

ECLA EUROPEAN CLASSIFICATION

F02B INTERNAL-COMBUSTION PISTON ENGINES; COMBUSTION ENGINES IN GENERAL (plants in which engines use combustion products F02C, F02G; internal-combustion turbines F02C) [M1204]

Notes

1. In this subclass, the following terms or expressions 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 embraces super-charging;
 - "scavenging" means forcing the combustion residues from the cylinders other than by movement of the working pistons and thus embraces tuned exhaust systems.
2. Attention is drawn to the Notes preceding class F01, specially as regards Note (1).
3. Engines with specified cycles or number of cylinders are classified in group [F02B75/02](#) or [F02B75/16](#), unless other classifying features predominate.

Guide heading: Engines characterised by the working fluid to be compressed, or characterised by the type of ignition (with both fuel-air mixture compression and air-compression, or with both positive ignition and compression ignition F02B11/00; with pre-combustion chambers F02B19/00; having air storage chambers F02B21/00; with special shape or construction of other combustion chambers F02B23/00)

F02B1/00 **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 [F02B11/00](#); characterised by precombustion chambers [F02B19/00](#); characterised by air-storage chambers [F02B21/00](#); characterised by special shape or construction of combustion chambers [F02B23/00](#)) [C0901] [M1204]

[N: **Note**

- in this group the following indexing codes are used:

[R02B700/02](#) to [R02B720/30](#)

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- F02B1/02 . with positive ignition (with non-timed positive ignition [F02B9/06](#))
- F02B1/04 . . with fuel-air mixture admission into cylinder
- F02B1/06 . . . Methods of operating
- F02B1/08 . . with separate admission of air and fuel into cylinder
- F02B1/10 . . . Methods of operating
- F02B1/12 . with compression ignition (with fuel-air charge ignited by compression ignition of an additional fuel [F02B7/00](#))
- F02B1/14 . . Methods of operating

F02B3/00 **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 [F02B11/00](#); characterised by precombustion chambers [F02B19/00](#); characterised by air-storage chambers [F02B21/00](#); characterised by special shape or construction of combustion chambers [F02B23/00](#)) [[C0901](#)] [[M1204](#)]

[N: **Note**

- in this group the following indexing codes are used:

[R02B700/02](#) to [R02B720/30](#)

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- [F02B3/02](#) . with positive ignition (with non-timed positive ignition [F02B9/06](#))
- [F02B3/04](#) . . Methods of operating
- [F02B3/06](#) . with compression ignition ([F02B13/02](#) takes precedence; with fuel-air charge ignited by compression ignition of an additional fuel [F02B7/00](#))
- [F02B3/08](#) . . Methods of operating ([F02B3/12](#) takes precedence)
- [F02B3/10](#) . . with intermittent fuel introduction
- [F02B3/12](#) . . . Methods of operating
- F02B5/00** **Engines characterised by positive ignition** ([F02B1/02](#), [F02B3/02](#) take precedence; with non-timed positive ignition [F02B9/06](#); characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition [F02B11/00](#); characterised by precombustion chambers [F02B19/00](#); characterised by air-storage chambers [F02B21/00](#); characterised by special shape or construction of combustion chambers [F02B23/00](#)) [[C0901](#)]
- [F02B5/02](#) . Methods of operating
- F02B7/00** **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 [F02B11/00](#); characterised by precombustion chambers [F02B19/00](#); characterised by air-storage chambers [F02B21/00](#); characterised by special shape or construction of combustion chambers [F02B23/00](#)) [[C0901](#)]
- [F02B7/02](#) . the fuel in the charge being liquid
- [F02B7/04](#) . . Methods of operating
- [F02B7/06](#) . the fuel in the charge being gaseous
- [F02B7/08](#) . . Methods of operating
- F02B9/00** **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 [F02B11/00](#); characterised by precombustion chambers [F02B19/00](#); characterised by air-storage chambers [F02B21/00](#); characterised by special shape or construction of combustion chambers [F02B23/00](#)) [[C0901](#)] [[M1204](#)]

[N: **Note**

- in this group the following indexing codes are used:

[R02B700/02](#) to [R02B720/30](#)

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- F02B9/02 . with compression ignition ([F02B1/12](#), [F02B3/06](#) take precedence)
- F02B9/04 . . Methods of operating
- F02B9/06 . with non-timed positive ignition, e.g. with hot-spots
- F02B9/08 . . with incandescent chambers
- F02B9/10 . . . Chamber shapes or constructions

- F02B11/00** **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** (characterised by recombustion chambers [F02B19/00](#); characterised by air-storage chambers [F02B21/00](#); characterised by special shape or construction of combustion chambers [F02B23/00](#)) [C0901]

- F02B11/02 . convertible from fuel-air mixture compression to air compression or vice-versa

- Guide heading:** **Engines characterised by the method of introducing fuel into cylinders** ([characterised by use of gaseous or solid fuels F02B43/00, F02B45/00; carburettors, fuel-injection apparatus F02M](#))

- F02B13/00** **Engines characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid** [C0901]

- F02B13/02 . Compression ignition engines using air or gas for blowing fuel into compressed air in cylinder
- F02B13/04 . . Arrangements or adaptations of pumps
- F02B13/06 . Engines having secondary air mixed with fuel in pump, compressed therein without ignition, and fuel-air mixture being injected into air in cylinder
- F02B13/08 . . Arrangements or adaptations of pumps
- F02B13/10 . Use of specific auxiliary fluids, e.g. steam, combustion gas

- F02B15/00** **Engines characterised by the method of introducing liquid fuel into cylinders and not otherwise provided for** [C0901]

- F02B15/02 . having means for sucking fuel directly into cylinder

- F02B17/00** **Engines characterised by means for effecting stratification of charge in cylinders**

