

CPC COOPERATIVE PATENT CLASSIFICATION

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

ENGINES OR PUMPS

F02 COMBUSTION ENGINES; HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS

F02M SUPPLYING COMBUSTION ENGINES IN GENERAL WITH COMBUSTIBLE MIXTURES OR CONSTITUENTS THEREOF

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

{In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.}

Carburettors for liquid fuels

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

- 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 ([dependent on both pressure in combustion-air or fuel-air-mixture intake and engine temperature F02M 1/10](#))

- 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 for carburettors (with means for facilitating engine's 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}
- 3/042 . . . {Fuel cut-off by altering the pressure in the float chamber; Arrangement of pneumatic accumulators for pressure equalization}
- 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}

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
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}		<u>WARNING</u>
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		Group F02M 7/06 is impacted by reclassification into groups F02M 71/00, F02M 71/02, and F02M 71/04.
3/075	. . . {the valve altering the fuel conduit cross-section being a slidable valve}		All groups listed in this Warning should be considered in order to perform a complete search.
3/08	. Other details of idling devices (fighting ice-formation by heating idling ports F02M 15/02)	7/08	. . using pumps
3/09	. . Valves responsive to engine conditions, e.g. manifold vacuum (carburettors with means for facilitating engine's idling below operational temperatures F02M 1/00)		<u>WARNING</u>
3/10	. . Fuel metering pins; Nozzles		Group F02M 7/08 is impacted by reclassification into groups F02M 71/00, F02M 71/02, and F02M 71/04.
2003/105	. . . {Needle adjustment limiter caps}		All groups listed in this Warning should be considered in order to perform a complete search.
3/12	. . Passageway systems		
3/14	. . Location of idling system outlet relative to throttle valve	7/083	. . . {a pump sucking fuel from the conduit system leading to the spray nozzle downstream of the metering cross-section during deceleration}
5/00	Float-controlled apparatus for maintaining a constant fuel level		<u>WARNING</u>
5/02	. with provisions to meet variations in carburettor position, e.g. upside-down position in aircraft		Group F02M 7/083 is impacted by reclassification into groups F02M 71/00, F02M 71/02, and F02M 71/04.
5/04	. . with pivotally or rotatably mounted float chambers {(basic adjustment of float chambers having variable position F02M 5/14)}		All groups listed in this Warning should be considered in order to perform a complete search.
5/06	. having adjustable float mechanism, e.g. to meet dissimilarities in specific gravity of different fuels		
5/08	. having means for venting float chambers	7/087	. . . changing output according to temperature in engine
5/085	. . {consisting of an overflow from the float chamber}		<u>WARNING</u>
5/10	. having means for preventing vapour lock, e.g. insulated float chambers or forced fuel circulation through float chamber with engine stopped		Group F02M 7/087 is impacted by reclassification into groups F02M 71/00, F02M 71/02, and F02M 71/04.
5/105	. . {Auxiliary input valve which can be regulated to obtain an increased fuel supply from the float chamber}		All groups listed in this Warning should be considered in order to perform a complete search.
5/12	. Other details, e.g. floats, valves, setting devices or tools		
5/125	. . {Shape of the jet needle}		
5/14	. . {Float chambers, e.g. adjustable in position (float chamber with a built-in intermediate reservoir F02M 7/06)}		
5/16	. . Floats		

- 7/093 . . . changing output according to intake vacuum
- WARNING**
- Group [F02M 7/093](#) is impacted by reclassification into groups [F02M 71/00](#), [F02M 71/02](#), and [F02M 71/04](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 7/10 . . Other installations, without moving parts, for influencing fuel/air ratio, e.g. electrical means (fuel aerating devices for influencing fuel/air ratio [F02M 7/23](#))
- WARNING**
- Group [F02M 7/10](#) is impacted by reclassification into groups [F02M 7/23](#), [F02M 7/24](#), [F02M 7/245](#), [F02M 7/26](#), and [F02M 7/28](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 7/103 . . {with self-acting equaliser jets}
- WARNING**
- Group [F02M 7/103](#) is impacted by reclassification into groups [F02M 7/23](#), [F02M 7/24](#), [F02M 7/245](#), [F02M 7/26](#), and [F02M 7/28](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 7/106 . . {Fluid amplifier as a device for influencing the fuel-air mixture}
- WARNING**
- Group [F02M 7/106](#) is impacted by reclassification into groups [F02M 7/23](#), [F02M 7/24](#), [F02M 7/245](#), [F02M 7/26](#), and [F02M 7/28](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 7/11 . . Altering float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor [F02M 1/18](#))
- WARNING**
- Group [F02M 7/11](#) is impacted by reclassification into groups [F02M 7/23](#), [F02M 7/24](#), [F02M 7/245](#), [F02M 7/26](#), and [F02M 7/28](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 7/12 . . Other installations, with moving parts, for influencing fuel/air ratio, e.g. having valves ([F02M 7/24](#) takes precedence)
- 7/127 . . Altering the float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor [F02M 1/18](#))
- 7/133 . . Auxiliary jets, i.e. operating only under certain conditions, e.g. full power (means for enriching charge at high combustion-air flow [F02M 7/04](#); means for enriching charge on sudden throttle opening, i.e. at acceleration [F02M 7/06](#))
- 7/14 . . with means for controlling cross-sectional area of fuel spray nozzle (dependent on air-throttle valve position [F02M 7/22](#))
- 7/16 . . . operated automatically, e.g. dependent on exhaust-gas analysis
- 7/17 by a pneumatically adjustable piston-like element, e.g. constant depression carburettors
- WARNING**
- Group [F02M 7/17](#) is incomplete pending reclassification of documents from groups [F02M 9/06](#) and [F02M 9/065](#).
- Groups [F02M 9/06](#), [F02M 9/065](#), and [F02M 7/17](#) should be considered in order to perform a complete search.
- 7/18 . . with means for controlling cross-sectional area of fuel-metering orifice (dependent on air-throttle position [F02M 7/22](#))
- 7/20 . . . operated automatically, e.g. dependent on altitude
- 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](#))
- 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}
- 7/23 . Fuel aerating devices
- WARNING**
- Groups [F02M 7/23](#), [F02M 7/24](#), [F02M 7/245](#), [F02M 7/26](#), and [F02M 7/28](#) are incomplete pending reclassification of documents from groups [F02M 7/10](#), [F02M 7/103](#), [F02M 7/106](#), and [F02M 7/11](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 7/24 . . Controlling flow of aerating air
- 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 (installations, operated automatically by a pneumatically adjustable piston-like element, for influencing fuel/air ratio [F02M 7/17](#))
- WARNING**
- Group [F02M 9/06](#) is impacted by reclassification into group [F02M 7/17](#).
- Groups [F02M 9/06](#) and [F02M 7/17](#) should be considered in order to perform a complete search.
- 9/065 . . . {Automatically and not automatically controlled throttle valves operating mutually}
- WARNING**
- Group [F02M 9/065](#) is impacted by reclassification into group [F02M 7/17](#).
- Groups [F02M 9/065](#) and [F02M 7/17](#) should be considered in order to perform a complete search.
- 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**
- 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 [F02M 1/00](#) - [F02M 15/00](#) (apparatus for treating combustion-air, fuel, or fuel-air mixture by catalysts, electric means, magnetism, rays, sonic 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 }	19/0225	{ Arrangement of nozzle in the suction passage (idling nozzles F02M 3/08) }
17/142	{ with the fuel exit nozzles in or near the valve seat or valve }	19/0228	{ Ring nozzles }
17/145	{ the valve being opened by the pressure of the passing fluid }	19/0232	{ Fuel nozzle with device for return flow of leaked fuel }
17/147	{ Valve carburettor with simultaneous air and fuel control }	19/0235	{ Arrangements of several spray nozzles not provided for in F02M 3/00 or F02M 11/00 }
17/16	Carburettors having continuously-rotating bodies, e.g. surface carburettors	19/0239	{ in a fixed aerofoil profile }
17/18	Other surface carburettors	19/0242	{ with inserts of porous material }
17/20	{ with fuel bath }	19/0246	{ Nozzle cleaning }
17/22	{ with air bubbling through bath }	19/025	Metering orifices not variable in diameter
17/24	{ with wicks }	19/03	Fuel atomising nozzles; Arrangement of emulsifying air conduits
17/26	{ with other wetted bodies }	19/035	Mushroom-shaped atomising nozzles
17/28	{ fuel being drawn through a porous body }	19/04	Fuel-metering pins or needles
17/30	Carburettors with fire-protecting devices, e.g. combined with fire-extinguishing apparatus	19/06	Other details of fuel conduits
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) }	19/063	{ Built-in electric heaters }
17/34	Other carburettors combined or associated with other apparatus, e.g. air filters	19/066	{ Built-in cleaning elements, e.g. filters }
17/36	Carburettors having fitments facilitating their cleaning	19/08	Venturis
17/38	Controlling of carburettors, not otherwise provided for (external control gear F02M 19/12)	19/081	{ Shape of venturis or cross-section of mixture passages being adjustable }
17/40	Selection of particular materials for carburettors, e.g. sheet metal, plastic, or translucent materials	19/082	{ Venturi section being axially slidable in the mixture passages }
17/42	Float-controlled carburettors not otherwise provided for	19/083	{ Venturi section consisting of a lamellae spring-like structure }
17/44	Carburettors characterised by draught direction and not otherwise provided for { , e.g. for model aeroplanes }	19/085	{ venturi section being made from elastic material, e.g. from rubber-like material }
17/46	{ with down- draught }	19/086	{ Venturi suction bypass systems }
17/48	{ with up- draught { and float draught, e.g. for lawnmower and chain saw motors }	19/087	{ Venturi throat consisting of automatically adjusting balls }
17/50	Carburettors having means for combating ice-formation (thermally F02M 15/02)	19/088	{ Whirl devices and other atomising means in or on the venturi walls }
17/52	Use of cold, produced by carburettors, for other purposes	19/10	{ in multiple arrangement { , e.g. arranged in series, fixed, arranged radially offset with respect to each other }
17/525	{ Use of the intake conduit vacuum }	19/105	{ movable axially relative to each other }
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	19/12	External control gear, e.g. having dash-pots (dampening means in later stages of multi-stage carburettors F02M 11/04)
19/01	Apparatus for testing, tuning, or synchronising carburettors, e.g. carburettor glow stands	19/122	{ Damping elements (pneumatic or hydraulic means for increasing idling speed F02M 3/062) }
19/02	Metering-orifices, e.g. variable in diameter (variable during operation F02M 7/18)	19/124	{ Connecting rods between at least two throttle valves (F02M 1/02 takes precedence) }
19/0203	{ the cross-sectional area being changed pneumatically, e.g. vacuum dependent }	19/126	{ Connecting rods between at least a throttle valve and an accelerating pump (F02M 7/08 takes precedence) }
19/0207	{ the cross-sectional area being changed electrically }	19/128	{ Reserve throttle idle return spring, e.g. for use upon failure of the main spring }
19/021	{ the cross-sectional area being changed mechanically }		
19/0214	{ Changing the nozzle cross-sectional area as a function of temperature }	21/00	Apparatus for supplying engines with non-liquid fuels, e.g. gaseous fuels stored in liquid form
19/0217	{ Movable mushroom-shaped spray nozzles }	21/02	for gaseous fuels
19/0221	{ with a roughened spray stimulating surface or the like, e.g. sieves near to the nozzle orifice }	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 or butane }
		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
- 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
- 21/08 . . for non-gaseous fuels
- 21/10 . . for fuels with low melting point, e.g. apparatus having heating means

