

CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

ENGINES OR PUMPS

F02 COMBUSTION ENGINES (cyclically operating valves therefor, lubricating, exhausting, or silencing engines F01); HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS

F02M SUPPLYING COMBUSTION ENGINES IN GENERAL, WITH COMBUSTIBLE MIXTURES OR CONSTITUENTS THEREOF (charging such engines F02B)

NOTES

1. Attention is drawn to the notes preceding class F01.
2. In this subclass the following terms are used with the meanings indicated:
 - "Carburettors" means essentially apparatus for mixing fuel with air, the fuel being brought into mixing contact with the air by lowering the air pressure, e.g. in a venturi;
 - "Fuel injection apparatus" means apparatus for introducing fuel into a space, e.g. engine cylinder, by pressurising the fuel, e.g. by a pump acting behind the fuel, and thus embraces the so-called "solid fuel injection" in which liquid fuel is introduced without any admixture of gas;
 - "Low-pressure fuel injection" means fuel injection in which the fuel-air mixture containing fuel thus injected will be substantially compressed in the compression stroke of the engine;
 - "Pumping element" means a single piston-cylinder unit in a reciprocating-piston fuel-injection pump or the equivalent unit in any other type of fuel-injection pump.

WARNING

The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

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| F02M 7/23 | covered by | F02M 7/103 |
| F02M 51/08 | covered by | F02M 51/06 |

Carburettors (for gaseous fuels F02M 21/00; combined with low-pressure fuel-injection apparatus F02M 71/00)

1/00 Carburettors with means for facilitating engine's starting or its idling below operational temperatures

NOTE

- in this group the following indexing codes are used: F02M 2700/4302

- 1/005 . {Remote display or control for displaying the operational situation of the starter}
- 1/02 . the means to facilitate starting or idling being chokes for enriching fuel-air mixture (automatic chokes F02M 1/08)
- 1/04 . the means to facilitate starting or idling being auxiliary carburetting apparatus able to be put into, and out of, operation, e.g. having automatically-operated disc valves
- 1/043 . . {Auxiliary carburetting apparatus controlled by rotary sliding valves}
- 1/046 . . {Auxiliary carburetting apparatus controlled by piston valves}
- 1/06 . . having axially-movable valves, e.g. piston-shaped
- 1/08 . the means to facilitate starting or idling becoming operative or inoperative automatically (in connection with auxiliary carburetting apparatus F02M 1/04)

- 1/10 . . dependent on engine temperature, e.g. having thermostat
- 1/12 . . . with means for electrically heating thermostat
- 1/14 . . dependent on pressure in combustion-air or fuel-air-mixture intake (F02M 1/10 takes precedence)
- 1/16 . Other means for enriching fuel-air mixture during starting; Priming cups; using different fuels for starting and normal operation
- 1/165 . . {Vaporizing light fractions from the fuel and condensing them for use during starting}
- 1/18 . . Enriching fuel-air mixture by depressing float to flood carburettor
- 1/185 . . . {Enriching the fuel-air mixture by altering the float chamber level by external means, e.g. by opening the input valve}
- 3/00 Idling devices (with means for facilitating idling below operational temperatures F02M 1/00)**
- 3/005 . {Idling fuel enrichment with motor driven instead of driving; Switching the fuel supply from the main to idling jet system}
- 3/02 . Preventing flow of idling fuel
- 3/04 . . under conditions where engine is driven instead of driving, e.g. driven by vehicle running down hill
- 3/041 . . . {Removal of the fuel from the main jet system, e.g. by means of a pump}

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| 3/042 | . . . {Fuel cut-off by altering the pressure in the float chamber; Arrangement of pneumatic accumulators for pressure equalization} | 5/14 | . . {Float chambers, e.g. adjustable in position (float chamber with a built-in intermediate reservoir F02M 7/06)} |
| 3/043 | . . . {Devices as described in F02M 3/005 , F02M 3/041 , F02M 3/042 , F02M 3/045 , F02M 3/05 and F02M 3/055 and also equipped with additional air} | 5/16 | . . Floats |
| 3/045 | . . . Control of valves situated in the idling nozzle system, or the passage system, by electrical means or by a combination of electrical means with fluidic or mechanical means | 7/00 | Carburettors with means for influencing, e.g. enriching or keeping constant, fuel/air ratio of charge under varying conditions (choke valves for starting F02M 1/00) |
| 3/05 | . . . Pneumatic or mechanical control, e.g. with speed regulation | 7/02 | . Carburettors having aerated fuel spray nozzles (with valve control for amount of air for aerating fuel F02M 7/24) |
| 3/055 | . . . Fuel flow cut-off by introducing air, e.g. brake air, into the idling fuel system | 7/025 | . . {Fuel cut-off by introducing brake air in the conduit system leading to the main jet (fuel cut-off by introducing brake air into the idling fuel system F02M 3/055)} |
| 3/06 | . Increasing idling speed | 7/04 | . Means for enriching charge at high combustion-air flow |
| 3/062 | . . {by altering as a function of motor r.p.m. the throttle valve stop or the fuel conduit cross-section by means of pneumatic or hydraulic means (external damping elements F02M 19/122)} | 7/045 | . . {Mechanical adjustment of the spray nozzle cross-section in connection with the choke} |
| 3/065 | . . {by randomly altering the throttle valve stop} | 7/06 | . Means for enriching charge on sudden {air} throttle opening, i.e. at acceleration, e.g. storage means in passage way system |
| 2003/067 | . . {the valve for controlling the cross-section of the conduit being rotatable, but not being a screw-like valve} | 7/08 | . . using pumps |
| 3/07 | . . by positioning the throttle flap stop, or by changing the fuel flow cross-sectional area, by electrical, electromechanical or electropneumatic means, according to engine speed | 7/083 | . . . {a pump sucking fuel from the conduit system leading to the spray nozzle downstream of the metering cross-section during deceleration} |
| 3/075 | . . . {the valve altering the fuel conduit cross-section being a slidable valve} | 7/087 | . . . changing output according to temperature in engine |
| 3/08 | . Other details of idling devices (fighting ice-formation by heating idling ports F02M 15/02) | 7/093 | . . . changing output according to intake vacuum |
| 3/09 | . . Valves responsive to engine conditions, e.g. manifold vacuum (F02M 1/00 , F02M 5/00 - F02M 33/00 take precedence) | 7/10 | . Other installations, without moving parts, for influencing fuel/air ratio, e.g. electrical means |
| 3/10 | . . Fuel metering pins; Nozzles | 7/103 | . . {with self-acting equaliser jets} |
| 2003/105 | . . . {Needle adjustment limiter caps} | 7/106 | . . {Fluid amplifier as a device for influencing the fuel-air mixture} |
| 3/12 | . . Passageway systems | 7/11 | . . Altering float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor F02M 1/18) |
| 3/14 | . . Location of idling system outlet relative to throttle valve | 7/12 | . Other installations, with moving parts, for influencing fuel/air ratio, e.g. having valves (F02M 7/24 takes precedence) |
| 5/00 | Float-controlled apparatus for maintaining a constant fuel level | 7/127 | . . Altering the float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor F02M 1/18) |
| 5/02 | . with provisions to meet variations in carburettor position, e.g. upside-down position in aircraft | 7/133 | . . Auxiliary jets, i.e. operating only under certain conditions, e.g. full power (F02M 7/04 , F02M 7/06 take precedence) |
| 5/04 | . . with pivotally or rotatably mounted float chambers ({basic adjustment of float chambers having variable position F02M 5/14)} | 7/14 | . . with means for controlling cross-sectional area of fuel spray nozzle (dependent on air-throttle valve position F02M 7/22) |
| 5/06 | . having adjustable float mechanism, e.g. to meet dissimilarities in specific gravity of different fuels | 7/16 | . . . operated automatically, e.g. dependent on exhaust-gas analysis |
| 5/08 | . having means for venting float chambers | 7/17 | by a pneumatically adjustable piston-like element, e.g. constant depression carburettors |
| 5/085 | . . {consisting of an overflow from the float chamber} | 7/18 | . . with means for controlling cross-sectional area of fuel-metering orifice (dependent on air-throttle position F02M 7/22) |
| 5/10 | . having means for preventing vapour lock, e.g. insulated float chambers or forced fuel circulation through float chamber with engine stopped | 7/20 | . . . operated automatically, e.g. dependent on altitude |
| 5/105 | . . {Auxiliary input valve which can be regulated to obtain an increased fuel supply from the float chamber} | 7/22 | . . fuel flow cross-sectional area being controlled dependent on air-throttle-valve position (the throttle valve being slidably arranged transversely to air passage F02M 9/06) |
| 5/12 | . Other details, e.g. floats, valves, setting devices or tools (floats in general F16K 33/00) | | |
| 5/125 | . . {Shape of the jet needle} | | |

- 7/225 . . . {The fuel orifice opening is controlled by a manually actuatable throttle valve so as to vary the cross-sectional area of the orifice}
- 7/24 . . with means for controlling amount of air for aerating fuel
- 7/245 . . . {Accessories, e.g. sieves, accelerating wheels, whirl generating devices and the like, for the intimate mixing of emulsifying air with fuel}
- 7/26 . . . dependent on position of optionally operable throttle means
- 7/28 . . . dependent on temperature or pressure
- 9/00 Carburettors having air or fuel-air mixture passage throttling valves other than of butterfly type (register-type carburettors F02M 11/00); Carburettors having fuel-air mixing chambers of variable shape or position**
- 9/02 . having throttling valves, e.g. of piston shape, slidably arranged transversely to the passage
- 9/023 . . {General constructional elements}
- 9/026 . . {with plate-like throttle valve}
- 9/04 . . with throttling valves sliding in a plane inclined to the passage
- 9/06 . . with means for varying cross-sectional area of fuel spray nozzle dependent on throttle position
- 9/065 . . . {Automatically and not automatically controlled throttle valves operating mutually}
- 9/08 . having throttling valves rotatably mounted in the passage
- 9/085 . . {Fuel spray nozzles in the throttling valves}
- 9/10 . having valves, or like controls, of elastic-wall type for controlling the passage, or for varying cross-sectional area, of fuel-air mixing chambers {or of the entry passage}
- 9/103 . . {Mechanical control}
- 9/106 . . {Pneumatic or hydraulic control}
- 9/12 . having other specific means for controlling the passage, or for varying cross-sectional area, of fuel-air mixing chambers
- 9/121 . . {Iris diaphragms}
- 9/122 . . {consisting of lamellae or wires, e.g. a hyperboloid formed by twisting a wire cylinder}
- 9/123 . . {Spiral springs}
- 9/124 . . {Throttle valves with an action corresponding to those in apparatus for re-atomising condensed fuel or homogenising fuel-air mixture (shape of throttle valves F02M 3/14)}
- 9/125 . . {specially shaped throttle valves not otherwise covered in groups F02M 9/121 - F02M 9/124}
- 9/127 . . Axially movable throttle valves concentric with the axis of the mixture passage
- 9/1275 . . . {Venturi-nozzle shaped type, e.g. a venturi nozzle being moved relative to a fixed mushroom-shaped body}
- 9/133 . . . the throttle valves having mushroom-shaped bodies
- 9/14 . having venturi and nozzle relatively displaceable essentially along the venture axis
- 11/00 Multi-stage carburettors, Register-type carburettors, i.e. with slidable or rotatable throttling valves in which a plurality of fuel nozzles, other than only an idling nozzle and a main one, are sequentially exposed to air stream by throttling valve**
- 11/02 . with throttling valve, e.g. of flap or butterfly type, in a later stage opening automatically
- 11/04 . . the later stage valves having damping means
- 11/06 . Other carburettors with throttling valve of flap or butterfly type
- 11/08 . Register carburettors with throttling valve movable transversally to air passage
- 11/10 . Register carburettors with rotatable throttling valves
- 11/105 . . {Shape of the idling system}
- 13/00 Arrangements of two or more separate carburettors (re-atomising condensed fuel or homogenising fuel-air mixture F02M 29/00); Carburettors using more than one fuel (apparatus for adding small quantities of secondary fuel F02M 25/00)**
- 13/02 . Separate carburettors
- 13/021 . . {Particular constructional measures of the intake conduits between carburettors and cylinder}
- 13/023 . . {Special construction of the control rods}
- 13/025 . . {Equalizing pipes between the carburettors, e.g. between the float chambers}
- 13/026 . . {Common functional groups for several carburettors, e.g. common idling system}
- 13/028 . . {Tuning apparatus for multi-stage carburettors installations (other carburettor tuning apparatus F02M 19/01)}
- 13/04 . . structurally united
- 13/043 . . . {arranged in series, e.g. initial and main carburettor}
- 13/046 . . . {arranged in parallel, e.g. initial and main carburettor}
- 13/06 . the carburettors using different fuels
- 13/08 . Carburettors adapted to use liquid and gaseous fuels, e.g. alternatively
- 15/00 Carburettors with heating, cooling, or thermal insulating means for combustion-air, fuel, or fuel-air mixture (heating, cooling, or thermally insulating float apparatus F02M 5/00; apparatus for thermally treating combustion-air, fuel, or fuel-air mixture not being part of a carburettor F02M 31/00)**
- 15/02 . with heating means, e.g. to combat ice-formation
- 15/022 . . {near to manually operated throttle valve}
- 15/025 . . {Fuel preheating}
- 15/027 . . {Air or air-fuel mixture preheating}
- 15/04 . . the means being electrical
- 15/045 . . . {for the fuel system, e.g. built into the fuel conduits or nozzles}
- 15/06 . Heat shieldings, e.g. from engine radiations
- 17/00 Carburettors having pertinent characteristics not provided for in, or of interest apart from, the apparatus of preceding main groups (apparatus for treating combustion-air, fuel, or fuel-air mixture by catalysts, electric means, magnetism, rays, sound waves, or the like F02M 27/00; combinations of carburettors and low-pressure fuel-injection apparatus F02M 71/00)**
- 17/02 . Floatless carburettors
- 17/04 . . having fuel inlet valve controlled by diaphragm
- 17/06 . . having overflow chamber determining constant fuel level