- F02B17/00D . [N: having direct injection in the combustion chamber] [N9707]

- Guide heading:** **Engines characterised by having pre-combustion chambers or air storage chambers, or characterised by shape or construction of combustion chambers to improve operation** ([engines with incandescent chambers F02B9/08](#))

- F02B19/00** **Engines characterised by precombustion chambers** (engines with incandescent chambers [F02B9/08](#)) [C0901]
- F02B19/02 . the chamber being periodically isolated from its cylinder
 - F02B19/04 . . the isolation being effected by a protuberance on piston or cylinder head
 - F02B19/06 . with auxiliary piston in chamber for transferring ignited charge to cylinder space
 - F02B19/08 . the chamber being of air-swirl type
 - F02B19/10 . with fuel introduced partly into pre-combustion chamber, and partly into cylinder ([F02B19/02](#) to [F02B19/08](#) take precedence)
 - F02B19/10A . . [N: details of combustion chamber, e.g. mounting arrangements]
 - F02B19/10A1 . . . [N: heating, cooling]
 - F02B19/10A2 . . . [N: design parameters, e.g. volume, torch passage cross sectional area, length, orientation, or the like]
 - F02B19/10B . . [N: with only one pre-combustion chamber ([F02B19/10A](#) take precedence)]
 - F02B19/10B1 . . . [N: pre-combustion chamber and cylinder being fed with fuel-air mixture(s)]
 - F02B19/10B1A [N: pre-combustion chamber and cylinder having both intake ports or valves, e.g. HONDS CVCC]
 - F02B19/10B1A1 [N: specially adapted valves, e.g. rotary valves, pre-combustion chamber being part of a valve]
 - F02B19/10B1A2 [N: timing of valves]
 - F02B19/10B1A3 [N: auxiliary intake, valve drive]
 - F02B19/10B1A4 [N: means for varying the size of the torch passage]
 - F02B19/10B1A5 [N: controlling, e.g. varying fuel-air ratio, quantity of charge]
 - F02B19/10B1A6 [N: with fuel injectors disposed upstream of intake valves]
 - F02B19/10B1A7 [N: with residuel gas chamber e.g. containing spark plug]
 - F02B19/10B1B [N: pre-combustion chamber having an inlet and an outlet port and with two distinct intake conduits or with one intake conduit in which the heavier fuel particles are separated from the main stream, e.g. by gravitational forces]
 - F02B19/10B1C [N: pre-combustion chamber having only one orifice, (i.e. an orifice by means of which it communicates with the cylinder); the intake system comprising two distinct intake conduits]
 - F02B19/10B1D [N: pre-combustion chamber being formed within the piston, e.g. two-cycle engines]
 - F02B19/10B2 [N: with fuel injection at least into pre-combustion chamber, i.e. injector mounted directly in the pre-combustion chamber]
 - F02B19/10B2A [N: controlling fuel injection]
 - F02B19/10B3 [N: with injection of a fuel-air mixture into the pre-combustion chamber by means of a pump, e.g. two-cycle engines]
 - F02B19/10C . . [N: with more than one pre-combustion chamber (a stepped form of the main combustion chamber above the piston is to be considered as a pre-combustion chamber if this stepped portion is not a squish area)]
 - F02B19/12 . with positive ignition ([F02B19/02](#) to [F02B19/10](#) take precedence)
 - F02B19/14 . with compression ignition ([F02B19/02](#) to [F02B19/10](#) take precedence)

- F02B19/16 . Chamber shapes or constructions not specific to sub-groups [F02B19/02](#) to [F02B19/10](#)
- F02B19/16B . . [N: The shape or construction of the pre-combustion chambers is specially adapted to be formed, at least in part, of ceramic material (surface coverings of combustion-gas-swept parts [F02B77/02](#); shaped ceramic products characterised by their composition or ceramic compositions [C04B35/00](#); ceramic material for engine casings [F02F7/00G1](#))]
- F02B19/18 . . Transfer passages between chamber and cylinder
- F02B21/00 Engines characterised by air-storage chambers [C0901]**
- F02B21/02 . Chamber shapes or constructions
- F02B23/00 Other engines characterised by special shape or construction of combustion chambers to improve operation (engines with incandescent chambers [F02B9/08](#)) [C0901]**
- [N: **Note**
- in this group the following indexing codes are used:
[R02B700/02](#) to [R02B720/30](#)
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- F02B23/02 . with compression ignition
- F02B23/04 . . the combustion space being subdivided into two or more chambers (with pre-combustion chambers [F02B19/00](#))
- F02B23/06 . . the combustion space being arranged in working piston ([F02B23/04](#) takes precedence)
- F02B23/06B . . . [N: at least part of the interior volume or the wall of the combustion space being made of material different from the surrounding piston part, e.g. combustion space formed within a ceramic part fixed to a metal piston head] [N9707] [C0312]
- F02B23/06D . . . [N: having in-cylinder means to influence the charge motion] [N0312]
- F02B23/06D2 [N: Squish flow] [N0312]
- F02B23/06D4 [N: Swirl flow] [N0312]
- F02B23/06D6 [N: having additional bores or grooves machined into the piston for guiding air or charge flow to the piston bowl] [N0312]
- F02B23/06D8 [N: the combustion space in the piston interacting fluid dynamically with the cylinder head, the injector body or the cylinder wall ([F02B23/04](#) takes precedence)] [N0312]
- F02B23/06E . . . [N: the combustion space being almost completely enclosed in the piston, i.e. having a small inlet in comparison to its volume] [N0312]
- F02B23/06F . . . [N: the combustion space having a substantially flat and horizontal bottom] [N0312]
- F02B23/06F2 [N: the combustion space having substantially the shape of a cylinder] [N0312]
- F02B23/06H . . . [N: the depth of the combustion space being much smaller than the diameter of the piston, e.g. the depth being in the order of one tenth of the diameter] [N0312]
- F02B23/06M . . . [N: Details related to the fuel injector or the fuel spray] [N0312]
- F02B23/06M2 [N: Means or methods to improve the spray dispersion, evaporation or

