

CPC COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING

(NOTES omitted)

MICROSTRUCTURAL TECHNOLOGY; NANOTECHNOLOGY

B81 MICROSTRUCTURAL TECHNOLOGY

(NOTES omitted)

B81B MICROSTRUCTURAL DEVICES OR SYSTEMS, e.g. MICROMECHANICAL DEVICES (piezoelectric, electrostrictive or magnetostrictive elements per se [H10N 30/00](#))

NOTES

- This subclass does not cover:
 - purely electrical or electronic devices per se which are covered by section [H](#), e.g. subclass [H01L](#) or class [H10](#);
 - purely optical devices per se which are covered by subclasses [G02B](#) or [G02F](#);
 - essentially two-dimensional structures, e.g. layered products which are covered by subclass [B32B](#);
 - chemical or biological structures per se which are covered by section [C](#);
 - structures in atomic scale produced by manipulation of single atoms or molecules, which are covered by group [B82B 1/00](#).
- Devices or systems classified in this subclass are also classified in appropriate subclasses providing for their structural or functional features, if such features are of interest.
- {Attention is drawn to the following places:

| | |
|----------------------------|---|
| A61K 9/50 | Microcapsules for medicinal preparations |
| B25J 7/00 | Micromanipulators |
| G02B 21/32 | Micromanipulators combined with microscopes |
| G11B 5/127 | Magnetic heads |
| H01P 3/08 | Waveguide microstrips. |
- {In this subclass, local "residual" subgroups, e.g. [B81B 7/0077](#), are used with the following purpose:
When classifying a document which does not fit in any of a set of subgroups with the same dot-level, the document should be classified in the residual group, if present, and not in the group at the hierarchical level one dot above.
In the example, the document shall be classified in [B81B 7/0077](#) and not in [B81B 7/0032](#) as [B81B 7/0077](#) is "residual" to [B81B 7/0035-B81B 7/0074](#)

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

| | | | |
|-------------|--|--------|--|
| 1/00 | Devices without movable or flexible elements, e.g. microcapillary devices | 3/0013 | . . {Structures dimensioned for mechanical prevention of stiction, e.g. spring with increased stiffness} |
| 1/002 | . {Holes characterised by their shape, in either longitudinal or sectional plane} | 3/0016 | . . {Arrangements for avoiding sticking of the flexible or moving parts not provided for in groups B81B 3/0005 - B81B 3/0013 } |
| 1/004 | . . {Through-holes, i.e. extending from one face to the other face of the wafer} | 3/0018 | . {Structures acting upon the moving or flexible element for transforming energy into mechanical movement or <u>vice versa</u> , i.e. actuators, sensors, generators} |
| 1/006 | . {Microdevices formed as a single homogeneous piece, i.e. wherein the mechanical function is obtained by the use of the device, e.g. cutters} | 3/0021 | . . {Transducers for transforming electrical into mechanical energy or <u>vice versa</u> (dynamo-electric machines H02K 99/00 ; electrostatic machines H02N 1/00 ; piezoelectric devices H10N 30/00)} |
| 1/008 | . . {Microtips} | 3/0024 | . . {Transducers for transforming thermal into mechanical energy or <u>vice versa</u> , e.g. thermal or bimorph actuators (electric motors using thermal effects H02N 10/00)} |
| 3/00 | Devices comprising flexible or deformable elements, e.g. comprising elastic tongues or membranes (B81B 5/00 takes precedence) | 3/0027 | . . {Structures for transforming mechanical energy, e.g. potential energy of a spring into translation, sound into translation} |
| 3/0002 | . {Arrangements for avoiding sticking of the flexible or moving parts} | | |
| 3/0005 | . . {Anti-stiction coatings} | | |
| 3/0008 | . . {Structures for avoiding electrostatic attraction, e.g. avoiding charge accumulation} | | |
| 3/001 | . . {Structures having a reduced contact area, e.g. with bumps or with a textured surface} | | |

