

# CPC COOPERATIVE PATENT CLASSIFICATION

## G PHYSICS (NOTES omitted)

### NUCLEONICS

## G21 NUCLEAR PHYSICS; NUCLEAR ENGINEERING

## G21C NUCLEAR REACTORS (fusion reactors, hybrid fission-fusion reactors [G21B](#); nuclear explosives [G21J](#))

### WARNINGS

- The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:  
[G21C 19/33](#) covered by [G21C 19/34](#)
- 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.

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|-------------|--|-------------|---|
| <b>1/00</b> | <b>Reactor types</b>   | 1/18        | . . . . . coolant being pressurised   |
| 1/02        | . Fast fission reactors, i.e. reactors not using a moderator {; Metal cooled reactors; Fast breeders}  | 1/20        | . . . . . moderator being liquid, e.g. pressure-tube reactor  |
| 1/022       | . . {characterised by the design or properties of the core}  | 1/22        | . . . using liquid or gaseous fuel  |
| 1/024       | . . . {where the core is divided in zones with fuel and zones with breeding material}  | 1/24        | . . Homogeneous reactors, i.e. in which the fuel and moderator present an effectively homogeneous medium to the neutrons  |
| 1/026       | . . . {Reactors not needing refuelling, i.e. reactors of the type breed-and-burn, e.g. travelling or deflagration wave reactors or seed-blanket reactors}                  | 1/26        | . . . Single-region reactors  |
| 1/028       | . . {cooled by a pressurised coolant (cooling arrangements <a href="#">G21C 15/00</a> )}   | 1/28        | . . . Two-region reactors   |
| 1/03        | . . cooled by a coolant not essentially pressurised, e.g. pool-type reactors   | 1/30        | . Subcritical reactors {; Experimental reactors other than swimming-pool reactors or zero-energy reactors}  |
| 1/04        | . Thermal reactors {; Epithermal reactors}   | 1/303       | . . {Experimental or irradiation arrangements inside the reactor (irradiation loops <a href="#">G21C 1/306</a> )}   |
| 1/06        | . . Heterogeneous reactors, i.e. in which fuel and moderator are separated   | 1/306       | . . {Irradiation loops}   |
| 1/07        | . . . Pebble-bed reactors; Reactors with granular fuel   | 1/32        | . Integral reactors, i.e. reactors wherein parts functionally associated with the reactor but not essential to the reaction, e.g. heat exchangers, are disposed inside the enclosure with the core ( <a href="#">G21C 1/02</a> - <a href="#">G21C 1/30</a> take precedence) |
| 1/08        | . . . moderator being highly pressurised, e.g. boiling water reactor, integral super-heat reactor, pressurised water reactor ( <a href="#">G21C 1/22</a> takes precedence) | 1/322       | . . {wherein the heat exchanger is disposed above the core}   |
| 1/082       | . . . . {Reactors where the coolant is overheated}   | 1/324       | . . {wherein the heat exchanger is disposed beneath the core}   |
| 1/084       | . . . . {Boiling water reactors}   | 1/326       | . . {wherein the heat exchanger is disposed next to or beside the core}   |
| 1/086       | . . . . {Pressurised water reactors}   | 1/328       | . . {wherein the prime mover is also disposed in the vessel}  |
| 1/088       | . . . . {Inherently safe boiling water reactors}   |             |   |
| 1/09        | . . . . Pressure regulating arrangements, i.e. pressurisers  | <b>3/00</b> | <b>Reactor fuel elements and their assemblies; Selection of substances for use as reactor fuel elements</b>   |
| 1/10        | . . . . moderator and coolant being different or separated   | 3/02        | . Fuel elements {(manufacture thereof <a href="#">G21C 21/02</a> )}   |
| 1/12        | . . . . . moderator being solid, e.g. Magnox reactor {or gas-graphite reactor}   | 3/04        | . . Constructional details  |
| 1/14        | . . . moderator being substantially not pressurised, e.g. swimming-pool reactor ( <a href="#">G21C 1/22</a> takes precedence)  | 3/041       | . . . {Means for removal of gases from fuel elements}   |
| 1/16        | . . . . moderator and coolant being different or separated, e.g. sodium-graphite reactor {, sodium-heavy water reactor or organic coolant-heavy water reactor}             | 3/042       | . . . {Fuel elements comprising casings with a mass of granular fuel with coolant passages through them}  |
|             |  | 3/044       | . . . {Fuel elements with porous or capillary structure}  |
|             |  | 3/045       | . . . {Pellets}   |

