CPC  COOPERATIVE PATENT CLASSIFICATION

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

ENGINES OR PUMPS

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

F02D  CONTROLLING COMBUSTION ENGINES (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)

NOTES
1. Attention is drawn to the notes preceding class F01.
2. In this subclass, the following words are 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.

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

Controlling, e.g. regulating, fuel injection (peculiar to engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures F02D 19/00; peculiar to supercharged engines F02D 23/00; automatic controllers for prime movers, in general G05D)

1/00 Controlling fuel-injection pumps, e.g. of high pressure injection type (F02D 3/00 takes precedence; controlling fuel-injection electrically F02D 41/30 {pumping elements on fuel pressure acting for varying fuel delivery in quantity or timing F02M})

NOTE
- in this subclass the following indexing codes are used:
  F02D 2700/0282 and F02D 2700/10
2001/0005  .  .  [Details, component parts or accessories of centrifugal governors]
2001/001  .  [Arrangement of centrifugal weights]
2001/0015  .  .  {the weights being cup-shaped and carrying governor springs}
2001/002  .  .  {Arrangement of governor springs}
2001/0025  .  .  {having at least two springs, one of them being idling spring}
2001/003  .  .  {the main spring being active at maximum speed only}
2001/0035  .  .  {the main spring being active at all speeds, e.g. its tension varying with the load, i.e. the position of pump control}

2001/004  .  .  {Arrangement of linkages between governor sleeve and pump control}
2001/0045  .  .  {Arrangement of means for influencing governor characteristics by operator}
2001/005  .  .  {varying main spring tension}
2001/0055  .  .  {varying pivotal point of linkages between governor sleeve and pump control}
2001/006  .  .  {Assembling; Disassembling; Replacing}
2001/0065  .  .  {Selection of particular materials}
2001/007  .  .  {Means for adjusting stops for minimum and maximum fuel delivery}
2001/0075  .  .  {using engine temperature, e.g. to adjust the idling speed at cold start}
2001/008  .  .  {using intake air pressure, e.g. adjusting full load stop at high supercharging pressures}
2001/0085  .  .  {Arrangements using fuel pressure for controlling fuel delivery in quantity or timing}
2001/009  .  .  {Means for varying the pressure of fuel supply pump according to engine working parameters}
2001/0095  .  {Mounting of control means with respect to injection apparatus or the engine}
1/02  .  .  not restricted to adjustment of injection timing, e.g. varying amount of fuel delivered
1/025  .  .  {by means dependent on engine working temperature (F02D 1/08 takes precedence)}
1/04  .  .  {by mechanical means dependent on engine speed, e.g. using centrifugal governors (F02D 1/08 takes precedence)}
1/045  .  .  {characterised by arrangement of springs or weights}
Controlling, e.g. regulating, fuel injection

NOTE

F02D 33/003 controlling the feeding of liquid fuel from storage controlling fuel-injection electrically F02D 41/30 other than controlling only an injection pump the compression stroke of the engine, by means injected will be substantially compressed by

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 (controlling fuel-injection electrically F02D 41/30; controlling the feeding of liquid fuel from storage containers to carburettors or fuel-injection apparatus F02D 33/003; ) carburettors F02M)

NOTE

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

3/04 . Controlling fuel-injection and carburation, e.g. of alternative systems

7/00 Other fuel-injection control

7/002 . (Throttling of fuel passages between pumps and injectors or overflow passages (low-pressure fuel injection F02M 69/00))

7/005 . (by mechanical means, e.g. using a centrifugal governor)

7/007 . (by fluid actuated means, e.g. slide valves)

7/02 . Controlling fuel injection where fuel is injected by compressed air

2007/025 . (Controlling compressed air quantity or pressure)

NOTES

1. accelerator lever means a lever actuated by foot or hand (e.g. pedal).

2. throttle lever means a lever connected to the accelerator lever via a force transmitting element (e.g. cable, link) and mounted on the throttle axis.

9/00 Controlling engines by throttling air or fuel-and-air induction conduits or exhaust conduits

NOTE

- in this group the following indexing codes are used: F02D 2700/00, F02D 2700/02, F02D 2700/04, F02D 2700/09

9/02 . concerning induction conduits (throttle valves, or arrangements thereof in conduits F02D 9/08)

2009/0201 . [Arrangements; Control features; Details thereof]

2009/0203 . [Mechanical governor]

2009/0205 . {working on the throttle valve and another valve, e.g. choke}

2009/0206 . [specially positioned with relation to engine or engine housing]

2009/0208 . {for small engines}

2009/0201 . {combined with an electromechanical governor, e.g. centrifuged governor and electric governor acting on the governor lever}

2009/0211 . [combined with another mechanical or pneumatic governor]

2009/0213 . [Electronic or electric governor]

2009/0215 . [Pneumatic governor]

2009/0216 . [of the air-vane type]

2009/0218 . [Details of governor springs]

2009/022 . [Throttle control function parameters]

2009/0222 . [Exhaust gas temperature]

2009/0223 . [Cooling water temperature]

2009/0225 . [Intake air or mixture temperature]

2009/0227 . [Atmospheric pressure]

2009/0228 . [Manifold pressure]

2009/023 . [Engine speed]

2009/0232 . [Fuel pump rack position]

2009/0233 . [Engine vibration]

2009/0235 . [Throttle control functions]

