

CPC COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING

(NOTES omitted)

SHAPING

B23 MACHINE TOOLS; METAL-WORKING NOT OTHERWISE PROVIDED FOR

(NOTES omitted)

B23K SOLDERING OR UNSOLDERING; WELDING; CLADDING OR PLATING BY SOLDERING OR WELDING; CUTTING BY APPLYING HEAT LOCALLY, e.g. FLAME CUTTING; WORKING BY LASER BEAM

NOTES

1. This subclass covers also electric circuits specially adapted for the purposes covered by the title of the subclass.
2. In this subclass, the following term is used with the meaning indicated:
 - "soldering" means uniting metals using solder and applying heat without melting either of the parts to be united

WARNING

The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

[B23K 35/04](#) - [B23K 35/20](#)

covered by

[B23K 35/0205](#) - [B23K 35/0294](#)

[B23K 35/363](#)

covered by

[B23K 35/3601](#) - [B23K 35/3618](#)

Soldering, e.g. brazing, or unsoldering (essentially requiring the use of welding machines or welding equipment, [see the relevant groups for the welding machines or welding equipment](#))

- 1/00 Soldering, e.g. brazing, or unsoldering** ([B23K 3/00 takes precedence](#))
- 1/0002 . {Soldering by means of dipping in a fused salt bath}
 - 1/0004 . {Resistance soldering}
 - 1/0006 . {Exothermic brazing}
 - 1/0008 . {specially adapted for particular articles or work}
 - 1/001 . . {Sealing small holes in metal containers, e.g. tins}
 - 1/0012 . . {Brazing of heat exchangers}
 - 1/0014 . . {Brazing of honeycomb sandwich structures}
 - 1/0016 . . {Soldering of electronic components}
 - 1/0018 . . {Brazing of turbine parts}
 - 1/002 . Soldering by means of induction heating
 - 1/005 . Soldering by means of radiant energy
 - 1/0053 . . {soldering by means of infrared [IR]}
 - 1/0056 . . {soldering by means of beams, e.g. lasers, electron beams [EB]}
 - 1/008 . Soldering within a furnace ([B23K 1/012 takes precedence](#))
 - 1/012 . Soldering with the use of hot gas
 - 1/015 . . Vapour-condensation soldering
 - 1/018 . Unsoldering; Removal of melted solder or other residues
 - 1/06 . making use of vibrations, e.g. supersonic vibrations
 - 1/08 . Soldering by means of dipping in molten solder
 - 1/085 . . {Wave soldering}
 - 1/14 . specially adapted for soldering seams
 - 1/16 . . longitudinal seams, e.g. of shells
 - 1/18 . . circumferential seams, e.g. of shells
 - 1/19 . taking account of the properties of the materials to be soldered

- 1/20 . Preliminary treatment of work or areas to be soldered, e.g. in respect of a galvanic coating
- 1/203 . . {Fluxing, i.e. applying flux onto surfaces}
- 1/206 . . {Cleaning}
- 3/00 Tools, devices or special appurtenances for soldering, e.g. brazing, or unsoldering, not specially adapted for particular methods**
- 3/02 . Soldering irons; Bits
- 3/021 . . {Flame-heated soldering irons}
- 3/022 . . . {using a gaseous fuel}
- 3/023 . . . {using a liquid fuel}
- 3/024 . . . {using a solid fuel}
- 3/025 . . {Bits or tips}
- 3/026 . . . {Removable soldering bits}
- 3/027 . . {Holders for soldering irons}
- 3/028 . . {Devices for cleaning soldering iron tips ([B23K 3/027 takes precedence](#))}
- 3/029 . . {Solder or residue removing devices}
- 3/03 . . electrically heated
- 3/0307 . . . {with current flow through the workpiece}
- 3/0315 . . . {Quick-heating soldering irons having the tip-material forming part of the electric circuit ([B23K 3/0323 takes precedence](#))}
- 3/0323 . . . {Battery-powered soldering irons}
- 3/033 . . . {comprising means for controlling or selecting the temperature or power}
- 3/0338 . . . {Constructional features of electric soldering irons}
- 3/0346 {Handles}
- 3/0353 {Heating elements or heating element housings}
- 3/0361 {Couplings between the handle and the heating element housing}

- 3/0369 {Couplings between the heating element housing and the bit or tip}
- 3/0376 . . . {comprising carbon heating elements or electrodes (B23K 3/0384, B23K 3/0392 take precedence)}
- 3/0384 . . . {the heat being generated by an arc}
- 3/0392 . . . {the heat being generated by contact resistance}
- 3/04 . Heating appliances
- 3/043 . . {Flame-heated appliances}
- 3/047 . . electric
- 3/0471 . . . {using resistance rod or bar, e.g. carbon silica}
- 3/0473 . . . {using Joule effect at the place of contact between a rod and the soldering tip}
- 3/0475 . . . {using induction effects, e.g. Kelvin or skin effects}
- 3/0476 . . . {Soldering pliers}
- 3/0478 . . . {comprising means for controlling or selecting the temperature or power}
- 3/053 . . . using resistance wires
- 3/06 . Solder feeding devices; Solder melting pans
- 3/0607 . . {Solder feeding devices}
- 3/0615 . . . {forming part of a soldering iron}
- 3/0623 . . . {for shaped solder piece feeding, e.g. preforms, bumps, balls, pellets, droplets}
- 3/063 . . . {for wire feeding}
- 3/0638 . . . {for viscous material feeding, e.g. solder paste feeding (B23K 3/0623 takes precedence)}
- 3/0646 . . {Solder baths}
- 3/0653 . . . {with wave generating means, e.g. nozzles, jets, fountains}
- 3/0661 . . . {Oscillating baths}
- 3/0669 . . . {with dipping means}
- 3/0676 {Conveyors therefor}
- 3/0684 {with means for oscillating the workpiece}
- 3/0692 . . . {with intermediary means for bringing solder on workpiece, e.g. rollers}
- 3/08 . Auxiliary devices therefor
- 3/082 . . {Flux dispensers; Apparatus for applying flux}
- 3/085 . . {Cooling, heat sink or heat shielding means}
- 3/087 . . {Soldering or brazing jigs, fixtures or clamping means}

