

# CPC COOPERATIVE PATENT CLASSIFICATION

## F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

### ENGINES OR PUMPS

#### F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

#### F01N GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR MACHINES OR ENGINES IN GENERAL; GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR INTERNAL-COMBUSTION ENGINES (arrangements in connection with gas exhaust of propulsion units in vehicles [B60K 13/00](#); combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines [F02M 35/00](#); protecting against, or damping, noise in general [G10K 11/16](#))

##### NOTE

Attention is drawn to the notes preceding Class [F01](#), especially as regards Note 3.

##### WARNING

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

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| <p><b>1/00</b>     <b>Silencing apparatus characterised by method of silencing</b></p> <p><b>NOTE</b></p> <p>{In this main group, it is desirable to add the indexing codes of <a href="#">F01N 2210/00</a>, <a href="#">F01N 2230/00</a>, <a href="#">F01N 2290/00</a>, <a href="#">F01N 2310/00</a>, <a href="#">F01N 2450/06</a>, <a href="#">F01N 2470/00</a>, <a href="#">F01N 2490/00</a> and <a href="#">F01N 2590/00</a>.}</p> <p>1/003     . {by using dead chambers communicating with exhaust gas flow passages}</p> <p>1/006     . . {comprising at least one perforated tube extending from inlet to outlet of the silencer}</p> <p>1/02     . by using resonance</p> <p>1/023     . . {Helmholtz resonators}</p> <p>1/026     . . {Annular resonance chambers arranged concentrically to an exhaust passage and communicating with it, e.g. via at least one opening in the exhaust passage}</p> <p>1/04     . . having sound-absorbing materials in resonance chambers</p> <p>1/06     . by using interference effect</p> <p>1/065     . . {by using an active noise source, e.g. speakers}</p> <p>1/08     . by reducing exhaust energy by throttling or whirling</p> <p>1/081     . . {by passing the exhaust gases through a mass of particles}</p> <p>1/082     . . {by passing the exhaust gases through porous members}</p> <p>1/083     . . {using transversal baffles defining a tortuous path for the exhaust gases or successively throttling exhaust gas flow}</p> <p>1/084     . . {the exhaust gases flowing through the silencer two or more times longitudinally in opposite directions, e.g. using parallel or concentric tubes}</p> | <p>1/085     . . {throttling exhaust gas flow using a central core in a flow passage}</p> <p>1/086     . . {having means to impart a whirling motion to the exhaust gases (with helically or spirally shaped channels <a href="#">F01N 1/12</a>)}</p> <p>1/087     . . . {using tangential inlets into a circular chamber}</p> <p>1/088     . . . {using vanes arranged on the flow path or flow tubes with tangentially directed apertures}</p> <p>1/089     . . {using two or more expansion chambers in series (<a href="#">F01N 1/083</a>, <a href="#">F01N 1/084</a>, <a href="#">F01N 1/086</a> take precedence)}</p> <p>1/10     . . in combination with sound-absorbing materials (<a href="#">F01N 1/125</a> takes precedence)</p> <p>1/12     . . using spirally or helically shaped channels (cyclones <a href="#">B04C</a>)</p> <p>1/125     . . . {in combination with sound-absorbing materials}</p> <p>1/14     . by adding air to exhaust gases {(in tailpipes <a href="#">F01N 13/082</a>, <a href="#">F01N 13/20</a>)}</p> <p>1/16     . by using movable parts</p> <p>1/161     . . {for adjusting resonance or dead chambers or passages to resonance or dead chambers}</p> <p>1/163     . . . {by means of valves}</p> <p>1/165     . . {for adjusting flow area}</p> <p>1/166     . . {for changing the flow path through the silencer or for adjusting the dimensions of a chamber or a pipe (<a href="#">F01N 1/165</a> takes precedence)}</p> <p>1/168     . . {for controlling or modifying silencing characteristics only}</p> <p>1/18     . . having rotary movement</p> <p>1/20     . . having oscillating or vibrating movement {(the parts being resilient walls <a href="#">F01N 1/22</a>)}</p> <p>1/22     . . the parts being resilient walls</p> |
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- 1/24 . . . by using sound-absorbing materials ([F01N 1/04](#), [F01N 1/06](#), [F01N 1/10](#), [F01N 1/14](#), [F01N 1/16](#) take precedence)
- 3/00 Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust** (electric control [F01N 9/00](#); monitoring or diagnostic devices for exhaust-gas treatment apparatus [F01N 11/00](#))
- 3/005 . . {for draining or otherwise eliminating condensates or moisture accumulating in the apparatus ([F01N 3/02](#) takes precedence)}
- 3/01 . . by means of electric or electrostatic separators
- 3/02 . . for cooling, or for removing solid constituents of, exhaust (by means of electric or electrostatic separators [F01N 3/01](#) ; mixing air with exhaust in tailpipes [F01N 13/082](#), [F01N 13/20](#))
- 3/0205 . . {using heat exchangers}
- 3/021 . . by means of filters
- 3/0211 . . . {Arrangements for mounting filtering elements in housing, e.g. with means for compensating thermal expansion or vibration}
- 3/0212 . . . {with one or more perforated tubes surrounded by filtering material, e.g. filter candles}
- 3/0214 . . . {with filters comprising movable parts, e.g. rotating filters}
- 3/0215 . . . {the filtering elements having the form of disks or plates}
- 3/0217 . . . {the filtering elements having the form of hollow cylindrical bodies}
- 3/0218 . . . {the filtering elements being made from spirally-wound filtering material}
- 3/022 . . . characterised by specially adapted filtering structure, e.g. honeycomb, mesh or fibrous
- NOTE**
- {In this subgroup, it is desirable to add the indexing codes of [F01N 2330/00](#).}
- 3/0222 . . . . {the structure being monolithic, e.g. honeycombs}
- NOTE**
- {In this subgroup, it is desirable to add the indexing codes of [F01N 2330/30](#).}
- 3/0224 . . . . {the structure being granular}
- 3/0226 . . . . {the structure being fibrous}
- 3/0228 . . . . {the structure being made of foamed rubber or plastics}
- 3/023 . . . using means for regenerating the filters, e.g. by burning trapped particles
- 3/0231 . . . . {using special exhaust apparatus upstream of the filter for producing nitrogen dioxide, e.g. for continuous filter regeneration systems [CRT]}
- 3/0232 . . . . {removing incombustible material from a particle filter, e.g. ash}
- 3/0233 . . . . {periodically cleaning filter by blowing a gas through the filter in a direction opposite to exhaust flow, e.g. exposing filter to engine air intake}
- 3/0234 . . . . {using heat exchange means in the exhaust line}
- 3/0235 . . . . {using exhaust gas throttling means}
- 3/0236 . . . . {using turbine waste gate valve}
- 3/0237 . . . . {for regenerating ex situ}
- 3/0238 . . . . {for regenerating during engine standstill}
- 3/025 . . . . using fuel burner or by adding fuel to exhaust
- 3/0253 . . . . . {adding fuel to exhaust gases}
- 3/0256 . . . . . {the fuel being ignited by electrical means}
- 3/027 . . . . using electric or magnetic heating means
- 3/0275 . . . . . {using electric discharge means}
- 3/028 . . . . using microwaves
- 3/029 . . . . by adding non-fuel substances to exhaust
- 3/0293 . . . . . {injecting substances in exhaust stream}
- 3/0296 . . . . . {having means for preheating additional substances}
- 3/031 . . . having means for by-passing filters, e.g. when clogged or during cold engine start
- NOTE**
- {In this subgroup, it is desirable to add the indexing codes of [F01N 2410/00](#).}
- 3/032 . . . . during filter regeneration only
- 3/033 . . . in combination with other devices {(with adsorbents or absorbents [F01N 3/0821](#))}
- 3/0335 . . . . {with exhaust silencers in a single housing}
- 3/035 . . . . with catalytic reactors
- NOTE**
- {In this subgroup, it is desirable to add the indexing codes of [F01N 2510/06](#).}
- 3/037 . . . by means of inertial or centrifugal separators, e.g. of cyclone type, optionally combined or associated with agglomerators
- 3/038 . . . by means of perforated plates defining expansion chambers associated with condensation and collection chambers
- 3/04 . . . using liquids
- 3/043 . . . . {without contact between liquid and exhaust gases}
- 3/046 . . . . {Exhaust manifolds with cooling jacket}
- 3/05 . . . by means of air, e.g. by mixing exhaust with air (silencers working by addition of air to exhaust [F01N 1/14](#); arrangements for the supply of additional air for the thermal or catalytic conversion of noxious components of exhaust [F01N 3/30](#))
- 3/055 . . . . {without contact between air and exhaust gases}
- 3/06 . . . for extinguishing sparks
- 3/08 . . . for rendering innocuous (using electric or electrostatic separators [F01N 3/01](#); chemical aspects [B01D 53/92](#))
- 3/0807 . . . {by using absorbents or adsorbents}
- 3/0814 . . . . {combined with catalytic converters, e.g. NO<sub>x</sub> absorption/storage reduction catalysts}
- 3/0821 . . . . {combined with particulate filter}
- 3/0828 . . . . {characterised by the absorbed or adsorbed substances}
- 3/0835 . . . . {Hydrocarbons}
- 3/0842 . . . . {Nitrogen oxides}
- 3/085 . . . . {Sulfur or sulfur oxides}
- 3/0857 . . . . {Carbon oxides}
- 3/0864 . . . . {Oxygen}