2009/0237 . [Increasing combustion chamber gas temperature]

2009/0238 . [Increasing ignition delay]

2009/024 . [Increasing intake vacuum]

2009/0242 . [Increasing exhaust brake effect]

2009/0244 . [Choking air flow at low speed and load]

2009/0245 . [Shutting down engine, e.g. working together with fuel cut-off]

2009/0247 . [Opening the throttle a little on engine shutdown]

2009/0249 . [Starting engine, e.g. closing throttle in Diesel engine to reduce starting torque]

2009/025 . [Opening the throttle a little during starting]

2009/0252 . [Opening a special valve-controlled intake passage (by-pass) during starting]

2009/0254 . [Mechanical control linkage between accelerator lever and throttle valve]

2009/0255 . [with means for correcting throttle position, e.g. throttle cable of variable length]

2009/0257 . [having a pin and slot connection ("Leerweg")]

Controlling, e.g. regulating, fuel injection

2009/0259 . . . [having a dashpot, e.g. working in the throttle opening and closing directions]
2009/0261 . . . [having a specially shaped transmission member, e.g. a cam, specially toothed gears, with a clutch]
2009/0262 . . . [having two or more levers on the throttle shaft]
2009/0264 . . . [in which movement is transmitted through a spring]
2009/0266 . . . [in which movement is transmitted through a vacuum motor]
2009/0267 . . . [for simultaneous action of a governor and an accelerator lever on the throttle]
2009/0269 . . . [Throttle closing springs; Acting of throttle closing springs on the throttle shaft]
2009/0271 . . . [with means for closing the throttle other than throttle closing springs]
2009/0272 . . . [Two or more throttles disposed in series]
2009/0274 . . . [one being controlled by pressure in intake conduit, e.g. for slowly opening the throttle as the other valve is suddenly opened]
2009/0276 . . . [Throttle and EGR-valve operated together]
2009/0277 . . . [Fail-safe mechanisms, e.g. with limp-home feature, to close throttle if actuator fails, or if control cable sticks or breaks]
2009/0279 . . . [Throttle valve control for intake system with two parallel air flow paths, each controlled by a throttle, e.g. a resilient flap disposed on a throttle]
2009/0281 . . . [with means for detecting malfunction of one throttle and actuating only the correctly working throttle]
2009/0283 . . . [Throttle in the form of an expander]
2009/0284 . . . [Throttle control device with means for signalling a certain throttle opening, e.g. by a steplike increase of throttle closing spring force]
2009/0286 . . . [Throttle control device with accelerator lever defining a stop for opening the throttle, e.g. the throttle itself being opened by air flow, a spring]
2009/0288 . . . [Throttle control device specially adapted for spark-assisted compression-ignition engine (Diesel engine)]
2009/0289 . . . [Throttle control device with means for establishing a variable resistance torque during throttle opening]
2009/0291 . . . [Throttle control device for throttle being disposed in a two-stroke engine transfer passage]
2009/0293 . . . [Throttle control device adapted to limit power development at low attitude]
2009/0294 . . . [Throttle control device with provisions for actuating electric or electronic sensors]
2009/0296 . . . [Throttle control device with stops for limiting throttle opening or closing beyond a certain position during certain periods of operation]
2009/0298 . . . [Throttle control device with holding devices, i.e. to hold throttle in a predetermined position]

9/04 . . . concerning exhaust conduits (throttle valves, or arrangements thereof in conduits F02D 9/08)
9/06 . . . Exhaust brakes
13/00 Controlling the engine output power by varying intake or exhaust valve operating characteristics, e.g. timing (modifying valve gear F01L)

2013/005 . . . . . [of throttleless spark ignited engines]
13/02 . . . . . during engine operation
13/0203 . . . . . [Variable control of intake and exhaust valves]
13/0207 . . . . . [changing valve lift or valve lift and timing]
13/0211 . . . . . [the change of valve timing is caused by the change in valve lift, i.e. both valve lift and timing are functionally related]
13/0215 . . . . . [changing the valve timing only]
13/0219 . . . . . [by shifting the phase, i.e. the opening periods of the valves are constant]
13/0223 . . . . . [Variable control of the intake valves only]
13/0226 . . . . . [changing valve lift or valve lift and timing]
13/023 . . . . . . . . . . . [the change of valve timing is caused by the change in valve lift, i.e. both valve lift and timing are functionally related]
13/0234 . . . . . [changing the valve timing only]
13/0238 . . . . . [by shifting the phase, i.e. the opening periods of the valves are constant]
13/0242 . . . . . [Variable control of the exhaust valves only]
13/0246 . . . . . [changing valve lift or valve lift and timing]
13/0249 . . . . . [changing the valve timing only]
13/0253 . . . . . [Fully variable control of valve lift and timing using camless actuation systems such as hydraulic, pneumatic or electromagnetic actuators, e.g. solenoid valves]
13/0257 . . . . . [Independent control of two or more intake or exhaust valves respectively, i.e. one of two intake valves remains closed or is opened partially while the other is fully opened]
13/0261 . . . . . [Controlling the valve overlap]
13/0265 . . . . . [Negative valve overlap for temporarily storing residual gas in the cylinder]
13/0269 . . . . . [Controlling the valves to perform a Miller-Atkinson cycle]
13/0273 . . . . . [Multiple actuations of a valve within an engine cycle]
13/0276 . . . . . [Actuation of an additional valve for a special application, e.g. for decompression, exhaust gas recirculation or cylinder scavenging]
13/028 . . . . . [for two-stroke engines]
13/0284 . . . . . [Variable control of exhaust valves only]
2013/0288 . . . . . [for cleaning the valves]
2013/0292 . . . . . [in the start-up phase, e.g. for warming-up cold engine or catalyst]
2013/0296 . . . . . [Changing the valve lift only]
13/04 . . . . . . . . . . [using engine as brake]
13/06 . . . . . . . . . . [Cutting-out cylinders]
13/08 . . . . . . . . . . [for rendering engine inoperative or idling]