- 17/08 . Carburettors having one or more fuel passages opening in a valve-seat surrounding combustion-air passage, the valve being opened by passing air
- 17/09 . . the valve being of an eccentrically mounted butterfly type
- 17/10 . Carburettors having one or more fuel passages opening in valve-member of air throttle
- 17/12 . . the valve member being of butterfly type
- 17/14 . Carburettors with fuel-supply parts opened and closed in synchronism with engine stroke { [Valve carburettors](#) }
- 17/142 . . { [with the fuel exit nozzles in or near the valve seat or valve](#) }
- 17/145 . . { [the valve being opened by the pressure of the passing fluid](#) }
- 17/147 . . { [Valve carburettor with simultaneous air and fuel control](#) }
- 17/16 . Carburettors having continuously-rotating bodies, e.g. surface carburettors ([fuel injection by centrifugal forces F02M 69/06](#))
- 17/18 . Other surface carburettors
- 17/20 . . with fuel bath
- 17/22 . . . with air bubbling through bath
- 17/24 . . with wicks
- 17/26 . . with other wetted bodies
- 17/28 . . . fuel being drawn through a porous body
- 17/30 . Carburettors with fire-protecting devices, e.g. combined with fire-extinguishing apparatus
- 17/32 . . automatically closing fuel conduits on outbreak of fire { [\(fire protection devices for stopping flow from or in pipes or hoses F16L 55/1026\)](#) }
- 17/34 . Other carburettors combined or associated with other apparatus, e.g. air filters ([predominant aspects of the apparatus, see the relevant classes for such apparatus](#))
- 17/36 . Carburettors having fitments facilitating their cleaning
- 17/38 . Controlling of carburettors, not otherwise provided for ([external control gear F02M 19/12](#))
- 17/40 . Selection of particular materials for carburettors, e.g. sheet metal, plastic, or translucent materials
- 17/42 . Float-controlled carburettors not otherwise provided for
- 17/44 . Carburettors characterised by draught direction and not otherwise provided for { , [e.g. for model aeroplanes](#) }
- 17/46 . . with down- draught
- 17/48 . . with up- draught { [and float draught, e.g. for lawnmower and chain saw motors](#) }
- 17/50 . Carburettors having means for combating ice-formation ([thermally F02M 15/02](#))
- 17/52 . Use of cold, produced by carburettors, for other purposes ([apparatus using the cold, see the relevant classes for such apparatus](#))
- 17/525 . . { [Use of the intake conduit vacuum](#) }
- 19/00 Details, component parts, or accessories of carburettors, not provided for in, or of interest apart from, the apparatus of groups [F02M 1/00](#) - [F02M 17/00](#) (measuring or testing apparatus in general G01)**
- 19/01 . Apparatus for testing, tuning, or synchronising carburettors, e.g. carburettor glow stands
- 19/02 . Metering-orifices, e.g. variable in diameter ([variable during operation F02M 7/18](#))
- 19/0203 . . { [the cross-sectional area being changed pneumatically, e.g. vacuum dependent](#) }
- 19/0207 . . { [the cross-sectional area being changed electrically](#) }
- 19/021 . . { [the cross-sectional area being changed mechanically](#) }
- 19/0214 . . { [Changing the nozzle cross-sectional area as a function of temperature](#) }
- 19/0217 . . { [Movable mushroom-shaped spray nozzles](#) }
- 19/0221 . . { [with a roughened spray stimulating surface or the like, e.g. sieves near to the nozzle orifice](#) }
- 19/0225 . . { [Arrangement of nozzle in the suction passage \(idling nozzles F02M 3/08\)](#) }
- 19/0228 . . { [Ring nozzles](#) }
- 19/0232 . . { [Fuel nozzle with device for return flow of leaked fuel](#) }
- 19/0235 . . { [Arrangements of several spray nozzles not provided for in \[F02M 3/00\]\(#\) or \[F02M 11/00\]\(#\)](#) }
- 19/0239 . . { [in a fixed aerofoil profile](#) }
- 19/0242 . . { [with inserts of porous material](#) }
- 19/0246 . . { [Nozzle cleaning](#) }
- 19/025 . . Metering orifices not variable in diameter
- 19/03 . . Fuel atomising nozzles; Arrangement of emulsifying air conduits ([atomising in general B05B](#))
- 19/035 . . Mushroom-shaped atomising nozzles
- 19/04 . Fuel-metering pins or needles
- 19/06 . Other details of fuel conduits
- 19/063 . . { [Built-in electric heaters](#) }
- 19/066 . . { [Built-in cleaning elements, e.g. filters](#) }
- 19/08 . Venturis
- 19/081 . . { [Shape of venturis or cross-section of mixture passages being adjustable](#) }
- 19/082 . . { [Venturi section being axially slidable in the mixture passages](#) }
- 19/083 . . { [Venturi section consisting of a lamellae spring-like structure](#) }
- 19/085 . . { [venturi section being made from elastic material, e.g. from rubber-like material](#) }
- 19/086 . . { [Venturi suction bypass systems](#) }
- 19/087 . . { [Venturi throat consisting of automatically adjusting balls](#) }
- 19/088 . . { [Whirl devices and other atomising means in or on the venturi walls](#) }
- 19/10 . . in multiple arrangement { , [e.g. arranged in series, fixed, arranged radially offset with respect to each other](#) }
- 19/105 . . . { [movable axially relative to each other](#) }
- 19/12 . External control gear, e.g. having dashpots ([dampening means in later stages of multistage carburettors F02M 11/04; carburettor control gear in which the carburettor aspects do not predominate, see the relevant classes](#))
- 19/122 . . { [Damping elements \(pneumatic or hydraulic means for increasing idling speed F02M 3/062\)](#) }
- 19/124 . . { [Connecting rods between at least two throttle valves \(\[F02M 1/02\]\(#\) takes precedence\)](#) }
- 19/126 . . { [Connecting rods between at least a throttle valve and an accelerating pump \(\[F02M 7/08\]\(#\) takes precedence\)](#) }

- 19/128 . . {Reserve throttle idle return spring, e.g. for use upon failure of the main spring}

21/00 Apparatus for supplying engines with non-liquid fuels, e.g. gaseous fuels stored in liquid form

NOTE

- in this group the following indexing codes are used: [F02M 2700/12](#) - [F02M 2700/13](#)

- 21/02 . for gaseous fuels ([apparatus for vaporising liquid fuel by heat F02M 31/00](#); engines with apparatus generating gas from solid fuel, e.g. from wood, [F02B 43/08](#))
- 21/0203 . . {characterised by the type of gaseous fuel}
- 21/0206 . . . {Non-hydrocarbon fuels, e.g. hydrogen, ammonia or carbon monoxide}
- 21/0209 . . . {Hydrocarbon fuels, e.g. methane or acetylene}
- 21/0212 {comprising at least 3 C-Atoms, e.g. liquefied petroleum gas [LPG], propane, butane or dimethyl ether [DME]}
- 21/0215 . . . {Mixtures of gaseous fuels; Natural gas; Biogas; Mine gas; Landfill gas}
- 21/0218 . . {Details on the gaseous fuel supply system, e.g. tanks, valves, pipes, pumps, rails, injectors or mixers}
- 21/0221 . . . {Fuel storage reservoirs, e.g. cryogenic tanks}
- 21/0224 {Secondary gaseous fuel storages}
- 21/0227 . . . {Means to treat or clean gaseous fuels or fuel systems, e.g. removal of tar, cracking, reforming or enriching}
- 21/023 . . . {Valves; Pressure or flow regulators in the fuel supply or return system}
- 21/0233 {Details of actuators therefor}
- 21/0236 {Multi-way valves; Multiple valves forming a multi-way valve system}
- 21/0239 {Pressure or flow regulators therefor}
- 21/0242 {Shut-off valves; Check valves; Safety valves; Pressure relief valves}
- 21/0245 . . . {High pressure fuel supply systems; Rails; Pumps; Arrangement of valves}
- 21/0248 . . . {Injectors}
- 21/0251 {Details of actuators therefor}
- 21/0254 {Electric actuators, e.g. solenoid or piezoelectric}
- 21/0257 {Details of the valve closing elements, e.g. valve seats, stems or arrangement of flow passages}
- 21/026 {Lift valves, i.e. stem operated valves}
- 21/0263 {Inwardly opening single or multi nozzle valves, e.g. needle valves}
- 21/0266 {Hollow stem valves; Piston valves; Stems having a spherical tip}
- 21/0269 {Outwardly opening valves, e.g. poppet valves}
- 21/0272 {Ball valves; Plate valves; Valves having deformable or flexible parts, e.g. membranes; Rotatable valves}
- 21/0275 {for in-cylinder direct injection, e.g. injector combined with spark plug}
- 21/0278 {Port fuel injectors for single or multipoint injection into the air intake system}

- 21/0281 {Adapters, sockets or the like to mount injection valves onto engines; Fuel guiding passages between injectors and the air intake system or the combustion chamber}
- 21/0284 . . . {Arrangement of multiple injectors or fuel-air mixers per combustion chamber}
- 21/0287 . . . {characterised by the transition from liquid to gaseous phase ([F02M 21/06](#) takes precedence); Injection in liquid phase; Cooling and low temperature storage}
- 21/029 . . . {Arrangement on engines or vehicle bodies; Conversion to gaseous fuel supply systems}
- 21/0293 . . . {Safety devices; Fail-safe measures}
- 21/0296 . . . {Manufacturing or assembly; Materials, e.g. coatings}
- 21/04 . . Gas-air mixing apparatus ([carburettors adapted to use liquid and gaseous fuels F02M 13/08](#); [carburetting gases in general C10J](#))
- 21/042 . . . {Mixer comprising a plurality of bores or flow passages}
- 21/045 . . . {Vortex mixer}
- 21/047 . . . {Venturi mixer}
- 21/06 . . Apparatus for de-liquefying, e.g. by heating ([discharging liquefied gases in general F17C](#))
- 21/08 . for non-gaseous fuels ([for engines operating on fuel containing oxidants F02B](#))
- 21/10 . . for fuels with low melting point, e.g. apparatus having heating means
- 21/12 . for fuels in pulverised state ([engine plants with fuel-pulverising apparatus F02B](#))

Engine-pertinent apparatus for feeding, or treating before their admission to engine, combustion-air, fuel, or fuel-air mixture {treatment by admission of activating fluids}

23/00 Apparatus for adding secondary air to fuel-air mixture

- 23/001 . {built into a flange}
- 23/003 . {Particular shape of air intake}
- 23/005 . {with a damping element in the secondary air control}
- 23/006 . {Valves specially shaped for supplying secondary air}
- 2023/008 . {by injecting compressed air directly into the combustion chamber}
- 23/02 . with personal control, or with secondary-air valve controlled by main combustion-air throttle
- 23/025 . . {Optional operation by means of a hand or foot switch}
- 23/03 . . the secondary air-valve controlled by main combustion-air throttle
- 23/04 . with automatic control
- 23/06 . . dependent on engine speed
- 23/062 . . . {Secondary air flow cut-off at low speed}
- 23/065 . . . {Secondary air flow cut-off at high torque}
- 23/067 . . . {Secondary air admission flow at high speeds and with the main butterfly valve closed, e.g. during deceleration}
- 23/08 . . dependent on pressure in main combustion-air induction system {, e.g. pneumatic-type apparatus}
- 23/085 . . . {specially adapted for secondary air admission during braking or travelling down steep slopes}
- 23/09 . . . using valves directly opened by low pressure
- 23/095 {with balls which are not spring loaded}

