SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

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

F02B INTERNAL-COMBUSTION PISTON ENGINES; COMBUSTION ENGINES IN GENERAL (gas-turbine plants F02C; hot-gas or combustion-product positive-displacement engine plants F02G)

Note(s)

1. In this subclass, the following terms or expression are used with the meanings indicated:
   - "positive ignition" means ignition by a source external to the working fluid, e.g. by spark or incandescent source;
   - "charging" means forcing air or fuel-air mixture into engine cylinders, and thus includes supercharging;
   - "scavenging" means forcing the combustion residues from the cylinders other than by movement of the working pistons, and thus includes tuned exhaust systems.
2. Attention is drawn to the Notes preceding class F01, especially as regards Note (1).
3. Engines with specified cycles or number of cylinders are classified in group F02B 75/02 or F02B 75/16, unless other classifying features predominate.

Subclass index

Engines characterised by the working fluid to be compressed or characterised by the type of ignition

1/00 Engines characterised by fuel-air mixture compression (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00) **[1, 2006.01]**

1/02 • with positive ignition (with non-timed positive ignition F02B 9/06) **[1, 2006.01]**

1/04 • • with fuel-air mixture admission into cylinder **[1, 2006.01]**

1/06 • • • Methods of operating **[1, 2006.01]**

1/08 • • with separate admission of air and fuel into cylinder **[1, 2006.01]**

1/10 • • • Methods of operating **[1, 2006.01]**

1/12 • with compression ignition (with fuel-air charge ignited by compression ignition of an additional fuel F02B 7/00) **[1, 2006.01]**

1/14 • • Methods of operating **[1, 2006.01]**

3/00 Engines characterised by air compression and subsequent fuel addition (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00) **[1, 2006.01]**

3/02 • with positive ignition (with non-timed positive ignition F02B 9/06) **[1, 2006.01]**

3/04 • • Methods of operating **[1, 2006.01]**

3/06 • with compression ignition (compression ignition engines using air or gas for blowing fuel into compressed air in cylinder F02B 13/02) **[1, 2006.01]**

3/08 • • Methods of operating (F02B 3/12 takes precedence) **[1, 2006.01]**

3/10 • • with intermittent fuel introduction **[1, 2006.01]**

3/12 • • • Methods of operating **[1, 2006.01]**

5/00 Engines characterised by positive ignition (engines characterised by fuel-air mixture compression with positive ignition F02B 1/02; engines characterised by air compression and subsequent fuel addition with positive ignition F02B 3/02; with non-timed positive ignition F02B 9/06; characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00) **[1, 2006.01]**

5/02 • Methods of operating **[1, 2006.01]**

7/00 Engines characterised by the fuel-air charge being ignited by compression ignition of an additional fuel (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00) **[1, 2006.01]**

7/02 • the fuel in the charge being liquid **[1, 2006.01]**

7/04 • • Methods of operating **[1, 2006.01]**

7/06 • the fuel in the charge being gaseous **[1, 2006.01]**

7/08 • • Methods of operating **[1, 2006.01]**

9/00 Engines characterised by other types of ignition (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00) **[1, 2006.01]**

9/02 • with compression ignition (engines characterised by fuel-air mixture compression with compression ignition F02B 1/12; engines characterised by air compression and subsequent fuel addition with compression ignition F02B 3/06) **[1, 2006.01]**

9/04 • • Methods of operating **[1, 2006.01]**

9/06 • with non-timed positive ignition, e.g. with hot-spots **[1, 2006.01]**

9/08 • • with incandescent chambers **[1, 2006.01]**

9/10 • • • Chamber shapes or constructions **[1, 2006.01]**

11/00 Engines characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition, e.g. in different cylinders [1, 2006.01]

11/02 • convertible from fuel-air mixture compression to air compression or vice versa **[1, 2006.01]**

Engines characterised by the method of introducing liquid fuel into cylinders

13/00 Engines characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid [1, 2006.01]

13/02 • Compression ignition engines using air or gas for blowing fuel into compressed air in cylinder **[1, 2006.01]**

13/04 • • Arrangements or adaptations of pumps **[1, 2006.01]**

13/06 • Engines having secondary air mixed with fuel in pump, compressed therein without ignition, and fuel-air mixture being injected into air in cylinder **[1, 2006.01]**

13/08 • • Arrangements or adaptations of pumps **[1, 2006.01]**

13/10 • Use of specific auxiliary fluids, e.g. steam, combustion gas **[1, 2006.01]**

15/00 Engines characterised by the method of introducing liquid fuel into cylinders and not otherwise provided for [1, 2006.01]

15/02 • having means for sucking fuel directly into cylinder **[1, 2006.01]**

17/00 Engines characterised by means for effecting stratification of charge in cylinders [1, 2006.01]

Engines characterised by precombustion chambers or air-storage chambers, or characterised by special shape or construction of combustion chambers to improve operation

19/00 Engines characterised by precombustion chambers [1, 2006.01]

19/02 • the chamber being periodically isolated from its cylinder **[1, 2006.01]**

19/04 • • the isolation being effected by a protuberance on piston or cylinder head **[1, 2006.01]**

19/06 • with auxiliary piston in chamber for transferring ignited charge to cylinder space **[1, 2006.01]**

19/08 • the chamber being of air-swirl type **[1, 2006.01]**

19/10 • with fuel introduced partly into pre-combustion chamber, and partly into cylinder **[1, 2006.01]**

19/12 • with positive ignition (engines with non-timed positive ignition, and with incandescent chambers F02B 9/08) **[1, 2006.01]**

19/14 • with compression ignition **[1, 2006.01]**

19/16 • Chamber shapes or constructions not specific to groups F02B 19/02-F02B 19/10 **[1, 2006.01]**

19/18 • • Transfer passages between chamber and cylinder **[1, 2006.01]**

21/00 Engines characterised by air-storage chambers [1, 2006.01]

21/02 • Chamber shapes or constructions **[1, 2006.01]**

23/00 Other engines characterised by special shape or construction of combustion chambers to improve operation (engines with incandescent chambers F02B 9/08) **[1, 2006.01]**

23/02 • with compression ignition **[1, 2006.01]**

23/04 • • the combustion space being subdivided into two or more chambers (with pre-combustion chambers F02B 19/00) **[1, 2006.01]**

23/06 • • the combustion space being arranged in working piston (F02B 23/04 takes precedence) **[1, 2006.01]**
23/08 • with positive ignition **[1, 2006.01]**
23/10 • • with separate admission of air and fuel into cylinder **[1, 2006.01]**

Engines characterised by provision for charging or scavenging

25/00 Engines characterised by using fresh charge for scavenging cylinders [1, 2006.01]
25/02 • using unidirectional scavenging **[1, 2006.01]**
25/04 • • Engines having ports both in cylinder head and in cylinder wall near bottom of piston stroke **[1, 2006.01]**
25/06 • • • the cylinder-head ports being controlled by working pistons, e.g. by sleeve-shaped extensions thereof **[1, 2006.01]**
25/08 • • Engines with oppositely-moving reciprocating working pistons **[1, 2006.01]**
25/10 • • • with one piston having a smaller diameter or shorter stroke than the other **[1, 2006.01]**
25/12 • • Engines with U-shaped cylinders, having ports in each arm **[1, 2006.01]**
25/14 • using reverse-flow scavenging, e.g. with both inlet and outlet ports arranged near bottom of piston stroke **[1, 2006.01]**
25/16 • • the charge flowing upward essentially along cylinder wall opposite the inlet ports **[1, 2006.01]**
25/18 • • the charge flowing upward essentially along cylinder wall adjacent the inlet ports, e.g. by means of deflection rib on piston **[1, 2006.01]**
25/20 • Means for reducing the mixing of charge and combustion residues or for preventing escape of fresh charge through outlet ports, not provided for in, or of interest apart from, groups F02B 25/02-F02B 25/18 **[1, 2006.01]**
25/22 • • by forming air cushion between charge and combustion residues **[1, 2006.01]**
25/24 • • Inlet or outlet openings being timed asymmetrically relative to bottom dead-centre **[1, 2006.01]**
25/26 • Multi-cylinder engines other than those provided for in, or of interest apart from, groups F02B 25/02-F02B 25/24 (internal-combustion aspects of rotary engines F02B 57/00) **[1, 2006.01]**
25/28 • • with V-, fan-, or star-arrangement of cylinders **[1, 2006.01]**

27/00 Use of kinetic or wave energy of charge in induction systems, or of combustion residues in exhaust systems, for improving quantity of charge or for increasing removal of combustion residues [1, 2006.01]
27/02 • the systems having variable, i.e. adjustable, cross-sectional areas, chambers of variable volume, or like variable means (in exhaust systems only F02B 27/06) **[1, 2006.01]**
27/04 • in exhaust systems only, e.g. for sucking-off combustion gases **[1, 2006.01]**
27/06 • • the systems having variable, i.e. adjustable, cross-sectional areas, chambers of variable volume, or like variable means **[1, 2006.01]**

29/00 Engines characterised by provision for charging or scavenging not provided for in groups F02B 25/00, F02B 27/00 or F02B 33/00-F02B 39/00; Details thereof [1, 2006.01]
29/02 • Other fluid-dynamic features of induction systems for improving quantity of charge (for also imparting a rotation to the charge in the cylinder F02B 31/00) **[1, 2006.01]**
29/04 • Cooling of air intake supply **[1, 2006.01]**
29/06 • After-charging, i.e. supplementary charging after scavenging **[1, 2006.01]**
29/08 • Modifying distribution valve timing for charging purposes (F02B 29/06 takes precedence) **[1, 2006.01]**

31/00 Modifying induction systems for imparting a rotation to the charge in the cylinder (air intakes or induction systems for internal-combustion engines F02M 35/10) **[1, 2006.01]**
31/02 • in engines having inlet valves arranged eccentrically to cylinder axis (F02B 31/08 takes precedence) **[1, 6, 2006.01]**
31/04 • by means within the induction channel, e.g. deflectors **[6, 2006.01]**
31/06 • • Movable means, e.g. butterfly valves **[6, 2006.01]**
31/08 • having multiple air inlets **[6, 2006.01]**

Engines characterised by provision of driven charging or scavenging pumps

33/00 Engines characterised by provision of pumps for charging or scavenging [1, 2006.01]
33/02 • Engines with reciprocating-piston pumps; Engines with crankcase pumps **[1, 2006.01]**
33/04 • • with simple crankcase pumps, i.e. with the rear face of a non-stepped working piston acting as sole pumping member in co-operation with the crankcase **[1, 2006.01]**
33/06 • • with reciprocating-piston pumps other than simple crankcase pumps **[1, 2006.01]**
33/08 • • • with the working-cylinder head arranged between working and pumping cylinders **[1, 2006.01]**
33/10 • • • with the pumping cylinder situated between working cylinder and crankcase, or with the pumping cylinder surrounding working cylinder **[1, 2006.01]**
33/12 • • • • the rear face of working piston acting as pumping member and co-operating with a pumping chamber isolated from crankcase, the connecting-rod passing through the chamber and co-operating with movable isolating member **[1, 2006.01]**
33/14 • • • • working and pumping pistons forming stepped piston **[1, 2006.01]**
33/16 • • • • working and pumping pistons having differing movements **[1, 2006.01]**
33/18 • • • with crankshaft being arranged between working and pumping cylinders **[1, 2006.01]**
33/20 • • • with pumping-cylinder axis arranged at an angle to working-cylinder axis, e.g. at an angle of 90° **[1, 2006.01]**
33/22 • • • with pumping cylinder situated at side of working cylinder, e.g. the cylinders being parallel **[1, 2006.01]**
33/24 • • with crankcase pumps other than with reciprocating pistons only **[1, 2006.01]**
33/26 • • Four-stroke engines characterised by having crankcase pumps **[1, 2006.01]**

33/28 • • Component parts, details, or accessories of crankcase pumps not provided for in, or of interest apart from, groups F02B 33/02-F02B 33/26 **[1, 2006.01]**

33/30 • • • Control of inlet or outlet ports **[1, 2006.01]**

33/32 • Engines with pumps other than of reciprocating-piston type (with crankcase pumps F02B 33/02) **[1, 2006.01]**

33/34 • • with rotary pumps (with cell-type pressure exchangers or the like F02B 33/42) **[1, 2006.01]**

33/36 • • • of positive-displacement type **[1, 2006.01]**

33/38 • • • • of Roots type **[1, 2006.01]**

33/40 • • • of non-positive-displacement type **[1, 2006.01]**

33/42 • • with driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge, e.g. with cell-type pressure exchangers **[1, 2006.01]**

33/44 • Passages conducting the charge from the pump to the engine inlet, e.g. reservoirs **[1, 2006.01]**

35/00 Engines characterised by provision of pumps for sucking combustion residues from cylinders [1, 2006.01]

35/02 • using rotary pumps **[1, 2006.01]**

37/00 Engines characterised by provision of pumps driven at least for part of the time by exhaust [1, 2006.01]

37/007 • with exhaust-driven pumps arranged in parallel **[6, 2006.01]**

37/013 • with exhaust-driven pumps arranged in series **[6, 2006.01]**

37/02 • Gas passages between engine outlet and pump drive, e.g. reservoirs **[1, 2006.01]**

37/04 • Engines with exhaust drive and other drive of pumps, e.g. with exhaust-driven pump and mechanically-driven second pump **[1, 2006.01]**

37/10 • • at least one pump being alternately driven by exhaust and other drive **[3, 2006.01]**

37/11 • • • driven by other drive at starting only **[6, 2006.01]**

37/12 • Control of the pumps **[3, 2006.01]**

37/14 • • of the alternation between exhaust drive and other drive of a pump, e.g. dependent on speed **[3, 2006.01]**

37/16 • • by bypassing charging air **[6, 2006.01]**

37/18 • • by bypassing exhaust **[6, 2006.01]**

37/20 • • by increasing exhaust energy, e.g. using combustion chambers **[6, 2006.01]**

37/22 • • by varying the cross-section of exhaust passages or air passages (F02B 37/24 takes precedence) **[6, 2006.01]**

37/24 • • by using pumps or turbines with adjustable guide vanes **[6, 2006.01]**

39/00 Component parts, details, or accessories relating to driven charging or scavenging pumps, not provided for in groups F02B 33/00-F02B 37/00 [1, 2006.01]

39/02 • Drives of pumps (exhaust drives or combined exhaust and other drives F02B 37/00); Varying pump drive gear ratio **[1, 2006.01]**

39/04 • • Mechanical drives; Variable-gear-ratio drives (non-mechanical pump drives having variable gear ratio F02B 39/08) **[1, 2006.01]**

39/06 • • • the engine torque being divided by a differential gear for driving a pump and the engine output shaft **[1, 2006.01]**

39/08 • • Non-mechanical drives, e.g. fluid drives having variable gear ratio **[1, 2006.01]**

39/10 • • • electric **[1, 2006.01]**

39/12 • • Drives characterised by use of couplings or clutches therein (using fluid slip couplings for varying gear ratio F02B 39/08) **[1, 2006.01]**

