

49 Mechanical metalworking**49 (IPC: B23) Machine tools; Metal-working not otherwise provided for****Notes:**

1. In addition to operations not provided for in any other class, this class provides, in subclass 49l, for combinations of operations provided for in different subclasses of classes 7, 31, 49 and 67, with the exception of subsidiary operations performed in conjunction with main operations covered by a single subclass.

2. In the following elaborations:

(a) The term "metal-working" should be understood as covering the working of other materials unless the context requires otherwise.

(b) The term "kind of operation" and similar expressions relate to such metal-working operations as boring, drilling, milling and grinding.

(c) The term "kind of machine" means a machine designed for a particular kind of metal-working operation (e.g. a lathe).

(d) The term "form of machine" means a machine of a particular kind adapted or arranged for a particular way of working or for particular kind adapted or arranged for a particular work, e.g. face-plate lathe, tailstock lathe, turret lathe).

(e) The term "different machines" is to be understood as covering different forms of machine for performing the same type of metal-working operation, e.g. vertical and horizontal boring machines.

3. Subclass 49m comprises features, specific to machine tools, which relate to a requirement or problem of a nature which is not peculiar to a particular kind of machine tool, e.g. feeding work, although the realisation of these features may differ according to the kind of machine tool concerned.

That subclass provides in general for such features, even if the feature or a specific function, in any particular case, is to some extent peculiar to, or is claimed only for, machine tools designed for one particular operation; only in exceptional cases are such features to be classified in the subclass for the machine tool concerned. Certain features of this general nature are, however, referred to subclasses relating to particular metal-working operations, especially 49a, in which case the subclasses in question are not restricted, in respect of those features, to the kind of machine tool with which they are primarily concerned. If details, components, or accessories have no essential feature specific to machine tools, the more general class, e.g. 47, takes precedence.

49a Turning, drilling, centre drilling and centre punching of metal articles; machines and devices covered by 49a combined with machines and devices covered by 49b – 49e

49a (IPC: B23B) Turning; Boring

49b Metal milling

49b (IPC: B23C) Milling

49c Planing, slotting, broaching, shearing, also hand shearing of sheet metal and wire, punching, sawing, filing, reaming, scraping, sorting, feeding

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| 49c | (IPC: B23D) Planing; Slotting; Shearing; Broaching; Sawing; Filing; Scraping; Like operations for working metal by removing material, not otherwise provided for |
| 49d | Production of gear teeth on gears and racks |
| 49d | (IPC: B23F) Making gears and toothed racks |
| 49e | Thread cutting and machining of screw heads and end faces of nuts |
| 49e | (IPC: B23G) Thread cutting; Working of screws, bolt heads, or nuts, in conjunction therewith |
| 49f | Production of files and rasps |
| 49g | Power hammers, forging presses, riveting machines |
| 49h | Forging, pressing, bending, straightening, soldering, welding, oxyacetylene cutting |
| 49h | (IPC: B23K) Soldering; Welding; Cutting by applying heat locally |
| 49i | Manufacture of forge and press products: horseshoes, bolts, screws, wheels, etc. |
| 49k | Production of chains |
| 49l | Working of metal not provided for in 49a – 49k |
| 49l | (IPC: B23P) Other working of metal; Combined operations; Universal machine tools |
| 49m | (IPC: B23Q) Details, components, or accessories for machine tools; Machine tools in general characterised by the construction of particular details or components; Combinations or associations of machine tools, not directed to a particular metal-working result |
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| 49a | Turning, drilling, centre drilling and centre punching of metal articles; machines and devices covered by 49a combined with machines and devices covered by 49b – 49e |
| | Metalworking lathes and similar devices |
| 49a-1/01 | Lathes in general, turning methods in general |
| 49a-1/02 | Lathes, hand and foot operated; bench lathes |
| 49a-2/01 | Special purpose lathes not provided for in 49a-3/01 – 49a-18, e.g. special lathes for wheel hubs, nipples, commutator rings, piston rods |
| 49a-2/02 | Vertical lathes, boring and turning mills |
| 49a-2/03 | Lathes for axles, shafts, tubes or rollers |
| 49a-2/04 | Lathes for nuts, washers, screw heads (49a-4; 49a-5/01) |
| 49a-2/05 | Lathes for machining rings, piston rings and pistons (49a-6/01 – 49a-7/02) |
| 49a-3/01 | Lathes for screw cutting with lead screw; devices for cutting square threads, helical oil grooves in bearing bushings, for automatic tool setting and resetting, etc., engagement and retraction of cutter, auxiliary headstocks |
| 49a-3/02 | Devices for indicating lead screw position; thread dial indicators |
| 49a-3/03 | Collet lathes |
| 49a-3/04 | Screw cutting with guide bar |
| 49a-3/05 | Screw cutting with lead screw on pipes and sleeves (49e-7/01 – 49a-7/02) |
| 49a-4 | Single-spindle semiautomatic and automatic lathes for bar stock |

- 49a-5/01 Multi-spindle semiautomatic and automatic lathes for bar stock
- 49a-5/02 Gang lathes for bar stock work
- 49a-5/03 Vertical multi-spindle lathes for bar stock work
- 49a-6/01 Semiautomatic lathes for single workpieces
- 49a-6/02 Multiple-spindle semiautomatic lathes for single workpieces
- 49a-7/01 Automatic lathes for single workpieces: automatic magazine feed
- 49a-7/02 Multi-spindle automatic magazine-feed machines
- 49a-8/01 Turret lathes except those in 49a-4 – 49a-7/02, also details of turret lathes
- 49a-8/02 Vertical turret lathes
- 49a-9 Lathes and devices for turning crankshafts and parts not located on single axis (49b-5)
- 49a-10 Lathes and devices for taper turning (49a-3/05; 49a-34; 49a-51)
- 49a-11 Lathes and devices for shape and noncircular turning without template or forming tool
- 49a-12/01 Lathes and devices for turning convex surfaces
- 49a-12/02 Lathes and devices for sphere turning
- 49a-12/03 Lathes and devices for turning globoidal surfaces
- 49a-13/01 Lathes and devices for shaping and noncircular turning with template (copying lathes)
- 49a-13/02 Lathes with hobs
- 49a-14 Lathes and devices for relieving (49a-13; 49b-5)
- 49a-15 Lathes and boring mills for the machining of wheels, lathes for wheel sets (49a-25; 49a-30; 49a-31v)
- 49a-16 Lathes and devices with revolving tool holders for turning flanges, end faces of bearings, etc. except those in 49a-9, 49a-18
- 49a-17 Lathes and devices for turning journals, crank pins, axle journals, etc. (49a-9)
- 49a-18 Lathes for cutting-off, also with use of cut-off rollers

Components of metalworking lathes

- 49a-20 Head stocks, spindle bearings, etc.
- 49a-21/01 Drives for lathes, change gear equipment, release devices, engageable safety devices, clutches
- 49a-21/02 Electric drives
- 49a-21/03 Hydraulic and pneumatic drives
- 49a-21/04 Reversing gears
- 49a-21/05 Planetary gearings
- 49a-21/06 Belt drives, also change and reversing gears
- 49a-21/07 Indexing cylinders
- 49a-22/01 Supply and feed devices for bar stock on lathes (49a-27)
- 49a-22/02 Supply and feed devices for other workpieces in lathes [magazine supply] (49a-7)
- 49a-23 Power feed locks, etc. on supports, for facing and longitudinal turning, also interlocking of the respective movements
- 49a-24/01 Supports, also hand tool rests, etc. engagement and retraction of cutter (49a-3), elimination of lost motion in slide spindles
- 49a-24/02 Cross slides with their drives
- 49a-24/03 Lathe beds, frames and ways
- 49a-25 Cam supports for wheel rims (49a-13/01; 49a-13/02; 49a-15)
- 49a-26/01 Tailstocks (49b-4/06)
- 49a-26/02 Lathe centres, live and dead
- 49a-27/01 Clamping devices for lathes, chucks, face plates, collets for bar stock, except those in 49a-22/01 – 49a-22/02 or 49a-29/01 – 49a-29/03
- 49a-27/02 Clamping by means of spindle
- 49a-27/03 Electrically operated chucks
- 49a-27/04 Pneumatically, hydraulically, and otherwise similarly operated chucks
- 49a-28 Mandrels, etc. for lathes

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| 49a-29/01 | Lathe clamping devices for special-purpose metal machining, except those in 49a-30 (49c-31) |
| 49a-29/02 | Angle plates |
| 49a-29/03 | Devices for non-coaxial clamping |
| 49a-30 | Lathe clamping devices for wheel sets (49a-15) |
| 49a-31 | Lathe dogs and carriers |
| 49a-32 | Follower rests, steady rests for lathes (49a-34/01; 49a-34/02) |
| 49a-33/01 | Turning tools, cutting-off tools, back facing tools, recessing tools, knurling tools, etc.; tool backing supports |
| 49a-33/02 | Forming cutters |
| 49a-33/03 | Hobbing tools (49a-13/02) |
| 49a-33/04 | Turning tools with inserted cutting edges, also diamond tools |
| 49a-34/01 | Tool holders, exclusive of those in 49a-35/01 – 49a-35/03 (49c-9) |
| 49a-34/02 | Tool holders with counter supports |
| 49a-35/01 | Multiple tool holders, box tools (49a-4 – 49a-8/02) |
| 49a-35/02 | Detachable indexing tool holders (49a-35/03) |
| 49a-35/03 | Turrets with indexing mechanisms and other devices, e.g. adjustable stops |
| 49a-36/01 | Special devices for lathes |
| 49a-36/02 | Indicating, adjusting, checking, measuring, equalising, balancing and counting devices for lathes |
| 49a-36/03 | Lathe safety, illumination, lubricating and cooling devices: chip removal |
| 49a-37 | Facing and recessing devices for turret lathes, semiautomatic and automatic lathes |
| | Drilling machines and drilling devices for metal (boring machines for wood 38b) |
| 49a-38 | Drilling machines in general, except those in 49a-39/01 – 49a-52, also drilling methods in general |
| 49a-39/01 | Drilling machines and devices for special purposes, except those in 49a-40/01 – 49a-52, automatic drilling machines for elements of bridges, ships, etc., slotting machines, key drilling machines, drilling in places not easily accessible |
| 49a-39/02 | Horizontal drilling, boring and milling machines, or mills |
| 49a-39/03 | Drill presses for beams, sheet metal, devices for working without marking out |
| 49a-39/04 | Machines for drilling and thread cutting |
| | Portable hydraulically, pneumatically and steam-operated drilling machines (46d-5; 14b-3; 5b-1 – 5b-3) |
| 49a-40/01 | with turbine and rotary drives |
| 49a-40/02 | driven by reciprocating pistons |
| 49a-41/01 | Electrically driven hand drilling machines |
| 49a-41/02 | HOLDERS and supports for electrically driven hand drilling machines |
| 49a-42 | Arm-type [radial] drilling machines |
| 49a-43/01 | Multi-spindle drilling machines |
| 49a-43/02 | Multi-spindle drilling machines with linear feed of work support or tool holder |
| 49a-43/03 | Multi-spindle drilling machines with circular feed of work support or tool holder |
| 49a-43/04 | Multi-spindle drilling machines with mutually opposed spindles, also radial spindles, drilling machines for wheel hubs |
| 49a-44 | Machines and devices for drilling metal cylinders, bearings, connecting rod heads, etc. |
| 49a-45/01 | Machines and devices for machining cannon and rifle barrels: boring, turning, rifling (72a-27/01 – 72a-27/07; 72c-15; 72d-14/01 – 72d-17/08) |
| 49a-45/02 | Helical broaching |
| 49a-45/03 | Boring and turning of projectiles |
| 49a-46 | Drilling devices for metalworking lathes |
| 49a-47/01 | Hand metal-drilling machines and devices (ratchet braces 49a-48); drilling in places not easily accessible (49a-39/01) |

- 49a-47/02 Hand drilling machines and devices for girders and rails
- 49a-47/03 Bow drills, strap drives
- 49a-48 Ratchet braces
- 49a-49 Portable drilling devices
- 49a-50 Machines and devices for drilling noncircular and angular holes (49a-11; 49a-13/01; 49a-13/02)
- 49a-51 Machines and devices for drilling tapered holes (49a-10)
- 49a-52 Devices for drilling pipes, etc. subjected to pressure
- 49a-53 Boiler drilling machines, etc.

Components of metal drilling machines and devices

- 49a-54/01 Drives for drilling machines (47h)
- 49a-54/02 Electric drives (49a-41)
- 49a-54/03 Hydraulic and pneumatic drives (39a-40)
- 49a-54/04 Change gears and reversing gears
- 49a-54/05 Belt and chain drives
- 49a-55/01 Feed and turn off devices for drilling machines and devices, automatic interruption of feed in case of drill breakage
- 49a-55/02 Hydraulically and pneumatically operated feeds
- 49a-56/01 Details and special devices for drilling machines, drill spindles, guides, balancing
- 49a-56/02 Drill tables and work-holding devices in drilling machines
- 49a-56/03 Workpiece feed devices in drilling machines
- 49a-56/04 Cooling and lubricating devices in drilling machines
- 49a-56/05 Safety and indicating devices in drilling machines, devices preventing running off centre and breaking of drills on breaking through, prevention of lost motion of feed spindle
- 49a-56/06 Chip removal from drill holes, chip protection
- 49a-56/07 Checking devices for drill holes
- 49a-57 Boring bars, etc. cutting of internal grooves, undercutting
- 49a-58 Jigs and drill bushings, guides for drill spindles
- 49a-59 Twist drills
- 49a-60/01 Flat and helix drills
- 49a-60/02 Hollow drills and core cutters
- 49a-60/03 Drills with lubrication
- 49a-60/04 Countersinks and burrs
- 49a-61 Drill heads (49a-50)
- 49a-62 Auxiliary drives with one or more spindles, to be fitted to the drill spindle (49a-3/01)
- 49a-63 Disk cutters
- Drill holders
- 49a-64/01 Drill chucks
- 49a-64/02 Floating chucks
- 49a-64/03 Holders for broken drills
- 49a-64/04 Taper sleeves
- 49a-64/05 Extractors
- 49a-64/06 Protection from drill breakage
- 49a-65 Frames for ratchet brace, suction cups, drilling abutments

Centring

- 49a-66 Devices for the centre drilling of metal articles (42b-23/01 – 42b-23/04)
- 49a-67 Devices for centring and for centre punching of metal articles (42b-23/01 – 42b-23/04)
- 49a-68 Other machine tools for metal machining, in combination with lathes or drilling machines

