

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 (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(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.

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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** (working sheet metal of limited length by stretching B21D 25/00; by localised hammering B21D 31/06) [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** (straightening of well casings in situ E21B)
- 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 (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)

- 5/01 • 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 (filling of tubes with such material B21D 9/16) [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 (corrugating or bending into wave form B21D 13/00, B21D 15/00; flanging B21D 19/00); **Twisting [2]**

- 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)
- 11/10 • 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 • Jogging
- 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 (tubes B21D 15/00)

- 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 (wrinkle-bending using mandrels or the like B21D 9/14) [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 (grooving or notching of bolts, studs, or the like B21K 1/54)
- 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)

- 19/02 • by continuously-acting tools moving along the edge (edge-curling B21D 19/12)
- 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. 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
- 22/04 • • 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; shaping over a die without external former B21D 11/02)
- 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 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 [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 (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
- 28/14 • • Dies (ejecting or stripping-off devices arranged in punching machines or 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

- 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)
- 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-B21D 28/00, e.g. for making expanded metal (B21D 47/00 takes precedence; enlarging tube ends B21D 41/02) [2]
- 31/06 • Deforming sheet metal, tubes or profiles by sequential impacts, e.g. hammering, beating, peen forming (forging hammers B21J 7/00)
- 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 • • Pivotaly-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; welding B23K; press-fitting, force-fitting, or shrinking in general B23P 11/00, B23P 19/00; by adhesives F16B 11/00); **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 unpling (in general B65G)
 - 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** (by winding wire or tape thereon B65H 54/00, B65H 81/00; specially adapted for manufacturing conductors or cables H01B 13/26)
- 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 isclassified only in group B21D 51/16.

51/04	• • built-up objects, e.g. objects with rigidly-attached bottom or cover	53/20	• • washers, e.g. for sealing
51/06	• • folded objects	53/22	• • • with means for preventing rotation
51/08	• • ball-shaped objects	53/24	• nuts or like thread-engaging members
51/10	• • conically or cylindrically shaped objects	53/26	• wheels or the like
51/12	• • objects with corrugated walls	53/28	• • gear wheels
51/14	• • Flattening hollow objects for transport or storage; Re-forming same (making tubes from doubled flat material B21C 37/14)	53/30	• • wheel rims
51/16	• characterised by the use of the objects (making heat exchangers B21D 53/02)	53/32	• • wheel covers
51/18	• • vessels, e.g. tubs, vats, tanks, sinks, or the like	53/34	• • brake drums
51/20	• • • barrels	53/36	• clips, clamps, or like fastening or attaching devices, e.g. for electric installation
51/22	• • • pots, e.g. for cooking	53/38	• locksmith's goods, e.g. handles
51/24	• • high-pressure containers, e.g. boilers, bottles	53/40	• • hinges, e.g. door hinge plates
51/26	• • cans or tins; Closing same in a permanent manner (making outlet arrangements B21D 51/38; welding or soldering B23K) [2]	53/42	• • keys
51/28	• • • Folding the longitudinal seam	53/44	• fancy goods, e.g. jewellery products
51/30	• • • Folding the circumferential seam	53/46	• haberdashery, e.g. buckles, combs; pronged fasteners, e.g. staples
51/32	• • • • by rolling	53/48	• • buttons, e.g. press-buttons, snap fasteners
51/34	• • • • by pressing	53/50	• • metal slide-fastener parts
51/36	• • collapsible or like thin-walled tubes, e.g. for toothpaste	53/52	• • • fastener elements; Attaching such elements so far as this procedure is combined with the process for making the elements
51/38	• • Making inlet or outlet arrangements of cans, tins, baths, bottles or other vessels; Making can ends; Making closures	53/54	• • • slides
51/40	• • • Making outlet openings, e.g. bung holes	53/56	• • • stops
51/42	• • • • Making or attaching spouts	53/58	• end-pieces for laces or ropes
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)	53/60	• cutlery wares; garden tools or the like
51/46	• • • • Placing sealings or sealing material	53/62	• • spoons; table forks
51/48	• • • • Making crown caps	53/64	• • knives; scissors; cutting blades (B21D 53/72 takes precedence; handle portions B21D 53/70)
51/50	• • • • Making screw caps	53/66	• • spades; shovels (handle portions B21D 53/70)
51/52	• • boxes, cigarette cases, or the like	53/68	• • rakes, garden forks, or the like (handle portions B21D 53/70)
51/54	• • cartridge cases, e.g. for ammunition, for letter carriers in pneumatic-tube plants	53/70	• • handle portions (B21D 53/72 takes precedence)
53/00	Making other particular articles (making wire fabrics B21F; making chains or chain parts B21L)	53/72	• • sickles; scythes
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]	53/74	• frames for openings, e.g. for windows, doors, handbags
53/04	• • of sheet metal	53/76	• writing or drawing instruments, e.g. writing pens, erasing pens
53/06	• • of metal tubes	53/78	• propeller blades; turbine blades
53/08	• • of both metal tubes and sheet metal (connecting tubes in openings B21D 39/06)	53/80	• dustproof covers; safety covers
53/10	• parts of bearings; sleeves; valve seats or the like	53/82	• perforated music sheets; pattern sheets, e.g. for control purposes, stencils
53/12	• • cages for bearings	53/84	• other parts for engines, e.g. connecting-rods
53/14	• belts, e.g. machine-gun belts	53/86	• other parts for bicycles or motorcycles
53/16	• rings, e.g. barrel hoops	53/88	• other parts for vehicles, e.g. cowlings, mudguards
53/18	• • of hollow or C-shaped cross-section, e.g. for curtains, for eyelets	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)