- ignition] [N0312]
- F02B23/06M2R [N: the fuel spray impinging on reflecting surfaces or being specially guided throughout the combustion space] [N0312]
- F02B23/06M4 [N: Thermal treatments, e.g. with heating elements or local cooling] [N0312]
- F02B23/06M4G [N: the spray interacting with one or more glow plugs] [N0312]
- F02B23/06M6 [N: the injector being located substantially off-set from the cylinder centre axis] [N0312]
- F02B23/06M8 [N: having multiple injectors per combustion chamber] [N0312]
- F02B23/06M10 [N: having a single fuel spray jet per injector nozzle] [N0312]
- F02B23/06M12 [N: having multiple fuel spray jets per injector nozzle] [N0312]
- F02B23/06Q [N: Omega-piston bowl, i.e. the combustion space having a central projection pointing towards the cylinder head and the surrounding wall being inclined towards the cylinder center axis (the surrounding wall being exactly vertical F02B23/06W)] [N0312]
- F02B23/06S [N: the combustion space being substantially spherical, hemispherical, ellipsoid or parabolic] [N0312]
- F02B23/06U [N: Unconventional, complex or non-rotationally symmetrical shapes of the combustion space, e.g. flower like, having special shapes related to the orientation of the fuel spray jets] [N0312]
- F02B23/06U2 [N: Square, rectangular or the like profiles] [N0312]
- F02B23/06U4 [N: Ring like bowl, e.g. toroidal] [N0312]
- F02B23/06U6 [N: Multiple bowls in the piston, e.g. one bowl per fuel spray jet] [N0312]
- F02B23/06U8 [N: characterised by its eccentricity from the cylinder axis] [N0312]
- F02B23/06U10 [N: the combustion space consisting of step-wise widened multiple zones of different depth] [N0312]
- F02B23/06W [N: W-piston bowl, i.e. the combustion space having a central projection pointing towards the cylinder head and the surrounding wall being inclined towards the cylinder wall] [N0312]
- F02B23/08 with positive ignition
- F02B23/10 with separate admission of air and fuel into cylinder
- F02B23/10C [N: the injector being placed on or close to the cylinder centre axis, e.g. with mixture formation using spray guided concepts] [N0303]
- F02B23/10S [N: the injector being placed on a side position of the cylinder] [N0303] [M1208]
- F02B23/10S2 [N: the fuel is sprayed directly onto or close to the spark plug] [N0303]

Guide heading: **Engines characterised by provisions for charging or scavenging** ([aspects concerned with driven charging or scavenging pumps F02B33/00 to F02B39/00](#))

F02B25/00 **Engines characterised by using fresh charge for scavenging cylinders** (aspects characterised by provision of driven charging or scavenging pumps [F02B33/00](#) to [F02B39/00](#)) [C0901] [M1204]

[N: **Note**

- in this group the following indexing codes are used:

[R02B700/02](#) to [R02B700/30](#)

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F02B25/02 using unidirectional scavenging

- F02B25/04 . . Engines having ports both in cylinder head and in cylinder wall near bottom of piston stroke
- F02B25/06 . . . the cylinder-head ports being controlled by working pistons, e.g. by sleeve-shaped extensions thereof
- F02B25/08 . . Engines with oppositely-moving reciprocating working pistons
- F02B25/10 . . . with one piston having a smaller diameter or shorter stroke than the other
- F02B25/12 . . Engines with U-shaped cylinders, having ports in each arm
- F02B25/14 . using reverse-flow scavenging, e.g. with both outlet and inlet ports arranged near bottom of piston stroke
- F02B25/14B . . [N: with intake and exhaust valves exclusively in the cylinder head]
- F02B25/16 . . the charge flowing upward essentially along cylinder wall opposite the inlet ports [N: (F02B25/14B takes precedence)]
- F02B25/18 . . the charge flowing upward essentially along cylinder wall adjacent the inlet ports, e.g. by means of deflection rib on piston [N: (F02B25/14B takes precedence)]
- F02B25/20 . 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, subgroups [F02B25/02](#) to [F02B25/18](#)
- F02B25/22 . . by forming air cushion between charge and combustion residues
- F02B25/24 . . Inlet or outlet openings being timed asymmetrically relative to bottom dead-centre
- F02B25/26 . Multi-cylinder engines other than those provided for in, or of interest apart from, groups [F02B25/02](#) to [F02B25/24](#) (internal-combustion aspects of rotary engines with movable cylinders [F02B57/00](#))
- F02B25/28 . . with V-, fan-, or star-arrangement of cylinders
- F02B27/00** **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** (aspects characterised by provision of driven charging or scavenging pumps [F02B33/00](#) to [F02B39/00](#), e.g. use of driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge [F02B33/42](#)) [C0901]
- F02B27/00B . [N: the system having electrically controlled acoustic pulse generating devices, e.g. loudspeakers]
- F02B27/00C . [N: using check valves] [N1201]
- F02B27/00P . [N: Oscillating pipes with charging achieved by arrangement, dimensions or shapes of intakes pipes or chambers; Ram air pipes] [N1201]
- F02B27/00P2 . . [N: of intake runners] [N1201]
- F02B27/00R . [N: Resonance charging] [N1201]
- F02B27/02 . the systems having variable, i.e. adjustable, cross-sectional areas, chambers of variable volume, or like variable means (in exhaust systems only [F02B27/06](#))
- F02B27/02H . . [N: characterised by the charging effect] [N1201]
- F02B27/02H2 . . . [N: Resonance charging (combined with oscillating pipe charging [F02B27/02H4R](#))] [N1201]