- 3/0871 . . . {using means for controlling, e.g. purging, the absorbents or adsorbents}
- 3/0878 . . . {Bypassing absorbents or adsorbents}
- NOTE**
- {In this subgroup, it is desirable to add the indexing codes of [F01N 2410/00](#).}
- 3/0885 . . . {Regeneration of deteriorated absorbents or adsorbents, e.g. desulfurization of NOx traps}
- 3/0892 . . {Electric or magnetic treatment, e.g. dissociation of noxious components}
- 3/10 . . by thermal or catalytic conversion of noxious components of exhaust
- 3/101 . . . {Three-way catalysts}
- 3/103 . . . {Oxidation catalysts for HC and CO only}
- 3/105 . . . {General auxiliary catalysts, e.g. upstream or downstream of the main catalyst}
- 3/106 . . . {Auxiliary oxidation catalysts}
- 3/108 . . . {Auxiliary reduction catalysts}
- 3/18 . . . characterised by methods of operation; Control
- 3/20 . . . specially adapted for catalytic conversion ([F01N 3/22](#) takes precedence)
- 3/2006 . . . {Periodically heating or cooling catalytic reactors, e.g. at cold starting or overheating (by electrically controlling the supply of combustible mixture or its constituents only [F02D 41/0235](#))}
- 3/2013 . . . {using electric or magnetic heating means}
- 3/202 . . . {using microwaves}
- 3/2026 . . . {directly electrifying the catalyst substrate, i.e. heating the electrically conductive catalyst substrate by joule effect}
- 3/2033 . . . {using a fuel burner or introducing fuel into exhaust duct}
- 3/204 . . . {using an exhaust gas igniter, e.g. a spark or glow plug, without introducing fuel into exhaust duct}
- 3/2046 . . . {Periodically cooling catalytic reactors}
- 3/2053 . . . {By-passing catalytic reactors, e.g. to prevent overheating}

