

NUCLEONICS

G 21 NUCLEAR PHYSICS; NUCLEAR ENGINEERING

G 21 B FUSION REACTORS (uncontrolled reactors G 21 J)

1/00 Alleged controlled-fusion reactors

- 1/02 . using a beam of particles some of which react with other particles

G 21 C NUCLEAR REACTORS (analogue computers therefor G 06 G 7/54; fusion reactors G 21 B; nuclear explosives G 21 J)

Subclass Index

REACTORS	1/00	CONTROL; MONITORING, TESTING	7/00; 17/00
REACTOR ELEMENTS		EMERGENCY PROTECTION	9/00
Fuel; moderator; cooling;		MANUFACTURE.....	21/00
containment; shielding	3/00; 5/00; 15/00;	ADAPTATIONS OF REACTORS FOR	
	13/00; 11/00	EXPERIMENTATION OR IRRADIATION	23/00
Handling fuel and other materials.....	19/00		

1/00 Reactors

- 1/01 . General details not provided for in groups 3/00 to 19/00 [3]
- 1/02 . Fast fission reactors, i.e. reactors not using a moderator
- 1/03 . . . cooled by a coolant not essentially pressurised, e.g. pool-type reactors [5]
- 1/04 . Thermal reactors
- 1/06 . . Heterogeneous reactors, i.e. in which fuel and moderator are separated
- 1/07 . . . Pebble-bed reactors; Reactors with granular fuel [5]
- 1/08 . . . moderator being highly pressurised, e.g. boiling-water reactor, integral-superheat reactor, pressurised-water reactor (1/22 takes precedence)
- 1/09 Pressure regulating arrangements, i.e. pressurisers [5]
- 1/10 moderator and coolant being different or separated
- 1/12 moderator being solid, e.g. Magnox reactor
- 1/14 moderator being substantially not pressurised, e.g. swimming-pool reactor (1/22 takes precedence)
- 1/16 moderator and coolant being different or separated, e.g. sodium-graphite reactor
- 1/18 coolant being pressurised
- 1/20 moderator being liquid, e.g. pressure-tube reactor
- 1/22 using liquid or gaseous fuel

- 1/24 . . Homogeneous reactors, i.e. in which fuel and moderator present an effectively homogeneous medium to the neutrons
- 1/26 . . . Single-region reactors
- 1/28 . . . Two-region reactors
- 1/30 . Subcritical reactors
- 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 (1/02 to 1/30 take precedence) [3]

3/00 Reactor fuel elements or their assemblies; Selection of substances for use as reactor fuel elements

- 3/02 . Fuel elements
- 3/04 . . Constructional details
- 3/06 . . . Casings; Jackets
- 3/07 characterised by their material, e.g. alloys [5]
- 3/08 provided with external means to promote heat-transfer, e.g. fins, baffles, corrugations
- 3/10 End closures
- 3/12 Means forming part of the element for locating it within the reactor core; External spacers for this purpose
- 3/14 Means forming part of the element for inserting it into, or removing it from, the core; Means for coupling adjacent elements
- 3/16 . . . Details of the construction within the casing

