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).

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

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

F01N 1/006 . . {comprising at least one perforated tube extending from inlet to outlet of the silencer}

F01N 1/02 . by using resonance

F01N 1/023 . . {Helmholtz resonators}

F01N 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}

F01N 1/04 . . having sound-absorbing materials in resonance chambers

F01N 1/06 . by using interference effect

F01N 1/065 . . {by using an active noise source, e.g. speakers}

F01N 1/08 . by reducing exhaust energy by throttling or whirling

F01N 1/081 . . {by passing the gases through a mass of particles}

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

F01N 1/083 .. {using transversal baffles defining a tortuous path for the gases or successively throttling gas flow}

F01N 1/084 .. {the gases flowing through the silencer two or more times longitudinally in opposite directions, e.g. using parallel or concentric tubes}

F01N 1/085 .. {using a central core throttling gas passage}

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

F01N 1/087 ... {using tangential inlets into a circular chamber}

F01N 1/088 ... {using vanes arranged on gas flow path or gas flow tubes with tangentially directed apertures}

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

F01N 1/10 .. in combination with sound-absorbing materials (F01N 1/125 takes precedence)

F01N 1/12 .. using spirally or helically shaped channels (cyclones B04C)

F01N 1/125 ... {in combination with sound-absorbing materials}

F01N 1/14 . by adding air to exhaust gases {(in tailpipes F01N 13/082 , F01N 13/20)}

F01N 1/16 . by using movable parts

F01N 1/161 .. {for adjusting resonance or dead chambers or passages to resonance or dead chambers}

F01N 1/163 ... {by means of valves}

F01N 1/165 .. {for adjusting flow area}

F01N 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)}

F01N 1/168 .. {for controlling or modifying silencing characteristics only}

F01N 1/18 .. having rotary movement

F01N 1/20 .. having oscillating or vibrating movement {(the parts being resilient walls F01N 1/22)}

F01N 1/22 .. the parts being resilient walls

F01N 1/24 . by using sound-absorbing materials (F01N 1/04 , F01N 1/06 , F01N 1/10 , F01N 1/14 , F01N 1/16 take precedence)

F01N 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})

F01N 3/005 . {for draining or otherwise eliminating condensates or moisture accumulating in the apparatus (F01N 3/02 takes precedence)}

F01N 3/01 . by means of electric or electrostatic separators

F01N 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})

F01N 3/0205 .. {using heat exchangers}

F01N 3/021 .. by means of filters

F01N 3/0211	...	{Arrangements for mounting filtering elements in housing, e.g. with means for compensating thermal expansion or vibration}
F01N 3/0212	...	{with one or more perforated tubes surrounded by filtering material, e.g. filter candles}
F01N 3/0214	...	{with filters comprising movable parts, e.g. rotating filters}
F01N 3/0215	...	{the filtering elements having the form of disks or plates}
F01N 3/0217	...	{the filtering elements having the form of hollow cylindrical bodies}
F01N 3/0218	...	{the filtering elements being made from spirally-wound filtering material}
F01N 3/022	...	characterised by specially adapted filtering structure, e.g. honeycomb, mesh or fibrous
F01N 3/0222	....	{the structure being monolithic, e.g. honeycombs}
F01N 3/0224	....	{the structure being granular}
F01N 3/0226	....	{the structure being fibrous}
F01N 3/0228	....	{the structure being made of foamed rubber or plastics}
F01N 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)
F01N 3/0231	....	{using special exhaust apparatus upstream of the filter for producing nitrogen dioxide, e.g. for continuous filter regeneration systems (CRT)}
F01N 3/0232	....	{removing incombustible material from a particle filter, e.g. ash}
F01N 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}
F01N 3/0234	....	{using heat exchange means in the exhaust line}
F01N 3/0235	....	{using exhaust gas throttling means}
F01N 3/0236	....	{using turbine waste gate valve}
F01N 3/0237	....	{for regenerating ex situ}
F01N 3/0238	....	{for regenerating during engine standstill}
F01N 3/025	....	using fuel burner or by adding fuel to exhaust
F01N 3/0253	.....	{adding fuel to exhaust gases}
F01N 3/0256	.....	{the fuel being ignited by electrical means}
F01N 3/027	....	using electric or magnetic heating means
F01N 3/0275	.....	{using electric discharge means}
F01N 3/028	.....	using microwaves
F01N 3/029	....	by adding non-fuel substances to exhaust
F01N 3/0293	.....	{injecting substances in exhaust stream}
F01N 3/0296	.....	{having means for preheating additional substances}
F01N 3/031	...	having means for by-passing filters, e.g. when clogged or during cold engine start
F01N 3/032	....	during filter regeneration only
F01N 3/033	...	in combination with other devices {(with adsorbents or absorbents F01N 3/0821)}
F01N 3/0335	....	{with exhaust silencers in a single housing}

F01N 3/035 .... with catalytic reactors,{e.g. catalysed diesel particulate filters}

