CPC COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING
(NOTES omitted)

SHAPING

B25 HAND TOOLS; PORTABLE POWER-DRIVEN TOOLS; MANIPULATORS
(NOTE omitted)

B25J MANIPULATORS; CHAMBERS PROVIDED WITH MANIPULATION DEVICES

({manipulators specially adapted for use in surgery A61B 34/70; manipulators used in cleaning hollow articles B08B 9/04} ; manipulators associated with rolling mills B21B 39/20; manipulators associated with forging machines B21J 13/10; {manipulators associated with picking-up and placing mechanisms B23P 19/007} ; means for holding wheels or parts thereof B60B 30/00; {vehicles with ground-engaging propulsion means, e.g. walking members B62D 57/02, B62D 57/032; devices for picking-up and depositing articles or materials between conveyors B65G 47/90, B65G 47/91; manipulators with gripping or holding means for transferring packages B65H 67/065}; cranes B66C; {manipulators used in the protection or supervision of pipe-line installations F17D 5/00; walking equipment adapted for nuclear steam-generators F22B 37/006}; manipulators specially adapted for, or associated with, nuclear reactors G21C; {apparatus used for handling wafers during manufacture or treatment of semiconductor H01L 21/68})

NOTE

In this subclass, the following term is used with the meaning indicated :

- "manipulator" covers handling tools, devices, or machines having a gripping or work head capable of bodily movement in space and of change of orientation, such bodily movement and change of orientation being controlled, at will, by means remote from the head.

WARNINGS

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

B25J 9/18	covered by	B25J 9/16
B25J 9/22	covered by	B25J 9/1656, G05B 19/42

2. 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 **Manipulators positioned in space by hand** (of master-slave type B25J 3/00; micromanipulators B25J 7/00)

1/02 . articulated or flexible

1/04 . rigid, e.g. shelf-reachers {(without grippers A47F 13/06)}

1/06 . of the lazy-tongs type

1/08 . movably mounted in a wall

1/10 . . Sleeve and pivot mountings therefor

1/12 . having means for attachment to a support stand

3/00 **Manipulators of master-slave type, i.e. both controlling unit and controlled unit perform corresponding spatial movements**

3/02 . involving a parallelogram coupling of the master and slave units (pantographic instruments B43L 13/00)

3/04 . involving servo mechanisms (servo-actuated heads B25J 15/02)

5/00 **Manipulators mounted on wheels or on carriages** (B25J 1/00 takes precedence; programme-controlled manipulators B25J 9/00 {; vehicle aspects B60, B62, e.g. remote-controlled steering for motor vehicles B62D 1/24; control of position of vehicles G05D 1/00})

5/002 . {mounted on an air cushion}

5/005 . {mounted on endless tracks or belts}

5/007 . {mounted on wheels}

5/02 . travelling along a guideway

5/04 . . wherein the guideway is also moved, e.g. travelling crane bridge type

5/06 . Manipulators combined with a control cab for the operator

7/00 **Micromanipulators {**(specimen supports for investigating or analysing materials G01N 23/2204; associated with microscopes G02B 21/32; means for supporting or positioning the objects or the material in discharge tubes H01J 37/20)**}**