**NOTE**

{In this subgroup, it is desirable to add the indexing codes of [F01N 2410/00](#).}

- 3/206 . . . {Adding periodically or continuously substances to exhaust gases for promoting purification, e.g. catalytic material in liquid form, NOx reducing agents}
- 3/2066 . . . {Selective catalytic reduction [SCR]}

**NOTE**

{In this subgroup, it is desirable to add the indexing codes of [F01N 2610/00](#).}

- 3/2073 . . . {Means for generating a reducing substance from the exhaust gases}
- 3/208 . . . {Control of selective catalytic reduction [SCR], e.g. by adjusting the dosing of reducing agent}

- 3/2086 . . . {Activating the catalyst by light, photo-catalysts}
- 3/2093 . . . {Periodically blowing a gas through the converter, e.g. in a direction opposite to exhaust gas flow or by reversing exhaust gas flow direction}
- 3/22 . . . Control of additional air supply only, e.g. using by-passes or variable air pump drives
- 3/222 . . . {using electric valves only}
- 3/225 . . . {Electric control of additional air supply}
- 3/227 . . . {using pneumatically operated valves, e.g. membrane valves}
- 3/24 . . . characterised by constructional aspects of converting apparatus ([filtering in combination with catalytic reactors F01N 3/035](#))
- 3/26 . . . Construction of thermal reactors
- 3/28 . . . Construction of catalytic reactors
- 3/2803 . . . {characterised by structure, by material or by manufacturing of catalyst support}
- 3/2807 . . . {Metal other than sintered metal ([F01N 3/2832](#) and [F01N 3/2835](#) take precedence)}
- 3/281 . . . {Metallic honeycomb monoliths made of stacked or rolled sheets, foils or plates}
- 3/2814 . . . {all sheets, plates or foils being corrugated}
- 3/2817 . . . {only with non-corrugated sheets, plates or foils}
- 3/2821 . . . {the support being provided with means to enhance the mixing process inside the converter, e.g. sheets, plates or foils with protrusions or projections to create turbulence}
- 3/2825 . . . {Ceramics ([F01N 3/2832](#), [F01N 3/2835](#) take precedence)}
- 3/2828 . . . {Ceramic multi-channel monoliths, e.g. honeycombs}
- 3/2832 . . . {granular, e.g. pellets}
- 3/2835 . . . {fibrous}
- 3/2839 . . . {Arrangements for mounting catalyst support in housing, e.g. with means for compensating thermal expansion or vibration}

**NOTE**

{In this subgroup, it is desirable to add the indexing codes of [F01N 2350/02](#).}

- 3/2842 . . . {specially adapted for monolithic supports, e.g. of honeycomb type ([F01N 3/2853](#) - [F01N 3/2871](#) take precedence)}
- 3/2846 . . . {specially adapted for granular supports, e.g. pellets}
- 3/285 . . . {specially adapted for fibrous supports, e.g. held in place by screens}
- 3/2853 . . . {using mats or gaskets between catalyst body and housing}
- 3/2857 . . . {the mats or gaskets being at least partially made of intumescent material, e.g. unexpanded vermiculite}

- 3/286 . . . . . {the mats or gaskets having corrugations or cavities}
- 3/2864 . . . . . {the mats or gaskets comprising two or more insulation layers}
- 3/2867 . . . . . {the mats or gaskets being placed at the front or end face of catalyst body}
- 3/2871 . . . . . {the mats or gaskets having an additional, e.g. non-insulating or non-cushioning layer, a metal foil or an adhesive layer}
- 3/2875 . . . . . {by using elastic means, e.g. spring leaves, for retaining catalyst body in the housing ([F01N 3/2853](#) - [F01N 3/2871](#) take precedence)}
- 3/2878 . . . . . {by using non-elastic means for retaining catalyst body in the housing, e.g. a metal chamfer, or by corrugation or deformation of the metal housing}
- 3/2882 . . . . . {Catalytic reactors combined or associated with other devices, e.g. exhaust silencers or other exhaust purification devices ([combined with absorbents or adsorbents only F01N 3/0814](#); [combined with particulate filters F01N 3/035](#))}
- 3/2885 . . . . . {with exhaust silencers in a single housing}
- 3/2889 . . . . . {with heat exchangers in a single housing}
- 3/2892 . . . . . {Exhaust flow directors or the like, e.g. upstream of catalytic device}
- 3/2896 . . . . . {Liquid catalyst carrier}
- 3/30 . . . . . Arrangements for supply of additional air (control, e.g. using by-passes or variable air pump drives, [F01N 3/22](#))
- 3/303 . . . . . {Filtering additional air}
- 3/306 . . . . . {Preheating additional air}
- 3/32 . . . . . using air pump ([using jet air pumps F01N 3/34](#); [pumps in general F04](#))
- 3/323 . . . . . {Electrically driven air pumps}
- 3/326 . . . . . {Engine-driven air pumps}
- 3/34 . . . . . using air conduits or jet air pumps, e.g. near the engine exhaust port
- 3/36 . . . . . Arrangements for supply of additional fuel

**NOTE**

{In this subgroup, it is desirable to add the indexing codes of [F01N 2610/14](#).}

- 3/38 . . . . . Arrangements for igniting

**5/00 Exhaust or silencing apparatus combined or associated with devices profiting by exhaust energy (using kinetic or wave energy of exhaust gases in exhaust systems for charging [F02B](#))**