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| 49a | (IPC: B23B) Turning; Boring (arrangements for copying or controlling 49m) |
| | <u>Turning</u> |
| 49a-1/00 | Methods for turning or working essentially requiring the use of turning-machines; Use of auxiliary equipment in connection with such methods |
| 49a-3/00 | General-purpose turning-machines or devices, e.g. centre lathes with feed rod and lead screw; Sets of turning-machines |
| 49a-3/02 | . Small lathes, e.g. for toolmakers (specially designed for watchmakers 83c-2) |
| 49a-3/04 | . Turning-machines in which the workpiece is rotated by means at a distance from the headstock |
| 49a-3/06 | . Turning-machines or devices characterised only by the special arrangement of constructional units (49m-37/00 takes precedence; structural features of details, see the relevant groups; such features of general applicability 49m) |
| 49a-3/08 | . Turning-machines characterised by the use of faceplates |
| 49a-3/10 | . . with the faceplate horizontal, i.e. vertical boring and turning machines |
| 49a-3/12 | . . with the faceplate vertical, i.e. face lathes |
| 49a-3/14 | . . Mountings or drives of faceplates |
| 49a-3/16 | . Turret lathes for turning individually-chucked workpieces |
| 49a-3/18 | . . with horizontal working-spindle |
| 49a-3/20 | . . with vertical working-spindle |
| 49a-3/22 | . Turning-machines or devices with rotary tool heads |
| 49a-3/24 | . . the tools of which do not perform a radial movement; Rotary tool heads therefor |
| 49a-3/26 | . . the tools of which perform a radial movement; Rotary tool heads thereof |
| 49a-3/28 | . Turning-machines in which the feed is controlled by a copying device, i.e. copying lathes (features of copying devices 49m-35/00) |
| 49a-3/30 | . Turning-machines with two or more working-spindles, e.g. in fixed arrangement |
| 49a-3/32 | . . for performing identical operations simultaneously on two or more workpieces |
| 49a-3/34 | . Short turning-machines with one or multiple working-spindles attended from the end (49a-3/12 takes precedence) |
| 49a-3/36 | . Associations of only turning-machines directed to a particular metal-working result (if the metal-working result is not essential 49m-39/00) |
| 49a-5/00 | Turning-machines or devices specially adapted for particular work; Accessories specially adapted therefor |
| 49a-5/02 | . for turning hubs or brake drums (49a-5/04 takes precedence) |
| 49a-5/04 | . for reconditioning hubs or brake drums or axle spindles without removing same from the vehicle |
| 49a-5/06 | . for turning valves or valve bodies |
| 49a-5/08 | . for turning axles, bars, rods, tubes, rolls, i.e. shaft-turning lathes, roll lathes; Centre-less turning |
| 49a-5/10 | . . for turning pilgrim rolls |
| 49a-5/12 | . . for peeling bars or tubes by making use of cutting bits arranged around the workpiece |
| 49a-5/14 | . Cutting-off lathes (shearing 49c) |
| 49a-5/16 | . for bevelling, chamfering, or deburring the ends of bars or tubes |
| 49a-5/18 | . for turning crankshafts, eccentrics, or cams, e.g. crankpin lathes |
| 49a-5/20 | . . without removing same from the engine |
| 49a-5/22 | . . Holding the workpiece in the machine, e.g. chucking devices |
| 49a-5/24 | . for turning pistons or other workpieces to a slightly non-circular cross-section |
| 49a-5/26 | . for simultaneously turning internal and external surfaces of a body |
| 49a-5/28 | . for turning wheels or wheel sets or cranks thereon, i.e. wheel lathes |
| 49a-5/30 | . . Arrangements providing for tool control by templates |
| 49a-5/32 | . . for reconditioning wheel sets without removing same from the vehicle; Underfloor wheel lathes for railway vehicles |
| 49a-5/34 | . . Holding the workpiece in the machine, e.g. chucking devices therefor; Drivers therefor |
| 49a-5/36 | . for turning specially-shaped surfaces by making use of relative movement of the tool and work produced by geometrical mechanisms, i.e. forming-lathes |

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| 49a-5/38 | . . for turning conical surfaces inside or outside, e.g. taper pins |
| 49a-5/40 | . . for turning spherical surfaces inside or outside |
| 49a-5/42 | . . for turning relieving surfaces, i.e. relieving-lathes |
| 49a-5/44 | . . for turning polygonal or other non-circular surfaces controlled by gear or guide mechanisms, i.e. eccentric lathes |
| 49a-5/46 | . . for turning helical or spiral surfaces (thread cutting 49e) |
| 49a-5/48 | . . . for cutting grooves, e.g. oil grooves of helicoidal shape |
| 49a-7/00 | Automatic or semi-automatic turning-machines with a single working-spindle, e.g. controlled by cams; Equipment therefor; Features common to automatic and semi-automatic turning-machines with one or more working-spindles |
| 49a-7/02 | . Automatic or semi-automatic machines for turning of stock |
| 49a-7/04 | . . Turret machines |
| 49a-7/06 | . . with sliding headstock |
| 49a-7/08 | . . with the working-spindle vertical |
| 49a-7/10 | . . Accessories, e.g. guards |
| 49a-7/12 | . Automatic or semi-automatic machines for turning of workpieces |
| 49a-7/14 | . . with the working-spindle horizontal |
| 49a-7/16 | . . with the working-spindle vertical |
| 49a-9/00 | Automatic or semi-automatic turning-machines with a plurality of working-spindles, e.g. automatic multiple-spindle machines with spindles arranged in a drum carrier able to be moved into pre-determined positions; Equipment therefor (equipment applicable to single-spindle machines 49a-7/00) |
| 49a-9/02 | . Automatic or semi-automatic machines for turning of stock |
| 49a-9/04 | . . with the working-spindles horizontal |
| 49a-9/06 | . . with the working-spindles vertical |
| 49a-9/08 | . Automatic or semi-automatic machines for turning of workpieces |
| 49a-9/10 | . . with the working-spindles horizontal |
| 49a-9/12 | . . with the working-spindles vertical |
| 49a-11/00 | Automatic or semi-automatic turning-machines incorporating equipment for performing other working procedures, e.g. slotting, milling, rolling |
| 49a-13/00 | Arrangements for automatically conveying or chucking or guiding stock |
| 49a-13/02 | . for turning-machines with a single working-spindle |
| 49a-13/04 | . for turning-machines with a plurality of working-spindles |
| 49a-13/06 | . Arrangements for switching-off the drive of turning-machines after the stock has been completely machined |
| 49a-13/08 | . Arrangements for reducing vibrations in feeding-passages or for damping noise (damping noise in general 42g-1/10) |
| 49a-13/10 | . with magazines for stock |
| 49a-13/12 | . Accessories, e.g. stops, grippers |
| 49a-15/00 | Arrangements for conveying, loading, adjusting, reversing, chucking, or discharging workpieces specially designed for automatic or semi-automatic turning-machines |
| <u>Components or accessories particularly for turning machines</u> | |
| 49a-17/00 | Lathe beds (foundation frames, carriage guides as such 49m-1/00) |
| 49a-19/00 | Headstocks; Equivalent parts of any machine tools |
| 49a-19/02 | . Working-spindles; Features relating thereto, e.g. supporting arrangements (49a-13/00 takes precedence) |
| 49a-21/00 | Lathe carriages; Cross-slides; Tool posts (tool holders 49a-29/00); Similar parts of any machine tools |
| 49a-23/00 | Tailstocks; Centres |
| 49a-23/02 | . Dead centres |

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| 49a-23/04 | . Live centres |
| 49a-25/00 | Accessories or auxiliary equipment for turning-machines (for machine tools in general 49m; cooling or lubricating 49m-11/12) |
| 49a-25/02 | . Arrangements for chip-breaking in turning-machines (on cutting tools 49a-27/22) |
| 49a-25/04 | . Safety guards specially designed for turning-machines (in general 47a4) |
| 49a-25/06 | . Measuring, gauging, or adjusting equipment on turning-machines for setting-on, feeding, controlling, or monitoring the cutting tools or work (measuring devices or gauges 42b) |
| 49a-27/00 | Tools for turning or boring machines (for drilling machines 49a-51/00); Tools of a similar kind in general; Accessories therefor |
| 49a-27/02 | . Cutting tools with straight main part and cutting edge at an angle (49a-27/04 to 49a-27/08 take precedence) |
| 49a-27/04 | . Cutting-off tools (49a-27/08 takes precedence) |
| 49a-27/06 | . Profile cutting tools, i.e. forming-tools |
| 49a-27/08 | . Cutting tools with blade- or disc-like main parts |
| 49a-27/10 | . Cutting tools with special provision for cooling |
| 49a-27/12 | . . with a continuously-rotated circular cutting edge; Holders therefor |
| 49a-27/14 | . Cutting tools of which the bits or tips are of special material |
| 49a-27/16 | . . with exchangeable cutting bits, e.g. able to be clamped |
| 49a-27/18 | . . with cutting bits or tips rigidly mounted, e.g. by brazing |
| 49a-27/20 | . . with diamond bits |
| 49a-27/22 | . Cutting tools with chip-braking equipment |
| 49a-27/24 | . Knurling tools |
| 49a-29/00 | Holders for non-rotary cutting tools (49a-27/12 takes precedence); Boring bars or boring heads; Accessories for tool holders |
| 49a-29/02 | . Boring bars |
| 49a-29/03 | . Boring heads |
| 49a-29/034 | . . with tools moving radially |
| 49a-29/04 | . Tool holders for a single cutting tool |
| 49a-29/06 | . . Tool holders equipped with longitudinally-arranged grooves for setting the cutting tool |
| 49a-29/08 | . . Tool holders equipped with grooves arranged crosswise to the longitudinal direction for setting the cutting tool |
| 49a-29/10 | . . . with adjustable counterbase for the cutting tool |
| 49a-29/12 | . . Special arrangements on tool holders |
| 49a-29/14 | . . . affording a yielding support of the cutting tool, e.g. by spring clamping |
| 49a-29/16 | . . . for supporting the workpiece in a backrest |
| 49a-29/18 | . . . for retracting the cutting tool |
| 49a-29/20 | . . . for placing same by shanks in sleeves of a turret |
| 49a-29/22 | . . . for tool adjustment by means of shims or spacers |
| 49a-29/24 | . Tool holders for a plurality of cutting tools, e.g. turrets |
| 49a-29/26 | . . Tool holders in fixed position |
| 49a-29/28 | . . Turrets manually adjustable about a vertical pivot |
| 49a-29/30 | . . Turrets manually adjustable about a horizontal pivot |
| 49a-29/32 | . . Turrets adjustable by power drive, i.e. turret heads |
| 49a-29/34 | . . Turrets equipped with triggers for releasing the cutting tools |
| 49a-31/00 | Chucks; Expansion mandrels; Adaptations thereof for remote control (similar devices not intended for use on spindles 49m; face-plates 49m; holding by magnetic or electrical force acting directly on work 49m-3/152) |
| 49a-31/02 | . Chucks |
| 49a-31/04 | . . for the shanks of tools, e.g. drills |
| 49a-31/06 | . . . Features relating to the removal of tools; Accessories therefor |
| 49a-31/08 | . . . Holding tools yieldably |
| 49a-31/10 | . . characterised by the gripping devices or their immediate operating means |
| 49a-31/12 | . . . Chucks with simultaneously-acting jaws, whether or not also individually adjustable |
| 49a-31/14 | . . . involving the use of centrifugal force |

- 49a-31/16 moving radially
- 49a-31/18 pivotally movable in planes containing the axis of the chuck
- 49a-31/19 moving parallel to the axis of the chuck
- 49a-31/20 Collet chucks
- 49a-31/22 Jaws in the form of balls
- 49a-31/24 . . characterised by features relating primarily to remote control of the gripping means
- 49a-31/26 . . . using mechanical transmission through the working-spindle
- 49a-31/28 . . . using electric or magnetic means in the chuck
- 49a-31/30 . . . using fluid-pressure means in the chuck
- 49a-31/32 . . with jaws carried by diaphragm
- 49a-31/34 . . with means enabling the workpiece to be reversed or tilted
- 49a-31/36 . . with means for adjusting the chuck with respect to the working-spindle
- 49a-31/38 . . with overload clutches
- 49a-31/40 . Expansion mandrels
- 49a-31/42 . . characterised by features relating primarily to remote control of the gripping means
- 49a-31/44 . Taper shanks, e.g. Morse-cones

49a-33/00 Drivers; Driving centres; Nose clutches, e.g. lathe dogs

Boring; Drilling (by electro-erosion 49l-1/00)

49a-35/00 Methods for boring or drilling, or for working essentially requiring the use of boring or drilling machines; Use of auxiliary equipment in connection with such methods

49a-37/00 Boring by making use of ultrasonic energy (essentially using abrasive material 67a)

49a-39/00 General-purpose boring or drilling machines or devices; Sets of boring or drilling machines

- 49a-39/02 . Boring machines; Combined horizontal boring and milling machines
- 49a-39/04 . Co-ordinate boring or drilling machines; Machines for making holes without previous marking
- 49a-39/06 . . Equipment for positioning work
- 49a-39/08 . . Devices for programme control
- 49a-39/10 . characterised by the drive, e.g. by fluid-pressure drive, pneumatic power drive
- 49a-39/12 . Radial drilling machines
- 49a-39/14 . with special provision to enable the machine or the drilling or boring head to be moved into any desired position, e.g. with respect to immovable work
- 49a-39/16 . Drilling machines with a plurality of working-spindles; Drilling automatons
- 49a-39/18 . . Setting work or tool carrier along a straight index line
- 49a-39/20 . . Setting work or tool carrier along a circular index line; Turret head drilling machines
- 49a-39/22 . . with working-spindles in opposite headstocks
- 49a-39/24 . . designed for programme control
- 49a-39/26 . in which the working position of tool or work is controlled by copying discrete points of a pattern (features of copying devices 49m-35/02)
- 49a-39/28 . Associations of only boring or drilling machines directed to a particular metal-working result (if not producing a particular metal-working result 49m-39/00)

49a-41/00 Boring or drilling machines or devices specially adapted for particular work; Accessories specially adapted therefor

- 49a-41/02 . for boring deep holes; Trepanning, e.g. of gun or rifle barrels
- 49a-41/04 . for boring polygonal or other non-circular holes
- 49a-41/06 . for boring conical holes
- 49a-41/08 . for boring, drilling, or tapping holes in tubes under fluid or gas pressure (sealing features or operations, combined with placing branch parts 47f1-41/04)
- 49a-41/10 . for boring holes in steam boilers
- 49a-41/12 . for forming working surfaces of cylinders, of bearings, e.g. in heads of driving rods, or of other engine parts

- 49a-41/14 . for very small holes
- 49a-41/16 . for boring holes with high-quality surface
- 49a-43/00 Boring or drilling devices able to be attached to a machine tool, whether or not replacing an operative portion of the machine tool (if specially adapted for particular work 49a-41/00)**
- 49a-43/02 . to the tailstock of a lathe
- 49a-45/00 Hand-held or like portable drilling machines, e.g. drill guns; Equipment therefor**
- 49a-45/02 . driven by electric power
- 49a-45/04 . driven by fluid-pressure or pneumatic power
- 49a-45/06 . driven by man-power
- 49a-45/08 . . for drilling rails or profiled stock
- 49a-45/10 . . by using a fiddle bow or a belt
- 49a-45/12 . . by using a ratchet brace
- 49a-45/14 . Means for holding or guiding the drilling device or for securing it to the work (49a-41/08 takes precedence); Thrust stands

Components or accessories for boring or drilling machines

- 49a-47/00 Constructional features of components specially designed for boring or drilling machines; Accessories therefor (working-spindles, bearing sleeves therefor 49a-19/02; for machine tools in general 49m)**
- 49a-47/02 . Drives; Gearings (49a-39/10 takes precedence)
- 49a-47/04 . . for rotating the working-spindle
- 49a-47/06 . . . driven essentially by electrical means
- 49a-47/08 . . . driven essentially by fluid-pressure or pneumatic power
- 49a-47/10 equipped with turbines or other rotating machines
- 49a-47/12 equipped with oscillating pistons
- 49a-47/14 . . . Change-speed gearings; Reversing gearings
- 49a-47/16 . . . Belt or chain drives
- 49a-47/18 . . for feeding or retracting tool or work
- 49a-47/20 . . . actuated essentially by electric power
- 49a-47/22 . . . actuated essentially by fluid-pressure or pneumatic power
- 49a-47/24 . . . Stops or feed interruption owing to fracture or overload of the boring or drilling tool
- 49a-47/26 . Lifiable and lowerable drill heads or headstocks; Balancing arrangements therefor
- 49a-47/28 . Drill jigs for workpieces (equipment for setting or guiding the drill 49a-49/00)
- 49a-47/30 . Additional gear with one or more working-spindles attachable to the main working-spindle and mounting the additional gear
- 49a-47/32 . Arrangements for preventing the running-out of drills or fracture of drills when getting through
- 49a-47/34 . Arrangements for removing chips out of the holes made; Chip-breaking arrangements attached to the tool
- 49a-49/00 Measuring or gauging equipment on boring machines for positioning or guiding the drill; Devices for indicating failure of drills during boring; Centring devices for holes to be bored (measuring devices, gauges 42b)**
- 49a-49/02 . Boring templates or bushings
- 49a-49/04 . Devices for boring or drilling centre holes in workpieces
- 49a-49/06 . Devices for drilling holes in brake bands or brake linings
- 49a-51/00 Tools for drilling machines**
- 49a-51/02 . Twist drills
- 49a-51/04 . Drills for trepanning; Tools for cutting discs from sheet
- 49a-51/06 . Drills with lubricating or cooling equipment
- 49a-51/08 . Drills combined with tool parts or tools for performing additional working
- 49a-51/10 . Bits for countersinking
- 49a-51/12 . Adapters for drills or chucks; Tapered sleeves
- 49a-51/14 . . Adapters for broken drills
- 49a-51/16 . for making chamfers or undercuttings

