

CPC**COOPERATIVE PATENT CLASSIFICATION****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**

(making metal-coated products by extruding metal [B21C 23/22](#) ; building up linings or coverings by casting [B22D 19/08](#) ; casting by dipping [B22D 23/04](#) ; manufacture of composite layers by sintering metal powder [B22F 7/00](#) ; arrangements on machine tools for copying or controlling [B23Q](#) ; covering metals or covering materials with metals, not otherwise provided for [C23C](#) ; burners [F23D](#))

NOTE

This subclass covers also electric circuits specially adapted for the purposes covered by the title of the subclass.

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 used in the CPC scheme. Subject matter covered by these 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](#) " [B23K 35/3601](#) - [B23K 35/3618](#)

Guidance heading: **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)

B23K 1/00

Soldering, e.g. brazing, or unsoldering ([B23K 3/00](#) takes precedence; characterised only by the use of special materials or media [B23K 35/00](#) ; dip or wave soldering in the manufacture of printed circuits [H05K 3/34](#))

- [B23K 1/0002](#) . { Soldering by means of dipping in a fused salt bath }
- [B23K 1/0004](#) . { Resistance soldering }
- [B23K 1/0006](#) . { Exothermic brazing }
- [B23K 1/0008](#) . { specially adapted for particular articles or work }
- [B23K 1/001](#) .. { Sealing small holes in metal containers, e.g. tins }
- [B23K 1/0012](#) .. { Brazing heat exchangers }
- [B23K 1/0014](#) .. { Brazing of honeycomb sandwich structures }
- [B23K 1/0016](#) .. { Brazing of electronic components }
- [B23K 1/0018](#) .. { Brazing of turbine parts }

- B23K 1/002 . Soldering by means of induction heating
- B23K 1/005 . Soldering by means of radiant energy
- B23K 1/0053 .. { soldering by means of I.R. }
- B23K 1/0056 .. { soldering by means of beams, e.g. lasers, E.B. }
- B23K 1/008 . Soldering within a furnace ([B23K 1/012](#) takes precedence)
- B23K 1/012 . Soldering with the use of hot gas
- B23K 1/015 .. Vapour-condensation soldering
- B23K 1/018 . Unsoldering ; Removal of melted solder or other residues
- B23K 1/06 . making use of vibrations, e.g. supersonic vibrations
- B23K 1/08 . Soldering by means of dipping in molten solder
- B23K 1/085 .. { Wave soldering }
- B23K 1/14 . specially adapted for soldering seams (making tubes involving operations other than soldering [B21C](#))
- B23K 1/16 .. longitudinal seams, e.g. of shells
- B23K 1/18 .. circumferential seams, e.g. of shells
- B23K 1/19 . taking account of the properties of the materials to be soldered
- B23K 1/20 . Preliminary treatment of work or areas to be soldered, e.g. in respect of a galvanic coating (preparation of surfaces in particular ways, see the relevant classes for the treatments or the materials treated, e.g. [C04B](#) , [C23C](#))
- B23K 1/203 .. { Fluxing, i.e. applying flux onto surfaces }
- B23K 1/206 .. { Cleaning }
- B23K 3/00** **Tools, devices, or special appurtenances for soldering, e.g. brazing, or unsoldering, not specially adapted for particular methods (materials used for soldering [B23K 35/00](#))**
- B23K 3/02 . Soldering irons ; Bits
- B23K 3/021 .. { Flame-heated soldering irons }
- B23K 3/022 ... { using a gaseous fuel }
- B23K 3/023 ... { using a liquid fuel }
- B23K 3/024 ... { using a solid fuel }
- B23K 3/025 .. { Bits or tips }
- B23K 3/026 ... { Removable soldering bits }
- B23K 3/027 .. { Holders for soldering irons }
- B23K 3/028 .. { Devices for cleaning soldering iron tips ([B23K 3/027](#) takes precedence) }
- B23K 3/029 .. { Solder or residue removing devices }
- B23K 3/03 .. electrically heated
- B23K 3/0307 ... { with current flow through the workpiece }

- B23K 3/0315 ... { Quick-heating soldering irons having the tip-material forming part of the electric circuit ([B23K 3/0323](#) takes precedence) }
- B23K 3/0323 ... { Battery-powered soldering irons }
- B23K 3/033 ... { comprising means for controlling or selecting the temperature or power }
- B23K 3/0338 ... { Constructional features of electric soldering irons }
- B23K 3/0346 { Handles }
- B23K 3/0353 { Heating elements or heating element housings }
- B23K 3/0361 { Couplings between the handle and the heating element housing }
- B23K 3/0369 { Couplings between the heating element housing and the bit or tip }
- B23K 3/0376 ... { comprising carbon heating elements or electrodes ([B23K 3/0384](#) and [B23K 3/0392](#) take precedence) }
- B23K 3/0384 ... { the heat being generated by an arc }
- B23K 3/0392 ... { the heat being generated by contact resistance }

- B23K 3/04 . Heating appliances (soldering lamps or blowpipes [F23D](#) ; electric heating in general [H05B](#))
- B23K 3/043 .. { Flame-heated appliances }
- B23K 3/047 .. electric
- B23K 3/0471 ... { using resistance rod or bar, e.g. carbon silica }
- B23K 3/0473 ... { using Joule effect at the place of contact between a rod and the soldering tip }
- B23K 3/0475 ... { using induction effects, e.g. Kelvin or skin effects }
- B23K 3/0476 ... { Soldering pliers }
- B23K 3/0478 ... { comprising means for controlling or selecting the temperature or power }
- B23K 3/053 ... using resistance wires

- B23K 3/06 . Solder feeding devices ; Solder melting pans
- B23K 3/0607 .. { Solder feeding devices }
- B23K 3/0615 ... { forming part of a soldering iron }
- B23K 3/0623 ... { for shaped solder piece feeding, e.g. preforms, bumps, balls, pellets, droplets }
- B23K 3/063 ... { for wire feeding }
- B23K 3/0638 ... { for viscous material feeding, e.g. solder paste feeding ([B23K 3/0623](#) takes precedence) }
- B23K 3/0646 .. { Solder baths }
- B23K 3/0653 ... { with wave generating means, e.g. nozzles, jets, fountains }
- B23K 3/0661 ... { Oscillating baths }
- B23K 3/0669 ... { with dipping means }
- B23K 3/0676 { Conveyers therefor }
- B23K 3/0684 { with means for oscillating the workpiece }
- B23K 3/0692 ... { with intermediary means for bringing solder on workpiece, e.g. rollers }

- B23K 3/08 . Auxiliary devices therefor (cleaning pipes or tubes or systems of pipes or tubes, e.g. before soldering, [B08B 9/02](#))
- B23K 3/082 .. { Flux dispensers; Apparatus for applying flux }
- B23K 3/085 .. { Cooling, heat sink or heat shielding means }
- B23K 3/087 .. { Soldering or brazing jigs, fixtures or clamping means }

Guidance heading: Flame welding or cutting**B23K 5/00 Gas flame welding**

- B23K 5/003 . { the welding zone being shielded against the influence of the surrounding atmosphere (selection of media [B23K 35/38](#)) }
- B23K 5/006 . { specially adapted for particular articles or work }
- B23K 5/02 . Seam welding (making tubes involving operations other than welding [B21C](#))
- B23K 5/023 . . { of horizontal seams in assembling vertical plates a welding unit being adapted to travel along the upper horizontal edge of the plates }
- B23K 5/026 . . { of non-horizontal seams in assembling non-horizontal plates }
- B23K 5/04 . . using additional profiled strips or the like of welding metal along seam edges
- B23K 5/06 . . Welding longitudinal seams
- B23K 5/08 . . Welding circumferential seams
- B23K 5/083 . . . { Welding three-dimensional seams }
- B23K 5/086 { helicoidal seams }
- B23K 5/10 . Welding workpieces essentially comprising layers of different metals, e.g. plated workpieces
- B23K 5/12 . taking account of the properties of the material to be welded
- B23K 5/14 . . of non-ferrous metals ([B23K 5/16](#) takes precedence)
- B23K 5/16 . . of different metals
- B23K 5/18 . for purposes other than joining parts, e.g. built-up welding
- B23K 5/20 . making use of vibrations, e.g. supersonic vibrations
- B23K 5/213 . Preliminary treatment
- B23K 5/22 . Auxiliary equipment, e.g. backings, guides
- B23K 5/24 . . Arrangements for supporting torches (not restricted to flame welding [B23K 37/02](#))