15/00 Varying compression ratio (modifying valve gear F01L)

NOTE
- in this group the following indexing codes are used: F02D 2700/03
15/02 . . . [by alteration or displacement of piston stroke]
15/04 . . . [by alteration of volume of compression space without changing piston stroke]

17/00 Controlling engines by cutting out individual cylinders; Rendering engines inoperative or idling (controlling or rendering inoperative by varying intake or exhaust valve operating characteristics F02D 13/00)

NOTE
- in this group the following indexing codes are used: F02D 2700/05
17/02 . . . . . . . . . . . [Cutting-out (cutting-out engines in multiple engine arrangements F02D 25/04)]
17/023 . . . . . . . . . . . [the inactive cylinders acting as compressor other than for pumping air into the exhaust system]
17/026 . . . . . . . . . . . [delivering compressed fluid, e.g. air, reformed gas, to the active cylinders other than during starting]
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)]

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)

19/02 . . . . . . . . . . . [peculiar to engines working with gaseous fuels (apparatus, or control parts thereof, for mixing gas and air F02M)]
19/021 . . . . . . . . . . . [Control of components of the fuel supply system]
19/022 . . . . . . . . . . . [to adjust the fuel pressure, temperature or composition]
19/023 . . . . . . . . . . . [to adjust the fuel mass or volume flow]
19/024 . . . . . . . . . . . [by controlling fuel injectors]
19/025 . . . . . . . . . . . [Failure diagnosis or prevention; Safety measures; Testing]
19/026 . . . . . . . . . . . [Measuring or estimating parameters related to the fuel supply system]
19/027 . . . . . . . . . . . [Determining the fuel pressure, temperature or volume flow, the fuel tank fill level or a valve position]
19/028 . . . . . . . . . . . [by estimation, i.e. without using direct measured parameter of a corresponding sensor]
19/029 . . . . . . . . . . . [Determining density, viscosity, concentration or composition]
19/04 . . . . . . . . . . . [peculiar to engines working with solid fuels, e.g. pulverised coal]
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]
Controlling peculiar to specified types or adaptations of engines

19/0602 . . . [Control of components of the fuel supply system]
19/0605 . . . [to adjust the fuel pressure or temperature]
19/0607 . . . [to adjust the fuel mass or volume flow]
19/061 . . . . [by controlling fuel injectors]
19/0613 . . . [Switch-over from one fuel to another (F02D 19/081 takes precedence)]
19/0615 . . . . [being initiated by automatic means, e.g. based on engine or vehicle operating conditions]
19/0618 . . . . [depending on the engine's or vehicle's position, e.g. on/off road or proximity to a harbor]
19/0621 . . . . [Purging of the fuel system]
19/0623 . . . . [Failure diagnosis or prevention; Safety measures; Testing]
19/0626 . . . . [Measuring or estimating parameters related to the fuel supply system]
19/0628 . . . . [Determining the fuel pressure, temperature or flow, the fuel tank fill level or a valve position]
19/0631 . . . . [by estimation, i.e. without using direct measurements of a corresponding sensor]
19/0634 . . . . [Determining a density, viscosity, composition or concentration (F02D 19/087 takes precedence)]
19/0636 . . . . [by estimation, i.e. without using direct measurements of a corresponding sensor]
19/0639 . . . . [characterised by the type of fuels]
19/0642 . . . . [at least one fuel being gaseous, the other fuels being gaseous or liquid at standard conditions]
19/0644 . . . . [the gaseous fuel being hydrogen, ammonia or carbon monoxide]
19/0647 . . . . [the gaseous fuel being liquefied petroleum gas [LPG], liquefied natural gas [LNG], compressed natural gas [CNG] or dimethyl ether [DME]]
19/0649 . . . . [Liquid fuels having different boiling temperatures, volatilities, densities, viscosities, cetane or octane numbers]
19/0652 . . . . [Biofuels, e.g. plant oils]
19/0655 . . . . [at least one fuel being an alcohol, e.g. ethanol (F02D 19/084 takes precedence)]
19/0657 . . . . [Heavy or light fuel oils; Fuels characterised by their impurities such as sulfur content or differences in grade, e.g. for ships]
19/066 . . . [Retrofit of secondary fuel supply systems; Conversion of engines to operate on multiple fuels]
19/0663 . . . [Details on the fuel supply system, e.g. tanks, valves, pumps, rails, injectors or mixers]
19/0665 . . . [Tanks, e.g. multiple tanks]
19/0668 . . . [Treating or cleaning means; Fuel filters]
19/0671 . . . . [Means to generate or modify a fuel, e.g. reformers, electrolytic cells or membranes]
19/0673 . . . . [Valves; Pressure or flow regulators; Mixers]
19/0676 . . . . [Multi-way valves; Switch-over valves]
19/0678 . . . . [Pressure or flow regulators therefor; Fuel metering valves therefor]
19/0681 . . . . [Shut-off valves; Check valves; Safety valves; Pressure relief valves]
19/0684 . . . . [High pressure fuel injection systems; Details on pumps, rails or the arrangement of valves in the fuel supply and return systems]
19/0686 . . . . [Injectors]
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. F01L, see that group; programme-control in general G05B 19/00)