- 49b** **Metal milling** (milling of wood 38b-5)
- Milling machines
- 49b-1/01 in general
 - 49b-1/02 with one horizontal spindle
 - 49b-1/03 with one vertical spindle
 - 49b-1/04 with several horizontal spindles
 - 49b-1/05 with several vertical spindles
 - 49b-1/06 with horizontal and vertical spindles
 - 49b-1/07 with rotating table
 - 49b-1/08 with several tables
 - 49b-1/09 Portable and hand milling machines
 - 49b-2 Stationary milling machines
 - 49b-3 Universal milling machines
- Milling machine components
- 49b-4/01 Main drives in general
 - 49b-4/02 Electric motor main drives
 - 49b-4/03 Hydraulic drives
 - 49b-4/04 Reversing gears, disengagement devices (engaging and disengaging clutches and their engaging and disengaging gears in general 47c-6 – 47c-16, 47d-20, 47d-21)
 - 49b-4/05 Tables, feed drives and feed mechanisms (drives 47h)
 - 49b-4/06 Tool spindles, spindle nose, tailstocks, outer supports
 - 49b-4/07 Miscellaneous
- Metal milling machines
- 49b-5/01 for circular milling
 - 49b-5/02 for milling crankshafts
 - 49b-5/03 for milling journals
 - 49b-5/04 for relieving (lathes and devices for relieving 49a-14)
 - 49b-5/05 Copying milling machines for metal (copying machines 75a-13 – 73a-15)
 - 49b-5/06 for producing cams
 - 49b-5/07 for machining sheet metal edges
 - 49b-5/08 for milling key bits
 - 49b-5/09 for stripping ingots prior to rolling
 - 49b-5/10 for machining helical surfaces of screw propellers and turbine blades
 - 49b-5/11 for burring pipe ends, and burring and milling nuts
 - 49b-5/12 for machining dies and matrices
 - 49b-5/13 for machining grooves at the ends of piston rings
 - 49b-5/14 for milling parts of musical instruments
 - 49b-5/15 for producing dental instruments, e.g. drills
 - 49b-5/16 for machining slots in screens
 - 49b-5/17 for machining anger bits for wood
 - 49b-5/30 for various purposes
 - 49b-6/01 for machining round and prismatic pieces
 - 49b-6/02 for machining angular holes
 - 49b-7 for production of balls
 - 49b-8 Twist drill milling machines
 - 49b-9/01 Slot cutting machines, general
 - 49b-9/02 Milling machines for machining keyways
 - 49b-9/03 Milling machines for machining lubrication grooves
 - 49b-10/01 Milling attachments for lathes
 - 49b-10/02 Milling attachments for planing machines

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| 49b-10/03 | Milling attachments for other machine tools |
| 49b-11 | Milling machines for machining valve seats, slide valve seats, etc. |
| | Milling tools (tools for production of gears and racks 49d-14/01 – 49d-14/05) |
| 49b-12/01 | Hobbing cutters with fixed teeth |
| 49b-12/02 | Hobbing cutters with inserted blades |
| 49b-12/03 | Grooved disk cutters with fixed teeth |
| 49b-12/04 | Grooved disk cutters with inserted blades |
| 49b-12/05 | Shaft keyway cutters with fixed or inserted teeth |
| 49b-12/06 | Hobbing and slotting cutters with adjustable blades |
| 49b-12/07 | Face milling heads with inserted blades |
| 49b-12/08 | End and countersinking cutters with fixed teeth |
| 49b-12/09 | Shank cutters and cutters with internal cutting teeth for milling bolts ends |
| 49b-12/10 | Securing and adjusting of blades in all types of milling heads |
| 49b-12/11 | Securing of milling cutters to mandrel and spindle |
| 49b-12/12 | Milling cutters for burring pipe ends and hole edges |
| 49b-12/13 | Miscellaneous elements and accessories for milling cutters |
| 49b-12/14 | Lubrication and cooling of milling cutters |
| 49b-12/15 | Milling cutters for special purposes |
| 49b-12/16 | Production of milling cutters |
| 49b-12/17 | Milling cutters with reversible blades |
| 49b-13 | Indexing heads and devices (indexing heads and devices for gear cutting machines 49d-15/04) |

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| 49b | (IPC: B23C) Milling (broaching 49c; broach-milling in making gears 49d; arrangements for copying or controlling 49m) |
| 49b-1/00 | Milling machines not designed for particular work or special operations |
| 49b-1/02 | . with one horizontal working-spindle |
| 49b-1/04 | . with a plurality of horizontal working-spindles |
| 49b-1/06 | . with one vertical working-spindle |
| 49b-1/08 | . with a plurality of vertical working-spindles |
| 49b-1/10 | . with both horizontal and vertical working-spindles |
| 49b-1/12 | . with spindle adjustable to different angles, e.g. either horizontally or vertically |
| 49b-1/14 | . with rotary work-carrying table |
| 49b-1/16 | . specially designed for control by copying devices |
| 49b-1/18 | . . for milling while revolving the work |
| 49b-1/20 | . Portable devices or machines; Hand-driven devices or machines |
| 49b-3/00 | Milling particular work; Special milling operations; Machines therefor (milling gear-teeth 49d) |
| 49b-3/02 | . Milling surfaces of revolution (49b-3/06, 49b-3/08 take precedence) |
| 49b-3/04 | . . while revolving the work |
| 49b-3/06 | . Milling crankshafts |
| 49b-3/08 | . Milling cams, camshafts, or the like |
| 49b-3/10 | . Relieving milling (lathes or turning devices for relieving 49a-5/42) |
| 49b-3/12 | . Trimming or finishing edges, e.g. deburring welded corners |
| 49b-3/14 | . Scrubbing or peeling ingots or similar workpieces |
| 49b-3/16 | . Working surfaces curved in two directions |
| 49b-3/18 | . . for shaping screw-propellers, turbine blades, or impellers |
| 49b-3/20 | . . for shaping dies |
| 49b-3/22 | . Forming overlapped joints, e.g. of the ends of piston-rings |
| 49b-3/24 | . Making square or polygonal ends on workpieces, e.g. key studs on tools |
| 49b-3/26 | . Making square or polygonal holes in workpieces, e.g. key holes in tools |
| 49b-3/28 | . Grooving workpieces (thread-cutting by milling 49e-1/32) |
| 49b-3/30 | . . Milling straight grooves, e.g. keyways |
| 49b-3/32 | . . Milling helical grooves, e.g. in making twist-drills |
| 49b-3/34 | . . Milling grooves of other forms, e.g. circumferential |

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| 49b-3/35 | . . Milling grooves in keys |
| 49b-3/36 | . Milling milling-cutters (49b-3/28 takes precedence) |
| 49b-5/00 | Milling-cutters (for cutting gear-teeth 49d-21/12) |
| 49b-5/02 | . characterised by the shape of the cutter |
| 49b-5/04 | . . Plain cutters, i.e. having essentially a cylindrical or tapered cutting surface of substantial length (49b-5/10 takes precedence) |
| 49b-5/06 | . . Face-milling cutters, i.e. having only or primarily a substantially flat cutting surface |
| 49b-5/08 | . . Disc-type cutters |
| 49b-5/10 | . . Shank-type cutters, i.e. with an integral shaft |
| 49b-5/12 | . . Cutters specially designed for producing particular profiles (49b-5/10 takes precedence) |
| 49b-5/14 | . . . essentially comprising curves |
| 49b-5/16 | . characterised by physical features other than shape |
| 49b-5/18 | . . with permanently-fixed cutter-bits or teeth |
| 49b-5/20 | . . with removable cutter-bits or teeth |
| 49b-5/22 | . . . Securing arrangements for bits or teeth |
| 49b-5/24 | adjustable |
| 49b-5/26 | . Securing milling-cutters to the driving spindle |
| 49b-5/28 | . Features relating to lubricating or cooling |
| 49b-7/00 | Milling devices able to be attached to a machine tool, whether or not replacing an operative portion of the machine tool |
| 49b-7/02 | . to lathes |
| 49b-7/04 | . to planing or slotting machines |
| 49b-9/00 | Details or accessories so far as specially adapted to milling machines or cutters (drives, control devices, or accessories, in general 49m) |

49c Planing, slotting, broaching, shearing, also hand shearing of sheet metal and wire, punching, sawing, filing, reaming, scraping, sorting, feeding (engraving 75a-6 – 75a-12)

Planing, slotting and broaching of metal

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| 49c-1/01 | Double-housing and single-column planing machines |
| 49c-1/02 | Hand planers |
| 49c-1/03 | Planing machines with special supports, e.g. for milling or grinding |
| 49c-1/04 | Frames, beds, tables, etc. for planing machines |
| 49c-1/05 | Supports, planing heads, indexing movement production |
| 49c-1/06 | Setting and securing of cross rail |
| 49c-1/07 | Drive of reciprocating workpiece or tool holder by means of rack gearing, belt shift drives, change gears, rope drives (drives 47h) |
| 49c-1/08 | Hydraulic drive for the reciprocating workpiece or tool holder |
| 49c-1/09 | Electric motor drive for planing machines |
| 49c-1/10 | Shock absorption on reversal of motion |
| 49c-1/11 | Other details |
| 49c-2/01 | Shaping machines |
| 49c-2/02 | Slotting machines |
| 49c-2/03 | Frames, tables, rams, supports |
| 49c-2/04 | Drive of ram by means of crank drive, crank slide drives, etc. |
| 49c-2/05 | Reciprocating drive of ram by means of hydraulic drive |
| 49c-2/06 | Control and arrangement of secondary drives |
| 49c-2/07 | Other details |
| 49c-3/01 | Cam planing machines and circular planing machines |
| 49c-3/02 | Machines for planing helical surfaces of screw propellers |
| 49c-3/03 | Planing machines for sheet metal edges |
| 49c-3/04 | Metal planing machines of all types for miscellaneous purposes |

- 49c-4 Planing and slotting machines for nuts and other prismatic metal articles
- 49c-5 Machines for slotting and groove cutting
- 49c-6 Machines and devices for planing and slotting of metal on forward and return stroke of work-piece or tool holder
- 49c-7 Attachments to other machine tools for planing and shaping of metal
- Broaching machines**
- 49c-8/01 Machines for broaching internal surfaces
- 49c-8/02 Machines for broaching external surfaces
- 49c-8/03 Details of broaching machines, drives, tool holders
- 49c-8/04 Tools for broaching machines, broaches
- 49c-9/01 Tools for planing and slotting machines
- 49c-9/02 Tool holders, also tool posts
- 49c-9/03 Tool holders with a number of simultaneously working tools
- 49c-9/04 Cutter lifting devices
- Shearing, punching and perforating of metal**
- 49c-10/01 Metal shears with parallel movement of the blades
- 49c-10/02 Plate shears
- 49c-10/03 Holding-down devices
- 49c-11/01 Metal shears with pivoted blades, lever shears
- 49c-11/50 Hydraulic shears
- 49c-12/01 Shears with revolving, circular blades
- 49c-12/02 Pipe cutting machines (pipe cutters for hand use 7c-19)
- 49c-12/03 Metal shears for cutting special shapes, cam cutting machines
- 49c-13/01 Travelling shears for rolled stock
- 49c-13/02 Rotary shears for rolled stock
- 49c-13/03 Compound rolled stock shears for cutting off and edging
- 49c-14/01 Shears for cutting structural and bar iron
- 49c-14/02 Bevelling cutters
- 49c-14/03 Torsion shears
- 49c-15/01 Metal comminuting machines, pig iron crushers
- 49c-15/02 Machines for breaking up chips
- 49c-16/01 Hand shears for sheet metal, wire, etc. (shears, general 69-1 – 69-9)
- 49c-16/02 Hand shears, electrically operated
- 49c-16/03 Hand shears, hydraulically or pneumatically operated
- 49c-17/01 Metal punch presses, general (punching of sheet metal or tubes in general 7c-10)
- 49c-17/02 Multiple punch presses
- 49c-17/03 Turnable punch presses
- 49c-17/04 Tong-type punch presses
- 49c-17/05 Punch presses combined with shears
- 49c-17/06 Electric and hydraulic drives for punch presses
- 49c-17/07 Connection of ram
- 49c-17/08 Shaft couplings
- 49c-17/09 Table feed for presses
- 49c-17/10 Electric connections for feed and clutch
- 49c-17/11 Protection against breakage
- 49c-17/12 Miscellaneous details
- 49c-18/01 Shearing machines, perforating machines and punch presses for special metalworking purposes
- 49c-18/02 Cross tie notching and perforating
- 49c-18/03 Burring of bolt heads
- 49c-19 Tools for shearing and punching: cutters, punches, dies, etc. and their fastening

Sawing, filing, reaming and scraping of metal

Metal saws with circular blades

- 49c-20/01 Circular saws
- 49c-20/02 High-speed friction saws

Metal saws with band-shaped blades

- 49c-21/01 Hacksaw machines
- 49c-21/02 Hand hacksaws
- 49c-21/03 Band saws
- 49c-22/01 Tooth setting tools

Machines and devices

- 49c-22/02 for setting the teeth
- 49c-22/03 for sharpening saw blades by means of files
- 49c-22/04 for sharpening saw blades by means of grinding disks
- 49c-22/05 for sharpening saw blades by upsetting the teeth
- 49c-22/06 Combined setting and sharpening devices
- 49c-22/07 Devices for clamping saw blades during setting and sharpening
- 49c-22/08 Forming, straightening and checking of-saw teeth
- 49c-23/01 Single-piece produced circular saw blades
- 49c-23/02 Circular saw blades with inserted tooth rings
- 49c-23/03 Circular saw blades with inserted tooth segments
- 49c-23/04 Circular saw blades with inserted teeth
- 49c-23/05 Circular saw blades with internal teeth
- 49c-23/06 Saw blades for longitudinal cutting
- 49c-23/07 Devices for removing chips from saw blade
- 49c-24/01 Punching and cutting of saw blades
- 49c-24/02 Milling of saw blades
- 49c-24/03 Grinding the side faces of saw blades

Filing machines

- 49c-25/01 with reciprocating tool
- 49c-25/02 with rotating file disk and with chainlike tools
- 49c-25/03 for special purposes
- 49c-25/04 Tools and clamping devices
- 49c-25/05 Hand file devices
- 49c-26/01 Hand files and rasps (49f)
- 49c-26/02 File attachments and rasps (49f)
- 49c-26/03 Combined files and rasps (49f)

Reamers

- 49c-27/01 with fixed blades
- 49c-27/02 with inserted blades
- 49c-27/03 with adjustable blades
- 49c-27/04 with expandable blades
- 49c-27/05 for special purposes
- 49c-27/06 Holding devices; floating reamers
- 49c-27/07 Devices for reaming

- 49c-28 Methods, devices and tools for scraping metal

General-purpose workpiece conveying devices for metalworking machines

- 49c-30/01 Devices for conveying and orienting metal workpieces (devices for conveying workpieces for thread cutting and machining of heads 49e-13)

- 49c-30/02 Devices for conveying, orienting and rotating metal workpieces
 49c-30/03 Devices for conveying sheets for shears and perforating presses

