SECTION B — PERFORMING OPERATIONS; TRANSPORTING

B23 MACHINE TOOLS; METAL-WORKING NOT OTHERWISE PROVIDED FOR

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 B23B 27/00); MACHINE TOOLS IN GENERAL, CHARACTERISED BY THE CONSTRUCTION OF PARTICULAR DETAILS OR COMPONENTS; COMBINATIONS OR ASSOCIATIONS OF METAL-WORKING MACHINES, NOT DIRECTED TO A PARTICULAR RESULT

Note(s)

1. In this subclass, groups designating parts of machine tools cover machine tools characterised by constructional features of such parts.
2. In this subclass, the following terms or expressions are used with the meanings indicated:
   - "controlling" means influencing a variable in any way, e.g. changing its direction or its value (including changing it to or from zero), maintaining it constant, limiting its range of variation;
   - "regulation" means maintaining a variable automatically at a desired value or within a desired range of values. The desired value or range may be fixed, or manually varied, or may vary with time according to a predetermined "programme" or according to variation of another variable. Regulation is a form of control;
   - "automatic control" is often used in the art as a synonym for regulation.
3. Attention is drawn to the Notes following the title of class B23.

Subclass index

BASIC COMPONENTS OF MACHINE TOOLS.....1/00, 9/00
DEVICES FOR SUPPORTING, HANDLING, OR FEEDING WORK OR TOOLS.....3/00, 5/00, 7/00
AUXILIARY EQUIPMENT, SAFETY DEVICES.....11/00, 13/00, 27/00
MEASURING; INDICATING; CONTROLLING
Controlling the movements of the tool or work.....15/00, 16/00, 23/00
Indicating.....17/00
COPYING.....33/00, 35/00
MACHINES COMPRISING UNITS OR SUB-ASSEMBLIES, TRANSFER MACHINES, ASSOCIATIONS OF MACHINES OR UNITS.....37/00, 39/00, 41/00

1/00 Members which are comprised in the general build-up of a form of machine, particularly relatively large fixed members (B23Q 37/00 takes precedence)

1/01 • Frames, beds, pillars or like members; Arrangement of ways **[6]**

1/03 • Stationary work or tool supports (B23Q 1/70 takes precedence; auxiliary tables B23Q 1/74; tailstocks B23B 23/00) **[6]**

1/25 • Movable or adjustable work or tool supports **[6]**

1/26 • • characterised by constructional features relating to the co-operation of relatively movable members; Means for preventing relative movement of such members **[6]**

1/28 • • • Means for securing sliding members in any desired position **[6]**

1/30 • • • controlled in conjunction with the feed mechanism **[6]**

1/32 • • • Relative movement obtained by co-operating spherical surfaces, e.g. ball-and-socket joints **[6]**

1/34 • • • Relative movement obtained by use of deformable elements, e.g. piezo-electric, magnetostrictive, elastic or thermally-dilatable elements (sensitive elements capable of producing movement or displacement for purposes not limited to measurement G12B 1/00) **[6]**

1/36 • • • • Springs **[6]**

1/38 • • • using fluid bearings or fluid cushion supports **[6]**

1/40 • • • using ball, roller or wheel arrangements **[6]**

1/42 • • • using T-, V-, dovetail-section or like guides (B23Q 1/40 takes precedence) **[6]**

1/44 • • using particular mechanisms (B23Q 1/26 takes precedence) **[6]**

Note(s)

1. In this group, the following expressions are used with the meaning indicated:
   - "sliding pair" means a pair consisting of two elements operating in such a way that only straight line movement between both elements is possible;

- "rotating pair" means a pair consisting of two elements operating in such a way that only rotary movement between both elements is possible;
- "screw pair" means a pair consisting of two elements operating in such a way as to produce simultaneous rotation and axial translation between both elements.

2. In this group, where more than one pair of elements is provided on the same axis for the same kind of movement, the pairs are regarded as a single pair for the purposes of classification.