- F02B27/02H4 . . . [N: Oscillating pipe charging, i.e. variable intake pipe length charging] [N1201]
- F02B27/02H4R [N: Resonance charging combined with oscillating pipe charging] [N1201]
- F02B27/02M . . [N: characterised by the means generating the charging effect] [N1201]
- F02B27/02M2 . . . [N: Movable ducts, walls or the like ([F02B27/02M6R](#) takes precedence)] [N1201]
- F02B27/02M2C [N: with continuously variable adjustment of a length or width] [N1201]
- F02B27/02M4 . . . [N: Fluid communication passages between intake ducts, runners or chambers] [N1201]
- F02B27/02M6 . . . [N: Plenum chambers; Resonance chambers or resonance pipes] [N1201]
- F02B27/02M6M [N: Multiple plenum chambers or plenum chambers having inner separation walls, e.g. comprising valves for the same group of cylinders] [N1201]
- F02B27/02M6R [N: Rotatable plenum chambers] [N1201]
- F02B27/02M6W [N: the plenum chamber and at least one of the intake ducts having a common wall, and the intake ducts wrap partially around the plenum chamber, i.e. snail-type ([F02B27/02M6R](#) takes precedence)] [N1201]
- F02B27/02M8 . . . [N: Valves] [N1201]
- F02B27/02M8F [N: Flap valves] [N1201]
- F02B27/02M8M [N: Multi-way valves] [N1201]
- F02B27/02M8R [N: Rotary slide valves] [N1201]
- F02B27/02M10 . . . [N: Intake runners having multiple intake valves per cylinder] [N1201]
- F02B27/02T . . [N: Actuators or controllers therefor; Diagnosis; Calibration] [N1201]

- F02B27/04 . . in exhaust systems only, e.g. for sucking-off combustion gases
- F02B27/06 . . the systems having variable, i.e. adjustable, cross-sectional areas, chambers of variable volume, or like variable means

F02B29/00 **Engines characterised by provision for charging or scavenging not provided for in groups [F02B25/00](#), [F02B27/00](#) or [F02B33/00](#) to [F02B39/00](#); Details thereof [C0901]**

- F02B29/02 . . Other fluid-dynamic features of induction systems for improving quantity of charge (for also imparting a rotation to the charge in the cylinder [F02B31/00](#); structural features of induction systems [F02M](#))

- F02B29/04 . . Cooling of air intake supply
- F02B29/04B . . . [N: Layout of the intake air cooling or coolant circuit] [N0312]
- F02B29/04B2 [N: Multiple heat exchangers arranged in parallel or in series] [N0312]
- F02B29/04B4 [N: the intake air cooler having a bypass or multiple flow paths within the heat exchanger to vary the effective heat transfer surface] [N0312]
- F02B29/04B6 [N: Air cooled heat exchangers] [N0312]
- F02B29/04B6B [N: Details or means to guide the ambient air to the heat exchanger, e.g. having a fan, flaps, a bypass or a special location in the engine compartment] [N0312]
- F02B29/04B8 [N: Liquid cooled heat exchangers] [N0312]
- F02B29/04B8L [N: Layout of the coolant or refrigerant circuit] [N0312]
- F02B29/04D . . [N: Constructional details of the heat exchangers, e.g. pipes, plates, ribs, insulation, materials, or manufacturing and assembly] [N0312]
- F02B29/04D2 . . . [N: Air cooled heat exchangers] [N0312]

- F02B29/04D4 . . . [N: Liquid cooled heat exchangers] [N0312]
- F02B29/04D6 . . . [N: Water separation or drainage means] [N0312]
- F02B29/04D8 . . . [N: the intake air cooler being combined with another device, e.g. heater, valve, compressor, filter or EGR cooler, or being assembled on a special engine location] [N0312]
- F02B29/04F . . [N: Intake air cooling by means others than heat exchangers, e.g. by rotating drum regenerators, cooling by expansion or by electrical means] [N0312]
- F02B29/04T . . [N: Controlling the air charge temperature] [N0312]
- F02B29/06 . After-charging, i.e. supplementary charging after scavenging
- F02B29/08 . Modifying distribution valve timing for charging purposes ([F02B29/06](#) takes precedence; valve gear therefor [F01L](#))
- F02B29/08A . . [N: Cyclically operated valves disposed upstream of the cylinder intake valve, controlled by external means] [N0002]
- F02B29/08B . . [N: the engine having two or more inlet valves]

- F02B31/00** **Modifying induction systems for imparting a rotation to the charge in the cylinder**
(structural features of induction systems [F02M](#))

- F02B31/02 . in engines having inlet valves arranged eccentrically to cylinder axis
- F02B31/04 . by means within the induction channel, e.g. deflectors
- F02B31/06 . . Movable means, e.g. butterfly valves
- F02B31/08 . . . having multiple air inlets, [N: i.e. having main and auxiliary intake passages] [N9602]
- F02B31/08A [N: the main passage having a helical shape around the intake valve axis; Engines characterised by provision of driven charging or scavenging pumps (introducing fuel into cylinders by air-pressure [F02B13/00](#); after-charging [F02B29/06](#); arrangements of such pumps or other auxiliary apparatus on engines [F02B67/00](#); combined engine pump control, control dependent on variables other than those generic to pump [F02D](#))] [N9602]
- F02B31/08E [N: having two inlet valves] [N9702]
- F02B31/08F [N: having three or more inlet valves] [N9702]