39/14 • Lubrication of pumps; Safety measures therefor **[1, 2006.01]**

39/16 • Other safety measures for, or other control of, pumps **[1, 2006.01]**

41/00 Engines characterised by special means for improving conversion of heat or pressure energy into mechanical power [1, 2006.01]

41/02 • Engines with prolonged expansion **[1, 2006.01]**

41/04 • • in main cylinders **[1, 2006.01]**

41/06 • • in compound cylinders **[1, 2006.01]**

41/08 • • • Two-stroke compound engines **[1, 2006.01]**

41/10 • • using exhaust turbines (use of exhaust turbines for charging F02B 37/00) **[1, 2006.01]**

Engines operating on non-liquid fuels; Plants including such engines, i.e. combinations of the engine with fuel-generating apparatus

43/00 Engines characterised by operating on gaseous fuels; Plants including such engines (engines characterised by the gas-air charge being ignited by compression ignition of an additional fuel F02B 7/06; engines convertible from gas to other fuel consumption F02B 69/04) **[1, 2006.01]**

43/02 • Engines characterised by means for increasing operating efficiency **[1, 2006.01]**

43/04 • • for improving efficiency of combustion **[1, 2006.01]**

43/06 • • for enlarging charge **[1, 2006.01]**

43/08 • Plants characterised by the engines using gaseous fuel generated in the plant from solid fuel, e.g. wood **[1, 2006.01]**

43/10 • Engines or plants characterised by use of other specific gases, e.g. acetylene, oxyhydrogen **[1, 2006.01]**

43/12 • • Methods of operating **[1, 2006.01]**

45/00 Engines characterised by operating on non-liquid fuels other than gas; Plants including such engines (plants involving generation of gaseous fuel from solid fuel F02B 43/08; engines convertible from gas to other fuel consumption F02B 69/04) **[1, 2006.01]**

45/02 • operating on powdered fuel, e.g. powdered coal (operating on fuel containing oxidant F02B 45/06) **[1, 2006.01]**

45/04 • • Plants, e.g. having coal-grinding apparatus **[1, 2006.01]**

45/06 • operating on fuel containing oxidant **[1, 2006.01]**

45/08 • operating on other solid fuels **[1, 2006.01]**

45/10 • operating on mixtures of liquid and non-liquid fuels, e.g. in pasty or foamed state **[1, 2006.01]**

Methods of operating engines involving specific pre-treating of, or adding specific substances to, combustion air, fuel or fuel-air mixture of the engines, and not otherwise provided for

47/00 Methods of operating engines involving adding non-fuel substances or anti-knock agents to combustion air, fuel, or fuel-air mixtures of engines [1, 2006.01]

47/02 • the substances being water or steam **[1, 2006.01]**

47/04 • the substances being other than water or steam only **[1, 2006.01]**
47/06 • • the substances including non-airborne oxygen (F02B 47/10 takes precedence) **[1, 2006.01]**
47/08 • • the substances including exhaust gas **[1, 2006.01]**
47/10 • • • Circulation of exhaust gas in closed or semi-closed circuits, e.g. with simultaneous addition of oxygen **[1, 2006.01]**

49/00 Methods of operating air-compressing compression-ignition engines involving introduction of small quantities of fuel in the form of a fine mist into the air in the engine's intake [1, 2006.01]

51/00 Other methods of operating engines involving pre-treating of, or adding substances to, combustion air, fuel, or fuel-air mixture of the engines [1, 2006.01]
51/02 • involving catalysts **[1, 2006.01]**
51/04 • involving electricity or magnetism **[1, 2006.01]**
51/06 • involving rays or sound waves **[1, 2006.01]**

Internal-combustion aspects of rotary-piston or oscillating-piston engines

53/00 Internal-combustion aspects of rotary-piston or oscillating-piston engines (internal-combustion aspects of rotary pistons or outer members for co-operation therewith F02B 55/00) **[1, 2006.01]**
53/02 • Methods of operating **[1, 2006.01]**
53/04 • Charge admission or combustion-gas discharge **[1, 2006.01]**
53/06 • • Valve control therefor **[1, 2006.01]**
53/08 • • Charging, e.g. by means of rotary-piston pump **[1, 2006.01]**
53/10 • Fuel supply; Introducing fuel to combustion space **[1, 2006.01]**
53/12 • Ignition **[1, 2006.01]**
53/14 • Adaptations of engines for driving, or engine combinations with, other devices **[1, 2006.01]**

55/00 Internal-combustion aspects of rotary pistons; Outer members for co-operation with rotary pistons [1, 2006.01]
55/02 • Pistons **[1, 2006.01]**
55/04 • • Cooling thereof **[1, 2006.01]**
55/06 • • • by air or other gas **[1, 2006.01]**
55/08 • Outer members for co-operation with rotary pistons; Casings **[1, 2006.01]**
55/10 • • Cooling thereof **[1, 2006.01]**
55/12 • • • by air or other gas **[1, 2006.01]**
55/14 • Shapes or constructions of combustion chambers **[1, 2006.01]**
55/16 • Admission or exhaust passages in pistons or outer members **[1, 2006.01]**

Internal-combustion aspects of reciprocating-piston engines with movable cylinders

57/00 Internal-combustion aspects of rotary engines in which the combusted gases displace one or more reciprocating pistons [1, 2006.01]
57/02 • Fuel or combustion-air supply (cylinder-charge admission or exhaust control F02B 57/04) **[1, 2006.01]**
57/04 • Control of cylinder-charge admission or exhaust (peculiar to two-stroke engines or to other engines with working-piston-controlled charge admission or exhaust F02B 57/06) **[1, 2006.01]**
57/06 • Two-stroke engines or other engines with working-piston-controlled cylinder-charge admission or exhaust (with combustion space in centre of star F02B 57/10) **[1, 2006.01]**
57/08 • Engines with star-shaped cylinder arrangements **[1, 2006.01]**
57/10 • • with combustion space in centre of star **[1, 2006.01]**

59/00 Internal-combustion aspects of other reciprocating-piston engines with movable, e.g. oscillating, cylinders (with yieldable walls F02B 75/38) **[1, 2006.01]**

Adaptations of engines for special use; Combinations of engines with devices other than engine parts or auxiliaries

61/00 Adaptations of engines for driving vehicles or for driving propellers; Combinations of engines with gearing (the engine torque being divided by a differential gear for driving a scavenging or charging pump and the engine output shaft F02B 39/06; adaptations or combinations of rotary-piston or oscillating-piston engines F02B 53/14) **[1, 2006.01]**
61/02 • for driving cycles **[1, 2006.01]**
61/04 • for driving propellers **[1, 2006.01]**
61/06 • Combinations of engines with mechanical gearing (F02B 61/02, F02B 61/04 take precedence) **[1, 2006.01]**

63/00 Adaptations of engines for driving pumps, hand-held tools or electric generators; Portable combinations of engines with engine-driven devices (of rotary-piston or oscillating-piston engines F02B 53/14) **[1, 2006.01]**
63/02 • for hand-held tools **[1, 2006.01]**
63/04 • for electric generators **[1, 2006.01]**
63/06 • for pumps **[1, 2006.01]**

65/00 Adaptations of engines for special uses not provided for in groups F02B 61/00 or F02B 63/00; Combinations of engines with other devices, e.g. with non-driven apparatus (of rotary-piston or oscillating-piston engines F02B 53/14; combinations of prime-movers consisting of electric motors and internal combustion engines for mutual or common propulsion B60K 6/20) **[1, 2006.01]**

Engines with pertinent characteristics other than those provided for in, or of interest apart from, preceding main groups

67/00 Engines characterised by the arrangement of auxiliary apparatus not being otherwise provided for, e.g. the apparatus having different functions; Driving auxiliary apparatus from engines, not otherwise provided for [1, 2006.01]
67/04 • of mechanically-driven auxiliary apparatus **[1, 2006.01]**
67/06 • • driven by means of chains, belts, or like endless members **[1, 2006.01]**
67/08 • of non-mechanically driven auxiliary apparatus **[1, 2006.01]**
67/10 • of charging or scavenging apparatus **[5, 2006.01]**

69/00 Internal-combustion engines convertible into other combustion-engine type, not provided for in group F02B 11/00; Internal-combustion engines of different types characterised by constructions facilitating use of same main engine-parts in different types [1, 2006.01]

69/02 • for different fuel types, other than engines indifferent to fuel consumed, e.g. convertible from light to heavy fuel **[1, 2006.01]**

69/04 • • for gaseous and non-gaseous fuels **[1, 2006.01]**

69/06 • for different cycles, e.g. convertible from two-stroke to four-stroke **[1, 2006.01]**

71/00 Free-piston engines; Engines without rotary main shaft [1, 2006.01]

71/02 • Starting **[1, 2006.01]**

71/04 • Adaptations of such engines for special use; Combinations of such engines with apparatus driven thereby **[1, 2006.01]**

71/06 • • Free-piston combustion gas generators **[1, 2006.01]**

73/00 Combinations of two or more engines, not otherwise provided for [1, 2006.01]

75/00 Other engines, e.g. single-cylinder engines [1, 2006.01]

75/02 • Engines characterised by their cycles, e.g. six-stroke **[1, 2006.01]**

75/04 • Engines with variable distances between pistons at top dead-centre positions and cylinder heads **[1, 2006.01]**

75/06 • Engines with means for equalising torque **[1, 2006.01]**

75/08 • Engines with means for preventing corrosion in gas-swept spaces **[1, 2006.01]**

75/10 • Engines with means for rendering exhaust gases innocuous (apparatus per se F01N 3/00) **[1, 2006.01]**

75/12 • Other methods of operation **[1, 2006.01]**

75/16 • Engines characterised by number of cylinders, e.g. single-cylinder engines (F02B 75/26 takes precedence) **[1, 2006.01]**

75/18 • • Multi-cylinder engines (scavenging aspects F02B 25/00) **[1, 2006.01]**

75/20 • • • with cylinders all in one line **[1, 2006.01]**

75/22 • • • with cylinders in V-, fan-, or star-arrangement **[1, 2006.01]**

75/24 • • • with cylinders arranged oppositely relative to main shaft and of "flat" type **[1, 2006.01]**

75/26 • Engines with cylinder axes coaxial with, or parallel or inclined to, main-shaft axis; Engines with cylinder axes arranged substantially tangentially to a circle centred on main-shaft axis **[1, 2006.01]**

75/28 • Engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders (arranged oppositely relative to main shaft F02B 75/24) **[1, 2006.01]**

75/30 • • with one working piston sliding inside another **[1, 2006.01]**

75/32 • Engines characterised by connections between pistons and main shafts and not specific to preceding main groups **[1, 2006.01]**

75/34 • Ultra-small engines, e.g. for driving models **[1, 2006.01]**

75/36 • Engines with parts of combustion- or working-chamber walls resiliently yielding under pressure **[1, 2006.01]**

75/38 • • Reciprocating-piston engines (F02B 75/04 takes precedence; with resiliently-urged auxiliary piston in pre-combustion chamber F02B 19/06) **[1, 2006.01]**

75/40 • Other reciprocating-piston engines **[1, 2006.01]**

77/00 Component parts, details, or accessories, not otherwise provided for [1, 2006.01]

77/02 • Surface coverings of combustion-gas-swept parts (of pistons F02F 3/10; of cylinders and cylinder heads F02F 1/00) **[1, 2006.01]**

77/04 • Cleaning of, preventing corrosion or erosion in, or preventing unwanted deposits in, combustion engines **[1, 2006.01]**

77/08 • Safety, indicating, or supervising devices (thermal insulation F02B 77/11; monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 11/00) **[1, 2006.01]**

77/10 • • Safety means relating to crankcase explosions **[1, 2006.01]**

77/11 • Thermal or acoustic insulation **[3, 2006.01]**

77/13 • • Acoustic insulation **[3, 2006.01]**

77/14 • Engine-driven auxiliary devices combined into units **[1, 2006.01]**

79/00 Running-in of internal-combustion engines (lubrication thereof F01M 7/00) **[1, 2006.01]**

F02C GAS-TURBINE PLANTS; AIR INTAKES FOR JET-PROPULSION PLANTS; CONTROLLING FUEL SUPPLY IN AIR-BREATHING JET-PROPULSION PLANTS (construction of turbines F01D; jet-propulsion plants F02K; construction of compressors or fans F04; combustion apparatus in which combustion takes place in a fluidised bed of fuel or other particles F23C 10/00; generating combustion products of high pressure or high velocity F23R; using gas turbines in compression refrigeration plants F25B 11/00; using gas-turbine plants in vehicles, see the relevant vehicle classes)

Note(s)

1. This subclass covers:
   - combustion product or hot gas turbine plants;
   - internal combustion turbines or turbine plants;
   - turbine plants in which the working fluid is an unheated, pressurised gas.
2. This subclass does not cover:
   - steam turbine plants, which are covered by subclass F01K;
   - special vapour plants, which are covered by subclass F01K.
3. In this subclass, the following expression is used with the meaning indicated:
   - "gas-turbine plants" covers all the subject matter of Note (1) above and covers also features of jet-propulsion plants common to gas-turbine plants.
4. Attention is drawn to the Notes preceding class F01.