B23K 7/00 Cutting, scarfing, or desurfacing by applying flames { (thermal deburring [B23D 79/005](#)) }

- B23K 7/001 . { for profiling plate edges or for cutting grooves }
- B23K 7/002 . { Machines, apparatus, or equipment for cutting plane workpieces, e.g. plates }
- B23K 7/003 . . { Machines, apparatus, or equipment for cutting long articles, e.g. cast stands, plates, in parts of predetermined length }
- B23K 7/004 . . { Seam tracking }
- B23K 7/005 . { Machines, apparatus, or equipment specially adapted for cutting curved workpieces, e.g. tubes }

- B23K 7/006 . . { for tubes }
- B23K 7/007 . . . { for obtaining tube intersection profiles }
- B23K 7/008 . { Preliminary treatment }
- B23K 7/06 . Machines, apparatus, or equipment specially designed for scarfing or desurfacing
- B23K 7/08 . by applying additional compounds or means favouring the cutting, scarfing, or desurfacing procedure
- B23K 7/10 . Auxiliary devices, e.g. for guiding or supporting the torch ([guiding means applicable to other metal-working machines B23Q](#))
- B23K 7/102 . . { for controlling the spacial relationship between the workpieces and the gas torch }
- B23K 7/105 . . { specially adapted for particular geometric forms }
- B23K 7/107 . . . { for cutting circles }

Guidance heading: Electric welding or cutting

- B23K 9/00** **Arc welding or cutting** ([electro-slag welding B23K 25/00](#) ; welding transformers [H01F](#) ; welding generators [H02K](#))
- B23K 9/0008 . { Welding without shielding means against the influence of the surrounding atmosphere }
 - B23K 9/0017 . . { using more than one electrode }
 - B23K 9/0026 . { specially adapted for particular articles or work }
 - B23K 9/0035 . . { of thin articles }
 - B23K 9/0043 . . { Locally welding a thin plate to a thick piece ([spot arc welding B23K 9/007](#)) }
 - B23K 9/0052 . . { Welding of pipe panels }
 - B23K 9/0061 . { Underwater arc welding }
 - B23K 9/007 . Spot arc welding
 - B23K 9/013 . Arc cutting, gouging, scarfing or desurfacing
 - B23K 9/0135 . . { Arc saw cutting }
 - B23K 9/02 . Seam welding ; Backing means ; Inserts
 - B23K 9/0203 . . { Inserts }
 - B23K 9/0206 . . { of horizontal seams in assembling vertical plates, a welding unit being adapted to travel along the upper horizontal edge of the plates }
 - B23K 9/0209 . . { of non-horizontal seams in assembling non-horizontal plates }
 - B23K 9/0213 . . { Narrow gap welding }
 - B23K 9/0216 . . { Seam profiling, e.g. weaving, multilayer }
 - B23K 9/022 . . Welding by making use of electrode vibrations
 - B23K 9/025 . . for rectilinear seams
 - B23K 9/0253 . . . { for the longitudinal seam of tubes }

- B23K 9/0256 . . . { for welding ribs on plates }
- B23K 9/028 . . for curved planar seams
- B23K 9/0282 . . . { for welding tube sections }
- B23K 9/0284 . . . { with an electrode working inside the tube }
- B23K 9/0286 . . . { with an electrode moving around the fixed tube during the welding operation }
- B23K 9/0288 . . . { for welding of tubes to tube plates }
- B23K 9/032 . . for three-dimensional seams
- B23K 9/0325 . . . { helicoidal seams }
- B23K 9/035 . . with backing means disposed under the seam
- B23K 9/0352 . . . { the backing means being movable during the welding operation }
- B23K 9/0354 . . . { the backing means being expandable }
- B23K 9/0356 . . . { the backing means being a tape or strip }
- B23K 9/0358 . . . { the backing means being a ring or sleeve }
- B23K 9/038 . . using moulding means (not restricted to arc welding [B23K 37/06](#))
- B23K 9/04 . . Welding for other purposes than joining, e.g. built-up welding
- B23K 9/042 . . { Built-up welding on planar surfaces }
- B23K 9/044 . . { Built-up welding on three-dimensional surfaces }
- B23K 9/046 . . . { on surfaces of revolution }
- B23K 9/048 . . . { on cylindrical surfaces }
- B23K 9/06 . . Arrangements or circuits for starting the arc, e.g. by generating ignition voltage, or for stabilising the arc
- B23K 9/067 . . Starting the arc
- B23K 9/0671 . . . { by means of brief contacts between the electrodes }
- B23K 9/0672 . . . { without direct contact between electrodes }
- B23K 9/0673 . . . { Ionisation of the arc gap by means of a tension with a step front (pulses or high frequency tensions) }
- B23K 9/0675 . . . { Ionization of the arc gap by means of radiation or particle bombardment }
- B23K 9/0676 . . . { Ionization of the arc gap by means of heating }
- B23K 9/0677 . . . { Ionization of the arc gap by means of a contact piece disposed between the electrodes }
- B23K 9/0678 . . . { Ionization of the arc gap by means of an auxiliary arc }
- B23K 9/073 . . Stabilising the arc
- B23K 9/0731 . . . { Stabilising of the arc tension }
- B23K 9/0732 . . . { Stabilising of the arc current }
- B23K 9/0734 . . . { Stabilising of the arc power }
- B23K 9/0735 . . . { Stabilising of the arc length }
- B23K 9/0737 . . . { Stabilising of the arc position }
- B23K 9/0738 . . . { Stabilising of the arc by automatic re-ignition means }
- B23K 9/08 . . Arrangements or circuits for magnetic control of the arc { stabilising of the arc position by magnetic means [B23K 9/0737](#) }
- B23K 9/09 . . Arrangements or circuits for arc welding with pulsed current or voltage

- B23K 9/091 .. { characterised by the circuits }
- B23K 9/092 ... { characterised by the shape of the pulses produced }
- B23K 9/093 ... { the frequency of the pulses produced being modulatable }

- B23K 9/095 . Monitoring or automatic control of welding parameters
- B23K 9/0953 .. { using computing means }
- B23K 9/0956 .. { using sensing means, e.g. optical }

- B23K 9/10 . Other electric circuits therefor ; Protective circuits ; Remote controls
- B23K 9/1006 .. { Power supply }
- B23K 9/1012 ... { characterised by parts of the process }
- B23K 9/1018 { Improvements of the cos (phi) of arc welding installations }
- B23K 9/1025 { Means for suppressing or reducing DC components in AC arc welding installations }
- B23K 9/1031 { Reduction of the arc voltage beneath the arc striking value, e.g. to zero voltage, during non-welding periods }
- B23K 9/1037 { Means preventing crater forming at the extremity of the seam }
- B23K 9/1043 ... { characterised by the electric circuit ([B23K 9/1012](#) takes precedence) }
- B23K 9/105 { by using discharge tubes or mechanical contactors ([B23K 9/1068](#) takes precedence) }
- B23K 9/1056 { by using digital means ([B23K 9/1068](#) takes precedence) }
- B23K 9/1062 { with computing means }
- B23K 9/1068 { Electric circuits for the supply of power to two or more arcs from a single source }
- B23K 9/1075 ... { Parallel power supply, i.e. multiple power supplies or multiple inverters supplying a single arc or welding current }
- B23K 9/1081 .. { Arc welding by means of accumulated energy }
- B23K 9/1087 .. { Arc welding using remote control }
- B23K 9/1093 .. { Consumable electrode or filler wire preheat circuits }