- 5/02 . the devices using heat
- 5/025 . . {the device being thermoelectric generators}
- 5/04 . the devices using kinetic energy

**9/00 Electrical control of exhaust gas treating apparatus (monitoring or diagnostic devices for exhaust-gas treatment apparatus [F01N 11/00](#); conjoint electrical control of two or more combustion engine functions [F02D 43/00](#))**

**NOTE**

{In this subgroup, it is desirable to add the indexing codes of [F01N 2900/00](#).}

- 9/002 . {of filter regeneration}
- 9/005 . {using models instead of sensors to determine operating characteristics of exhaust systems, e.g. calculating catalyst temperature instead of measuring it directly}
- 9/007 . {Storing data relevant to operation of exhaust systems for later retrieval and analysis, e.g. to research exhaust system malfunctions}

**11/00 Monitoring or diagnostic devices for exhaust-gas treatment apparatus**

**NOTE**

{In this subgroup, it is desirable to add the indexing codes of [F01N 2550/00](#) and [F01N 2900/00](#).}

- 11/002 . {the diagnostic devices measuring or estimating temperature or pressure in, or downstream of the exhaust apparatus}
- 11/005 . . {the temperature or pressure being estimated, e.g. by means of a theoretical model}
- 11/007 . {the diagnostic devices measuring oxygen or air concentration downstream of the exhaust apparatus}

**13/00 Exhaust or silencing apparatus characterised by constructional features**

- 13/001 . {Exhaust gas flow channels or chambers being at least partly formed in the structural parts of the engine or machine ([using structural parts of the vehicle B60K 13/06](#))}
- 13/002 . {Apparatus adapted for particular uses, e.g. for portable devices driven by machines or engines}
- 13/004 . {specially adapted for marine propulsion, i.e. for receiving simultaneously engine exhaust gases and engine cooling water ([for submerged exhausting F01N 13/12](#); [treating exhaust by using liquids F01N 3/04](#))}
- 13/005 . . {with parts constructed of non-metallic material, e.g. of rubber}
- 13/007 . {Apparatus used as intake or exhaust silencer}
- 13/008 . {Mounting or arrangement of exhaust sensors in or on exhaust apparatus ([sensor arrangements for engine control F02D 41/1439](#))}
- 13/009 . {having two or more separate purifying devices arranged in series}
- 13/0093 . . {the purifying devices are of the same type}
- 13/0097 . . {the purifying devices are arranged in a single housing}
- 13/011 . {having two or more purifying devices arranged in parallel}
- 13/017 . . {the purifying devices are arranged in a single housing}
- 13/02 . having two or more separate silencers in series
- 13/04 . having two or more silencers in parallel, e.g. having interconnections for multi-cylinder engines



13/06	. specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds	13/1866	. . . {the channels or tubes thereof being made integrally with the housing}
13/08	. Other arrangements or adaptations of exhaust conduits {(pipes, joints or supports therefor in general F16L; collecting or removing exhaust gases of vehicle engines in workshops B08B 15/00, on highways E01C 1/005)}	13/1872	. . {the assembly using stamp-formed parts or otherwise deformed sheet-metal}
13/082	. . {of tailpipe, e.g. with means for mixing air with exhaust for exhaust cooling, dilution or evacuation (F01N 13/20 takes precedence)}	13/1877	. . . {the channels or tubes thereof being made integrally with the housing}
13/085	. . {having means preventing foreign matter from entering exhaust conduit}	13/1883	. . {manufactured by hydroforming}
13/087	. . {having valves upstream of silencing apparatus for by-passing at least part of exhaust directly to atmosphere (valves for changing flow path through the silencer F01N 1/166)}	13/1888	. . {the housing of the assembly consisting of two or more parts, e.g. two half-shells}
13/10	. . of exhaust manifolds {(with cooling jacket F01N 3/046)}	13/1894	. . . {the parts being assembled in longitudinal direction}
13/102	. . . {having thermal insulation}	13/20	. having flared outlets, e.g. of fish-tail shape
13/105	. . . {having the form of a chamber directly connected to the cylinder head, e.g. without having tubes connected between cylinder head and chamber}	<b>99/00</b>	<b>Subject matter not provided for in other groups of this subclass</b>
13/107	. . . {More than one exhaust manifold or exhaust collector}	<b>Indexing scheme related to gas-flow silencers or exhaust apparatus</b>	
13/12	. specially adapted for submerged exhausting	<b>2210/00</b>	<b>Combination of methods of silencing</b>
13/14	. having thermal insulation {(exhaust manifolds F01N 13/102)}	2210/02	. Resonance and interference
13/141	. . {Double-walled exhaust pipes or housings}	2210/04	. Throttling-expansion and resonance
13/143	. . . {with air filling the space between both walls}	2210/06	. Throttling-expansion and interference
13/145	. . . {with a gas other than air filling the space between both walls}	<b>2230/00</b>	<b>Combination of silencers and other devices</b>
13/146	. . . {with vacuum in the space between both walls}	2230/02	. Exhaust filters
13/148	. . {Multiple layers of insulating material}	2230/04	. Catalytic converters
13/16	. Selection of particular materials	2230/06	. Spark arresters
13/18	. Construction facilitating manufacture, assembly, or disassembly	2230/08	. Thermal reactors
13/1805	. . {Fixing exhaust manifolds, exhaust pipes or pipe sections to each other, to engine or to vehicle body (pipe joints in general F16L; fixing auxiliaries in motor vehicles in general B60K)}	<b>2240/00</b>	<b>Combination or association of two or more different exhaust treating devices, or of at least one such device with an auxiliary device, not covered by indexing codes F01N 2230/00 or F01N 2250/00, one of the devices being</b>
13/1811	. . . {with means permitting relative movement, e.g. compensation of thermal expansion or vibration}	2240/02	. a heat exchanger
13/1816	. . . . {the pipe sections being joined together by flexible tubular elements only, e.g. using bellows or strip-wound pipes}	2240/04	. an electric, e.g. electrostatic, device other than a heater
13/1822	. . . . {for fixing exhaust pipes or devices to vehicle body}	2240/05	. a magnetic, e.g. electromagnetic, device other than a valve
13/1827	. . . {Sealings specially adapted for exhaust systems (sealings in general F16J 15/00)}	2240/06	. an inertial, e.g. centrifugal, device
13/1833	. . {specially adapted for small internal combustion engines, e.g. used in model applications}	2240/10	. a heat accumulator
13/1838	. . {characterised by the type of connection between parts of exhaust or silencing apparatus, e.g. between housing and tubes, between tubes and baffles}	2240/12	. a thermal reactor
13/1844	. . . {Mechanical joints}	2240/14	. a fuel burner
13/185	. . . . {the connection being realised by deforming housing, tube, baffle, plate, or parts thereof}	2240/16	. an electric heater, i.e. a resistance heater
13/1855	. . . . {the connection being realised by using bolts, screws, rivets or the like}	2240/18	. an adsorber or absorber
13/1861	. . {the assembly using parts formed by casting or moulding}	2240/20	. a flow director or deflector
		2240/22	. a condensation chamber
		2240/25	. an ammonia generator
		2240/26	. an exhaust gas reservoir, e.g. emission buffer
		2240/28	. a plasma reactor
		2240/30	. a fuel reformer
		2240/32	. a fuel cell
		2240/34	. an electrolyser
		2240/36	. an exhaust flap
		2240/38	. an ozone (O <sub>3</sub> ) generator, e.g. for adding ozone after generation of ozone from air
		2240/40	. a hydrolysis catalyst
		<b>2250/00</b>	<b>Combinations of different methods of purification</b>
		2250/02	. filtering and catalytic conversion
		2250/04	. afterburning and catalytic conversion
		2250/06	. afterburning and filtering
		2250/08	. filtering and inertial particulate separation
		2250/10	. cooling and filtering