F01N 3/037 .. by means of inertial or centrifugal separators, e.g. of cyclone type, optionally combined or associated with agglomerators

F01N 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

F01N 3/04 .. using liquids

F01N 3/043 ... {without contact between liquid and exhaust gases}

F01N 3/046 .... {Exhaust manifolds with cooling jacket}

F01N 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})

F01N 3/055 ... {without contact between air and exhaust gases}

F01N 3/06 . for extinguishing sparks

F01N 3/08 . for rendering innocuous (using electric or electrostatic separators F01N 3/01 ; chemical aspects B01D 53/92)

F01N 3/0807 .. {by using absorbents or adsorbents}

F01N 3/0814 ... {combined with catalytic converters, e.g. NOx absorption/storage reduction catalysts}

F01N 3/0821 ... {combined with particulate filters (catalysed diesel particulate filters F01N 3/035)}

F01N 3/0828 ... {characterised by the absorbed or adsorbed substances}

F01N 3/0835 .... {Hydrocarbons}

F01N 3/0842 .... {Nitrogen oxides}

F01N 3/085 .... {Sulfur or sulfur oxides}

F01N 3/0857 .... {Carbon oxides}

F01N 3/0864 .... {Oxygen}

F01N 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)}

F01N 3/0878 .... {Bypassing absorbents or adsorbents}

F01N 3/0885 .... {Regeneration of deteriorated absorbents or adsorbents, e.g. desulfurization of NOx traps}

F01N 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)}

F01N 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)

F01N 3/101 ... {Three-way catalysts}

F01N 3/103 ... {Oxidation catalysts for HC and CO only}

F01N 3/105 ... {General auxiliary catalysts, e.g. upstream or downstream of the main catalyst}

F01N 3/106 .... {Auxiliary oxidation catalysts}

F01N 3/108 .... {Auxiliary reduction catalysts}

F01N 3/18 ... characterised by methods of operation; Regulation

F01N 3/20 .... specially adapted for catalytic conversion;{Methods of operation or regulation of catalytic converters }(F01N 3/22 takes precedence)

F01N 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)}

F01N 3/2013 ..... {using electric or magnetic heating means}

F01N 3/202 ..... {using microwaves}

F01N 3/2026 ..... {directly electrifying the catalyst substrate, i.e. heating the electrically conductive catalyst substrate by joule effect}

F01N 3/2033 ..... {using a fuel burner or introducing fuel into exhaust duct}

F01N 3/204 ..... {using an exhaust gas igniter, e.g. a spark or glow plug, without introducing fuel into exhaust duct}

F01N 3/2046 ..... {Periodically cooling catalytic reactors}

F01N 3/2053 ..... {By-passing catalytic reactors, e.g. to prevent overheating}

F01N 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)}

F01N 3/2066 ..... {Selective catalytic reduction (SCR)}

F01N 3/2073 ..... {with means for generating a reducing substance from the exhaust gases}

F01N 3/208 ..... {Control of selective catalytic reduction (SCR), e.g. dosing of reducing agent}

F01N 3/2086 ..... {Activating the catalyst by light, photo-catalysts}

F01N 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}

F01N 3/22 .... Regulation of additional air supply only, e.g. using by-passes or variable air pump drives

F01N 3/222 ..... {using electric valves only}

F01N 3/225 ..... {Electric control of additional air supply}

F01N 3/227 ..... {using pneumatically operated valves, e.g. membrane valves}

F01N 3/24 ... characterised by constructional aspects of converting apparatus (filtering in combination with catalytic reactors F01N 3/035)

F01N 3/26 .... Construction of thermal reactors

F01N 3/28 .... Construction of catalytic reactors

F01N 3/2803 ..... {characterised by structure, by material or by manufacturing of catalyst support}

F01N 3/2807 ..... {Metal other than sintered metal (F01N 3/2832 and F01N 3/2835 take precedence)}

F01N 3/281 ..... {Metallic honeycomb monoliths made of stacked or rolled sheets, foils or plates}

F01N 3/2814 ..... {all sheets, plates or foils being corrugated}

F01N 3/2817 ..... {only with non-corrugated sheets, plates or foils}

F01N 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}

F01N 3/2825 . . . . . {Ceramics (F01N 3/2832 , F01N 3/2835 take precedence)}

F01N 3/2828 . . . . . {Ceramic multi-channel monoliths, e.g. honeycombs}

F01N 3/2832 . . . . . {granular, e.g. pellets}

F01N 3/2835 . . . . . {fibrous}

F01N 3/2839 . . . . . {Arrangements for mounting catalyst support in housing, e.g. with means for compensating thermal expansion or vibration}

F01N 3/2842 . . . . . {specially adapted for monolithic supports, e.g. of honeycomb type (F01N 3/2853 to F01N 3/2871 take precedence)}

F01N 3/2846 . . . . . {specially adapted for granular supports, e.g. pellets}

F01N 3/285 . . . . . {specially adapted for fibrous supports, e.g. held in place by screens}