Guide heading: **Engines characterised by provision of driven charging or scavenging pumps**
(introducing fuel into cylinders by air-pressure [F02B13/00](#); after-charging [F02B29/06](#); arrangements of such pumps or other auxiliary apparatus on engines [F02B67/00](#); combined engine and pump control, control dependent on variables other than those generic to pump [F02D](#)) [N: Details or constructional aspects of turbines [F01D](#); turbochargers [F02C](#); pumps [F04](#)]

F02B33/00 **Engines characterised by provision of pumps for charging or scavenging**
(characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid [F02B13/00](#); characterised by after-charging [F02B29/06](#); characterised by provision of pumps for sucking combustion residues from cylinders [F02B35/00](#); characterised by provision of exhaust-driven pumps [F02B37/00](#)) [C0901] [M1204]

[N: **Note**

- in this group the following indexing code is used:

R02M700/33

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- F02B33/02 . Engines with reciprocating-piston pumps; Engines with crankcase pumps
- F02B33/04 . . with simple crankcase pump, i.e. with the rear face of a non-stepped working piston acting as sole pumping member in co-operation with the crankcase
- F02B33/06 . . with reciprocating-piston pumps other than simple crankcase pumps
- F02B33/08 . . . with the working-cylinder head arranged between working and pumping cylinders
- F02B33/10 . . . with the pumping cylinder situated between working cylinder and crankcase, or with the pumping cylinder surrounding working cylinder
- F02B33/12 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
- F02B33/14 working and pumping pistons forming stepped piston
- F02B33/16 working and pumping pistons having differing movements
- F02B33/18 . . . with crankshaft being arranged between working and pumping cylinders
- F02B33/20 . . . with pumping-cylinder axis arranged at an angle to working-cylinder axis, e.g. at an angle of 90 degrees
- F02B33/22 . . . with pumping cylinder situated at side of working cylinder, e.g. the cylinders being parallel
- F02B33/24 . . with crankcase pumps other than with reciprocating pistons only
- F02B33/26 . . Four-stroke engines characterised by having crankcase pumps
- F02B33/28 . . Component parts, details or accessories of crankcase pumps, not provided for in, or of interest apart from, subgroups [F02B33/02](#) to [F02B33/26](#)
- F02B33/30 . . . Control of inlet or outlet ports ([controlling only working-cylinder inlets F01L](#))
- F02B33/32 . Engines with pumps other than of reciprocating-piston type ([with crankcase pumps F02B33/02](#))
- F02B33/34 . . with rotary pumps ([with cell-type pressure exchangers or the like F02B33/42](#))
- F02B33/36 . . . of positive-displacement type
- F02B33/38 of Roots type
- F02B33/40 . . . of non-positive-displacement type
- F02B33/42 . . with driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge, e.g. with cell-type pressure exchangers (pressure exchangers per se F04F 13/00) [\[C0901\]](#)
- F02B33/44 . Passages conducting the charge from the pump to the engine inlet, e.g. reservoirs ([cooling of charge after leaving pumps F02B29/04](#))
- F02B33/44B . . [\[N: Heating of charging air, e.g. for facilitating the starting\]](#)
- F02B33/44C . . [\[N: having valves for admission of atmospheric air to engine, e.g. at starting\]](#)
- F02B35/00** **Engines characterised by provision of pumps for sucking combustion residues from cylinders [\[C0901\]](#)**

- F02B35/02 . using rotary pumps

- F02B37/00** **Engines characterised by provision of pumps driven at least for part of the time by exhaust** (characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid [F02B13/00](#); characterised by after-charging [F02B29/06](#); characterised by passages conducting the charge from the pump to the engine inlet [F02B33/44](#)) [C0901]

- F02B37/00A . [N: using exhaust drives arranged in parallel] [N1205]
- F02B37/00A2 . . [N: the exhaust supply to one of the exhaust drives can be interrupted] [N1205]
- F02B37/00B . [N: with exhaust drives arranged in series] [N1205]
- F02B37/00D . [N: Exhaust driven pumps being combined with an exhaust driven auxiliary apparatus, e.g. a ventilator]
- F02B37/007 . with exhaust-driven pumps arranged in parallel, [N: e.g. at least one pump supplying alternatively] [N9602]
- F02B37/013 . with exhaust-driven pumps arranged in series [N9602]
- F02B37/02 . Gas passages between engine outlet and pump drive, e.g. reservoirs
- F02B37/02B . . [N: Multiple scrolls or multiple gas passages guiding the gas to the pump drive] [N1106]
- F02B37/04 . Engines with exhaust drive and other drive of pumps, e.g. with exhaust-driven pump and mechanically-driven second pump
- F02B37/10 . . at least one pump being alternatively [N: or simultaneously] driven by exhaust and other drive, [N: e.g. by pressurised fluid from a reservoir or an engine-driven pump]
- F02B37/10B . . . [N: exhaust drive and pump being both connected through gearing to engine-driven shaft] [C0407]
- F02B37/11 . . driven by other drive at starting only [N9602]
- F02B37/12 . Control of the pumps
- F02B37/12D . . [N: by bypassing air from the pump inlet, e.g. to the pump outlet (bypassing charging air [F02B37/16](#); valves for admission of atmospheric air to engine [F02B33/44C](#))] [N1208]
- F02B37/14 . . [N: Control] of the alternation between [N: or the operation of] exhaust drive and other drive of a pump, e.g. dependent on speed
- F02B37/16 . . by bypassing charging air [N: (bypassing air from the pump inlet, e.g. to the pump outlet [F02B37/12D](#))] [N1208]
- F02B37/16B . . . [N: the bypassed air being used in an auxiliary apparatus, e.g. in an air turbine] [N9602]
- F02B37/16B2 [N: the auxiliary apparatus being a combustion chamber, e.g. upstream of turbine] [N9602]
- F02B37/16D . . . [N: into the exhaust conduit ([F02B37/18B2](#) takes precedence)] [N1110]
- F02B37/18 . . by bypassing exhaust [N: from the inlet to the outlet of turbine or to the atmosphere] [N9602]
- F02B37/18B . . . [N: Arrangements of bypass valves or actuators therefor] [N0901]
- F02B37/18B2 [N: Arrangements of actuators or linkage for bypass valves] [N0901]