- 21/12 . . for fuels in pulverised state

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}
- 23/10 . . dependent on temperature, e.g. engine temperature
- 23/12 . characterised by being combined with device for, or by secondary air effecting, re-atomising of condensed fuel
- 23/14 . characterised by adding hot {secondary} air
- 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 ([adding secondary air to fuel-air mixture F02M 23/00](#); [adding exhaust gases F02M 26/00](#); [fuel-injection apparatus operating simultaneously on two or more fuels or on a liquid fuel and another liquid F02M 43/00](#))**
 - 25/022 . Adding fuel and water emulsion, water or steam
 - 25/0221 . . {Details of the water supply system, e.g. pumps or arrangement of valves}
 - 25/0222 . . . {Water recovery or storage}
 - 25/0224 . . . {Water treatment or cleaning ([F02M 25/032](#) takes precedence)}
 - 25/0225 . . . {Water atomisers or mixers, e.g. using ultrasonic waves}
 - 25/0227 . . {Control aspects; Arrangement of sensors; Diagnostics; Actuators}
 - 25/0228 . . {Adding fuel and water emulsion}
 - 25/025 . . Adding water
 - 25/028 . . . into the charge intakes

25/03	. . . into the cylinder {or the pre-combustion chamber}	26/02	. EGR systems specially adapted for supercharged engines
25/032	. . Producing and adding steam	26/03	. . with a single mechanically or electrically driven intake charge compressor
25/035	. . . into the charge intakes	26/04	. . with a single turbocharger
25/038	. . . into the cylinder {or the pre-combustion chamber}	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
25/06	. adding lubricant vapours	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
25/08	. adding fuel vapours drawn from engine fuel reservoir {(electrical control of purge system F02D 41/003)}	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
25/0809	. . {Judging failure of purge control system}	26/08	. . for engines having two or more intake charge compressors or exhaust gas turbines, e.g. a turbocharger combined with an additional compressor
25/0818	. . . {having means for pressurising the evaporative emission space}	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
25/0827	. . . {by monitoring engine running conditions}	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
25/0836	. . {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}	26/11	. Manufacture or assembly of EGR systems; Materials or coatings specially adapted for EGR systems
2025/0845	. . {Electromagnetic valves}	26/12	. characterised by means for attaching parts of an EGR system to each other or to engine parts
25/0854	. . {Details of the absorption canister}	26/13	. Arrangement or layout of EGR passages, e.g. in relation to specific engine parts or for incorporation of accessories
2025/0863	. . {with means dealing with condensed fuel or water, e.g. having a liquid trap}	26/14	. . in relation to the exhaust system
25/0872	. . {Details of the fuel vapour pipes or conduits}	26/15	. . . in relation to engine exhaust purifying apparatus
2025/0881	. . {with means to heat or cool the canister}	26/16	. . . with EGR valves located at or near the connection to the exhaust system
25/089	. . {Layout of the fuel vapour installation}	26/17	. . in relation to the intake system
25/10	. adding acetylene, non-waterborne hydrogen, non-airborne oxygen, or ozone	26/18	. . . Thermal insulation or heat protection
25/12	. . the apparatus having means for generating such gases (using rays and simultaneously generating ozone F02M 27/06)	26/19	. . . Means for improving the mixing of air and recirculated exhaust gases, e.g. venturis or multiple openings to the intake system
25/14	. adding anti-knock agents, not provided for in subgroups F02M 25/022 - F02M 25/10	26/20	. . . Feeding recirculated exhaust gases directly into the combustion chambers or into the intake runners
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	26/21	. . . with EGR valves located at or near the connection to the intake system
2026/001	. {Arrangements; Control features; Details}	26/22	. . with coolers in the recirculation passage
2026/002	. . {EGR valve being controlled by vacuum or overpressure}	26/23	. . . Layout, e.g. schematics
2026/0025	. . . {Intake vacuum or overpressure modulating valve}	26/24	. . . . with two or more coolers
2026/003	. . {EGR valve controlled by air measuring device}	26/25	. . . . with coolers having bypasses
2026/004	. . {EGR valve controlled by a temperature signal or an air/fuel ratio (lambda) signal}	26/26	. . . . characterised by details of the bypass valve
2026/005	. . {EGR valve controlled by an engine speed signal}	26/27	. . . . with air-cooled heat exchangers
2026/0055	. . {EGR valve controlled by inertia, e.g. having a pendulum controlling the EGR valve}		
2026/006	. . {EGR specially adapted for intake systems having two or more fuel injectors per cylinder}		
2026/007	. . {EGR specially adapted for engines having two or more spark plugs per cylinder}		
2026/008	. . {EGR specially adapted for engines having a combustion chamber divided by the piston at TDC into two or more sub-chambers}		
2026/009	. . {EGR combined with means to change air/fuel ratio, ignition timing, charge swirl in the cylinder}		
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		