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| 3/047  | . . . . {Pellet-clad interaction}   | 3/33   | . . . Supporting or hanging of elements in the bundle (spacer grids G21C 3/34); Means forming part of the bundle for inserting it into, or removing it from, the core; Means for coupling adjacent bundles  |
| 3/048  | . . . . {Shape of pellets}  | 3/3305 | . . . . {Lower nozzle}  |
| 3/06   | . . . Casings; Jackets  | 3/331  | . . . . {Comprising hold-down means, e.g. springs}  |
| 3/07   | . . . . characterised by their material, e.g. alloys  | 3/3315 | . . . . {Upper nozzle}  |
| 3/08   | . . . . provided with external means to promote heat-transfer, e.g. fins, baffles   | 3/332  | . . . . Supports for spacer grids   |
| 3/10   | . . . . End closures {; Means for tight mounting therefor}  | 3/334  | . . . Assembling {, maintenance or repair of} the bundles {(assembling, maintenance or repair of other reactor components G21C 19/207)}   |
| 3/105  | . . . . . {Flattened end-closures}  | 3/335  | . . . Exchanging elements in irradiated bundles   |
| 3/12   | . . . . Means forming part of the element for locating it within the reactor core {(means not forming part of the element G21C 5/06)}   | 3/336  | . . . Spacer elements for fuel rods in the bundle (spacer grids G21C 3/34)  |
| 3/14   | . . . . Means forming part of the element for inserting it into, or removing it from, the core; Means for coupling adjacent elements {, e.g. to form a stringer}  | 3/338  | . . . . Helicoidal spacer elements  |
| 3/16   | . . . Details of the construction within the casing   | 3/34   | . . . Spacer grids  |
| 3/17   | . . . . Means for storage or immobilisation of gases in fuel elements   | 3/3408 | . . . . {Compact spacer grids, e.g. made of a plate or a blade}   |
| 3/18   | . . . . Internal spacers or other non-active material within the casing, e.g. compensating for expansion of fuel rods or for compensating excess reactivity (interlayers G21C 3/20)   | 3/3416 | . . . . {Spacer grids formed by metallic wires, e.g. springs}   |
| 3/20   | . . . . with coating on fuel or on inside of casing; with non-active interlayer between casing and active material {with multiple casings or multiple active layers}  | 3/3424 | . . . . {Fabrication of spacer grids}   |
| 3/22   | . . with fissile or breeder material in contact with coolant  | 3/3432 | . . . . {Grids designed to influence the coolant, i.e. coolant mixing function}   |
| 3/24   | . . with fissile or breeder material in fluid form within a non-active casing   | 3/344  | . . . . formed of assembled tubular elements  |
| 3/26   | . . with fissile or breeder material in powder form within a non-active casing  | 3/348  | . . . . formed of assembled non-intersecting strips   |
| 3/28   | . . with fissile or breeder material in solid form within a non-active casing   | 3/352  | . . . . formed of assembled intersecting strips   |
| 3/30   | . Assemblies of a number of fuel elements in the form of a rigid unit   | 3/356  | . . . . being provided with fuel element supporting members   |
| 3/32   | . . Bundles of parallel pin-, rod-, or tube-shaped fuel elements  | 3/3563 | . . . . . {Supporting members formed only by deformations in the strips}  |
| 3/3206 | . . . {Means associated with the fuel bundle for filtering the coolant, e.g. nozzles, grids}  | 3/3566 | . . . . . {Supporting members formed only of elements fixed on the strips}  |
| 3/3213 | . . . {Means for the storage or removal of fission gases (means for the storage of fission gases in the elements G21C 3/16; means for the removal of fission gases from elements G21C 3/04)}                                    | 3/36   | . . Assemblies of plate-shaped fuel elements or coaxial tubes   |
| 3/322  | . . . Means to influence the coolant flow through or around the bundles   | 3/38   | . Fuel units consisting of a single fuel element in a supporting sleeve {or in another supporting element}  |
| 3/3225 | . . . . {by waterrods}  | 3/40   | . Structural combination of fuel element with thermoelectric element for direct production of electric energy from fission heat (for temperature measurement G21C 17/10 ) {or with another arrangement for direct production of electric energy, e.g. a thermionic device (combination with thermoelements for temperature measurements G21C 17/102)} |
| 3/324  | . . . Coats or envelopes for the bundles  | 3/42   | . Selection of substances for use as reactor fuel   |
| 3/3245 | . . . . {made of moderator material}  | 3/44   | . . Fluid or fluent reactor fuel  |
| 3/326  | . . . comprising fuel elements of different composition; comprising, in addition to the fuel elements, other pin-, rod-, or tube-shaped elements, e.g. control rods, grid support rods, fertile rods, poison rods or dummy rods | 3/46   | . . . Aqueous compositions  |
| 3/3262 | . . . . {Enrichment distribution in zones}  | 3/48   | . . . . True or colloidal solutions of the active constituent   |
| 3/3265 | . . . . . {Radial distribution}   | 3/50   | . . . . Suspensions of the active constituent; Slurries   |
| 3/3267 | . . . . . {Axial distribution}  | 3/52   | . . . Liquid metal compositions   |
| 3/328  | . . . . Relative disposition of the elements in the bundle lattice  | 3/54   | . . . Fused salt, oxide or hydroxide compositions   |
|        |   | 3/56   | . . . Gaseous compositions; Suspensions in a gaseous carrier  |
|        |   | 3/58   | . . Solid reactor fuel {Pellets made of fissile material}   |
|        |   | 3/60   | . . . Metallic fuel; Intermetallic dispersions  |
|        |   | 3/62   | . . . Ceramic fuel  |
|        |   | 3/623  | . . . . {Oxide fuels}   |
|        |   | 3/626  | . . . . {Coated fuel particles}   |