- F02B37/20 . . by increasing exhaust energy, e.g. using combustion chamber [N: by after-burning (using an auxiliary combustion chamber supplied by charging air [F02B37/16B2](#))] [N9602]
- F02B37/22 . . by varying cross-section of exhaust passages or air passages, [N: e.g. by throttling turbine inlets or outlets or by varying effective number of guide conduits ([F02B37/24](#) takes precedence)] [N9602]
- F02B37/22B . . . [N: air passages] [N9602]
- F02B37/24 . . by using pumps or turbines with adjustable guide vanes [N9602]

F02B39/00 **Component parts, details, or accessories relating to, driven charging or scavenging pumps, not provided for in groups [F02B33/00](#) to [F02B37/00](#) [C0901]**

- F02B39/00C . [N: Cooling of pump drives]
- F02B39/02 . Drives of pumps (exhaust drives or combined exhaust and other drives [F02B37/00](#)); Varying pump drive gear ratio (control acting both on engine and on pump drive gear ratio [F02D](#))
- F02B39/04 . . Mechanical drives; Variable-gear-ratio drives (non-mechanical pump drives having variable gear ratio [F02B39/08](#))
- F02B39/06 . . . the engine torque being divided by a differential gear for driving a pump and the engine output shaft
- F02B39/08 . . Non-mechanical drives, e.g. fluid drives having variable gear ratio
- F02B39/08E . . . [N: the fluid drive using expansion of fluids other than exhaust gases, e.g. a Rankine cycle] [N1205]
- F02B39/10 . . . electric
- F02B39/12 . . Drives characterised by use of couplings or clutches therein (using fluid slip couplings for varying gear ratio [F02B39/08](#))
- F02B39/14 . Lubrication of pumps; Safety measures therefor
- F02B39/16 . Other safety measures for, or other control of, pumps

F02B41/00 **Engines characterised by special means for improving conversion of heat or pressure energy into mechanical power [C0901]**

- F02B41/02 . Engines with prolonged expansion
- F02B41/04 . . in main cylinders
- F02B41/06 . . in compound cylinders
- F02B41/08 . . . Two-stroke compound engines
- F02B41/10 . . in exhaust turbines (use of exhaust turbines for charging [F02B37/00](#); turbines constructions [F01D](#); gas turbine plant [F02C](#))

Guide heading: **Engines operating on non-liquid fuels; Plants including such engines, i.e. combinations of the engines with fuel-generating apparatus (engines having gas-air charge ignited by compression-ignition of an additional fuel [F02B7/06](#); engines convertible from gas to other fuel consumption [F02B69/04](#); apparatus for generating fuel, e.g. gas, see the relevant classes, e.g. C10)**

F02B43/00 **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 [F02B7/06](#); engines convertible from gas to other fuel consumption [F02B69/04](#)) [C0901] [M1204]

[N: **Note**

- in this group the following indexing codes are used:

[R02B700/02](#) to [R02B720/30](#)

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- [F02B43/02](#) . Engines characterised by means for increasing operating efficiency
- [F02B43/04](#) . . for improving efficiency of combustion
- [F02B43/06](#) . . for enlarging charge
- [F02B43/08](#) . Plants characterised by the engines using gaseous fuel generated in the plant from solid fuel, e.g. wood
- [F02B43/10](#) . Engines or plants characterised by use of other specific gases, e.g. acetylene, oxyhydrogen
- [F02B43/12](#) . . Methods of operating
- [F02B45/00](#) Engines characterised by operating on non-liquid fuels other than gas; Plants including such engines** (plants involving generation of gaseous fuel from solid fuel [F02B43/08](#); engines convertible from gas to other fuel consumption [F02B69/04](#)) [C0901]
- [F02B45/02](#) . operating on powdered fuel e.g. powdered coal (operating on fuel containing oxidant [F02B45/06](#))
- [F02B45/04](#) . . Plants, e.g. having coal-grinding apparatus
- [F02B45/06](#) . operating on fuel containing oxidant
- [F02B45/08](#) . operating on other solid fuels
- [F02B45/10](#) . operating on mixtures of liquid and non-liquid fuels, e.g. in pasty or foamed state
- Guide heading:** **Methods of operating engines involving specific pre-treating of, or adding specific substances to, combustion air, or fuel air-mixture, of the engines and not otherwise provided for** ([apparatus for performing such pre-treatment or additions F02M](#))
- [F02B47/00](#) Methods of operating engines involving adding non-fuel substances or anti-knock agents to combustion air, fuel, or fuel-air mixtures of engines**
- [F02B47/02](#) . the substances being water or steam
- [F02B47/04](#) . the substances being other than water or steam only
- [F02B47/06](#) . . the substance including non-airborne oxygen ([F02B47/10](#) takes precedence)
- [F02B47/08](#) . . the substances including exhaust gas
- [F02B47/10](#) . . . Circulation of exhaust gas in closed or semi-closed circuits, e.g. with simultaneous addition of oxygen
- [F02B49/00](#) 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

F02B51/00 **Other methods of operating engines involving pretreating of, or adding substances to, combustion air, fuel, or fuel-air mixture of the engines**

- F02B51/02 . involving catalysts
- F02B51/04 . involving electricity or magnetism
- F02B51/06 . involving rays or sound waves