- B23K 9/12 . Automatic feeding or moving of electrodes or work for spot or seam welding or cutting
- B23K 9/121 .. { Devices for the automatic supply of at least two electrodes one after the other }
- B23K 9/122 .. { Devices for guiding electrodes, e.g. guide tubes }
- B23K 9/123 ... { Serving also as contacting devices supplying welding current to an electrode }
- B23K 9/124 .. { Circuits or methods for feeding welding wire }
- B23K 9/125 ... { Feeding of electrodes (for stabilising arc [B23K 9/073](#)) }
- B23K 9/126 .. { Controlling the spatial relationship between the work and the gas torch (between wire tip and piece [B23K 9/073](#)) }
- B23K 9/127 .. Means for tracking lines during arc welding or cutting (copying in general [B23Q 35/00](#))
- B23K 9/1272 ... { Geometry oriented, e.g. beam optical trading }
- B23K 9/1274 { Using non-contact, optical means, e.g. laser means }
- B23K 9/1276 { Using non-contact, electric or magnetic means, e.g. inductive means }
- B23K 9/1278 { Using mechanical means }
- B23K 9/133 .. Means for feeding electrodes, e.g. drums, rolls, motors

B23K 9/1333	...	{ Dereeling means }
B23K 9/1336	...	{ Driving means }
B23K 9/14	.	making use of insulated electrodes
B23K 9/142	..	{ Drag welding, the arc length being determined by an insulated layer between the welding electrode and the welding spot or seam }
B23K 9/145	...	{ the insulated welding electrode being laid along the seam }
B23K 9/147	...	{ the insulated welding electrode resting with one extremity on the workpiece }
B23K 9/16	.	making use of shielding gas { selection of media B23K 35/38 }
B23K 9/162	..	{ making use of a stationary fluid }
B23K 9/164	..	{ making use of a moving fluid }
B23K 9/167	..	and of a non-consumable electrode
B23K 9/1675	...	{ making use of several electrodes }
B23K 9/173	..	and of a consumable electrode
B23K 9/1735	...	{ making use of several electrodes }
B23K 9/18	.	Submerged-arc welding
B23K 9/182	..	{ making use of a non-consumable electrode }
B23K 9/184	...	{ making use of several electrodes }
B23K 9/186	..	{ making use of a consumable electrodes }
B23K 9/188	...	{ making use of several electrodes }
B23K 9/20	.	Stud welding
B23K 9/201	..	{ of the extremity of a small piece on a great or large basis }
B23K 9/202	...	{ by means of portable equipment, e.g. stud welding gun }
B23K 9/203	..	{ of cooling fins }
B23K 9/205	..	{ Means for determining, controlling or regulating the arc interval }
B23K 9/206	..	{ with automatic stud supply }
B23K 9/207	..	{ Features related to studs (welding studs per se B23K 35/0288) }
B23K 9/208	...	{ Ferrules, e.g. for confining molten material }
B23K 9/22	.	Percussion welding
B23K 9/23	.	taking account of the properties of the materials to be welded
B23K 9/232	..	{ of different metals }
B23K 9/235	.	Preliminary treatment
B23K 9/24	.	Features related to electrodes (form or composition of electrodes B23K 35/00)
B23K 9/26	..	Accessories for electrodes, e.g. ignition tips
B23K 9/28	..	Supporting devices for electrodes (not restricted to arc welding or cutting B23K 37/02)
B23K 9/282	...	{ Electrode holders not supplying shielding means to the electrode }
B23K 9/285	...	{ Cooled electrode holders }

- B23K 9/287 . . . { Supporting devices for electrode holders (not restricted to arc welding [B23K 37/02](#)) }
- B23K 9/29 . . . Supporting devices adapted for making use of shielding means
- B23K 9/291 { the shielding means being a gas }
- B23K 9/293 { using consumable electrode-rod }
- B23K 9/295 { using consumable electrode-wire }
- B23K 9/296 { using non-consumable electrodes }
- B23K 9/298 { the shielding means being a powder }
- B23K 9/30 . . . Vibrating holders for electrodes ([B23K 9/022](#) takes precedence)

- B23K 9/32 . Accessories (earthing connections [H01R](#))
- B23K 9/321 . . { Protecting means (protecting means in general [F16P 1/06](#)) }
- B23K 9/322 . . . { Head protecting means (masks, shields or hoods for weldersp [A61F 9/06](#)) }
- B23K 9/323 . . { Combined coupling means, e.g. gas, electricity, water or the like (electrical only [H01R](#)) }
- B23K 9/324 . . { Devices for supplying or evacuating a shielding or a welding powder, e.g. a magnetic powder }
- B23K 9/325 . . { Devices for supplying or evacuating shielding gas }
- B23K 9/326 . . . { Purge gas rings, i.e. devices for supplying or evacuating shielding gas inside of hollow or tubular articles, e.g. pipes, vessels }
- B23K 9/327 . . { Means for transporting supplies (carriages in general [B23K 37/02](#)) }
- B23K 9/328 . . { Cleaning of weld torches, i.e. removing weld-spatter; Preventing weld-spatter, e.g. applying anti-adhesives }

B23K 10/00 Welding or cutting by means of a plasma

- B23K 10/003 . { Scarfing, desurfacing or deburring (by applying flames [B23K 7/06](#)) }
- B23K 10/006 . { Control circuits therefor (circuits for plasma torches [H05H 1/36](#)) }
- B23K 10/02 . Plasma welding
- B23K 10/022 . . { Spot welding }
- B23K 10/025 . . { by making use of electrode vibrations }
- B23K 10/027 . . { Welding for purposes other than joining, e.g. build-up welding }

B23K 11/00 Resistance welding ; Severing by resistance heating

- B23K 11/0006 . { the welding zone being shielded against the influence of the surrounding atmosphere (selection of media [B23K 35/38](#)) }
- B23K 11/0013 . { welding for reasons other than joining, e.g. build up welding }
- B23K 11/002 . { specially adapted for particular articles or work }
- B23K 11/0026 . . { Welding of thin articles }
- B23K 11/0033 . . { Welding locally a thin plate to a large piece }
- B23K 11/004 . . { Welding of a small piece to a great or broad piece }

- B23K 11/0046 . . . { the extremity of a small piece being welded to a base, e.g. cooling studs or fins to tubes or plates }
- B23K 11/0053 { Stud welding, i.e. resistive (with an arc [B23K 9/20](#)) }
- B23K 11/006 { Welding a tip to a base, e.g. pen point nibs }
- B23K 11/0066 . . . { Riveting }
- B23K 11/0073 . . { Butt welding of long articles advanced axially }
- B23K 11/008 . . { Manufacturing of metallic grids or mats by spot welding }
- B23K 11/0086 . . . { Grids or mats used in concrete structures ([B23K 11/11](#) takes precedence) }
- B23K 11/0093 . . { Welding of honeycomb sandwich structures (brazing of honeycomb sandwich structure [B23K 1/0014](#)) }

- B23K 11/02 . Pressure butt welding

- B23K 11/04 . Flash butt welding
- B23K 11/043 . . { characterised by the electric circuits used therewith }
- B23K 11/046 . . { Apparatus therefor }

- B23K 11/06 . using roller electrodes
- B23K 11/061 . . { for welding rectilinear seams }
- B23K 11/062 . . . { for welding longitudinal seams of tubes }
- B23K 11/063 { Lap welding }
- B23K 11/065 . . { for welding curved planar seams }
- B23K 11/066 . . . { of tube sections }
- B23K 11/067 . . { for welding three-dimensional seams }
- B23K 11/068 . . . { of helicoidal seams }

- B23K 11/08 . Seam welding not restricted to one of the preceding sub-groups
- B23K 11/082 . . { of three-dimensional seams }
- B23K 11/084 . . . { of helicoidal seams }
- B23K 11/087 . . for rectilinear seams
- B23K 11/0873 . . . { of the longitudinal seam of tubes }
- B23K 11/0876 { Lap welding }
- B23K 11/093 . . for curved planar seams
- B23K 11/0935 . . . { of tube sections }

- B23K 11/10 . Spot welding ; Stitch welding
- B23K 11/105 . . { Stitch welding }
- B23K 11/11 . . Spot welding
- B23K 11/115 . . . { by means of two electrodes placed opposite one another on both sides of the welded parts }
- B23K 11/12 . . making use of vibrations

- B23K 11/14 . Projection welding

- B23K 11/16 . taking account of the properties of the material to be welded
- B23K 11/163 . . { Welding of coated materials }

- B23K 11/166 . . . { of galvanized or tinned materials }
- B23K 11/18 . . of non-ferrous metals ([B23K 11/20](#) takes precedence)
- B23K 11/185 . . . { of aluminium or aluminium alloys }
- B23K 11/20 . . of different metals