F01N 3/2853 . . . . . {using mats or gaskets between catalyst body or housing}

F01N 3/2857 . . . . . {the mats or gaskets being at least partially made of intumescent material, e.g. unexpanded vermiculite}

F01N 3/286 . . . . . {the mats or gaskets having corrugations or cavities}

F01N 3/2864 . . . . . {the mats or gaskets comprising two or more insulation layers}

F01N 3/2867 . . . . . {the mats or gaskets being placed at the front or end face of catalyst body}

F01N 3/2871 . . . . . {the mats or gaskets having an additional, e.g. non-insulating or non-cushioning layer, a metal foil or an adhesive layer}

F01N 3/2875 . . . . . {by using elastic means, e.g. spring leaves, for retaining catalyst body in the housing (F01N 3/2853 to F01N 3/2871 take precedence)}

F01N 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}

F01N 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)}

F01N 3/2885 . . . . . {with exhaust silencers in a single housing}

F01N 3/2889 . . . . . {with heat exchangers in a single housing}

F01N 3/2892 . . . . . {Exhaust flow directors or the like, e.g. upstream of catalytic device}

F01N 3/2896 . . . . . {Liquid catalyst carrier}

F01N 3/30 . . . . Arrangements for supply of additional air (regulation, e.g. using air by-passes or variable air pump drives F01N 3/22)

F01N 3/303 . . . . . {Filtering additional air}

F01N 3/306 . . . . . {Preheating additional air}

F01N 3/32 . . . . . using air pump (using jet air pumps F01N 3/34 ; pumps in general F04)

F01N 3/323 . . . . . {Electrically driven air pumps}

F01N 3/326 . . . . . {Engine-driven air pumps}

F01N 3/34 . . . . . using air conduits or jet air pumps, e.g. near the engine exhaust port

F01N 3/36 . . . . Arrangements for supply of additional fuel

F01N 3/38 . . . . Arrangements for igniting

F01N 5/00 **Exhaust or silencing apparatus combined or associated with devices profiting by exhaust energy** (predominant aspects of such devices, see the relevant classes for the devices; using kinetic or wave energy of exhaust gases in exhaust systems for charging F02B)

F01N 5/02 . the devices using heat

F01N 5/025 . . {the device being thermoelectric generators}

F01N 5/04 . the devices using kinetic energy

F01N 9/00 **Electrical control of exhaust gas treating apparatus** (monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 11/00 ; { electrical control of supply of combustible mixture or its constituents in relation with the state of the exhaust gas treating apparatus F02D 41/0235} ; controlling combustion engines conjoint electrical control of two or more combustion engine functions F02D 43/00)

F01N 9/002 . {of filter regeneration, e.g. detection of clogging}

F01N 9/005 . {using models instead of sensors to determine operating characteristics of exhaust systems, e.g. calculating catalyst temperature instead of measuring it directly}

F01N 9/007 . {Storing data relevant to operation of exhaust systems for later retrieval and analysis, e.g. to research exhaust system malfunctions}

F01N 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)**}**

F01N 11/002 . {the diagnostic devices measuring or estimating temperature or pressure in, or downstream of the exhaust apparatus}

F01N 11/005 . . {the temperature or pressure being estimated, e.g. by means of a theoretical model}

F01N 11/007 . {the diagnostic devices measuring oxygen or air concentration downstream of the exhaust apparatus}

F01N 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 to F01N 5/00 , F01N 9/00 , F01N 11/00}**

F01N 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)}

F01N 13/002 . {Apparatus adapted for particular uses, e.g. for portable devices driven by machines or engines}

F01N 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)}

F01N 13/005 . . {with parts constructed of non-metallic material, e.g. of rubber}

F01N 13/007 . {Apparatus used as intake or exhaust silencer (silencing methods F01N 1/00 ; intake silencers F02M 35/12)}

F01N 13/008 . {Mounting or arrangement of exhaust sensors in or on exhaust apparatus (sensor arrangements for engine control F02D 41/1439)}

F01N 13/009 . {having two or more separate purifying devices arranged in series}

F01N 13/0093 .. {the purifying devices are of the same type}

F01N 13/0097 .. {the purifying devices are arranged in a single housing}

F01N 13/011 . {having two or more purifying devices arranged in parallel}

F01N 13/017 .. {the purifying devices are arranged in a single housing}

F01N 13/02 . having two or more separate silencers in series

F01N 13/04 . having two or more silencers in parallel e.g. having interconnections for multi-cylinder engines

F01N 13/06 . specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds

F01N 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)}

F01N 13/082 .. {of tailpipe, e.g. with means for mixing air with exhaust for exhaust cooling, dilution or evacuation (F01N 13/20 takes precedence)}

F01N 13/085 .. {having means preventing foreign matter from entering exhaust conduit}

