

CPC**COOPERATIVE PATENT CLASSIFICATION****F24J****PRODUCING OR USE OF HEAT NOT OTHERWISE PROVIDED FOR**

(materials therefor [C09K 5/00](#); engines or other mechanisms for producing mechanical power from heat, see the relevant classes, e.g. [F03G](#) for using natural heat)

F24J 1/00

Apparatus or devices using heat produced by exothermal chemical reactions other than by combustion (for cooking-vessels [A47J 36/28](#); self-heating compresses [A61F { A61F 7/04C }](#); materials for the production of heat or cold involving non-reversible chemical reactions, other than by combustion, when used [C09K 5/18](#))

F24J 2/00

Use of solar heat, e.g. solar heat collectors (distillation or evaporation of water using solar energy [C02F 1/14](#); devices for producing mechanical power from solar energy [F03G 6/00](#); semiconductor devices adapted for converting solar energy into electrical energy [H01L 25/00](#), [H01L 31/04](#); semiconductor devices including arrays of solar cells using heat energy [H01L 31/058](#); generators in which light radiation is directly converted into electrical energy [H02N 6/00](#))

F24J 2/0007

- . { Passive solar heat collectors }

F24J 2/0015

- . { Solar heat collectors absorbing essentially direct solar radiation combined with a solar heat collector absorbing concentrated radiation }

F24J 2/0023

- . { Solar heat collector using additional ambient air heat or another heat source, e.g. electrical }

F24J 2/02

- . Solar heat collectors with support for article heated, e.g. stoves, ranges, crucibles, furnaces or ovens using solar heat

F24J 2/04

- . Solar heat collectors having working fluid conveyed through collector

F24J 2/0422

- .. { Solar collectors integrated in fixed constructions, e.g. in buildings }

F24J 2/0427

- ... { in the form of a fence, a balustrade or a handrail }

F24J 2/0433

- ... { in the form of a window }

F24J 2/0438

- ... { in the form of a floor construction }

F24J 2/0444

- ... { in the form of a façade construction }

F24J 2/045

- ... { in the form of a roof construction ([F24J 2/0455](#) takes precedence) }

F24J 2/0455

- ... { in the form of shingles or tiles }

F24J 2/0461

- .. { using pools or ponds }

F24J 2/0466

- ... { Salt gradient solar ponds }

F24J 2/0472

- ... { Floating solar collectors or covers }

F24J 2/0477

- .. { having circuits for more than one working fluid ([F24J 2/30](#) takes precedence) }

F24J 2/0483

- .. { having two or more passages for the same working fluid ([F24J 2/20](#), [F24J 2/24](#) take precedence) }

F24J 2/0488

- .. { Solar heat collectors having absorber surfaces of a particular form }

F24J 2/0494

- ... { having two or more absorber surfaces }

F24J 2/05

- .. surrounded by a transparent enclosure, e.g. evacuated solar collectors

F24J 2/055	...	{ the enclosure being cylindrical }
F24J 2/06	..	having concentrating elements (optical elements or systems per se G02B)
F24J 2/062	...	{ Prisms }
F24J 2/065	...	{ Fluorescent material }
F24J 2/067	...	{ Light guides }
F24J 2/07	...	Receivers working at high temperature, e.g. for solar power plants
F24J 2/08	...	having lenses as concentrating elements
F24J 2/085	....	{ having discontinuous faces, e.g. Fresnel lenses }
F24J 2/10	...	having reflectors as concentrating elements
F24J 2/1047	....	{ having discontinuous faces }
F24J 2/1052	....	{ flexible (F24J 2/125 , F24J 2/145 take precedence) }
F24J 2/1057	....	{ characterised by the material or the construction of the reflector }
F24J 2/12	....	parabolic
F24J 2/125	.....	{ flexible }
F24J 2/13	....	hemispherical
F24J 2/14	....	semi-cylindrical or cylindro-parabolic
F24J 2/145	.....	{ flexible }
F24J 2/15	....	conical
F24J 2/16	....	having flat plates
F24J 2/18	....	spaced, opposed interacting reflecting surfaces
F24J 2/20	..	the working fluid being conveyed between plates
F24J 2/201	...	{ having conduits of plastic material }
F24J 2/202	...	{ having conduits formed by paired plates and internal partition means }
F24J 2/204	...	{ having conduits formed by paired plates, only one of which is plane }
F24J 2/205	...	{ having conduits formed by paired non-plane plates }
F24J 2/207	...	{ having curved plate-like conduits, e.g. semi-spherical }
F24J 2/208	...	{ having conduits formed by inflation of portions of a pair of joined sheets }
F24J 2/22	...	having extended surfaces, e.g. protrusions, corrugations (F24J 2/28 takes precedence)
F24J 2/23	..	the working fluid trickling freely { or flowing in a continuous film } over collector elements
F24J 2/24	..	the working fluid being conveyed through tubular heat absorbing conduits
F24J 2/242	...	{ the tubular conduits being integrated in a block; the tubular conduits touching each other }
F24J 2/243	...	{ the tubular conduits being of plastic material }
F24J 2/244	...	{ the tubular conduits are not fixed to heat absorbing plates and are not touching each other }
F24J 2/245	....	{ the conduits being parallel to each other }
F24J 2/246	....	{ the conduits being helically coiled }
F24J 2/247	....	{ the conduits being spirally coiled }
F24J 2/248	....	{ the conduits being otherwise bent, e.g. zig-zag }
F24J 2/26	...	having extended surfaces, e.g. protrusions (F24J 2/28 takes precedence)]
F24J 2/265	....	{ the conduits being parallel to each other }