1/00 **Gas-turbine plants characterised by the use of hot gases or unheated pressurised gases, as the working fluid** (by the use of combustion products F02C 3/00, F02C 5/00) **[1, 3, 2006.01]**

1/02 • the working fluid being an unheated pressurised gas **[1, 3, 2006.01]**

1/04 • the working fluid being heated indirectly **[1, 3, 2006.01]**

1/05 • • characterised by the type or source of heat, e.g. using nuclear or solar energy **[3, 2006.01]**

1/06 • • • using reheated exhaust gas (F02C 1/08 takes precedence) **[1, 3, 2006.01]**

1/08 • • Semi-closed cycles **[3, 2006.01]**

1/10 • • Closed cycles **[3, 2006.01]**

3/00 **Gas-turbine plants characterised by the use of combustion products as the working fluid** (generated by intermittent combustion F02C 5/00) **[1, 2006.01]**

3/02 • using exhaust-gas pressure in a pressure exchanger to compress combustion-air (pressure exchangers per se F04F 13/00) **[1, 2006.01]**

3/04 • having a turbine driving a compressor (power transmission arrangements F02C 7/36; control of working fluid flow F02C 9/16) **[1, 5, 2006.01]**

3/045 • • having compressor and turbine passages in a single rotor (F02C 3/073 takes precedence) **[3, 2006.01]**

3/05 • • • the compressor and the turbine being of the radial flow type **[3, 2006.01]**

3/055 • • the compressor being of the positive-displacement type **[3, 2006.01]**

3/06 • • the compressor comprising only axial stages (F02C 3/10 takes precedence) **[1, 3, 2006.01]**

3/067 • • • having counter-rotating rotors (F02C 3/073 takes precedence) **[3, 2006.01]**

3/073 • • • the compressor and turbine stages being concentric **[3, 2006.01]**

3/08 • • the compressor comprising at least one radial stage (F02C 3/10 takes precedence) **[1, 3, 2006.01]**

3/09 • • • of the centripetal type **[3, 2006.01]**

3/10 • • with another turbine driving an output shaft but not driving the compressor **[1, 2006.01]**

3/107 • • with two or more rotors connected by power transmission **[5, 2006.01]**

3/113 • • • with variable power transmission between rotors **[5, 2006.01]**

3/13 • • having variable working fluid interconnections between turbines or compressors or stages of different rotors **[5, 2006.01]**

3/14 • characterised by the arrangement of the combustion chamber in the plant (combustion chambers per se F23R) **[1, 3, 2006.01]**

3/16 • • the combustion chambers being formed at least partly in the turbine rotor **[1, 2006.01]**

3/20 • using a special fuel, oxidant, or dilution fluid to generate the combustion products **[1, 3, 2006.01]**

3/22 • • the fuel or oxidant being gaseous at standard temperature and pressure (F02C 3/28 takes precedence) **[1, 3, 2006.01]**

3/24 • • the fuel or oxidant being liquid at standard temperature and pressure **[1, 3, 2006.01]**

3/26 • • the fuel or oxidant being solid or pulverulent, e.g. in slurry or suspension **[1, 2006.01]**

3/28 • • • using a separate gas producer for gasifying the fuel before combustion **[3, 2006.01]**

3/30 • • Adding water, steam or other fluids to the combustible ingredients or to the working fluid before discharge from the turbine (heating of air intakes to prevent icing F02C 7/047) **[3, 2006.01]**

3/32 • Inducing air flow by fluid jet, e.g. ejector action **[3, 2006.01]**

3/34 • with recycling of part of the working fluid, i.e. semi-closed cycles with combustion products in the closed part of the cycle **[3, 2006.01]**

3/36 • Open cycles **[3, 2006.01]**

5/00 **Gas-turbine plants characterised by the working fluid being generated by intermittent combustion [1, 2006.01]**

5/02 • characterised by the arrangement of the combustion chamber in the plant (combustion chambers per se F23R) **[1, 3, 2006.01]**

5/04 • • the combustion chambers being formed at least partly in the turbine rotor **[1, 2006.01]**

5/06 • the working fluid being generated in an internal-combustion gas generator of the positive-displacement type having essentially no mechanical power output (internal-combustion engines with prolonged expansion using exhaust gas turbines F02B) **[1, 2006.01]**

5/08 • • the gas generator being of the free-piston type **[1, 2006.01]**

5/10 • the working fluid forming a resonating or oscillating gas column, i.e. the combustion chambers having no positively actuated valves, e.g. using Helmholtz effect **[1, 3, 2006.01]**

5/11 • • using valveless combustion chambers **[3, 2006.01]**

5/12 • the combustion chambers having inlet or outlet valves, e.g. Holzwarth gas-turbine plants **[1, 2006.01]**

6/00 **Plural gas-turbine plants; Combinations of gas-turbine plants with other apparatus** (aspects predominantly concerning such apparatus, see the relevant classes for the apparatus)**; Adaptations of gas-turbine plants for special use [3, 2006.01]**

6/02 • Plural gas-turbine plants having a common power output **[3, 2006.01]**

6/04 • Gas-turbine plants providing heated or pressurised working fluid for other apparatus, e.g. without mechanical power output (F02C 6/18 takes precedence) **[3, 2006.01]**

6/06 • • providing compressed gas (F02C 6/10 takes precedence) **[3, 2006.01]**

6/08 • • • the gas being bled from the gas-turbine compressor **[3, 2006.01]**

6/10 • • supplying working fluid to a user, e.g. a chemical process, which returns working fluid to a turbine of the plant **[3, 2006.01]**

6/12 • • • Turbochargers, i.e. plants for augmenting mechanical power output of internal-combustion piston engines by increase of charge pressure **[3, 2006.01]**

6/14 • Gas-turbine plants having means for storing energy, e.g. for meeting peak loads **[3, 2006.01]**

6/16 • • for storing compressed air **[3, 2006.01]**

6/18 • using the waste heat of gas-turbine plants outside the plants themselves, e.g. gas-turbine power heat plants (using waste heat as source of energy for refrigeration plants F25B 27/02) **[3, 2006.01]**

6/20 • Adaptations of gas-turbine plants for driving vehicles **[3, 2006.01]**

7/00 Features, component parts, details or accessories, not provided for in, or of interest apart from, groups F02C 1/00-F02C 6/00; Air intakes for jet-propulsion plants (controlling F02C 9/00) **[1, 3, 2006.01]**

7/04 • Air intakes for gas-turbine plants or jet-propulsion plants **[1, 3, 2006.01]**

7/042 • • having variable geometry **[3, 2006.01]**

7/045 • • having provisions for noise suppression **[3, 2006.01]**

7/047 • • Heating to prevent icing **[3, 2006.01]**

7/05 • • having provisions for obviating the penetration of damaging objects or particles **[3, 2006.01]**

7/052 • • • with dust-separation devices **[3, 2006.01]**

7/055 • • • with intake grids, screens or guards **[3, 2006.01]**

7/057 • • Control or regulation (conjointly with fuel supply control F02C 9/50, with nozzle area control F02K 1/16) **[3, 2006.01]**

7/06 • Arrangement of bearings (bearings F16C); Lubricating (of engines in general F01M) **[1, 3, 2006.01]**

7/08 • Heating air supply before combustion, e.g. by exhaust gases **[1, 2006.01]**

7/10 • • by means of regenerative heat-exchangers **[1, 2006.01]**

7/105 • • • of the rotary type (rotary heat exchangers per se F28D) **[3, 2006.01]**

7/12 • Cooling of plants (of component parts, see the relevant subclasses, e.g. F01D; cooling of engines in general F01P) **[1, 2006.01]**

7/14 • • of fluids in the plant **[1, 2006.01]**

7/141 • • • of working fluid (F02C 3/30 takes precedence) **[3, 2006.01]**

7/143 • • • • before or between the compressor stages **[3, 2006.01]**

7/16 • • characterised by cooling medium **[1, 2006.01]**

7/18 • • • the medium being gaseous, e.g. air **[1, 2006.01]**

7/20 • Mounting or supporting of plant; Accommodating heat expansion or creep **[1, 2006.01]**

7/22 • Fuel supply systems **[1, 2006.01]**

7/224 • • Heating fuel before feeding to the burner **[3, 2006.01]**

7/228 • • Dividing fuel between various burners **[3, 2006.01]**

7/232 • • Fuel valves; Draining valves or systems (valves in general F16K) **[3, 2006.01]**

7/236 • • Fuel delivery systems comprising two or more pumps **[3, 2006.01]**

7/24 • Heat or noise insulation (air intakes having provisions for noise suppression F02C 7/045; turbine exhaust heads, chambers, or the like F01D 25/30; silencing nozzles of jet-propulsion plants F02K 1/00) **[1, 3, 2006.01]**

7/25 • • Fire protection or prevention (in general A62) **[3, 2006.01]**

7/26 • Starting; Ignition **[1, 2006.01]**

7/262 • • Restarting after flame-out **[3, 2006.01]**

7/264 • • Ignition **[3, 2006.01]**

7/266 • • • Electric (sparking plugs H01T) **[3, 2006.01]**

7/268 • • Starting drives for the rotor **[3, 2006.01]**

7/27 • • • Fluid drives (turbine starters F02C 7/277) **[3, 2006.01]**

7/272 • • • • generated by cartridges **[3, 2006.01]**

7/275 • • • Mechanical drives **[3, 2006.01]**

7/277 • • • • the starter being a turbine **[3, 2006.01]**

7/28 • Arrangement of seals **[1, 2006.01]**

7/30 • Preventing corrosion in gas-swept spaces **[1, 2006.01]**

7/32 • Arrangement, mounting, or driving, of auxiliaries **[1, 2006.01]**

7/36 • Power transmission between the different shafts of the gas-turbine plant, or between the gas-turbine plant and the power user (F02C 7/32 takes precedence; couplings for transmitting rotation F16D; gearing in general F16H) **[3, 2006.01]**

9/00 Controlling gas-turbine plants; Controlling fuel supply in air-breathing jet-propulsion plants (controlling air intakes F02C 7/057; controlling turbines F01D; controlling compressors F04D 27/00) **[1, 3, 2006.01]**

9/16 • Control of working fluid flow (F02C 9/48 takes precedence; control of air-intake flow F02C 7/057) **[3, 2006.01]**

9/18 • • by bleeding, by-passing or acting on variable working fluid interconnections between turbines or compressors or their stages **[3, 5, 2006.01]**

9/20 • • by throttling; by adjusting vanes **[3, 2006.01]**

9/22 • • • by adjusting turbine vanes **[3, 2006.01]**

9/24 • • Control of the pressure level in closed cycles **[3, 2006.01]**

9/26 • Control of fuel supply (F02C 9/48 takes precedence; fuel valves F02C 7/232) **[3, 2006.01]**

9/28 • • Regulating systems responsive to plant or ambient parameters, e.g. temperature, pressure, rotor speed (F02C 9/30-F02C 9/38, F02C 9/44 take precedence) **[3, 2006.01]**

9/30 • • characterised by variable fuel pump output **[3, 2006.01]**

9/32 • • characterised by throttling of fuel (F02C 9/38 takes precedence) **[3, 2006.01]**

9/34 • • • Joint control of separate flows to main and auxiliary burners **[3, 2006.01]**

9/36 • • characterised by returning of fuel to sump (F02C 9/38 takes precedence) **[3, 2006.01]**

9/38 • • characterised by throttling and returning of fuel to sump **[3, 2006.01]**

9/40 • • specially adapted to the use of a special fuel or a plurality of fuels **[3, 2006.01]**

9/42 • • specially adapted for the control of two or more plants simultaneously **[3, 2006.01]**

9/44 • • responsive to the speed of aircraft, e.g. Mach number control, optimisation of fuel consumption **[3, 2006.01]**

9/46 • • Emergency fuel control **[3, 2006.01]**

9/48 • Control of fuel supply conjointly with another control of the plant (with nozzle section control F02K 1/17) **[3, 2006.01]**

9/50 • • with control of working fluid flow **[3, 2006.01]**

9/52 • • • by bleeding or by-passing the working fluid **[3, 2006.01]**

9/54 • • • by throttling the working fluid, by adjusting vanes **[3, 2006.01]**

9/56 • • with power transmission control **[3, 2006.01]**

9/58 • • • with control of a variable-pitch propeller **[3, 2006.01]**

F02D **CONTROLLING COMBUSTION ENGINES** (vehicle fittings, acting on a single sub-unit only, for automatically controlling vehicle speed B60K 31/00; conjoint control of vehicle sub-units of different type or different function, road vehicle drive control systems for purposes other than the control of a single sub-unit B60W; cyclically operating valves for combustion engines F01L; controlling combustion engine lubrication F01M; cooling internal-combustion engines F01P; supplying combustion engines with combustible mixtures or constituents thereof, e.g. carburettors, injection pumps, F02M; starting of combustion engines F02N; controlling of ignition F02P; controlling gas-turbine plants, jet-propulsion plants, or combustion-product engine plants, see the relevant subclasses for these plants) **[4, 2006.01]**

Note(s) [4]

1. In this subclass, the following term or expression is used with the meanings indicated:
   - "fuel injection" means the introduction of a combustible substance into a space, e.g. cylinder, by means of a pressure source, e.g. a pump, continuously or cyclically acting behind the substance;
   - "supercharging" means supplying to the working space, e.g. cylinder, combustion-air pressurised by means of a pressure source, e.g. a pump.
2. Attention is drawn to the Notes preceding class F01.
3. In this subclass, electrical aspects of control arrangements are classified in groups F02D 41/00-F02D 45/00.

Subclass index

Controlling, e.g. regulating, fuel injection

1/00 **Controlling fuel-injection pumps, e.g. of high-pressure injection type** (F02D 3/00 takes precedence) **[1, 2, 2006.01]**

1/02 • not restricted to adjustment of injection timing, e.g. varying amount of fuel delivered **[1, 2006.01]**

1/04 • • by mechanical means dependent on engine speed, e.g. using centrifugal governors (F02D 1/08 takes precedence) **[1, 2006.01]**

1/06 • • by means dependent on pressure of engine working fluid (F02D 1/08 takes precedence) **[1, 2006.01]**

1/08 • • Transmission of control impulse to pump control, e.g. with power drive or power assistance **[1, 2006.01]**

1/10 • • • mechanical **[1, 2006.01]**

1/12 • • • non-mechanical, e.g. hydraulic **[1, 2006.01]**

1/14 • • • • pneumatic **[1, 2006.01]**

1/16 • Adjustment of injection timing (F02D 1/02 takes precedence) **[1, 2006.01]**

1/18 • • with non-mechanical means for transmitting control impulse; with amplification of control impulse **[1, 2006.01]**

3/00 **Controlling low-pressure fuel injection, i.e. where the air-fuel mixture containing fuel thus injected will be substantially compressed by the compression stroke of the engine, by means other than controlling only an injection pump** (carburettors F02M) **[1, 2, 2006.01]**

Note(s) [5]

When the control apparatus or system forms part of the low-pressure fuel-injection apparatus it is classified in group F02M 69/00.