Guide heading: **Internal-combustion aspects of rotary-piston or oscillating-piston engines**

F02B53/00 **Internal-combustion aspects of rotary-piston or oscillating-piston engines**
(internal-combustion aspects of rotary pistons or outer members for co-operation therewith [F02B55/00](#)) **[M1204]**

[N: **Note**
- in this group the following indexing codes are used:
[R02B730/01](#) to [R02B730/09](#)
]

- F02B53/02 . Methods of operating
- F02B53/04 . Charge admission or combustion-gas discharge
- F02B53/06 . . Valve control therefor
- F02B53/08 . . Charging, e.g. by means of rotary-piston pump
- F02B53/10 . Fuel supply; Introducing fuel to combustion space
- F02B53/12 . Ignition
- F02B53/14 . Adaptations of engines for driving, or engine combinations with, other devices (aspects predominantly concerning such devices, see the relevant classes for the devices)

F02B55/00 **Internal-combustion aspects of rotary pistons; Outer members for co-operation with rotary pistons**

- F02B55/02 . Pistons
- F02B55/04 . . Cooling thereof
- F02B55/06 . . . by air or other gas
- F02B55/08 . Outer members for co-operation with rotary pistons; Casings
- F02B55/10 . . Cooling thereof
- F02B55/12 . . . by air or other gas

- F02B55/14 . Shapes or constructions of combustion chambers
- F02B55/16 . Admission or exhaust passages in pistons or outer members

Guide heading: **Internal-combustion aspects of reciprocating-piston engines with movable cylinders**

F02B57/00 **Internal-combustion aspects of rotary engines in which the combusted gases displace one or more reciprocating pistons**

- F02B57/02 . Fuel or combustion-air supply ([cylinder-charge admission or exhaust control F02B57/04](#))
- F02B57/04 . Control of cylinder-charge admission or exhaust ([peculiar to two-stroke engines or to other engines with working-piston-controlled charge admission or exhaust F02B57/06](#))
- F02B57/06 . Two-stroke engines or other engines with working-piston-controlled cylinder-charge admission or exhaust ([with combustion space in centre of star F02B57/10](#))
- F02B57/08 . Engines with star-shaped cylinder arrangements
- F02B57/08T . . [\[N: having two parallel main shafts\] \[N0402\]](#)
- F02B57/10 . . with combustion space in centre of star

F02B59/00 **Internal-combustion aspects of other reciprocating-piston engines with movable, e.g. oscillating, cylinders ([with yieldable walls F02B75/38](#))**

Guide heading: **Adaptations of engines for special use; Combinations of engines with devices other than engine parts or auxiliaries (of rotary-piston or oscillating-piston engines [F02B53/14](#); aspects predominantly concerning such devices, see the relevant classes for the devices)**

F02B61/00 **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 [F02B39/06](#); adaptations or combinations of rotary-piston or oscillating-piston engines [F02B53/14](#); arrangements in vehicles, see the relevant classes for vehicles) [\[C0901\]](#)**

- F02B61/02 . for driving cycles
- F02B61/04 . for driving propellers
- F02B61/04B . . [\[N: for outboard marine engines\]](#)
- F02B61/06 . Combinations of engines with mechanical gearing ([F02B61/02](#), [F02B61/04](#) take precedence)

F02B63/00 **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 [F02B53/14](#)) [\[C0901\]](#)**

- F02B63/02 . for hand-held tools
- F02B63/04 . for electric generators
- F02B63/04L . . [N: Linear electric generators] [N1203]
- F02B63/04R . . [N: Rotating electric generators] [N1203]
- F02B63/04S . . [N: Electric generators using oscillating movement] [N1203]
- F02B63/04V . . [N: the engine-generator unit being placed on a frame or in an housing] [N1203]
- F02B63/04V3 . . . [N: Movable engine-generator combinations on wheels] [N1203]
- F02B63/04V5 . . . [N: Portable engine-generator combinations] [N1203]
- F02B63/06 . for pumps
- F02B65/00** **Adaptations of engines for special uses not provided for in groups [F02B61/00](#) or [F02B63/00](#); Combinations of engines with other devices, e.g. with non-driven apparatus (of rotary-piston or oscillating-piston engines [F02B53/14](#); combinations of prime-movers consisting of electric motors and internal combustion engines for mutual or common propulsion [B60K6/20](#)) [C0901]**
- Guide heading:** **Engines with pertinent characteristics other than those provided for in or of interest apart from, preceding main groups**
- F02B67/00** **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**
- F02B67/04 . of mechanically-driven auxiliary apparatus
- F02B67/06 . . driven by means of chains, belts, or like endless members
- F02B67/08 . of non-mechanically driven auxiliary apparatus
- F02B67/10 . of charging or scavenging apparatus [N9602] [C0409]
- F02B69/00** **Internal-combustion engines convertible into other combustion-engine type, not provided for in [F02B11/00](#); Internal-combustion engines of different types characterised by constructions facilitating use of same main engine-parts in different types**
- F02B69/02 . for different fuel types, other than engines indifferent to fuel consumed, e.g. convertible from light to heavy fuel
- F02B69/04 . . for gaseous and non-gaseous fuels
- F02B69/06 . for different cycles, e.g. convertible from two-stroke to four stroke
- F02B71/00** **Free-piston engines; Engines without rotary main shaft**
- F02B71/02 . Starting
- F02B71/04 . Adaptations of such engines for special use; Combinations of such engines with

apparatus driven thereby (aspects predominantly concerning driven apparatus, see the relevant classes for such apparatus)

F02B71/04H

- . . [N: with hydrostatic transmission]

F02B71/06

- . . Free-piston combustion gas generators per se

F02B73/00

Combinations of two or more engines, not otherwise provided for

F02B75/00

Other engines

F02B75/00B

- . [N: Double acting engines]