Flame welding or cutting

- 5/00 Gas flame welding**
- 5/003 . {the welding zone being shielded against the influence of the surrounding atmosphere}
- 5/006 . {specially adapted for particular articles or work}
- 5/02 . Seam welding
- 5/023 . . {of horizontal seams in assembling vertical plates, a welding unit being adapted to travel along the upper horizontal edge of the plates}
- 5/026 . . {of non-horizontal seams in assembling non-horizontal plates}
- 5/04 . . using additional profiled strips or {the} like of welding metal along seam edges
- 5/06 . . Welding longitudinal seams
- 5/08 . . Welding circumferential seams
- 5/083 . . . {Welding three-dimensional seams}
- 5/086 {helicoidal seams}
- 5/10 . Welding workpieces essentially comprising layers of different metals, e.g. plated workpieces

- 5/12 . taking account of the properties of the material to be welded
- 5/14 . . of non-ferrous metals (B23K 5/16 takes precedence)
- 5/16 . . of different metals
- 5/18 . for purposes other than joining parts, e.g. built-up welding
- 5/20 . making use of vibrations, e.g. supersonic vibrations
- 5/213 . Preliminary treatment
- 5/22 . Auxiliary equipment, e.g. backings, guides
- 5/24 . . Arrangements for supporting torches

7/00 Cutting, scarfing, or desurfacing by applying flames

- 7/001 . {for profiling plate edges or for cutting grooves}
- 7/002 . {Machines, apparatus or equipment for cutting plane workpieces, e.g. plates}
- 7/003 . . {Machines, apparatus or equipment for cutting long articles, e.g. cast stands, plates, in parts of predetermined length}
- 7/004 . . {Seam tracking}
- 7/005 . {Machines, apparatus or equipment specially adapted for cutting curved workpieces}
- 7/006 . . {for tubes}
- 7/007 . . . {for obtaining tube intersection profiles}
- 7/008 . {Preliminary treatment}
- 7/06 . Machines, apparatus or equipment specially designed for scarfing or desurfacing
- 7/08 . by applying additional compounds or means favouring the cutting, scarfing or desurfacing procedure
- 7/10 . Auxiliary devices, e.g. for guiding or supporting the torch
- 7/102 . . {for controlling the spatial relationship between the workpieces and the gas torch}
- 7/105 . . {specially adapted for particular geometric forms}
- 7/107 . . . {for cutting circles}

Electric welding or cutting

- 9/00 Arc welding or cutting**
- 9/0008 . {Welding without shielding means against the influence of the surrounding atmosphere}
- 9/0017 . . {using more than one electrode}
- 9/0026 . {specially adapted for particular articles or work}
- 9/0035 . . {of thin articles}
- 9/0043 . . {Locally welding a thin plate to a thick piece (spot arc welding B23K 9/007)}
- 9/0052 . . {Welding of pipe panels}
- 9/0061 . {Underwater arc welding}
- 9/007 . Spot arc welding
- 9/013 . Arc cutting, gouging, scarfing or desurfacing
- 9/0135 . . {Arc saw cutting}
- 9/02 . Seam welding; Backing means; Inserts
- 9/0203 . . {Inserts}
- 9/0206 . . {of horizontal seams in assembling vertical plates, a welding unit being adapted to travel along the upper horizontal edge of the plates}
- 9/0209 . . {of non-horizontal seams in assembling non-horizontal plates}
- 9/0213 . . {Narrow gap welding}
- 9/0216 . . {Seam profiling, e.g. weaving, multilayer}
- 9/022 . . Welding by making use of electrode vibrations

- 9/025 . . for rectilinear seams
- 9/0253 . . . {for the longitudinal seam of tubes}
- 9/0256 . . . {for welding ribs on plates}
- 9/028 . . for curved planar seams
- 9/0282 . . . {for welding tube sections}
- 9/0284 {with an electrode working inside the tube}
- 9/0286 {with an electrode moving around the fixed tube during the welding operation}
- 9/0288 . . . {for welding of tubes to tube plates}
- 9/032 . . for three-dimensional [3D] seams
- 9/0325 . . . {helicoïdal seams}
- 9/035 . . with backing means disposed under the seam
- 9/0352 . . . {the backing means being movable during the welding operation}
- 9/0354 . . . {the backing means being expandable}
- 9/0356 . . . {the backing means being a tape or strip}
- 9/0358 . . . {the backing means being a ring or sleeve}
- 9/038 . . using moulding means
- 9/04 . . Welding for other purposes than joining, e.g. built-up welding
- 9/042 . . {Built-up welding on planar surfaces}
- 9/044 . . {Built-up welding on three-dimensional surfaces}
- 9/046 . . . {on surfaces of revolution}
- 9/048 {on cylindrical surfaces}
- 9/06 . . Arrangements or circuits for starting the arc, e.g. by generating ignition voltage, or for stabilising the arc
- 9/067 . . Starting the arc
- 9/0671 . . . {by means of brief contacts between the electrodes}
- 9/0672 . . . {without direct contact between electrodes}
- 9/0673 {Ionisation of the arc gap by means of pulsed or high-frequency voltages}
- 9/0675 {Ionization of the arc gap by means of radiation or particle bombardment}
- 9/0676 {Ionization of the arc gap by means of heating}
- 9/0677 {Ionization of the arc gap by means of a contact piece disposed between the electrodes}
- 9/0678 {Ionization of the arc gap by means of an auxiliary arc}
- 9/073 . . Stabilising the arc
- 9/0731 . . . {Stabilising of the arc tension}
- 9/0732 . . . {Stabilising of the arc current}
- 9/0734 . . . {Stabilising of the arc power}
- 9/0735 . . . {Stabilising of the arc length}
- 9/0737 . . . {Stabilising of the arc position}
- 9/0738 . . . {Stabilising of the arc by automatic re-ignition means}
- 9/08 . . Arrangements or circuits for magnetic control of the arc
- 9/09 . . Arrangements or circuits for arc welding with pulsed current or voltage
- 9/091 . . {characterised by the circuits}
- 9/092 . . . {characterised by the shape of the pulses produced}
- 9/093 . . . {the frequency of the pulses produced being modulable}
- 9/095 . . Monitoring or automatic control of welding parameters
- 9/0953 . . {using computing means}
- 9/0956 . . {using sensing means, e.g. optical}
- 9/10 . . Other electric circuits therefor; Protective circuits; Remote controls
- 9/1006 . . {Power supply}
- 9/1012 . . . {characterised by parts of the process}
- 9/1018 {Improvements of the power factor of arc welding installations}
- 9/1025 {Means for suppressing or reducing direct-current [DC] components in alternating-current [AC] arc welding installations}
- 9/1031 {Reduction of the arc voltage beneath the arc striking value, e.g. to zero voltage, during non-welding periods}
- 9/1037 {Means preventing crater forming at the extremity of the seam}
- 9/1043 . . . {characterised by the electric circuit [\(B23K 9/1012 takes precedence\)](#)}
- 9/105 {by using discharge tubes or mechanical contactors [\(B23K 9/1068 takes precedence\)](#)}
- 9/1056 {by using digital means [\(B23K 9/1068 takes precedence\)](#)}
- 9/1062 {with computing means}
- 9/1068 {Electric circuits for the supply of power to two or more arcs from a single source}
- 9/1075 . . . {Parallel power supply, i.e. multiple power supplies or multiple inverters supplying a single arc or welding current}
- 9/1081 . . {Arc welding by means of accumulated energy}
- 9/1087 . . {Arc welding using remote control}
- 9/1093 . . {Consumable electrode or filler wire preheat circuits}
- 9/12 . . Automatic feeding or moving of electrodes or work for spot or seam welding or cutting
- 9/121 . . {Devices for the automatic supply of at least two electrodes one after the other}
- 9/122 . . {Devices for guiding electrodes, e.g. guide tubes}
- 9/123 . . . {Serving also as contacting devices supplying welding current to an electrode}
- 9/124 . . {Circuits or methods for feeding welding wire}
- 9/125 . . . {Feeding of electrodes [\(for stabilising arc B23K 9/073\)](#)}
- 9/126 . . {Controlling the spatial relationship between the work and the gas torch [\(between wire tip and piece B23K 9/073\)](#)}
- 9/127 . . Means for tracking lines during arc welding or cutting
- 9/1272 . . . {Geometry oriented, e.g. beam optical trading}
- 9/1274 {Using non-contact, optical means, e.g. laser means}
- 9/1276 {Using non-contact, electric or magnetic means, e.g. inductive means}
- 9/1278 {Using mechanical means}
- 9/133 . . Means for feeding electrodes, e.g. drums, rolls, motors
- 9/1333 . . . {Dereeling means}
- 9/1336 . . . {Driving means}
- 9/14 . . making use of insulated electrodes
- 9/142 . . {Drag welding, the arc length being determined by an insulated layer between the welding electrode and the welding spot or seam}
- 9/145 . . . {the insulated welding electrode being laid along the seam}
- 9/147 . . . {the insulated welding electrode resting with one extremity on the workpiece}
- 9/16 . . making use of shielding gas