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| 23/10 | . . dependent on temperature, e.g. engine temperature | 2026/002 | . . {EGR valve being controlled by vacuum or overpressure} |
| 23/12 | . characterised by being combined with device for, or by secondary air effecting, re-atomising of condensed fuel | 2026/0025 | . . . {Intake vacuum or overpressure modulating valve} |
| 23/14 | . characterised by adding hot {secondary} air | 2026/003 | . . {EGR valve controlled by air measuring device} |
| 25/00 | Engine-pertinent apparatus for adding non-fuel substances or small quantities of secondary fuel to combustion-air, main fuel, or fuel-air mixture (F02M 43/00 takes precedence; adding secondary air to fuel-air mixture F02M 23/00; adding exhaust gases F02M 26/00) | 2026/004 | . . {EGR valve controlled by a temperature signal or an air/fuel ratio (lambda) signal} |
| 25/022 | . Adding fuel and water emulsion, water or steam | 2026/005 | . . {EGR valve controlled by an engine speed signal} |
| 25/0221 | . . {Details of the water supply system, e.g. pumps or arrangement of valves} | 2026/0055 | . . {EGR valve controlled by inertia, e.g. having a pendulum controlling the EGR valve} |
| 25/0222 | . . . {Water recovery or storage} | 2026/006 | . . {EGR specially adapted for intake systems having two or more fuel injectors per cylinder} |
| 25/0224 | . . . {Water treatment or cleaning (F02M 25/032 takes precedence)} | 2026/007 | . . {EGR specially adapted for engines having two or more spark plugs per cylinder} |
| 25/0225 | . . . {Water atomisers or mixers, e.g. using ultrasonic waves} | 2026/008 | . . {EGR specially adapted for engines having a combustion chamber divided by the piston at TDC into two or more sub-chambers} |
| 25/0227 | . . {Control aspects; Arrangement of sensors; Diagnostics; Actuators} | 2026/009 | . . {EGR combined with means to change air/fuel ratio, ignition timing, charge swirl in the cylinder} |
| 25/0228 | . . {Adding fuel and water emulsion} | 26/01 | . Internal exhaust gas recirculation, i.e. wherein the residual exhaust gases are trapped in the cylinder or pushed back from the intake or the exhaust manifold into the combustion chamber without the use of additional passages |
| 25/025 | . . Adding water | 26/02 | . EGR systems specially adapted for supercharged engines |
| 25/028 | . . . into the charge intakes | 26/03 | . . with a single mechanically or electrically driven intake charge compressor |
| 25/03 | . . . into the cylinder {or the pre-combustion chamber} | 26/04 | . . with a single turbocharger |
| 25/032 | . . Producing and adding steam | 26/05 | . . . High pressure loops, i.e. wherein recirculated exhaust gas is taken out from the exhaust system upstream of the turbine and reintroduced into the intake system downstream of the compressor |
| 25/035 | . . . into the charge intakes | 26/06 | . . . Low pressure loops, i.e. wherein recirculated exhaust gas is taken out from the exhaust downstream of the turbocharger turbine and reintroduced into the intake system upstream of the compressor |
| 25/038 | . . . into the cylinder {or the pre-combustion chamber} | 26/07 | . . . Mixed pressure loops, i.e. wherein recirculated exhaust gas is either taken out upstream of the turbine and reintroduced upstream of the compressor, or is taken out downstream of the turbine and reintroduced downstream of the compressor |
| 25/06 | . adding lubricant vapours | 26/08 | . . for engines having two or more intake charge compressors or exhaust gas turbines, e.g. a turbocharger combined with an additional compressor |
| 25/08 | . adding fuel vapours drawn from engine fuel reservoir {(electrical control of purge system F02D 41/003)} | 26/09 | . . Constructional details, e.g. structural combinations of EGR systems and supercharger systems; Arrangement of the EGR and supercharger systems with respect to the engine |
| 25/0809 | . . {Judging failure of purge control system} | 26/10 | . . . having means to increase the pressure difference between the exhaust and intake system, e.g. venturis, variable geometry turbines, check valves using pressure pulsations or throttles in the air intake or exhaust system |
| 25/0818 | . . . {having means for pressurising the evaporative emission space} | 26/11 | . Manufacture or assembly of EGR systems; Materials or coatings specially adapted for EGR systems |
| 25/0827 | . . . {by monitoring engine running conditions} | 26/12 | . characterised by means for attaching parts of an EGR system to each other or to engine parts |
| 25/0836 | . . {Arrangement of valves controlling the admission of fuel vapour to an engine, e.g. valve being disposed between fuel tank or absorption canister and intake manifold} | | |
| 2025/0845 | . . {Electromagnetic valves} | | |
| 25/0854 | . . {Details of the absorption canister} | | |
| 2025/0863 | . . {with means dealing with condensed fuel or water, e.g. having a liquid trap} | | |
| 25/0872 | . . {Details of the fuel vapour pipes or conduits} | | |
| 2025/0881 | . . {with means to heat or cool the canister} | | |
| 25/089 | . . {Layout of the fuel vapour installation} | | |
| 25/10 | . adding acetylene, non-waterborne hydrogen, non-airborne oxygen, or ozone | | |
| 25/12 | . . the apparatus having means for generating such gases (using rays and simultaneously generating ozone F02M 27/06) | | |
| 25/14 | . adding anti-knock agents, not provided for in subgroups F02M 25/022 - F02M 25/10 | | |
| 26/00 | Engine-pertinent apparatus for adding exhaust gases to combustion-air, main fuel or fuel-air mixture, e.g. by exhaust gas recirculation [EGR] systems | | |
| 2026/001 | . {Arrangements; Control features; Details} | | |

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| 26/13 | • Arrangement or layout of EGR passages, e.g. in relation to specific engine parts or for incorporation of accessories | 26/44 | • . . . in which a main EGR passage is branched into multiple passages |
| 26/14 | • . . in relation to the exhaust system | 26/45 | • Sensors specially adapted for EGR systems |
| 26/15 | • . . . in relation to engine exhaust purifying apparatus | 26/46 | • . . for determining the characteristics of gases, e.g. composition |
| 26/16 | • . . . with EGR valves located at or near the connection to the exhaust system | 26/47 | • . . . the characteristics being temperatures, pressures or flow rates |
| 26/17 | • . . in relation to the intake system | 26/48 | • . . EGR valve position sensors (details of the sensor installation in the valve housing F02M 26/72) |
| 26/18 | • . . . Thermal insulation or heat protection | 26/49 | • Detecting, diagnosing or indicating an abnormal function of the EGR system |
| 26/19 | • . . . Means for improving the mixing of air and recirculated exhaust gases, e.g. venturis or multiple openings to the intake system | 26/50 | • Arrangements or methods for preventing or reducing deposits, corrosion or wear caused by impurities (F02M 26/35 , F02M 26/74 take precedence) |
| 26/20 | • . . . Feeding recirculated exhaust gases directly into the combustion chambers or into the intake runners | 26/51 | • EGR valves combined with other devices, e.g. with intake valves or compressors (combined with intake air throttles F02M 26/64) |
| 26/21 | • . . . with EGR valves located at or near the connection to the intake system | 26/52 | • Systems for actuating EGR valves |
| 26/22 | • . . with coolers in the recirculation passage | 26/53 | • . . using electric actuators, e.g. solenoids |
| 26/23 | • . . . Layout, e.g. schematics | 26/54 | • . . . Rotary actuators, e.g. step motors |
| 26/24 | • with two or more coolers | 26/55 | • . . using vacuum actuators |
| 26/25 | • with coolers having bypasses | 26/56 | • . . . having pressure modulation valves |
| 26/26 | • characterised by details of the bypass valve | 26/57 | • using electronic means, e.g. electromagnetic valves |
| 26/27 | • with air-cooled heat exchangers | 26/58 | • . . . Constructional details of the actuator; Mounting thereof |
| 26/28 | • with liquid-cooled heat exchangers | 26/59 | • . . using positive pressure actuators; Check valves therefor |
| 26/29 | • . . . Constructional details of the coolers, e.g. pipes, plates, ribs, insulation or materials | 26/60 | • . . . in response to air intake pressure |
| 26/30 | • Connections of coolers to other devices, e.g. to valves, heaters, compressors or filters; Coolers characterised by their location on the engine | 26/61 | • . . . in response to exhaust pressure |
| 26/31 | • Air-cooled heat exchangers | 26/615 | • { the exhaust back pressure } |
| 26/32 | • Liquid-cooled heat exchangers | 26/62 | • . . . in response to fuel pressure |
| 26/33 | • . . . controlling the temperature of the recirculated gases | 26/63 | • . . the EGR valve being directly controlled by an operator (F02M 26/64 takes precedence) |
| 26/34 | • . . with compressors, turbines or the like in the recirculation passage | 26/64 | • . . the EGR valve being operated together with an intake air throttle |
| 26/35 | • . . with means for cleaning or treating the recirculated gases, e.g. catalysts, condensate traps, particle filters or heaters | 26/65 | • Constructional details of EGR valves |
| 26/36 | • . . with means for adding fluids other than exhaust gas to the recirculation passage; with reformers | 26/66 | • . . Lift valves, e.g. poppet valves |
| 26/37 | • . . with temporary storage of recirculated exhaust gas (internal exhaust gas recirculation F02M 26/01) | 26/67 | • . . . Pintles; Spindles; Springs; Bearings; Sealings; Connections to actuators |
| 26/38 | • . . with two or more EGR valves disposed in parallel | 26/68 | • . . . Closing members; Valve seats; Flow passages |
| 26/39 | • . . with two or more EGR valves disposed in series | 26/69 | • . . . having two or more valve-closing members |
| 26/40 | • . . with timing means in the recirculation passage, e.g. cyclically operating valves or regenerators; with arrangements involving pressure pulsations | 26/70 | • . . Flap valves; Rotary valves; Sliding valves; Resilient valves |
| 26/41 | • . . characterised by the arrangement of the recirculation passage in relation to the engine, e.g. to cylinder heads, liners, spark plugs or manifolds; characterised by the arrangement of the recirculation passage in relation to specially adapted combustion chambers | 26/71 | • . . Multi-way valves |
| 26/42 | • . . having two or more EGR passages; EGR systems specially adapted for engines having two or more cylinders | 26/72 | • . . Housings |
| 26/43 | • . . . in which exhaust from only one cylinder or only a group of cylinders is directed to the intake of the engine | 26/73 | • . . . with means for heating or cooling the EGR valve |
| | | 26/74 | • . . Protection from damage, e.g. shielding means |
| | | 27/00 | Apparatus for treating combustion-air, fuel, or fuel-air mixture, by catalysts, electric means, magnetism, rays, sound waves, or the like |
| | | 27/02 | • by catalysts |
| | | 27/04 | • by electric means, { ionisation , polarisation } or magnetism |
| | | 27/042 | • . . { by plasma } |
| | | 27/045 | • . . { by permanent magnets } |
| | | 2027/047 | • . . { with a pulsating magnetic field } |
| | | 27/06 | • by rays {, e.g. infra-red and ultra-violet } |
| | | 27/065 | • . . { Radioactive radiation } |
| | | 27/08 | • by sonic or ultrasonic waves |

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| 29/00 | Apparatus for re-atomising condensed fuel or homogenising fuel-air mixture (combined with secondary-air supply F02M 23/12 ; collecting condensed fuel F02M 33/02) | 31/087 | Heat-exchange arrangements between the air intake and exhaust gas passages, e.g. by means of contact between the passages |
| 29/02 | . having rotary parts {, e.g. fan wheels} | 31/093 | Air intake passage surrounding the exhaust gas passage; Exhaust gas passage surrounding the air intake passage |
| 29/04 | . having screens, gratings, baffles, or the like (rotary F02M 29/02) | 31/10 | . . . by hot liquids, e.g. lubricants {or cooling water} |
| 29/06 | . . generating whirling motion of mixture | 31/102 | {Particular constructional characteristics of the shape of the heat exchange surfaces} |
| 29/08 | . . having spirally-wound wires | 31/105 | {Particular constructional characteristics of the switching apparatus} |
| 29/10 | . . adjustable | 31/107 | {Controlled or manual switching} |
| 29/12 | . having homogenising valves held open by mixture current | 31/12 | . . electrically |
| 29/14 | . re-atomising or homogenising being effected by unevenness of internal surfaces of mixture intake | 31/125 | . . . Fuel |
| 31/00 | Apparatus for thermally treating combustion-air, fuel, or fuel-air mixture (F02M 21/06, F02M 21/10 take precedence; such apparatus being part of a carburettor or fuel-injection apparatus F02M 15/00, F02M 53/00; adding hot secondary air to fuel-air mixture F02M 23/14) | 31/13 | . . . Combustion air |
| 31/005 | . {using a heat-pipe (heat-pipe per se F28D)} | 31/135 | . . . Fuel-air mixture |
| 31/02 | . for heating {(F02M 31/005 takes precedence)} | 31/14 | . . by using heat from working cylinders or cylinder heads |
| 31/04 | . . combustion-air or fuel-air mixture (electrically F02M 31/12 ; by using heat from working cylinders or cylinder heads F02M 31/14 ; heating of combustion-air as an engine starting aid F02N 7/04) | 31/145 | . . . {with particular constructional means} |
| 31/042 | . . . {Combustion air} | 31/16 | . . Other apparatus for heating fuel |
| 31/045 | . . . {Fuel-air mixture} | 31/163 | . . . {Preheating by burning an auxiliary mixture} |
| 31/047 | {for fuel enriched partial mixture flow path} | 31/166 | . . . {with mechanical generation of heat, e.g. by surface friction} |
| 31/06 | . . . by hot gases, e.g. by mixing cold and hot air | 31/18 | . . . to vaporise fuel |
| 31/062 | {with thermostat and pneumatic actuator both working on the air mixture control valve} | 31/183 | {Control} |
| 31/064 | {pneumatically controlled (F02M 31/062 takes precedence)} | 31/186 | {with simultaneous mixing of secondary air} |
| 31/066 | {operated manually, e.g. by means of valves on the air filter} | 31/20 | . for cooling (cooling of charging-air or of scavenging-air F02B ; use of cold F02M 17/52 ; F02M 31/005 takes precedence)} |
| 31/068 | {particular constructional aspects of the switching devices, e.g. connecting linkage between two control valves} | 31/205 | . . {Control} |
| 31/07 | Temperature-responsive control, e.g. using thermostatically-controlled valves (F02M 31/083 takes precedence) | 33/00 | Other apparatus for treating combustion-air, fuel, or fuel-air mixture (combustion-air cleaners F02M 35/00; arrangements for purifying liquid fuel F02M 37/22) |
| 31/08 | the gases being exhaust gases {(adding exhaust gases to the air intake passage F02M 26/00)} | 33/02 | . for collecting and returning condensed fuel {(apparatus for re-atomising condensed fuel F02M 29/00)} |
| 31/0805 | {Pneumatic control of the amount of exhaust gas or combustion air directed to the heat exchange surfaces, e.g. as a function of the pressure in the air intake passage} | 33/025 | . . {Means not otherwise provided for} |
| 31/081 | {Manual switching of the fluids directed to the heat exchange surfaces} | 33/04 | . . returning to the intake passage |
| 31/0815 | {Heat exchange surfaces arranged inside a flange} | 33/043 | . . . {Coating of the intake passage with a porous material} |
| 31/082 | {Particular shape of air input passage near to the branch} | 33/046 | . . . {Coating of the intake passage with material preventing the formation of condensation} |
| 31/0825 | {Particular constructional characteristics of the heat exchange surfaces, e.g. finned pipes, coiled pipes or the like} | 33/06 | . . . with simultaneous heat supply |
| 31/083 | Temperature-responsive control of the amount of exhaust gas or combustion air directed to the heat exchange surface | 33/08 | . . returning to the fuel tank |
| | | 35/00 | Combustion-air cleaners, air intakes, intake silencers, or induction systems specially adapted for, or arranged on, internal-combustion engines (air cleaners in general B01D) |
| | | 35/02 | . Air cleaners |
| | | 35/0201 | . . {Housings; Casings; Frame constructions; Lids; Manufacturing or assembling thereof} |
| | | 35/0202 | . . . {Manufacturing or assembling; Materials for air cleaner housings} |
| | | 35/0203 | {by using clamps, catches, locks or the like, e.g. for disposable plug-in filter cartridges} |
| | | 35/0204 | . . . {for connecting or joining to other devices, e.g. pipes} |
| | | 35/0205 | . . . {Details, e.g. sensors or measuring devices} |
| | | 35/0207 | {on the clean air side} |