3/02 • with continuous injection or continuous flow upstream of the injection nozzle **[1, 2, 2006.01]**

3/04 • Controlling fuel injection and carburation, e.g. of alternative systems **[1, 2006.01]**

7/00 **Other non-electrical fuel injection control [1, 4, 2006.01]**

7/02 • Controlling fuel injection where fuel is injected by compressed air **[1, 2006.01]**

9/00 **Controlling engines by throttling air or fuel-and-air induction conduits or exhaust conduits [1, 2006.01]**

9/02 • concerning induction conduits (throttle valves, or arrangements thereof in conduits F02D 9/08) **[1, 2006.01]**

9/04 • concerning exhaust conduits (throttle valves, or arrangements thereof in conduits F02D 9/08) **[1, 2006.01]**

9/06 • • Exhaust brakes **[1, 2006.01]**

9/08 • Throttle valves specially adapted therefor; Arrangements of such valves in conduits (throttle valves modified for use in, or arranged in, carburettors F02M; throttle valves in general F16K) **[1, 2006.01]**

9/10 • • having pivotally-mounted flaps **[1, 2006.01]**

9/12 • • having slidably-mounted valve-members; having valve-members movable longitudinally of conduit **[1, 2006.01]**

9/14 • • • the members being slidable transversely of conduit **[1, 2006.01]**

9/16 • • • the members being rotatable **[1, 2006.01]**

9/18 • • having elastic-wall valve-members **[1, 2006.01]**

11/00 **Arrangements for, or adaptations to, non-automatic engine control initiation means, e.g. operator initiated** (specially for reversing F02D 27/00; arrangement or mounting of prime-mover control devices in vehicles B60K 26/00) **[1, 2, 5, 2006.01]**

11/02 • characterised by hand, foot, or like operator controlled initiation means **[1, 5, 2006.01]**

11/04 • characterised by mechanical control linkages (with power drive or assistance F02D 11/06) **[1, 5, 2006.01]**

11/06 • characterised by non-mechanical control linkages, e.g. fluid control linkages or by control linkages with power drive or assistance **[1, 5, 2006.01]**

11/08 • • of the pneumatic type **[1, 5, 2006.01]**

11/10 • • of the electric type **[1, 5, 2006.01]**

13/00 **Controlling the engine output power by varying inlet or exhaust valve operating characteristics, e.g. timing** (modifying valve gear F01L) **[1, 2006.01]**

13/02 • during engine operation **[1, 2006.01]**

13/04 • • using engine as brake **[1, 2006.01]**

13/06 • • Cutting-out cylinders **[1, 2006.01]**

13/08 • for rendering engine inoperative or idling **[1, 2006.01]**

15/00 **Varying compression ratio** (modifying valve-gear F01L) **[1, 2006.01]**

15/02 • by alteration or displacement of piston stroke **[1, 2006.01]**

15/04 • by alteration of volume of compression space without changing piston stroke **[1, 2006.01]**

17/00 **Controlling engines by cutting-out individual cylinders; Rendering engines inoperative or idling** (controlling or rendering inoperative by varying inlet or exhaust valve operating characteristics F02D 13/00) **[1, 2006.01]**

17/02 • Cutting-out (cutting-out engines in multiple-engine arrangements F02D 25/04) **[1, 2006.01]**

17/04 • rendering engines inoperative or idling, e.g. caused by abnormal conditions (dependent on lubricating conditions F01M 1/22; dependent on cooling F01P 5/14) **[1, 2006.01]**

Controlling peculiar to specified types or adaptations of engines

19/00 **Controlling engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures** (the non-fuel substances being gaseous F02D 21/00) **[1, 2006.01]**

19/02 • peculiar to engines working with gaseous fuels (apparatus, or control parts thereof, for mixing gas and air F02M) **[1, 2006.01]**

19/04 • peculiar to engines working with solid fuels, e.g. pulverised coal **[1, 2006.01]**

19/06 • peculiar to engines working with pluralities of fuels, e.g. alternatively with light and heavy fuel oil, other than engines indifferent to the fuel consumed **[1, 2006.01]**

19/08 • • simultaneously using pluralities of fuels (F02D 19/12 takes precedence) **[1, 2006.01]**

19/10 • • • peculiar to compression-ignition engines in which the main fuel is gaseous **[1, 2006.01]**

19/12 • peculiar to engines working with non-fuel substances or with anti-knock agents, e.g. with anti-knock fuel (apparatus, or control parts thereof, for delivering such substances or agents F02M) **[1, 2006.01]**

21/00 **Controlling engines characterised by their being supplied with non-airborne oxygen or other non-fuel gas [1, 2006.01]**

21/02 • peculiar to oxygen-fed engines **[1, 2006.01]**

21/04 • • with circulation of exhaust gases in closed or semi-closed circuits **[1, 2006.01]**

21/06 • peculiar to engines having other non-fuel gas added to combustion-air **[1, 2006.01]**

21/08 • • the other gas being the exhaust gas of engine (circulation of exhaust gas in oxygen-fed engines F02D 21/04) **[1, 2006.01]**

21/10 • • having secondary air added to fuel-air mixture (apparatus, or control parts thereof, for delivering secondary air F02M) **[1, 2006.01]**

23/00 **Controlling engines characterised by their being supercharged [1, 2006.01]**

23/02 • the engines being of fuel-injection type **[1, 2006.01]**

25/00 **Controlling two or more co-operating engines [1, 2006.01]**

25/02 • to synchronise speed **[1, 2006.01]**

25/04 • by cutting-out engines **[1, 2006.01]**

27/00 **Controlling engines characterised by their being reversible [1, 2006.01]**

27/02 • by performing a programme **[1, 2006.01]**

28/00 **Programme-control of engines** (programme-control specific to a type or purpose covered by one of the groups of this subclass, except groups F02D 29/00, F02D 39/00, or by one group of another subclass, e.g. of F01L, see that group) **[2, 2006.01]**

29/00 **Controlling engines, such controlling being peculiar to the devices driven thereby, the devices being other than parts or accessories essential to engine operation, e.g. controlling of engines by signals external thereto [1, 2, 2006.01]**

29/02 • peculiar to engines driving vehicles; peculiar to engines driving variable-pitch propellers **[1, 2, 2006.01]**

29/04 • peculiar to engines driving pumps **[1, 2006.01]**

29/06 • peculiar to engines driving electric generators **[1, 2006.01]**

Other non-electrical control of combustion engines [4]

31/00 Use of non-electrical speed-sensing governors to control combustion engines, not otherwise provided for [1, 2006.01]

33/00 Non-electrical control of delivery of fuel or combustion-air, not otherwise provided for [1, 2006.01]

33/02 • of combustion-air **[1, 2006.01]**

35/00 Non-electrical control of engines, dependent on conditions exterior or interior to engines, not otherwise provided for [1, 2006.01]

35/02 • on interior conditions **[1, 2006.01]**

37/00 Non-electrical conjoint control of two or more functions of engines, not otherwise provided for [1, 2006.01]

37/02 • one of the functions being ignition (ignition control per se F02P) **[1, 2006.01]**

39/00 Other non-electrical control [1, 4, 2006.01]

39/02 • for four-stroke engines **[1, 2006.01]**

39/04 • for engines with other cycles than four-stroke, e.g. two-stroke **[1, 2006.01]**

39/06 • for engines adding the fuel substantially at end of compression stroke **[1, 2006.01]**

39/08 • for engines adding the fuel substantially before compression stroke **[1, 2006.01]**

39/10 • for free-piston engines; for engines without rotary main shaft **[1, 2006.01]**

Electrical control of combustion engines [4]

Note(s) [4, 6]

1. Groups F02D 41/00-F02D 45/00cover electrical aspects of electrically controlled devices.
2. Groups F02D 41/00-F02D 45/00do not cover:
   - non-electrical aspects of electrically controlled devices, which are covered by groups F02D 1/00-F02D 39/00 or by subclass F02M;
   - both electrical and non-electrical aspects of electrically controlled devices, which are covered by groups F02D 1/00-F02D 39/00 or by subclass F02M.

41/00 Electrical control of supply of combustible mixture or its constituents (F02D 43/00 takes precedence) **[4, 2006.01]**

41/02 • Circuit arrangements for generating control signals **[4, 2006.01]**

41/04 • • Introducing corrections for particular operating conditions (F02D 41/14 takes precedence) **[4, 2006.01]**

41/06 • • • for engine starting or warming up **[4, 2006.01]**

41/08 • • • for idling (F02D 41/06, F02D 41/16 take precedence) **[4, 2006.01]**

41/10 • • • for acceleration **[4, 2006.01]**

41/12 • • • for deceleration **[4, 2006.01]**

41/14 • • Introducing closed-loop corrections **[4, 2006.01]**

41/16 • • • for idling **[4, 2006.01]**

41/18 • • by measuring intake air flow (measuring flow, in general G01F) **[4, 2006.01]**

41/20 • Output circuits, e.g. for controlling currents in command coils (current control in inductive loads in general H03K 17/64) **[4, 2006.01]**

41/22 • Safety or indicating devices for abnormal conditions **[4, 2006.01]**

41/24 • characterised by the use of digital means **[4, 2006.01]**

41/26 • • using computer, e.g. microprocessor **[4, 2006.01]**

41/28 • • • Interface circuits **[4, 2006.01]**

41/30 • Controlling fuel injection **[4, 2006.01]**

41/32 • • of the low pressure type **[4, 2006.01]**

41/34 • • • with means for controlling injection timing or duration (ignition timing F02P 5/00) **[4, 2006.01]**

41/36 • • • with means for controlling distribution (arrangement of ignition distributors F02P 7/00) **[4, 2006.01]**

41/38 • • of the high pressure type **[4, 2006.01]**

41/40 • • • with means for controlling injection timing or duration **[4, 2006.01]**

43/00 Conjoint electrical control of two or more functions, e.g. ignition, fuel-air mixture, recirculation, supercharging, exhaust-gas treatment (electrical control of exhaust gas treating apparatus per se F01N 9/00) **[4, 2006.01]**

43/02 • using only analogue means **[4, 2006.01]**

43/04 • using only digital means **[4, 2006.01]**

45/00 Electrical control not provided for in groups F02D 41/00-F02D 43/00 (electrical control of exhaust gas treating apparatus F01N 9/00; electrical control of one of the functions: ignition, lubricating, cooling, starting, intake-heating, see the relevant subclasses for such functions) **[4, 2006.01]**

F02F CYLINDERS, PISTONS, OR CASINGS FOR COMBUSTION ENGINES; ARRANGEMENTS OF SEALINGS IN COMBUSTION ENGINES [2]

Note(s)

1. Attention is drawn to the Notes preceding class F01.
2. Class F16 takes precedence over this subclass, except for subject matter specific to combustion engines.

1/00 Cylinders; Cylinder heads [1, 2006.01]

1/02 • having cooling means (cylinder heads F02F 1/26) **[1, 2006.01]**

1/04 • • for air cooling **[1, 2006.01]**

1/06 • • • Shape or arrangement of cooling fins; Finned cylinders **[1, 2006.01]**

1/08 • • • • running-liner and cooling-part of cylinder being different parts or of different material **[1, 2006.01]**

1/10 • • for liquid cooling **[1, 2006.01]**
1/12 • • • Preventing corrosion of liquid-swept surfaces **[1, 2006.01]**
1/14 • • • Cylinders with means for directing, guiding, or distributing liquid stream **[1, 2006.01]**
1/16 • • • Cylinder liners of wet type **[1, 2006.01]**
1/18 • Other cylinders **[1, 2006.01]**
1/20 • • characterised by constructional features providing for lubrication **[1, 2006.01]**
1/22 • • characterised by having ports in cylinder wall for scavenging or charging **[1, 2006.01]**
1/24 • Cylinder heads **[1, 2006.01]**
1/26 • • having cooling means **[1, 2006.01]**
1/28 • • • for air cooling **[1, 2006.01]**
1/30 • • • • Finned cylinder heads **[1, 2006.01]**
1/32 • • • • • the cylinder heads being of overhead-valve type **[1, 2006.01]**
1/34 • • • • • with means for directing or distributing cooling medium **[1, 2006.01]**
1/36 • • • for liquid cooling **[1, 2006.01]**
1/38 • • • • the cylinder heads being of overhead-valve type **[1, 2006.01]**
1/40 • • • • cylinder heads with means for directing, guiding, or distributing liquid stream **[1, 2006.01]**
1/42 • • Shape or arrangement of intake or exhaust channels in cylinder heads **[1, 2006.01]**

3/00 Pistons [1, 2006.01]

3/02 • having means for accommodating or controlling heat expansion **[1, 2006.01]**
3/04 • • having expansion-controlling inserts **[1, 2006.01]**
3/06 • • • the inserts having bimetallic effect **[1, 2006.01]**
3/08 • • • the inserts being ring-shaped **[1, 2006.01]**
3/10 • having surface coverings (F02F 3/02 takes precedence) **[1, 2006.01]**
3/12 • • on piston heads **[1, 2006.01]**
3/14 • • • within combustion chambers **[1, 2006.01]**
3/16 • having cooling means **[1, 2006.01]**
3/18 • • the means being a liquid or solid coolant, e.g. sodium, in a closed chamber in piston **[1, 2006.01]**
3/20 • • the means being a fluid flowing through or along piston **[1, 2006.01]**
3/22 • • • the fluid being liquid **[1, 2006.01]**
3/24 • having means for guiding gases in cylinders, e.g. for guiding scavenging charge in two-stroke engines **[1, 2006.01]**
3/26 • having combustion chamber in piston head (the surface thereof being covered F02F 3/14) **[1, 2006.01]**
3/28 • Other pistons with specially-shaped head **[1, 2006.01]**

5/00 Piston rings, e.g. associated with piston crown [1, 2006.01]

7/00 Casings, e.g. crankcases [1, 2006.01]

11/00 Arrangements of sealings in combustion engines (piston rings F02F 5/00) **[1, 2006.01]**

F02G HOT-GAS OR COMBUSTION-PRODUCT POSITIVE-DISPLACEMENT ENGINE PLANTS (steam engine plants, special vapour plants, plants operating on either hot gas or combustion-product gases together with other fluid F01K; gas-turbine plants F02C; jet-propulsion plants F02K)**; USE OF WASTE HEAT OF COMBUSTION ENGINES, NOT OTHERWISE PROVIDED FOR**

Note(s)

Attention is drawn to the Notes preceding class F01.

1/00 Hot gas positive-displacement engine plants [1, 3, 2006.01]
1/02 • of open-cycle type **[1, 2006.01]**
1/04 • of closed-cycle type **[1, 2006.01]**
1/043 • • the engine being operated by expansion and contraction of a mass of working gas which is heated and cooled in one of a plurality of constantly communicating expansible chambers, e.g. Stirling cycle type engines **[3, 2006.01]**
1/044 • • • having at least two working members, e.g. pistons, delivering power output **[3, 2006.01]**
1/045 • • • Controlling **[3, 2006.01]**
1/047 • • • • by varying the heating or cooling **[3, 2006.01]**
1/05 • • • • by varying the rate of flow or quantity of the working gas **[3, 2006.01]**
1/053 • • • Component parts or details **[3, 2006.01]**
1/055 • • • • Heaters or coolers **[3, 2006.01]**
1/057 • • • • Regenerators **[3, 2006.01]**
1/06 • Controlling **[1, 2006.01]**

3/00 Combustion-product positive-displacement engine plants [1, 3, 2006.01]
3/02 • with reciprocating-piston engines **[1, 2006.01]**

5/00 Profiting from waste heat of combustion engines, not otherwise provided for [1, 2006.01]
5/02 • Profiting from waste heat of exhaust gases **[1, 2006.01]**
5/04 • • in combination with other waste heat from combustion engines **[1, 2006.01]**

F02K **JET-PROPULSION PLANTS** (arrangement or mounting of jet-propulsion plants in land vehicles or vehicles in general B60K; arrangement or mounting of jet-propulsion plants in waterborne vessels B63H; controlling aircraft attitude, flight direction, or altitude by jet reaction B64C; arrangement or mounting of jet-propulsion plants in aircraft B64D; plants characterised by the power of the working fluid being divided between jet propulsion and another form of propulsion, e.g. propeller, F02B, F02C; features of jet-propulsion plants common to gas-turbine plants, air intakes or fuel supply control of air-breathing jet-propulsion plants F02C)

Note(s)

1. In this subclass, the following expression is used with the meaning indicated:
   - "jet-propulsion plants" means plants using combustion to produce a fluid stream from which a propulsive thrust on the plants is obtained on the reaction principle.
2. Attention is drawn to the Notes preceding class F01.