F01N 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)}

F01N 13/10 .. of exhaust manifolds {(with cooling jacket F01N 3/046)}

F01N 13/102 ... {having thermal insulation}

F01N 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}

F01N 13/107 ... {More than one exhaust manifold or exhaust collector}

F01N 13/12 . specially adapted for submerged exhausting

F01N 13/14 . having thermal insulation {(exhaust manifolds F01N 13/102)}

F01N 13/141 .. {Double-walled exhaust pipes or housings}

F01N 13/143 ... {with air filling the space between both walls}

F01N 13/145 ... {with gas other than air filling the space between both walls}

F01N 13/146 ... {with vacuum in the space between both walls}

F01N 13/148 .. {Multiple layers of insulating material}

F01N 13/16 . Selection of particular materials

F01N 13/18 . Construction facilitating manufacture, assembly, or disassembly

F01N 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)}

F01N 13/1811 ... {with means permitting relative movement, e.g. compensation of thermal expansion or vibration}

F01N 13/1816 .... {the pipe sections being joined together by flexible tubular elements only, e.g. using bellows or strip-wound pipes}

F01N 13/1822 .... {for fixing exhaust pipes or devices to vehicle body}

F01N 13/1827 ... {Sealings specially adapted for exhaust systems (sealings in general F16J 15/00)}

F01N 13/1833 .. {specially adapted for small internal combustion engines, e.g. used in model applications}

F01N 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}

F01N 13/1844 ... {Mechanical joints}

F01N 13/185 .... {the connection being realised by deforming housing, tube, baffle, plate, or parts thereof}

F01N 13/1855 .... {the connection being realised by using bolts, screws, rivets or the like}

F01N 13/1861 .. {the assembly using parts formed by casting or moulding}

F01N 13/1866 ... {the channels or tubes thereof being made integrally with the housing}

F01N 13/1872 .. {the assembly using stamp-formed parts or otherwise deformed sheet-metal}

F01N 13/1877 ... {the channels or tubes thereof being made integrally with the housing}

F01N 13/1883 .. {manufactured by hydroforming}

F01N 13/1888 .. {the housing of the assembly consisting of two or more parts, e.g. two half-shells}

F01N 13/1894 ... {the parts being assembled in longitudinal direction}

F01N 13/20 . having flared outlets, e.g. of fish-tail shape

F01N 2210/00 Combination of methods of silencing

F01N 2210/02 . Resonance and interference

F01N 2210/04 . Throttling-expansion and resonance

F01N 2210/06 . Throttling-expansion and interference

F01N 2230/00 Combination of silencers and other devices

F01N 2230/02 . Exhaust filters

F01N 2230/04 . Catalytic converters

F01N 2230/06 . Spark arresters

F01N 2230/08 . Thermal reactors

F01N 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

F01N 2240/02 . a heat exchanger

F01N 2240/04 . an electric, e.g. electrostatic, device other than a heater

F01N 2240/05 . a magnetic, e.g. electromagnetic, device other than a valve

F01N 2240/06 . an inertial, e.g. centrifugal, device

F01N 2240/10 . a heat accumulator

F01N 2240/12 . a thermal reactor

F01N 2240/14 . a fuel burner

F01N 2240/16 . an electric heater, i.e. a resistance heater

F01N 2240/18 . an adsorber or absorber

F01N 2240/20 . a flow director or deflector

F01N 2240/22 . a condensation chamber

F01N 2240/25 . an ammonia generator

F01N 2240/26 . an exhaust gas reservoir, e.g. emission buffer

F01N 2240/28 . a plasma reactor
F01N 2240/30 . a fuel reformer
F01N 2240/32 . a fuel cell
F01N 2240/34 . an electrolyser
F01N 2240/36 . an exhaust flap
F01N 2240/38 . an ozone (O_3) generator, e.g. for adding ozone after generation of ozone from air
F01N 2240/40 . a hydrolysis catalyst

F01N 2250/00 Combinations of different methods of purification
F01N 2250/02 . filtering and catalytic conversion
F01N 2250/04 . afterburning and catalytic conversion
F01N 2250/06 . afterburning and filtering
F01N 2250/08 . filtering and inertial particulate separation
F01N 2250/10 . cooling and filtering
F01N 2250/12 . absorption or adsorption, and catalytic conversion
F01N 2250/14 . absorption or adsorption, and filtering

F01N 2260/00 Exhaust treating devices having provisions not otherwise provided for
F01N 2260/02 . for cooling the device
F01N 2260/022 . . using air
F01N 2260/024 . . using a liquid
F01N 2260/04 . for regeneration or reactivation, e.g. of catalyst
F01N 2260/06 . for improving exhaust evacuation or circulation, or reducing back-pressure
F01N 2260/08 . for preventing heat loss or temperature drop, using other means than layers of heat-insulating material
F01N 2260/10 . for avoiding stress caused by expansions or contractions due to temperature variations
F01N 2260/12 . for resisting high pressure
F01N 2260/14 . for modifying or adapting flow area or back-pressure
F01N 2260/16 . for reducing exhaust flow pulsations
F01N 2260/18 . for improving rigidity, e.g. by wings, ribs
F01N 2260/20 . for heat or sound protection, e.g. using a shield or specially shaped outer surface of exhaust device
F01N 2260/22 . for preventing theft of exhaust parts or devices, e.g. anti-theft arrangements
F01N 2260/24 . for identifying exhaust parts or devices, e.g. by labels, stickers or directly printing
F01N 2260/26 . for preventing enter of dirt into the device