- B23K 11/22 . Severing by resistance heating

- B23K 11/24 . Electric supply or control circuits therefor
- B23K 11/241 . . { Electric supplies ([B23K 11/248](#) takes precedence) }
- B23K 11/243 . . . { Multiple welding installations fed by one source }
- B23K 11/245 . . . { using a stepping counter in synchronism with the welding pulses ([electromagnetic counters G06M](#)) }
- B23K 11/246 . . . { for flash welding }
- B23K 11/248 . . { Electric supplies using discharge tubes }
- B23K 11/25 . . Monitoring devices
- B23K 11/251 . . . { using analog means }
- B23K 11/252 . . . { using digital means }
- B23K 11/253 { the measured parameter being a displacement or a position }
- B23K 11/255 { the measured parameter being a force ([B23K 11/253](#) takes precedence) }
- B23K 11/256 { the measured parameter being the inter-electrode electrical resistance }
- B23K 11/257 { the measured parameter being an electrical current }
- B23K 11/258 { the measured parameter being a voltage }
- B23K 11/26 . . Storage discharge welding

- B23K 11/28 . Portable welding equipment

- B23K 11/30 . Features relating to electrodes ([form or composition of electrodes B23K 35/00](#))
- B23K 11/3009 . . { Pressure electrodes }
- B23K 11/3018 . . . { Cooled pressure electrodes }
- B23K 11/3027 . . { Slide or drag electrodes }
- B23K 11/3036 . . { Roller electrodes }
- B23K 11/3045 . . . { Cooled roller electrodes }
- B23K 11/3054 . . { Cooled electrodes ([B23K 11/3018](#) , [B23K 11/3045](#) take precedence) }
- B23K 11/3063 . . { Electrode maintenance, e.g. cleaning, grinding }
- B23K 11/3072 . . { Devices for exchanging or removing electrodes or electrode tips }
- B23K 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 }

- B23K 11/309 . . { Wire electrodes }
- B23K 11/31 . . Electrode holders { and actuating devices therefor } ([not restricted to resistance welding or severing by resistance heating B23K 37/02](#))
- B23K 11/311 . . . { the actuating device comprising an electric motor }
- B23K 11/312 . . . { for several electrodes }
- B23K 11/314 . . . { Spot welding guns, e.g. mounted on robots }
- B23K 11/315 { with one electrode moving on a linear path }

- B23K 11/317 . . . { Equalizing; Balancing devices for electrode holders }
- B23K 11/318 . . . { Supporting devices for electrode holders }
- B23K 11/34 . Preliminary treatment
- B23K 11/36 . Auxiliary equipment ([B23K 11/31](#) takes precedence)
- B23K 11/362 . . { Contact means for supplying welding current to the electrodes }
- B23K 11/364 . . . { Clamping contacts }
- B23K 11/366 . . . { Sliding contacts }
- B23K 11/368 . . . { Liquid contacts, e.g. mercury contacts }

B23K 13/00 Welding by high-frequency current heating

- B23K 13/01 . by induction heating
- B23K 13/015 . . { Butt welding }
- B23K 13/02 . . Seam welding
- B23K 13/025 . . . { for tubes }
- B23K 13/04 . by conduction heating (([B23K 13/02](#) takes precedence))
- B23K 13/043 . . { Seam welding }
- B23K 13/046 . . . { for tubes }
- B23K 13/06 . characterised by the shielding of the welding zone against influence of the surrounding atmosphere (selection of media [B23K 35/38](#))
- B23K 13/08 . Electric supply or control circuits therefor

Guidance heading: Other welding or cutting ; Working by laser beam

B23K 15/00 Electron-beam welding or cutting (electron- or ion- beam tubes [H01J 37/00](#))

- B23K 15/0006 . { specially adapted for particular articles }
- B23K 15/0013 . { Positioning or observing workpieces, e.g. with respect to the impact; Aligning, aiming or focusing electronbeams }
- B23K 15/002 . { Devices involving relative movement between electronbeam and workpiece }
- B23K 15/0026 . { Auxiliary equipment }
- B23K 15/0033 . { Preliminary treatment }
- B23K 15/004 . { Tandem beams or torches, i.e. working simultaneously with several beams or torches }
- B23K 15/0046 . { Welding }
- B23K 15/0053 . . { Seam welding }

- B23K 15/006 . . . { of rectilinear seams }
- B23K 15/0066 . . . { with backing means disposed under the seams }
- B23K 15/0073 . . . { with interposition of particular material to facilitate connecting the parts, e.g. using a filler }
- B23K 15/008 . . { Spot welding }
- B23K 15/0086 . . { welding for purposes other than joining, e.g. built-up welding }
- B23K 15/0093 . . { characterised by the properties of the materials to be welded }

B23K 15/02 . Control circuits therefor

B23K 15/04 . for welding annular seams

B23K 15/06 . within a vacuum chamber ([B23K 15/04](#) takes precedence)

B23K 15/08 . Removing material, e.g. by cutting, by hole drilling

B23K 15/085 . . { Boring }

B23K 15/10 . Non-vacuum electron beam-welding or cutting

B23K 17/00 use of the energy of nuclear particles in welding or related techniques

B23K 20/00 Non-electric welding by applying impact or other pressure, with or without the application of heat, e.g. cladding or plating

B23K 20/001 . { by extrusion or drawing }

B23K 20/002 . { specially adapted for particular articles or work ([B23K 20/129](#) takes precedence) }

B23K 20/004 . . { Wire welding }

B23K 20/005 . . . { Capillary welding }

B23K 20/007 { Ball bonding }

B23K 20/008 . { pressure combined with radiant energy }

B23K 20/02 . by means of a press; { Diffusion bonding ([B23K 20/001](#) , [B23K 20/04](#) take precedence) }

B23K 20/021 . . { Isostatic pressure welding }

B23K 20/023 . . { Thermo-compression bonding }

B23K 20/025 . . . { Bonding tips therefor }

B23K 20/026 . . . { with diffusion of soldering material }

B23K 20/028 . . { Butt welding }

B23K 20/04 . by means of a rolling mill

B23K 20/06 . by means of high energy impulses, e.g. magnetic energy

B23K 20/08 . . Explosive welding

B23K 20/085 . . . { for tubes, e.g. plugging }

B23K 20/10 . making use of vibrations, e.g. ultrasonic welding

- B23K 20/103 .. { using a roller }
- B23K 20/106 .. { Features related to sonotrodes }

- B23K 20/12 . the heat being generated by friction ; Friction welding
- B23K 20/1205 .. { using translation movement }
- B23K 20/121 .. { Control circuits therefor }
- B23K 20/1215 .. { for other purposes than joining, e.g. built-up welding }
- B23K 20/122 .. { using a non-consumable tool, e.g. friction stir welding }
- B23K 20/1225 ... { Particular aspects of welding with a non-consumable tool }

WARNING

This group only contains recent documents which are in the process of being reclassified into groups [B23K 20/123](#) to [B23K 20/1265](#)

- B23K 20/123 ... { Controlling or monitoring the welding process }

WARNING

This group and its subgroups are incomplete. For recent documents see also [B23K 20/1225](#)

- B23K 20/1235 { with temperature control during joining }
- B23K 20/124 { at the beginning or at the end of a weld }
- B23K 20/1245 ... { characterised by the apparatus }

WARNING

This group and its subgroups are incomplete. For recent documents see also [B23K 20/1225](#)

- B23K 20/125 { Rotary tool drive mechanism }
- B23K 20/1255 { Tools therefor, e.g. characterised by the shape of the probe }
- B23K 20/126 { Workpiece support, i.e. backing or clamping }
- B23K 20/1265 ... { Non-butt welded joints, e.g. overlap-joints, T-joints or spot welds }

WARNING

This group is incomplete. For recent documents see also [B23K 20/1225](#)

- B23K 20/127 ... { friction stir welding involving a mechanical connection (forged connections [B21K 25/005](#) ; riveted connections [B21J 15/027](#)) }
- B23K 20/1275 ... { involving metallurgical change }
- B23K 20/128 ... { making use of additional material }
- B23K 20/1285 .. { Portable friction welding machines }
- B23K 20/129 .. { specially adapted for particular articles or workpieces }
- B23K 20/1295 ... { Welding studs }

