

# CPC COOPERATIVE PATENT CLASSIFICATION

**F01N** **GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR MACHINES OR ENGINES IN GENERAL; GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR INTERNAL COMBUSTION ENGINES** ({[evacuation of fumes from the area where they are produced B08B 15/00](#); [arrangement of exhaust or silencing apparatus on percussive tools B25D 17/12](#)} ; [arrangements in connection with gas exhaust of propulsion units in vehicles B60K 13/00](#), {[on ships or other waterborne vessels B63H 21/32](#), [on aircraft B64D 33/04](#); [arrangement of exhaust or silencing apparatus on firearms F41A 21/30](#); [ground installations for reducing aircraft engine or jet noise B64F 1/26](#); [silencers specially adapted for steam engines F01B 31/16](#); [air-intake silencers for gas turbine or jet propulsion plants F02C 7/045](#); [jet pipe or nozzles for jet propulsion plants F02K](#)} ; [combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines F02M 35/00](#); {[combating noise or silencing in positive displacement machines or pumps F04B 39/0027](#), [in rotary-piston machines or pumps F04C 29/06](#), [in non-positive displacement pumps F04D 29/66](#); [means in valves for absorbing noise F16K 47/02](#); [noise absorbers in pipe system F16L 55/02](#); [conducting smoke or fumes from various locations to the outside F23J 11/00](#); [means for preventing or suppressing noise in air-conditioning or ventilation systems F24F 13/24](#)} ; [protecting against, or damping, noise in general G10K 11/16](#))

## NOTE

Attention is drawn to the notes preceding Class [F01](#), especially as regards Note 2(b).

1/00	<b>Silencing apparatus characterised by method of silencing</b> {(by cooling <a href="#">F01N 3/02</a> ; using liquids <a href="#">F01N 3/04</a> )}	1/088	. . . {using vanes arranged on gas flow path or gas flow tubes with tangentially directed apertures}
1/003	. {by using dead chambers communicating with gas flow passages (resonance chambers <a href="#">F01N 1/02</a> ; chambers containing sound-absorbing materials <a href="#">F01N 1/24</a> )}	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)}
1/006	. . {comprising at least one perforated tube extending from inlet to outlet of the silencer}	1/10	. . in combination with sound-absorbing materials ( <a href="#">F01N 1/125</a> takes precedence)
1/02	. by using resonance	1/12	. . using spirally or helically shaped channels (cyclones <a href="#">B04C</a> )
1/023	. . {Helmholtz resonators}	1/125	. . . {in combination with sound-absorbing materials}
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}	1/14	. by adding air to exhaust gases {(in tailpipes <a href="#">F01N 13/082</a> , <a href="#">F01N 13/20</a> )}
1/04	. . having sound-absorbing materials in resonance chambers	1/16	. by using movable parts
1/06	. by using interference effect	1/161	. . {for adjusting resonance or dead chambers or passages to resonance or dead chambers}
1/065	. . {by using an active noise source, e.g. speakers}	1/163	. . . {by means of valves}
1/08	. by reducing exhaust energy by throttling or whirling	1/165	. . {for adjusting flow area}
1/081	. . {by passing the gases through a mass of particles}	1/166	. . {for changing gas flow path through the silencer or for adjusting the dimensions of a chamber or a pipe ( <a href="#">F01N 1/165</a> takes precedence)}
1/082	. . {the gases passing through porous members ( <a href="#">F01N 1/081</a> takes precedence)}	1/168	. . {for controlling or modifying silencing characteristics only}
1/083	. . {using transversal baffles defining a tortuous path for the gases or successively throttling gas flow}	1/18	. . having rotary movement
1/084	. . {the gases flowing through the silencer two or more times longitudinally in opposite directions, e.g. using parallel or concentric tubes}	1/20	. . having oscillating or vibrating movement {(the parts being resilient walls <a href="#">F01N 1/22</a> )}