F01N 2270/00 Mixing air with exhaust gases
F01N 2270/02 . for cooling exhaust gases or the apparatus
F01N 2270/04 . for afterburning
F01N 2270/06 . for silencing
F01N 2270/08 . for evacuation of exhaust gases, e.g. in tail-pipes

F01N 2270/10 . for rendering exhaust innocuous, e.g. by dilution

F01N 2290/00 Movable parts or members in exhaust systems for other than for control purposes

F01N 2290/02 . with continuous rotary movement

F01N 2290/04 . . driven by exhaust gases

F01N 2290/06 . . driven by auxiliary drive

F01N 2290/08 . with oscillating or vibrating movement

F01N 2290/10 . . actuated by pressure of exhaust gases, e.g. exhaust pulses

F01N 2310/00 Selection of sound absorbing or insulating material

F01N 2310/02 . Mineral wool, e.g. glass wool, rock wool, asbestos or the like

F01N 2310/04 . Metallic wool, e.g. steel wool, copper wool or the like

F01N 2310/06 . Porous ceramics

F01N 2310/08 . Exfoliated vermiculite, e.g. zonolite, coke, pumice

F01N 2310/10 . Plastic foam

F01N 2310/12 . Granular material

F01N 2310/14 . Wire mesh fabric, woven glass cloth or the like

F01N 2330/00 Structure of catalyst support or particle filter

F01N 2330/02 . Metallic plates or honeycombs, e.g. superposed or rolled-up corrugated or otherwise deformed sheet metal

F01N 2330/04 . . Methods of manufacturing

F01N 2330/06 . Ceramic, e.g. monoliths

F01N 2330/08 . Granular material

F01N 2330/10 . Fibrous material, e.g. mineral or metallic wool

F01N 2330/101 . . using binders, e.g. to form a permeable mat, paper or the like

F01N 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

F01N 2330/12 . Metallic wire mesh fabric or knitting

F01N 2330/14 . Sintered material

F01N 2330/18 . Composite material

F01N 2330/20 . Plastics, e.g. polymers, polyester, polyurethane

F01N 2330/22 . Metal foam

F01N 2330/30 . Honeycomb supports characterised by their structural details

F01N 2330/32 . . characterised by the shape, form or number of corrugations of plates, sheets or foils

F01N 2330/321 . . . with two or more different kinds of corrugations in the same substrate

F01N 2330/322 . . . Corrugations of trapezoidal form

F01N 2330/323 . . . Corrugations of saw-tooth or triangular form

F01N 2330/324 . . . Corrugations of rectangular form

F01N 2330/325 . . . Corrugations of omega form

F01N 2330/34 . . with flow channels of polygonal cross section

F01N 2330/36 . . with flow channels formed by tubes

F01N 2330/38 . . flow channels with means to enhance flow mixing,(e.g. protrusions or projections)

F01N 2330/40 . . made of a single sheet, foil or plate

F01N 2330/42 . . made of three or more different sheets, foils or plates stacked one on the other

F01N 2330/44 . . made of stacks of sheets, plates or foils that are folded in S-form

F01N 2330/48 . . characterised by the number of flow passages, e.g. cell density

F01N 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

F01N 2340/00 Dimensional characteristics of the exhaust system, e.g. length, diameter or volume of the apparatus; Spatial arrangements of exhaust apparatuses

F01N 2340/02 . characterised by the distance of the apparatus to the engine, or the distance between two exhaust treating apparatuses

F01N 2340/04 . characterised by the arrangement of an exhaust pipe, manifold or apparatus in relation to vehicle frame or particular vehicle parts

F01N 2340/06 . characterised by the arrangement of the exhaust apparatus relative to the turbine of a turbocharger

F01N 2350/00 Arrangements for fitting catalyst support or particle filter element in the housing

F01N 2350/02 . Fitting ceramic monoliths in a metallic housing

F01N 2350/04 . . with means compensating thermal expansion

F01N 2350/06 . . with means preventing gas flow by-pass or leakage

F01N 2350/08 . with means for compressing granular material

F01N 2370/00 Selection of materials for exhaust purification

F01N 2370/02 . used in catalytic reactors

F01N 2370/04 . . Zeolitic material

F01N 2370/22 . used in non-catalytic purification apparatus

F01N 2370/24 . . Zeolitic material

F01N 2370/30 . . Materials having magnetic properties

F01N 2370/40 . Activated carbon or charcoal

F01N 2390/00 Arrangements for controlling or regulating exhaust apparatus

F01N 2390/02 . using electric components only

F01N 2390/04 . using electropneumatic components

F01N 2390/06 . using pneumatic components only

F01N 2390/08 . using mechanical components only, e.g. actuated manually

F01N 2410/00 By-passing, at least partially, exhaust from inlet to outlet of apparatus, to atmosphere or to other device