Subclass index

1/00 **Plants characterised by the form or arrangement of the jet pipe or nozzle; Jet pipes or nozzles peculiar thereto** (rocket nozzles F02K 9/97) **[1, 2006.01]**

1/04 • Mounting of an exhaust cone in the jet pipe **[1, 2006.01]**

1/06 • Varying effective area of jet pipe or nozzle (F02K 1/30 takes precedence) **[1, 3, 2006.01]**

1/08 • • by axially moving or transversely deforming an internal member, e.g. the exhaust cone **[1, 2006.01]**

1/09 • • by axially moving an external member, e.g. a shroud (F02K 1/12 takes precedence) **[3, 2006.01]**

1/10 • • by distorting the jet pipe or nozzle **[1, 2006.01]**

1/11 • • by means of pivoted eyelids **[3, 2006.01]**

1/12 • • by means of pivoted flaps **[1, 2006.01]**

1/15 • • Control or regulation **[3, 2006.01]**

1/16 • • • conjointly with another control **[1, 3, 2006.01]**

1/17 • • • • with control of fuel supply **[3, 2006.01]**

1/18 • • • automatic **[1, 3, 2006.01]**

1/28 • using fluid jets to influence the jet flow **[3, 2006.01]**

1/30 • • for varying effective area of jet pipe or nozzle **[3, 2006.01]**

1/32 • • for reversing thrust **[3, 2006.01]**

1/34 • • for attenuating noise **[3, 2006.01]**

1/36 • having an ejector **[3, 2006.01]**

1/38 • Introducing air inside the jet (F02K 1/28 takes precedence) **[3, 2006.01]**

1/40 • Nozzles having means for dividing the jet into a plurality of partial jets or having an elongated cross-section outlet **[3, 2006.01]**

1/42 • • the means being movable into an inoperative position **[3, 2006.01]**

1/44 • Nozzles having means, e.g. a shield, reducing sound radiation in a specified direction (F02K 1/40 takes precedence) **[3, 2006.01]**

1/46 • Nozzles having means for adding air to the jet or for augmenting the mixing region between the jet and the ambient air, e.g. for silencing (F02K 1/28, F02K 1/36, F02K 1/38 take precedence) **[3, 2006.01]**

1/48 • • Corrugated nozzles **[3, 2006.01]**

1/50 • • Deflecting outwardly a portion of the jet by retractable scoop-like baffles **[3, 2006.01]**

1/52 • Nozzles specially constructed for positioning adjacent to another nozzle or to a fixed member, e.g. fairing **[3, 2006.01]**

1/54 • Nozzles having means for reversing jet thrust (F02K 1/32 takes precedence) **[3, 2006.01]**

1/56 • • Reversing jet main flow **[3, 2006.01]**

1/58 • • • Reversers mounted on the inner cone or the nozzle housing **[3, 2006.01]**

1/60 • • • by blocking the rearward discharge by means of pivoted eyelids or clamshells, e.g. target-type reversers **[3, 2006.01]**

1/62 • • • by blocking the rearward discharge by means of flaps **[3, 2006.01]**

1/64 • • Reversing fan flow **[3, 2006.01]**

1/66 • • • using reversing fan blades **[3, 2006.01]**

1/68 • • • Reversers mounted on the engine housing downstream of the fan exhaust section **[3, 2006.01]**

1/70 • • • using thrust reverser flaps or doors mounted on the fan housing **[3, 2006.01]**

1/72 • • • • the aft end of the fan housing being movable to uncover openings in the fan housing for the reversed flow **[3, 2006.01]**

1/74 • • Reversing at least one flow in relation to at least one other flow in a plural-flow engine **[3, 2006.01]**

1/76 • • Control or regulation of thrust reversers **[3, 2006.01]**

1/78 • Other construction of jet pipes **[3, 2006.01]**

1/80 • • Couplings or connections **[3, 2006.01]**

1/82 • • Jet pipe walls, e.g. liners **[3, 2006.01]**

3/00 **Plants including a gas turbine driving a compressor or a ducted fan [1, 2006.01]**

3/02 • in which part of the working fluid by-passes the turbine and combustion chamber **[1, 2006.01]**

3/04 • • the plant including ducted fans, i.e. fans with high volume, low-pressure outputs, for augmenting jet thrust, e.g. of double-flow type **[1, 2006.01]**

3/06 • • • with front fan **[1, 2006.01]**

3/062 • • • with aft fan **[3, 2006.01]**

3/065 • • • with front and aft fans **[3, 2006.01]**

3/068 • • • being characterised by a short axial length relative to diameter **[3, 2006.01]**
3/072 • • • with counter-rotating rotors **[3, 2006.01]**
3/075 • • • controlling flow ratio between flows **[3, 2006.01]**
3/077 • • • the plant being of the multiple flow type, i.e. having three or more flows **[3, 2006.01]**
3/08 • with supplementary heating of the working fluid (after-burners, combustion chambers F23R); Control thereof (control of fuel supply therefor F02C 9/26) **[1, 3, 2006.01]**
3/10 • • by after-burners (F02K 3/105 takes precedence) **[1, 3, 2006.01]**
3/105 • • Heating the by-pass flow **[3, 2006.01]**
3/11 • • • by means of burners or combustion chambers **[3, 2006.01]**
3/115 • • • by means of indirect heat exchange **[3, 2006.01]**
3/12 • characterised by having more than one gas turbine **[1, 2006.01]**

5/00 Plants including an engine, other than a gas turbine, driving a compressor or a ducted fan [1, 2006.01]
5/02 • the engine being of the reciprocating-piston type **[1, 2006.01]**

7/00 Plants in which the working-fluid is used in a jet only, i.e. the plants not having a turbine or other engine driving a compressor or a ducted fan; Control thereof (rocket-engine plants F02K 9/00) **[1, 2006.01]**
7/02 • the jet being intermittent, i.e. pulse jet **[1, 2006.01]**
7/04 • • with resonant combustion chambers **[1, 2006.01]**
7/06 • • with combustion chambers having valves **[1, 2006.01]**
7/067 • • • having aerodynamic valves **[3, 2006.01]**
7/075 • • with multiple pulse-jet engines **[3, 2006.01]**
7/08 • the jet being continuous **[1, 2006.01]**
7/10 • characterised by having ram-action compression, i.e. aero-thermo-dynamic-ducts or ram-jet engines **[1, 2006.01]**
7/12 • • Injection-induction jet engines **[3, 2006.01]**
7/14 • • with external combustion, e.g. scram-jet engines **[3, 2006.01]**
7/16 • • Composite ram-jet/turbo-jet engines **[3, 2006.01]**
7/18 • • Composite ram-jet/rocket engines **[3, 2006.01]**
7/20 • • Composite ram-jet/pulse-jet engines **[3, 2006.01]**

9/00 Rocket-engine plants, i.e. plants carrying both fuel and oxidant therefor; Control thereof (chemical composition of propellants C06B, C06D) **[1, 3, 2006.01]**
9/08 • using solid propellants (F02K 9/72 takes precedence; using semi-solid or pulverulent propellants F02K 9/70) **[3, 2006.01]**
9/10 • • Shape or structure of solid propellant charges **[3, 2006.01]**
9/12 • • • made of two or more portions burning at different rates **[3, 2006.01]**
9/14 • • • made from sheet-like materials, e.g. of carpet-roll type, of layered structure **[3, 2006.01]**
9/16 • • • of honeycomb structure **[3, 2006.01]**
9/18 • • • of the internal-burning type having a star or like shaped internal cavity **[3, 2006.01]**
9/20 • • • of the external-burning type **[3, 2006.01]**
9/22 • • • of the front-burning type **[3, 2006.01]**
9/24 • • Charging rocket engines with solid propellants; Methods or apparatus specially adapted for working solid propellant charges **[3, 2006.01]**
9/26 • • Burning control **[3, 2006.01]**
9/28 • • having two or more propellant charges with the propulsion gases exhausting through a common nozzle **[3, 2006.01]**
9/30 • • with the propulsion gases exhausting through a plurality of nozzles **[3, 2006.01]**
9/32 • • Constructional parts; Details (shape or structure of solid propellant charges F02K 9/10; starting or ignition means or arrangements F02K 9/95; rocket nozzles F02K 9/97) **[3, 2006.01]**
9/34 • • • Casings; Combustion chambers; Liners thereof **[3, 2006.01]**
9/36 • • • Propellant charge supports **[3, 2006.01]**
9/38 • • • Safety devices, e.g. to prevent accidental ignition **[3, 2006.01]**
9/40 • • • Cooling arrangements **[3, 2006.01]**
9/42 • using liquid or gaseous propellants (F02K 9/72 takes precedence) **[3, 2006.01]**
9/44 • • Feeding propellants **[3, 2006.01]**
9/46 • • • using pumps (pumps per se F04) **[3, 2006.01]**
9/48 • • • • driven by a gas turbine fed by propellant combustion gases **[3, 2006.01]**
9/50 • • • using pressurised fluid to pressurize the propellants **[3, 2006.01]**
9/52 • • • Injectors (in general B05B) **[3, 2006.01]**
9/54 • • • Leakage detectors; Purging systems; Filtration systems (filters per se B01D) **[3, 2006.01]**
9/56 • • • Control **[3, 2006.01]**
9/58 • • • • Propellant feed valves (valves in general F16K) **[3, 2006.01]**
9/60 • • Constructional parts; Details (starting or ignition means or arrangements F02K 9/95; rocket nozzles F02K 9/97) **[3, 2006.01]**
9/62 • • • Combustion or thrust chambers **[3, 2006.01]**
9/64 • • • • having cooling arrangements **[3, 2006.01]**
9/66 • • • • of the rotary type **[3, 2006.01]**
9/68 • • • Decomposition chambers **[3, 2006.01]**
9/70 • using semi-solid or pulverulent propellants **[3, 2006.01]**
9/72 • using liquid and solid propellants, i.e. hybrid rocket-engine plants **[3, 2006.01]**
9/74 • combined with another jet-propulsion plant **[3, 2006.01]**
9/76 • • with another rocket-engine plant; Multistage rocket-engine plants **[3, 2006.01]**
9/78 • • with an air-breathing jet-propulsion plant (with a ram-jet engine F02K 7/18) **[3, 2006.01]**
9/80 • characterised by thrust or thrust vector control (F02K 9/26, F02K 9/56, F02K 9/94 take precedence) **[3, 2006.01]**
9/82 • • by injection of a secondary fluid into the rocket exhaust gases **[3, 2006.01]**
9/84 • • using movable nozzles **[3, 2006.01]**
9/86 • • using nozzle throats of adjustable cross-section **[3, 2006.01]**
9/88 • • using auxiliary rocket nozzles **[3, 2006.01]**
9/90 • • using deflectors (F02K 9/82 takes precedence) **[3, 2006.01]**
9/92 • • incorporating means for reversing or terminating thrust **[3, 2006.01]**
9/94 • Re-ignitable or restartable rocket-engine plants; Intermittently operated rocket-engine plants **[3, 2006.01]**
9/95 • characterised by starting or ignition means or arrangements (safety devices F02K 9/38) **[3, 2006.01]**

9/96 • characterised by specially adapted arrangements for testing or measuring **[3, 2006.01]**

9/97 • Rocket nozzles (thrust or thrust vector control F02K 9/80) **[3, 2006.01]**

99/00 Subject matter not provided for in other groups of this subclass [2009.01]

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

Note(s)

1. In this subclass, the following terms or expressions 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 includes 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.
2. Attention is drawn to the Notes preceding class F01.

Subclass index

Carburettors for liquid fuels

1/00 Carburettors with means for facilitating engine's starting or its idling below operational temperatures [1, 2006.01]

1/02 • the means to facilitate starting or idling being chokes for enriching fuel-air mixture (automatic chokes F02M 1/08) **[1, 2006.01]**

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, 2006.01]**

1/06 • • having axially-movable valves, e.g. piston-shaped **[1, 2006.01]**

1/08 • the means to facilitate starting or idling becoming operative or inoperative automatically (in connection with auxiliary carburetting apparatus F02M 1/04) **[1, 2006.01]**

1/10 • • dependent on engine temperature, e.g. having thermostat **[1, 2006.01]**

1/12 • • • with means for electrically heating thermostat **[1, 2006.01]**

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, 2006.01]**

1/16 • Other means for enriching fuel-air mixture during starting; Priming cups; using different fuels for starting and normal operation **[1, 2006.01]**

1/18 • • Enriching fuel-air mixture by depressing float to flood carburettor **[1, 2006.01]**

3/00 Idling devices for carburettors (with means for facilitating idling below operational temperatures F02M 1/00) **[1, 2006.01]**

3/02 • Preventing flow of idling fuel **[1, 2006.01]**

3/04 • • under conditions where engine is driven instead of driving, e.g. driven by vehicle running down hill **[1, 2006.01]**

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 **[4, 2006.01]**

3/05 • • • Pneumatic or mechanical control, e.g. with speed regulation **[4, 2006.01]**

3/055 • • • Fuel flow cut-off by introducing air, e.g. brake air, into the idling fuel system **[4, 2006.01]**

3/06 • Increasing idling speed **[1, 2006.01]**

3/07 • • by positioning the throttle flap stop, or by changing the fuel flow cross-sectional area, by electrical, electromechanical or electropneumatical means, according to engine speed **[4, 2006.01]**

3/08 • Other details of idling devices (fighting ice-formation by heating idling ports F02M 15/02) **[1, 2006.01]**

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) **[5, 2006.01]**

3/10 • • Fuel metering pins; Nozzles **[4, 2006.01]**

3/12 • • Passage way systems **[4, 2006.01]**

3/14 • • Location of idling system outlet relative to throttle valve **[4, 2006.01]**

5/00 Float-controlled apparatus for maintaining a constant fuel level in carburettors [1, 2006.01]

5/02 • with provisions to meet variations in carburettor position, e.g. upside-down position in aircraft **[1, 2006.01]**

5/04 • • with pivotally or rotatably mounted float chambers **[1, 4, 2006.01]**

5/06 • having adjustable float mechanism, e.g. to meet dissimilarities in specific gravity of different fuels **[1, 2006.01]**

5/08 • having means for venting float chambers **[1, 2006.01]**

5/10 • having means for preventing vapour lock, e.g. insulated float chambers or forced fuel circulation through float chamber with engine stopped **[1, 2006.01]**

5/12 • Other details, e.g. floats, valves, setting devices or tools **[1, 2006.01]**

5/16 • • Floats **[4, 2006.01]**

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) **[1, 2006.01]**

7/02 • Carburettors having aerated fuel spray nozzles **[1, 2006.01]**

7/04 • Means for enriching charge at high combustion-air flow **[1, 2006.01]**

7/06 • Means for enriching charge on sudden throttle opening, i.e. at acceleration, e.g. storage means in passage way system **[1, 2006.01]**

7/08 • • using pumps **[1, 2006.01]**

7/087 • • • changing output according to temperature in engine **[4, 2006.01]**

7/093 • • • changing output according to intake vacuum **[4, 2006.01]**

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) **[1, 4, 2006.01]**

7/11 • • Altering float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor F02M 1/18) **[5, 2006.01]**

7/12 • Other installations, with moving parts, for influencing fuel/air ratio, e.g. having valves (F02M 7/24 takes precedence) **[1, 4, 2006.01]**