1/46 • • • with screw pairs **[6]**
1/48 • • • with sliding pairs and rotating pairs (B23Q 1/46 takes precedence) **[6]**
1/50 • • • with rotating pairs only **[6]**
1/52 • • • • a single rotating pair **[6]**
1/54 • • • • two rotating pairs only **[6]**
1/56 • • • with sliding pairs only **[6]**
1/58 • • • • a single sliding pair **[6]**
1/60 • • • • two sliding pairs only **[6]**
1/62 • • • • • with perpendicular axes, e.g. cross-slides **[6]**
1/64 • • characterised by the purpose of the movement (indexing equipment B23Q 16/02) **[6]**
1/66 • • • Work-tables interchangeably movable into operating positions **[6]**
1/68 • • • for withdrawing tool or work during reverse movement **[6]**
1/70 • Stationary or movable members for carrying working-spindles for attachment of tools or work (headstocks or the like, working-spindle supports B23B 19/00; working-spindles B23B 19/02) **[6]**
1/72 • Auxiliary arrangements; Interconnections between auxiliary tables and movable machine elements **[6]**
1/74 • • Auxiliary tables **[6]**
1/76 • • Steadies; Rests **[6]**

3/00 Devices holding, supporting, or positioning, work or tools, of a kind normally removable from the machine (work-tables or other parts, e.g. faceplates, normally not incorporating means for securing work B23Q 1/00; automatic position control B23Q 15/00; rotary tool heads for turning-machines B23B 3/24, B23B 3/26; non-driven tool holders B23B 29/00; general features of turrets B23B 29/24; tools or bench devices for fastening, connecting, disengaging or holding B25B)

3/02 • for mounting on a work-table, tool-slide, or analogous part (B23Q 3/15 takes precedence)
3/04 • • adjustable in inclination
3/06 • • Work-clamping means
3/08 • • • other than mechanically-actuated
3/10 • • Auxiliary devices, e.g. bolsters, extension members
3/12 • for securing to a spindle in general (B23Q 3/152 takes precedence; chucks B23B 31/02)
3/14 • • Mandrels in general (expansion mandrels B23B 31/40)
3/15 • Devices for holding work using magnetic or electric force acting directly on the work
3/152 • • Rotary devices
3/154 • • Stationary devices
3/155 • Arrangements for automatic insertion or removal of tools
3/157 • • of rotary tools
3/16 • controlled in conjunction with the operation of the tool
3/18 • for positioning only

5/00 Driving or feeding mechanisms; Control arrangements therefor (automatic control B23Q 15/00; copying B23Q 33/00, B23Q 35/00; specially adapted for boring or drilling machines B23B 39/10, B23B 47/02)

5/02 • Driving main working members
5/027 • • reciprocating members **[2]**
5/033 • • • driven essentially by fluid pressure **[2]**
5/04 • • rotary shafts, e.g. working-spindles
5/06 • • • driven essentially by fluid pressure or pneumatic power
5/08 • • • • electrically controlled
5/10 • • • driven essentially by electrical means
5/12 • • • Mechanical drives with means for varying the speed ratio
5/14 • • • • step-by-step
5/16 • • • • infinitely-variable
5/18 • • • • Devices for preselecting speed of working-spindle
5/20 • • • Adjusting or stopping working-spindles in a predetermined position
5/22 • Feeding members carrying tools or work
5/26 • • Fluid-pressure drives **[3]**
5/28 • • Electric drives **[3]**
5/32 • • Feeding working-spindles (feeding working-spindle supports B23Q 5/34) **[3]**
5/34 • • Feeding other members supporting tools or work, e.g. saddles, tool-slides, through mechanical transmission **[3]**
5/36 • • • in which a servomotor forms an essential element **[3]**
5/38 • • • feeding continuously **[3]**
5/40 • • • • by feed shaft, e.g. lead screw **[3]**
5/42 • • • • • Mechanism associated with headstock **[3]**
5/44 • • • • • Mechanism associated with the moving member **[3]**
5/46 • • • • with variable speed ratio **[3]**
5/48 • • • • • by use of toothed gears **[3]**
5/50 • • • feeding step by step **[3]**
5/52 • • Limiting feed movement
5/54 • Arrangements or details not restricted to group B23Q 5/02 or group B23Q 5/22 respectively
5/56 • • Preventing backlash
5/58 • • Safety devices

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 B23B 13/00, B23B 19/02; for automatic or semi-automatic turning machines B23B 15/00) **[2]**