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

NOTE - in this group the following indexing codes are used: F02D 2700/07

29/02 . peculiar to engines driving vehicles; peculiar to engines driving variable pitch propellers
29/04 . peculiar to engines driving pumps
29/06 . peculiar to engines driving electric generators

Other controlling of engines

31/00 Use of speed-sensing governors to control combustion engines, not otherwise provided for
31/001 . [Electric control of rotation speed]
31/002 . . . [controlling air supply]
31/003 . . . . [for idle speed control]
31/004 . . . . . [by controlling a throttle stop]
31/005 . . . . . . [by controlling a throttle by-pass]
31/006 . . . . [for maximum speed control]
31/007 . . . [controlling fuel supply]
31/008 . . . [for idle speed control]
31/009 . . . [for maximum speed control]

33/00 Controlling delivery of fuel or combustion-air, not otherwise provided for ([using exhaust gas sensors F02D 35/0023, F02D 35/0046])
33/003 . . . [Controlling the feeding of liquid fuel from storage containers to carburettors or fuel-injection apparatus (control of electrical fuel pumps F02D 41/3082, controlling fuel flow to a common rail F02D 41/3845); Failure or leakage prevention; Diagnosis or detection of failure; Arrangement of sensors in the fuel system; Electric wiring; Electrostatic discharge]

33/006 . . . . [depending on engine operating conditions, e.g. start, stop or ambient conditions]
33/02 . of combustion-air

35/00 Controlling engines, dependent on conditions exterior or interior to engines, not otherwise provided for
35/0007 . . [using electrical feedback (F02D 35/0015 takes precedence)]

NOTE Attention is drawn to the note preceding F02D 41/00.

35/0015 . . [using exhaust gas sensors (F02D 41/14 takes precedence)]
35/0023 . . . [Controlling air supply]
35/003 . . . [by means of by-pass passages]
35/0038 . . . [by means of air pumps]
35/0046 . . . [Controlling fuel supply]

35/0053 . . . . [by means of a carburettor]
35/0061 . . . . . [Controlling the emulsifying air only (F02D 35/0076, F02D 35/0084 take precedence)]
35/0069 . . . . . [Controlling the fuel flow only (F02D 35/0076, F02D 35/0084 take precedence)]
35/0076 . . . . . . [using variable venturi carburettors]
35/0084 . . . [using two barrel carburettors]
35/0092 . . . . [by means of fuel injection]
35/02 . on interior conditions
35/021 . . . [using an ionic current sensor]
35/022 . . . [using an optical sensor, e.g. in-cylinder light probe]
35/023 . . . . [by determining the cylinder pressure]
35/024 . . [by determining an estimation]
35/025 . . . . [by determining temperatures inside the cylinder, e.g. combustion temperatures]
35/026 . . . [by determining an estimation]
35/027 . . . [using knock sensors]
35/028 . . . [by determining the combustion timing or phasing]

37/00 Controlling jointly two or more functions of engines, not otherwise provided for
37/02 . one of the functions being ignition (ignition control per se F02P, automatically advancing or retarding ignition combined with electronic control of other engine functions, e.g. fuel injection F02P 5/045)

39/00 Other non-electrical control
39/02 . for four-stroke engines
39/04 . for engines with other cycles than four-stroke, e.g. two-stroke
39/06 . for engines adding the fuel substantially at the end of compression stroke
39/08 . for engines adding the fuel substantially before compression stroke
39/10 . for free-piston engines; for engines without rotary main shaft

Electrical control of combustion engines

NOTES
1. Groups F02D 41/00 - F02D 45/00 cover electrical aspects of electrically controlled devices.
2. Groups F02D 41/00 - F02D 45/00 do 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 (; control of engine starters F02N 11/08, electrical control of engine ignition timing F02P 5/145))
41/0002 . . . [Controlling intake air]
41/0005 . . . [during deceleration]
41/0007 . . . [for control of turbo-charged or super-charged engines (control of the pumps per se F02B 37/12)]
2041/001 . . . [for engines with variable valve actuation]
2041/0012 . . . [with selective deactivation of cylinders]
Electrical control of combustion engines

