### Muscle-operated starting apparatus

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/00</td>
<td>Starting apparatus having hand cranks (with intermediate power storage F02N 5/00 - F02N 15/00)</td>
</tr>
<tr>
<td>1/005</td>
<td>. (Safety means (F02N 1/02 takes precedence))</td>
</tr>
<tr>
<td>1/02</td>
<td>. having safety means preventing damage caused by reverse rotation</td>
</tr>
<tr>
<td>3/00</td>
<td>Other muscle-operated starting apparatus (with intermediate power storage F02N 5/00 - F02N 15/00)</td>
</tr>
<tr>
<td>3/02</td>
<td>. having pull-cords</td>
</tr>
<tr>
<td>3/04</td>
<td>. having foot-actuated levers</td>
</tr>
</tbody>
</table>

### Power-operated starting apparatus: Muscle-operated starting apparatus with intermediate power storage

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/00</td>
<td>Starting apparatus having mechanical power storage</td>
</tr>
<tr>
<td>5/02</td>
<td>. of spring type</td>
</tr>
<tr>
<td>5/04</td>
<td>. of inertia type</td>
</tr>
<tr>
<td>7/00</td>
<td>Starting apparatus having fluid-driven auxiliary engines or apparatus</td>
</tr>
<tr>
<td>7/02</td>
<td>. the apparatus being of single-stroke piston type, e.g. pistons acting on racks or pull-cords</td>
</tr>
<tr>
<td>7/04</td>
<td>. the pistons acting on screw-threaded members to effect rotation</td>
</tr>
<tr>
<td>7/06</td>
<td>. the engines being of reciprocating-piston type (of internal-combustion type F02N 7/10)</td>
</tr>
<tr>
<td>7/08</td>
<td>. the engines being of rotary type</td>
</tr>
<tr>
<td>7/10</td>
<td>. characterised by using auxiliary engines or apparatus of combustion type (by using explosive cartridges F02N 13/00)</td>
</tr>
<tr>
<td>7/12</td>
<td>. the engines being of rotary type, e.g. turbines (F02N 7/14 takes precedence)</td>
</tr>
<tr>
<td>7/14</td>
<td>. the starting engines being readily removable from main engines, e.g. of portable type</td>
</tr>
</tbody>
</table>

### Starting of engines by supplying auxiliary pressure fluid to their working chambers

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/00</td>
<td>Starting of engines by supplying auxiliary pressure fluid to their working chambers</td>
</tr>
<tr>
<td>9/02</td>
<td>. the pressure fluid being generated directly by combustion (by using explosive cartridges F02N 13/00)</td>
</tr>
<tr>
<td>9/04</td>
<td>. the pressure fluid being generated otherwise, e.g. by compressing air</td>
</tr>
</tbody>
</table>

### Starting of engines by means of electric motors

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/00</td>
<td>Starting of engines by means of electric motors (arrangement or mounting of prime-movers consisting of electric motors and internal combustion engines for mutual or common propulsion B60K 6/20)</td>
</tr>
<tr>
<td>11/003</td>
<td>. said electric motor being also used as a drive for auxiliaries, e.g. for driving transmission pumps or fuel pumps during engine stop</td>
</tr>
<tr>
<td>11/006</td>
<td>. (using a plurality of electric motors)</td>
</tr>
<tr>
<td>11/02</td>
<td>. the motors having longitudinally-shiftable rotors</td>
</tr>
<tr>
<td>11/04</td>
<td>. the motors being associated with current generators</td>
</tr>
<tr>
<td>11/06</td>
<td>. and with ignition apparatus</td>
</tr>
<tr>
<td>11/08</td>
<td>. Circuits (or control means) specially adapted for starting of engines</td>
</tr>
<tr>
<td>11/0803</td>
<td>. (characterised by means for initiating engine start or stop (F02N 11/0814 takes precedence))</td>
</tr>
<tr>
<td>11/0807</td>
<td>. [Remote means]</td>
</tr>
<tr>
<td>11/0811</td>
<td>. [using a timer]</td>
</tr>
<tr>
<td>11/0814</td>
<td>. (comprising means for controlling automatic idle-start-stop)</td>
</tr>
<tr>
<td>11/0818</td>
<td>. [Conditions for starting or stopping the engine or for deactivating the idle-start-stop mode]</td>
</tr>
<tr>
<td>11/0822</td>
<td>. [related to action of the driver]</td>
</tr>
<tr>
<td>11/0825</td>
<td>. [related to prevention of engine restart failure, e.g. disabling automatic stop at low battery state]</td>
</tr>
<tr>
<td>11/0829</td>
<td>. [related to special engine control, e.g. giving priority to engine warming-up or learning]</td>
</tr>
<tr>
<td>11/0833</td>
<td>. [Vehicle conditions (F02N 11/0822, F02N 11/0825 take precedence)]</td>
</tr>
</tbody>
</table>
Power-operated starting apparatus; Muscle-operated starting apparatus with intermediate power storage