- B23K 20/14 . Preventing or minimising gas access, or using protective gases or vacuum during welding (formed by material interposed between workpieces [B23K 20/18](#))

- B23K 20/16 . with interposition of special material to facilitate connection of the parts, e.g. material for absorbing or producing gas
- B23K 20/165 . . { involving an exothermic reaction of the interposed material }
- B23K 20/18 . Zonal welding by interposing weld-preventing substances between zones not to be welded
- B23K 20/20 . Special methods allowing subsequent separation, e.g. of metals of high quality from scrap material
- B23K 20/22 . taking account of the properties of the materials to be welded
- B23K 20/227 . . with ferrous layer
- B23K 20/2275 . . . { the other layer being aluminium }
- B23K 20/233 . . without ferrous layer
- B23K 20/2333 . . . { one layer being aluminium, magnesium or beryllium }
- B23K 20/2336 . . . { both layers being aluminium }
- B23K 20/24 . Preliminary treatment
- B23K 20/26 . Auxiliary equipment
- B23K 23/00 Alumino-thermic welding**
- B23K 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 ([B23K 23/00](#) takes precedence; submerged-arc welding [B23K 9/18](#))**
- B23K 25/005 . { Welding for purposes other than joining, e.g. built-up welding }
- B23K 26/00 Working by laser beam, e.g. welding, cutting, boring (lasers per se [H01S 3/00](#) ; { laser assisted deposition [C23C](#) ; laser inspection or alignment [G01B](#) ; laser sintering of metallic powder [B22F 3/105](#) , of plastics [B29C 67/00](#) , of glass [C03B 19/06](#) , of ceramics [C04B 35/64](#) ; applying identification marks by laser [B41M 5/24](#) })**
- B23K 26/0003 . { Trimming, tuning }
- B23K 26/0006 . { taking account of the properties of the material involved ([B23K 26/20](#) , [B23K 26/36](#) take precedence) }
- B23K 26/0009 . . { Metallic material }
- B23K 26/0012 . . . { Non-ferrous metals or alloys }
- B23K 26/0015 { Refractory metals }
- B23K 26/0018 { Light metals }
- B23K 26/0021 . . { Non-metallic material (laser surface treatment of glass not in the form of fibres or filaments [C03C 23/0025](#) , of glass in the form of fibres or filaments [C03C 25/6233](#)) }
- B23K 26/0024 . . . { Organic material }
- B23K 26/0027 { Material from living organisms, e.g. skin (surgical instruments, devices or

- methods for applying laser energy to the body [A61B 18/20](#) ; dental laser [A61C 1/0046](#) ; eye surgery using laser [A61F 9/008](#)) }
- B23K 26/003 { Fabrics }
 - B23K 26/0033 { Paper }
 - B23K 26/0036 { Plastics }
 - B23K 26/0039 . . . { Inorganic material }
 - B23K 26/0042 { Semiconductor material, e.g. Si or Ge based }
 - B23K 26/0045 { Ceramics }
 - B23K 26/0048 . . { Composite material, e.g. fibre reinforced, sandwich steel plate }
 - B23K 26/0051 . . { Surface-treated material, e.g. plated, painted }

 - B23K 26/0054 . { Working by transmitting the laser beam within the workpiece }
 - B23K 26/0057 . . { by modifying or reforming the material inside the workpiece, e.g. for producing break initiation cracks }
 - B23K 26/006 . . { by creating voids inside the workpiece, e.g. for forming flow passages or flow patterns }
 - B23K 26/0063 . . { the laser beam entering a face of the workpiece from which it is transmitted through the workpiece material to work on a face remote from the face where the laser beam entered the workpiece, e.g. for effecting removal, fusion splicing, modifying or reforming }

 - B23K 26/0066 . { for surface treatment (for changing the physical structure of ferrous metals or alloys [C21D](#) , of non-ferrous metals or alloys [C22F](#) ; for alloying [C23C](#) ; annealing crystalline material [C30B 33/02](#) ; laser treatment of semiconductors [H01L](#)) }
 - B23K 26/0069 . . { Laser shock processing (modifying the physical properties of ferrous metals by laser shock processing [C21D 10/005](#)) }
 - B23K 26/0072 . . { Modifying rugosity }
 - B23K 26/0075 . . . { Diminishing rugosity, e.g. grinding; Polishing; Smoothing }
 - B23K 26/0078 . . . { Increasing rugosity, e.g. roughening }
 - B23K 26/0081 . . { by melting (laser re-melting of metals by wave energy [C22B 9/22](#) ; laser melting of glass [C03C](#) ; laser melting for crystal growth [C30B](#)) }
 - B23K 26/0084 . . { Texturing }
 - B23K 26/0087 . . { by providing a line or line pattern, e.g. a dotted break initiation line }

 - B23K 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](#)) }

 - B23K 26/0093 . { combined with mechanical machining or metal-working covered by other subclasses than [B23K](#) (combined with an electric arc [B23K 26/1429](#) ; combined welding or cutting procedures or apparatus [B23K 28/02](#)) ; Heating a metal workpiece by laser during machining [B23P 25/006](#) }

 - B23K 26/0096 . { Portable laser equipment, e.g. hand-held laser apparatus (Surgical laser instruments [A61B 18/20](#) , Dental Lasers [A61C 1/0046](#) , Hand-held laser dental apparatus for curing resins [A61C 19/004](#)) }

 - B23K 26/02 . Positioning or observing the workpiece, e.g. with respect to the point of impact ; Aligning, aiming or focusing the laser beam
 - B23K 26/023 . . { Aligning, aiming or focussing the laser beam by pressing on the workpiece, e.g. pressing roller foot }

B23K 26/026	..	{ Aligning the laser beam (B23K 26/023 takes precedence; automatically aligning the laser beam B23K 26/041) }
B23K 26/03	..	Observing, { e.g. monitoring, } the workpiece { (protective devices for the eye, carried on the body or in the hand A61F 9/02 , A61F 9/04) }
B23K 26/032	...	{ using optical means }
B23K 26/034	...	{ Observing temperature of the workpiece }
B23K 26/036	...	{ Observing magnetic field related to the workpiece }
B23K 26/038	...	{ Observing speed of the workpiece }
B23K 26/04	..	Automatically aligning, aiming or focusing the laser beam, e.g. using the back-scattered light
B23K 26/041	...	{ Automatically aligning the laser beam }
B23K 26/043	....	{ along the beam path, i.e. alignment of laser beam axis relative to laser beam apparatus }
B23K 26/045	...	{ for tracking lines during welding or cutting, e.g. seam tracking }
B23K 26/046	...	{ Automatically focusing the laser beam }
B23K 26/048	....	{ by controlling the distance between laser head and workpiece }
B23K 26/06	..	Shaping the laser beam, e.g. by masks or multi-focusing (optical elements, systems, or apparatus, in general G02B { beam shaping for applications of laser not covered in this group H01S 3/005 })
B23K 26/0604	...	{ by a combination of beams }
B23K 26/0608	....	{ in the same heat affected zone [HAZ] (B23K 26/0613 , B23K 26/0621 take precedence) }
B23K 26/0613	....	{ having a common axis (B23K 26/0621 takes precedence) }
B23K 26/0617	.....	{ and with spots spaced along the common axis }
B23K 26/0621	....	{ with spots located on opposed surfaces of the workpiece }
B23K 26/0626	...	{ Energy control of the laser beam (temporal shaping of laser beam H01S 3/0057) }
B23K 26/063	....	{ Pulse shaping }
B23K 26/0635	.....	{ using ultrashort pulses, i.e. pulses of 1ns or less }
B23K 26/0639	...	{ by means of optical elements }
B23K 26/0643	....	{ comprising mirrors }
B23K 26/0648	....	{ comprising lenses }
B23K 26/0652	....	{ comprising prisms }
B23K 26/0656	....	{ comprising a mask (for lithography G03F) }
B23K 26/0661	.....	{ disposed on the workpiece }
B23K 26/0665	...	{ by beam condensation on the workpiece, e.g. for focusing }
B23K 26/067	...	Dividing the beam into multiple beams, e.g. multifocusing
B23K 26/0673	....	{ into independently operating sub-beams, e.g. beam multiplexing to provide laser beams for several stations }
B23K 26/0676	....	{ into dependently operating sub-beams, e.g. an array of spots with fixed spatial relationship or for performing simultaneously identical operations }
B23K 26/073	...	Shaping the laser spot
B23K 26/0732	....	{ into a rectangular shape }
B23K 26/0734	....	{ into an annular shape }
B23K 26/0736	....	{ into an oval shape, e.g. elliptic shape }