- 9/162 . . {making use of a stationary fluid}
- 9/164 . . {making use of a moving fluid}
- 9/167 . . and of a non-consumable electrode
- 9/1675 . . . {making use of several electrodes}
- 9/173 . . and of a consumable electrode
- 9/1735 . . . {making use of several electrodes}
- 9/18 . Submerged-arc welding
- 9/182 . . {making use of a non-consumable electrode}
- 9/184 . . . {making use of several electrodes}
- 9/186 . . {making use of a consumable electrodes}
- 9/188 . . . {making use of several electrodes}
- 9/20 . Stud welding
- 9/201 . . {of the extremity of a small piece on a large basis}
- 9/202 . . . {by means of portable equipment, e.g. stud-welding gun}
- 9/203 . . {of cooling fins}
- 9/205 . . {Means for determining, controlling or regulating the arc interval}
- 9/206 . . {with automatic stud supply}
- 9/207 . . {Features related to studs}
- 9/208 . . . {Ferrules, e.g. for confining molten material}
- 9/22 . Percussion welding
- 9/23 . taking account of the properties of the materials to be welded
- 9/232 . . {of different metals}
- 9/235 . Preliminary treatment
- 9/24 . Features related to electrodes
- 9/26 . . Accessories for electrodes, e.g. ignition tips
- 9/28 . . Supporting devices for electrodes
- 9/282 . . . {Electrode holders not supplying shielding means to the electrode}
- 9/285 . . . {Cooled electrode holders}
- 9/287 . . . {Supporting devices for electrode holders}
- 9/29 . . . Supporting devices adapted for making use of shielding means
- 9/291 {the shielding means being a gas}
- 9/293 {using consumable rod electrodes}
- 9/295 {using consumable wire electrodes}
- 9/296 {using non-consumable electrodes}
- 9/298 {the shielding means being a powder}
- 9/30 . . . Vibrating holders for electrodes ([B23K 9/022 takes precedence](#))
- 9/32 . Accessories
- 9/321 . . {Protecting means}
- 9/322 . . . {Head protecting means}
- 9/323 . . {Combined coupling means, e.g. gas, electricity, water or the like}
- 9/324 . . {Devices for supplying or evacuating a shielding or a welding powder, e.g. a magnetic powder}
- 9/325 . . {Devices for supplying or evacuating shielding gas}
- 9/326 . . . {Purge gas rings, i.e. devices for supplying or evacuating shielding gas inside of hollow or tubular articles, e.g. pipes, vessels}
- 9/327 . . {Means for transporting supplies}
- 9/328 . . {Cleaning of weld torches, i.e. removing weld-spatter; Preventing weld-spatter, e.g. applying anti-adhesives}
- 10/00** **Welding or cutting by means of a plasma**
- 10/003 . {Scarfig, desurfacing or deburring}
- 10/006 . {Control circuits therefor}
- 10/02 . Plasma welding
- 10/022 . . {Spot welding}
- 10/025 . . {by making use of electrode vibrations}
- 10/027 . . {Welding for purposes other than joining, e.g. build-up welding}
- 11/00** **Resistance welding; Severing by resistance heating**
- 11/0006 . {the welding zone being shielded against the influence of the surrounding atmosphere}
- 11/0013 . {welding for purposes other than joining, e.g. build-up welding}
- 11/002 . {specially adapted for particular articles or work}
- 11/0026 . . {Welding of thin articles}
- 11/0033 . . {Welding locally a thin plate to a large piece}
- 11/004 . . {Welding of a small piece to a large or broad piece}
- 11/0046 . . . {the extremity of a small piece being welded to a base, e.g. cooling studs or fins to tubes or plates}
- 11/0053 {Stud welding, i.e. resistive}
- 11/006 {Welding a tip to a base, e.g. pen point nibs}
- 11/0066 . . . {Riveting}
- 11/0073 . . {Butt welding of long articles advanced axially}
- 11/008 . . {Manufacturing of metallic grids or mats by spot welding}
- 11/0086 . . . {Grids or mats used in concrete structures ([B23K 11/11 takes precedence](#))}
- 11/0093 . . {Welding of honeycomb sandwich structures}
- 11/02 . Pressure butt welding
- 11/04 . Flash butt welding
- 11/043 . . {characterised by the electric circuits used therewith}
- 11/046 . . {Apparatus therefor}
- 11/06 . using roller electrodes
- 11/061 . . {for welding rectilinear seams}
- 11/062 . . . {for welding longitudinal seams of tubes}
- 11/063 {Lap welding}
- 11/065 . . {for welding curved planar seams}
- 11/066 . . . {of tube sections}
- 11/067 . . {for welding three-dimensional seams}
- 11/068 . . . {of helicoidal seams}
- 11/08 . Seam welding not restricted to one of the preceding subgroups
- 11/082 . . {of three-dimensional seams}
- 11/084 . . . {of helicoidal seams}
- 11/087 . . for rectilinear seams
- 11/0873 . . . {of the longitudinal seam of tubes}
- 11/0876 {Lap welding}
- 11/093 . . for curved planar seams
- 11/0935 . . . {of tube sections}
- 11/10 . Spot welding; Stitch welding
- 11/105 . . {Stitch welding}
- 11/11 . . Spot welding
- 11/115 . . . {by means of two electrodes placed opposite one another on both sides of the welded parts}
- 11/12 . . making use of vibrations
- 11/14 . Projection welding
- 11/16 . taking account of the properties of the material to be welded
- 11/163 . . {Welding of coated materials}
- 11/166 . . . {of galvanized or tinned materials}
- 11/18 . . of non-ferrous metals ([B23K 11/20 takes precedence](#))