11/0837  . . . . [Environmental conditions thereof, e.g. traffic, weather or road conditions]
11/084  . . . . [State of vehicle accessories, e.g. air condition or power steering]
11/0844  . . . [with means for restarting the engine directly after an engine stop request, e.g. caused by change of driver mind]
11/0848  . . . [with means for detecting successful engine start, e.g. to stop starter actuation]
11/0851  . . . [characterised by means for controlling the engagement or disengagement between engine and starter, e.g. meshing of pinion and engine gear]
11/0855  . . . [during engine shutdown or after engine stop before start command, e.g. pre-engagement of pinion]
11/0859  . . . [specially adapted to the type of the starter motor or integrated into it]
11/0862  . . . [characterised by the electrical power supply means, e.g. battery]
11/0866  . . . [comprising several power sources, e.g. battery and capacitor or two batteries]
11/087  . . . [Details of the switching means in starting circuits, e.g. relays or electronic switches]
2011/0874  . . . [characterised by said switch being an electronic switch]
2011/0877  . . . [said switch being used as a series-parallel switch, e.g. to switch circuit elements from series to parallel connection]
2011/0881  . . . [Components of the circuit not provided for by previous groups]
2011/0885  . . . [Capacitors, e.g. for additional power supply]
2011/0888  . . . [DC/DC converters]
2011/0892  . . . [Two coils being used in the starting circuit, e.g. in two windings in the starting relay or two field windings in the starter]
2011/0896  . . . [Inverters for electric machines, e.g. starter-generators]
11/10  . . . . Safety devices (F02N 11/08 takes precedence)
11/101  . . . . [for preventing engine starter actuation or engagement (preventing unauthorised use or theft of vehicles B60R 25/04)]
11/103  . . . . [according to the vehicle transmission or clutch status]
11/105  . . . . [when the engine is already running (F02N 11/0848 takes precedence)]
11/106  . . . . [for stopping or interrupting starter actuation]
11/108  . . . . [for diagnosis of the starter or its components]
11/12  . . . . Starting of engines by means of mobile, e.g. portable, starting sets
11/14  . . . . Starting of engines by means of electric starters with external current supply (F02N 11/12 takes precedence)
13/00 Starting of engines, or driving of starting apparatus by use of explosives, e.g. stored in cartridges
13/02  . . . . Cartridges specially adapted therefor (gas cartridges in general F42B 3/04)
15/00 Other power-operated starting apparatus; Component parts, details, or accessories, not provided for in, or of interest apart from groups F02N 5/00 - F02N 13/00
15/003  . . . . [Starters comprising a brake mechanism]
15/006  . . . . [Assembling or mounting of starting devices]
15/002  . . . . Gearing between starting-engines and started engines; Engagement or disengagement thereof
15/021  . . . . [the gearing including disenganging starter jaws]
15/022  . . . . [the starter comprising an intermediate clutch]
15/023  . . . . [of the overrunning type]
15/025  . . . . [of the friction type]
15/026  . . . . [of the centrifugal type]
15/027  . . . . [of the pawl type]
15/028  . . . . [of the jaw type]
15/04  . . . . the gearing including disengaging toothed gears
15/043  . . . . [the gearing including a speed reducer]
15/046  . . . . [of the planetary type]
15/06  . . . . the toothed gears being moved by axial displacement
2015/061  . . . . [said axial displacement being limited, e.g. by using a stopper]
15/062  . . . . [Starter drives]
15/063  . . . . [with resilient shock absorbers]
15/065  . . . . [with blocking means]
15/066  . . . . [the starter being of the coaxial type]
15/067  . . . . [the starter comprising an electromagnetically actuated lever]
15/068  . . . . [starter drive being actuated by muscular force]
15/08  . . . . the gearing being of friction type
15/10  . . . . Safety devices not otherwise provided for

