corrugating sheet metal, rods or profiles; Bending sheet metal, rods or profiles into wave form**
13/02 • by pressing
13/04 • by rolling
13/06 • by drawing
13/08 • by combined methods
13/10 • into a peculiar profiling shape

**15/00 Corrugating tubes [2]**
15/02 • longitudinally
15/03 • • by applying fluid pressure
15/04 • transversely, e.g. helically
15/06 • • annularly
15/10 • • by applying fluid pressure
15/12 • Bending tubes into wave form

**17/00 Forming single grooves in sheet metal or tubular or hollow articles**
17/02 • by pressing
17/04 • by rolling

**19/00 Flanging or other edge treatment, e.g. of tubes**
19/02 • by continuously-acting tools moving along the edge
19/04 • • shaped as rollers
19/06 • • • working inwardly
19/08 • by single or successive action of pressing tools, e.g. vice jaws
19/10 • • working inwardly
19/12 • Edge-curling
19/14 • • Reinforcing edges, e.g. by armouring
19/16 • Reverse flanging of tube ends

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

**<u>Stamping; Spinning; Deep-drawing; Working sheet metal of limited length by stretching; Punching</u>**

**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
22/04 • • 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
22/12 • • using enclosed flexible chambers
22/14 • Spinning
22/16 • • over shaping mandrels or formers
22/18 • • using tools guided to produce the required profile
22/20 • Deep-drawing (special deep-drawing arrangements in, or in connection with, presses B21D 24/00)
22/21 • • without fixing the border of the blank **[2]**
22/22 • • with devices for holding the edge of the blanks (B21D 22/24-B21D 22/30 take precedence)
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
22/30 • • to finish articles formed by deep-drawing

**24/00 Special deep-drawing arrangements in, or in connection with, 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 [2]**
25/02 • by pulling over a die **[2]**
25/04 • Clamping arrangements **[2]**

**26/00 Shaping without cutting otherwise than by using rigid devices or tools or yieldable or resilient pads, e.g. shaping by applying fluid pressure or magnetic forces**
26/02 • by applying fluid pressure **[2, 2011.01]**
26/021 • • Deforming sheet bodies **[2011.01]**
26/023 • • • including an additional treatment performed by fluid pressure, e.g. perforating **[2011.01]**
26/025 • • • Means for controlling the clamping or opening of the moulds **[2011.01]**
26/027 • • • Means for controlling fluid parameters, e.g. pressure or temperature **[2011.01]**
26/029 • • • Closing or sealing means **[2011.01]**
26/031 • • • Mould construction (B21D 26/025-B21D 26/029 take precedence) **[2011.01]**
26/033 • • Deforming tubular bodies (corrugating tubes by applying fluid pressure B21D 15/03, B21D 15/10) **[2011.01]**
26/035 • • • including an additional treatment performed by fluid pressure, e.g. perforating **[2011.01]**
26/037 • • • Forming branched tubes **[2011.01]**
26/039 • • • Means for controlling the clamping or opening of the moulds **[2011.01]**
26/041 • • • Means for controlling fluid parameters, e.g. pressure or temperature **[2011.01]**
26/043 • • • Means for controlling the axial pusher **[2011.01]**
26/045 • • • Closing or sealing means **[2011.01]**
26/047 • • • Mould construction (B21D 26/037-B21D 26/045 take precedence) **[2011.01]**
26/049 • • • Deforming bodies having a closed end **[2011.01]**
26/051 • • • Deforming double-walled bodies **[2011.01]**
26/053 • • characterised by the material of the blanks **[2011.01]**
26/055 • • • Blanks having super-plastic properties **[2011.01]**
26/057 • • • Tailored blanks **[2011.01]**
26/059 • • • Layered blanks **[2011.01]**
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 **[2]**
26/14 • applying magnetic forces

**28/00 Shaping by press-cutting; Perforating**
28/02 • Punching blanks or articles with or without obtaining scrap; 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
28/14 • • Dies (ejecting or stripping-off devices arranged in punching tools B21D 45/00)
28/16 • • Shoulder or burr prevention
28/18 • • Yieldable, e.g. rubber, punching pads
28/20 • • Applications of drives
28/22 • • Notching the peripheries of circular blanks, e.g. laminations for dynamo-electric machines
28/24 • Perforating, i.e. punching holes
28/26 • • in sheets or flat parts
28/28 • • in tubes or other hollow bodies
28/30 • • in annular parts, e.g. rims
28/32 • • in other articles of special shape
28/34 • • Perforating tools; Die holders
28/36 • • using rotatable work or tool holders