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| <p>26/28 with liquid-cooled heat exchangers</p> <p>26/29 . . . Constructional details of the coolers, e.g. pipes, plates, ribs, insulation or materials</p> <p>26/30 Connections of coolers to other devices, e.g. to valves, heaters, compressors or filters; Coolers characterised by their location on the engine</p> <p>26/31 Air-cooled heat exchangers</p> <p>26/32 Liquid-cooled heat exchangers</p> <p>26/33 . . . controlling the temperature of the recirculated gases</p> <p>26/34 . . with compressors, turbines or the like in the recirculation passage</p> <p>26/35 . . with means for cleaning or treating the recirculated gases, e.g. catalysts, condensate traps, particle filters or heaters</p> <p>26/36 . . with means for adding fluids other than exhaust gas to the recirculation passage; with reformers</p> <p>26/37 . . with temporary storage of recirculated exhaust gas (internal exhaust gas recirculation F02M 26/01)</p> <p>26/38 . . with two or more EGR valves disposed in parallel</p> <p>26/39 . . with two or more EGR valves disposed in series</p> <p>26/40 . . with timing means in the recirculation passage, e.g. cyclically operating valves or regenerators; with arrangements involving pressure pulsations</p> <p>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</p> <p>26/42 . . having two or more EGR passages; EGR systems specially adapted for engines having two or more cylinders</p> <p>26/43 . . . in which exhaust from only one cylinder or only a group of cylinders is directed to the intake of the engine</p> <p>26/44 . . . in which a main EGR passage is branched into multiple passages</p> <p>26/45 . Sensors specially adapted for EGR systems</p> <p>26/46 . . for determining the characteristics of gases, e.g. composition</p> <p>26/47 . . . the characteristics being temperatures, pressures or flow rates</p> <p>26/48 . . EGR valve position sensors (details of the sensor installation in the valve housing F02M 26/72)</p> <p>26/49 . Detecting, diagnosing or indicating an abnormal function of the EGR system</p> <p>26/50 . Arrangements or methods for preventing or reducing deposits, corrosion or wear caused by impurities (arrangement or layout of EGR passages with means for cleaning or treating the recirculated gases F02M 26/35; protection of EGR valves from damage F02M 26/74)</p> <p>26/51 . EGR valves combined with other devices, e.g. with intake valves or compressors (combined with intake air throttles F02M 26/64)</p> <p>26/52 . Systems for actuating EGR valves</p> <p>26/53 . . using electric actuators, e.g. solenoids</p> <p>26/54 . . . Rotary actuators, e.g. step motors</p> <p>26/55 . . using vacuum actuators</p> <p>26/56 . . . having pressure modulation valves</p> | <p>26/57 using electronic means, e.g. electromagnetic valves</p> <p>26/58 . . . Constructional details of the actuator; Mounting thereof</p> <p>26/59 . . using positive pressure actuators; Check valves therefor</p> <p>26/60 . . . in response to air intake pressure</p> <p>26/61 . . . in response to exhaust pressure</p> <p>26/615 {the exhaust back pressure}</p> <p>26/62 . . . in response to fuel pressure</p> <p>26/63 . . the EGR valve being directly controlled by an operator (the EGR valve being operated together with an intake air throttle F02M 26/64)</p> <p>26/64 . . the EGR valve being operated together with an intake air throttle</p> <p>26/65 . Constructional details of EGR valves</p> <p>26/66 . . Lift valves, e.g. poppet valves</p> <p>26/67 . . . Pintles; Spindles; Springs; Bearings; Sealings; Connections to actuators</p> <p>26/68 . . . Closing members; Valve seats; Flow passages</p> <p>26/69 . . . having two or more valve-closing members</p> <p>26/70 . . Flap valves; Rotary valves; Sliding valves; Resilient valves</p> <p>26/71 . . Multi-way valves</p> <p>26/72 . . Housings</p> <p>26/73 . . . with means for heating or cooling the EGR valve</p> <p>26/74 . . Protection from damage, e.g. shielding means</p> <p>27/00 Apparatus for treating combustion-air, fuel, or fuel-air mixture, by catalysts, electric means, magnetism, rays, sound waves, or the like</p> <p>27/02 . by catalysts</p> <p>27/04 . by electric means, {ionisation, polarisation} or magnetism</p> <p>27/042 . . {by plasma}</p> <p>27/045 . . {by permanent magnets}</p> <p>2027/047 . . {with a pulsating magnetic field}</p> <p>27/06 . by rays {, e.g. infra-red and ultra-violet}</p> <p>27/065 . . {Radioactive radiation}</p> <p>27/08 . by sonic or ultrasonic waves</p> <p>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})</p> <p>29/02 . having rotary parts {, e.g. fan wheels}</p> <p>WARNING</p> <p>Group F02M 29/02 is impacted by reclassification into groups F02M 29/04, F02M 29/06, F02M 29/08, and F02M 29/10.</p> <p>All groups listed in this Warning should be considered in order to perform a complete search.</p> |
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- 29/04 . . . having screens, gratings, baffles or the like
- WARNING**
- Groups [F02M 29/04](#), [F02M 29/06](#), [F02M 29/08](#), and [F02M 29/10](#) are incomplete pending reclassification of documents from group [F02M 29/02](#).
- Groups [F02M 29/02](#) and [F02M 29/04](#) should be considered in order to perform a complete search.
- 29/06 . . . generating whirling motion of mixture
- 29/08 . . . having spirally-wound wires
- 29/10 . . . adjustable
- 29/12 . . . having homogenising valves held open by mixture current
- 29/14 . . . re-atomising or homogenising being effected by unevenness of internal surfaces of mixture intake
- 31/00 Apparatus for thermally treating combustion-air, fuel, or fuel-air mixture** (carburettors with heating, cooling or thermal insulating means for combustion-air, fuel or fuel-air mixture [F02M 15/00](#); apparatus for de-liquefying non-liquid fuels by heating [F02M 21/06](#); apparatus having heating means for non-gaseous fuels with low melting point [F02M 21/10](#); apparatus characterised by adding hot secondary air to fuel-air mixture [F02M 23/14](#); fuel-injection apparatus characterised by having heating, cooling or thermally insulating means [F02M 53/00](#))
- 31/005 . . . {using a heat-pipe (heat-pipe per se [F28D](#))}
- 31/02 . . . for heating ({[F02M 31/005](#) takes precedence; } for purifying liquid fuel [F02M 37/30](#))
- WARNING**
- Group [F02M 31/02](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/02](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 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](#))
- WARNING**
- Group [F02M 31/04](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/04](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 31/042 . . . {Combustion air}
- WARNING**
- Group [F02M 31/042](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/042](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