General-purpose workpiece clamping tables for metalworking machines with clamping accessories (machine and parallel vices 87a-1; chucks 49a, 49b)

- 49c-31/01 Fixture for mechanical clamping
 49c-31/02 Fixtures for hydraulic or pneumatic clamping
 49c-31/03 Electromagnetic clamping plates and fixtures
 49c-31/05 Permanent-magnet clamping plates and fixtures
 49c-31/10 Accessories, such as clamping devices for mechanical fixtures
 49c-31/12 Accessories for hydraulic or pneumatic fixtures

49c (IPC: B23D) Planing; Slotting; Shearing; Broaching; Sawing; Filing; Scraping; Like operations for working metal by removing material, not otherwise provided for (making toothed gears or the like 49d; cutting metal by applying heat locally 49h; arrangements for copying or controlling 49m)

Planing; Slotting

- 49c-1/00 Planing or slotting machines cutting by relative movement of the tool and workpiece in a horizontal straight line only**
- 49c-1/02 . by movement of the work-support
 - 49c-1/04 . . with the tool supported only on one side of the bed
 - 49c-1/06 . . with the tool supported on both sides of the bed
 - 49c-1/08 . by movement of the tool
 - 49c-1/10 . . with means for adjusting the tool-guide vertically
 - 49c-1/12 . . . with the tool supported only on one side of the bed
 - 49c-1/14 . . . with the tool supported on both sides of the bed
 - 49c-1/16 . . without means for adjusting the tool-guide vertically
 - 49c-1/18 . cutting on both the forward and the return stroke
 - 49c-1/20 . with tool-supports or work-supports specially mounted or guided for working in different directions or at different angles; Special purpose machines
 - 49c-1/22 . . for planing ingots or the like
 - 49c-1/24 . . for planing inner surfaces, e.g. of moulds
 - 49c-1/26 . . for planing edges or ridges or cutting grooves (cutting helical grooves 49c-5/02)
 - 49c-1/28 . . in which the tool or workpiece is fed otherwise than in a straight line, e.g. for planing profiled stock
 - 49c-1/30 . . . in which the direction of feed is controlled by a copying device, e.g. by a pattern (features of copying devices 49m-35/00)
- 49c-3/00 Planing or slotting machines cutting by relative movement of the tool and workpiece in a vertical or inclined straight line**
- 49c-3/02 . for cutting grooves (cutting helical grooves 49c-5/02)
 - 49c-3/04 . in which the tool or workpiece is fed otherwise than in a straight line
 - 49c-3/06 . . in which the direction of feed is controlled by a copying device, e.g. by a pattern (features of copying devices 49m-35/00)
- 49c-5/00 Planing or slotting machines cutting otherwise than by relative movement of the tool and workpiece in a straight line**
- 49c-5/02 . involving rotary and straight-line movements only, e.g. for cutting helical grooves
 - 49c-5/04 . controlled by a copying device, e.g. by a pattern (features of copying devices 49m-35/00)
- 49c-7/00 Planing or slotting machines characterised only by constructional features of particular parts** (constructional features of these parts per se 49m)
- 49c-7/02 . of frames, of work-table beds
 - 49c-7/04 . of pillars, of cross-beams

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| 49c-7/06 | . of tool-carrying arrangements |
| 49c-7/08 | . of work-tables |
| 49c-7/10 | . of drives for reciprocating parts |
| 49c-7/12 | . of arrangements for impact damping or regenerating energy |
| 49c-9/00 | Hand-operated planing devices; Portable planing apparatus |
| 49c-11/00 | Planing or slotting devices able to be attached to a machine tool, whether or not replacing an operative portion of the machine tool |
| 49c-13/00 | Tools or tool holders specially designed for planing or slotting machines (features applicable also to turning-machines 49a-27/00, 49a-29/00; for cutting gear teeth 49d-21/04) |
| 49c-13/02 | . Pivotaly-mounted holders |
| 49c-13/04 | . Holders for tool sets |
| 49c-13/06 | . Devices for lifting or lowering the tool |
| <u>Shearing; Similar cutting</u> | |
| 49c-15/00 | Shearing machines or shearing devices cutting by blades which move parallel to themselves |
| 49c-15/02 | . having both upper and lower moving blades |
| 49c-15/04 | . having only one moving blade |
| 49c-15/06 | . Sheet shears |
| 49c-15/08 | . . with a blade moved in one plane, e.g. perpendicular to the surface of the sheet |
| 49c-15/10 | . . with a blade moved in a curved surface, e.g. for producing an edge with a curved cross-section |
| 49c-15/12 | . characterised by drives or gearings therefor |
| 49c-15/14 | . . actuated by fluid or gas pressure |
| 49c-17/00 | Shearing machines or shearing devices cutting by blades pivoted on a single axis (on an axis parallel to the blade 49c-15/10; hand-held devices 49c-29/00) |
| 49c-17/02 | . characterised by drives or gearings therefor |
| 49c-17/04 | . . actuated by a rotary shaft |
| 49c-17/06 | . . actuated by fluid or gas pressure |
| 49c-17/08 | . . actuated by hand or foot operated lever mechanism |
| 49c-19/00 | Shearing machines or shearing devices cutting by rotary discs (by friction saw-discs 49c-45/00) |
| 49c-19/02 | . having both a fixed shearing blade and a rotary shearing disc |
| 49c-19/04 | . having rotary shearing discs arranged in co-operating pairs |
| 49c-19/06 | . . with several spaced pairs of shearing discs working simultaneously, e.g. for trimming or making strips |
| 49c-19/08 | . for special use, e.g. for cutting curves, for chamfering edges |
| 49c-21/00 | Machines or devices for shearing or cutting tubes (by sawing, see the relevant groups for sawing machines or sawing devices; as additional equipment for deep-drawing presses 7c-24/16) |
| 49c-21/02 | . otherwise than in a plane perpendicular to the axis of the tube, e.g. for making mitred cuts, for making bicycle frames |
| 49c-21/04 | . Tube-severing machines with rotating tool-carrier |
| 49c-21/06 | . Hand-operated tube cutters |
| 49c-21/08 | . . with cutting wheels |
| 49c-21/10 | . . with other cutting blades or tools |
| 49c-21/12 | . . . with provision for hammering on the tool |
| 49c-21/14 | . cutting inside the tube |
| 49c-23/00 | Machines or devices for shearing or cutting profiled stock (hand-held devices 49c-29/00) |
| 49c-23/02 | . otherwise than in a plane perpendicular to the axis of the stock |
| 49c-23/04 | . by means of holding-dies, arranged side by side, subjecting the stock to torsional stress |

49c-25/00 **Machines or arrangements for shearing stock while the latter is travelling otherwise than in the direction of the cut** (controlling slack in travelling flexible stock 7b-47/10)

- 49c-25/02 . Flying shearing machines (49c-25/12 takes precedence)
- 49c-25/04 . . in which a cutting unit moves bodily with the work while cutting (49c-25/06 takes precedence)
- 49c-25/06 . . having a cutting device mounted on an oscillating lever
- 49c-25/08 . . having two coacting shearing blades mounted independently
- 49c-25/10 . . . on co-operating beams moving parallel to each other and attached to lever mechanisms
- 49c-25/12 . Shearing machines with blades on coacting rotating drums
- 49c-25/14 . without regard to the exact dimensions of the resulting material, e.g. for cutting-up scrap
- 49c-25/16 . Control arrangements specially adapted for machines for shearing travelling stock

49c-27/00 **Machines or devices for cutting by a nibbling action**

- 49c-27/02 . Hand-held devices
- 49c-27/04 . . actuated by electric power
- 49c-27/06 . . actuated by fluid or gas pressure

49c-29/00 **Hand-held metal-shearing or metal-cutting devices** (with nibbling action 49c-27/02; hand-operated devices for metal-cutting otherwise than by shearing 69)

- 49c-29/02 . Hand-operated metal-shearing devices

49c-31/00 **Shearing machines or shearing devices covered by none or more than one of the groups 49c-15/00 to 49c-29/00; Combinations of shearing machines**

- 49c-31/02 . for performing different cutting operations on travelling stock, e.g. slitting and severing simultaneously
- 49c-31/04 . for trimming stock combined with devices for shredding scrap

49c-33/00 **Accessories for shearing machines or shearing devices** (feeding stock to machines or removing stock 7c-43/00)

- 49c-33/02 . Arrangements for holding, guiding, or feeding work during the operation
- 49c-33/04 . . for making circular cuts
- 49c-33/06 . . in which the direction of feed is controlled by a copying device, e.g. by a pattern (features of copying devices 49m-35/00)
- 49c-33/08 . Press-pads; Counter-bases; Hold-down devices
- 49c-33/10 . Stops for positioning work
- 49c-33/12 . Equipment for indicating where to cut

49c-35/00 **Tools for shearing machines or shearing devices; Holders or chucks for shearing tools****Broaching****49c-37/00** **Broaching machines or broaching devices**

- 49c-37/02 . Broaching machines with horizontally-arranged working tools
- 49c-37/04 . . for broaching inner surfaces
- 49c-37/06 . . for broaching outer surfaces
- 49c-37/08 . Broaching machines with vertically-arranged working tools
- 49c-37/10 . . for broaching inner surfaces
- 49c-37/12 . . for broaching outer surfaces
- 49c-37/14 . Broaching machines with rotatably-arranged working tools
- 49c-37/16 . . for broaching helical grooves
- 49c-37/18 . Broaching machines with working tools mounted on an endless chain or belt
- 49c-37/20 . Broaching machines with arrangements for working in opposite directions
- 49c-37/22 . for special purposes (49c-37/14 takes precedence)

49c-39/00 **Accessories for broaching machines or broaching devices**

49c-41/00 Broaching machines or broaching devices characterised only by constructional features of particular parts (constructional features of these parts per se 49m)

- 49c-41/02 . of frames; of work supports
- 49c-41/04 . of tool-carrying arrangements
- 49c-41/06 . of devices for feeding, clamping, or ejecting workpieces
- 49c-41/08 . of drives; of control devices

49c-43/00 Broaching tools (for cutting gear teeth 49d-21/26)

- 49c-43/02 . for cutting by rectilinear movement (49c-43/08 takes precedence)
- 49c-43/04 . . having inserted cutting edges
- 49c-43/06 . for cutting by rotational movement
- 49c-43/08 . mounted on an endless chain or belt

Sawing (sawing wood or similar material 38a)

49c-45/00 Sawing machines or sawing devices with circular saw blades or with friction saw discs (shearing machines with rotary discs 49c-19/00 to 49c-25/00)

- 49c-45/02 . with a circular saw blade or the stock mounted on a carriage
- 49c-45/04 . with a circular saw blade or the stock carried by a pivoted lever
- 49c-45/06 . with a circular saw blade arranged underneath a stationary work-table
- 49c-45/08 . with a ring blade having inside saw teeth
- 49c-45/10 . with a plurality of circular saw blades
- 49c-45/12 . with a circular saw blade for cutting tubes
- 49c-45/14 . for cutting otherwise than in a plane perpendicular to the axis of the stock, e.g. for making a mitred cut
- 49c-45/16 . Hand-held sawing devices with circular saw blades
- 49c-45/18 . Machines with circular saw blades for sawing stock while the latter is travelling otherwise than in the direction of the cut
- 49c-45/20 . . Flying sawing machines, the saw carrier of which is reciprocated in a guide and moves with the travelling stock during sawing
- 49c-45/22 . . Flying sawing machines with lever-supported saw carrier which moves in a complete circular path
- 49c-45/24 . . Flying sawing machines with lever-supported saw carrier which oscillates in an arc
- 49c-45/26 . With high-speed cutting discs, performing the cut by frictional heat melting the material

49c-47/00 Sawing machines or sawing devices working with circular saw blades, characterised only by constructional features of particular parts (constructional features of these parts per se 49m)

- 49c-47/02 . of frames; of guiding arrangements for work-table or saw-carrier
- 49c-47/04 . of devices for feeding, positioning, clamping, or rotating work
- 49c-47/06 . . for stock of indefinite length
- 49c-47/08 . of devices for bringing the circular saw blade to the workpiece or removing same therefrom
- 49c-47/10 . . actuated by fluid or gas pressure
- 49c-47/12 . of drives for circular saw blades

49c-49/00 Machines or devices for sawing with straight reciprocating saw blades, e.g. hacksaws

- 49c-49/02 . Hacksaw machines with straight saw blades secured to a rectilinearly-guided frame, e.g. with the frame fed stepwise in the plane of the guide
- 49c-49/04 . Hacksaw machines with straight saw blades secured to a pivotally-arranged frame
- 49c-49/06 . Hacksaw machines with straight saw blades for special use
- 49c-49/08 . Pad-saw machines, i.e. machines in which the blade is attached to a carrier at one end only
- 49c-49/10 . Hand-held or hand-operated sawing devices with straight saw blades
- 49c-49/12 . . Hacksaws (49c-49/16 takes precedence; bows adjustable in length or height 49c-51/12)
- 49c-49/14 . . Pad saws (49c-49/16 takes precedence)

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| 49c-49/16 | . . . actuated by electric or magnetic power or prime movers |
| 49c-51/00 | Sawing machines or sawing devices working with straight blades, characterised only by constructional features of particular parts (constructional features of these parts per se 49m); Carrying or attaching means for tools, dealt with in this subclass, which are connected to a carrier at both ends |
| 49c-51/02 | . . . of beds; of guiding arrangements for work-tables or saw carriers |
| 49c-51/04 | . . . of devices for feeding, positioning, clamping, or rotating work |
| 49c-51/06 | . . . for stock of indefinite length |
| 49c-51/08 | . . . of devices for mounting straight saw blades or other tools |
| 49c-51/10 | . . . for hand-held or hand-operated devices |
| 49c-51/12 | . . . for use with tools, dealt with in this subclass, which are connected to a carrier at both ends, e.g. bows adjustable in length or height |
| 49c-51/14 | Attachment of the tool |
| 49c-51/16 | . . . of drives or feed mechanisms for straight tools, e.g. saw blades, or bows |
| 49c-51/18 | . . . actuated by fluid or gas pressure (49c-51/20 takes precedence) |
| 49c-51/20 | . . . with controlled feed of the tool, or with special arrangements for relieving or lifting the tool on the return stroke |
| 49c-53/00 | Machines or devices for sawing with strap saw blades which are effectively endless in use, e.g. for contour cutting |
| 49c-53/02 | . . . with stationarily-mounted wheels carrying the strap (49c-53/06 takes precedence) |
| 49c-53/04 | . . . with the wheels carrying the strap mounted shiftably or swingingly, other than merely for adjustment |
| 49c-53/06 | . . . with shiftable or swinging work-table |
| 49c-53/08 | . . . for cutting profiled stock |
| 49c-53/10 | . . . Sawing devices working with strap saw blades able to be attached to a machine tool, whether or not replacing an operative portion of the machine tool |
| 49c-53/12 | . . . Hand-held or hand-operated sawing devices working with strap saw blades |
| 49c-55/00 | Sawing machines or sawing devices working with strap saw blades, characterised only by constructional features of particular parts (constructional features of these parts per se 49m) |
| 49c-55/02 | . . . of frames; of tables |
| 49c-55/04 | . . . of devices for feeding or clamping work |
| 49c-55/06 | . . . of drives for strap saw blades; of wheel mountings |
| 49c-55/08 | . . . of devices for guiding or feeding strap saw blades |
| 49c-55/10 | . . . of devices for tensioning strap saw blades (49c-55/06 takes precedence; incorporated in the strap 49c-61/12) |
| 49c-57/00 | Sawing machines or sawing devices not covered by one of the preceding groups 49c-45/00 to 49c-55/00 |
| 49c-57/02 | . . . with chain saws |
| 49c-59/00 | Accessories specially designed for sawing machines or sawing devices (lubricating or cooling machine tools in general 49m-11/12) |
| 49c-59/02 | . . . Devices for lubricating or cooling circular saw blades |
| 49c-59/04 | . . . Devices for lubricating or cooling straight or strap saw blades |
| 49c-61/00 | Tools for sawing machines or sawing devices (tools for trepanning 49a-51/04); Clamping devices for these tools |
| 49c-61/02 | . . . Circular saw blades |
| 49c-61/04 | with inserted saw teeth |
| 49c-61/06 | in exchangeable arrangement |
| 49c-61/08 | Ring saw blades with internal saw teeth |
| 49c-61/10 | clamped between hubs; Clamping or aligning devices therefor |
| 49c-61/12 | . . . Straight saw blades; Strap saw blades |
| 49c-61/14 | with inserted saw teeth |
| 49c-61/16 | in exchangeable arrangement |
| 49c-61/18 | . . . Sawing tools of special type, e.g. wire saw strands, saw blades or saw wire equipped with diamonds or other abrasive particles in selected individual positions |