- 3/17 Means for storage or immobilisation of gases in fuel elements [5]
- 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 3/20)
- 3/20 with coating on fuel or on inside of casing; with non-active interlayer between casing and active material
- 3/22 . . with fissile or breeder material in contact with coolant
- 3/24 . . with fissile or breeder material in fluid form within a non-active casing
- 3/26 . . with fissile or breeder material in powder form within a non-active casing
- 3/28 . . with fissile or breeder material in solid form within a non-active casing
- 3/30 . Assemblies of a number of fuel elements in the form of a rigid unit
- 3/32 . . Bundles of parallel pin-, rod-, or tube-shaped fuel elements
- 3/322 Means to influence the coolant flow through or around the bundles [5]
- 3/324 Coats or envelopes for the bundles [5]
- 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 [5]
- 3/328 Relative disposition of the elements in the bundle lattice [5]
- 3/33 Supporting or hanging of elements in the bundle (spacer grids 3/34); Means forming part of the bundle for inserting it into, or removing it from, the core; Means for coupling adjacent bundles [5]
- 3/332 Supports for spacer grids [5]
- 3/334 Assembling the bundles [5]
- 3/335 Exchanging elements in irradiated bundles [5]
- 3/336 Spacer elements for fuel rods in the bundle (spacer grids 3/34) [5]
- 3/338 Helicoidal spacer elements [5]
- 3/34 Spacer grids
- 3/344 formed of assembled tubular elements [5]
- 3/348 formed of assembled non-intersecting strips [5]
- 3/352 formed of assembled intersecting strips [5]
- 3/356 being provided with fuel element supporting members [5]
- 3/36 . . Assemblies of plate-shaped fuel elements or coaxial tubes
- 3/38 . Fuel units consisting of a single fuel element in a supporting sleeve
- 3/40 . Structural combination of fuel element with thermoelectric element for direct production of electric energy from fission heat (for temperature measurement 17/10)
- 3/42 . Selection of substances for use as reactor fuel
- 3/44 . . Fluid or fluent reactor fuel
- 3/46 Aqueous compositions
- 3/48 True or colloidal solutions of the active constituent
- 3/50 Suspensions of the active constituent; Slurries
- 3/52 Liquid metal compositions
- 3/54 Fused salt, oxide, or hydroxide compositions
- 3/56 Gaseous compositions; Suspensions in a gaseous carrier
- 3/58 . . Solid reactor fuel
- 3/60 Metallic fuel; Intermetallic dispersions
- 3/62 Ceramic fuel
- 3/64 Ceramic dispersion fuel, e.g. cermet
- 5/00 Moderator or core structure; Selection of materials for use as moderator**
- 5/02 . Details
- 5/04 . . Spatial arrangements allowing for Wigner growth
- 5/06 . . Means for locating or supporting fuel elements
- 5/08 . . Means for preventing undesired asymmetric expansion of the complete structure
- 5/10 . . Means for supporting the complete structure
- 5/12 . characterised by composition, e.g. the moderator containing additional substances which ensure improved heat resistance of the moderator
- 5/14 . characterised by shape
- 5/16 . . Shape of its constituent parts
- 5/18 . characterised by the provision of more than one active zone
- 5/20 . . wherein one zone contains fissile material and another zone contains breeder material
- 5/22 . . wherein one zone is a superheating zone
- 7/00 Control of nuclear reaction**
- 7/02 . by using self-regulating properties of reactor materials (arrangements that involve temperature stability 7/32)
- 7/04 . . of burnable poisons (burnable poisons in fuel rods 3/326) [5]
- 7/06 . by application of neutron-absorbing material, i.e. material with absorption cross-section very much in excess of reflection cross-section
- 7/08 . . by displacement of solid control elements, e.g. control rods
- 7/10 Construction of control elements
- 7/103 Control assemblies containing one or more absorbants as well as other elements, e.g. fuel or moderator elements [5]
- 7/107 Control elements adapted for pebble-bed reactors [5]
- 7/11 Deformable control elements, e.g. flexible, telescopic, articulated [5]