- B23K 26/0738 { into a linear shape }
- B23K 26/08 . Devices involving relative movement between laser beam and workpiece
- B23K 26/0807 . . { Devices involving movement of the laser beam relative to the laser head, i.e. scanning devices }
- B23K 26/0815 . . . { using multifaceted mirrors, e.g. polygonal mirror (scanning devices using multifaceted mirrors, in general [G02B 26/12](#)) }
- B23K 26/0823 . . { Devices involving rotation of the workpiece }
- B23K 26/083 . . { Devices involving movement of the workpiece in at least one axial direction }
- B23K 26/0838 . . . { by using an endless conveyor belt }
- B23K 26/0846 { for moving elongated workpieces longitudinally, e.g. wire or strip material }
- B23K 26/0853 . . . { Devices involving movement of the workpiece in at least in two axial directions, e.g. in a plane }
- B23K 26/0861 { in at least in three axial directions }
- B23K 26/0869 . . { Devices involving movement of the laser head in at least one axial direction }
- B23K 26/0876 . . . { in at least two axial directions }
- B23K 26/0884 { in at least in three axial directions, e.g. manipulators, robots }
- B23K 26/0892 . . . { Controlling the laser beam travel length }
- B23K 26/10 . . using a fixed support, { i.e. involving moving the laser beam }
- B23K 26/103 . . . { the laser beam rotating around the fixed workpiece ([B23K 26/28](#) takes precedence) }
- B23K 26/106 { inside the workpiece }
- B23K 26/12 . in a special atmosphere, e.g. in an enclosure
- B23K 26/121 . . { in a liquid, e.g. underwater }
- B23K 26/122 . . { in vacuum }
- B23K 26/123 . . { in an atmosphere of particular gases }
- B23K 26/125 . . . { of mixed gases }
- B23K 26/126 . . { in an atmosphere of gases chemically reacting with the workpiece (chemical etching of glass [C03C 15/00](#) , [C03C 25/68](#) ; chemical etching of metallic material [C23F 1/00](#) ; etching of crystallised non-metallic material with defined structure in gas atmosphere [C30B 33/12](#)) }
- B23K 26/127 . . { in an enclosure }
- B23K 26/128 . . . { Laser beam path enclosures }
- B23K 26/14 . using a flow, e.g. a jet of gas, in conjunction with the laser beam; { Nozzles therefor } ([B23K 26/12](#) takes precedence)
- B23K 26/1405 . . { for the removal of by-products, e.g. by aspiration }
- B23K 26/1411 . . { the flow containing particles, e.g. powder }
- B23K 26/1417 . . { the flow containing a liquid }
- B23K 26/1423 . . { the flow carrying an electric current }
- B23K 26/1429 . . . { the flow carrying an electric arc, e.g. laser arc hybrid welding }
- B23K 26/1435 . . { involving specially adapted flow control means }
- B23K 26/1441 . . . { for pressure control }
- B23K 26/1447 . . . { for debit control }
- B23K 26/1452 . . . { for directional control }

- B23K 26/1458 .. { Nozzles; Features related to nozzles }
- B23K 26/1464 ... { Supply to, or discharge from, nozzles of media, e.g. gas, powder, wire }
- B23K 26/147 { Features outside the nozzle for feeding media towards the workpiece }
- B23K 26/1476 { Features inside the nozzle for feeding media through the nozzle }
- B23K 26/1482 ... { Detachable nozzles, e.g. exchangeable or with breakaway lines }
- B23K 26/1488 ... { Means for protecting nozzles, e.g. the tip surface (by breakaway lines [B23K 26/1482](#)) }
- B23K 26/1494 ... { Maintenance of nozzles }

- B23K 26/16 . Removing of by-products, e.g. particles or vapours produced during treatment of a workpiece (by a flow of gas [B23K 26/14](#))

- B23K 26/18 . using absorbing layers on the material being worked, e.g. for marking or protecting purposes { (observing devices provided with laser radiation protection devices [B23K 26/03](#) ; using masks on the workpiece for shaping the laser beam [B23K 26/0661](#) ; interposing material for facilitating bonding [B23K 26/203](#) ; laser anti-reflection devices, e.g. optical isolators [H01S 3/0064](#)) }

- B23K 26/20 . Bonding, e.g. welding (soldering by means of radiant energy [B23K 1/005](#) ; joining of preformed plastics parts by heating using laser beam [B29C 65/16](#))
- B23K 26/203 .. { with interposition of material for facilitating bonding (with interposition of adhesive being heated by laser [C09J 5/06](#) ; with interposition of solder [B23K 1/0056](#)) }
- B23K 26/206 .. { Laser sealing }
- B23K 26/22 .. Spot welding
- B23K 26/24 .. Seam welding
- B23K 26/243 ... { Fillet welding }
- B23K 26/246 ... { Overlap welding }
- B23K 26/26 ... of rectilinear seams
- B23K 26/265 { Longitudinal seams of tubes }
- B23K 26/28 ... of curved planar seams
- B23K 26/285 { Tube sections }
- B23K 26/30 ... of three-dimensional seams
- B23K 26/305 { Helicoidal seams }
- B23K 26/32 .. taking account of the properties of the material involved
- B23K 26/3206 ... { Metallic material }
- B23K 26/3213 { Non-ferrous metals or alloys }
- B23K 26/322 { Refractory metals }
- B23K 26/3226 { Light metals }
- B23K 26/3233 { Dissimilar metal materials }
- B23K 26/324 ... { Non-metallic material (joining glass to glass by fusing with laser [C03B 23/20](#) , by processes other than by fusing using laser [C03C 27/06](#) ; joining ceramics [C04B 37/00](#)) }
- B23K 26/3246 { Organic material (devices or method using laser on the body [A61B 18/20](#) ; dental laser [A61C 1/0046](#) ; eye laser surgery [A61F 9/008](#) ; Treatment of micro-organisms with electric or wave energy [C12N 13/00](#)) }
- B23K 26/3253 { Fabrics }
- B23K 26/326 { Paper }

B23K 26/3266	...	{ Inorganic material }
B23K 26/3273	....	{ Ceramics }
B23K 26/328	...	{ Composite material, e.g. fibre reinforced, sandwich steel plate }
B23K 26/3286	...	{ Surface-treated material, e.g. plated, painted }
B23K 26/3293	....	{ Coated material }
B23K 26/34	.	Welding for purposes other than joining, e.g. build-up welding { (laser alloying or sintering C23C) }
B23K 26/345	..	{ Build-up welding }
B23K 26/36	.	Removing material { (laser wire stripping H02G 1/128 ; cleaning by laser treatment B08B 7/0042) }
B23K 26/362	..	{ Mechanical trimming (trimming of electric components B23K 26/0003) ; Deburring; Scarfing or desurfacing }
B23K 26/365	..	{ Laser etching, i.e. the material is removed superficially or partially through the workpiece by the laser beam (laser etching for decorative purposes B44C 1/22 , laser etching for manufacturing printed circuit boards H05K 3/00) }
B23K 26/367	...	{ for making a groove or trench, e.g. scribing a break initiation groove }
B23K 26/38	..	by boring or cutting
B23K 26/381	...	{ Boring (Via connections through an SC device substrate H01L 21/486) }
B23K 26/383	....	{ of specially shaped holes }
B23K 26/385	....	{ of blind holes (Laser ablation of PCB substrate blind holes having a metal layer at the bottom H05K 3/0035) }
B23K 26/386	....	{ Trepanning }
B23K 26/388	....	{ of fluid openings, e.g. nozzles, jets (Laser machining of inkjet nozzles B41J 2/1634) }
B23K 26/40	..	taking account of the properties of the material involved
B23K 26/4005	...	{ Metallic material }
B23K 26/401	....	{ Non-ferrous metals or alloys }
B23K 26/4015	....	{ Refractory metals }
B23K 26/402	....	{ Light metals }
B23K 26/4025	...	{ Non-metal material }
B23K 26/403	....	{ Organic material }
B23K 26/4035	.....	{ Material from living organisms, e.g. skin (devices or method using laser on the body A61B 18/20 ; dental laser A61C 1/0046 ; eye laser surgery A61F 9/008 ; Treatment of micro-organisms with electric or wave energy C12N 13/00 ; Introduction of foreign genetic material into plant cells by physical or non-biological means C12N 15/8206) }
B23K 26/404	.....	{ Leather (clicking, perforating, or cutting leather C14B 5/00) }
B23K 26/4045	.....	{ Wood or similar (working or preserving wood or similar material B27B - B27M) }
B23K 26/405	.....	{ Fibrous material }
B23K 26/4055	.....	{ Fabrics }
B23K 26/406	.....	{ Paper (metallic paper B23K 26/4005) }
B23K 26/4065	.....	{ Plastics }
B23K 26/407	....	{ Inorganic material }