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| 3/64        | . . . . Ceramic dispersion fuel, e.g. cermet   | 7/22         | . . by displacement of a fluid or fluent neutron-absorbing material {, e.g. by adding neutron-absorbing material to the coolant}  |
| <b>5/00</b> | <b>Moderator or core structure; Selection of materials for use as moderator</b>  | 7/24         | . . Selection of substances for use as neutron-absorbing material   |
| 5/02        | . Details  | 7/26         | . by displacement of the moderator or parts thereof {by changing the moderator concentration}   |
| 5/04        | . . Spatial arrangements allowing for Wigner growth  | 7/27         | . . Spectral shift control  |
| 5/06        | . . Means for locating or supporting fuel elements { (means forming part of the element G21C 3/12) }   | 7/28         | . by displacement of the reflector or parts thereof   |
| 5/08        | . . Means for preventing undesired asymmetric expansion of the complete structure {; Stretching devices, pins}   | 7/30         | . by displacement of the reactor fuel or fuel elements  |
| 5/10        | . . Means for supporting the complete structure { (arrangements for supporting vessels and core-structures G21C 13/024) }  | 7/32         | . by varying flow of coolant through the core {by adjusting the coolant or moderator temperature}   |
| 5/12        | . characterised by composition, e.g. the moderator containing additional substances which ensure improved heat resistance of the moderator { (purification of fluid moderators during the operation of the reactor G21C 19/30) } | 7/34         | . by utilisation of a primary neutron source  |
| 5/123       | . . {Moderators made of organic materials}   | 7/36         | . Control circuits  |
| 5/126       | . . {Carbonic moderators (carbon and graphite in general C01B 32/00; refractory carbon-bulbs C04B 35/00; carbon electrodes C25B) }   | <b>9/00</b>  | <b>Emergency protection arrangements structurally associated with the reactor {, e.g. safety valves provided with pressure equalisation devices} (emergency cooling arrangements G21C 15/18)</b>                    |
| 5/14        | . characterised by shape   | 9/001        | . {against explosions, e.g. blast shields}  |
| 5/16        | . . Shape of its constituent parts   | 9/002        | . {against Na- or Ka- reactions}  |
| 5/18        | . characterised by the provision of more than one active zone  | 9/004        | . Pressure suppression  |
| 5/20        | . . wherein one zone contains fissile material and another zone contains breeder material  | 9/008        | . . by rupture-discs or -diaphragms   |
| 5/22        | . . wherein one zone is a superheating zone  | 9/012        | . . by thermal accumulation or by steam condensation, e.g. ice condensers   |
| <b>7/00</b> | <b>Control of nuclear reaction</b>   | 9/016        | . Core catchers   |
| 7/005       | . {Flux flattening}  | 9/02         | . Means for effecting very rapid reduction of the reactivity factor under fault conditions, e.g. reactor fuse; {Control elements having arrangements activated in an emergency} (control elements per se G21C 7/00) |
| 7/02        | . by using self-regulating properties of reactor materials, {e.g. Doppler effect} (arrangements that involve temperature stability G21C 7/32)  | 9/022        | . . {Reactor fuses}   |
| 7/04        | . . of burnable poisons (burnable poisons in fuel rods G21C 3/326)   | 9/024        | . . {Rupture diaphragms}  |
| 7/06        | . by application of neutron-absorbing material, i.e. material with absorption cross-section very much in excess of reflection cross-section  | 9/027        | . . by fast movement of a solid, e.g. pebbles   |
| 7/08        | . . by displacement of solid control elements, e.g. control rods   | 9/033        | . . by an absorbent fluid   |
| 7/10        | . . . Construction of control elements   | 9/04         | . Means for suppressing fires {; Earthquake protection}   |
| 7/103       | . . . . Control assemblies containing one or more absorbants as well as other elements, e.g. fuel or moderator elements  | 9/06         | . . Means for preventing accumulation of explosives gases, e.g. recombiners   |
| 7/107       | . . . . Control elements adapted for pebble-bed reactors   | <b>11/00</b> | <b>Shielding structurally associated with the reactor</b>   |
| 7/11        | . . . . Deformable control elements, e.g. flexible, telescopic, articulated  | 11/02        | . Biological shielding (in general G21F) {; Neutron or gamma shielding}   |
| 7/113       | . . . . Control elements made of flat elements; Control elements having cruciform cross-section  | 11/022       | . . {inside the reactor vessel}   |
| 7/117       | . . . . Clusters of control rods; Spider construction  | 11/024       | . . . {structurally combined with the casing}   |
| 7/12        | . . . Means for moving control elements to desired position (dropping rods in an emergency G21C 9/02)  | 11/026       | . . {in apertures or channels through a wall}   |
| 7/14        | . . . . Mechanical drive arrangements  | 11/028       | . . {characterised by the form or by the material}  |
| 7/16        | . . . . Hydraulic or pneumatic drive   | 11/04        | . . on waterborne craft   |
| 7/18        | . . . Means for obtaining differential movement of control elements  | 11/06        | . Reflecting shields, i.e. for minimising loss of neutrons  |
| 7/20        | . . . Disposition of shock-absorbing devices (shock-absorbers in general F16F) {; Braking arrangements}  | 11/08        | . Thermal shields; Thermal linings, i.e. for dissipating heat from gamma radiation which would otherwise heat an outer biological shield {; Thermal insulation}   |
|             |  | 11/081       | . . {consisting of a non-metallic layer of insulating material}   |
|             |  | 11/083       | . . {consisting of one or more metallic layers}   |
|             |  | 11/085       | . . . {consisting exclusively of several metallic layers}   |
|             |  | 11/086       | . . {consisting of a combination of non-metallic and metallic layers, e.g. metal-sand-metal-concrete}   |
|             |  | 11/088       | . . {consisting of a stagnant or a circulating fluid}   |