- 7/113 Control elements made of flat elements; Control elements having cruciform cross-section [5]
- 7/117 Clusters of control rods; Spider construction [5]
- 7/12 . . . Means for moving control elements to desired position (dropping rods in an emergency 9/02)
- 7/14 Mechanical drive arrangements
- 7/16 Hydraulic or pneumatic drive arrangements
- 7/18 . . . Means for obtaining differential movement of control elements
- 7/20 . . . Disposition of shock-absorbing devices (shock-absorbers in general F 16 F)
- 7/22 . . by displacement of a fluid or fluent neutron-absorbing material
- 7/24 . . Selection of substances for use as neutron-absorbing material
- 7/26 . . by displacement of the moderator or parts thereof
- 7/27 . . Spectral shift control [5]
- 7/28 . . by displacement of the reflector or parts thereof
- 7/30 . . by displacement of reactor fuel or fuel elements
- 7/32 . . by varying flow of coolant through the core
- 7/34 . . by utilisation of a primary neutron source
- 7/36 . Control circuits
- 9/00 Emergency protection arrangements structurally associated with the reactor** (emergency cooling arrangements 15/18)
- 9/004 . Pressure suppression [5]
- 9/008 . . by rupture-discs or -diaphragms [5]
- 9/012 . . by thermal accumulation or by steam condensation, e.g. ice condensers [5]
- 9/016 . Core catchers [5]
- 9/02 . Means for effecting very rapid reduction of the reactivity factor under fault conditions, e.g. reactor fuse
- 9/027 . . by fast movement of a solid, e.g. pebbles [5]
- 9/033 . . by an absorbent fluid [5]
- 9/04 . Means for suppressing fires
- 9/06 . . Means for preventing accumulation of explosives gases, e.g. recombiners [5]
- 11/00 Shielding structurally associated with the reactor**
- 11/02 . Biological shielding (in general G 21 F)
- 11/04 . . on waterborne craft
- 11/06 . Reflecting shields, i.e. for minimising loss of neutrons
- 11/08 . Thermal shields; Thermal linings, i.e. for dissipating heat from gamma radiation which would otherwise heat an outer biological shield
- 13/00 Pressure vessels; Containment vessels; Containment in general** (for chemical or physical processes B 01 J 3/00; pressure vessels in general F 16 J 12/00)
- 13/02 . Details
- 13/024 . . Supporting constructions for pressure vessels or containment vessels [5]
- 13/028 . . Seals, e.g. for pressure vessels or containment vessels [5]
- 13/032 . . Joints between tubes and vessel walls, e.g. taking into account thermal stresses [5]
- 13/036 . . . the tube passing through the vessel wall, i.e. continuing on both sides of the wall [5]
- 13/04 . . Arrangements for expansion and contraction
- 13/06 . . Sealing-plugs (for pressure vessels in general F 16 J 13/00)
- 13/067 . . . for tubes, e.g. standpipes; Locking devices for plugs [5]
- 13/073 . . . Closures for reactor-vessels, e.g. rotatable [5]
- 13/08 . Vessels characterised by the material; Selection of materials for pressure vessels
- 13/087 . . Metallic vessels [5]
- 13/093 . . Concrete vessels [5]
- 13/10 . Means for preventing contamination in event of leakage
- 15/00 Cooling arrangements within the pressure vessel containing the core; Selection of specific coolants**
- 15/02 . Arrangement or disposition of passages in which heat is transferred to the coolant, e.g. for coolant circulation through the supports of the fuel elements
- 15/04 . . from fissile or breeder material
- 15/06 . . . in fuel elements
- 15/08 . . from moderating material
- 15/10 . . from reflector or thermal shield
- 15/12 . . from pressure vessel; from containment vessel
- 15/14 . . from ducts conducting a hot fluid; from ducts comprising auxiliary apparatus, e.g. pumps, cameras
- 15/16 . comprising means for separating liquid and steam (separating in general B 01 D; steam traps F 16 T)
- 15/18 . Emergency cooling arrangements; Removing shut-down heat
- 15/20 . Partitions or thermal insulation between fuel channel and moderator, e.g. in pressure tube reactors
- 15/22 . Structural association of coolant tubes with headers or other pipes, e.g. in pressure tube reactors (joints of tubes in general F 16 L) [4]
- 15/24 . Promoting flow of the coolant (electrodynamic pumps H 02 K 44/02)
- 15/243 . . for liquids [5]
- 15/247 . . . for liquid metals [5]
- 15/25 . . . using jet pumps [5]
- 15/253 . . for gases, e.g. blowers [5]
- 15/257 . . using heat-pipes [5]
- 15/26 . . by convection, e.g. using chimneys, using divergent channels
- 15/28 . Selection of specific coolants (if serving as the moderator 5/12; heat-transfer or heat-exchange materials C 09 K 5/00)
- 17/00 Monitoring; Testing** (measuring in general G 01)
- 17/003 . Remote inspection of vessels, e.g. pressure vessels [5]
- 17/007 . . Inspection of the outer surfaces of vessels [5]
- 17/01 . . Inspection of the inner surfaces of vessels [5]
- 17/013 . . Inspection vehicles [5]