- F24J 2/266 { the conduits being spirally coiled }
- F24J 2/268 { the conduits being otherwise bent, e.g. zig-zag }
- F24J 2/28 . . having permeable mass, foraminous or porous materials
- F24J 2/30 . . with means to exchange heat between plural fluids
- F24J 2/32 . . having evaporator and condenser section, e.g. heat pipe
- F24J 2/34 . . having heat storage mass
- F24J 2/345 . . . { Hot water storage }

- F24J 2/36 . Rollable or foldable collector units

- F24J 2/38 . employing tracking means ([F24J 2/02](#), [F24J 2/06](#) take precedence; direction- finders for determining the direction from which electromagnetic waves are being received [G01S 3/78](#) { , e.g. solar tracking systems [G01S 3/7861](#) }; control of position or direction [G05D 3/00](#) { , e.g. [G05D 3/105](#) })

- F24J 2/40 . Control arrangements; { Control of position for tracking [F24J 2/38](#) }
- F24J 2/402 . . { responsive to temperature }
- F24J 2/405 . . { responsive to wind }
- F24J 2/407 . . { for controlling transmission of solar radiation }

- F24J 2/42 . Solar heat systems not otherwise provided for { (solar heat systems in greenhouses [A01G 9/243](#); distillation by solar energy [C02F 1/14](#); devices for producing mechanical power from solar energy [F03G 6/00](#); central heat systems using heat solar energy [F24D 11/003](#), [F24D 11/007](#), [F24D 11/0221](#), [F24D 11/0264](#); domestic hot-water supply systems using solar energy [F24D 17/0015](#), [F24D 17/00F3](#), [F24D 17/0042](#), [F24D 17/0063](#); air-conditioning systems using solar energy [F24F 5/0046](#); refrigeration machines, plants or systems using solar energy [F25B 27/002](#); drying solid materials or objects by radiation, e.g. from the sun [F26B 3/28](#)) }

- F24J 2/423 . . { for swimming pools }
- F24J 2/426 . . { for showers }
- F24J 2/44 . . having thermosiphonic circulation

- F24J 2/46 . Component parts, details or accessories of solar heat collectors
- F24J 2/4607 . . { Safety or protection arrangements; Arrangements for preventing malfunction; Auxiliary devices, e.g. means for testing (control means [F24J 2/40](#)) }
- F24J 2/4609 . . . { Protective covers, lids; closure members ([F24J 2/50](#) takes precedence) }
- F24J 2/461 . . . { Means for cleaning or for removing snow }
- F24J 2/4612 . . . { Means for preventing corrosion or protecting against contaminants, e.g. preventing condensations }
- F24J 2/4614 { for draining rain water }
- F24J 2/4616 { for maintaining vacuum, e.g. by using getters }
- F24J 2/4618 { for preventing condensation }
- F24J 2/462 { for deaerating or degassing the working fluid }
- F24J 2/4621 . . . { Means for overtemperature protection (arrangements for draining the working fluid: [F24J 2/4634](#)); Means for overpressure protection }
- F24J 2/4623 { Arrangements for modifying heat collecting features, e.g. by defocusing or by changing the position of heat receiving elements }
- F24J 2/4625 { Cooling arrangements, e.g. by using external heat dissipating means or internal cooling circuits ([F24J 2/4627](#) takes precedence) }

