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 ({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).

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.

1/00 **Silencing apparatus characterised by method of silencing {**(by cooling F01N 3/02; using liquids F01N 3/04)**}**

1/003 . {by using dead chambers communicating with gas flow passages (resonance chambers F01N 1/02; chambers containing sound-absorbing materials F01N 1/24)}

1/006 . . {comprising at least one perforated tube extending from inlet to outlet of the silencer}

1/02 . by using resonance

1/023 . . {Helmholtz resonators}

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}

1/04 . . having sound-absorbing materials in resonance chambers

1/06 . by using interference effect

1/065 . . {by using an active noise source, e.g. speakers}

1/08 . by reducing exhaust energy by throttling or whirling

1/081 . . {by passing the gases through a mass of particles}

1/082 . . {the gases passing through porous members (F01N 1/081 takes precedence)}

1/083 . . {using transversal baffles defining a tortuous path for the gases or successively throttling gas flow}

1/084 . . {the gases flowing through the silencer two or more times longitudinally in opposite directions, e.g. using parallel or concentric tubes}

1/085 . . {using a central core throttling gas passage}

1/086 . . {having means to impart whirling motion to the gases (with helically or spirally shaped channels F01N 1/12)}

1/087 . . . {using tangential inlets into a circular chamber}

1/088 . . . {using vanes arranged on gas flow path or gas flow tubes with tangentially directed apertures}

1/089 . . {using two or more expansion chambers in series (F01N 1/083, F01N 1/084, F01N 1/086 take precedence)}

1/10 . . in combination with sound-absorbing materials (F01N 1/125 takes precedence)
1/12 . . using spirally or helically shaped channels (cyclones B04C)
1/125 . . . {in combination with sound-absorbing materials}
1/14 . by adding air to exhaust gases {(in tailpipes F01N 13/082, F01N 13/20)}
1/16 . by using movable parts
1/161 . . {for adjusting resonance or dead chambers or passages to resonance or dead chambers}
1/163 . . . {by means of valves}
1/165 . . {for adjusting flow area}
1/166 . . {for changing gas flow path through the silencer or for adjusting the dimensions of a chamber or a pipe (F01N 1/165 takes precedence)}
1/168 . . {for controlling or modifying silencing characteristics only}
1/18 . . having rotary movement
1/20 . . having oscillating or vibrating movement {(the parts being resilient walls F01N 1/22)}
1/22 . . the parts being resilient walls
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 {; collecting or removing exhaust gases of vehicle engines in workshops B08B 15/00, on highways E01C 1/005})

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
3/0222 . . . . {the structure being monolithic, e.g. honeycombs}
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 (by electrically controlling the supply of combustible mixture or its constituents only F02D 41/0235)
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
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 {, e.g. catalysed diesel particulate filters}
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, e.g. for adiabatic expansion of gases and subsequent collection of condensed liquids
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 {; in tailpipes F01N 13/082})
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. NOx absorption/storage reduction catalysts}
3/0821 . . . {combined with particulate filters (catalysed diesel particulate filters F01N 3/035)}
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 . . . {Regulation of absorbents or adsorbents, e.g. purging (by electrically controlling the supply of combustible mixture or its constituents only F02D 41/0235)}
3/0878 . . . . {Bypassing absorbents or adsorbents}
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 (electric filters F01N 3/01; regeneration of exhaust filters F01N 3/023; heating catalytic converters F01N 3/2006)}
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; Control
3/20 . . . . specially adapted for catalytic conversion (F01N 3/22 takes precedence){; Methods of operation or control of catalytic converters}
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, NOx 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 . . . . 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}
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
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)
9/002 . {of filter regeneration, e.g. detection of clogging}
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 {, e.g. for catalytic activity** (safety, indicating or supervising devices for internal combustion engines F02B 77/08; testing of machines G01M 13/00)**}**
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 {; Exhaust or silencing apparatus, or parts thereof, having pertinent characteristics not provided for in, or of interest apart from, groups F01N 1/00 - F01N 5/00, F01N 9/00, F01N 11/00}**
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 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 (silencing methods F01N 1/00; intake silencers F02M 35/12)}
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
13/08 . 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)}