2041/0015 . . . (for engines with means for controlling swirl or tumble flow, e.g. by using swirl valves)
2041/0017 . . . (by simultaneous control of throttle and exhaust gas recirculation)
2041/002 . . . (by simultaneous control of throttle and variable valve actuation)
2041/0022 . . . (for diesel engines by throttle control)
41/0025 . . . (Controlling engines characterised by use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures)
41/0027 . . . (the fuel being gaseous (non-electrical control F02D 19/02))
41/003 . . . (Adding fuel vapours, e.g. drawn from engine fuel reservoir)
41/0032 . . . (Controlling the purging of the canister as a function of the engine operating conditions) 
41/0035 . . . (to achieve a special effect, e.g. to warm up the catalyst)
41/0037 . . . (for diagnosing the engine (diagnosis of purge control systems F02M 25/0809))
41/004 . . . (Control of the valve or purge actuator, e.g. duty cycle, closed loop control of position)
41/0042 . . . (Controlling the combustible mixture as a function of the canister purging, e.g. control of injected fuel to compensate for deviation of air fuel ratio when purging)
41/0045 . . . (Estimating, calculating or determining the purging rate, amount, flow or concentration)
41/0047 . . . (Controlling exhaust gas recirculation [EGR] (temperature control with cooler in recirculation circuit F02M 26/33))
41/005 . . . (according to engine operating conditions)
41/0052 . . . (Feedback control of engine parameters, e.g. for control of air/fuel ratio or intake air amount)
41/0055 . . . (Special engine operating conditions, e.g. for regeneration of exhaust gas treatment apparatus)
41/0057 . . . (Specific combustion modes (combustion modes per se F02D 41/3017))
41/006 . . . (using internal EGR (control of valve overlap for internal EGR F02D 13/026); arrangements for internal EGR F02M 26/01))
41/0062 . . . (Estimating, calculating or determining the internal EGR rate, amount or flow)
41/0065 . . . (Specific aspects of external EGR control (constructional details of EGR system F02M 26/00))
2041/0067 . . . (Determining the EGR temperature)
2041/007 . . . (by estimation)
41/0072 . . . (Estimating, calculating or determining the EGR rate, amount or flow (sensors in EGR systems F02M 26/45))
2041/0075 . . . (by using flow sensors)
41/0077 . . . (Control of the EGR valve or actuator, e.g. duty cycle, closed loop control of position (EGR valve position sensor F02M 26/48))
41/008 . . . (Controlling each cylinder individually)
41/0082 . . . (per groups or banks (F02D 41/0087 takes precedence))
41/0085 . . . (Balancing of cylinder outputs, e.g. speed, torque or air-fuel ratio)
41/0087 . . . (Selective cylinder activation, i.e. partial cylinder operation (deceleration cut-off F02D 41/123))
41/009 . . . (using means for generating position or synchronisation signals)
2041/0092 . . . (Synchronisation of the cylinders at engine start)
2041/0095 . . . (Synchronisation of the cylinders during engine shutdown)
41/0097 . . . (using means for generating speed signals)
41/02 . . . (Circuit arrangements for generating control signals)
41/0205 . . . (using an auxiliary engine speed control (engine speed control per se F02D 31/00))
41/021 . . . (Introducing corrections for particular conditions exterior to the engine (conjunct control of vehicle sub-units for propelling the vehicle B60W 30/18))
41/0215 . . . (in relation with elements of the transmission)
41/022 . . . (in relation with the clutch status)
41/0225 . . . (in relation with the gear ratio or shift lever position)
41/023 . . . (in relation with the gear ratio shifting (conjunct control for improving gear change B60W 30/19))
41/0235 . . . (in relation with the state of the exhaust gas treating apparatus (control of exhaust gas treating apparatus per se F04N))
41/024 . . . (to increase temperature of the exhaust gas treating apparatus)
41/0245 . . . (by increasing temperature of the exhaust gas leaving the engine)
41/025 . . . (by changing the composition of the exhaust gas, e.g. for exothermic reaction on exhaust gas treating apparatus)
41/0255 . . . (to accelerate the warming-up of the exhaust gas treating apparatus at engine start)
2041/026 . . . (using an external load, e.g. by increasing generator load or by changing the gear ratio)
2041/0265 . . . (to decrease temperature of the exhaust gas treating apparatus)
41/027 . . . (to purge or regenerate the exhaust gas treating apparatus)
41/0275 . . . (the exhaust gas treating apparatus being a NOx trap or adsorbent)
41/028 . . . (Desulphurisation of NOx traps or adsorbent)
41/0285 . . . (the exhaust gas treating apparatus being a SOx trap or adsorbent)
41/029 . . . (the exhaust gas treating apparatus being a particulate filter)
41/0295 . . . (Control according to the amount of oxygen that is stored on the exhaust gas treating apparatus)
41/04 . . . (Introducing corrections for particular operating conditions (F02D 41/14 takes precedence))
41/042 . . . (for stopping the engine)
41/045 . . . (Detection of accelerating or decelerating state (detection thereof in general G01P))
41/047 . . . (Taking into account fuel evaporation or wall wetting (special correction after fuel cut-off F02D 41/126))
41/06 . . . (for engine starting or warming up (F02D 41/0255 takes precedence))
41/061 . . . (the corrections being time dependent)
41/062 . . . (for starting (F02D 41/061 takes precedence))
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<td>Electrical control of combustion engines</td>
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Electrical control of combustion engines