- 17/017 . . . Inspection or maintenance of pipe-lines or tubes in nuclear installations [5]
- 17/02 . . . Devices or arrangements for monitoring coolant or moderator
- 17/022 . . . for monitoring liquid coolants or moderators [5]
- 17/025 . . . for monitoring liquid metal coolants [5]
- 17/028 . . . for monitoring gaseous coolants [5]
- 17/032 . . . Reactor-coolant flow measuring or monitoring [5]
- 17/035 . . . Moderator- or coolant-level detecting devices [5]
- 17/038 . . . Boiling detection in moderator or coolant [5]
- 17/04 . . . Detecting burst slugs
- 17/06 . . . Devices or arrangements for monitoring or testing fuel or fuel elements outside the reactor core, e.g. for burn-up, for contamination (17/08, 17/10 take precedence; detecting leaking fuel elements during reactor operation 17/04)
- 17/07 . . . Leak testing [5]
- 17/08 . . . Structural combination of reactor core or moderator structure with viewing means, e.g. with television camera, periscope, window
- 17/10 . . . Structural combination of fuel element, control rod, reactor core, or moderator structure with sensitive instruments, e.g. for measuring radioactivity, strain
- 17/104 . . . Measuring reactivity [5]
- 17/108 . . . Measuring reactor flux [5]
- 17/112 . . . Measuring temperature [5]
- 17/116 . . . Passages or insulators, e.g. for electric cables [5]
- 17/12 . . . Sensitive element forming part of control element
- 17/14 . . . Period meters
- 19/00 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 [2]**
- 19/02 . . . Details of handling arrangements
- 19/04 . . . Means for controlling flow of coolant over objects being handled; Means for controlling flow of coolant through channel being serviced
- 19/06 . . . Means for supporting or storing fuel elements or control elements [4]
- 19/07 . . . Storage racks; Storage pools [5]
- 19/08 . . . Means for heating fuel elements before introduction into the core; Means for heating or cooling fuel elements after removal from the core
- 19/10 . . . Lifting devices or pulling devices adapted for co-operation with fuel elements or with control elements (manipulators B 25 J)
- 19/105 . . . with grasping or spreading coupling elements [5]
- 19/11 . . . with revolving coupling elements, e.g. socket coupling [5]
- 19/115 . . . with latching devices and ball couplings [5]
- 19/12 . . . Arrangements for exerting direct hydraulic or pneumatic force on fuel element or on control element
- 19/14 . . . characterised by their adaptation for use with horizontal channels in the reactor core
- 19/16 . . . Articulated or telescopic chutes or tubes for connection to channels in the reactor core
- 19/18 . . . Apparatus for bringing fuel elements to the reactor charge area, e.g. from a storage place
- 19/19 . . . Reactor parts specifically adapted to facilitate handling, e.g. to facilitate charging or discharging of fuel elements [3]
- 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
- 19/22 . . . Arrangements for obtaining access to the interior of a pressure vessel whilst the reactor is operating
- 19/24 . . . by using an auxiliary vessel which is temporarily sealed to the pressure vessel
- 19/26 . . . Arrangements for removing jammed or damaged fuel elements or control elements; Arrangements for moving broken parts thereof
- 19/28 . . . Arrangements for introducing fluent material into the reactor core; Arrangements for removing fluent material from the reactor core (pumping coolant G 21 D)
- 19/30 . . . with continuous purification of circulating fluent material, e.g. by extraction of fission products
- 19/303 . . . specially adapted for gases (decontamination of gases G 21 F 9/02) [5]
- 19/307 . . . specially adapted for liquids (decontamination of liquids G 21 F 9/04) [5]
- 19/31 . . . for molten metals [5]
- 19/313 . . . using cold traps [5]
- 19/317 . . . Recombination devices for radiolytic dissociation products [5]
- 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 (disposal of waste material G 21 F 9/00)
- 19/33 . . . Apparatus or processes for dismantling strings of spent fuel elements (19/34 takes precedence) [2]
- 19/34 . . . Apparatus or processes for dismantling nuclear fuel, e.g. before reprocessing (shielded cells G 21 F 7/00) [5]
- 19/36 . . . Mechanical means only
- 19/365 . . . Removing cannings or casings from fuel [5]
- 19/37 . . . by separating into pieces both the canning or the casing and the fuel element, e.g. by cutting or shearing [5]
- 19/375 . . . Compacting devices, e.g. for fuel assemblies [5]
- 19/38 . . . Chemical means only