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| 35/0208 | {with sensing means on both, the air feeding side and the clean air side} | 35/046 | {Inline cleaners, i.e. the cleaner being arranged along the length of a wall of a pipe or manifold} |
| 35/0209 | . . . {comprising flexible, resilient, movable or rotatable elements, e.g. with vibrating or contracting movements; Springs; Valves; Flaps (F02M 35/06, F02M 35/08 take precedence) } | 35/048 | . . . {Arranging or mounting on or with respect to engines or vehicle bodies} |
| 35/021 | . . . {Arrangements of air flow meters in or on air cleaner housings} | 35/06 | . . . combined or associated with engine's cooling blower or fan, or with flywheel |
| 35/0212 | . . {Multiple cleaners} | 35/08 | . . with means for removing dust, {particles or liquids} from cleaners; with means for indicating clogging; with by-pass means; {Regeneration of cleaners} |
| 35/0214 | . . . {arranged concentrically or coaxially} | 35/082 | . . . {By-pass means} |
| 35/0215 | . . . {arranged in parallel} | 35/084 | . . . {Dust collection chambers or discharge sockets, e.g. chambers fed by gravity or closed by a valve} |
| 35/0216 | . . . {arranged in series, e.g. pre- and main filter in series} | 35/086 | . . . {Dust removal by flushing, blasting, pulsating or aspirating flow, washing or the like; Mechanical dust removal, e.g. by using scrapers} |
| 35/0217 | . . {acting by electric discharge; Electrostatic precipitators therefor} | 35/088 | . . . {Water, snow or ice proofing; Separation or drainage of water, snow or ice} |
| 35/0218 | . . {acting by absorption or adsorption; trapping or removing vapours or liquids, e.g. originating from fuel} | 35/09 | . . . Clogging indicators {; Diagnosis or testing of air cleaners (sensors therefore F02M 35/10373) } |
| 35/022 | . . acting by gravity, by centrifugal, or by other inertial forces, e.g. with moistened walls | 35/10 | . Air intakes; Induction systems (using kinetic or wave energy of charge in induction systems for improving quantity of charge F02B 27/00) } |
| 35/0223 | . . . {by centrifugal forces, e.g. cyclones} | 35/10006 | . . {characterised by the position of elements of the air intake system in direction of the air intake flow, i.e. between ambient air inlet and supply to the combustion chamber} |
| 35/0226 | . . . {by gravity or by mass inertia, e.g. labyrinths, deflectors} | 35/10013 | . . . {Means upstream of the air filter; Connection to the ambient air} |
| 35/024 | . . using filters, e.g. moistened (F02M 35/026 takes precedence; cleaning of the filtering material F02M 35/08) } | 35/10019 | . . . {Means upstream of the fuel injection system, carburettor or plenum chamber (F02M 35/10013 takes precedence) } |
| 35/02408 | . . . {Manufacturing filter elements} | 35/10026 | . . . {Plenum chambers} |
| 35/02416 | . . . {Fixing, mounting, supporting or arranging filter elements; Filter element cartridges} | 35/10032 | {specially shaped or arranged connecting duct between carburettor or air inlet duct and the plenum chamber; specially positioned carburettors or throttle bodies with respect to the plenum chamber} |
| 35/02425 | {Support structures increasing the stability or stiffness of the filter element} | 35/10039 | {Intake ducts situated partly within or on the plenum chamber housing} |
| 35/02433 | {Special alignment with respect to the air intake flow, e.g. angled or in longitudinal flow direction} | 35/10045 | {Multiple plenum chambers; Plenum chambers having inner separation walls (for V-engines F02M 35/116; for resonance charging F02B 27/02) } |
| 35/02441 | . . . {Materials or structure of filter elements, e.g. foams} | 35/10052 | {special shapes or arrangements of plenum chambers; Constructional details} |
| 35/0245 | {Pleated, folded, corrugated filter elements, e.g. made of paper} | 35/10059 | {Swirl chamber upstream of the plenum chamber} |
| 35/02458 | {consisting of multiple layers, e.g. coarse and fine filters; Coatings; Impregnations; Wet or moistened filter elements} | 35/10065 | {Valves arranged in the plenum chamber} |
| 35/02466 | {Meshes; Grids; Perforated plates} | 35/10072 | . . . {Intake runners} |
| 35/02475 | . . . {characterised by the shape of the filter element} | 35/10078 | . . . {Connections of intake systems to the engine} |
| 35/02483 | {Cylindrical, conical, oval, spherical or the like filter elements; wounded filter elements} | 35/10085 | {having a connecting piece, e.g. a flange, between the engine and the air intake being foreseen with a throttle valve, fuel injector, mixture ducts or the like} |
| 35/02491 | {Flat filter elements, e.g. rectangular} | 35/10091 | . . {characterised by details of intake ducts: shapes; connections; arrangements (ducts within or on the plenum chamber F02M 35/10039) } |
| 35/026 | . . acting by guiding the air over or through an oil or other liquid bath, e.g. combined with filters | 35/10098 | . . . {Straight ducts} |
| 35/04 | . . specially arranged with respect to engine {, to intake system or specially adapted to vehicle}; Mounting thereon {; Combinations with other devices (combined with silencers F02M 35/14) } | 35/10104 | . . . {Substantially vertically arranged ducts} |
| 35/042 | . . . {combined with other devices, e.g. heaters (F02M 35/021, F02M 35/06, F02M 35/14 take precedence) ; for use other than engine air intake cleaning, e.g. air intake filters arranged in the fuel vapour recovery system} | | |
| 35/044 | . . . {Special arrangements of cleaners in or with respect to the air intake system, e.g. in the intake plenum, in ducts or with respect to carburettors} | | |

- 35/10111 . . . {Substantially V-, C- or U-shaped ducts in direction of the flow path}
- 35/10118 . . . {with variable cross-sections of intake ducts along their length; Venturis; Diffusers}
- 35/10124 . . . {Ducts with special cross-sections, e.g. non-circular cross-section}
- 35/10131 . . . {Ducts situated in more than one plane; Ducts of one plane crossing ducts of another plane}
- 35/10137 . . . {Flexible ducts, e.g. bellows or hoses}
- 35/10144 . . . {Connections of intake ducts to each other or to another device}
- 35/1015 . . {characterised by the engine type (engine intake manifolds [F02M 35/104](#))}
- 35/10157 . . . {Supercharged engines}
- 35/10163 . . . {having air intakes specially adapted to selectively deliver naturally aspirated fluid or supercharged fluid}
- 35/1017 . . . {Small engines, e.g. for handheld tools, or model engines; Single cylinder engines}
- 35/10177 . . . {Engines having multiple fuel injectors or carburettors per cylinder}
- 35/10183 . . . {Engines having intake ducts fed from a separate carburettor or injector, the idling system being considered as a separate carburettor}
- 35/1019 . . . {Two-stroke engines; Reverse-flow scavenged or cross scavenged engines}
- 35/10196 . . . {Carburetted engines}
- 35/10203 . . . {Rotary, e.g. "Wankel", engines; Engines with cylinders in star arrangement; Radial piston engines; W-engines ([F02M 35/112](#) and [F02M 35/116](#) take precedence)}
- 35/10209 . . {Fluid connections to the air intake system; their arrangement of pipes, valves or the like}
- 35/10216 . . . {Fuel injectors; Fuel pipes or rails; Fuel pumps or pressure regulators}
- 35/10222 . . . {Exhaust gas recirculation [EGR]; Positive crankcase ventilation [PCV]; Additional air admission, lubricant or fuel vapour admission}
- 35/10229 . . . {the intake system acting as a vacuum or overpressure source for auxiliary devices, e.g. brake systems; Vacuum chambers (air storage chamber [F02B 21/00](#))}
- 35/10236 . . . {Overpressure or vacuum relief means; Burst protection}
- 35/10242 . . {Devices or means connected to or integrated into air intakes; Air intakes combined with other engine or vehicle parts (filters [F02M 35/02](#); silencers [F02M 35/12](#) and [F02M 35/14](#); air coolers [F02B 29/04](#); heaters [F02M 31/00](#); air storage tanks [F02B 21/00](#); compressors [F02B 33/00](#); sensors [F02M 35/10373](#))}
- 35/10249 . . . {Electrical or electronic devices fixed to the intake system; Electric wiring (electric heaters [F02M 31/12](#); sensors [F02M 35/10373](#))}
- 35/10255 . . . {Arrangements of valves; Multi-way valves ([F02M 35/10032](#) takes precedence; valves in the plenum chamber [F02M 35/10065](#); check valves [F02M 35/10275](#))}
- 35/10262 . . . {Flow guides, obstructions, deflectors or the like (for generating a charge motion in the cylinder [F02B 31/00](#); for re-atomising condensed fuel or homogenising fuel-air mixture [F02M 29/00](#))}
- 35/10268 . . . {Heating, cooling or thermal insulating means (air coolers [F02B 29/04](#); thermal treatment of combustion-air, fuel or fuel-air mixture [F02M 31/00](#); details of the throttle valve housing [F02D 9/1035](#))}
- 35/10275 . . . {Means to avoid a change in direction of incoming fluid, e.g. all intake ducts diverging from plenum chamber at acute angles; Check valves; Flame arrestors for backfire prevention}
- 35/10281 . . . {Means to remove, re-atomise or redistribute condensed fuel; Means to avoid fuel particles from separating from the mixture (apparatus for re-atomising condensed fuel or homogenising fuel-air mixture [F02M 29/00](#); other apparatus for treating combustion-air, fuel or fuel-air mixture [F02M 33/00](#))}
- 35/10288 . . . {Air intakes combined with another engine part, e.g. cylinder head cover or being cast in one piece with the exhaust manifold, cylinder head or engine block}
- 35/10295 . . . {Damping means, e.g. tranquillising chamber to dampen air oscillations (intake silencers [F02M 35/12](#))}
- 35/10301 . . . {Flexible, resilient, pivotally or movable parts; Membranes ([F02M 35/10255](#) and [F02M 35/10032](#) take precedence)}
- 35/10308 . . . {Equalizing conduits, e.g. between intake ducts or between plenum chambers}
- 35/10314 . . {Materials for intake systems (for sound damping [F02M 35/12](#); for air cleaners [F02M 35/02](#))}
- 35/10321 . . . {Plastics; Composites; Rubbers}
- 35/10327 . . . {Metals; Alloys (catalysts [F02M 27/02](#))}
- 35/10334 . . . {Foams; Fabrics; Porous media; Laminates; Ceramics; Coatings}
- 35/1034 . . {Manufacturing and assembling intake systems}
- 35/10347 . . . {Moulding, casting or the like}
- 35/10354 . . . {Joining multiple sections together (joining plastic materials together in general [B29C 65/00](#))}
- 35/1036 . . . {by welding, bonding or the like (welding plastic materials together in general [B29C 65/02](#))}
- 35/10367 . . . {Machining, e.g. milling, grinding, punching, sanding; Bending; Surface treatments}
- 35/10373 . . {Sensors for intake systems (throttle position sensors [F02D 9/105](#))}
- 35/1038 . . . {for temperature or pressure}
- 35/10386 . . . {for flow rate (air flow meters in air cleaners [F02M 35/021](#); circuit arrangements for generating control signals by measuring intake air flow [F02D 41/18](#))}
- 35/10393 . . . {for characterising a multi-component mixture, e.g. for the composition such as humidity, density or viscosity}
- 35/104 . . Intake manifolds
- 35/1042 . . . {characterised by provisions to avoid mixture or air supply from one plenum chamber to two successively firing cylinders}
- 35/1045 . . . {characterised by the charge distribution between the cylinders/combustion chambers or its homogenisation}