7/127 • • Altering the float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor F02M 1/18) **[5, 2006.01]**

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) **[5, 2006.01]**

7/14 • • with means for controlling cross-sectional area of fuel spray nozzle (dependent on air-throttle valve position F02M 7/22) **[1, 2006.01]**

7/16 • • • operated automatically, e.g. dependent on exhaust-gas analysis **[1, 2006.01]**

7/17 • • • • by a pneumatically adjustable piston-like element, e.g. constant depression carburettors **[5, 2006.01]**

7/18 • • with means for controlling cross-sectional area of fuel-metering orifice (dependent on air-throttle position F02M 7/22) **[1, 2006.01]**

7/20 • • • operated automatically, e.g. dependent on altitude **[1, 2006.01]**

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) **[1, 2006.01]**

7/23 • Fuel aerating devices **[4, 2006.01]**

7/24 • • Controlling flow of aerating air **[1, 4, 2006.01]**

7/26 • • • dependent on position of optionally operable throttle means **[4, 2006.01]**

7/28 • • • dependent on temperature or pressure **[4, 2006.01]**

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 [1, 2006.01]**

9/02 • having throttling valves, e.g. of piston shape, slidably arranged transversely to the passage **[1, 2006.01]**

9/04 • • with throttling valves sliding in a plane inclined to the passage **[1, 2006.01]**

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) **[1, 5, 2006.01]**

9/08 • having throttling valves rotatably mounted in the passage **[1, 2006.01]**

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 **[1, 2006.01]**

9/12 • having other specific means for controlling the passage, or for varying cross-sectional area, of fuel-air mixing chambers **[1, 2006.01]**

9/127 • • Axially movable throttle valves concentric with the axis of the mixture passage **[5, 2006.01]**

9/133 • • • the throttle valves having mushroom-shaped bodies **[5, 2006.01]**

9/14 • having venturi and nozzle relatively displaceable essentially along the venturi axis **[1, 2006.01]**

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 [1, 2006.01]

11/02 • with throttling valve, e.g. of flap or butterfly type, in a later stage opening automatically **[1, 2006.01]**

11/04 • • the later-stage valves having damping means **[1, 2006.01]**

11/06 • Other carburettors with throttling valve of flap or butterfly type **[1, 2006.01]**

11/08 • Register carburettors with throttling valve movable transversally to air passage **[1, 2006.01]**

11/10 • Register carburettors with rotatable throttling valves **[1, 2006.01]**

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) **[1, 2006.01]**

13/02 • Separate carburettors **[1, 2006.01]**

13/04 • • structurally united **[1, 2006.01]**

13/06 • the carburettors using different fuels **[1, 2006.01]**

13/08 • Carburettors adapted to use liquid and gaseous fuels, e.g. alternatively **[1, 2006.01]**

15/00 Carburettors with heating, cooling or thermal insulating means for combustion-air, fuel or fuel-air mixture [1, 2006.01]

15/02 • with heating means, e.g. to combat ice-formation **[1, 2006.01]**

15/04 • • the means being electrical **[1, 2006.01]**

15/06 • Heat shieldings, e.g. from engine radiations **[1, 2006.01]**

17/00 Carburettors having pertinent characteristics not provided for in, or of interest apart from, the apparatus of 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) **[1, 2006.01]**

17/02 • Floatless carburettors **[1, 2006.01]**

17/04 • • having fuel inlet valve controlled by diaphragm **[1, 2006.01]**

17/06 • • having overflow chamber determining constant fuel level **[1, 2006.01]**

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 **[1, 2006.01]**

17/09 • • the valve being of an eccentrically mounted butterfly type **[5, 2006.01]**

17/10 • Carburettors having one or more fuel passages opening in valve-member of air throttle **[1, 2006.01]**

17/12 • • the valve-member being of butterfly type **[1, 2006.01]**

17/14 • Carburettors with fuel-supply parts opened and closed in synchronism with engine stroke **[1, 2006.01]**

17/16 • Carburettors having continuously-rotating bodies, e.g. surface carburettors **[1, 2006.01]**

17/18 • Other surface carburettors **[1, 2006.01]**

17/20 • • with fuel bath **[1, 2006.01]**

17/22 • • • with air bubbling through bath **[1, 2006.01]**

17/24 • • with wicks **[1, 2006.01]**

17/26 • • with other wetted bodies **[1, 2006.01]**

17/28 • • • fuel being drawn through a porous body **[1, 2006.01]**

17/30 • Carburettors with fire-protecting devices, e.g. combined with fire-extinguishing apparatus **[1, 2006.01]**

17/32 • • automatically closing fuel conduits on outbreak of fire **[1, 2006.01]**

17/34 • Other carburettors combined or associated with other apparatus, e.g. air filters **[1, 2006.01]**

17/36 • Carburettors having fitments facilitating their cleaning **[1, 2006.01]**

17/38 • Controlling of carburettors, not otherwise provided for (external control gear F02M 19/12) **[1, 2006.01]**

17/40 • Selection of particular materials for carburettors, e.g. sheet metal, plastic, or translucent materials **[1, 2006.01]**

17/42 • Float-controlled carburettors not otherwise provided for **[1, 2006.01]**

17/44 • Carburettors characterised by draught direction and not otherwise provided for **[1, 2006.01]**

17/46 • • with down-draught **[1, 2006.01]**

17/48 • • with up-draught **[1, 2006.01]**

17/50 • Carburettors having means for combating ice-formation (thermally F02M 15/02) **[1, 2006.01]**

17/52 • Use of cold, produced by carburettors, for other purposes **[1, 2006.01]**

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 [1, 2006.01]

19/01 • Apparatus for testing, tuning, or synchronising carburettors, e.g. carburettor flow stands **[3, 2006.01]**

19/02 • Metering-orifices, e.g. variable in diameter (variable during operation F02M 7/18) **[1, 2006.01]**

19/025 • • Metering orifices not variable in diameter **[4, 2006.01]**

19/03 • Fuel atomising nozzles; Arrangement of emulsifying air conduits **[4, 2006.01]**

19/035 • • Mushroom-shaped atomising nozzles **[4, 2006.01]**

19/04 • Fuel-metering pins or needles **[1, 2006.01]**

19/06 • Other details of fuel conduits **[1, 2006.01]**

19/08 • Venturis **[1, 2006.01]**

19/10 • • in multiple arrangement **[1, 2006.01]**

19/12 • External control gear, e.g. having dash-pots (dampening means in later stages of multi-stage carburettors F02M 11/04) **[1, 2006.01]**

21/00 Apparatus for supplying engines with non-liquid fuels, e.g. gaseous fuels stored in liquid form [1, 2006.01]

21/02 • for gaseous fuels **[1, 2006.01]**

21/04 • • Gas-air mixing apparatus **[1, 2006.01]**

21/06 • • Apparatus for de-liquefying, e.g. by heating **[1, 2006.01]**

21/08 • for non-gaseous fuels **[1, 2006.01]**

21/10 • • for fuels with low melting point, e.g. apparatus having heating means **[1, 2006.01]**

21/12 • for fuels in pulverised state **[1, 2006.01]**

Engine-pertinent apparatus for feeding, or treating before their admission to engine, combustion-air, fuel, or fuel-air mixture

23/00 Apparatus for adding secondary air to fuel-air mixture [1, 2006.01]

23/02 • with personal control **[1, 2006.01]**

23/03 • • the secondary air-valve controlled by main combustion-air throttle **[5, 2006.01]**

23/04 • with automatic control **[1, 2006.01]**

23/06 • • dependent on engine speed **[1, 2006.01]**

23/08 • • dependent on pressure in main combustion-air induction system **[1, 2006.01]**

23/09 • • • using valves directly opened by low pressure **[6, 2006.01]**

23/10 • • dependent on temperature, e.g. engine temperature **[1, 2006.01]**

23/12 • characterised by being combined with device for, or by secondary air effecting, re-atomising of condensed fuel **[1, 2006.01]**

23/14 • characterised by adding hot air **[1, 2006.01]**

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) **[1, 2006.01]**

25/022 • Adding fuel and water emulsion, water or steam **[6, 2006.01]**

25/025 • • Adding water **[6, 2006.01]**

25/028 • • • into the charge intakes **[6, 2006.01]**

25/03 • • • into the cylinders **[6, 2006.01]**

25/032 • • Producing and adding steam **[6, 2006.01]**

25/035 • • • into the charge intakes **[6, 2006.01]**

25/038 • • • into the cylinders **[6, 2006.01]**

25/06 • adding lubricant vapours **[1, 2006.01, 2016.01]**

25/08 • adding fuel vapours drawn from engine fuel reservoir **[1, 2006.01]**

25/10 • adding acetylene, non-waterborne hydrogen, non-airborne oxygen, or ozone **[1, 2006.01]**

25/12 • • the apparatus having means for generating such gases (using rays and simultaneously generating ozone F02M 27/06) **[1, 2006.01]**

25/14 • adding anti-knock agents, not provided for in groups F02M 25/022-F02M 25/10 **[1, 2006.01]**

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 [2016.01]

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 **[2016.01]**

26/02 • EGR systems specially adapted for supercharged engines **[2016.01]**

26/03 • • with a single mechanically or electrically driven intake charge compressor **[2016.01]**

26/04 • • with a single turbocharger **[2016.01]**

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 **[2016.01]**

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 **[2016.01]**

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 **[2016.01]**

26/08 • • for engines having two or more intake charge compressors or exhaust gas turbines, e.g. a turbocharger combined with an additional compressor **[2016.01]**

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 **[2016.01]**

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 **[2016.01]**

26/11 • Manufacture or assembly of EGR systems; Materials or coatings specially adapted for EGR systems **[2016.01]**

26/12 • characterised by means for attaching parts of an EGR system to each other or to engine parts **[2016.01]**

26/13 • Arrangement or layout of EGR passages, e.g. in relation to specific engine parts or for incorporation of accessories **[2016.01]**

26/14 • • in relation to the exhaust system **[2016.01]**

26/15 • • • in relation to engine exhaust purifying apparatus **[2016.01]**

26/16 • • • with EGR valves located at or near the connection to the exhaust system **[2016.01]**

26/17 • • in relation to the intake system **[2016.01]**

26/18 • • • Thermal insulation or heat protection **[2016.01]**

26/19 • • • Means for improving the mixing of air and recirculated exhaust gases, e.g. venturis or multiple openings to the intake system **[2016.01]**

26/20 • • • Feeding recirculated exhaust gases directly into the combustion chambers or into the intake runners **[2016.01]**

26/21 • • • with EGR valves located at or near the connection to the intake system **[2016.01]**

26/22 • • with coolers in the recirculation passage **[2016.01]**

26/23 • • • Layout, e.g. schematics **[2016.01]**

26/24 • • • • with two or more coolers **[2016.01]**

26/25 • • • • with coolers having bypasses **[2016.01]**

26/26 • • • • • characterised by details of the bypass valve **[2016.01]**

26/27 • • • • with air-cooled heat exchangers **[2016.01]**

26/28 • • • • with liquid-cooled heat exchangers **[2016.01]**

26/29 • • • Constructional details of the coolers, e.g. pipes, plates, ribs, insulation or materials **[2016.01]**

26/30 • • • • Connections of coolers to other devices, e. g. to valves, heaters, compressors or filters; Coolers characterised by their location on the engine **[2016.01]**

26/31 • • • • Air-cooled heat exchangers **[2016.01]**

26/32 • • • • Liquid-cooled heat exchangers **[2016.01]**

26/33 • • • controlling the temperature of the recirculated gases **[2016.01]**

26/34 • • with compressors, turbines or the like in the recirculation passage **[2016.01]**

26/35 • • with means for cleaning or treating the recirculated gases, e.g. catalysts, condensate traps, particle filters or heaters **[2016.01]**

26/36 • • with means for adding fluids other than exhaust gas to the recirculation passage; with reformers **[2016.01]**

26/37 • • with temporary storage of recirculated exhaust gas (internal exhaust gas recirculation F02M 26/01) **[2016.01]**

26/38 • • with two or more EGR valves disposed in parallel **[2016.01]**

26/39 • • with two or more EGR valves disposed in series **[2016.01]**

26/40 • • with timing means in the recirculation passage, e.g. cyclically operating valves or regenerators; with arrangements involving pressure pulsations **[2016.01]**

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 **[2016.01]**

26/42 • • having two or more EGR passages; EGR systems specially adapted for engines having two or more cylinders **[2016.01]**

26/43 • • • in which exhaust from only one cylinder or only a group of cylinders is directed to the intake of the engine **[2016.01]**

26/44 • • • in which a main EGR passage is branched into multiple passages **[2016.01]**

26/45 • Sensors specially adapted for EGR systems **[2016.01]**

26/46 • • for determining the characteristics of gases, e.g. composition **[2016.01]**

26/47 • • • the characteristics being temperatures, pressures or flow rates **[2016.01]**

26/48 • • EGR valve position sensors (details of the sensor installation in the valve housing F02M 26/71) **[2016.01]**

26/49 • Detecting, diagnosing or indicating an abnormal function of the EGR system **[2016.01]**

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) **[2016.01]**

26/51 • EGR valves combined with other devices, e.g. with intake valves or compressors (combined with intake air throttles F02M 26/64) **[2016.01]**

26/52 • Systems for actuating EGR valves **[2016.01]**

26/53 • • using electric actuators, e.g. solenoids **[2016.01]**

26/54 • • • Rotary actuators, e.g. step motors **[2016.01]**

26/55 • • using vacuum actuators **[2016.01]**

26/56 • • • having pressure modulation valves **[2016.01]**

26/57 • • • • using electronic means, e.g. electromagnetic valves **[2016.01]**

26/58 • • • Constructional details of the actuator; Mounting thereof **[2016.01]**

26/59 • • using positive pressure actuators; Check valves therefor **[2016.01]**

26/60 • • • in response to air intake pressure **[2016.01]**

26/61 • • • in response to exhaust pressure **[2016.01]**

26/62 • • • in response to fuel pressure **[2016.01]**

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) **[2016.01]**

26/64 • • the EGR valve being operated together with an intake air throttle **[2016.01]**

26/65 • Constructional details of EGR valves **[2016.01]**

26/66 • • Lift valves, e.g. poppet valves **[2016.01]**

26/67 • • • Pintles; Spindles; Springs; Bearings; Sealings; Connections to actuators **[2016.01]**

26/68 • • • Closing members; Valve seats; Flow passages **[2016.01]**

26/69 • • • having two or more valve-closing members **[2016.01]**

26/70 • • Flap valves; Rotary valves; Sliding valves; Resilient valves **[2016.01]**

26/71 • • Multi-way valves **[2016.01]**

26/72 • • Housings **[2016.01]**

26/73 • • • with means for heating or cooling the EGR valve **[2016.01]**

26/74 • • Protection from damage, e.g. shielding means **[2016.01]**

27/00 Apparatus for treating combustion-air, fuel, or fuel-air mixture, by catalysts, electric means, magnetism, rays, sonic waves, or the like [1, 2006.01]