- 2250/12 . . absorption or adsorption, and catalytic conversion
- 2250/14 . . absorption or adsorption, and filtering
- 2260/00 Exhaust treating devices having provisions not otherwise provided for**
- 2260/02 . . for cooling the device
- 2260/022 . . . using air
- 2260/024 . . . using a liquid
- 2260/04 . . for regeneration or reactivation, e.g. of catalyst
- 2260/06 . . for improving exhaust evacuation or circulation, or reducing back-pressure
- 2260/08 . . for preventing heat loss or temperature drop, using other means than layers of heat-insulating material
- 2260/10 . . for avoiding stress caused by expansions or contractions due to temperature variations
- 2260/12 . . for resisting high pressure
- 2260/14 . . for modifying or adapting flow area or back-pressure
- 2260/16 . . for reducing exhaust flow pulsations
- 2260/18 . . for improving rigidity, e.g. by wings, ribs
- 2260/20 . . for heat or sound protection, e.g. using a shield or specially shaped outer surface of exhaust device
- 2260/22 . . for preventing theft of exhaust parts or devices, e.g. anti-theft arrangements
- 2260/24 . . for identifying exhaust parts or devices, e.g. by labels, stickers or directly printing
- 2260/26 . . for preventing enter of dirt into the device
- 2270/00 Mixing air with exhaust gases**
- 2270/02 . . for cooling exhaust gases or the apparatus
- 2270/04 . . for afterburning
- 2270/06 . . for silencing
- 2270/08 . . for evacuation of exhaust gases, e.g. in tail-pipes
- 2270/10 . . for rendering exhaust innocuous, e.g. by dilution
- 2290/00 Movable parts or members in exhaust systems for other than for control purposes**
- 2290/02 . . with continuous rotary movement
- 2290/04 . . . driven by exhaust gases
- 2290/06 . . . driven by auxiliary drive
- 2290/08 . . with oscillating or vibrating movement
- 2290/10 . . . actuated by pressure of exhaust gases, e.g. exhaust pulses
- 2310/00 Selection of sound absorbing or insulating material**
- 2310/02 . . Mineral wool, e.g. glass wool, rock wool, asbestos or the like
- 2310/04 . . Metallic wool, e.g. steel wool, copper wool or the like
- 2310/06 . . Porous ceramics
- 2310/08 . . Exfoliated vermiculite, e.g. zonolite, coke, pumice
- 2310/10 . . Plastic foam
- 2310/12 . . Granular material
- 2310/14 . . Wire mesh fabric, woven glass cloth or the like
- 2330/00 Structure of catalyst support or particle filter**
- 2330/02 . . Metallic plates or honeycombs, e.g. superposed or rolled-up corrugated or otherwise deformed sheet metal
- 2330/04 . . . Methods of manufacturing
- 2330/06 . . Ceramic, e.g. monoliths
- 2330/08 . . Granular material
- 2330/10 . . Fibrous material, e.g. mineral or metallic wool
- 2330/101 . . . using binders, e.g. to form a permeable mat, paper or the like
- 2330/102 . . . fibrous material being fiber reinforced polymer made of plastic matrix reinforced by fine glass or in the form of a loose mass of filaments or fibers
- 2330/12 . . Metallic wire mesh fabric or knitting
- 2330/14 . . Sintered material
- 2330/18 . . Composite material
- 2330/20 . . Plastics, e.g. polymers, polyester, polyurethane
- 2330/22 . . Metal foam
- 2330/30 . . Honeycomb supports characterised by their structural details
- 2330/32 . . . characterised by the shape, form or number of corrugations of plates, sheets or foils
- 2330/321 . . . . with two or more different kinds of corrugations in the same substrate
- 2330/322 . . . . Corrugations of trapezoidal form
- 2330/323 . . . . Corrugations of saw-tooth or triangular form
- 2330/324 . . . . Corrugations of rectangular form
- 2330/325 . . . . Corrugations of omega form
- 2330/34 . . . with flow channels of polygonal cross section
- 2330/36 . . . with flow channels formed by tubes
- 2330/38 . . . flow channels with means to enhance flow mixing, (e.g. protrusions or projections)
- 2330/40 . . . made of a single sheet, foil or plate
- 2330/42 . . . made of three or more different sheets, foils or plates stacked one on the other
- 2330/44 . . . made of stacks of sheets, plates or foils that are folded in S-form
- 2330/48 . . . characterised by the number of flow passages, e.g. cell density
- 2330/60 . . Discontinuous, uneven properties of filter material, e.g. different material thickness along the longitudinal direction; Higher filter capacity upstream than downstream in same housing
- 2340/00 Dimensional characteristics of the exhaust system, e.g. length, diameter or volume of the exhaust apparatus; Spatial arrangements of exhaust apparatuses**
- 2340/02 . . Distance of the exhaust apparatus to the engine or between two exhaust apparatuses
- 2340/04 . . Arrangement of the exhaust system relative to a vehicle or parts thereof
- 2340/06 . . Arrangement of the exhaust apparatus relative to the turbine of a turbocharger
- 2340/08 . . Series-connected exhaust apparatuses mounted in a side-by-side spatial arrangement, e.g. U- or S-shaped
- 2350/00 Arrangements for fitting catalyst support or particle filter element in the housing**
- 2350/02 . . Fitting ceramic monoliths in a metallic housing
- 2350/04 . . . with means compensating thermal expansion
- 2350/06 . . . with means preventing gas flow by-pass or leakage
- 2350/08 . . with means for compressing granular material
- 2370/00 Selection of materials for exhaust purification**
- 2370/02 . . used in catalytic reactors
- 2370/04 . . . Zeolitic material
- 2370/22 . . used in non-catalytic purification apparatus
- 2370/24 . . . Zeolitic material
- 2370/30 . . . Materials having magnetic properties
- 2370/40 . . Activated carbon or charcoal