F24J 2/4627	....	{ Arrangements for venting solar collector enclosures }
F24J 2/4629	....	{ Arrangements for preventing overpressure inside solar collector enclosures (F24J 2/4627 takes precedence) }
F24J 2/463	....	{ Arrangements for preventing overpressure inside solar collector circuits }
F24J 2/4632	...	{ Means for freezing protection (arrangements for draining the working fluid: F24J 2/4634) }
F24J 2/4634	...	{ Arrangements for draining the working fluid }
F24J 2/4636	...	{ Arrangements to accommodate differential expansion of solar collector elements }
F24J 2/4638	...	{ Arrangements for protecting solar collectors against adverse weather conditions (F24J 2/4609 takes precedence) }
F24J 2/464	..	{ Casings }
F24J 2/4641	...	{ characterised by using specific material }
F24J 2/4643	....	{ Plastic materials }
F24J 2/4645	....	{ Metallic materials }
F24J 2/4647	..	{ Means for fluidically interconnecting different solar collectors or for connecting solar connectors with other components; Headers; Fluid distributing means }
F24J 2/4649	..	{ Selection of particular working medium (materials for heat transfer C09K 5/00) }
F24J 2/465	..	{ Arrangements of sealing means }
F24J 2/4652	..	{ Solar heat collectors having absorber surfaces provided with special coatings, e.g. anti-reflective coatings }
F24J 2/4654	..	{ Materials for the heat-exchange conduits (F24J 2/201 , F24J 2/243 , F24J 2/48 take precedence) }
F24J 2/48	..	characterised by absorber material
F24J 2/481	...	{ of metallic material (F24J 2/487 takes precedence) }
F24J 2/482	...	{ of plastic (F24J 2/488 takes precedence) }
F24J 2/484	...	{ of ceramic; of concrete; of natural stone (F24J 2/485 takes precedence) }
F24J 2/485	...	{ using absorber coatings (radiation-absorbing paints C09D 5/32) }
F24J 2/487	....	{ of metallic material }
F24J 2/488	....	{ of plastic material }
F24J 2/50	..	Transparent coverings
F24J 2/505	...	{ characterised by using specific material }
F24J 2/506	....	{ plastic material }
F24J 2/507	...	{ using evacuated elements (F24J 2/05 takes precedence) }
F24J 2/51	..	Thermal insulation (F24J 2/50 takes precedence)
F24J 2/515	...	{ characterised by the material }
F24J 2/52	..	Arrangement of mountings or supports
F24J 2/5201	...	{ Stationary supporting structures for solar modules; Load-bearing elements for movable supporting structures }
F24J 2/5203	....	{ comprising elongated rigid mounting elements, e.g. mounting profiles or rails for covering a building surface with solar modules; Module frames (F24J 2/523 takes precedence) }
F24J 2/5205	.....	{ Substantially planar profile assemblies, e.g. grids comprising coplanar profiles or stacked profiles }
F24J 2/5207	.....	{ comprising profiles of particular shape having in cross-section first and second module supporting portions for coupling adjacent solar