- 11/185 . . . {of aluminium or aluminium alloys}
 - 11/20 . . of different metals
 - 11/22 . Severing by resistance heating
 - 11/24 . Electric supply or control circuits therefor
 - 11/241 . . {Electric supplies ([B23K 11/248](#) takes precedence)}
 - 11/243 . . . {Multiple welding installations fed by one source}
 - 11/245 . . . {using a stepping counter in synchronism with the welding pulses}
 - 11/246 . . . {for flash welding}
 - 11/248 . . {Electric supplies using discharge tubes}
 - 11/25 . . Monitoring devices
 - 11/251 . . . {using analogue means}
 - 11/252 . . . {using digital means}
 - 11/253 {the measured parameter being a displacement or a position}
 - 11/255 {the measured parameter being a force ([B23K 11/253](#) takes precedence)}
 - 11/256 {the measured parameter being the inter-electrode electrical resistance}
 - 11/257 {the measured parameter being an electrical current}
 - 11/258 {the measured parameter being a voltage}
 - 11/26 . . Storage discharge welding
 - 11/28 . Portable welding equipment
 - 11/30 . Features relating to electrodes
 - 11/3009 . . {Pressure electrodes}
 - 11/3018 . . . {Cooled pressure electrodes}
 - 11/3027 . . {Slide or drag electrodes}
 - 11/3036 . . {Roller electrodes}
 - 11/3045 . . . {Cooled roller electrodes}
 - 11/3054 . . {Cooled electrodes ([B23K 11/3018](#), [B23K 11/3045](#) take precedence)}
 - 11/3063 . . {Electrode maintenance, e.g. cleaning, grinding}
 - 11/3072 . . {Devices for exchanging or removing electrodes or electrode tips}
 - 11/3081 . . {Electrodes with a seam contacting part shaped so as to correspond to the shape of the bond area, e.g. for making an annular bond without relative movement in the longitudinal direction of the seam between the electrode holder and the work}
 - 11/309 . . {Wire electrodes}
 - 11/31 . . Electrode holders {and actuating devices therefor}
 - 11/311 . . . {the actuating device comprising an electric motor}
 - 11/312 {for several electrodes}
 - 11/314 {Spot welding guns, e.g. mounted on robots}
 - 11/315 {with one electrode moving on a linear path}
 - 11/317 . . . {Equalizing; Balancing devices for electrode holders}
 - 11/318 {Supporting devices for electrode holders}
 - 11/34 . Preliminary treatment
 - 11/36 . Auxiliary equipment ([B23K 11/31](#) takes precedence)
 - 11/362 . . {Contact means for supplying welding current to the electrodes}
 - 11/364 {Clamping contacts}
 - 11/366 {Sliding contacts}
 - 11/368 {Liquid contacts, e.g. mercury contacts}
 - 13/00** **Welding by high-frequency current heating**
 - 13/01 . . by induction heating
 - 13/015 . . . {Butt welding}
 - 13/02 . . Seam welding
 - 13/025 {for tubes}
 - 13/04 . . by conduction heating
 - 13/043 . . . {Seam welding}
 - 13/046 {for tubes}
 - 13/06 . . characterised by the shielding of the welding zone against influence of the surrounding atmosphere
 - 13/08 . . Electric supply or control circuits therefor
- Other welding or cutting; Working by laser beam**
- 15/00** **Electron-beam welding or cutting**
 - 15/0006 . . {specially adapted for particular articles or work}
 - 15/0013 . . {Positioning or observing workpieces, e.g. with respect to the impact; Aligning, aiming or focusing electron beams}
 - 15/002 . . {Devices involving relative movement between electron beam and workpiece}
 - 15/0026 . . {Auxiliary equipment}
 - 15/0033 . . {Preliminary treatment}
 - 15/004 . . {Tandem beams or torches, i.e. working simultaneously with several beams or torches}
 - 15/0046 . . {Welding}
 - 15/0053 . . . {Seam welding}
 - 15/006 {of rectilinear seams}
 - 15/0066 {with backing means disposed under the seams}
 - 15/0073 {with interposition of particular material to facilitate connecting the parts, e.g. using a filler}
 - 15/008 . . . {Spot welding}
 - 15/0086 . . . {welding for purposes other than joining, e.g. build-up welding}
 - 15/0093 . . . {characterised by the properties of the materials to be welded}
 - 15/02 . . Control circuits therefor
 - 15/04 . . for welding annular seams
 - 15/06 . . within a vacuum chamber ([B23K 15/04](#) takes precedence)
 - 15/08 . . Removing material, e.g. by cutting, by hole drilling
 - 15/085 . . . {Boring}
 - 15/10 . . Non-vacuum electron beam-welding or cutting
 - 17/00** **Use of the energy of nuclear particles in welding or related techniques**
 - 20/00** **Non-electric welding by applying impact or other pressure, with or without the application of heat, e.g. cladding or plating**
 - 20/001 . . {by extrusion or drawing}
 - 20/002 . . {specially adapted for particular articles or work ([B23K 20/129](#) takes precedence)}
 - 20/004 . . . {Wire welding}
 - 20/005 {Capillary welding}
 - 20/007 {Ball bonding}
 - 20/008 . . {combining pressure with radiant energy}
 - 20/02 . . by means of a press {; Diffusion bonding}
 - 20/021 . . . {Isostatic pressure welding}
 - 20/023 . . . {Thermo-compression bonding}
 - 20/025 {Bonding tips therefor}
 - 20/026 {with diffusion of soldering material}
 - 20/028 . . . {Butt welding}