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| <b>13/00</b> | <b>Pressure vessels; Containment vessels; Containment in general (for chemical or physical processes <a href="#">B01J 3/00</a>; pressure vessels in general <a href="#">F16J 12/00</a>)</b>   | 15/247       | . . . for liquid metals  |
| 13/02        | . Details   | 15/25        | . . . using jet pumps  |
| 13/022       | . . {Ventilating arrangements}  | 15/253       | . . for gases, e.g. blowers  |
| 13/024       | . . Supporting constructions for pressure vessels or containment vessels  | 15/257       | . . using heat-pipes {(in general <a href="#">F28D</a> , <a href="#">F28F</a> )}   |
| 13/028       | . . Seals, e.g. for pressure vessels or containment vessels   | 15/26        | . . by convection, e.g. using chimneys, using divergent channels   |
| 13/0285      | . . . {for container apertures}   | 15/28        | . Selection of specific coolants (if serving as the moderator <a href="#">G21C 5/12</a> ; compositions per se <a href="#">C09K 5/00</a> ; {organic coolants <a href="#">G21C 5/123</a> }); {Additions to the reactor coolants, e.g. against moderator corrosion (purification and regeneration of the reactor coolants <a href="#">G21C 19/30</a> )} |
| 13/032       | . . Joints between tubes and vessel walls, e.g. taking into account thermal stresses  | <b>17/00</b> | <b>Monitoring; Testing (measuring in general <a href="#">G01</a>); {Maintaining}</b>   |
| 13/036       | . . . the tube passing through the vessel wall, i.e. continuing on both sides of the wall   | 17/001       | . {Mechanical simulators (electrical or magnetic simulators <a href="#">G06G 7/54</a> )}   |
| 13/04        | . . Arrangements for expansion and contraction  | 17/002       | . {Detection of leaks (by testing the coolant or the moderator <a href="#">G21C 17/04</a> )}   |
| 13/06        | . . Sealing-plugs (for pressure vessels in general <a href="#">F16J 13/00</a> )   | 17/003       | . Remote inspection of vessels, e.g. pressure vessels  |
| 13/063       | . . . {Seals for closures or for rotatable closures}  | 17/007       | . . Inspection of the outer surfaces of vessels  |
| 13/067       | . . . for tubes, e.g. standpipes; Locking devices for plugs   | 17/01        | . . Inspection of the inner surfaces of vessels  |
| 13/0675      | . . . . {Seals for the plugs}   | 17/013       | . . Inspection vehicles  |
| 13/073       | . . . Closures for reactor-vessels, e.g. rotatable  | 17/017       | . Inspection or maintenance of pipe-lines or tubes in nuclear installations  |
| 13/0735      | . . . . {Seals for closures or for rotatable closures}  | 17/02        | . Devices or arrangements for monitoring coolant or moderator  |
| 13/08        | . Vessels characterised by the material; Selection of materials for pressure vessels  | 17/021       | . . {Solid moderators testing, e.g. graphite}  |
| 13/087       | . . Metallic vessels  | 17/022       | . . for monitoring liquid coolants or moderators   |
| 13/0875      | . . . {Tube-type vessels, e.g. for not essentially pressurised coolants}  | 17/0225      | . . . {Chemical surface treatment, e.g. corrosion (corrosion prevention in presence of water from scale removal or by modification of the properties of the liquid <a href="#">C02F 5/00</a> ; inhibiting corrosion by adding corrosion inhibitors <a href="#">C23F 11/00</a> )}   |