- 2390/00 Arrangements for controlling or regulating exhaust apparatus**
- 2390/02 . using electric components only
  - 2390/04 . using electropneumatic components
  - 2390/06 . using pneumatic components only
  - 2390/08 . using mechanical components only, e.g. actuated manually
- 2410/00 By-passing, at least partially, exhaust from inlet to outlet of apparatus, to atmosphere or to other device**
- 2410/02 . in case of high temperature, e.g. overheating of catalytic reactor
  - 2410/03 . in case of low temperature
  - 2410/04 . during regeneration period, e.g. of particle filter
  - 2410/06 . at cold starting
  - 2410/08 . in case of clogging, e.g. of particle filter
  - 2410/10 . for reducing flow resistance, e.g. to obtain more engine power
  - 2410/12 . in case of absorption, adsorption or desorption of exhaust gas constituents
  - 2410/14 . in case of excessive pressure, e.g. using a safety valve
- 2430/00 Influencing exhaust purification, e.g. starting of catalytic reaction, filter regeneration, or the like, by controlling engine operating characteristics**
- 2430/02 . by cutting out a part of engine cylinders
  - 2430/04 . by adding non-fuel substances to combustion air or fuel, e.g. additives
  - 2430/06 . by varying fuel-air ratio, e.g. by enriching fuel-air mixture
  - 2430/08 . by modifying ignition or injection timing
  - 2430/085 . . at least a part of the injection taking place during expansion or exhaust stroke
  - 2430/10 . by modifying inlet or exhaust valve timing
- 2450/00 Methods or apparatus for fitting, inserting or repairing different elements**
- 2450/02 . Fitting monolithic blocks into the housing
  - 2450/04 . Filling or emptying a chamber with granular material
  - 2450/06 . Inserting sound absorbing material into a chamber
  - 2450/08 . Repairing the housing or pipe-joints
  - 2450/10 . Fitting temporarily exhaust apparatus on exhaust conduit, e.g. in confined environment, garage or the like
  - 2450/16 . by using threaded joints
  - 2450/18 . by using quick-active type locking mechanisms, e.g. clips
  - 2450/20 . by mechanical joints, e.g. by deforming housing, tube, baffle plate or parts thereof
  - 2450/22 . by welding or brazing
  - 2450/24 . by bolts, screws, rivets or the like
  - 2450/26 . by bayonet fittings
  - 2450/28 . by using adhesive material, e.g. cement
  - 2450/30 . Removable or rechargeable blocks or cartridges, e.g. for filters
  - 2450/40 . Retrofitting exhaust apparatus
- 2470/00 Structure or shape of exhaust gas passages, pipes or tubes**
- 2470/02 . Tubes being perforated
  - 2470/04 . . characterised by shape, disposition or dimensions of apertures
  - 2470/06 . Tubes being formed by assembly of stamped or otherwise deformed sheet-metal
  - 2470/08 . Exhaust gas passages being formed between the walls of an outer shell and an inner chamber
  - 2470/10 . Tubes having non-circular cross section
  - 2470/12 . Tubes being corrugated
  - 2470/14 . Plurality of outlet tubes, e.g. in parallel or with different length
  - 2470/16 . Plurality of inlet tubes, e.g. discharging into different chambers
  - 2470/18 . the axis of inlet or outlet tubes being other than the longitudinal axis of apparatus
  - 2470/20 . Dimensional characteristics of tubes, e.g. length, diameter
  - 2470/22 . Inlet and outlet tubes being positioned on the same side of the apparatus
  - 2470/24 . Concentric tubes or tubes being concentric to housing, e.g. telescopically assembled
  - 2470/26 . Tubes being formed by extrusion, drawing or rolling
  - 2470/28 . Tubes being formed by moulding or casting x
  - 2470/30 . Tubes with restrictions, i.e. venturi or the like, e.g. for sucking air or measuring mass flow
- 2490/00 Structure, disposition or shape of gas-chambers**
- 2490/02 . Two or more expansion chambers in series connected by means of tubes
  - 2490/04 . . the gases flowing longitudinally from inlet to outlet only in one direction
  - 2490/06 . . the gases flowing longitudinally from inlet to outlet in opposite directions
  - 2490/08 . Two or more expansion chambers in series separated by apertured walls only
  - 2490/10 . Two or more expansion chambers in parallel
  - 2490/12 . Chambers having variable volumes
  - 2490/14 . Dead or resonance chambers connected to gas flow tube by relatively short side-tubes
  - 2490/15 . Plurality of resonance or dead chambers
  - 2490/155 . . being disposed one after the other in flow direction
  - 2490/16 . Chambers with particular shapes, e.g. spherical
  - 2490/18 . Dimensional characteristics of gas chambers
  - 2490/20 . Chambers being formed inside the exhaust pipe without enlargement of the cross section of the pipe, e.g. resonance chambers
- 2510/00 Surface coverings**
- 2510/02 . for thermal insulation
  - 2510/04 . for sound absorption
  - 2510/06 . for exhaust purification, e.g. catalytic reaction
  - 2510/061 . . usable with leaded fuels
  - 2510/063 . . zeolites
  - 2510/065 . . for reducing soot ignition temperature
  - 2510/067 . . usable with sulfurised fuels
  - 2510/068 . . characterised by the distribution of the catalytic coatings
  - 2510/0682 . . . having a discontinuous, uneven or partially overlapping coating of catalytic material, e.g. higher amount of material upstream than downstream or vice versa
  - 2510/0684 . . . having more than one coating layer, e.g. multi-layered coatings
  - 2510/08 . for corrosion prevention
  - 2510/10 . for preventing carbon deposits, e.g. chromium
  - 2510/12 . for smell removal