- [2041/202] (characterised by the control of the circuit)
- [2041/2024] (the control switching a load after time-on and time-off pulses)
- [2041/2027] (Control of the current by pulse width modulation or duty cycle control)
- [2041/2031] (Control of the current by means of delays or monostable multivibrators)
- [2041/2034] (Control of the current gradient)
- [2041/2037] (for preventing bouncing of the valve needle)
- [2041/2041] (for controlling the current in the free-wheeling phase)
- [2041/2044] (using pre-magnetisation or post-magnetisation of the coils)
- [2041/2048] (said control involving a limitation, e.g. applying current or voltage limits)
- [2041/2051] (using voltage control)
- [2041/2055] (with means for determining actual opening or closing time)
- [2041/2058] (using information of the actual current value)
- [2041/2062] (the current value is determined by simulation or estimation)
- [2041/2065] (the control being related to the coil temperature)
- [2041/2068] (characterised by the circuit design or special circuit elements)
- [2041/2072] (Bridge circuits, i.e. the load being placed in the diagonal of a bridge to be controlled in both directions)
- [2041/2075] (Type of transistors or particular use thereof)
- [2041/2079] (the circuit having several coils acting on the same anchor)
- [2041/2082] (the circuit being adapted to distribute current between different actuators or recuperate energy from actuators)
- [2041/2086] (with means for detecting circuit failures)
- [2041/2089] (detecting open circuits)
- [2041/2093] (detecting short circuits)
- [41/2096] (for controlling piezo-electric injectors (drive and control circuit for piezo-electric devices in general H01L 41/042))
- [41/22] Safety or indicating devices for abnormal conditions
- [2041/201] (in air/fuel ratio feedback systems F02D 41/1495, in electric control linkage F02D 11/107, in purge control systems F02M 25/0809)
- [41/221] (relating to the failure of actuators or electrically driven elements)
- [41/222] (relating to the failure of sensors or parameter detection devices)
- [2041/223] (Diagnosis of fuel pressure sensors)
- [2041/224] (Diagnosis of the fuel system)
- [2041/225] (Leakage detection)
- [2041/226] (Fail safe control for fuel injection pump)
- [2041/227] (Limping Home, i.e. taking specific engine control measures at abnormal conditions)
- [2041/228] (Warning displays)
- [41/24] characterised by the use of digital means
- [41/2403] (using essentially up/down counters)
- [41/2406] (using essentially read only memories)
- [41/2409] (Addressing techniques specially adapted therefor)
- [41/2412] (One-parameter addressing technique)
- [41/2416] (Interpolation techniques)

2041/1468 . . . . . . . [the characteristics being an ammonia content or concentration of the exhaust gases]
2041/1469 . . . . . . . [with determination means using an estimation]
2041/147 . . . . . . . . . . [the characteristics being a hydrogen content or concentration of the exhaust gases]
2041/1472 . . . . . . . . . . [the characteristics being a humidity or water content of the exhaust gases]
41/1473 . . . . . . . . . . . [characterised by the regulation method]
41/1474 . . . . . . . . . . . {by detecting the commutation time of the sensor}
41/1475 . . . . . . . . . . . {Regulating the air fuel ratio at a value other than stoichiometry}
41/1476 . . . . . . . . . . . {Biasing of the sensor}
41/1477 . . . . . . . . . . . [characterised by the regulation circuit or part of it, e.g. comparator, PI regulator, output]
41/1479 . . . . . . . . . . . {Using a comparator with variable reference}
41/148 . . . . . . . . . . . . . . . . {by using a boost voltage source}
41/1481 . . . . . . . . . . . . . . . . {by using a boost inductance}
41/1482 . . . . . . . . . . . . . . . . {using a hot wire flow sensor}
41/1483 . . . . . . . . . . . . . . . . {using a vortex flow sensor}
41/1484 . . . . . . . . . . . . . . . . {Output circuit}
41/1486 . . . . . . . . . . . . . . . . with correction for particular operating conditions
41/1487 . . . . . . . . . . . . . . . . {Correcting the instantaneous control value}
41/1488 . . . . . . . . . . . . . . . . {Inhibiting the regulation}
41/1489 . . . . . . . . . . . . . . . . {Replacing of the control value by a constant}
41/149 . . . . . . . . . . . . . . . . {Replacing of the control value by another parameter}
41/1491 . . . . . . . . . . . . . . . . {Replacing of the control value by a mean value}
41/1493 . . . . . . . . . . . . . . . . [Details]
41/1494 . . . . . . . . . . . . . . . . [Control of sensor heater]
41/1495 . . . . . . . . . . . . . . . . [Detection of abnormalities in the air/fuel ratio feedback system]
41/1496 . . . . . . . . . . . . . . . . [Measurement of the conductivity of a sensor (F02D 41/1455 takes precedence)]
41/1497 . . . . . . . . . . . . . . . . [With detection of the mechanical response of the engine]
41/1498 . . . . . . . . . . . . . . . . [measuring engine roughness]
41/16 . . . . . . . . . . . . . . . . . . . . . . for idling
41/18 . . . . . . . . . . . . . . . . . . . . . . by measuring intake air flow (measuring flow in general G01F)
41/182 . . . . . . . . . . . . . . . . . . . . . . for the control of a fuel injection device
41/185 . . . . . . . . . . . . . . . . . . . . . . using a vortex flow sensor
41/187 . . . . . . . . . . . . . . . . . . . . . . using a hot wire flow sensor
41/20 . . . Output circuits, e.g. for controlling currents in command coils (current control in inductive loads in general H03K 17/64)
2041/2003 . . . . . . . . . . . . . . . . using means for creating a boost voltage, i.e. generation or use of a voltage higher than the battery voltage, e.g. to speed up injector opening
2041/2006 . . . . . . . . . . . . . . . . by using a boost capacitor
2041/201 . . . . . . . . . . . . . . . . . . . . . . by using a boost inductance
2041/2013 . . . . . . . . . . . . . . . . . . . . . . by using a boost voltage source
2041/2017 . . . . . . . . . . . . . . . . . . . . . . using means for creating a boost current or using reference switching
Electrical control of combustion engines