		modules }
F24J 2/5209	.....	{ Substantially coplanar profile assemblies comprising longitudinal profiles laterally coupled with transversal profiles }
F24J 2/5211	.....	{ Solar module peripheral frames }
F24J 2/5228	....	{ comprising plate-like mounting elements, e.g. profiled or corrugated plates; Plate-like module frames (F24J 2/523 takes precedence) }
F24J 2/523	....	{ comprising elongated standing elements, e.g. posts, legs; Standing structures for supporting solar modules at defined orientation; Three-dimensional frameworks; Volumetric supporting structures, e.g. box-like elements or shaped bodies }
F24J 2/5232	.....	{ Posts coupled with upper profiles }
F24J 2/5233	.....	{ Profile arrangements, e.g. assemblies of base profiles with vertical or inclined profiles, three-dimensional frameworks (F24J 2/5232 takes precedence) }
F24J 2/5235	.....	{ comprising bent plates or assemblies of plates }
F24J 2/5237	.....	{ comprising shaped bodies, e.g. molded box-like elements, concrete elements, foamed elements; Massive supporting structures }
F24J 2/5239	.....	{ Interconnected assemblies of stands; Stands having first and second module supporting portions for coupling adjacent modules }
F24J 2/5241	....	{ comprising elongated non rigid elements, e.g. straps, wires, ropes }
F24J 2/5243	....	{ Fixation means, e.g. connectors or fasteners }
F24J 2/5245	.....	{ Connectors for anchoring solar modules or supporting elements to the ground or to building structures }
F24J 2/5247	.....	{ in the form of bent strips or assemblies of strips; Hook-like connectors; Connectors to be mounted between building covering elements }
F24J 2/5249	.....	{ for anchoring to protrusions of buildings, e.g. to corrugations or to standing seams }
F24J 2/525	.....	{ Ground anchoring means; Foundations for supporting elements; Massive elements for anchoring supporting structures to the ground or to flat horizontal surfaces }
F24J 2/5252	.....	{ Connectors for fixing solar modules, or solar module peripheral frames to supporting elements, e.g. to profiled mounting members }
F24J 2/5254	.....	{ Solar module side connectors or base connectors }
F24J 2/5256	.....	{ Clamping or clipping elements }
F24J 2/5258	.....	{ with clamping action by using screw-threaded elements }
F24J 2/526	.....	{ Connectors for coupling adjacent supporting elements together, e.g. profile to profile connectors }
F24J 2/5262	.....	{ Connectors for coupling adjacent solar modules or solar module peripheral frames together (F24J 2/5252 takes precedence) }
F24J 2/5264	....	{ comprising means for adjusting the final position or the final orientation of a supporting element relative to another one or relative to a mounting surface; comprising means for compensating mounting tolerances }
F24J 2/5266	...	{ adapted for non-rotary movement }
F24J 2/5267	...	{ Waterborne solar collectors }
F24J 2/5269	....	{ Moving platforms }
F24J 2/5271	...	{ Airborne solar collectors, e.g. using inflated structures (F24J 2/04B16C , F24J 2/5267 take precedence) }

- F24J 2/54 . . . specially adapted for rotary movement { ([F24J 2/5269](#) takes precedence) }
- F24J 2/5403 { with only one rotation axis }
- F24J 2/5406 { with vertical axis }
- F24J 2/541 { with horizontal axis }
- F24J 2/5413 { with inclined axis }
- F24J 2/5417 { with two rotation axis }
- F24J 2/542 { with vertical primary axis }
- F24J 2/5424 { with horizontal primary axis }
- F24J 2/5427 { with inclined primary axis }
- F24J 2/5431 { with more than two rotation axis or with multiple degrees of freedom }

F24J 3/00 **Other production or use of heat, not derived from combustion (use of solar heat [F24J 2/00](#))**

- F24J 3/003 . { using heat resulting from internal friction of a moving fluid or from friction between a fluid and a moving body }
- F24J 3/006 . . { the fluid passing through a restriction means }
- F24J 3/06 . using natural heat
- F24J 3/08 . . using geothermal heat
- F24J 3/081 . . . { by circulating a working fluid through underground channels, the working fluid not coming into direct contact with the ground }
- F24J 3/082 { Compact tube assemblies inserted into the ground, e.g. geothermal probes }
- F24J 3/083 { in the form of bent tubes or in the form of tubes assembled with connectors or with return headers }
- F24J 3/084 { in the form of tubes being closed at one end, i.e. return type }
- F24J 3/085 . . . { by injecting a working fluid directly into the ground or by using underground water, e.g. systems using injection and recovery wells }
- F24J 3/086 . . . { by injecting a working fluid into a closed well; by using intermediate working fluids, e.g. by using heat pipes }

F24J 2002/00 **Use of solar heat, e.g. solar heat collectors (distillation or evaporation of water using solar energy [C02F 1/14](#); devices for producing mechanical power from solar energy [F03G 6/00](#); semiconductor devices adapted for converting solar energy into electrical energy [H01L 25/00](#), [H01L 31/04](#); semiconductor devices including arrays of solar cells using heat energy [H01L 31/058](#); generators in which light radiation is directly converted into electrical energy [H02N 6/00](#))**