27/02 • by catalysts **[1, 2006.01]**

27/04 • by electric means or magnetism **[1, 2006.01]**

27/06 • by rays **[1, 2006.01]**

27/08 • by sonic or ultrasonic waves **[1, 2006.01]**

29/00 Apparatus for re-atomising condensed fuel or homogenising fuel-air mixture (combined with secondary-air supply F02M 23/12) **[1, 2006.01]**

29/02 • having rotary parts **[1, 2006.01]**

29/04 • having screens, gratings, baffles or the like **[1, 2006.01]**

29/06 • • generating whirling motion of mixture **[1, 2006.01]**

29/08 • • having spirally-wound wires **[1, 2006.01]**

29/10 • • adjustable **[1, 2006.01]**
29/12 • having homogenising valves held open by mixture current **[1, 2006.01]**
29/14 • re-atomising or homogenising being effected by unevenness of internal surfaces of mixture intake **[1, 2006.01]**

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) **[1, 2006.01]**

31/02 • for heating (for purifying liquid fuel F02M 37/30) **[1, 2006.01, 2019.01]**
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 19/04) **[1, 4, 2006.01]**
31/06 • • • by hot gases, e.g. by mixing cold and hot air **[1, 2006.01]**
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) **[6, 2006.01]**
31/08 • • • • the gases being exhaust gases **[1, 2006.01]**
31/083 • • • • • Temperature-responsive control of the amount of exhaust gas or combustion air directed to the heat exchange surface **[6, 2006.01]**
31/087 • • • • • Heat-exchange arrangements between the air intake and exhaust gas passages, e.g. by means of contact between the passages **[5, 2006.01]**
31/093 • • • • • • Air intake passage surrounding the exhaust gas passage; Exhaust gas passage surrounding the air intake passage **[5, 2006.01]**
31/10 • • • by hot liquids, e.g. lubricants **[1, 2006.01]**
31/12 • • electrically **[1, 2006.01]**
31/125 • • • Fuel **[5, 2006.01]**
31/13 • • • Combustion air **[5, 2006.01]**
31/135 • • • Fuel-air mixture **[5, 2006.01]**
31/14 • • by using heat from working cylinders or cylinder heads **[1, 2006.01]**
31/16 • • Other apparatus for heating fuel **[1, 2006.01]**
31/18 • • • to vaporise fuel **[1, 2006.01]**
31/20 • for cooling (cooling of charging-air or of scavenging-air F02B 29/04) **[1, 2006.01]**

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) **[1, 2006.01]**

33/02 • for collecting and returning condensed fuel **[1, 2006.01]**
33/04 • • returning to the intake passage **[5, 2006.01]**
33/06 • • • with simultaneous heat supply **[5, 2006.01]**
33/08 • • returning to the fuel tank **[5, 2006.01]**

35/00 Combustion-air cleaners, air intakes, intake silencers, or induction systems specially adapted for, or arranged on, internal-combustion engines [1, 2006.01]

35/02 • Air cleaners **[1, 2006.01]**
35/022 • • acting by gravity, by centrifugal, or by other inertial forces, e.g. with moistened walls **[2, 2006.01]**
35/024 • • using filters, e.g. moistened (F02M 35/026 takes precedence; cleaning of the filtering material F02M 35/08) **[2, 2006.01]**
35/026 • • acting by guiding the air over or through an oil or other liquid bath, e.g. combined with filters **[2, 2006.01]**
35/04 • • specially arranged with respect to engine; Mounting thereon **[1, 2006.01]**
35/06 • • • combined or associated with engine's cooling blower or fan, or with flywheel **[1, 2006.01]**
35/08 • • with means for removing dust from cleaners; with means for indicating clogging; with by-pass means **[1, 2006.01]**
35/09 • • • Clogging indicators **[6, 2006.01]**
35/10 • Air intakes; Induction systems **[1, 2006.01]**
35/104 • • Intake manifolds **[6, 2006.01]**
35/108 • • • with primary and secondary intake passages **[6, 2006.01]**
35/112 • • • for engines with cylinders all in one line **[6, 2006.01]**
35/116 • • • for engines with cylinders in V-arrangement or arranged oppositely relative to the main shaft **[6, 2006.01]**
35/12 • Intake silencers **[1, 2006.01]**
35/14 • Combined air cleaners and silencers **[1, 2006.01]**
35/16 • characterised by use in vehicles **[1, 2006.01]**

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 [1, 5, 2006.01]

37/02 • Feeding by means of suction apparatus, e.g. by air flow through carburettors (by driven pumps F02M 37/04) **[1, 2006.01]**
37/04 • Feeding by means of driven pumps **[1, 2006.01]**
37/06 • • mechanically driven **[1, 2006.01]**
37/08 • • electrically driven **[1, 2006.01]**
37/10 • • • submerged in fuel, e.g. in reservoir **[1, 2006.01]**
37/12 • • fluid-driven, e.g. by compressed combustion-air **[1, 2006.01]**
37/14 • • the pumps being combined with other apparatus **[1, 2006.01]**
37/16 • • characterised by provision of personally-, e.g. manually-, operated pumps **[1, 2006.01]**
37/18 • • characterised by provision of main and auxiliary pumps **[1, 2006.01]**
37/20 • characterised by means for preventing vapour lock **[1, 2006.01]**
37/22 • Arrangements for purifying liquid fuel specially adapted for, or arranged on, internal-combustion engines, e.g. arrangements in the feeding system **[3, 2006.01, 2019.01]**
37/24 • • characterised by water separating means **[2019.01]**
37/26 • • • with water detection means **[2019.01]**
37/28 • • • • with means activated by the presence of water, e.g. alarms or means for automatic drainage **[2019.01]**
37/30 • • characterised by heating means **[2019.01]**

37/32 • • characterised by filters or filter arrangements **[2019.01]**
37/34 • • • by the filter structure, e.g. honeycomb, mesh or fibrous **[2019.01]**
37/36 • • • with bypass means **[2019.01]**
37/38 • • • with regeneration means **[2019.01]**
37/40 • • • with means for detection of clogging **[2019.01]**
37/42 • • • Installation or removal of filters **[2019.01]**
37/44 • • • Filters structurally associated with pumps **[2019.01]**
37/46 • • • Filters structurally associated with pressure regulators **[2019.01]**
37/48 • • • Filters structurally associated with fuel valves **[2019.01]**
37/50 • • • Filters arranged in or on fuel tanks **[2019.01]**
37/52 • • • using magnetic means **[2019.01]**
37/54 • • characterised by air purging means (having priming pumps F02M 37/16) **[2019.01]**

Fuel-injection apparatus

Note(s) [2009.01]

Low-pressure fuel injection is classified in groups F02M 51/00, F02M 69/00 or F02M 71/00.

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) **[1, 2006.01]**
39/02 • Arrangements of fuel-injection apparatus to facilitate the driving of pumps; Arrangements of fuel-injection pumps; Pump drives **[1, 2006.01]**

41/00 Fuel-injection apparatus with two or more injectors fed from a common pressure-source sequentially by means of a distributor [1, 2006.01]
41/02 • the distributor being spaced from pumping elements **[1, 2006.01]**
41/04 • • the distributor reciprocating **[1, 2006.01]**
41/06 • • the distributor rotating **[1, 2006.01]**
41/08 • the distributor and pumping elements being combined **[1, 2006.01]**
41/10 • • pump pistons acting as the distributor **[1, 2006.01]**
41/12 • • • the pistons rotating to act as the distributor **[1, 2006.01]**
41/14 • • rotary distributor supporting pump pistons **[1, 2006.01]**
41/16 • characterised by the distributor being fed from a constant-pressure source, e.g. accumulator **[1, 2006.01]**

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 [1, 2006.01]
43/02 • Pumps peculiar thereto **[1, 2006.01]**
43/04 • Injectors peculiar thereto **[1, 2006.01]**

45/00 Fuel-injection apparatus characterised by having a cyclic delivery of specific time/pressure or time/quantity relationship [1, 2006.01]
45/02 • with each cyclic delivery being separated into two or more parts **[1, 2006.01]**
45/04 • • with a small initial part **[1, 2006.01]**
45/06 • • • Pumps peculiar thereto **[1, 2006.01]**
45/08 • • • Injectors peculiar thereto **[1, 2006.01]**
45/10 • • Other injectors with multiple-part delivery, e.g. with vibrating valves **[1, 2006.01]**
45/12 • providing a continuous delivery with variable pressure **[1, 2006.01]**

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) **[1, 2006.01]**
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 **[1, 2006.01]**
47/04 • using fluid, other than fuel, for injection-valve actuation **[1, 2006.01]**
47/06 • Other fuel injectors peculiar thereto **[1, 2006.01]**

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 [1, 2006.01]
49/02 • using the cylinder pressure, e.g. compression end pressure **[1, 2006.01]**
49/04 • using the piston impact **[1, 2006.01]**

51/00 Fuel-injection apparatus characterised by being operated electrically [1, 2006.01]
51/02 • specially for low-pressure fuel-injection (pumps per se F02M 51/04; injectors per se F02M 51/08) **[1, 2006.01]**
51/04 • Pumps peculiar thereto **[1, 2006.01]**
51/06 • Injectors peculiar thereto **[1, 2006.01]**
51/08 • • specially for low-pressure fuel-injection **[1, 2006.01]**

53/00 Fuel-injection apparatus characterised by having heating, cooling, or thermally-insulating means [1, 2006.01]
53/02 • with fuel-heating means, e.g. for vaporising **[1, 2006.01]**
53/04 • Injectors with heating, cooling, or thermally-insulating means **[1, 2006.01]**
53/06 • • with fuel-heating means, e.g. for vaporising **[1, 2006.01]**
53/08 • • with air cooling **[1, 2006.01]**

55/00 Fuel-injection apparatus characterised by their fuel conduits or their venting means [1, 2006.01]
55/02 • Conduits between injection pumps and injectors **[1, 2006.01]**
55/04 • Means for damping vibrations in injection-pump inlets **[1, 2006.01]**

57/00 Fuel injectors combined or associated with other devices [1, 2006.01]
57/02 • Injectors structurally combined with fuel-injection pumps **[1, 2006.01]**
57/04 • the devices being combustion-air intake or exhaust valves **[1, 2006.01]**
57/06 • the devices being sparking-plugs **[1, 2006.01]**

59/00 Pumps specially adapted for fuel-injection and not provided for in groups F02M 39/00-F02M 57/00 [1, 2006.01]
59/02 • of reciprocating-piston type **[1, 2006.01]**

59/04 • • characterised by special arrangement of cylinders with respect to piston-driving shaft, e.g. arranged parallel to that shaft **[1, 2006.01]**

59/06 • • • with cylinders arranged radially to driving shaft, e.g. in V- or star-arrangement **[1, 2006.01]**

59/08 • • characterised by two or more pumping elements with conjoint outlet **[1, 2006.01]**

59/10 • • characterised by the piston drive **[1, 2006.01]**

59/12 • having other positive-displacement pumping elements, e.g. rotary **[1, 2006.01]**

59/14 • • of elastic-wall type **[1, 2006.01]**

59/16 • characterised by having multi-stage compression of fuel **[1, 2006.01]**

59/18 • characterised by the pumping action being achieved through release of pre-compressed springs **[1, 2006.01]**

59/20 • Varying fuel delivery in quantity or timing **[1, 2006.01]**

59/22 • • Varying quantity by adjusting cylinder-head space **[1, 2006.01]**

59/24 • • with constant-length-stroke pistons having variable effective portion of stroke **[1, 2006.01]**

59/26 • • • caused by movements of pistons relative to their cylinders **[1, 2006.01]**

59/28 • • • • Mechanisms therefor **[1, 2006.01]**

59/30 • • with variable-length-stroke pistons **[1, 2006.01]**

59/32 • • fuel delivery being controlled by means of fuel-displaced auxiliary pistons, which effect injection **[1, 2006.01]**

59/34 • • by throttling of passages to pumping elements or of overflow passages **[1, 2006.01]**

59/36 • • by variably-timed valves controlling fuel passages **[1, 2006.01]**

59/38 • Pumps characterised by adaptations to special uses or conditions **[1, 2006.01]**

59/40 • • for reversible engines **[1, 2006.01]**

59/42 • • for starting of engines **[1, 2006.01]**

59/44 • Details, component parts, or accessories not provided for in, or of interest apart from, the apparatus of groups F02M 59/02-F02M 59/42 **[1, 2006.01]**

59/46 • • Valves **[1, 2006.01]**

59/48 • • Assembling; Disassembling; Replacing **[1, 2006.01]**

61/00 Fuel injectors not provided for in groups F02M 39/00-F02M 57/00 or F02M 67/00 [1, 2006.01]

61/02 • of valveless type **[1, 2006.01]**

61/04 • having valves **[1, 2006.01]**

61/06 • • the valves being furnished at seated ends with pintle- or plug-shaped extensions **[1, 2006.01]**

61/08 • • the valves opening in direction of fuel flow **[1, 2006.01]**

61/10 • • Other injectors with elongated valve bodies, i.e. of needle-valve type **[1, 2006.01]**

61/12 • • • characterised by the provision of guiding or centring means for valve bodies **[1, 2006.01]**

61/14 • Arrangements of injectors with respect to engines; Mounting of injectors **[1, 2006.01]**

61/16 • Details not provided for in, or of interest apart from, the apparatus of groups F02M 61/02-F02M 61/14 **[1, 2006.01]**

61/18 • • Injection nozzles, e.g. having valve-seats **[1, 2006.01]**

61/20 • • Closing valves mechanically, e.g. arrangements of springs or weights **[1, 2006.01]**

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 [1, 2006.01]

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 **[1, 2006.01]**

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. of constant-pressure pump or accumulator, when that mechanism releases the valve **[1, 2006.01]**

63/06 • Use of pressure wave generated by fuel inertia to open injection valves **[1, 2006.01]**

65/00 Testing fuel-injection apparatus, e.g. testing injection timing [1, 2006.01]

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) **[1, 2006.01]**

67/02 • the gas being compressed air, e.g. compressed in pumps **[1, 2006.01]**

67/04 • • the air being extracted from working cylinders of the engine **[1, 2006.01]**

67/06 • the gas being other than air, e.g. steam, combustion gas **[1, 2006.01]**

67/08 • • the gas being generated by combustion of part of fuel other than in engine working cylinders **[1, 2006.01]**

67/10 • Injectors peculiar thereto, e.g. of valveless type **[1, 2006.01]**

67/12 • • having valves **[1, 2006.01]**

67/14 • characterised by provisions for injecting different fuels, e.g. main fuel and readily self-igniting starting-fuel **[1, 2006.01]**

69/00 Low-pressure fuel-injection apparatus [1, 2006.01]

69/02 • Pumps peculiar thereto **[1, 2006.01]**

69/04 • Injectors peculiar thereto **[1, 2006.01]**

69/06 • characterised by the pressurisation of the fuel being caused by centrifugal force acting on the fuel **[1, 2006.01]**

69/08 • characterised by the fuel being carried by compressed air into main stream of combustion-air **[1, 2006.01]**