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| 49c-63/00 | Dressing the tools of sawing machines or sawing devices for use in cutting any kind of material, e.g. in the manufacture of sawing tools |
| 49c-63/02 | . Setting saw teeth by means of hand-operated devices |
| 49c-63/04 | . Setting saw teeth of circular, straight, or strap saw blades by means of power-operated devices |
| 49c-63/06 | . Upsetting the cutting edges of saw teeth, e.g. swaging |
| 49c-63/08 | . Sharpening the cutting edges of saw teeth |
| 49c-63/10 | . . by filing |
| 49c-63/12 | . . by grinding |
| 49c-63/14 | . . . Sharpening circular saw blades |
| 49c-63/16 | . . of chain saws (of mortise chain cutters 67a-1) |
| 49c-63/18 | . Straightening damaged saw blades; Reconditioning the side surfaces of saw blades, e.g. by grinding |
| 49c-63/20 | . Combined processes for dressing saw teeth, e.g. both hardening and setting |
| 49c-65/00 | Making tools for sawing machines or sawing devices for use in cutting any kind of material |
| 49c-65/02 | . Making saw teeth by punching, cutting, or planing |
| 49c-65/04 | . Making saw teeth by milling |
| <u>Filing or rasping (sharpening saw teeth thereby 49c-63/10)</u> | |
| 49c-67/00 | Filing or rasping machines or devices (securing arrangements for files or rasps 49c-71/00) |
| 49c-67/02 | . with reciprocating tools, mounted on a yoke or the like |
| 49c-67/04 | . with reciprocating tools, attached to a carrier at one end only |
| 49c-67/06 | . with rotating tools |
| 49c-67/08 | . with tools mounted on an endless chain or belt |
| 49c-67/10 | . for special use, e.g. for filing keys; Accessories therefor |
| 49c-67/12 | . Hand-held or hand-operated filing or rasping devices (hand files or rasps 49c-71/04) |
| 49c-69/00 | Filing or rasping machines or devices, characterised only by constructional features of particular parts, e.g. guiding arrangements, drives (constructional features of these parts per se 49m); Accessories for filing or rasping (attached to the tool 49c-71/10) |
| 49c-69/02 | . Guiding arrangements for hand tools |
| 49c-71/00 | Filing or rasping tools; Securing arrangements therefor (tool holders for machine tools 49m-3/00; handles for hand implements 87d) |
| 49c-71/02 | . for filing or rasping machines or devices |
| 49c-71/04 | . Hand files or hand rasps (carrying or attaching means for tools which are connected to a carrier at both ends 49c-51/12; guiding arrangements 49c-69/02) |
| 49c-71/06 | . . using a single interchangeable blade |
| 49c-71/08 | . . using a plurality of interchangeable cutting elements |
| 49c-71/10 | . Accessories for filing or rasping tools, e.g. for preventing scoring of workpieces by the edges of the tool |
| 49c-73/00 | Making files or rasps |
| 49c-73/02 | . Preliminary treatment of blanks, e.g. grinding, polishing, specially adapted for the manufacture of files or rasps |
| 49c-73/04 | . Methods or machines for the manufacture of files or rasps (non-mechanical methods in the relevant classes) |
| 49c-73/06 | . . Cutting the working surfaces by means of chisels |
| 49c-73/08 | . . Milling, planing, slotting, knurling, or broaching the working surfaces |
| 49c-73/10 | . . Grinding the working surfaces |
| 49c-73/12 | . . Peculiar procedures for sharpening or otherwise treating the working surfaces (special treatment by sand-blast 67b; sharpening files by etching 48d1-1/06) |
| 49c-73/14 | . Tools or accessories specially adapted for making files or rasps, e.g. chisels, supporting-frames |

Reaming bored holes

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| 49c-75/00 | Reaming machines or reaming devices (tool holders for machine tools 49m-3/00; handles for hand implements 87d) |
| 49c-77/00 | Reaming tools |
| 49c-77/02 | . Reamers with inserted cutting edges |
| 49c-77/04 | . . with cutting edges adjustable to different diameters along the whole cutting length |
| 49c-77/06 | . Reamers with means for compensating wear (49c-77/04 takes precedence) |
| 49c-77/08 | . . by spreading slotted parts of the tool body |
| 49c-77/10 | . . by expanding a tube-like non-slotted part of the tool body |
| 49c-77/12 | . Reamers with cutting edges arranged in tapered form |
| 49c-77/14 | . Reamers for special use, e.g. for working cylinder ridges |
| 49c-79/00 | Methods, machines or devices not covered elsewhere, for working metal by removal of material (by combined operations 49c-81/00; tool holders for machine tools 49m-3/00; handles for hand implements 87d) |
| 49c-79/02 | . Machines or devices for scraping (turning machines for bevelling, chamfering, or deburring the ends of bars or tubes 49a-5/16) |
| 49c-79/04 | . . with rotating cutting-tool, e.g. for smoothing linings of bearings |
| 49c-79/06 | . . with reciprocating cutting-tool |
| 49c-79/08 | . . Hand scraping-implements |
| 49c-79/10 | . . Accessories for holding scraping tools or work to be scraped |
| 49c-81/00 | Methods, machines, or devices for working metal, covered by more than one main group in this subclass (in combination with other metal-working operations 49l-13/00, 49l-23/00) |

49d Production of gear teeth on gears and racks

Methods and devices for producing gear teeth by means of a tool with a cutting profile corresponding to the profile of the teeth to be produced

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| 49d-1/01 | Grinding by means of specially shaped grinding disks |
| 49d-1/02 | Planing and shaping by means of shaping cutters |
| 49d-1/03 | Milling by means of tooth-shaping cutters |
| 49d-1/04 | Gear teeth production by means of broaches |

Methods and devices for producing gear teeth, with tooth profile obtained from a template

| | |
|----------|---------------------|
| 49d-2/01 | Grinding |
| 49d-2/02 | Planing and shaping |
| 49d-2/03 | Milling |

Methods and devices for producing the tooth flanks according to the generating process

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|----------|--|
| 49d-3/01 | Grinding according to the generating process |
| 49d-3/02 | Planing and shaping by means of a tool with a cutting edge corresponding to the tooth flank of a rack tooth or a face gear tooth |
| 49d-3/03 | Planing and shaping by means of tools embodying part of a rack |
| 49d-3/04 | Planing and shaping by means of a gear-like cutter, pinion-type cutters |
| 49d-3/05 | Machining of tooth flanks by one or more cutters, moved according to the curvature of the tooth flanks |
| 49d-3/06 | Hobbing, especially by means of helical hob |
| 49d-4 | Production of herringbone gears |
| | Production of teeth curved in the longitudinal direction |
| 49d-5/01 | Production by means of helical hobs |
| 49d-5/02 | Production by planing with a rotating cutter |

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| 49d-5/03 | Production by means of single reciprocating cutters, gear-type tools, disk-type milling cutters or other tools |
| 49d-6 | Production of worm gears |
| 49d-7 | Production of worms |
| 49d-8 | Production of gears with intersecting axes, such as helical gears and hyperboloidal gears, also such with curved teeth |
| 49d-9 | Production of various types of gears, e.g. noncircular and elliptic gears, production of cycloidal curves |
| 49d-10 | Production of gears for watches |
| 49d-11 | Special production processes and devices |
| 49d-12 | Running-in and grinding-in of all types of gears, lapping |
| 49d-13 | Rounding-off the edges of gears |
| | Tools for the production of gear teeth |
| 49d-14/01 | Grinding tools |
| 49d-14/02 | Shaping milling cutters |
| 49d-14/03 | Hobs |
| 49d-14/04 | Planing tools, rack-form cutters, pinion-type cutters, broaches |
| 49d-14/05 | Rotating cutter heads for planing curved teeth |
| | Components of machines for production of gear teeth |
| 49d-15/01 | Workpiece supports, tool holders, outer supports |
| 49d-15/02 | Hobbing devices |
| 49d-15/03 | Truing devices for grinding disks |
| 49d-15/04 | Indexing devices |
| 49d-15/05 | Compensation of errors in indexing drives |
| 49d-15/06 | Miscellaneous arrangements |

49d (IPC: B23F) Making gears and toothed racks (by stamping 7c; by rolling 7f; by forging or pressing 7h; by casting 31b; arrangements for copying or controlling 49m)

Notes:

This subclass includes primarily the use of methods and apparatus specially designed to produce accurately the shapes of gear teeth which are essential for proper intermeshing of toothed gearing elements to ensure the required relative motions. It also includes the use of similar methods and apparatus in the production of other articles of toothed or like form, e.g. dog clutches, splined shafts, milling cutters, but the production of such articles using other methods and apparatus is not included.

In this subclass:

- (1) The term "gear teeth" is to be understood as covering the teeth or lobes of other accurately-intermeshing members having relative movement of a similar kind, such as rotors of rotary pumps and blowers.**
- (2) The term "profile" may include the outline of both faces or only one face of a tooth, or the opposing faces of adjacent teeth.**
- (3) The term "straight" means that a tooth as a whole (ignoring any curvature of the tooth-face alone, e.g. crowning) is straight in the direction of its length, for example as seen in the direction of a radius of a spur wheel. It accordingly includes the teeth of helical gears and of the normal type of bevel gear.**
- (4) "Broach-milling" means milling with a rotary cutter having a number of teeth of progressively increasing depth or width.**

49d-1/00 Making gear teeth by tools of which the profile matches the profile of the required surface (special adaptations for making curved teeth 49d-9/00)

- 49d-1/02 . by grinding
- 49d-1/04 . by planing or slotting
- 49d-1/06 . by milling
- 49d-1/08 . by broaching; by broach-milling

49d-3/00 Making gear teeth involving copying operations controlled by templates having a profile which matches that of the required tooth face or part thereof or a copy thereof to a different scale (copying systems or devices per se 49m-35/00)

49d-5/00 Making straight gear teeth involving moving a tool relatively to a workpiece with a rolling-off or an enveloping motion with respect to the gear teeth to be made

- 49d-5/02 . by grinding
- 49d-5/04 . . the tool being a grinding worm
- 49d-5/06 . . the tool being a grinding disc with a plane front surface
- 49d-5/08 . . the tool being a grinding disc having a profile which is the same as the tooth or teeth of a rack
- 49d-5/10 . . the tool being a grinding disc having a profile which is the same as the tooth or teeth of a crown wheel
- 49d-5/12 . by planing or slotting
- 49d-5/14 . . the tool having the same profile as a tooth or teeth of a rack
- 49d-5/16 . . the tool having a shape similar to that of a spur wheel or part thereof
- 49d-5/18 . . the tool having the same profile as a tooth of a crown wheel
- 49d-5/20 . by milling
- 49d-5/22 . . the tool being a hob for making spur gears
- 49d-5/24 . . the tool being a hob for making bevel gears
- 49d-5/26 . . the tool having the same profile as a tooth or teeth of a rack, for making spur gears
- 49d-5/28 . by broaching; by broach-milling

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| 49d-7/00 | Making herring-bone gear teeth |
| 49d-9/00 | Making gears having teeth curved in their longitudinal direction |
| 49d-9/02 | . by grinding |
| 49d-9/04 | . by planing or slotting with reciprocating cutting tools |
| 49d-9/06 | . . having a shape similar to a spur wheel of part thereof |
| 49d-9/08 | . by milling, e.g. with helicoidal hob |
| 49d-9/10 | . . with a face-mill |
| 49d-11/00 | Making worm wheels, e.g. by hobbing |
| 49d-13/00 | Making worms by methods essentially requiring the use of machines of the gear-cutting type (making screw-thread 49e) |
| 49d-13/02 | . Making worms of cylindrical shape |
| 49d-13/04 | . . by grinding |
| 49d-13/06 | . Making worms of globoidal shape |
| 49d-13/08 | . . by grinding |
| 49d-15/00 | Methods or machines for making gear wheels of special kinds not covered by 49d-7/00 to 49d-13/00 |
| 49d-15/02 | . Making gear teeth on wheels of varying radius of operation, e.g. on elliptical wheels |
| 49d-15/04 | . Making fine-pitch gear teeth on clock wheels or the like by special machining |
| 49d-15/06 | . Making gear teeth on the front surface of wheels, e.g. for clutches or couplings with toothed faces |
| 49d-15/08 | . Making intermeshing rotors, e.g. of pumps |
| 49d-17/00 | Special methods or machines for making gear teeth, not covered by the preceding groups |
| 49d-19/00 | Finishing gear teeth by other tools than those used for manufacturing gear teeth |
| 49d-19/02 | . Lapping gear teeth |
| 49d-19/04 | . . Lapping spur gears by making use of a correspondingly shaped counterpart |
| 49d-19/06 | . Shaving the faces of gear teeth |
| 49d-19/08 | . . by means of a tools moving depthwise relatively to the teeth |
| 49d-19/10 | . Chamfering the end edges of gear teeth |
| 49d-19/12 | . . by grinding |
| 49d-21/00 | Tools specially adapted for use in machines for manufacturing gear teeth |
| 49d-21/02 | . Grinding discs; Grinding worms (truing grinding tools, grinding tools in general 67c) |
| 49d-21/04 | . Planing or slotting tools |
| 49d-21/06 | . . having a profile which matches a gear tooth profile |
| 49d-21/08 | . . having the same profile as a tooth or teeth of a rack |
| 49d-21/10 | . . Gear-shaper cutters having a shape similar to a spur wheel or part thereof |
| 49d-21/12 | . Milling tools |
| 49d-21/14 | . . Profile cutters of disc type |
| 49d-21/16 | . . Hobs |
| 49d-21/18 | . . . Taper hobs, e.g. for bevel gears |
| 49d-21/20 | . . Fly cutters |
| 49d-21/22 | . . Face-mills for longitudinally-curved gear teeth |
| 49d-21/24 | . Broach-milling tools |
| 49d-21/26 | . Broaching tools |
| 49d-21/28 | . Shaving cutters |
| 49d-23/00 | Accessories or equipment combined with or arranged in, or specially designed to form part of, gear-cutting machines (tool-guiding mechanisms, see the relevant groups for making gear teeth; accessories or equipment not restricted to gear-cutting machines 49m) |
| 49d-23/02 | . Loading arrangements; Chucking arrangements |
| 49d-23/04 | . . Loading arrangements |
| 49d-23/06 | . . Chucking arrangements |
| 49d-23/08 | . Index mechanisms |

- 49d-23/10 . Arrangements for compensating irregularities in drives or indexing mechanisms
- 49d-23/12 . Other devices, e.g. tool holders; Checking devices for controlling workpieces in machines for manufacturing gear teeth

49e Thread cutting (on lead-screw lathes 49a; twist drills 49b-8; by grinding 67a-3; by rolling 7f-9) and machining of screw heads and end faces of nuts

- 49e-1 Single-spindle screw cutting machines, general
- 49e-2 Multi-spindle screw cutting machines, general
- 49e-3 Screw cutting machines with gear-like, rotary cutting tools, also for wood screws
- 49e-4 Single-spindle tapping machines
- 49e-5 Multi-spindle tapping machines
- 49e-6 Thread milling machines, thread milling cutters (49b)
- 49e-7 Thread cutting on pipes (49a-3/05; 80a-50/01; 80a-50/05)
- 49e-8 Die stocks
- 49e-9 Die plates
- 49e-10 Taps and tapping heads, tap wrenches
- 49e-11 Thread cutting heads
- 49e-12 Machines for machining screw heads and end faces of nuts: screw head slotting machines, etc.
- 49e-13 Devices for conveying workpieces in thread cutting or head machining (49c-30/01 – 49c-30/03)
- 49e-14 Special processes, devices and tools for thread cutting, also nut screwing machines

49e (IPC: B23G) Thread cutting; Working of screws, bolt heads, or nuts, in conjunction therewith (thread-forming by corrugating tubes 7c-15/04; by rolling 7f-3/02, by forging, pressing, or hammering 7h-1/56; making helical grooves by turning 49a5/48, by milling 49b-3/32; by grinding 67a-3; arrangements for copying or controlling 49m)

Note:

The term "thread cutting" is to be understood as including the use of tools similar both in form and in manner of use to thread-cutting tools, but without removing any material.