9/00 **Programme-controlled manipulators**

9/0003 . {Home robots, i.e. small robots for domestic use}
9/0006 . {Exoskeletons, i.e. resembling a human figure}
9/0009 . {Constructional details, e.g. manipulator supports, bases}
9/0012 . . {making use of synthetic construction materials, e.g. plastics, composites}
9/0015 . . {Flexure members, i.e. parts of manipulators having a narrowed section allowing articulation by flexion}
9/0018 . . {Bases fixed on ceiling, i.e. upside down manipulators}
9/0021 . . {All motors in base}
9/0024 . . {Wrist motors at rear part of the upper arm}
9/0027 . . {Means for extending the operation range}
9/003 . {having parallel kinematics}
9/0033 . . {with kinematics chains having a prismatic joint at the base}
9/0036 . . . {with kinematics chains of the type prismatic-rotary-rotary}
9/0039 . . . {with kinematics chains of the type prismatic-spherical-spherical}
9/0042 . . . {with kinematics chains of the type prismatic-universal-universal}
9/0045 . . {with kinematics chains having a rotary joint at the base}
9/0048 . . . {with kinematics chains of the type rotary-rotary-rotary}
9/0051 . . . {with kinematics chains of the type rotary-universal-universal or rotary-spherical-spherical, e.g. Delta type manipulators}
9/0054 . . {with kinematics chains having a spherical joint at the base}
9/0057 . . . {with kinematics chains of the type spherical-prismatic-spherical}
9/006 . . . {with kinematics chains of the type spherical-prismatic-universal}
9/0063 . . {with kinematics chains having an universal joint at the base}
9/0066 . . . {with kinematics chains of the type universal-prismatic-spherical}
9/0069 . . . {with kinematics chains of the type universal-prismatic-universal}
9/0072 . . {of the hybrid type, i.e. having different kinematics chains}
9/0075 . . {Truss}
9/0078 . . {actuated by cables}
9/0081 . {with master teach-in means}
9/0084 . {comprising a plurality of manipulators}
9/0087 . . {Dual arms (double SCARA arms B25J 9/043)}
9/009 . . {being mechanically linked with one another at their distal ends}
9/0093 . {co-operating with conveyor means}
9/0096 . {co-operating with a working support, e.g. work-table}
9/02 . characterised by movement of the arms, e.g. cartesian coordinate type (B25J 9/06 takes precedence)
9/023 . . {Cartesian coordinate type}
9/026 . . . {Gantry-type}
9/04 . . by rotating at least one arm, excluding the head movement itself, e.g. cylindrical coordinate type or polar coordinate type
9/041 . . . {Cylindrical coordinate type}
9/042 . . . . {comprising an articulated arm}
9/043 . . . . . {double selective compliance articulated robot arms [SCARA]}
9/044 . . . . . {with forearm providing vertical linear movement}
9/045 . . . {Polar coordinate type}
9/046 . . . {Revolute coordinate type}
9/047 . . . . {the pivoting axis of the first arm being offset to the vertical axis}
9/048 . . . {Pendulum type}
9/06 . characterised by multi-articulated arms
9/065 . . {Snake robots}
9/08 . characterised by modular constructions
9/10 . characterised by positioning means for manipulator elements
9/1005 . . {comprising adjusting means}
9/101 . . . {using limit-switches, -stops}
9/1015 . . . {using additional, e.g. microadjustment of the end effector}
9/102 . . {Gears specially adapted therefor, e.g. reduction gears (gearings in general F16H)}
9/1025 . . . {Harmonic drives (in general: F16H 49/001)}
9/103 . . . {with backlash-preventing means}
9/1035 . . . {Pinion and fixed rack drivers, e.g. for rotating an upper arm support on the robot base}
9/104 . . {with cables, chains or ribbons}
9/1045 . . . {comprising tensioning means}
9/105 . . {using eccentric means (B25J 9/109 takes precedence)}
9/1055 . . {by gravity}
9/106 . . {with articulated links}
9/1065 . . . {with parallelograms}
9/107 . . . . {of the froglegs type}
9/1075 . . {with muscles or tendons}
9/108 . . {Bearings specially adapted therefor (bearings in general F16C)}
9/1085 . . {positioning by means of shape-memory materials (shape memory actuators F03G 7/06)}
9/109 . . {comprising mechanical programming means, e.g. cams}
9/1095 . . {chemically actuated}
9/12 . . electric
9/123 . . . {Linear actuators}
9/126 . . . {Rotary actuators}
9/14 . . fluid
9/142 . . . {comprising inflatable bodies}
9/144 . . . {Linear actuators}
9/146 . . . {Rotary actuators}
9/148 . . . . {of the oscillating vane-type (in general F15B 15/12)}
9/16 . Programme controls (programme controls in general G05B 19/00, e.g. numerical pogramme controls G05B 19/18; {recording or playback systems G05B 19/42})
9/1602 . . {characterised by the control system, structure, architecture}