7/02 • by means of drums or rotating tables or discs
7/03 • by means of endless chain conveyors (B23Q 7/16 takes precedence) **[2]**
7/04 • by means of grippers
7/05 • by means of roller-ways (B23Q 7/16 takes precedence) **[2]**
7/06 • by means of pushers
7/08 • by means of slides or chutes
7/10 • by means of magazines
7/12 • Sorting arrangements
7/14 • co-ordinated in production lines

7/16 • Loading work on to conveyors; Arranging work on conveyors, e.g. varying spacing between individual workpieces **[2]**

7/18 • • Orienting work on conveyors **[2]**

9/00 Arrangements for supporting or guiding portable metal-working machines or apparatus (for tapping pipes B23B 41/08; specially designed for drilling B23B 45/14)

9/02 • for securing machines or apparatus to workpieces, or other parts, of particular shape, e.g. to beams of particular cross-section

Accessories

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 B23B 47/24, B23B 47/32 take precedence; safety devices in general F16P)

11/02 • Devices for removing scrap from the cutting teeth of circular cutters

11/04 • Arrangements preventing overload of tools, e.g. restricting load

11/06 • Safety devices for circular cutters

11/08 • Protective coverings for parts of machine tools; Splash guards

11/10 • Arrangements for cooling or lubricating tools or work (incorporated in tools, see the relevant subclass for the tool) **[1, 2006.01]**

11/12 • Arrangements for cooling or lubricating parts of the machine (B23Q 11/14 takes precedence) **[1, 2006.01]**

11/14 • Methods or arrangements for maintaining a constant temperature in parts of machine tools **[1, 2006.01]**

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

Measuring; Indicating; Controlling [3]

15/00 Automatic control or regulation of feed movement, cutting velocity or position of tool or work [3]

15/007 • while the tool acts upon the workpiece **[3]**

15/013 • • Control or regulation of feed movement (B23Q 15/12 takes precedence) **[3]**

15/02 • • • according to the instantaneous size and the required size of the workpiece acted upon (B23Q 15/06 takes precedence) **[3]**

15/04 • • • according to the final size of the previously machined workpiece (B23Q 15/06 takes precedence) **[3]**

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 **[3]**

15/08 • • Control or regulation of cutting velocity (B23Q 15/12 takes precedence) **[3]**

15/10 • • • to maintain constant cutting velocity between tool and workpiece **[3]**

15/12 • • Adaptive control, i.e. adjusting itself to have a performance which is optimum according to a preassigned criterion **[3]**

15/14 • • Control or regulation of the orientation of the tool with respect to the work **[3]**

15/16 • • Compensation for wear of the tool **[3]**

15/18 • • Compensation of tool-deflection due to temperature or force **[3]**

15/20 • before or after the tool acts upon the workpiece **[3]**

15/22 • • Control or regulation of position of tool or workpiece **[3]**

15/24 • • • of linear position **[3]**

15/26 • • • of angular position **[3]**

15/28 • • with compensation for tool wear **[3]**

16/00 Equipment for precise positioning of tool or work into particular locations not otherwise provided for (automatic control or regulation of position of tool or work B23Q 15/22; arrangements for indicating or measuring existing or desired position of tool or work B23Q 17/22) **[4]**

16/02 • Indexing equipment (specially adapted for gear-cutting machines B23F 23/08) **[4]**

16/04 • • having intermediate members, e.g. pawls, for locking the relatively movable parts in the indexed position **[4]**

16/06 • • • Rotary indexing **[4]**

16/08 • • having means for clamping the relatively movable parts together in the indexed position **[4]**

16/10 • • • Rotary indexing **[4]**

16/12 • • using optics **[4]**

17/00 Arrangements for indicating or measuring on machine tools (for automatic control or regulation of feed movement, cutting velocity or position of tool or work B23Q 15/00) **[3, 4]**

17/09 • for indicating or measuring cutting pressure or cutting-tool condition, e.g. cutting ability, load on tool (arrangements preventing overload of tools B23Q 11/04; devices for indicating failure of drills during boring B23B 49/00) **[4]**

17/10 • for indicating or measuring cutting speed or number of revolutions

17/12 • for indicating or measuring vibration

17/20 • for indicating or measuring workpiece characteristics, e.g. contour, dimension, hardness **[4]**

17/22 • for indicating or measuring existing or desired position of tool or work **[4]**

17/24 • using optics **[4]**

23/00 Arrangements for compensating for irregularities or wear, e.g. of ways, of setting mechanisms (automatic control B23Q 15/00) **[3]**

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

Copying

Note(s)

In groups B23Q 33/00 or B23Q 35/00, the following term is used with the meaning indicated:

- "copying" covers 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. This term 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 B23Q 27/00.