- 31/045 . . . {Fuel-air mixture}
- WARNING**
- Group [F02M 31/045](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/045](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 31/047 {for fuel enriched partial mixture flow path}
- WARNING**
- Group [F02M 31/047](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/047](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 31/06 . . . by hot gases, e.g. by mixing cold and hot air
- WARNING**
- Group [F02M 31/06](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/06](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 31/062 {with thermostat and pneumatic actuator both working on the air mixture control valve}
- WARNING**
- Group [F02M 31/062](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/062](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 31/064 {pneumatically controlled ([F02M 31/062](#) takes precedence)}
- WARNING**
- Group [F02M 31/064](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/064](#) and [F02M 37/30](#) should be considered in order to perform a complete search.
- 31/066 {operated manually, e.g. by means of valves on the air filter}
- WARNING**
- Group [F02M 31/066](#) is impacted by reclassification into group [F02M 37/30](#).
- Groups [F02M 31/066](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/068 {particular constructional aspects of the switching devices, e.g. connecting linkage between two control valves}

WARNING

Group [F02M 31/068](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/068](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/07 Temperature-responsive control, e.g. using thermostatically-controlled valves (temperature-responsive control of the amount of exhaust gas or combustion air directed to the heat exchange surface [F02M 31/083](#))

WARNING

Group [F02M 31/07](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/07](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/08 the gases being exhaust gases {(adding exhaust gases to the air intake passage [F02M 26/00](#))}

WARNING

Group [F02M 31/08](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/08](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

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}

WARNING

Group [F02M 31/0805](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/0805](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/081 {Manual switching of the fluids directed to the heat exchange surfaces}

WARNING

Group [F02M 31/081](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/081](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/0815 {Heat exchange surfaces arranged inside a flange}

WARNING

Group [F02M 31/0815](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/0815](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/082 {Particular shape of air input passage near to the branch}

WARNING

Group [F02M 31/082](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/082](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/0825 {Particular constructional characteristics of the heat exchange surfaces, e.g. finned pipes, coiled pipes or the like}

WARNING

Group [F02M 31/0825](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/0825](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/083 Temperature-responsive control of the amount of exhaust gas or combustion air directed to the heat exchange surface

WARNING

Group [F02M 31/083](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/083](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/087 Heat-exchange arrangements between the air intake and exhaust gas passages, e.g. by means of contact between the passages

WARNING

Group [F02M 31/087](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/087](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/093 Air intake passage surrounding the exhaust gas passage; Exhaust gas passage surrounding the air intake passage

WARNING

Group [F02M 31/093](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/093](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/10 . . . by hot liquids, e.g. lubricants {or cooling water}

WARNING

Group [F02M 31/10](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/10](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/102 {Particular constructional characteristics of the shape of the heat exchange surfaces}

WARNING

Group [F02M 31/102](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/102](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/105 {Particular constructional characteristics of the switching apparatus}

WARNING

Group [F02M 31/105](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/105](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/107 {Controlled or manual switching}

WARNING

Group [F02M 31/107](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/107](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/12 . . electrically

WARNING

Group [F02M 31/12](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/12](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/125 . . . Fuel

WARNING

Group [F02M 31/125](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/125](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/13 . . . Combustion air

WARNING

Group [F02M 31/13](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/13](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/135 . . . Fuel-air mixture

WARNING

Group [F02M 31/135](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/135](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/14 . . by using heat from working cylinders or cylinder heads

WARNING

Group [F02M 31/14](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/14](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/145 . . . {with particular constructional means}

WARNING

Group [F02M 31/145](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/145](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/16 . . Other apparatus for heating fuel

WARNING

Group [F02M 31/16](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/16](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

31/163 . . . {Preheating by burning an auxiliary mixture}

WARNING

Group [F02M 31/163](#) is impacted by reclassification into group [F02M 37/30](#).
Groups [F02M 31/163](#) and [F02M 37/30](#) should be considered in order to perform a complete search.