9/1605 . . . {Simulation of manipulator lay-out, design, modelling of manipulator}
9/1607 . . . {Calculation of inertia, jacobian matrixes and inverses}
9/161 . . . {Hardware, e.g. neural networks, fuzzy logic, interfaces, processor}
9/1612 . . {characterised by the hand, wrist, grip control}
9/1615 . . {characterised by special kind of manipulator, e.g. planar, scara, gantry, cantilever, space, closed chain, passive/active joints and tendon driven manipulators}
9/1617 . . . {Cellular, reconfigurable manipulator, e.g. cebot}
9/162 . . . {Mobile manipulator, movable base with manipulator arm mounted on it}
9/1623 . . . {Parallel manipulator, Stewart platform, links are attached to a common base and to a common platform, plate which is moved parallel to the base}
9/1625 . . . {Truss-manipulator for snake-like motion}
9/1628 . . {characterised by the control loop}
9/163 . . . {learning, adaptive, model based, rule based expert control}
9/1633 . . . {compliant, force, torque control, e.g. combined with position control}
9/1635 . . . {flexible-arm control}
9/1638 . . . {compensation for arm bending/inertia, pay load weight/inertia}
9/1641 . . . {compensation for backlash, friction, compliance, elasticity in the joints}
9/1643 . . . {redundant control}
9/1646 . . . {variable structure system, sliding mode control}
9/1648 . . . {non-linear control combined or not with linear control}
9/1651 . . . {acceleration, rate control}
9/1653 . . . {parameters identification, estimation, stiffness, accuracy, error analysis}
9/1656 . . {characterised by programming, planning systems for manipulators}
9/1658 . . . {characterised by programming language}
9/1661 . . . {characterised by task planning, object-oriented languages}
9/1664 . . . {characterised by motion, path, trajectory planning}
9/1666 . . . . {Avoiding collision or forbidden zones}
9/1669 . . . {characterised by special application, e.g. multi-arm co-operation, assembly, grasping}
9/1671 . . . {characterised by simulation, either to verify existing program or to create and verify new program, CAD/CAM oriented, graphic oriented programming systems}
9/1674 . . {characterised by safety, monitoring, diagnostic}
9/1676 . . . {Avoiding collision or forbidden zones}
9/1679 . . {characterised by the tasks executed}
9/1682 . . . {Dual arm manipulator; Coordination of several manipulators}
9/1684 . . . {Tracking a line or surface by means of sensors}
9/1687 . . . {Assembly, peg and hole, palletising, straight line, weaving pattern movement}
9/1689 . . . {Teleoperation}
9/1692 . . . {Calibration of manipulator}
9/1694 . . {characterised by use of sensors other than normal servo-feedback from position, speed or acceleration sensors, perception control, multi-sensor controlled systems, sensor fusion}
9/1697 . . . {Vision controlled systems}
9/20 . . fluidic

11/00 Manipulators not otherwise provided for

11/0005 . {Manipulators having means for high-level communication with users, e.g. speech generator, face recognition means}
11/001 . . {with emotions simulating means}
11/0015 . . {Face robots, animated artificial faces for imitating human expressions}
11/002 . {Manipulators for defensive or military tasks}
11/0025 . . {handling explosives, bombs or hazardous objects}
11/003 . {Manipulators for entertainment}
11/0035 . . {Dancing, executing a choreography}
11/004 . . {Playing a music instrument}
11/0045 . {Manipulators used in the food industry}
11/005 . {Manipulators for mechanical processing tasks}
11/0055 . . {Cutting}
11/006 . . {Deburring or trimming}
11/0065 . . {Polishing or grinding}
11/007 . . {Riveting}
11/0075 . {Manipulators for painting or coating}
11/008 . {Manipulators for service tasks}
11/0085 . . {Cleaning}
11/009 . . {Nursing, e.g. carrying sick persons, pushing wheelchairs, distributing drugs}
11/0095 . {Manipulators transporting wafers}

13/00 Controls for manipulators (programme controls B25J 9/16; control in general G05)