F01N 2410/02 . in case of high temperature, e.g. overheating of catalytic reactor

F01N 2410/03 . in case of low temperature
F01N 2410/04 . during regeneration period, e.g. of particle filter
F01N 2410/06 . at cold starting
F01N 2410/08 . in case of clogging, e.g. of particle filter
F01N 2410/10 . for reducing flow resistance, e.g. to obtain more engine power
F01N 2410/12 . in case of absorption, adsorption or desorption of exhaust gas constituents
F01N 2410/14 . in case of excessive pressure, e.g. using a safety valve

F01N 2430/00 Influencing exhaust purification, e.g. starting of catalytic reaction, filter regeneration, or the like, by controlling engine operating characteristics
F01N 2430/02 . by cutting out a part of engine cylinders
F01N 2430/04 . by adding non-fuel substances to combustion air or fuel, e.g. additives
F01N 2430/06 . by varying fuel-air ratio, e.g. by enriching fuel-air mixture
F01N 2430/08 . by modifying ignition or injection timing
F01N 2430/085 . . at least a part of the injection taking place during expansion or exhaust stroke
F01N 2430/10 . by modifying inlet or exhaust valve timing

F01N 2450/00 Methods or apparatus for fitting, inserting or repairing different elements
F01N 2450/02 . Fitting monolithic blocks into the housing
F01N 2450/04 . Filling or emptying a chamber with granular material
F01N 2450/06 . Inserting sound absorbing material into a chamber
F01N 2450/08 . Repairing the housing or pipe-joints
F01N 2450/10 . Fitting temporarily exhaust apparatus on exhaust conduit, e.g. in confined environment, garage or the like
F01N 2450/16 . by using threaded joints
F01N 2450/18 . by using quick-active type locking mechanisms, e.g. clips
F01N 2450/20 . by mechanical joints, e.g. by deforming housing, tube, baffle plate or parts thereof
F01N 2450/22 . by welding or brazing
F01N 2450/24 . by bolts, screws, rivets or the like
F01N 2450/26 . by bayonet fittings
F01N 2450/28 . by using adhesive material, e.g. cement
F01N 2450/30 . Removable or rechangeable blocks or cartridges, e.g. for filters
F01N 2450/40 . Retrofitting exhaust apparatus

F01N 2470/00 Structure or shape of gas passages, pipes or tubes
F01N 2470/02 . Tubes being perforated
F01N 2470/04 . . characterised by shape, disposition or dimensions of apertures
F01N 2470/06 . Tubes being formed by assembly of stamped or otherwise deformed sheet-metal
F01N 2470/08 . Gas passages being formed between the walls of an outer shell and an inner chamber
F01N 2470/10 . Tubes having non-circular cross section
F01N 2470/12 . Tubes being corrugated
F01N 2470/14 . Plurality of outlet tubes, e.g. in parallel or with different length

F01N 2470/16 . Plurality of inlet tubes, e.g. discharging into different chambers
F01N 2470/18 . the axis of inlet or outlet tubes being other than the longitudinal axis of apparatus
F01N 2470/20 . Dimensional characteristics of tubes, e.g. length, diameter
F01N 2470/22 . Inlet and outlet tubes being positioned on the same side of the apparatus
F01N 2470/24 . Concentric tubes or tubes being concentric to housing, e.g. telescopically assembled
F01N 2470/26 . Tubes being formed by extrusion, drawing or rolling
F01N 2470/28 . Tubes being formed by moulding or casting x
F01N 2470/30 . Tubes with restrictions, i.e. venturi or the like, e.g. for sucking air or measuring mass flow

F01N 2490/00 Structure, disposition or shape of gas-chambers
F01N 2490/02 . Two or more expansion chambers in series connected by means of tubes
F01N 2490/04 . . the gases flowing longitudinally from inlet to outlet only in one direction
F01N 2490/06 . . the gases flowing longitudinally from inlet to outlet in opposite directions
F01N 2490/08 . Two or more expansion chambers in series separated by apertured walls only
F01N 2490/10 . Two or more expansion chambers in parallel
F01N 2490/12 . Chambers having variable volumes
F01N 2490/14 . Dead or resonance chambers connected to gas flow tube by relatively short side-tubes
F01N 2490/15 . Plurality of resonance or dead chambers
F01N 2490/155 . . being disposed one after the other in flow direction
F01N 2490/16 . Chambers with particular shapes, e.g. spherical
F01N 2490/18 . Dimensional characteristics of gas chambers
F01N 2490/20 . Chambers being formed inside the exhaust pipe without enlargement of the cross section of the pipe, e.g. resonance chambers