- 3/0029 . . {Transducers for transforming light into mechanical energy or viceversa}
 - 3/0032 . . {Structures for transforming energy not provided for in groups [B81B 3/0021](#) - [B81B 3/0029](#)}
 - 3/0035 . {Constitution or structural means for controlling the movement of the flexible or deformable elements}
 - 3/0037 . . {For increasing stroke, i.e. achieve large displacement of actuated parts}
 - 3/004 . . {Angular deflection}
 - 3/0043 . . . {Increasing angular deflection}
 - 3/0045 . . . {Improve properties related to angular swinging, e.g. control resonance frequency}
 - 3/0048 . . . {Constitution or structural means for controlling angular deflection not provided for in groups [B81B 3/0043](#) - [B81B 3/0045](#)}
 - 3/0051 . . {For defining the movement, i.e. structures that guide or limit the movement of an element ([mechanical arrangements for preventing or damping vibration or shock H01H 3/60](#))}
 - 3/0054 . . {For holding or placing an element in a given position}
 - 3/0056 . . {Adjusting the distance between two elements, at least one of them being movable, e.g. air-gap tuning}
 - 3/0059 . . {Constitution or structural means for controlling the movement not provided for in groups [B81B 3/0037](#) - [B81B 3/0056](#)}
 - 3/0062 . {Devices moving in two or more dimensions, i.e. having special features which allow movement in more than one dimension}
 - 3/0064 . {Constitution or structural means for improving or controlling the physical properties of a device}
 - 3/0067 . . {Mechanical properties}
 - 3/007 . . . {For controlling stiffness, e.g. ribs}
 - 3/0072 . . . {For controlling internal stress or strain in moving or flexible elements, e.g. stress compensating layers}
 - 3/0075 . . . {For improving wear resistance}
 - 3/0078 . . . {Constitution or structural means for improving mechanical properties not provided for in [B81B 3/007](#) - [B81B 3/0075](#)}
 - 3/0081 . . {Thermal properties}
 - 3/0083 . . {Optical properties}
 - 3/0086 . . {Electrical characteristics, e.g. reducing driving voltage, improving resistance to peak voltage}
 - 3/0089 . . {Chemical or biological characteristics, e.g. layer which makes a surface chemically active}
 - 3/0091 . . {Magnetic properties, e.g. guiding magnetic flux}
 - 3/0094 . . {Constitution or structural means for improving or controlling physical properties not provided for in [B81B 3/0067](#) - [B81B 3/0091](#)}
 - 3/0097 . {Devices comprising flexible or deformable elements not provided for in groups [B81B 3/0002](#) - [B81B 3/0094](#)}
 - 5/00** **Devices comprising elements which are movable in relation to each other, e.g. comprising slidable or rotatable elements**
 - 7/00** **Microstructural systems; {Auxiliary parts of microstructural devices or systems}**
 - 7/0003 . {MEMS mechanisms for assembling automatically hinged components, self-assembly devices ([self-assembly processes B81C 1/00007](#))}
 - 7/0006 . {Interconnects}
 - 7/0009 . {Structural features, others than packages, for protecting a device against environmental influences ([B81C 1/00777](#) takes precedence)}
 - 7/0012 . . {Protection against reverse engineering, unauthorised use, use in unintended manner, wrong insertion or pin assignment}
 - 7/0016 . . {Protection against shocks or vibrations, e.g. vibration damping}
 - 7/0019 . . {Protection against thermal alteration or destruction ([B81B 7/0083](#) takes precedence)}
 - 7/0022 . . {Protection against electrostatic discharge (circuit arrangements for protecting electronic switching circuits used for pulse technique against overcurrent or overvoltage [H03K 17/08](#); electrostatic discharge protection for electronic semiconductor circuits [H10D 89/60](#))}
 - 7/0025 . . {Protection against chemical alteration}
 - 7/0029 . . {Protection against environmental influences not provided for in groups [B81B 7/0012](#) - [B81B 7/0025](#)}
 - 7/0032 . {Packages or encapsulation ([processes for packaging MEMS B81C 1/00261](#); [packaging of smart-MEMS B81C 1/0023](#))}
 - 7/0035 . . {for maintaining a controlled atmosphere inside of the chamber containing the MEMS}
 - 7/0038 . . . {using materials for controlling the level of pressure, contaminants or moisture inside of the package, e.g. getters}
 - 7/0041 . . . {maintaining a controlled atmosphere with techniques not provided for in [B81B 7/0038](#)}
 - 7/0045 . . {for reducing stress inside of the package structure}
 - 7/0048 . . . {between the MEMS die and the substrate}
 - 7/0051 . . . {between the package lid and the substrate}
 - 7/0054 . . . {between other parts not provided for in [B81B 7/0048](#) - [B81B 7/0051](#)}
 - 7/0058 . . {for protecting against damages due to external chemical or mechanical influences, e.g. shocks or vibrations}
 - 7/0061 . . {suitable for fluid transfer from the MEMS out of the package or *vice versa*, e.g. transfer of liquid, gas, sound}
 - 7/0064 . . {for protecting against electromagnetic or electrostatic interferences}
 - 7/0067 . . {for controlling the passage of optical signals through the package}
 - 7/007 . . {Interconnections between the MEMS and external electrical signals}
 - 7/0074 . . {3D packaging, i.e. encapsulation containing one or several MEMS devices arranged in planes non-parallel to the mounting board}
 - 7/0077 . . {Other packages not provided for in groups [B81B 7/0035](#) - [B81B 7/0074](#)}
 - 7/008 . {MEMS characterised by an electronic circuit specially adapted for controlling or driving the same ([B81B 7/0087](#) takes precedence; [arrangements for starting, regulating, braking, or otherwise controlling an actuator H02N](#); [control arrangements or circuits for visual indicators G09G 3/00](#))}
- NOTES**
1. {This group covers: only MEMS with an electronic circuit which is not specific to a particular application. }