- 35/1047 . . . {characterised by some cylinders being fed from one side of engine block and the other cylinders being fed from the other side of engine block}
- 35/108 . . . with primary and secondary intake passages
- 35/1085 {the combustion chamber having multiple intake valves (modifying induction systems for imparting a rotation to the charge in the cylinder and having multiple air inlets [F02B 31/08](#); shape or arrangement of intake or exhaust channels in cylinder heads [F02F 1/42](#))}
- 35/112 . . . for engines with cylinders all in one line ([F02M 35/108](#) takes precedence)
- 35/116 . . . for engines with cylinders in V-arrangement or arranged oppositely relative to the main shaft ([F02M 35/108](#) takes precedence)
- 35/1165 {Boxer or pancake engines}
- 35/12 . Intake silencers {Sound modulation, transmission or amplification (intake silencers also used as exhaust silencer [F01N 13/007](#); filters for compressors [F04B 39/16](#))}
- 35/1205 . . {Flow throttling or guiding}
- 35/1211 . . . {by using inserts in the air intake flow path, e.g. baffles, throttles or orifices; Flow guides ([F02M 35/1244](#) takes precedence)}
- 35/1216 . . . {by using a plurality of holes, slits, protrusions, perforations, ribs or the like; Surface structures; Turbulence generators}
- 35/1222 . . . {by using adjustable or movable elements, e.g. valves, membranes, bellows, expanding or shrinking elements}
- 35/1227 . . . {by using multiple air intake flow paths, e.g. bypass, honeycomb or pipes opening into an expansion chamber}
- 35/1233 . . . {by using expansion chambers in the air intake flow path}
- 35/1238 . . . {by using secondary connections to the ambient, e.g. covered by a membrane or a porous member}
- 35/1244 . . {using interference; Masking or reflecting sound}
- 35/125 . . . {by using active elements, e.g. speakers}
- 35/1255 . . {using resonance}
- 35/1261 . . . {Helmholtz resonators}
- 35/1266 . . . {comprising multiple chambers or compartments}
- 35/1272 . . {using absorbing, damping, insulating or reflecting materials, e.g. porous foams, fibres, rubbers, fabrics, coatings or membranes}
- 35/1277 . . {Reinforcement of walls, e.g. with ribs or laminates; Walls having air gaps or additional sound damping layers}
- 35/1283 . . {Manufacturing or assembly; Connectors; Fixations}
- 35/1288 . . {combined with or integrated into other devices ([F02M 35/14](#) takes precedence); Plurality of air intake silencers ([F02M 35/1266](#) takes precedence)}
- 35/1294 . . {Amplifying, modulating, tuning or transmitting sound, e.g. directing sound to the passenger cabin; Sound modulation}
- 35/14 . Combined air cleaners and silencers
- 35/16 . characterised by use in vehicles (predominant vehicle aspects, [see the relevant classes for the vehicles](#))
- 35/161 . . {Arrangement of the air intake system in the engine compartment, e.g. with respect to the bonnet or the vehicle front face}
- 35/162 . . {Motorcycles; All-terrain vehicles, e.g. quads, snowmobiles; Small vehicles, e.g. forklifts}
- 35/164 . . {Heavy duty vehicles, e.g. trucks, trains, agricultural or construction machines}
- 35/165 . . {Marine vessels; Ships; Boats}
- 35/167 . . . {having outboard engines; Jet-skis}
- 35/168 {with means, e.g. valves, to prevent water entry}
- 37/00 Apparatus or systems for feeding liquid fuel from storage containers to carburettors or fuel-injection apparatus ([F02M 69/00](#) takes precedence ; fuel injection apparatus characterised by their conduits and venting means [F02M 55/00](#); fuel injection apparatus having a common rail [F02M 63/0225](#); control of fuel feeding [F02D 33/003](#)); feeding liquid fuel to combustion apparatus, in general [F23K 5/00](#); fuel supply to apparatus for generating combustion products of high pressure or high velocity [F23R 3/28](#)); Arrangements for purifying liquid fuel specially adapted for, or arranged on, internal-combustion engines (separating apparatus, filters [per se](#) [B01D](#); centrifuges [B04B](#))**
- 37/0011 . {Constructional details; Manufacturing or assembly of elements of fuel systems; Materials therefor}
- 37/0017 . . {related to fuel pipes or their connections, e.g. joints or sealings ([F02M 55/004](#) takes precedence)}
- 37/0023 . . {Valves in the fuel supply and return system}
- 37/0029 . . . {Pressure regulator in the low pressure fuel system (pressure regulator in low-pressure injection apparatus [F02M 69/54](#))}
- 37/0035 . . . {Thermo sensitive valves}
- 37/0041 . . {Means for damping pressure pulsations (equalisation of pulses in positive displacement pumps [F04B 1/00](#); devices for damping fluid pulsations in pipes [F16L 55/04](#))}
- 37/0047 . {Layout or arrangement of systems for feeding fuel (fuel injection apparatus characterised by their conduits and venting means [F02M 55/00](#); fuel injection apparatus having a common rail [F02M 63/0225](#); arrangement of fuel conduits of low pressure fuel injection apparatus [F02M 69/462](#))}
- 37/0052 . . {Details on the fuel return circuit; Arrangement of pressure regulators}
- 37/0058 . . . {Returnless fuel systems, i.e. the fuel return lines are not entering the fuel tank}
- 37/0064 . . {for engines being fed with multiple fuels or fuels having special properties, e.g. bio-fuels; varying the fuel composition (controlling engines working with pluralities of fuels [F02D 19/06](#))}
- 37/007 . . {characterised by its use in vehicles, in stationary plants or in small engines, e.g. hand held tools}
- 37/0076 . {Details of the fuel feeding system related to the fuel tank (vehicle fuel tanks [B60K 15/03](#))}
- 37/0082 . . {Devices inside the fuel tank other than fuel pumps or filters (electrical pumps submerged in fuel tanks [F02M 37/10](#), jet pumps [F02M 37/025](#))}
- 37/0088 . . {Multiple separate fuel tanks or tanks being at least partially partitioned}
- 37/0094 . . . {Saddle tanks; Tanks having partition walls}

- 37/02 . . Feeding by means of suction apparatus, e.g. by air flow through carburettors ([by driven pumps F02M 37/04](#))
- 37/025 . . {Feeding by means of a liquid fuel-driven jet pump ([jet pumps per se F04F](#))}
- 37/04 . . Feeding by means of driven pumps ([pump construction F04](#))
- 37/041 . . {Arrangements for driving gear-type pumps}
- 37/043 . . {Arrangements for driving reciprocating piston-type pumps}
- 37/045 . . {Arrangements for driving rotary positive-displacement pumps}
- 37/046 . . {Arrangements for driving diaphragm-type pumps}
- 37/048 . . {Arrangements for driving regenerative pumps, i.e. side-channel pumps}
- 37/06 . . mechanically driven
- 37/08 . . electrically driven
- 2037/082 . . . {Details of the entry of the current supply lines into the pump housing, e.g. wire connectors, grommets, plugs or sockets}
- 2037/085 . . . {Electric circuits therefor}
- 2037/087 {Controlling fuel pressure valve}
- 37/10 . . . submerged in fuel, e.g. in reservoir
- 37/103 {Mounting pumps on fuel tanks}
- 37/106 {the pump being installed in a sub-tank}
- 37/12 . . fluid-driven, e.g. by compressed combustion-air
- 37/14 . . the pumps being combined with other apparatus
- 37/16 . . characterised by provision of personally-, e.g. manually-, operated pumps
- 37/18 . . characterised by provision of main and auxiliary pumps
- 37/20 . . characterised by means for preventing vapour lock
- 37/22 . . Arrangements for purifying liquid fuel specially adapted for, or arranged on, internal-combustion engines, e.g. arrangement in the feeding system
- 37/221 . . {having water separator means}
- 37/223 . . {having heating means ([F02M 37/221 takes precedence](#))}
- 2037/225 . . {having pump means in the filter housing}
- 2037/226 . . {having pressure regulator means in the filter housing}
- 2037/228 . . {Fuel tank strainers}

Fuel-injection apparatus (carrying the fuel into cylinders by high-pressure gas [F02M 67/00](#); low-pressure fuel-injection [F02M 69/00](#))

39/00 Arrangements of fuel-injection apparatus with respect to engines; Pump drives adapted to such arrangements (arrangements of injectors [F02M 61/14](#))

NOTE

Low-pressure fuel injection is classified in groups [F02M 51/00](#), [F02M 69/00](#) or [F02M 71/00](#).

- 39/005 . . {Arrangements of fuel feed-pumps with respect to fuel injection apparatus ([F02M 37/00 takes precedence](#))}
- 39/02 . . Arrangements of fuel-injection apparatus to facilitate the driving of pumps; Arrangements of fuel-injection pumps; Pump drives ([F02M 49/00 takes precedence](#))

41/00 Fuel-injection apparatus with two or more injectors fed from a common pressure-source sequentially by means of a distributor

NOTE

- in this group the following indexing codes are used: [F02M 2700/1329](#)

- 41/02 . . the distributor being spaced from pumping elements
- 41/04 . . the distributor reciprocating
- 41/042 . . . {by means of mechanical drive}
- 41/045 . . . {by means of hydraulic or pneumatic drive}
- 41/047 . . . {by means of electric drive}
- 41/06 . . the distributor rotating
- 41/063 . . . {the distributor and rotary valve controlling fuel passages to pumping elements being combined}
- 41/066 {Arrangements for adjusting the rotary valve-distributor}
- 41/08 . . the distributor and pumping elements being combined
- 41/10 . . pump pistons acting as the distributor
- 41/12 . . . the pistons rotating to act as the distributor
- 41/121 {with piston arranged axially to driving shaft ([F02M 41/123 takes precedence](#))}
- 41/122 {with piston arranged radially to driving shaft ([F02M 41/123 takes precedence](#))}
- 41/123 {characterised by means for varying fuel delivery or injection timing}
- 41/124 {Throttling of fuel passages to or from the pumping chamber}
- 41/125 {Variably-timed valves controlling fuel passages}
- 41/126 {valves being mechanically or electrically adjustable sleeves slidably mounted on rotary piston}
- 41/127 {valves being fluid-actuated slide-valves, e.g. differential rotary-piston pump}
- 41/128 {Varying injection timing by angular adjustment of the face-cam or the rollers support}
- 41/14 . . rotary distributor supporting pump pistons
- 41/1405 . . . {pistons being disposed radially with respect to rotation axis}
- 41/1411 {characterised by means for varying fuel delivery or injection timing}
- 41/1416 {Devices specially adapted for angular adjustment of annular cam}
- 41/1422 {Injection being effected by means of a free-piston displaced by the pressure of fuel}
- 41/1427 {Arrangements for metering fuel admitted to pumping chambers, e.g. by shuttles or by throttle-valves}
- 41/1433 . . . {pistons being parallel to rotation axis}
- 2041/1438 . . . {Arrangements or details pertaining to the devices classified in [F02M 41/14](#) and subgroups}
- 2041/1444 {Feed-pumps; Arrangements or pressure regulation therefor}
- 2041/145 {Throttle valves for metering fuel to the pumping chamber}

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|--------------|--|--------------|---|
| 2041/1455 | {Shuttles <u>per se</u> , or shuttles associated with throttle valve for metering fuel admitted to the pumping chamber} | 47/00 | Fuel-injection apparatus operated cyclically with fuel-injection valves actuated by fluid pressure (F02M 49/00 takes precedence; apparatus with injection valves opened by fuel pressure and closed by non-fluid means, see the groups providing for other characteristics) |
| 2041/1461 | {Axial displacement of rotor for varying piston stroke or for controlling fuel passages} | 47/02 | . of accumulator-injector type, i.e. having fuel pressure of accumulator tending to open, and fuel pressure in other chamber tending to close, injection valves and having means for periodically releasing that closing pressure |
| 2041/1466 | {Piston-stroke variation by other means than axial displacement of rotor} | 47/022 | . . {Mechanically actuated valves draining the chamber to release the closing pressure} |
| 2041/1472 | {Devices for limiting maximum delivery or for providing excess fuel for starting or for correcting advance at starting} | 47/025 | . . {Hydraulically actuated valves draining the chamber to release the closing pressure} |
| 2041/1477 | {Releasing fuel pressure or adjusting quantity-time characteristics of fuel delivery, e.g. by conducting pressurised fuel to a variable volume space, an accumulator or a return conduit} | 47/027 | . . {Electrically actuated valves draining the chamber to release the closing pressure} |
| 2041/1483 | {Variably timed valves controlling fuel passages, e.g. sleeve-valves mounted on the rotor} | 47/04 | . using fluid, other than fuel, for injection-valve actuation |
| 2041/1488 | {Electric actuation of valves or other parts} | 47/043 | . . {Fluid pressure acting on injection-valve in the period of non-injection to keep it closed} |
| 2041/1494 | {Details of cams, tappets, rotors, venting means, specially arranged valves, e.g. in the rotor} | 47/046 | . . {Fluid pressure acting on injection-valve in the period of injection to open it} |
| 41/16 | . characterised by the distributor being fed from a constant pressure source, e.g. accumulator {or constant pressure positive displacement pumps} | 47/06 | . Other fuel injectors peculiar thereto |
| 43/00 | Fuel-injection apparatus operating simultaneously on two or more fuels or on a liquid fuel and another liquid, e.g. the other liquid being an anti-knock additive | 49/00 | Fuel-injection apparatus in which injection pumps are driven or injectors are actuated, by the pressure in engine working cylinders, or by impact of engine working piston |
| 43/02 | . Pumps peculiar thereto | 49/02 | . using the cylinder pressure, e.g. compression end pressure |
| 43/04 | . Injectors peculiar thereto | 49/04 | . using the piston impact |
| 45/00 | Fuel-injection apparatus characterised by having a cyclic delivery of specific time/pressure or time/quantity relationship (fuel-injectors having such deliveries by means of valves furnished at seated ends with pintle- or plug-shaped extensions F02M 61/06 {; pumps having such delivery by means of delivery valves F02M 59/462}) | 51/00 | Fuel-injection apparatus characterised by being operated electrically |
| 45/02 | . with each cyclic delivery being separated into two or more parts | 51/005 | . {Arrangement of electrical wires and connections, e.g. wire harness, sockets, plugs; Arrangement of electronic control circuits in or on fuel injection apparatus} |
| 45/04 | . . with a small initial part {, e.g. initial part for partial load and initial and main part for full load} | 51/02 | . specially for low-pressure fuel-injection (F02M 51/005 takes precedence); pumps <u>per se</u> F02M 51/04) |
| 45/06 | . . . Pumps peculiar thereto | 51/04 | . Pumps peculiar thereto |
| 45/063 | {Delivery stroke of piston being divided into two or more parts, e.g. by using specially shaped cams} | 51/06 | . Injectors peculiar thereto {with means directly operating the valve needle} |
| 45/066 | {Having specially arranged spill port and spill contour on the piston (F02M 45/063 takes precedence)} | 51/0603 | . . {using piezo-electric or magnetostrictive operating means} |
| 45/08 | . . . Injectors peculiar thereto | 51/0607 | . . . {the actuator being hollow, e.g. with needle passing through the hollow space} |
| 45/083 | {Having two or more closing springs acting on injection-valve} | 51/061 | . . {using electromagnetic operating means} |
| 45/086 | {Having more than one injection-valve controlling discharge orifices} | 51/0614 | . . . {characterised by arrangement of electromagnets or fixed armature} |
| 45/10 | . . Other injectors with multiple-part delivery, e.g. with vibrating valves | 51/0617 | {having two or more electromagnets} |
| 45/12 | . providing a continuous {cyclic} delivery with variable pressure | 51/0621 | {acting on one mobile armature (F02M 51/0628 takes precedence)} |
| | | 51/0625 | . . . {characterised by arrangement of mobile armatures} |
| | | 51/0628 | {having a stepped armature} |
| | | 51/0632 | {having a spherically or partly spherically shaped armature, e.g. acting as valve body} |
| | | 51/0635 | {having a plate-shaped or undulated armature not entering the winding (if entering the winding F02M 51/0664)} |
| | | 51/0639 | {the armature acting as a valve} |