13/082 . . {of tailpipe, e.g. with means for mixing air with exhaust for exhaust cooling, dilution or evacuation (F01N 13/20 takes precedence)}
13/085 . . {having means preventing foreign matter from entering exhaust conduit}
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 F01N 1/166)}
13/10 . . of exhaust manifolds {(with cooling jacket F01N 3/046)}
13/102 . . . {having thermal insulation}
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}
13/107 . . . {More than one exhaust manifold or exhaust collector}
13/12 . specially adapted for submerged exhausting
13/14 . having thermal insulation {(exhaust manifolds F01N 13/102)}
13/141 . . {Double-walled exhaust pipes or housings}
13/143 . . . {with air filling the space between both walls}
13/145 . . . {with gas other than air filling the space between both walls}
13/146 . . . {with vacuum in the space between both walls}
13/148 . . {Multiple layers of insulating material}
13/16 . Selection of particular materials
13/18 . Construction facilitating manufacture, assembly, or disassembly
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)}
13/1811 . . . {with means permitting relative movement, e.g. compensation of thermal expansion or vibration}
13/1816 . . . . {the pipe sections being joined together by flexible tubular elements only, e.g. using bellows or strip-wound pipes}
13/1822 . . . . {for fixing exhaust pipes or devices to vehicle body}
13/1827 . . . {Sealings specially adapted for exhaust systems (sealings in general F16J 15/00)}
13/1833 . . {specially adapted for small internal combustion engines, e.g. used in model applications}
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}
13/1844 . . . {Mechanical joints}
13/185 . . . . {the connection being realised by deforming housing, tube, baffle, plate, or parts thereof}
13/1855 . . . . {the connection being realised by using bolts, screws, rivets or the like}
13/1861 . . {the assembly using parts formed by casting or moulding}
13/1866 . . . {the channels or tubes thereof being made integrally with the housing}
13/1872 . . {the assembly using stamp-formed parts or otherwise deformed sheet-metal}
13/1877 . . . {the channels or tubes thereof being made integrally with the housing}
13/1883 . . {manufactured by hydroforming}
13/1888 . . {the housing of the assembly consisting of two or more parts, e.g. two half-shells}
13/1894 . . . {the parts being assembled in longitudinal direction}
13/20 . having flared outlets, e.g. of fish-tail shape

99/00 Subject matter not provided for in other groups of this subclass

2210/00 Combination of methods of silencing
2210/02 . Resonance and interference
2210/04 . Throttling-expansion and resonance
2210/06 . Throttling-expansion and interference

2230/00 Combination of silencers and other devices
2230/02 . Exhaust filters
2230/04 . Catalytic converters
2230/06 . Spark arresters
2230/08 . Thermal reactors

2240/00 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
2240/02 . a heat exchanger
2240/04 . an electric, e.g. electrostatic, device other than a heater
2240/05 . a magnetic, e.g. electromagnetic, device other than a valve
2240/06 . an inertial, e.g. centrifugal, device
2240/10 . a heat accumulator
2240/12 . a thermal reactor
2240/14 . a fuel burner
2240/16 . an electric heater, i.e. a resistance heater
2240/18 . an adsorber or absorber
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_3) generator, e.g. for adding ozone after generation of ozone from air
2240/40 . a hydrolysis catalyst

2250/00 Combinations of different methods of purification
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 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 rechangeable 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

2560/00 Exhaust systems with means for detecting or measuring exhaust gas components or characteristics

2560/02 . the means being an exhaust gas sensor
2560/021 . . for measuring or detecting ammonia NH_3
2560/022 . . for measuring or detecting CO or CO_2
2560/023 . . for measuring or detecting HC
2560/024 . . for measuring or detecting hydrogen H_2
2560/025 . . for measuring or detecting O_2, 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

2570/00 Exhaust treating apparatus eliminating, absorbing or adsorbing specific elements or compounds

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_2S)

2590/00 Exhaust or silencing apparatus adapted to particular use, e.g. for military applications, airplanes, submarines

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

2610/00 Adding substances to exhaust gases

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

2900/00 Details of electrical control or of the monitoring of the exhaust gas treating apparatus

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_3-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