20/04	• by means of a rolling mill	25/00	Slag welding, i.e. using a heated layer or mass of powder, slag or the like in contact with the material to be joined
20/06	• by means of high energy impulses, e.g. magnetic energy		
20/08	• • Explosive welding	25/005	• {Welding for purposes other than joining, e.g. build-up welding}
20/085	• • • {for tubes, e.g. plugging}		
20/10	• making use of vibrations, e.g. ultrasonic welding	26/00	Working by laser beam, e.g. welding, cutting or boring
20/103	• • {using a roller}		
20/106	• • {Features related to sonotrodes}		
20/12	• the heat being generated by friction; Friction welding		NOTES
20/1205	• • {using translation movement}		1. This subclass <u>covers</u> :
20/121	• • {Control circuits therefor}		• laser working for making a weakened layer, with or without removing material;
20/1215	• • {for other purposes than joining, e.g. built-up welding}		• laser shock processing;
20/122	• • {using a non-consumable tool, e.g. friction stir welding}		• apparatus for laser surface treatment;
20/1225	• • • {Particular aspects of welding with a non-consumable tool}		• laser ablation.
20/123	• • • {Controlling or monitoring the welding process}		2. This subclass <u>does not cover</u> :
20/1235	• • • • {with temperature control during joining}		• laser assisted deposition which is covered by subclass C23C ;
20/124	• • • • {at the beginning or at the end of a weld}		• laser sintering which is covered by group B22F 3/105 for metallic powder, by group B29C 67/04 for plastics, by group C03B 19/06 for glass or by group C04B 35/64 for ceramics;
20/1245	• • • {characterised by the apparatus}		• laser assisted chemical etching which is covered by group C23F 1/00 .
20/125	• • • • {Rotary tool drive mechanism}		
20/1255	• • • • {Tools therefor, e.g. characterised by the shape of the probe}	26/0006	• {taking account of the properties of the material involved (B23K 26/32 , B23K 26/40 take precedence)}
20/126	• • • • {Workpiece support, i.e. backing or clamping}	26/009	• {using a non-absorbing, e.g. transparent, reflective or refractive, layer on the workpiece (using a mask on the workpiece B23K 26/0661)}
20/1265	• • • {Non-butt welded joints, e.g. overlap-joints, T-joints or spot welds}	26/0093	• {combined with mechanical machining or metal-working covered by other subclasses than B23K }
20/127	• • • {Friction stir welding involving a mechanical connection}	26/0096	• {Portable laser equipment, e.g. hand-held laser apparatus}
20/1275	• • • {involving metallurgical change}	26/02	• Positioning or observing the workpiece, e.g. with respect to the point of impact; Aligning, aiming or focusing the laser beam
20/128	• • • {making use of additional material}	26/03	• • Observing, e.g. monitoring, the workpiece
20/1285	• • {Portable friction welding machines}	26/032	• • • {using optical means}
20/129	• • {specially adapted for particular articles or work}	26/034	• • • {Observing the temperature of the workpiece}
20/1295	• • • {Welding studs}	26/0342	• • • {Observing magnetic fields related to the workpiece}
20/14	• Preventing or minimising gas access, or using protective gases or vacuum during welding (formed by material interposed between workpieces B23K 20/18)	26/0344	• • • {Observing the speed of the workpiece}
20/16	• with interposition of special material to facilitate connection of the parts, e.g. material for absorbing or producing gas	26/035	• • Aligning the laser beam (automatically B23K 26/042)
20/165	• • {involving an exothermic reaction of the interposed material}	26/037	• • • {by pressing on the workpiece, e.g. using a pressing roller foot}
20/18	• Zonal welding by interposing weld-preventing substances between zones not to be welded	26/04	• • Automatically aligning, aiming or focusing the laser beam, e.g. using the back-scattered light
20/20	• Special methods allowing subsequent separation, e.g. of metals of high quality from scrap material	26/042	• • • Automatically aligning the laser beam
20/22	• taking account of the properties of the materials to be welded	26/043	• • • • {along the beam path, i.e. alignment of laser beam axis relative to laser beam apparatus}
20/227	• • with ferrous layer	26/044	• • • Seam tracking
20/2275	• • • {the other layer being aluminium}	26/046	• • • Automatically focusing the laser beam
20/233	• • without ferrous layer	26/048	• • • • {by controlling the distance between laser head and workpiece}
20/2333	• • • {one layer being aluminium, magnesium or beryllium}	26/06	• • Shaping the laser beam, e.g. by masks or multi-focusing
20/2336	• • • {both layers being aluminium}	26/0604	• • • {by a combination of beams}
20/24	• Preliminary treatment	26/0608	• • • • {in the same heat affected zone [HAZ] (B23K 26/0613 , B23K 26/0619 take precedence)}
20/26	• Auxiliary equipment		
23/00	Alumino-thermic welding		