1/085	. . {using a central core throttling gas passage}	1/22	. . the parts being resilient walls
1/086	. . {having means to impart whirling motion to the gases (with helically or spirally shaped channels <a href="#">F01N 1/12</a> )}	1/24	. by using sound-absorbing materials ( <a href="#">F01N 1/04</a> , <a href="#">F01N 1/06</a> , <a href="#">F01N 1/10</a> , <a href="#">F01N 1/14</a> , <a href="#">F01N 1/16</a> take precedence)
1/087	. . . {using tangential inlets into a circular chamber}		

<b>3/00</b>	<b>Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust</b> (electric control <a href="#">F01N 9/00</a> ; monitoring or diagnostic devices for exhaust-gas treatment apparatus <a href="#">F01N 11/00</a> ; {collecting or removing exhaust gases of vehicle engines in workshops <a href="#">B08B 15/00</a> , on highways <a href="#">E01C 1/005</a> })	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}
3/005	. {for draining or otherwise eliminating condensates or moisture accumulating in the apparatus ( <a href="#">F01N 3/02</a> takes precedence)}	3/031	. . . having means for by-passing filters, e.g. when clogged or during cold engine start
3/01	. by means of electric or electrostatic separators	3/032	. . . . . during filter regeneration only
3/02	. for cooling, or for removing solid constituents of, exhaust (by means of electric or electrostatic separators <a href="#">F01N 3/01</a> ; mixing air with exhaust in tailpipes <a href="#">F01N 13/082</a> , <a href="#">F01N 13/20</a> )	3/033	. . . in combination with other devices {(with adsorbents or absorbents <a href="#">F01N 3/0821</a> )}
3/0205	. . {using heat exchangers}	3/0335	. . . . . {with exhaust silencers in a single housing}
3/021	. . by means of filters	3/035	. . . . . with catalytic reactors, {e.g. catalysed diesel particulate filters}
3/0211	. . . {Arrangements for mounting filtering elements in housing, e.g. with means for compensating thermal expansion or vibration}	3/037	. . by means of inertial or centrifugal separators, e.g. of cyclone type, optionally combined or associated with agglomerators
3/0212	. . . {with one or more perforated tubes surrounded by filtering material, e.g. filter candles}	3/038	. . by means of perforated plates defining expansion chambers associated with condensation and collection chambers, e.g. for adiabatic expansion of gases and subsequent collection of condensed liquids
3/0214	. . . {with filters comprising movable parts, e.g. rotating filters}	3/04	. . using liquids
3/0215	. . . {the filtering elements having the form of disks or plates}	3/043	. . . {without contact between liquid and exhaust gases}
3/0217	. . . {the filtering elements having the form of hollow cylindrical bodies}	3/046	. . . . . {Exhaust manifolds with cooling jacket}
3/0218	. . . {the filtering elements being made from spirally-wound filtering material}	3/05	. . by means of air, e.g. by mixing exhaust with air (silencers working by addition of air to exhaust <a href="#">F01N 1/14</a> ; arrangements for the supply of additional air for the thermal or catalytic conversion of noxious components of exhaust <a href="#">F01N 3/30</a> ; {in tailpipes <a href="#">F01N 13/082</a> })
3/022	. . . characterised by specially adapted filtering structure, e.g. honeycomb, mesh or fibrous	3/055	. . . {without contact between air and exhaust gases}
3/0222	. . . . {the structure being monolithic, e.g. honeycombs}	3/06	. for extinguishing sparks
3/0224	. . . . {the structure being granular}	3/08	. for rendering innocuous (using electric or electrostatic separators <a href="#">F01N 3/01</a> ; chemical aspects <a href="#">B01D 53/92</a> )
3/0226	. . . . {the structure being fibrous}	3/0807	. . {by using absorbents or adsorbents}