F02B75/00H

- . [N: having horizontal cylinders ([F02B75/00V](#) takes precedence)]

F02B75/00V

- . [N: having vertical crankshafts]

F02B75/02

- . Engines characterised by their cycles, e.g. six-stroke

F02B75/02C

- . . [N: having six or more strokes per cycle]

F02B75/04

- . Engines with variable distances between pistons at top dead-centre positions and cylinder heads

F02B75/04A

- . . [N: by means of cylinder or cylinderhead positioning]

F02B75/04A1

- . . . [N: the cylinderhead comprising a counter-piston]

F02B75/04B

- . . [N: by means of an adjustable piston length]

F02B75/04C

- . . [N: by means of a variable connecting rod length]

F02B75/04D

- . . [N: by means of variable crankshaft position]

F02B75/04E

- . . [N: by means of a variable crank stroke length]

F02B75/06

- . Engines with means for equalising torque ([compensation of inertial forces, suppression of vibration in systems F16E](#))

F02B75/06C

- . . [N: with double connecting rods or crankshafts]

F02B75/08

- . Engines with means for preventing corrosion in gas-swept spaces

F02B75/10

- . Engines with means for rendering exhaust gases innocuous (apparatus per se F01N) [M1204]

[N: **Note**

- in this group the following indexing code is used:

[R02M700/34](#)

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F02B75/12

- . Other methods of operation

F02B75/16

- . Engines characterised by number of cylinders, e.g. single-cylinder engines ([F02B75/26](#) takes precedence)

F02B75/18

- . . Multi-cylinder engines ([scavenging aspects F02B25/00](#))

F02B75/18P

- . . . [N: with two or more pistons connected to one crank and having a common combustion space] [N9509]

- F02B75/20 . . . with cylinders all in one line
- F02B75/22 . . . with cylinders in V, fan, or star arrangement
- F02B75/22A [N: with cylinder banks in narrow V-arrangement, having a single cylinder head]
- F02B75/22B [N: with cylinders in star arrangement]
- F02B75/22C [N: with cylinders in fan arrangement]
- F02B75/22D [N: having two or more crankshafts]
- F02B75/22E [N: with cylinder banks in X-arrangement, e.g. double-V engines]
- F02B75/22U [N: with cylinders arranged in parallel banks] [N9509]
- F02B75/24 . . . with cylinders arranged oppositely relative to main shaft and of "flat" type
- F02B75/24B [N: with only one crankshaft of the "boxer" type, e.g. all connecting rods attached to separate crankshaft bearings]
- F02B75/24P [N: with only one crankshaft of the "pancake" type, e.g. pairs of connecting rods attached to common crankshaft bearing]

- F02B75/26 . 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
- F02B75/26T . . [N: Engines with cylinder axes substantially tangentially to a circle centred on main-shaft axis]

- F02B75/28 . Engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders (arranged oppositely relative to main shaft [F02B75/24](#))
- F02B75/28A . . [N: the pistons having equal strokes] [N9509]
- F02B75/28B . . [N: comprising a free auxiliary piston]
- F02B75/28C . . [N: with several pistons positioned in one cylinder one behind the other] [N9509]
- F02B75/30 . . with one working piston sliding inside another

- F02B75/32 . Engines characterised by connections between pistons and main shafts and not specific to preceding main groups

- F02B75/34 . Ultra-small engines, e.g. for driving models

- F02B75/36 . Engines with parts of combustion- or working-chamber walls resiliently yielding under pressure
- F02B75/38 . . Reciprocating - piston engines ([F02B75/04](#) takes precedence; with resiliently-urged auxiliary piston in pre-combustion chamber [F02B19/06](#))

- F02B75/40 . Other reciprocating-piston engines

- F02B77/00** **Component parts, details or accessories, not otherwise provided for**

- F02B77/00B . [N: Plugs]
- F02B77/02 . Surface coverings of combustion-gas-swept parts (of pistons or cylinders only [F02E](#))
- F02B77/04 . Cleaning of, preventing corrosion or erosion in, or preventing unwanted deposits in, combustion engines [N: (cleaning of fuel injection apparatus [F02M65/00](#))] [C9701]
- F02B77/08 . Safety, indicating or supervising devices (thermal insulation [F02B77/11](#); [N: rendering

- engines inoperative or idling [F02D17/04](#); dependent on lubricating conditions [F01M1/22](#); dependent on cooling [F01P11/14](#))
- F02B77/08B . . [N: relating to endless members (endless members, e.g. belts, for driving auxiliary apparatus [F02B67/04](#))]
 - F02B77/08C . . [N: relating to valves]
 - F02B77/08D . . [N: relating to maintenance, e.g. diagnostic device (relating to lubrication [F01M11/10](#))]
 - F02B77/08E . . [N: indicating economy]
 - F02B77/08F . . [N: with sensors measuring combustion processes, e.g. knocking, pressure, ionization, combustion flame]
 - F02B77/08F1 . . . [N: Sensor arrangements in the exhaust, e.g. for temperature, misfire, air/fuel ratio, oxygen sensors] [C9809]
 - F02B77/08G . . [N: determining top dead centre or ignition-timing]
 - F02B77/08H . . [N: relating to tightness]
 - F02B77/08K . . [N: relating to engine temperature (concerning coolant temperature [F01P11/16](#))]
 - F02B77/10 . . Safety means relating to crankcase explosions

 - F02B77/11 . Thermal or acoustic insulation
 - F02B77/13 . . Acoustic insulation

 - F02B77/14 . Engine-driven auxiliary devices combined into units

 - F02B79/00** **Running-in of internal-combustion engines** (lubrication thereof [F01M](#))