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|---|---|--------------|---|
| 51/0642 | {the armature having a valve attached thereto} | 55/005 | . . {for high pressure conduits, e.g. connected to pump outlet or to injector inlet} |
| 51/0646 | {the valve being a short body, e.g. sphere or cube} | 55/007 | . {Venting means} |
| 51/065 | {the valve being spherical or partly spherical} | 55/008 | . {Arrangement of fuel passages inside of injectors} |
| 51/0653 | {the valve being an elongated body, e.g. a needle valve} | 55/02 | . Conduits between injection pumps and injectors {, e.g. conduits between pump and common-rail or conduits between common-rail and injectors} |
| 51/0657 | {the body being hollow and its interior communicating with the fuel flow} | 55/025 | . . {Common rails} |
| 51/066 | {the armature and the valve being allowed to move relatively to each other or not being attached to each other} | 55/04 | . Means for damping vibrations {or pressure fluctuations} in injection pump inlets {or outlets} |
| 51/0664 | {having a cylindrically or partly cylindrically shaped armature, e.g. entering the winding; having a plate-shaped or undulated armature entering the winding} | 57/00 | Fuel-injectors combined or associated with other devices |
| 51/0667 | {the armature acting as a valve or having a short valve body attached thereto} | NOTE | |
| 51/0671 | {the armature having an elongated valve body attached thereto} | | in this group the following indexing codes are used: F02M 2700/1335 |
| 51/0675 | {the valve body having cylindrical guiding or metering portions, e.g. with fuel passages} | 57/005 | . {the devices being sensors} |
| 51/0678 | {all portions having fuel passages, e.g. flats, grooves, diameter reductions} | 57/02 | . Injectors structurally combined with fuel-injection pumps |
| 51/0682 | {the body being hollow and its interior communicating with the fuel flow (F02M 51/0675 takes precedence)} | 57/021 | . . {the injector being of valveless type, e.g. the pump piston co-operating with a conical seat of an injection nozzle at the end of the pumping stroke} |
| 51/0685 | {the armature and the valve being allowed to move relatively to each other or not being attached to each other} | 57/022 | . . {characterised by the pump drive} |
| 51/0689 | . . . {and permanent magnets (F02M 51/0696 takes precedence)} | 57/023 | . . . {mechanical} |
| 51/0692 | {as valve or armature return means} | 57/024 | {with hydraulic link for varying the piston stroke} |
| 51/0696 | . . . {characterised by the use of movable windings} | 57/025 | . . . {hydraulic, e.g. with pressure amplification} |
| 2051/08 | . . {Specially for low-pressure fuel-injection} | 57/026 | {Construction details of pressure amplifiers, e.g. fuel passages or check valves arranged in the intensifier piston or head, particular diameter relationships, stop members, arrangement of ports or conduits} |
| 53/00 | Fuel-injection apparatus characterised by having heating, cooling or thermally-insulating means | 57/027 | . . . {electric} |
| NOTE | | 57/028 | . . . {pneumatic (using engine cylinder pressure F02M 49/02)} |
| - in this group the following indexing codes are used : F02M 2700/077 | | 57/04 | . the devices being combustion-air intake or exhaust valves |
| 53/02 | . with fuel-heating means, e.g. for vaporising | 57/06 | . the devices being sparking plugs |
| 53/04 | . Injectors with heating, cooling, or thermally-insulating means | 59/00 | Pumps specially adapted for fuel-injection and not provided for in groups F02M 39/00 - F02M 57/00, {e.g. rotary cylinder-block type pumps} (general features of pumps F04) |
| 53/043 | . . {with cooling means other than air cooling} | NOTE | |
| 53/046 | . . {with thermally-insulating means} | | - in this group the following indexing codes are used: F02M 2700/1323 , F02M 2700/1341 , F02M 2700/1352 , F02M 2700/1388 |
| 53/06 | . . with fuel-heating means, e.g. for vaporising | 59/02 | . of reciprocating-piston {or reciprocating-cylinder} type |
| 53/08 | . . with air cooling | 59/022 | . . {having an accumulator storing pressurised fuel during pumping stroke of the piston for subsequent delivery to the injector} |
| 55/00 | Fuel-injection apparatus characterised by their fuel conduits or their venting means; {Arrangements of conduits between fuel tank and pump F02M 37/00 (venting in general B01D 19/00)} | 59/025 | . . {characterised by a single piston} |
| 55/001 | . {Pumps with means for preventing erosion on fuel discharge} | 59/027 | . . . {Unit-pumps, i.e. single piston and cylinder pump-units, e.g. for cooperating with a camshaft} |
| 55/002 | . {Arrangement of leakage or drain conduits in or from injectors} | 59/04 | . . characterised by special arrangement of cylinders with respect to piston-driving shaft, e.g. arranged parallel to that shaft {or swash-plate type pumps (with rotary valve F02M 59/362)} |
| 55/004 | . {Joints; Sealings} | | |

- 59/06 . . . with cylinders arranged radially to driving shaft, e.g. in V or star arrangement
- 59/08 . . characterised by two or more pumping elements with conjoint outlet {or several pumping elements feeding one engine cylinder (feeding common rails [F02M 63/0225](#))}
- 59/10 . . characterised by the piston-drive
- 59/102 . . . {Mechanical drive, e.g. tappets or cams ([F02M 45/063](#) takes precedence)}
- 59/105 . . . {hydraulic drive ([F02M 59/32](#) takes precedence)}
- 59/107 . . . {pneumatic drive, e.g. crankcase pressure drive ([F02M 49/00](#) takes precedence)}
- 59/12 . . having other positive-displacement pumping elements, e.g. rotary
- 59/14 . . of elastic-wall type
- 59/16 . . characterised by having multi-stage compression of fuel
- 59/18 . . characterised by the pumping action being achieved through release of pre-compressed springs
- 59/20 . . Varying fuel delivery in quantity or timing (for distributor pumps [F02M 41/123](#), [F02M 41/1411](#))
- 59/205 . . {Quantity of fuel admitted to pumping elements being metered by an auxiliary metering device}
- 59/22 . . Varying quantity {or timing} by adjusting cylinder-head space
- 59/24 . . with constant-length-stroke pistons having variable effective portion of stroke
- 59/243 . . . {caused by movement of cylinders relative to their pistons}
- 59/246 {Mechanisms therefor}
- 59/26 . . . caused by movements of pistons relative to their cylinders
- 59/265 {characterised by the arrangement or form of spill port of spill contour on the piston ([F02M 45/066](#) takes precedence)}
- 59/28 Mechanisms therefor
- 59/30 . . with variable-length-stroke pistons {(swash-plate type pumps [F02M 59/04](#))}
- 59/32 . . fuel delivery being controlled by means of fuel-displaced auxiliary pistons, which effect injection {(combined with rotary distributor supporting pump pistons [F02M 41/1422](#); low pressure fuel-injection [F02M 69/12](#))}
- 59/34 . . by throttling of passages to pumping elements or of overflow passages {, e.g. throttling by means of a pressure-controlled sliding valve having liquid stop or abutment}
- 59/36 . . by variably-timed valves controlling fuel passages {to pumping elements or overflow passages}
- 59/361 . . . {Valves being actuated mechanically}
- 59/362 {valves rotating (combined with rotary fuel distributor [F02M 41/063](#))}
- 59/363 {arrangements for adjusting the rotary valve}
- 59/365 . . . {valves being actuated by the fluid pressure produced in an auxiliary pump, e.g. pumps with differential pistons; Regulated pressure of supply pump actuating a metering valve, e.g. a sleeve surrounding the pump piston}
- 59/366 . . . {Valves being actuated electrically}
- 59/367 {Pump inlet valves of the check valve type being open when actuated}
- 59/368 {Pump inlet valves being closed when actuated}
- 59/38 . . Pumps characterised by adaptations to special uses or conditions
- 59/40 . . for reversible engines
- 59/42 . . for starting of engines {(supply of excess fuel [F02M 59/447](#))}
- 59/44 . . Details, components parts, or accessories not provided for in, or of interest apart from, the apparatus of groups [F02M 59/02](#) - [F02M 59/42](#); {Pumps having transducers, e.g. to measure displacement of pump rack or piston}
- 59/442 . . {means preventing fuel leakage around pump plunger, e.g. fluid barriers}
- 59/445 . . {Selection of particular materials}
- 59/447 . . {means specially adapted to limit fuel delivery or to supply excess of fuel temporarily, e.g. for starting of the engine (combined with fuel pump regulating devices [F02D](#))}
- 59/46 . . Valves (in general [F16K](#))
- 59/462 . . . {Delivery valves}
- 59/464 . . . {Inlet valves of the check valve type}
- 59/466 . . . {Electrically operated valves, e.g. using electromagnetic or piezo-electric operating means}
- 59/468 {using piezo-electric operating means}
- 59/48 . . Assembling; Disassembling; Replacing
- 59/485 . . . {Means for fixing delivery valve casing and barrel to each other or to pump casing}
- 61/00 Fuel-injectors not provided for in groups [F02M 39/00](#) - [F02M 57/00](#) or [F02M 67/00](#)**
- NOTE**
- in this group the following indexing codes are used: [F02M 2700/07](#), [F02M 2700/074](#)
- 61/02 . . of valveless type
- 61/04 . . having valves, {e.g. having a plurality of valves in series} (valves in general [F16K](#))
- 61/042 . . {The valves being provided with fuel passages}
- 61/045 . . . {The valves being provided with fuel discharge orifices}
- 61/047 . . {the valves being formed by deformable nozzle parts, e.g. flexible plates or discs with fuel discharge orifices}
- 61/06 . . the valves being furnished at seated ends with pintle or plug shaped extensions
- 61/08 . . the valves opening in direction of fuel flow {([F02M 61/047](#) takes precedence)}
- 61/10 . . Other injectors with elongated valve bodies, i.e. of needle-valve type
- 61/12 . . . characterised by the provision of guiding or centring means for valve bodies
- 61/14 . . Arrangements of injectors with respect to engines; Mounting of injectors
- 61/145 . . {the injection nozzle opening into the air intake conduit}
- 61/16 . . Details not provided for in, or of interest apart from, the apparatus of groups [F02M 61/02](#) - [F02M 61/14](#)
- 61/161 . . {Means for adjusting injection-valve lift}
- 61/162 . . {Means to impart a whirling motion to fuel upstream or near discharging orifices}
- 61/163 . . . {Means being injection-valves with helically or spirally shaped grooves}

- 61/165 . . {Filtering elements specially adapted in fuel inlets to injector}
- 61/166 . . {Selection of particular materials}
- 61/167 . . {Means for compensating clearance or thermal expansion}
- 61/168 . . {Assembling; Disassembling; Manufacturing; Adjusting}
- 61/18 . . Injection nozzles, e.g. having valve seats; {Details of valve member seated ends, not otherwise provided for}
- 61/1806 . . . {characterised by the arrangement of discharge orifices, e.g. orientation or size}
- 61/1813 {Discharge orifices having different orientations with respect to valve member direction of movement, e.g. orientations being such that fuel jets emerging from discharge orifices collide with each other}
- 61/182 {Discharge orifices being situated in different transversal planes with respect to valve member direction of movement}
- 61/1826 {Discharge orifices having different sizes}
- 61/1833 {Discharge orifices having changing cross sections, e.g. being divergent}
- 61/184 {Discharge orifices having non circular sections}
- 61/1846 {Dimensional characteristics of discharge orifices}
- 61/1853 . . . {Orifice plates}
- 61/186 {Multi-layered orifice plates}
- 61/1866 . . . {Valve seats or member ends having multiple cones}
- 61/1873 . . . {Valve seats or member ends having circumferential grooves or ridges, e.g. toroidal}
- 61/188 . . . {Spherical or partly spherical shaped valve member ends}
- 61/1886 . . . {Details of valve seats not covered by groups [F02M 61/1866](#) - [F02M 61/188](#)}
- 61/1893 . . . {Details of valve member ends not covered by groups [F02M 61/1866](#) - [F02M 61/188](#)}
- 61/20 . . Closing valves mechanically, e.g. arrangements of springs or weights {or permanent magnets; Damping of valve lift ([F02M 61/205](#) takes precedence)}
- 61/205 . . . {Means specially adapted for varying the spring tension or assisting the spring force to close the injection-valve, e.g. with damping of valve lift}
- 63/00 Other fuel-injection apparatus having pertinent characteristics not provided for in groups [F02M 39/00](#) - [F02M 57/00](#) or [F02M 67/00](#); Details, component parts, or accessories of fuel-injection apparatus, not provided for in, or of interest apart from, the apparatus of groups [F02M 39/00](#) - [F02M 61/00](#) or [F02M 67/00](#); {Combination of fuel pump with other devices, e.g. lubricating oil pump}**
- NOTE**
- in this group the following indexing codes are used: [F02M 2700/05](#), [F02M 2700/072](#)
- 63/0001 . {Fuel-injection apparatus with specially arranged lubricating system, e.g. by fuel oil ([lubrication of engines F01M](#))}
- 63/0003 . {Fuel-injection apparatus having a cyclically-operated valve for connecting a pressure source, e.g. constant pressure pump or accumulator, to an injection valve held closed mechanically, e.g. by springs, and automatically opened by fuel pressure ([having a distributor F02M 41/16](#); [low pressure fuel injection F02M 69/14](#))}
- 63/0005 . . {using valves actuated by fluid pressure}
- 63/0007 . . {using electrically actuated valves ([injection valves F02M 51/06](#))}
- 63/0008 . . {using mechanically actuated valves}
- 63/001 . {Fuel-injection apparatus having injection valves held closed mechanically, e.g. by springs, and opened by a cyclically-operated mechanism for a time ([F02M 67/12](#) takes precedence; operated by fluid pressure [F02M 47/00](#); operated electrically [F02M 51/06](#); opened by fuel pressure [F02M 61/00](#))}
- 63/0012 . {Valves (for fuel metering [see the relevant groups, e.g. F02M 59/34](#); inlet or outlet check valves for fuel injection pumps [F02M 59/46](#); for fuel injectors [see the relevant groups, e.g. F02M 61/00](#))}
- 63/0014 . . {characterised by the valve actuating means}
- 63/0015 . . . {electrical, e.g. using solenoid}
- 63/0017 {using electromagnetic operating means}
- 63/0019 {characterised by the arrangement of electromagnets or fixed armatures}
- 63/0021 {characterised by the arrangement of mobile armatures}
- 63/0022 {the armature and the valve being allowed to move relatively to each other}
- 63/0024 {in combination with permanent magnet}
- 63/0026 {using piezoelectric or magnetostrictive actuators}
- 63/0028 . . . {hydraulic}
- 63/0029 {using a pilot valve controlling a hydraulic chamber}
- 63/0031 . . {characterized by the type of valves, e.g. special valve member details, valve seat details, valve housing details}
- 63/0033 . . . {Lift valves, i.e. having a valve member that moves perpendicularly to the plane of the valve seat}
- 63/0035 {Poppet valves, i.e. having a mushroom-shaped valve member that moves perpendicularly to the plane of the valve seat}
- 63/0036 {with spherical or partly spherical shaped valve member ends}
- 63/0038 . . . {rotary}
- 63/004 . . . {Sliding valves, e.g. spool valves, i.e. whereby the closing member has a sliding movement along a seat for opening and closing}
- 63/0042 {combined with valve seats of the lift valve type}
- 63/0043 . . . {Two-way valves}
- 63/0045 . . . {Three-way valves}
- 63/0047 . . . {Four-way valves or valves with more than four ways}
- 63/0049 . . . {Combined valve units, e.g. for controlling pumping chamber and injection valve}
- 63/005 . . . {Pressure relief valves}
- 63/0052 {with means for adjusting the opening pressure, e.g. electrically controlled}