3/0228	. . . . {the structure being made of foamed rubber or plastics}	3/0814	. . . {combined with catalytic converters, e.g. NOx absorption/storage reduction catalysts}
3/023	. . . using means for regenerating the filters, e.g. by burning trapped particles (by electrically controlling the supply of combustible mixture or its constituents only <a href="#">F02D 41/0235</a> )	3/0821	. . . {combined with particulate filters (catalysed diesel particulate filters <a href="#">F01N 3/035</a> )}
3/0231	. . . . {using special exhaust apparatus upstream of the filter for producing nitrogen dioxide, e.g. for continuous filter regeneration systems [CRT]}	3/0828	. . . {characterised by the absorbed or adsorbed substances}
3/0232	. . . . {removing incombustible material from a particle filter, e.g. ash}	3/0835	. . . . . {Hydrocarbons}
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}	3/0842	. . . . . {Nitrogen oxides}
3/0234	. . . . {using heat exchange means in the exhaust line}	3/085	. . . . . {Sulfur or sulfur oxides}
3/0235	. . . . {using exhaust gas throttling means}	3/0857	. . . . . {Carbon oxides}
3/0236	. . . . {using turbine waste gate valve}	3/0864	. . . . . {Oxygen}
3/0237	. . . . {for regenerating ex situ}	3/0871	. . . {Regulation of absorbents or adsorbents, e.g. purging (by electrically controlling the supply of combustible mixture or its constituents only <a href="#">F02D 41/0235</a> )}
3/0238	. . . . {for regenerating during engine standstill}	3/0878	. . . . . {Bypassing absorbents or adsorbents}
3/025	. . . . using fuel burner or by adding fuel to exhaust	3/0885	. . . . {Regeneration of deteriorated absorbents or adsorbents, e.g. desulfurization of NOx traps}
3/0253	. . . . . {adding fuel to exhaust gases}	3/0892	. . {Electric or magnetic treatment, e.g. dissociation of noxious components (electric filters <a href="#">F01N 3/01</a> ; regeneration of exhaust filters <a href="#">F01N 3/023</a> ; heating catalytic converters <a href="#">F01N 3/2006</a> )}
3/0256	. . . . . {the fuel being ignited by electrical means}		
3/027	. . . . using electric or magnetic heating means		

- 3/10 . . . by thermal or catalytic conversion of noxious components of exhaust (by using other chemical processes, chemical aspects of catalytic conversion, e.g. using specified catalysts, [B01D 53/34](#))
- 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; Regulation
- 3/20 . . . . specially adapted for catalytic conversion; {Methods of operation or regulation of catalytic converters} ([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}
- 3/206 . . . . . {Adding periodically or continuously substances to exhaust gases for promoting purification, e.g. catalytic material in liquid form, NO<sub>x</sub> reducing agents ([F01N 3/2066](#) takes precedence)}
- 3/2066 . . . . . {Selective catalytic reduction [SCR]}
- 3/2073 . . . . . {with means for generating a reducing substance from the exhaust gases}
- 3/208 . . . . . {Control of selective catalytic reduction [SCR], e.g. 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 . . . . Regulation 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}
- 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 <a href="#">F01N 3/0814</a> ; combined with particulate filters <a href="#">F01N 3/035</a> )}	11/007	. {the diagnostic devices measuring oxygen or air concentration downstream of the exhaust apparatus}
3/2885	. . . . . {with exhaust silencers in a single housing}	<b>13/00</b>	<b>Exhaust or silencing apparatus characterised by constructional features; {Exhaust or silencing apparatus, or parts thereof, having pertinent characteristics not provided for in, or of interest apart from, groups <a href="#">F01N 1/00</a> - <a href="#">F01N 5/00</a>, <a href="#">F01N 9/00</a>, <a href="#">F01N 11/00</a>}</b>