- F24J 2002/003 . Heat traps
- F24J 2002/0038 . Solar modules layout; Modular arrangements
- F24J 2002/0046 . . in the form of multiple rows and multiple columns, all solar modules being coplanar
- F24J 2002/0053 . . Coplanar arrangements with frame overlapping portions
- F24J 2002/0061 . . Overlaying arrangements similar to roof tiles
- F24J 2002/0069 . . Stepped arrangements, e.g. in parallel planes, without module overlapping
- F24J 2002/0076 . . Non-parallel arrangements

- F24J 2002/0084 . . Preventing shading effects
- F24J 2002/0092 . . Arrangements of solar thermal modules combined with solar PV modules

- F24J 2002/04 . Solar heat collectors having working fluid conveyed through collector
- F24J 2002/0405 . . having a particular shape, e.g. prismatic, pyramidal
- F24J 2002/0411 . . . in the form of louvers
- F24J 2002/0416 . . . allowing change of position for optimization of heat collection
- F24J 2002/06 . . having concentrating elements ([optical elements or systems per se G02B](#))
- F24J 2002/07 . . . Receivers working at high temperature, e.g. for solar power plants
- F24J 2002/075 movable or adjustable
- F24J 2002/10 . . . having reflectors as concentrating elements
- F24J 2002/1004 Special shape not covered by [F24J 2/1047](#) - [F24J 2/18](#)
- F24J 2002/1009 corrugated
- F24J 2002/1014 curved
- F24J 2002/1019 dish-shaped
- F24J 2002/1023 trough-shaped
- F24J 2002/1028 asymmetric
- F24J 2002/1033 spiral
- F24J 2002/1038 hyperbolic
- F24J 2002/1042 involutes
- F24J 2002/1061 Reflective elements inside solar collector casings
- F24J 2002/1066 Micro-reflectors
- F24J 2002/1071 in the form of reflective coatings
- F24J 2002/1076 Reflectors layout
- F24J 2002/108 Assemblies of spaced reflective elements on common support, e.g. Fresnel reflectors
- F24J 2002/1085 Reflectors formed by assemblies of adjacent similar reflective facets
- F24J 2002/109 Reflectors formed by assemblies of adjacent reflective elements having different orientation or different features
- F24J 2002/1095 Assemblies of spaced reflective elements in the form of grids, e.g. vertical or inclined reflective elements extending over heat absorbing elements

- F24J 2002/24 . . the working fluid being conveyed through tubular heat absorbing conduits
- F24J 2002/241 . . . the conduits having a non-circular cross-section
- F24J 2002/26 . . . having extended surfaces, e.g. protrusions ([F24J 2/28 takes precedence](#))]
- F24J 2002/261 Special fins
- F24J 2002/263 extending obliquely

- F24J 2002/38 . . employing tracking means ([F24J 2/02](#), [F24J 2/06](#) take precedence; [direction- finders for determining the direction from which electromagnetic waves are being received G01S 3/78 { , e.g. solar tracking systems G01S 3/7861 }](#); control of position or direction [G05D 3/00 { , e.g. G05D 3/105 }](#))
- F24J 2002/385 . . Calibration means; Methods for initial positioning of solar concentrators or solar receivers

- F24J 2002/46 . Component parts, details or accessories of solar heat collectors