G 21 C, D

- 19/40 . Arrangements for preventing occurrence of critical conditions, e.g. during storage
 - 19/42 . Reprocessing of irradiated fuel
 - 19/44 . . of irradiated solid fuel
 - 19/46 . . . Aqueous processes
 - 19/48 . . . Non-aqueous processes
 - 19/50 . . of irradiated fluid fuel
 - 21/00 Apparatus or processes specially adapted to the manufacture of reactors or parts thereof** (in general, section B, e.g. [B 23](#))
 - 21/02 . Manufacture of fuel elements or breeder elements contained in non-active casings
 - 21/04 . . by vibrational compaction or tamping
 - 21/06 . . by swaging
 - 21/08 . . by a slip-fit cladding process
 - 21/10 . . by extrusion, drawing, or stretching
 - 21/12 . . by hydrostatic or thermo-pneumatic canning
 - 21/14 . . by plating in a fluid
 - 21/16 . . by casting or dipping techniques
 - 21/18 . Manufacture of control elements covered by group [7/00](#)
 - 23/00 Adaptations of reactors to facilitate experimentation or irradiation [3]**
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G 21 D NUCLEAR POWER PLANT (electric or magnetic analogue computers, e.g. simulators, for nuclear physics [G 06 G 7/54](#))

- 1/00 Details of nuclear power plant** (control [3/00](#))
- 1/02 . Arrangements of auxiliary equipment
- 1/04 . Pumping arrangements (by means within the reactor pressure vessel [G 21 C 15/24](#); electrodynamic pumps [H 02 K 44/02](#))
- 3/00 Control of nuclear power plant** (control of nuclear reaction in general [G 21 C 7/00](#))
- 3/02 . Manual control
- 3/04 . Safety arrangements (emergency protection of reactor [G 21 C 9/00](#))
- 3/06 . . responsive to faults within the plant (in the reactor [G 21 C 9/00](#))
- 3/08 . Regulation of any parameters in the plant
- 3/10 . . by a combination of a variable derived from neutron flux with other controlling variables, e.g. derived from temperature, cooling flow, pressure
- 3/12 . . by adjustment of the reactor in response only to changes in engine demand
- 3/14 . . . Varying flow of coolant
- 3/16 . . . Varying reactivity
- 3/18 . . by adjustment of plant external to the reactor only in response to change in reactivity
- 5/00 Arrangements of reactor and engine in which reactor-produced heat is converted into mechanical energy**
- 5/02 . Reactor and engine structurally combined, e.g. portable
- 5/04 . Reactor and engine not structurally combined
- 5/06 . . with engine working medium circulating through reactor core
- 5/08 . . with engine working medium heated in a heat exchanger by the reactor coolant
- 5/10 . . . Liquid working medium partially heated by reactor and vaporised by heat source external to the core, e.g. with oil heating
- 5/12 . . . Liquid working medium vaporised by reactor coolant
- 5/14 and also superheated by reactor coolant
- 5/16 superheated by separate heat source
- 7/00 Arrangements for direct production of electric energy from fusion or fission reactions** (obtaining electric energy from radioactive sources [G 21 H 1/00](#))
- 7/02 . using magneto-hydrodynamic generators
- 7/04 . using thermoelectric elements (structural combination of fuel element with thermoelectric element [G 21 C 3/40](#); thermoelectric elements per se [H 01 L 35/00](#), [37/00](#))
- 9/00 Arrangements to provide heat for purposes other than conversion into power, e.g. for heating buildings**

G 21 F PROTECTION AGAINST X-RADIATION, GAMMA RADIATION, CORPUSCULAR RADIATION, OR PARTICLE BOMBARDMENT; TREATING RADIOACTIVELY CONTAMINATED MATERIAL; DECONTAMINATION ARRANGEMENTS THEREFOR (radiation protection by pharmaceutical means [A 61 K 7/40](#); in cosmonautic vehicles [B 64 G](#); combined with a reactor [G 21 C 11/00](#); combined with X-ray tubes [H 01 J 35/16](#); combined with X-ray apparatus [H 05 G 1/02](#))