3/2889	. . . . . {with heat exchangers in a single housing}	13/001	. {Gas flow channels or gas chambers being at least partly formed in the structural parts of the engine or machine (using structural parts of the vehicle <a href="#">B60K 13/06</a> )}
3/2892	. . . . . {Exhaust flow directors or the like, e.g. upstream of catalytic device}	13/002	. {Apparatus adapted for particular uses, e.g. for portable devices driven by machines or engines}
3/2896	. . . . . {Liquid catalyst carrier}	13/004	. {specially adapted for marine propulsion, i.e. for receiving simultaneously engine exhaust gases and engine cooling water (for submerged exhausting <a href="#">F01N 13/12</a> ; treating exhaust by using liquids <a href="#">F01N 3/04</a> )}
3/30	. . . . . Arrangements for supply of additional air (regulation, e.g. using air by-passes or variable air pump drives <a href="#">F01N 3/22</a> )	13/005	. . {with parts constructed of non-metallic material, e.g. of rubber}
3/303	. . . . . {Filtering additional air}	13/007	. {Apparatus used as intake or exhaust silencer (silencing methods <a href="#">F01N 1/00</a> ; intake silencers <a href="#">F02M 35/12</a> )}
3/306	. . . . . {Preheating additional air}	13/008	. {Mounting or arrangement of exhaust sensors in or on exhaust apparatus (sensor arrangements for engine control <a href="#">F02D 41/1439</a> )}
3/32	. . . . . using air pump (using jet air pumps <a href="#">F01N 3/34</a> ; pumps in general <a href="#">F04</a> )	13/009	. {having two or more separate purifying devices arranged in series}
3/323	. . . . . {Electrically driven air pumps}	13/0093	. . {the purifying devices are of the same type}
3/326	. . . . . {Engine-driven air pumps}	13/0097	. . {the purifying devices are arranged in a single housing}
3/34	. . . . . using air conduits or jet air pumps, e.g. near the engine exhaust port	13/011	. {having two or more purifying devices arranged in parallel}
3/36	. . . . . Arrangements for supply of additional fuel	13/017	. . {the purifying devices are arranged in a single housing}
3/38	. . . . . Arrangements for igniting	13/02	. having two or more separate silencers in series
<b>5/00</b>	<b>Exhaust or silencing apparatus combined or associated with devices profiting from exhaust energy (using kinetic or wave energy of exhaust gases in exhaust systems for charging <a href="#">F02B</a>; predominant aspects of such devices, see the relevant classes for the devices)</b>	13/04	. having two or more silencers in parallel, e.g. having interconnections for multi-cylinder engines
5/02	. the devices using heat	13/06	. specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds
5/025	. . {the device being thermoelectric generators}	13/08	. Other arrangements or adaptations of exhaust conduits {(pipes, joints or supports therefor in general <a href="#">F16L</a> ; collecting or removing exhaust gases of vehicle engines in workshops <a href="#">B08B 15/00</a> , on highways <a href="#">E01C 1/005</a> )}
5/04	. the devices using kinetic energy	13/082	. . {of tailpipe, e.g. with means for mixing air with exhaust for exhaust cooling, dilution or evacuation ( <a href="#">F01N 13/20</a> takes precedence)}
<b>9/00</b>	<b>Electrical control of exhaust gas treating apparatus (monitoring or diagnostic devices for exhaust-gas treatment apparatus <a href="#">F01N 11/00</a>; {electrical control of supply of combustible mixture or its constituents in relation with the state of the exhaust gas treating apparatus <a href="#">F02D 41/0235</a>} ; controlling combustion engines conjoint electrical control of two or more combustion engine functions <a href="#">F02D 43/00</a>)}</b>	13/085	. . {having means preventing foreign matter from entering exhaust conduit}
9/002	. {of filter regeneration, e.g. detection of clogging}	13/087	. . {having valves upstream of silencing apparatus for by-passing at least part of exhaust directly to atmosphere (valves for changing gas flow path through the silencer <a href="#">F01N 1/166</a> )}