- 26/0613 {having a common axis ([B23K 26/0619](#) takes precedence)}
- 26/0617 {and with spots spaced along the common axis}
- 26/0619 {with spots located on opposed surfaces of the workpiece}
- 26/062 by direct control of the laser beam
- 26/0622 by shaping pulses
- 26/0624 {using ultrashort pulses, i.e. pulses of 1 ns or less}
- 26/0626 {Energy control of the laser beam ([B23K 26/0622](#) takes precedence)}
- 26/064 by means of optical elements, e.g. lenses, mirrors or prisms
- 26/0643 {comprising mirrors}
- 26/0648 {comprising lenses}
- 26/0652 {comprising prisms}
- 26/066 by using masks
- 26/0661 {disposed on the workpiece}
- 26/0665 {by beam condensation on the workpiece, e.g. for focusing}
- 26/067 Dividing the beam into multiple beams, e.g. multi-focusing
- 26/0673 {into independently operating sub-beams, e.g. beam multiplexing to provide laser beams for several stations}
- 26/0676 {into dependently operating sub-beams, e.g. an array of spots with fixed spatial relationship or for performing simultaneously identical operations}
- 26/073 Shaping the laser spot
- 26/0732 {into a rectangular shape}
- 26/0734 {into an annular shape}
- 26/0736 {into an oval shape, e.g. elliptical shape}
- 26/0738 {into a linear shape}
- 26/08 Devices involving relative movement between laser beam and workpiece
- 26/082 Scanning systems, i.e. devices involving movement of the laser beam relative to the laser head
- 26/0821 {using multifaceted mirrors, e.g. polygonal mirror}
- 26/0823 {Devices involving rotation of the workpiece}
- 26/083 {Devices involving movement of the workpiece in at least one axial direction}
- 26/0838 {by using an endless conveyor belt}
- 26/0846 {for moving elongated workpieces longitudinally, e.g. wire or strip material}
- 26/0853 {Devices involving movement of the workpiece in at least two axial directions, e.g. in a plane}
- 26/0861 {in at least three axial directions}
- 26/0869 {Devices involving movement of the laser head in at least one axial direction}
- 26/0876 {in at least two axial directions}
- 26/0884 {in at least three axial directions, e.g. manipulators, robots}
- 26/0892 {Controlling the laser beam travel length}
- 26/10 using a fixed support {, i.e. involving moving the laser beam}
- 26/103 {the laser beam rotating around the fixed workpiece ([B23K 26/28](#) takes precedence)}
- 26/106 {inside the workpiece}
- 26/12 in a special environment or atmosphere, e.g. in an enclosure
- 26/122 in a liquid, e.g. underwater
- 26/1224 {in vacuum}
- 26/123 {in an atmosphere of particular gases}
- 26/125 {of mixed gases}
- 26/126 {in an atmosphere of gases chemically reacting with the workpiece}
- 26/127 {in an enclosure}
- 26/128 {Laser beam path enclosures}
- 26/14 using a fluid stream, e.g. a jet of gas, in conjunction with the laser beam; Nozzles therefor ([B23K 26/12](#) takes precedence)
- 26/142 for the removal of by-products
- 26/1423 {the flow carrying an electric current}
- 26/1435 {involving specially adapted flow-control means}
- 26/1436 {for pressure control}
- 26/1437 {for flow-rate control}
- 26/1438 {for directional control}
- 26/144 the fluid stream containing particles, e.g. powder
- 26/146 the fluid stream containing a liquid
- 26/1462 {Nozzles; Features related to nozzles}
- 26/1464 {Supply to, or discharge from, nozzles of media, e.g. gas, powder, wire}
- 26/147 {Features outside the nozzle for feeding the fluid stream towards the workpiece}
- 26/1476 {Features inside the nozzle for feeding the fluid stream through the nozzle}
- 26/1482 {Detachable nozzles, e.g. exchangeable or provided with breakaway lines}
- 26/1488 {Means for protecting nozzles, e.g. the tip surface ([by breakaway lines B23K 26/1482](#))}
- 26/1494 {Maintenance of nozzles}
- 26/16 Removal of by-products, e.g. particles or vapours produced during treatment of a workpiece ([by a fluid stream B23K 26/142](#))
- 26/18 using absorbing layers on the workpiece, e.g. for marking or protecting purposes
- 26/20 Bonding ([soldering by means of radiant energy B23K 1/005](#))
- 26/206 {Laser sealing}
- 26/21 by welding
- 26/211 with interposition of special material to facilitate connection of the parts
- 26/22 Spot welding
- 26/24 Seam welding
- 26/242 Fillet welding, i.e. involving a weld of substantially triangular cross section joining two parts
- 26/244 Overlap seam welding
- 26/26 of rectilinear seams
- 26/262 of longitudinal seams of tubes
- 26/28 of curved planar seams
- 26/282 of tube sections
- 26/30 of three-dimensional [3D] seams
- 26/302 of helicoidal seams
- 26/32 taking account of the properties of the material involved
- 26/322 involving coated metal parts ([using absorbing layers on the workpiece B23K 26/18](#))
- 26/323 involving parts made of dissimilar metallic material
- 26/324 involving non-metallic parts