F01N 2510/00 Surface coverings
F01N 2510/02 . for thermal insulation
F01N 2510/04 . for sound absorption
F01N 2510/06 . for exhaust purification, e.g. catalytic reaction
F01N 2510/061 . . usable with leaded fuels
F01N 2510/063 . . zeolites
F01N 2510/065 . . for reducing soot ignition temperature
F01N 2510/067 . . usable with sulfurised fuels
F01N 2510/068 . . characterised by the distribution of the catalytic coatings
F01N 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
F01N 2510/0684 . . . having more than one coating layer, e.g. multi-layered coatings
F01N 2510/08 . for corrosion prevention
F01N 2510/10 . for preventing carbon deposits, e.g. chromium
F01N 2510/12 . for smell removal

F01N 2510/14 . for dehydrating

F01N 2530/00 Selection of materials for tubes, chambers or housings

F01N 2530/02 . Corrosion resistive metals

F01N 2530/04 . . Steel alloys, e.g. stainless steel

F01N 2530/06 . Aluminium or alloys thereof

F01N 2530/18 . Plastics material, e.g. polyester resin

F01N 2530/20 . . reinforced with mineral or metallic fibres

F01N 2530/22 . Flexible elastomeric material

F01N 2530/24 . Sintered porous material, e.g. bronze, aluminium or the like

F01N 2530/26 . Multi-layered walls

F01N 2550/00 Monitoring or diagnosing the deterioration of exhaust systems

F01N 2550/02 . Catalytic activity of catalytic converters

F01N 2550/03 . of sorbing activity of adsorbents or absorbents

F01N 2550/04 . Filtering activity of particulate filters

F01N 2550/05 . Systems for adding substances into exhaust

F01N 2550/06 . By-pass systems

F01N 2550/10 . . of catalytic converters

F01N 2550/12 . . of particulate filters

F01N 2550/14 . Systems for adding secondary air into exhaust

F01N 2550/20 . Monitoring artificially aged exhaust systems

F01N 2550/22 . of electric heaters for exhaust systems or their power supply

F01N 2550/24 . Determining the presence or absence of an exhaust treating device

F01N 2560/00 Exhaust systems with means for detecting or measuring exhaust gas components or characteristics

F01N 2560/02 . the means being an exhaust gas sensor

F01N 2560/021 . . for measuring or detecting ammonia NH_3

F01N 2560/022 . . for measuring or detecting CO or CO_2

F01N 2560/023 . . for measuring or detecting HC

F01N 2560/024 . . for measuring or detecting hydrogen H_2

F01N 2560/025 . . for measuring or detecting O_2, e.g. lambda sensors

F01N 2560/026 . . for measuring or detecting NOx

F01N 2560/027 . . for measuring or detecting SOx

F01N 2560/028 . . for measuring or detecting humidity or water

F01N 2560/05 . the means being a particulate sensor

F01N 2560/06 . the means being a temperature sensor

F01N 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

F01N 2560/08 . the means being a pressure sensor

F01N 2560/12 . Other sensor principles, e.g. using electro conductivity of substrate or radio frequency

F01N 2560/14 . having more than one sensor of one kind

F01N 2560/20 . Sensor having heating means

F01N 2570/00 Exhaust treating apparatus eliminating, absorbing or adsorbing specific elements or compounds

F01N 2570/02 . Lead

F01N 2570/04 . Sulfur or sulfur oxides

F01N 2570/06 . Zinc

F01N 2570/08 . Phosphorus

F01N 2570/10 . Carbon or carbon oxides

F01N 2570/12 . Hydrocarbons

F01N 2570/14 . Nitrogen oxides

F01N 2570/145 . . Dinitrogen oxide

F01N 2570/16 . Oxygen

F01N 2570/18 . Ammonia

F01N 2570/20 . Formaldehyde

F01N 2570/22 . Water or humidity

F01N 2570/24 . Hydrogen sulfide (H_2S)

F01N 2590/00 Exhaust or silencing apparatus adapted to particular use, e.g. for military applications, airplanes, submarines

F01N 2590/02 . for marine vessels or naval applications

F01N 2590/021 . . for outboard engines

F01N 2590/022 . . for jetskis

F01N 2590/04 . for motorcycles

F01N 2590/06 . for hand-held tools or portables devices

F01N 2590/08 . for heavy duty applications, e.g. trucks, buses, tractors, locomotives

F01N 2590/10 . for stationary applications

F01N 2590/11 . for hybrid vehicles

F01N 2610/00 Adding substances to exhaust gases

F01N 2610/01 . the substance being catalytic material in liquid form

F01N 2610/02 . the substance being ammonia or urea

F01N 2610/03 . the substance being hydrocarbons, e.g. engine fuel

F01N 2610/04 . the substance being hydrogen

F01N 2610/05 . the substance being carbon monoxide

F01N 2610/06 . the substance being in the gaseous form

F01N 2610/08 . with prior mixing of the substances with a gas, e.g. air

F01N 2610/085 . . Controlling the air supply

F01N 2610/10 . the substance being heated, e.g. by heating tank or supply line of the added substance