41/2419 . . . . [Non-linear variation along at least one coordinate]
41/2422 . . . . [Selective use of one or more tables]
41/2425 . . . . [Particular ways of programming the data]
41/2429 . . . . [Methods of calibrating or learning]
41/2432 . . . . [Methods of calibration]
41/2435 . . . . [characterised by the writing medium, e.g. bar code]
41/2438 . . . . [Active learning methods]
41/2441 . . . . [characterised by the learning conditions]
41/2445 . . . . [characterised by a plurality of learning conditions or ranges]
41/2448 . . . . [Prohibition of learning]
41/2451 . . . . [characterised by what is learned or calibrated]
41/2454 . . . . [Learning of the air-fuel ratio control]
41/2458 . . . . [with an additional dither signal]
41/2461 . . . . [by learning a value and then controlling another value]
41/2464 . . . . [Characteristics of actuators]
41/2467 . . . . [for injectors]
41/247 . . . . . . [Behaviour for small quantities]
41/2474 . . . . [Characteristics of sensors]
41/2477 . . . . [characterised by the method used for learning]
41/248 . . . . [using a plurality of learned values]
41/2483 . . . . [restricting learned values]
41/2487 . . . . [Methods for rewriting]
41/249 . . . . . . [Methods for preventing the loss of data]
41/2493 . . . . [Resetting of data to a predefined set of values]
41/2496 . . . . [the memory being part of a closed loop]
41/26 . . . . . . [using computer, e.g. microprocessor]
41/263 . . . . . . [the program execution being modifiable by physical parameters]
41/266 . . . . . . [the computer being backed-up or assisted by another circuit, e.g. analogue]
41/28 . . . . . . [Interface circuits]
2041/281 . . . . [between sensors and control unit]
2041/283 . . . . [the sensor directly giving at least one digital reading]
2041/285 . . . . [the sensor having a signal processing unit external to the engine control unit]
2041/286 . . . . [comprising means for signal processing]
2041/288 . . . . [for performing a transformation into the frequency domain, e.g. Fourier transformation]
41/30 . . . . [Controlling fuel injection ([F02D 41/182, F02D 41/24 take precedence])]
3005 . . . . [Details not otherwise provided for]
3011 . . . . [according to or using specific or several modes of combustion]
3017 . . . . [characterised by the mode(s) being used]
3023 . . . . [a mode being the stratified charge spark-ignited mode]
3029 . . . . [further comprising a homogeneous charge spark-ignited mode]
3035 . . . . [a mode being the premixed charge compression-ignition mode]
3041 . . . . [with means for triggering compression ignition, e.g. spark plug]
3047 . . . . [said means being a secondary injection of fuel]
2041/3052 . . . . [the mode being the stratified charge compression-ignition mode]
41/3058 . . . . [the engine working with a variable number of cycles]
41/3064 . . . . [with special control during transition between modes]
41/307 . . . . [to avoid torque shocks]
41/3076 . . . . [with special conditions for selecting a mode of combustion, e.g. for starting, for diagnosing]
41/3082 . . . . [Control of electrical fuel pumps]
2041/3088 . . . . [for air assisted injectors]
41/3094 . . . . [the fuel injection being effected by at least two different injectors, e.g. one in the intake manifold and one in the cylinder]
41/28 . . . . [of the low pressure type ([F02D 41/3082 takes precedence])]
41/34 . . . . . . [with means for controlling injection timing or duration (ignition timing F02P 5/00)]
41/345 . . . . . . [Controlling injection timing (F02D 41/365 takes precedence)]
41/36 . . . . . . [with means for controlling distribution (arrangement of ignition distributors F02P 7/00)]
41/365 . . . . [with means for controlling timing and distribution]
41/38 . . . . [of the high pressure type]
41/3809 . . . . [Common rail control systems (common rail apparatus F02M 55/025, F02M 63/0225)]
41/3818 . . . . [for petrol engines]
41/3827 . . . . [for diesel engines]
41/3836 . . . . [Controlling the fuel pressure]
41/3845 . . . . [by controlling the flow into the common rail, e.g. the amount of fuel pumped]
41/3854 . . . . [with elements in the low pressure part, e.g. low pressure pump]
41/3863 . . . . [by controlling the flow out of the common rail, e.g. using pressure relief valves]
41/3872 . . . . [characterised by leakage flow in injectors]
2041/3881 . . . . [with multiple common rails, e.g. one rail per cylinder bank, or a high pressure rail and a low pressure rail]
2041/389 . . . . [for injecting directly into the cylinder]
41/40 . . . . [with means for controlling injection timing or duration]
41/401 . . . . [Controlling injection timing (F02D 41/402 takes precedence)]
41/402 . . . . [Multiple injections]
41/403 . . . . [with pilot injections]
41/405 . . . . [with post injections]
41/406 . . . . [Electrically controlling a diesel injection pump (F02D 41/401 takes precedence)]
41/407 . . . . [of the in-line type]
41/408 . . . . [of the distributing type]
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)
43/02 . . . . . . using only analogue means
43/04 . . . . . . using only digital means
Electrical control of combustion engines