| 13/093       | . . Concrete vessels  | 17/025       | . . . for monitoring liquid metal coolants {(molten metal sampling in general <a href="#">G01N 1/125</a> )}  |
| 13/0933      | . . . {made of prestressed concrete}  | 17/0255      | . . . . {Liquid metal leaks detection (detecting leaks in pipe-line systems in general <a href="#">F17D 5/00</a> )}  |
| 13/0936      | . . . . {Particulars concerning prestressing devices and cables}  | 17/028       | . . for monitoring gaseous coolants  |
| 13/10        | . Means for preventing contamination in the event of leakage, {e.g. double wall}  | 17/032       | . . Reactor-coolant flow measuring or monitoring {(measuring volume or mass flow in general <a href="#">G01F</a> )}  |
| <b>15/00</b> | <b>Cooling arrangements within the pressure vessel containing the core; Selection of specific coolants</b>  | 17/035       | . . Moderator- or coolant-level detecting devices {(indicating or measuring liquid level in general <a href="#">G01F 23/00</a> )}  |
| 15/02        | . Arrangements or disposition of passages in which heat is transferred to the coolant; {Coolant flow control devices ( <a href="#">G21C 19/04</a> takes precedence; coolant flow control through fuel assemblies, e.g. flow restrictors <a href="#">G21C 3/322</a> )} | 17/038       | . . Boiling detection in moderator or coolant  |
| 15/04        | . . from fissile or breeder material {( <a href="#">G21C 3/32</a> takes precedence)}  | 17/04        | . . Detecting burst slugs  |
| 15/06        | . . . in fuel elements  | 17/041       | . . . {characterised by systems for checking the coolant channels, e.g. matrix systems}  |
| 15/08        | . . from moderating material  | 17/042       | . . . {Devices for selective sampling, e.g. valves, shutters, rotatable selector valves}   |
| 15/10        | . . from reflector or thermal shield  | 17/044       | . . . {Detectors and metering devices for the detection of fission products}   |
| 15/12        | . . from pressure vessel; from containment vessel   | 17/045       | . . . . {Precipitation chambers}   |
| 15/14        | . . from headers; from joints in ducts  | 17/047       | . . . . {Detection and metering circuits}  |
| 15/16        | . comprising means for separating liquid and steam (separating in general <a href="#">B01D</a> ; steam traps <a href="#">F16D</a> )   | 17/048       | . . . {characterised by a special construction of fuel elements, e.g. by a confined "tracer"}  |
| 15/18        | . Emergency cooling arrangements; Removing shut-down heat   | 17/06        | . Devices or arrangements for monitoring or testing fuel or fuel elements outside the reactor core, e.g. for burn-up, for contamination ( <a href="#">G21C 17/08</a> , <a href="#">G21C 17/10</a> take precedence; detecting leaking fuel elements during reactor operation <a href="#">G21C 17/04</a> )   |
| 15/182       | . . {comprising powered means, e.g. pumps}  |              |  |
| 15/185       | . . . {using energy stored in reactor system}   |              |  |
| 15/187       | . . . {using energy from the electric grid}   |              |  |
| 15/20        | . Partitions or thermal insulation between fuel channel and moderator   |              |  |
| 15/22        | . Structural association of coolant tubes with headers (joints of tubes in general <a href="#">F16L</a> )   |              |  |
| 15/24        | . Promoting flow of the coolant (electrodynamic pumps <a href="#">H02K 44/02</a> )  |              |  |
| 15/243       | . . for liquids   |              |  |



