

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)}[c0809]
- 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](#))

WARNING

New subgroups of [F01N 3/10](#) are not complete pending a reorganisation

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)}

WARNING

This subgroup is not complete pending a reorganisation. See also group [F01N 3/206](#) for documents published before March 2004.

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}

WARNING

This group is not complete pending a reorganisation. See also [F01N 3/2853](#) and [F01N 3/2857](#)

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}

WARNING

This group is not complete pending a reorganisation. See also [F01N 3/2853](#) and [F01N 3/2857](#)

[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}

WARNING

This group is not complete pending a reorganisation. See also [F01N 3/2853](#) and [F01N 3/2857](#)

[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](#))

NOTE

- in this group the following indexing code is used: [F02M 2700/31](#)

[F01N 5/02](#) . the devices using heat

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

WARNING

This group is not complete pending a reorganisation. See also [F01N 5/02](#)

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 rechargeable 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 NH₃

F01N 2560/022 . . for measuring or detecting CO or CO₂

F01N 2560/023 . . for measuring or detecting HC

F01N 2560/024 . . for measuring or detecting hydrogen H₂

F01N 2560/025 . . for measuring or detecting O₂, e.g. lambda sensors

F01N 2560/026 . . for measuring or detecting NO_x

F01N 2560/027 . . for measuring or detecting SO_x

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 ₂ S)
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	...	NH3-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