9/005	. {using models instead of sensors to determine operating characteristics of exhaust systems, e.g. calculating catalyst temperature instead of measuring it directly}	13/10	. . of exhaust manifolds {(with cooling jacket <a href="#">F01N 3/046</a> )}
9/007	. {Storing data relevant to operation of exhaust systems for later retrieval and analysis, e.g. to research exhaust system malfunctions}	13/102	. . . {having thermal insulation}
<b>11/00</b>	<b>Monitoring or diagnostic devices for exhaust-gas treatment apparatus, {e.g. for catalytic activity (safety, indicating or supervising devices for internal combustion engines <a href="#">F02B 77/08</a>; testing of machines <a href="#">G01M 13/00</a>)}</b>	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}
11/002	. {the diagnostic devices measuring or estimating temperature or pressure in, or downstream of the exhaust apparatus}	13/107	. . . {More than one exhaust manifold or exhaust collector}
11/005	. . {the temperature or pressure being estimated, e.g. by means of a theoretical model}		



13/12	. specially adapted for submerged exhausting	<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 <a href="#">F01N 2230/00</a> or <a href="#">F01N 2250/00</a>, one of the devices being</b>
13/14	. having thermal insulation {( <a href="#">exhaust manifolds F01N 13/102</a> )}	2240/02	. a heat exchanger
13/141	. . {Double-walled exhaust pipes or housings}	2240/04	. an electric, e.g. electrostatic, device other than a heater
13/143	. . . {with air filling the space between both walls}	2240/05	. a magnetic, e.g. electromagnetic, device other than a valve
13/145	. . . {with gas other than air filling the space between both walls}	2240/06	. an inertial, e.g. centrifugal, device
13/146	. . . {with vacuum in the space between both walls}	2240/10	. a heat accumulator
13/148	. . {Multiple layers of insulating material}	2240/12	. a thermal reactor
13/16	. Selection of particular materials	2240/14	. a fuel burner
13/18	. Construction facilitating manufacture, assembly, or disassembly	2240/16	. an electric heater, i.e. a resistance heater
13/1805	. . {Fixing exhaust manifolds, exhaust pipes or pipe sections to each other, to engine or to vehicle body ( <a href="#">pipe joints in general F16L</a> ; <a href="#">fixing auxiliaries in motor vehicles in general B60K</a> )}	2240/18	. an adsorber or absorber
13/1811	. . . {with means permitting relative movement, e.g. compensation of thermal expansion or vibration}	2240/20	. a flow director or deflector
13/1816	. . . . {the pipe sections being joined together by flexible tubular elements only, e.g. using bellows or strip-wound pipes}	2240/22	. a condensation chamber
13/1822	. . . . {for fixing exhaust pipes or devices to vehicle body}	2240/25	. an ammonia generator
13/1827	. . . {Sealings specially adapted for exhaust systems ( <a href="#">sealings in general F16J 15/00</a> )}	2240/26	. an exhaust gas reservoir, e.g. emission buffer
13/1833	. . {specially adapted for small internal combustion engines, e.g. used in model applications}	2240/28	. a plasma reactor
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}	2240/30	. a fuel reformer
13/1844	. . . {Mechanical joints}	2240/32	. a fuel cell
13/185	. . . . {the connection being realised by deforming housing, tube, baffle, plate, or parts thereof}	2240/34	. an electrolyser
13/1855	. . . . {the connection being realised by using bolts, screws, rivets or the like}	2240/36	. an exhaust flap
13/1861	. . {the assembly using parts formed by casting or moulding}	2240/38	. an ozone (O <sub>3</sub> ) generator, e.g. for adding ozone after generation of ozone from air
13/1866	. . . {the channels or tubes thereof being made integrally with the housing}	2240/40	. a hydrolysis catalyst