- 49e-1/00 Thread cutting; Automatic machines specially designed therefor**
- 49e-1/02 . on an external or internal cylindrical or conical surface, e.g. on recesses (49e-1/16, 49e-1/22, 49e-1/32, 49e-1/36 take precedence)
 - 49e-1/04 . . Machines with one working-spindle
 - 49e-1/06 . . . specially adapted for making conical screws, e.g. wood-screws
 - 49e-1/08 . . Machines with a plurality of working-spindles
 - 49e-1/10 . . . specially adapted for making conical screws, e.g. wood-screws
 - 49e-1/12 . . Machines with a toothed cutter in the shape of a spur gear or the like which is rotated to generate the thread profile as the work rotates
 - 49e-1/14 . . . specially adapted for making conical screws, e.g. wood-screws
 - 49e-1/16 . in holes of workpieces by taps (49e-1/26, 49e-1/32, 49e-1/36 take precedence)
 - 49e-1/18 . . Machines with one working-spindle
 - 49e-1/20 . . Machines with a plurality of working-spindles
 - 49e-1/22 . Machines specially designed for operating on pipes or tubes
 - 49e-1/24 . . portable
 - 49e-1/26 . Manually-operated thread-cutting devices (features of the threading tool per se 49e-5/00)
 - 49e-1/28 . . with means for adjusting the threading tool
 - 49e-1/30 . . without means for adjusting the threading tool, e.g. with die-stocks (tap wrenches 87a-22)
 - 49e-1/32 . by milling

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| 49e-1/34 | . . with a cutting bit moving in a closed path arranged eccentrically with respect to the axis of the rotating workpiece |
| 49e-1/36 | . by grinding |
| 49e-1/38 | . . with grinding discs guided along the workpiece in accordance with the pitch of the required thread |
| 49e-1/40 | . . with grinding discs guided radially to the workpiece |
| 49e-1/42 | . Centreless grinding |
| 49e-1/44 | . Equipment or accessories specially designed for machines or devices for thread cutting |
| 49e-1/46 | . . for holding the threading tools |
| 49e-1/48 | . . for guiding the threading tools |
| 49e-1/50 | . . for cutting thread by successive operations |
| 49e-1/52 | . . for operating on pipes or tubes |
| 49e-3/00 | Arrangements or accessories for enabling machine tools not specially designed only for thread cutting to be used for this purpose, e.g. arrangements for reversing the working-spindle |
| 49e-3/02 | . for withdrawing or resetting the threading tool |
| 49e-3/04 | . . for repeatedly setting the threading tool in a predetermined working position |
| 49e-3/06 | . for compensating inaccuracies in the pitch of the lead-screw |
| 49e-3/08 | . for advancing or controlling the threading tool or the work by templates, cams, or the like |
| 49e-3/10 | . . for cutting thread of variable pitch |
| 49e-3/12 | . . for using several adjacently-arranged threading tools, e.g. using several chasers |
| 49e-3/14 | . . for cutting thread of conical shape |
| 49e-5/00 | Thread-cutting tools; Die-heads |
| 49e-5/02 | . without means for adjustment |
| 49e-5/04 | . . Dies |
| 49e-5/06 | . . Taps (chucks therefor 49a-31/00) |
| 49e-5/08 | . with means for adjustment |
| 49e-5/10 | . . Die-heads |
| 49e-5/12 | . . . self-releasing |
| 49e-5/14 | . . Tapping-heads |
| 49e-5/16 | . . . self-releasing |
| 49e-5/18 | . Milling cutters |
| 49e-5/20 | . combined with other tools, e.g. drills |
| 49e-7/00 | Forming thread by means of tools similar both in form and in manner of use to thread-cutting tools, but without removing any material (features of machines or devices not specially adapted to the particular mode of forming the thread 49e-1/00) |
| 49e-7/02 | . Tools for this purpose |
| 49e-9/00 | Working screws, bolt heads or nuts in conjunction with thread cutting, e.g. slotting screw heads or shanks, removing burrs from screw heads or shanks; Finishing, e.g. polishing, any screw thread |
| 49e-11/00 | Feeding or discharging mechanisms combined with, or arranged in, or specially adapted for use in connection with, thread-cutting machines (for machine tools in general 49m) |
| 49f | Production of files and rasps (38e-5; 49c-25/01 – 49c-26/03) |
| 49f-1 | Cutting of files and rasps |
| 49f-2 | Production of files by milling and grinding |
| 49f-3 | Production of files by planing, shaping, turning and broaching |
| 49f-4 | Special production processes |
| 49f-5 | Preliminary machining of file blanks, e.g. planing the cut, milling, grinding and sharpening |
| 49f-6 | Regrinding of files |

- 49f-7 Tools for producing files and rasps
- 49g Power hammers (hand hammers 87b), forging presses, riveting machines**
- Power hammers**
- 49g-1 Steam and gas power hammers
- 49g-2 Pneumatic hammers (pneumatic hand hammers 87b-2/01 – 87b-2/20)
- 49g-3 Power hammers driven by electric motor (structure of the electric part 21c, 21d; hand hammers 87b-3/01 – 87b-3/05)
- 49g-4 Mechanical hammers, e.g. spring hammers (mechanically driven hand hammers 87b-3/01 – 87b-3/05)
- 49g-5 Revolving impact machines (hand hammers 87b-3/01 – 87b-3/05; beaters for boiler descaling 13e-4/01 – 13e-4/02)
- 49g-6 Bar drop hammers, also driven by steam or compressed air
- 49g-7 Belt drop hammers
- 49g-8 Tilt hammers, helve hammers
- 49g-9 Power hammer details: anvil blocks, rams, etc.
- Forging presses (forging and upsetting machines 49h-11)**
- 49g-10/01 Purely hydraulic (hydraulic presses in general 58a)
- 49g-10/02 Electrohydraulic
- 49g-11 Steam-hydraulic; other arrangements for pressure transmission
- 49g-12 Mechanical: lever presses, friction disk presses, spindle presses, crank presses, eccentric presses and toggle presses (forging machines 49h-3/01 – 49h-3/03; presses in general 58b; drawing presses 7c)
- Riveting machines**
- 49g-13 Hydraulic riveting machines, also hydro-pneumatic
- 49g-14 Pneumatic riveting machines (compressed-air hand hammers 87b)
- 49g-15/01 Mechanical riveting machines
- 49g-15/02 Tong-type riveting devices (sealing pliers 87b)
- 49g-16/01 Devices for riveting, e.g. dollies
- 49g-16/02 Devices for riveting hollow articles
- 49g-16/03 Feeding arrangements for rivets
- 49g-16/04 Devices for centring, packing and removing rivets
- 49g-16/05 Auxiliary devices for riveting
- 49g-16/06 Riveting methods, shaping of rivets
- 49g-16/07 Details of riveting machines
- 49g-17 Electric motor driven riveting machines (21h)
- 49h Forging, pressing, bending, straightening, soldering, welding, oxyacetylene cutting (hardening and heating furnaces 18c, 40d-2/10 – 40d-2/40; metal treatment by means of electric heat, method of electric heat generation: 21h-29/01 – 21h-32/12)**
- Forging, perforating of metal blocks and pressing**
- 49h-1 Upsetting with forging (7d-5)
- 49h-2 Perforation of metal blocks (7b-10/10)
- Forging machines
- 49h-3/01 with clamping jaws movable across the direction of pressing
- 49h-3/02 with rotating hammers, drawing machines
- 49h-3/03 Others
- Auxiliary tools
- 49h-4 Anvils

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| 49h-5 | Manipulators |
| 49h-6 | Other auxiliary tools: dies, etc. |
| | Heating devices |
| 49h-7 | Tuyeres for forge fires |
| 49h-8 | Forge hearths |
| 49h-9 | Forge fires |
| 49h-10 | Wheel tyre fires |
| 49h-11 | Metal pressing in general (forging presses 49g-10/01 – 49g-12; manufacture of metal forge and press products 49i) |
| | Bending and straightening of metal, excluding wire and sheet metal (7b-17; 7c-4/02 – 7c-4/06; 7d-1; 7d-2; 19a-28/02; 19a-31/08) |
| 49h-12 | Bending of metal bars, e.g. structural iron, rails, by means of formers |
| 49h-13 | Bending machines for reinforced concrete iron |
| | Bending by means of two abutments and one pressure element |
| 49h-14/01 | of metal bars |
| 49h-14/02 | of sheet springs |
| 49h-15 | Bending of metal bars by means of rotating rolls |
| 49h-16 | Twisting of metal rods, torsion of multiple throw crankshafts |
| | Bending of metal tubes by means of formers |
| 49h-17/01 | without mandrel |
| 49h-17/02 | with mandrel |
| 49h-18 | Bending of metal tubes by means of two abutments and one pressure element |
| 49h-19 | Bending pliers (for conduit 21c-18/02) |
| 49h-20 | Helical bending of metal rods and tubes, coiled tubes |
| | Straightening of metal bars and tubes |
| 49h-21 | by means of two abutments and one pressure element |
| 49h-22 | Straightening by means of rotating rolls or by bending back and forth by means of rotating parts |
| 49h-23 | Tapping machines for metal tubes for packing of sand filling prior to bending |
| 49h-24 | Special bending and straightening processes and devices, and details, also pipe elbow benders, gauging of pipe bends |
| | Soldering, welding (electric soldering or welding, methods of electric heat generation 21h-29/01 – 21h-32/12); oxyacetylene cutting (rail joints, aside from the special method of soldering or welding, 19a-26, 19a-11/44) |
| | Soldering heavy metals |
| 49h-25 | Soldering processes |
| 49h-26/01 | Material composition of solders |
| 49h-26/02 | Solders according to form and external condition (production of soldering wire by drawing or stretching 7b-14/60) |
| 49h-27 | Fluxes (49h-31/13, 49h-36/10) |
| 49h-28/01 | Soldering irons |
| 49h-28/02 | Devices and furnaces for heating soldering irons (burners for heating soldering irons 4g-44/01 – 4g-44/50) |
| 49h-28/03 | Self-heating soldering irons |
| 49h-28/04 | Soldering irons with solder chamber |
| 49h-29 | Blow torches and blow pipes (burners for blow torches 4g-29) |
| 49h-30 | Auxiliary tools for soldering, except those in 49h-28, 49h-29 |
| | Soldering and welding of light metals |
| 49h-31/01 | Composition of solders and weld fillers |

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| 49h-31/02 | Solders and weld fillers according to form and external condition |
| 49h-31/10 | Soldering and welding processes |
| 49h-31/13 | Soldering and welding fluxes |
| | Soldering of cans, e.g. food cans |
| 49h-32/01 | Soldering the longitudinal seam of can bodies |
| 49h-32/02 | Soldering the bottom and head seams |
| 49h-33 | Soldering furnaces (soldering apparatus for dentists 30b-17) |
| | Welding of heavy metals |
| 49h-34/01 | Fusion welding (methods of electric heat generation 21h-29/01 – 21h-32/12; blow pipes 4g-44/01 – 4g-44/50) |
| 49h-34/02 | Built-up welding, e.g. for repair purposes |
| 49h-34/03 | Production of economy tools by soldering or welding |
| 49h-35/01 | Aluminothermic welding |
| 49h-35/02 | Other welding processes |
| 49h-36/01 | Composition of weld fillers |
| 49h-36/02 | Weld fillers: filler rods, welding wire, etc. according to shape and external condition (welding electrodes 21h-30/16) |
| 49h-36/10 | Welding agents |
| 49h-37 | Oxyacetylene cutting (burners 4g-44/01 – 4g-44/50) |

49h (IPC: B23K) Soldering; Welding; Cutting by applying heat locally, e.g. flame cutting (plating 49l-3/00; arrangements for copying or controlling 49m)

Note:

Electric circuits specially adapted for these purposes are dealt with in this subclass.

Soldering, i.e. uniting metals using solder and applying heat without melting either of the parts to be united (essentially requiring the use of welding machines or welding equipment, in the relevant groups for the welding machines or welding equipment)

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| 49h-1/00 | Soldering metal (49h-3/00 takes precedence; characterised only by the use of special materials or media 49h-35/00) |
| 49h-1/02 | . Soft soldering |
| 49h-1/04 | . Brazing or high-temperature soldering |
| 49h-1/06 | . making use of vibrations, e.g. supersonic vibrations |
| 49h-1/08 | . Soldering by means of dipping in molten solder |
| 49h-1/10 | . Arc-stud soldering |
| 49h-1/12 | . specially adapted for particular articles of work |
| 49h-1/14 | . . for soldering seams (making tubes involving operations other than soldering 7b) |
| 49h-1/16 | . . . longitudinal seams, e.g. of shells |
| 49h-1/18 | . . . circumferential seams, e.g. of shells |
| 49h-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 in the relevant classes for the treatments or the materials treated, e.g. 48b, 80b) |
| 49h-3/00 | Tools, devices, or special appurtenances for soldering, not adapted for special methods (materials used for soldering 49h-35/00) |
| 49h-3/02 | . Soldering irons; Bits |
| 49h-3/04 | . Heating appliances (soldering lamps or blowpipes 4g; electric heating elements 21h) |
| 49h-3/06 | . Solder feeding devices; Solder melting pans |

Flame welding or cutting

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| 49h-5/00 | Gas flame welding |
| 49h-5/02 | . Seam welding (making tubes involving operations other than welding 7b) |

- 49h-5/04 . . using additional profiled strips or like of welding metal along seam edges
- 49h-5/06 . . Welding longitudinal seams
- 49h-5/08 . . Welding circumferential seams
- 49h-5/10 . Welding workpieces essentially comprising layers of different metals, e.g. plated workpieces
- 49h-5/12 . taking account of the properties of the material to be welded
- 49h-5/14 . . of non-ferrous metals (49h-5/16 takes precedence)
- 49h-5/16 . . of different metals
- 49h-5/18 . for purposes other than joining parts, e.g. built-up welding
- 49h-5/20 . making use of vibrations, e.g. supersonic vibrations
- 49h-5/22 . Auxiliary equipment, e.g. backings, guides
- 49h-5/24 . . Arrangements for supporting torches (not restricted to flame welding 49h-37/02)

49h-7/00 Cutting, scarfing, or desurfacing by applying flames

- 49h-7/02 . Machines, apparatus, or equipment for cutting plane workpieces, e.g. plates
- 49h-7/04 . Machines, apparatus, or equipment specially adapted for cutting curved workpieces, e.g. tubes
- 49h-7/06 . Machines, apparatus, or equipment specially designed for scarfing or desurfacing
- 49h-7/08 . by applying additional compounds or means favouring the cutting, scarfing, or desurfacing procedure
- 49h-7/10 . Auxiliary devices, e.g. for guiding or supporting the torch (guiding means applicable to other metal-working machines 49m)