- 31/166 . . . {with mechanical generation of heat, e.g. by surface friction}
WARNING
 Group F02M 31/166 is impacted by reclassification into group F02M 37/30.
 Groups F02M 31/166 and F02M 37/30 should be considered in order to perform a complete search.
- 31/18 . . . to vaporise fuel
WARNING
 Group F02M 31/18 is impacted by reclassification into group F02M 37/30.
 Groups F02M 31/18 and F02M 37/30 should be considered in order to perform a complete search.
- 31/183 {Control}
WARNING
 Group F02M 31/183 is impacted by reclassification into group F02M 37/30.
 Groups F02M 31/183 and F02M 37/30 should be considered in order to perform a complete search.
- 31/186 {with simultaneous mixing of secondary air}
WARNING
 Group F02M 31/186 is impacted by reclassification into group F02M 37/30.
 Groups F02M 31/186 and F02M 37/30 should be considered in order to perform a complete search.
- 31/20 . for cooling ((F02M 31/005 takes precedence; use of cold F02M 17/52;) cooling of charging-air or of scavenging-air F02B 29/04)
- 31/205 . . {Control}
- 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)**
- 33/02 . for collecting and returning condensed fuel {(apparatus for re-atomising condensed fuel F02M 29/00)}
- 33/025 . . {Means not otherwise provided for}
- 33/04 . . returning to the intake passage
- 33/043 . . . {Coating of the intake passage with a porous material}
- 33/046 . . . {Coating of the intake passage with material preventing the formation of condensation}
- 33/06 . . . with simultaneous heat supply
- 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**
- 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}
- 35/0208 {with sensing means on both, the air feeding side and the clean air side}
- 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)}
- 35/021 . . . {Arrangements of air flow meters in or on air cleaner housings}
- 35/0212 . . {Multiple cleaners}
- 35/0214 . . . {arranged concentrically or coaxially}
- 35/0215 . . . {arranged in parallel}
- 35/0216 . . . {arranged in series, e.g. pre- and main filter in series}
- 35/0217 . . {acting by electric discharge; Electrostatic precipitators therefor}
- 35/0218 . . {acting by absorption or adsorption; trapping or removing vapours or liquids, e.g. originating from fuel}
- 35/022 . . acting by gravity, by centrifugal, or by other inertial forces, e.g. with moistened walls
- 35/0223 . . . {by centrifugal forces, e.g. cyclones}
- 35/0226 . . . {by gravity or by mass inertia, e.g. labyrinths, deflectors}
- 35/024 . . using filters, e.g. moistened (F02M 35/026 takes precedence; cleaning of the filtering material F02M 35/08)
- 35/02408 . . . {Manufacturing filter elements}
- 35/02416 . . . {Fixing, mounting, supporting or arranging filter elements; Filter element cartridges}
- 35/02425 {Support structures increasing the stability or stiffness of the filter element}
- 35/02433 {Special alignment with respect to the air intake flow, e.g. angled or in longitudinal flow direction}
- 35/02441 . . . {Materials or structure of filter elements, e.g. foams}
- 35/0245 {Pleated, folded, corrugated filter elements, e.g. made of paper}
- 35/02458 {consisting of multiple layers, e.g. coarse and fine filters; Coatings; Impregnations; Wet or moistened filter elements}
- 35/02466 {Meshes; Grids; Perforated plates}
- 35/02475 . . . {characterised by the shape of the filter element}
- 35/02483 {Cylindrical, conical, oval, spherical or the like filter elements; wounded filter elements}
- 35/02491 {Flat filter elements, e.g. rectangular}
- 35/026 . . acting by guiding the air over or through an oil or other liquid bath, e.g. combined with filters
- 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)}
- 35/042 . . . {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}
- 35/046 . . . {Inline cleaners, i.e. the cleaner being arranged along the length of a wall of a pipe or manifold}
- 35/048 . . . {Arranging or mounting on or with respect to engines or vehicle bodies}
- 35/06 . . . combined or associated with engine's cooling blower or fan, or with flywheel
- 35/08 . . with means for removing dust, {particles or liquids} from cleaners; with means for indicating clogging; with by-pass means; {Regeneration of cleaners}
- 35/082 . . . {By-pass means}
- 35/084 . . . {Dust collection chambers or discharge sockets, e.g. chambers fed by gravity or closed by a valve}
- 35/086 . . . {Dust removal by flushing, blasting, pulsating or aspirating flow, washing or the like; Mechanical dust removal, e.g. by using scrapers}
- 35/088 . . . {Water, snow or ice proofing; Separation or drainage of water, snow or ice}
- 35/09 . . . Clogging indicators {; Diagnosis or testing of air cleaners ([sensors therefore F02M 35/10373](#))}
- 35/10 . Air intakes; Induction systems
- 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}
- 35/10013 . . . {Means upstream of the air filter; Connection to the ambient air}
- 35/10019 . . . {Means upstream of the fuel injection system, carburettor or plenum chamber ([F02M 35/10013 takes precedence](#))}
- 35/10026 . . . {Plenum chambers}
- 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}
- 35/10039 . . . {Intake ducts situated partly within or on the plenum chamber housing}
- 35/10045 . . . {Multiple plenum chambers; Plenum chambers having inner separation walls ([for V-engines F02M 35/116; for resonance charging F02B 27/02](#))}
- 35/10052 . . . {special shapes or arrangements of plenum chambers; Constructional details}
- 35/10059 . . . {Swirl chamber upstream of the plenum chamber}
- 35/10065 . . . {Valves arranged in the plenum chamber}
- 35/10072 . . . {Intake runners}
- 35/10078 . . . {Connections of intake systems to the engine}
- 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}
- 35/10091 . . {characterised by details of intake ducts: shapes; connections; arrangements ([ducts within or on the plenum chamber F02M 35/10039](#))}
- 35/10098 . . . {Straight ducts}
- 35/10104 . . . {Substantially vertically arranged ducts}
- 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
- WARNING**
- Group [F02M 35/108](#) is impacted by reclassification into groups [F02M 35/112](#), [F02M 35/116](#), and [F02M 35/1165](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 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](#))}
- WARNING**
- Group [F02M 35/1085](#) is impacted by reclassification into groups [F02M 35/112](#), [F02M 35/116](#), and [F02M 35/1165](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 35/112 . . . for engines with cylinders all in one line
- WARNING**
- Group [F02M 35/112](#) is incomplete pending reclassification of documents from groups [F02M 35/108](#) and [F02M 35/1085](#).
- Groups [F02M 35/108](#), [F02M 35/1085](#), and [F02M 35/112](#) should be considered in order to perform a complete search.
- 35/116 . . . for engines with cylinders in V-arrangement or arranged oppositely relative to the main shaft
- WARNING**
- Group [F02M 35/116](#) is incomplete pending reclassification of documents from groups [F02M 35/108](#) and [F02M 35/1085](#).
- Groups [F02M 35/108](#), [F02M 35/1085](#), and [F02M 35/116](#) should be considered in order to perform a complete search.
- 35/1165 {Boxer or pancake engines}
- WARNING**
- Group [F02M 35/1165](#) is incomplete pending reclassification of documents from groups [F02M 35/108](#) and [F02M 35/1085](#).
- Groups [F02M 35/108](#), [F02M 35/1085](#), and [F02M 35/1165](#) should be considered in order to perform a complete search.
- 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
- 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; Arrangements for purifying liquid fuel specially adapted for, or arranged on, internal-combustion engines**
- 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
- 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. arrangements in the feeding system

WARNING

Group [F02M 37/22](#) is impacted by reclassification into groups [F02M 37/24](#), [F02M 37/26](#), [F02M 37/28](#), [F02M 37/30](#), [F02M 37/32](#), [F02M 37/34](#), [F02M 37/36](#), [F02M 37/38](#), [F02M 37/40](#), [F02M 37/42](#), [F02M 37/44](#), [F02M 37/46](#), [F02M 37/48](#), [F02M 37/50](#), [F02M 37/52](#), and [F02M 37/54](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 37/24 . . characterised by water separating means

WARNING

Group [F02M 37/24](#) is impacted by reclassification into groups [F02M 37/24](#) – [F02M 37/30](#).

All groups listed above should be considered in order to perform a complete search.

- 37/26 . . . with water detection means

WARNING

Group [F02M 37/26](#) is incomplete pending reclassification of documents from groups [F02M 37/22](#) and [F02M 37/24](#).

Groups [F02M 37/22](#), [F02M 37/24](#), and [F02M 37/26](#) should be considered in order to perform a complete search.

- 37/28 with means activated by the presence of water, e.g. alarms or means for automatic drainage

WARNING

Group [F02M 37/28](#) is incomplete pending reclassification of documents from groups [F02M 37/22](#) and [F02M 37/24](#).

Groups [F02M 37/22](#), [F02M 37/24](#), and [F02M 37/28](#) should be considered in order to perform a complete search.

- 37/30 . . characterised by heating means

WARNING

Group [F02M 37/30](#) is incomplete pending reclassification of documents from groups [F02M 31/02](#), [F02M 31/04](#), [F02M 31/042](#), [F02M 31/045](#), [F02M 31/047](#), [F02M 31/06](#), [F02M 31/062](#), [F02M 31/064](#), [F02M 31/066](#), [F02M 31/068](#), [F02M 31/07](#), [F02M 31/08](#), [F02M 31/0805](#), [F02M 31/081](#), [F02M 31/0815](#), [F02M 31/082](#), [F02M 31/0825](#), [F02M 31/083](#), [F02M 31/087](#), [F02M 31/093](#), [F02M 31/10](#), [F02M 31/102](#), [F02M 31/105](#), [F02M 31/107](#), [F02M 31/12](#), [F02M 31/125](#), [F02M 31/13](#), [F02M 31/135](#), [F02M 31/14](#), [F02M 31/145](#), [F02M 31/16](#), [F02M 31/163](#), [F02M 31/166](#), [F02M 31/18](#), [F02M 31/183](#), [F02M 31/186](#), [F02M 37/22](#), and [F02M 37/24](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 37/32 . . characterised by filters or filter arrangements

WARNING

Group [F02M 37/32](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/32](#) should be considered in order to perform a complete search.

- 37/34 . . . by the filter structure, e.g. honeycomb, mesh or fibrous

WARNING

Group [F02M 37/34](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/34](#) should be considered in order to perform a complete search.

- 37/36 . . . with bypass means

WARNING

Group [F02M 37/36](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/36](#) should be considered in order to perform a complete search.

- 37/38 . . . with regeneration means

WARNING

Group [F02M 37/38](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/38](#) should be considered in order to perform a complete search.

37/40 . . . with means for detection of clogging

WARNING

Group [F02M 37/40](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/40](#) should be considered in order to perform a complete search.