13/1872	. . {the assembly using stamp-formed parts or otherwise deformed sheet-metal}	<b>2250/00</b>	<b>Combinations of different methods of purification</b>
13/1877	. . . {the channels or tubes thereof being made integrally with the housing}	2250/02	. filtering and catalytic conversion
13/1883	. . {manufactured by hydroforming}	2250/04	. afterburning and catalytic conversion
13/1888	. . {the housing of the assembly consisting of two or more parts, e.g. two half-shells}	2250/06	. afterburning and filtering
13/1894	. . . {the parts being assembled in longitudinal direction}	2250/08	. filtering and inertial particulate separation
13/20	. having flared outlets, e.g. of fish-tail shape	2250/10	. cooling and filtering
<b>2210/00</b>	<b>Combination of methods of silencing</b>	2250/12	. absorption or adsorption, and catalytic conversion
2210/02	. Resonance and interference	2250/14	. absorption or adsorption, and filtering
2210/04	. Throttling-expansion and resonance	<b>2260/00</b>	<b>Exhaust treating devices having provisions not otherwise provided for</b>
2210/06	. Throttling-expansion and interference	2260/02	. for cooling the device
<b>2230/00</b>	<b>Combination of silencers and other devices</b>	2260/022	. . using air
2230/02	. Exhaust filters	2260/024	. . using a liquid
2230/04	. Catalytic converters	2260/04	. for regeneration or reactivation, e.g. of catalyst
2230/06	. Spark arresters	2260/06	. for improving exhaust evacuation or circulation, or reducing back-pressure
2230/08	. Thermal reactors	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
		<b>2270/00</b>	<b>Mixing air with exhaust gases</b>

- 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 apparatus; Spatial arrangements of exhaust apparatuses**
- 2340/02 . characterised by the distance of the apparatus to the engine, or the distance between two exhaust treating apparatuses
- 2340/04 . characterised by the arrangement of an exhaust pipe, manifold or apparatus in relation to vehicle frame or particular vehicle parts
- 2340/06 . characterised by the arrangement of the exhaust apparatus relative to the turbine of a turbocharger
- 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 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 . 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
- 2530/00 Selection of materials for tubes, chambers or housings**
- 2530/02 . Corrosion resistive metals
- 2530/04 . . Steel alloys, e.g. stainless steel
- 2530/06 . Aluminium or alloys thereof
- 2530/18 . Plastics material, e.g. polyester resin
- 2530/20 . . reinforced with mineral or metallic fibres
- 2530/22 . Flexible elastomeric material
- 2530/24 . Sintered porous material, e.g. bronze, aluminium or the like
- 2530/26 . Multi-layered walls
- 2550/00 Monitoring or diagnosing the deterioration of exhaust systems**
- 2550/02 . Catalytic activity of catalytic converters
- 2550/03 . of sorbing activity of adsorbents or absorbents
- 2550/04 . Filtering activity of particulate filters
- 2550/05 . Systems for adding substances into exhaust
- 2550/06 . By-pass systems
- 2550/10 . . of catalytic converters
- 2550/12 . . of particulate filters
- 2550/14 . Systems for adding secondary air into exhaust
- 2550/20 . Monitoring artificially aged exhaust systems
- 2550/22 . of electric heaters for exhaust systems or their power supply
- 2550/24 . Determining the presence or absence of an exhaust treating device

<b>2560/00</b>	<b>Exhaust systems with means for detecting or measuring exhaust gas components or characteristics</b>	
2560/02	. the means being an exhaust gas sensor	
2560/021	. . for measuring or detecting ammonia NH <sub>3</sub>	
2560/022	. . for measuring or detecting CO or CO <sub>2</sub>	
2560/023	. . for measuring or detecting HC	
2560/024	. . for measuring or detecting hydrogen H <sub>2</sub>	