B81B

B81B 7/008

(continued)

2. {This group does not cover: electronic circuits per se, e.g. for controlling or driving application specific MEMS. }

7/0083 . {Temperature control}

7/0087 . . {On-device systems and sensors for controlling, regulating or monitoring}

7/009 . . {Maintaining a constant temperature by heating or cooling}

7/0093 . . . {by cooling}

7/0096 . . . {by heating}

7/02 . containing distinct electrical or optical devices of particular relevance for their function, e.g. microelectro-mechanical systems [MEMS] ([B81B 7/04 takes precedence](#))

7/04 . Networks or arrays of similar microstructural devices

2201/00 Specific applications of microelectromechanical systems

2201/01 . Switches

2201/012 . . characterised by the shape

2201/014 . . . having a cantilever fixed on one side connected to one or more dimples

2201/016 . . . having a bridge fixed on two ends and connected to one or more dimples

2201/018 . . . Switches not provided for in [B81B 2201/014](#) - [B81B 2201/016](#)

2201/02 . Sensors

2201/0207 . . Bolometers

2201/0214 . . Biosensors; Chemical sensors

2201/0221 . . Variable capacitors

2201/0228 . . Inertial sensors

2201/0235 . . . Accelerometers

2201/0242 . . . Gyroscopes

2201/025 . . . Inertial sensors not provided for in [B81B 2201/0235](#) - [B81B 2201/0242](#)

2201/0257 . . Microphones or microspeakers

2201/0264 . . Pressure sensors

2201/0271 . . Resonators; ultrasonic resonators

2201/0278 . . Temperature sensors

2201/0285 . . Vibration sensors

2201/0292 . . Sensors not provided for in [B81B 2201/0207](#) - [B81B 2201/0285](#)

2201/03 . Microengines and actuators

2201/031 . . Thermal actuators

2201/032 . . Bimorph and unimorph actuators, e.g. piezo and thermo

2201/033 . . Comb drives

2201/034 . . Electrical rotating micromachines

2201/035 . . Microgears

2201/036 . . Micropumps

2201/037 . . Microtransmissions

2201/038 . . Microengines and actuators not provided for in [B81B 2201/031](#) - [B81B 2201/037](#)

2201/04 . Optical MEMS

2201/042 . . Micromirrors, not used as optical switches

2201/045 . . Optical switches

2201/047 . . Optical MEMS not provided for in [B81B 2201/042](#) - [B81B 2201/045](#)