37/42 . . . Installation or removal of filters

WARNING

Group [F02M 37/42](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/42](#) should be considered in order to perform a complete search.

37/44 . . . Filters structurally associated with pumps

WARNING

Group [F02M 37/44](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/44](#) should be considered in order to perform a complete search.

37/46 . . . Filters structurally associated with pressure regulators

WARNING

Group [F02M 37/46](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/46](#) should be considered in order to perform a complete search.

37/48 . . . Filters structurally associated with fuel valves

WARNING

Group [F02M 37/48](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/48](#) should be considered in order to perform a complete search.

37/50 . . . Filters arranged in or on fuel tanks

WARNING

Group [F02M 37/50](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/50](#) should be considered in order to perform a complete search.

37/52 . . . using magnetic means

WARNING

Group [F02M 37/52](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/52](#) should be considered in order to perform a complete search.

37/54 . . characterised by air purging means (having priming pumps [F02M 37/16](#))

WARNING

Group [F02M 37/54](#) is incomplete pending reclassification of documents from group [F02M 37/22](#).

Groups [F02M 37/22](#) and [F02M 37/54](#) should be considered in order to perform a complete search.

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 (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 [F02M 49/00](#); 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](#).

WARNING

Group [F02M 39/00](#) is impacted by reclassification into groups [F02M 49/00](#), [F02M 49/02](#), and [F02M 49/04](#).

All groups listed in this Warning should be considered in order to perform a complete search.

39/005

. {Arrangements of fuel feed-pumps with respect to fuel injection apparatus ([F02M 37/00](#) takes precedence)}

WARNING

Group [F02M 39/005](#) is impacted by reclassification into groups [F02M 49/00](#), [F02M 49/02](#), and [F02M 49/04](#).

All groups listed in this Warning should be considered in order to perform a complete search.

39/02

. Arrangements of fuel-injection apparatus to facilitate the driving of pumps; Arrangements of fuel-injection pumps; Pump drives

41/00

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

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	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}
41/063	. . . {the distributor and rotary valve controlling fuel passages to pumping elements being combined}	2041/1483	. . . . {Variably timed valves controlling fuel passages, e.g. sleeve-valves mounted on the rotor}
41/066	. . . . {Arrangements for adjusting the rotary valve-distributor}	2041/1488	. . . . {Electric actuation of valves or other parts}
41/08	. the distributor and pumping elements being combined	2041/1494	. . . . {Details of cams, tappets, rotors, venting means, specially arranged valves, e.g. in the rotor}
41/10	. . pump pistons acting as the distributor	41/16	. characterised by the distributor being fed from a constant pressure source, e.g. accumulator {or constant pressure positive displacement pumps}
41/12	. . . the pistons rotating to act as the distributor	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
41/121	. . . . {with piston arranged axially to driving shaft (F02M 41/123 takes precedence)}	43/02	. Pumps peculiar thereto
41/122	. . . . {with piston arranged radially to driving shaft (F02M 41/123 takes precedence)}	43/04	. Injectors peculiar thereto
41/123	. . . . {characterised by means for varying fuel delivery or injection timing}	45/00	Fuel-injection apparatus characterised by having a cyclic delivery of specific time/pressure or time/quantity relationship {(pumps having such delivery by means of delivery valves F02M 59/462)}
41/124	. . . . . {Throttling of fuel passages to or from the pumping chamber}	45/02	. with each cyclic delivery being separated into two or more parts
41/125	. . . . . {Variably-timed valves controlling fuel passages}	45/04	. . with a small initial part {, e.g. initial part for partial load and initial and main part for full load}
41/126	. . . . . {valves being mechanically or electrically adjustable sleeves slidably mounted on rotary piston}	45/06	. . . Pumps peculiar thereto
41/127	. . . . . {valves being fluid-actuated slide-valves, e.g. differential rotary-piston pump}	45/063	. . . . {Delivery stroke of piston being divided into two or more parts, e.g. by using specially shaped cams}
41/128	. . . . . {Varying injection timing by angular adjustment of the face-cam or the rollers support}	45/066	. . . . {Having specially arranged spill port and spill contour on the piston (F02M 45/063 takes precedence)}
41/14	. . rotary distributor supporting pump pistons	45/08	. . . Injectors peculiar thereto
41/1405	. . . {pistons being disposed radially with respect to rotation axis}	45/083	. . . . {Having two or more closing springs acting on injection-valve}
41/1411	. . . . {characterised by means for varying fuel delivery or injection timing}	45/086	. . . . {Having more than one injection-valve controlling discharge orifices}
41/1416	. . . . . {Devices specially adapted for angular adjustment of annular cam}	45/10	. . Other injectors with multiple-part delivery, e.g. with vibrating valves
41/1422	. . . . . {Injection being effected by means of a free-piston displaced by the pressure of fuel}	45/12	. providing a continuous {cyclic} delivery with variable pressure
41/1427	. . . . . {Arrangements for metering fuel admitted to pumping chambers, e.g. by shuttles or by throttle-valves}	47/00	Fuel-injection apparatus operated cyclically with fuel-injection valves actuated by fluid pressure (fuel- injectors actuated by the pressure in engine working cylinders F02M 49/00)
41/1433	. . . {pistons being parallel to rotation axis}	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
2041/1438	. . . {Arrangements or details pertaining to the devices classified in F02M 41/14 and subgroups}	47/022	. . {Mechanically actuated valves draining the chamber to release the closing pressure}
2041/1444	. . . . {Feed-pumps; Arrangements or pressure regulation therefor}	47/025	. . {Hydraulically actuated valves draining the chamber to release the closing pressure}
2041/145	. . . . {Throttle valves for metering fuel to the pumping chamber}	47/027	. . {Electrically actuated valves draining the chamber to release the closing pressure}
2041/1455	. . . . {Shuttles <i>per se</i> , or shuttles associated with throttle valve for metering fuel admitted to the pumping chamber}	47/04	. using fluid, other than fuel, for injection-valve actuation
2041/1461	. . . . {Axial displacement of rotor for varying piston stroke or for controlling fuel passages}		
2041/1466	. . . . {Piston-stroke variation by other means than axial displacement of rotor}		
2041/1472	. . . . {Devices for limiting maximum delivery or for providing excess fuel for starting or for correcting advance at starting}		

- 47/043 . . {Fluid pressure acting on injection-valve in the period of non-injection to keep it closed}
- 47/046 . . {Fluid pressure acting on injection-valve in the period of injection to open it}
- 47/06 . Other fuel injectors peculiar thereto
- 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**

WARNING

Groups [F02M 49/00](#), [F02M 49/02](#), and [F02M 49/04](#) are incomplete pending reclassification of documents from groups [F02M 39/00](#) and [F02M 39/005](#).

Groups [F02M 39/00](#), [F02M 39/005](#), and [F02M 49/00](#) should be considered in order to perform a complete search.

- 49/02 . using the cylinder pressure, e.g. compression end pressure
- 49/04 . using the piston impact
- 51/00 Fuel-injection apparatus characterised by being operated electrically**
- 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}
- 51/02 . specially for low-pressure fuel-injection ([F02M 51/005](#) takes precedence; [pumps per se F02M 51/04](#); [injectors per se F02M 51/08](#))
- 51/04 . Pumps peculiar thereto
- 51/06 . Injectors peculiar thereto {with means directly operating the valve needle}

WARNING

Group [F02M 51/06](#) is impacted by reclassification into group [F02M 51/08](#).

Groups [F02M 51/06](#) and [F02M 51/08](#) should be considered in order to perform a complete search.