33/00 Methods for copying

35/00 Control systems or devices for copying directly from a pattern or a master model; Devices for use in copying manually

35/02 • Copying discrete points from the pattern, e.g. for determining the position of holes to be drilled
35/04 • using a feeler or the like travelling along the outline of the pattern, model or drawing; Feelers, patterns, or models therefor
35/06 • • specially adapted for controlling successive operations, e.g. separate cuts, on a workpiece
35/08 • • Means for transforming movement of the feeler or the like into feed movement of tool or work
35/10 • • • mechanically only
35/12 • • • involving electrical means (programme recording for copying purposes in a separate apparatus G05, G11)
35/121 • • • • using mechanical sensing
35/122 • • • • • the feeler opening or closing electrical contacts
35/123 • • • • • the feeler varying the impedance in a circuit
35/124 • • • • • • varying resistance
35/125 • • • • • • varying capacitance
35/126 • • • • • • varying inductance
35/127 • • • • using non-mechanical sensing
35/128 • • • • • Sensing by using optical means
35/129 • • • • • Sensing by means of electric discharges
35/13 • • • • • Sensing by using magnetic means
35/14 • • • • controlling one or more electromotors
35/16 • • • • controlling fluid motors
35/18 • • • involving fluid means (B23Q 35/16 takes precedence)
35/20 • • • with special means for varying the ratio of reproduction
35/22 • • • specially adapted for compensating for wear of the tool
35/24 • • Feelers; Feeler units
35/26 • • • designed for physical contact with a pattern or a model
35/28 • • • • for control of a mechanical copying system
35/30 • • • • for control of an electrical or electro-hydraulic copying system
35/32 • • • • • in which the feeler makes and breaks an electrical contact or contacts, e.g. with brush-type tracers
35/34 • • • • • in which the feeler varies an electrical characteristic in a circuit, e.g. capacity, frequency
35/36 • • • • for control of a hydraulic or pneumatic copying system
35/38 • • • designed for sensing the pattern, model, or drawing without physical contact (sensing by means of a fluid jet B23Q 35/36)
35/40 • • • • involving optical or photoelectrical systems
35/42 • • Patterns; Master models
35/44 • • • provided with means for adjusting the contact face, e.g. comprising flexible bands held by set-screws
35/46 • • • Supporting devices therefor
35/48 • using a feeler or the like travelling to-and-fro between opposite parts of the outline of the pattern, model, or drawing

Metal-working machines comprising units or sub-assemblies; Associations of metal-working machines or units

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. B23P 23/00)

39/00 Metal-working machines incorporating a plurality of sub-assemblies, each capable of performing a metal-working operation (B23Q 33/00, B23P 23/00 take precedence; if the operations are similar and the kind of operation is essential, see the relevant subclass for the operation)

39/02 • the sub-assemblies being capable of being brought to act at a single operating station
39/04 • the sub-assemblies 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 B23Q 41/00)

41/00 Combinations or associations of metal-working machines not directed to a particular result according to classes B21, B23, or B24 (B23Q 37/00, B23Q 39/00 take precedence; features relating to operations performed, if the different metal-working operations are of the same kind, see the subclass for the kind of operation, e.g. punching B21D, welding B23K, grinding B24B; features relating to technically specified combinations of different metal-working operations B23P 23/00)

41/02 • Features relating to transfer of work between machines (arrangements for handling work for machine tools co-ordinated in production lines B23Q 7/14)
41/04 • Features relating to relative arrangements of machines
41/06 • Features relating to organisation of working of machines
41/08 • Features relating to maintenance of efficient operation