Other welding or cutting; Working metal by laser beam

49h-9/00 Arc welding or cutting (electro-slag welding 49h-25/00; welding transformers 21d2; welding generators 21d1, 21d2, 21d3)

- 49h-9/02 . Seam welding; Backing means; Inserts
- 49h-9/04 . Welding for other purposes than joining, e.g. built-up welding
- 49h-9/06 . Arrangements or circuits for generating ignition voltage and stabilising the arc
- 49h-9/08 . Arrangements or circuits for magnetic control of the arc
- 49h-9/10 . Other electric circuits therefor; Protective circuits; Remote controls
- 49h-9/12 . Automatic feeding of electrodes or work for spot or seam welding or cutting
- 49h-9/14 . making use of insulated electrodes
- 49h-9/16 . making use of shielding gas
- 49h-9/18 . Submerged-arc welding
- 49h-9/20 . Stud welding
- 49h-9/22 . Percussion welding
- 49h-9/24 . Features related to electrodes (form or composition of electrodes 49h-35/00)
- 49h-9/26 . . Accessories for electrodes, e.g. ignition tips
- 49h-9/28 . . Supporting devices for electrodes (not restricted to arc welding or cutting 49h-37/02)
- 49h-9/30 . . . Vibrating holders for electrodes
- 49h-9/32 . Accessories

49h-11/00 Resistance welding; Severing by resistance heating

- 49h-11/02 . Pressure butt welding
- 49h-11/04 . Flash butt welding
- 49h-11/06 . using roller electrodes
- 49h-11/08 . Seam welding not restricted to one of the preceding subgroups
- 49h-11/10 . Spot welding; Stitch welding
- 49h-11/12 . . making use of vibrations
- 49h-11/14 . Projection welding
- 49h-11/16 . taking account of the properties of the material to be welded
- 49h-11/18 . . of non-ferrous metals (49h-11/20 takes precedence)
- 49h-11/20 . . of different metals
- 49h-11/22 . Severing by resistance heating
- 49h-11/24 . Electric supply or control circuits therefor
- 49h-11/26 . . Storage discharge welding
- 49h-11/28 . Portable welding equipment
- 49h-11/30 . Features relating to electrodes (form or composition of electrodes 49h-35/00)

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| 49h-13/00 | Welding by induction heating |
| 49h-13/02 | . Seam welding |
| 49h-15/00 | Electron-beam welding or cutting |
| 49h-17/00 | Using the energy of nuclear particles in welding or related techniques |
| 49h-19/00 | Welding by applying impact or other pressure after or during heating of the workpieces (forging, hammering, pressing 7g, 7h) |
| 49h-21/00 | Cold pressure welding (forging, hammering, pressing 7g, 7h) |
| 49h-23/00 | Alumino-thermic welding |
| 49h-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 (49h-23/00 takes precedence; submerged-arc welding 49h-9/18) |
| 49h-27/00 | Welding or cutting otherwise than mentioned before, e.g. electrolytic welding by laser beam (working of metal by electro-erosion 49I-1/00, e.g. electrolytic cutting 49I-1/04) |
| 49h-29/00 | Welding not restricted to procedures covered by one of the preceding main groups |
| 49h-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 7b-37/04, 7b-37/08) |
| 49h-31/02 | . relating to soldering or welding |
| 49h-31/04 | . . Connecting cutting edges or the like to tools |
| 49h-31/06 | . . Making tubes with soldering or welding |
| 49h-31/08 | . . Making profiled bars with soldered or welded seams |
| 49h-31/09 | . . Exclusively electric welding of rails, grids etc. |
| 49h-31/10 | . relating to cutting or desurfacing |
| 49h-33/00 | Specially-profiled edge portions of workpieces for making soldering or welding connections; Filling the seams formed thereby |
| 49h-35/00 | Rods, electrodes, materials, or media, for use in soldering, welding, or cutting |
| 49h-35/02 | . characterised by mechanical features, e.g. shape |
| 49h-35/04 | . . specially designed for use as electrodes (ignition tips for arc welding or cutting 49h-9/26) |
| 49h-35/06 | . . . of non-circular cross-section; with special arrangement, e.g. internal |
| 49h-35/08 | multi-cored; multiple |
| 49h-35/10 | with more than one layer of coating or sheathing material |
| 49h-35/12 | . . not specially designed for use as electrodes |
| 49h-35/14 | . . . for soldering |
| 49h-35/16 | . . . of non-circular cross-section; with special arrangement, e.g. internal (49h-35/14 takes precedence) |
| 49h-35/18 | multi-cored; multiple |
| 49h-35/20 | with more than one layer of coating or sheathing material |
| 49h-35/22 | . characterised by the composition or nature of the material |
| 49h-35/24 | . . Selection of soldering or welding materials proper (49h-35/34 takes precedence) |
| 49h-35/26 | . . . with the principal constituent melting at less than 400 °C |
| 49h-35/28 | . . . with the principal constituent melting at less than 950 °C |
| 49h-35/30 | . . . with the principal constituent melting at less than 1550 °C |
| 49h-35/32 | . . . with the principal constituent melting at more than 1550 °C |
| 49h-35/34 | . . comprising compounds which yield metals when heated |
| 49h-35/36 | . . Selection of non-metallic compositions, e.g. coatings, fluxes (49h-35/34 takes precedence) |
| 49h-35/38 | . . Selection of media, e.g. special atmospheres for surrounding the working area |

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| 49h-35/40 | . Making wire or rods for soldering or welding (processes involving a single technical art, see the relevant classes, e.g. 75c, 7b) |
| 49h-37/00 | Auxiliary devices not specially adapted to a procedure covered by only one of the preceding main groups (applicable to metal-working machines other than soldering, welding, and flame-cutting machines 49m; eye-shields for welders worn on the operators' body or carried in the hand 30d-27/01 – 30d-27/02; other protective shields 47a4-1/06) |
| 49h-37/02 | . Carriages for supporting the welding or cutting element |
| 49h-37/04 | . for holding or positioning work |
| 49h-37/06 | . for positioning the molten material, e.g. confining it to a desired area |

49i Manufacture of forge and press products: horseshoes, bolts, screws, wheels, etc.

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| 49i-1 | Horseshoes |
| 49i-2 | Horseshoe calks, toe and heel |
| 49i-3 | Heel irons |
| 49i-4 | Bolts and screws |
| 49i-5 | Stay bolts |
| 49i-6 | Rivets (7e-20) |
| 49i-7 | Nuts |
| 49i-8 | Wheels |
| 49i-10 | Drills, especially twist drills (49a-59 – 49a-60/04; 49b-8) |
| 49i-11 | Production and re-sharpening of rock drills |
| 49i-12 | of railroad requisites (20e-25) |
| 49i-13 | Restoration of worn or deformed parts for track structure, etc. |
| 49i-14 | Production of cutting tools, e.g. knives, scissors, etc. |
| 49i-15 | of balls |
| 49i-16 | of various forge and press products not previously mentioned |

49k Production of chains (bicycle chains 63k-29; chains as machine elements 47d-13 – 47d-15; chains for cleaning bottles, etc. 64b-3; conveyor chains 81e; ornamental chains 44a-40; safety chains 68b-8; cattle chains 45h-2, 45h-1/06; production of chains by casting 31c-22)

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| 49k-1 | Production of suspension chains by bending round or flat iron with subsequent welding |
| 49k-2 | Production of suspension chains by simple bending of wire without subsequent welding |
| 49k-3 | Production of suspension chains by coiling wire, round bar iron or flat iron and welding |
| 49k-4 | Production of suspension chains by forging or rolling from the solid without welding |
| 49k-5 | Electric welding of chains, when electric heat generation is not concerned |
| 49k-6 | Forming and trimming chain links |
| 49k-7 | Production of driving chains |

49l Working of metal not provided for in 49a – 49k: production of gold foil, hard solder (of bronze 50c; of bronze paints 22f), **doubling, pulverisation, mounting of tool diamonds; production of turbine blades, etc.**

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| 49l-2 | Production of metal foil, especially gold foil (22g-10) |
| 49l-3 | Production of metal powder by pulverisation (by pounding 50c-17/01, 50c-17/40); of metal balls and grains, hard solder |
| 49l-5 | Doubling of wire, tubes (sheathing of wire and tubes 7b-6/01, 7b-21), plating, etc; production of compound metal (40b; 48b-11 – 48b-12; 48d) |
| 49l-6 | Mounting of tool diamonds (32a-33, 32a-33/10; mounting of drawing dies 7b-4/10) |

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| 49I-7 | Production of turbine blades (7f; 14c; 31c) |
| 49I-8 | Production of steel wool, etc. |
| 49I-9 | Production of piston rings |
| 49I-10 | Production of pistons |
| 49I-11 | Production of crossbar connections |
| 49I-12 | Miscellaneous in connection with metalworking, stationary machines and devices for dismantling and mounting of wheels, for forcing in and fitting bushings, for connecting and disconnecting machine components, for producing flexible connections (hand tools, see 87a-22 and 63d-5/02) |

49I (IPC: B23P) Other working of metal; Combined operations; Universal machine tools (arrangements for copying or controlling 49m)

Notes:

Attention is drawn to the notes immediately following the title of class 49.

(1) In interpreting the phrase "combined operations", the assembly of parts is regarded as an operation if it is not an essential feature of the next metal-working operation.

(2) The term "Working of metal" and equivalent terms are to be understood as covering non-mechanical treatment of metal so far as it is not provided for in a single other class such as 18c, 40b, 40d, 48. Thus, combinations of such treatment with other metal-working may be classified in this subclass.

(3) In so far as non-mechanical treatments other than those specifically mentioned in this subclass are concerned (see (2) above), non-metallic materials are excluded.

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| 49I-1/00 | Working of metal by electro-erosion, i.e. removing particles from metal objects by direct action of high concentrations of electric current applied by devices taking the place of tools; Other metal-working using the same technique (tools for electrolytic grinding 67c; electrolytic surface treatment in general 48a; using low concentrations of electric current, i.e. electrolytic etching or polishing 48a-3/00) |
| 49I-1/02 | . Apparatus; Devices; Electric circuits |
| 49I-1/04 | . . for performing electro-erosion within an electrolytic medium |
| 49I-1/06 | . . for arc discharge |
| 49I-1/08 | . . for spark discharge |
| 49I-1/10 | . . for combined erosion procedures; for simultaneous erosion and mechanical working of metal (mechanical grinding or polishing 67) |
| 49I-1/12 | . Electrodes; Moving or positioning electrodes relatively to work |
| 49I-1/14 | . . Maintaining the desired spacing between electrodes and work |
| 49I-1/16 | . Applications of particular working media, e.g. dielectrics, electrolytes |
| 49I-1/18 | . for built-up working, e.g. hard facing |
| 49I-1/20 | . for producing effects on surfaces, e.g. smoothing or roughening |
| 49I-1/30 | . Working by means of plasma |
| 49I-1/32 | . Working by means of laser beams |
| 49I-3/00 | Plating metal; Joining metal workpieces by the same procedures (plating by extrusion 7b; procedures or apparatus covered by a single other subclass, and not restricted to plating, see the relevant subclass, e.g. 7c-39/00; by sintering metallic powder 31b3; by adhesives 47a1-11/00) |
| 49I-3/02 | . by application of pressure only, or pressure and heat; Preparation of workpieces therefor |
| 49I-3/04 | . . by means of a press |
| 49I-3/06 | . . by passing through a rolling mill |
| 49I-3/08 | . . by cold pressure welding |

- 49I-3/09 . . of blast pressure
- 49I-3/10 . involving melting the metal of one layer
- 49I-3/12 . Preventing air access during plating; Using protective gases or vacuum during plating (formed by means of an interposed layer of material 49I-3/14)
- 49I-3/14 . by interposing a special layer, e.g. for absorbing or producing gas, favouring the formation of the connection of the parts
- 49I-3/16 . Zonal plating by interposing weld-preventing substances between zones not to be welded
- 49I-3/18 . . for making hollow objects of interjoined sheets or strips to be inflated or otherwise expanded (processes involving the inflation 7c); Pretreatments therefor
- 49I-3/20 . of laminations of different materials, e.g. bimetallic strip, not covered by one of the preceding subgroups
- 49I-3/22 . Joining to specific portions of workpieces parts of another quality
- 49I-3/24 . . Attaching reinforcements to workpieces, e.g. wear-resisting zones to table ware
- 49I-3/26 . . for forming the working portions of tools, e.g. cutting edges
- 49I-3/28 . Special methods allowing subsequent separation, e.g. of metals of high quality from scrap material

49I-5/00 Setting gems or the like on metal parts, e.g. diamonds on tools

49I-7/00 Restoring or reconditioning objects (by casting 31b2-19/10; procedures or apparatus covered by a single other subclass, and not restricted to restoring or reconditioning, see the relevant subclass)

- 49I-7/02 . pistons or cylinders
- 49I-7/04 . Repairing fractures or cracked metal parts or products, e.g. castings

49I-9/00 Treating or finishing surfaces mechanically, with or without calibrating, primarily to resist wear or impact, e.g. smoothing or roughening turbine blades or bearings (treatment covered by a single other subclass, see the relevant subclass, e.g. 67b, 18c-7/00, 40d-1/00); **Features of such surfaces not otherwise provided for, their treatment being unspecified**

- 49I-9/02 . Treating or finishing by applying pressure, e.g. knurling (49I-9/04 takes precedence)
- 49I-9/04 . Treating or finishing by hammering or applying repeated pressure

49I-11/00 Connecting metal parts or objects by metal-working procedures, not covered wholly by either 7g or 49h (49I-3/00 takes precedence; connecting sheet metal or metal tubes, rods or profiles 7c-39/00; objects produced by methods not important per se, see the relevant subclasses dealing with the objects, e.g. 7d-15/00, 7i-19/00; hand tools for connecting wire or strip 87a-21; connecting metal parts by adhesives 47a1-11/00)

- 49I-11/02 . by first expanding and then shrinking or vice versa, e.g. by using pressure fluids; by making force fits

49I-13/00 Making metal objects by operations essentially involving machining but not covered by a single other subclass (making specific objects 49I-15/00)

- 49I-13/02 . in which only the machining operations are important
- 49I-13/04 . involving slicing of profiled material

49I-15/00 Making specific metal objects by operations not covered by a single other subclass or a group in this subclass

Note:

This group is to be understood as restricted to objects covered by its subgroups.