- 51/0603 . . {using piezo-electric or magnetostrictive operating means}
- 51/0607 . . . {the actuator being hollow, e.g. with needle passing through the hollow space}
- 51/061 . . {using electromagnetic operating means}
- 51/0614 . . . {characterised by arrangement of electromagnets or fixed armature}
- 51/0617 {having two or more electromagnets}
- 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}
- 51/0642 {the armature having a valve attached thereto}

- 51/0646 {the valve being a short body, e.g. sphere or cube}
- 51/065 {the valve being spherical or partly spherical}
- 51/0653 {the valve being an elongated body, e.g. a needle valve}
- 51/0657 {the body being hollow and its interior communicating with the fuel flow}
- 51/066 {the armature and the valve being allowed to move relatively to each other or not being attached to each other}
- 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}
- 51/0667 {the armature acting as a valve or having a short valve body attached thereto}
- 51/0671 {the armature having an elongated valve body attached thereto}
- 51/0675 {the valve body having cylindrical guiding or metering portions, e.g. with fuel passages}
- 51/0678 {all portions having fuel passages, e.g. flats, grooves, diameter reductions}
- 51/0682 {the body being hollow and its interior communicating with the fuel flow ([F02M 51/0675](#) takes precedence)}
- 51/0685 {the armature and the valve being allowed to move relatively to each other or not being attached to each other}
- 51/0689 . . . {and permanent magnets ([F02M 51/0696](#) takes precedence)}
- 51/0692 {as valve or armature return means}
- 51/0696 . . . {characterised by the use of movable windings}
- 51/08 . . specially for low-pressure fuel-injection

WARNING

Group [F02M 51/08](#) is incomplete pending reclassification of documents from group [F02M 51/06](#).

Groups [F02M 51/06](#) and [F02M 51/08](#) should be considered in order to perform a complete search.

53/00 Fuel-injection apparatus characterised by having heating, cooling or thermally-insulating means

- 53/02 . with fuel-heating means, e.g. for vaporising
- 53/04 . Injectors with heating, cooling, or thermally-insulating means
- 53/043 . . {with cooling means other than air cooling}
- 53/046 . . {with thermally-insulating means}
- 53/06 . . with fuel-heating means, e.g. for vaporising
- 53/08 . . with air cooling

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](#))}

- 55/001 . {Pumps with means for preventing erosion on fuel discharge}
- 55/002 . {Arrangement of leakage or drain conduits in or from injectors}

- 55/004 . {Joints; Sealings}
- 55/005 . . {for high pressure conduits, e.g. connected to pump outlet or to injector inlet}
- 55/007 . {Venting means}
- 55/008 . {Arrangement of fuel passages inside of injectors}
- 55/02 . Conduits between injection pumps and injectors {, e.g. conduits between pump and common-rail or conduits between common-rail and injectors}
- 55/025 . . {Common rails}
- 55/04 . Means for damping vibrations {or pressure fluctuations} in injection pump inlets {or outlets}
- 57/00 Fuel-injectors combined or associated with other devices**
- 57/005 . {the devices being sensors}
- 57/02 . Injectors structurally combined with fuel-injection pumps
- 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}
- 57/022 . . {characterised by the pump drive}
- 57/023 . . . {mechanical}
- 57/024 {with hydraulic link for varying the piston stroke}
- 57/025 . . . {hydraulic, e.g. with pressure amplification}
- 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}
- 57/027 . . . {electric}
- 57/028 . . . {pneumatic (using engine cylinder pressure [F02M 49/02](#))}
- 57/04 . the devices being combustion-air intake or exhaust valves
- 57/06 . the devices being sparking plugs
- 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 of pumps}**
- 59/02 . of reciprocating-piston {or reciprocating-cylinder} type
- 59/022 . . {having an accumulator storing pressurised fuel during pumping stroke of the piston for subsequent delivery to the injector}
- 59/025 . . {characterised by a single piston}
- 59/027 . . . {Unit-pumps, i.e. single piston and cylinder pump-units, e.g. for cooperating with a camshaft}
- 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](#))}
- 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
- 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 {Rotary valves}
- 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
- 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**
- 61/02 . of valveless type
- 61/04 . having valves {, e.g. having a plurality of valves in series}
- 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}
- 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}**
- 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
- 67/14 . characterised by provisions for injecting different fuels, e.g. main fuel and readily self-igniting starting fuel

69/00 Low-pressure fuel-injection apparatus {; Apparatus with both continuous and intermittent injection; Apparatus injecting different types of fuel}

NOTE

- in this group the following indexing codes are used: [F02B 2720/15](#)

- 69/002 . {characterised by means for intermittently metering the portion of fuel injected ([F02M 69/12](#), [F02M 69/14](#) take precedence)}
- 69/005 . {characterised by control of air admission to the engine according to the fuel injected}
- 69/007 . . {by means of devices using fuel pressure deviated from main fuel circuit acting on air throttle valve}
- 69/02 . Pumps peculiar thereto {(elastic wall type pumps [F02M 59/14](#))}
- 69/04 . Injectors peculiar thereto

- 69/041 . . {having vibrating means for atomizing the fuel, e.g. with sonic or ultrasonic vibrations}
- 69/042 . . {Positioning of injectors with respect to engine, e.g. in the air intake conduit (mounting of injectors [F02M 61/14](#))}
- 69/043 . . . {for injecting into the intake conduit upstream of an air throttle valve}
- 69/044 . . . {for injecting into the intake conduit downstream of an air throttle valve}
- 69/045 . . . {for injecting into the combustion chamber ([F02M 69/046](#) takes precedence)}
- 69/046 . . . {for injecting into both the combustion chamber and the intake conduit}
- 69/047 . . {injectors with air chambers, e.g. communicating with atmosphere for aerating the nozzles ([F02M 69/325](#) takes precedence)}
- 69/048 . . {having variable fuel outlets, e.g. controlled by a valve actuated by operator}
- 69/06 . characterised by the pressurisation of the fuel being caused by centrifugal force acting on the fuel
- 69/08 . characterised by the fuel being carried by compressed air into main stream of combustion-air
- 69/10 . peculiar to scavenged two-stroke engines, e.g. injecting into crankcase-pump chamber
- 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](#))}
- 69/125 . . {Means for varying the stroke of the free-piston}
- 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](#))}
- 69/142 . . {the valves being operated by fluid impulses, e.g. using bistable fluid operated valves}
- 69/145 . . {the valves being actuated electrically (electrically-operated injectors [F02M 51/06](#))}
- 69/147 . . {the valves being actuated mechanically, e.g. rotating}
- 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
- 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 (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 [F02M 69/26](#))
- 69/20 . . . the device being a servo-motor, e.g. using engine intake air pressure or vacuum (the actuating device comprising a member movably mounted in the air intake conduit and displaced according to the quantity of air admitted to the engine [F02M 69/22](#))
- 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

- 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
- 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
- 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
- 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
- 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
- 69/325 . . . {with an auxiliary injection nozzle therein (F02M 69/34 takes precedence)}
- 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
- 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}
- 69/38 . . . using fuel pressure, e.g. by varying fuel pressure in the control chambers of the fuel metering device (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 F02M 69/26)
- 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}
- 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}
- 69/40 . . . using variably controlled air pressure, e.g. by modifying the intake air vacuum signal acting on the fuel metering device
- 69/42 . . . using other means than variable fluid pressure, e.g. acting on the fuel metering device mechanically or electrically
- 69/44 . characterised by means for supplying extra fuel to the engine on sudden air throttle opening, e.g. at acceleration
- 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
- 69/462 . . {Arrangement of fuel conduits, e.g. with valves for maintaining pressure in the pipes after the engine being shut-down}
- 69/465 . . . {of fuel rails}

- 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)}
- 69/48 . . Arrangement of air sensors {(F02M 69/22 takes precedence)}
- 69/50 . . Arrangement of fuel distributors {, e.g. with means for supplying equal portion of metered fuel to injectors (F02M 69/147 takes precedence)}
- 69/52 . . Arrangement of fuel metering devices {(F02M 69/18 takes precedence)}
- 69/54 . . Arrangement of fuel pressure regulators

71/00 Combinations of carburettors and low-pressure fuel-injection apparatus

WARNING

Groups F02M 71/00, F02M 71/02, and F02M 71/04 are incomplete pending reclassification of documents from groups F02M 7/06, F02M 7/08, F02M 7/083, F02M 7/087, and F02M 7/093.