1/00 Shielding characterised by the composition of the material

- 1/02 . Selection of uniform shielding materials
- 1/04 . . Concretes; Other hydraulic hardening materials
- 1/06 . . Ceramics; Glasses; Refractories (cermets [1/08](#))
- 1/08 . . Metals; Alloys; Cermets, i.e. sintered mixtures of ceramics and metals
- 1/10 . . Organic substances; Dispersions in organic carriers
- 1/12 . Laminated shielding materials

3/00 Shielding characterised by its physical form, e.g. granules, or shape of the material

- 3/02 . Clothing (protective clothing or garments in general [A 41 D 13/00](#))
- 3/025 . . Clothing completely surrounding the wearer **[5]**
- 3/03 . . Aprons **[5]**
- 3/035 . . Gloves (mounting means on glove boxes [7/053](#)) **[5]**
- 3/04 . Bricks; Shields made up therefrom

5/00 Transportable or portable shielded containers

- 5/002 . Containers for fluid radioactive wastes **[5]**
- 5/005 . Containers for solid radioactive wastes, e.g. for ultimate disposal **[5]**
- 5/008 . . Containers for fuel elements **[5]**
- 5/012 . . . Fuel element racks in the containers **[5]**
- 5/015 . for storing radioactive sources, e.g. source carriers for irradiation units; Radioisotope containers **[5]**
- 5/018 . . Syringe shields or holders (syringe shielding for applying radioactive material to the body [A 61 M 36/08](#)) **[5]**
- 5/02 . with provision for restricted exposure of a radiation source within the container
- 5/04 . . Means for controlling exposure, e.g. time, size of aperture (controlling exposure to X-radiation [H 05 G 1/30](#))
- 5/06 . Details of, or accessories to, the containers **[5]**
- 5/08 . . Shock-absorbers, e.g. impact buffers for containers **[5]**
- 5/10 . . Heat-removal systems, e.g. using circulating fluid or cooling fins **[5]**
- 5/12 . . Closures for containers; Sealing arrangements **[5]**
- 5/14 . . Devices for handling containers or shipping-casks, e.g. transporting devices **[5]**

7/00 Shielded cells or rooms (chambers provided with manipulating devices in general [B 25 J](#))

- 7/005 . Shielded passages through walls; Locks; Transferring devices between rooms (between glove-boxes [7/047](#)) **[5]**
- 7/01 . . Transferring by fluidic means **[5]**
- 7/015 . Room atmosphere, temperature or pressure control devices **[5]**
- 7/02 . Observation devices permitting vision but shielding the observer
- 7/03 . . Windows, e.g. shielded **[5]**
- 7/04 . Shielded glove-boxes (glove-boxes in general [B 25 J 21/02](#))
- 7/047 . . Shielded passages; Closing or transferring means between glove-boxes **[5]**
- 7/053 . . Glove mounting means **[5]**
- 7/06 . Structural combination with remotely-controlled apparatus, e.g. with manipulators (manipulators [B 25 J](#); remote control in general [G 05](#))

9/00 Treating radioactively contaminated material; Decontamination arrangements therefor [2,5]

- 9/02 . Treating gases **[2]**
- 9/04 . Treating liquids **[2]**
- 9/06 . . Processing (separating different isotopes of the same chemical element [B 01 D 59/00](#))
- 9/08 . . . by evaporation; by distillation
- 9/10 . . . by flocculation
- 9/12 . . . by absorption; by adsorption; by ion-exchange
- 9/14 . . . by incineration; by calcination, e.g. desiccation
- 9/16 . . . by fixation in stable solid media
- 9/18 . . . by biological processes
- 9/20 . . Disposal of liquid waste
- 9/22 . . . by storage in a tank or other container
- 9/24 . . . by storage in the ground; by storage under water, e.g. in ocean
- 9/26 . . . by dilution in water, e.g. in ocean, in stream
- 9/28 . Treating solids **[2]**
- 9/30 . . Processing (separating different isotopes of the same chemical element [B 01 D 59/00](#))
- 9/32 . . . by incineration
- 9/34 . . Disposal of solid waste
- 9/36 . . . by packaging; by baling

