F01N  GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR MACHINES OR ENGINES IN GENERAL; GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR INTERNAL COMBUSTION ENGINES

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

. . using spirally or helically shaped channels (cyclones B04C)

{ in combination with sound-absorbing materials}

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

. . by using movable parts

. . { for adjusting resonance or dead chambers or passages to resonance or dead chambers

. . { by means of valves

. . { for adjusting flow area

. . { for changing gas flow path through the silencer or for adjusting the dimensions of a chamber or a pipe (F01N 1/165 takes precedence)

. . { for controlling or modifying silencing characteristics only

. . having rotary movement

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

. . the parts being resilient walls

. . 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 1/100 {; 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 3/012 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 3/030 {; 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 53/02)
Conversion, e.g. using specified catalysts, processes, chemical aspects of catalytic components of exhaust (by using other chemical processes),-characterised by the absorbed or adsorbed substances;

Hydrocarbons;

[Nitrogen oxides];

[Sulfur or sulfur oxides];

[Carbon oxides];

(Oxygen);

Regulation of absorbers or adsorbents, e.g. purging (by electrically controlling the supply of combustible mixture or its constituents only);

Bypassing absorbers or adsorbents;

Regeneration of deteriorated absorbers or adsorbents, e.g. desulfurization of NOx traps;

Electric or magnetic treatment, e.g. dissociation of noxious components (electric filters)

F01N 3/035

Construction of thermal reactors

F02D 41/0235

periodically blowing a gas through the converter, e.g. in a direction opposite to exhaust gas flow or by reversing exhaust gas flow direction;

Control of additional air supply only, e.g. using by-passes or variable air pump drives;

Electric control of additional air supply;

Electric control of additional air supply;

using electrically operated valves, e.g. membrane valves;

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

Construction of thermal reactors

Construction of catalytic reactors

characterised by structure, by material or by manufacturing of catalyst support;

Metal other than sintered metal (F01N 3/2832 and F01N 3/2833 take precedence);

Metallic honeycomb monoliths made of stacked or rolled sheets, foils or plates;

(all sheets, plates or foils being corrugated);

only with non-corrugated sheets, plates or foils;

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;

Ceramics (F01N 3/2832, F01N 3/2835 take precedence);


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 from exhaust energy (using kinetic or wave energy of exhaust gases in exhaust systems for charging F02B; predominant aspects of such devices, see the relevant classes for the devices) 
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] 

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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 B01C 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 B66K)]

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 F16L 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

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 (O₃) 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
Selection of sound absorbing or insulating material

- Mineral wool, e.g. glass wool, rock wool, asbestos or the like
- Metallic wool, e.g. steel wool, copper wool or the like
- Porous ceramics
- Exfoliated vermiculite, e.g. zonolite, coke, pumice
- Plastic foam
- Granular material
- Wire mesh fabric, woven glass cloth or the like

Structure of catalyst support or particle filter

- Metallic plates or honeycombs, e.g. superposed or rolled-up corrugated or otherwise deformed sheet metal
- Methods of manufacturing
- Ceramic, e.g. monoliths
- Granular material
- Fibrous material, e.g. mineral or metallic wool
- Using binders, e.g. to form a permeable mat, paper or the like
- 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
- Metallic wire mesh fabric or knitting
- Sintered material
- Composite material
- Plastics, e.g. polymers, polyester, polyurethane

Arrangements for fitting catalyst support or particle filter element in the housing

- Fitting ceramic monoliths in a metallic housing
- With means compensating thermal expansion
- With means preventing gas flow by-pass or leakage
- With means for compressing granular material

Selection of materials for exhaust purification

- Used in catalytic reactors
- Zeolitic material
- Used in non-catalytic purification apparatus
- Zeolitic material
- Materials having magnetic properties
- Activated carbon or charcoal

Arrangements for controlling or regulating exhaust apparatus

- Using electric components only
- Using electropneumatic components
- Using pneumatic components only
- Using mechanical components only, e.g. actuated manually

By-passing, at least partially, exhaust from inlet to outlet of apparatus, to atmosphere or to other device
Influencing exhaust purification, e.g. starting of catalytic reaction, filter regeneration, or the like, by controlling engine operating characteristics

- by cutting out a part of engine cylinders
- by adding non-fuel substances to combustion air or fuel, e.g. additives
- by varying fuel-air ratio, e.g. by enriching fuel-air mixture
- by modifying ignition or injection timing
- at least a part of the injection taking place during expansion or exhaust stroke
- by modifying inlet or exhaust valve timing

Methods or apparatus for fitting, inserting or repairing different elements

- Fitting monolithic blocks into the housing
- Filling or emptying a chamber with granular material
- Inserting sound absorbing material into a chamber
- Repairing the housing or pipe-joints
- Fitting temporarily exhaust apparatus on exhaust conduit, e.g. in confined environment, garage or the like
- by using threaded joints
- by using quick-active type locking mechanisms, e.g. clips
- by mechanical joints, e.g. by deforming housing, tube, baffle plate or parts thereof
- by welding or brazing
- by bolts, screws, rivets or the like
- by bayonet fittings
- by using adhesive material, e.g. cement
- Removable or rechangeable blocks or cartridges, e.g. for filters
- Retrofitting exhaust apparatus