All groups listed in this Warning should be considered in order to perform a complete search.

- 71/02 . with fuel-air mixture being produced by the carburettor and being compressed by a pump for subsequent injection into main combustion-air
- 71/04 . with carburettor being used at starting or idling only and injection apparatus being used during normal operation of engine {or vice versa}

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

2200/00 Details of fuel-injection apparatus, not otherwise provided for

- 2200/02 . Fuel-injection apparatus having means for reducing wear
- 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
- 2200/04 . Fuel-injection apparatus having means for avoiding effect of cavitation, e.g. erosion
- 2200/05 . Fuel-injection apparatus having means for preventing corrosion
- 2200/06 . Fuel-injection apparatus having means for preventing coking, e.g. of fuel injector discharge orifices or valve needles
- 2200/07 . Fuel-injection apparatus having means for avoiding sticking of valve or armature, e.g. preventing hydraulic or magnetic sticking of parts
- 2200/08 . Fuel-injection apparatus having special means for influencing magnetic flux, e.g. for shielding or guiding magnetic flux
- 2200/09 . Fuel-injection apparatus having means for reducing noise
- 2200/16 . Sealing of fuel injection apparatus not otherwise provided for
- 2200/18 . Fuel-injection apparatus having means for maintaining safety not otherwise provided for
- 2200/185 . . means for improving crash safety
- 2200/20 . Fuel-injection apparatus with permanent magnets

- 2200/21 . Fuel-injection apparatus with piezo-electric or magnetostrictive elements
- 2200/215 . . Piezo-electric or magnetostrictive elements being able to tilt in its housing
- 2200/22 . Fuel-injection apparatus with bimetallic or memory shape alloy elements
- 2200/24 . Fuel-injection apparatus with sensors
- 2200/241 . . Acceleration or vibration sensors
- 2200/242 . . Displacement sensors
- 2200/244 . . Force sensors
- 2200/245 . . Position sensors, e.g. Hall sensors
- 2200/247 . . Pressure sensors
- 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
- 2200/46 . Valves, e.g. injectors, with concentric valve bodies
- 2200/50 . Arrangements of springs for valves used in fuel injectors or fuel injection pumps
- 2200/502 . . Springs biasing the valve member to the open position
- 2200/505 . . Adjusting spring tension by sliding spring seats
- 2200/507 . . Adjusting spring tension by screwing spring seats
- 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
- 2200/70 . 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	2700/1394	. . Knock sensors
2547/001	. Control chambers formed by movable sleeves	2700/31	. Use of exhaust gas of combustion engines
2547/003	. Valve inserts containing control chamber and valve piston	2700/33	. Compressors for piston combustion engines
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	2700/331	. . Charging and scavenging compressors
2547/006	. Springs assisting hydraulic closing force	2700/333	. . . Drive thereof
2547/008	. Means for influencing the flow rate out of or into a control chamber, e.g. depending on the position of the needle	2700/335	. . . 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
2700/00	Supplying, feeding or preparing air, fuel, fuel air mixtures or auxiliary fluids for a combustion engine; Use of exhaust gas; Compressors for piston engines	2700/43	. Arrangements for supplying air, fuel or auxiliary fluids to a combustion space of mixture compressing engines working with liquid fuel
2700/05	. Miscellaneous constructional elements; Leakage detection	2700/4302	. . whereby air and fuel are sucked into the mixture conduit
2700/055	. . Fuel distribution among injection nozzles	2700/4304	. . . working only with one fuel
2700/07	. Nozzles and injectors with controllable fuel supply	2700/4307	. . . . without mixing chambers disposed in parallel
2700/071	. . Injectors having valves	2700/4309	. . . . specially adapted for motorcycles
2700/072	. . Injection valve actuated by engine for supply of pressurised fuel; Electrically or electromagnetically actuated injectors	2700/4311	. . . . with mixing chambers disposed in parallel
2700/074	. . Injection valve actuated by fuel pressure for pressurised fuel supply	2700/4314	. . . with mixing chambers disposed in parallel
2700/075	. . Injection valve actuated by cylinder pressure or other air pressure for pressurised fuel supply	2700/4316	. . . . without mixing chambers disposed in parallel
2700/077	. . Injectors having cooling or heating means	2700/4319	. . . . with mixing chambers disposed in parallel
2700/078	. . Injectors combined with fuel injection pump	2700/4321	. . . working with fuel and admission of auxiliary fluids such as water, anti-knock agents, hydrogen, ozone or the like
2700/12	. Devices or methods for making a gas mixture for a combustion engine	2700/4323	. . . Throttling devices (not control systems thereof)
2700/123	. . Fuel supply devices	2700/4326	. . . . Means for preventing back-fire
2700/126	. . Devices for the supply or mixing of air and gas	2700/4328	. . . Reservoirs
2700/13	. Special devices for making an explosive mixture; Fuel pumps	2700/433	. . . . without limitation of the liquid level
2700/1305	. . Auxiliary air supply devices for carburettors	2700/4333	. . . . with limitation of the liquid level
2700/1311	. . Devices for controlling register carburettors or for carburettors disposed in parallel	2700/4335	. . . Transport devices
2700/1317	. . Fuel pumpo for internal combustion engines	2700/4338	. . . . Acceleration pumps
2700/1323	. . . Controlled diaphragm type fuel pump	2700/434	. . . Heating or cooling devices
2700/1329	. . . Controlled rotary fuel pump with parallel pistons or with a single piston in the extension of the driving shaft	2700/4342	. . . . Heating devices
2700/1335	. . . Fuel pump combined with the fuel injector	2700/4345	. . . . . by means of exhaust gases
2700/1341	. . . Fuel pump driven by the differential pressure of a gas	2700/4347	. . . . . by means of water
2700/1347	. . . Fuel pump acting on a carburetoor; Acceleration pumps	2700/435	. . . . . by means of electricity
2700/1352	. . . Fuel pump with a constant stroke piston without control means	2700/4352	. . . . . by means of hot air
2700/1358	. . . Fuel pump with control of fuel inlet to the pumping chamber	2700/4354	. . . . . by means of heat radiated from the engine
2700/1364	. . . Fuel pump controlled by means of a fuel return valve	2700/4357	. . . . . by other means
2700/137	. . . Fuel pump with control of fuel outlet of pumping chamber to delivery pipe	2700/4359	. . . . Cooling devices
2700/1376	. . . Fuel pump with control of the pump piston stroke	2700/4361	. . . Mixing chambers
2700/1382	. . . Fuel pump with control of the cylinder relative to non-rotary piston	2700/4364	. . . . with fuel atomization
2700/1388	. . . Fuel pump with control of the piston relative to a fixed cylinder	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

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- 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