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**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; embossing decorations or marks B44B 5/00)
31/02 • Stabbing or piercing, e.g. for making sieves
31/04 • Expanding other than provided for in groups B21D 1/00-B21D 28/00, e.g. for making expanded metal (B21D 47/00 takes precedence) **[2]**
31/06 • Deforming sheet metal, tubes or profiles by sequential impacts, e.g. hammering, beating, peen forming

**33/00 Special measures in connection with working metal foils, e.g. gold foils** (cutting or perforating of metal foil analogous to paper B26)

**35/00 Combined processes according to methods covered by groups B21D 1/00-B21D 31/00** (B21D 21/00 takes precedence)

**37/00 Tools as parts of machines covered by this subclass** (forms or constructions of tools uniquely adapted for particular operations, see in the relevant groups for the operations)
37/01 • Selection of materials **[2]**
37/02 • Die constructions enabling assembly of the die parts in different ways (B21D 37/06 takes precedence)
37/04 • Movable or exchangeable mountings for tools
37/06 • • Pivotally-arranged tools, e.g. disengageable (die sets with dies pivoted to one another B21D 37/12)
37/08 • Dies with different parts for several steps in a process
37/10 • Die sets; Pillar guides
37/12 • • Particular guiding equipment; Special arrangements for interconnection or cooperation of dies

37/14 • Particular arrangements for handling and holding in place complete dies
37/16 • Heating or cooling
37/18 • Lubricating
37/20 • Making tools by operations not covered a single other subclass

**39/00 Application of procedures in order to connect objects or parts, e.g. coating with sheet metal otherwise than by plating** (riveting B21J; uniting components by forging or pressing to form integral members B21K 25/00)**; Tube expanders**
39/02 • of sheet metal by folding, e.g. connecting edges of a sheet to form a cylinder
39/03 • of sheet metal otherwise than by folding **[2]**
39/04 • of tubes with tubes; of tubes with rods
39/06 • of tubes in openings, e.g. rolling-in
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 **[2]**

**41/00 Application of procedures in order to alter the diameter of tube ends** (B21D 39/00 takes precedence)
41/02 • Enlarging
41/04 • Reducing; 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)
43/02 • Advancing work in relation to the stroke of the die or tool
43/04 • • by means in mechanical engagement with the work
43/05 • • • specially adapted for multi-stage presses
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
43/08 • • • by rollers
43/09 • • • • by one or more pairs of rollers for feeding sheet or strip material **[2]**
43/10 • • • by grippers
43/11 • • • • for feeding sheet or strip material **[2]**
43/12 • • • by chains or belts
43/13 • • • by linearly moving tables **[2]**
43/14 • • • by turning devices, e.g. turn-tables
43/16 • • by gravity, e.g. chutes
43/18 • • by means in pneumatic or magnetic engagement with the work
43/20 • Storage arrangements; Piling or unpiling
43/22 • • Devices for piling sheets
43/24 • • Devices for removing sheets from a stack
43/26 • Stops
43/28 • Associations of cutting devices therewith

**45/00 Ejecting or stripping-off devices arranged in machines or tools dealt with in this subclass**
45/02 • Ejecting devices **[2]**
45/04 • • interrelated with motion of tool **[2]**
45/06 • Stripping-off devices **[2]**
45/08 • • interrelated with motion of tool **[2]**
45/10 • Combined ejecting and stripping-off devices **[2]**

**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**
47/01 • beams or pillars **[2]**
47/02 • • by expanding **[2]**
47/04 • composite sheet metal profiles

**49/00 Sheathing or stiffening 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(s) [2009.01]**

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; Subsequent re-forming
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 cans or tins in a permanent manner (making outlet arrangements B21D 51/38) **[2]**
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
51/38 • • Making inlet or outlet arrangements of cans, tins, baths, bottles or other vessels; Making can ends; Making closures
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 them B67B)
51/46 • • • • Placing sealings or sealing material
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 chains or chain parts B21L)

53/02 • heat exchangers, e.g. radiators, condensers (making finned or ribbed tubes by fixing strip material or the like to tubes B21C 37/22) **[2]**
53/04 • • of sheet metal
53/06 • • of metal tubes
53/08 • • of both metal tubes and sheet metal
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
53/28 • • 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
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)
53/66 • • 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
53/76 • 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
53/86 • other parts for bicycles or motorcycles
53/88 • other parts for vehicles, e.g. cowlings, mudguards
53/90 • • axle-housings
53/92 • other parts for aircraft

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**55/00 Safety devices protecting the machine or the operator, specially adapted for apparatus or machines dealt with in this subclass**