- B23K 26/4075 { Brittle material, e.g. semi-conductor wafers (severing glass using laser [C03B 33/0222](#) , [C03B 33/091](#)) }
- B23K 26/408 { Ceramics }
- B23K 26/4085 . . . { Composite material, e.g. fibre reinforced, sandwich steel plate }
- B23K 26/409 { Multi-layered material wherein at least one layer is non-metallic }
- B23K 26/4095 . . . { Surface-treated material, e.g. plated, painted }

- B23K 26/42 . Preliminary treatment ; Auxiliary operations or equipment ([B23K 26/16](#) takes precedence)
- B23K 26/421 . . { Preliminary treatment }
- B23K 26/422 . . { Auxiliary equipment }
- B23K 26/423 . . . { Cooling arrangements (by using a flow [B23K 26/14](#)) }
- B23K 26/425 . . . { Beam dispersers, e.g. beam wells }
- B23K 26/426 . . . { Beam measuring device (beam monitoring per se [G01J 1/4257](#)) }
- B23K 26/427 . . . { Protective screens (goggles or eye-masks for welders carried on the body or in the hand [A61F 9/02](#) , [A61F 9/06](#)) }
- B23K 26/428 . . . { for monitoring laser beam transmission optics }

- B23K 28/00** **Welding or cutting not covered by any of the preceding groups, e.g. electrolytic welding**

- B23K 28/003 . { Welding in a furnace }
- B23K 28/006 . { Welding metals by means of an electrolyte (working metal, e.g. cutting, by means of an electrolyte [B23H](#)) }
- B23K 28/02 . Combined welding or cutting procedures or apparatus

- B23K 31/00** **Processes relevant to this subclass, specially adapted for particular articles or purposes, but not covered by only one of the preceding main groups (making tubes or profiled bars involving operations other than soldering or welding [B21C 37/04](#) , [B21C 37/08](#))**

- B23K 31/003 . { relating to controlling of welding distortion }
- B23K 31/006 . { relating to using of neural networks }
- B23K 31/02 . relating to soldering or welding (dip or wave soldering in the manufacture of printed circuits [H05K 3/34](#))
- B23K 31/022 . . { Making profiled bars with soldered or welded seams }
- B23K 31/025 . . { Connecting cutting edges or the like to tools; Attaching reinforcements to workpieces, e.g. wear-resisting zones to tableware }
- B23K 31/027 . . { Making tubes with soldering or welding }
- B23K 31/10 . relating to cutting or desurfacing
- B23K 31/12 . relating to investigating the properties, e.g. the weldability, of materials
- B23K 31/125 . . { Weld quality monitoring }

B23K 33/00	Specially-profiled edge portions of workpieces for making soldering or welding connections ; Filling the seams formed thereby { (B23K 11/14 takes precedence) }
B23K 33/002	. { Crimping or bending the workpieces at the joining area }
B23K 33/004	. { Filling of continuous seams }
B23K 33/006	.. { for cylindrical workpieces }
B23K 33/008	.. { for automotive applications }
B23K 35/00	Rods, electrodes, materials, or media, for use in soldering, welding, or cutting
B23K 35/001	. { Interlayers, transition pieces for metallurgical bonding of workpieces }
B23K 35/002	.. { at least one of the workpieces being of light metal }
B23K 35/004	.. { at least one of the workpieces being of a metal of the iron group }
B23K 35/005	.. { at least one of the workpieces being of a refractory metal }
B23K 35/007	.. { at least one of the workpieces being of copper or another noble metal }
B23K 35/02	. characterised by mechanical features, e.g. shape
B23K 35/0205	.. { Non-consumable electrodes; C-electrodes }
B23K 35/0211	.. { for use in cutting (B23K 35/0205 takes precedence) }
B23K 35/0216	... { Rods, electrodes, wires }
B23K 35/0222	.. { for use in soldering, brazing (B23K 35/0205 takes precedence) }
B23K 35/0227	... { Rods, wires (B23K 35/0244 takes precedence) }
B23K 35/0233	... { Sheets, foils (B23K 35/0244 takes precedence) }
B23K 35/0238	.... { layered }
B23K 35/0244	... { Powders, particles or spheres; Preforms made therefrom }
B23K 35/025	.... { Pastes, creams, slurries }
B23K 35/0255	.. { for use in welding (B23K 35/0205 takes precedence) }
B23K 35/0261	... { Rods, electrodes, wires }
B23K 35/0266	.... { flux-cored }
B23K 35/0272	.... { with more than one layer of coating or sheathing material }
B23K 35/0277	.... { of non-circular cross-section }
B23K 35/0283	.... { multi-cored; multiple }
B23K 35/0288	... { Welding studs }
B23K 35/0294	... { Consumable guides }
B23K 35/22	. characterised by the composition or nature of the material
B23K 35/222	.. { Non-consumable electrodes }
B23K 35/224	.. { Anti-weld compositions; Braze stop-off compositions }
B23K 35/226	.. { Non-corrosive coatings; Primers applied before welding }
B23K 35/228	.. { Selection of materials for cutting }
B23K 35/24	.. Selection of soldering or welding materials proper (B23K 35/34 takes precedence)
B23K 35/26	... with the principal constituent melting at less than 400 degrees C

B23K 35/262	....	{ Sn as the principal constituent }
B23K 35/264	....	{ Bi as the principal constituent }
B23K 35/266	....	{ Cd as the principal constituent }
B23K 35/268	....	{ Pb as the principal constituent }
B23K 35/28	...	with the principal constituent melting at less than 950 degrees C
B23K 35/282	....	{ Zn as the principal constituent }
B23K 35/284	....	{ Mg as the principal constituent }
B23K 35/286	....	{ Al as the principal constituent }
B23K 35/288	.....	{ with Sn or Zn }
B23K 35/30	...	with the principal constituent melting at less than 1550 degrees C
B23K 35/3006	....	{ Ag as the principal constituent }
B23K 35/3013	....	{ Au as the principal constituent }
B23K 35/302	....	{ Cu as the principal constituent }
B23K 35/3026	....	{ Mn as the principal constituent }
B23K 35/3033	....	{ Ni as the principal constituent }
B23K 35/304	.....	{ with Cr as the next major constituent }
B23K 35/3046	....	{ Co as the principal constituent }
B23K 35/3053	....	{ Fe as the principal constituent }
B23K 35/306	.....	{ with C as next major constituent, e.g. cast iron }
B23K 35/3066	.....	{ with Ni as next major constituent }
B23K 35/3073	.....	{ with Mn as next major constituent }
B23K 35/308	.....	{ with Cr as next major constituent }
B23K 35/3086	.....	{ containing Ni or Mn }
B23K 35/3093	.....	{ with other elements as next major constituents }
B23K 35/32	...	with the principal constituent melting at more than 1550 degrees C
B23K 35/322	....	{ a Pt-group metal as principal constituent }
B23K 35/325	....	{ Ti as the principal constituent }
B23K 35/327	....	{ comprising refractory compounds, e.g. carbides }
B23K 35/34	..	comprising compounds which yield metals when heated
B23K 35/36	..	Selection of non-metallic compositions, e.g. coatings, fluxes (B23K 35/34 takes precedence) ; Selection of soldering or welding materials, conjoint with selection of non-metallic compositions, both selections being of interest (selection of soldering or welding materials proper B23K 35/24)
B23K 35/3601	...	{ with inorganic compounds as principal constituents }
B23K 35/3602	....	{ Carbonates, basic oxides or hydroxides }
B23K 35/3603	....	{ Halide salts }
B23K 35/3605	.....	{ Fluorides }
B23K 35/3606	....	{ Borates or B-oxides }
B23K 35/3607	....	{ Silica or silicates }
B23K 35/3608	....	{ Titania or titanates }
B23K 35/361	....	{ Alumina or aluminates }
B23K 35/3611	....	{ Phosphates }
B23K 35/3612	...	{ with organic compounds as principal constituents }