F01N 2610/102 . . after addition to exhaust gases, e.g. by a passively or actively heated surface in the exhaust conduit

F01N 2610/105 . . Control thereof

F01N 2610/107 . . using glow plug heating elements

F01N 2610/11 . the substance or part of the dosing system being cooled

F01N 2610/12 . the substance being in solid form, e.g. pellets or powder

F01N 2610/14 . Arrangements for the supply of substances, e.g. conduits

F01N 2610/1406 . . Storage means for substances, e.g. tanks or reservoirs

F01N 2610/1413 . . . Inlet and filling arrangements therefore

F01N 2610/142 . . . Controlling the filling of the tank

F01N 2610/1426 . . Filtration means

F01N 2610/1433 . . Pumps

F01N 2610/144 . . . Control thereof

F01N 2610/1446 . . Means for damping of pressure fluctuations in the delivery system, e.g. by puffer volumes or throttling

F01N 2610/1453 . . Sprayers or atomisers; Arrangement thereof in the exhaust apparatus

F01N 2610/146 . . . Control thereof, e.g. control of injectors or injection valves

F01N 2610/1466 . . Means for venting air out of conduits or tanks

F01N 2610/1473 . . Overflow or return means for the substances, e.g. conduits or valves for the return path

F01N 2610/148 . . Arrangement of sensors

F01N 2610/1486 . . Means to prevent the substance from freezing

F01N 2610/1493 . . Means for prevention of clogging, e.g. purging

F01N 2900/00 **Details of electrical control or of the monitoring of the exhaust gas treating apparatus**

F01N 2900/04 . Methods of control or diagnosing

F01N 2900/0402 . . using adaptive learning

F01N 2900/0404 . . using a data filter

F01N 2900/0406 . . using a model with a division of the catalyst or filter in several cells

F01N 2900/0408 . . using a feed-back loop

F01N 2900/0411 . . using a feed-forward control

F01N 2900/0412 . . using pre-calibrated maps, tables or charts

F01N 2900/0414 . . using a state observer

F01N 2900/0416 . . using the state of a sensor, e.g. of an exhaust gas sensor

F01N 2900/0418 . . using integration or an accumulated value within an elapsed period

F01N 2900/0421 . . using an increment counter when a predetermined event occurs

F01N 2900/0422 . . measuring the elapsed time

F01N 2900/06 . Parameters used for exhaust control or diagnosing

F01N 2900/0601 . . being estimated

F01N 2900/0602 . . Electrical exhaust heater signals

F01N 2900/08 .. said parameters being related to the engine

F01N 2900/10 .. said parameters being related to the vehicle or its components

F01N 2900/102 ... Travelling distance

F01N 2900/104 ... Battery status

F01N 2900/12 .. said parameters being related to the vehicle exterior

F01N 2900/14 .. said parameters being related to the exhaust gas

F01N 2900/1402 ... Exhaust gas composition

F01N 2900/1404 ... Exhaust gas temperature

F01N 2900/1406 ... Exhaust gas pressure

F01N 2900/1411 ... Exhaust gas velocity

F01N 2900/16 .. said parameters being related to the exhaust apparatus, e.g. particulate filter or catalyst

F01N 2900/1602 ... Temperature of exhaust gas apparatus

F01N 2900/1606 ... Particle filter loading or soot amount

F01N 2900/1611 ... Particle filter ash amount

F01N 2900/1612 ... SOx amount trapped in catalyst

F01N 2900/1614 ... NOx amount trapped in catalyst

F01N 2900/1616 ... NH_3-slip from catalyst

F01N 2900/1618 ... HC-slip from catalyst

F01N 2900/1621 ... Catalyst conversion efficiency

F01N 2900/1622 ... Catalyst reducing agent absorption capacity or consumption amount

F01N 2900/1624 ... Catalyst oxygen storage capacity

F01N 2900/1626 ... Catalyst activation temperature

F01N 2900/1628 ... Moisture amount in exhaust apparatus

F01N 2900/1631 ... Heat amount provided to exhaust apparatus

F01N 2900/18 .. said parameters being related to the system for adding a substance into the exhaust

F01N 2900/1804 ... Properties of secondary air added directly to the exhaust

F01N 2900/1806 ... Properties of reducing agent or dosing system

F01N 2900/1808 .... Pressure

F01N 2900/1811 .... Temperature

F01N 2900/1812 .... Flow rate

F01N 2900/1814 .... Tank level

F01N 2900/1818 .... Concentration of the reducing agent

F01N 2900/1821 .... Injector parameters

F01N 2900/1822 .... Pump parameters

F01N 2900/1824 .... Properties of the air to be mixed with added substances, e.g. air pressure or air temperature