13/003 . {by means of an audio-responsive input (audible safety signals B25J 19/061)}
13/006 . {by means of a wireless system for controlling one or several manipulators}
13/02 . Hand grip control means {(handles or pedals for crane control B66C 13/56; for measuring the force applied to control members G01L 5/22; hand-held casings for switching devices, e.g. joy-sticks H01H 9/0214)}
13/025 . . {comprising haptic means}
13/04 . Foot-operated control means
13/06 . Control stands, e.g. consoles, switchboards
13/065 . . {comprising joy-sticks}
13/08 . by means of sensing devices, e.g. viewing or touching devices
13/081 . . {Touching devices, e.g. pressure-sensitive}
13/082 . . . {Grasping-force detectors (in general G01L 5/16, G01L 5/22)}
13/083 . . . . {fitted with slippage detectors}
13/084 . . . {Tactile sensors (in general G01L 5/16, G01L 5/22)}
13/085 . . {Force or torque sensors (B25J 13/082, B25J 13/084 take precedence)}
13/086 . . {Proximity sensors}
13/087 . . {for sensing other physical parameters, e.g. electrical or chemical properties}
13/088 . . {with position, velocity or acceleration sensors}

13/089 . . . {Determining the position of the robot with reference to its environment}

15/00 Gripping heads {and other end effectors (grippers used in machine tools B23Q 7/04; gripping members fitted on cranes B66C 1/42, B66C 1/44; gripping means used in the manufacture of semiconductors H01L 21/68707; gripping means used for mounting electrical components H05K 13/04)**}**

15/0004 . {with provision for adjusting the gripped object in the hand}
15/0009 . {comprising multi-articulated fingers, e.g. resembling a human hand}
15/0014 . {having fork, comb or plate shaped means for engaging the lower surface on a object to be transported}
15/0019 . {End effectors other than grippers}
15/0023 . {Gripper surfaces directly activated by a fluid (flexible fingers B25J 15/12)}
15/0028 . {with movable, e.g. pivoting gripping jaw surfaces}
15/0033 . {with gripping surfaces having special shapes}
15/0038 . . {Cylindrical gripping surfaces}
15/0042 . . {V-shaped gripping surfaces}
15/0047 . {for internally gripping hollow or recessed objects}
15/0052 . {multiple gripper units or multiple end effectors}
15/0057 . . {mounted on a turret}
15/0061 . . {mounted on a modular gripping structure}
15/0066 . . {with different types of end effectors, e.g. gripper and welding gun (B25J 15/0057 and B25J 15/0061 take precedence)}
15/0071 . {with needles engaging into objects to be gripped}
15/0076 . {with means, e.g. Pelletier elements, for freezing a fluid interface between the gripping head and an object to be gripped}
15/008 . {with sticking, gluing or adhesive means}
15/0085 . {with means for applying an electrostatic force on the object to be gripped}
15/009 . {with pins for accurately positioning the object on the gripping head}
15/0095 . {with an external support, i.e. a support which does not belong to the manipulator or the object to be gripped, e.g. for maintaining the gripping head in an accurate position, guiding it or preventing vibrations}
15/02 . servo-actuated
15/0206 . . {comprising articulated grippers}
15/0213 . . . {actuated by gears}
15/022 . . . {actuated by articulated links}
15/0226 . . . {actuated by cams}
15/0233 . . . {actuated by chains, cables or ribbons}
15/024 . . . {having fingers directly connected to actuator}
15/0246 . . {actuated by an electromagnet}
15/0253 . . {comprising parallel grippers}
15/026 . . . {actuated by gears}
15/0266 . . . {actuated by articulated links}
15/0273 . . . . {comprising linear guide means}
15/028 . . . {actuated by cams}
15/0286 . . . {actuated by chains, cables or ribbons}
15/0293 . . . {having fingers directly connected to actuator}
15/04 . with provision for the remote detachment or exchange of the head or parts thereof
15/0408 . . {Connections means}
15/0416 . . . {having balls}
15/0425 . . . {having cams}
15/0433 . . . {having gripping members}
15/0441 . . . {having vacuum or magnetic means}
15/045 . . . {having screw means}
15/0458 . . . {having a frustroconical member}
15/0466 . . {with means for checking exchange completion}
15/0475 . . {Exchangeable fingers}
15/0483 . . {with head identification means}
15/0491 . . {comprising end-effector racks}
15/06 . with vacuum or magnetic holding means
15/0608 . . {with magnetic holding means}
15/0616 . . {with vacuum}
15/0625 . . . {provided with a valve}
15/0633 . . . . {Air-flow-actuated valves}
15/0641 . . . . {Object-actuated valves}
15/065 . . . {provided with separating means for releasing the gripped object after suction}
15/0658 . . . . {Pneumatic type, e.g. air blast or overpressure}
15/0666 . . . . {Other types, e.g. pins or springs}
15/0675 . . . {of the ejector type}
15/0683 . . . {Details of suction cup structure, e.g. grooves or ridges}
15/0691 . . . {Suction pad made out of porous material, e.g. sponge or foam}
15/08 . having finger members (B25J 15/02, B25J 15/04 take precedence)
15/083 . . {with means for locking the fingers in an open or closed position}
15/086 . . {with means for synchronizing the movements of the fingers}
15/10 . . with three or more finger members {(B25J 15/0009 takes precedence)}
15/103 . . . {for gripping the object in three contact points}
15/106 . . . {moving in parallel relationship}
15/12 . . with flexible finger members