F24J 2002/4601	..	Arrangements for heat transfer optimization
F24J 2002/4603	...	Flow guiding means; Inserts inside conduits
F24J 2002/4605	...	Arrangements for one-way heat transfer, e.g. thermal diodes
F24J 2002/4656	..	Arrangements for reinforcement of solar collector elements
F24J 2002/4658	..	Fastening; Joining
F24J 2002/4659	...	by using hook and loop-type fasteners
F24J 2002/4661	...	by using hooks
F24J 2002/4663	...	by clamping
F24J 2002/4665	...	by clipping, e.g. by using snap connectors
F24J 2002/4667	...	by screwed connection
F24J 2002/4669	...	by using threaded elements, e.g. stud bolts
F24J 2002/467	...	by using form-fitting connection means, e.g. tongue and groove
F24J 2002/4672	...	by using toothed elements
F24J 2002/4674	...	by deforming the material, e.g. by crimping or clinching
F24J 2002/4676	...	by bonding, e.g. by using adhesives
F24J 2002/4678	...	by welding or brazing
F24J 2002/4679	...	Joining different materials
F24J 2002/4681	....	Joining glass with non-glass elements
F24J 2002/4683	..	Selection of particular materials
F24J 2002/4685	...	Ceramics
F24J 2002/4687	...	Concrete
F24J 2002/4689	...	Foams
F24J 2002/469	...	Carbone, e.g. graphite
F24J 2002/4692	...	Plastics
F24J 2002/4694	...	Textiles; Fabrics
F24J 2002/4696	...	Natural materials, e.g. wood
F24J 2002/4698	...	Recycled materials
F24J 2002/50	..	Transparent coverings
F24J 2002/501	...	Special shape
F24J 2002/502	....	in the form of multiple covering elements
F24J 2002/503	....	in the form of curved covering elements
F24J 2002/508	...	Transparent insulation; Convection preventing members
F24J 2002/52	..	Arrangement of mountings or supports
F24J 2002/5201	...	{ Stationary supporting structures for solar modules; Load-bearing elements for movable supporting structures }
F24J 2002/5203	....	{ comprising elongated rigid mounting elements, e.g. mounting profiles or rails for covering a building surface with solar modules; Module frames (F24J 2/523 takes precedence) }
F24J 2002/5213	.....	Special profiles
F24J 2002/5215	.....	having hollow parts with closed cross-section
F24J 2002/5216	.....	having circular or oval cross-section
F24J 2002/5218	.....	having a central web, e.g. I-shaped, inverted T- shaped
F24J 2002/522	.....	U-, C- or O-shaped; Hat profiles

F24J 2002/5222	.....	in the form of corrugated profiles
F24J 2002/5224	.....	having curved portions
F24J 2002/5226	.....	having undercut grooves
F24J 2002/5273	...	Details; Special support components or methods
F24J 2002/5275	....	Arrangements for mounting elements inside solar collectors; Spacers inside solar collectors
F24J 2002/5277	....	Foldable support elements
F24J 2002/5279	....	Stackable support elements
F24J 2002/5281	....	Methods for installing support elements
F24J 2002/5283	....	Supports with play between elements
F24J 2002/5284	....	Filling or spacing means; Elastic means
F24J 2002/5286	....	Tensioning means
F24J 2002/5288	....	Means for preventing movements, e.g. stops
F24J 2002/529	....	Means for accommodating irregularities on mounting surface; Tolerance compensation means
F24J 2002/5292	....	Ballasting means
F24J 2002/5294	....	Sealing means between support elements and mounting surface
F24J 2002/5296	....	Sealing means between support elements, e.g. overlapping arrangements; Gap closing arrangements
F24J 2002/5298	....	Means for preventing theft; Locking means
F24J 2002/54	...	specifically adapted for rotary movement { (F24J 2/5269 takes precedence) }
F24J 2002/5434	....	Special components
F24J 2002/5437	.....	Driving means
F24J 2002/5441	.....	hydraulic or pneumatic
F24J 2002/5444	.....	Coupling means
F24J 2002/5448	.....	Transmissions
F24J 2002/5451	.....	in the form of articulated bars
F24J 2002/5455	.....	in the form of compasses, scissors or parallelograms
F24J 2002/5458	.....	in the form of flexible elements, e.g. belts, chains, ropes
F24J 2002/5462	.....	in the form of gearings or rack-and-pinion transmissions
F24J 2002/5465	.....	in the form of threaded elements
F24J 2002/5468	.....	for moving several solar collectors by common transmission elements
F24J 2002/5472	.....	for deriving one movement from another one, e.g. for deriving elevation movement from azimuth movement
F24J 2002/5475	.....	Movement guiding means
F24J 2002/5479	.....	Tracks
F24J 2002/5482	.....	Bearings
F24J 2002/5486	.....	Hinged elements; Pin connections
F24J 2002/5489	.....	Spherical joints
F24J 2002/5493	.....	Load balancing means, e.g. use of counter-weights
F24J 2002/5496	.....	Movement dampening means; Braking means

F24J 2003/00 **Other production or use of heat, not derived from combustion ([use of solar heat F24J 2/00](#))**

- F24J 2003/06 . . . using natural heat
- F24J 2003/08 using geothermal heat
- F24J 2003/087 Component parts, details or accessories
- F24J 2003/088 Methods for installation
- F24J 2003/089 Control arrangements

F24J 2200/00 Prediction; Simulation

- F24J 2200/04 . . . for solar techniques
- F24J 2200/06 . . . for geothermal techniques