- 49I-15/02 . turbine or like blades from one piece
- 49I-15/04 . turbine or like blades from several pieces
- 49I-15/06 . piston rings from one piece
- 49I-15/08 . piston rings from several pieces
- 49I-15/10 . pistons
- 49I-15/12 . gratings
- 49I-15/14 . gear parts, e.g. gear wheels
- 49I-15/16 . plates with holes of very small diameter e.g. for spinning or burner nozzles

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| 49I-15/18 | . brake shoes |
| 49I-15/20 | . railroad requirements, e.g. buffers |
| 49I-15/22 | . cartridges or like shells |
| 49I-15/24 | . dies (7b-3/18, 7b-25/10, 7c-37/20 take precedence) |
| 49I-15/26 | . heat exchangers or the like |
| 49I-15/28 | . cutting tools (sawing tools 49c-63/00, 49c-65/00; files or rasps 49c-73/00) |
| 49I-15/30 | . . lathe or like tools |
| 49I-15/32 | . . twist-drills |
| 49I-15/34 | . . milling cutters |
| 49I-15/36 | . . . for thread cutting |
| 49I-15/38 | . . planing or slotting tools (49I-15/30 takes precedence) |
| 49I-15/40 | . . shearing tools |
| 49I-15/42 | . . broaching tools |
| 49I-15/44 | . . scraping or shaving tools |
| 49I-15/46 | . . reaming tools |
| 49I-15/48 | . . threading tools (milling cutters for thread-cutting 49I-15/36) |
| 49I-15/50 | . . . dies |
| 49I-15/52 | . . . taps |
| 49I-17/00 | Metal-working operations, not covered by a single other subclass or another group in this subclass |
| 49I-17/02 | . Single metal-working processes; Machines or apparatus therefor |
| 49I-17/04 | . characterised by the nature of the material involved or the kind of product independently of its shape |
| 49I-17/06 | . . Making steel wool or the like |
| 49I-19/00 | Machines for simply fitting together or separating metal parts or objects whether or not involving some deformation (interference fits 49I-11/00); Tools or devices therefor so far as not provided for in other classes (hand tools in general 87) |
| 49I-19/02 | . for connecting objects by press fit or for detaching same |
| 49I-19/04 | . for assembling or disassembling parts |
| 49I-19/06 | . . Screw or nut setting or loosening machines |
| 49I-19/08 | . . Machines for placing washers, circlips, or the like on bolts or other members |
| 49I-21/00 | Machines for assembling a multiplicity of different parts to compose units, with or without preceding or subsequent working of such parts, e.g. with programme control |
| 49I-23/00 | Machines or arrangements of machines for performing specified combinations of different metal-working operations not covered by a single other subclass (if the particular kinds of operation are not essential 49m-37/00 to 49m-41/00; features relating to operations covered by a single subclass, see the relevant subclass for the operation) |
| 49I-23/02 | . Machine tools for performing different machining operations (lathes, e.g. capstan lathes, 49a; combined horizontal boring and milling machines 49a-39/02) |
| 49I-23/04 | . for both machining and other metal-working operations |
| 49I-23/06 | . Metal-working plant comprising a number of associated machines or apparatus |
| 49I-25/00 | Auxiliary treatment of workpieces, before or during machining operations, to facilitate the action of the tool or the attainment of a desired final condition of the work, e.g. relief of internal stress |

49m (IPC: B23Q) Details, components, or accessories for machine tools, e.g. arrangements for copying or controlling (tools of the kind used in lathes or boring machines 49a-27/00); Machine tools in general characterised by the construction of particular details or components; Combinations or associations of machine tools, not directed to a particular metal-working result

Notes:

Attention is drawn to the notes immediately following the title of class 49.

In this subclass groups designating parts of machine tools are to be understood as covering machine tools characterised by constructional features of such parts.

- 49m-1/00 Members which are comprised in the general build-up of a form of machine, particularly relatively large fixed members (49m-37/00 takes precedence)**
- 49m-1/02 . Frames, beds, pillars, or analogous members; Work-tables not designed to be fed or driven (rotatable 49m-1/16); Arrangements of ways
 - 49m-1/04 . . Work-tables or other members, variable or adjustable in inclination
 - 49m-1/06 . . Work-tables interchangeably movable into operating positions
 - 49m-1/08 . carrying working-spindles for attachment of tools or work or of devices for supporting or holding same (49m-1/02 takes precedence; if designed to be fed or driven 49m-1/14; headstocks or the like, working-spindle supports 49a-19/00)
 - 49m-1/10 . . Movable members, e.g. swinging arms
 - 49m-1/12 . . variable or adjustable in inclination
 - 49m-1/14 . Work-tables or analogous members, designed to be fed or driven; Similar members carrying tool mountings
 - 49m-1/16 . . Rotatable members, e.g. faceplates
 - 49m-1/18 . . Members slidable in a line, e.g. reciprocable
 - 49m-1/20 . Carriages, cross-slides, or analogous members (of lathe or similar type 49a-21/00; non-driven tool holders 49a-29/00)
 - 49m-1/22 . Other stationary supporting devices for tools or moving work (parts holding tools or work 49m-3/00; tailstocks 49a-23/00)
 - 49m-1/24 . . Auxiliary devices, e.g. steadies, rests
 - 49m-1/26 . Constructional features relating to the co-operation of relatively slidable members; Means for preventing relative movement of such members (bearings for linearly-moving parts 47b-29/00)
 - 49m-1/28 . . Means for securing sliding members in any desired position
 - 49m-1/30 . . controlled in conjunction with the feed mechanism
- 49m-3/00 Devices holding, supporting, or positioning, work or tools more or less directly, of a kind normally removable from the machine (work-tables or other parts, e.g. faceplates, normally not incorporating means for securing work 49m-1/00; positioning controlled by indicating or measuring equipment 49m-17/00; rotary tool heads for turning-machines 49a-3/24, 49a-3/26; non-driven tool holders 49a-29/00; general features of turrets 49a-29/24)**
- 49m-3/02 . for mounting on a work-table, tool-slide, or analogous part (49m-3/15 takes precedence)
 - 49m-3/04 . . adjustable in inclination
 - 49m-3/06 . . Work-clamping means (if not specially adapted for machine tools 87a)
 - 49m-3/08 . . . other than mechanically-actuated
 - 49m-3/10 . . Auxiliary devices, e.g. bolsters, extension members
 - 49m-3/12 . for securing to a spindle in general (49m-3/152 takes precedence; chucks 49a-31/02)
 - 49m-3/14 . . Mandrels in general (expansion mandrels 49a-31/40)
 - 49m-3/15 . Devices for holding work using magnetic or electric force acting directly on the work
 - 49m-3/152 . . Rotary devices
 - 49m-3/154 . . Stationary devices

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| 49m-3/155 | . Arrangements for automatic insertion or removal of tools |
| 49m-3/157 | . . of rotary tools |
| 49m-3/16 | . controlled in conjunction with the operation of the tool |
| 49m-3/18 | . for positioning only |
| 49m-5/00 | Driving or feeding mechanisms; Control arrangements therefor (copying 49m-33/00, 49m-35/00; specially adapted for boring or drilling machines 49a-39/10, 49a-47/02; automatic control of a series of stops 42r1-19/00) |
| 49m-5/02 | . Driving main working members |
| 49m-5/04 | . . rotary shafts, e.g. working-spindles |
| 49m-5/06 | . . . driven essentially by fluid pressure or pneumatic power |
| 49m-5/08 | electrically controlled |
| 49m-5/10 | . . . driven essentially by electrical means |
| 49m-5/12 | . . . Mechanical drives with means for varying the speed ratio |
| 49m-5/14 | step-by-step |
| 49m-5/16 | infinitely-variable |
| 49m-5/18 | Devices for preselecting speed of working-spindle |
| 49m-5/20 | . . . Adjusting or stopping working-spindles in a predetermined position |
| 49m-5/22 | . Feeding members carrying tools or work directly or indirectly |
| 49m-5/24 | . . not mechanically connected to the main drive, e.g. with separate motor(s) (connected to main drive through servomotors 49m-5/36) |
| 49m-5/26 | . . . Fluid-pressure drives |
| 49m-5/28 | . . . Electric drives |
| 49m-5/30 | . . mechanically derived from main drive |
| 49m-5/32 | . . . feeding working-spindles (feeding working-spindle supports 49m-5/34) |
| 49m-5/34 | . . . Feeding other members supporting tools or work, e.g. saddles, tool-slides, through mechanical transmission |
| 49m-5/36 | in which a servomotor forms an essential element |
| 49m-5/38 | feeding continuously |
| 49m-5/40 | by feed shaft, e.g. lead screw |
| 49m-5/42 | Mechanism associated with headstock |
| 49m-5/44 | Mechanism associated with the moving member |
| 49m-5/46 | with variable speed ratio |
| 49m-5/48 | by use of toothed gears |
| 49m-5/50 | feeding step-by-step |
| 49m-5/52 | . . Limiting feed movement |
| 49m-5/54 | . Arrangements or details not restricted to group 49m-5/02 or group 49m-5/22 respectively |
| 49m-5/56 | . . Preventing backlash |
| 49m-5/58 | . . Safety devices |
| 49m-7/00 | Arrangements for handling work specially combined with or arranged in, or specially adapted for use in connection with, machine tools, e.g. for conveying, loading, positioning, discharging, sorting (incorporated in working-spindles 49a-13/00, 49a-19/02) |
| 49m-7/02 | . by means of drums or rotating tables or discs |
| 49m-7/04 | . by means of grippers |
| 49m-7/06 | . by means of pushers |
| 49m-7/08 | . by means of slides or chutes |
| 49m-7/10 | . by means of magazines |
| 49m-7/12 | . Sorting arrangements |
| 49m-7/14 | . co-ordinated in production lines |
| 49m-9/00 | Arrangements for supporting or guiding portable metal-working machines or apparatus (for tapping pipes 49a-41/08; specially designed for drilling 49a-45/14) |
| 49m-9/02 | . for securing machines or apparatus to workpieces, or other parts, of particular shape, e.g. to beams of particular cross-section |

Accessories

49m-11/00 **Accessories fitted to machine tools for keeping tools or parts of the machine in good working condition or for cooling work; Safety devices specially combined with or arranged in, or specially adapted for use in connection with, machine tools** (in respect of boring or drilling machines 49a-47/24, 49a-47/32 take precedence; safety devices in general 47a4)

- 49m-11/02 . Devices for removing scrap from the cutting teeth of circular cutters
- 49m-11/04 . Arrangements preventing overload of tools, e.g. restricting load
- 49m-11/06 . Safety devices for circular cutters
- 49m-11/08 . Protective coverings for parts of machine tools; Splash guards
- 49m-11/10 . Arrangements of devices for cooling or lubricating tools or work (incorporated in tools, see the relevant subclass for the tool)
- 49m-11/12 . Arrangements for cooling or lubricating machine parts
- 49m-11/14 . Measures or means for maintaining a constant temperature in parts of machine tools

49m-13/00 **Equipment for use with tools or cutters when not in operation, e.g. protectors for storage**

Measuring; Indicating; Controlling (automatic control of a series of steps, automatic production of records 42r1-19/00)

49m-15/00 **Measuring or gauging equipment for controlling the feed movement of tool or work** (measuring or gauging instruments per se 42b)

- 49m-15/02 . according to the instantaneous size and the required size of the workpiece acted upon (49m-15/06 takes precedence)
- 49m-15/04 . according to the final size of the previously machined workpiece (49m-15/06 takes precedence)
- 49m-15/06 . according to measuring results produced by two or more gauging methods using different measuring principles, e.g. by both optical and mechanical gauging

49m-17/00 **Indexing equipment; Arrangements of indicating or measuring equipment on machine tools** (instruments per se 42); **Support or mounting of indicating or measuring equipment; Control of position of tool or work by such equipment** (particularly for co-ordinate boring or drilling machines 49a-39/06)

- 49m-17/02 . Indexing equipment
- 49m-17/04 . . for dividing angles; Dividing heads
- 49m-17/06 . of vernier dials
- 49m-17/08 . of equipment for measuring cutting pressure
- 49m-17/10 . of equipment for measuring cutting speed or number of revolutions
- 49m-17/12 . of equipment for measuring vibration
- 49m-17/14 . of autocollimator equipment
- 49m-17/16 . of measuring faces on component parts of machine tools, e.g. on tool holders
- 49m-17/18 . Controlling position of tool or work

49m-19/00 **Arrangements, e.g. optical projecting means, for enabling the operator to see the position of the tool in relation to the work**

49m-21/00 **Equipment for controlling starting or stopping of the movement of tool or work in a predetermined position, e.g. for exact in-feed**

- 49m-21/02 . with means for withdrawing tool or work during reverse movement

49m-23/00 **Arrangements for compensating for irregularities or wear, e.g. of ways, of setting mechanisms**

49m-27/00 **Geometrical mechanisms for the production of work of particular shapes, not fully provided for in another subclass**

Copying**Note:**

The term "copying" is to be understood as covering the derivation of a required shape from a pattern, of the same or a different shape or scale, by a mechanism or equivalent means controlled by a member following the pattern. The pattern may be a model or drawing, or an element such as a cam incorporated in the operating mechanism of a machine. The term "copying" does not cover the derivation of a required shape from simple geometrical shapes, e.g. generating a cycloid by a rolling circle, which in general is provided for in group 49m-27/00

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| 49m-33/00 | Methods for copying |
| 49m-35/00 | Control systems or devices for copying directly from a pattern or a master model; Devices for use in copying manually |
| 49m-35/02 | . Copying discrete points from the pattern, e.g. for determining the position of holes to be drilled |
| 49m-35/04 | . using a feeler or the like travelling along the outline of the pattern, model or drawing; Feelers, patterns, or models therefor |
| 49m-35/06 | . . specially adapted for controlling successive operations, e.g. separate cuts, on a workpiece |
| 49m-35/08 | . . Means for transforming movement of the feeler or the like into feed movement of tool or work |
| 49m-35/10 | . . . mechanically only |
| 49m-35/12 | . . . involving electrical means |
| 49m-35/121 | using mechanical sensing |
| 49m-35/122 | the feeler opening or closing electrical contacts |
| 49m-35/123 | the feeler varying the impedance in a circuit |
| 49m-35/124 | varying resistance |
| 49m-35/125 | varying capacitance |
| 49m-35/126 | varying inductance |
| 49m-35/127 | using non-mechanical sensing |
| 49m-35/128 | Sensing by using optical means |
| 49m-35/129 | Sensing by means of electric discharges |
| 49m-35/13 | Sensing by using magnetic means |
| 49m-35/14 | controlling one or more electromotors |
| 49m-35/16 | controlling fluid motors |
| 49m-35/18 | . . . involving fluid means (49m-35/16 takes precedence) |
| 49m-35/20 | . . . with special means for varying the ratio of reproduction |
| 49m-35/22 | . . . specially adapted for compensating for wear of the tool |
| 49m-35/24 | . . Feelers; Feeler units |
| 49m-35/26 | . . . designed for physical contact with a pattern or a model |
| 49m-35/28 | for control of a mechanical copying system |
| 49m-35/30 | for control of an electrical or electro-hydraulic copying system |
| 49m-35/32 | in which the feeler makes and breaks an electrical contact or contacts, e.g. with brush-type tracers |
| 49m-35/34 | in which the feeler varies an electrical characteristic in a circuit, e.g. capacity, frequency |
| 49m-35/36 | for control of a hydraulic or pneumatic copying system |
| 49m-35/38 | . . . designed for sensing the pattern, model, or drawing without physical contact (sensing by means of a fluid jet 49m-35/36) |
| 49m-35/40 | involving optical or photoelectrical systems |
| 49m-35/42 | . . Patterns; Master models |
| 49m-35/44 | . . . provided with means for adjusting the contact face, e.g. comprising flexible bands held by set-screws |
| 49m-35/46 | . . . Supporting devices therefor |
| 49m-35/48 | . Using a feeler or the like travelling to-and-fro between opposite parts of the outline of the pattern, model, or drawing |

Machines comprising units or subassemblies; Transfer machines; Associations of machines or units

- 49m-37/00** **Metal-working machines, or constructional combinations thereof, built-up from units designed so that at least some of the units can form parts of different machines or combinations; Units therefor in so far as the feature of interchangeability is important** (features relating to particular metal-working operations, see the relevant subclasses, e.g. 49l-23/00)
- 49m-39/00** **Machines incorporating a plurality of subassemblies, each capable of performing a metal-working operation** (49m-33/00, 49l-23/00 take precedence; if the operations are similar and the kind of operation is essential, see the relevant subclass for the operation)
- 49m-39/02 . the subassemblies being capable of being brought to act at a single operating station
- 49m-39/04 . the subassemblies being arranged to operate simultaneously at different stations, e.g. with an annular work-table moved in steps (associations of machines connected only by work-transferring means 49m-41/00)
- 49m-41/00** **Combinations or associations of machines covered by classes 7, 31b, 38, 39a, 49, 58, 67 or 80d** (49m-37/00, 49m-39/00 take precedence; features relating to the operation performed, if the latter is of one particular kind, see the subclass for the kind of operation; features essentially relating to specified combinations of different metal-working operations 49l-23/00)
- 49m-41/02 . Features relating to transfer of work between machines
- 49m-41/04 . Features relating to relative arrangements of machines
- 49m-41/06 . Features relating to organisation of working of machines
- 49m-41/08 . Features relating to maintenance of efficient operation