- 63/0054 . . . {Check valves ([F02M 59/462](#), [F02M 59/464](#) take precedence)}
- 63/0056 . . . {Throttling valves, e.g. having variable opening positions throttling the flow}
- 63/0057 . . {Means for avoiding fuel contact with valve actuator, e.g. isolating actuators by using bellows or diaphragms}
- 63/0059 . . {Arrangements of valve actuators}
- 63/0061 . . . {Single actuator acting on two or more valve bodies}
- 63/0063 . . . {Two or more actuators acting on a single valve body}
- 63/0064 . . . {Two or more actuators acting on two or more valve bodies}
- 63/0066 . . . {Combination of electromagnetic and piezoelectric or magnetostrictive actuators}
- 63/0068 . . . {Actuators specially adapted for partial and full opening of the valves}
- 63/007 . . {Details not provided for in, or of interest apart from, the apparatus of the groups [F02M 63/0014](#) - [F02M 63/0059](#)}
- 63/0071 . . . {characterised by guiding or centering means in valves including the absence of any guiding means, e.g. "flying arrangements"}
- 63/0073 . . . {Pressure balanced valves}
- 63/0075 . . . {Stop members in valves, e.g. plates or disks limiting the movement of armature, valve or spring}
- 63/0077 . . . {Valve seat details}
- 63/0078 . . . {Valve member details, e.g. special shape, hollow or fuel passages in the valve member}
- 63/008 {Hollow valve members, e.g. members internally guided}
- 63/02 . . Fuel-injection apparatus having several injectors fed by a common pumping element, or having several pumping elements feeding a common injector; Fuel-injection apparatus having provisions for cutting-out pumps, pumping elements, or injectors; Fuel-injection apparatus having provisions for variably interconnecting pumping elements and injectors alternatively
- 63/0205 . . {for cutting-out pumps or injectors in case of abnormal operation of the engine or the injection apparatus, e.g. over-speed, break-down of fuel pumps or injectors ([safety devices acting on engine fuel system on lubricant pressure failure F01M 1/24](#)); for cutting-out pumps for stopping the engine}
- 63/021 . . . {by locking pump pistons}
- 63/0215 . . . {by draining or closing fuel conduits}
- 63/022 . . . {by acting on fuel control mechanism}
- 63/0225 . . {Fuel-injection apparatus having a common rail feeding several injectors ([F02M 63/0003](#) takes precedence); Means for varying pressure in common rails; Pumps feeding common rails}
- 63/023 . . . {Means for varying pressure in common rails ([pressure control F02D 41/3845](#))}
- 63/0235 {by bleeding fuel pressure}
- 63/024 {between the low pressure pump and the high pressure pump}
- 63/0245 {between the high pressure pump and the common rail}
- 63/025 {from the common rail}

- 63/026 {Means for reducing the pressure in common rails at power off ([pressure control F02D 41/3845](#))}
- 63/0265 . . . {Pumps feeding common rails}
- 63/027 {More than one high pressure pump feeding a single common rail}
- 63/0275 . . . {Arrangement of common rails}
- 63/028 {Returnless common rail system}
- 63/0285 {having more than one common rail}
- 63/029 {per cylinder bank, e.g. storing different fuels or fuels at different pressure levels per cylinder bank}
- 63/0295 {for V- or star- or boxer-engines}
- 63/04 . . Fuel-injection apparatus having injection valves held closed by a cyclically-operated mechanism for a time and automatically opened by fuel pressure, e.g. constant-pressure pump or accumulator, when that mechanism releases the valve
- 63/06 . . Use of pressure wave generated by fuel inertia to open injection valves
- 65/00 Testing fuel-injection apparatus, e.g. testing injection timing {(testing of ignition [F02P 17/00](#); measuring fuel consumption [G01F 9/00](#)); Cleaning of fuel-injection apparatus}**
 - 65/001 . {Measuring fuel delivery of a fuel injector}
 - 65/002 . {Measuring fuel delivery of multi-cylinder injection pumps}
 - 65/003 . {Measuring variation of fuel pressure in high pressure line}
 - 65/005 . {Measuring or detecting injection-valve lift, e.g. to determine injection timing}
 - 65/006 . {Measuring or detecting fuel leakage of fuel injection apparatus}
 - 65/007 . {Cleaning}
 - 65/008 . . {of injectors only}

Fuel-injection by high-pressure gas carrying the fuel into engine working cylinders; Low-pressure fuel-injection

- 67/00 Apparatus in which fuel-injection is effected by means of high-pressure gas, the gas carrying the fuel into working cylinders of the engine, e.g. air-injection type (using compressed air for low-pressure fuel-injection apparatus [F02M 69/08](#))**
- NOTE**
 - in this group the following indexing codes are used: [F02B 2720/25](#)
- 67/005 . {fuel-gas mixture being compressed in a pump for subsequent injection into the engine}
- 67/02 . the gas being compressed air, e.g. compressed in pumps ([arrangements or adaptations of such pumps F02B](#))
- 67/04 . . the air being extracted from working cylinders of the engine
- 67/06 . the gas being other than air, e.g. steam, combustion gas
- 67/08 . . the gas being generated by combustion of part of fuel other than in engine working cylinders
- 67/10 . Injectors peculiar thereto, e.g. valve less type
- 67/12 . . having valves

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| <p>67/14 . characterised by provisions for injecting different fuels, e.g. main fuel and readily self-igniting starting fuel</p> <p>69/00 Low-pressure fuel-injection apparatus (electrically operated F02M 51/00); {Apparatus with both continuous and intermittent injection; Apparatus injecting different types of fuel}</p> <p>NOTE</p> <p>- in this group the following indexing codes are used: F02B 2720/15</p> <p>69/002 . {characterised by means for intermittently metering the portion of fuel injected (F02M 69/12, F02M 69/14 take precedence)}</p> <p>69/005 . {characterised by control of air admission to the engine according to the fuel injected}</p> <p>69/007 . . {by means of devices using fuel pressure deviated from main fuel circuit acting on air throttle valve}</p> <p>69/02 . Pumps peculiar thereto {(elastic wall type pumps F02M 59/14)}</p> <p>69/04 . Injectors peculiar thereto</p> <p>69/041 . . {having vibrating means for atomizing the fuel, e.g. with sonic or ultrasonic vibrations}</p> <p>69/042 . . {Positioning of injectors with respect to engine, e.g. in the air intake conduit (mounting of injectors F02M 61/14)}</p> <p>69/043 . . . {for injecting into the intake conduit upstream of an air throttle valve}</p> <p>69/044 . . . {for injecting into the intake conduit downstream of an air throttle valve}</p> <p>69/045 . . . {for injecting into the combustion chamber (F02M 69/046 takes precedence)}</p> <p>69/046 . . . {for injecting into both the combustion chamber and the intake conduit}</p> <p>69/047 . . {injectors with air chambers, e.g. communicating with atmosphere for aerating the nozzles (F02M 69/325 takes precedence)}</p> <p>69/048 . . {having variable fuel outlets, e.g. controlled by a valve actuated by operator}</p> <p>69/06 . characterised by the pressurisation of the fuel being caused by centrifugal force acting on the fuel</p> <p>69/08 . characterised by the fuel being carried by compressed air into main stream of combustion-air</p> <p>69/10 . peculiar to scavenged two-stroke engines, e.g. injecting into crankcase-pump chamber</p> <p>69/12 . comprising a fuel-displaced free-piston for intermittently metering and supplying fuel to injection nozzles {(high-pressure fuel-injection with fuel-displaced auxiliary pistons F02M 59/32)}</p> <p>69/125 . . {Means for varying the stroke of the free-piston}</p> <p>69/14 . having cyclically-operated valves connecting injection nozzles to a source of fuel under pressure during the injection period {(high-pressure fuel injection apparatus F02M 63/0003)}</p> <p>69/142 . . {the valves being operated by fluid impulses, e.g. using bistable fluid operated valves}</p> <p>69/145 . . {the valves being actuated electrically (electrically-operated injectors F02M 51/06)}</p> <p>69/147 . . {the valves being actuated mechanically, e.g. rotating}</p> | <p>69/16 . characterised by means for metering continuous fuel flow to injectors or means for varying fuel pressure upstream of {continuously or intermittently operated} injectors</p> <p>69/18 . . the means being metering valves throttling fuel passages to injectors or by-pass valves throttling overflow passages, the metering valves being actuated by a device responsive to the engine working parameters, e.g. engine load, speed, temperature or quantity of air (F02M 69/26 takes precedence)</p> <p>69/20 . . . the device being a servo-motor, e.g. using engine intake air pressure or vacuum (F02M 69/22 takes precedence)</p> <p>69/22 . . . the device comprising a member movably mounted in the air intake conduit and displaced according to the quantity of air admitted to the engine</p> <p>69/24 . . . the device comprising a member for transmitting the movement of the air throttle valve actuated by the operator to the valves controlling fuel passages</p> <p>69/26 . . the means varying fuel pressure in a fuel by-pass passage, the pressure acting on a throttle valve against the action of metered or throttled fuel pressure for variably throttling fuel flow to injection nozzles, e.g. to keep constant the pressure differential at the metering valve</p> <p>69/28 . characterised by means for cutting-out the fuel supply to the engine or to main injectors during certain operating periods, e.g. deceleration</p> <p>69/30 . characterised by means for facilitating the starting-up or idling of engines or by means for enriching fuel charge, e.g. below operational temperatures or upon high power demand of engines (at acceleration F02M 69/44)</p> <p>69/32 . . with an air by-pass around the air throttle valve or with an auxiliary air passage, e.g. with a variably controlled valve therein</p> <p>69/325 . . . {with an auxiliary injection nozzle therein (F02M 69/34 takes precedence)}</p> <p>69/34 . . with an auxiliary fuel circuit supplying fuel to the engine, e.g. with the fuel pump outlet being directly connected to injection nozzles</p> <p>69/36 . . having an enrichment mechanism modifying fuel flow to injectors, e.g. by acting on the fuel metering device or on the valves throttling fuel passages to injection nozzles or overflow passages {(at acceleration F02M 69/44)}</p> <p>69/38 . . . using fuel pressure, e.g. by varying fuel pressure in the control chambers of the fuel metering device (F02M 69/26 takes precedence)</p> <p>69/383 {the fuel passing through different passages to injectors or to a drain, the pressure of fuel acting on valves to close or open selectively these passages}</p> <p>69/386 {variably controlling the pressure of the fuel by-passing the metering valves, e.g. by valves responsive to signals of temperature or oxygen sensors}</p> <p>69/40 . . . using variably controlled air pressure, e.g. by modifying the intake air vacuum signal acting on the fuel metering device</p> |
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| 69/42 | . . . using other means than variable fluid pressure, e.g. acting on the fuel metering device mechanically or electrically | 2200/08 | . Fuel-injection apparatus having special means for influencing magnetic flux, e.g. for shielding or guiding magnetic flux |
| 69/44 | . characterised by means for supplying extra fuel to the engine on sudden air throttle opening, e.g. at acceleration | 2200/09 | . Fuel-injection apparatus having means for reducing noise |
| 69/46 | . Details, component parts or accessories not provided for in, or of interest apart from, the apparatus covered by groups F02M 69/02 - F02M 69/44 | 2200/16 | . Sealing of fuel injection apparatus not otherwise provided for |
| 69/462 | . . {Arrangement of fuel conduits, e.g. with valves for maintaining pressure in the pipes after the engine being shut-down} | 2200/18 | . Fuel-injection apparatus having means for maintaining safety not otherwise provided for |
| 69/465 | . . . {of fuel rails} | 2200/185 | . . means for improving crash safety |
| 69/467 | . . {Devices using intake air for generating a control signal acting on fuel delivery (F02M 69/125 , F02M 69/20 , F02M 69/40 take precedence)} | 2200/20 | . Fuel-injection apparatus with permanent magnets |
| 69/48 | . . Arrangement of air sensors {(F02M 69/22 takes precedence)} | 2200/21 | . Fuel-injection apparatus with piezo-electric or magnetostrictive elements |
| 69/50 | . . Arrangement of fuel distributors {, e.g. with means for supplying equal portion of metered fuel to injectors (F02M 69/147 takes precedence)} | 2200/215 | . . Piezo-electric or magnetostrictive elements being able to tilt in its housing |
| 69/52 | . . Arrangement of fuel metering devices {(F02M 69/18 takes precedence)} | 2200/22 | . Fuel-injection apparatus with bimetallic or memory shape alloy elements |
| 69/54 | . . Arrangement of fuel pressure regulators | 2200/24 | . Fuel-injection apparatus with sensors |
| 71/00 | Combinations of carburettors and low-pressure fuel-injection apparatus (means for enriching charge on sudden air throttle opening of carburettors F02M 7/06) | 2200/241 | . . Acceleration or vibration sensors |
| | NOTE | 2200/242 | . . Displacement sensors |
| | - in this group the following indexing codes are used: F02M 2700/1347 | 2200/244 | . . Force sensors |
| 71/02 | . with fuel-air mixture being produced by the carburettor and being compressed by a pump for subsequent injection into main combustion-air (adaptations or arrangements of such pumps F02B) | 2200/245 | . . Position sensors, e.g. Hall sensors |
| 71/04 | . with carburettor being used at starting or idling only and injection apparatus being used during normal operation of engine {or vice versa } | 2200/247 | . . Pressure sensors |
| 99/00 | Subject matter not provided for in other groups of this subclass | 2200/248 | . . Temperature sensors |
| | | 2200/25 | . Fuel-injection apparatus with heat-expansible elements |
| | | 2200/26 | . Fuel-injection apparatus with elastically deformable elements other than coil springs |
| | | 2200/27 | . Fuel-injection apparatus with filters |
| | | 2200/28 | . Details of throttles in fuel-injection apparatus |
| | | 2200/29 | . Fuel-injection apparatus having rotating means (rotary valves F02M 63/0038) |
| | | 2200/30 | . Fuel-injection apparatus having mechanical parts, the movement of which is damped |
| | | 2200/302 | . . using electrical means |
| | | 2200/304 | . . using hydraulic means |
| | | 2200/306 | . . using mechanical means |
| | | 2200/308 | . . using pneumatic means |
| | | 2200/31 | . Fuel-injection apparatus having hydraulic pressure fluctuations damping elements |
| | | 2200/315 | . . for damping fuel pressure fluctuations |
| | | 2200/40 | . Fuel-injection apparatus with fuel accumulators, e.g. a fuel injector having an integrated fuel accumulator |
| | | 2200/44 | . Valves, e.g. injectors, with valve bodies arranged side-by-side |
| 2200/00 | Details of fuel-injection apparatus, not otherwise provided for | 2200/46 | . Valves, e.g. injectors, with concentric valve bodies |
| 2200/02 | . Fuel-injection apparatus having means for reducing wear | 2200/50 | . Arrangements of springs for valves used in fuel injectors or fuel injection pumps |
| 2200/03 | . Fuel-injection apparatus having means for reducing or avoiding stress, e.g. the stress caused by mechanical force, by fluid pressure or by temperature variations | 2200/502 | . . Springs biasing the valve member to the open position |
| 2200/04 | . Fuel-injection apparatus having means for avoiding effect of cavitation, e.g. erosion | 2200/505 | . . Adjusting spring tension by sliding spring seats |
| 2200/05 | . Fuel-injection apparatus having means for preventing corrosion | 2200/507 | . . Adjusting spring tension by screwing spring seats |
| 2200/06 | . Fuel-injection apparatus having means for preventing coking, e.g. of fuel injector discharge orifices or valve needles | 2200/60 | . Fuel-injection apparatus having means for facilitating the starting of engines, e.g. with valves or fuel passages for keeping residual pressure in common rails |
| 2200/07 | . Fuel-injection apparatus having means for avoiding sticking of valve or armature, e.g. preventing hydraulic or magnetic sticking of parts | 2200/70 | . Linkage between actuator and actuated element, e.g. between piezoelectric actuator and needle valve or pump plunger |
| | | 2200/701 | . . mechanical |
| | | 2200/702 | . . . with actuator and actuated element moving in different directions, e.g. in opposite directions |
| | | 2200/703 | . . hydraulic |