69/10 • peculiar to scavenged two-stroke engines, e.g. injecting into crankcase-pump chamber **[1, 2006.01]**

69/12 • comprising a fuel-displaced free piston for intermittently metering and supplying fuel to injection nozzles **[5, 2006.01]**

69/14 • having cyclically-operated valves connecting injection nozzles to a source of fuel under pressure during the injection period **[5, 2006.01]**

69/16 • characterised by means for metering continuous fuel flow to injectors or means for varying fuel pressure upstream of injectors **[5, 2006.01]**

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) **[5, 2006.01]**

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) **[5, 2006.01]**

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 **[5, 2006.01]**

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 **[5, 2006.01]**

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 **[5, 2006.01]**

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 **[5, 2006.01]**

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 **[5, 2006.01]**

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 **[5, 2006.01]**

69/34 • • with an auxiliary fuel circuit supplying fuel to the engine, e.g. with the fuel pump outlet being directly connected to the injection nozzles **[5, 2006.01]**

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 **[5, 2006.01]**

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) **[5, 2006.01]**

69/40 • • • using variably controlled air pressure, e.g. by modifying the intake air vacuum signal acting on the fuel metering device **[5, 2006.01]**

69/42 • • • using other means than variable fluid pressure, e.g. acting on the fuel metering device mechanically or electrically **[5, 2006.01]**

69/44 • characterised by means for supplying extra fuel to the engine on sudden air throttle opening, e.g at acceleration **[5, 2006.01]**

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 **[5, 2006.01]**

69/48 • • Arrangement of air sensors **[5, 2006.01]**

69/50 • • Arrangement of fuel distributors **[5, 2006.01]**

69/52 • • Arrangement of fuel metering devices **[5, 2006.01]**

69/54 • • Arrangement of fuel pressure regulators **[5, 2006.01]**

71/00 Combinations of carburettors and low-pressure fuel-injection apparatus [1, 2006.01]

71/02 • with fuel-air mixture being produced by the carburettor and being compressed by a pump for subsequent injection into main combustion-air **[1, 2006.01]**

71/04 • with carburettor being used at starting or idling only and injection apparatus being used during normal operation of engine **[1, 2006.01]**

99/00 Subject matter not provided for in other groups of this subclass [2006.01]

F02N STARTING OF COMBUSTION ENGINES; STARTING AIDS FOR SUCH ENGINES, NOT OTHERWISE PROVIDED FOR

Note(s)

1. Attention is drawn to the Notes preceding class F01.
2. The starting of engines which are not explicitly stated to be combustion engines is classified in this subclass in so far as their starting is equivalent to that of combustion engines.

Subclass index

Muscle-operated starting apparatus

1/00 **Starting apparatus having hand cranks** (with intermediate power storage F02N 5/00-F02N 15/00) **[1, 2006.01]**

1/02 • having safety means preventing damage caused by reverse rotation **[1, 2006.01]**

3/00 **Other muscle-operated starting apparatus** (with intermediate power storage F02N 5/00-F02N 15/00) **[1, 2006.01]**

3/02 • having pull-cords **[1, 2006.01]**

3/04 • having foot-actuated levers **[1, 2006.01]**

Power-operated starting apparatus; Muscle-operated starting apparatus with intermediate power storage

5/00 **Starting apparatus having mechanical power storage [1, 2006.01]**

5/02 • of spring type **[1, 2006.01]**

5/04 • of inertia type **[1, 2006.01]**

7/00 **Starting apparatus having fluid-driven auxiliary engines or apparatus [1, 2006.01]**

7/02 • the apparatus being of single-stroke piston type, e.g. pistons acting on racks or pull-cords **[1, 2006.01]**

7/04 • • the pistons acting on screw-threaded members to effect rotation **[1, 2006.01]**

7/06 • the engines being of reciprocating-piston type (of internal-combustion type F02N 7/10) **[1, 2006.01]**

7/08 • the engines being of rotary type **[1, 2006.01]**

7/10 • characterised by using auxiliary engines or apparatus of combustion type (by using explosive cartridges F02N 13/00) **[1, 2006.01]**

7/12 • • the engines being of rotary type, e.g. turbines (F02N 7/14 takes precedence) **[1, 2006.01]**

7/14 • • the starting engines being readily removable from main engines, e.g. of portable type **[1, 2006.01]**

9/00 **Starting of engines by supplying auxiliary pressure fluid to their working chambers [1, 2006.01]**

9/02 • the pressure fluid being generated directly by combustion (by using explosive cartridges F02N 13/00) **[1, 2006.01]**

9/04 • the pressure fluid being generated otherwise, e.g. by compressing air **[1, 2006.01]**

11/00 **Starting of engines by means of electric motors [1, 2006.01]**

11/02 • the motors having longitudinally-shiftable rotors **[1, 2006.01]**

11/04 • the motors being associated with current generators **[1, 2006.01]**

11/06 • • and with ignition apparatus **[1, 2006.01]**

11/08 • Circuits specially adapted for starting of engines **[1, 2006.01]**

11/10 • Safety devices (F02N 11/08 takes precedence) **[1, 2006.01]**

11/12 • Starting of engines by means of mobile, e.g. portable, starting sets **[1, 2006.01]**

11/14 • Starting of engines by means of electric starters with external current supply (F02N 11/12 takes precedence) **[1, 2006.01]**

13/00 **Starting of engines, or driving of starting apparatus by use of explosives, e.g. stored in cartridges [1, 2006.01]**

13/02 • Cartridges specially adapted therefor **[1, 2006.01]**

15/00 **Other power-operated starting apparatus; Component parts, details, or accessories, not provided for in, or of interest apart from, groups F02N 5/00-F02N 13/00 [1, 2006.01]**

15/02 • Gearing between starting-engines and started engines; Engagement or disengagement thereof **[1, 2006.01]**

15/04 • • the gearing including disengaging toothed gears **[1, 2006.01]**

15/06 • • • the toothed gears being moved by axial displacement **[1, 2006.01]**

15/08 • • the gearing being of friction type **[1, 2006.01]**

15/10 • Safety devices not otherwise provided for **[1, 2006.01]**

19/00 **Starting aids for combustion engines, not otherwise provided for [2010.01]**

19/02 • Aiding engine start by thermal means, e.g. using lighted wicks **[2010.01]**

19/04 • • by heating of fluids used in engines **[2010.01]**

19/06 • • • by heating of combustion-air by flame generating means, e.g. flame glow-plugs **[2010.01]**

19/08 • • • • Arrangement thereof **[2010.01]**

19/10 • • • by heating of engine coolants **[2010.01]**

99/00 **Subject matter not provided for in the other groups of this subclass [2010.01]**

F02P **IGNITION, OTHER THAN COMPRESSION IGNITION, FOR INTERNAL-COMBUSTION ENGINES; TESTING OF IGNITION TIMING IN COMPRESSION-IGNITION ENGINES** (specially adapted for rotary-piston or oscillating-piston engines F02B 53/12; ignition of combustion apparatus in general, glowing plugs F23Q; measuring of physical variables in general G01; controlling in general G05; data processing in general G06; electrical components in general, see section H; sparking plugs H01T)

Subclass index

Electric spark ignition installations characterised by the type of ignition power generation or storage

1/00 Installations having electric ignition energy generated by magneto- or dynamo-electric generators without subsequent storage [1, 2006.01]

1/02 • the generator rotor being characterised by forming part of the engine flywheel **[1, 2006.01]**

1/04 • the generator being specially adapted for use with specific engine types, e.g. engines with V-arrangement of cylinders **[1, 2006.01]**

1/06 • Generator drives, e.g. having snap couplings **[1, 2006.01]**

1/08 • Layout of circuits **[1, 2006.01]**

3/00 Other electric spark ignition installations characterised by the type of ignition power generation storage [1, 2006.01]

3/01 • Electric spark ignition installations without subsequent energy storage, i.e. energy supplied by an electrical oscillator (with magneto- or dynamo-electric generators F02P 1/00; piezo-electric ignition F02P 3/12; with continuous electric spark F02P 15/10) **[4, 2006.01]**

3/02 • having inductive energy storage, e.g. arrangements of induction coils **[1, 2006.01]**

3/04 • • Layout of circuits **[1, 2006.01]**

3/045 • • • for control of the dwell or anti-dwell time **[4, 2006.01]**

3/05 • • • for control of the magnitude of the current in the ignition coil (during starting F02P 15/12) **[4, 2006.01]**

3/055 • • • with protective means to prevent damage to the circuit or the ignition coil **[4, 2006.01]**

3/06 • having capacitive energy storage (piezo-electric or electrostatic ignition F02P 3/12) **[1, 2006.01]**

3/08 • • Layout of circuits (for low tension F02P 3/10) **[1, 2006.01]**

3/09 • • • for control of the charging current in the capacitor (F02P 15/12 takes precedence) **[4, 2006.01]**

3/10 • • Low-tension installation, e.g. using surface-discharge sparking plugs **[1, 2006.01]**

3/12 • Piezo-electric ignition; Electrostatic ignition **[1, 2006.01]**

Advancing or retarding electric ignition spark; Arrangements of distributors or of circuit-makers or -breakers for electric spark ignition; Electric spark ignition control or safety means, not otherwise provided for

5/00 Advancing or retarding electric ignition spark; Control therefor [1, 6, 2006.01]

5/02 • non-automatically; dependent on position of personal controls of engine, e.g. throttle position **[1, 2006.01]**

5/04 • automatically, as a function of the working conditions of the engine or vehicle or of the atmospheric conditions (dependent on position of personal controls of engine F02P 5/02) **[1, 2006.01]**

5/05 • • using mechanical means **[4, 2006.01]**

5/06 • • • dependent on engine speed **[1, 4, 2006.01]**

5/07 • • • • Centrifugal timing mechanisms **[6, 2006.01]**

5/10 • • • dependent on fluid pressure in engine, e.g. combustion-air pressure **[1, 4, 2006.01]**

5/12 • • • • dependent on a specific pressure other than that of combustion-air, e.g. of exhaust, cooling fluid, lubricant **[1, 4, 2006.01]**

5/14 • • • dependent on specific conditions other than engine speed or engine fluid pressure, e.g. temperature **[1, 4, 2006.01]**

5/145 • • using electrical means **[4, 2006.01]**

5/15 • • • Digital data processing **[4, 2006.01]**

5/152 • • • • dependent on pinking (detecting or indicating knocks in internal-combustion engines G01L 23/22) **[6, 2006.01]**

5/153 • • • • dependent on combustion pressure **[6, 2006.01]**

5/155 • • • Analogue data processing **[4, 2006.01]**

5/16 • characterised by the mechanical transmission between sensing elements or personal controls and final actuating elements **[1, 2006.01]**

7/00 Arrangement of distributors, circuit-makers, circuit-breakers or pick-up devices for electric spark ignition (advancing or retarding ignition or control therefor F02P 5/00; such devices per se, see the relevant classes of section H, e.g. rotary switches H01H 19/00, contact-breakers, distributors H01R 39/00, generators H02K) **[1, 2006.01]**

7/02 • of distributors **[1, 2006.01]**

7/03 • • with electrical means (ignition occurring simultaneously at different places in one engine cylinder or in two or more separate engine cylinders F02P 15/08) **[4, 2006.01]**

7/04 • • having distributors with air-tight casing **[1, 2006.01]**

7/06 • of circuit-makers or -breakers, or pick-up devices adapted to sense particular points of the timing cycle **[1, 4, 2006.01]**

7/063 • • Mechanical pick-up devices, circuit-makers or -breakers, e.g. contact-breakers **[4, 2006.01]**

7/067 • • Electromagnetic pick-up devices **[4, 2006.01]**

7/07 • • • Hall-effect pick-up devices **[4, 2006.01]**

7/073 • • Optical pick-up devices **[4, 2006.01]**

7/077 • • Circuits therefor, e.g. pulse generators **[4, 2006.01]**

7/08 • • having air-tight casings **[1, 2006.01]**

7/10 • Drives of distributors or of circuit-makers or -breakers **[1, 2006.01]**

9/00 Electric spark ignition control, not otherwise provided for [1, 2006.01]

11/00 Safety means for electric spark ignition, not otherwise provided for [1, 2006.01]

11/02 • Preventing damage to engines or engine-driven gearing **[1, 2006.01]**

11/04 • Preventing unauthorised use of engines (of vehicles B60R 25/04; ignition locks H01H 27/00) **[1, 2006.01]**

11/06 • Indicating unsafe conditions **[1, 2006.01]**

13/00 **Sparking plugs structurally combined with other parts of internal-combustion engines** (with fuel injectors F02M 57/06; predominant aspects of the parts, see the relevant subclasses) **[1, 2006.01]**

15/00 **Electric spark ignition having characteristics not provided for in, or of interest apart from, groups F02P 1/00-F02P 13/00 [1, 2006.01]**

15/02 • Arrangements having two or more sparking plugs **[1, 2006.01]**

15/04 • one of the spark electrodes being mounted on the engine working piston **[1, 2006.01]**

15/06 • the electric spark triggered by engine working cylinder compression **[1, 2006.01]**

15/08 • having multiple-spark ignition, i.e. ignition occurring simultaneously at different places in one engine cylinder or in two or more separate engine cylinders **[1, 2006.01]**

15/10 • having continuous electric sparks **[1, 2006.01]**

15/12 • having means for strengthening spark during starting **[1, 2006.01]**

17/00 **Testing of ignition installations, e.g. in combination with adjusting** (testing fuel injection apparatus F02M 65/00; testing ignition installations in general F23Q 23/00)**; Testing of ignition timing in compression-ignition engines [1, 4, 2006.01]**

17/02 • Checking or adjusting ignition timing **[6, 2006.01]**

17/04 • • dynamically **[6, 2006.01]**

17/06 • • • using a stroboscopic lamp **[6, 2006.01]**

17/08 • • • using a cathode-ray oscilloscope (F02P 17/06 takes precedence) **[6, 2006.01]**

17/10 • Measuring dwell or antidwell time **[6, 2006.01]**

17/12 • Testing characteristics of the spark, ignition voltage or current **[6, 2006.01]**

Other ignition

19/00 **Incandescent ignition, e.g. during starting of internal-combustion engines; Combination of incandescent and spark ignition [1, 4, 2006.01]**

19/02 • electric, e.g. layout of circuits of apparatus having glowing plugs **[1, 2006.01]**

19/04 • non-electric, e.g. heating incandescent spots by burners (use of burners for direct ignition F02P 21/00) **[1, 2006.01]**

21/00 **Direct use of flames or burners for ignition [1, 2006.01]**

21/02 • the flames being kept burning essentially external to engine working chambers **[1, 2006.01]**

21/04 • Burning-cartridges or like inserts being arranged in engine working chambers (as starting aid F02N 19/02) **[1, 2006.01]**

23/00 **Other ignition [1, 2006.01]**

23/02 • Friction, pyrophoric, or catalytic ignition **[1, 2006.01]**

23/04 • Other physical ignition means, e.g. using laser rays **[1, 2006.01]**