2201/05 . Microfluidics

2201/051 . . Micromixers, microreactors

2201/052 . . Ink-jet print cartridges

2201/054 . . Microvalves

2201/055 . . Microneedles

2201/057 . . Micropipets, dropformers

2201/058 . . Microfluidics not provided for in [B81B 2201/051](#) - [B81B 2201/054](#)

2201/06 . Bio-MEMS

2201/07 . Data storage devices, static or dynamic memories

2201/10 . Microfilters, e.g. for gas or fluids

2201/11 . Read heads, write heads or micropositioners for hard- or optical disks

2201/12 . STM or AFM microtips

2201/13 . Mechanical connectors, i.e. not functioning as an electrical connector

2203/00 Basic microelectromechanical structures

2203/01 . Suspended structures, i.e. structures allowing a movement

2203/0109 . . Bridges

2203/0118 . . Cantilevers

2203/0127 . . Diaphragms, i.e. structures separating two media that can control the passage from one medium to another; Membranes, i.e. diaphragms with filtering function

2203/0136 . . Comb structures

2203/0145 . . Flexible holders

2203/0154 . . . Torsion bars

2203/0163 . . . Spring holders

2203/0172 . . . Flexible holders not provided for in [B81B 2203/0154](#) - [B81B 2203/0163](#)

2203/0181 . . See-saws

2203/019 . . characterized by their profile

2203/03 . Static structures

2203/0307 . . Anchors

2203/0315 . . Cavities

2203/0323 . . Grooves

2203/033 . . . Trenches

2203/0338 . . . Channels

2203/0346 . . . Grooves not provided for in [B81B 2203/033](#) - [B81B 2203/0338](#)

2203/0353 . . Holes

2203/0361 . . Tips, pillars

2203/0369 . . characterized by their profile

2203/0376 . . . rounded profile

2203/0384 . . . sloped profile

2203/0392 . . . profiles not provided for in [B81B 2203/0376](#) - [B81B 2203/0384](#)

2203/04 . Electrodes

2203/05 . Type of movement

2203/051 . . Translation according to an axis parallel to the substrate

2203/053 . . Translation according to an axis perpendicular to the substrate

2203/055 . . Translation in a plane parallel to the substrate, i.e. enabling movement along any direction in the plane

2203/056 . . Rotation in a plane parallel to the substrate

2203/058 . . Rotation out of a plane parallel to the substrate

2203/06 . Devices comprising elements which are movable in relation to each other, e.g. slidable or rotatable

2207/00 Microstructural systems or auxiliary parts thereof

2207/01 . comprising a micromechanical device connected to control or processing electronics, i.e. Smart-MEMS

B81B

- 2207/012 . . the micromechanical device and the control or processing electronics being separate parts in the same package
- 2207/015 . . the micromechanical device and the control or processing electronics being integrated on the same substrate
- 2207/017 . . Smart-MEMS not provided for in [B81B 2207/012](#) - [B81B 2207/015](#)
- 2207/03 . . Electronic circuits for micromechanical devices which are not application specific, e.g. for controlling, power supplying, testing, protecting
- 2207/05 . . Arrays
- 2207/053 . . of movable structures
- 2207/056 . . of static structures
- 2207/07 . . Interconnects
- 2207/09 . . Packages
- 2207/091 . . Arrangements for connecting external electrical signals to mechanical structures inside the package
- 2207/092 . . . Buried interconnects in the substrate or in the lid
- 2207/093 . . . Conductive package seal
- 2207/094 . . . Feed-through, via
- 2207/095 through the lid
- 2207/096 through the substrate
- 2207/097 . . . Interconnects arranged on the substrate or the lid, and covered by the package seal
- 2207/098 . . . Arrangements not provided for in groups [B81B 2207/092](#) - [B81B 2207/097](#)
- 2207/11 . . Structural features, others than packages, for protecting a device against environmental influences
- 2207/115 . . Protective layers applied directly to the device before packaging
- 2207/99 . . Microstructural systems or auxiliary parts thereof not provided for in [B81B 2207/01](#) - [B81B 2207/115](#)