2510/14	. for dehydrating	2570/145	. . Dinitrogen oxide
<b>2530/00</b>	<b>Selection of materials for tubes, chambers or housings</b>	2570/16	. Oxygen
2530/02	. Corrosion resistive metals	2570/18	. Ammonia
2530/04	. . Steel alloys, e.g. stainless steel	2570/20	. Formaldehyde
2530/06	. Aluminium or alloys thereof	2570/22	. Water or humidity
2530/18	. Plastics material, e.g. polyester resin	2570/24	. Hydrogen sulfide (H <sub>2</sub> S)
2530/20	. . reinforced with mineral or metallic fibres	<b>2590/00</b>	<b>Exhaust or silencing apparatus adapted to particular use, e.g. for military applications, airplanes, submarines</b>
2530/22	. Flexible elastomeric material	2590/02	. for marine vessels or naval applications
2530/24	. Sintered porous material, e.g. bronze, aluminium or the like	2590/021	. . for outboard engines
2530/26	. Multi-layered walls	2590/022	. . for jetskis
<b>2550/00</b>	<b>Monitoring or diagnosing the deterioration of exhaust systems</b>	2590/04	. for motorcycles
2550/02	. Catalytic activity of catalytic converters	2590/06	. for hand-held tools or portables devices
2550/03	. of sorbing activity of adsorbents or absorbents	2590/08	. for heavy duty applications, e.g. trucks, buses, tractors, locomotives
2550/04	. Filtering activity of particulate filters	2590/10	. for stationary applications
2550/05	. Systems for adding substances into exhaust	2590/11	. for hybrid vehicles
2550/06	. By-pass systems	<b>2610/00</b>	<b>Adding substances to exhaust gases</b>
2550/10	. . of catalytic converters	2610/01	. the substance being catalytic material in liquid form
2550/12	. . of particulate filters	2610/02	. the substance being ammonia or urea
2550/14	. Systems for adding secondary air into exhaust	2610/03	. the substance being hydrocarbons, e.g. engine fuel
2550/20	. Monitoring artificially aged exhaust systems	2610/04	. the substance being hydrogen
2550/22	. of electric heaters for exhaust systems or their power supply	2610/05	. the substance being carbon monoxide
2550/24	. Determining the presence or absence of an exhaust treating device	2610/06	. the substance being in the gaseous form
<b>2560/00</b>	<b>Exhaust systems with means for detecting or measuring exhaust gas components or characteristics</b>	2610/08	. with prior mixing of the substances with a gas, e.g. air
2560/02	. the means being an exhaust gas sensor	2610/085	. . Controlling the air supply
2560/021	. . for measuring or detecting ammonia NH <sub>3</sub>	2610/10	. the substance being heated, e.g. by heating tank or supply line of the added substance
2560/022	. . for measuring or detecting CO or CO <sub>2</sub>	2610/102	. . after addition to exhaust gases, e.g. by a passively or actively heated surface in the exhaust conduit
2560/023	. . for measuring or detecting HC	2610/105	. . Control thereof
2560/024	. . for measuring or detecting hydrogen H <sub>2</sub>	2610/107	. . using glow plug heating elements
2560/025	. . for measuring or detecting O <sub>2</sub> , e.g. lambda sensors	2610/11	. the substance or part of the dosing system being cooled
2560/026	. . for measuring or detecting NOx	2610/12	. the substance being in solid form, e.g. pellets or powder
2560/027	. . for measuring or detecting SOx	2610/14	. Arrangements for the supply of substances, e.g. conduits
2560/028	. . for measuring or detecting humidity or water	2610/1406	. . Storage means for substances, e.g. tanks or reservoirs
2560/05	. the means being a particulate sensor	2610/1413	. . . Inlet and filling arrangements therefore
2560/06	. the means being a temperature sensor	2610/142	. . . Controlling the filling of the tank
2560/07	. the means being an exhaust gas flow rate or velocity meter or sensor, intake flow meters only when exclusively used to determine exhaust gas parameters	2610/1426	. . Filtration means
2560/08	. the means being a pressure sensor	2610/1433	. . Pumps
2560/12	. Other sensor principles, e.g. using electro conductivity of substrate or radio frequency	2610/144	. . . Control thereof
2560/14	. having more than one sensor of one kind	2610/1446	. . Means for damping of pressure fluctuations in the delivery system, e.g. by puffer volumes or throttling
2560/20	. Sensor having heating means	2610/1453	. . Sprayers or atomisers; Arrangement thereof in the exhaust apparatus
<b>2570/00</b>	<b>Exhaust treating apparatus eliminating, absorbing or adsorbing specific elements or compounds</b>	2610/146	. . . Control thereof, e.g. control of injectors or injection valves
2570/02	. Lead	2610/1466	. . Means for venting air out of conduits or tanks
2570/04	. Sulfur or sulfur oxides	2610/1473	. . Overflow or return means for the substances, e.g. conduits or valves for the return path
2570/06	. Zinc	2610/148	. . Arrangement of sensors
2570/08	. Phosphorus	2610/1486	. . Means to prevent the substance from freezing
2570/10	. Carbon or carbon oxides	2610/1493	. . Purging the reducing agent out of the conduits or nozzle
2570/12	. Hydrocarbons		
2570/14	. Nitrogen oxides		