G 21 G CONVERSION OF CHEMICAL ELEMENTS; RADIOACTIVE SOURCES (applications of radiation in general [G 21 H 5/00](#); handling particles, e.g. neutrons, or electromagnetic radiation not otherwise provided for [G 21 K](#)) [2]

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| <p>1/00 Arrangements for converting chemical elements by electromagnetic radiation, corpuscular radiation, or particle bombardment, e.g. producing radioactive isotopes (separation of different isotopes of the same element B 01 D 59/00) [2]</p> <p>1/02 . in nuclear reactors (by thermonuclear reactions G 21 B; conversion of nuclear fuel G 21 C)</p> <p>1/04 . outside of nuclear reactors or particle accelerators [2]</p> <p>1/06 . . by neutron irradiation [2]</p> <p>1/08 . . . accompanied by nuclear fission [2]</p> <p>1/10 . . by bombardment with electrically-charged particles (irradiation devices G 21 K 5/00) [2]</p> <p>1/12 . . by electromagnetic irradiation, e.g. with gamma or X-rays (applications of radiation G 21 H 5/00; irradiation devices G 21 K 5/00) [2]</p> | <p>4/00 Radioactive sources (producing neutrons or other subatomic particles, X- or gamma rays, in fusion reactors G 21 B, in nuclear reactors C, by cosmic radiation G 21 H 7/00, in accelerators H 05 H; X-ray tubes H 01 J 35/00; gamma masers H 01 S 4/00) [2]</p> <p>4/02 . Neutron sources [2]</p> <p>4/04 . Radioactive sources other than neutron sources (radioactive dressings A 61 M 36/14) [2]</p> <p>4/06 . . characterised by constructional features [2]</p> <p>4/08 . . . specially adapted for medical applications (radiation therapy using radioactive sources A 61 N 5/10) [2]</p> <p>4/10 . . with radium emanation [2]</p> <p>5/00 Alleged conversion of chemical elements by chemical reaction</p> |
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G 21 H OBTAINING ENERGY FROM RADIOACTIVE SOURCES; APPLICATIONS OF RADIATION FROM RADIOACTIVE SOURCES; UTILISING COSMIC RADIATION (measurement of nuclear or X-radiation [G 01 T](#); fusion reactors [G 21 B](#); nuclear reactors [G 21 C](#); semiconductor devices sensitive to electromagnetic or corpuscular radiation [H 01 L 31/00](#))