Structure or shape of gas passages, pipes or tubes

- Tubes being perforated
- characterised by shape, disposition or dimensions of apertures
- Tubes being formed by assembly of stamped or otherwise deformed sheet-metal
- Gas passages being formed between the walls of an outer shell and an inner chamber
- Tubes having non-circular cross section
- Tubes being corrugated
- Plurality of outlet tubes, e.g. in parallel or with different length
- Plurality of inlet tubes, e.g. discharging into different chambers
- the axis of inlet or outlet tubes being other than the longitudinal axis of apparatus

Dimensional characteristics of tubes, e.g. length, diameter

Inlet and outlet tubes being positioned on the same side of the apparatus

Concentric tubes or tubes being concentric to housing, e.g. telescopically assembled

Tubes being formed by extrusion, drawing or rolling

Tubes being formed by moulding or casting

Tubes with restrictions, i.e. venturi or the like, e.g. for sucking air or measuring mass flow

Structure, disposition or shape of gas-chambers

Two or more expansion chambers in series connected by means of tubes

the gases flowing longitudinally from inlet to outlet only in one direction

the gases flowing longitudinally from inlet to outlet in opposite directions

Two or more expansion chambers in series separated by apertured walls only

Two or more expansion chambers in parallel

Chambers having variable volumes

Dead or resonance chambers connected to gas flow tube by relatively short side-tubes

Plurality of resonance or dead chambers

being disposed one after the other in flow direction

Chambers with particular shapes, e.g. spherical

Dimensional characteristics of gas chambers

Chambers being formed inside the exhaust pipe without enlargement of the cross section of the pipe, e.g. resonance chambers

Surface coverings

for thermal insulation

for sound absorption

for exhaust purification, e.g. catalytic reaction

usable with leaded fuels

zeolites

for reducing soot ignition temperature

usable with sulfurised fuels

characterised by the distribution of the catalytic coatings

having a discontinuous, uneven or partially overlapping coating of catalytic material, e.g. higher amount of material upstream than downstream or vice versa

having more than one coating layer, e.g. multi-layered coatings

Corrosion resistive metals

Steel alloys, e.g. stainless steel

Aluminium or alloys thereof

Plastics material, e.g. polyester resin

reinforced with mineral or metallic fibres

Flexible elastomeric material

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
2560/0201 . for measuring or detecting ammonia NH\textsubscript{3}
2560/0202 . . for measuring or detecting CO or CO\textsubscript{2}
2560/0203 . . for measuring or detecting HC
2560/0204 . . for measuring or detecting hydrogen H\textsubscript{2}
2560/0205 . . for measuring or detecting O\textsubscript{2}; e.g. lambda sensors
2560/0206 . . for measuring or detecting NOx
2560/0207 . . for measuring or detecting SOx
2560/0208 . . for measuring or detecting humidity or water
2560/0506 . the means being a particulate sensor
2560/0606 . the means being a temperature sensor
2560/0706 . 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
2560/0806 . the means being a pressure sensor
2560/1206 . Other sensor principles, e.g. using electro conductivity of substrate or radio frequency
2560/1406 . having more than one sensor of one kind
2560/2006 . 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\textsubscript{2}S)

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
2590/0201 . . for outboard engines
2590/0202 . . for jetskis
2590/04 . for motorcycles
2590/06 . for hand-held tools orportables 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
using the state of a sensor, e.g. of an exhaust gas sensor

using integration or an accumulated value within an elapsed period

using an increment counter when a predetermined event occurs

measuring the elapsed time

Parameters used for exhaust control or diagnosing

being estimated

Electrical exhaust heater signals

said parameters being related to the engine

said parameters being related to the vehicle or its components

Travelling distance

Battery status

said parameters being related to the vehicle exterior

said parameters being related to the exhaust gas

Exhaust gas composition

Exhaust gas temperature

Exhaust gas pressure

Exhaust gas flow rate, e.g. mass flow rate or volumetric flow rate

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

Temperature of exhaust gas apparatus

Particle filter loading or soot amount

Particle filter ash amount

SOx amount trapped in catalyst

NOx amount trapped in catalyst

NH3-slip from catalyst

HC-slip from catalyst

Catalyst conversion efficiency

Catalyst reducing agent absorption capacity or consumption amount

Catalyst oxygen storage capacity

Catalyst activation temperature

Moisture amount in exhaust apparatus

Heat amount provided to exhaust apparatus

said parameters being related to the system for adding a substance into the exhaust

Properties of secondary air added directly to the exhaust

Properties of reducing agent or dosing system

Pressure

Temperature

Flow rate

Tank level

Concentration of the reducing agent

Injector parameters

Pump parameters

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