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| 17/063       | . . {Burn-up control ( <a href="#">G21C 17/066</a> takes precedence)}  | 19/207       | . . {Assembling, maintenance or repair of reactor components ( <a href="#">G21C 3/334</a> takes precedence)}  |
| 17/066       | . . {Control of spherical elements}  | 19/22        | . . Arrangements for obtaining access to the interior of a pressure vessel whilst the reactor is operating  |
| 17/07        | . . Leak testing   | 19/24        | . . . by using an auxiliary vessel which is temporarily sealed to the pressure vessel   |
| 17/08        | . Structural combination of reactor core or moderator structure with viewing means, e.g. with television camera, periscope, window   | 19/26        | . Arrangements for removing jammed or damaged fuel elements or control elements; Arrangements for moving broken parts thereof   |
| 17/10        | . Structural combination of fuel element, control rod, reactor core, or moderator structure with sensitive instruments, e.g. for measuring radioactivity, strain   | 19/28        | . Arrangements for introducing fluent material into the reactor core; Arrangements for removing fluent material from the reactor core ( <a href="#">pumping coolant G21D</a> )  |
| 17/102       | . . {the sensitive element being part of a fuel element or a fuel assembly (structural combination with a thermoelectric element for direct production of electrical energy <a href="#">G21C 3/40</a> )} | 19/30        | . . with continuous purification of circulating fluent material, e.g. by extraction of fission products {deterioration or corrosion products, impurities, e.g. by cold traps ( <a href="#">purification of circulating fluid fuels G21C 19/50</a> ; separation in general <a href="#">B01D</a> )} |
| 17/104       | . . Measuring reactivity   | 19/303       | . . . specially adapted for gases ( <a href="#">decontamination of gases G21F 9/02</a> )  |
| 17/108       | . . Measuring reactor flux   | 19/307       | . . . specially adapted for liquids ( <a href="#">decontamination of liquids G21F 9/04</a> )  |
| 17/112       | . . Measuring temperature  | 19/31        | . . . . for molten metals   |
| 17/116       | . . Passages or insulators, e.g. for electric cables   | 19/313       | . . . . . using cold traps  |
| 17/12        | . . Sensitive element forming part of control element  | 19/317       | . . . Recombination devices for radiolytic dissociation products  |
| 17/14        | . Period meters  | 19/32        | . Apparatus for removing radioactive objects or materials from the reactor discharge area, e.g. to a storage place; Apparatus for handling radioactive objects or materials within a storage place or removing them therefrom ( <a href="#">disposal of waste material G21F 9/00</a> )            |
| <b>19/00</b> | <b>Arrangements for treating, for handling, or for facilitating the handling of, fuel or other materials which are used within the reactor, e.g. within its pressure vessel</b>                          | 19/34        | . Apparatus or processes for dismantling nuclear fuel, e.g. before reprocessing {; Apparatus or processes for dismantling strings of spent fuel elements} ( <a href="#">shielded cells G21F 7/00</a> )  |
| 19/02        | . Details of handling arrangements   | 19/36        | . . Mechanical means only   |
| 19/04        | . . Means for controlling flow of coolant over objects being handled; Means for controlling flow of coolant through channel being serviced {, e.g. for preventing "blow-out"}                            | 19/365       | . . . Removing cannings or casings from fuel  |