26/34	• Laser welding for purposes other than joining	28/02	• Combined welding or cutting procedures or apparatus
26/342	• • Build-up welding		
26/346	• in combination with welding or cutting covered by groups B23K 5/00 - B23K 25/00 , e.g. in combination with resistance welding	31/00	Processes relevant to this subclass, specially adapted for particular articles or purposes, but not covered by any single one of main groups B23K 1/00 - B23K 28/00
26/348	• • in combination with arc heating, e.g. tungsten inert gas [TIG], metal inert gas [MIG] or plasma welding	31/003	• {relating to controlling of welding distortion}
26/351	• for trimming or tuning of electrical components	31/006	• {relating to using of neural networks}
26/352	• for surface treatment	31/02	• relating to soldering or welding
26/354	• • by melting	31/022	• • {Making profiled bars with soldered or welded seams}
26/355	• • {Texturing}		
26/356	• • by shock processing	31/025	• • {Connecting cutting edges or the like to tools; Attaching reinforcements to workpieces, e.g. wear-resisting zones to tableware}
26/3568	• • {Modifying rugosity}		
26/3576	• • • {Diminishing rugosity, e.g. by grinding, polishing or smoothing}	31/027	• • {Making tubes by soldering or welding}
26/3584	• • • {Increasing rugosity, i.e. roughening}	31/10	• relating to cutting or desurfacing
26/359	• • by providing a line or line pattern, e.g. a dotted break initiation line	31/12	• relating to investigating the properties, e.g. the weldability, of materials
26/36	• Removing material (B23K 26/55 , B23K 26/57 take precedence)	31/125	• • {Weld quality monitoring}
26/361	• • for deburring or mechanical trimming (B23K 26/351 takes precedence)	33/00	Specially-profiled edge portions of workpieces for making soldering or welding connections; Filling the seams formed thereby
26/362	• • Laser etching	33/002	• {Crimping or bending the workpieces at the joining area}
26/364	• • • for making a groove or trench, e.g. for scribing a break initiation groove	33/004	• {Filling of continuous seams}
26/38	• • by boring or cutting	33/006	• • {for cylindrical workpieces}
26/382	• • • by boring	33/008	• • {for automotive applications}
26/384	• • • • of specially shaped holes		
26/386	• • • • of blind holes	35/00	Rods, electrodes, materials, or media, for use in soldering, welding, or cutting
26/388	• • • • Trepanning, i.e. boring by moving the beam spot about an axis	35/001	• {Interlayers, transition pieces for metallurgical bonding of workpieces}
26/389	• • • • {of fluid openings, e.g. nozzles, jets}	35/002	• • {at least one of the workpieces being of light metal}
26/40	• • taking account of the properties of the material involved	35/004	• • {at least one of the workpieces being of a metal of the iron group}
26/402	• • • involving non-metallic material, e.g. isolators	35/005	• • {at least one of the workpieces being of a refractory metal}
26/50	• Working by transmitting the laser beam through or within the workpiece	35/007	• • {at least one of the workpieces being of copper or another noble metal}
26/53	• • for modifying or reforming the material inside the workpiece, e.g. for producing break initiation cracks	2035/008	• • {at least one of the workpieces being of silicon}
26/55	• • for creating voids inside the workpiece, e.g. for forming flow passages or flow patterns	35/02	• characterised by mechanical features, e.g. shape
26/57	• • the laser beam entering a face of the workpiece from which it is transmitted through the workpiece material to work on a different workpiece face, e.g. for effecting removal, fusion splicing, modifying or reforming	35/0205	• • {Non-consumable electrodes; C-electrodes}
26/60	• Preliminary treatment	35/0211	• • {for use in cutting (B23K 35/0205 takes precedence)}
26/70	• Auxiliary operations or equipment	35/0216	• • • {Rods, electrodes or wires}
26/702	• • {Auxiliary equipment}	35/0222	• • {for use in soldering or brazing (B23K 35/0205 takes precedence)}
26/703	• • • {Cooling arrangements (by using a fluid stream B23K 26/14)}	35/0227	• • • {Rods or wires (B23K 35/0244 takes precedence)}
26/704	• • • • {Beam dispersers, e.g. beam wells}	35/0233	• • • {Sheets or foils (B23K 35/0244 takes precedence)}
26/705	• • • • {Beam measuring devices}	35/0238	• • • • {layered}
26/706	• • • • {Protective screens}	35/0244	• • • • {Powders, particles or spheres; Preforms made therefrom}
26/707	• • • • {for monitoring laser beam transmission optics}	35/025	• • • • {Pastes, creams or slurries}
28/00	Welding or cutting not covered by groups B23K 5/00 - B23K 26/00	35/0255	• • {for use in welding (B23K 35/0205 takes precedence)}
28/003	• {Welding in a furnace}	35/0261	• • • {Rods, electrodes or wires}
28/006	• {Welding metals by means of an electrolyte}	35/0266	• • • • {flux-cored}
		35/0272	• • • • {with more than one layer of coating or sheathing material}
		35/0277	• • • • • {of non-circular cross-section}

- 35/0283 {multi-cored; multiple}
- 35/0288 . . . {Welding studs}
- 35/0294 . . . {Consumable guides}
- 35/22 . characterised by the composition or nature of the material
- 35/222 . . {Non-consumable electrodes}
- 35/224 . . {Anti-weld compositions; Braze stop-off compositions}
- 35/226 . . {Non-corrosive coatings; Primers applied before welding}
- 35/228 . . {Selection of materials for cutting}
- 35/24 . . Selection of soldering or welding materials proper (B23K 35/34 takes precedence)
- 35/26 . . . with the principal constituent melting at less than 400°C
- 35/262 {Sn as the principal constituent}
- 35/264 {Bi as the principal constituent}
- 35/266 {Cd as the principal constituent}
- 35/268 {Pb as the principal constituent}
- 35/28 . . . with the principal constituent melting at less than 950°C
- 35/282 {Zn as the principal constituent}
- 35/284 {Mg as the principal constituent}
- 35/286 {Al as the principal constituent}
- 35/288 {with Sn or Zn}
- 35/30 . . . with the principal constituent melting at less than 1550°C
- 35/3006 {Ag as the principal constituent}
- 35/3013 {Au as the principal constituent}
- 35/302 {Cu as the principal constituent}
- 35/3026 {Mn as the principal constituent}
- 35/3033 {Ni as the principal constituent}
- 35/304 {with Cr as the next major constituent}
- 35/3046 {Co as the principal constituent}
- 35/3053 {Fe as the principal constituent}
- 35/306 {with C as next major constituent, e.g. cast iron}
- 35/3066 {with Ni as next major constituent}
- 35/3073 {with Mn as next major constituent}
- 35/308 {with Cr as next major constituent}
- 35/3086 {containing Ni or Mn}
- 35/3093 {with other elements as next major constituents}
- 35/32 . . . with the principal constituent melting at more than 1550°C
- 35/322 {a Pt-group metal as principal constituent}
- 35/325 {Ti as the principal constituent}
- 35/327 {comprising refractory compounds, e.g. carbides}
- 35/34 . . comprising compounds which yield metals when heated
- 35/36 . . Selection of non-metallic compositions, e.g. coatings or fluxes (B23K 35/34 takes precedence); Selection of soldering or welding materials, conjoint with selection of non-metallic compositions, both selections being of interest
- 35/3601 . . . {with inorganic compounds as principal constituents}
- 35/3602 {Carbonates, basic oxides or hydroxides}
- 35/3603 {Halide salts}
- 35/3605 {Fluorides}
- 35/3606 {Borates or B-oxides}
- 35/3607 {Silica or silicates}
- 35/3608 {Titania or titanates}
- 35/361 {Alumina or aluminates}
- 35/3611 {Phosphates}
- 35/3612 . . . {with organic compounds as principal constituents}
- 35/3613 {Polymers, e.g. resins}
- 35/3615 {N-compounds}
- 35/3616 {Halogen compounds}
- 35/3617 {B-compounds}
- 35/3618 {Carboxylic acids or salts}
- 35/362 . . . Selection of compositions of fluxes (B23K 35/365, B23K 35/368 take precedence)
- 35/365 . . . Selection of non-metallic compositions of coating materials either alone or conjoint with selection of soldering or welding materials
- 35/368 . . . Selection of non-metallic compositions of core materials either alone or conjoint with selection of soldering or welding materials
- 35/38 . . Selection of media, e.g. special atmospheres for surrounding the working area
- 35/383 . . . {mainly containing noble gases or nitrogen}
- 35/386 . . . {for condensation soldering}
- 35/40 . Making wire or rods for soldering or welding
- 35/402 . . {Non-consumable electrodes; C-electrodes}
- 35/404 . . {Coated rods; Coated electrodes}
- 35/406 . . {Filled tubular wire or rods (B23K 35/402 takes precedence)}
- 2035/408 . . . {with welded longitudinal seam}
- 37/00** **Auxiliary devices or processes, not specially adapted for a procedure covered by only one of the other main groups of this subclass**
- 37/003 . Cooling means for welding or cutting
- 37/006 . Safety devices for welding or cutting
- 37/02 . Carriages for supporting the welding or cutting element
- 37/0205 . . {guided by hand}
- 37/0211 . . {travelling on a guide member, e.g. rail, track}
- 37/0217 . . . {the guide member being fixed to the workpiece}
- 37/0223 {the guide member being a part of the workpiece}
- 37/0229 . . . {the guide member being situated alongside the workpiece}
- 37/0235 . . . {the guide member forming part of a portal}
- 37/0241 . . {Attachments between the welding or cutting element and the carriage}
- 37/0247 . . {Driving means}
- 37/0252 . . {Steering means}
- 37/0258 . . {Electric supply or control circuits therefor}
- 37/0264 . . {magnetically attached to the workpiece}
- 37/027 . . {for making circular cuts or welds}
- 37/0276 . . {for working on or in tubes (B23K 37/0211 takes precedence)}
- 37/0282 . . {Carriages forming part of a welding unit}
- 37/0288 . . {Carriages forming part of a cutting unit}
- 37/0294 . . {Transport carriages or vehicles}
- 37/04 . for holding or positioning work
- 37/0408 . . {for planar work}
- 37/0417 . . {for spherical work}
- 37/0426 . . {Fixtures for other work}
- 37/0435 . . . {Clamps}
- 37/0443 {Jigs}