2560/025	. . for measuring or detecting O <sub>2</sub> , e.g. lambda sensors	
2560/026	. . for measuring or detecting NOx	
2560/027	. . for measuring or detecting SOx	
2560/028	. . for measuring or detecting humidity or water	
2560/05	. the means being a particulate sensor	
2560/06	. the means being a temperature sensor	
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	
2560/08	. the means being a pressure sensor	
2560/12	. Other sensor principles, e.g. using electro conductivity of substrate or radio frequency	
2560/14	. having more than one sensor of one kind	
2560/20	. Sensor having heating means	
<b>2570/00</b>	<b>Exhaust treating apparatus eliminating, absorbing or adsorbing specific elements or compounds</b>	
2570/02	. Lead	
2570/04	. Sulfur or sulfur oxides	
2570/06	. Zinc	
2570/08	. Phosphorus	
2570/10	. Carbon or carbon oxides	
2570/12	. Hydrocarbons	
2570/14	. Nitrogen oxides	
2570/145	. . Dinitrogen oxide	
2570/16	. Oxygen	
2570/18	. Ammonia	
2570/20	. Formaldehyde	
2570/22	. Water or humidity	
2570/24	. Hydrogen sulfide (H <sub>2</sub> S)	
<b>2590/00</b>	<b>Exhaust or silencing apparatus adapted to particular use, e.g. for military applications, airplanes, submarines</b>	
2590/02	. for marine vessels or naval applications	
2590/021	. . for outboard engines	
2590/022	. . for jetskis	
2590/04	. for motorcycles	
2590/06	. for hand-held tools or portables devices	
2590/08	. for heavy duty applications, e.g. trucks, buses, tractors, locomotives	
2590/10	. for stationary applications	
2590/11	. for hybrid vehicles	
<b>2610/00</b>	<b>Adding substances to exhaust gases</b>	
2610/01	. the substance being catalytic material in liquid form	
2610/02	. the substance being ammonia or urea	
2610/03	. the substance being hydrocarbons, e.g. engine fuel	
2610/04	. the substance being hydrogen	
2610/05	. the substance being carbon monoxide	
2610/06	. the substance being in the gaseous form	
2610/08	. with prior mixing of the substances with a gas, e.g. air	
2610/085	. . Controlling the air supply	
2610/10	. the substance being heated, e.g. by heating tank or supply line of the added substance	
2610/102	. . after addition to exhaust gases, e.g. by a passively or actively heated surface in the exhaust conduit	
2610/105	. . Control thereof	
2610/107	. . using glow plug heating elements	
2610/11	. the substance or part of the dosing system being cooled	
2610/12	. the substance being in solid form, e.g. pellets or powder	
2610/14	. Arrangements for the supply of substances, e.g. conduits	
2610/1406	. . Storage means for substances, e.g. tanks or reservoirs	
2610/1413	. . . Inlet and filling arrangements therefore	
2610/142	. . . Controlling the filling of the tank	
2610/1426	. . Filtration means	
2610/1433	. . Pumps	
2610/144	. . . Control thereof	
2610/1446	. . Means for damping of pressure fluctuations in the delivery system, e.g. by puffer volumes or throttling	
2610/1453	. . Sprayers or atomisers; Arrangement thereof in the exhaust apparatus	
2610/146	. . . Control thereof, e.g. control of injectors or injection valves	
2610/1466	. . Means for venting air out of conduits or tanks	
2610/1473	. . Overflow or return means for the substances, e.g. conduits or valves for the return path	
2610/148	. . Arrangement of sensors	
2610/1486	. . Means to prevent the substance from freezing	
2610/1493	. . Purging the reducing agent out of the conduits or nozzle	
<b>2900/00</b>	<b>Details of electrical control or of the monitoring of the exhaust gas treating apparatus</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 velocity
- 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 . . . SO<sub>x</sub> amount trapped in catalyst
- 2900/1614 . . . NO<sub>x</sub> 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
- 2900/1824 . . . . Properties of the air to be mixed with added substances, e.g. air pressure or air temperature