2200/00 Input parameters for engine control

- The parameters being related to the engine
- Engine temperature
- Estimation of engine temperature
- Temperature of lubricating oil or working fluid
- Fluid pressure of lubricating oil or working fluid
- Engine noise, e.g. determined by using an acoustic sensor
- Engine intake system parameters
- Throttle position
- Intake manifold pressure
- Estimation of intake manifold pressure
- Volumetric efficiency
- Air temperature
- Estimation of air temperature
- Air humidity
- Fuel or fuel supply system parameters
- Fuel pressure
- Estimation of fuel pressure
- Fuel temperature
- Estimation of fuel temperature
- Fuel type, fuel composition or fuel quality
- Determined by estimation
- Actual fuel mass or fuel injection amount
- Determined by estimation
- Actual fuel injection timing or delay, e.g. determined from fuel pressure drop
- Fuel consumption, e.g. measured in fuel liters per 100 kms or miles per gallon
- Lift of the valve needle
- Exhaust gas treatment apparatus parameters
- Temperature of the exhaust gas treatment apparatus
- Estimation of the temperature of the exhaust gas treatment apparatus
- NOx storage amount, i.e. amount of NOx stored on NOx trap
- NOx storage capacity, i.e. maximum amount of NOx that can be stored on NOx trap
- NOx storage efficiency
- Particle filter loading
- Oxygen storage amount
- Oxygen storage capacity
- SOx storage amount, e.g. for SOx trap or NOx trap
- Parameters related to the engine output, e.g. engine torque or engine speed
- Output torque
- Estimation of the output torque
- Engine torque losses, e.g. friction or pumping losses or losses caused by external loads of accessories

Controlling, e.g. regulating, fuel injection (peculiar to engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures F02D 19/00; peculiar to supercharged engines F02D 23/00; automatic controllers for prime movers, in general G05D)

2250/00 Engine control related to specific problems or objectives

- Fuel evaporation in fuel rails, e.g. in common rails
- Fuel pressure pulsation in common rails
- Reverse rotation of engine
- Engine blow-by from crankcase chamber
- Oil dilution, i.e. prevention thereof or special controls according thereto
- Timing of calculation, i.e. specific timing aspects when calculation or updating of engine parameter is performed
- Timing of measurement, e.g. synchronisation of measurements to the engine cycle
- End position calibration, i.e. calculation or measurement of actuator end positions, e.g. for throttle or its driving actuator
- Control of the engine output torque
- during a transition between engine operation modes or states
- by keeping a torque reserve, i.e. with temporarily reduced drive train or engine efficiency
- by using an external load, e.g. a generator
- by applying a torque limit
- Control for reducing torsional vibrations, e.g. at acceleration
- Control of the fuel pressure
- Air-fuel ratio control in a diesel engine
- Control of exhaust back pressure, e.g. for turbocharged engines
- Control for minimising NOx emissions
- Control for minimising smoke emissions, e.g. by applying smoke limitations on the fuel injection amount
Controlling, e.g. regulating, fuel injection

2700/00  Mechanical control of speed or power of a single cylinder piston engine

2700/02  Controlling by changing the air or fuel supply
2700/0202  for engines working with gaseous fuel, including those working with an ignition liquid
2700/0205  Controlling the air supply as well as the fuel supply
2700/0207  Controlling the air or mixture supply
2700/021  Engines without compressor
2700/0212  Engines with compressor
2700/0215  Controlling the fuel supply
2700/0217  for mixture compressing engines using liquid fuel
2700/022  Controlling the air or the mixture supply as well as the fuel supply
2700/0223  Engines with fuel injection
2700/0225  Control of air or mixture supply
2700/0228  Engines without compressor
2700/023  by means of one throttle device
2700/0233  depending on several parameters
2700/0235  depending on the pressure of a gaseous or liquid medium
2700/0238  depending on the number of revolutions of a centrifugal governor
2700/0241  depending on another parameter
2700/0243  by means of a plurality of throttle devices
2700/0246  for engines with compressor
2700/0248  by means of throttle devices
2700/0251  in the intake conduit
2700/0253  in the outlet conduit
2700/0256  by changing the speed of the compressor
2700/0258  by other means
2700/0261  Control of the fuel supply
2700/0264  for engines with a fuel jet working with depression
2700/0266  for engines with fuel injection

2700/0269  for air compressing engines with compression ignition
2700/0271  Controlling the air supply as well as the fuel supply
2700/0274  Controlling the air supply
2700/0276  Engines without compressor
2700/0279  Engines with compressor
2700/0282  Control of fuel supply
2700/0284  by acting on the fuel pump control element
2700/0287  depending on several parameters
2700/0289  depending on the pressure of a gaseous or liquid medium
2700/0292  depending on the speed of a centrifugal governor
2700/0294  depending on another parameter
2700/0297  by control means in the fuel conduit between pump and injector
2700/03  Controlling by changing the compression ratio
2700/035  without modifying the volume of the compression space, e.g. by changing the valve timing
2700/04  Controlling by throttling the exhaust conduit
2700/05  Controlling by preventing combustion in one or more cylinders
2700/052  Methods therefor
2700/054  by keeping the exhaust valves open
2700/056  by interrupting the medium supply
2700/058  by another method
2700/07  Automatic control systems according to one of the preceding groups in combination with control of the mechanism receiving the engine power
2700/09  Other ways of controlling
2700/10  Control of the timing of the fuel supply period with relation to the piston movement