19/00 Starting aids for combustion engines, not otherwise provided for
19/001  . . . . [Arrangements thereof]
19/2009/02  . . . . [Aiding engine start by acting on fuel]
19/004  . . . . [Aiding engine start by using decompression means or variable valve actuation]
19/005  . . . . [Aiding engine start by starting from a predetermined position, e.g. pre-positioning or reverse rotation]
19/007  . . . . [using inertial reverse rotation]
19/008  . . . . [the engine being stopped in a particular position]
19/02  . . . . Aiding engine start by thermal means, e.g. using lighted wicks (using electrically-heated glow-plugs F02P 19/02)
19/04  . . . . by heating of fluids used in engines (heating of lubricants F01M 5/02)
19/06  . . . . by heating of combustion-air by flame generating means, e.g. flame glow-plugs
19/08  . . . . Arrangement thereof
19/10  . . . . by heating of engine coolants
99/00 Subject matter not provided for in other groups of this subclass
99/002  . . . . [Starting combustion engines by ignition means]
99/004  . . . . [Generation of the ignition spark]
99/006  . . . . [Providing a combustible mixture inside the cylinder]
99/008  . . . . [Providing a combustible mixture outside the cylinder]
2200/00 Parameters used for control of starting apparatus
2200/002  . . . . said parameters being related to the engine
2200/021  . . . . Engine crank angle
said parameters being related to the starter motor

- Engine speed
- Engine temperature
- Engine oil temperature
- Engine oil pressure
- Catalyst temperature
- said parameters being related to the starter motor
- Starter speed
- Starter torque
- Starter voltage
- Starter current
- Starter temperature or parameters related to it
- Energy or power necessary for starting
- Information about pinion position
- Information about pinion speed, both translational or rotational speed

said parameters being related to the power supply or driving circuits for the starter

- Battery state of charge [SOC]
- Battery current
- Battery voltage
- Battery temperature
- Relay current
- Relay temperature
- said parameters being related to the vehicle or its components

- Vehicle speed
- Transmission state, e.g. gear ratio or neutral state
- Parking brake state
- Temperature inside the vehicle cabin
- Detection of vehicle emergency state, e.g. from ABS, ESP, external sensors
- Air condition state
- Brake booster state
- Steering state, e.g. state of power assisted steering
- Electrical loads
- Heating state
- Power-take-off state
- Windscreen wiper state
- Bonnet switches
- Vehicle door sensors
- said parameters being related to driver demands or status

- Accelerator pedal position
- Brake pedal position
- Clutch pedal position
- Driver's intention to turn, e.g. by evaluating direction indicators
- Driver behaviours or types, e.g. sportive or economic type driver
- Driver presence, e.g. detected by door lock, seat sensor or belt sensor

said parameters being related to the vehicle exterior

- Atmospheric pressure, e.g. for determination of geodetic height
- Atmospheric temperature
- Information about vehicle position, e.g. from navigation systems or GPS signals
- Information about road conditions, e.g. road inclination or surface
- Information about other vehicles, traffic lights or traffic congestion

said parameter being related to wear of starter or other components, e.g. based on total number of starts or age

Muscle-operated starting apparatus

Problems related to engine starting or engine's starting apparatus

- Battery voltage drop at start, e.g. drops causing ECU reset
- Reverse rotation of the engine
- Engine stall and related control features, e.g. for automatic restart
- Lubrication of starters; Sealing means for starters

Control related aspects of engine starting

- characterised by the control output, i.e. means or parameters used as a control output or target
- Control of the starter motor speed; Control of the engine speed during cranking
- Control of the starter motor torque
- Control of starter current
- Duty cycle control or pulse width modulation [PWM]
- characterised by the control method
- using different starting modes, methods, or actuators depending on circumstances, e.g. engine temperature or component wear
- using adaptive control
- using prediction of future conditions
- using a model
- Control involving a delay; Control involving a waiting period before engine stop or engine start
- characterised by the use of digital means
- using data communication
- with other systems inside the vehicle
- with external senders or receivers, e.g. receiving signals from traffic lights, other vehicles or base stations