<b>2900/00</b>	<b>Details of electrical control or of the monitoring of the exhaust gas treating apparatus</b>	<b>2900/1824</b>	<b>. . . . Properties of the air to be mixed with added substances, e.g. air pressure or air temperature</b>
2900/04	. Methods of control or diagnosing		
2900/0402	. . using adaptive learning		
2900/0404	. . using a data filter		
2900/0406	. . using a model with a division of the catalyst or filter in several cells		
2900/0408	. . using a feed-back loop		
2900/0411	. . using a feed-forward control		
2900/0412	. . using pre-calibrated maps, tables or charts		
2900/0414	. . using a state observer		
2900/0416	. . using the state of a sensor, e.g. of an exhaust gas sensor		
2900/0418	. . using integration or an accumulated value within an elapsed period		
2900/0421	. . using an increment counter when a predetermined event occurs		
2900/0422	. . measuring the elapsed time		
2900/06	. Parameters used for exhaust control or diagnosing		
2900/0601	. . being estimated		
2900/0602	. . Electrical exhaust heater signals		
2900/08	. . said parameters being related to the engine		
2900/10	. . said parameters being related to the vehicle or its components		
2900/102	. . . Travelling distance		
2900/104	. . . Battery status		
2900/12	. . said parameters being related to the vehicle exterior		
2900/14	. . said parameters being related to the exhaust gas		
2900/1402	. . . Exhaust gas composition		
2900/1404	. . . Exhaust gas temperature		
2900/1406	. . . Exhaust gas pressure		
2900/1411	. . . Exhaust gas flow rate, e.g. mass flow rate or volumetric flow rate		
2900/16	. . said parameters being related to the exhaust apparatus, e.g. particulate filter or catalyst		
2900/1602	. . . Temperature of exhaust gas apparatus		
2900/1606	. . . Particle filter loading or soot amount		
2900/1611	. . . Particle filter ash amount		
2900/1612	. . . SOx amount trapped in catalyst		
2900/1614	. . . NOx amount trapped in catalyst		
2900/1616	. . . NH <sub>3</sub> -slip from catalyst		
2900/1618	. . . HC-slip from catalyst		
2900/1621	. . . Catalyst conversion efficiency		
2900/1622	. . . Catalyst reducing agent absorption capacity or consumption amount		
2900/1624	. . . Catalyst oxygen storage capacity		
2900/1626	. . . Catalyst activation temperature		
2900/1628	. . . Moisture amount in exhaust apparatus		
2900/1631	. . . Heat amount provided to exhaust apparatus		
2900/18	. . said parameters being related to the system for adding a substance into the exhaust		
2900/1804	. . . Properties of secondary air added directly to the exhaust		
2900/1806	. . . Properties of reducing agent or dosing system		
2900/1808	. . . . Pressure		
2900/1811	. . . . Temperature		
2900/1812	. . . . Flow rate		
2900/1814	. . . . Tank level		
2900/1818	. . . . Concentration of the reducing agent		
2900/1821	. . . . Injector parameters		
2900/1822	. . . . Pump parameters		