17/00 Joints

17/02 . Wrist joints
17/0208 . . {Compliance devices}
17/0216 . . . {comprising a stewart mechanism}
17/0225 . . . {with axial compliance, i.e. parallel to the longitudinal wrist axis}
17/0233 . . . {with radial compliance, i.e. perpendicular to the longitudinal wrist axis}
17/0241 . . {One-dimensional joints}
17/025 . . . {mounted in series}
17/0258 . . {Two-dimensional joints}
17/0266 . . . {comprising more than two actuating or connecting rods}
17/0275 . . . {Universal joints, e.g. Hooke, Cardan, ball joints}
17/0283 . . {Three-dimensional joints}
17/0291 . . . {having axes crossing at an oblique angle, i.e. other than 90 degrees}

18/00 Arms

18/002 . {comprising beam bending compensation means}
18/005 . {having a curved shape}
18/007 . {the end effector rotating around a fixed point}
18/02 . extensible
18/025 . . {telescopic}
18/04 . . rotatable
18/06 . flexible

19/00 **Accessories fitted to manipulators, e.g. for monitoring, for viewing; Safety devices combined with or specially adapted for use in connection with manipulators** (safety-devices in general F16P; protection against radiation in general G21F)

19/0004 . {Braking devices (brakes in general F16D)}
19/0008 . {Balancing devices}
19/0012 . . {using fluidic devices}
19/0016 . . {using springs}
19/002 . . {using counterweights}
19/0025 . {Means for supplying energy to the end effector}
19/0029 . . {arranged within the different robot elements}
19/0033 . . . {with axial connectors in end effector flange}
19/0037 . . . {comprising a light beam pathway, e.g. laser}
19/0041 . . . {having rotary connection means}
19/0045 . . {Contactless power transmission, e.g. by magnetic induction}
19/005 . {using batteries, e.g. as a back-up power source}
19/0054 . {Cooling means}
19/0058 . {Means for cleaning manipulators, e.g. dust removing means}
19/0062 . {Lubrication means}
19/0066 . {Means or methods for maintaining or repairing manipulators}
19/007 . {Means or methods for designing or fabricating manipulators}
19/0075 . {Means for protecting the manipulator from its environment or vice versa}
19/0079 . . {using an internal pressure system}
19/0083 . . {using gaiters}
19/0087 . . {using an antibacterial coating}
19/0091 . {Shock absorbers (in general F16F)}
19/0095 . {Means or methods for testing manipulators}
19/02 . Sensing devices
19/021 . . {Optical sensing devices}
19/022 . . . {using lasers}
19/023 . . . {including video camera means}
19/025 . . . {including optical fibres}
19/026 . . {Acoustical sensing devices}
19/027 . . {Electromagnetic sensing devices}
19/028 . . {Piezoresistive or piezoelectric sensing devices}
19/04 . . Viewing devices
19/06 . Safety devices
19/061 . . {with audible signals (audio controls B25J 13/003)}
19/063 . . {working only upon contact with an outside object}
19/065 . . . {Mechanical fuse}
19/066 . . {Redundant equipment}
19/068 . . {Actuating means with variable stiffness}

21/00 **Chambers provided with manipulation devices** (constructional features of the mounting of the manipulator in the wall B25J 1/08 {; glove-boxes for nuclear applications G21F 7/04})

21/005 . {Clean rooms}
21/02 . Glove-boxes, i.e. chambers in which manipulations are performed by the human hands in gloves built into the chamber walls {(glove- boxes for removal of dirt B08B 15/026; glove-boxes shielded against radiation G21F 7/04)}; Gloves therefor