- 37/0452 . . . {Orientable fixtures ([B23K 37/0461](#) takes precedence)}
- 37/0461 . . {Welding tables}
- 37/047 . . moving work to adjust its position between soldering, welding or cutting steps ([B23K 37/053](#) takes precedence)
- 37/053 . . aligning cylindrical work; Clamping devices therefor
- 37/0531 . . . Internal pipe alignment clamps
- 37/0533 . . . External pipe alignment clamps
- 37/0535 . . . Longitudinal pipe seam alignment clamps
- 37/0536 . . . for maintaining flanges on tubes
- 37/0538 . . . for rotating tubes, e.g. rollers
- 37/06 . . for positioning the molten material, e.g. confining it to a desired area
- 37/08 . . for flash removal

Indexing scheme associated with groups B23K 1/00 - B23K 31/00, relating to articles made by soldering, welding or cutting or to materials to be soldered, welded or cut

2101/00 Articles made by soldering, welding or cutting

- 2101/001 . . {Turbines}
- 2101/002 . . {Drill-bits}
- 2101/003 . . {Pistons}
- 2101/005 . . {Camshafts}
- 2101/006 . . {Vehicles}
- 2101/007 . . {Marks, e.g. trade marks}
- 2101/008 . . {Gears}
- 2101/02 . . Honeycomb structures
- 2101/04 . . Tubular or hollow articles
- 2101/045 . . {Hollow panels}
- 2101/06 . . Tubes
- 2101/08 . . . finned or ribbed
- 2101/10 . . Pipe-lines
- 2101/12 . . Vessels
- 2101/125 . . . {Cans}
- 2101/14 . . Heat exchangers
- 2101/16 . . Bands or sheets of indefinite length
- 2101/18 . . Sheet panels
- 2101/185 . . {Tailored blanks}
- 2101/20 . . Tools
- 2101/22 . . Nets, wire fabrics or the like
- 2101/24 . . Frameworks
- 2101/26 . . Railway- or like rails
- 2101/28 . . Beams
- 2101/30 . . Chains, hoops or rings
- 2101/32 . . Wires
- 2101/34 . . Coated articles {; [Surface treated articles](#)}
- 2101/35 . . {[Surface treated articles](#)}
- 2101/36 . . Electric or electronic devices
- 2101/38 . . Conductors
- 2101/40 . . Semiconductor devices
- 2101/42 . . Printed circuits

2103/00 Materials to be soldered, welded or cut

- 2103/02 . . Iron or ferrous alloys
- 2103/04 . . Steel {[or steel](#)} alloys
- 2103/05 . . . {[Stainless steel](#)}
- 2103/06 . . Cast-iron alloys
- 2103/08 . . Non-ferrous metals or alloys
- 2103/10 . . Aluminium or alloys thereof
- 2103/12 . . Copper or alloys thereof

- 2103/14 . . Titanium or alloys thereof
- 2103/15 . . {[Magnesium or alloys thereof](#)}
- 2103/16 . . Composite materials
- 2103/166 . . {[Multilayered materials](#)}
- 2103/172 . . . {wherein at least one of the layers is non-metallic}
- 2103/18 . . Dissimilar materials
- 2103/20 . . Ferrous alloys and aluminium or alloys thereof
- 2103/22 . . Ferrous alloys and copper or alloys thereof
- 2103/24 . . Ferrous alloys and titanium or alloys thereof
- 2103/26 . . {[Alloys of Nickel and Cobalt and Chromium](#)}
- 2103/30 . . {[Organic materials](#)}
- 2103/32 . . {[Material from living organisms, e.g. skins](#)}
- 2103/34 . . . {[Leather](#)}
- 2103/36 . . {[Wood or similar materials](#)}
- 2103/38 . . {[Fabrics; Fibrous materials](#)}
- 2103/40 . . {[Paper](#)}
- 2103/42 . . {[Plastics other than composite materials](#)}
- 2103/50 . . {[Inorganic materials other than metals or composite materials](#)}
- 2103/52 . . {[Ceramics](#)}
- 2103/54 . . {[Glass](#)}
- 2103/56 . . {[being semiconducting](#)}