B23K 35/3613	....	{ Polymers, e.g. resins }
B23K 35/3615	....	{ N-compounds }
B23K 35/3616	....	{ Halogen compounds }
B23K 35/3617	....	{ B-compounds }
B23K 35/3618	....	{ Carboxylic acids or salts }
B23K 35/362	...	Selection of compositions of fluxes (B23K 35/365 , B23K 35/368 take precedence)
B23K 35/365	...	Selection of non-metallic compositions of coating materials either alone or conjoint with selection of soldering or welding materials
B23K 35/368	...	Selection of non-metallic compositions of core materials either alone or conjoint with selection of soldering or welding materials
B23K 35/38	..	Selection of media, e.g. special atmospheres for surrounding the working area
B23K 35/383	...	{ mainly containing noble gases or nitrogen }
B23K 35/386	...	{ for condensation soldering }
B23K 35/40	.	Making wire or rods for soldering or welding (processes involving a single technical art, see the relevant subclasses, e.g. B05D , B21C)
B23K 35/402	..	{ Non-consumable electrodes; C-electrodes }
B23K 35/404	..	{ Coated rods; Coated electrodes }
B23K 35/406	..	{ Filled tubular wire or rods (B23K 35/402 takes precedence) }
B23K 37/00		Auxiliary devices or processes, not specially adapted to a procedure covered by only one of the preceding main groups (eye-shields for welders worn on the operator's body or carried in the hand A61F 9/00 { i.e. A61F 9/02 } ; applicable to metal-working machines other than soldering, welding, or flame-cutting machines B23Q ; { laser protective screens B23K 26/427 ; } protective shields for other welding methods F16P 1/06)
B23K 37/003	.	{ Cooling means }
B23K 37/006	.	{ Safety devices }
B23K 37/02	.	Carriages for supporting the welding or cutting element
B23K 37/0205	..	{ guided by hand }
B23K 37/0211	..	{ travelling on a guide member, e.g. rail, track }
B23K 37/0217	...	{ the guide member being fixed to the workpiece }
B23K 37/0223	....	{ the guide member being a part of the workpiece }
B23K 37/0229	...	{ the guide member being situated alongside the workpiece }
B23K 37/0235	...	{ the guide member forming part of a portal }
B23K 37/0241	..	{ Attachments between the welding or cutting element and the carriage }
B23K 37/0247	..	{ Driving means }
B23K 37/0252	..	{ Steering means }
B23K 37/0258	..	{ Electric supply or control circuits therefor }
B23K 37/0264	..	{ magnetically attached to the workpiece }
B23K 37/027	..	{ for making circular cuts or welds }
B23K 37/0276	..	{ for working on or in tubes (B23K 37/0211 takes precedence) }

- B23K 37/0282 . . { Carriages forming part of a welding unit }
- B23K 37/0288 . . { Carriages forming part of a cutting unit }
- B23K 37/0294 . . { Transport carriages or vehicles }

- B23K 37/04 . for holding or positioning work
- B23K 37/0408 . . { for planar work }
- B23K 37/0417 . . { for spherical work }
- B23K 37/0426 . . { Fixtures for other work }
- B23K 37/0435 . . . { Clamps }
- B23K 37/0443 . . . { Jigs }
- B23K 37/0452 . . { Orientable fixtures ([B23K 37/0461](#) takes precedence) }
- B23K 37/0461 . . { Welding tables }
- B23K 37/047 . . moving work to adjust its position between soldering, welding or cutting steps ([B23K 37/053](#) takes precedence)
- B23K 37/053 . . aligning cylindrical work ; Clamping devices therefor
- B23K 37/0531 . . . { internal pipe alignment clamps }
- B23K 37/0533 . . . { external pipe alignment clamps }
- B23K 37/0535 . . . { longitudinal pipe seam alignment clamps }
- B23K 37/0536 . . . { for maintaining flanges on tubes }
- B23K 37/0538 . . . { for rotating tubes, e.g. rollers }

- B23K 37/06 . for positioning the molten material, e.g. confining it to a desired area
- B23K 37/08 . for flash removal

Guidance heading:

- B23K 2001/00** **Soldering, e.g. brazing, or unsoldering** ([B23K 3/00](#) takes precedence; characterised only by the use of special materials or media [B23K 35/00](#) ; dip or wave soldering in the manufacture of printed circuits [H05K 3/34](#))
- B23K 2001/12 . specially adapted for particular articles or work
- B23K 2005/00** **Gas flame welding**
- B23K 2005/207 . specially adapted for particular articles or work
- B23K 2035/00** **Rods, electrodes, materials, or media, for use in soldering, welding, or cutting**
- B23K 2035/001 . { Interlayers, transition pieces for metallurgical bonding of workpieces }
- B23K 2035/008 . . at least one of the workpieces being of silicium
- B23K 2035/40 . Making wire or rods for soldering or welding (processes involving a single technical art, see the relevant subclasses, e.g. [B05D](#) , [B21C](#))
- B23K 2035/406 . . { Filled tubular wire or rods ([B23K 35/402](#) takes precedence) }

B23K 2035/408 . . . with welded longitudinal seam

Guidance heading:

B23K 2201/00 Articles made by soldering, welding or cutting by applying heat locally

- B23K 2201/001 . Turbines
- B23K 2201/002 . Drill-bits
- B23K 2201/003 . Pistons
- B23K 2201/005 . Camshafts
- B23K 2201/006 . Vehicles
- B23K 2201/007 . Marks, e.g. trade marks
- B23K 2201/008 . Gears
- B23K 2201/02 . Honeycomb structures
- B23K 2201/04 . Tubular or hollow articles
- B23K 2201/045 . . Hollow panels
- B23K 2201/06 . . Tubes
- B23K 2201/08 . . . finned or ribbed
- B23K 2201/10 . . Pipe-lines
- B23K 2201/12 . . Vessels
- B23K 2201/125 . . . Cans
- B23K 2201/14 . . Heat exchangers
- B23K 2201/16 . Bands or sheets of indefinite length
- B23K 2201/18 . Sheet panels
- B23K 2201/185 . . Tailored blanks
- B23K 2201/20 . Tools
- B23K 2201/22 . Nets, wire fabrics or the like
- B23K 2201/24 . Frameworks
- B23K 2201/26 . Railway or like rails
- B23K 2201/28 . Beams
- B23K 2201/30 . Chains, hoops or rings
- B23K 2201/32 . Wires

- B23K 2201/34 . Coated articles
- B23K 2201/36 . Electric or electronic devices
- B23K 2201/38 . . Conductors
- B23K 2201/40 . . Semiconductor devices
- B23K 2201/42 . . Printed circuits

Guidance heading:

B23K 2203/00 Materials to be soldered, welded or cut

- B23K 2203/02 . Iron or ferrous alloys
- B23K 2203/04 . . Steel or steel alloys
- B23K 2203/06 . . Cast-iron alloys
- B23K 2203/08 . Non-ferrous metals or alloys
- B23K 2203/10 . . Aluminium or alloys thereof
- B23K 2203/12 . . Copper or alloys thereof
- B23K 2203/14 . . Titanium or alloys thereof
- B23K 2203/16 . Composite materials
- B23K 2203/18 . Dissimilar materials
- B23K 2203/20 . . Ferrous alloys and aluminium or alloys thereof
- B23K 2203/22 . . Ferrous alloys and copper or alloys thereof
- B23K 2203/24 . . Ferrous alloys and titanium or alloys thereof