

SECTION B — SECTION B - PERFORMING OPERATIONS; TRANSPORTING

B21 MECHANICAL METAL-WORKING WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING METAL (casting, powder metallurgy B22; shearing B23D; working of metal by the action of a high concentration of electric current B23H; soldering, welding, flame-cutting B23K; other working of metal B23P; punching sheet material in general B26F; processes for changing of physical properties of metals C21D, C22F; electroforming C25D 1/00)

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.

Subclass indexes

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
SAFETY	55/00
SPECIAL TREATMENT FOR THE MANUFACTURE OF SPECIFIED ARTICLES	47/00-53/00

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 . 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 (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]
 - 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)
- 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

B21D

- 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 . not characterised by the particular use (cans or tins B21D 51/26)
- 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 particular structure or use (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) [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
- 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)
- 51/46 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 wire fabrics B21F; making chains or chain parts B21L)	53/52	. . . fastener elements; Attaching such elements so far as this procedure is combined with the process for making the elements
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]	53/54	. . . slides
53/04	. . of sheet metal	53/56	. . . stops
53/06	. . of metal tubes	53/58	. end-pieces for laces or ropes
53/08	. . of both metal tubes and sheet metal (connecting tubes in openings B21D 39/06)	53/60	. cutlery wares; garden tools or the like
53/10	. parts of bearings; sleeves; valve seats or the like	53/62	. . spoons; table forks
53/12	. . cages for bearings	53/64	. . knives; scissors; cutting blades (B21D 53/72 takes precedence; handle portions B21D 53/70)
53/14	. belts, e.g. machine-gun belts	53/66	. . spades; shovels (handle portions B21D 53/70)
53/16	. rings, e.g. barrel hoops	53/68	. . rakes, garden forks, or the like (handle portions B21D 53/70)
53/18	. . of hollow or C-shaped cross-section, e.g. for curtains, for eyelets	53/70	. . handle portions (B21D 53/72 takes precedence)
53/20	. . washers, e.g. for sealing	53/72	. . sickles; scythes
53/22	. . . with means for preventing rotation	53/74	. frames for openings, e.g. for windows, doors, handbags
53/24	. nuts or like thread-engaging members	53/76	. writing or drawing instruments, e.g. writing pens, erasing pens
53/26	. wheels or the like	53/78	. propeller blades; turbine blades
53/28	. . gear wheels	53/80	. dustproof covers; safety covers
53/30	. . wheel rims	53/82	. perforated music sheets; pattern sheets, e.g. for control purposes, stencils
53/32	. . wheel covers	53/84	. other parts for engines, e.g. connecting-rods
53/34	. . brake drums	53/86	. other parts for bicycles or motorcycles
53/36	. clips, clamps, or like fastening or attaching devices, e.g. for electric installation	53/88	. other parts for vehicles, e.g. cowlings, mudguards
53/38	. locksmith's goods, e.g. handles	53/90	. . axle-housings
53/40	. . hinges, e.g. door hinge plates	53/92	. other parts for aircraft
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		
		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)