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| <p>1/00 Arrangements for obtaining electrical energy from radioactive sources, e.g. from radioactive isotopes</p> <p>1/02 . Cells charged directly by beta radiation</p> <p>1/04 . Cells using secondary emission induced by alpha radiation, beta radiation, or gamma radiation (discharge tubes H 01 J 40/00, 47/00)</p> <p>1/06 . Cells wherein radiation is applied to the junction of different semiconductor materials</p> <p>1/08 . Cells in which radiation ionises a gas in the presence of a junction of two dissimilar metals, i.e. contact potential-difference cells (discharge tubes H 01 J)</p> <p>1/10 . Cells in which radiation heats a thermoelectric junction or a thermionic converter (discharge tubes functioning as thermionic generators H 01 J 45/00; thermoelectric devices comprising a junction of dissimilar materials H 01 L 35/00) [2]</p> <p>1/12 . Cells using conversion of the radiation into light combined with subsequent photoelectric conversion into electric energy</p> <p>3/00 Arrangements for direct conversion of radiation energy from radioactive sources into forms of energy other than electric energy, e.g. light (lasers H 01 S 3/00)</p> <p>3/02 . in which material is excited to luminesce by the radiation (lamps in which a gas filling or screen or coating is excited to luminesce by radioactive material structurally associated with the lamp H 01 J 65/00)</p> | <p>5/00 Applications of radiation from radioactive sources or arrangements therefor (producing mutation in plants A 01 H 1/06; preservation of dairy products A 23 C; preservation of foodstuffs A 23 L 3/26; for therapeutic purposes A 61 N 5/10; in chemical, physical or physicochemical processes in general B 01 J 19/08; in electrostatic separation B 03 C 3/38; for after-treatment of coatings applied as liquids or other fluent materials B 05 D 3/06; for action between electric vehicles and tracked apparatus B 61 L 1/10, 3/06; introducing isotopes into organic compounds C 07 B 59/00; for preparation of organic chemical compounds C 07, C 08, e.g. C 08 F 2/46; for treating macromolecular substances or articles made therefrom B 29 C 71/04, C 08 J 3/28, 7/18; for cracking of hydrocarbon oils C 10 G 15/00, 32/04; for reforming naphtha C 10 G 35/16; preservation or ageing of products obtained from fermentation processes C 12 H 1/06, 1/16; for bleaching fibres D 06 L 3/04; measuring G 01; irradiation devices, gamma- or X-ray microscopes G 21 K; in discharge tubes H 01 J; apparatus for generating ions to be introduced into non-enclosed gases, e.g. into the atmosphere, H 01 T 23/00; for carrying-off electrostatic charges H 05 F 3/06)</p> <p>5/02 . as tracers</p> <p>7/00 Use of effects of cosmic radiation</p> |
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G 21 J NUCLEAR EXPLOSIVES; APPLICATIONS THEREOF (electric or magnetic analogue computers, e.g. simulators, for nuclear physics [G 06 G 7/54](#))

Note

This subclass covers uncontrollable fission or fusion reactions.

1/00 Nuclear explosive devices

3/00 Peaceful applications of nuclear explosive devices

3/02 . for excavation

5/00 Detection arrangements for nuclear explosions
(individual measuring devices [G 01](#))

G 21 K TECHNIQUES FOR HANDLING PARTICLES OR ELECTROMAGNETIC RADIATION NOT OTHERWISE PROVIDED FOR; IRRADIATION DEVICES; GAMMA- OR X-RAY MICROSCOPES (X-ray technique [H 05 G](#); plasma technique [H 05 H](#)) [2]

1/00 Arrangements for handling radiation or particles, e.g. focusing, moderating (radiation filters [3/00](#)) [2]

1/02 . using diaphragms, collimators [2]

1/04 . . using variable diaphragms, shutters, choppers [2]

1/06 . using diffraction, refraction, or reflection, e.g. monochromators ([1/10](#), [7/00](#) take precedence) [2]

1/08 . Deviation, concentration, or focusing of the beam by electric or magnetic means (electron-optical arrangements in electric discharge tubes [H 01 J 29/46](#)) [2]

1/087 . . by electrical means [4]

1/093 . . by magnetic means [4]

1/10 . Scattering devices; Absorbing devices [2]

1/12 . . Resonant absorbers or driving arrangements therefor, e.g. for Mössbauer-effect devices [3]

1/14 . using charge exchange devices, e.g. for neutralising or changing the sign of the electrical charges of beams (producing or accelerating neutral particle beams [H 05 H 3/00](#)) [3]

1/16 . using polarising devices, e.g. for obtaining a polarised ion beam [3]

3/00 Radiation filters, e.g. X-ray filters [2]

4/00 Conversion screens for the conversion of the spatial distribution of X-rays or particle radiation into visible images, e.g. fluoroscopic screens (photographic processes using X-ray intensifiers [G 03 C 5/17](#); discharge tubes comprising luminescent screens [H 01 J 1/62](#); cathode ray tubes for X-ray conversion with optical output [H 01 J 31/50](#)) [3]

5/00 Irradiation devices (adaptations of reactors to facilitate irradiation [G 21 C 23/00](#); discharge tubes for irradiating [H 01 J 33/00](#), [37/00](#)) [2]

5/02 . having no beam-forming means [2]

5/04 . with beam-forming means [2]

5/08 . Holders for targets or for objects to be irradiated [2]

5/10 . with provision for relative movement of beam source and object to be irradiated [3]

7/00 Gamma- or X-ray microscopes [2]