| 19/06        | . . Magazines for holding fuel elements or control elements  | 19/37        | . . . . by separating into pieces both the canning or the casing and the fuel element, e.g. by cutting or shearing  |
| 19/065       | . . . {Rotatable magazines}  | 19/375       | . . . Compacting devices, e.g. for fuel assemblies  |
| 19/07        | . . . Storage racks; Storage pools   | 19/38        | . . Chemical means only   |
| 19/08        | . . Means for heating fuel elements before introduction into the core; Means for heating or cooling fuel elements after removal from the core  | 19/40        | . Arrangements for preventing occurrence of critical conditions, e.g. during storage  |
| 19/10        | . . Lifting devices or pulling devices adapted for co-operation with fuel elements or with control elements ( <a href="#">manipulators B25J</a> )  | 19/42        | . Reprocessing of irradiated fuel   |
| 19/105       | . . . with grasping or spreading coupling elements   | 19/44        | . . of irradiated solid fuel  |
| 19/11        | . . . with revolving coupling elements, e.g. socket coupling   | 19/46        | . . . Aqueous processes {, e.g. by using organic extraction means, including the regeneration of these means}   |
| 19/115       | . . . with latching devices and ball couplings   | 19/48        | . . . Non-aqueous processes   |
| 19/12        | . . Arrangements for exerting direct hydraulic or pneumatic force on fuel element or on control element  | 19/50        | . . of irradiated fluid fuel {, e.g. regeneration of fuels while the reactor is in operation}   |
| 19/14        | . characterised by their adaptation for use with horizontal channels in the reactor core   | <b>21/00</b> | <b>Apparatus or processes specially adapted to the manufacture of reactors or parts thereof (in general section B, e.g. <a href="#">B23</a>)</b>  |
| 19/16        | . Articulated or telescopic chutes or tubes for connection to channels in the reactor core   | 21/02        | . Manufacture of fuel elements or breeder elements contained in non-active casings  |
| 19/18        | . Apparatus for bringing fuel elements to the reactor charge area, e.g. from a storage place   | 21/04        | . . by vibrational compaction or tamping {of fuel in the jacket}  |
| 19/19        | . Reactor parts specifically adapted to facilitate handling, e.g. to facilitate charging or discharging of fuel elements   | 21/06        | . . by {rotatable} swaging {of the jacket around the fuel}  |
| 19/20        | . Arrangements for introducing objects into the pressure vessel; Arrangements for handling objects within the pressure vessel; Arrangements for removing objects from the pressure vessel                | 21/08        | . . by a slip-fit cladding process {by crimping the jacket around the fuel}   |
| 19/202       | . . {Arrangements for handling ball-form, i.e. pebble fuel}  |              |   |
| 19/205       | . . {Interchanging of fuel elements in the core, i.e. fuel shuffling}  |              |   |

## G21C

- 21/10 . . by extrusion, drawing, or stretching {by rolling, e.g. "picture frame" technique}
- 21/12 . . by hydrostatic or thermo-pneumatic canning {in general by pressing without lengthening, e.g. explosive coating}
- 21/14 . . by plating {the fuel} in a fluid
- 21/16 . . by casting or dipping techniques
- 21/18 . Manufacture of control elements covered by group [G21C 7/00](#)

### **23/00 Adaptations of reactors to facilitate experimentation or irradiation**