- 2200/704 . . . with actuator and actuated element moving in different directions, e.g. in opposite directions
- 2200/705 . . . with means for filling or emptying hydraulic chamber, e.g. for compensating clearance or thermal expansion
- 2200/706 Valves for filling or emptying hydraulic chamber
- 2200/707 . . . with means for avoiding fuel contact with actuators, e.g. isolating actuators by using bellows or diaphragms
- 2200/708 . . . with hydraulic chambers formed by a movable sleeve
- 2200/80 . Fuel injection apparatus manufacture, repair or assembly
- 2200/8007 . . Storing data on fuel injection apparatus, e.g. by printing, by using bar codes or EPROMs
- 2200/8015 . . Provisions for assembly of fuel injection apparatus in a certain orientation, e.g. markings, notches or specially shaped sleeves other than a clip
- 2200/8023 . . the assembly involving use of quick-acting mechanisms, e.g. clips
- 2200/803 . . using clamp elements and fastening means; e.g. bolts or screws
- 2200/8038 . . the assembly involving use of adhesives, glue or the like
- 2200/8046 . . the manufacture involving injection moulding, e.g. of plastic or metal
- 2200/8053 . . involving mechanical deformation of the apparatus or parts thereof
- 2200/8061 . . involving press-fit, i.e. interference or friction fit
- 2200/8069 . . involving removal of material from the fuel apparatus, e.g. by punching, hydro-erosion or mechanical operation
- 2200/8076 . . involving threaded members
- 2200/8084 . . involving welding or soldering
- 2200/8092 . . adjusting or calibration
- 2200/85 . Mounting of fuel injection apparatus
- 2200/851 . . provisions for adjusting the angular, rotational or axial position of injectors
- 2200/852 . . provisions for mounting the fuel injection apparatus in a certain orientation, e.g. markings or notches
- 2200/853 . . involving use of quick-acting mechanism, e.g. clips
- 2200/855 . . using clamp elements or fastening means, e.g. bolts or screws
- 2200/856 . . characterised by mounting injector to fuel or common rail, or *vice versa*
- 2200/857 . . characterised by mounting fuel or common rail to engine
- 2200/858 . . sealing arrangements between injector and engine
- 2200/90 . Selection of particular materials
- 2200/9007 . . Ceramic materials
- 2200/9015 . . Elastomeric or plastic materials
- 2200/9023 . . Fibrous materials
- 2200/903 . . Glass
- 2200/9038 . . Coatings
- 2200/9046 . . Multi-layered materials
- 2200/9053 . . Metals
- 2200/9061 . . . Special treatments for modifying the properties of metals used for fuel injection apparatus, e.g. modifying mechanical or electromagnetic properties
- 2200/9069 . . . Non-magnetic metals
- 2200/9076 . . . Non-ferrous metals
- 2200/9084 . . Rheological fluids
- 2200/9092 . . Sintered materials
- 2200/95 . Fuel injection apparatus operating on particular fuels, e.g. biodiesel, ethanol, mixed fuels
- 2200/953 . . Dimethyl ether, DME
- 2200/956 . . Ethanol
- 2547/00 Special features for fuel-injection valves actuated by fluid pressure**
- 2547/001 . Control chambers formed by movable sleeves
- 2547/003 . Valve inserts containing control chamber and valve piston
- 2547/005 . Fuel injectors without fuel return, i.e. the pressure in the control chamber is released into the combustion chamber with fluid flow only in one direction
- 2547/006 . Springs assisting hydraulic closing force
- 2547/008 . Means for influencing the flow rate out of or into a control chamber, e.g. depending on the position of the needle
- 2700/00 Supplying, feeding or preparing air, fuel, fuel air mixtures or auxiliary fluids for a combustion engine; Use of exhaust gas; Compressors for piston engines**
- WARNING**
- Groups [F02M 2700/00](#) – [F02M 2700/4397](#) are no longer used for the classification of documents as of January 1, 1975.
- 2700/05 . Miscellaneous constructional elements; Leakage detection
- 2700/055 . . Fuel distribution among injection nozzles
- 2700/07 . Nozzles and injectors with controllable fuel supply
- 2700/071 . . Injectors having valves
- 2700/072 . . Injection valve actuated by engine for supply of pressurised fuel; Electrically or electromagnetically actuated injectors
- 2700/074 . . Injection valve actuated by fuel pressure for pressurised fuel supply
- 2700/075 . . Injection valve actuated by cylinder pressure or other air pressure for pressurised fuel supply
- 2700/077 . . Injectors having cooling or heating means
- 2700/078 . . Injectors combined with fuel injection pump
- 2700/12 . Devices or methods for making a gas mixture for a combustion engine
- 2700/123 . . Fuel supply devices
- 2700/126 . . Devices for the supply or mixing of air and gas
- 2700/13 . Special devices for making an explosive mixture; Fuel pumps
- 2700/1305 . . Auxiliary air supply devices for carburettors
- 2700/1311 . . Devices for controlling register carburettors or for carburettors disposed in parallel
- 2700/1317 . . Fuel pumpo for internal combustion engines
- 2700/1323 . . . Controlled diaphragm type fuel pump
- 2700/1329 . . . Controlled rotary fuel pump with parallel pistons or with a single piston in the extension of the driving shaft
- 2700/1335 . . . Fuel pump combined with the fuel injector
- 2700/1341 . . . Fuel pump driven by the differential pressure of a gas
- 2700/1347 . . . Fuel pump acting on a carburetoor; Acceleration pumps

- 2700/1352 . . . Fuel pump with a constant stroke piston without control means
- 2700/1358 . . . Fuel pump with control of fuel inlet to the pumping chamber
- 2700/1364 . . . Fuel pump controlled by means of a fuel return valve
- 2700/137 . . . Fuel pump with control of fuel outlet of pumping chamber to delivery pipe
- 2700/1376 . . . Fuel pump with control of the pump piston stroke
- 2700/1382 . . . Fuel pump with control of the cylinder relative to non-rotary piston
- 2700/1388 . . . Fuel pump with control of the piston relative to a fixed cylinder
- 2700/1394 . . Knock sensors
- 2700/31 . Use of exhaust gas of combustion engines
- 2700/33 . Compressors for piston combustion engines
- 2700/331 . . Charging and scavenging compressors
- 2700/333 . . . Drive thereof
- 2700/335 . . . Control therefor
- 2700/336 . . . Arrangements thereof on the engine
- 2700/338 . . Injection air compressors
- 2700/34 . Measures, also constructive measures, for avoiding the generation of nixious products such as CO in the exhaust gases
- 2700/43 . Arrangements for supplying air, fuel or auxiliary fluids to a combustion space of mixture compressing engines working with liquid fuel
- 2700/4302 . . whereby air and fuel are sucked into the mixture conduit
- 2700/4304 . . . working only with one fuel
- 2700/4307 without mixing chambers disposed in parallel
- 2700/4309 specially adapted for motorcycles
- 2700/4311 with mixing chambers disposed in parallel
- 2700/4314 with mixing chambers disposed in parallel
- 2700/4316 without mixing chambers disposed in parallel
- 2700/4319 with mixing chambers disposed in parallel
- 2700/4321 . . . working with fuel and admission of auxiliary fluids such as water, anti-knock agents, hydrogen, ozone or the like
- 2700/4323 . . . Throttling devices (not control systems thereof)
- 2700/4326 Means for preventing back-fire
- 2700/4328 . . . Reservoirs
- 2700/433 without limitation of the liquid level
- 2700/4333 with limitation of the liquid level
- 2700/4335 . . . Transport devices
- 2700/4338 Acceleration pumps
- 2700/434 . . . Heating or cooling devices
- 2700/4342 Heating devices
- 2700/4345 by means of exhaust gases
- 2700/4347 by means of water
- 2700/435 by means of electricity
- 2700/4352 by means of hot air
- 2700/4354 by means of heat radiated from the engine
- 2700/4357 by other means
- 2700/4359 Cooling devices
- 2700/4361 . . . Mixing chambers
- 2700/4364 with fuel atomization
- 2700/4366 with fuel atomization by a valve
- 2700/4369 with fuel atomization from an open fuel surface
- 2700/4371 with fuel atomization from a fuel film dispersed over a surface
- 2700/4373 . . . Mixture improving devices
- 2700/4376 Mechanical devices
- 2700/4378 Other devices
- 2700/438 . . . Supply of liquid to a carburettor reservoir with limitation of the liquid level; Aerating devices; Mounting of fuel filters
- 2700/4383 with fuel displacement by gas pressure working on the fuel
- 2700/4385 the pressure being an overpressure
- 2700/4388 with fuel displacement by a pump
- 2700/439 the pump being a membrane pump
- 2700/4392 . . . Conduits, manifolds, as far as heating and cooling if not concerned; Arrangements for removing condensed fuel
- 2700/4395 Other details
- 2700/4397 . . whereby air or fuel are admitted in the mixture conduit by means other than vacuum or an acceleration pump